

Transforming Canada's
economy for a global
low-carbon future

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SINK or SWIM

CANADIAN INSTITUTE FOR
CLIMATE CHOICES



INSTITUT CANADIEN POUR DES
CHOIX CLIMATIQUES

CONTENTS

- 1. Introduction3**
- 2. Understanding transition implications for Canada5**
 - 2.1 A portrait of the global low-carbon transition.....6
 - 2.2 The high stakes for Canada.....12
 - 2.3 Policy implications 20
- 3. Assessing Canada’s transition readiness..... 21**
 - 3.1 Stress-testing publicly traded companies.....22
 - 3.2 Company-level strategies to build transition readiness32
 - 3.3 Policy implications.....39
- 4. Uncovering Canada’s hidden potential..... 42**
 - 4.1 Assessing Canadian growth opportunities..... 42
 - 4.2 Policy implications.....52
- 5. Empowering people and communities..... 57**
 - 5.1 High stakes for people.....58
 - 5.2 Risks to communities.....68
 - 5.3 Aligning transition with Indigenous rights and reconciliation.....71
 - 5.4 Policy implications.....73
- 6. Improving market transparency, disclosure, and metrics..... 75**
 - 6.1 Transition-related disclosures.....76
 - 6.2 Product labelling and social and environmental considerations.....80
 - 6.3 Policy implications84
- 7. Recommendations 86**
 - 7.1 Forward-looking decision making.....87
 - 7.2 Future-fit innovation and economic development programming91
 - 7.3 Local and people-focused transition plans.....96
 - 7.4 Disclosure of decision-useful metrics101
- Acknowledgments 105**
- References..... 120**

ABOUT THE INSTITUTE

The Canadian Institute for Climate Choices brings together experts from diverse disciplines to undertake rigorous research, conduct insightful analysis, and engage a range of stakeholders and rightsholders to bring clarity to the climate challenges and transformative policy choices ahead for Canada. We are publicly funded, non-partisan, and independently governed. Learn more at climatechoices.ca



INTRODUCTION

The green wave—the wide-scale global economic transformation necessary to avoid the worst impacts of climate change—is coming fast, and what Canadian governments and businesses do over the next few years to respond and prepare will determine whether we sink or swim.

Big changes in global markets bring big opportunities, but also big risks. And the scale and scope of the changes coming from global policy responses to climate change are going to be massive. As a result, Canada is at a pivotal point. Choices made today—whether through deliberate policy changes or passive inaction—will influence Canada's prosperity for decades.

Current international trends in policy, technology, and markets suggest that the conversation about climate policy and competitiveness in Canada needs to shift. Climate policy analysts and stakeholders have long debated the short-term competitiveness implications for Canadian industry of moving too far ahead of global trading partners. Now, however, accelerating rates of global change make falling behind trading partners a far greater competitive risk. Canada's long-term prosperity will depend on how businesses

and policymakers work together to anticipate the green wave of global market transformation.

Whatever course Canadian climate policy takes in the years ahead, companies will face significant shifts in demand, commodity prices, and the cost of emitting greenhouse gases. Canadian exporters and multinationals are more emissions intensive than those in other countries, with a heavy weighting towards oil, gas, vehicle manufacturing, minerals, metals, and chemicals. Increased pressure on investors to reduce the emissions intensity of their portfolios is leading to higher costs of capital and—in some cases—divestment.

Many of Canada's historic sources of economic growth and prosperity will need to adapt and adjust to new market realities to remain competitive. The stakes are high for the economy, for workers, for communities, and for Indigenous Peoples. There are enormous opportunities in new markets, but also significant potential for disruption.

One thing is clear: Canada is not ready. Big investments are not happening at the scale needed. Businesses are vulnerable to sudden changes in global markets or investor sentiment. Promising

companies that could drive future growth struggle to attract financing. And there are limited plans to protect and empower workers and communities most affected by change.

Addressing these challenges is not just the responsibility of the private sector: our analysis finds that policy plays a clear role in navigating global market shifts. We recommend that governments at all levels act now to develop and implement forward-looking, globally minded economic strategies and transition plans that secure competitiveness. Those plans need to focus on where global markets are heading and emphasize capturing opportunities over managing risks.

Governments and businesses, like people, tend to have a status quo bias, with concern for losing what exists today overshadowing the potential for larger-scale future gains in new markets. But with foresight, transparency, and proactive policy, Canadian governments can support inclusive growth and prosperity in Canada through a period of rapid global change. This report analyzes what the green wave could mean for Canada. It also provides targeted policy advice for how Canada can seize opportunities, create a smoother transition, and mobilize private capital to ensure we ride the wave rather than being swamped by it.

Getting the incentives right is key, and governments can use policy to drive private companies to take action by providing greater certainty on measures such as carbon pricing and regulation. Factoring long-term competitiveness into

climate policy decision making is essential, as it will lead to stronger investment incentives and could enable a more strategic approach to infrastructure and procurement. Government innovation and economic development programming can also help de-risk and accelerate large-scale, high-potential investments. And national and regional transition roadmaps can help empower people and communities to create jobs and capture new economic opportunities, while driving more inclusive growth pathways.

Improving market transparency is another piece of the puzzle. To make good, forward-thinking decisions, consumers and investors need good information about climate-related risks and opportunities at the company and product levels. This will require a coordinated effort across governments, securities regulators, and the private sector to ensure appropriate guidance and oversight of the evolving climate-related disclosure and investment landscape.

Canada can thrive through this transition. In fact, the green wave represents a huge opportunity to build a cleaner, more durable, and more inclusive economy. But success will not happen on its own. It requires early planning, collaboration, coordination, and direction. It also requires building a shared vision of a better future that everyone can get behind.

Slow and steady will not win the race to capture opportunities in rapidly changing markets. This is a time when bold, innovative, and nimble early movers are most likely to succeed.



UNDERSTANDING TRANSITION IMPLICATIONS FOR CANADA

The transition to a global low-carbon economy is picking up speed. Governments around the world are rallying around the goal of achieving net zero emissions by mid-century and are starting to back up their commitments with ambitious policy. These policies are driving significant changes in energy and vehicle markets and are beginning to influence broader trade patterns for minerals, metals, technology, and other resources.

Capital markets are also funneling unprecedented sums into low-carbon investments, and governments and investors are pressing for companies to better disclose their climate-related risks and opportunities.

These trends are set to accelerate. Momentum is building across all three drivers of change—policy, markets, and technology. Perceptions of climate action as a cost are shifting toward a recognition of enormous economic opportunity, with countries and companies racing to position themselves to compete. Traditional sources of opposition are weakening as new business coalitions and unions push for greater action.

Yet, while the general direction of the global low-carbon transition is clear, the timing and

scale of change in specific markets remain highly uncertain. Trends in wind and solar power production and electric vehicles are relatively clear, but policy trajectories, investment patterns, and technology choices are less clear in newer markets or where “wild cards”—high-risk solutions still in early stages of development—are needed.

No matter how the global low-carbon transition unfolds, it will have profound implications for Canada. As a small and open economy, Canada derives a sizable proportion of its economic success from exporting goods to large foreign markets. The transition will impact companies, sectors, and the financial system. These impacts matter, as they can affect government fiscal stability, workers, and communities. Canada has the ingredients and capacity to succeed, but there could be significant disruptions along the way.

To get a better sense of what is at stake for Canada, the first half of this section looks at the major catalysts of the global transition. The second half explores how these catalysts could specifically impact Canada.

2.1 A PORTRAIT OF THE GLOBAL LOW-CARBON TRANSITION

Predicting what the future will look like 30 years from now is fraught. The global low-carbon transition makes it particularly difficult, since the pace and scale of change ultimately depend on countless decisions of people around the world—those leading governments and businesses, and those acting as consumers, investors, and voters.

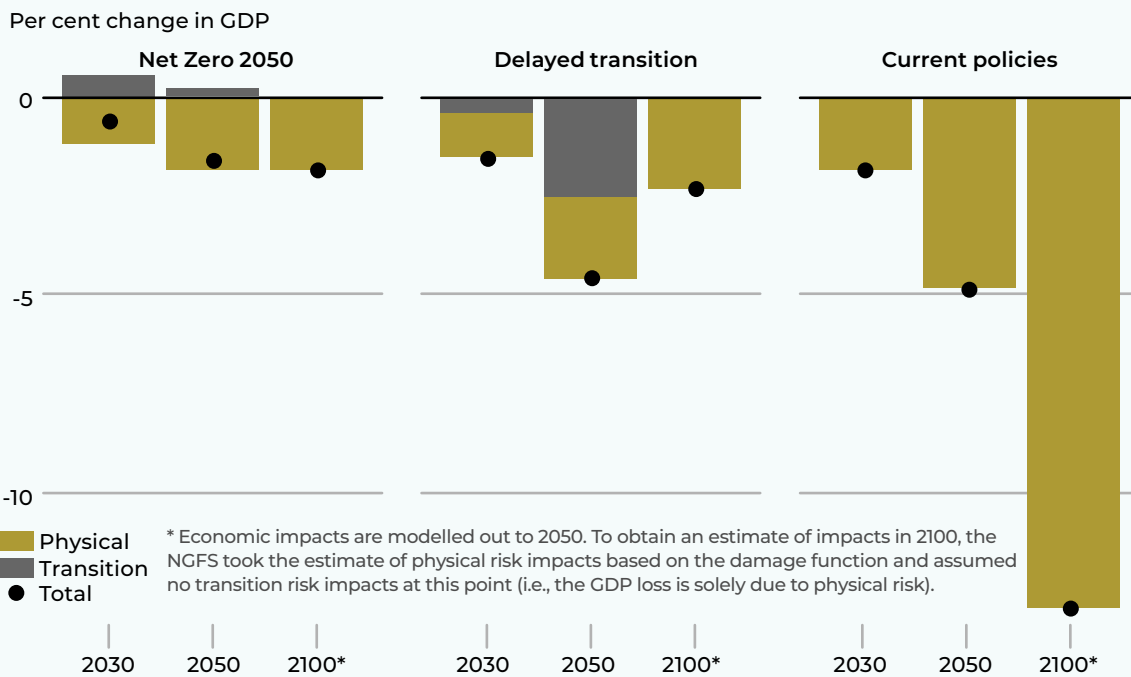
Predictions are especially challenging when rates of change are non-linear. Historically, the pace of transition has been relatively slow. Despite decades of incremental improvements in climate policy, the use of coal, oil, and natural gas has continued to expand. Yet global trends now suggest tremendous change is coming. The green wave is accelerating and could come faster than expected.

The costs of inaction are becoming clearer

As the effects of climate change become more frequent and increasingly severe through heat-waves, wildfires, floods, droughts, and other impacts, governments and citizens are acknowledging the need to rapidly reduce greenhouse gas emissions to avoid the worst outcomes. The global human, environmental, and economic costs of failing to reduce greenhouse gas emissions far outweigh the costs of transitioning to a low-carbon economy. In fact, work by the Central Banks and Supervisors Network for Greening the Financial System (NGFS) shows that overall global gross domestic product (GDP) reductions are lowest in scenarios where the world takes significant near-term action consistent with reaching net zero emissions by 2050 (Figure 1).

Figure 1

Ambitious transition costs less than inaction



Source: NGFS (2021a). Note: The figure above shows the per cent change in gross domestic product associated with the physical impacts of a changing climate in yellow, and the per cent change associated with the low-carbon transition in grey relative to a prior trend under three different scenarios developed by the Network of Central Banks and Governors for Greening the Financial System.

The stringency and ambition of global climate policy is increasing

Government climate commitments around the world are shifting dramatically. A growing number of countries have committed to reaching net-zero greenhouse gas emissions by mid-century, representing over half of the world's emissions and oil demand and over 70 per cent of global GDP (IEA, 2020a; IMF, 2020). If these targets are backed by meaningful policies such as carbon pricing and regulations, the global transition will accelerate rapidly. If zero-emission innovations exceed expectations, the transition might unfold even faster.

Countries have set targets in the past and failed to meet them, but this time is different for several reasons:

- **Governments are starting to implement tough policies.** There is a greater understanding of the scale and scope of policy needed to meet global goals (IEA, 2021d). For example, the United States has introduced a bill targeting 100 per cent clean electricity by 2035, the European Union tightened its cap-and-trade system to meet 2030 targets, the United Kingdom banned sales of gasoline and diesel vehicles by 2030, and China launched a new emission-trading system while cracking down on steel-sector emissions (European Commission, 2020; Hu, 2021; IISD, 2021; Morehouse, 2021; Walker, 2020).
- **Climate policy is now a factor in trade and economic agendas.** The European Union is moving forward with a Carbon Border Adjustment Mechanism to impose a price on certain imports from countries with weaker regulations on greenhouse gas emissions (European Commission, 2021a). The United States may

follow suit and has vowed to use foreign policy to push other countries to increase climate ambition (Iverson, 2020; Greber, 2021). Exporters around the world are more likely to face a carbon price in the coming years, regardless of action in their home countries.

- **The geopolitics of energy are changing.** While fossil fuels are concentrated in specific locations, renewable energy is available in some form almost everywhere (Bordoff, 2020). For a country such as China, which is a net fossil fuel importer but an early leader in electric vehicle and solar technology, there is a strategic interest in having the world shift away from fossil fuels (CCGET, 2019). Countries are increasingly recognizing that their future economic success will depend on developing competitive low-carbon products and services.
- **Traditional sources of opposition are switching sides.** New business coalitions and labour trends are weakening domestic resistance to climate policies in many regions. As markets for renewable energy and electric vehicles grow, low-carbon businesses are pushing against the traditionally louder voices of incumbent lobbies. For example, American electric vehicle companies have banded together to create the Zero Emission Transportation Association (Lambert, 2020). Wind turbine service technicians and solar photovoltaic installers are projected to be among the fastest growing occupations in the United States over the coming decade (USBLS, 2019). And automotive unions are now pushing for electric vehicle manufacturing investments, recognizing that these will be an essential part of securing long-term employment (Berman, 2020).

► **Courts are starting to play a role in climate action.** A 2021 ruling in the Netherlands, for example, could force Shell to increase its greenhouse gas reduction target from 20 per cent to 45 per cent by 2030 (Graney and Jones, 2021). Courts in Germany and France have also weighed into climate policy, considering issues relating to insufficient and unmet emission targets (Jordans, 2021; Bairn and Woodyatt, 2021).

The direction of global climate policy is converging for the first time, but the specific way it will ultimately play out remains unclear. It depends, for example, on which policies countries choose and emphasize, how quickly they ramp up ambition, and whether or not they favour certain technologies.

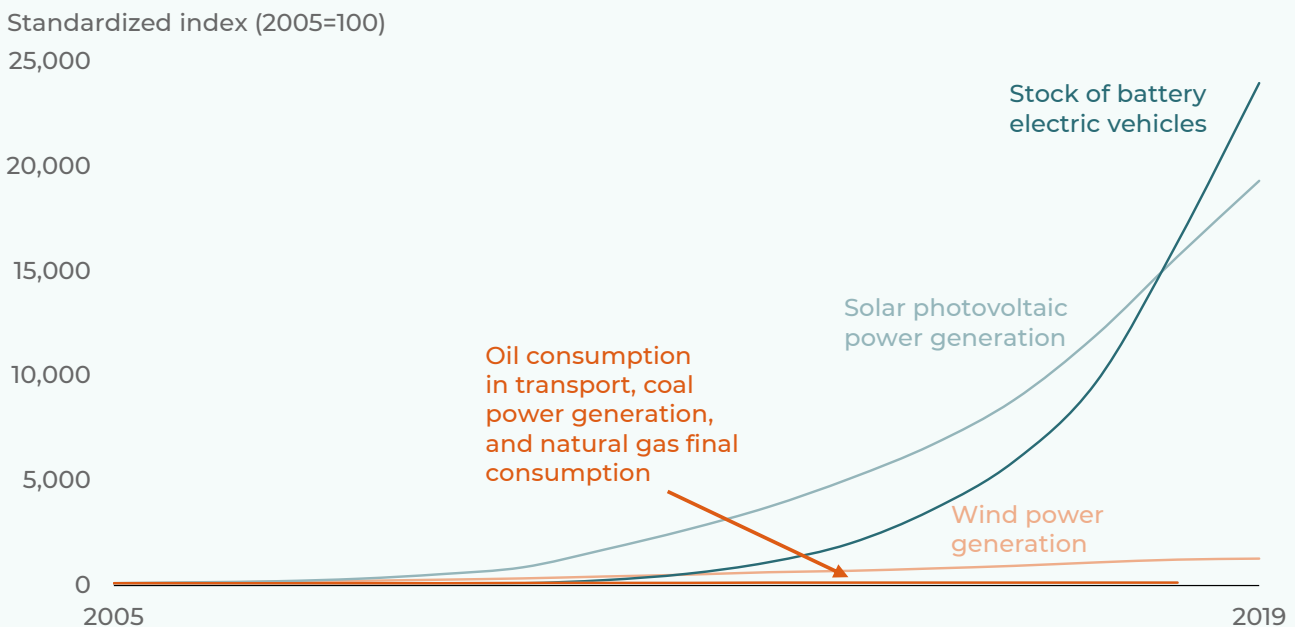
Global product and capital markets are shifting faster than expected

Product and capital markets are starting to change in response to current and anticipated government policy. While the change may seem small in absolute terms, growth rates for low-carbon products and technologies continually surpass expectations. The tipping point for markets may be even faster than for policies, as investors try to anticipate global policy and technology trends.

Wind and solar electricity generation are growing at high rates, while growth in fossil fuel use is almost flat (Figure 2). The International Energy Agency (IEA) forecasts that wind and solar will represent 90 per cent of new power capacity in

Figure 2

Global renewable electricity and electric vehicle growth rates are significantly greater than those of fossil fuels



Source: IEA (2020c); (2020d). Note: Growth rates are based on various units of production or consumption. Oil consumption in transport, coal power generation, and natural gas final consumption saw little growth between 2005 and 2018.

2. UNDERSTANDING TRANSITION IMPLICATIONS FOR CANADA

2021 and 2022 and will exceed global coal and natural gas capacity by 2025 (IEA, 2020a; IEA, 2021a; IEA, 2021b). And while electric cars only accounted for 4.6 per cent of global car sales in 2020, the stock has grown from only 20,000 vehicles in 2010 to almost 7 million vehicles in 2020. The IEA projects that by 2030, electric cars will represent between 17 and 35 per cent of sales, depending on the pace of government policy (IEA, 2021c). In June 2021, 85 per cent of car sales in Norway were electric vehicles, illustrating how quickly markets can shift (InsideEVs, 2021). Most major car manufacturers have already committed to switch to electric passenger car production by 2030-2040, with some accelerating plans in response to policy and market developments (Lekach, 2021; Rauwald, 2021).

Acceleration in renewable and electric vehicle adoption will have significant implications for coal, oil, and natural gas consumption. Several projections—including those by oil and gas major BP—show that demand for fossil fuels such as coal and oil may have already peaked (BP, 2020). Natural gas demand is more variable across scenarios, but most projections show it peaking between 2025 and 2035 (IEA, 2020a; NGFS, 2021b; BP, 2020; IEA, 2021d). If demand declines faster than expected, this will have significant implications for oil and gas producers. Global low-carbon transition scenarios show a decline in oil prices to US\$25–45 per barrel by 2050 (Planetricks, 2021; IEA, 2021e).

Capital markets are also shifting. The market capitalization of U.S. electric vehicle maker Tesla grew from just US\$3.38 billion in November 2010 to over US\$568 billion in May 2021, moving past many large auto manufacturers (PitchBook Data Inc., 2021). Danish wind turbine manufacturer Vestas' market capitalization grew from US\$6.4

billion to US\$227 billion over the same period (PitchBook Data Inc., 2021). Canadian hydrogen fuel cell maker Ballard Power surpassed a market capitalization of \$5 billion in May 2021 (PitchBook Data Inc., 2021).

Investors are now pushing for accelerated change, spurred by increased pressure from regulators and the courts to address and disclose climate-related risks. More than 500 investors with USD \$55 trillion in assets under management have signed the Climate Action 100+ initiative that aims to ensure the world's largest corporate emitters curb emissions, improve governance, and strengthen climate-related financial disclosures (Climate Action 100+, 2021). Another initiative, called the Net Zero Asset Managers Initiative, represents over 128 international investors committed to supporting the goal of net zero greenhouse gas emissions by 2050, with \$43 trillion in assets under management (NZAMI, 2021).

An increasing number of asset managers and institutional investors have announced plans to move away from high-emission investments such as coal power, coal mining, and oil sands (Healing, 2020). Several have gone even further, committing to align their portfolios with a goal of reaching net zero emissions by mid-century (Morgan Stanley, 2020). International oil majors are also expected to sell off oil sands assets as they seek to reduce emissions and shift into new market opportunities such as renewable energy (Hussain, 2021). In early 2021, Blackrock and Temasek jointly committed \$600 million to finance late-stage, low-carbon technologies (Schatzker, 2021).

In addition, insurers are moving away from emissions-intensive projects and companies. Lloyd's of London—an insurance market that acts as an

intermediary between clients, brokers, underwriters, and insurance companies—announced it and its members will end new investment in thermal coal-fired power plants, thermal coal mines, oil sands, and new Arctic energy exploration activities in 2022. They will also phase out existing investment in companies which derive 30 per cent or more of their revenues from these sectors by 2025. Lloyds asked its members—who operate as syndicates to spread out the risk of various clients—to stop providing new insurance cover in these areas by 2022, and to phase out existing cover by 2030 (Cohn, 2020).

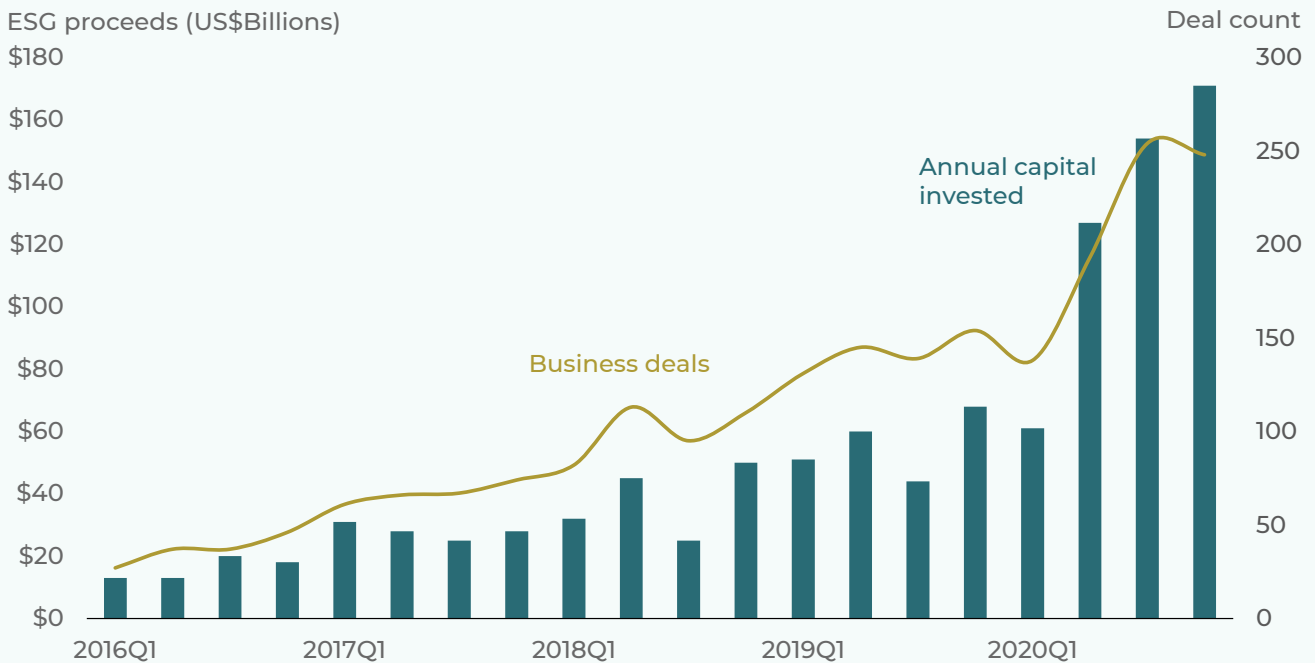
Investment in low-carbon and environmental, social, and governance (ESG) funds has been steadily growing (Figure 3). While growth has been greatest in Europe, funds are now expand-

ing in North America and Asia. Shareholders are also increasingly supporting environmental and social resolutions. In 2020, 21 such resolutions received majority support compared to 13 in 2019 and 5 in 2017 (Mooney, 2020). In 2021, oil major Exxon Mobil lost three board seats to candidates nominated by an activist hedge fund seeking greater climate action (Hiller and Herbst-Bayliss, 2021; Freedman, 2021).

Many of these shifts in global markets are happening faster than expected. Yet, while the direction seems clear, risks and uncertainties abound. Capital markets can be volatile, and investors tend to focus on short-term signals more than long-term probabilities. If short-term signals start to indicate major changes, however, markets could move rapidly.

Figure 3

Global ESG investment is growing



Source: Generation Investment Management LLP (2021).

Technological advancements are making the transition easier and cheaper

Low-carbon technologies are quickly becoming cheaper and better. Lower-cost technologies make it easier for businesses to reduce emissions, which enables governments to implement more ambitious policy. New technologies are also continually emerging, with the potential to further accelerate the pace of change.

Cost reductions in wind and solar power continue to surpass expectations. Over the past decade, solar photovoltaic module prices have fallen by around 90 per cent, while wind turbine prices have fallen by 55 to 60 per cent (IRENA, 2020). The cost of constructing and operating wind and solar power plants is often now cheaper than coal plants, and on par with efficient natural gas plants (Schumacher et al., 2020).

At the same time, utility-scale battery storage technology is improving and becoming cheaper. The levelized cost of energy for lithium-ion battery storage dropped 76 per cent between 2012 and 2019 (Colthorpe, 2020). These cost declines will make decarbonizing electricity systems easier, helping reduce the need for investments in base-load power generation by storing excess variable renewable generation (IRENA, 2019).

Technological improvements and cost reductions are also making electric vehicles—and other forms of electric mobility, such as e-bikes and e-scooters—more attractive to consumers. Ranges of electric vehicles are expanding, battery costs are declining, and consumer vehicle options are increasing (IEA, 2020c). Electric vehicle purchase prices are projected to become cost competitive with internal-combustion-engine vehicles well before 2030, but many are already more affordable when reduced gasoline

and maintenance costs are included (Bannon, 2021). The pace of improvement is also increasing innovation in other vehicle applications, including buses and trucks. The new electric Ford F-150 Lightning pickup truck is attracting interest partly because it could also be a source of backup power (Stumpf, 2021).

Other emerging technologies could become increasingly attractive with continued innovation and declining costs. These include geothermal energy, small modular nuclear reactors, hydrogen, second-generation biofuels, and a wide range of clean technologies.

The Global Cleantech 100 report highlights companies most likely to make a significant market impact over the next decade (Cleantech Group, 2020). These companies are developing a wide range of products people might not normally associate with the low-carbon transition, for example:

- Agriculture technology, such as insect proteins and microbe-powered technologies.
- Enabling technologies, such as industrial software analytics platforms, artificial intelligence, big data analytics, and Internet of Things solutions.
- Energy and power solutions, such as pay-as-you-go solar products for off-grid households and lithium-ion battery recycling technology.
- Alternative materials such as bioplastics.
- Transportation and logistics support, such as fleet management platforms to optimize autonomous vehicles.

Of all the drivers of the global low-carbon transition, the impacts from technological change are perhaps least certain. Some degree of technological change is inevitable, but breakthroughs

can be unpredictable and disruptive (Lipsey et al., 2006; Lipsey, 2001). This is particularly true in markets that are at early stages of development, where consumers have multiple options. One technology may appear to be following a typical “s” curve of technology adoption, when an innovation can suddenly take markets in a different direction, resulting in financial losses for companies and investors betting on the old technology (Harris, 2021).¹

2.2 THE HIGH STAKES FOR CANADA

Canadian competitiveness and prosperity—today and in the future—are directly tied to global trends in policy, markets, and technology. Canada’s trade dependency, combined with the emissions intensity of exports, means the stakes are higher than they may be for other developed countries.

On one hand, Canada is well positioned to capture enormous market opportunities from the global transition. Canada’s private sector is dynamic and innovative, matched by a highly educated workforce and substantial expertise in energy and clean technology. Its financial system is considered one of the safest and most stable in the world and could play a pivotal role in financing Canada’s transition. The country’s abundance of renewable resources, minerals and metals, geological carbon storage capacity, and biomass is also an advantage.

However, the composition of Canada’s economy means that greater changes will be required to respond to climate-driven trends in global markets and investment than in many other countries. Canada’s financial sector is also deeply

connected to emissions-intensive sectors, raising the possibility of systemic financial risk, and increasing the importance of company-level disclosure and reporting.

The green wave will have big implications for Canadian exports and foreign direct investment

International exports and foreign direct investment are the backbone of Canada’s economy. Exports, for example, generated one third of Canadian GDP in 2019 (Statistics Canada, 2021a). In that same year, the total book value of foreign direct investment in Canada surpassed \$1 trillion (Statistics Canada, 2021b). This trade and investment activity provides well-paying jobs and income for millions of Canadians and generates tax revenues that help fund health care, education, infrastructure, and social services (Dodge, 2020; Canada Senate, 2018a).

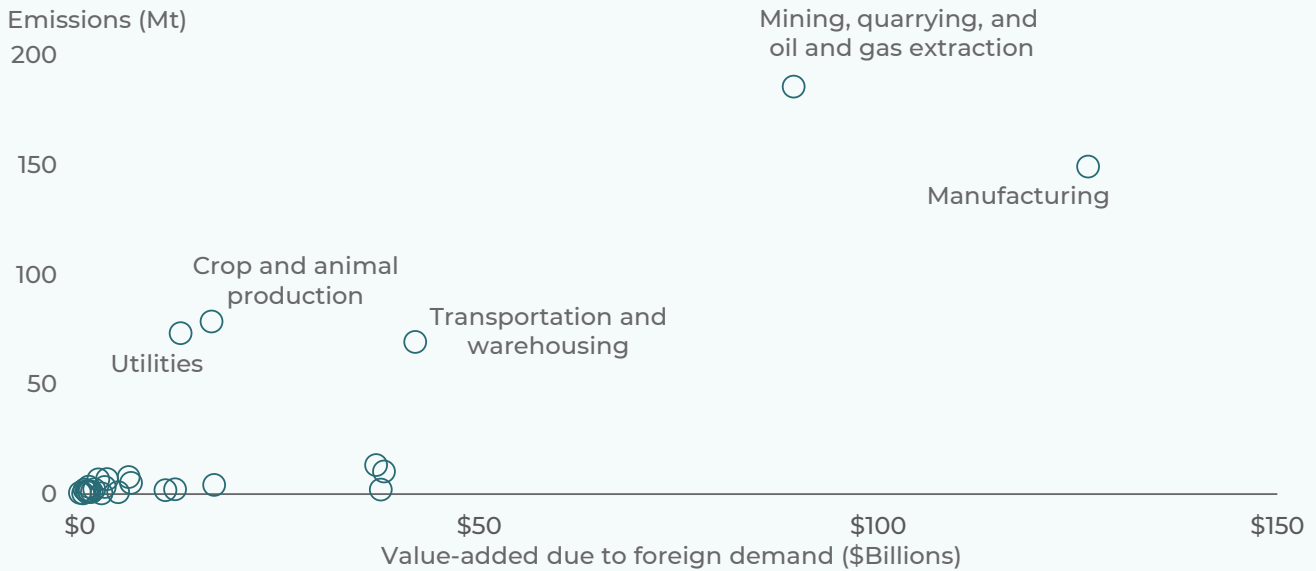
Yet Canada’s biggest export sectors are some of the most likely to be disrupted by the global low-carbon transition. Figure 4 shows Canada’s export sectors (measured by value added due to foreign demand) and greenhouse gas emissions. The manufacturing and mining, quarrying, and oil and gas extraction sectors stand out because they are both high value-added sectors as well as significant greenhouse gas emitters.

Canada’s manufacturing sector generated \$126 billion in value-added trade in 2018. In the same year, the sector produced 149 Mt of greenhouse gas emissions (Statistics Canada, 2021c; 2021d). Manufacturing includes sub-sectors, such as motor vehicle manufacturing and chemicals, that are highly traded and vulnerable to transition-related market change. The mining, quarry-

¹ Technology adoption often follows the shape of an “s”, with slow increases in adoption in early stages, followed by rapid growth, and then a tapering off of adoption once the technology is mature.

Figure 4

Emissions-intensive export-oriented sectors are important contributors to Canada’s economy



Source: Statistics Canada (2021c; 2021d). Notes: This figure shows greenhouse emissions and value-added from exports for 46 different subsectors in the Canadian economy in 2018. Greenhouse gas emissions include Scope 1 emissions only. Including Scope 2 and 3 emissions would amplify exposure to the global transition and alter the relative positioning of subsectors in the figure.

ing, and oil and gas sector generated \$89 billion in value added due to foreign demand, and nearly 186 Mt of greenhouse gas emissions, in 2018 (Statistics Canada, 2021c; 2021d).

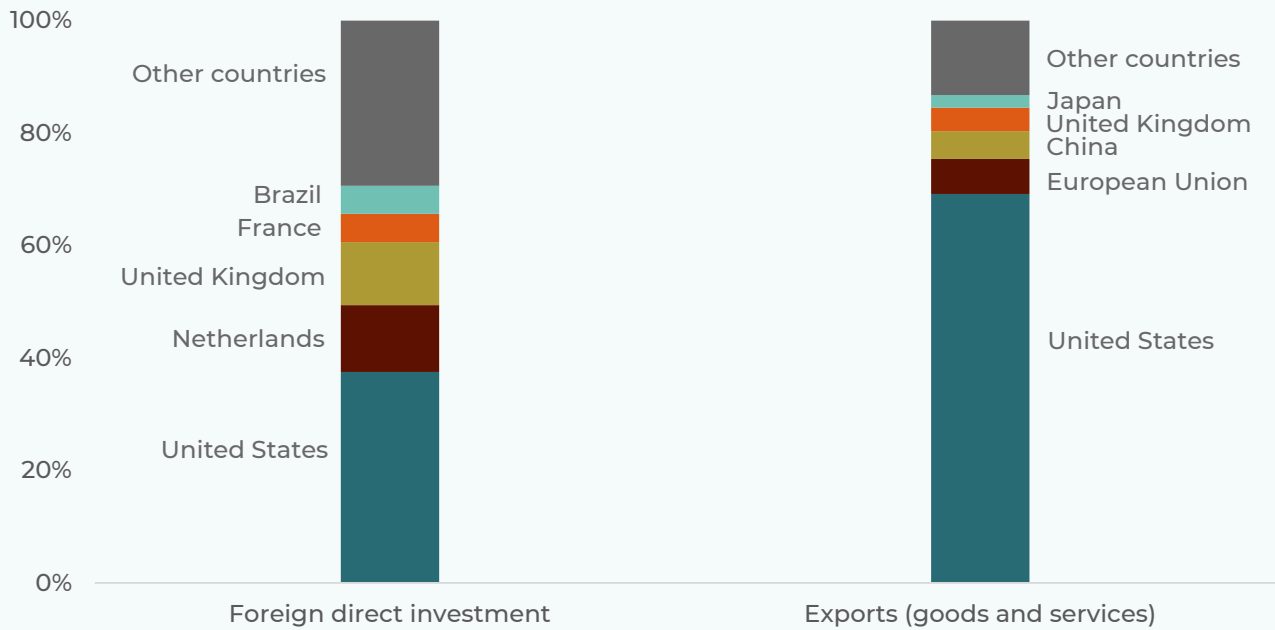
Critically, Figure 4 does not tell the full global transition story, as it only includes operational (or Scope 1) emissions. Some sectors are often significant users of electricity and heat (Scope 2 emissions). The full supply chain (Scope 3 emissions) for industries that are resource-intensive, or that produce products that generate significant emissions downstream (such as traditional vehicles or oil and gas) can also be relevant, because consumers of these products are likely to face carbon constraints through increasing climate policy in their own jurisdiction.

The majority of foreign direct investment into Canada funnels into many of these sectors that will face market disruption. Energy and mining were the largest recipients of foreign direct investment in 2019, receiving \$19 billion. Manufacturing follows closely behind at \$18 billion. These sectors also experienced the strongest growth in foreign direct investment between 2000 and 2019 (Statistics Canada, 2021b; Global Affairs Canada, 2020).

Canada has a relatively small number of export and investment trading partners who are actively transitioning to a lower-carbon economy (Figure 5). Policy developments in the United States could have the largest and most immediate impact on demand for Canadian exports.

Figure 5

The United States is Canada's most important trading partner



Source: Global Affairs Canada (2021). Notes: This figure shows the breakdown of Canada's sources of foreign direct investment (FDI) and export destinations. The United States, as Canada's largest trading partner, is the source of 38 per cent of Canada's FDI and the destination of 70 per cent of exports in 2020.

Most of Canada's oil and gas exports are sent to the United States (Canada Senate, 2018b). At the same time, nearly 40% of foreign direct investment coming into Canada originates from the U.S. (NRCAN, 2020; Global Affairs Canada, 2020).²

Canada's other major trading partners are also developing policies that could have serious implications. For example, the E.U.'s Carbon Border

Adjustment Mechanism could affect Canada's emissions-intensive exports if Canadian products are not exempted (see Box 1). European countries with financial hubs are also major sources of incoming foreign direct investment, which could be affected by increasingly stringent European climate-related disclosure and reporting requirements (discussed below).

² Energy exports include crude oil, natural gas, uranium, petroleum products, electricity, and coal.

BOX 1



The prospect of border carbon adjustments from Canada's largest trading partners

Border carbon adjustments are designed to counteract competitiveness challenges by allowing countries to increase the stringency of climate policies—such as carbon pricing—without unfairly disadvantaging companies in domestic markets. Border carbon adjustments level the playing field by applying the same carbon costs paid domestically to incoming imports, thereby reducing the likelihood of domestic companies relocating to another jurisdiction with weaker climate policy (i.e., “leakage”).

While border carbon adjustments have been discussed for decades, they are now gaining traction. The European Union released a formal proposal for some products in July 2021, and expects to implement border carbon adjustments by 2023. The Biden Administration in the United States is considering border carbon adjustments, as is Canada.

How border carbon adjustments might affect Canada, however, is still unclear. Designing them effectively is complex and challenging due to differences in policy design across countries, the sophistication of supply chains, and differences in emission calculations. Because exporters in Canada already pay a carbon price, they should be less affected by border carbon adjustment policies in other countries. At the same time, however, Canada's output-based pricing system for large emitters—that effectively reduces the average carbon price that large emitters pay—could complicate equivalence calculations. Depending on the coverage of border carbon adjustments, it may be preferable to adjust domestic carbon pricing systems so that they align more closely with policies in other countries, thus keeping revenues within Canada's economy that would otherwise be collected by importing governments.

Sources: Cosby et al. (2021); Government of Canada (2020); Bernasconi-Osterwalder and Cosby (2021); Lawder (2021); European Commission (2021a).

Taken together, these trade and investment trends create high stakes for Canada's economy. The country's trade balance, currency, and sovereign credit worthiness could all be negatively affected by the transition, with longer-term implications for Canadian competitiveness.

Yet the global low-carbon transition could also generate significant upsides to help offset potential losses.

Canada has an abundance of renewable energy potential, mineral and metal wealth, geological carbon storage potential, and biomass resources, many of which could see increased demand in a global low-carbon economy. Many traditional businesses could also capture opportunities by shifting towards lower-carbon products (explored in Section 3). Additionally, Canada has hundreds of innovative companies poised to capture emerging opportunities in growing transition-relevant markets (explored in Section 4).

For example, the real value of Canadian exports of environmental and clean technology goods and services increased by 26 per cent between 2012 and 2019 (Statistics Canada, 2021e). These exports represent less than one per cent of Canadian GDP but could accelerate quickly as global demand grows. Canadian clean technology companies are more active in international markets than the average for small and medium enterprises. In 2017, 41 per cent of Canadian cleantech small and medium enterprises reported export sales outside of Canada versus 12 per cent for all Canadian small and medium enterprises (Jiang, 2020).

The green wave could be a source of systemic risk in Canada's financial sector

Canada's financial sector is renowned for its stability and security. It weathered the 2007-08

financial crisis and is well capitalized relative to international peers (Bank of Canada, 2021).

However, the country's banks, pension funds, hedge funds, and insurers have substantial investments in Canada's emissions-intensive sectors, which could expose the financial system to systemic risk (Box 2).

Canada's banking sector is more exposed to carbon-intensive assets than its peers. Canada's big five banks financed 17.5 per cent (or \$559 billion) of the roughly \$3.8 trillion that international banks lent to the oil and gas sector between 2016 and 2020. They were among the top 6 largest lenders to the Canadian oil sands, and three of Canada's big banks ranked in the top 12 largest lenders of the global oil and gas sector (Rainforest Action Network, 2021; Bak, 2020). At the same time, Canadian banks are heavily invested in other sectors that will see transition-related impacts, such as mining and metals, utilities, transport, and manufacturing (Royal Bank of Canada, 2021; TD Bank 2019; Vasil, 2020).

In addition, pension funds and other institutional investors hold significant positions in Canada's emissions-intensive sectors—often with longer investment horizons (Stares, 2018). Canada Pension Plan Investments, for example, manages \$497 billion of retirement income for 20 million Canadians and is one of the largest investors in Canada's energy sector (Nauman, 2021; CPP Investments, 2021). Between 2011 and early 2021, the fund's fossil fuel investments grew from \$0.3 billion to \$10 billion (CPP Investments, 2021). In 2019, about one third of these investments were in Canadian oil and gas companies (Meyer, 2019).

BOX 2



The origins and dangers of systemic financial risk

Systemic financial risk refers to how sudden or abrupt shocks within one segment of the economy can trigger instability or even collapse of the entire system. In the 2007-08 financial crisis, for example, a build-up of risky sub-prime (junk) loans and a sudden rise in mortgage defaults (among other factors) cascaded throughout the financial sector. This triggered insolvencies, panic, and distrust almost overnight, and imposed massive public and social costs.

Climate change poses potentially similar systemic risks. A warming and increasingly volatile climate will affect nearly every facet of society—both through physical impacts such as wildfires and floods and through changes resulting from the low-carbon transition—meaning financial systems are exposed to multiple and overlapping vulnerabilities.

When it comes to the global transition, the major concern is that long-term transition risks are not fully reflected in market prices, tilting capital flows toward riskier, emissions-intensive assets and away from low-carbon assets. If market expectations change suddenly in the future due to an acceleration in global policy, a technological breakthrough, or a series of extreme weather events, it could cause a massive repricing event. In this scenario, billions of dollars worth of emission-intensive assets could become stranded—losses that could then cascade throughout the entire financial system.

While research on climate-related financial risk is still relatively new, prominent global financial institutions and organizations are starting to pay greater attention. The Financial Stability Board, which reports to the G20, was among the first major international organizations to recognize the links between climate change and financial instability. More recently, the U.S. Commodity Futures Trading Commission, the U.S. Federal Reserve, and the French central bank have released papers that assess how climate-related events can threaten financial stability. The International Monetary Fund, the NGFS, and the Bank of Canada are also undertaking research in this area.

Sources: Bank of Canada (2019; 2021); Bolton et al. (2020); Thoma and Chenet (2016); USCFTC (2020); 2° Investing Initiative (2017); Sen et al. (2018); Zhou et al. (2021); Financial Stability Board (2020); Bateson and Saccardi (2020); Veena (2021); U.S. Federal Reserve (2020).

While the dangers of systemic risk are serious, moderating factors within Canada's financial system help reduce exposure. Loans to at-risk sectors, for example, are only a small share of the total loan profile of Canada's biggest banks (typically less than 5 per cent) and credit risk from these at-risk sectors appears small (Alexander and Orland, 2020; Rendell, 2020, TD, 2021). Banks and other investors also operate on short investment time horizons—typically one to five years—which could help them adapt as global markets shift. In fact, many institutions are already making changes to reduce transition risks and capture emerging opportunities (Kiladze, 2020; Jones, 2021). In addition, existing controls and regulations moderate banks' risk exposure.³

The Bank of Canada and the Office of the Superintendent of Financial Institutions (OSFI) are currently conducting research on climate-related systemic risk to better understand its importance. Ideally, future research will include other economic vulnerabilities—such as the physical impacts of climate change or high levels of government and household debt—that could interact with and amplify transition-related risks.

One way to help ensure that risk is effectively and efficiently priced into markets and to reduce market instability and systemic financial risk is to require better company disclosure of climate-related risks (OJEU, 2019; Krueger et al. 2021). Governments in the European Union, the United Kingdom, and New Zealand, for example, have made climate-related reporting mandatory. The same body that sets international standards for financial disclosures—the International Financial Reporting Standards

Foundation—has established the Sustainability Standards Board to help harmonize climate-related disclosures globally. All these initiatives are grounded in the 2017 recommendations from the Financial Stability Board's Task Force for Climate-related Financial Disclosures (TCFD), which has become the gold standard.

The trend toward stronger climate-related disclosure and reporting practices could have outsized impacts for an emissions-intensive economy like Canada. Investor and insurer actions to reduce climate-related risk in their portfolios will affect the cost of capital, likelihood of divestment, and the ability to underwrite assets in the coal, oil, and gas sectors (UN, 2020; Krueger et al., 2021; EPSF, 2019).

The green wave poses different risks and opportunities for provinces and territories

The opportunities and risks from the global transition—discussed throughout this section—will affect provinces and territories in different ways. At a high level, provinces and territories that are decoupling economic growth from greenhouse gas emissions could be more insulated from downside risks. Nova Scotia, New Brunswick, and Prince Edward Island, for example, reduced greenhouse gas emissions between 2005 and 2018 while growing GDP (Canadian Institute for Climate Choices, 2020).

When it comes to opportunities from the transition, all provinces and territories have enormous potential to benefit, albeit in different ways. Canada's largest cities, including Vancouver, Montreal, and Toronto, have developed mature hubs of cleantech research, development, and

³ As the value of oil and gas reserves declines with global prices, banks automatically tighten their lending practices (Alexander and Orland, 2020). Canadian banks must also comply with high capital requirements, which help guard against shocks to the financial system (Zochodne, 2019). Portfolio diversification provides further protection against Canada-specific risk. The Canada Pension Plan Investment Board, for example, has only 16 per cent of its net assets in Canada—a share that has decreased over time (CPP Investments, 2020).

investment. Canada’s supply of low-carbon electricity in provinces like Quebec, British Columbia, and Manitoba could help support electrification of heavy industry.

Still, the global transition poses significant challenges. Ontario’s manufacturing sector, for example, is an important part of its economy and could be directly impacted by changing global markets for steel, cement, chemicals, and gasoline-powered vehicles.

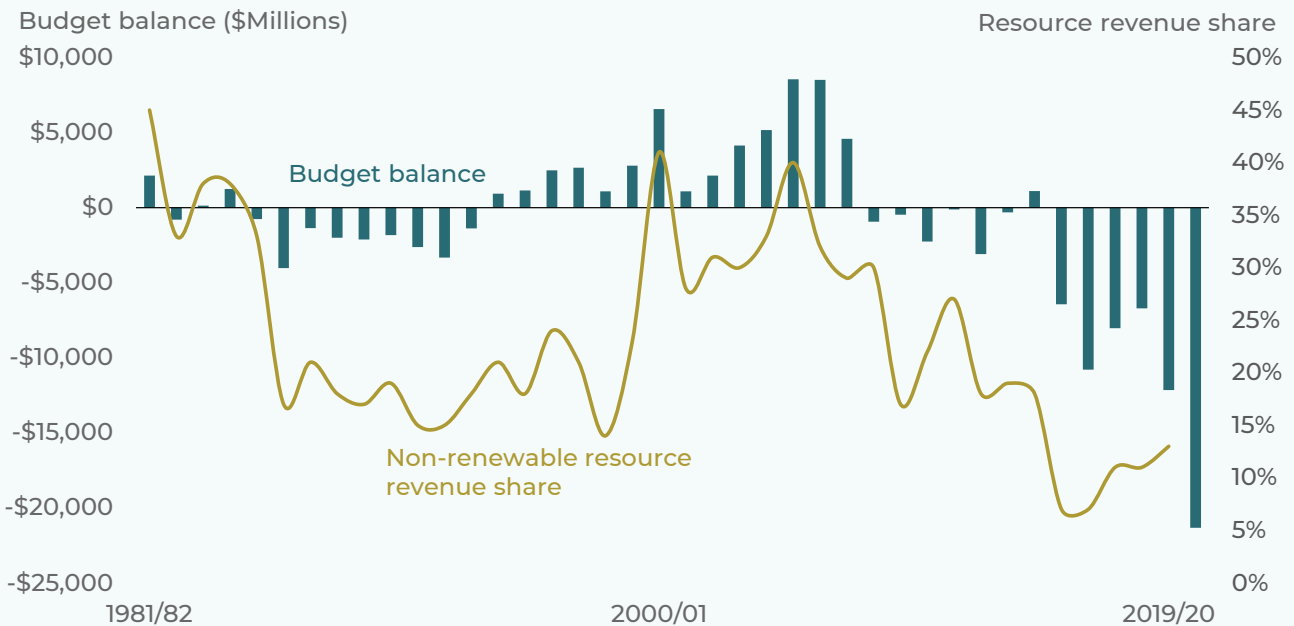
The magnitude of required transformation is likely greatest in Alberta, Saskatchewan, and Newfoundland and Labrador, where the oil and gas sector accounts for a larger share of jobs, income, and government revenues (Cosbey et al., 2021). While oil sands producers have been relatively resilient to short-term shocks to date, the

longer-term competitiveness of Canadian producers is unclear if global oil prices fall to US\$25–45 per barrel (Planetrics, 2021; IEA, 2021e). Some projects in Canada have higher break-even prices than other oil producers globally (Rystad, 2020; Fawcett, 2021) and the likelihood of investment in large new greenfield projects is declining (Green Car Congress, 2020; IEA, 2021d).

A sustained, long-term drop in oil prices could have significant consequences for resource revenues and how provinces pay for essential public services. In Newfoundland and Labrador, for example, royalties from its offshore oil and gas sector comprised one third of government revenues in 2012-13. By 2018-19, these royalties shrank to one sixth of government revenues, due primarily to lower oil prices (Drummond and Lévesque, 2021; Government of Newfoundland

Figure 6

The Alberta government’s budget balance depends heavily on resource revenues



Sources: Government of Alberta (2021a); Royal Bank of Canada (2021b). Notes: This figure shows non-renewable resource revenues as a share of total provincial government revenues between 1981 and 2020 (right axis) and the government’s annual budget balance (left axis). Overall, budget deficits track closely to resource revenues. In an average year, changes in oil prices have swung provincial government revenues up or down by \$1 billion.

and Labrador, 2013). The province's debt-to-GDP ratio increased from 46 per cent to 56 per cent between 2018 and 2021, signaling structural economic and fiscal challenges for the province moving forward (Drummond, 2021). In Alberta, where the oil and gas sector generated nearly one third of Alberta's GDP in 2020, budget deficits and surpluses have closely mirrored global oil prices (Figure 6) (Statistics Canada, 2021a).

These same provinces also have significant resource advantages, however. Alberta, for example, has some of the best solar and wind potential in the country and significant geological storage potential for carbon capture and storage (Wilson, 2020; NRCAN, 2018). Furthermore, with one of the country's only deregulated electricity markets, Alberta is attracting corporate investments from across the country in its renewable energy sector. It also has expertise in hydrogen and geothermal energy (Cretney and Park, 2021). Saskatchewan is a major uranium producer and could see growth if countries expand nuclear power production (World Nuclear Association, 2021). Newfoundland and Labrador has significant offshore wind potential, low-carbon hydro-electricity production, minerals and metals, and biofuels refining (Robinson, 2021; Canada Energy Regulator, 2021; Jamasmie, 2020; Quinn, 2021).

How provinces and territories respond to the transition will determine whether they experience a net economic gain or loss.

2.3 POLICY IMPLICATIONS

Global trends show that the low-carbon transition is inevitable. There may be uncertainty in the pace or scale of evolution across specific

markets or regions, but overall momentum for change is accelerating. It is now more a question of *when* than *if* the transition will drive significant market adjustment.

The trade and investment linkages between Canada and other countries mean that, regardless of the climate policies implemented by Canadian governments, companies will face the transition in the form of foreign demand, investment, and trade-related carbon costs. Shoring up Canada's economic resilience and low-carbon competitiveness is critical to long-term economic growth.

Governments have a number of policy tools at their disposal to help companies prepare. In fact, governments around the world are developing strategies to capture transition-related opportunities. The United Kingdom launched a 10-point plan in late 2020, focused on preparing for a green industrial revolution (UK DBEIS, 2020). The United States has linked its climate action to job creation and economic growth (Aton, 2021). The European Green Deal promises a transformation to a modern, resource-efficient, and competitive economy (European Commission, 2021b).

However, selecting and designing the best policies for Canada requires understanding the specifics of how the transition will affect competitiveness, and where Canada has the best chance of capturing new market opportunities. The following two sections provide analysis to support these policy decisions, exploring the transition's implications for publicly traded companies and identifying emerging companies positioned to capture future growth.



ASSESSING CANADA'S TRANSITION READINESS

3

The global low-carbon transition presents an enormous economic opportunity for Canada, but only if companies position themselves to succeed. In many cases, success will require large-scale investment to build transition readiness before markets change.

This section assesses Canada's publicly traded company performance under different global low-carbon scenarios. It shows that many large businesses in Canada with international sales and operations are not yet transition-ready. There has been a proliferation of net zero commitments, and the number of investments is growing, but the changes are not yet consistent with the scale or speed of change required. Canadian companies also appear hesitant to make the big, risky investments needed for the transition. Some companies are sticking a toe in the water, and more will inevitably follow as global markets shift, but most have not yet been willing to jump in with large-scale, transformative change.

Reducing emissions is most important in sectors where demand will stay strong but carbon costs

will rise. Companies producing minerals, metals, and materials needed through the transition will need to invest in low-carbon technologies and processes to stay globally competitive.

Transition readiness is about more than just emission reductions, however. In sectors where global demand is expected to increase, Canada needs to grow globally competitive companies. In sectors where global demand is expected to decline, such as coal and oil, companies need to transform into new business lines.

Transition success will ultimately be determined at the company, rather than sector, level. Those that innovate, invest, and adapt will be able to succeed.

At the economy-wide level, a combination of status quo bias, weak and uncertain policy signals, and unbalanced capital markets is slowing the investments needed to improve transition resilience. Without bold, forward-looking strategies that aim to not just manage risks but capture opportunities, Canada's economy could get left behind.

3.1 STRESS-TESTING PUBLICLY TRADED COMPANIES

One of the ways to assess transition readiness is to stress test companies under different low-carbon transition scenarios. Investors around the world are increasingly engaging analytics companies to stress test their portfolios, drawing on recommendations from the international Financial Stability Board's Task Force on Climate-related Financial Disclosure. As investors seek to reduce climate-related risks, they will reduce exposure to companies identified as high risk. Climate Choices commissioned Planetrics, an international climate-risk analytics company, to stress test Canadian publicly traded companies and companies with Canadian operations (methodology available upon request).

The analysis uses three scenarios from the Network of Central Banks and Supervisors for Greening the Financial System (NGFS): (1) a baseline scenario with no new climate policy; (2) a delayed 2-degree scenario where significant global action does not kick in until 2030, but then ramps up to maintain the global average temperature increase to 2 degrees Celsius; and (3) an immediate 1.5-degree scenario, where action starts right away and steadily increases to maintain the global average temperature increase to 1.5 degrees Celsius. Scenarios (2) and (3) could be considered within reach of the internationally agreed goal of keeping temperature rise "well below 2 degrees" (Box 3). For added variation, the 2-degree scenario includes limited access to carbon dioxide removal options such as planting trees, while the 1.5-degree scenario has more generous access.

BOX 3

How accurate are transition scenarios?

The scenarios used for stress testing are not meant to be predictions of the future. Rather, they are useful to analyze key aspects of transition risk: (1) timing of market change—immediate vs. delayed, and (2) access to carbon dioxide removal options.

Even if the world as a whole does not take enough action to meet global 1.5- or 2-degree temperature goals, section 2 highlighted several trends that show it is reasonable to expect major global markets—including Canada's closest trading partners—to experience large-scale change. That change could happen later than the scenarios show, but it could also happen earlier. In fact, the scenarios may underestimate the pace and scale of disruption in the markets that matter most to Canada. For example, only 40 per cent of global 2050 transportation energy demand is non-emitting under the immediate 1.5-degree scenario (though 100 per cent of passenger vehicles sales are electric). Rapidly changing technologies and growing policy and investor pressure could drive more rapid change in freight transportation.

Sources: NGFS, 2020; Planetrics, 2021.

Many Canadian exporters and multinationals are not yet transition ready

Stress-testing Canada's publicly traded companies shows that roughly half of large exporters and multinationals are not yet transition ready. Based on reported assets, sales, production costs, and emissions in December 2020, these companies have significant work to do to thrive through either transition scenario. That doesn't mean they cannot adjust: the purpose of this analysis is to identify opportunities for adjustment, not to predict a foregone conclusion.

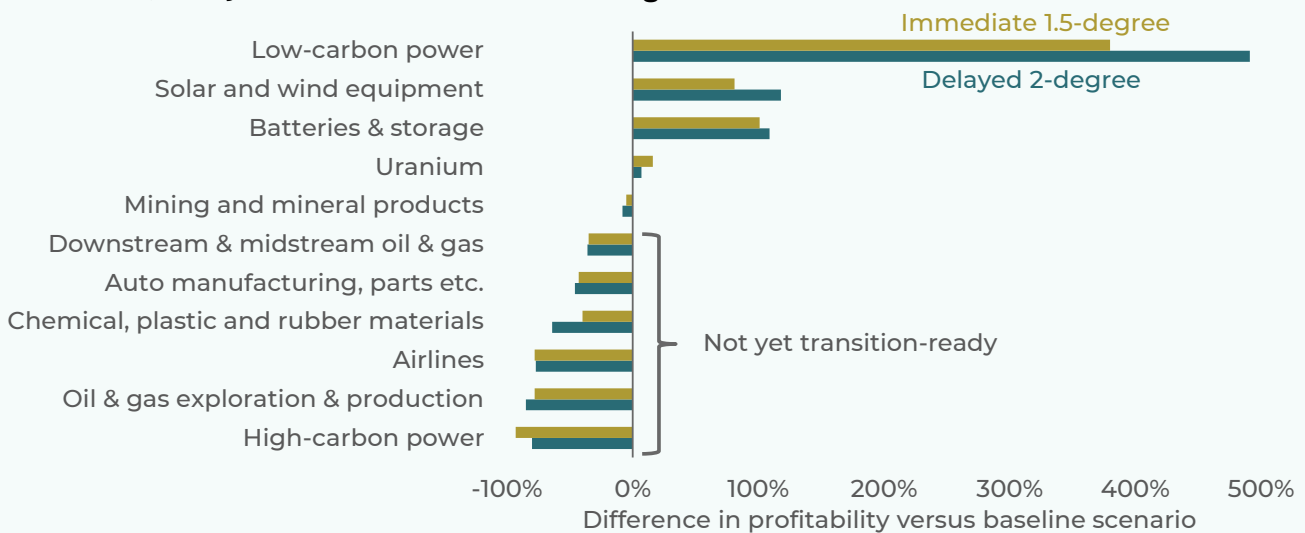
Figure 7 shows the stress testing results for sectors where companies would see significant profit gain or loss through the global low-car-

bon transition. Those active in low-carbon power, batteries and storage, and solar and wind equipment are well-positioned to grow through the transition. The delayed scenario results in greater profit gains in these sectors over the course of 2021 to 2050, since the steep post-2030 decline requires more stringent policy and there is less access to carbon dioxide removal options.

Without major changes, transition-vulnerable sectors such as high-carbon power, upstream and downstream oil and gas, airlines, chemicals, and automobile manufacturing and parts would see significant profit loss under both transition scenarios. Uranium and mining and mineral product companies also have more to do to reduce risks and capture opportunities.

Figure 7

While some Canadian companies will be more profitable through the global low-carbon transition, many will be vulnerable without significant action



Source: Canadian Institute for Climate Choices (2021c) based on modelling and analysis commissioned from Planetrics. Notes: The figure above shows the net present value of the difference in weighted average market capitalization between the baseline scenario and two low-carbon transition scenarios for Canadian companies' international sales and operations between 2021 and 2050. Results are shown for sectors most affected by transition, where there are more than three publicly traded Canadian companies. Low-carbon power represents the 25 per cent least emissions-intensive assets (hydroelectric, other renewables, and nuclear) while high-carbon power represents the 25 per cent most emissions-intensive assets (coal and natural gas). Results for companies operating both high and low-carbon facilities are split across the categories.

Transformative, not incremental, change is needed to build transition readiness

The stress testing incorporated the standard approaches companies might take to respond to the scenarios:

- **Reducing emissions** according to sector and region-specific abatement cost curves;
- **Producing less of currently sold products** where demand is shrinking; and
- **Producing more of currently sold products** where demand is growing.

To improve outcomes, companies will need to either adopt innovative technologies that have not yet been tested at scale or shift into new business lines. Some of these changes are already underway.

In automotive manufacturing, for example, many companies have committed to switching to electric vehicle production (Rosenberg, 2021). Auto parts suppliers are also retooling to support the

shift (Exro Technologies, 2021). There is still disruption ahead, however, particularly as companies jockey to secure electric vehicle battery manufacturing capacity (Friedman, 2021).

Oil and gas companies have started to write off higher-cost assets and make investments in transition-relevant projects (Hussain, 2020). Pembina Pipeline Corp. and TC Energy Corp., for example, announced a plan to develop a transportation and sequestration system in Alberta capable of transporting more than 20 million tonnes of carbon dioxide annually (Canadian Press, 2021). Oil sands companies have banded together to work towards achieving net zero Scope 1 and 2 emissions by 2050 (Reuters, 2020). Some companies are also investing in alternative energy sources, though others have committed to stay focused on oil and gas production (Bakx, 2021).

While there has been some progress, it is not yet clear that the transition will be smooth for



all companies and sectors. Many of the changes required rely on technologies that are only at the demonstration stage, or on translating success in one product to success in another business line (IEA, 2020e, Wood Mackenzie, 2021). There is significant potential, but history is full of examples—like Kodak or Blockbuster—where companies have been too slow to adjust to market disruption (Anthony, 2016; Satell, 2014).

Transition success will be more about individual companies than sectors

The stress testing results in Figure 7 reflect the weighted average performance of companies by sector. Figure 8, however, highlights the significant differences in performance of companies *within* sectors in the global market. It includes additional sectors due to the larger number of companies in the analysis.

The analysis shows that globally, some companies in emissions-intensive, transition-vulnerable sectors could increase profitability over the 2020–2050 period, such as the best performers in iron and steel, aluminum, and cement. These companies are already transition-ready, with lower emissions intensities than their competitors. In other sectors, like coal mining, there are smaller differences across companies. Canadian companies are slightly ahead of the global average in mining and aluminum, but at or below the global average in other sectors.

It is also important to recognize that the composition of global companies will not remain the same. Companies will adjust over time, and new companies will emerge. A similar stress-testing analysis in ten years could look quite different.

In many ways, the shift to focusing on the transition readiness of individual companies is parallel

to the latest approaches to productivity research. These new approaches to productivity focus on improving and changing conditions at the level of individual companies, instead of at an economy-wide level. The low-carbon transition requires a similar focus on companies as the vehicle of change, whether by incubating new companies in areas with growth potential, encouraging existing companies to innovate and adapt, or shifting capital towards companies that are transition-ready (Drummond and Samson, 2020; Cusolito and Maloney, 2018).

Three impact drivers will reshape Canada's economy

To better understand how companies can compete through the global low-carbon transition, we have identified three impact drivers that will propel the decarbonization of the Canadian economy: *demand creation* in transition-opportunity sectors and companies, and *demand decline* and *carbon costs* in transition-vulnerable sectors and companies:

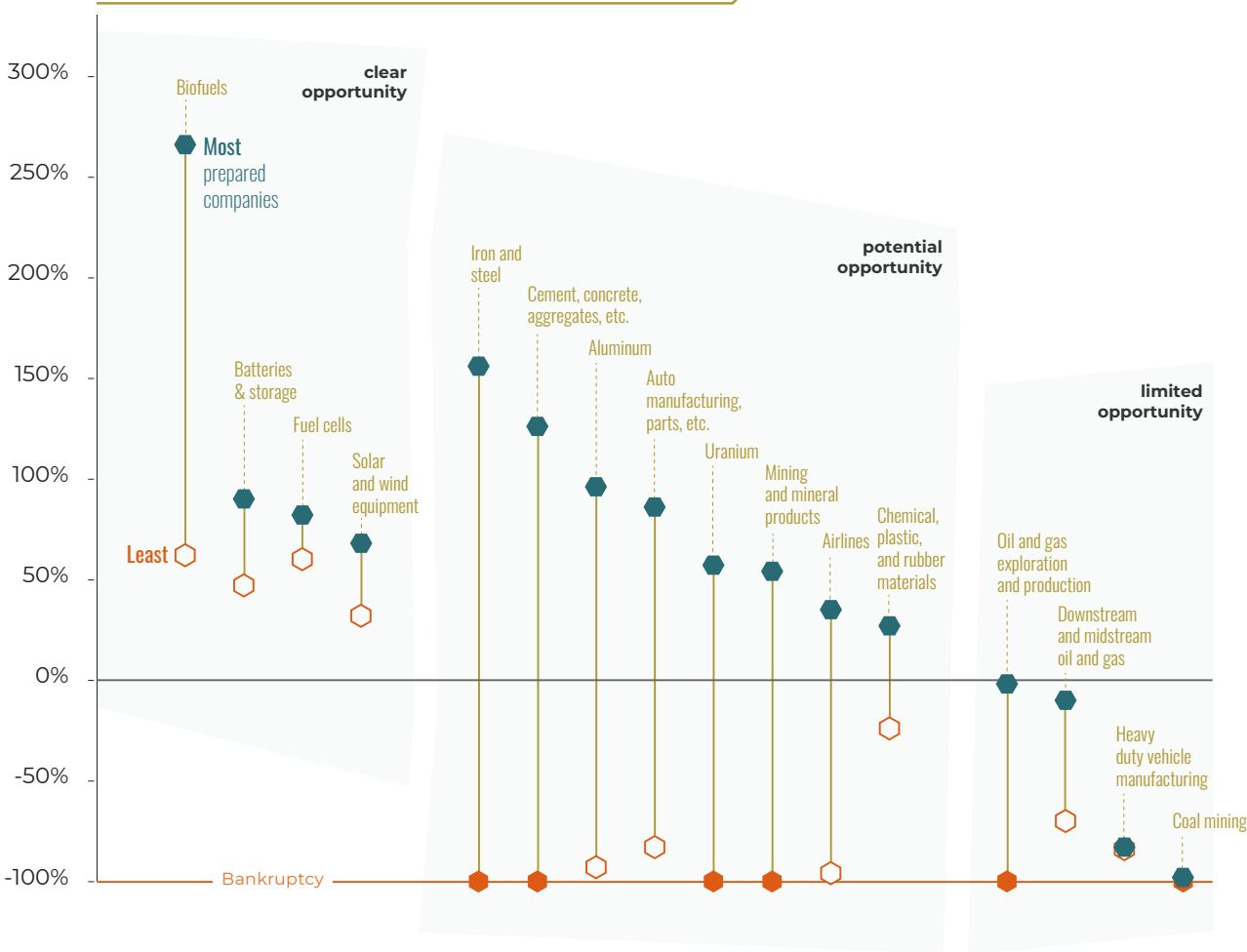
- **Demand creation:** Rising demand for transition-consistent goods and services (e.g., low-carbon energy, electric vehicles, and minerals and metals required for batteries and renewable energy) will generate opportunities for companies to increase sales and/or market share.
- **Carbon costs:** Companies will pay a higher price on their emissions as a result of carbon pricing, regulations, and/or border measures.
- **Demand decline:** Declining demand for fossil fuels and internal combustion engine vehicles will reduce the size of markets and increase competition for sales and/or market share.

In addition to these three impact drivers, the

Figure 8

Preparation for global low-carbon transition will determine whether companies sink or swim

Impact of transition on profitability in 2050



Source: Canadian Institute for Climate Choices (2021c), based on modelling and analysis commissioned from Planetrics. Notes: This figure shows the difference in profitability between the baseline scenario and the immediate 1.5-degree scenario in 2050. It compares the performance of the bottom 10 per cent of global equities in a sector (bottom node) with the performance of the top 10 per cent of global equities in a sector (top node). It illustrates that sector average results do not necessarily represent the performance of individual companies through transition.

rising cost of carbon will impel carbon-intensive companies to respond in two key ways:

- **Abatement:** Companies can take actions to reduce their emissions (e.g., fuel switching, adopting energy efficient technology).
- **Cost pass-through:** Some companies can pass on a portion of their carbon costs to consumers. The extent of cost pass-through depends on the unique market structure and responsiveness of demand to changes in price.

Figure 9 shows which impact drivers and responses dominate in each sector. To capture a broad range of sectors, it examines all publicly traded companies operating in Canada, but results are similar for Canadian companies operating in the global market (Box 4).

Using the analysis, we can divide sectors into categories based on the primary impact driver they face.

Demand creation sectors include solar and wind equipment, fuel cells, biofuels, and batteries and storage. Demand creation also drives increases

in power demand, which—in combination with carbon costs—increases the profitability of low carbon power.

Carbon costs are the main impact driver for the chemicals, aluminum, iron and steel, airlines, and cement sectors. Uranium and mining cross between demand creation and carbon costs, with both impact drivers playing a role. For some minerals and metals, there will be significant demand creation (Box 5).

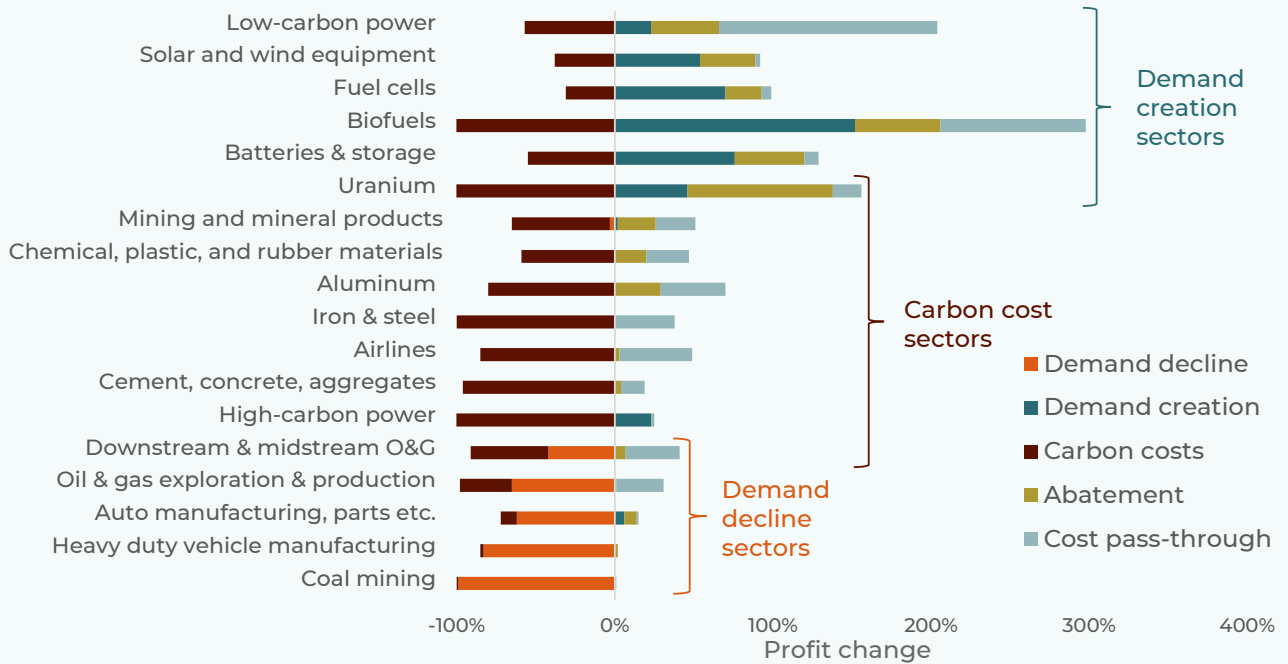
Demand decline drives changes in profitability for oil and gas, auto manufacturing and parts, heavy duty vehicles and coal mining. As the world shifts away from fossil fuels and vehicles that use fossil fuels, competition for a share of shrinking markets intensifies.

Oil producers, for example, would need to reduce production-related emissions and costs to remain competitive as global oil demand contracts. Canadian oil companies have, on average, relatively higher emissions intensities and higher breakeven costs than international competitors (Rystad, 2019).



Figure 9

Each sector faces different drivers of profit change. For some sectors, changes in market demand are more important than emissions



Source: Canadian Institute for Climate Choices (2021c), based on modelling and analysis commissioned from Planetrics. Notes: This figure breaks down the three major impact drivers and two company-level responses that determine the future profitability of companies under different low-carbon scenarios. It shows all equities operating in the Canadian market under the 1.5 degree scenario in 2050. Demand decline is the most significant factor for coal mining, heavy duty vehicle manufacturing, oil and gas, and automobiles. Carbon costs are a more important factor for biofuels, mining, chemicals, aluminum, airlines, and heavy building materials. Many of the biofuel companies included in the analysis are biofuel refiners. Biofuel refining is currently an emissions-intensive process, which results in high carbon costs. However, costs are offset by increased demand for biofuels, abatement of emissions, and cost pass-through to consumers.

BOX 4



Will carbon costs converge over time?

The stress testing analysis uses one uniform implicit carbon cost globally, consistent with stress tests done by investors and central banks. Carbon costs could be direct through carbon pricing or implicit through regulation. The carbon cost applies to all emissions across all sectors. This does not reflect the reality of the policy environment today, with partial coverage of sectors and emissions.

However, as action ramps up to achieve global emission reduction goals, the likelihood of trade measures such as border carbon tariffs or adjustments increases. By 2050 (and likely 2040), it is reasonable to assume that there will be significant pressure to increase coverage of emissions and sectors if major economies are taking action consistent with the 1.5- or 2-degree goals.

If countries exclude certain sectors or emissions from climate policy, they will need to impose greater costs on other sectors to achieve emission reduction goals. Of course, governments can implement measures to reduce carbon costs, such as recycling carbon tax revenues to businesses or financing emission-reducing investments. These measures, however, would not fully address the challenges exporters and multi-nationals face from declining demand.

Sources: Bank of England (2021); Principles for Responsible Investment (2021).

BOX 5

Mining opportunities for Canadian businesses through global low-carbon transition

The stress testing of mining and mineral products does not fully reflect risks and opportunities across different minerals and metals. Some minerals and metals will see demand growth to support battery production, low-carbon energy generation, and low-carbon construction. A report by the International Energy Agency (IEA) projected a four-to-six-fold increase in demand for mineral inputs under global low-carbon transition scenarios. The stress-testing analysis includes several transition-essential minerals and metals: uranium, aluminum, cobalt, copper, lithium, nickel, and silver.

Natural Resources Canada has, however, identified 31 minerals and metals considered critical for the sustainable economic success of Canada and its allies. Canada ranks as either a top-10 producer or in the top 10 for reserves of several minerals and metals (see table below). There is also potential in emerging minerals such as vanadium, where Canada's total reserves are unknown but could be significant. Vanadium flow batteries—an area where Canadian companies have expertise—are of interest for industrial and grid-scale applications due to their larger scale and longer life.

Canada is in the top 10 for many transition-relevant minerals and metals

	Production	Reserves
Uranium	#2	#3
Niobium*	#2	#2
Aluminum	#4	N/A
Lithium*	#4	#6
Titanium*	#4	#7
Nickel	#5	#9
Molybdenum*	#7	#10
Cobalt	#8	#5
Zinc	#8	#10
Rare earths	N/A	#9

Rankings are based on 2019 data, except those with a * which are 2018.
Sources: NRCAN (2021); USGS (2021); World Mining Data (2019); World Nuclear Association (2020, 2021).

Carbon costs will be a factor in global competitiveness. Canadian mines can build an advantage by electrifying mining vehicles and machinery with low-carbon electricity sources. Newmont Goldcorp's Borden Gold Mine near Timmins, Ontario, was Canada's first all-electric mine, opening in 2019.

Coal mining, however, is shown to face significant demand decline through transition. Despite this, there were 10 proposals to build new or expand existing metallurgical coal mines in British Columbia and Alberta in the spring of 2021. The federal government has said it will not approve thermal coal mines, but most of the proposals are metallurgical coal for steel. Whether or not these mines will have a market in 10 or 20 years largely depends on what steel producers in China, Japan, South Korea, and India do to reduce emissions. China and India account for 65 per cent of global coal demand (for power and steel), and China alone accounts for 64 per cent of metallurgical coal demand. China, Japan, and South Korea have committed to reach net zero emissions by mid-century and India is considering similar commitments. While near-term demand may be secure, new green steel-making technologies and growing pressure to shift away from coal power could lead to abrupt changes in demand toward 2030 and 2040.

Sources: IAAC (2021); IEA (2021f); NRCAN (2021); Arangio (2019); Watkins (2014); Weber (2021a); Vaughan (2020); You (2021); Gerretsen (2020); Jaiswal & Kwatra (2021); Choo (2021); Smee and Butler (2020).

Transition success also depends on getting the timing right

The two scenarios used for stress testing highlight the implications of variations in the pace and scale of the transition for different sectors. In the delayed 2-degree scenario, profit impacts in 2030 are relatively minor across sectors. In the immediate 1.5-degree scenario, however, high-carbon power, coal mining, and cement would see notable decreases in profitability by 2030 (Canadian Institute for Climate Choices, 2021c).

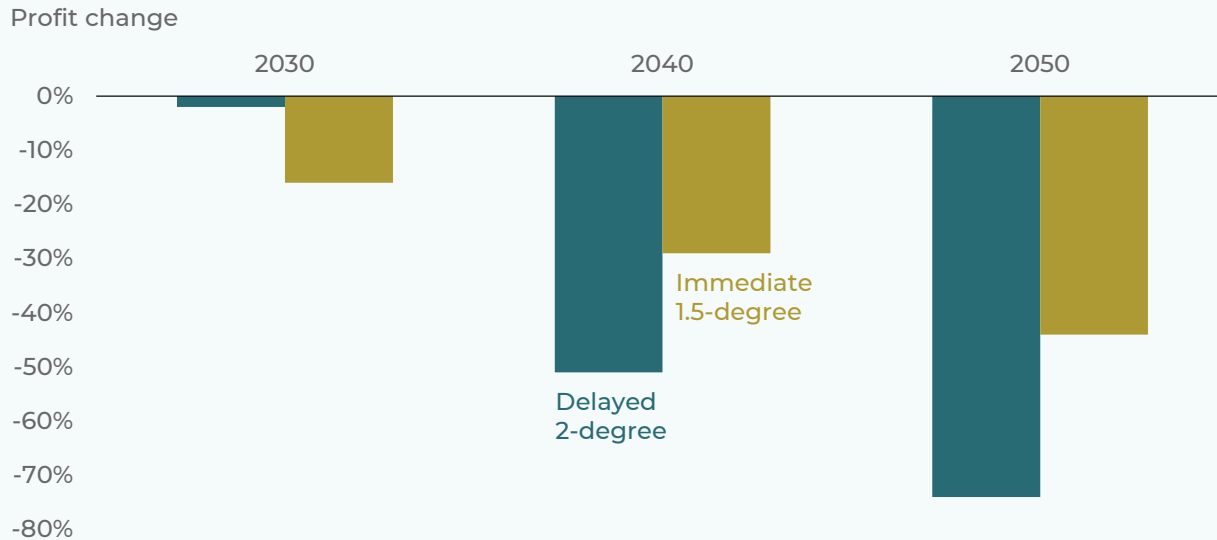
Timing also has notable implications for impacts in 2050. In the delayed scenario, the continued operation of coal plants and other emissions-intensive activities globally use up a greater proportion of the carbon budget by 2030. This means that after 2030, carbon prices need to be much

higher than in the immediate 1.5-degree scenario to hit the 2-degree goal. The delayed scenario results in reduced impacts in the near term, but much greater impacts in 2040 and 2050 for oil and gas, coal mining, and emissions-intensive industries such as chemicals (Figure 10). Another important factor in the 2-degree scenario is the limited access to carbon dioxide removal options such as planting trees (Canadian Institute for Climate Choices, 2021c).

These differing scenarios illustrate the challenges businesses face when planning for the future, particularly for those that need to make large-scale, slow-to-build investments to improve transition readiness. Companies' choices will often depend on which global scenario they believe will play out, in combination with domestic drivers. This creates risk if market changes move faster

Figure 10

For companies in the chemicals, plastics, and rubber materials sector, there are near-term benefits to delayed action but long-term costs



Source: Canadian Institute for Climate Choices (2021c), based on modelling and analysis commissioned from Planetrics. Notes: This figure shows the change in profit (weighted average market capitalization) performance for Canadian exporters and multinationals in the chemicals, plastics, and rubber materials sector between the baseline and low-carbon scenarios in 2030, 2040, and 2050. In 2030, delayed action results in minimal profit impact. However, by 2040 and 2050, the stringency of policy required to achieve the 2-degree goal (with limited carbon dioxide removal) results in greater profit impacts.

than anticipated, drying up revenues before businesses can make transition investments. Similarly, betting on the widespread availability of affordable carbon dioxide removal options in 2040 and 2050 could be a risky approach to securing long-term competitiveness.

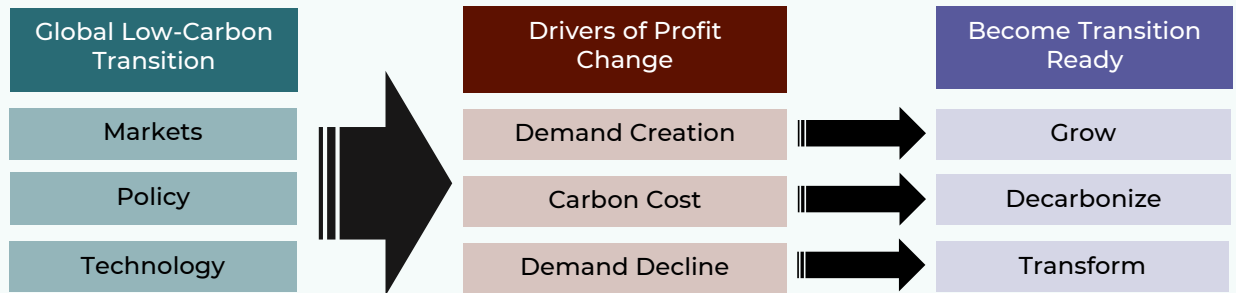
The timing question also relates to company management practices, and the relative emphasis placed on maximizing near-term profitability versus securing long-term competitiveness. While some companies can adapt quickly, those with long-lived, costly assets require long lead times to change direction.

3.2 COMPANY-LEVEL STRATEGIES TO BUILD TRANSITION READINESS

As we have noted, the modelling above is not a prediction, but rather an indicator of possible risks, absent changes in course. At a firm level, companies will have different strategies available to make those adjustments, based on their strengths and expectations about market change. The best strategies will consider the main impact driver affecting the sector or product (Figure 11).

Figure 11

The global low-carbon transition will affect Canadian companies differently, requiring different strategies



For companies that expect demand creation for their products, the primary objective should be to *grow* sales and capture export opportunities. Firms facing high carbon costs, but steady or growing demand, will need to *decarbonize* to compete in markets seeking low-carbon goods. And companies facing demand decline will need to *transform* into new business lines.

Companies most affected by demand creation need to grow to compete

For sectors where demand creation is the main impact driver, the challenge will be to grow more Canadian companies able to compete in global markets, and for currently active companies to scale and expand.

Canada has relatively few publicly traded companies operating in international markets expected to see demand growth through the transition. The analysis includes 20 companies in the low-carbon power sector, but only five in each of batteries and storage and solar and wind equipment. Results for biofuel and fuel cell companies were not included in Figure 7, as there are fewer than three Canadian companies in each category.

Publicly traded companies do not, however, tell the whole story regarding growth potential. Section 4 provides an analysis highlighting hundreds of smaller private Canadian companies with technologies and products that will be in high demand through the transition, and that could be publicly traded in the future.

Growing the number of internationally active companies in demand-creation sectors requires creating an attractive investment environment in Canada. While favourable taxation, enabling infrastructure, and a skilled workforce are important factors, climate policies are critical to attracting investment in demand-creation sectors. Ambitious and predictable carbon prices, regulations, and procurement policies drive greater technology adoption and create a better business case for opportunity investment (Shivakumar et al., 2019). For large capital investments that take many years to see a financial return, a lack of long-term policy and market certainty increases risk. Moving early could help companies gain a foothold in markets but could also lead to losses if growth is slower than anticipated or demand shifts towards an alternative technology.



Companies most affected by carbon costs need to decarbonize to compete

For companies for whom carbon costs are the main impact driver, reducing emissions intensity will be the most important factor in maintaining or gaining market share through the transition. Many of the investments needed involve high capital costs and technologies not yet proven at commercial scale. Table 1 provides some examples of the types of technologies that companies could pursue. While the focus will be on reducing emissions, there may also be opportunities in shifting or expanding the product mix these companies offer.

For iron and steel, for example, companies could shift towards greater use of recycled material; invest in carbon capture, utilization, and storage (CCUS); and/or shift away from coal to low-carbon hydrogen. Swedish company H2 Green Steel is building a plant that will produce zero emission steel using green hydrogen. The first phase of the project is estimated to require 2.5 billion euros in financing (C\$3.7 billion) (Frangoul, 2021). Canadian company Algoma Steel is aiming to become Canada's greenest flat-rolled steel producer, making a substantial investment in low-carbon electric-arc steelmaking with support from the federal government (Shrestha, 2021).

Table 1

Carbon cost sectors have multiple options to build transition readiness, but they require significant investment

	Options for emissions reduction	Options to shift product mix
High-carbon power	Carbon capture and storage, hydrogen blending (where cost-competitive)	Shift to low-carbon power (wind, solar, hydro, nuclear, geothermal, tidal, etc.)
Cement, concrete, aggregates	Material efficiency, clinker substitution, carbon capture, utilization, and storage (CCUS), new chemistries	Material efficiency technologies, CO ₂ , sequestering in concrete
Iron and steel	Energy/material efficiency, steel from recycled scrap, CCUS, iron ore reduction by electrolysis, hydrogen reducing agent and fuel, biomass to replace coal, electrification for furnaces/boilers	Recycling, material efficiency technologies, green steel technologies
Airlines	Bio/synthetic liquid for long-haul flights, electric short-haul flights	N/A
Aluminum	Energy/material efficiency, low-carbon electricity, and bauxite electrolysis	Recycling, material efficiency technologies
Chemicals, plastic and rubber materials	Recycled plastic feedstocks, low-carbon hydrogen, electrically heated steam crackers, CCUS	Alternative uses of chemicals (e.g., methanol or ammonia for shipping), biochemicals, bioplastics
Mining and mineral products	Electrification, improved extraction efficiency, alternative smelting methods	Shift to minerals and metals projected to see demand growth, recycling technologies

Sources: BASF (2021), Bataille et al. (2018), CSPA (2021), Dietz et al. (2021), Clean Energy Canada (2021), Tullo (2019). Note: The cells coloured in teal show less feasible options to build transition readiness. For example, it will be difficult for high-carbon power with carbon capture and storage to compete with the declining costs of renewable energy and storage options over time. The global IEA net zero scenarios show a small increase in coal and natural gas power generation with CCUS to 2040, followed by a decline to 2050 (IEA, 2021d). While most of the companies in these sectors will focus on emissions reductions, they could also pursue shifts or expansion of product lines suggested in the second column.

Asset managers are starting to compare the transition readiness of multinational companies based on emissions intensity. Box 6 provides an example of emissions intensity benchmarking for the aluminum sector developed by the Transition Pathways Initiative.

It can be challenging to convince investors to make the multibillion-dollar investments in technologies that have not been widely applied

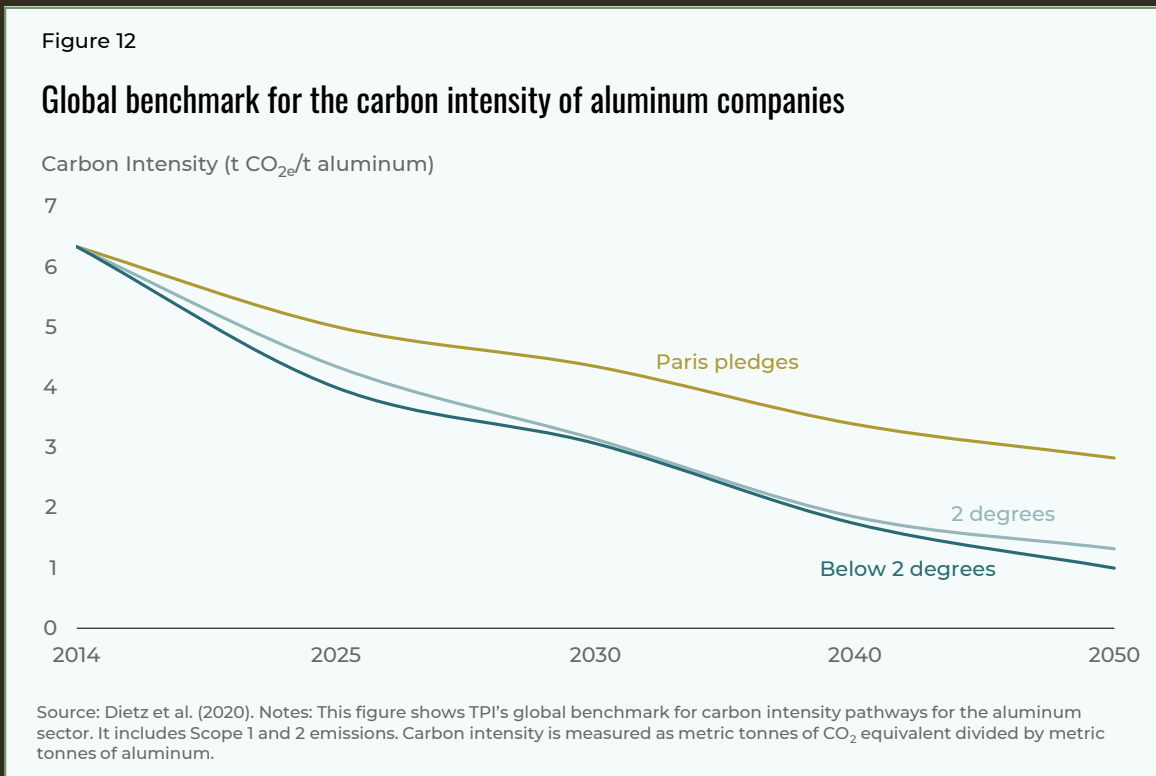
at commercial scale. Even within large multinational companies, convincing headquarters that investments in Canada will pay off can be difficult, particularly when the timing of market change is uncertain. Moving too early could mean absorbing costs not faced by competitors, while moving too late could mean losing market share to lower-carbon alternatives.

BOX 6



Benchmarking aluminum sector emissions intensity

The asset owner-led Transition Pathway Initiative (TPI) developed emissions intensity benchmarks for various sectors based on different global transition scenarios. The figure below shows the benchmark for the aluminum sector, with declining emissions intensities over time linked to global scenarios.



TPI assesses Rio Tinto and Alcoa, companies that are both active in Canada, as some of the best performing companies on both carbon intensity and climate change management. Rio Tinto's 2019 emissions intensity—including operational and electricity emissions—of 5.44 tonnes of CO₂ equivalent (tCO_{2e}) per tonne of aluminum is consistent with low-carbon transition pathways, and it has set a target to reach net zero emissions by 2050. Alcoa's 2019 intensity (6.48) is slightly above the transition benchmark, but it has set targets that put it on track by 2025. These intensities are well below some companies, such as Australia's South 32 (16.21), but above Norway's Norsk Hydro (3.11). The carbon intensity of local electricity generation can be a major factor in Scope 2 carbon costs. Jurisdictions with low-carbon electricity generation—such as Quebec—will therefore be more attractive for aluminum sector investment.

Many decarbonization investments also depend on the development of other sectors. Shifting to hydrogen or biofuels, for example, requires reliable supply chains. The business case for electrification may depend on affordable supplies of clean electricity, either from a centralized grid or off-grid with energy storage. The question is which investments come first—clean energy production that faces uncertain industry demand or industrial technology investments that face uncertain clean energy supply.

Companies most affected by demand decline need to transform to compete

Companies facing demand decline can either compete for a share of shrinking global markets or transform business lines to shift into new markets. In reality, most companies will likely pursue some mix of both strategies initially but move toward transformation over time (Table 2).

Some auto manufacturers, for example, might maintain heavy-duty pickup truck production for some models while shifting car manufacturing to electric vehicles (Voelcker, 2021). Eventually,

all new vehicles will need to produce zero emissions. General Motors has announced plans to invest US\$27 billion in its shift to all-electric vehicle production by 2035 (Wayland, 2020). Ford and GM have announced partnerships with Asian battery manufacturers to secure supplies and gain a foothold in a lucrative piece of the automotive sector of the future (Friedman, 2021).

Oil and gas companies can reduce emissions intensity in the near term, while investing in longer-term transformation. Demand may decline faster for oil than for natural gas, with gas trajectories highly variable across low-carbon scenarios (NGFS, 2021b; IEA, 2021d; Wood Mackenzie, 2021). To transform, companies could shift their product mix towards transition-consistent products such as low-carbon hydrogen, biofuels, carbon capture technology, or geothermal technology. Canadian oil and gas company Suncor plans to reduce emissions in oil sands operations while growing its renewable fuels, electricity, and hydrogen businesses (Suncor, 2021).

Table 2

Demand decline sectors have options to reduce emissions, but need greater emphasis on shifting their product mix

	Options for emissions reduction	Options to shift product mix
Coal mining	Electrification, improved extraction efficiency	Minerals and metals that see demand creation through the transition
Heavy duty vehicle manufacturing	Bio/synthetic liquid fuel replacement	Low-carbon vehicle manufacturing (e.g., hydrogen or electric)
Oil and gas exploration and production	Energy efficiency, electrification, small modular nuclear, CCUS, solvents for steam-assisted gravity drainage, molten carbonate fuel cells, fugitive emission tech	Blue hydrogen, biofuels, geothermal electricity, and other renewables. Non-combustion uses for bitumen (Table 3)
Auto manufacturing, parts, etc.	Energy and operational efficiency, low-carbon electricity and heat, lighter low-carbon materials	Electric or hydrogen vehicle manufacturing, parts and maintenance, mobility as a service
Downstream and midstream oil and gas	Reduce methane leaks, biofuel or hydrogen mixing, CCUS	Hydrogen, renewable natural gas, bio and synthetic fuels, electric vehicle charging infrastructure

Sources: Bataille (2021), Bataille et al. (2021), Dietz et al. (2021), Clean Energy Canada (2021a), COSIA (2021), Tullo (2019). Note: This table illustrates different options available to companies in demand decline sectors to build transition readiness. The dark teal cells show the least favourable strategy. Light teal cells show strategies that may be feasible in the short term or under certain conditions. For example, an electrified coal mine will still face significant demand decline through the transition.

Oil sands facilities have the potential to increase revenue from each barrel of oil by co-producing non-combusted bitumen products such as asphalt binder, carbon fibres, activated carbon, and polymers, as well as minerals and metals such as lithium, vanadium, nickel, and titanium (see Table 3). The added revenue could reduce break-even costs and improve resilience to lower oil prices. Various market, technical, cost, and environmental challenges will need to be overcome, however. Asphalt binder and activated carbon appear to have greater practical potential in the near term (ADI Analytics, 2021). Relying entirely on these bitumen-beyond-combustion products for future oil company competitiveness would be risky.

The key challenge for demand-decline companies is getting the timing right. Moving too quickly into new business lines, before markets

are well established or technologies are proven at scale, could reduce profitability. Moving too slowly, however, could leave companies in a situation where revenues decline before they have made sufficient investment in transformation. In sectors where investments are capital intensive and long-lived, the stakes are even higher. Getting the timing wrong could result in significant profit loss and potential stranded assets.

While auto manufacturers may have a more clearly defined (but still potentially volatile) path to new business lines focused on electric vehicles and batteries, the transformation of oil and gas companies is less obvious. There are opportunities in hydrogen, biofuels, carbon capture and storage technology, geothermal technology, and more, but there is no one-size-fits-all pathway.

Table 3

Bitumen beyond combustion can increase the value of a barrel, but needs to overcome cost, emission, and technological challenges

Product	Opportunity	Challenge
Asphalt binder	Growing global market for road construction, potentially superior quality product.	Emissions-intensive and expensive transport. New technologies could turn asphalt binder into transportable pellets.
Carbon fibre	Growing market for strong, non-corrosive, low-cost building or manufacturing materials that can be produced from “bottom of the barrel” asphaltenes.	Uncertainty in market demand and cost-competitiveness relative to alternatives. Less emissions-intensive than combustion, but not zero emission. Potential to integrate with steel, concrete, wood, plastics, textiles.
Activated carbon	Various market opportunities including hydrogen storage, solvent recovery, and water/air purification.	Technology is in early stages of development, but AdvEn Industries is constructing a 300-tonne-per-year demonstration plant.
Polymers	Potential to use bitumen to develop compostable and biodegradable plastics.	Significant barriers to capturing market share in competitive market.
Vanadium, lithium, titanium	Minerals in substantial quantities in bitumen, wastewater.	Technical and cost barriers.

Sources: Alberta Innovates (2021); ADI Analytics (2021); Stantec Consulting Ltd. (2018); Shell (2018); Titanium Corporation (2021); E3 Metals Corp. (2021). Note: The table above describes some of the opportunities for increasing the value of oil sands production through bitumen-beyond-combustion products. For each opportunity, there is a challenge to commercial viability. Significant innovation is required to realize these opportunities.

3.3 POLICY IMPLICATIONS

While the strategies of individual companies matter, Section 2 highlights how the aggregate performance of companies has much larger implications for exports, foreign direct investment, and government tax revenues. These economic and fiscal implications are particularly relevant for certain provinces and territories.

With so much at stake, governments play a critical role in helping the private sector navigate—and succeed through—the global low-carbon transition. In particular, government policy can focus on

addressing barriers to implementing the strategies identified in Section 3.2.

We identified four major policy challenges holding back progress:

- 1. Uncertainty regarding timing and technology choices:** Section 2 shows that in some areas, like wind, solar, and electric passenger vehicles, market signals are strong and increasing. In other areas, however, there is uncertainty about exactly when markets will change or which technology direction they will go. The pace and direction of China’s emission reduction efforts, for example, will play a major role

in market demand for fossil fuels, and there is not yet a clear pathway in each economic sector (Liu et al., 2021). Technologies are also still in flux in a number of sectors, such as hard-to-abate industries that could switch to hydrogen or biomass or electrification, or rely on carbon capture and storage (Pooler, 2021). The outcome may end up being a mix of all those choices, with companies choosing the most suitable technology for each region and facility. Scenario analysis helps, but investors are reluctant to move without clear market direction. Governments can play a role in improving demand certainty and de-risking investment.

- 2. Insufficient market information:** Investors and potential buyers attempting to make decisions based on the transition readiness of a company do not have the necessary information to make informed choices. For example, investors might choose to avoid iron and steel companies based on the perceived transition risk associated with the sector. This could leave a world-leading producer of low-carbon steel facing challenges in obtaining private investment. Similarly, an oil and gas company actively moving into renewable energy and biofuels could struggle to obtain investment for a transformative project with high export potential. Investors need a way to make decisions based on company performance rather than sector averages. Governments can help improve market clarity through stronger reporting requirements and providing regulatory oversight.
- 3. Weak incentives in industrial carbon pricing:** Carbon pricing systems are designed to maintain near-term competitiveness in emissions-intensive, trade-exposed sectors by reducing the average costs that companies face while maintaining a marginal incen-

tive to reduce emissions. A Climate Choices assessment of Canada's federal and provincial carbon pricing systems found that large emitters faced low and extremely variable average costs in 2020, ranging from \$1.80/tonne of CO_{2e} in Nova Scotia to \$25.60/tonne in British Columbia. Combined with uncertainty regarding the consistency of carbon pricing across jurisdictions, a higher carbon price alone is unlikely to drive the capital-intensive investments required to improve transition readiness (Canadian Institute for Climate Choices, 2021a). Governments could improve investment incentives by adjusting the performance standards that apply to large industrial emitters to raise average costs and by providing greater long-term certainty on their future trajectory.

- 4. Financial and tax support for demand-decline sectors:** Various federal and provincial spending programs and tax incentives support metallurgical coal mining, oil, and gas production, liquified natural gas production, natural gas power, and fossil fuel vehicle manufacturing (OECD, 2019; Government of Canada, 2021; Corkal et al., 2021). These supports weaken market signals that would otherwise encourage greater investment in transformation. Governments could improve market signals by reducing supports for fossil fuel extraction and use.

One of the challenges that governments need to overcome is a status quo bias. People prefer things to stay the same, even when faced with information that would lead a rational person to make a change (Behavioral Economics, 2021). When there is uncertainty, status quo bias is even more prevalent (Ortoleva, 2010).

As companies and investors wrestle with the implications of the global low-carbon transition,

there will be a strong temptation to find ways to maintain the status quo. Most climate-related discussions of competitiveness, for example, focus on the risk of carbon leakage—where investment and production move to jurisdictions with weaker climate policy (Murillo, 2019).

However, the stress-testing analysis in this section shows that there are significant future competitiveness risks for companies that do not act in the near term to improve their transition readiness, particularly those in transition-vulnerable sectors. These risks have historically been absent from debates on climate action.

There may also be a strong temptation to take a cautious, go-slow approach to building transition readiness. However, if the global transition accel-

erates faster than expected, revenues and investment could dry up before companies have made the investments needed. In some provinces, the resulting reduction in tax and royalty revenue could make it more challenging to publicly finance transition projects at that point. There is therefore a strong case for government involvement at an earlier stage to improve economic resilience to global market change.

Canadian companies that move slowly also risk missing out on market opportunities as foreign companies gain early advantages. Section 4 analyzes the main areas of growth potential in Canada, and some of the challenges that are holding companies back.



UNCOVERING CANADA'S HIDDEN POTENTIAL

4

Canada has hundreds of smaller, private businesses active in areas poised for growth through the transition. If these emerging companies can attract the investment they need to commercialize and scale, they could be serious contenders in global markets. Fully realizing Canada's growth potential could offset export, investment, and job losses experienced in transition-vulnerable sectors.

Canadian companies active in clean energy and technology markets face several barriers that are hindering growth, however. Attracting the large-scale financing needed to commercialize, scale, and compete globally is challenging, particularly for earlier-stage technologies and markets. Canadian investors have historically favoured established companies and markets, and delayed investment increases the risk that promising Canadian companies will be acquired by foreign companies or move to larger markets.

Clean technology adoption rates have also remained stubbornly low in Canada, constraining domestic demand, which can be crucial for helping companies grow quickly. The biggest barrier is that of early-stage, commercial-scale adoption of capital-intensive technologies. Such

commercial-scale projects offer some of the greatest economic and societal benefits, starting a cycle of increased demand for technology development, lower technology costs, and easier emission reductions.

Coordination across sectors and companies is also currently lacking. Greater collaboration across emerging companies, incumbent companies, and financial institutions could generate mutually beneficial progress.

4.1 ASSESSING CANADIAN GROWTH OPPORTUNITIES

Transition's growth potential is often hidden in analyses that focus on large companies or model major sectors of Canada's current economy. Many of the companies with high potential for growth, however, are not publicly traded. They are also not just in one sector. They are spread across the economy. Assessing the potential of these emerging companies requires analyzing both past performance and future opportunities, looking at investment trends, future demand scenarios, and market dynamics that could influence competitiveness.

This section provides a summary assessment. For additional detail on the analysis in each opportunity category, see the “transition-opportunity snapshots” available on our website. (The methodology for this analysis is available upon request.)

Canada has hundreds of transition-opportunity companies attracting investment

To analyze investment trends, we used private market data from PitchBook Data Inc. on financial transactions to identify Canadian companies that are active and successfully attracting investment in areas relevant to the low-carbon transition. We then slotted companies

into nine distinct opportunity sectors to chart annual investment in each sector and develop trend lines (Table 4). For global comparison, we used the same categorization for international companies and constructed global investment trend lines.

We found that Canada has hundreds of private and public companies producing technologies, software, products, and services expected to see growing demand through the low-carbon transition. Overall, investment and deals across the nine transition-opportunity sectors we identified are trending steadily upwards (Figure 13).

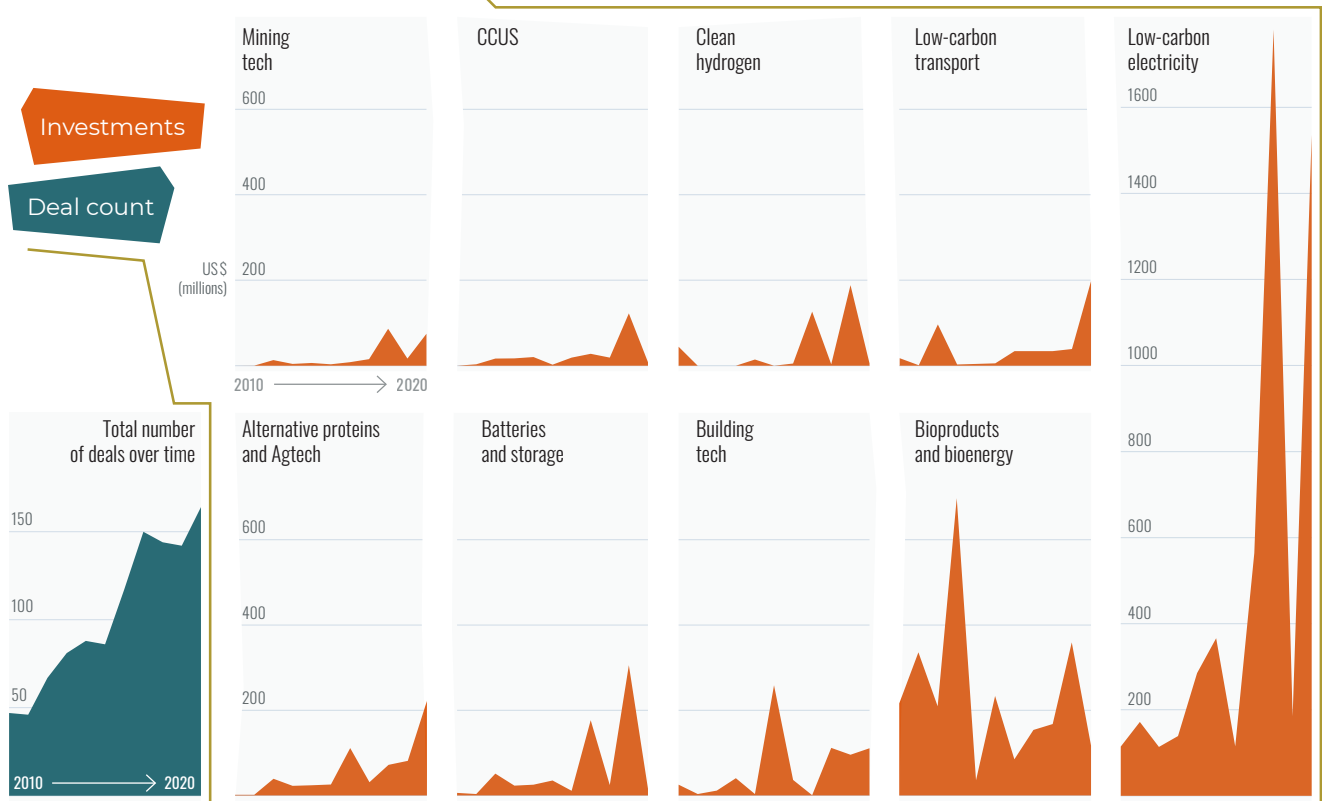
Table 4

There are a wide range of products, technologies, and services included in opportunity sectors

Opportunity sector	Examples of products, technologies, and services
Low-carbon electricity	Wind, solar, tidal, geothermal, and nuclear generation, distribution, and associated technology or software, such as smart grid technologies
Batteries and storage	Vehicle and grid-scale batteries and thermal, mechanical, or pumped hydro storage, as well as lithium battery recycling
Low-carbon transport	Electric cars, buses, trucks, bikes, boats, and snowmobiles; charging infrastructure and car/ride/ bike/scooter sharing and related technology
Building tech	Sustainable building materials, software, and technology to reduce building energy use
Carbon Capture, Utilization, and Storage	Technologies that capture CO ₂ emissions from industrial facilities, biomass combustion, or the atmosphere, and use or store these emissions permanently
Clean hydrogen and technology	Blue hydrogen produced from natural gas with CCUS, green hydrogen produced by electrolysis from clean electricity, fuel cells, and associated technologies
Mining tech	Technologies or processes that improve the environmental performance of mining, including extraction of minerals and metals from tailings, recycling, underground mining, and electric or efficient mining vehicles/equipment
Alternative proteins, ag tech	Alternative proteins from insects, plants, and lab-grown meat/seafood, sustainable fertilizers/ pesticides, and technology and software that reduce fertilizer and/or energy use
Bioproducts and bioenergy	Biofuels, biodiesel, biogas, biochemicals, biochar, bioplastics, synthetic renewable fuels, sustainable feedstocks, and related technologies

Figure 13

Investment in Canada’s transition-opportunity sectors is trending upwards, but some companies and sectors still struggle to attract financing



Source: Analysis by the Canadian Institute for Climate Choices using data from PitchBook (2021). Notes: This figure shows the total capital invested across nine transition-opportunity sectors in US dollars and the number of completed business deals (i.e., investment transactions). Values include private equity, venture capital, corporate and strategic mergers and acquisitions, initial public offerings (IPOs) and liquidity, and debt. The analysis captures businesses that are primarily focused on the relevant technologies, products, and services in each sector. More detailed analysis on each opportunity is available at <https://climatechoices.ca/reports/sink-or-swim>. Data is drawn from a custom search and has not been reviewed by PitchBook Analysts.



Of course, not all forms of investment are equal. Companies at different stages of development require different types of capital, ranging from early-stage angel investing through to venture capital financing and later-stage project capital. Large investments in renewable energy projects, for example, overshadow a lack of financing for technology developers looking to commercialize and scale.

Low-carbon transition scenarios show substantial market opportunities

To assess market growth potential, we analyzed low-carbon transition scenarios to 2050 under each product category, drawing on a range of data sources. For global demand, we relied on the same scenarios used for the incumbent analysis (Section 3) wherever possible.

For domestic demand, we mainly used the analysis undertaken for the Institute's February 2021

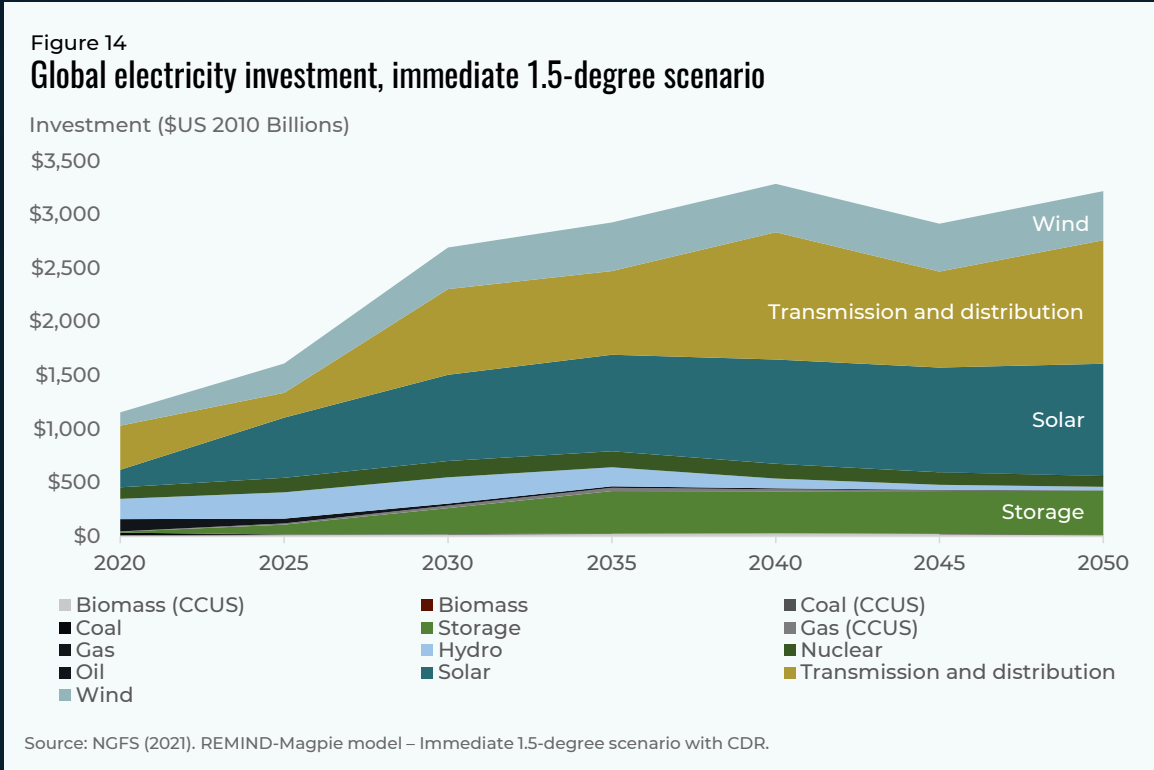
report on pathways to achieving Canada's 2050 net zero target, *Canada's Net Zero Future*. We also used shorter-term forecasts of compound annual growth rates as a complementary indicator of market demand growth, or in cases where a product was not adequately captured in transition scenarios.

The global low-carbon transition scenarios show massive market growth potential across the nine transition-opportunity sectors where Canadian companies are active. For example, low-carbon electricity investment, including renewables, energy storage, and transmission infrastructure, is projected to grow three- or four-fold by 2050 (Box 7). By then, almost all passenger vehicles, and between 25 and 45 per cent of total transportation-sector energy use, will be electric (NGFS, 2021b). Between 65 and 75 per cent of building energy demand will also come from electricity (NGFS, 2021b; IEA, 2021d).

BOX 7

Global electricity investment accelerates through the low-carbon transition

All global scenarios for the low-carbon transition show dramatic increases in investment in wind and solar power, energy storage, and infrastructure for electricity transmission and distribution as countries endeavour to reduce electricity emissions and electrify transport, buildings, and industry. The amount and mix of investment and technology varies by scenario, but there is no doubt that market opportunities relating to electricity technologies, products, and services will be significantly greater than today.



The type of energy used will also change dramatically. Global hydrogen production could increase substantially, providing between 3 and 24 per cent of final energy demand by 2050 (NGFS, 2021b; IEA, 2021d; Dezem, 2020). Solid, liquid, and gaseous bioenergy supply could be three times larger than today (IEA, 2021d). There will still be some continued use of traditional fossil fuels, and demand for carbon capture and storage could be between 40 and 80 times larger in 2050 than in 2020, with applications including blue hydrogen, cement, and iron and steel production as well as biofuel refining (NGFS, 2020).

Global markets for agriculture technology and alternative proteins are also likely to grow as population growth, changing climate, changing consumer preferences, and emissions and environmental goals collide (Ranganathan et al., 2018).

The low-carbon transition will need more minerals and metals, with some global scenarios showing a four- to six-fold increase in revenues from transition-related minerals by 2050 (IEA, 2021f). As countries seek to expand mining while addressing emissions and other environmental challenges, demand for mining technologies could grow.

The Canadian market would see increases in electricity demand under scenarios where Canada achieves its 2050 net zero target (Canadian Institute for Climate Choices, 2021b). While over 80 per cent of Canada's electricity already comes from clean sources, a push toward electrification will create significant growth opportunity in low-carbon electricity, energy storage, and smart grid technologies. Canada's natural-resource-based economy could also mean greater relative demand for CCUS, hydrogen, and mining and agricultural technology than in other industrialized countries.

Canadian companies can succeed in multiple global markets

The ability of Canadian companies to gain market share will also depend on their position relative to competitors, and whether they have a cost or technological advantage. To assess market dynamics, we analyzed each of the nine transition-opportunity sectors, considering the potential for leading Canadian companies to capture global market share.

Some markets, such as batteries for electric vehicles, are dominated by large foreign companies with deep pockets, and will be highly competitive (Palandrani, 2020). But opportunities are emerging in sub-market areas such as vehicle battery recycling, charging stations, and related technology (Market Research Future, 2021). Similarly, while big-name manufacturers dominate solar photovoltaic and wind manufacturing, there are emerging opportunities in grid-scale energy storage and smart-grid technology and software (Business Wire, 2021).

In fact, Canadian companies are leaders in many areas. They dominate mining technology and are at the forefront of carbon capture and storage and direct air capture technology development (PitchBook Data Inc., 2021). Canada also has leading companies in fuel cell technology and potential in low-carbon hydrogen. Canada is one of the world's largest suppliers of plant-based proteins such as lentils, chickpeas, peas, and beans (NRCC, 2019).

In many cases, the biggest opportunities for Canadian export growth are in sub-markets or niche areas where Canadian companies are early global leaders. Canada's proximity and connection to the United States, which is poised to see substantial market growth across all nine areas, is an important advantage.

4. UNCOVERING CANADA'S HIDDEN POTENTIAL

While it may be tempting to prioritize specific technologies or markets from the nine categories, our analysis shows that individual companies are likely greater determinants of growth than any specific technology or product (Box 8).

Canadian companies can succeed as small fish in a big pond and as big fish in a small pond—opportunities abound both domestically and internationally. Even with a niche product, a Canadian company that can export to global markets could see significant growth. Quebec-based Taiga Motors, for example, raised \$80 million and became publicly traded on the TSX in 2021. It has developed a line of electric snowmobiles and watercraft. This might seem niche, until one realizes that the global powersports market is expected to exceed US\$ 12 billion by 2027 and

that there are already 1.7 million registered snowmobiles in Canada and the United States alone (Fortune Business Insight, 2021; ISMA, 2021).

Some indicators of growth potential are more certain than others

While all indicators point to future growth across the nine transition-opportunity sectors, there is still uncertainty in the specific ways that markets will evolve. Table 5 highlights some of the areas of uncertainty, drawing on the investment, scenario, and market analysis undertaken for each opportunity sector. Boxes shaded in light teal indicate limited certainty on the timing and magnitude of growth potential.

In some cases, investment trends are strongly positive, while in others they are relatively flat.

BOX 8

Identifying companies with high-growth potential

Researchers and investors use various metrics to identify companies with high growth potential. Government organizations and researchers are more likely to assess companies' job-creation potential, as jobs produce significant societal benefits. An OECD-Eurostat paper defined high-growth companies as those with more than 10 employees that grow their workforce by more than 20 per cent per year over three consecutive years. The U.S. Bureau of Labor Statistics includes companies with fewer than 10 employees that grow by eight or more employees over a three-year period.



Job growth does not tell the whole story, however. Venture capital investors focus on issues such as market size, company leadership, team dynamics, and sales revenue growth. They also look at how much it costs the company to generate an additional dollar of revenue, potential rates of return given market size and growth, and the amount of investment needed to realize a return. If a company is attracting significant investment from a range of private investors, it likely has high growth potential.

Sources: Liu (2016); Côté and Rosa (2017); Crichton (2014).

Table 5

Emerging Canadian companies in transition-opportunity sectors have strong growth potential, but uncertainties remain

	Global			Canada		
	Investment trends	Demand in low-carbon scenarios	Market dynamics	Investment trends	Demand in low-carbon scenarios	Market dynamics
	10-year investment and deal trend	Demand outlook across global scenarios	Space for new entrants, niche players	10-year investment and deal trend	Demand outlook across net zero scenarios	Canadian advantage, notable firms
Low-carbon electricity	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty
Batteries and storage	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty
Low-carbon transport	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty
Building tech	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty
Carbon capture, utilization, and storage	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty
Clean hydrogen and technology	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty
Mining tech	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty
Alternative proteins, ag tech	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty
Bioproducts and bioenergy	Opportunity positive, limited certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, significant certainty	Opportunity positive, limited certainty	Opportunity positive, significant certainty

	Opportunity positive, significant certainty
	Opportunity positive, limited certainty

4. UNCOVERING CANADA'S HIDDEN POTENTIAL

For certain technologies, all global low-carbon transition scenarios show strong increases in investment. For others, there are substantial differences across scenarios.

Uncertainty is greater in sectors where the magnitude and direction of trends are not yet clear. In bioproducts and bioenergy, for example, global investment trends are shaded light teal. Our analysis shows that investment trends have been relatively flat over the past decade. This indicates that the growth trajectory is still unclear.

Demand for clean hydrogen and fuel cell technologies shows opportunity, but the size of market growth differs across low-carbon transition scenarios. Ultimate market size will depend on which technologies win out in certain markets or applications, like long-haul trucking.

In low-carbon electricity, there are many players in the market—including some very large companies—and it is difficult to know if there will be significant space for smaller Canadian players to grow. In grid-scale energy storage, however, Canadian companies are attracting significant investment.

In the agriculture sector, more analysis is needed to fully understand transition risks and opportunities (Box 9). For example, the analysis in section 3 did not capture beef producers that are not publicly traded, and the analysis in this section does not capture other important risks such as the changing climate and constraints on land use.

Ultimately, the ability to capture market share will depend on multiple factors, including the entrepreneurial capacity of individual companies, their ability to attract investment, and the evolution of policy, markets, and technology.



BOX 9

Further analysis is needed on the risks and opportunities in agriculture

Canada's agriculture sector faces intersecting impacts from the global low-carbon transition, the physical impacts of a changing climate, and population growth. Food production—including land use change and supply chains—accounts for around one quarter of global emissions. By 2050, global food systems will need to provide 70 per cent more calories than in 2015 due to projected population growth.

At the same time, the changing climate will affect agricultural productivity in many regions. Growing demand, combined with increased water stress, pests, storms, and other challenges will impact food affordability and availability. While Canada will experience challenges associated with a warming climate, productivity impacts will be less severe in aggregate than in arid and semi-arid regions.

Simultaneously meeting growing global food demand while reducing domestic emissions requires significant innovation. Most Canadian agriculture greenhouse gas emissions come from fertilizer use in crop production and methane emissions from farm animals. The stress test analysis in Section 3 only included publicly traded companies, which does not capture cattle producers. If a broader range of agriculture companies were stress tested, agriculture could be considered a transition-critical sector. Other global analyses have highlighted agricultural transition risks in relation to restrictions on converting forested land and carbon costs associated with high-emission products such as beef. Fertilizers could also be a focus of border carbon adjustments (see Box 1).

Our analysis of emergent opportunity sectors shows that there is significant room for Canadian companies to support agricultural innovation that would reduce transition risks. Canadian companies are producing alternative proteins, such as pulse crops, insect-based proteins, and lab-grown meat that could help reduce consumption of emissions-intensive beef. They are also developing bio-based fertilizer alternatives, and precision-agriculture software that can reduce energy and fertilizer use. In addition, farmers will have transition opportunities in supplying biomass feedstocks, biogas production, regenerative agriculture, and land-based CO₂ sequestration.

Sources: Ritchie (2019); Goedde et al. (2015); Mbow and Rosenzweig (2019); AAFC (2020); Venugopal et al. (2020); Simon (2021).

4.2 POLICY IMPLICATIONS

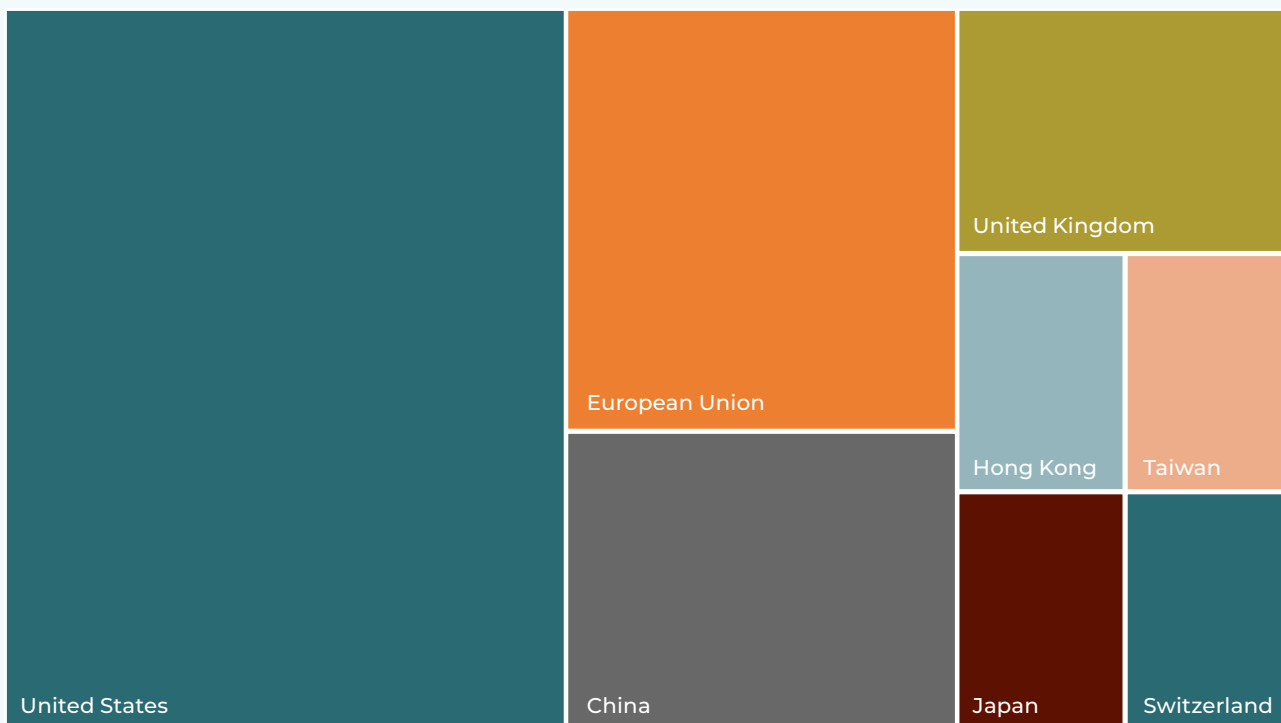
While emerging Canadian businesses have opportunities, they also face major challenges. Canada's transition success hinges on businesses' ability to capture new market opportunities. Yet commercializing and scaling new technologies in Canada is difficult, and global markets will be fiercely competitive. Without government policy intervention, there is a risk that promising Canadian companies will struggle to get the financing they need to be a source of growth in Canada.

Canadian investors are under-financing emerging companies because of perceived and real risks

International investors and incumbents have been more active in large commercialization-stage investments and in acquisition than Canadian investors (Figure 15). Of 185 companies involved in mergers and acquisitions or buyout transactions with Canadian cleantech companies between 2015 and 2020, 114 were headquartered outside of Canada (PitchBook Data Inc., 2021). While foreign direct investment is positive and desirable, it increases the risk of jobs and

Figure 15

U.S. and E.U. companies are some of the most prominent acquirers of Canadian cleantech companies



Source: Analysis by the Canadian Institute for Climate Choices using data from PitchBook Data Inc., (2021). Note: This figure shows the headquarters location of cleantech foreign acquisitions and buyouts of Canadian cleantech companies between 2015 and 2020. There were a total of 23 foreign acquisitions or buyouts of Canadian cleantech companies between 2015 and 2020. The figure shows the regional share based on the headquarters location of the purchasing company. Data is drawn from a custom search and has not been reviewed by PitchBook Analysts.

investment moving out of the country. The U.S. market is a major draw due to its size and more risk-tolerant investor culture (GEDl, 2020).

Canada has large investors and incumbents capable of providing the financing that emerging companies need. The two largest low-carbon investors (by number of companies in their active portfolio) have been Caisse de dépôt et placement du Québec and Brookfield Asset Management (PitchBook Data Inc., 2021). They have, however, tended to support established renewable energy, electric transport, or low-carbon building projects rather than emerging companies (CDPQ, 2020; Brookfield, 2021).

A number of public institutions, including Sustainable Development Technology Canada and Emission Reductions Alberta, support

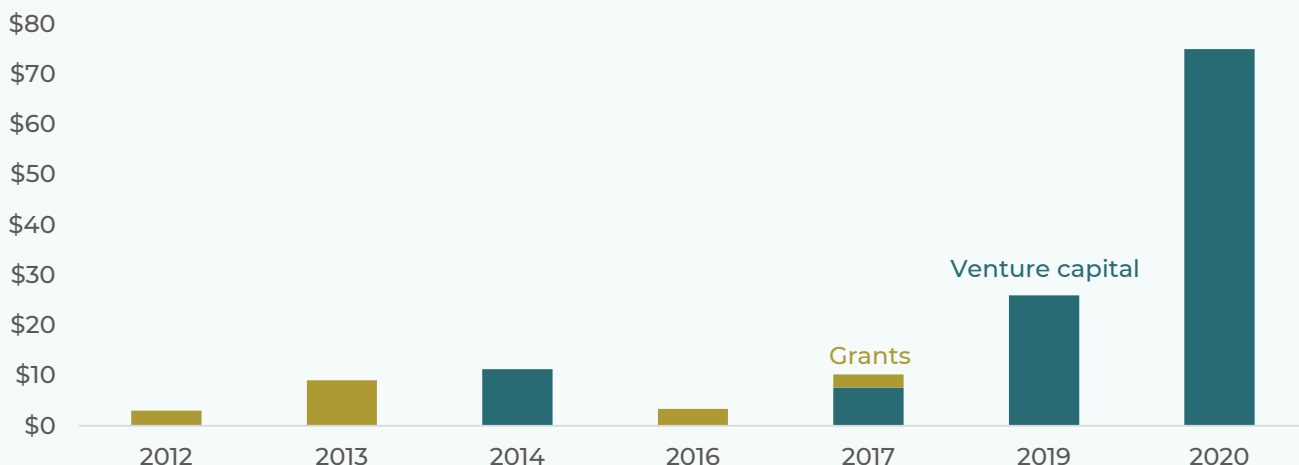
early-stage technology development, but do not provide the scale of investment needed to commercialize and grow companies to compete internationally (PitchBook Data Inc., 2021). For example, Figure 16 provides an example of deals made in a Canadian clean technology company, with public grants in early stages leading to larger-scale private venture capital investment.

Private investors such as large banks, pension funds, venture capitalists, and incumbent companies are critical to moving earlier-stage emerging companies to the next level of growth. Investors have, however, been reluctant to finance emerging companies because of both real and perceived risks. Clean technologies and energy products often require more upfront capital, and take longer to realize returns (WGCTIJ, 2016).

Figure 16

Cleantech companies are often supported by public grants in early stages, followed by private venture capital

Funding (US\$Millions)



Source: Analysis by the Canadian Institute for Climate Choices using data from PitchBook Data, Inc. (2021). Notes: This figure shows an example deal history from an unnamed Canadian cleantech company (in \$US). While a number of public institutions provide early-stage support to companies (e.g., Sustainable Development Technology Canada), a smaller number provide support at later stages of business development (e.g., Business Development Canada). Data is drawn from a custom search and has not been reviewed by PitchBook Analysts.

And, as with incumbents, policy, market, and technology uncertainty increases investment risk.

Governments can help de-risk these investments through a variety of policy tools, including grants for commercial-scale demonstration projects, loans and loan guarantees, contracts for difference (that guarantee a fixed carbon price), and targeted procurement (UNDP, 2020; Sartor and Bataille, 2019; USDOE, 2021; Clean Energy Canada, 2021b).

Technology adoption rates are too low to capture broader, public benefits

Domestic clean technology adoption rates remain low, despite increases in carbon pricing and regulatory policy (Figure 17). There are four main barriers to clean technology adoption: (1) long capital stock turnover timelines; (2) technical feasibility, knowledge, and skill; (3) high

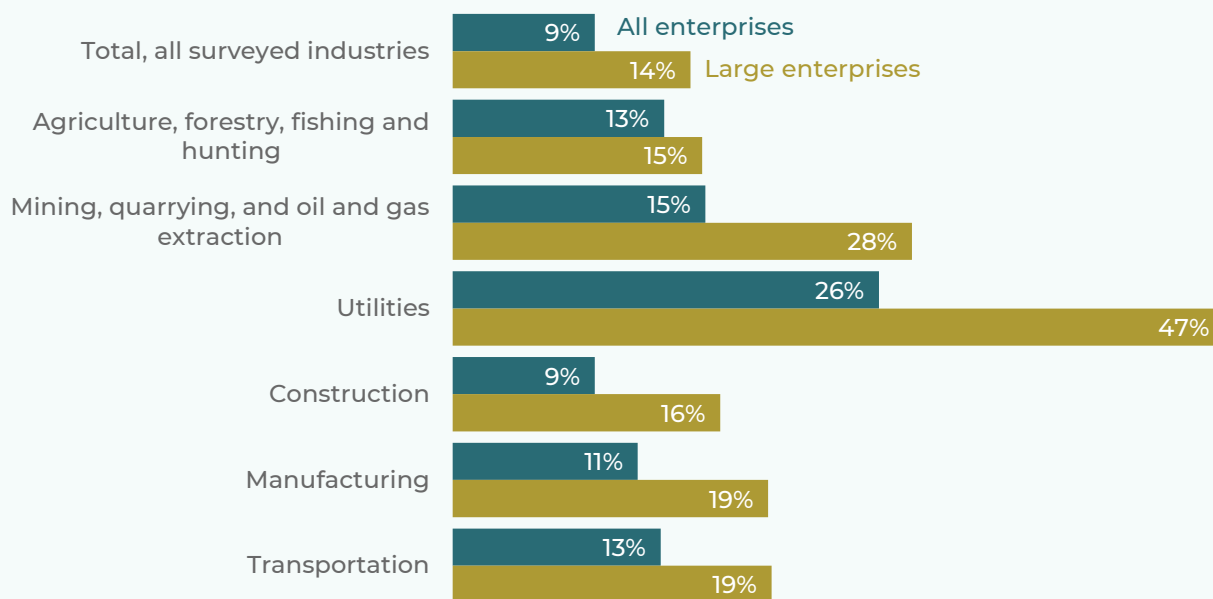
costs and uncertain returns; and (4) government policy uncertainty (Canadian Institute for Climate Choices, 2020).

For cost-competitive clean technologies with well-established markets (such as wind and solar power), there are fewer barriers to adoption. However, for technologies that have not yet been proven at commercial scale, and markets that are at an early stage, there are substantial barriers (ISED, 2018). If investors lack knowledge about the technology and its future market potential, securing financing can prove difficult.

There can, however, be significant broader economic advantages to early domestic technology adoption. First-of-their-kind, commercial-scale adoption can help to de-risk a given technology for investors and other customers, including those outside Canada. This facilitates

Figure 17

Clean technology adoption rates in Canada remain low



Source: Statistics Canada (2021f). Notes: This figure draws from Statistics Canada's Survey of Innovation and Business Strategy, 2019. It shows the percentage of businesses surveyed that are using clean technologies by sector for all enterprises, and for large enterprises with more than 250 employees. While large utilities have relatively high rates of clean technology use at 47 percent, the total across all surveyed industries remains low at 9 per cent. In the 2017 survey, total clean technology use was 10 percent.

greater adoption, which benefits both the technology developer and the adopter. As adoption rates increase, there are “learning-by-doing” benefits that lead to declining technology costs and increased feasibility (Elshurafa, 2018).

Adoption rates drive an important feedback loop (also termed a “green spiral” or “green vortex”) in which the resulting learning drives down technology costs and increases feasibility, which in turn further increases adoption rates and makes more ambitious climate policy politically feasible (Meyer, 2021a). The indirect and long-term climate and economic benefits of accelerating early commercial-scale adoption can therefore be much greater than those directly associated with specific projects or sales.

Government policy can help capture these broader public benefits by encouraging early-stage adoption. This can be done by co-financing first-of-their-kind projects, providing financial incentives to early adopters, or allocating additional funding to government procurement programs targeted at early-stage technologies and products. Skills development policies and educational programming can also help improve the knowledge and awareness of technologies and market opportunities.

A lack of coordination and collaboration means missed economic and societal opportunities

Clean energy and technology companies need financing and adoption. Industry needs to decarbonize and transform. And the financial sector needs to reduce transition risks associated with investment and lending portfolios. There is significant scope for mutually beneficial coordination and collaboration among these sectors that would carry significant public benefit.

For example, regional industry clusters could be established to pool demand for clean hydrogen supplies, generating a viable business case for investment in new hydrogen production infrastructure and accelerating industry transition. The growing number of successful energy storage companies in Canada could also support electrification of remote mines, leading to growth opportunities, transition readiness, and better environmental outcomes (LeadIt, 2021). Leading biofuel companies, partnering with airlines and oil and gas companies, could help develop bio-aviation fuel business lines (ICAO, 2021). Banks and pension funds could help finance these collaborative initiatives and generate significant returns as markets grow.

Companies, on their own, are not well positioned to consider the broader economic and societal benefits of coordinated action. Governments are best placed to establish platforms for collaboration that can yield these benefits. Several initiatives have partly addressed the issue, but most are not strategically oriented towards generating future transition-ready economic growth opportunities (Government of Alberta, 2021b; Finance Canada, 2021a). Investissement Québec (2021a) is one exception, with a mandate to drive new sources of low-carbon growth and exports while helping industry decarbonize.

There are also some examples of incumbent partnerships with clean technology companies. For example, auto parts company Linamar formed a strategic alliance with Ballard, aimed at co-developing fuel cell powertrains and components for class 1 and 2 vehicles, such as utility vans, minivans, and pickup trucks. They are targeting international markets from the outset, initially in North America and Europe (Ballard, 2021). The federal commitment to a 50 per cent

4. UNCOVERING CANADA'S HIDDEN POTENTIAL

lower corporate and small-business income tax rate for businesses that manufacture zero-emission technologies was likely a factor in the alliance (Finance Canada, 2021b).

Governments can help drive greater collaboration by identifying areas of opportunity and bringing together the relevant players. They can also provide financial incentives that encourage greater collaboration through the design of policies and programs. For example, the United Kingdom provided funding to a consortium of companies in the Humber region seeking to

establish a zero-emission industry cluster with shared carbon capture and storage and hydrogen infrastructure (Zero Carbon Humber, 2021).

In fact, local governments and communities could be innovative sources of ideas for collaborative hubs and projects. Section 5 shows that there are many regions across Canada that could benefit from expanded transition-consistent economic activity.



EMPOWERING PEOPLE AND COMMUNITIES

5

The implications of global transition go beyond company competitiveness and economic growth. Even if Canada's economy continues to grow through transition, some people and communities could experience significant upheaval and disruption. Job losses in transition-vulnerable sectors will have direct impacts on the health and well-being of workers and their families and could affect the economic and social vitality of entire communities. In some cases, market forces alone will be unable to address these complex and deep-rooted challenges. The global transition will be felt locally.

Addressing these distributional impacts is critical to a successful and smooth transition in Canada. But achieving success is also about more than supporting affected workers in transition-vulnerable companies or sectors. Success will come from generating strong and inclusive economic growth that improves the well-being of *all* Canadians—a broader notion of success consistent with the U.N. Sustainable Development Goals and Climate Choices' own [definition of clean growth](#).

It is not possible to prepare Canada for the low-carbon transition without also addressing longstanding injustices and inequities already holding people back from reaching their full potential, including systemic racism, colonialism, regional disparities, and income inequality. Without deliberate efforts to address these inequities, economic shocks can exacerbate existing vulnerabilities. Some communities will face multiple climate-related shocks over the coming decades due to both the low-carbon transition and the physical impacts of a changing climate.

A successful transition will leverage new opportunities to empower the people and communities who have not benefited from past economic growth while, at the same time, preventing losses for those that have. It will also ensure that youth and future generations are positioned to capture economic opportunities and jobs.

While this section highlights significant challenges for Canada's labour force, every challenge is also an opportunity to build a more inclusive and prosperous future.

5.1 HIGH STAKES FOR PEOPLE

Hundreds of thousands of people in Canada work in companies that will experience market disruption due to the global low-carbon transition. Companies that fail to navigate the transition successfully could face contraction or even bankruptcy, leaving many workers jobless.

New opportunities will emerge and will offset some of these job losses. However, regional and skills mismatches may lead to a bumpy transition for some people. It could be particularly bumpy for those who already face discrimination and other barriers to employment, including Indigenous Peoples and visible minorities. Youth and future generations, along with the least skilled, would bear the brunt of an unsuccessful transition.

Transition readiness matters to workers in vulnerable sectors

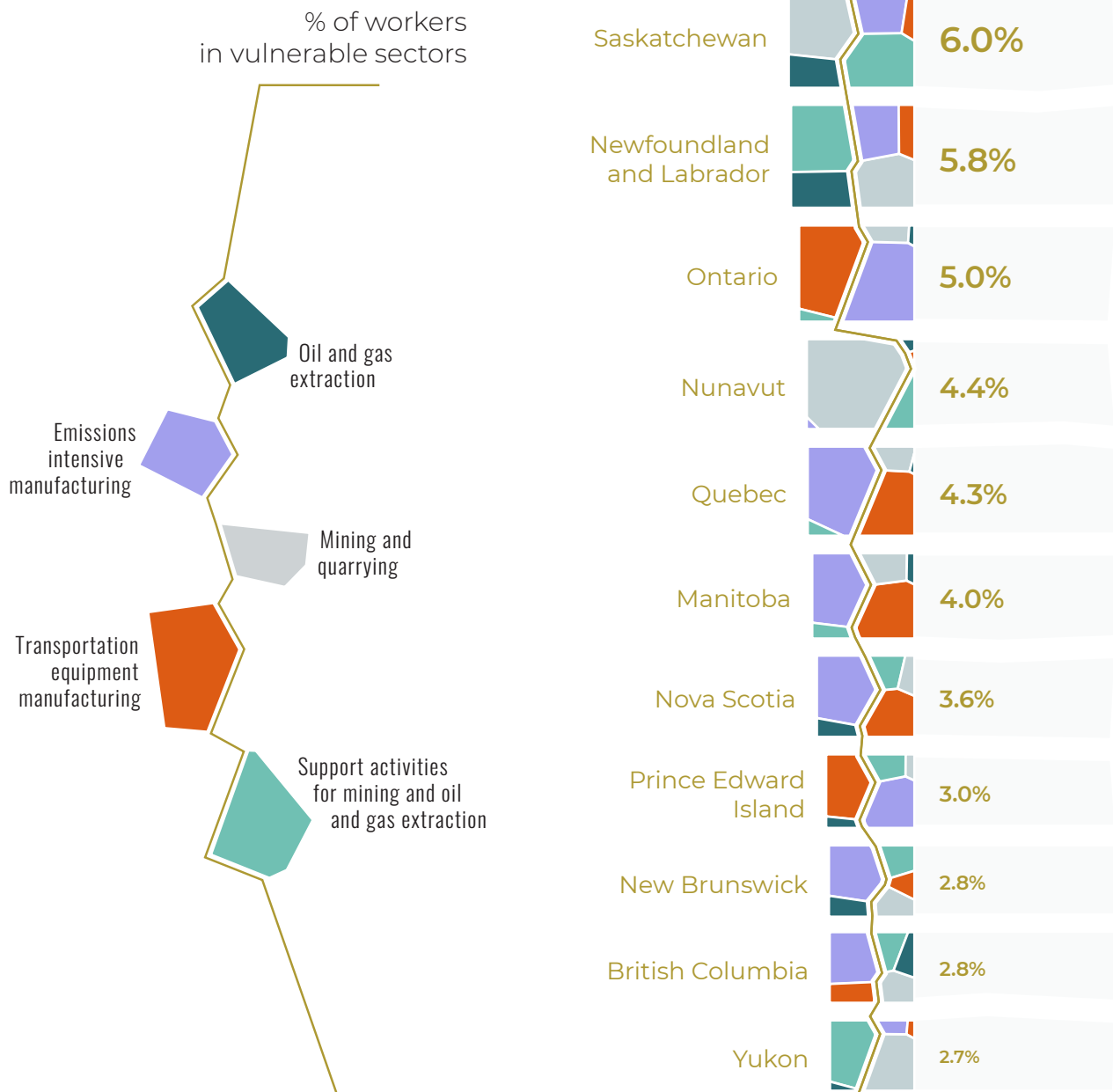
Section 3 identified several sectors where Canadian companies are not yet transition ready or face significant barriers to decarbonization. Companies in these sectors need to make transformational investments—while remaining competitive in the near term—to reduce the risk of profit loss and capture global market opportunities.

Figure 18 shows that every province and territory has workers in transition-vulnerable sectors, with some regions particularly exposed. Two thirds of all jobs in the oil and gas sector, for example, are located in Alberta, employing nearly eight per cent of the province's workforce (Statistics

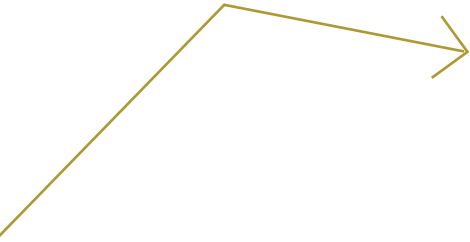


Figure 18

There are workers in transition-vulnerable sectors in every province and territory



Source: Analysis by the Canadian Institute for Climate Choices (2021) based on data from Statistics Canada (2016a). Notes: This figure shows the share of the workforce directly employed in transition-vulnerable sectors by province and territory. The size of each square represents the share of workers in transition-vulnerable sectors relative to each province and territory's total workforce. The size of polygons within each square illustrates the share of workers within individual sectors. Emissions-intensive manufacturing includes NAICS codes 324, 325, 326, 327 and 331.



“Today is an historic day. Today is about a vision... It’s about saying to young people that we have a plan for jobs not just for today, but more importantly for tomorrow.”

*Jerry Dias, Unifor National President,
following the October 2020 announcement of
battery electric vehicle production in Oakville, Ontario.*

Source: Unifor (2020)

Canada, 2016a). By contrast, the Northwest Territories has the highest proportion of workers in mining (diamonds). Saskatchewan has a mix of oil and gas and mining employment, in both transition-vulnerable sectors such as coal and transition-opportunity sectors such as uranium. Ontario, Quebec, and Manitoba have higher proportions of employment in transition-vulnerable manufacturing sectors such as auto manufacturing and parts, as well as chemical, plastics, and rubber manufacturing.

With such high levels of employment in transition-vulnerable sectors, the success of Canadian company actions is a high-stakes issue for workers across Canada. Even successful companies might cut back on employment as they try to reduce production costs or invest in new business lines. Growth in opportunity sectors will help offset some of these job losses, but it will not always be in the same region or require similar skills.

Ultimately, the extent to which companies in these provinces can build transition readiness and capture emerging opportunities will determine the number and types of jobs available in the future.

The global transition could be extremely disruptive to Canadian workers if companies are not prepared

Much of Canada’s experience with the low-carbon transition so far relates to the phase-out of coal-fired power plants. In response to climate and air pollution policies, coal plants are being closed across the country. Following Canada’s 2018 announcement of the phase-out of coal-fired power by 2030, the federal government launched a Just Transition Task Force to advise on appropriate support mechanisms for affected workers and communities. They recommended measures such as a pension bridging program, extended employment insurance, funding for skills retraining, and the establishment of local transition centres to operate as a hub for transition-related supports (Government of Canada, 2019).

Unlike many other transition-vulnerable sectors, coal power is heavily regulated and mainly supplies the domestic market. Advance notice has generally allowed for a planned, gradual transition that is smoother for workers and communities. The 2019 federal budget included a \$150 million infrastructure fund to support priority projects and economic diversification in impacted

communities (PPCA, 2021). The Canada Coal Transition Initiative is also supporting economic development and training (WED Canada, 2020).

Transition-vulnerable companies that operate in global markets, such as oil, gas, steel, aluminum, and coal mining, may not have such long lead times. An ambitious new climate policy in the U.S., or a sudden shift in commodity prices, could result in immediate layoffs. This makes planning for workers more difficult. The scale of the challenge is also quite different. Around 2,000 workers have been affected by coal power closures, whereas over 880,000 people work in the transition-vulnerable sectors identified in Figure 18.

Workers in transition-vulnerable sectors are starting to recognize the high stakes. A growing number of unions are pushing for company investments in transformation, decarbonization, and growth opportunities (Singh and Hopton, 2021). Transition will be smoother for workers at companies that adapt and adjust by decarbonizing and transforming to meet new market realities. Where there is job loss, outcomes will be better in regions where there are other sources of job growth, and workers are provided with the training they need to make the switch (CCPA, 2021).

Companies may not always have strong enough incentives to adapt and protect workers, however. As explored in earlier sections of this report, the uncertainty in the scale and timing of the global low-carbon transition can discourage firms from making significant investments to help shift their operations and workforce. In addition, large or multinational companies often have weaker connections and relationships to communities than the workers and families who live there. Shutting down or relocating may be easier for companies than for the people they employ.

Job loss intersects with barriers facing Indigenous Peoples and visible minorities

While job loss can be challenging for anyone, it will be more challenging for those facing discrimination in hiring practices. Indigenous Peoples and visible minorities face greater barriers to employment than white Canadians.

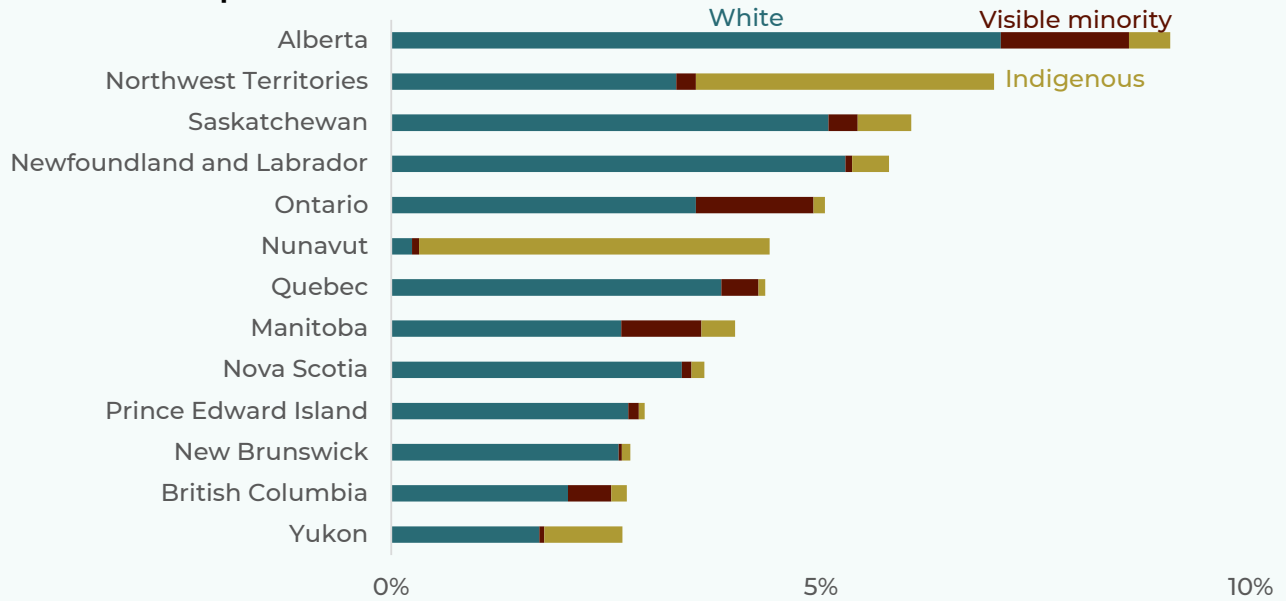
Census data from 2016 suggests that Indigenous Peoples and visible minorities in some provinces and territories could see disproportionate employment risks from global transition (Figure 19). In Manitoba, for example, visible minorities are overrepresented in transition-vulnerable sectors relative to their share of the population

“The process of colonization established the reserve system which fundamentally isolated Indigenous peoples from the territories and created economic isolation and displacement. The Indian Act removed Indigenous inherent sense of responsibility for place – replacing it with externalized structures and establishing the conditions of the marginalization of Indigenous peoples. Indigenous Peoples cannot remain on the margins of the transition to a low-carbon and climate-resilient economy.”

Carol Anne Hilton, CEO and Founder of the Indigenomics Institute, “Indigenomics: Our eyes on the land”

Figure 19

Indigenous Peoples and visible minorities are over-represented in transition-vulnerable sectors in some provinces and territories



Source: Analysis by the Canadian Institute for Climate Choices based on data from Statistics Canada (2016a, 2016b). Notes: This figure shows the percentage of employment, by ethnicity, in the same sectors identified in Figure 18. In many provinces and territories, Indigenous Peoples and/or visible minorities are over-represented in transition-vulnerable sectors relative to their population.

(23 per cent vs. 18 per cent). Indigenous Peoples in the territories and PEI are likewise overrepresented. In Nunavut, for example, 93 per cent of transition-vulnerable workers are Indigenous, though they represent only 71 per cent of the overall workforce (Statistics Canada, 2016a).

The national rate of Indigenous employment in the agriculture, natural resource, and utility sectors is higher than the non-Indigenous population (six per cent vs. four per cent). The difference is even greater for male workers, with 10 per cent of Indigenous males employed in resource sectors compared to 6 per cent of non-Indigenous males (Statistics Canada, 2021g). In some provinces and territories, the relative proportions are even higher.

Barriers to employment for Indigenous Peoples could be particularly problematic in the transition. Racism and discrimination are major compli-

cating factors, stemming from a long history of marginalization and colonialism. Poverty, lack of housing, and related stresses can themselves become significant barriers to employment. Remote communities face several practical barriers as well, such as a lack of transportation, child-care, internet connectivity, and employment, education, and training opportunities (ICT Inc., 2019; OAG 2018; Cybera, 2020). Indigenous unemployment rates have consistently been almost twice as high as the Canadian average, and Indigenous workers may be reluctant to move away from their traditional lands and culture to find new employment (Statistics Canada, 2021h).

At the same time, however, Indigenous Peoples represent a growing proportion of the country's economy and workforce. Indigenous Peoples are around nine years younger, on average, than the non-Indigenous population. By 2036, Indigenous

people could make up 83 per cent of labour force growth in the three territories and 73 per cent and 52 per cent of labour force growth in Saskatchewan and Manitoba, respectively, if the Indigenous labour force participation rate draws equal to the non-Indigenous rate (Drummond et al., 2017).

Visible minorities also face barriers to employment relating to racism and discrimination that could make economic transition more difficult. Challenges may be even greater for Black, Arab, and West Asian Canadians (See Box 10).

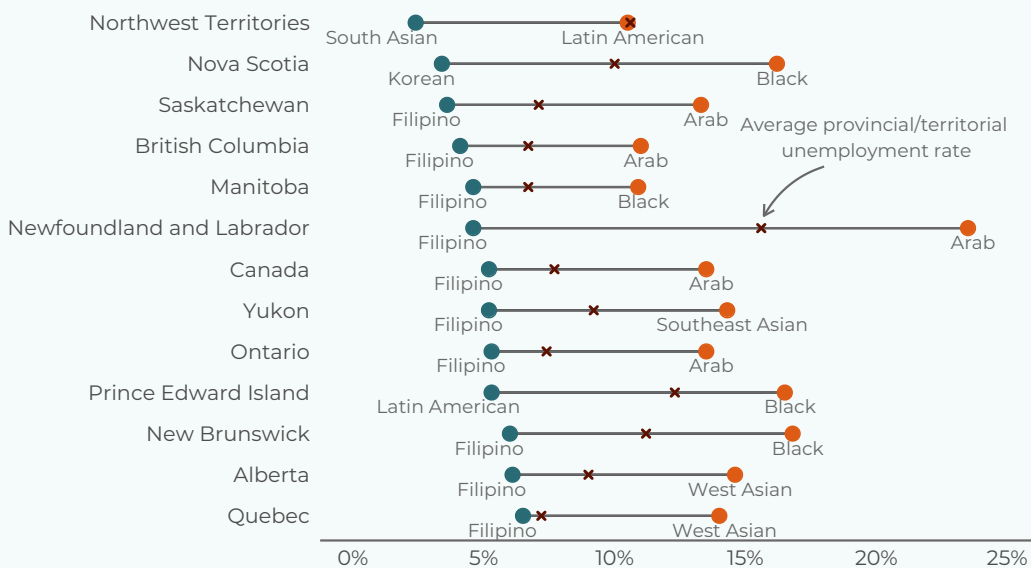


Unemployment is unevenly distributed

Unemployment data suggests that some ethnicities may face greater barriers to employment than others. The figure below identifies the ethnicities with the highest and lowest unemployment rates for each province and territory. Black, Arab, and West Asian ethnicities consistently have higher rates of unemployment, except in the Yukon and Northwest Territories where Canadians of Southeast Asian descent are the most unemployed.

Figure 20

Certain visible minorities already struggle with high unemployment rates



Source: Statistics Canada (2016c). Notes: This figure shows the highest and lowest unemployment rates by ethnicity and province/territory from 2016. The Northwest Territories' high average unemployment rate is due to high levels of unemployment among visible minorities that are outside of the analysis.

The reasons behind these differences are complex and multifaceted, but discrimination in hiring and promotion practices likely plays a role. Research indicates that some employers are less likely to hire women with head coverings (worn by nearly half of all Muslim women in Canada), which might help explain why the unemployment rate for Muslim women is more than double that of white women. Immigrants also face additional barriers with language, culture, access to networks, and lack of recognition of foreign credentials. A study from Ontario showed that 50 per cent of women with engineering degrees from outside of Canada were unemployed.

Sources: Ng and Gagnon (2020), Carmichael (2017), Neuman (2016), Woo (2021).

Education and skills are the foundation of resilience to market shifts

Education levels and unemployment rates are strongly connected. Workers without a high school or post-secondary education are far more likely to be unemployed and more likely to lose their job in a recession (Figure 21). The combined forces of the global low-carbon transition, digitization, and automation will increase the importance of education in Canada (Conference Board, 2020). A 2020 study forecasts that automation alone could eliminate 30 per cent of jobs in the oil and gas sector by 2040—a trend already well underway (Mortlock, 2020; Hussey, 2020).

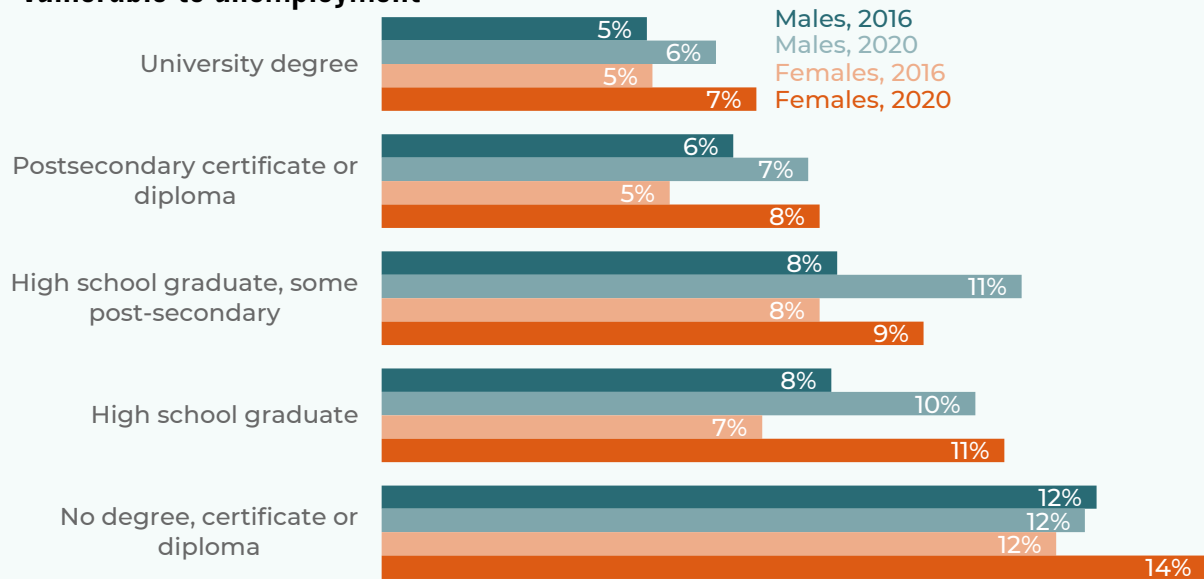
The people most likely to face future hardship and poverty are those without a high school or post-secondary education. Research shows that the biggest obstacle to further progress is improving rates of high school completion and getting youth into a post-secondary program (Chatoor et al., 2020). The percentage of Canadians without a high school diploma declined between 2005 and 2018 but then stayed steady at around 8 per cent into 2020. This rate varies across provinces and territories, from 6 per cent in British Columbia to 37 per cent in Nunavut and 16 per cent in the Northwest Territories (Statistics Canada, 2021j).

A 2021 study by Statistics Canada and the Assembly of First Nations highlighted gaps in high school completion among First Nations people in Canada. The percentage of off-reserve First Nations youth with a high school diploma increased from 53 to 68 per cent between 2006 and 2016, and the percentage of on-reserve First Nations youth with a high school diploma increased from 32 to 41 per cent. Both, however, remain far below the 88 per cent of non-Indigenous people who have a high school diploma (Statistics Canada, 2021k). And with a rapidly growing First Nations population in Canada, the number of young people with lower levels of education is increasing. Box 11 explores some of the complex reasons behind these lower education outcomes among Indigenous Peoples, including the deeply damaging legacy of residential schools.

All youth with parents who did not complete post-secondary education are less likely to complete post-secondary education themselves and are more than twice as likely to drop out of high school (Chatoor et al., 2019). Intergenerational income mobility—how much children make throughout their lives relative to their parents—has worsened over time in Canada, in large part due to the persistence of this linkage between parent and child educational outcomes (Connolly et al., 2021).

Figure 21

People with lower levels of education are more likely to be unemployed and are more vulnerable to unemployment



Source: Statistics Canada (2021i). Notes: This figure compares unemployment rates in 2016 and 2020 for men and women. Overall, it shows that those with lower levels of education are more likely to be unemployed and are more vulnerable to unemployment in a recession, such as the pandemic-related downturn in 2020. While previous recessions have tended to result in more layoffs for men with lower education levels, the 2020 recession had a greater impact on women in all education groups except those that had some post-secondary schooling.

BOX 11

Impacts of Residential Schools on educational outcomes

Education is critical to reducing poverty, improving health outcomes, and alleviating socioeconomic and power inequality. Yet, due to a range of longstanding systemic barriers and inequities in Canadian society—including systemic racism and discrimination—education outcomes among Indigenous Peoples in Canada lag behind non-Indigenous populations.

The historical and ongoing effects from the residential school system in Canada is perhaps the most prominent barrier affecting education outcomes among Indigenous Peoples today. For over a century, up until the 1990s, the Canadian government, in partnership with Christian churches, operated and funded a residential school system for Indigenous children with the goal of forcibly assimilating Indigenous People into Euro-Canadian society (TRC, 2012). Law and policy were used as tools to require attendance of many Indigenous children at residential schools, and also provided authority for government officials to select and remove Indigenous children from their homes for placement in residential schools.

The experiences of Indigenous children at residential schools, now well documented, were extremely traumatic due to emotional, physical and sexual abuse, neglect, and forced disconnection from families, communities and cultures (see Feir, 2015). According to a report by the former Ministry of Indian Affairs, the mortality rate in residential schools in the early 1900s was 40 to 60 per cent. Many of the children who did not survive residential schools were buried in unmarked graves, which is now receiving more attention as the remains of over one thousand children have been discovered on the grounds of former residential schools across Canada. The funding and operation of these schools, along with their associated assimilation-driven mandate, were acts of genocide against Indigenous Peoples.

The devastating impacts of residential schools spans across multiple generations, contributing to a myriad of social problems including (but not limited to) health issues and poor educational outcomes among Indigenous Peoples. These impacts, along with continued racism and other systemic barriers, have led to a deep-rooted sense of distrust among many Indigenous Peoples of government, and residential schools have had a direct impact on the way Indigenous students perceive Eurocentric education systems.

Sources: The Lancet, (2020); Feir, (2015); Reconciliation Canada (2021); Dickson and Watson 2021).

For youth to have the same or better quality of life as their parents, advances are needed in the rates of education and skills training. Yet education is broader than getting a traditional university or college degree. There are a growing number of well-paying jobs in skilled trades (Kong, 2020; Conference Board of Canada, 2020). In fact, the percentage of off-reserve Indigenous people qualified in a skilled trade is higher than among the non-Indigenous population

(Statistics Canada, 2021). There is significant potential to expand skills training relating to the adoption, installation, and maintenance of clean technologies (ECO Canada, 2021; Iron and Earth, 2021). Indigenous youth can also capture expanding opportunities as Indigenous Guardians, employed to monitor wildlife, patrol protected areas, and reduce the impacts of climate change (Indigenous Guardians Toolkit, 2021).

“Indigenous-led conservation is proven to generate sustainable prosperity. Guardians programs offer well-paying jobs that create outsized benefits in small communities—each job supporting family members and purchases in the local economy. Indigenous Protected and Conserved Areas (IPCAs) and Guardians programs also generate new business opportunities and spur investment in regional economies.”

Frank Brown, Indigenous Leadership Initiative, “Our people have borne witness to climate change through deep time: Indigenous place-based people transitioning to a low-carbon economy”

It is also not just the level of education that matters. Youth will need access to education and skills training that align with future shifts in global markets, and employers will need workers with an awareness and understanding of the implications of transition. In this sense, all post-secondary education programs—including trades, engineering, science, economics, and business—can support transition success by incorporating future skills and knowledge needs into their curricula and programming. There may also be greater need for cross-collaboration. Several clean technology studies have highlighted the need for building stronger busi-

ness and leadership skills to capture opportunities in global markets (WGCTIJ, 2016).

Ensuring youth have the skills and education to succeed in rapidly shifting global markets need not be complicated. An initiative by the Canadian Business Youth Council for Sustainable Development, for example, is pushing business schools across Canada to incorporate climate change and sustainability into their curricula, as they are currently absent or inadequate in many schools (CBYCSD, 2021). In some cases, the solution is simply to build in greater awareness and understanding of climate change, technologies, and potential market opportunities.



5.2 RISKS TO COMMUNITIES

Ensuring a smooth and inclusive low-carbon transition requires thinking not just about how individuals will navigate the transition, but also communities. Some communities are highly dependent on transition-vulnerable sectors, while others are already in great need of new employment opportunities.

The global low-carbon transition could result in job loss in vulnerable communities, as well as significant opportunities for new investment and job creation. However, many small communities lack the resources and capacity needed to plan for and manage risks and attract new businesses. As we explain in the following section, recent examples illustrate both the long-term consequences of poorly managed transitions and the benefits of getting it right.

Communities dependent on transition-vulnerable sectors face greater risks

Community dependence on single companies or sectors carries risks beyond those to workers directly affected by job loss. A facility closure can have cascading effects that resonate across families and sectors. Without other local job opportunities, skilled workers and youth face pressure to move away from home. Local municipal or Indigenous governments could face revenue losses that constrain community services.

Dozens of communities across Canada are dependent on transition-vulnerable sectors. Analysis of census data identifies 55 communities of 10,000 people or more that have more than 3 per cent of their workforce employed in transition-vulnerable sectors (Figure 22). Some of these communities have high levels of employment in more than one identified sector and

therefore have more than one marker in the figure (e.g., Wood Buffalo, Fort St. John, and Val-D'or), meaning that the 55 communities that we examined actually represent 69 community-sector pairs.

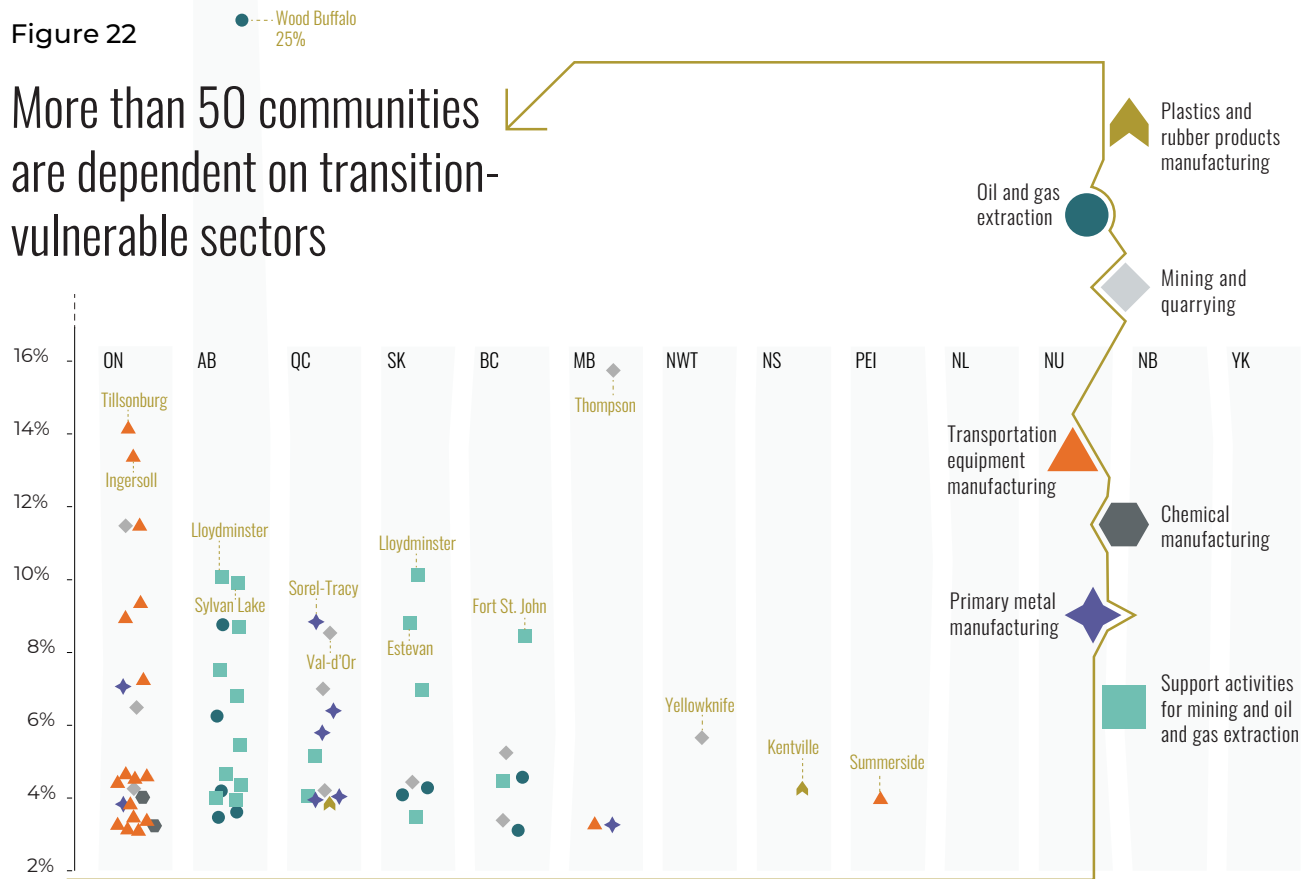
Of the 69 community-sector pairs, nine are highly dependent on a single transition-vulnerable sector, with more than 10 per cent of the workforce employed in that sector. Another 22 communities are moderately dependent, with more than five per cent of employment in the same sector, and a further 38 are somewhat dependent, with more than three per cent of employment in a transition-vulnerable sector. The two communities with the largest proportion of employment in transition-vulnerable sectors are Wood Buffalo, Alberta (oil and gas extraction), and Thompson, Manitoba (mining and quarrying).

Wood Buffalo, Alberta, includes the town of Fort McMurray and is the centre of Canada's oil sands activity. Over 25 per cent of the workforce is employed in the oil and gas sector and a further four per cent work in related support activities. A decline in oil and gas activity could bring significant disruption to the community, and transition impacts may interact with the physical impacts of climate change, as the region is at high risk from both wildfire and flooding (Heidenreich, 2021).

A decline in oil and gas would also affect Indigenous Peoples and communities. Over 9 per cent the population of Wood Buffalo is Indigenous (Government of Alberta, 2021c). There are five First Nations within the region that are connected to the oil sands through employment or contracts (Ramp, 2021). There are some efforts to build new sources of transition-compatible growth, however. Three of the First Nations formed a corporation—Three Nations

Figure 22

More than 50 communities are dependent on transition-vulnerable sectors



Source: Analysis by the Canadian Institute for Climate Choices based on data from Statistics Canada (2016d). Notes: This figure shows census metropolitan areas (CMA) and census agglomerations (CA) that have more than three per cent employment in transition-vulnerable sectors. Communities within each province and territory are plotted according to the total share of their workforce within a single transition-vulnerable sector. Some communities appear twice, illustrating that they have a concentrated workforce in multiple transition-vulnerable sectors. For example, Wood Buffalo in Alberta has 25 per cent of its workforce employed in oil and gas extraction, and four per cent of its workforce in related support activities for mining and oil and gas extraction.

Energy (3NE)—and built a 2.2-megawatt solar farm in Fort Chipewyan (Cruikshank, 2020).

Thompson, Manitoba, is a nickel-mining town that has seen ups and downs in employment as nickel prices rise and fall. In 2016, 16 per cent of the workforce worked in mining and quarrying. Since the 2016 census, Thompson has seen a mine and refinery close, with hundreds of jobs lost (Froese, 2020). In 2021, however, Vale announced a \$150 million investment in expanding its nickel mine, citing growing demand for renewable energy and electric vehicles (Macdonald, 2021). Almost 40 per cent of Thompson’s population is Indigenous (TownFolio, 2021).

Many smaller towns, not captured in Figure 22 because they are not large enough to be census metropolitan areas, are also highly dependent on transition-vulnerable sectors. Elkford and Sparwood, for example, are two towns in British Columbia that are home to about 2,500 and 3,800 people, respectively. The towns are heavily dependent on metallurgical coal mining (Box 5). The largest employer is a single company, Teck Coal, which runs several mining sites (Kootney Business, 2018). In Elkford, Teck Coal’s workforce makes up half of the town’s entire population (Government of Elkford, 2019). As global demand for coal begins to decline, these towns will face significant challenges.

The knock-on effects from high unemployment in these small- and mid-sized communities could cause substantial social and economic disruption. In the small coal town of Coronach, Saskatchewan, nearly 44 per cent of the town's workforce was employed in either the coal mine or the coal-fired electricity plant in 2016 (28 per cent of the town's entire population). As both its coal mine and utility gradually close over the coming decade to align with federal and provincial coal phase-out schedules, many of these jobs will be lost. By 2041, the town estimates that household incomes could drop by 89 per cent, equivalent to \$400 million in GDP. About two thirds of its population could move to find work elsewhere, especially younger people. Its tax base would be cut in half (MDB Insight, 2019).

These economic and social impacts can linger for decades if communities are unprepared and the transition goes unmanaged. Towns in Atlantic Canada, once dependent on the cod fishery and coal mining, know these challenges well. The cod collapse, marked by the federal fishing moratorium in 1992, for example, left tens of thousands of people jobless. Some workers were absorbed into other sectors such as shellfish and tourism, but others left the region entirely (Higgins, 2008). Many communities in Atlantic Canada continue to struggle with high unemployment rates and a heavy reliance on unemployment benefit programs today (PPF, 2020). In fact, Western Canada's oil and gas industry has helped absorb a substantial portion of Atlantic Canada's weak labour market. In 2008, for example, about six per cent of the entire labour force in Newfoundland and Labrador and Cape Breton (NS) worked in the Alberta oil and gas sector (Lionais et al., 2020).

Canada's large metropolitan areas will likely be more resilient to global transition, benefiting

from diverse economies and larger employment pools (Caranci et al., 2021). Cities such as Calgary, Edmonton, and Windsor, however, could be disproportionately impacted. In 2016, for example, the oil and gas sector directly employed one per cent of Edmonton's labour force and four per cent of Calgary's (Statistics Canada 2016c). Windsor, Ontario has over nine per cent of its employment concentrated in transportation equipment manufacturing (Statistics Canada, 2016c). When indirect or induced jobs are considered—suppliers, sub-contractors, and other services—the initial impacts could extend much further across the local economy.

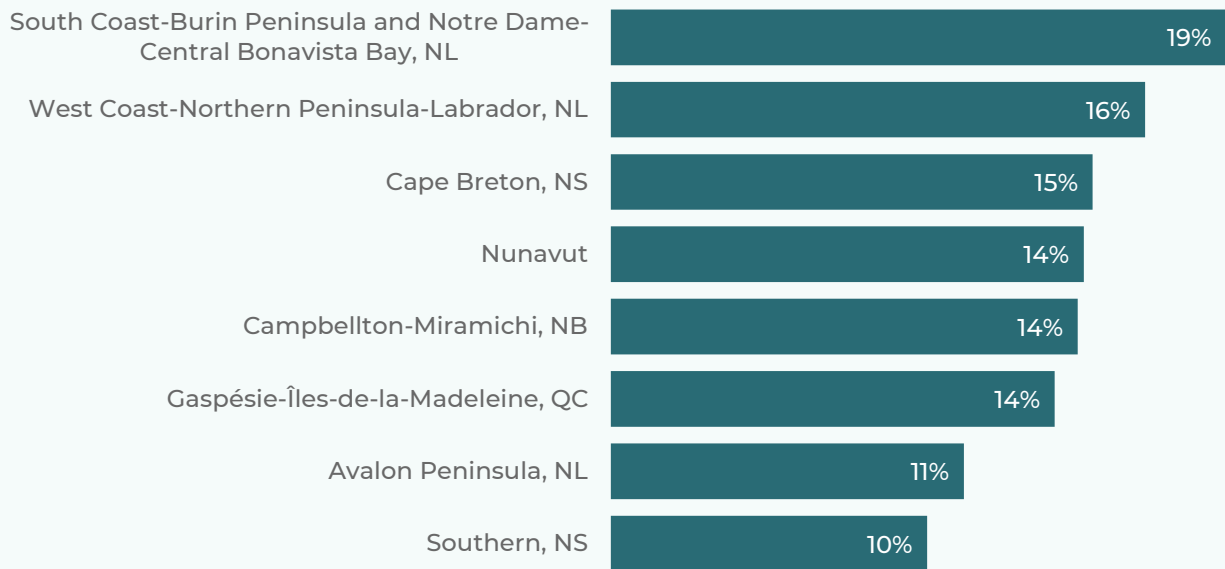
The transition may offer opportunities for communities that are already struggling

While many efforts to assess the impacts of the global transition have focused on communities that could face job loss, communities that already have persistently high levels of unemployment cannot be forgotten. Figure 23 identifies economic regions of Canada with the highest average rates of unemployment between 2015 and 2020. Atlantic Canada has six of the eight regions identified. The entire territory of Nunavut had high levels of unemployment over the period.

Unemployment rates may not always tell the whole story, however. In some regions, people have given up looking for work and are no longer reflected in unemployment statistics. Participation rates in the regions identified in Figure 23 are lower than average, except in Nunavut. The size of the labour force (including both employed and unemployed) also declined over the period in the Atlantic and Quebec regions, but remained steady in Nunavut (Statistics Canada, 2021m).

Figure 23

Communities in Atlantic Canada, Quebec, and Nunavut have persistent, high levels of unemployment



Source: Statistics Canada (2021h). Notes: This figure shows the top eight economic regions in terms of average unemployment rates from 2015 to 2020. Note that large urban economic regions are excluded from the figure, since the focus is on smaller communities.

The global low-carbon transition may offer new opportunities for these communities. In Atlantic Canada, there is growing interest in developing clean energy opportunities. The Cape Breton region, for example, has potential to expand onshore wind power (Grant, 2021). The decision to switch the slated-for-closure Come by Chance oil refinery in the Avalon peninsula of Newfoundland to renewable fuels is also a notable example of capturing transition opportunities to offset job losses (Quinn, 2021).

In the Gaspé region of Quebec, international wind turbine manufacturer LM Wind Power employs over 210 full-time workers and is one of the largest employers of the region. The facility is part of a Wind Energy Cluster established by the government of Québec. It now includes 30 businesses that employ 1,000 people in the Gaspésie-

Îles-de-la-Madeleine and MRC de la Matanie (QWEC, 2021). Nunavut, meanwhile, may have opportunities in mining, provided local communities determine the overall benefits exceed the costs (ISID, 2013).

Low-carbon transition opportunities can also come with other benefits, if companies invest in local infrastructure, and large anchor companies draw in other sources of economic activity (McHugh et al., 2020).

5.3 ALIGNING TRANSITION WITH INDIGENOUS RIGHTS AND RECONCILIATION

The global low-carbon transition could have important implications for Indigenous Peoples.

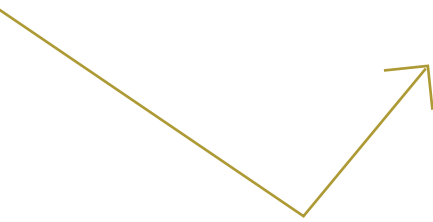
5. EMPOWERING PEOPLE AND COMMUNITIES

Many nations and communities have become dependent on transition-vulnerable sectors for jobs and income. Indigenous youth are more vulnerable to economic disruption and the shift toward higher-skilled jobs. The movement to capture global opportunities in mining, clean energy, and biofuels will also necessarily involve Indigenous leadership and active participation.

Many nations and communities have suffered historic injustices as a result of colonization and dispossession of their lands, territories, and resources (Gunn, 2021). Legislation to implement the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)—which received Royal Assent on June 21, 2021—is intended to correct this power imbalance toward Indigenous Peoples. The Act requires the Government of Canada, in consultation and cooperation with Indigenous Peoples, to take all measures necessary to ensure the laws of Canada are consistent with the Declaration, prepare and implement an action plan to achieve the Declaration’s objectives, and table an annual report on progress to

align the laws of Canada with the action plan (DOJ Canada, 2021).

There are a growing number of examples of Indigenous nations and communities leading economic development. The Tahltan First Nation Central Government in northwest British Columbia, which has a shared decision-making agreement in place with the provincial government, oversees a territory that covers 11 per cent of the province. Within the territory, there are multiple hydroelectric and mining projects. The Tahltan president has stated that, while they take pride in being meaningfully employed and independent, they will stand united in efforts to protect wildlife, fish, the environment, and their culture for future generations. The Tahltan have developed agreements that all companies must adhere to and have refused to deal with companies that are disrespectful (Tahltan Central Government, 2021). In early 2021, the Tahltan government said it would do everything in its power to eject mining company Doubleview for failing to meet its standards (Barker, 2021).



“To be blunt – if proponents, policy makers and potential partners do not consider Indigenous partnerships or build policies for Indigenous ownership, further development in the clean energy sector will be stalled.”

Tabatha Bull, President and CEO of the Canadian Council for Aboriginal Business, “Indigenous partnerships—the key to meeting Canada’s climate commitments?”

Indigenous nations and businesses can benefit from having stronger leadership roles in resource management and building transition-related developments on their own terms (Davis and Beaucage, 2021). Almost 200 medium- to large-scale clean energy projects (>1 MW) operating across Canada have Indigenous involvement through ownership, co-ownership, or impact benefit agreements, along with an additional 1,200 smaller projects (Indigenous Clean Energy, 2021; Van Tassel, 2019; Hoicka et al., 2021).⁴ One example is the Oneida Energy Storage project—a joint venture between NRSTor Inc. and Six Nations of the Grand River Development Corporation—which has the potential to be the largest energy storage facility in Canada. The Canadian Infrastructure Bank has committed to provide up to \$170 million in support (NRSTor, 2021).

Expanding the number of Indigenous-led projects faces challenges, however. The 200 clean energy projects mentioned above, for example, include projects such as the Site C and Muskrat Falls dams, which have received significant criticism for their impacts on Indigenous Peoples. Indigenous nations also have little or no stake in many of these projects, limiting their ownership and control (Hoicka et al., 2021). In other projects, the full economic benefits fail to materialize for communities (Belayneh et al., 2018).

Capacity is another significant issue, particularly for smaller communities, with both partnerships and Indigenous-owned projects. Evaluating projects and negotiating terms takes considerable resources, knowledge, and time. Organizations such as the First Nations Major Projects Coalition and Ontario's new Centre of Excellence for Indigenous Mineral Development

can provide much-needed support, but dedicated community capacity is also often needed (FNMPC, 2021a; Kelly, 2020). Obtaining financing can be challenging, though there are some programs that provide low-cost loans or other financial supports (FNFA, 2021).

Better access to company-level performance information could also support Indigenous communities in evaluating project proposals. The Canadian Council for Aboriginal Business, for example, provides Progressive Aboriginal Business ratings of gold, silver, bronze, and committed (CCAB, 2021).

5.4 POLICY IMPLICATIONS

In addition to supporting a prosperous transition overall, government policy also has a role in ensuring growth takes place across Canada and is inclusive and aligned with societal objectives. The global low-carbon transition will have real implications for workers, families, and the places where they live, and some will face larger impacts than others.

Designing effective policies to support people and communities starts with recognizing that the global transition will be felt locally. Risks and opportunities for each region, community, and individual will be different, reflecting local context, culture, and needs. Governments at all levels can undertake the analysis needed to better understand these local nuances, engaging the people most affected. That engagement can then feed into broader, more inclusive transition strategies. They can also empower communities and people to proactively address their unique circumstances. The involvement of Indigenous Peoples and nations in these plans is essential at every

⁴ See Raderschall et al. (2020) for best practices in designing impact benefit agreements.

stage, as they are both implicated in transition and essential to future clean growth success.

While studies of the impacts of the low-carbon transition often focus on areas of potential job loss, it is equally important for governments to support communities already facing high levels of unemployment. Inclusive growth requires connecting these communities with economic opportunities that arise from decarbonization wherever possible. This is particularly important for Indigenous communities, many of which have not fully benefited from previous economic growth.

There are also underlying vulnerabilities that need to be addressed to ensure that the transition does not worsen inequality or poverty.

Improving education outcomes is critical in this regard. In particular, government policies and programs that improve educational outcomes for vulnerable youth, and address discriminatory hiring practices, can help ensure that future growth trajectories are truly inclusive.

Ultimately, success through this transformation cannot simply be measured by whether the overall economy is growing. If Canada's response to global market shifts is to be sustainable and lasting—and not perpetuate existing inequities in society—it must empower those who have not benefited from growth in the past, along with those who have. Policies should have the well-being of Canadians at their core.



IMPROVING MARKET TRANSPARENCY, DISCLOSURE, AND METRICS

6

The preceding sections have highlighted that Canada faces significant challenges with mobilizing private investment to improve the transition readiness of its economy. Finance is the circulatory system of the economy and is an essential part of helping both Canada's transition-vulnerable and its transition-opportunity sectors retool and adapt to changing global markets. Access to finance and capital will allow companies in emerging transition-opportunity sectors to scale up and expand exports and is critical to community efforts to generate new sources of employment and income.

Currently, however, Canada is not channeling sufficient levels of investment into transition-opportunity sectors and is not doing enough to ensure that transition-vulnerable sectors are reducing emissions and diversifying. Financial flows still weight heavily towards companies and sectors that are not yet ready for the global transition, exacerbating transition risk.

While weak and uncertain policy and market signals are a major factor in this misallocation of resources, poor data and information in financial markets is also an important driver.

Company-level data on transition readiness and environmental, social, and governance (ESG) performance are often inconsistent and incompatible, making it more difficult for investors to make informed decisions. Without high-quality data, markets cannot efficiently price in risks and opportunities, which can increase financial losses and missed opportunities for investors and increase capital costs for companies and projects (UN, 2020; Millani, 2021; Financial Stability Board, 2021). At an economy-wide level, poor data increases the potential for market instability, systemic financial risks, stranded assets, and abrupt market corrections (OJEU, 2019).

Addressing these challenges—and redirecting and mobilizing capital flows—to prepare Canada for the low-carbon transition will be an essential component to Canada's success in the years ahead. It could also open up new opportunities for Canada to become a world leader in ESG transparency and help shape the development of international standards.

Yet improving market transparency depends on getting the details right. How should company-level metrics be aligned with international

data? How can metrics for Canadian companies show the company's degree of alignment with global market transition, as well as with domestic environmental and social objectives? What are the specific government policy interventions that will facilitate better market transparency? This section sheds light on these challenging and urgent issues.

6.1 TRANSITION-RELATED DISCLOSURES

Better disclosure is fundamental to long-term competitiveness and attracting investment. Without consistent and comparable information, investors and consumers risk making decisions based on generalized interpretations of which companies are “green” or “non-green” instead of a more nuanced approach that allows for transition-ready companies. Nuance is not possible without quantitative metrics that allow for cross-company comparisons.

International standards and norms on disclosure are changing rapidly

Company-level disclosures and metrics are key components of how companies communicate risk to investors, lenders, and underwriters. In Canada, and in most high-income countries, publicly listed firms are legally required to file and disclose information that could materially affect company value and performance. Companies comply by using a set of standardized rules for disclosure, established by global standard-setting organizations, such as the International Financial Standards Reporting (IFRS) Foundation. Metrics are used to operationalize disclosures by quantifying firm-level performance according to key indicators, which can then be compared against other firms in the market.

Historically, these international disclosure and metrics standards have focused narrowly on financial information such as debt and earnings. Non-financial information, such as a company's environmental performance, has historically been considered outside international reporting frameworks and disclosed on a voluntary basis, separate from financial filings. As a result, a complex and dizzying array of voluntary standards have emerged. By one estimate, the number of ESG guidelines and metrics globally grew from around 700 in 2009 to more than 1,700 by 2019, contained in more than 360 different ESG accounting standards (The Economist, 2020).

What companies are expected or required to disclose is converging rapidly, however. Some governments, such as the European Union and the United Kingdom, are making climate-related disclosures mandatory for both publicly traded and large privately listed companies. The same body that sets international standards for financial disclosures—the IFRS—is establishing the Sustainability Standards Board to help harmonize climate-related disclosures globally in the coming years. At the same time, the U.S. Securities and Exchange Commission is conducting public consultations on climate-related disclosure (USSEC, 2021). (The trend toward better disclosure applies to both low-carbon transition risks and the physical risks of a changing climate; however, the focus of this report is transition risks.)

All of these initiatives are coalescing around the 2017 recommendations from the Financial Stability Board's Task Force for Climate-related Financial Disclosures (TCFD), which has become the gold standard for climate-related disclosures (Millani, 2021). There is also broad support among the global investment community for better climate-related disclosure. The Climate Action

100+ Initiative, for example, includes members who manage over \$55 trillion in assets (including Blackrock, the world's largest asset manager). Other supportive investor-led initiatives include the Net Zero Asset Managers Initiative (managing \$43 trillion in assets) and the Transition Pathway Initiative (\$29 trillion in assets).

The TCFD framework centres on several core metrics and targets. It requires companies to disclose their Scope 1 (operations) and Scope 2 (electricity and heat) emissions, along with their emissions intensity. It also requires companies to disclose their Scope 3 (supply chain) emissions in cases where these emissions are material to company operations and investors. In its most recent proposed guidance, this would apply to any company where Scope 3 emissions represent more than 40 per cent of total lifecycle emissions associated with their product, such as oil and gas and the automotive sector (TCFD, 2021a; 2021b). Critically, the TCFD framework would require companies to disclose standardized, transition-consistent emissions targets, along with detailed plans on how to achieve these targets.

Improved company-level disclosure will enable better financial sector reporting

Just as better company-level disclosures can help investors price risk at the asset level, improving how financial institutions disclose their *financed emissions* is critical to understanding the broader systemic risks from global transition. Financed emissions represent the emissions associated with financial institutions' lending, investing, and insurance underwriting, which can be 700 times larger than operational emissions from the financial sector (CDP, 2021).

Until recently, financial companies and institutions have lacked the methods and data required to estimate financed emissions. In November 2020, the international industry-led Partnership for Carbon Accounting Financials (PCAF) published a global greenhouse gas emissions accounting and reporting standard, which is being widely adopted within the financial industry (including Crown corporations, such as Export Development Canada) (PCAF, 2020). The standard provides detailed methodological guidance for six asset classes: listed equity and corporate bonds; business loans and unlisted equity; project finance; commercial real estate; mortgages; and motor vehicle loans.

The PCAF standard notes that limited company-level data is the main challenge in calculating financed emissions. Better company reporting would therefore enable improved financial sector reporting. If all companies within an investment portfolio reported consistent and comparable 2030 emissions targets, for example, financial institutions could include forward-looking metrics in their own reporting. This could help to address the short-term horizon of decision making and support a more strategic approach to assessing balance sheet risk.

There could still be some remaining gaps, however. Loan and investment portfolios of financial institutions can contain hundreds of assets, all with different emissions profiles. Some companies within these portfolios are publicly traded, in which case information and data may be increasingly available; however, portfolios also contain privately listed companies, for which climate-related information is less available and less reliable.

Canadian companies are falling behind emerging international disclosure standards

Despite the changing international norms around disclosure and the advantages of communicating clear and consistent metrics, many Canadian companies lag. A 2021 study by the Institute for Sustainable Finance, for example, found that nearly three quarters of the companies listed on the TSX either do not disclose their emissions (32 per cent) or do not verify their emissions data (39 per cent) (see Figure 24). Another study by Millani (2021) found that only 23 per cent of companies on the TSX and S&P make disclosures that align with the TCFD framework; 54 per cent of companies make no mention of TCFD at all. Climate-related disclosures among privately listed companies are patchier still (Ferreira et al., 2021; CPA Canada, 2020).

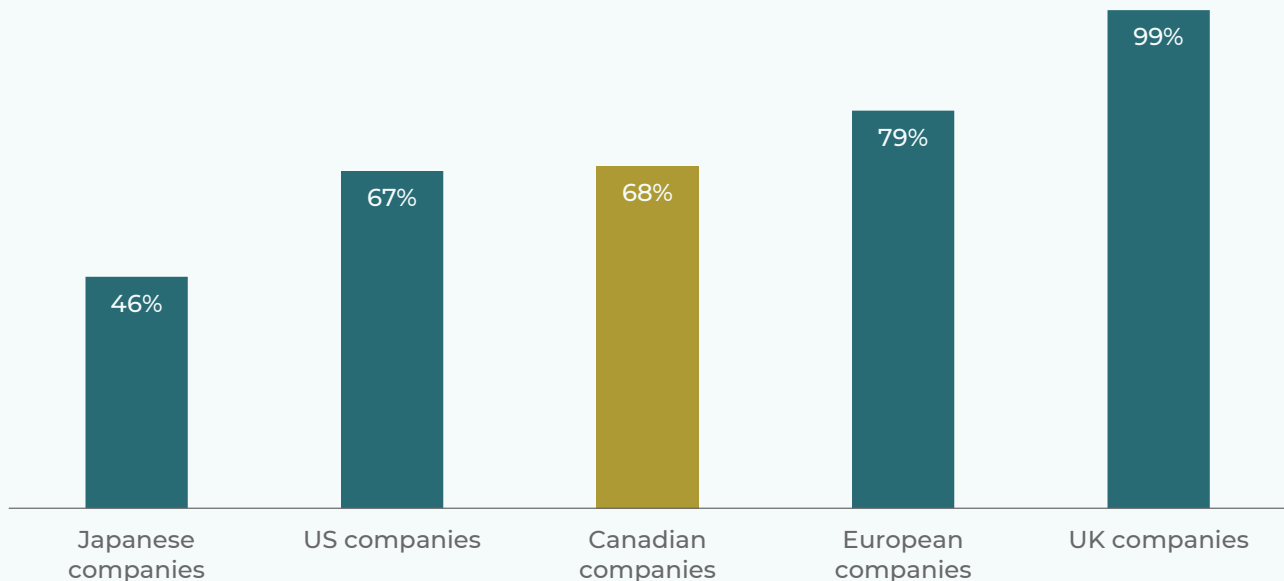
The other issue is that when companies *do* disclose climate-related information, they use metrics and targets that are inconsistent and incomparable. A study of Canadian publicly traded companies by the Chartered Professional Accountants of Canada (2017) found that most company disclosures did not include metrics or targets at all. The lack of consistency has been flagged as an issue by governments, professional associations, investors, and companies alike—both globally and within Canada (CPA Canada, 2017; Canadian Securities Administrators, 2019; IFRS Foundation, 2021a).

Some sectors in Canada are better at climate-related disclosures than others, however. The renewable and alternative energy sector, for example, is among the worst performers when it comes to disclosing climate-related information in Canada

Figure 24

Canadian publicly traded companies lag behind international peers on GHG disclosure

Percentage of firms disclosing GHG emissions



Source: Cleary and Hakes (2021). Notes: This figure shows the percentage of firms disclosing greenhouse gas emissions. Overall, roughly two-thirds of publicly traded companies in Canada disclose their emissions.

(Millani, 2021). And while this may seem reasonable, as they face smaller downside risks, it could represent a missed opportunity to showcase transition resilience and growth potential. Conversely, Canada’s mining and oil and gas sectors were among the first in Canada to regularly report and disclose climate-related information (Millani, 2021).

Canada’s financial sector, including large pension funds, has also improved the frequency and quality of their climate-related disclosures, and is working to estimate and (eventually) disclose the sector’s financed emissions. Bank of Montreal, Toronto Dominion Bank, and Scotiabank already disclose climate-related risks according to the TCFD framework. These three banks have also joined the PCAF initiative and have announced plans to standardize their approach to estimating financed emissions. Still, even with these

pockets of improvement, data are often inconsistent within sectors in Canada (CPA, 2017).

International shifts toward disclosure could draw financial flows away from Canadian companies—particularly if metrics lack nuance

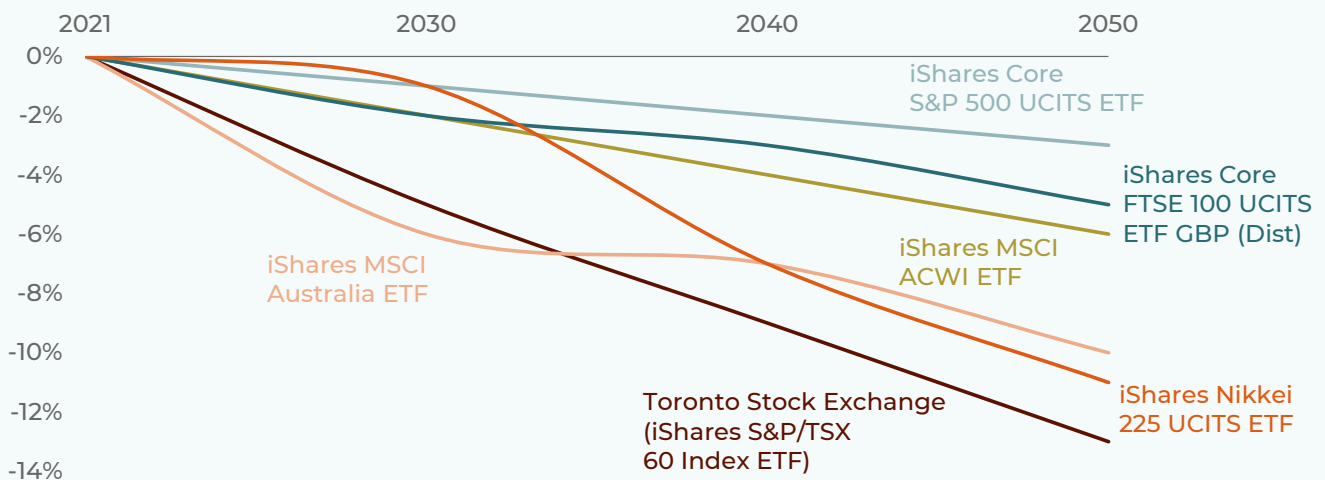
Canada’s large exporters and multinationals tend to perform worse in transition stress-testing than those in other countries. Figure 25 helps illustrate the challenge. It shows the low-carbon transition performance of the 60 largest companies on the Toronto Stock Exchange (TSX) relative to publicly traded companies on other major stock indices.

International investors undertaking similar stress testing analyses may choose to shift away from companies that present a transition risk—raising

Figure 25

Canada's stock market is more exposed to transition risks than other major international stock markets

Market capitalization impacts of select exchanges



Source: Canadian Institute for Climate Choices (2021c), based on modelling and analysis commissioned from Planetrics. Notes: This figure shows profitability (weighted average market capitalization) impacts between 2021 and 2050 for several exchange traded funds in the Immediate 1.5-degree scenario from Section 3. The ETFs in the figure broadly represent the TSX and other international stock exchanges. And while the TSX is not representative of Canada’s entire economy, it is the largest capital market in Canada—with a \$3.3 trillion market capitalization—and the tenth largest stock exchange in the world (TMX Group Limited, 2021; Arora, 2021). Most large exporters and Canadian-headquartered multinationals are listed on the exchange.

the stakes for the types of information Canadian companies choose to disclose. If investors are not making decisions based on the best possible data, it could lead them to base their decisions on entire sectors rather than companies. However, Section 3 shows that transition readiness should really be measured at the company level. Individual companies in all sectors can build transition readiness through investment in decarbonization and transformation. Without better company-level data, investors may not see opportunities in leading companies within transition-vulnerable sectors (Millani, 2021).

Disclosure practices at the company level also have implications for Canadian financial institutions—including banks, pension funds, private equity funds, and public organizations such as Export Development Canada—that hold equity and debt in these Canadian companies. Measuring and disclosing these financed emissions is critical to understanding and managing the dangers of systemic risk for individual financial institutions but could lead to a shift away from emissions-intensive companies within portfolios (IFRS Foundation, 2021a; Ens and Johnston, 2020).

To avoid a significant shift away from financing promising Canadian companies in transition-vulnerable sectors, private and public institutions need company-specific measures that truly reflect transition readiness. This requires understanding the relevant impact drivers—demand creation, demand decline, or carbon costs—and assessing the companies based on metrics that reflect appropriate pathways to transition success. For example, assessing a company facing a decline in demand using only emissions metrics will miss the larger transition risk associated with shrinking global demand for their product. Aligning

disclosure practices with Canada's largest trading partners—the United States in particular—will be increasingly important, considering that many publicly traded companies in Canada are cross-listed on stock exchanges in other countries.

Better company-level metrics could also allow investors to work with companies to improve transition readiness over time. For example, investors can press for companies to commit to aggressive emission reduction targets or investment in new business lines. Investors could then part ways with companies that consistently fail to meet their targets.

6.2 PRODUCT LABELLING AND SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

The push for better climate-related disclosures reflects a larger shift by investors and consumers who are considering a broader range of ESG information when making decisions (CFA Institute, 2020; Berg et al., 2020). Companies increasingly need to showcase ESG credentials to access capital. At the same time, they need to actively respond to the social, environmental, and governance concerns of communities in which they operate to attain—and maintain—social license.

Here too, better data will be essential for a successful transition in Canada. In some cases, it will be at the company level, but in others, better metrics are needed at the product level. And in many cases, including in demand-creation sectors, there will be a need for metrics that address climate, environmental, social, and Indigenous objectives.

A lack of standardized labelling of financial products could mean financial flows are misdirected

The number of ESG-labelled financial products is growing rapidly. ESG funds are projected to grow from US\$51 billion in 2020 to US\$ 1 trillion by 2030 (Gurdus, 2021). There has also been a proliferation of exchange-traded funds (ETFs) and bonds with labels linked to green, transition-readiness and/or sustainability criteria.

Amid this exceptional growth, however, there is little oversight of labelling, and investors and

consumers are left to sort through the various criteria and definitions on their own (Onstad and Desai, 2020; Sarra, 2021). Neither Canada nor the United States regulates the use of these labels, and the criteria used to determine the equities within the funds is often neither transparent nor consistent. The lack of guidance on financial products means institutional or retail (individual) investors may believe they are shifting their investments towards transition-consistent, sustainable activities when they are, in fact, supporting activities inconsistent with transition (Box 12).

BOX 12

ESG labels do not necessarily mean transition-ready

The past decade has seen rapid growth in financial products with an ESG label or ranking. For example, roughly \$30 trillion of all professionally managed assets in the United States—fully one third—are subject to some type of ESG criteria according to the U.S. Securities Exchange Commission (SEC). Despite a global pandemic, 2020 set records for new investments in ESG funds, cleantech IPOs, and new investment product offerings.

In the absence of clear, consistent, and comparable standards, the credibility of these rankings has been mixed. The lack of information, and occasionally the misinformation, can lead to misallocated capital or, worse still, greenwashing (where businesses and investors intentionally make false claims related to their green or clean credentials to attract higher fees, lower financing costs, or higher investment volumes). A study in 2021 by InfluenceMap, for example, assessed 118 global ETFs and mutual funds that were marketed on their climate credentials; 22 of the funds had exposure to thermal coal, oil, and natural gas. A \$500 million ETF provided by Vanguard marketed as an ESG product was later found to have 1.4 per cent of its portfolio in oil and gas.

These examples, among many others, prompted the U.S. SEC to issue an investor alert in 2021, drawing attention to the lack of clear standards on ESG products. It launched a division of examinations for ESG products and issued a warning that misleading statements, management inconsistencies, and mislabelling funds as ESG may qualify as a securities violation. ESG ratings of equities undertaken by various data providers are also not consistent or transparent.

Sources: InfluenceMap (2021); Rennison and Nauman, (2021); Mathieson, (2018); Li and Polychronopoulos (2020); USSEC (2021); Berg et al., (2020).

Several markets are starting to address the lack of consistency in product labelling and certifications. The European Union, for example, recently introduced a taxonomy for sustainable activities to ensure a standardized methodology and classification system for determining the degree to which economic activities are environmentally and socially sustainable. The taxonomy will create sustainability labels for financial products based on their use of proceeds, which will then influence firms' eligibility for funding and access to capital through green bonds and green loans (Lee, 2020).

The European Union has also established two climate-related benchmarks for sustainable finance. The first is a Paris-Aligned Benchmark (PAB) that includes alignment with the Paris Climate Agreement's emission-reduction targets (by excluding oil and gas, coal mining, and high-carbon power activities) and a 50 per cent lower weighted average greenhouse gas emission intensity than the total market. The second, the EU Climate Transition Benchmark (CTB), is primarily intended for large institutional investors, but still requires a 30 per cent lower greenhouse gas emissions intensity than the total market. The right to use the European Union's PAB and CTB labels is strictly controlled. Failure to reach targets three times within 10 years will result in a loss of labelling rights (KPMG, 2020; SSGA, 2020).

The European Union's CTB benchmark does not, however, address the issues with financial products outlined in Box 12. Ideally, investors would have a choice of funds that only include transition-consistent economic activities (i.e., only include companies investing in the "grow", "decarbonize" or "transform" activities from the analysis in Section 3). This would likely require a significant improvement in compara-

ble data and the establishment of company or sector-specific benchmarks.

The path to creating internationally harmonized standards for ESG metrics is still in its early stages. Amid calls for greater standardization from investors and governments, international organizations such as the CFA Institute have started to develop preliminary disclosure standards for ESG investment products. So far, however, these standards focus narrowly on improving market transparency and will not include consistent criteria for economic, environmental, and social performance (Portilla et al., 2020; CFA Institute, 2021). Overall, the primary focus of international efforts continues to be on establishing baseline standards for climate-related disclosures first, including the work of the new international Sustainability Standards Board (KPMG, 2021).

A lack of climate and environmental metrics at the product level could mislead consumers and investors

The same inconsistency challenges with financial products also apply to physical goods. With current company-level disclosures and product labels, the low-carbon and environmental value proposition of products is not always easy for investors and consumers to assess. Without fair comparisons across products, there is a risk that investment and purchasing decisions will be misaligned with economic, climate, and environmental objectives. It could also mean that leading companies have trouble attracting financing.

There are already some moves towards product labelling, such as low-carbon aluminum or green steel. For example, the London Metal Exchange now includes a low-carbon aluminum standard and Platts has announced "green" pricing for low-carbon aluminum (Onstad, 2021). Some steel

makers have also started to market certified green steel (Bone, 2021). These types of labels could start to play a significant role in consumer decision making, increasing the importance of government oversight.

As markets for hydrogen, biofuels, minerals and metals, and other transition-opportunity products grow, there will be increased demand for metrics to compare the low-carbon performance of products. For example, hydrogen is currently labelled “green,” “blue,” “grey,” and other colours according to how the hydrogen was produced. Over time, discerning consumers and leading producers will increasingly want quantitative estimates of life-cycle emissions from such fuels to avoid misleading labels. This is particularly relevant for products such as biomass, uranium, mining, blue hydrogen, and alternative proteins.

For many companies, there will be other criteria for the environmental impact of their products. For example, there may be concerns relating to air pollution, water pollution, land use, water use, biodiversity, material use, or waste. Indigenous interests and concerns relating to projects are also often intertwined with environmental concerns, increasing the imperative to pursue leading practices in mining and energy projects situated on or near Indigenous lands.

Without better Indigenous and diversity metrics, financial flows could be misaligned with societal objectives

Within the wide spectrum of ESG considerations, there are two areas relating to the “S” and the “G” that are particularly relevant for Canada: Indigenous and diversity metrics. Performance in both areas can have impacts that extend far beyond individual companies and interact with broader societal objectives, such as inclusiveness,

fairness, and the advancement of reconciliation with Indigenous Peoples. They will also increasingly be material to the ability of Canadian companies to mobilize capital and secure social license.

There are several gaps in company- and product-level reporting of Indigenous performance in Canada and internationally. The First Nations Major Project Coalition issued a report in March 2021 highlighting the gaps in current ESG ratings and reporting frameworks, with the majority of such frameworks failing to include any Indigenous component (FNMPC, 2021a). If this gap were closed, it could help channel capital towards projects that provide greater benefits to Indigenous Peoples and communities.

A lack of company-level reporting also makes it difficult for investors and Indigenous communities to assess company performance. A 2021 report from the Reconciliation and Responsible Investment Initiative assessed the Indigenous-related disclosures of 76 TSX-listed Canadian companies from eight different sectors. While there have been improvements since the last assessment in 2016, there are still relatively few companies disclosing reconciliation performance (Table 6).

The report notes that companies in the renewable energy and clean technology sectors lag behind the average. For example, none of the six companies included in the assessment referenced UNDRIP and only two reported involvements in community investment (Wheatley and Lau, 2021). Improved reporting could help drive greater action across companies to respect Indigenous rights and provide employment and income benefits.

When it comes to diversity metrics, there is also room to improve performance. An amendment to the Canada Business Corporations

Table 6

Survey of 74 TSX-listed companies shows limited disclosure of Indigenous performance

Indicator	Share of Companies Reporting
Indigenous board member	28 per cent
Employee diversity reference	14 per cent
Employment - quantitative	14 per cent
Indigenous partnerships	21 per cent
Contracting and procurement - quantitative	12 per cent
References to UNDRIP	12 per cent
Community funding	41 per cent

Source: Wheatley and Lau (2021). Note: The above table includes a subset of the 17 indicators assessed in the report.

Act requires—as of January 2020—that federal distributing corporations (publicly traded companies) disclose information on the diversity of their boards of directors and senior management teams (ISED, 2021a). The latest assessment shows that of 403 distributing corporations, less than two per cent had one Indigenous board member and only 16 per cent had one visible minority board member (ISED, 2021a).

While the new reporting requirements are an improvement, they do not yet factor into many company ESG ratings or ESG-labelled financial products. The reporting is also incomplete, as it does not capture important considerations of company performance such as respect for Indigenous rights, equity partnerships, community funding, contracting and procurement, investments in training, and overall employment.

6.3 POLICY IMPLICATIONS

Improving the resilience of Canada's economy to the global low-carbon transition and turning current risks into opportunities requires rebalancing the flows of private capital. Increasing

financing for Canadian companies in demand creation sectors, and those working to improve transition readiness, is critical to an effective transition strategy.

Consistent, comparable, and decision-useful data based on clear standards is essential to mobilizing and redirecting finance. In the absence of good metrics, the decisions of investors and consumers could be ad hoc and ill-informed. Yet Canadian companies are lagging international best practices in many respects. Investors and consumers lack the data required to make informed decisions, which will ultimately hurt leading companies' ability to access debt and equity, or worse, lead to greater market instability and systemic financial risk (Sarra, 2021).

Governments and regulators play a clear role in establishing the standards, rules, and norms around market transparency. International markets, for example, already rely on harmonized standards for financial disclosures among publicly traded companies, which are interpreted and codified into Canadian, provincial and federal law. Governments around the world,

particularly the United Kingdom, the European Union, and the United States, are also acting quickly to establish clearer disclosure and information standards that will help align market expectations with global sustainability goals.

At the moment, climate-related disclosures for publicly traded companies in Canada—regulated by provincial security commissions—remain voluntary, although momentum is building for a more formalized approach.⁵ The federal government has committed to engaging with provinces and territories to make climate disclosures consistent with TCFD guidance and part of regular disclosure practices for a broad spectrum of the Canadian economy (TCFD, 2017; 2021a; Finance Canada, 2021c). Finance ministers and central bank governors within the G7—of which Canada is a member—recently called for “high quality, comparable, and reliable information on climate risks” and they are moving toward mandatory climate disclosures that align with the TCFD framework (IOSCO, 2021).

The call for mandatory disclosure has also come from several other influential reports in recent years. In its 2019 final report, the Expert Panel on Sustainable Finance recommended a phased “comply or explain” approach starting with the largest companies and financial institutions (EPSF, 2019). In 2020, Ontario’s Capital Markets Modernization Taskforce recommended mandatory disclosure and for the Canadian Securities Administrators to have a strong role in leading these efforts.

While there is a strong economic case for aligning disclosure practices in Canada with what is emerging internationally, Canadian companies may have reason to go beyond the baseline metrics laid out by the TCFD and others. International metrics may not fully capture the nuances of transition-consistent companies in Canada. This is particularly the case for transition-vulnerable sectors, where investors may want information not just on a company’s absolute emissions or emissions intensity, but on whether the company is actively transforming its business into new growth areas. Investors may also want information on how transition-vulnerable companies plan to reduce costs to stay competitive, or the transition-related assumptions used in projecting future growth, such as the price of oil or other commodities.

Demonstrating leadership on disclosures and product standards could have enormous competitive benefits for Canadian companies and would build on Canada’s strong track record of supporting international standards development (CPA Canada, 2021). Canada could provide helpful insights that speak to transition challenges that other emissions-intensive countries will encounter. Canada could also become a leader in Indigenous and diversity metrics—an area that is gaining more traction among governments and investors.

⁵ Importantly, Canadian companies are required to disclose material risks that could affect their financial performance, including climate-related risks (Canadian Securities Administrators, 2018). What is missing, however, are clear definitions on which climate-related risks are considered material and standards on how to disclose these risks (Sarraf, 2021; CMMT, 2021).



7

RECOMMENDATIONS

The analysis in this report underscores the importance of a managed transition that guides and mobilizes private actions toward a set of desirable public policy goals. Governments can play an essential role in establishing the underlying framework for all regions and individuals across Canada to thrive.

Our recommendations focus on four priorities for government action: forward-looking decision making; future-fit innovation and economic development programming; local and people-focused transition plans; and actionable disclosure and metrics. These are the areas where government involvement is most needed to overcome market and non-market barriers to successfully navigate the low-carbon transition.

Without government action, real and perceived uncertainties and risks could slow the private investments needed to build transition readiness and capture market opportunities. If global change accelerates more quickly than anticipated, revenues from traditional sources of growth could decline before sufficient investment has been made in new areas of growth.

Governments have tended to focus too much on near-term competitiveness risks and not enough on those looming on the horizon. In the face of the global transition, Canada's prosperity depends more on capturing low-carbon transition opportunities than it does on managing risks.

Thinking of climate policy separately from economic and social policy is also a recipe for greater risk and missed opportunity. Instead, governments at all levels should actively manage transition pathways to support and reinforce economic, emission-reduction, climate-adaptation, environmental, societal, and Indigenous reconciliation objectives. This type of systemic approach may require new governance models that cut across traditional mandates.

A lack of clear, quantified, and comparable measurement of company performance across climate, environmental, social, and governance issues also creates significant market inefficiencies. Despite a flurry of activity around climate-related disclosure, there is still a lot of work to do to close all information gaps.

Canada has a chance to be a global leader, providing the energy, technology, materials, products, and services the world needs to successfully meet climate change goals. But to realize Canada's full

potential, governments need to aim higher and look towards the future, while smoothing out bumps along the way.

7.1 PRIORITIZE FORWARD-LOOKING DECISION MAKING

RECOMMENDATION 1:

Federal, provincial, territorial, municipal, and Indigenous government decision making on carbon pricing, regulations, procurement, and infrastructure investments should explicitly account for the future competitive benefits of near-term climate action, including improved transition readiness and increased demand for clean energy and technologies. Canadian governments can and should wield a range of existing policy tools to smooth the transition, improve policy and market certainty, and ensure long-term competitiveness. They can only do so, however, with a fundamental change to how policy decisions are made.

Implementation example: Zero emissions vehicle mandate

Province X is considering a Zero Emission Vehicle (ZEV) mandate to require a certain percentage of vehicles sold to be non-emitting by 2035. Traditional cost-benefit analyses would lead the province to consider the additional costs to manufacturers and consumers, as well as fuel savings and climate and health benefits from emission reductions. However, such an analysis would not generally include the long-term competitiveness benefits to manufacturers associated with greater certainty around the shift to electric vehicle production. It would also not consider the demand creation benefits to companies selling charging technology, batteries, battery recycling, battery minerals and metals, and more. Including these benefits would help to align decision making with effective long-term transition strategies.



7. RECOMMENDATIONS

The pivot toward a low-carbon global economy requires changing the way governments make decisions. Too many policy decisions—on carbon pricing, regulations, procurement, and infrastructure investments—focus on a narrow definition of costs and benefits and take a short-term view of competitiveness risks and opportunities. Decision-making processes in government have generally been designed for small, incremental changes rather than large, transformative restructuring.

For example, if a regulation sets a standard for emission performance and drives a company to invest in a new technology, that investment is often viewed purely as a cost. If that cost is higher than what is faced by competitors in other jurisdictions, the focus of the decision often shifts to negative competitiveness implications and “carbon leakage” concerns.

The analysis in this report shows, however, that these near-term investments, rather than threatening competitiveness, are key to *improving* the long-term competitiveness of companies in the global low-carbon transition beyond 2030.

Climate policy can improve competitiveness in three ways:

- **Demand creation:** Government climate policy, and the response of businesses to that policy, is the biggest driver of market growth and opportunity through the transition. Leading companies in demand-creation markets can use their early advantage to firmly establish their competitive strengths (Suarez and Lanzolla, 2005).
- **Carbon competitiveness:** In sectors that will face high carbon costs and no significant decline in demand, investments that reduce the emissions intensity of production can make companies more resilient to market

changes and generate new growth opportunities. For example, the transition will drive increased demand for low-carbon steel, aluminum, and cement (Holzman, 2020).

- **Technology adoption:** Increased technology adoption drives a feedback loop that supports technology development and lowers emission reduction costs, making it easier for companies to meet future policy and market challenges (Meyer, 2021b).

Governments should better capture the competitive benefits of climate policy in decision making, whether by incorporating estimates quantitatively into cost-benefit analyses or qualitatively as part of economic strategies. While estimating future benefits is more difficult than future costs, there are methods that can indicate both the direction and magnitude of opportunity. Cost-benefit analyses are already an imprecise instrument, using hard-to-calculate metrics such as the social cost of carbon to measure the long-term benefits of greenhouse gas emission reductions (Rivers and Samson, 2020). As with the measurement of environmental and health benefits, however, it is a worse error to use a value of zero than an inexact estimate. Some potential approaches include:

- **Global stress-testing analysis:** Section 3 analyzed the performance of publicly traded companies under transition scenarios. It showed areas of demand creation in low-carbon goods and the potential for individual companies to thrive in sectors such as aluminum, iron and steel, cement, and mining—if they make the investments needed to be carbon competitive in global markets. Table 7 illustrates the estimated increase in profitability above net present value through the global low-carbon transition for the top 10 per cent of

Table 7

Transition benefits for top-performing companies

Opportunity	Top 10% of global companies (NPV % Increase in Profits Between Baseline Scenario and Immediate 1.5 Degree Low-Carbon Scenario, 2021-2050)
Low-carbon power	+ 310%
Solar and wind equipment	+ 109%
Fuel cells	+ 112%
Biofuels	+ 187%
Batteries and storage	+ 113%
Uranium	+ 44%
Mining and mineral products	+ 48%
Chemical, plastic, and rubber materials	+ 19%
Aluminum	+ 69%
Iron and steel	+ 127%
Cement, concrete, aggregates	+ 103%
Electric vehicle manufacturing and parts	+ 93%

Source: Canadian Institute for Climate Choices (2021c), based on modelling and analysis commissioned from Planetrics.

performers in each sector (between the baseline and Immediate 1.5 Degree scenarios). This provides a strong indication of the competitive opportunity that is available to proactive, cutting-edge companies, though over time competition for market share and the number of new entrants will increase.

► **Domestic potential analysis:** Section 4 identified nine areas of opportunity where Canadian companies are poised to grow—if they can secure the financing they need. This includes the sectors identified in Table 7, but also carbon capture, utilization, and storage technology, clean hydrogen, low-carbon transport beyond passenger vehicles, building technology, mining technology, alternative proteins, and agriculture technology, and other bioproducts beyond biofuels. Policies that increase demand for these products are likely to

also increase sales for competitive Canadian companies. Domestic demand creation also helps attract foreign direct investment. Developing databases of Canadian companies that could benefit from climate policies could help governments better understand the potential upside associated with demand creation.

► **Modelling:** Economic modellers are improving their ability to estimate the economic and employment benefits of transition. For example, a 2021 report by Clean Energy Canada and Navius Research projected clean energy GDP growth of 58 per cent, and 85,000 new clean energy jobs by 2030, as a result of the policies included in the federal climate plan announced in December 2020 (Clean Energy Canada, 2021c).

Where there are companies with high growth potential, or the possibility of an internationally

7. RECOMMENDATIONS

attractive market for investment, climate policies and programs should be considered as a strategic tool within economic development strategies. For example, infrastructure investments that support municipal purchases of electric buses help generate demand that in turn supports the growth and competitiveness of Canada's electric bus manufacturers (Sarabia, 2021).

Industrial carbon pricing regimes could also be viewed as an incentive for companies to improve transition readiness. A 2021 report by the Canadian Institute for Climate Choices found that, in 2020, existing carbon pricing systems across Canada provided a weak and uneven incentive for industry to make large low-carbon investments (Canadian Institute for Climate Choices, 2021a). Adjusting pricing regimes to better balance near-term and long-term competitiveness considerations, combined with greater federal and provincial clarity and certainty on long-term average costs to large

emitters, would increase investment incentives.

Procurement is another area where government decision making overemphasizes near-term cost minimization, while failing to account for longer term economic and societal benefits. Governments can play an important role as first or early customers for new innovations, helping to de-risk products and technologies for subsequent buyers. Green building materials such as low-carbon steel and cement could, for example, be used in the construction of new government buildings (Krupnick, 2020).

Governments may need to set up specialized teams that cut across multiple ministries to develop the capacity and expertise needed to identify and measure strategic transition opportunities. Changing the way decisions are made will not be easy, but it can have a big long-term impact if it leads to choices that accelerate demand creation and investments in transition readiness.

7.2 EMPHASIZE FUTURE-FIT INNOVATION AND ECONOMIC DEVELOPMENT PROGRAMMING

RECOMMENDATION 2:

Federal, provincial, and territorial governments should rebalance public investments and tax incentives towards activities with export and growth potential that face barriers to private investment. Improving the resilience of the Canadian economy means directing less public support to current economic activities that will see declining global demand—such as coal mining and oil production—and increasing support for “future-fit” areas expected to see strong demand growth, such as hydrogen, renewables, biofuels, clean technology, and carbon capture, utilization, and storage technology.

Implementation example: Future-fit fund

Province Y is setting up a new fund to support economic development consistent with its net zero target. Metallurgical coal mining has been an important source of provincial economic growth historically, while some small companies active in areas such as grid-scale energy storage and bioplastics have struggled to scale up to the point where they can be globally competitive. There have been calls to focus the fund on reducing emissions from coal mining to protect jobs. A future-fit fund would, however, instead emphasize the growth and expansion of energy storage and bioplastic companies where analysis shows global demand will grow through low-carbon transition. The approach could include addressing some of the barriers facing those companies, such as collaborating with electric utilities to accelerate adoption of energy storage technology. Focusing investments on coal would see a lower long-term economic growth return since a low-emission coal mine would still be vulnerable to demand decline as global steel makers shift away from using coal. Private companies and investors may, of course, still choose to bet on continued future demand and make those investments on their own.



7. RECOMMENDATIONS

Innovation and economic development programs can help overcome uncertainty barriers to private investment and accelerate large investments earlier than what would be driven by climate policies alone (Harvey, 2018). Federal, provincial, and territorial governments have a variety of programs, funds, and tax incentives aimed at supporting innovation and economic development. Some directly target emission reduction goals, while others focus on supporting investment and economic growth (ECCC, 2020a; ISED, 2021b; 2021c; Government of Ontario, 2021; Government of Alberta, 2021c).

While these initiatives are generating some success, they are missing an overarching strategic direction that would better target and focus efforts on future economic and societal value. A major part of that strategic direction should be to consider the global competitive landscape under the low-carbon transition scenarios detailed in this report and, more specifically, the transition readiness of each new project and initiative. Public investments that successfully drive future economic growth are more likely to have long-term fiscal benefits that outweigh near-term costs (Box 13).

BOX 13

Should taxpayers bear the risk of demand decline?

When does it make sense for governments to use public funds to support private investments? Public funds can help overcome market and non-market barriers to private investments that drive broader and longer-term societal benefits, such as the growth of new export sectors. However, poorly targeted public funding can distort market incentives and shift large private risks onto public entities. For example, if a company is facing declining demand for their product, public funding could lead to a moral hazard where companies continue to invest in demand-decline assets instead of new business lines because they do not bear the risk of future transition-related financial losses. Publicly funded assets could then end up stranded, with societal benefits lost.

7. RECOMMENDATIONS

There are currently several areas of policy misalignment:

➤ **Insufficient support for transformation:**

Based on the analysis in this report, public investments in demand-decline sectors would better support future competitiveness if they focused on transformation into new business lines, rather than decarbonization. For oil companies, this could mean a shift away from public investments in reducing emissions from oil production, towards support for oil company investments in transition-opportunity sectors such as hydrogen or biofuels. Oil companies would still be able to finance their own efforts to remain competitive, low-carbon oil suppliers through the global transition.

➤ **Insufficient support for wild cards:** Potentially game-changing, market-disrupting “wild card” technologies risk languishing in obscurity if innovation and economic development supports focus only on commercial or pre-commercial technologies that are likely to yield near-term returns. Higher-risk, higher-reward technologies should also be considered. Increasing risk tolerance also means accepting that some projects will not succeed (Aldy, 2019; Radwanski, 2020).

➤ **Focusing on specific technologies instead of companies with high growth potential:**

Technology-specific incentives, such as the carbon capture, utilization, and storage tax credit announced in the 2021 federal budget, can be an inefficient use of public financing if they distort investment decisions. The CCUS tax credit may create an incentive to invest in carbon capture, utilization, and storage, but it could also distort decision making by leading companies to favour CCUS over other solutions such as electrification or hydrogen that

may be better suited to a specific project, and preferable from a long-run economic and environmental perspective (Dion, 2021).

Targeted financial supports through programs such as the federal Net Zero Accelerator or Investissement Québec may be the most efficient way to provide targeted support for large industrial projects that face barriers to private investment. Such programs offer greater flexibility to evaluate the specific considerations relevant to a given project. Interaction with project proponents also provides the potential for program administrators to encourage cross-company collaboration and support first-of-their-kind commercial-scale technology deployments that may not be envisioned today.

Greater program flexibility and risk tolerance also create implementation risks, however. Harvard economist Dani Rodrik has advocated that industrial policy programs should incorporate three design elements to overcome risks associated with information asymmetry between administrators and proponents and with the potential for administrators to be unduly supportive of specific sectors or companies (Rodrik, 2008):

➤ **Embeddedness:** Fostering strategic collaboration and coordination between the private sector and the government, where government representatives are partially embedded within the sector or company, can serve to uncover the most significant bottlenecks to private investment and design more effective policy interventions. The industry emission-reduction roadmaps created by Fossil Free Sweden are an example of an embedded approach (LeadIt, 2021).

➤ **Carrots and sticks:** Balancing incentives that encourage private investment with sticks

7. RECOMMENDATIONS

such as conditions, sunset clauses, program reviews, monitoring, and benchmarking can weed out failures. Korea and Taiwan, for example, realized significant success from export subsidies conditional on export performance (Rodrik, 2008). Reverse auctions (where proponents bid against each other for financing) can be another way to identify the most promising projects, if appropriately designed (Lackner et al., 2019). Germany is using a pilot program for its steel and chemical industrials that offers carbon “contracts for difference” that guarantee investors a fixed and predictable carbon price (LeadIt, 2021).

- **Accountability:** Setting specific objectives or targets for programs, establishing criteria for decision making, and requiring transparent reporting on outcomes are effective ways to ensure project accountability. Investissement Quebec, for example, reports annually against set objectives, with quantitative indicators that measure results (Investissement Quebec, 2021).

The Government of Quebec, through various organizations and programs, has shown a willingness to invest in projects aimed at spurring

export growth through the global low-carbon transition (Box 14). While there is always room for improvement, their approach shows a significant amount of flexibility in terms of the financial tools being deployed, ranging from purchasing shares, taking equity stakes, and providing loans or grants.

There are also innovative approaches to draw on from around the world that could capture game-changing opportunities, including the XPRIZE Foundation that organizes competitive processes around innovation challenges, and the U.S. ARPA-E (Advanced Research Projects Agency—Energy) that provides funding for high-risk, high-reward research (XPRIZE, 2021; ARPA-E, 2021).

More experimentation, research, and analysis are needed to determine the best mix of policy tools and the optimal program design to support transition success in Canada. This is not a reason for governments to hesitate. Instead, programs can build in continual processes of evaluation and adjustment that account for changes in global market conditions to ensure that public investments and tax incentives are providing the greatest possible value.

BOX 14

Quebec uses a mix of financial tools to support transition-related investment

The Quebec government and its agencies have used a diversity of financial instruments to support cleantech initiatives, including grants from innovation and greenhouse gas mitigation programs, loans, loan guarantees, green bonds, and equity participation.

In line with its strategy for the development of the battery industry, the Quebec government, through Investissement Québec (IQ), supported Nemaska Lithium, a spodumene or lithium ore mine located in Nemaska, 300 kilometers north of Chibougamau in the James Bay Eeyou-Istchee territory. IQ partnered with The Pallinghurst Group to purchase outstanding shares (50-50) and put a newly formed entity controlled by Orion Mine Finance on solid financial footing. The transaction cost IQ \$80 million. Nemaska Lithium also benefited from guaranteed bonds worth \$50 million through Ressources Quebec, an IQ subsidiary.

Another example is EV manufacturer Lion Electric, based in Saint-Jerome. In March 2021, the Government of Quebec and the Government of Canada announced that they would each loan \$50 million to Lion Electric for a new \$185 million battery pack assembly plant in Saint-Jerome. Quebec's loan is at the Quebec bond rate, and \$15 million (or 30 per cent) of it is forgivable. Among the conditions to convert the \$15 million into a grant are creating and maintaining jobs locally, configuring the plant to serve the Canadian market, maintaining the head office in Saint-Jerome, and creating a research and development centre.

IQ also invested in Elysis, a joint venture between Alcoa and Rio Tinto to develop the world's first carbon-free aluminum smelting process at the Elysis plant in Alma. IQ purchased equity for \$60 million at 3.5 per cent, which was matched by \$60M from the federal government. More recently, in April 2021, IQ announced \$20 million of additional financing for Elysis through a venture loan and a subscription.

Additionally, the government of Quebec supported a new \$875 million low-carbon fuel facility by Enerkem in Varennes. Enerkem developed a technology that turns commercial and industrial waste into biofuels and renewable chemicals. Oil and gas companies Suncor and Shell and methanol producer Proman are investors in the facility, along with Hydro-Québec and the governments of Canada (\$74 million) and Quebec (\$160 million).

Sources: Enerkem (2021); Investissement Quebec (2020, 2021b); Nemaska Lithium (2020); Halin (2021); Elysis (2018); Infrastructure Canada (2020).

7.3 DEVELOP LOCAL AND PEOPLE-FOCUSED TRANSITION PLANS

RECOMMENDATION 3:

Federal, provincial, territorial, municipal, and Indigenous governments should work together to develop detailed transition plans to support workers and communities and improve overall well-being. Transition plans should aim to attract new sources of growth and jobs, support worker transition and skill development, improve youth education outcomes and readiness, ensure alignment with Sustainable Development Goals, and empower Indigenous economic leadership.

Implementation example: Community transition plan

Community Z relies heavily on a single sector that will experience declining global demand in the coming decade. To prepare for what could potentially be a very disruptive shock to the community, it is developing a transition plan to support economic diversification and address unemployment. With support from a provincial transition fund, the community starts a five-stage process to develop a transition plan: (1) consultation; (2) analysis; (3) options evaluation; (4) engagement; and (5) plan development. The entire process follows a bottom-up approach, integrating the concerns and ideas of industry representatives, unions, workers, youth, local Indigenous communities, NGOs, and experts from a diversity of disciplines. After commissioning a series of studies based on what they heard and conducting additional engagement with the community and implicated levels of government, the community finalizes and implements the proposal. One of the outcomes of the transition plan is the establishment of an employment hub for affected workers, which provides targeted retraining programs, a space to work on their resumes, and regional job postings.



7. RECOMMENDATIONS

The low-carbon transition is an opportunity to build a stronger, more inclusive, and more diverse economy. This requires governments at all levels to be actively involved in planning and managing transition.

Some regions and communities will require more economic transformation than others. Economic shocks can also worsen existing inequities and vulnerabilities, making it even more important to explicitly target those issues as part of transition.

Transition plans should not only provide social support and training for workers that experience job loss, but should actively pursue new sources of investment and job growth in affected regions and communities. These programs could apply not just to transition-vulnerable communities, but to those most in need of new opportunities, including Indigenous communities and communities with high pre-existing levels of unemployment.

Empowering communities to capture opportunities

Companies active in areas that will experience demand growth, as well as transition-ready companies, can provide opportunities to diversify and expand local economies. Clean energy sources such as wind, solar, and geothermal as well as mining, agriculture, and biomass products could provide local job creation outside of large urban centres where it may be harder to find alternative employment.

Federal and provincial governments can help vulnerable communities overcome barriers to investment in several ways:

► **Infrastructure investment:** Many northern communities lack the road, transportation,

and broadband internet infrastructure needed to attract new investment (NIEDB, 2016). Other communities looking to develop clean energy may lack the transmission infrastructure needed to sell the power generated.

► **Project financing:** Financing is a significant barrier for smaller and Indigenous communities, particularly when the community or a local business is a project proponent or partner. Low-cost loans or loan guarantees, combined with grants for feasibility studies and due diligence capacity, can help overcome financial barriers. Examples include:

- » The First Nations Major Project Coalition has called for credit enhancements from governments, such as loan guarantees, to overcome challenges that First Nations face in raising the capital to purchase equity stakes (FNMPC, 2021a).
- » Governments could expand existing programs such as Aboriginal Financial Institutions (AFIs) and the Indigenous Growth Fund (NACCA, 2021).
- » Governments could increase the attractiveness of investments through procurement commitments. For example, the federal government has committed to achieve a target of at least five per cent of federal contracts awarded to businesses managed and led by Indigenous Peoples by 2024 (Office of the Prime Minister, 2019; PSPC, 2021).
- » The U.S. has explicitly included a 40 per cent carveout for transition-affected and vulnerable communities in its proposed clean energy and sustainability accelerator fund (St. John, 2021).

7. RECOMMENDATIONS

» The EU developed a new 19.3 billion euro Just Transition Fund and a public sector loan facility leveraged by the European Investment Bank (EIB) to mobilize public and private finance for transition (European Commission, 2021c).

► **Capacity building and analytical support:**

Smaller communities often lack the dedicated, knowledgeable proponents needed to identify and attract new investment opportunities. Regional advisory hubs could work closely with communities to build capacity and connect communities with potential investors and growth-oriented companies, as well as public programs that could support projects and worker transition. The InvestEU advisory hub, aimed at facilitating and mobilizing private investment, was included as one of the three pillars of the European Union's Just Transition plan (European Commission, 2021c; InvestEU, 2021). The U.S. State of Colorado established an Office of Just Transition to help workers and communities transition from work in coal mines or power plants by supporting new job opportunities, schools, and training (Kohler, 2021).

► **Skills development and retraining:** Companies need skilled workers to meet the challenges of transition, and workers will require retraining if they change jobs or their company transforms. Initiatives such as the Future Skills Centre, funded largely through the federal government, help analyze labour force trends and provide programs to support skills development and retraining. One of their programs supports displaced or underemployed oil and gas workers looking to transfer into petrochemicals, cleantech, high tech, renewables,

and industrial construction (Future Skills, 2021). Skills programming should be ramped up over time with additional provincial and federal financial support to keep pace with transition needs, and continually adjusted to reflect the latest needs and opportunities.

Building resilience in Canada's workforce

Improving the resilience of Canada's workforce to shocks from the low-carbon transition, as well as digitization and automation requires a renewed focus on improving youth education outcomes at the local, regional, and national levels. Right now, low-income and Indigenous youth are least likely to complete high school and post-secondary education. Efforts to improve outcomes need to accelerate to reverse rates of unemployment and poverty.

Various programs across Canada have shown some success in addressing educational outcomes and could be expanded in line with the following policy objectives.

► **Increased supports for vulnerable youth:**

The Pathways to Education program provides targeted supports to low-income high school students. It estimates that every dollar spent by the program generates \$24 in social returns, with 74 per cent of graduates going on to post-secondary education, providing skills that employers need and breaking the parent-child cycle of poverty (Pathways to Education, 2021a). The program is concentrated in cities, however, and does not have locations in Newfoundland and Labrador or the Territories. Federal and provincial funding accounts for around 65 per cent of the organization's revenues, with corporate and individual donations and foundation support accounting for the remainder (Pathways to Education, 2021b).

- **More post-secondary institutions in Northern regions:** In the Northwest Territories, a new polytechnic university will launch in 2025. It will focus on skilled trades in technology, mining, and environmental management, as well as business, education, health, and community services (Williams, 2020). Expanding post-secondary programs and accessibility can help build skills needed through transition while reducing workforce vulnerability.
- **Indigenous-centred education programming:** British Columbia uses Education Enhancement Agreements, where the British Columbia Ministry of Education pursues agreements with school districts and local Indigenous communities to increase student success and improve Indigenous learning. One school in the Central Okanagan school district partnered with the local Indigenous community to design an alternative Indigenous-led program, and saw the Indigenous graduation rate at the school increase from 61 per cent in 2011 to 78 per cent in 2016 (Pathways to Education, 2018). The Government of the Yukon is establishing a First Nations School Board that will focus on land-based education, involvement from elders and other community members, and alternative ways of assessing progress (Tukker, 2021).
- **Non-institutional learning and skill development:** Indigenous Guardians programs across Canada are engaging children and youth to provide hands-on experiences and increase their sense of belonging, abilities, pride, and cultural connection (Indigenous Guardians Toolkit, 2021). The youth of today could be future leaders caring for lands and waters, tracking climate change, and helping to mitigate its impacts (Brown, 2021). Their role will be even

more important as mining and clean energy developments proliferate in remote areas and there is increased recognition of the importance of traditional land management practices for addressing climate change.

At the same time, there should be a re-examination of post-secondary education programs across skilled trades, colleges, and universities, to ensure that these programs are creating a workforce capable of seizing market and technological opportunities. The youth of today will be Canada's future innovators, business leaders, engineers, and technicians. The better equipped they are to navigate transition-related market and technological changes, the more likely Canada will succeed.

Aligning transition plans with other policy objectives

Canada's transition can be designed to support broader economic and societal objectives, including Indigenous reconciliation and the United Nations' Sustainable Development Goals. In fact, an unmanaged transition could run counter to these objectives. While considering multiple intersecting transition objectives adds complexity to decision making, it is much easier to resolve conflicts at the design stage than after investments have been made. To ensure alignment, transition plans should include:

- **Opportunities for Indigenous leadership:** Transition planning should involve Indigenous governments, communities, and organizations at every step, but should also seek to empower Indigenous leadership. The best transition plans will include strong support for Indigenous entrepreneurship, income generation, and land management, and align with UN-DRIP legislation and reconciliation objectives.

7. RECOMMENDATIONS

- ▶ **Vulnerability assessments:** Ensuring that transition improves overall well-being outcomes and leaves no one worse off requires understanding who is most vulnerable. Distributional analyses of possible negative impacts on employment, income, health, and other outcomes should be undertaken at the national, provincial/territorial, and local levels to identify specific policy interventions to reduce vulnerability.
- ▶ **Sustainability considerations:** Transition plans should ensure that movement away from traditional economic activities, and the development of new economic activities, are consistent with national, regional, and local greenhouse gas emission-reduction objectives as well as other objectives such as air pollution reduction, water protection, biodiversity conservation, and resilience to a changing climate. For example, transition

plans will need to address environmental and liability concerns relating to abandoned oil and gas wells, coal mines, and other facilities. In 2020, Alberta alone had over 100,000 abandoned wells (Weber, 2021). Expanded mining activity in northern regions and on Indigenous lands will also need careful management.

Transition planning is an opportunity to build a shared vision and common understanding of the economic and societal changes needed to thrive through the global low-carbon transition while simultaneously meeting our economic, social, and environmental objectives. Setting out a plan with specific objectives, targets, actions, and timelines will ensure that communities are prepared to seize transition opportunities as they arise and effectively manage bumps in the road.

7.4 MANDATE THE DISCLOSURE OF CLIMATE-RELATED METRICS THAT ARE DECISION-USEFUL

RECOMMENDATION 4:

The federal government—with leadership from the Privy Council Office—should work with the Sustainable Finance Action Council, securities and financial regulators, provincial and territorial governments, standards associations, and Indigenous organizations to accelerate the development and require the use of quantitative and comparable company- and product-level metrics, standards, and certifications that measure climate, environmental, social, and Indigenous performance. Building on international approaches, the federal government should address priority gaps where Canadian-led work is needed, including better disclosure metrics, coverage of large private companies, leadership from Crown corporations and public entities, product certification, financial product oversight, and Indigenous metrics.

Implementation example: ESG standards and certification

Mining company A has committed to adopting a suite of new technologies to minimize its Scope 1 and 2 greenhouse gas emissions at a proposed northern cobalt mine. In addition, it has committed to world-leading tailings management and reclamation, with negligible impact to natural ecosystems. The company has also reached an agreement with three local First Nations communities that includes equity stakes in the project, a formal role in any decisions that would alter land-use or reclamation plans, and commitments to hire and procure goods and services from the communities.

Company A has, however, struggled to obtain financing for the project, even with a growing number of electric battery manufacturers interested in moving away from cobalt imports associated with human rights abuses and poor environmental performance. The company included some of its environmental and social performance in its annual sustainability report, but investors were unable to differentiate between company A and others that make similar sustainability claims.

A new standard developed in Canada offers a clear methodology, with transparent, comparable, and quantifiable metrics, combined with third-party certification for low emissions and exemplary environmental, social, and Indigenous performance. Once Company A was certified, it was able to attract investors right away and move forward with the project.

7. RECOMMENDATIONS

Investors and consumers are increasingly making decisions based on their understanding of the climate-related and ESG (environmental, social, and governance) performance of companies and products. However, it is difficult to do an apples-to-apples comparison without consistent, decision-useful, quantitative, and comparable metrics or credible certifications to validate labels like *green*, *sustainable*, *low-carbon* or *ESG*.

While international approaches are emerging, and the new International Sustainability Standards Board has committed to provide clear disclosure guidance in the near term, Canada needs a more coordinated and strategic approach to address remaining gaps and opportunities. This approach should be led by the federal government—with leadership from the Privy Council Office—in collaboration with the Sustainable Finance Action Council (SFAC), which is tasked with increasing the number of companies completing climate-related disclosures and addressing gender and diversity reporting (Finance Canada, 2021d).

The Privy Council Office, as a central agency, is capable of making connections across the government's policy priorities. It is best placed to coordinate a horizontal interdepartmental team to help identify where Canada should lead and influence international approaches, and where Canada should develop its own certifications or standards to address remaining gaps. Through close collaboration with SFAC, the Privy Council Office could coordinate across multiple departments (including Finance Canada, Environment and Climate Change Canada, Natural Resources Canada, Innovation, Science and Economic Development Canada, and Crown-Indigenous Relations and Northern Affairs Canada), as well as provincial securities regulators, the Office of the Superintendent of Financial Institutions (OSFI), provincial and terri-

torial governments, standards associations, and Indigenous organizations. This work should also be done in close consultation with relevant Crown corporations and industry associations and, where possible, be aligned with disclosure requirements implemented in Canada's major trading partners (the United States in particular).

Based on our analysis, there are six key areas where Canadian-led work is needed:

- ▶ **Gaps in disclosure:** International approaches to company-level reporting, such as the guidance provided by the TCFD, may not address all issues relevant to Canada. Some companies may wish to go beyond minimum disclosure requirements in order to showcase their transition readiness or their environmental or social leadership. Doing this in a standardized way—even if it is only initially done in Canada—could make it easier for investors and consumers to interpret the information. For example, Table 8 provides an indication of the types of metrics that could be decision-useful based on the transition impact drivers identified in this report.
- ▶ **Gaps in coverage:** Disclosure is primarily envisioned for publicly traded companies and financial institutions. To avoid unintended consequences, such as companies selling emissions-intensive assets to private companies, there may also need to be reporting requirements for certain types of private firms. These could be linked to existing facility-level federal Greenhouse Gas Reporting Program requirements, but with company-specific information packaged in a more accessible and comparable format for investors (ECCC, 2021). This would help institutions that invest in both public and private companies make informed decisions.

Table 8

Decision-useful company-level performance metrics

Impact driver	Low-carbon transition performance		Forward-looking targets		Other decision-useful information	
Demand-creation and carbon-cost sectors	1	Company: Scope 1 and 2 emissions divided by company enterprise value, or revenue	3	2030: emissions-intensity targets for #1 and #2, with absolute emission implications	6	Offsets: type, tonnes of CO _{2e} , as a per cent of total emissions
	2	Product: Scope 1 and 2 emissions divided by sector-specific production metric (e.g., tonnes, kWh, megajoules), and per cent of revenue by product	4	2050: emissions goal (absolute or intensity)	7	Lifecycle or Scope 3 emissions: from purchased inputs, product use
			5	Plan: Specific changes or investments to meet the targets outlined in #3 (and #4 if possible)	8	ESG: Indigenous and human rights commitments, gender, diversity, and environmental performance (e.g., ecosystems, water)
Demand-decline sectors (in addition to #1-8)	9	Transformation: Scope 3 emissions, investment in and/or revenue from transition-consistent business lines	11	2030: target sales revenues from transition-consistent business lines	13	2050: transformation goals and pathways out to 2050
	10	Competitiveness: non-proprietary indicators of reduced production costs/added product value (e.g., breakeven oil price)	12	2030: target production cost, product value improvements (e.g., lower breakeven oil price)	14	2050: production cost, product value goals out to 2050

➤ **Gaps in public reporting:** Crown corporations and other public entities will increasingly be expected to undertake climate-related and ESG reporting that meets or exceeds private-sector best practices. For example, the federal Net-Zero Emissions Accountability Act (Bill C-12) will require the Minister of Finance, in cooperation with the Minister of Environment and Climate Change, to publish an annual report outlining measures that departments and Crown corporations take to manage financial risks and opportunities related to climate change (ECCC, 2021). This is an opportunity to demonstrate leading reporting practices, and to drive stronger

alignment across climate, economic, environmental, social, and Indigenous policy objectives. Provinces and territories should pursue similar approaches.

➤ **Product certification:** There is likely to be growing market interest in—and scrutiny of—the climate, environmental, and social performance of products. For example, transition minerals, hydrogen, and biofuels could raise concerns relating to domestic climate goals, biodiversity, or Indigenous rights. To support informed decisions and leading companies, comparable reporting metrics and rigorous and transparent certification processes are

7. RECOMMENDATIONS

needed. For example, Canada could develop a low-carbon hydrogen certification standard that would allow consumers and investors to fairly compare the performance of blue and green hydrogen producers.

- **Financial product oversight:** The proliferation of financial products with varying labels such as ESG, sustainable, and green requires oversight. Work by the CFA Institute on ESG standards is a helpful starting point for voluntary action to improve market transparency. Standards may eventually need to be regulated by provincial securities commissions to protect investors. The federal government should also weigh in with labelling guidelines and criteria that better align with climate, environmental, economic, and social policy objectives.
- **Indigenous metrics:** ESG ratings and products, and proposed standards, do not address company-level performance relating to Indigenous Peoples, such as hiring and procurement practices, partnerships, community funding, and adherence to UNDRIP. This is an area where Canada can provide international leadership. The federal government could partner with Indigenous organizations to lead a process to develop appropriate reporting metrics. Canadian companies could then be required to report these metrics (in a similar way to gender and diversity reporting require-

ments), through either securities regulators or the Canada Business Corporations Act.

Making progress on these six key areas will require collaboration and coordination across multiple levels of government, the private sector, and civil society. The cross-cutting nature of these issues creates significant governance challenges. Many of the six issues do not fall neatly into the existing mandates of government departments or public regulators. It is not possible or desirable to separate issues of financial stability, market transparency, competitiveness, trade, inclusion, climate change, environment, and Indigenous reconciliation. These issues are inherently interconnected.

Success may require new governance models to bring together experts on finance with experts on climate, environment, economic growth, international markets, technologies, inclusion, and Indigenous rights and reconciliation. The analysis in this report underlines the importance of taking system-wide approaches to the low-carbon transition that identify interconnections and areas of potential misalignment. This type of system-wide policy development requires government employees to work across traditional mandates. Cross-mandate work is best achieved with strong leadership from the centre, including clear direction and accountability from central agencies and the offices of the Prime Minister and Premiers.

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