ontario chamber of commerce

THE CLIMATE CATALYST:

ONTARIO'S LEADERSHIP IN THE GREEN GLOBAL ECONOMY

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Executive Summary

The science is clear. Human activity is disrupting the climate in every region of our planet, and many of those changes are irreversible over centuries. The climate crisis presents a significant and material threat to individuals, businesses, and natural habitats. In Canada, those impacts are disproportionate for Indigenous, Northern, and low-income communities.

The economics are also clear. Confronting climate change spells opportunities for innovation, job creation, and regional economic development. While there is no vaccine or silver bullet solution to this crisis, Ontario has competitive advantages that it can leverage globally, including its low-carbon energy, world-class colleges and universities, talented workforce, sustainable natural resources, and cleantech sector.

Governments should enable the transition to net-zero emissions by catalyzing continued investment in climate action from the private sector. This report offers a window into the challenges and opportunities for Ontario in the global green economy, with case studies and policy recommendations to inform decisionmakers and inspire action.

- **Part 1 – Climate Change in Canada and Ontario** – outlines the status of climate change, including the impacts of extreme weather events on businesses and communities, a breakdown of emission sources, and key policy milestones.
- **Part 2 – Leadership and Opportunities** – shines a spotlight on sustainable innovation in Ontario with case studies from organizations in different sectors that are taking a leadership role on climate. Specifically, this section highlights climate action plans, low-carbon energy, cleantech, transportation, heavy industry, agriculture, circular goods, buildings, and sustainable finance.
- **Part 3 – Policy Recommendations** – offers recommendations for policymakers to help unlock further investment and innovation at the organizational level. We offer specific solutions around policy stability, clean energy, low-carbon transportation, cleantech, sustainable procurement, exports, waste, real estate, climate adaptation, and climate disclosures.

Major policy priorities in this report can be summarized under the following themes:

1. **Minimize uncertainty.** Improve predictability around climate policies and long-term energy procurement.
2. **Mobilize clean energy solutions.** Use flexible regulation, risk-sharing partnerships, tax incentives, and Indigenous-led projects to accelerate investments in a suite of low-carbon energy technologies.
3. **Support cleantech.** Invest in research and commercialization, expand skills training, and de-risk private financing for clean technology.
4. **Strengthen climate adaptation.** Coordinate strategies across levels of government, make tangible commitments and investments, and advance Indigenous reconciliation.

Summary of Recommendations

Recommendations	Government		
	Ontario	Canada	Municipalities
1. Minimize uncertainty:			
a. Outline a clear decision-making framework for future climate policy decisions.	ON	CA	
b. Clarify how Ontario will use proceeds from its Emissions Performance Standards program.	ON		
c. Establish a provincial framework for carbon offsets.	ON		
d. Use public-private partnerships more strategically to share risks with investors.	ON	CA	
e. Develop a long-term energy framework focused on reliability, sustainability, and affordability and ensure there is a competitive and transparent process for long-term energy contacts that leverages existing assets where possible.	ON		
2. Mobilize clean energy solutions:			
a. Allow utilities to rate base RNG projects, hydrogen projects, and EV charging infrastructure.	ON		
b. Expand federal tax incentives to nuclear technology.		CA	
c. Encourage municipalities to deploy district energy systems.	ON	CA	
d. Support SMR pilot projects in Northern and remote regions.	ON	CA	
e. Champion Indigenous-led clean energy projects and build equitable partnerships that provide tangible economic benefits to Indigenous communities.	ON	CA	
3. Support cleantech:			
a. Invest in cleantech research with promising commercial applications.	ON	CA	
b. Promote and expand skills training opportunities in science and technology.	ON	CA	
c. Support regional innovation centres and technology transfer offices at post-secondary institutions.	ON		
d. De-risk private financing with targeted loan guarantees and tax incentives.	ON	CA	
4. Leverage sustainable procurement:			
a. Consider lifecycle costs and sustainability metrics as part of public sector contracts.	ON	CA	MU

Recommendations	Government		
	Ontario	Canada	Municipalities
5. Expand low-carbon transportation:			
a. Make decarbonization an explicit objective in regional transportation plans.	ON		
b. Support expansion of rail networks and investments in fuel-efficient rail technologies.	ON	CA	
c. Advance transportation technology projects.	ON	CA	
d. Develop a ZEV strategy that integrates EVs, RNG, hydrogen, and hybrid technologies.	ON	CA	
e. Fast-track investments in EV charging infrastructure and work towards standardized EV charging plugs.	ON	CA	
f. Incentivize consumers to use mass transit.	ON		
g. Encourage greater investment and collaboration from municipalities on transit.	ON		
6. Go global:			
a. Help establish a global market for voluntary carbon credits.		CA	
b. Explore the potential for a Canadian carbon border adjustment program.		CA	
c. Develop a bold strategy for low-carbon exports.		CA	
d. Diversify trade towards markets with growing demand for green suppliers.		CA	
e. Attract foreign investment in Ontario's cleantech, mining, and automotive sectors.	ON		
7. Tackle waste challenges:			
a. Work towards a solution for end-of-life battery disposal.	ON		
b. Harmonize waste diversion policies and support industry during the transition.	ON		
c. Reconsider the proposed ban on organic waste in landfills or exempt landfills that generate RNG.	ON		
8. Improve building efficiency and resilience:			
a. Expand energy efficiency programs for small and medium-sized businesses.	ON	CA	
b. Accelerate retrofits by coordinating supply chains, using mass-produced assemblies, and offering long-term financing and guarantees for building owners.	ON	CA	

Recommendations	Government		
	Ontario	Canada	Municipalities
c. Advance green mortgage markets by standardizing criteria, filling data gaps, establishing clear regulatory frameworks, and reducing asset capital requirements for green mortgage lenders.		CA	
d. Incrementally evolve building codes to support net-zero energy readiness and climate resilience.	ON		
e. Support workforce training programs geared towards low-carbon construction, architecture, urban design, and engineering.	ON	CA	
f. Incentivize recycling and repurposing of building materials to extend their lifecycle.			MU
9. Strengthen climate adaptation:			
a. Make concrete commitments to support communities with climate adaptation and asset management through adequate and sustained funding.	ON	CA	
b. Support the federal Task Force on Flood Insurance and Relocation's mandates around flood insurance and relocation, as well as Canada's National Adaptation Strategy.	ON		
c. Implement climate adaptation strategies that specify clear institutional responsibilities, integrate capabilities across siloes, and advance Indigenous reconciliation.	ON	CA	MU
10. Standardize climate disclosures:			
a. Adopt a standardized framework for climate-related disclosures in line with international norms.	ON	CA	
b. Ensure there is sufficient transition time and guidance around climate disclosures.	ON	CA	

Glossary

Biochar

A charcoal-like material produced from the thermal decomposition (pyrolysis) of organic materials (biomass).

Biomass

Organic matter (such as wood and agricultural waste), which can be used as fuel to produce renewable energy.

Carbon border adjustment

A tariff imposed on imported goods based on their emissions intended to level the playing field for businesses in jurisdictions with carbon pricing.

Carbon capture, use, and storage (CCUS)

The process of capturing carbon emissions from power generation or industrial processes before they are released into the atmosphere and either storing it permanently in deep geological formations or using it for other applications such a steel or cement production.

Carbon credit

A certificate showing the quantity of green-house gases that an organization or country has kept out of the atmosphere or removed from it, which can be sold or traded with other parties.

Circular economy

An economic system in which value is recovered from resources by reusing, repairing, refurbishing, remanufacturing, repurposing, or recycling products and materials. Circularity eliminates emissions across the supply chain by changing everything from how goods are designed, produced, consumed, and/or disposed of.

Clean technologies (cleantech)

Products and services that reduce greenhouse gas emissions or increase environmental sustainability.

Climate change

A long-term change in global or regional climate patterns. Since the early 20th century, climate change has been largely driven by human activities.

Combined heat and power (CHP) (also known as cogeneration)

An energy system that produces both electricity and heat from a single fuel source onsite. Natural gas is the most common source, but CHP can also be powered by biomass, biogas, and waste heat. Micro-CHP systems can be used for single homes or small office buildings.

District energy systems

Networks of underground pipes that distribute thermal energy to multiple buildings in an area or neighbourhood. These systems reduce greenhouse gas emissions by delivering economies of scale and enabling the use of less carbon-intensive fuel sources.

Electric vehicles (EVs)

Vehicles that are powered entirely or partially by electricity from a battery that requires charging.

Environmental, social, and governance (ESG)

Criteria increasingly used by investors to assess a company's operations. Environmental factors look at the firm's impact on nature and climate. Social factors focus on its relationships with communities, customers, employees, and suppliers. Governance factors deal with leadership, executive pay, shareholder rights, and other internal processes.

Fuel cell electric vehicles (FCEV)

An electric vehicle that uses a fuel cell, sometimes in combination with a small battery or supercapacitor, to power its electric motor. Fuel cells in vehicles generate electricity generally using oxygen from the air and compressed hydrogen.

Greenhouse gas (GHG) emissions

Gasses that trap heat in the atmosphere, such as carbon dioxide and methane.

Green bond

A fixed-income instrument designed specifically to support climate-related or environmental projects.

Green mortgage

A mortgage designed to incentivize demand for properties that have a lower carbon footprint. Some green mortgages offer preferential terms for buildings that meet certain environmental criteria. Others link the cost of borrowing to the energy performance of the associated property.

Hydrogen

A chemical element that can be produced from electricity, biomass, or natural gas and used as a low-carbon fuel.

Natural gas

A fuel that occurs naturally underground and consists mainly of methane.

Net-zero emissions

A state in which the level of GHG gases entering the atmosphere is no greater than the level being removed.

Net-zero energy ready (NZER) building

A property that is designed to be highly energy efficient. NZER buildings are built and wired such that they could, with the addition of solar panels or other renewable energy technologies, achieve net-zero energy performance.

Precision agriculture

A method of farming that uses technology such as drones and sensors to collect data and optimize resource allocation.

Public-private partnership (P3)

A contractual, risk-sharing arrangement between a private sector consortium and the public sector to deliver, finance, and/or maintain infrastructure assets.

Pyrolysis

The decomposition of biomass through heat in the complete or near absence of oxygen.

Renewable natural gas (RNG)

Gas that is produced by capturing and purifying the biogas emitted from decomposing organic waste.

Small modular reactors (SMRs)

Nuclear reactors that are smaller than traditional power plants (typically under 300 megawatts electric) designed using modular technology.

Sustainable finance

The process of taking ESG considerations into account when making investment decisions.

Sustainable procurement

A process which focuses on buying products with low environmental impact and positive social results.

Vertical farming

The practice of growing crops in vertically stacked layers.

Zero-emission vehicles (ZEVs)

Vehicles that can operate without producing tailpipe emissions. ZEVs can use battery -electric, plug-in hybrid, or hydrogen fuel cell technology.

PART 1 – Climate Change in Canada and Ontario

In August 2021, the United Nations' Intergovernmental Panel on Climate Change (IPCC) released an update: **every region of our world is facing unprecedented changes to its climate**, many of which are irreversible under even the most optimistic scenarios.[i] The planet is getting warmer, rainfalls and droughts are intensifying, sea levels are rising, oceans are acidifying, permafrost is thawing, and extreme weather events are becoming more severe and more frequent. Notably, the IPCC's report reflects major advances in the science of attribution, drawing causal connections between human activities, climate systems, and extreme weather events.

The report has been described as 'code red for humanity.'[ii] But what does climate change mean for Canada and Ontario?

1.1 Extreme Weather Events in Canada

Canada's experience with climate change is characterized by a rise in extreme weather events, attributed to changes in climate patterns. Figures 1 and 2 show forecasted changes in average temperature and precipitation levels for Canada under a moderate-emissions scenario that assumes relatively stringent climate policies, widespread adoption of low-carbon technologies, and changes in the way lands are used.[1] Although this is far from a worst-case scenario, it shows Canada's average temperatures rising by two degrees Celsius and precipitation levels increasing by five percent from now to 2060. Research also shows Canada warming twice as fast as the rest of the world.[iii]

Figure 1: Forecasted change in mean temperature in Canada (degrees Celsius)[iv]

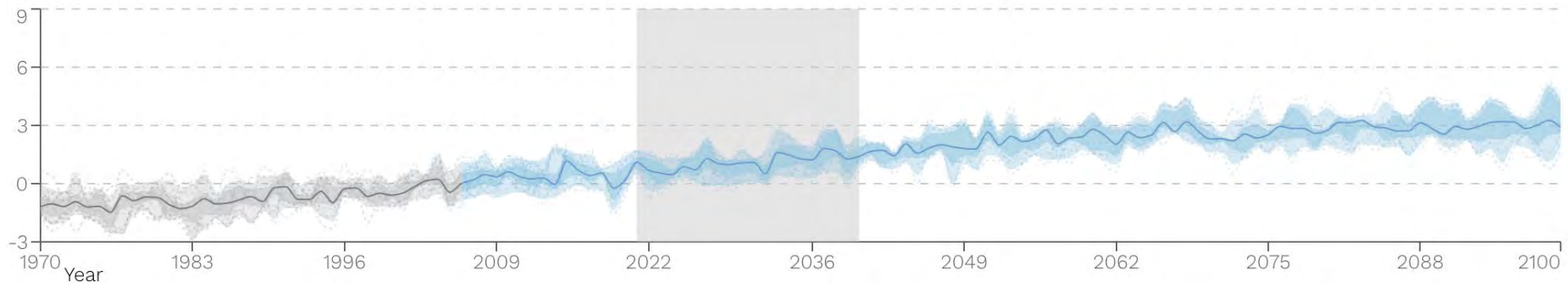
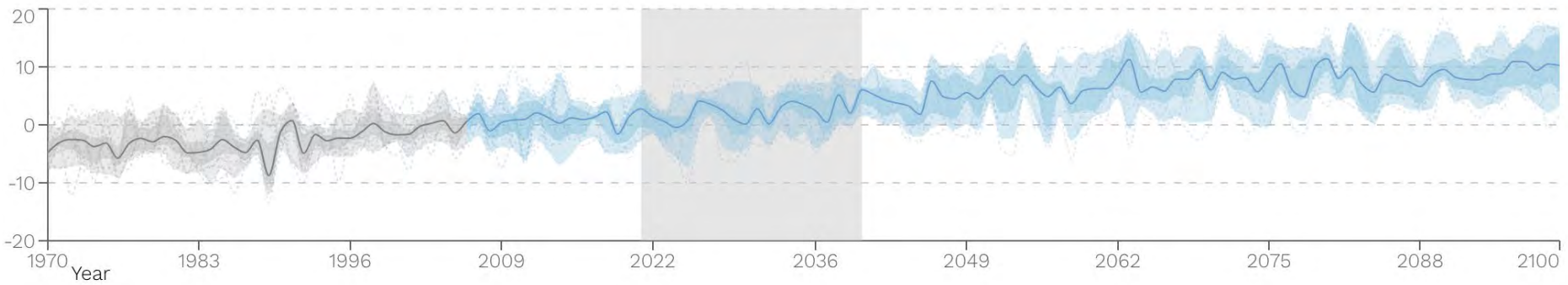


Figure 2: Forecasted change in precipitation in Canada (%)[v]



1 Representative Concentration Pathway (RCP) 4.5 is described by the IPCC as an intermediate scenario. Emissions in RCP 4.5 peak around 2040, then decline to reach roughly half of the levels of 2050 by 2100.

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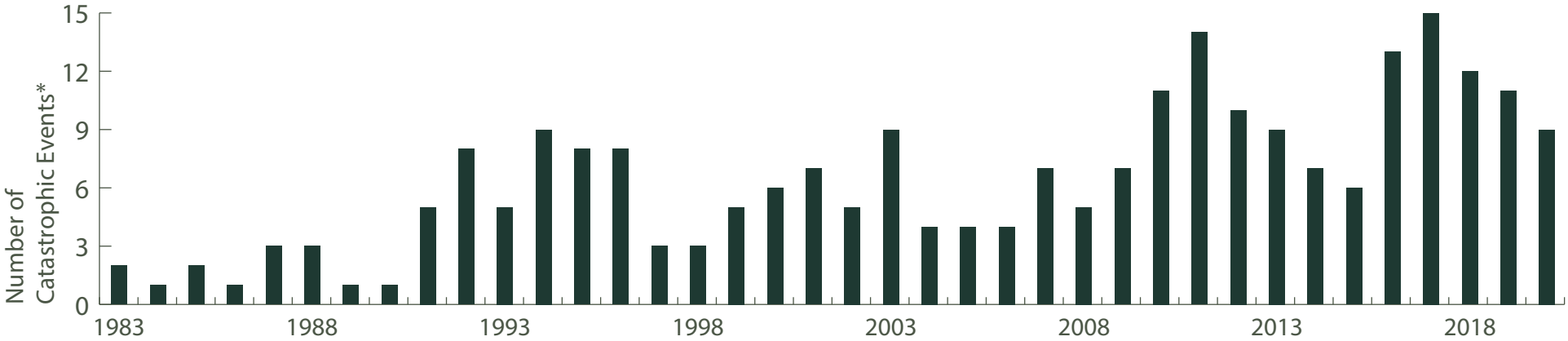
As a result of these changes to our climate, **extreme weather events are becoming both more frequent and more severe** (Figure 3).[vi] In June 2021, the highest temperature on record in Canadian history was registered in Lytton, British Columbia. The previous year, Calgary broke a national record for the most damaging hailstorm. Alberta also experienced extreme flooding in 2020 when ice-choked rivers flooded downtown Fort McMurray, a community that was ravaged by a devastating wildfire in 2016.

The types of extreme weather events with the greatest risk to businesses in Canada include: [vii]

Ontario is far from immune. During the first half of 2021, Northern Ontario had recorded 900 wildfires – nearly twice the 10-year average – caused by drought and lightening.[viii] Extreme flooding, thunderstorms, and wind-storms in Southern and Eastern Ontario have also become increasingly prevalent in recent years.[ix]

The frequency and intensity of catastrophic weather events will continue to increase until at least mid-century under all emissions scenarios considered by the IPCC.[x] Today's headlines are expected to become commonplace tomorrow.

Figure 3: Number of catastrophic weather events in Canada (1983 to 2019) [xi]
*Events costing $25 million or more in insured damages



1.2 Impacts on Ontario Businesses and Communities

Climate change has costly implications for both residents and businesses in Ontario. The majority (53 percent) of respondents to the OCC's 2021 Survey on Business Confidence agree climate change poses a threat to the communities in which they operate.[xii] Many are likely underestimating the threat; a 2019 review of corporate adaptation strategies published in *Nature* found that businesses tend to overlook the impacts of climate change on their own supply chains and the broader economy.[xiii]

For primary sectors such as agriculture and forestry, these impacts are direct. Climate change can destroy habitats suddenly through single weather events and more gradually through changing weather patterns. Farmers are seeing droughts, flooding, and disruption of supply chains, as well as changes to crops, milk production, and weight gain in animals.

In Ontario, extreme weather events are disproportionately affecting Northern and Indigenous communities. Nearly 4,000 people from First Nations communities in Northwestern Ontario were evacuated due to wildfires during the 2021 summer season alone.[xiv] Evacuations are becoming larger, more frequent, and more difficult to manage in the Far North, and the impacts on many Indigenous communities are further compounded by aging infrastructure, lack of access to clean drinking water, and reliance on diesel.

There are also ways in which the climate crisis impacts businesses across all sectors, including the physical damage inflicted on transportation, electricity, telecommunication, and other infrastructure.[xv] Looking at roads and railways alone, increasing temperature and precipitation levels could lead to damages costing more than $12 billion annually in Canada by the end of the century.[xvi] Infrastructure damage will hinder the delivery of services across the economy, leading to widespread social and economic consequences that are more difficult to measure but equally concerning.[xvii]

Insurance providers, faced with increased risk of weather-related events and claims, have no option but to price that risk within premiums. Between 1983 and 2000, catastrophic insurable losses averaged $79 million per year in Ontario and $399 million per year in Canada. Since then, **average annual insurable losses have increased by more than 500 percent**, to $510 million in Ontario and $2.1 billion in Canada between 2010 and 2020 (Figure 4). In 2020, severe weather events caused $2.3 billion in insured damage across Canada, the fourth highest on record.[xviii]

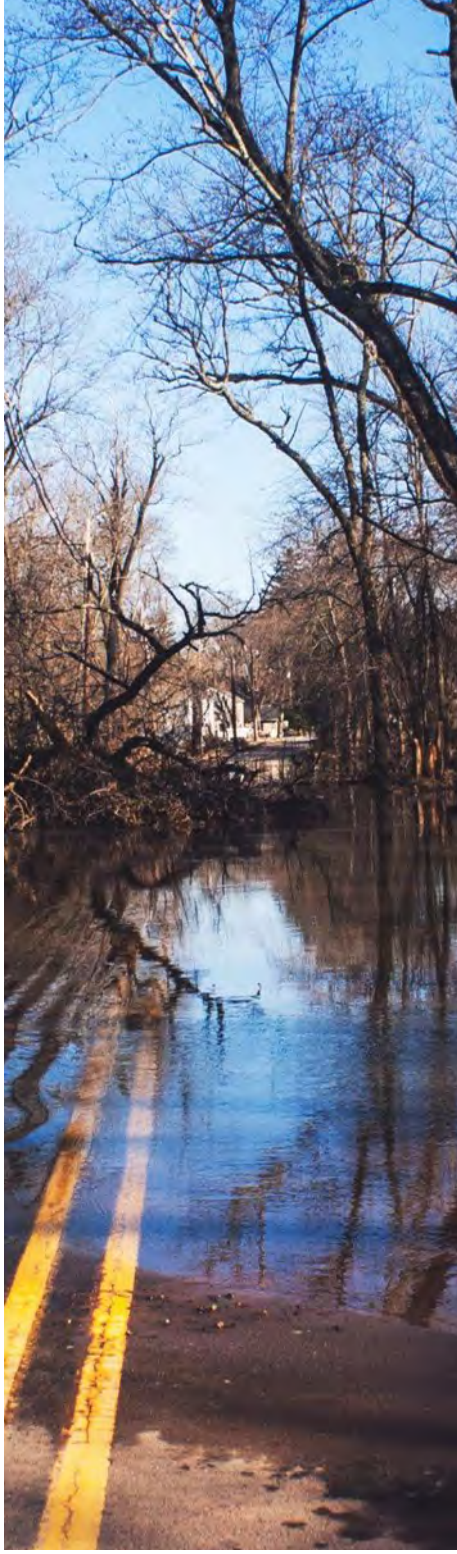
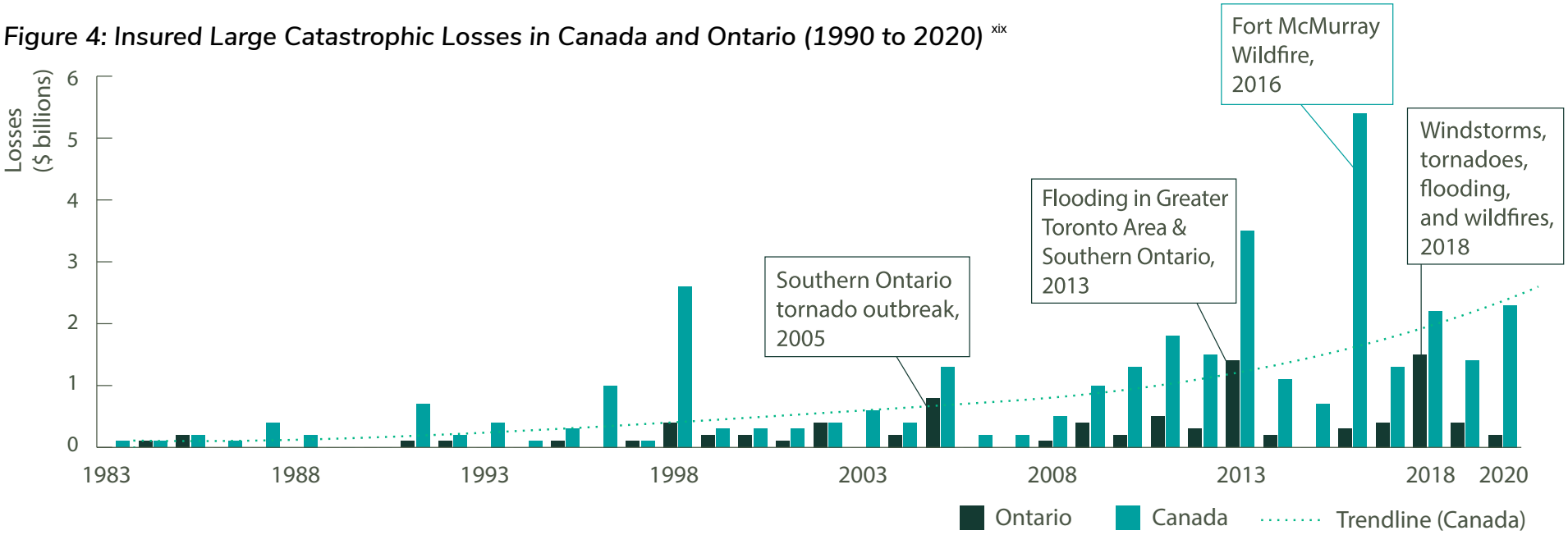


Figure 4: Insured Large Catastrophic Losses in Canada and Ontario (1990 to 2020) [xix]



Flooding is the most widespread natural disaster across Canada and the lead driver of rising catastrophic insurable losses.[xx] It accounts for roughly three quarters of federal Disaster Financial Assistance payments.[xxi]

In some residential areas in Canada where repeated flooding has occurred, residential flood insurance has become more expensive and in some cases the coverage is no longer available.[xxii] The upshot is that even when properties are insurable, the total amount of potential damage covered by insurance will decline in concert with the growing risk.[xxiii]

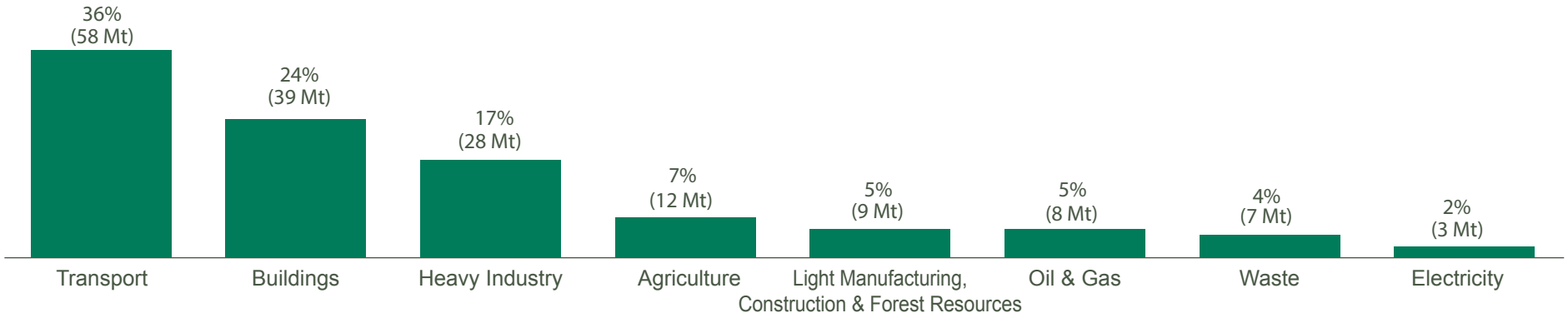
Climate change affects shipping costs as well, which has broad consequences for supply chains. When water levels are low, marine shipping companies are forced to lighten their vessel loads, which leads them to apply low-water surcharges on cargo. In 2021, water levels on the St. Lawrence River saw their driest conditions since 1966.[xxiv]

Finally, the socioeconomic impacts of climate change – on public health,[xxv] social stability,[xxvi] and resource availability[xxvii] – represent a serious threat to the underpinnings of society and business prosperity. The 2013 floods in Alberta show the magnitude of potential economic losses; more than 150,000 people could not access office buildings located in downtown Calgary for approximately two weeks. The result was five million lost work hours, equivalent to $500 million in GDP.[xxviii] Mitigating climate change benefits business insofar as it benefits a functioning society and economy.

1.3 Ontario's Greenhouse Gas Emissions

Climate change is caused by a concentration of greenhouse gas (GHG) emissions in the atmosphere. In Ontario, the bulk of GHG emissions come from transportation, industry, and buildings. Figure 5 shows a breakdown of emissions by sector for the province.

Figure 5: Emissions in Ontario (2019) by Sector, Mt CO_2-eq (Megatonnes of Carbon dioxide equivalent)[xxix]



Transportation: The transportation sector accounts for 36 percent of Ontario's annual GHG emissions. Of those emissions, 84 percent come from road transportation.[xxx] While most sectors have seen their emissions drop on an absolute basis over the past five years, transportation emissions have increased by nine percent, outpacing population growth over the same period.[xxxi]

Buildings: Residential and commercial/institutional buildings account for 24 percent of emissions in Ontario (13 and 11 percent respectively). These emissions have increased by 42 percent since 1990. Although improvements have been made to the energy efficiency of buildings and the energy supply mix, these effects have been outweighed by population growth and increases in per-capita floor space.[xxxii]

Heavy industry:[2] Emissions from heavy industry have declined by 15 Mt (or 35 percent) since 1990, mostly in the chemicals and fertilizers subsector due to the closure of an adipic acid factory.[xxxiii]

Agriculture: The agricultural sector's emissions have remained stable over the years. The sources are broken down into three parts: on-farm fuel use (2.5 Mt), crop production (3.4 Mt), and animal production (6.3 Mt).

Other: The remaining sources include oil and gas (5 percent, largely from petroleum refining), waste (4 percent), light manufacturing (4 percent), construction (2 percent), electricity (2 percent), and forest resources (<1 percent). Since phasing out coal-fired electricity generation, Ontario has one of the cleanest energy systems in North America (discussed further in Section 2.2).

By comparison, 34 percent of Canada's emissions come from the energy sector (including 26 percent from oil and gas and eight percent from electricity). The next leading sources for Canada are transportation (25 percent), buildings (12 percent), heavy industry (11 percent), and agriculture (10 percent).[xxxiv]

2 Heavy industry includes metal and nonmetal mining activities, as well as smelting and refining, pulp and paper, iron and steel, cement, lime and gypsum, and chemicals and fertilizers.

1.4 Policy Milestones

There is broad consensus among mainstream political parties in Canada that addressing climate change is important. During the 2021 federal election, all major party platforms referenced 'climate change', 'global warming', 'climate crisis', 'net-zero', 'sustainable', and/or 'sustainability' – 87 times by the Liberal Party, 32 times by the Conservative Party, 78 times by the New Democratic Party, 90 times by the Green Party, 12 times by the Bloc Québécois, and five times by the People's Party (although all references in the latter's platform involved denials of human activity's link to the crisis or a promise to withdraw from global climate agreements).[3]

Momentum around climate action has increased over the past two decades, but it has not always been linear or tightly coordinated across federal and provincial lines. This is partly a result of jurisdictional ambiguity around environmental issues and the inherent complexity of regulating it. The following timeline highlights key policy milestones in Ontario and Canada since the early 2000s.

ONTARIO		CANADA
	2001	Canada becomes the first country to ratify the Stockholm Convention, a global agreement aimed at safeguarding human health and the environment from persistent organic pollutants
	2002	The *Species at Risk Act* is passed to protect species that could become extinct, endangered, or threatened due to human activity Canada ratifies the Kyoto Protocol, which enters into force in 2005 and commits Canada to reducing its GHG emissions to an average of 6% below 1990 levels between 2008 and 2012
Ontario commits to phasing out coal-fired electricity generation	2003	
Ontario passes *The Greenbelt Act* and establishes the Greenbelt Plan to protect environmentally sensitive areas and agricultural land	2005	Canada hosts the Convention of the Parties (COP11) of the United Nations Framework Convention on Climate Change, where over 40 important decisions were made to coordinate international climate action
Ontario passes the *Clean Water Act*, which makes municipalities responsible for protecting local drinking water sources	2006	

3 Only includes terms within a relevant context, excluding tables of contents and reference sections.

	2008	Canada passes the *Federal Sustainable Development Act* to create a legal framework for implementing a Federal Sustainable Development Strategy that will make environmental decision-making more transparent and accountable
Ontario passes *The Green Energy Act*, intended to expand renewable energy production in the province	2009	Canada signs the Copenhagen Accord, agreeing to reduce greenhouse gas emissions to 17% below 2005 levels by 2020
Ontario introduces the Electric Vehicle Incentive Program	2010	The *Environmental Enforcement Act* is passed to strengthen and harmonize the enforcement regimes of nine key environmental acts
Coal-fired generation is phased out in Ontario and largely replaced by nuclear power	2014	Canada launches a National Conservation Plan to coordinate conservation efforts across the country Environment Canada releases a report stating that Canada will not meet its Copenhagen Accord target, and that its GHG emissions might increase by 2020
Ontario's Climate Change Strategy is released	2015	Canada signs the Paris Agreement, committing to reduce Canada's GHG emissions by 30% below 2005 levels by 2030 Federal, provincial, and territorial governments release the 2020 Biodiversity Goals and Targets
	2016	Canada's First Ministers adopt the Pan-Canadian Framework on Clean Growth and Climate Change – Canada's first-ever national climate plan
The cap-and-trade system begins in Ontario Ontario introduces a *Strategy for a Waste Free Ontario: Building the Circular Economy*	2017	
Ontario's Cleantech Strategy is released Ontario cancels the cap-and-trade system Ontario cancels the Electric Vehicle Incentive Program Ontario introduces its Made-in-Ontario Environment Plan, with a target of reducing GHG emissions by 30% below 2005 levels by 2030	2018	The federal carbon pollution pricing system (*The Greenhouse Gas Pollution Pricing Act*) comes into force, providing a federal backstop for provinces/territories that request it or *fail to implement their own systems* consistent with federal standards Canada announces final regulations to phase-out traditional coal-fired electricity by 2030 and published GHG regulations for natural gas-fired electricity Together with its G7 partners, Canada launched the Oceans Plastic Charter to help improve the management of plastics

Ontario repeals *The Green Energy Act* Kingston, Ontario becomes *the first municipality in Ontario to declare a climate emergency* *Ontario releases its* Emissions Performance Standards, which are accepted by the Government *of Canada as an alternative to the federal output-based pricing system the following year*	**2019**	Canada's carbon pricing scheme begins, with a federal minimum price of $20 per tonne of emissions, set to increase incrementally until reaching $170 per tonne in 2030
Ontario releases *Protecting People and Property: Ontario's Flooding Strategy* Ontario initiates its first-ever climate change impact assessment The Province releases its Ontario Low-Carbon Hydrogen Strategy – Discussion Paper	**2020**	Canada passes the *Canadian Net-Zero Emissions Accountability Act*, which commits Canada to reaching net zero by 2050 Canada introduces a strengthened climate plan (*A Healthy Environment and a Healthy Economy*) with new federal targets and $15 billion in investments Canada releases its Hydrogen Strategy
	2021	Canada's 2021 Budget proposes $17.6 billion in investments towards a green recovery and climate change Canada enhances climate targets by committing to reduce GHG emissions by 40-45% below 2005 levels by 2030 Canada mandates 100% of car and passenger truck sales be zero-emission by 2035

1.5 International Context

Domestic policies rarely exist in a vacuum, and this is especially true for climate policy. After all, emissions ignore borders, and solutions should too. Climate commitments adopted abroad send signals to organizations, governments, and investors everywhere. Global agreements such as those signed (or not signed) in Kyoto, Copenhagen, and Paris, serve as guideposts for decision-makers.

Today, approximately 70 percent of the world's economy is now committed to reaching net-zero emissions, with every member of the G7 on a pathway to net zero by 2050.[xxxv] Under the Biden administration, the United States pledged to reduce its GHG emissions by at least 50 percent by 2030, backed by multi-trillion dollars in federal spending promises. China has said it will aim for carbon neutrality by 2060.[xxxvi]

Collectively, these efforts constitute a patchwork of carbon prices, emission standards, building codes, and industrial policies. In jurisdictions with tighter rules, some governments have attempted to level the playing field and prevent carbon leakage across borders to protect business competitiveness. For example, in July 2021, the European Union (EU) released its proposal for a carbon border adjustment mechanism, which would impose a tariff on imports from countries that do not have a price on carbon. At the Glasgow Climate Change Conference (COP26) in November 2021, leaders from around the world are meeting to negotiate the rules needed to implement the Paris Agreement, including solutions to establish robust systems for carbon credits and reporting.

International coordination on climate is far from absolute, but it does signal a growing consensus among leaders on the need for action. The global market for low-carbon solutions will create unprecedented economic opportunities for businesses and workers that are well equipped to support the transition to net zero.

PART 2 – Leadership and Opportunities

In 2020, despite a pandemic that constrained economic activity, global carbon emissions only fell by less than six percent[xxxvii] – suggesting the answer to climate change is not simply to consume less, but to consume smarter. For most countries to reach anywhere near their emissions targets, every sector of the economy will need to invest in low-carbon strategies and sustainable innovation.

Fortunately, as the global economy transitions to net-zero, Ontario has a lot to offer. Its low-carbon natural resource sectors, burgeoning clean technology industry, and early adoption of emission standards make it well positioned to engage in global markets that increasingly recognize and value sustainability. The following section explores some of the competitive advantages and recent initiatives undertaken by organizations in Ontario to advance decarbonization, providing a snapshot of opportunities with clear economic and environmental benefits.

2.1 Climate Action Plans

Organizations are increasingly embedding sustainability considerations into every aspect of their operations. Some are developing comprehensive strategies with commitments to reach net zero. A few corporate examples include CN's Climate Action Plan,[xxxviii] Ontario Power Generation's Climate Change Plan,[xxxix] Enbridge's Sustainability Report,[xl] SNC-Lavalin's Sustainability Report,[xli] Bruce Power's NZ-2050 Strategy,[xlii] and many others referenced in this report. Within the post-secondary sector, the University of Toronto is recognized as a global leader in championing sustainability (see Case Study #1).

Case Study #1: Climate Action at the University of Toronto

The University of Toronto is a global leader in demonstrating and promoting sustainability. As the first university in the world to join the UN-Convened Net-Zero Asset Owner Alliance, it has committed to a set of actions that will accelerate the University's and Ontario's transition to a sustainable green economy.

These actions include investments to transform university operations, integrated and interdisciplinary research initiatives, divestment from fossil fuel companies, and embedding sustainability in teaching at all levels, these commitments are being rapidly translated into reality.

At the centre of operational activities is a geoexchange system that will create Canada's largest urban ground source heat pump system, located at the centre of its downtown campus. Above ground, expanded public green space will enhance Toronto's public realm. By leveraging the natural thermal storage properties of the ground to regulate building temperature, the geoexchange system will reduce the carbon footprint of several energy-intensive research buildings as part of an upgraded district energy system. Aging infrastructure is also being replaced with state-of-the-art systems that rely on electricity instead of fossil fuels, while new infrastructure integrates low-carbon technologies.

The University's campus plan complements its leadership in cleantech research, which is helping drive emission reductions across all sectors of the economy. The University of Toronto's Climate +VE Energy Initiative will leverage the scale and excellence of the university's research enterprise to help the world hit net zero. The initiative is a unique, interdisciplinary approach that brings together over 90 researchers across eight faculties and 28 divisions to tackle the technological, political, and societal factors that pose barriers to reaching net zero.

The University of Toronto's researchers, in partnership with global industry and local startups, will improve renewable energy generation, storage, transmission, and efficiency to reduce emissions and decarbonize energy systems. This work integrates the complex political and socio-economic realities of clean energy in different jurisdictions around the world. With a focus on adoption, commercialization, and market creation, the Climate +VE Energy Initiative can play a critical role in transforming Canada from one of the world's highest CO_2 emitters per capita to a model for the rest of the world.

2.2 Low-Carbon Energy

The main reason Ontario is ahead of most jurisdictions in achieving net-zero emissions is by virtue of its energy assets. Since most of the province's electricity comes from nuclear and hydro (Figure 6), the carbon intensity of its electricity (approximately 30 grams per kilowatt hour in 2019) is one seventh that of California and one twelfth that of Germany.[xliii] Continued innovation and investments in the province's energy industry can provide a foundation for decarbonization domestically and abroad.

Nuclear power played a key role in the province's transition away from coal-fired generation and currently accounts for most of its electricity supply. Ongoing refurbishments at Bruce Power and Darlington will secure approximately 10,000 megawatts of electricity for decades to come.[xlv]

Further, as more industries and jurisdictions look to electrify their energy sources, the sector is developing the next generation of nuclear. Small modular reactors (SMRs) will offer the same benefits of traditional nuclear reactors – low emissions, reliable baseload power, and the ability to operate around the clock under all weather conditions – with a much smaller land footprint. Since SMRs are modular, they are easier to build and operate. They can generate electricity and produce heat for commercial or residential needs, hybrid energy systems, water desalination, or heavy industry applications. They also provide a clean alternative to diesel in Northern and remote communities.

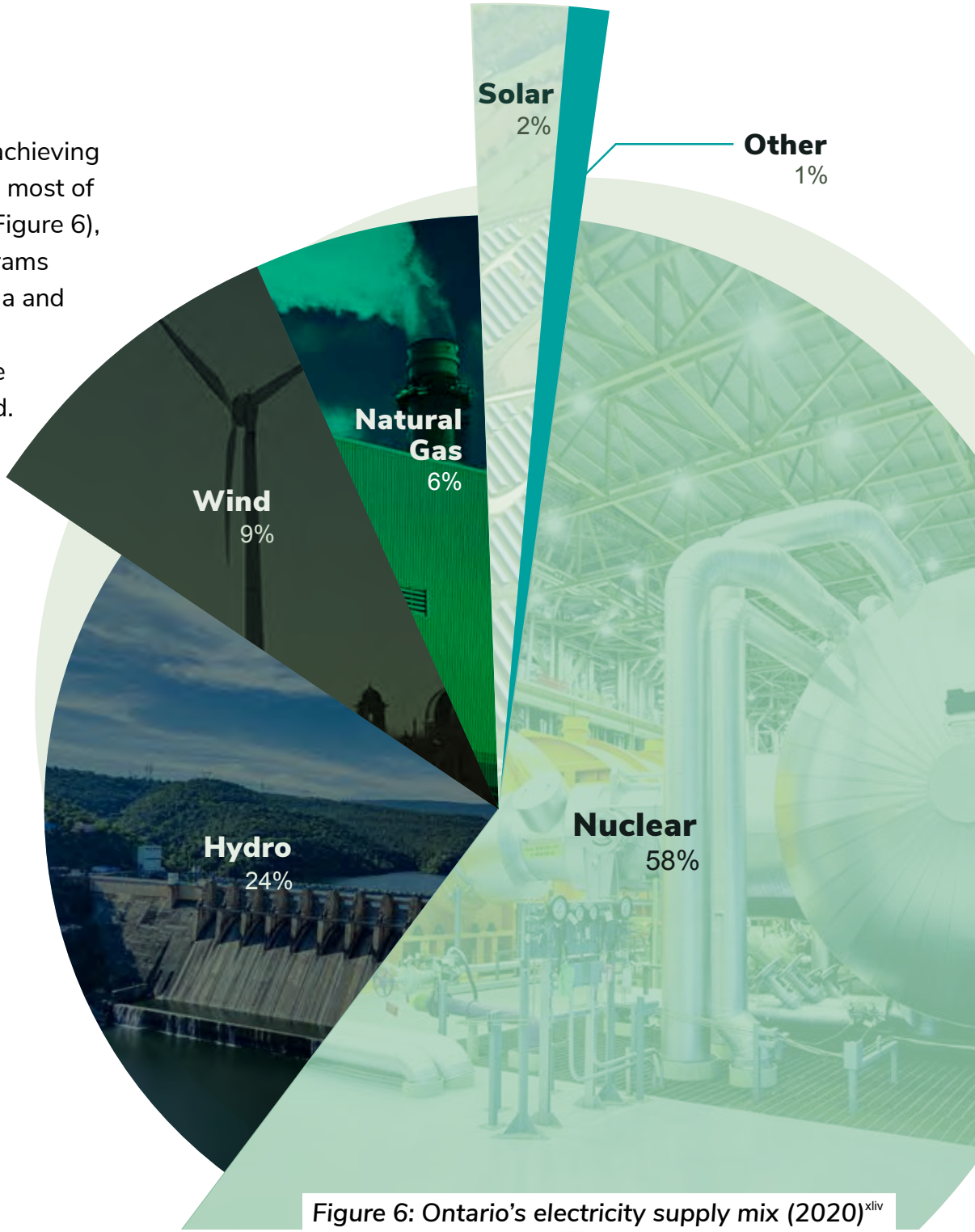


Figure 6: Ontario's electricity supply mix (2020)[xliv]

In 2021, industry released a feasibility report outlining a three-stream approach to SMR deployment based on commercial and technical considerations.[xlvi] The report was prepared by Ontario Power Generation (OPG), Bruce Power, NB Power, and SaskPower for the governments of Ontario, New Brunswick and Saskatchewan following the Memorandum of Understanding signed by those provinces in 2019.

Since then, additional feasibility studies have been carried out to explore specific deployment scenarios. This includes a recent study by OPG at a mine in the Far North, which found SMRs could reduce emissions by 85 percent at the mine.[xlvii] The most economical energy mix would involve SMRs providing 90 percent of baseload power for mining operations and associated uses,[xlviii] with peak demand periods supplied using diesel or biomass that can be sourced from Northern Ontario. See Case Study #2 for more details about OPG's SMR initiatives.

Natural gas will be an integral part of Ontario's green transition, ensuring reliability and affordability for ratepayers as other technologies evolve. When the Pickering Nuclear Generating Station is fully decommissioned in 2025, the province will lose 24 percent of its nuclear capacity, most of which will be replaced by natural gas. According to a recent report by the Independent Electricity System Operator (IESO), phasing out gas generation in Ontario by 2030 would lead to blackouts and a 60 percent (or $100 per month) increase in average residential electricity bills.[xlix]

In addition to already being the cleanest burning fossil fuel, Ontario's natural gas industry is increasingly blending lower-carbon fuels such as hydrogen into its supply. The industry is investing in carbon-neutral technologies for heat and transportation, as well as integrating with the electricity system to optimize energy efficiency. Combined heat and power systems use natural gas to produce both heat and electricity onsite, leading to lower costs and higher efficiency as less fuel is required to generate the same amount of energy than conventional power plants. Hybrid natural gas and electric heating solutions can switch from electricity to natural gas during peak demand periods, which mitigates the need for new electricity generation capacity.

Renewable natural gas (RNG) is a carbon-neutral fuel created by capturing methane emissions from organic waste, landfills, and wastewater treatment plants. RNG can be used to fuel transportation fleets, power industry, and heat buildings. Case Study #3 is an example of one of the many RNG projects already operational in Ontario. Over time, implementation of carbon capture, utilization, and storage (CCUS) technologies are expected to further reduce emissions from natural gas.

Meanwhile, natural gas conservation programs are helping consumers reduce their energy usage, leading to lower bills and lower emissions. Between 1995 and 2020, Enbridge Gas's energy efficiency programs reduced consumers' energy consumption in Ontario by 29 billion cubic metres of natural gas, which is enough savings to service nearly 12.7 million homes for one year. These gas savings have resulted in a reduction of 54.7 million tonnes of GHG emissions, roughly equivalent to removing 12 million cars from the road for a year.[lh]

Hydrogen is an element that can be produced from existing low-carbon energy sources and used to offset emissions in a variety of industrial, commercial, and residential applications. For example, it can be injected into the natural gas pipeline for heating systems, used for industrial production of steel and cement, and stored in fuel cells to power vehicles. Demand for hydrogen is expected to grow globally as commercial viability is proven, providing Ontario with a promising export opportunity.

Despite high capital costs, a few low-carbon hydrogen projects are already underway in Ontario, such as Enbridge's hydrogen blending program (see Case Study #4). Atura Power – a subsidiary of OPG – is implementing a hydrogen program in Halton Hills and Niagara Region that aims to have 1 Gigawatts of installed electrolyzer capacity by 2030, resulting in approximately 1.3 Mt of CO_2-equivalent emissions abatement across sectors, including steel production, mining, fertilizer production, and heavy-duty trucking.

Meanwhile, Ontario's nuclear industry is exploring the technical viability and business case for producing hydrogen from nuclear power. In June 2021, the Nuclear Innovation Institute launched Canada's first-ever feasibility study on nuclear hydrogen with support from Bruce Power and Greenfield Global.[li]

Biomass, or fuel derived from organic materials, is a carbon-neutral source of energy and an important pillar of the forest products industry, mining industry, and regional economies in Ontario. Electricity generated from biomass supports the province's power grid during peak periods and strengthens the reliability of the grid in Northwestern Ontario. Ash produced from the generation process also provides nutrients for farmland and mine remediation, while harvesting dry woody material reduces forest fire risk. It also contributes to provincial stumpage revenue and reforestation trust funds. Responsible use of biomass can both help combat climate change and advance the province's Critical Minerals Framework and its Forestry Strategy.

Finally, **renewable energy** sources (primarily wind and solar) are gradually becoming more reliable and affordable. Between 2009 and 2019, the average global cost of electricity from solar dropped by 89 percent, while wind fell by 70 percent.[lii] However, one challenge with renewables is that they are intermittent and therefore require backup generation. As **energy storage** technologies evolve, renewables can be deployed more widely and dispatched as needed to meet demand. Batteries, hydrogen, pumped storage, and other technologies are all part of the solution to Ontario's storage needs.

In Ontario, energy storage has even more potential when coupled with baseload supply that is not subject to the weather variability of renewables. Specifically, community-level energy storage resources that are connected to the electricity grid and supplied by nuclear or hydro power would be a highly cost-effective option for the province to meet its long-term electricity needs.[liii]

The Oneida Energy Storage project in Southwestern Ontario is set to become the largest energy storage facility in Canada and one of the largest in the world.[4] Once completed, the facility will be able to draw and store baseload and renewable energy during off-peak periods and release power to the grid when energy demand is at its peak. Its value to the system will be magnified if additional nuclear capacity is installed after Pickering is retired.

Indigenous communities are active players, and often proponents, of clean energy projects across Canada. A great example is Wataynikaneyap Power's construction of an 1,800-kilometre transmission line to connect 17 First Nations communities to the Ontario power grid.[liv] Wataynikaneyap means "the line that brings light" in Anishinaabemowin.[lv] The company is majority-owned by First Nations and manages the project according to guiding principles developed by those communities, such as a prohibition on the use of herbicides along the line.[lvi] Wataynikaneyap is expected to displace more than 6.6 million tonnes of GHG emissions over 40 years by supplying electricity to Indigenous communities that now rely on diesel.[lvii]

4 Oneida Energy Storage LP is a joint venture between NRStor Incorporated and Six Nations of the Grand River Development Corporation with investment from the Canada Infrastructure Bank.

Case Study #2: Ontario Power Generation's SMR Projects

As demand for clean electricity grows in Ontario and abroad, Ontario Power Generation (OPG) is breaking new ground in the advancement of new nuclear.

Specifically, through its Darlington New Nuclear Project (DNNP), OPG is exploring the development of a commercial grid-scale SMR at Darlington, the only site in Canada currently licensed for new nuclear. Pending regulatory approvals, OPG has an aspirational goal to deploy the SMR at Darlington by as early as 2028. As it proceeds through the planning stage, OPG is working with SMR technology developers to advance engineering and design work with the goal of identifying options for future deployment.

The DNNP will advance opportunities for businesses and workers within Canada's nuclear industry and across its supply chains. A Conference Board of Canada study found that a single grid-scale SMR unit in Ontario could generate $2.6 billion in GDP, $1.7 billion in wages, and $873 million in taxes for the provincial economy.[lviii] It would support an annual average of approximately 700 jobs during project development, 1,600 jobs during manufacturing and construction, and 200 jobs during operations.[lix]

Meanwhile, Global First Power (GFP) – a Canadian energy company jointly owned by OPG and Ultra Safe Nuclear Corporation – is advancing the development and deployment of a smaller-scale SMR solution, known as the Micro Modular Reactor (MMR). With a small land use footprint, MMRs have the capability to produce 15 megawatts of thermal output, which can be converted to five megawatts of electrical power. It is the first SMR project in Canada to submit a Licence to Prepare Site with the Canadian Nuclear Safety Commission and has fulfilled the requirements to move to a detailed technical review. The GFP initiative is also the first SMR project in Canada undergoing a simultaneous environmental assessment.

The supply of low-carbon energy from SMRs is a key pillar in OPG's Climate Change Plan, with a commitment by OPG to reach net zero by 2040 and support Ontario in becoming a net-zero economy by 2050.[lx]

OPG has engaged regularly with Indigenous communities, the public, government agencies, and other stakeholders on all aspects of project development and licence renewal. OPG respects the Treaty Rights and priorities of identified Indigenous communities regarding the protection of the natural environment, nuclear safety, and meaningful engagement.

Case Study #3: Waste Connections of Canada's RNG Facilities

When food and other organic matter decomposes in a landfill, it produces methane gas, which is significantly more potent than carbon dioxide. Since methane is a highly potent greenhouse gas, landfills capture and flare the gas to prevent it from being released into the atmosphere.

However, engineers have developed a technology that can convert methane captured from landfills into renewable natural gas (RNG). The RNG can be used interchangeably with conventional natural gas for transportation fuel and heating homes, schools, and hospitals. But unlike other forms of natural gas, it does not add any new carbon dioxide into the environment and is therefore considered carbon neutral. In other words, technology has been used to create something positive (energy) from something negative (waste) and reduce the economy's demand for fossil fuels.

How it works: A system of vertical wells and pipelines collects the gas from a landfill and directs it to a separate treatment facility. There, the raw gas is upgrading, often carried out through water scrubbing units and pressure swing absorbers. The landfill then sells the purified biogas to distributors and/or directly to industrial consumers.

The Lachenaie landfill in Terrebonne, Quebec has been successfully converting landfill gas to RNG since Waste Connections Canada invested $50 million in the technology in 2014. In 2019, Lachenaie's gas treatment facility received 1.3 million tonnes of waste, captured 98 percent of methane gas, and injected 2.2 million gigajoules of RNG into the pipeline. The landfill – one of the largest of its kind in Canada – sells its RNG for commercial use. Additionally, Waste Connection uses the RNG generated from its landfills to fuel its own waste collection compressed natural gas fleets, establishing circular economies within their business operations.

At present, landfills that generate RNG exist in the United States and elsewhere in Canada but are only found on a small scale in Ontario. Waste Connections is currently planning on building a facility at its Ridge landfill near Chatham, Ontario, similar in scale to its Lachenaie facility.

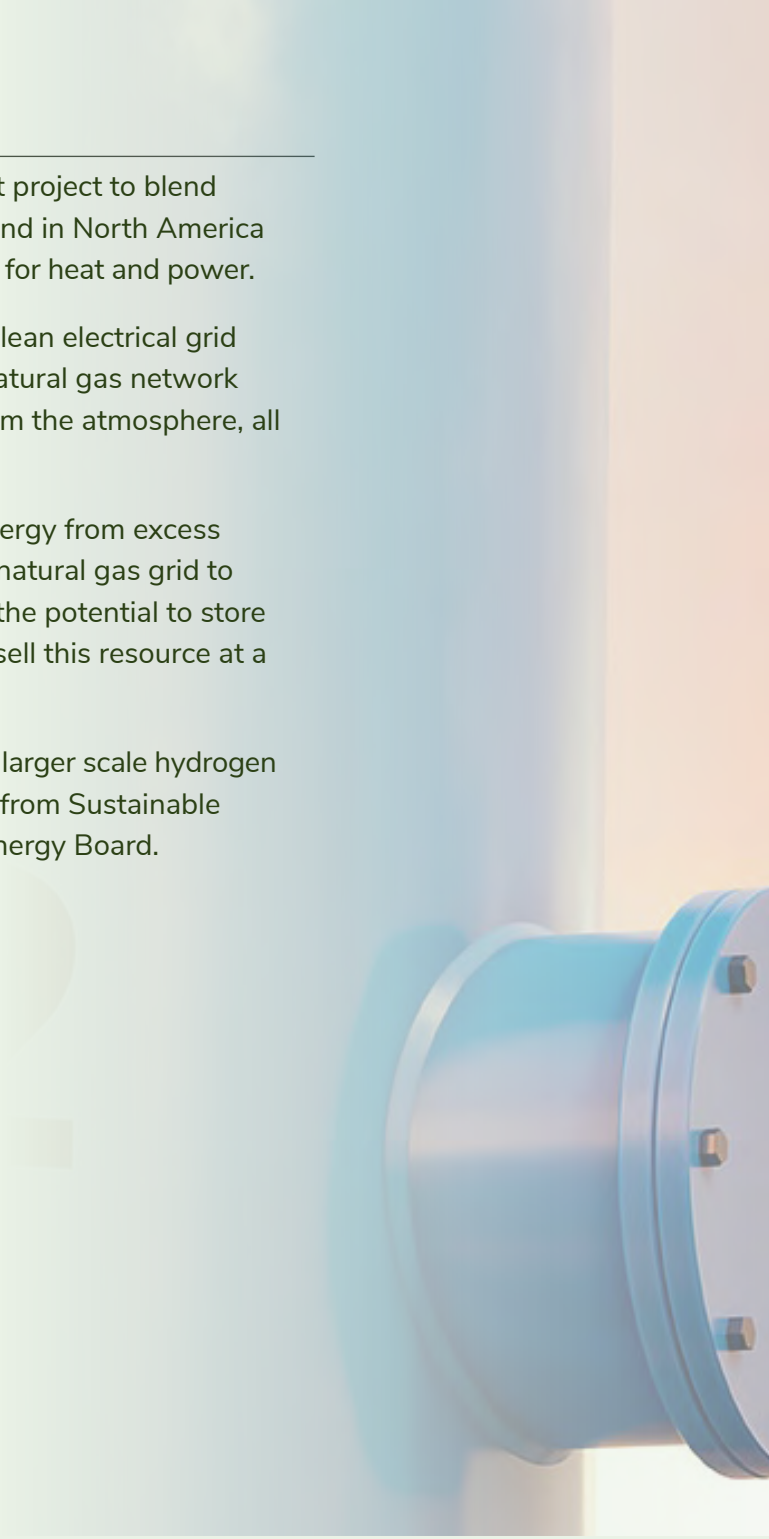
Case Study #4: Enbridge's Hydrogen Blending Project in Markham

In Fall 2021, Enbridge Gas and Cummings Inc. (formerly Hydrogenics) began a $5.2-million pilot project to blend renewable hydrogen into Ontario's existing natural gas network. The initiative is the first of its kind in North America and an important step towards greening the natural gas that homeowners and businesses rely on for heat and power.

To produce low-carbon hydrogen for the pilot, Enbridge is using surplus energy from Ontario's clean electrical grid that would otherwise go to waste. The hydrogen is then injected into a portion of the existing natural gas network that serves approximately 3,600 customers in Markham, abating up to 117 tonnes of carbon from the atmosphere, all without impacting customers' bills.

Hydrogen blending or energy storage via hydrogen in the natural gas system is used to store energy from excess electricity using the existing natural gas network, which acts as a giant battery. Connecting the natural gas grid to the electrical grid creates an intertie that benefits both sets of ratepayers. The gas network has the potential to store a considerable amount of excess electricity for long-term seasonal needs, negating the need to sell this resource at a loss to other jurisdictions or build new infrastructure.

Successful validation of the hydrogen blending pilot will enable Enbridge to pursue additional and larger scale hydrogen blending activities in other parts of its distribution system. The pilot was launched with support from Sustainable Development Technology Canada and has received the necessary approvals from the Ontario Energy Board.



2.3 Cleantech

When it comes to clean technologies, Ontario punches well above its weight. Researchers and companies across the province are developing a wide range of innovative solutions to support climate action – from hydrogen and battery storage to biochar, water treatment devices, vertical farms, CCUS technologies, and the world's first battery-powered underground mine.[lxi]

Aside from its environmental value, cleantech has widespread economic impacts:[lxii] [lxiii]

In Ontario, the cleantech sector generates

$20 billion in annual revenues,

$1 billion in exports,

and more than **130,000** high-quality jobs.

12 of the 2020 Global Cleantech **100** companies are Canadian.

Canada exported nearly **$11 billion** in cleantech products in 2019.

Globally, the cleantech sector is expected to reach **$2.5 trillion** in market value by 2022.[lxiv]

Post-secondary institutions are seizing the opportunity. In 2021, a partnership of five colleges and universities launched the EaRTH Consortium to advance the cleantech sector through research, academic programming, and commercialization (see Case Study #5). Another cleantech research program is the University of Toronto's Climate + VE Institutional Research Initiative (discussed in Case Study #1).

While some of these technologies are well established, others are emerging with promising commercial applications. For example, biochar is a substance produced from the thermal decomposition (pyrolysis) of organic materials (biomass). When biochar is added to soil, it absorbs carbon dioxide from the atmosphere and sequesters it underground. Biochar also enriches soil by improving water retention and moderating the soil's acidity, which in turn improves crop production. In Ontario, it is being explored as a tool for the forestry and agricultural industries. Researchers are working to understand the risks and benefits of biochar, including how long carbon remains sequestered and how much it could impact GHG emissions.

Looking ahead, global investments in cleantech are only forecasted to grow. According to RBC Economics, the Biden administration's investments in climate innovation represent "one of the clearest opportunities for Canada" in the global economy.[lxv] CCUS markets alone are potentially worth $12 billion per year in Canada and $90 billion in the United States.[lxvi] Future increases to Canada's carbon price will also make these technologies more appealing to businesses and investors.

Case Study #5: The EaRTH Consortium

Canada has set a target – that clean technology be one of its top five exporting industries by 2025. Leadership in the clean technology sector is crucial as Canada confronts the challenges of climate change and it requires a unified approach. Responding to this call to action is the Environmental and Related Technologies Hub (EaRTH), a partnership between Centennial College, the University of Toronto–Scarborough, Ontario Tech University, Durham College, and Trent University. In October 2021, a memorandum of understanding was signed between the institutional leaders of EaRTH to accelerate and advance the development of clean technologies in the eastern Greater Toronto Area (GTA) through research excellence, academic programming, and commercialization.

The EaRTH consortium is focused on enabling collaborations among researchers, businesses, governments, industries, and community partners through innovative projects that strengthen Canada's clean technology sector. This consortium was founded on the recognition that collaboration around clean technology has enormous potential to enhance community resilience, create high-quality jobs, and enable sustainable economic growth in Canada and abroad.

One initiative of the EaRTH consortium that was recently launched is the Collaborative Research Consortium Program (CRCP). The CRCP supports and provides seed funding for faculty/staff at the participating institutions to initiate, deepen, and extend collaborative research projects in areas of mutual strength and shared interest with the goal of enabling principal investigators to make joint proposals to external funding sources for the next phase of their research.

The EaRTH consortium is also focused on the co-creation of a green campus called the EaRTH District. The first-of-its-kind in Ontario, EaRTH District is focused on enabling greater possibilities for a live, work, study, and play ecosystem in the Eastern GTA. In its initial phase, the EaRTH District is comprised of three facilities: the Environmental Science and Chemistry Building, the Clean Technology Facility, and the Advanced Environmental Technologies Building.

A study by Stiletto Consulting forecasts EaRTH District is projected to generate $8.4 billion in total direct cumulative output and $1 billion in taxes, educate 35,000 students in clean technology disciplines, and create 4,470 direct jobs between 2021 and 2040. The same study forecasted that EaRTH District has the potential to reduce travel by over 36 million kilometers – yielding a reduction of over eight million kilograms of CO_2 emissions, millions in cost savings, and improvements in the quality of life for regional residents by reducing their commute time.

As a dynamic hub of activity, the EaRTH District offers an environment unlike any other, one that fosters the eastern GTA's expertise, talent, and innovation to drive growth in clean technology, mitigate the impacts of climate change, build resilient communities across Ontario, and ultimately position Canada as a leader in the global clean economy.

2.4 Zero-Emission Vehicles

By most accounts, the market for zero-emission vehicles (ZEVs) is expected to grow at breakneck speed. In June 2021, the Government of Canada mandated 100 percent of new light-duty cars and passenger truck sales to be ZEVs by 2035. This is an ambitious target, as less than four percent of passenger vehicles sold in Canada were ZEVs in 2020.[lxvii]

Decarbonization of vehicles will require a combination fuel blending, electrification, and improvements to the efficiency of internal combustion engines. Efforts to reduce transportation emissions should leverage a range of technologies.

Battery storage is largely the path forward for passenger vehicles – with the global market for electric vehicle (EV) batteries expected to reach $1 trillion by 2030[lxviii] – and Ontario has what it takes to be a leader in EV supply chains. The province has known deposits of four of the five critical minerals required to make lithium-ion batteries – lithium, cobalt, graphite, and nickel.[lxix] Its automotive sector is home to world renowned manufacturing companies, over 700 parts suppliers, and over 500 tool, die, and mould companies.[lxx] All told, Ontario is the second largest vehicle-producing jurisdiction in North America after Michigan and the second largest technology hub in North America after California's Silicone Valley.

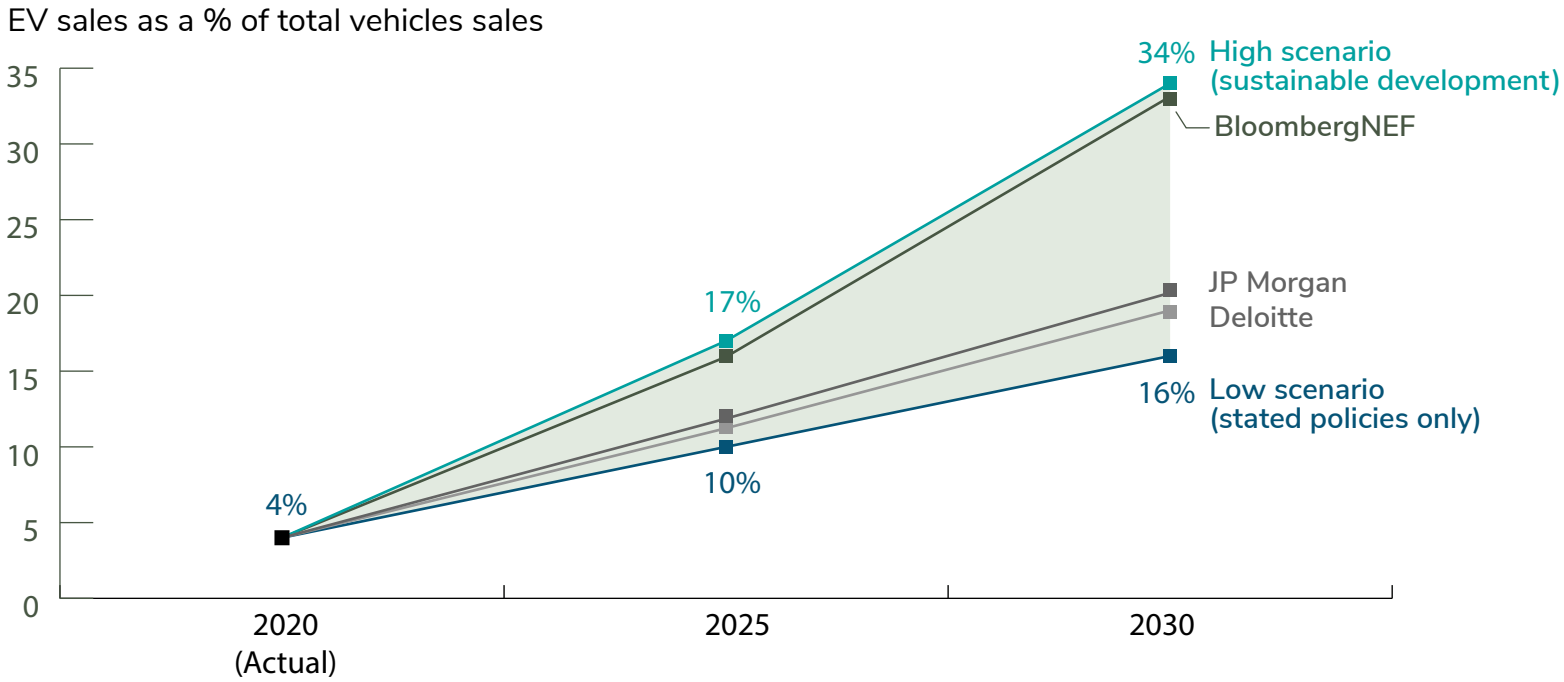
Meanwhile, hydrogen and compressed or renewable natural gas are essential to decarbonizing high-mileage and heavy-duty vehicles, as these are more challenging to electrify. Hydrogen fuel cell electric vehicles (FCEVs) are carbon-neutral and able to match the range offered by their diesel counterparts. Ontario is currently home to 18 percent of the world's hydrogen fuel cell activities, with research spearheaded at leading universities and companies such as Enbridge, Hydrogenics, and Next Hydrogen.[lxxi] In Germany, all Coradia iLint hydrogen passenger trains use technology supplied by Hydorgenics. As the technology evolves, the cost of FCEVs is expected to fall by nearly 50 percent over the next 10 years.[lxxii]

Natural gas and RNG vehicles also promise significant GHG emissions for freight transportation. Replacing diesel with RNG can reduce vehicle emissions by 95 percent[lxxiii] and up to 382 percent depending on the RNG source.[lxxiv]

Businesses are actively investing ZEV capacity across Ontario. The Ivy Charging Network is a joint venture by OPG and Hydro One that will become Ontario's largest EV fast-charger network by the end of 2021 with 180 chargers across more than 60 sites. The Automotive Parts Manufacturers Association of Canada recently launched Project Arrow, which is set to become the first all-Canadian-made ZEV concept.[lxxv]

In 2021, the Government of Ontario also created the Ontario Vehicle Innovation Network, a hub focused on accelerating the development of next generation electric, connected, and autonomous vehicle and mobility technologies. Both the federal and provincial governments are actively supporting the auto industry's transformation, including a joint investment to retool the Ford Oakville Assembly Complex into a global hub for battery EV production.

Figure 7: Range of Projections for Global EV Sales to 2030[lxxvi]



2.5 Mass Transit

While industry is working to reduce the emissions intensity of vehicles, it is also investing in alternatives to improve the overall efficiency of transportation. For passenger vehicles, this includes public transit. Reducing the average distance traveled per vehicle in Canada by 26 percent could achieve the same GHG reduction as a transition to 30 percent ZEVs by 2030.[lxxvii]

Well-connected transit systems also help reduce congestion, which further reduces emissions on roads, improves labour productivity, and allows municipalities to accommodate more of the population growth projected in Ontario's large cities. Case Study #6 explores how CN is leading in low-carbon rail.

Case Study #6: CN's Low-Carbon Transition Plan

Railways are one of the most efficient and low-carbon ways to move goods. As such, they are a critical part of any modern transportation system.

CN is at the forefront of sustainable rail, with a 20,000-mile rail network that spans Canada and Mid-America, connecting ports on three coasts: the Atlantic, the Pacific and the Gulf of Mexico. Now, the company is taking sustainability a step further by making rail more efficient than ever.

Through its Low-Carbon Transition Plan, CN is working to meet a company-wide emissions reduction target of 29 percent (compared to 2015 levels) by 2030. Its strategy is focused on five key initiatives:

- **Fleet renewal** – Cleaner, more fuel-efficient rail and non-rail equipment will help CN continue to decouple growth from GHG emissions. Already, the company is making significant investments in Tier 4 locomotives, new-generation railcars, as well as hybrid and electric vehicles.
- **Technology** – CN continues to explore and invest in innovative technologies. From locomotive telemetry systems to distributed power and advanced energy management systems, it aims for significant improvements in train handling, braking performance, and overall fuel efficiency.
- **Big data** – Locomotive telemetry systems collect data to improve performance and fuel conservation. In addition, its in-house built Horsepower Tonnage Analyzer uses data collected from CN's systems to optimize a locomotive's horsepower-to-tonnage ratio.
- **Operations** – Building on CN's foundational Precision Scheduled Railroading model, the company is focused on providing on-the-job training on operational practices to optimize fuel efficiency. Real-time information is used to track performance, which enables fuel conservation through notch limiting, idling reduction, and horsepower optimization.
- **Cleaner fuels** – Driven by regulatory requirements, the growth of clean fuels presents an opportunity for CN to further reduce emissions. The company is actively testing and exploring increased use of renewable fuel blends in its locomotives to meet efficiency objectives and compliance obligations.

Given the large distance between communities in Ontario, rail has tremendous potential to reduce emissions from transportation. Continued investments in railways along critical corridors, further development of clean fuel technologies, and policies to de-risk low-carbon infrastructure are all part of the solution to the future of sustainable transportation in Ontario.

2.6 Net-Zero Industry

Heavy industry – mainly consisting of mining, steel, chemicals, and cement production – is the third largest source of emissions in Ontario. Decarbonization is uniquely challenging for these industries as they require vast quantities of energy and high temperatures that are almost exclusively possible from burning fossil fuels. Additionally, the lifespan of their facilities and other capital assets are decades long, and the industries are exposed to highly competitive global markets.[lxxviii]

Each of these industries has developed their own targets and strategies for reducing emissions through adoption of cleaner energy sources (such as low-carbon fuels and electrification) and emerging technologies such as CCUS.

For example, Canada's chemistry industry has reduced its GHG emissions by 67 percent since 1992 and is working to develop chemistry-based solutions to support economy-wide decarbonization, including bio-based chemistries, hydrogen, and eliminating plastic pollution.[lxxix] In 1985, the Canadian chemicals industry launched Responsible Care®, an initiative through which producers voluntarily commit to sustainability principles and regular third-party verification. Responsible Care® is now practised in 73 countries, by 96 percent of the largest chemical producers in the world.[lxxx]

A similar momentum is seen in Ontario's steel industry – where several decarbonization initiatives were announced in 2021 with support from the Government of Canada's Net-Zero Accelerator initiative. Arcelor-Mittal Dofasco and the federal government invested $1.765 billion at Dofasco's Hamilton plant to convert its production process and replace coal furnaces, which will reduce the company's annual emissions by approximately 60 percent within the next seven years.[lxxxi] In Sault Ste. Marie, the federal government committed up to $420 million in support towards a similar transformation at Algoma Steel.[lxxxii] Together, these two projects will reduce emissions by up to six million tonnes per year.[lxxxiii]

Ontario's mining sector has a unique role to play in the green transition, supplying the critical minerals needed to manufacture low-carbon technologies such as batteries and solar panels. Many mines in the province are going electric. For example, Newmont Goldcorp's Borden mine near Chapleau is Canada's first all-battery-electric underground mine. Further, in 2020, Canada Nickel launched a subsidiary called NetZero Metals that is developing a net-zero carbon production facility for nickel, cobalt, and iron in the Timmins region using a range of existing technologies.[lxxxiv] The company's Crawford Nickel-Cobalt Sulphide project largely consists of serpentine rock, which naturally absorbs carbon dioxide when exposed to air – making it a key opportunity for carbon sequestration.[lxxxv]

2.7 Sustainable Agriculture

The agri-food sector has innovated consistently since the Second World War to improve its productivity and reliability. With climate change directly affecting its output, the sector is now applying its innovation capacity to address this challenge.

Canada is one of the founding members of the Global Research Alliance on Agricultural Greenhouse Gases, a group of 65 member countries collaborating on research to reduce on-farm emissions. In Ontario, the sector's efforts to decarbonize include the use of farm waste to generate biogas, which can help farmers capture energy from waste to reduce their emissions and diversify their revenue.[lxxxvi]

Most farms in Ontario are also adopting precision agriculture technologies in some capacity within their crop production businesses.[lxxxvii] These technologies include chlorophyll sensors, drone imagery, fertilizer application tools, geographic information systems for field mapping, and yield monitoring technologies. They help use site-specific data to optimize resource allocation and minimize waste.

Vertical farms are growing in popularity as well. They involve stacking crops in layers, which minimizes land use required for agriculture production. Vertical farms can also be located closer to major population centres, reducing the emissions involved in transporting goods to market.[lxxxviii]

Beyond technology, sustainable agriculture is also about using land efficiently to preserve natural infrastructure that mitigates the effects of climate change. Part of the solution, as proposed by industry, involves incentivizing the restoration and conservation of wetlands (see Case Study #7).

Case Study #7: Proactively Restoring Wetlands on Agricultural Land

The City of Windsor is currently the highest per-capita loss area for flooding in Canada. There are a few reasons for this. Subdivisions were built directly on drained wetlands. It rains frequently, often with sudden, intense downpours. Further, 95 percent of its upstream wetlands have been drained for agricultural purposes. As a result, Windsor is prone to high runoff both in spring and during extreme precipitation events.

To address this challenge, one solution proposed by experts would involve municipalities adopting an insurance-based framework to incent the proactive restoration and conservation of wetlands.

Here is how it could work. The municipality would take out an insurance policy to protect its public infrastructure, thereby transferring part of the risk to insurers. The insurer prices the policy in a way that incents resilience investment over the course of the policy term. A trust fund is established (or some other pooled fund mechanism) to hold the fund and manage the resilience activities. To lower its assumed risk, the insurer can also contribute to risk management and resilience building activities.

Currently, public infrastructure losses due to flooding are backstopped by provincial and federal disaster financial assistance programs (85 percent of the funds paid by these programs are for public infrastructure losses). Therefore, these governments hold a portion of the risk for flood events. To lower their portion of risk, these governments could also pay into the trust fund. The result is a trust fund capitalized by a range of public and private interests. This is known as a "blended finance" solution.

The trust fund is first used to pay for studies into local hydrology and how/where wetlands may maximize resilience and other co-benefits. The fund can then pay for the restoration and conservation of wetlands on private lands and to compensate landowners for the use of their land. Ideally, this process would also be a source of local job creation.

Upon policy renewal, the pricing of the insurance contract would take into account the lower risk resulting from the restoration of wetlands and any other measures taken by the municipality. A new round of investment into the trust fund (recapitalization) could take place at that time. A multi-year policy (3 to 5 years) is recommended, to encourage the longer-term commitment of all parties.

Should several municipalities within a watershed wish to collaborate, they could take out an insurance contract together, which would be priced lower on average than it would for any single municipality, as long as their risk is not correlated. Since flooding would not affect every municipality simultaneously or to the same extent, the flood risk would be spread out over multiple locations.

Ultimately, by pricing the inherent value of wetlands, this approach creates a strong incentive to restore and conserve them without compromising agricultural land that is critical to many rural economies in Ontario.

2.8 Circular Goods

A circular economy is one in which all or most value is recovered from resources by reusing, repairing, refurbishing, repurposing, or recycling products and materials. Waste and emissions are minimized by changing how products are designed, manufactured, consumed, and disposed of.

In Ontario, businesses leading in circularity include Coca-Cola Canada (which has set ambitious targets for recycled content and recovery through its World Without Waste initiative) and IKEA Canada (through its use of renewable and recyclable materials as well as its furniture leasing and sell-back programs). Many businesses that operate in the province are part of the Ellen MacArthur Foundation's global circular economy network, including 3M, HP, Schneider Electric, Google, BASF, Cisco, Amazon, Ford Motors, and many others.[lxxxix]

Some municipalities in the province have also begun embracing circularity. The City of Toronto's Circular Economy Procurement Implementation Plan and Framework outlines objectives and opportunities to leverage the city's buying power to support circularity in a variety of sectors such as food, waste management, textiles and clothing, information and technology, construction, and engineering.[xc] The City of Guelph and County of Wellington are aiming to become Canada's first circular food economy by 2025.[xci]

2.9 Green Buildings

Reaching net-zero emissions is a challenge for real estate because most existing properties were designed and built without the systems and technologies needed to optimize energy efficiency. Efforts are underway in Canada and around the world to reduce the carbon footprint of these buildings through retrofits, while many new buildings are being designed and constructed according to newer standards.

Some developers in the province are moving the goalposts for sustainable urban design. At the West 5 development in London, Ontario, Sifton Properties is integrating solar parkades, EV chargers, high performance roads, and other technologies to minimize emissions across its 70-acre multi-use community.[xcii] Recently, the Government of Ontario selected West 5 as the demonstration site for its new community net metering model, which will allow communities to sell excess power they generate from renewables to the electricity grid for credits on their electricity bills.[xciii]

The industry is also adapting to reflect the growing threat of extreme weather events such as flooding. In 2019, the Intact Centre on Climate Adaptation partnered with Building Owners and Managers Association (BOMA) Canada and REALPAC to release a national guideline to help commercial real estate owners and managers improve their flood resilience.[xciv] BOMA Toronto has also published a technical guidance paper with practical recommendations to strengthen resilience around extreme weather events more broadly.[xcv]

2.10 Sustainable Finance

The green economy is backed by a growing supply of capital. Public and private leaders are increasingly using environmental, social, and governance (ESG) considerations to guide their investments and practices, recognizing both the risks and opportunities embedded in sustainability. In 2020, environmental and climate issues were the top risks to growth identified by Canadian CEOs,[xcvi] and ESG funds are outperforming the broader market.[xcvii]

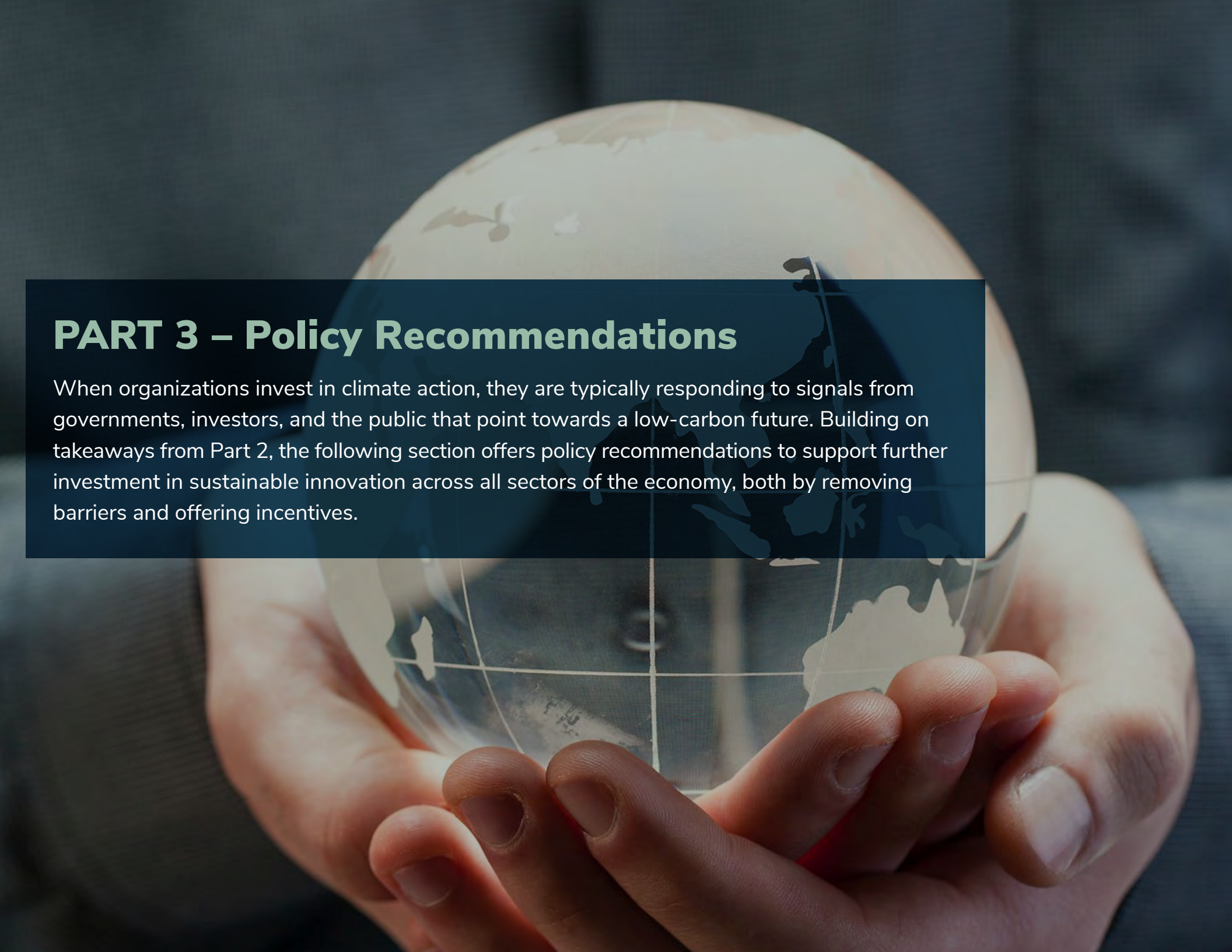
As a result, most publicly traded companies disclose their emissions to some extent.[xcviii] Adoption of ESG metrics at the firm level has accelerated in part because large institutional investors are demanding transparency around climate-related financial risks.[xcix] In Canada, the country's largest pension funds have publicly urged businesses to report their ESG data in a standardized way.[c] Universities across the country have also committed to sustainable investment practices. Recently, the University of Toronto announced that its Asset Management Corporation (UTAM) will divest its $4-billion endowment of all direct investment in fossil fuel companies over the next 12 months. By 2030, UTAM will also divest from indirect investments. This commitment builds on the university's membership in the "Investing to Address Climate Change" charter, which was led by the University of Toronto and McGill University and signed by more than a dozen universities in 2020.[ci]

However, take-up of ESG reporting tends to be far lower among small businesses – which represent most employers – and overall, only six percent of firms across Canada measure their environmental footprint.[cii] Platforms and services are emerging to help these businesses catch up. For example, Manifest Climate is an Ontario-based software company that provides personalized data and analysis to help businesses of various sizes identify, disclose, and manage their climate-related financial risks.

Further, Indigenous business leaders note there has been very little engagement with Indigenous peoples in the development of common ESG frameworks, notwithstanding ad hoc efforts made by some institutional investors.[ciii] Far more work needs to be done to incorporate Indigenous viewpoints and interests into mainstream ESG standards as they become more widely adopted.[civ]

Financial institutions are also issuing sustainable debt mechanisms such as green bonds and green mortgages to support climate-related investments. Green bond markets have expanded rapidly since the first issuance in 2007,[cv] with 50 percent growth in the Canadian market in 2019 alone.[cvi] Ontario has used green bonds to finance transit projects such as the Eglington Crosstown Light Rail Transit and GO Expansion projects, as well as conservation projects across the province. In 2021, the Government of Canada announced its first-ever federal green bond issuance with a target of $5 billion in partnership with TD Securities,[cvii] which has issued $1.7 billion in green bonds since 2014.[cviii]

Green mortgages are used to incentivize demand for properties that have a lower carbon footprint, often by providing preferential terms or linking the cost of borrowing to the energy performance of the associated property. Green mortgages are gaining popularity abroad, including in the United Kingdom, Netherlands, and emerging markets. The Canada Mortgage and Housing Corporation (CMHC) recently published a three-part research series exploring the potential for sustainable mortgage bonds in Canada.[cix]



PART 3 – Policy Recommendations

When organizations invest in climate action, they are typically responding to signals from governments, investors, and the public that point towards a low-carbon future. Building on takeaways from Part 2, the following section offers policy recommendations to support further investment in sustainable innovation across all sectors of the economy, both by removing barriers and offering incentives.

3.1 Minimize Uncertainty

Uncertainty about future government policies is one of the main barriers that deters the private sector from making major investments. This is especially true when it comes to climate and energy policies, where volatility can significantly impact financial returns.

CLIMATE POLICY:

Carbon pricing provides the right foundation for climate action by establishing a long-term incentive and multiple paths to compliance. The fact that Canada's carbon price is scheduled to rise to $170 per tonne by 2030 should, in theory, give businesses the confidence they need to invest in decarbonization.[cx] Yet many companies in Canada are holding back, in part because they consider it too risky to bet on future climate policy.

In fact, the OCC's 2021 Survey on Business Confidence found uncertainty about long-term government policy was the second biggest barrier to decarbonization for large businesses in Ontario after capital costs.[cxi] Climate policies constantly evolve along with changes in leadership, information, and feedback from constituents. Some degree of uncertainty is part of a healthy democracy, yet too much of it paralyzes progress.

While businesses do not expect to know all the outcomes of future policy choices, they need more transparency and predictability around the decision-making process to understand how policies and regulations will impact their investments. Federal and provincial governments should **establish a coherent decision-making framework that outlines the criteria, considerations, and procedures upon which climate policies will be based.** How will jobs, emission reductions, and other benefits be weighed against costs? Where will decisions rely on Indigenous governance, leadership, and knowledge? When and how will industry expertise be leveraged? This framework should take a whole-of-government approach to clarify how each ministry and department is working towards collective climate targets.

For further clarity, Ontario should **outline how it will use proceeds from its Emissions Performance Standards**, a program that will impact large industrial emitters and should be designed to support their investments in decarbonization. Businesses would also support the Province in **establishing a framework for carbon offsets** to help reduce compliance costs while creating a market for emission-reducing activities.

Additionally, governments should **use public-private partnerships (P3s) more strategically** to share the risks of policy and technology volatility with investors. To date, the Canada Infrastructure Bank (CIB) has played a valuable but limited role in low-carbon infrastructure. Going forward, the CIB should expand its

leadership in this space, delivering on its promised $10 billion Growth Plan. Similarly, Infrastructure Ontario, the Business Development Bank of Canada, and Export Development Canada can adopt an expanded role in climate oriented P3s.

However, there are two major challenges with the current approach to P3s. First, in Ontario, the way in which risk is allocated between parties has made businesses reluctant to bid for contracts, which leads to delays and higher costs.[cxii] Risks must be allocated more equitably between contractors and agencies going forward. Second, P3 projects have largely been selected on an ad hoc basis, rather than being integrated into a broader strategy. Priority should be placed on initiatives that reduce grid emissions as a first step to enable decarbonization across other sectors.

Building on the need for risk-sharing, the C.D. Howe Institute has suggested the CIB could offer a sort of insurance on carbon prices.[cxiii] If a future government were to remove or relax Canada's carbon price, the CIB would take on the loss in incremental value that investors would have received from low-carbon projects, and vice versa if the carbon price increases more than expected.[cxiv] Creative solutions like this one may be considered as part of a broader commitment to share risk with the private sector.

ENERGY POLICY:

Long-term uncertainty may also interfere with the energy transition. The IESO is forecasting peak capacity gaps that begin to emerge in 2022 and continue to grow as demand for electricity increases and available capacity decreases.[cxv] Within the next 10 years, Ontario will need to renew or replace nearly 40 percent of its generation infrastructure.[cxvi]

It will take several years to plan, approve, and develop the nuclear, biomass, hydro, hydrogen, storage, transmission and distribution lines, and other low-carbon energy infrastructure needed to fill that capacity gap. To secure the right investments, Ontario must **develop a long-term energy framework focused on the three principles of reliability, sustainability, and affordability.** The Ministry should provide clear policy direction to be implemented by the IESO through its planning and procurement activities.

Historically in Ontario, investments in both supply and transmission have been supported by long-term contracts or regulated rates of return, and the need for such stable mechanisms is only expected to increase over the course of the energy transition. There is a perception among some stakeholders that all long-term contracts must involve greater risk (and therefore higher costs) for ratepayers because they lock in costs even if assets become less competitive when new technologies evolve. However, this ignores the fact that

this risk must be priced somewhere. Long-term contracts attract low-cost, competitive capital that benefits ratepayers. Shorter contracts that do not cover an asset's operating lifespan are riskier for generators, who may choose not to invest altogether, or otherwise pass that risk onto ratepayers in the form of higher prices.

Specifically, there is a concern among stakeholders that the timelines identified in the IESO's Annual Acquisition Report (seven to 10 years for long-term commitments) may fall short of providing enough certainty for generators, particularly for assets that operate for well over a decade. As part of its long-term energy plan, Ontario should work with industry to **ensure there is a competitive and transparent process for long-term energy contacts that leverages existing assets where possible** and attracts competitive investments in new supply.

3.2 Mobilize Clean Energy Solutions

To address Ontario's growing demand for low-carbon energy, the private sector will need to continue investing in a variety of energy technologies.[cxvii] The government's principal role is to develop the right environment and incentives for continued investment within the market.

For example, spreading construction and installation costs over more ratepayers over time helps accelerate investments. The Ontario government can **allow utilities to rate base low-carbon energy infrastructure investments** that have widespread economic and environmental benefits, such as RNG and hydrogen projects, as well as EV charging infrastructure.

Tax incentives should be deployed where there is a public benefit. Canada's 2021 Budget proposes a temporary program to reduce the general corporate and small business income tax rates by 50 percent for businesses that manufacture zero-emissions technologies. The federal government should **expand this tax incentive program – as well as its accelerated capital cost allowance – to include investments in new nuclear**.

Similarly, grants and low-interest loans can spur investments in energy networks that are more energy efficient, such as district energy systems. Using underground pipes to supply thermal energy to multiple buildings within a geographic area reduces emissions through economies of scale and the use of less carbon-intensive fuel sources.

Provincial and federal governments can collaborate on a grant or interest-free loan program to **encourage municipal uptake of district energy systems**. The distribution systems and associated revenues could be owned by municipalities to support their fiscal self-reliance.

Pilot projects can be used to inform the commercial feasibility of specific solutions for different regions. For example, governments can **support SMR pilot projects in Northern and remote regions**, where geography and access to the grid make it more challenging for industry and communities to reduce their reliance on diesel.

Private investment can be unlocked effectively through risk-sharing partnerships, as discussed in Section 3.2. The CIB's clean power projects offer a template and lessons for future investments. Reconciliation with Indigenous communities should be front and centre of these initiatives. As policymakers and business leaders advance clean energy projects, they should **champion Indigenous-led projects and build equitable partnerships that provide tangible economic benefits to Indigenous communities.** Long-term relationships, capacity building, and sufficient lead time for meaningful engagement are essential to ensure Indigenous communities can succeed as participants (or even better, as proponents) of clean energy projects.[cxviii]

3.3 Support Cleantech

The competitiveness of Ontario's cleantech sector is neither accidental nor guaranteed. Colleges and universities are breeding grounds for cleantech skills training and research breakthroughs, and government must support them as vital partners in the innovation process:

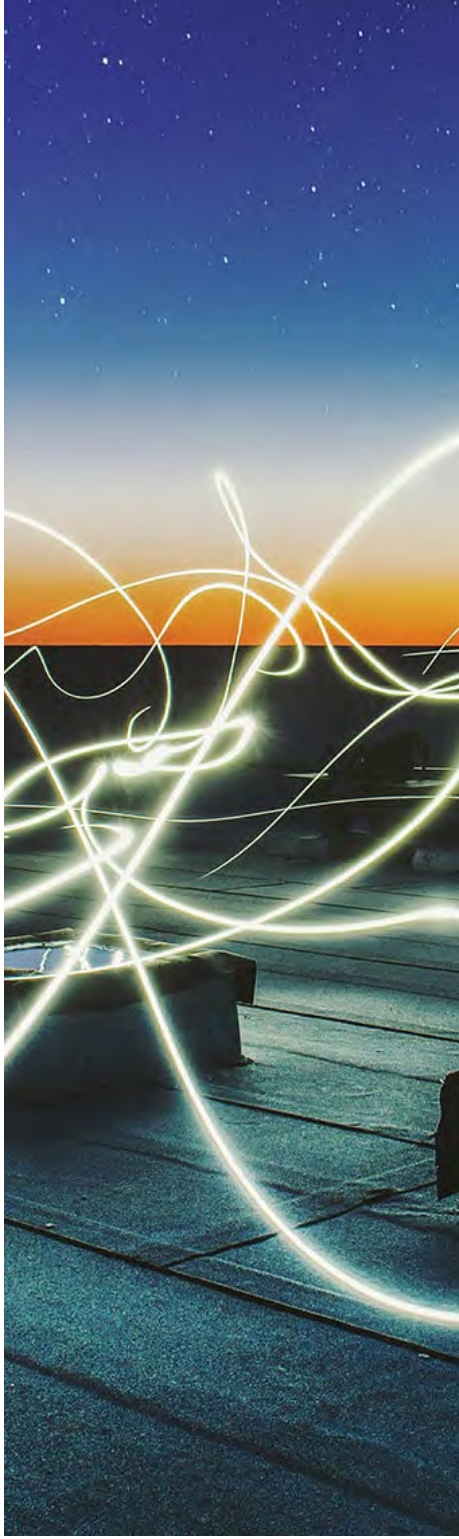
At the R&D stage, public investment in the sector is necessary to de-risk research. Case in point: it was direct government funding that led to innovations like the Internet and Global Positioning System (GPS) technologies. Governments should not shy away from **investing in cleantech research with promising commercial applications**, such as biochar (see Section 2.3). Well-funded research is essential to better understand potential uses, risks, and the kinds of regulations that will be needed to ensure responsible implementation of emerging clean technologies.[cxix]

As the sector grows, demand for specific skillsets is increasing and cleantech firms often find it challenging to access and retain talent. Provincial and federal governments should continue to **promote and expand skills training opportunities in science and technology** at Ontario's colleges and universities to ensure the sector can remain competitive domestically and abroad.

R&D is followed by commercialization and application of the technology. Ontario's Intellectual Property Action Plan, released in 2020, should help harness the economic value of innovation generated within the province. The Ontario government should also **increase its investments in regional innovation centres and technology transfer offices** within post-secondary institutions, they help transfer cleantech from researchers to industry and broader society.

Commercialization requires access to capital, which can be a challenge in the cleantech sector. The inherent risk associated with innovative firms – as well as lower risk tolerance compared to the United States – make it difficult for Ontario's cleantech firms to secure the financing they need to scale. Ontario's venture capital and private equity sectors are growing, which will support the growth of innovative small businesses.[cxx] The federal and provincial governments can help **de-risk private financing of cleantech by implementing targeted loan guarantees and/or investment tax credits**. These strategies can be highly effective and fiscally sustainable as they attract significant private capital over the long term.

Another challenge is access to markets, which can be addressed in part through sustainable procurement (discussed below). Exporting is the final stage (see Section 3.7).



3.4 Leverage Sustainable Procurement

The Government of Canada alone spends approximately $22 billion buying goods and services each year, while provincial and municipal governments spend billions on top of that.[cxxi] To date, government procurement in Canada has largely focused on finding the lowest-cost supplier, despite the long-term economic value that comes from circular goods, resilient supply chains, and cleantech.

Paradoxically, government's focus on spending less in the short-term results in higher long-term costs and less value for taxpayers. As an example, consider the purchase of a laptop. Focusing on lowest upfront cost would result in laptops that break more easily, need to be replaced sooner, and are more difficult to recycle.

In the long-term, this becomes more expensive for the purchaser and worse for the environment. Given the number of goods being procured by governments, Crown corporations, and public sector agencies, this represents a major opportunity cost.

Governments across Canada should embrace sustainable procurement as an opportunity to support local cleantech firms. Their requests for proposals should **consider questions around sustainability and lifecycle costs** to ensure they are getting the best outcomes for their spending. For example, the US government evaluates potential suppliers based on their carbon footprints, which incentivizes large companies that bid for government contracts to partner with cleantech subcontractors.[cxxii] The Government of New South Wales in Australia has geared its procurement strategies to supporting both small firms and environmental objectives.[cxxiii]

3.5 Expand Low-Carbon Transportation

Given the share of emissions generated from transportation, the Government of Ontario should **make decarbonization an explicit objective within all regional transportation plans**. A multi-pronged solution will be necessary to address the various challenges associated with passenger and freight mobility in urban, rural, and remote communities.

Rail should be part of the solution, since shifting from diesel trucks to rail could reduce GHG emissions by 75 percent for a given volume of freight.[cxxiv] Federal and provincial governments should **support the expansion of rail networks and investments in fuel-efficient rail technologies** to reduce emissions from freight transportation.

However, roads and highways will remain essential to moving people and goods across a geography as large as Ontario. Governments should **continue advancing transportation technology projects**, such as those being developed through the Ontario's Autonomous Vehicle Innovation Network, that help reduce fuel emissions and congestion along major transportation corridors.

Further, research suggests that jurisdictions with bold ZEV policies are leading in adoption rates.[cxxv] Demand-side incentives – such as the 100 percent federal tax write-off on all commercial ZEVs – will help Canada meet its targets but may not be sufficient.[cxxvi] To capitalize on the opportunity, federal and provincial governments should work together to **develop a targeted ZEV strategy** that integrates battery electric,

RNG, hydrogen, and hybrid solutions for different vehicle classes. Fully realizing the economic benefits of these technologies in Ontario will require investments in a vertically integrated supply chain, from minerals to manufacturing. Such a ZEV strategy must engage remote and Indigenous communities to ensure the transition is just, particularly as many of these communities rely on revenues from fossil fuels (including gas stations) and do not have the necessary infrastructure to benefit equitably from the transition.

One of the main barriers to demand for plug-in vehicles is range anxiety, as large gaps between charging stations make it impractical for most drivers to rely on them as primary vehicles. Governments should help **fast-track private sector investments in charging infrastructure** with funding, tax incentives, and/or partnerships through the Canada Infrastructure Bank.[cxxvii] As noted in Section 3.2, allowing utilities to rate-base investments in EV charging infrastructure would also accelerate installation. Direct funding from government should be directed towards remote regions where there is less of a business case for private investment. Another challenge is that there are three styles of fast-charging plug types in Canada, adding more uncertainty for drivers; federal policymakers should work with industry to **standardize EV plugs**, as seen in Europe and China.[cxxviii]

Meanwhile, transportation planners should seek to **encourage greater reliance on public transit**, particularly until ZEVs become the norm. Congestion will only get worse in regions like the GTA, where the population is expected to grow by more than 40 percent by 2046.[cxxix] Cost is one barrier to demand; currently, a monthly transit pass in Toronto costs $156, meaning it is only economical for passengers who commute at least six days per week.[5] This is a missed opportunity to incentivize greater transit use among workers in population centres where congestion is both an economic and environmental problem.

A key barrier to transit uptake in Ontario is the gap in connectivity between regional transit systems. The provincial government should **incentivize municipal investment and collaboration on transit**. This can be done by expanding Ontario's Community Transportation Grant Program for green transit and creating multi-region transportation plans. The Province should also develop a mechanism to allow multiple municipalities who co-invest in regional transit networks to report the jobs and other economic outcomes proportional to their financial contributions. Currently, municipalities are not recognized for investments they make strictly outside their jurisdictional borders, even when the benefits spill over.

5 At a cost of $3.20 per ride using the PRESTO card.

3.6 Go Global

Canada will increasingly need to coordinate its climate policies at the international level to minimize carbon leakage and protect business competitiveness. The federal government should work with Canada's trading partners **to establish a global market for voluntary carbon credits** in which emissions that are offset domestically can be sold as credits abroad to meet foreign standards, and vice versa, to reflect the borderless nature of the climate crisis.[cxxx] It is estimated that the market for carbon credits could be worth upward of $50 billion by 2030[cxxxi] – a massive opportunity for Ontario businesses leading in sustainable innovation.

The federal government should also **evaluate the potential for its own carbon border adjustments**, as promised in its most recent climate plan, to protect domestic trade-exposed sectors.[cxxxii] As the United States considers adopting a similar tariff, it will be important for Canada to ensure the sustainability standards of its businesses are appropriately recognized under the US system.

Further, the global market for sustainable Canadian goods and services is ripe as the United States and other Western nations have expressed a desire to limit their reliance on China for critical minerals. Canada should **adopt a bold strategy for low-carbon exports** that positions Ontario's energy, cleantech, and natural resource sectors as strategic tools in the transition to net zero.

Within North America, specific opportunities include advancing the Canada-US Joint Action Plan on Critical Minerals Collaboration – a roadmap launched in 2020 to secure critical mineral supply chains through research, information sharing, and industry supports – and building a Canada-US-Mexico Council to coordinate strategies for EVs, batteries, and other cleantech products.[cxxxiii] Beyond North America, Canada should **target markets that are rapidly expanding and where there is growing demand for low-carbon suppliers.**[cxxxiv] Additionally, Invest Ontario should **continue attracting foreign investment** in Ontario's cleantech, mining, and automotive sectors.

3.7 Tackle Waste Challenges

The green economy comes with significant waste challenges that require long-term policy solutions.

Consider the lithium-ion batteries used in EVs. Unlike traditional car batteries, these are larger, heavier, contain hazardous materials, and can explode if disassembled incorrectly.[cxxxv] Governments will need to **clarify the rules around end-of-life battery disposal**, as there is currently no law in Canada that requires them to be recycled. Governments should adopt best practices from the nuclear industry, which has developed a long-term management plan for used nuclear fuel after extensive scientific evaluation and stakeholder engagement.[cxxxvi] Global collaboration will be critical to ensure batteries are properly disposed of, wherever they end up.

Another challenge for policymakers is how to encourage the circular economy. Since waste policy falls under provincial jurisdiction, Canada has a patchwork of rules, differing even between neighbouring municipalities. The Ontario government is shifting towards making producers responsible for the waste they produce with the intent to promote innovation and harmonize rules across the province. There is some concern that the complexity of Ontario's new rules may lead to compliance challenges, especially for small businesses. Policymakers will need to **provide sufficient guidance and support to facilitate the transition and improve cohesiveness across jurisdictions** to reduce red tape for businesses operating across the country.

For organic waste, industry is adopting technology that turns landfill gas into RNG (see Section 2.2). However, the Government of Ontario is now proposing to ban organics from landfills. The problem with this approach is threefold. First, evidence from other jurisdictions such as Nova Scotia and Vancouver suggests organic bans are difficult to enforce. Second, even if the ban were successful, Ontario lacks sufficient infrastructure to process the organic material that would be diverted from landfills. In Vancouver, much of the waste ended up in the United States, which defeats the intention. Third, an organics ban prevents technologically advanced landfill operators from using waste to generate RNG. Thus, Ontario should **reconsider its landfill ban proposal or exempt landfills that convert waste emissions to RNG.**

3.8 Improve Building Efficiency and Resilience

Investing in sustainable buildings is a good strategy for economic stimulus because measures can be implemented quickly, and every dollar invested in energy efficiency programs leads to an estimated $7 in GDP growth.[cxxxvii]

Retrofits are necessary to reduce emissions from existing buildings. For brick-and-mortar businesses, these measures help lower overhead costs by reducing energy consumption, but there is often a capacity gap that prevents small and medium-sized businesses from adopting them. To support demand, governments can **expand energy efficiency grants or low-interest loans**. For example, the IESO currently offers an Energy Manager program for Small and Medium Enterprises and the Ontario government previously offered an Energy Audit program (now cancelled). The flexible structure of these programs is helpful as it does not assume a one-size-fits-all solution at the firm level.

However, with around 10 million buildings in Canada, the current approach to retrofits is relatively slow and fails to leverage economies of scale. Hence, governments should **consider a more widescale approach to retrofits**, such as the 'energiesprong' model used in the Netherlands.[cxxxviii] Rather than tackling retrofits as distinct projects, this approach transforms multiple buildings by coordinating supply chains, using mass-produced assemblies and mechanical pods, and offering long-term financing and loan guarantees to building owners.[cxxxix]

Further, as the Conference Board of Canada notes, public funding should be complemented by private sector capital – such as green mortgages and securitization of property-assessed clean energy (PACE) financing.[cxl] The Government of Canada should help advance the green mortgage market by working with industry to **standardize definitions and criteria around sustainable properties, fill data gaps, and establish clear regulatory frameworks** that give stakeholders confidence to invest in the market.[cxli] It should also **consider reducing asset capital requirements for green mortgage lenders** given the lower risk associated with low-carbon homes.[6] [cxlii]

For construction of new buildings, Ontario should **continue to incrementally evolve its building codes to improve climate resilience and net-zero readiness**. To avoid a piecemeal approach, it is important for provincial, territorial, and municipal governments to take federal direction from Infrastructure Canada's

6 For more information about the link between energy efficiency and risk for mortgage lenders, see the Energy Efficient Mortgages Action Plan (EeMAP) initiative. https://eemap.energyefficientmortgages.eu/services/.

Climate-Resilient Buildings and Core Public Infrastructure Initiative, and ongoing upgrades to Canada's National Building Code. Climate-resilient building codes will help communities withstand extreme weather events, particularly wind, fire, and flooding. Meanwhile, adoption of net-zero energy ready (NZER) building codes would allow Ontario to reap similar benefits as Vancouver, where they are forecasted to generate $3.3 billion in market demand for high-performance building products and technologies between 2019 and 2032.[cxliii]

All of this requires highly skilled workers. In the context of economic stimulus and recovery, federal and provincial governments should **support workforce training programs geared towards low-carbon construction, architecture, urban design, and engineering**. These efforts should build on existing micro-credential programs and partnerships between colleges, universities, and industry to help upskill and reskill workers (including projects supported by Ontario's Skills Development Fund). They should seek to attract workers who were pushed out of the labour market because of the pandemic, as well as the next generation of talent.

Finally, municipalities should **consider adopting policies that facilitate recycling and repurposing of building materials** to extend their lifecycle. Brick, stone, and concrete used in building construction can usually be recycled for other applications such as new roads or backfill. Some cities – such as Paris and Portland – have issued deconstruction ordinances that require a certain proportion of building materials to be deconstructed rather than demolished.[cxliv] The City of Seattle has chosen to accelerate demolition permit approvals as an incentive for those who relocate or deconstruct a building rather than demolishing it. Ontario's municipalities can explore similar policies as part of their climate action plans.

3.9 Strengthen Climate Adaptation

While reducing global emissions is necessary, the reality of climate change means we must also learn to adapt to its effects. Communities will need strong physical and natural infrastructure, asset management policies, and emergency response protocols to manage the increasing frequency and severity of extreme weather events. Municipalities are on the front lines of this issue, and they need more support. Merely avoiding the worst impacts of climate change at the municipal level will cost an estimated $5.3 billion per year, and existing funding streams are inadequate.[cxlv]

Federal and provincial governments should make concrete commitments to **support communities with climate adaptation and asset management, backed by adequate and sustained funding**. This includes dedicated funding for water, wastewater, and stormwater infrastructure – as research shows leaky pipes are dumping millions of cubic metres of treated drinking water into the ground every year across Ontario, a challenge that will only be exacerbated by climate change.[cxlvi]

Flood management is of particular concern. In 2016, Ontario received the top grade (B-) among all evaluated jurisdictions, but a follow-up study in 2019 reassessed its grade to a C at a time when most other provinces saw improvements.[cxlvii] While the Government of Ontario has since updated its Flooding Strategy, it has also passed legislation that limits the mandate of Conservation Authorities, putting wetlands at risk and compromising the best natural flood mitigation infrastructure.[cxlviii]

The Government of Ontario should **actively support the federal Task Force on Flood Insurance and Relocation**, which is composed of representatives from all orders of government and the insurance industry. Ontario should play a leadership role in fulfilling the group's mandate to create a low-cost national flood insurance program and a national action plan to assist high-risk homeowners with relocation to safer areas. Municipalities may also consider insurance-based frameworks as part of the solution to incentivize conservation and restoration of local wetlands (as discussed in Case Study #7).

More fundamentally, Canada needs a National Adaptation Strategy (NAS), as seen in Germany, Australia, Japan, France, the Netherlands, the United Kingdom, and elsewhere. In December 2020, the Government of Canada announced its commitment to developing a NAS. As all orders of government collaborate to develop the NAS, they should **adopt recommendations made by the International Institute for Sustainable Development**.[cxlix] These include:

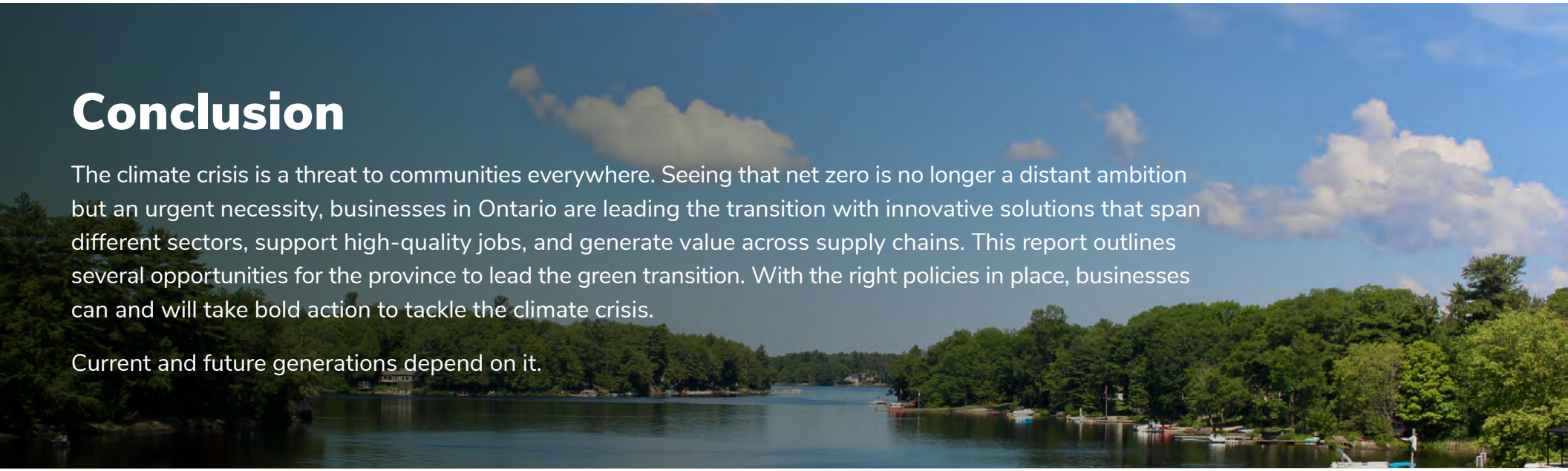
- Allocate clear institutional roles, accountability mechanisms, and sufficient human resources to the execution of the strategy. Oversight bodies can sit within or outside government, but they must be equipped to monitor and report on progress.
- Improve coordination. Climate adaptation requires a whole-of-society approach that integrates data, risk assessments, and capabilities from different sources, including government departments, research institutions, insurance providers, and municipalities.
- Advance reconciliation with Indigenous peoples, who have stewarded these lands sustainably since time immemorial. Climate adaptation strategies should be developed with Indigenous leadership and executed in a manner consistent with the Truth and Reconciliation Commission's Calls to Action and the United Nations Declaration on the Rights of Indigenous Peoples.

3.10 Standardize Climate Disclosures

Several countries are codifying climate-related disclosure rules in line with recommendations made by the Task Force on Climate-Related Financial Disclosures (TCFD), including New Zealand, the United Kingdom, Switzerland, France, China, and Australia.[cl] Meanwhile, the International Financial Reporting Standards Foundation is working to harmonize requirements across jurisdictions to avoid a piecemeal approach.

In Canada, provincial and federal governments and regulatory bodies are engaging in consultations to enhance climate disclosures, but some firms and investors feel there has been sluggish progress in implementing a standardized approach.[cli] There is also a concern that domestic businesses will face a competitive disadvantage if national requirements are not consistent with major trading partners, particularly as Canadian firms are ahead of many other jurisdictions in their adoption of voluntary disclosures.

Considering the rapid growth of ESG markets, regulators in Canada and Ontario should **prioritize the adoption of a standardized framework** consistent with international norms. Any new legislation must **ensure there is sufficient transition time and guidance for firms**, particularly for smaller firms that are less likely to have already implemented the TCFD's recommendations.[clii] International coordination will be essential to avoid competitiveness issues for Canadian businesses.



Conclusion

The climate crisis is a threat to communities everywhere. Seeing that net zero is no longer a distant ambition but an urgent necessity, businesses in Ontario are leading the transition with innovative solutions that span different sectors, support high-quality jobs, and generate value across supply chains. This report outlines several opportunities for the province to lead the green transition. With the right policies in place, businesses can and will take bold action to tackle the climate crisis.

Current and future generations depend on it.

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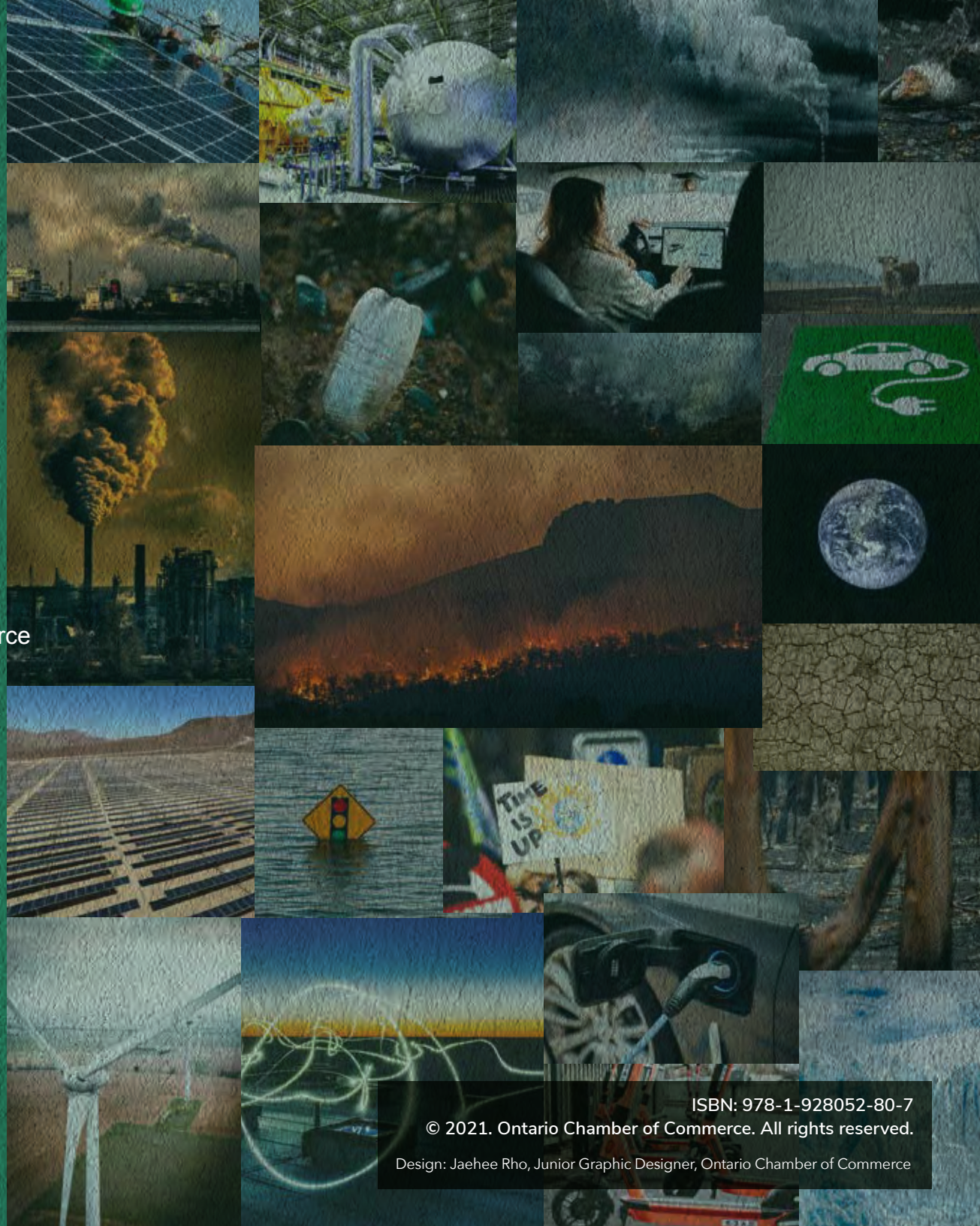

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