VOLT STRATEGIC RESEARCH

CLEANTECH INDUSTRY REPORT

OCTOBER 2021

All the numbers are in Canadian Dollars, unless stated otherwise.

INDUSTRY OVERVIEW

Public interests and expectations around ESG (Environmental, Social, and Governance) practices are impacting both purchasing and investing behaviours. Sustainable investing is certainly not a new concept, but investors have arguably become more bullish on cleantech as a result. Some suggest the surge toward cleantech is being driven by greater public awareness of high-profile global responses to climate change (e.g., the Paris Agreement or the UN's Sustainable Development Goals). In contrast, others cite shifting generational beliefs in disruptive tech and "social change for good" as root causes for spiking interest. **Regardless, a lot of significant and investable cleantech innovation is emerging from Canada, being driven by several small-cap companies offering solutions to both industrial and societal challenges.**

In the last two decades, the global average surface temperature has risen 1.2°C, a trend that climate scientists confidently link to a long-term increase in greenhouse gas (GHG) emissions. Rising temperatures have intensified high-impact and life-threatening natural disasters—heat waves, severe cold, forest fires, hurricanes, and flooding, among others — costing billions of dollars every year. **In 2020, the Government of Canada reported nine climate events with ~$2.5B total insured losses[1], while the United States reported a record 22 climate events costing ~US$95B that year, contributing to five-year total losses of US$600B[2].**

To limit greenhouse gas (GHG) emissions and climate change, 196 countries negotiated and signed on to the Paris Agreement in 2015, a global framework with a long-term goal of holding the global average temperature increase to less than 2.0°C from the pre-industrial levels. Under the Paris Agreement, signatory countries have submitted nationally determined contributions (NDC), setting targets for GHG emission reductions by 2030 and a more ambitious percentage (net carbon zero) by 2050.

1 https://www.ncdc.noaa.gov/sotc/global/202013
2 https://www.ncdc.noaa.gov/sotc/national/202013

In the United States, the Biden administration has set a national 2030 GHG emissions target of 50-52% below 2005 levels and achieve carbon neutrality by 2050[3]. Key policy areas the US intends to promote and fund include making electricity 100% carbon-free by 2035; investing in innovation and incentivizing a greener workforce; modernizing the transportation and infrastructure sector, supporting renewables/alternative energy sources, and enhancing carbon sinks and other methods that significantly promote carbon sequestration. California has announced bans on the sale of new cars with internal combustion engines (ICEs) by 2035.[4] Similar to the U.S., Canada's enhanced NDC plan targets GHG emission cuts of 40-45% below the 2005 level by 2030, and to reach net-zero by 2050. Canada has also set a 2035 ban on ICEs[5]. **Both Canada and the US are expanding extended producer responsibility (EPR) programsin which companies are given significant financial and/or physical responsibilities for the treatment of post-consumer products.**

Moving towards a more circular economy and pushing to improve annual greenhouse gas emissions has no doubt helped stimulate cleantech innovation. And with this innovation comes a greenfield of investment opportunity to reduce pressure on the environment by limiting annual greenhouse gas emissions that considers the lifecycle of products and resources.

The Canadian Cleantech Opportunity

Just as ESG has helped drive corporate interest in identifying and incorporating cleantech solutions into business best practices, public policymakers across North America and around the globe are making decisions that are shaping industry regulations and investment across the cleantech economy. Key focus areas for cleantech adoption include:

- Renewable/Low Carbon Energy Sources
- Batteries and Charging Technologies
- Carbon Capture
- Waste Management
- Waste Treatment and Conversion

Financial markets, too, reflect the growing focus on a greener economy. Green bonds, IPOs, and private placements in cleantech now readily compete with other sectors in many global economies, while improvements in the transparency and standardization of ESG reporting help to support such investments.

3 https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets- 2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s- leadership-on-clean-energy-technologies/

4 https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasoline-pow- ered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/

5 https://www.canada.ca/en/environment-climate-change/news/2021/07/government-of-canada-confirms-ambi- tious-new-greenhouse-gas-emissions-reduction-target.html

In Canada, it is estimated that the federal Government will need to invest $128B in the next ten years to achieve the 2030 carbon emission reduction targets[6]. The Government's continued investments in sustainability initiatives at both national and local levels foster a healthy investment ecosystem for institutional and retail investors. It is worth highlighting that the Canadian Responsible Investing (RI.) Assets have risen 7 times in four years, from $459B in 2016 to $3.2T in 2019, forming approximately 62% of the total Canadian AUM in 2019.

Investors are increasingly optimistic as they consider how best to integrate ESG and select cleantech opportunities into their financial holdings. Businesses that can showcase sound ESG practices are favourably positioned with investors and are often rewarded with greater access to capital as countries pledge to reach net-zero targets in the coming years. **The shift from carbon economies to carbon neutrality is indeed in full swing.**

Note: Unless stated otherwise $ represents Canadian Dollars.

6 https://smith.queensu.ca/insight/content/the-price-tag-for-clean-growth-in-canada.php

> "The climate is like a bathtub that's slowly filling up with water. Even if we slow the flow of water to a trickle, the tub will eventually fill up and water will come spilling out onto the floor. That's the disaster we have to prevent. Setting a goal to only reduce our emissions—but not eliminate them—won't do it."
>
> **— Bill Gates, How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need**

> "The point is that when we focus on all three things at once—technology, policies, and markets—we can encourage innovation, spark new companies, and get new products into the market fast."
>
> **— Bill Gates, How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need**

TABLE OF CONTENTS

FROM CARBON ECONOMIES TO CARBON NEUTRALITY: OVERVIEW & TRENDS

1. A WORLD RESHAPED BY CLIMATE CHANGE

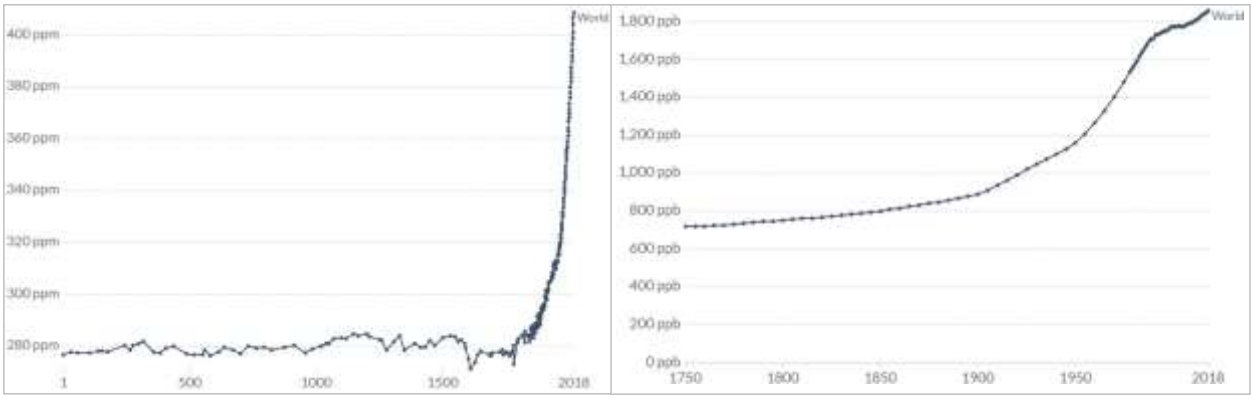
1.1 THE IMPACTS OF GREENHOUSE GASES

The Industrial Revolution reshaped our world, and that includes Earth's climate. Our planet now has a surplus of CO_2 and other forms of so-called greenhouse gases (GHGs) in its atmosphere, that includes methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFC). This imbalance of GHGs has led to a global climate change crisis.

According to a 2020 World Meteorological Organization report, the concentration of CO_2, (which accounts for about 74% of total GHG emissions), methane (7.3%), and nitrous oxide have now risen +148%, +260%, and +123% respectively from pre-industrial levels (Exhibit 1).[7] The continuous increase in GHGs has led, in the last two decades alone, to a 1.2°C increase in the average global temperature, intensifying life-altering natural disasters like heat waves, severe cold, forest fires, hurricanes, flooding, and drought.

These disasters cost billions of dollars every year. Just in 2020, the Government of Canada reported nine climate events with approximately $2.5B total insured losses, while the US recorded 22 climate events worth ~US$95B in losses, contributing to five-year total losses of US$600B[8].

Exhibit 1: Global CO_2 (Left) and CH_4 (Right) Concentration, 2018



Source: ourworldindata.org

7 https://library.wmo.int/doc_num.php?explnum_id=10618
8 https://www.ncdc.noaa.gov/sotc/global/202013

1.2 GHG EMISSIONS AND NORTH AMERICA

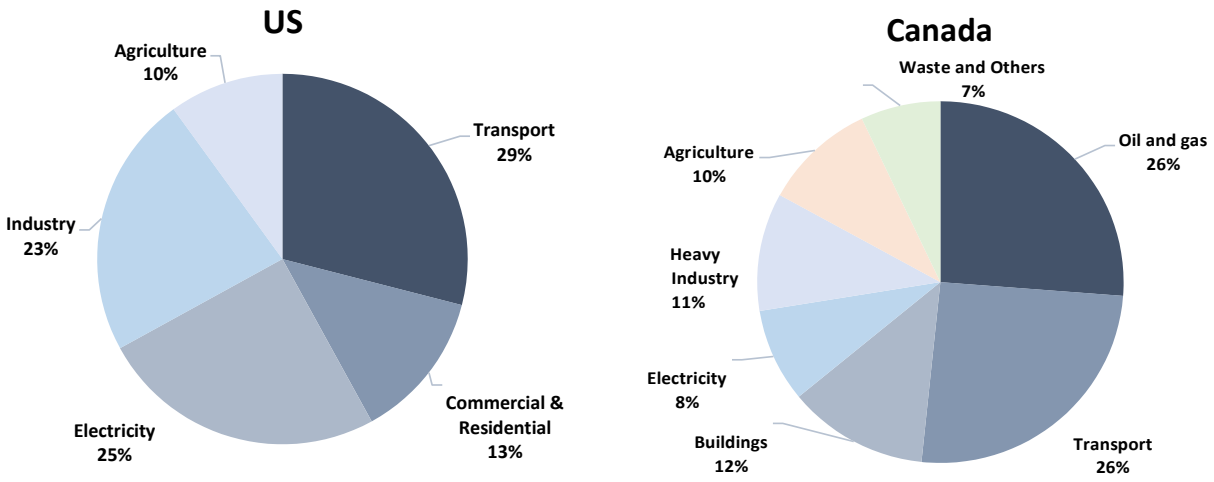
North America contributed ~30% to the total global CO_2 emissions of 36.4B tons in 2019. The US alone contributed ~25%, which is also the US's long-term average contribution to the accumulated GHG in the environment worldwide (Exhibit 3). The industrial sources contributing to GHG emissions vary from region to region (Exhibit 2). However, the transportation sector (25-35% of the total emission) remains at the top in most cases due to the burning of fossil fuels to operate the vehicles. In Canada, the Oil and Gas sector is the second major contributor due to exploration and production facilities, followed by buildings, heavy industry, and agriculture. In the US, however, electricity generation is the second-largest contributor, serving other significant sectors like transportation, industrials, residential and commercial usage, and agriculture. Definitely classifying emissions sources is a challenge due to interdependencies between industries (Exhibit 2).

1.3 GHG EMISSION REDUCTION MEASURES

A wide range of emission control measures are applied in the economy. In broad terms, they fall into three categories:

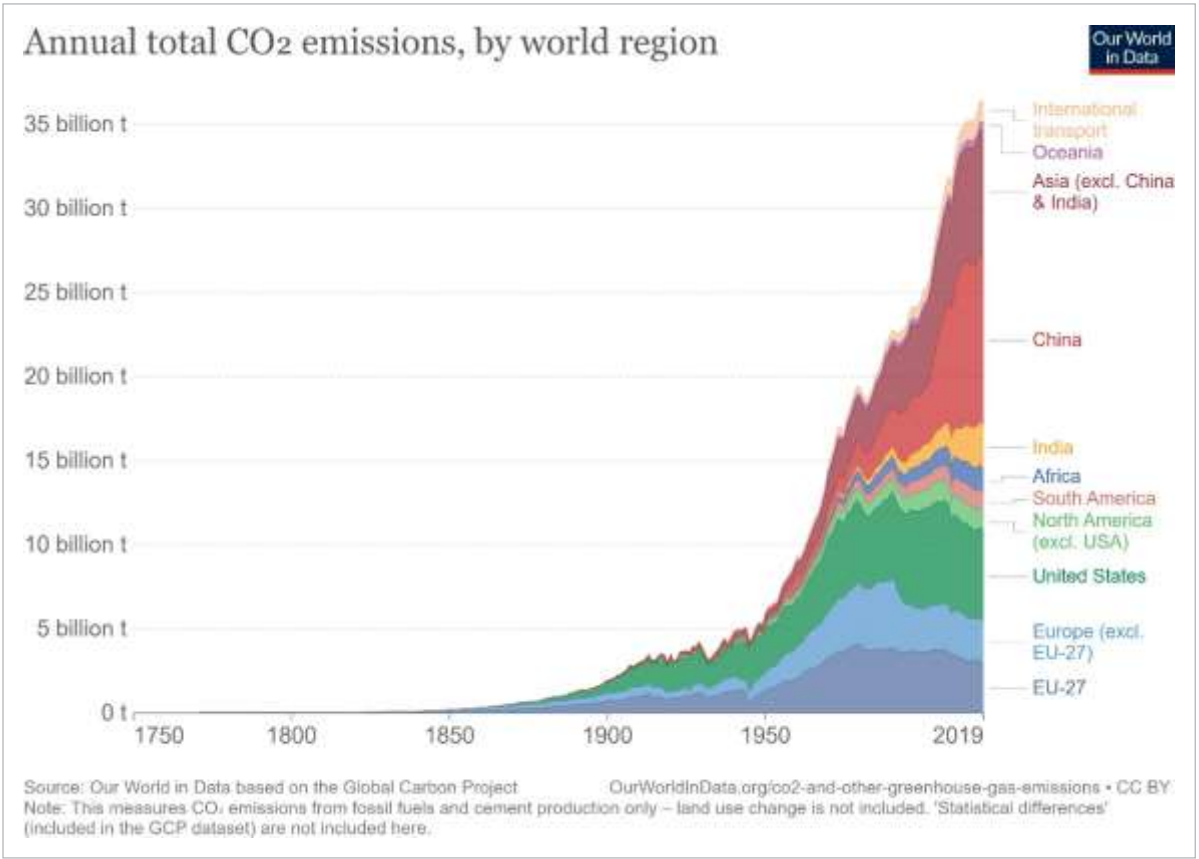
- **Energy efficiency:** Use of energy-efficient devices, emission control, and efficient logistic planning, among others
- **Use of cleaner energy supply alternatives:** Use of renewable and alternative energy sources versus fossil fuels
- **Reduction in and/or reuse of waste:** Includes recycling waste to produce materials instead of net-new resource extraction, particularly fossil fuels for plastics

Exhibit 2: GHG Emission - By Source, 2019

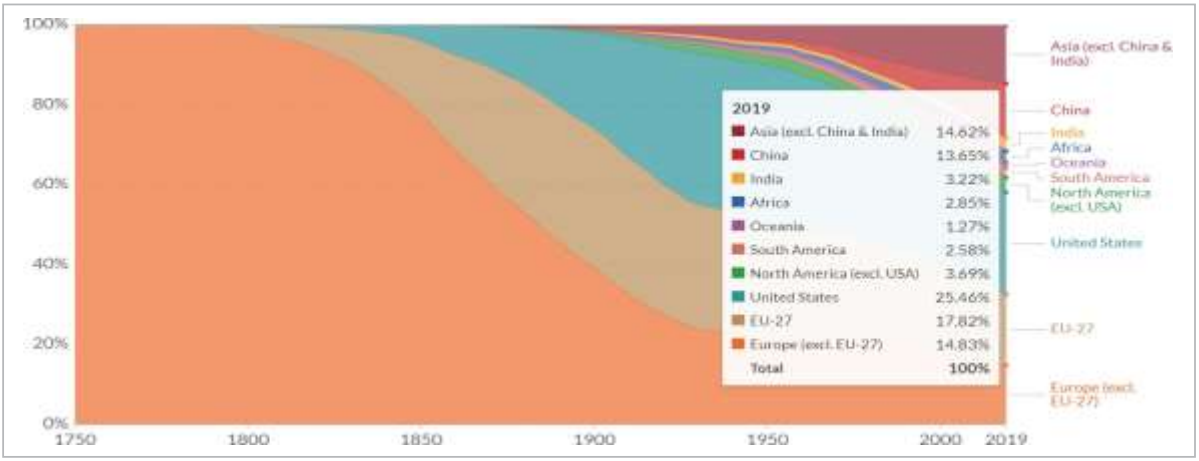


Source: Volt Strategic Research, EPA, Environment and Climate Change Canada 2021 report

Exhibit 3: Major CO_2 Contributors, 2019



Global CO2 emission (2019): 36.4B tons, **US:** 5.8B tons, **Canada:** 576.7M tons



Source: ourworldindata.org

2. ESG INVESTMENT TRENDS AND FUNDAMENTALS

Bloomberg estimates Global ESG assets to reach US$53T by 2025, ~one-third of the total global projected AUM. ESG markets will be shaped broadly by GHG emissions targets and the infrastructure investments that will be required to achieve them. This section of the report examines trends that are shaping the industry.

2.1 NET ZERO[9] EMISSION TARGETS

GHGs remain in the atmosphere for hundreds of years, thus requiring long-lasting, efficient plans to mitigate the consequences of more than 100 years of environmental negligence. There is also global economic risk: **According to research from Swiss Re, global GDP could lose 11-18% of its value by 2050 if net-zero emission targets as set by the Paris Agreement are not met.[10]**

The Paris Agreement[11], adopted in 2015 by nearly 200 countries, provides a global framework to limit climate change by holding the global average temperature increase by 2100 to less than 2.0°C from pre-industrial levels. Signatory countries have submitted their nationally determined contributions (NDCs) under the Paris Agreement to reduce their carbon emission to a target percentage by 2030 and a more ambitious percentage (net carbon zero) by 2050.

The 'Emission Gap Report 2020'[12] highlights that the emission targets determined by the unconditional NDCs, will still lead to a temperature increase of 3.2°C between 2000 and 2100, of which 1.2°C has already occurred in the last two decades. The full implementation of more ambitious conditional NDCs, which are contingent on certain conditions as decided by the individual countries, will increase by 2.0°C. (Exhibit 4)

While the Paris Agreement has brought global economies together to fight climate change—70% of global GDP and total emissions are covered by net-zero emission commitment by 2050 (China: 2060)[13]— some suggest that many countries, especially the top emitters like the US and China, have a high probability of missing their NDC targets, putting additional pressure on other global economies. Western countries and private industries will likely face mounting pressure to re-prioritize investment and achieve more ambitious GHG emission targets.

9 Achieving net-zero emissions means the economy either emits no greenhouse gas emissions or offsets its emissions, for example, through actions such as tree planting or employing technologies that can capture carbon before it is released into the air. – Source: Government of Canada, Canada.ca

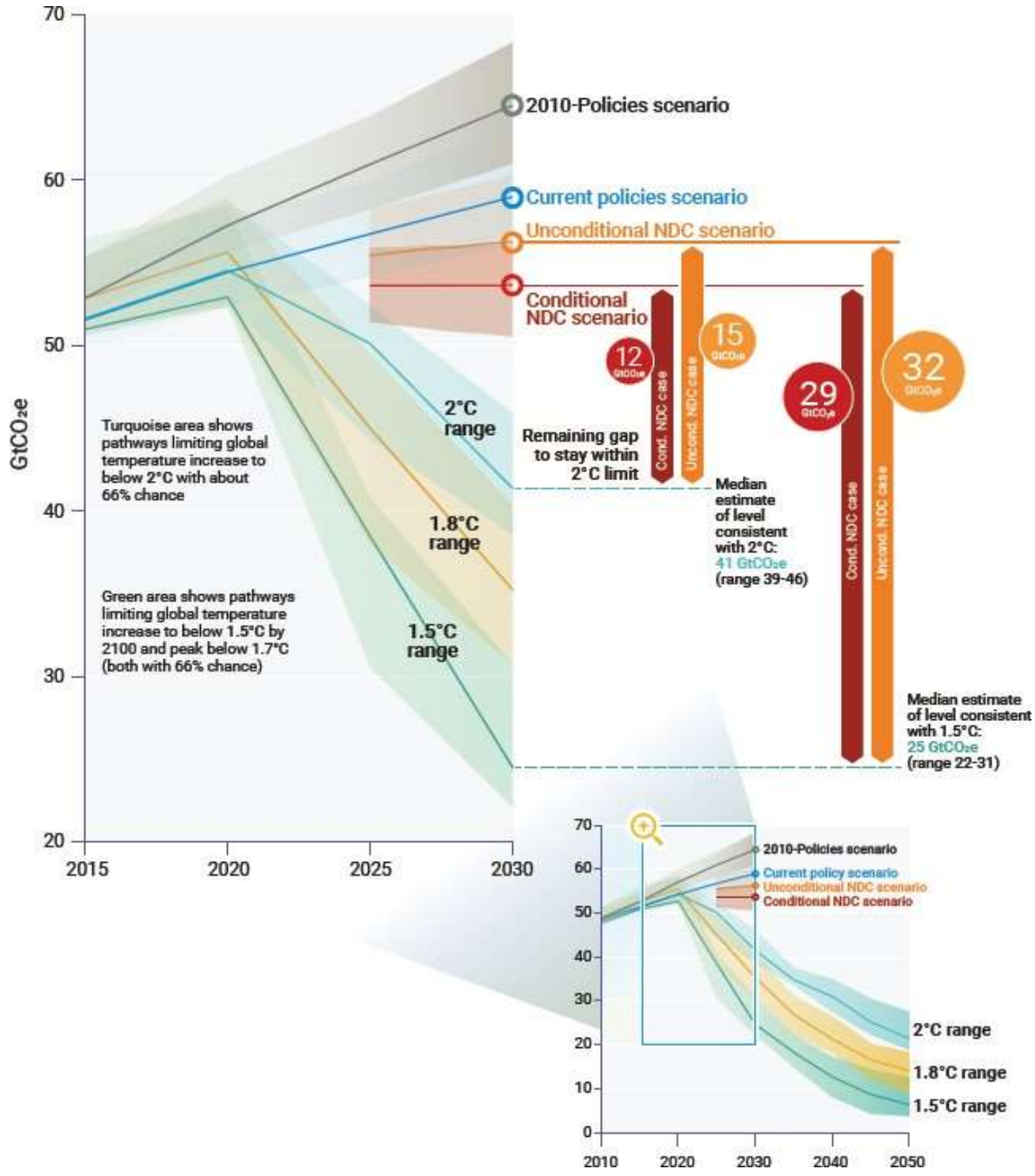
10 https://www.swissre.com/dam/jcr:e73ee7c3-7f83-4c17-a2b8-8ef23a8d3312/swiss-re-institute-expertise-publication-economics-of-climate-change.pdf

11 https://s3.documentcloud.org/documents/2646274/Updated-l09r01.pdf

12 https://www.unep.org/interactive/emissions-gap-report/2020/

13 https://iea.blob.core.windows.net/assets/0716bb9a-6138-4918-8023-cb24caa47794/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf

Exhibit 4: Global CO_2 (Left) and CH_4 Concentration, 2018



Source: Emission Gap Report, 2020, United Nations Environment Program (UNEP)

2.2 NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

Under the Biden administration, the US has set a national target to reduce GHG emissions 50-52% below 2005 levels by 2030 and achieve carbon neutrality by 2050. Like the US, Canada's enhanced NDC plan aims to achieve emission cuts of 40-45% below the 2005 level by 2030 and achieve net-zero emissions by 2050. The Government of Canada has already invested over $100B toward climate action and clean growth since 2015, with approximately $60B invested between 2015 and 2019 and nearly $53.6B invested in less than 12 months since October 2020.[14]

Elsewhere in the world, the United Kingdom and European Union nations have more ambitious emission reduction targets. The UK aims to reduce emissions by 78% by 2035, while the EU seeks to reduce by 55% below 1990 levels by 2030.[15] Countries in Asia are the most significant contributors to global GHG emissions, with 1/3rd of the world's total emissions coming from China and India. China's emissions have tripled in the last three decades, and the Government has vowed to peak the emissions by 2030 to reach net-zero by 2060.

For a country to reach its NDCs, policies must be implemented at the federal, state, municipal, and even household levels. This requires investing in innovation, infrastructure, and implementation**,** creating both incentive systems and penalties for individuals, private corporations, and public sector entities**,** devising and adopting transparent and uniform emission and ESG reporting standards, among others, for direct and indirect emissions.

2.3 TRACKING AND REPORTING EMISSIONS

Greenhouse Gases Protocol (GHGP), created by World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), aims at standardizing corporate accounting and reporting emissions for businesses and governments. The protocol has three scopes to differentiate between direct and indirect emission sources:

Scope 1: Direct GHG emissions: Direct GHG emissions occur from sources owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.

Scope 2: Electricity indirect GHG emissions: Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the company's organizational boundary—examples: Facilities where electricity is generated.

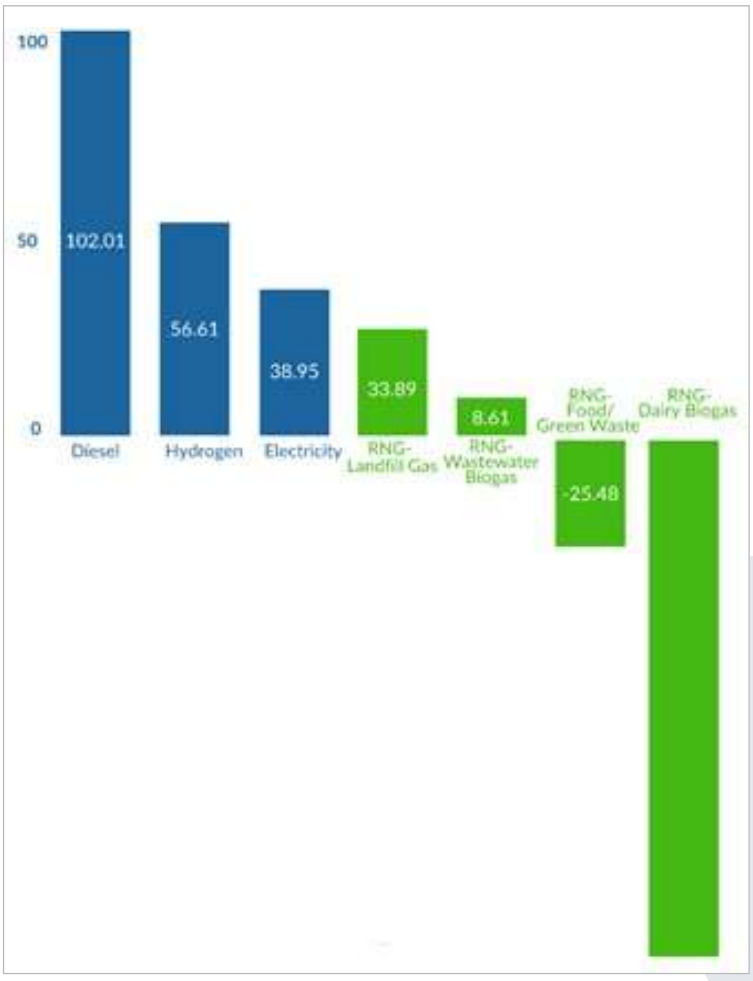
Scope 3: Other indirect GHG emissions: Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the company's activities but occur from sources not owned or by the company. Example: Extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

14 https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/actions-healthy-environment-economy.html

15 https://www.bbc.com/news/world-europe-56828383

As depicted in exhibit 6, Fuel Carbon Intensity is one factor that impacts a firm's GHG emissions. 'Fuel Carbon intensity' is a fuel's lifecycle, or "well-to-wheel", greenhouse gas emissions per unit of transportation energy delivered. The score is used under the GREET[16] model in the US and JEC WTW[17] reporting in Europe. **Fuel mix can be a crucial driver at reducing GHGs in organizations and at the national level. Renewable natural gas provides an alternative to fossil fuels with low to negative carbon intensity ratings.**

Exhibit 5: Carbon Intensity by Transportation Fuel

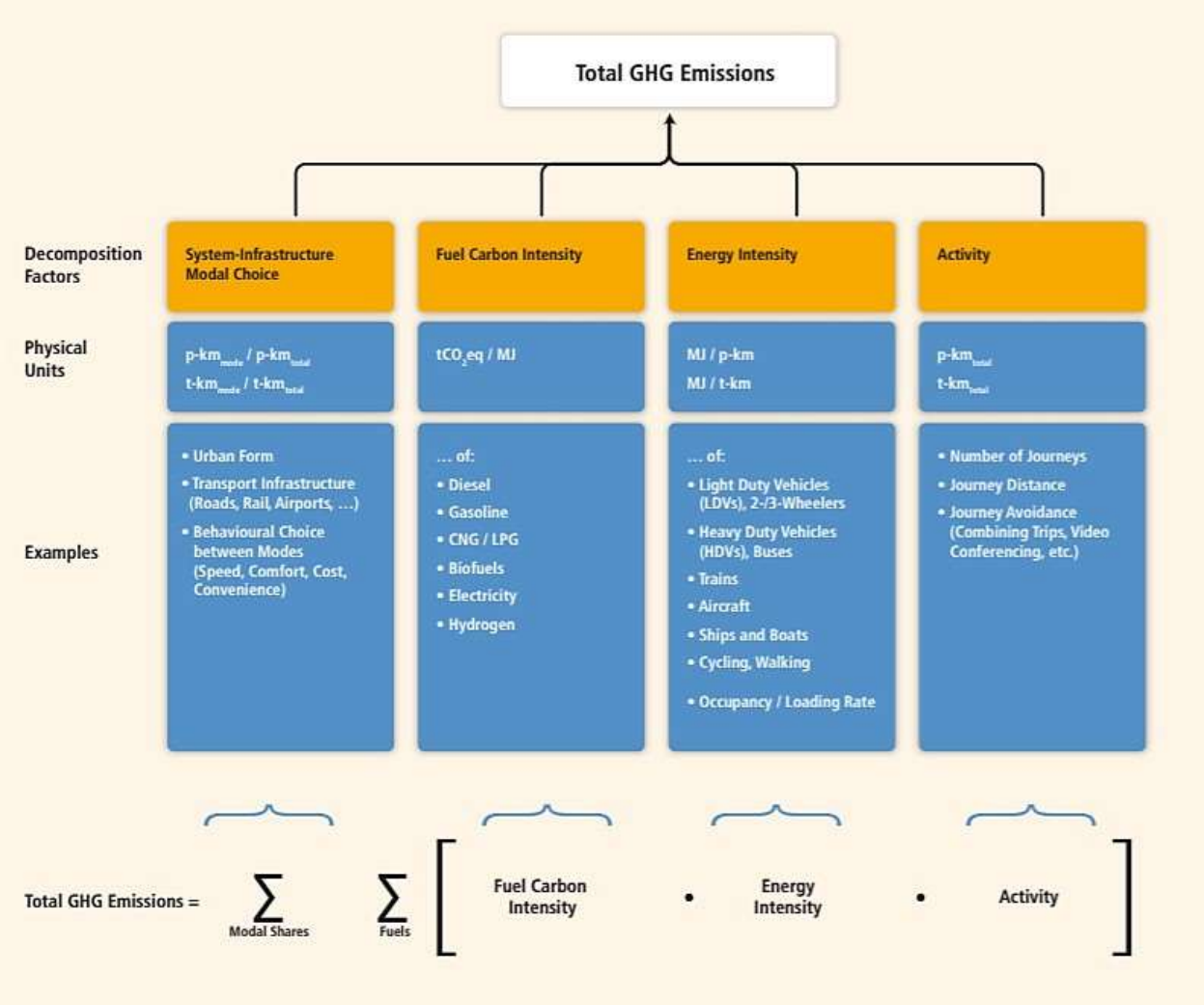


Source: California Air Associations Board (CARB)

16 GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) models emissions of the three traditional greenhouse gases (CO2, CH4 and N2O) and the criteria pollutants from transportation fuels used in the United States.

17 JEC WTW (the Joint Research Centre of the European Commission, Well to Wheel) evaluates GHG emissions and is used in Europe.

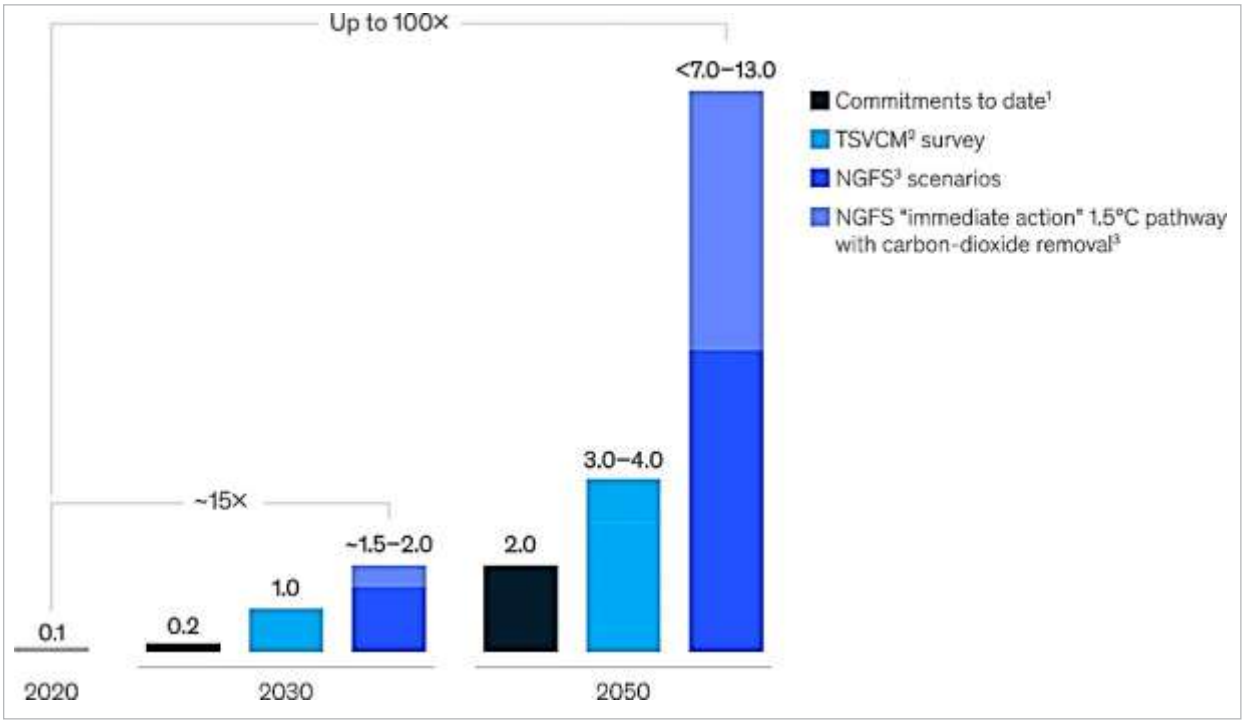
Exhibit 6: Transportation Direct GHG Emission



Carbon emission accounting allows for trading carbon offset credits either to meet minimum compliance or for voluntary requirements**. McKinsey expects voluntary carbon offset credit market alone to be more than US$50B in 2030 as the demand for carbon credit goes up by 15x (exhibit 7) and would require technological and infrastructural development as a part of generating ethical carbon credit creation.**

Carbon trading is explained in the CNBC documentary: VIDEO.

Exhibit 7: Voluntary Carbon Credit Demand Scenarios



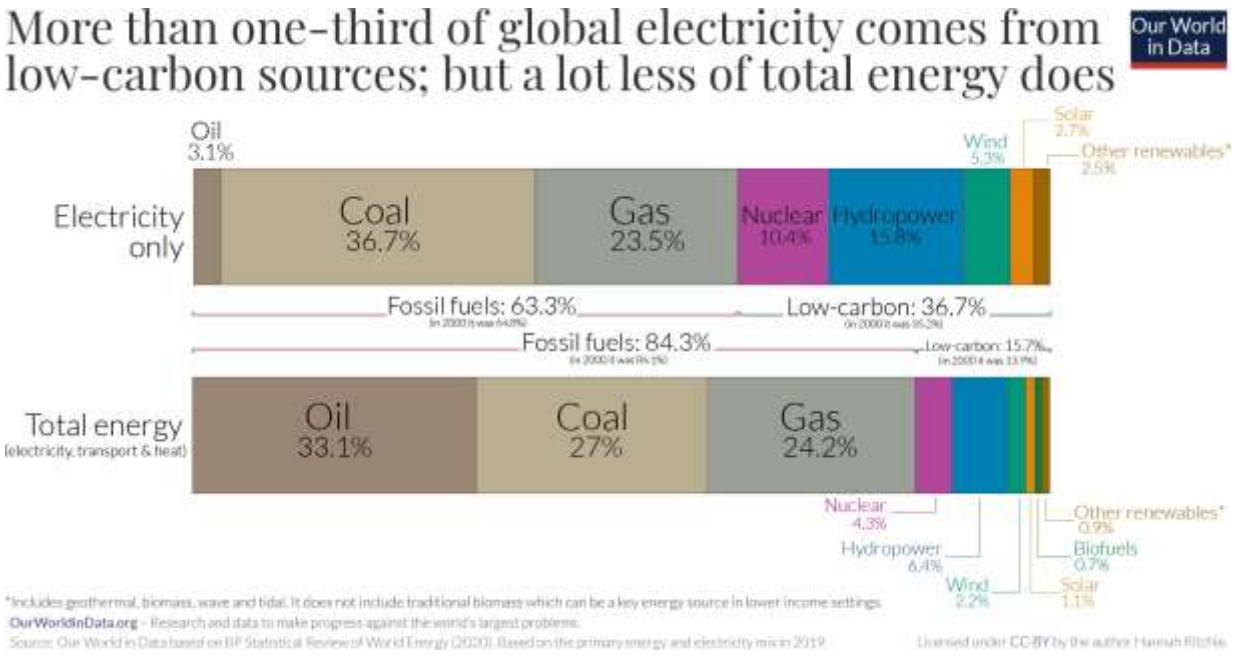
[1]These amounts reflect demand established by climate commitments of more than 700 large companies. They are lower bounds because they do not account for likely growth in commitments and do not represent all companies worldwide.
[2]TSVCM = Taskforce on Scaling Voluntary Carbon Markets. These amounts reflect demand based on a survey of subject-matter experts in the TSVCM.
[3]NGFS = Network for Greening the Financial System. These amounts reflect demand based on carbon-dioxide removal and sequestration requirements under the NGFS's 1.5°C and 2.0°C scenarios. Both amounts reflect an assumption that all carbon-dioxide removal and sequestration results from carbon credits purchased on the voluntary market (whereas some removal and sequestration will result from carbon credits purchased in compliance markets and some will result from efforts other than carbon-offsetting projects).

Source: NGFC, TSVCM, McKinsey Sustainability

2.4 INVESTMENTS IN INFRASTRUCTURE AND TECHNOLOGICAL ADVANCEMENTS

Renewable/Low-Carbon Energy Sources: Moving away from fossil fuels as a primary source of energy to electricity generated by renewable and alternative energy sources remains a top priority. According to Global Affairs Canada's 2020-23 Departmental Sustainable Development Strategy, Canada will invest $26.9B by the end of 2028 in funding for green infrastructure initiatives to reduce greenhouse gas emissions and improve climate resilience and environment quality. The investment includes coast-to-coast installation of EV chargers, natural gas stations, and hydrogen stations to transform the transportation sector. Globally, a more significant portion of the electricity is produced using low carbon and renewable energy sources than the total energy market (36.7% versus 15.7%, as shown in the exhibit below).

Exhibit 8: Global Energy (and Electricity) Source Mix, 2019



Source: OurWorldinData.org

Batteries and Charging Technologies: We expect to see continuous improvement in battery technology and other power electronics systems to support consumer adoption of plug-in electric vehicles (PEVs) across the globe. We anticipate that with the advent of more advanced technology, batteries will continue to become lighter, smaller, more efficient, and require less time to charge. Canada has set a target of 2035 to phase out sales of combustion engine vehicles. In the US, California will phase out sales by 2035, but Washington and Hawaii as soon as 2030. The adoption of electric vehicles is expected to also support the adoption of renewable energy sources by sectors other than transportation. For example, vehicle-to-grid (V2G) technology is designed to help vehicles store and discharge energy from renewable sources like solar or wind sources, communicate with the power grid, and then deliver during peak demand to the stations.

Companies that we are watching include Calgary-based Exro Technologies; Vancouver-based Nano One Materials and Hillcrest Energy Technologies.

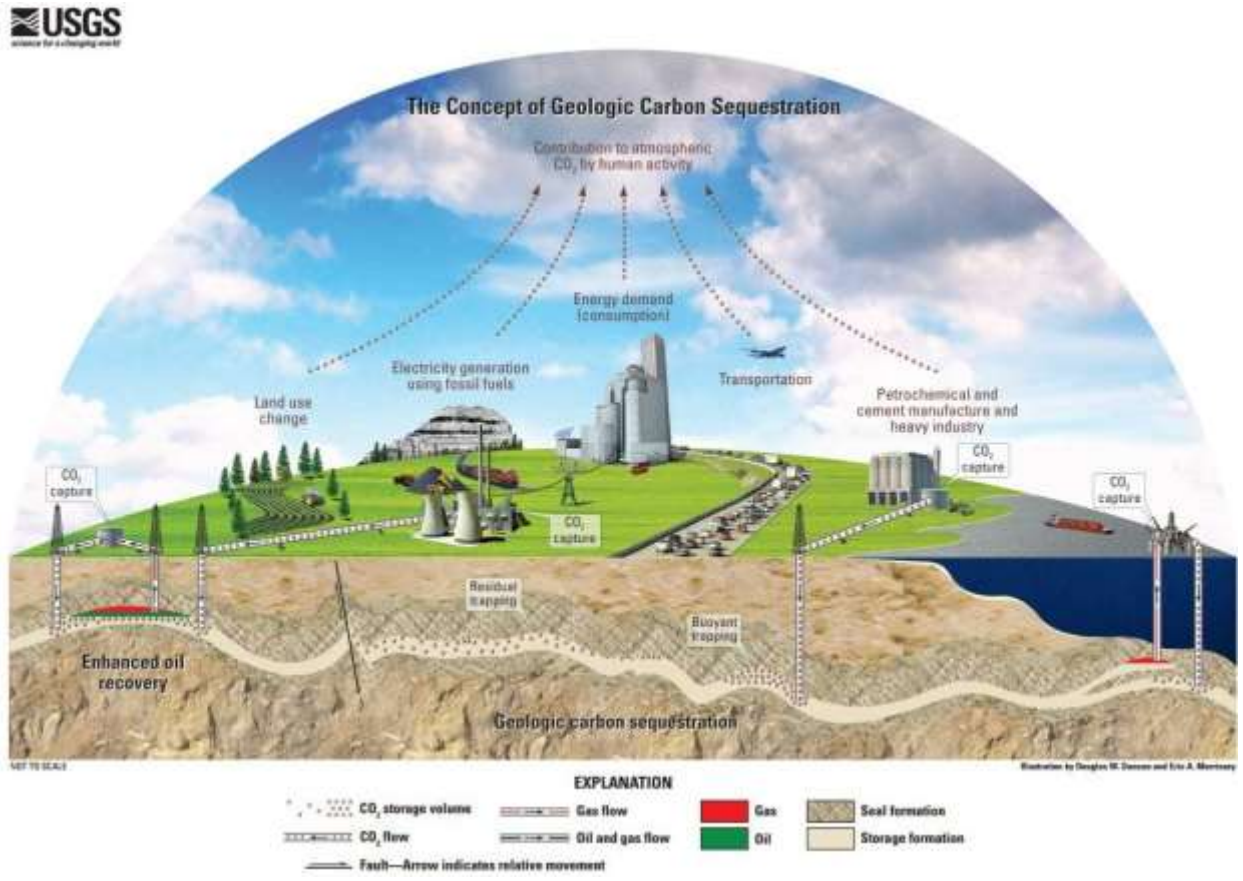
Carbon capture, utilization, and storage or sequestration (CCUS): Typically, this technology includes removal of CO_2 directly at the source (AKA Flue Gas method) or from the atmosphere (AKA Direct Air Capture or DAC). Flue Gas method captures CO_2 using carbon absorption chemicals like ammonia from the industrial flue gases before it is released into the atmosphere. DAC, on the other hand, uses fans to pull in atmospheric air, that is then passed through absorbents to capture CO_2, and finally releases clean air back into the environment. There are two different

methods to deal with the captured CO_2: Carbon Capture and Storage (CCS) and Carbon Capture and Utilization (CCU). CCS technology takes the captured CO_2 and stores in the deep underground geological formations (Exhibit 9) whereas CCU utilizes CO_2 in manufacturing materials like plastics, textile or carbonated drinks.

Carbon capture technology remains expensive for large scale implementation. However, due to its promising outcomes, its development is gaining momentum. The IEA (International Energy Agency) has publicly stated that it expects carbon removal to play a key role in the transition to a net-zero energy system. And thrusting it into the current cultural zeitgeist, Elon Musk has announced his intent to donate US$100M for the best carbon capture technology.

Multiple Canadian companies are working on promising carbon capture technology, including the Vancouver-based Progressive Planet Inc., Calgary-based Carbonova Corp. and CleanO2 Carbon Capture Technologies Inc.; Toronto- based CO2 Gro Inc.; Ottawa-based Hyperion Global Energy Corp.; and Calgary-based Carbon Upcycling Technologies.

Exhibit 9: Carbon Capture Infographics



Source: USGC

Waste Management: The circular economy and more efficient uses of materials present new opportunities for reducing greenhouse gas emissions. With two billion tons of waste created annually, the disposal of waste continues to be a massive problem for most countries in the world. The waste management hierarchy has source reduction at the top, followed by re-use, then recycle/composting, then energy recovery, and, in the end, treatment and disposal.

According to a nationwide 2016 study, nearly 73% of Canada's 34M tons of municipal waste is disposed of in landfills or incineration facilities. In the US, 50% of that country's 292.4M tons of waste is sent to landfills annually, while 11.8% is combusted with energy recovery. The non-degradable waste accounted for ~36% of the total nation waste in Canada in 2016 – primarily consisting of plastics, rubber, and building materials. The Canadian Government has laid out a detailed plan to achieve zero-plastic waste status by 2030. To support plastic waste reduction, prevent plastic pollution, and support the transition to a national circular plastics economy, in 2021, the Government announced $1.3M to support five projects, followed by investing $4.2M in 2020 to study plastic pollutants.

The five projects listed in the most recent announcement includes:

- **Bluenose Coastal Action Foundation** to receive $0.1M to study the link between single-use plastic pollution and microplastic accumulation, as well as provide strategies for preventing plastic pollution in Atlantic Canada
- **Canadian Coalition for Green Healthcare** to receive $0.25M to recycle personal protective equipment from hospitals and medical single-use plastic waste to keep them out of the environment
- **Conference Board of Canada** to receive $0.39M to conduct research and develop a convening platform to inform Canada's transition to a circular plastics economy
- **Ontario Ministry of the Environment, Conservation, and Parks Ontario** to receive $0.25M to improve the management of compostable products and support the development of new standards for bioplastics
- **Scout Environmental** to receive $0.3M to develop a network that to be used to facilitate industry collaboration to reduce plastic waste

Only 9% of Canadian plastic is estimated to be recycled, and 91% goes to landfills, waste-to-energy facilities, or the environment. The low recycling rates can be due to multiple reasons, including lack of sorting and recycling infrastructure, lack of demand for lower grade recycled plastic, and low virgin plastic prices. This presents a vast scope for innovation in sorting, recycling, upscaling, and 'plastics to energy' converters to support a circular economy and to reach zero plastic waste by 2030 target set by the Government.

Waste Treatment and Conversion Technologies: The waste treatment technologies are broadly classified as thermal and non-thermal.

Thermal waste treatment technologies include incineration, pyrolysis, plasma, torrefaction, liquefaction, and gasification technologies. Incineration is simply burning the waste in the presence of oxygen to convert waste into ashes, water, and other gases that are either released

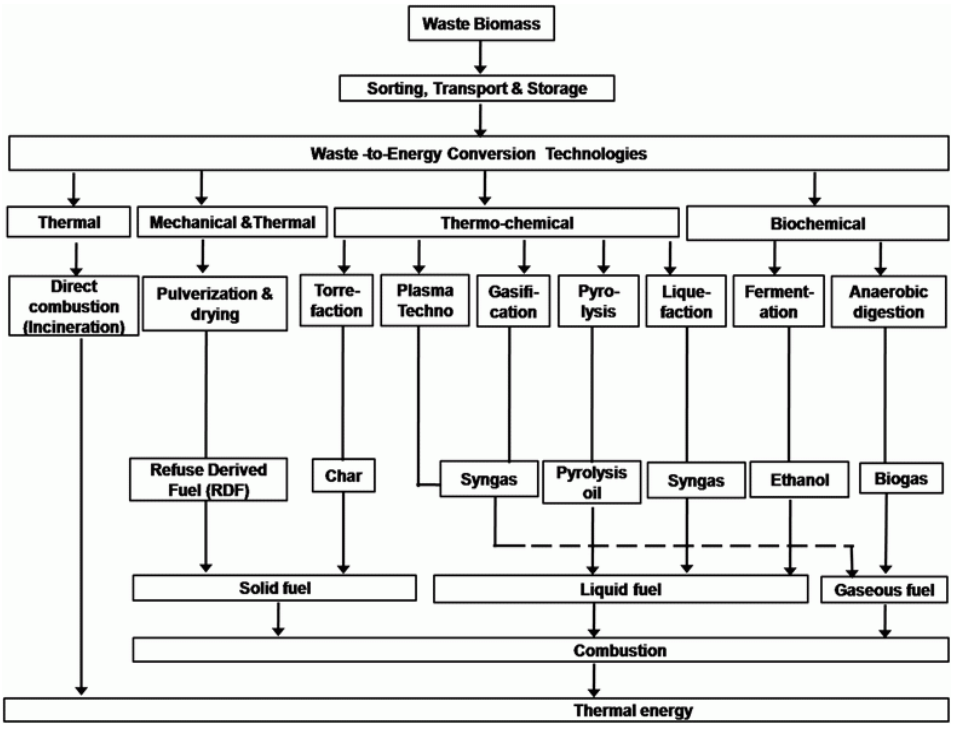
in the environment or are treated to be safe before they enter the atmosphere. Incineration is an alternative to landfills with the advantage of reducing the volume of the waste by ~20x. Landfilling, on the other hand, is cheap and requires very little capital investment. There are around 26 publicly owned incinerators in Canada as of 2018, mostly in Alberta (14), 716 engineered landfills, and 736 dumpsites.

Pyrolysis, plasma, torrefaction, liquefaction, and gasification processes can be grouped as thermo-chemical waste-to-energy (WtE). **Pyrolysis is the most common WtE technology that burns the waste into energy or other valuable materials/metals, in the absence of oxygen, to decompose the waste to its elemental composition and then combining again in the presence of catalysts to get desired products.** Pyrolysis can treat any biomass, rubber, or plastic waste.

Non-thermal waste treatment includes biochemical processes to decompose biomass (e.g., paper, wood, yard waste, etc.) using anaerobic digestion, fermentation, or composting to recover biogas and valuable chemicals like ethanol, biodiesel, etc. There were 61 anaerobic digestion facilities and 576 composting facilities in 2018 across Canada. The non-biochemical non-thermal process includes mechanical sorting facilities to recover recyclable materials (895 sorting facilities as of 2018).

Companies that we are watching include Red Deer, AB-based Cielo Waste Solutions, Sarnia, ON- based Aduro Clean Technologies, Montreal, QC-based Ecolomondo Corporation, Whitby, ON-based Environmental Waste International and Burnaby, BC-based Greenlane Renewables among others.

Exhibit 10: Waste Treatment Methods



Source: PreScouter

3. CANADIAN 'CLIMATE CHANGE' INVESTMENT ECOSYSTEM

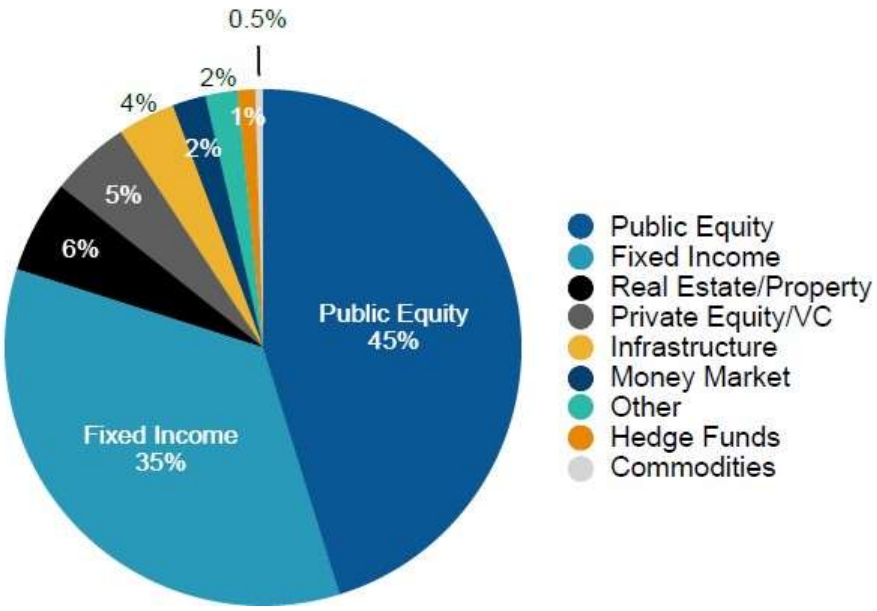
The investment in the cleantech ecosystem would ascertain the constant development and growth in the industry to support Canada's 2050 net-zero emission targets. The Canadian Government would need to invest $128B[18] in the next ten years to achieve the 2030 carbon emission reduction targets. The Government has continued to invest in the sustainability project at federal and local levels, creating a healthy investment ecosystem for institutional and retail investors. At the federal level, the 2021 budget included the Government's commitment to invest $17.6B in cleantech, up from $15B spent in 2020. There are a number of initiatives to support climate-change initiatives at the provincial level. For example, British Columbia's Innovate Clean Energy Fund, Ignite Program, and Fast Pilot Program; Alberta's Alberta Innovates Vouchers, Carbon Capture Utilization Program; and Ontario's Voucher for Innovation and Productivity, to name a few.

Private financing in the sector has gained a lot of traction, starting from seed to development to commercialization to growth stages, both in the form of equity and debt investing. We also see more cleantech companies going public or raising money for expansion. Total capital raised by the 'CleanTech and Renewable Energy' companies listed on the Canadian TSX or TSXV exchanges in the first eight months of 2021 was at $3.3B versus only $2.0B in the same time period last year, +65% y/y.

We strongly believe that the growing interest in the ESG investments also supports the overall cleantech ecosystem, more specifically the 'E' of the ESG and is worth mentioning as the investor preference would ascertain that the cleantech technologies are getting adopted at the commercial and industrial level by the large-mid-small tier corporates. Canadian Responsible Investing (RI) Assets[19], ESG being one of the top investment strategies within RI, rose from just $459B in 2016 to $3.2T in 2019, nearly +700% in four years, forming ~62% of the total Canadian AUM in 2019 (~40% in 2016). Equity and fixed income continue to be significant contributors with 45% and 35% of the AUM, respectively.

18 https://smith.queensu.ca/insight/content/the-price-tag-for-clean-growth-in-canada.php
19 https://www.riacanada.ca/research/2020-canadian-ri-trends-report/

Exhibit 11: Asset Allocation – Responsible Investing Assets Management, 2019



Source: 2020 Canadian Responsible Investment Trends Report

3.1 CANADIAN EQUITY MARKET

Cleantech Equity Funding

As of August 31, 2021, 91 'CleanTech & Renewable Energy'[20] issuers were listed on the TSXV (51) and TSX (40), representing a total market cap of $88.2B ($3.7B on TSXV and $84.5B on TSX). In the first eight months of 2021, 21 new public listings occurred (nine on TSXV and 12 on TSX) compared to two in the first eight months of 2020 and only five for the full year 2020. Total capital raised by the end of August this year is at $3.3B ($401M on TSXV and $2.9B on TSX) compared to $2.0B ($107M on TSXV and $1.9B on TSX) in the first eight months of 2020 and $3.1B ($467M on TSXV and $2.6B on TSX) for the full-year 2020. The exhibit below shows issuances by IPO, PO (public offerings), and PP (private placement) deals as of August 2021.

Canadian cleantech is well-positioned to have considerable long-term growth potential as the country competes with other nations to reach its net-zero targets in the stipulated time frame.

20 https://www.tsx.com/resource/en/2663/mi-g-report-may-2021-en.pdf

Exhibit 12: Financing on TSX and TSXV as of August 2021, August 2020, and Full-year 2020

What's Financed on TSX and TSX Venture Exchange by Sector (YTD August 2021)

	TSX Venture Exchange (C$ Millions)				Toronto Stock Exchange (C$ Millions)				TSXV and TSX (C$ Millions)			
Sector	IPO	PO	PP	Total	IPO	PO*	PP	Total	IPO	PO	PP	Total
Clean Technology & Renewable Energy	21.8	180.8	198.4	**401.0**	525.1	2,175.6	200.1	**2,900.8**	546.9	2,356.3	398.6	**3,301.9**
Closed-End Funds					975.9	977.9	-	**1,953.8**	975.9	977.9	-	**1,953.8**
Comm. & Media	-	11.5	-	**11.5**	170.1	1,300.5	14.71	**1,485.3**	170.1	1,312.0	14.7	**1,496.8**
Consumer Products & Services	-	94.7	162.6	**257.2**	546.3	172.2	854.0	**1,572.5**	546.3	266.9	1,016.5	**1,829.7**
CPC/SPAC	43.9	-	2.6	**46.5**	126.9	-	-	**126.9**	170.7	-	2.6	**173.3**
ETFs					295.8	250.0	-	**545.8**	295.8	250.0	-	**545.8**
Financial Services	-	187.6	90.7	**278.3**	100.0	3,224.1	68.9	**3,392.9**	100.0	3,411.7	159.5	**3,671.2**
Industrial Products & Services	-	78.0	39.4	**117.4**	110.0	711.6	532.9	**1,354.5**	110.0	789.6	572.4	**1,471.9**
Life Sciences	37.1	381.5	254.1	**672.7**	1,446.4	865.4	290.2	**2,602.0**	1,483.4	1,246.9	544.3	**3,274.6**
Mining	46.0	987.6	3,153.7	**4,187.2**	301.4	1,996.4	825.2	**3,123.0**	347.4	2,984.0	3,978.9	**7,310.3**
Oil & Gas	-	292.5	193.8	**486.3**	-	424.7	3.0	**427.7**	-	717.2	196.8	**914.0**
Real Estate	32.4	120.7	155.3	**308.3**	-	2,348.2	627.0	**2,975.2**	32.4	2,468.8	782.3	**3,283.5**
Technology	-	516.4	786.8	**1,303.2**	2,865.1	5,889.2	806.5	**9,560.7**	2,865.1	6,405.6	1,593.3	**10,863.9**
Utilities & Pipelines	-	-	-	-	-	287.6	-	**287.6**	-	287.6	-	**287.6**
TOTAL	181.2	2,851.1	5,037.4	**8,069.7**	7,462.8	20,623.4	4,222.5	**32,308.7**	7,644.0	23,474.5	9,259.8	**40,378.3**

What's Financed on TSX and TSX Venture Exchange by Sector (YTD August 2020)

	TSX Venture Exchange (C$ Millions)				Toronto Stock Exchange (C$ Millions)				TSXV and TSX (C$ Millions)			
Sector	IPO	PO	PP	Total	IPO	PO*	PP	Total	IPO	PO	PP	Total
Clean Technology & Renewable Energy	-	48.6	58.5	**107.1**	-	1,206.9	703.0	**1,910.0**	-	1,255.6	761.5	**2,017.1**
Closed-End Funds					222.2	334.8	11.9	**568.9**	222.2	334.8	11.9	**568.9**
Comm. & Media	-	-	2.2	**2.2**	-	1,811.3	-	**1,811.3**	-	1,811.3	2.2	**1,813.4**
Consumer Products & Services	-	-	26.5	**26.5**	-	1,243.3	38.4	**1,281.7**	-	1,243.3	64.9	**1,308.2**
CPC/SPAC	8.1	-	5.7	**13.8**	267.1	-	-	**267.1**	275.1	-	5.7	**280.9**
ETFs					1,433.6	6.7	-	**1,440.3**	1,433.6	6.7	-	**1,440.3**
Financial Services	-	-	44.6	**44.6**	-	210.4	8.3	**218.7**	-	210.4	52.9	**263.3**
Industrial Products & Services	-	5.8	44.7	**50.5**	1,908.4	1,654.6	1,099.1	**4,662.1**	1,908.4	1,660.4	1,143.9	**4,712.6**
Life Sciences	-	210.4	118.1	**328.5**	-	852.0	217.8	**1,069.8**	-	1,062.4	335.9	**1,398.4**
Mining	36.4	333.9	2,142.4	**2,512.7**	-	1,009.4	1,121.7	**2,131.1**	36.4	1,343.3	3,264.1	**4,643.8**
Oil & Gas	-	23.7	180.4	**204.1**	-	-	75.7	**75.7**	-	23.7	256.1	**279.8**
Real Estate	51.3	202.6	23.5	**277.3**	-	1,360.4	274.9	**1,635.3**	51.3	1,563.0	298.4	**1,912.6**
Technology	-	180.5	101.0	**281.5**	172.5	2,454.5	21.2	**2,648.1**	172.5	2,635.0	122.2	**2,929.7**
Utilities & Pipelines	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	95.7	1,005.4	2,747.6	**3,848.8**	4,003.8	12,144.3	3,572.1	**19,720.1**	4,099.5	13,149.7	6,319.6	**23,568.9**

What's Financed on TSX and TSX Venture Exchange by Sector (YTD December 2020)

	TSX Venture Exchange (C$ Millions)				Toronto Stock Exchange (C$ Millions)				TSXV and TSX (C$ Millions)			
Sector	IPO	PO	PP	Total	IPO	PO*	PP	Total	IPO	PO	PP	Total
Clean Technology & Renewable Energy	-	309.3	157.7	**467.0**	-	1,855.7	768.7	**2,624.5**	-	2,165.0	926.4	**3,091.5**
Closed-End Funds					523.2	749.9	11.9	**1,285.0**	523.2	749.9	11.9	**1,285.0**
Comm. & Media	-	-	2.2	**2.2**	-	1,811.3	-	**1,811.3**	-	1,811.3	2.2	**1,813.4**
Consumer Products & Services	-	-	67.9	**67.9**	-	2,404.0	132.1	**2,536.0**	-	2,404.0	200.0	**2,603.9**
CPC/SPAC	14.1	-	6.0	**20.1**	267.1	-	-	**267.1**	281.2	-	6.0	**287.2**
ETFs					1,925.3	13.2	-	**1,938.5**	1,925.3	13.2	-	**1,938.5**
Financial Services	-	19.0	51.3	**70.3**	-	357.3	4,522.1	**4,879.4**	-	376.3	4,573.4	**4,949.7**
Industrial Products & Services	-	5.8	55.6	**61.4**	1,908.4	1,677.8	1,139.1	**4,725.3**	1,908.4	1,683.5	1,194.8	**4,786.7**
Life Sciences	-	293.0	206.4	**499.5**	74.8	1,277.2	271.0	**1,623.0**	74.8	1,570.3	477.5	**2,122.5**
Mining	81.0	543.3	3,484.7	**4,109.0**	200.2	1,810.5	1,381.6	**3,392.3**	281.2	2,353.8	4,866.3	**7,501.3**
Oil & Gas	-	23.7	230.4	**254.1**	230.5	47.3	179.7	**457.5**	230.5	71.0	410.1	**711.6**
Real Estate	57.9	219.8	32.4	**310.2**	143.1	2,004.5	1,124.0	**3,271.7**	201.0	2,224.4	1,156.5	**3,581.8**
Technology	60.0	465.6	256.5	**782.2**	1,487.3	5,359.6	454.9	**7,301.9**	1,547.3	5,825.3	711.5	**8,084.1**
Utilities & Pipelines	-	-	-	-	-	62.9	3.7	**66.5**	-	62.9	3.7	**66.5**
TOTAL	213.0	1,879.6	4,551.2	**6,643.8**	6,759.9	19,431.1	9,988.9	**36,179.9**	6,972.9	21,310.7	14,540.1	**42,823.7**

Source: TSX

3.2 CANADIAN ESG BOND MARKET

According to Bloomberg reports, Canadian ESG-related bonds[21] are estimated to reach $20B in 2021, as part of global issuance estimated to be more than US$1T. So far in 2021, there have been five $500M+ corporate ESG deals compared to only one in 2020, according to National Bank[22], as companies refinance conventional loans into ESG loans to benefit from demand and low-interest rates. Typically, there are three types of ESG loans:

- **Green Bonds**: Addresses environmental and climate-change issues, including carbon emissions and renewable energy
- **Social Bonds:** Addresses social disparities, such as childcare or gender inequality
- **Sustainability-linked Bonds:** Allow issuers to use the funds for their general funding plans, including transitioning operations to clean technologies, paying off existing debt and funding capital projects.

In the case of sustainability-linked loans, a type of ESG loan, the interest rates are linked to the emission control target set by the issuer, i.e. interest rates are low if GHG reduction targets are met and much higher if the target is not met. The interest rate discount is also known as 'greenium' as investors are buying at a premium to pay for the greener environment. Telus Corp. was the first Canadian company to issue sustainability-linked bonds, raising $750M.

3.3 ESG REPORTING — DATA STANDARDIZATION AND TRANSPARENCY

Clearer standards help showcase accountability and support investment. Global Reporting Initiative (GRI) and Sustainability Accounting Standards Board (SASB) are two prominent independent bodies responsible for laying out sustainable investing reporting guidelines for ESG reporting and both internal and external stakeholder communication. Each plays a complementary but different role: GRI standards support broad disclosures for a comprehensive understanding of an organization's impacts on the economy, environment, and society, while companies adopt SASB accounting standards for reporting ESG data in their annual reports, other fillings, and sustainability reports. SASB standards also offer an industry-focused perspective on a subset of financially material issues.

21 ESG-focused debt products cover three general themes: green bonds address environmental and climate-change issues, including carbon emissions and renewable energy; social bonds target social disparities, such as childcare or gender inequality; and sustainability-linked bonds allow issuers to use the funds for their general funding plans, including transitioning operations to clean technologies, paying off existing debt and funding capital projects.

22 https://financialpost.com/fp-finance/the-esg-focus-has-exploded-sustainability-linked-bonds-bringing-new-issuers-to-the-table

Other standard-setting organizations include CDP (Carbon Disclosure Project), CDSB (Climate Disclosure Standards Board), and IIRC (International Integrated Reporting Council). All five organizations have announced[23] a shared vision to come together and standardize the ESG reporting stands across the border to facilitate global investments.

CONCLUSION

The growing interest in cleantech has been accelerated by many forces -- from national and international environmental policies and corporate ESG efforts to circular economy movements and the rise of responsible investing. Still, cleantech sits at a crossroad -- while quickly becoming more mainstream and generally accepted, the vast majority of these companies continue to wrestle with early-stage business challenges, facing high expectations with so much more still to prove. At the end of the day, most investors are looking for value creation and solid returns on their investment. But while many small cap cleantech companies are rightfully considered high-risk, breakthrough technological advancements are becoming the new normal, offering significant returns to their investors.

23 https://www.cdp.net/en/articles/media/comprehensive-corporate-reporting

VOLT STRATEGIC RESEARCH

Head Office: Burrard Building, 1030 W Georgia St #1010,
Vancouver, BC V6E 2Y3

info@voltstrategic.ca