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INTERIM REPORT OF THE EXPERT PANEL

ON SUSTAINABLE FINANCE

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Environment and Climate Change Canada
Public Inquiries Centre
12th Floor, Fontaine Building
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Email: ec.enviroinfo.ec@canada.ca

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INTERIM REPORT

Of The Expert Panel on Sustainable Finance

INTRODUCTION

This spring, Canada's Ministers of Environment and Climate Change (ECCC), and Finance appointed the Expert Panel on Sustainable Finance to engage a wide range of stakeholders on opportunities and challenges relating to sustainable finance and climate-related risk disclosures, and to recommend next steps for the Government of Canada to consider in promoting low carbon, clean economic growth in Canada.

Since its induction, the Panel has engaged hundreds of contributors across financial and business networks, governments, financial regulators, professional services, think tanks, and academia. Throughout these early consultations, the Panel witnessed remarkable institutional commitment to progress; important pockets of growth in sustainable finance; and widespread confidence in Canada's opportunity to prosper in the global movement toward clean, climate-resilient economic growth. Yet, overall, Canada's sustainable finance market is not growing in a manner that reflects the dialogue. This warranted inquiry into what wider dynamics might be delaying mainstream market engagement or hindering the pursuit of sustainable finance objectives. Through further exploration and consultation, a clear set of crosscutting themes have emerged.

Given the scope and complexity of these themes, the Panel's original mandate to deliver its recommendations in the fall of 2018 has been extended to enable deeper and more targeted consultations. Intended as a discussion paper, this Interim Report provides a snapshot of what the Panel has heard and observed in early consultations thus far. Drawing from these insights, it presents a set of elements that appear to be foundational in unlocking mainstream engagement in sustainable finance in Canada. Building on those elements, it also explores a range of financial market structures, activities, and products with the potential to offer transformative and economic benefits to Canada as it builds building a Paris-aligned future.

Each discussion area poses a series of questions that the Panel hopes to explore in targeted consultations and roundtables throughout the fall, with the intention to deliver a final report of findings and recommendations to the Government of Canada in spring 2019.

While the Panel has a federal mandate, priming Canada for climate resiliency and prosperity in a low carbon economy is a shared national priority. Establishing the investment and financing structures required to deliver on Canada's objectives is similarly a shared focus at the national, regional, provincial, and local levels. The necessary scope of action in every regard will require integrated, multi-jurisdictional, multi-sector collaboration.

Although some of the opportunities and ideas expressed herein point to potential measures or roles, this report does not presume any specific outcomes or actors. The stated observations reflect the opinions of a diverse array of stakeholders within the financial sector and beyond.

The Panel would like to thank those who have contributed thus far for the extraordinary level of engagement and insight, and encourages ongoing outreach from Canada's extensive business and financial ecosystems.

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1. SETTING THE CONTEXT

Defining Sustainable Finance

The relationship between the economy and the environment is at a critical inflection point. In 2015, 197 nations and territories from around the world agreed to actions to limit global warming to no more than 2°C (the Paris Agreement). If these commitments are to be fulfilled, climate resiliency and clean growth will become one of the defining economic opportunities of the 21st century.

This is a new horizon for even the world's most progressive economies and will require a sea change in the interaction between rapid technological innovation, international policy, consumption patterns, and investment behaviours. For every one of these aspects, the global financial system plays a critical role in directing necessary capital flows, managing complex risks, and unlocking economic potential.

While there is yet no universal definition of ***Sustainable Finance****, for the purposes of discussion, the Panel views it as capital flows (as reflected in lending and investment), risk management activities (such as insurance and risk assessment), and financial processes (including disclosures, valuation, and oversight) that assimilate environmental and social factors as a means of promoting sustainable economic growth and the long-term stability of the financial system.*

In particular, the Panel's focus is engaging mainstream financial markets in activities that align with climate risk mitigation and adaptation as well as the transition to a prosperous low-carbon economy. This includes the assessment of measures to promote enhanced climate-related financial disclosures as a critical building block.

Discussions around mitigative climate action tend to focus on solutions for reducing future emissions. Yet, we are paying today for irreversible climate disruption that has already occurred. Under even the most optimistic scenarios, increasingly severe and variable weather conditions will continue to yield significant climate impacts and ecological challenges. Sustainable finance is as much about strengthening adaptation and resilience to those unavoidable impacts as it is about preventing further exacerbation. These impacts will be broad based: research by the Sustainability Accounting Standards Board (SASB) indicates that 72 out of 79 industry subsectors will be materially and systemically impacted by climate change.[i]

Examples of sustainable finance in practice could include:

- A rental car company issuing a green bond to finance a fleet of hybrid vehicles.
- A public/private financing arrangement for carbon capture and storage technology or smart grid capabilities.
- A homeowner or building owner taking out a loan for an energy efficiency build or renovation, or resiliency improvements.
- An investment fund aggregating and packaging such consumer loans for resale through structured securities.
- A public issuer or financial institution committing to enhanced climate-related financial disclosures.
- A venture capital firm investing in an early stage cleantech company.
- An oil and gas company issuing equity or debt to invest in measures to reduce energy consumption or methane emission in extraction, production or distribution.
- A bank taking broad ESG risks into account in their lending decisions, or investing in geospatial climate analysis to price mortgage risk.
- An insurance company offering preferred rates for flood resiliency measures.

The Global Setting

The proliferation of activity around the Paris Agreement shows a concerted focus by major nations to translate climate goals into transformative economic policies and practices.

Leaders across jurisdictions are working with financial industries and businesses to accelerate sustainable finance in an aggressive bid to stake out competitive standing in budding green and low carbon markets.

A number of countries have established similar sustainable finance initiatives to Canada's, including China, the EU, the UK, Italy, France, Australia, New Zealand, the Netherlands, Norway, Singapore, and Sweden (See Annex I for further detail on international activity). Many are at the point of implementing their strategic and policy roadmaps. China, for instance, has incorporated the majority of its task force's recommendations into the country's latest five-year plan, including ambitious goals in areas such as solar, electric vehicles, and electricity transmission. Similarly, the UK is outspoken in its intention for London to be the leading global centre for sustainable finance.

Over 450 companies across all major sectors have committed to setting specific emissions reduction targets in line with the Paris Agreement under the *Science Based Targets* (SBT) Initiative. More than 120 targets have already been established by major corporations such as Walmart and L'Oréal, and nearly 900 additional companies have indicated ambitions to set science-based targets in the next two years.[ii]

As these shifts progress, many economic and commercial patterns will likely be reshaped. While some economies will move faster than others, in today's interdependent world, no single nation can remain meaningfully out of step with progress. How we position our country within that context will in many ways determine our longer-term economic and employment trajectory. Canada has the ingredients and capacity to act with other global leaders as a "shaper" rather than a "taker" of decisions that will define the global context within which the Canadian economy operates.

Among other economies with strong natural resource endowments, Canada is navigating what sustainable growth means for its core, emissions-intensive sectors such as oil and gas, transportation, mineral extraction, building and materials, and agriculture.

These sectors contribute significantly to Canada's real economy, and we have many jobs and livelihoods that depend on their future prosperity. We also have banks that lend to them, institutional investors that invest in them, insurers that backstop them against risks, and a wide spectrum of services and global consumers that rely on their outputs.

Canada's incumbent industries have the potential to play a vital role in the transition to low carbon growth. Despite a sometimes polarized dialogue about what that role might be, stakeholders the Panel spoke to were not focused on how to prepare for the future exclusion of these carbon intensive sectors – but rather how their relative strengths could be leveraged to competitively and sustainably serve the market needs of the future. In fact, it was consistently articulated to the Panel that, with the right investment and focus, Canada has the innovative capacity to become one of the cleanest and most efficient energy producers in the world.

Canada Already has its Transition Blueprint

As part of the Paris Agreement, Canada has committed to reducing its GHG emissions to 30% below 2005 levels by 2030.[iii] Canada's Mid-Century Strategy, which examines long-term emissions pathways for Canada that are consistent with the Paris Agreement's 1.5-2°C temperature goal, models net emissions of 80% below 2005 levels by 2050.[iv]

To realize Canada's 2030 Paris commitment, federal, provincial, and territorial governments have announced a number of bold climate policy initiatives. The *Pan-Canadian Framework on Clean Growth and Climate Change* (PCF) is a joint federal, provincial, and territorial plan for achieving Canada's 2030 targets by reducing the country's

carbon footprint; adapting to and building resilience against the changing climate; and fostering new jobs and export opportunities through clean growth innovation and transition (see Annex II for a summary of the PCF). The plan is similar to parallel efforts worldwide.

As Annex III illustrates, all of the measures in the PCF will be needed to meet Canada's Paris pledge, as Canada is one of the most carbon-intensive economies in the OECD. The oil and gas sector is the country's largest emitter, accounting for 26% of GHG emissions, followed closely by transportation, at 25%. Buildings, electricity, heavy industry, and agriculture each account for a further 10-11% of domestic emissions.[v] Canada's 2030 target will require a substantial reduction in the carbon intensity of these high-emitting sectors; the pursuit of which will entail broad measures by governments, consumers and businesses.

With 2030 only a little more than a decade away, the Panel heard an active call for accelerated and enhanced strategic dialogue between industry, finance, government, the innovation community, and subject matter experts on how to propel action from here. Measures taken over the next few years will be critical to the achievement of our targets. The sooner we define key starting points and convene relevant players in strategic collaboration, the likelier we are to stake out a sustainable, gainful pathway and avoid unnecessary dislocation.

The anticipated investment trajectory will require mainstream financial market engagement.

Globally, it is estimated that the Paris Agreement will require over $100 trillion in global investment over the next decade.[vi] The total necessary investment for Canada in that time could be more than $2 trillion.[1] This scale of spending will require the engagement of mainstream financial markets.

Canada has one of the healthiest financial systems in the world with a well-earned reputation for good governance, risk management, and sound regulation. This system has a critical role to play in delivering the financing ingenuity and capital flows required to execute Canada's transition objectives. And the business imperative for doing so is becoming increasingly apparent. Corporate Knights estimates that, by 2025, the annual revenue attributable to the sustainable finance opportunity for Canada's financial sector could be between $27 billion and $110 billion.[vii]

> The *International Network of Financial Centres for Sustainability* (FC4S) was launched in September 2017 with a vision of facilitating "…rapid global growth of green and sustainable finance across the world's financial centres, supported by strengthened international connectivity and a framework for common approaches". Toronto recently joined this initiative, alongside London, Paris, Shanghai, Casablanca, Dublin and others.

Canada's banks are large, diverse institutions that encompass many facets of the financial industry. These institutions have an opportunity to approach sustainable finance as a strategic opportunity (not dissimilar to other transformative areas such as big data and artificial intelligence) and fulfill a proactive role as enablers of a vital economic transition that is necessary for Canada's long-term competitiveness.

Similarly, Canada's large public pension funds are global leaders in long-term investment and have an influential voice across virtually every industry. These institutions have the opportunity to help drive economic transformation in Canada by further integrating ESG issues into their investment practices and their dialogue with companies.

These themes echo across insurance, asset management and many other corners of Canada's financial system.

[1] Proxy value based on prorating $100 trillion required globally to Canada's GDP share in the world (2.1%), Canada's emissions share in the world (1.6%), and Canada's share of energy use in the world (2.2%).

While Canada is well positioned to play a leading role in sustainable finance, it will require more systematic uptake by top-level leaders across sectors and an overall financial system that considers sustainable growth a normal aspect of everyday decisions and business practices. Once that happens, longer-term impacts come into focus; the availability and reliability of information (including disclosures) matures and becomes more decision-useful; and markets increasingly reflect the cost of externalities - all of which means a more sustainable allocation of capital.

Still, the overwhelming message to the Panel was that the financial system will continue to tread lightly without certain foundational elements soundly in place. These themes underlie many of the observations and questions throughout this report.

2. SUSTAINABLE FINANCE IN CANADA

2.1 Canada's Relative Global Standing in Sustainable Finance

Given its relatively short tenure, it is no surprise that sustainable finance is not historically well measured or defined. While various stakeholders have made good attempts to define parameters for "green" investment, early criteria are narrow and do not necessarily capture the full scale of sustainable activities and exposures in play. As a result, international comparison is challenging.

With that caveat, the broad metrics below give some colour to where Canada stands relative to other jurisdictions with respect to progress on sustainable finance. See Annex IV for a more thorough review of this and other data on Canada's sustainable finance market relative to its peers.

Canada's large financial institutions are generally supportive of the TCFD recommendations for climate-related financial disclosures.[viii] Canada ranks third internationally (behind the UK, and the US) in terms of organizations that have officially announced their support for the TCFD. These include Canada's five largest banks and six of its eight largest pension funds.[ix] Most remain at a very early stage in their implementation of the framework (see Section 3.3).

Green bond issuance in Canada increased dramatically in 2017, exceeding the total of all previous years combined, and 2018 has shown continued strength so far. This includes both issuance by governments and crown corporations (particularly Ontario, Quebec, EDC, and CPPIB) and private-sector issuance (e.g. TD and Manulife). The rapid growth in Canada is being mirrored elsewhere, so while issuance has expanded considerably, we still ranked only 10th in the world in terms of cumulative green bond issuance which is slightly below our ranking of 8th in the world for the total size of our debt market.[x]

A variety of other measures indicate that sustainable finance is growing in Canada, but at a pace and scale outstripped by many of our peers. Investments that incorporate ESG principles, for example, are becoming more widespread, led by our large pension funds. This activity rose to 38% of total assets under management in 2016, pulling ahead of the US (at just over 20%) yet well behind Europe (at over 50%).[xi] Clean energy investment relative to GDP in Canada has also broadly kept pace with the US, but both countries generally trail other G7 counterparts.

At roughly 3%, corporate green revenues in Canada are also well behind most other G7 countries.[xii] Canada's broad index exchange-traded funds (ETFs) have a particularly high carbon intensity compared to those of other peer countries, reflecting the importance of resource extraction in our economy. Finally, while difficult to compare across countries, available information on bank lending to environmentally beneficial activities puts Canada's large banks, in aggregate, in the middle of the pack at best.

The net of it suggests that while Canada is making progress, it is not as far along as many of its G7 peers with more cohesive strategies in place.

2.2 Panel Observations on Financial Sector Engagement on Sustainable Finance

To supplement quantitative information, the Panel met with a broad spectrum of market participants. Below is a snapshot of some of the key themes that emerged in early consultations with representatives from the financial sector, including property and casualty (P&C) insurers and reinsurers as well as life and health insurers; pension funds and other institutional investors; major banks; retail asset managers and investors; financial support services; stock exchanges; cleantech funders; information providers, and financial regulators.

While each segment has its idiosyncratic challenges and norms, a few crosscutting issues came forward, including:

- A growing number of financial players are approaching sustainable finance in their own ways, yet efforts remain diffused and there is little organized effort within and across sectors to tackle broader issues. There is a strong suggestion that the lack of momentum may be due to a generally insufficient view of the scale of the market potential and the pace of change required to meet our Paris commitments.
- The PCF is a comprehensive framework, but until the various building blocks are articulated in a more concrete form and there is demonstration of wider implementation, market participants will hesitate to devote concerted energy and resources toward understanding its financial implications and pursuing its opportunities.
- Climate risks are often considered too uncertain or distant to be relevant to lending decisions today, particularly relative to other pressing matters such as cybersecurity, regulatory compliance, and digital transformation.
- Low broad-based education and insufficient tools for understanding climate and sustainability considerations are reinforcing traditional investment and risk management approaches.
- The climate change knowledge and capacity base within the financial services support ecosystem (lawyers, consultants, auditors, information providers, rating agencies, etc.) is underdeveloped. Financial institutions are challenged to find guidance in their efforts to capture climate-related exposures or opportunities, navigate the low-carbon economy (LCE) transition, or prepare disclosures in line with the recommendations of the TCFD.
- Outdated perceptions about the materiality of ESG issues within the scope of fiduciary duty may be hindering responsiveness to risks and opportunities. Sustainable finance is generally not seen or treated as a significant return driver or strategic priority in itself.
- Canada, like its global peers, is seeing increasing institutional and retail investment in low-cost, index-based funds. These products direct flows in a manner that reinforces status quo corporate strategies and market capitalizations; many of which may be inconsistent with a low carbon economy.
- Financial regulators are trying to balance even treatment of risks, the need to opine on ESG-related disclosures, and the reporting burden on issuers. There remains a lack of clarity as to how these bodies are analyzing or contemplating ESG risks, and how they intend to interact with the financial sector in this regard. While there is wide acknowledgement that capital requirements are an integral part of the financial regulatory system and were put in place to manage solvency risk, there is some concern that certain requirements may not reflect the evolving nature of risk.

The cumulative result of these issues is inhibited momentum toward sustainable finance mandates in the financial sector, and reluctant transition to low carbon across non-financial sectors. Despite varying degrees of progress by some leading players (with sizeable resources and global influence), the cross-industry average remains low. For Canada to be an outsized

player in sustainable finance, all segments of the financial system need to begin approaching it more strategically, both individually and as a whole.

A number of companies spoke to the positive impact that their corporate commitment to sustainability has had on talent attraction and retention. Millennials in particular, who will compose 50% of the working population by 2020, place strong value on rewarding work and contribution to a sustainable future.[xiii]

In addition to these overarching observations, industry participants from across the financial system offered a range of comments on the particular challenges and opportunities within their market segments.

Property and Casualty ("P&C") Insurers and reinsurers

- Integration of climate change considerations in business and strategy is relatively advanced at P&C insurers and reinsurers. They have experienced the real and significant financial consequences of climate change in the form of a dramatic rise in weather-related damage claims. Globally, in 2017, disasters triggered by weather and climate-related hazards led to $US 320 billion in losses.[xiv]
- These firms are leading the financial sector in strategic thinking around climate risk and devoting significant time and resources to data collection, proprietary risk analysis, and sophisticated predictive climate modeling capabilities.
- Work within the P&C insurance space generally focuses on climate adaptation and resilience over mitigation or transition to a LCE, given the industry's role in absorbing the impact of escalating claims associated with intensifying and higher frequency weather events.

Institutional Investors

- ESG integration in institutional investment practices is at an early stage and thus holds various forms. A handful of leading pension plans are integrating ESG considerations into decision-making where materiality is evident, but more comprehensive strategic focus is hindered by many of the general barriers outlined above. These leaders describe ESG integration as a journey that requires consistent leadership, education, and reinforcement.

ESG integration refers to an accounting of the financial implications of environmental (E), social (S), and governance (G) aspects and information in the investment research and decision-making processes.

- Otherwise, the majority of investors remain confident that they can adjust their portfolios if or when climate impacts become more tangible and are not meaningfully adjusting their investment strategies today.
- Traditional market-based benchmark indices remain a dominant driver of investment allocation. Most benchmarks today are not constructed with climate or sustainability criteria, nor is there transparency into their climate impact or carbon exposure. As a result, many of the core benchmark indices currently in use are believed to represent 4-5 degree scenarios rather than the Paris-aligned 2 degree scenario.[xv]
- Conventional modeling techniques based on historical data are not well adapted to climate risk. In the absence of tools, information, and knowledgeable advisory resources, investors are challenged to accurately assess all aspects of climate change risk (physical, transitional, regulatory) and prepare for various transition pathways. Smaller investors with limited resources and reliance on external managers are particularly burdened.
- Without globally coordinated policy and strategies for managing climate change or carbon exposure, pension funds and other institutional investors are facing increasing pressure from members and other external stakeholders to divest from carbon-intensive sectors or transition to low carbon indices.

Major Banks

- Canada's leading banks are more directly and comprehensively involved in the real economy

than any other segment of the financial sector. They have the potential to play a crucial role in enabling and catalyzing a broad transition to a LCE, not only from a position of responsibility, but as a means of ensuring their own long-term income streams; the enduring success of their clients; and the growth, stability and international competitiveness of the Canadian economy.

- Despite this influential position, the market, shareholder, and regulatory signals that would engage banks in this role are muted. From a market perspective, the relative short-term tenor of loan books leads to the perception of lower exposure to the long-term impacts of climate change. Client and shareholder engagement on resiliency and climate issues is relatively low. There is limited scrutiny or pressure from financial regulators on these topics, and low knowledge and capacity on the part of auditors and advisors.
- In late 2018, a large consortium of international banks will publish a set *of Sustainable Banking Principles*.[xvi] No Canadian banks are currently members of this initiative, but participation could help support global alignment and give context to the central role of the banking industry in creating a more sustainable future. With that said, all five of Canada's largest banks are members of the *Carbon Pricing Leadership Coalition*; a global network of major corporations that support carbon pricing to bring down emissions and drive investment in sustainable growth.[xvii]
- A more proactive role by banks could extend to advising and assisting clients in their transition plans, building market capacity for sustainable financing products such as green and transition bonds, evolving investment management practices, research, risk management and disclosure practices; as well as collaborating to address financing gaps in areas such as energy efficiency retrofit, sustainable infrastructure development, and cleantech commercialization.

Retail Asset Managers

- Growing empirical evidence of the attractive financial performance from ESG integration as a sustainable investment strategy is slowly increasing demand from retail clients. Specialty/niche funds have cropped up, but by and large, ESG-themed products and services are not prominent among mainstream players. As a result, access to options is limited and overall demand remains low.
- New flows in the retail space remain dominated by low-cost, index-based funds strategies that allocate flows based on current market weightings, and thus reward existing corporate strategies. Some large institutional investors and ETF providers are now engaging with underlying issuers on ESG topics, either on their own, or via collaborative initiatives such as Climate Action 100+.

2.3. The Path Forward

Given the observations articulated in Section 2.2, the Panel sees two interconnected aspects to propelling mainstream capital flows toward sustainable finance. These are *Foundational Elements* and *Financial Markets and Products*.

First, market development will continue to be slow without certain *Foundational Elements* soundly in place. These foundational elements get to the heart of institutional, attitudinal and economic incentives and structures. At a high level, they are:

a) Clarity on climate and carbon policy
b) Reliable information
c) Effective climate-related financial disclosures
d) Clear interpretation of fiduciary and legal duties
e) A knowledgeable support ecosystem
f) Relevant and consistent financial regulation

In addition to these *Foundational Elements*, several markets and financial activities appear to demonstrate particular value and economic potential in transitioning key sectors of the Canadian economy to lower-carbon growth. There is strong correlation between these themes and the actions required to align with the PCF. Some represent existing areas of progress that could benefit from a targeted nudge; others have yet to

develop or achieve the necessary scale. These *Financial Markets and Products* include:

a) Building Retrofits for Energy Efficiency and Climate Adaptation
b) Sustainable Infrastructure
c) Cleantech Innovation
d) Innovation in the Oil & Gas Industry
e) Optimized Electricity Generation and Transmission
f) Sustainable Asset Management and Financial Products
g) Green and Transition-linked Financial Products

Given their scope, these measures will understandably require wide-ranging and multi-faceted change across Canada's economy and a new degree of cross-collaboration.

The ensuing sections share observations and questions related to these *Foundational Elements* and *Financial Products and Markets* motivated by the Panel's engagements thus far. Before issuing a final report, the Panel plans to pursue targeted consultations with relevant practitioners and specialists across industry, government, finance, academia and the innovation community to identify key implementation aspects within each theme, and what parties might be best suited to facilitate those themes. This information will be used to develop practical and executable recommendations for federal consideration.

In addition to these discussions and roundtables, the Panel encourages volunteered insights and responses to the questions posed herein via the following website:

https://www.canada.ca/en/environment-climate-change/services/climate-change/expert-panel-sustainable-finance.html

The Panel appreciates that interpretations of and responses to the questions will reflect individual perspectives. A wide range of views is essential to a complete understanding of the challenges and opportunities. Given the expansive scope of inputs and information, the Panel simply requests that commentators provide any supportive information or literature that they feel brings important context or background to their contributions.

3. FOUNDATIONAL ELEMENTS

3.1 Clarity on Climate and Carbon Policy

In general, the financial sector will react rationally to the price of carbon, and it will also take important cues from government priorities and their connection to regulatory standards and oversight. Because of this, clear and consistent policy signals are critical to providing the certainty that market participants need to size the opportunity and invest in support of Canada's transition objectives. Most of Canada's necessary change measures are capital intensive and will require mainstream investment to augment available public funds.

For long-horizon concepts such as climate change and decarbonization, policy can help promote accurate pricing of risk, which supports informed and effective capital allocation decisions. Typically, estimated future cash flows are captured in the current price of an asset by discounting them at a rate that reflects estimated risk. The more uncertain future cash flows are, the heavier the compensating risk premium must be. For investors, this translates to a higher required rate of return, and for borrowers or lenders, it is a higher interest rate for loans. Climate change and low carbon transition are unfamiliar, mutable concepts today. Without a clearer view of their economic consequences, conservative risk discounting can make it challenging to deploy capital toward sustainability-oriented opportunities.

A clear price on carbon is arguably the most direct measure for persuading markets to make more sustainable choices. A price on carbon lowers the relative cost of projects that reduce emissions, thereby increasing their relative potential for profitability. As a result, carbon pricing and emissions trading schemes are

becoming central tools for policymakers in this respect (See Annex III).

Carbon pricing is now in place or planned in 70 countries or jurisdictions, including the implementation of a pan-Canadian carbon price in 2019. Business support is also growing: Almost 1,400 major companies (including those in the oil and gas industry) and some large development banks have committed to applying a shadow internal carbon price to 'future-proof' their investment decisions.

Nevertheless, carbon pricing alone is not a sufficient policy response and must be part of a broader, complementary package. The policy scope is wide-ranging, from project prioritization to industry sector regulations, expectations and parameters surrounding public/private partnerships, securities oversight, mandates for disclosures and labeling, evaluation of subsidies, government procurement, fiscal policies and otherwise. The more aligned and mutually reinforcing these various aspects are, the more confident markets will become in investing sustainably.

Observations:

- Stakeholders echoed the importance of certainty around climate and carbon policy as a vital prerequisite to unleashing innovation and providing a sufficiently reliable trajectory to put long-term capital to work.
- Canada's federal government has committed to introducing a minimum price on carbon across all jurisdictions in 2019. While many see carbon pricing as a necessary long-term market measure, the feedback to the Panel was that until this policy is implemented, markets will question its certainty.
- Commentators also opined that carbon pricing alone is not a sufficient policy response. The implementation of other measures such as performance standards for electricity generation, emission standards for vehicles, or the implementation of 'net-zero energy ready' building codes would create quantifiable future scenarios and further increase certainty in our transition pathway.
- Most of these standards and codes fall in the purview of provincial or municipal jurisdiction, but given their limited resources, many of these bodies would likely benefit from federal collaboration.
- The federal government also plays a key role in developing the narrative that will help the average Canadian understand the importance and benefits of this long-term journey for the economy as a whole, as well as their role in making sustainable consumer choices along the way.
- The Panel frequently heard that while the PCF provides a comprehensive overlay of the major steps Canada must take to meet its 2030 target, decisive action will require a more concrete view of the execution agenda and what investment it will entail.
- There is a consensus view that a cohesive national investment plan for achieving Canada's 2030 targets would provide markets and institutional investors a predictable view of the long-term pathway and opportunity. This plan should be developed in concert between leaders and economic decision-makers at all government, sectoral, and business levels, with inputs from a diverse array of subject matter experts and stakeholders.

Questions:

- *What information around the execution, investment opportunity, and intended outcomes for each key element of the PCF would be most helpful in providing the necessary clarity and certainty to engage large pools of capital?*
- *What other critical policy gaps, inconsistencies or confusions are hampering the flow of sustainable finance in Canada overall? And specifically concerning sustainable infrastructure, innovation/cleantech investment, and promoting energy efficiency?*
- *Would execution of the federal carbon pricing backstop and complementary regulatory actions to reduce emissions provide the policy*

clarity that private sector players need to make "rational" decisions reflecting the cost of pollution and carbon emissions in market pricing?

3.2 Reliable Information

Access to reliable climate and emissions data and the ability to translate such data into intuitive financial outcomes is central to sustainability-related risk assessment and financial decision-making. While quality scientific climate data exists, there are no centralized public sources of such information, or accessible analytical models for assessing it in the context of investment, lending, and insurance underwriting decisions.

Access to this data would better inform a wide array of activities, including (but by no means limited to): insurance underwriting decisions, lending and investment decisions, community and infrastructure development, policy development, and analytical efforts by financial support services.

The *Canadian Climate Information Portal* launching this fall serves as a positive first step in centralizing useful climate information, but there is an outstanding need for translation of such data into decision-useful financial and business analysis.[xviii] This translation will require cooperative effort between industry, government and the scientific and academic communities.

Observations

- Sophisticated institutions with deep resources, such as P&C insurers and banks, have the means and increasingly the expertise to pursue climate-oriented information and analysis. Yet, they find it difficult and expensive acting on their own. Beyond these large institutions there is little access to consistent, reliable, cost-effective climate or carbon data throughout the financial system.
- It was widely expressed to the Panel that the absence of a simple means of assessing climate impacts in the context of decision-useful financial considerations is impeding the flow of capital into sustainable finance.
- There is overarching private sector support for a centralized source of climate data and financial analysis, whether through expansion of the *Canadian Climate Information Portal* or a separate body (or bodies, depending on the type of data). Many players are willing to actively support development.
- Such an effort would require a better understanding of what data is currently available, what is missing, what information needs to be centralized, who needs it, and in what format.
- Getting this right provides an opportunity for Canada to become a leader in customized, industry-relevant environmental analytics and associated financial decision and scenario analysis. These efforts can play into Canada's big data and AI initiatives and facilitate technological innovation across crucial industries.

Questions:

- *Given the breadth of data needs across industries and roles, what critical areas of data would meet the widest need and should be prioritized? What are the best sources of that information today?*
- *Is there significant benefit to combining climate science with financial and economic information and analytics?*
- *Is there a mutually acceptable means by which proprietary data can be leveraged for public good? If so, what would enable that?*
- *Could existing organizations collaborate or be combined and scaled to manage the collection, organization, and distribution of this information, or do we need to build an entity from the ground up? If collaboration is a possible means, who might the key players be, and with what mandate?*
- *Through what channels should the data be made available so that it is accessible, reliable and user-friendly?*

3.3 Effective Climate-Related Financial Disclosures

In 2016, the Financial Stability Board commissioned an industry-led Task Force on Climate-related Financial Disclosures (TCFD) to develop recommendations for how firms and financial organizations could put forward more consistent and comparable disclosures of climate-related financial risks and opportunities.[xix] The logic underlying this initiative was that a more robust bottom-up view of climate resiliency and systemic risks and opportunities would promote more informed credit, investment, and insurance underwriting decisions.

The voluntary framework published in 2017 was built around four pillars: governance; strategy; risk management; and metrics and targets. It is meant to be flexible, decision-useful and forward-looking, and apply to companies of any size across every industry and type of financial institution.

Adoption of the TCFD framework has become a global effort with strong endorsement from over 500 supporters, including 457 companies and 56 other organizations such as industry associations and governments. The supporting companies represent a broad range of sectors with a combined market capitalization of over $7.9 trillion, and include over 287 financial firms responsible for nearly $100 trillion in assets.[xx] The reach garnered by the TCFD has played a significant role in catalyzing broader awareness and focus on climate-related risk and opportunity.

While it remains early stage, the TCFD implementation journey may serve as a model for scaled financial sector commitment to sustainable finance.

Observations:

- Mainstream financial market implementation of the TCFD framework is subject to many of the same barriers and drivers as parallel efforts in sustainable finance. Overall progress remains nascent and the small subset of sophisticated players making individual and collective efforts say they are learning by doing. Smaller players consider the effort particularly daunting and say they cannot rely on their normal support ecosystem because of its current limited capacity on the topic.
- There are opposing views as to whether the TCFD recommendations should remain voluntary or become mandatory. The TCFD was designed as a voluntary initiative, but some players feel that a pathway to compulsory compliance would be helpful.

  > Economies such as France, China, and the European Commission have already either legislated mandatory disclosures of climate-related financial risks or are issuing stronger policy reforms around disclosure requirements (see Annex I).

- A fair proportion of commentators indicated that stronger signals from both financial regulators and investors on reporting expectations and financial materiality would prompt wider focus by issuers, as well as among supporting services such as auditors, accountants, lawyers, and information providers. This observation was similarly identified in the Canadian Securities Administrators (CSA) review on the state of climate-related disclosures in Canada.[xxi]
- With that said, it was noted that any policy mandate should be designed to encourage enhanced practices and not burden issuers with unnecessary regulations and requirements that could discourage market participation.
- Considerable concern was expressed that mandating disclosure before sufficient expertise or capacity had been established in the marketplace would cause undue burden and deliver flawed information. Some companies expressed further concern that disclosing longer-term and uncertain information could expose them to legal liability.
- It was suggested that, if mandated, a phased approach to full adoption may be most logical, beginning with a requirement for a qualitative discussion of governance, strategy and risk management, followed by requirements around targets, metrics and other risk measures as

relevant information becomes more accessible and analytical capacity is developed. Once those elements are in place, scenario analysis could follow. Recent joint efforts by Chinese and UK authorities appear to reflect a similar approach.

- The task of translating climate science into forward-looking financial scenarios was identified as a particularly challenging element of the TCFD recommendations. Right now, individual assumptions and methodologies differ greatly. There is some concern that without a standardized set of climate scenarios (particularly a common two-degree scenario) the resulting variability in outputs will impede comparability across companies. Notwithstanding the benefits of comparability and a common "language", there was an equally strong view that proprietary models best reflect an institution's view of its vulnerabilities. Both schools of thought can likely be accommodated through a combined approach.
- Many see large institutional investors as important catalysts of change, as they exert wide influence over corporate behaviours. The *Institutional Investor G7 Leadership Initiative* and *United Nations Environment Program Finance Initiative (in conjunction with global banks)* are two examples of global industry efforts to help kick-start the implementation of uniform and comparable climate-related disclosures (see Annex V).
- There is also some debate as to whether TCFD disclosures are best housed in mainstream financial reports or auxiliary reports (such as CSR or sustainability). However, there is a common view that climate-related disclosures should be held to the same standard of rigour and internal review as traditional financial disclosures, regardless of where the disclosures sit.
- Information support is piecemeal and early stage, and the foundation for useful metrics and scenario analysis will take time. In the meantime, the *TCFD knowledge Hub* and initiatives such as the *Sustainability Accounting Standards Board (SASB) Conceptual Framework*; *CCGG Directors' E&S Guidebook;* and *Principles for Responsible Investment* are examples of useful resources cited by commentators.

Questions:

- *What would accelerate adoption of the TCFD disclosure framework? Are there any critical enablers or barriers to adoption that have not been discussed?*
- *Should the Government of Canada become an official supporter of the TCFD?*
- *Is there a need for climate-related disclosures to be included in mainstream financial statements, or is that not necessary so long as other conditions are met (i.e. robust oversight and governance of the reporting process and quality)?*
- *Should larger firms be looked upon to demonstrate leadership to small- and medium-sized enterprises?*
- *Is there a need for further guidance on the relationship between climate-related risks and materiality? How can the understanding of what is material be improved?*
- *Are there mechanisms that would help overcome the hesitation to make appropriate disclosures with uncertain information in good faith, such as some form of regulatory safe harbour?*
- *What is the role of a board - and specifically the audit committee - in overseeing climate-related financial disclosures?*

  Are there any other standards that could be combined with the TCFD to reduce reporting burden?

3.4 Clear Interpretation of Fiduciary Duty

In broad terms, fiduciary duty is a legal concept that imposes a duty of loyalty on a person who has been entrusted to look after the best interests of another.[xxii] In investment terms, fiduciary duties exist to ensure that those who

exercise discretion in managing others' assets employ due care, skill, and prudence in pursuing an overall investment strategy suitable to their clients', beneficiaries' or organizations' trust.

The historical categorization of ESG matters as non-financial has created a legacy perception among some boards, investment committees, and advisors that weighing ESG considerations transgresses fiduciary duty. However, evidence and understanding of the financial materiality of ESG issues is mounting, particularly as it relates to climate change impacts. The World Economic Forum cites climate-related risks as among the world's top five risks in terms of probability and impact.

A growing evidence base suggests that appropriate consideration of material ESG factors can lead to better investment decisions and superior risk-adjusted returns, particularly over a longer-term horizon. As a result, asset owners are increasingly committing to responsible investment practices and some countries are introducing regulations requiring institutional investors to take account of ESG issues in investment decisions. Jurisdictions such as the UK and the EU are considering steps to clarify the requirements of fiduciary duty concerning ESG factors in an effort to improve consideration of these risks and opportunities by key board committees, investment committees, and investment advisors, among others.

This shifting mentality suggests the need for a systemic reconsideration of the materiality of ESG considerations in prudent capital management. The lack of clarity regarding whether or how ESG fits within the remit of fiduciary duty may be hindering responsiveness to material risks and opportunities.

Observations:

- Legal practitioners indicated to the Panel that fiduciaries who fail to consider relevant long-term ESG matters, such as climate-related risks or potential for stranded assets, could expose themselves or their firms to legal liability from claims of negligence in the event that risks materialize.
- There was wide suggestion that this lack of consideration is indeed occurring by virtue of an outdated interpretation of financial fiduciary duty, and that there is a need for broad clarification of why and how ESG factors require due attention by boards and other financial stewards.
- There is a parallel need for clarity on how (practically) that objective could be met. Specific areas of uncertainty include the mechanisms for identifying and managing material ESG risks and opportunities, the board structures or committees to best oversee such factors for a particular institution, and under what circumstances other longer-term risks should be similarly incorporated into fiduciaries' decision-making processes. These are important aspects to clarify, as each are captured as recommended disclosures under the TCFD framework.

Questions:

- *Is there a need to more clearly define the scope of fiduciary duty with respect to the evaluation of climate-related or broader ESG factors in financial decision-making in Canada? What would be the best ways to effect change, and who are the key stakeholders in facilitating this change?*
- *What is the best way to incorporate ESG into rules or regulations that govern Canadian financial institutions?*
- *What are the responsibilities of investment agents and advisers for identifying and acting in accordance with the preferences of clients regarding sustainability issues? What is the most effective manner for these preferences to be identified and communicated?*
- *What is the most effective method for delivering board education on climate risk and ESG/sustainability issues? Does education need to include guidance on effective governance and committee modeling for ESG oversight?*

3.5 A Knowledgeable Financial Support Ecosystem

Canada's financial sector is supported by an ecosystem of professional services. Among these are auditors, accountants, rating agencies, stock exchanges, investment advisors, third-party non-audit assurance providers, lawyers, brokers, and data providers. Generally speaking, Canada's system of professional services is strong and well developed, and many companies and investors depend on these supportive bodies to navigate emerging themes, financial decision-making, and disclosures. These service providers' ability to offer sound investment options and advice relies on a comprehensive understanding of systemic risks and opportunities.

The investment of these players in specialized expertise and capacity is largely demand-driven. Unless demand for a particular area of focus reaches critical mass, or there is a sufficient regulatory imperative, support or service firms will not generally build capacity around it.

Observations:

- There seems to be a circular dynamic wherein companies say the knowledge and aptitude of professional services providers on climate-related financial analysis and disclosure is limited. Service providers, in turn, note that it is difficult to make a business case for further capacity at the current level of demand. Several service providers indicated that even an early sign of the prospective demand would give them more confidence to move forward.
- Some players are beginning to explore and make aspirational statements but, for the most part, efforts remain limited relative to other high demand topics.
- Industry associations play an important role in facilitating awareness and understanding of developing themes within their member bases, but they too are preoccupied with other issues and not seeing the necessary demand signals.
- It was expressed to the Panel that Canada's financial support ecosystem could potentially gain benefit and insight from expanded participation in international initiatives and partnership models. An example was the opportunity for Canada's stock exchanges to join the 76-member global *Sustainable Stock Exchanges Initiative*.

Questions:

- *Given the breadth of climate-related considerations and diverse needs across industries, what professional services are most critical today? What are the crosscutting challenges and opportunities that they should focus on first?*
- *What catalysts might accelerate investment in building the necessary capabilities and capacity?*
- *In self-regulated segments of the financial support ecosystem, can associations effectively deliver necessary education and awareness amongst constituents? If so, should relevant authorities ask that associations develop plans for effecting change among their constituents? Would mandatory training programs on key topics be effective?*
- *How might the various professional bodies (CFA, CPA, SOA, etc.) coordinate efforts to consistently and efficiently mobilize change and align on best practices in ESG education and capacity?*
- *How could the industry do a better job of plugging into international initiatives?*
- *Should ESG aspects be integrated into university curricula to build competency and awareness among future professionals prior to entering the workforce?*

3.6 Relevant and Consistent Financial Regulations

Financial regulators play a critical role in setting the standards by which financial participants operate. In establishing their principles and guidance, financial regulators take note of important issues affecting the financial system in

order to provide cues to institutions on capital, risk, and governance. As the effects of climate change continue to materialize, maturation in understanding and focus will become increasingly important for both Canada's financial industry leaders and the regulatory authorities that oversee the health and stability of the financial system as a whole.

International financial regulators are advancing work on how climate-related risks could affect the financial system. For example, a consortium of central banks and supervisors established the *International Network for Greening the Financial System* in 2017 to advance regulatory understanding of the climate-related opportunities and vulnerabilities for financial institutions. The network endeavours to strengthen the role of the global financial system in managing climate risks and mobilizing capital for green and low-carbon investment.

While Canada's financial regulatory structure is somewhat distributed, authorities such as the Office of the Superintendent of Financial Institutions (OSFI) and the Bank of Canada are well placed to assess the systemic stability of the financial system as it relates to physical and transition climate risks.

Observations:

- Canadian financial authorities are involved in several international forums focusing on sustainable finance issues (including the G20, G7, and FSB), however, a number of commentators expressed a lack of clarity as to how these bodies are analyzing or contemplating ESG risks and how they intend to interact with the financial sector in this regard.
- In particular, several asset owners and asset managers felt that financial regulators could: (i) communicate stronger expectations, and (ii) engage more in the oversight of domestic firms' climate-related strategies, governance processes, and disclosures. It was noted that without such clearer, consistent signals, actions by financial players would likely continue to focus on other areas of priority.
- There was a common suggestion that Canada's financial authorities could benefit from greater cross-jurisdictional collaboration (both domestically and internationally) to promote knowledge sharing, capacity building, and policy alignment on climate-related financial issues. A number of institutions that are subject to multi-jurisdictional oversight suggested that better regulatory alignment could help alleviate undue compliance burden.
- There is general acknowledgement of the progress that has been made across Canada's regulatory landscape. For example, many cited the Ontario Pension Benefits Act requirement for pension plans to disclose whether and how ESG factors are addressed in their Statement of investment Policies and Procedures. Later this year, OSFI will include questions on climate risk oversight to its supervisory process.
- The Bank of Canada plays a key role in assessing systemic economic risk and has the analytic capacity to assess the risk impact of improved climate-related financial disclosures and sustainable investment practices. Participation in international initiatives could facilitate further understanding and analysis.
- Finally, there is wide acknowledgement that capital requirements are an integral part of the financial regulatory system and were put in place to manage solvency risk. Because capital weightings and risk assessments are based on historical experience, there is some concern that certain requirements may not reflect the evolving nature of risk.

Questions:

- *Are climate risks different than other material financial risks? How could climate risk be best integrated into the financial regulatory oversight process?*
- *Is there an appropriate dialogue to be had between financial regulators and interested private sector organizations and relevant bodies?*

- *What expectations, if any, should stock exchanges place on issuers regarding ESG disclosure?*
- *Are there significant anomalies within the current rule set that have not caught up to some of the realities of differentiated asset class exposures to climate impact or carbon intensity?*
- *Are there particular areas where financial regulators should accelerate their work? What are those priorities? What can be reprioritized to enable focus without undue burden?*

4. FINANCIAL MARKETS AND PRODUCTS FOR SUSTAINABLE GROWTH

Assuming that these *Foundational Elements* are in place, Part four of this report discusses several *Financial Products and Markets* that consistently emerged in consultations as having transformative importance and economic potential in building strong, sustainable, low-carbon growth in Canada. Given Canada's relatively high carbon profile, these themes focus on the financial incentives or necessary sustainable financing mechanisms to facilitate transition by Canada's top emitting, high priority sectors.

The identified measures closely align with national and international sustainability objectives. They are also highly interconnected, where actions in one area will in many cases reinforce, support or accelerate complementary progress across other systems or sectors. What resonates across all is the need to secure financing and boost investment and innovation, underpinning the need for a robust sustainable finance market.

4.1 Energy Efficiency and Resiliency Retrofits

Canadian buildings represent 11% of domestic GHG emissions and are more energy-intensive than those of other developed countries, including those with similar climates.[2] It is estimated that today's buildings will represent 75% of the stock in 2030.[xxiii] Therefore, while Canada's low carbon pathway will require higher standards for new builds, retrofitting our existing building sector to reduce energy consumption and manage climate risk is also a critical building block of Canada's transition plan. Gains have been made, but full potential remains unrealized.

Based on commitments made under the PCF, federal, provincial, and territorial governments have committed to jointly-developing a model energy code for existing buildings, which is on track for publication by fiscal year 2022-23. This will follow with *Net Zero Energy Ready* codes for new buildings by 2030.

> *Net Zero Energy Ready*: where the total annual amount of energy used by a building is equal to the amount of energy created onsite, thereby eliminating excess energy consumption and greenhouse gas production.

Building retrofitting is proving to be one of the most cost-effective measures in Canada's clean energy strategy, with benefits to all stakeholders. Done well, these projects offer significantly reduced energy consumption and emissions (and therefore lower costs) while simultaneously enhancing property values and associated tax revenues, improving conditions for occupants, creating employment opportunities and sources of expertise within the real estate sector; all while producing attractive returns for lenders or investors. The Atmospheric Fund (TAF) argues that an integrated, multi-measure retrofit can reduce energy use by 20-30% and generate a double-digit internal rate of return.[xxiv] The estimated scope of investment opportunity across Canada's current

[2] According to the International Energy Agency (IEA), residential buildings in Canada are 10% more energy intensive than buildings in similar climates such as Sweden and Norway.

building stock quoted to the Panel is between $250-300 billion.

Reaching economies of scale in building retrofit will require more concerted action and scaled investment in skills, technology, and financing solutions. Were Canada to successfully develop expertise and a practical, cost-effective, replicable project model, it could become a marketable commodity. Organizations such as *The Atmospheric Fund* and the *UK Carbon Trust* are already demonstrating the economic and operational viability of a commercialized model.

Observations:

- While sector experts highly endorse the business case for building retrofits, consultations suggest some practical barriers to wider action and investment. A resonating theme was the need for increased awareness and distribution of knowledge.
- From a project implementation perspective, the most commonly cited challenges were: (i) a generally inadequate understanding of the cost/benefit trade-off and life cycle of various retrofit options; (ii) an overall perception that projects are too capital intensive and, in some cases, present split incentives;[3] (iii) insufficient information and analytical tools to assess, prioritize, implement and audit upgrade measures; and (iv) difficulty sourcing financing and expertise.
- Over the years, the large owners of Class A buildings have leveraged their access to sophisticated resources and analytical capabilities to pursue opportunistic efficiency upgrades. Many of these buildings have reached high Leadership in Energy and Environmental Design (LEED) certification. Although LEED captures a building's environmental footprint, it does not guarantee a reduction in GHG emissions nor necessarily include considerations of resiliency. However, until there is a more concrete market or policy imperative, these building owners have limited impetus to invest in further efficiency or resiliency measures over other capital priorities.
- Smaller real estate owners (Class B or C) that represent the majority are often less aware of the opportunity or challenged by competing priorities. They also generally lack access to the analytical tools or expertise to assess where to start, how to navigate a project successfully, or what outcomes they can expect. Moreover, most property owners have already pledged the property as collateral for loans, making it difficult to secure additional debt to finance upfront retrofit costs.
- When it comes to residential properties, the Panel was told that energy efficiency or resiliency improvements are typically not front of mind for individual homeowners, and as such, decisions are frequently overruled by aesthetics, cost, and convenience. Furthermore, owing to cash flow considerations, energy efficiency or resiliency investments are typically skewed to higher net worth demographics, relatively disadvantaging those with lesser means.

  While perhaps not generally well known, there are creative financing solutions available, such as municipal-run property assessed clean energy (PACE) financing programs, on-bill financing and energy performance contracts. A number of commentators noted that these measures could be scaled up, or supplemented with other existing structures outside of Canada that are easily adaptable to our market.

- For investors, a one-off retrofit transaction process can be long, complex and relatively costly. Individual opportunities are often too small for large investors to justify and conversely beyond the administrative scope or budget of smaller or relatively inexperienced players.
- As a result of all of the above, economically viable, low-risk retrofit projects are often not prioritized or able to source affordable financing on a standalone basis. In light of this,

[3] Split incentives happen when energy efficiency benefits do not accrue to the party paying them. A common form is in leased buildings, where owners pay for efficiency upgrades but tenants who pay the utility bills benefit from the energy savings.

there was a strong message that project aggregation and securitization will be essential measures for crowding private capital into the retrofit market.

- Commentators suggested that preferential insurance and mortgage rates for retrofitted real estate (such as green mortgages) could serve as an additional incentive, and could potentially be leveraged to create pooled, securitized products for retrofit.
- The call for a national investment plan was particularly prominent when it came to the retrofit market, along with a centralized platform for facilitation and public/private partnership. There was a general view that, with an enhanced sustainability mandate from the federal government, an entity such as the Canada Housing and Mortgage Corporation (CMHC) or the Canadian Infrastructure Bank (CIB) could be well placed to play this role.
- This entity would: (i) promote a pipeline of scalable projects, or strategically bundle smaller projects into vehicles to be matched with suitable investors; (ii) provide a platform for collaboration and knowledge sharing between key stakeholders; (iii) serve as a centre of expertise and a trusted advisory partner on best-practice project selection, structuring and delivery; (iv) collect and distribute centralized industry information; and (iv) pioneer a diverse range of blended finance instruments to attract and mobilize institutional investment in retrofit projects.

  Blended finance is the strategic use of public finance to attract commercial investment into frontier markets by reducing both perceived and real risk through a range of instruments such as aggregation, credit enhancement, and loan guarantees.

- This national body could facilitate these roles either directly, or by assisting in the establishment and seeding of regional lending entities to provide more locally tailored insights and solutions, similar to the New York Green Bank model.

  The NY Green Bank is a state-sponsored entity similar in structure and governance to a national infrastructure bank. While it is a lender in its own right, it is also pursuing mechanisms to create, seed, and support other state and local green banks. Recognizing that conditions vary by region and state, it focuses on best possible consistency in scale, structure, and reporting and facilitates a shared capital network that can be leveraged cross-state for larger projects.

  Similarly, the US Coalition for Green Capital (CGC) is a leading non-profit expert and technical assistance provider on Green Bank modeling and financing. The CGC works with partners, local actors and funders to systematically establish banks in a repeatable fashion, following global best practices.

  Internationally, green banks have facilitated billions of dollars in total clean energy investment and created thousands of jobs. Many commentators suggested that a similar national or regional lending model in Canada could fill a number of investment gaps that exist in the pursuit of Canada's macro clean growth themes.

- Groups such as the *Investor Confidence Project* and *The Atmospheric Fund* have developed scalable models for deep retrofit due diligence, project administration, private investment, and performance measurement. It was suggested that these models could serve as a reference point in the development of a national approach.
- As a commitment under the PCF, Natural Resources Canada (NRCan) is in the process of developing a mandatory energy efficiency labeling and disclosure program for Canadian buildings in collaboration with the provinces and territories, along with a national data platform.[xxv] The Panel heard wide support for this initiative and the benefit it would have in enhancing awareness, supporting more informed decision analysis, and providing the basis for innovation-driven research. Some participants suggested that as a further measure, the disclosure of energy efficiency and physical risk vulnerability could be required for the sale and lease of residential homes.

- There is also support for the government's role in piloting and modeling energy labeling and deep retrofit on the existing public building stock. In addition to federal buildings, this includes the much larger "MUSH" (Municipalities, Universities, Schools, and Hospitals) sector. This demonstration would advance expertise and test market scale for innovative technological solutions (such as smart meters and control systems) while simultaneously providing benchmark standardization of contracts, project approaches, finance structuring, and performance expectations for the private sector and provincial/municipal governments.

Questions:

- *Is there a role for the federal government in motivating the case for retrofits? Would the government taking a lead in demonstrating deep retrofit and net-zero energy ready construction with public buildings help in this regard?*
- *Is there a leading model for retrofit financing? Would establishing a pooled, aggregated, securitized market in retrofit loans be an effective way to help boost activity in Canada?*
- *Should the government consider facilitating such loans through the CMHC and/or CIB either directly, or by assisting in the establishment of specialized regional lenders?*
- *How much reliance should be placed on national or provincial building codes to mandate specific levels of energy performance to spur efficiency improvements?*
- *Will mandating public labeling and disclosure of building energy efficiency facilitate or motivate forward progress?*
- *What conditions need to be present to support the average residential property owner in pursuing energy efficiency or resilience-related retrofits? How can homeowners become more aware of the simple, low-cost measures available?*

4.2 Sustainable Infrastructure

Investment in infrastructure is an essential aspect of clean growth and the transition to a low carbon economy. *Sustainable infrastructure* refers to a wide array of activities from climate resiliency upgrades of urban assets to diversified energy systems, projects to build physical and digital connectivity, watershed management to protect natural infrastructure, and beyond. A solid base of sustainable infrastructure is critical to many of Canada's climate goals.

Canada, like many other parts of the world, has a significant infrastructure gap. The exact magnitude of Canada's infrastructure gap is difficult to assess, but it is estimated to be between $150 billion and $1 trillion. The federal commitment of $180 billion in infrastructure investment over the next ten years is a critical action from the public sector. While this sum vastly increases the historical infrastructure budget, it is likely not enough to close the funding gap and will need to be amplified by innovative methods of alternative financing. Given the scope of necessary investment, bridging the national infrastructure gap through public funds alone would unduly burden Canadian taxpayers.

Recognizing the need for private investment, the Government of Canada has established the Canada Infrastructure Bank (CIB) as a platform for public-private co-investment in new revenue-generating infrastructure projects. The CIB will work with all levels of the government and the financial community to develop and match a pipeline of high potential public projects to suitable investors, and create innovative blended financing instruments to de-risk projects and attract institutional capital. It will also serve as a centre of expertise for governments on infrastructure projects involving private sector investment, and warehouse best-practice advice and information on project planning, financing, and delivery. Where capital availability represents a barrier, the CIB may provide loan guarantees or capital investment to ensure that large, transformational projects are built.

Municipalities are responsible for nearly 60% of Canada's public infrastructure and sub-national jurisdictions carry out 91% of public investment and almost 70% of public spending in Canada.[xxvi] Nearly 98% of public infrastructure assets in Canada are owned by provinces and municipalities.[xxvii] As such, each are key players in Canada's sustainable development strategy.

The CIB's investment mandate is $35 billion over the next decade.[xxviii] While sizeable, when compared to the necessary scope of infrastructure development in that timeframe, it is clear that a significant amount of investment will need to occur beyond the CIB.

Observations:

- Even with the understanding that the CIB is still scaling up, there is lingering uncertainty around its mandate, status, and role in green-related projects such as those that reduce greenhouse gas emissions, deliver clean water systems, and promote renewable power.
- It was important to many commentators that the CIB's intention to apply a sustainability filter to its total investment mandate carry through in practical implementation. Concern was expressed that only a relatively modest portion of the CIB's mandate ($5 billion) is specifically earmarked for "green" infrastructure projects that align with the objectives of the PCF, such as electrification of transportation, smart grid technology, transmissions lines for renewable energy, retrofit of buildings, and clean power storage. Some suggested that alignment with the PCF should be core to the CIB's total investment strategy.
- Recognizing that the CIB is a crown corporation and requires sufficient independence to maintain commercial credibility, some argued that the federal government should set objectives for the CIB to role model progressive transition-oriented strategies and sustainable finance solutions on commercial terms.
- Sector experts highlighted that infrastructure could be considered a distinct asset class with corresponding financing structures, risk considerations, regulatory designations, and capital requirements.

It is worth noting that the G20 recently announced plans to develop the regulatory and market architecture to formally establish infrastructure as an asset class. Sustainability could be a central aspect to this.

- Within the infrastructure asset class, it was noted that designation between early stage project development/construction and post-construction operational assets might result in more efficient market outcomes, as these two stages display very different risk and return characteristics. Such a classification would likely attract different types of private investors and require different risk management strategies.
- As an operational asset, infrastructure can offer low-risk investment characteristics and stable returns. Many noted that, with the appropriate regulatory framework, infrastructure can be a desirable asset for long-term institutional investors such as pension funds. Canada's major public pension funds are among the top infrastructure investors in the world and have had a longstanding appetite for investment in domestic infrastructure. Because private infrastructure investment has not been widely pursued in Canada, these funds are largely invested offshore.

Analysis by Macquarie suggests that for every $1 billion in defined pension funds allocated from corporate bonds to infrastructure debt, a reduction in pension liabilities of $270 million could be achieved.[xxix]

- Similar to the retrofit market, many cited a national investment plan and project pipeline as a vital resource in illustrating the investment opportunity and encouraging project development to serve the addressable market.
- Again, similar to retrofit, the bundling and securitization of smaller projects or assets into investable vehicles for large capital flows was widely indicated as a key measure for attracting private investors. This need could be met

directly by the CIB, or through the establishment of regional lending entities to provide more locally tailored insights and solutions.

- It was expressed that greater shared access to reliable, consistent, timely information and more modern assessment methodologies would both eliminate redundant effort and cost, and enhance risk comfort among investors, lenders, insurance underwriters, and developers. A further imperative was raised for the right groups to come together early in the planning process to ensure aspects such as insurability and financeability.
- Many saw a role for digital technology in supporting analytics on the value delivered by projects. This would enable financial innovation in the ability to connect performance outcomes with financial results, which may appeal to long-term investors.

Questions:

- *How can Canada promote the systematic incorporation of climate resiliency and energy emissions measures in infrastructure development across the country? What role can sustainable finance play in that?*
- *If the CIB or another body facilitated the aggregation and securitization of smaller municipal, territorial, and provincial projects into indirect lending vehicles, would it help attract institutional-scale investment? Are there more effective or attractive measures?*
- *Would the establishment of regional lending bodies help facilitate investment in smaller, more localized sustainable infrastructure development? Could the CIB play a role in establishing and/or seeding such institutions?*
- *Is there a reasonable means to ensure that relevant stakeholders (i.e. insurers and financing sources) are engaged early in project development to validate suitability for market-based financing?*

4.3 Cleantech Innovation

Cleantech is a rapid-growing field of products or services that improve productivity or efficiency, energy consumption, or environmental pollution. Often thought of as a small, emerging sector grounded in renewable energy, cleantech is in fact a broad-based set of digital technologies and innovations with application in every economic industry. We are seeing global advances in a cross-cutting array of proven (or promising) solutions for cleaner, more climate-smart business models across the economy.

Canada's capacity for clean, green innovation will be a critical driver of economic growth.[xxx]The cleantech sector has the potential to be a significant source of quality jobs while improving the environmental performance of Canada's economy and building international export competitiveness. Statistics Canada estimates that more than 274,000 jobs are already attributed to environmental and clean technology activity, contributing $59.3 billion, or 3.1%, to GDP.[xxxi]

Canada is a leader in cleantech R&D but underperforms in funding the commercialization and scaling of new technologies. The cleantech sector accounted for $1.5 billion in business R&D in 2015; however, cleantech producers face barriers to adequate capital, and financing gaps exist at multiple stages of the commercialization process.[xxxii]

Canada ranks third in the world for total venture capital funding available as a share of GDP; however, only 3% of Canadian venture capital was invested in cleantech in 2016.[xxxiii] Furthermore, the majority of this 3% went toward information and communications technology-related cleantech, which has "capital lite" characteristics that align more closely with traditional technology investments and investor preferences.

Bringing innovation to bear will require international, interdisciplinary, and cross-sectoral collaboration. A more strategic intersection between industry, finance, governments, academia, research facilities, and

the innovation community will be critical to creating the financing solutions that will enable Canada to capitalize on its capacity for innovation and bring leading solutions to markets, both domestically and abroad.

Observations:

- The cleantech start-up space tends to comprise small companies, which mainstream investors and lenders say fall outside of their size and risk/return criteria. Angel and venture capital funding exists, but in general there is a dearth of patient growth capital in the space.
- For more capital-intensive or long-term solutions, performance demonstration is critical to securing investment from traditional capital providers. The cost to fund scaled demonstration (for example, a large format prototype) is typically beyond the reach of venture/angel investors, yet remains too small or risky for larger pools of longer-term capital.
- Many pointed to policy and regulatory certainty as likely prerequisites to greater private investment in the cleantech space. Carbon pricing is perhaps the most significant example. As with any tech investment, there is considerable uncertainty about the technology itself. Without a clear carbon price, investors face the added uncertainty that even if the technology works as expected, there may not be a market need for it. Advances to building codes, efficiency standards, and emissions targets would help inform the need and drive demand for cleantech solutions.
- Similarly, many say that access to credible and timely information on climate issues and carbon intensity within key industry sectors is critical to prompting innovation.
- Investors and lenders say that in addition to interpreting policy and regulatory signals, assessing which early-stage technologies will break through the competitive landscape and ultimately scale to deliver the promised environmental or commercial benefits requires expertise that is not always housed internally. Expert opinion can be costly or challenging to source, and without it, performance and payback uncertainty impedes willingness to take on the risk.
- A number of institutional investors expressed interest in credible venture-stage aggregation and commercialization platforms that would enable large investors to take stakes in a pool of cleantech scale-up companies. This interest came with the caveat that such platforms have appropriate governance and a clear risk profile, return mandate, and time horizon. MaRS currently has a proposal to build an innovation fund in this spirit. Such platforms may also intersect with the activities of the Business Development Bank of Canada (BDC) and Export Development Canada (EDC).
- Capital-heavy or longer-mandate demonstration initiatives are particularly challenged by financing access. Many felt that the sector could benefit from specially designed pools of debt and equity finance for such projects.
- Innovation providers say that while public support programs exist (such as the Build in Canada Innovation Program),[xxxiv] the requests for proposal process can be costly, time-consuming, and involve a high degree of uncertainty. Many spoke to the value of more practical information on how to source high potential funding outlets and navigate applications processes.
- There was a clear message from the cleantech industry that regulatory procedures relating to permitting, procurement and regulatory approvals are a key barrier. Current processes are restrictive, costly, slow with uncertain outcomes, and often cause missed opportunities or cause projects to be unfinanceable (as regulatory approval is often a prerequisite for financing).
- This barrier was noted as one of the primary reasons why countries like China are leading Canada in the cleantech space, as China has full circle government support. It was suggested that a separate regulatory process for smaller innovative businesses introducing new technologies or solutions could help stimulate development.

- It was indicated that the private sector often looks to the government for cues on high potential new technologies and innovations. As a result, the public sector has an important role to play in demonstrating and helping commercialize capital-intensive yet potentially transformative cleantech. In early innovation stages, this could mean greater direct public investment in R&D and potentially targeted policies to encourage private spending in key sectors. At later stages, governments can provide patient scale-up capital either directly, or through their support for other dedicated platforms.
- Furthermore, the government can accelerate the deployment of promising solutions by serving as an early buyer through public procurement. This demonstrates commercial viability while enabling cost reductions and learning. This served as a powerful tool in boosting renewables to self-sustaining commercial scale.

> For example, in 2007, the ecoENERGY for Biofuels Initiative invested up to $1.5 billion over 9 years to boost Canada's production of biofuels. The program ran from 2008 to 2017 and was administered by NRCan.

Questions:

- *What are the promising areas of cleantech across Canada's key economic sectors, and how might they be better enabled or accelerated through sustainable finance? What are the principal barriers to greater investment in cleantech, either by specific area, or in general?*
- *Would pooled venture funds have a magnifying impact within the private sector? What other investment vehicles might be useful in enabling lower cost and lower risk private investment in cleantech?*
- *Would the establishment of regional green banks be helpful in promoting, facilitating, or aggregating investment in smaller, more regional projects?*
- *Are there changes to the government procurement process that would help smaller entities scale in an accelerated manner?*
- *Are there good international models for streamlining regulatory processes for scale-up opportunities?*
- *Is more centralized information and assistance required for innovators to efficiently access government support programs and/or gain access to suppliers of risk capital?*

4.4 Innovation in the Oil and Gas Industry

Canada's oil and gas sector is both an economic powerhouse and a major emitter of GHG emissions. Canada is currently the fourth largest oil producer and exporter in the world, with a similar position in natural gas. It holds the third largest proven reserves of oil globally.[xxxv]Direct GHG emissions from Canada's oil and gas sector make up about 26% of Canada's total GHG emissions.

Given its international position, the sector is a vital source of wealth, prosperity, and social value for Canada. It supports employment, both directly and indirectly, and attracts the largest portion of capital investment in any sector of the country at over $40 billion in 2017.[xxxvi] Many facets of our economy rely on the oil and gas sector continuing to thrive in the future.

Observing the themes surrounding the Paris Agreement, it is apparent that we are embarking on the next great energy transition, from fossil fuel dominance to a mix of low carbon energy sources.[4] The 2017 *Generation Energy Council Report*[5] highlights four essential pathways to a sustainable energy future: (i) cleaner oil and gas; (ii) more renewable fuels; (iii) clean electricity; and (iv) lower consumption/higher efficiency. By many measures, growth in global energy demand will require an integrated mix of all forms of energy, albeit with lower demand for coal and oil over time

[4] Major transitions of the past include wood to coal and coal to broader fossil fuels

[5] The Generation Energy Council report drew its insight heavily from industry participants.

(see Annex VI). The projected degree and speed of transition from these fossil fuels varies greatly depending on embedded assumptions around policy, technological innovation, costs, energy prices, market access, infrastructure development, and carbon capture and storage, among other factors. This suggests that Canada's energy future will not be determined by any single force, but rather the interaction of many.

Nevertheless, as the world moves toward a lower-carbon future, it is expected that future market access will hinge on the ability to develop resources sustainably and at low cost, and transport them to market with minimal environmental impact. For Canada, uncertainty about a timely transition by the oil and gas sector is shifting demand and investment patterns. Investors are slowly transitioning from traditional energy sources such as thermal coal toward alternatives. Market access and resulting product price outcomes are now being affected by environmental considerations, and capex is beginning to shift to shorter cycle projects with a quick payback.

Canada's sector leaders have a vital opportunity to embrace the transition and pursue medium- and long-term energy efficiency capital improvements either directly, or by diversifying into alternative energy sources. Aside from improving productivity, such decisive investment in transition would enable a competitive market position in the low-carbon economy. It may even position Canada as a global leader in clean and efficient production, providing long-term export opportunity in both products and services.

In 2013, Alberta-based TransAlta Corp. spun off TransAlta Renewables in an initial public offering (IPO) on the TSX. Five years later, TransAlta Renewables has tripled in value and is now worth a third more than its parent corporation.[xxxvii]

Observations

- The consensus message to the Panel was that the transition of the oil and gas sector is less constrained by the capacity for transformation than by cost and a concrete market imperative. Many believe that the industry already has the proven technology at its disposal to transform traditional extraction and production to a level that would position Canada as leading global provider of clean, efficient energy. Some of these proven technologies include paraffinic froth treatment at oil sands mines and solvent-based methods at *in situ* facilities.
- This could represent a massive competitive edge in meeting future demand from both developed and developing countries. Similar to other major aspects of Canada's transition plan, a rational view of the opportunity and imperative relies on clear capital planning and policy signaling, particularly concerning carbon pricing.
- The industry as a whole is reasonably diverse, spanning different energy sources, emissions profiles, and roles in the supply chain. All face individual challenges, but the two key factors likely to define overarching long-term competitiveness are cost efficiency and clean credentials.
- Investors and asset managers are facing intensifying pressure from stakeholders to separate from carbon-intensive sectors such as oil and gas. Some are responding with divestment while others are turning to low carbon indices. Either method contributes to the growing signals of international capital flight from these sectors. Some express concern that a significant proportion of listed and future reserves might need to stay in the ground in order to meet climate commitments.
- Similarly, many expect to see increasing legal proceedings by interest groups and stakeholders seeking remedies from leading energy companies for the effects of unmanaged climate change risks (Exxon is a recent and notable example). Such liability risk for a company and its directors would negatively impact the sector as a whole and could escalate

if companies do not provide adequate disclosures on climate change risk to stakeholders.

- Because oil and gas is a capital-intensive sector, the Panel was told that companies can be challenged to gain investor support to fund transformative development and upgrades. For some companies, shareholders prefer a strategy of maximizing near-term cash flows rather than investment in long-term innovation, irrespective of the impact on future growth or market positioning. Those that do choose to invest in transition face a lingering risk of exclusion from investors simply by virtue of their sector and geography and an emphasis on "green" taxonomies that do not accommodate fossil fuel producers' attempts to become more sustainable.
- As a result, many of those consulted expressed interest in how a market for transition-linked financial products could help bridge the gap between green-focused investors and firms in emissions-intensive industries that are transitioning to more sustainable business processes. Transition-linked covenants could provide green-focused investors assurance that their investments are contributing to tangible progress on climate-related outcomes, while providing continued access to low-cost capital for transitioning firms.
- Technological innovation is viewed as foundational to change in the oil and gas sector, either through scaled solutions within the industry itself or in partnership with bourgeoning cleantech entities. Many technologies that can accelerate transition are already known and proven, which underlies the necessity (as discussed in section 4.3) for Canada to develop the means to deploy solutions at scale.

Norway, a nation whose economy is similarly reliant on oil and gas revenues, recently set up a dedicated *Expert Committee for Green Competitiveness* to collaborate with sector leaders and civil society in identifying sectoral road maps for transition to a low-carbon future. The process helped build widespread buy-in to the transformative changes needed to transition to clean energy and identified a number of innovative solutions, which will rely on patient capital and political support.

- Some suggested a need for more timely and accessible aggregated Canadian industry information to enable better-informed sector risk analysis, policymaking, investment and lending decisions, and solution innovation. As discussed in Section 3.3, enhanced company disclosures would play a key role in the broader amalgamation of company-level data for such purposes.
- The Panel heard that the perception of the oil and gas industry as "denialists" did not paint an accurate picture as a whole. Some progressive players have initiated transition in their own ways and are demonstrating leading practices in climate change strategies and disclosures. For example, Suncor has published a sustainability report for more than 20 years and has started to publish an additional report on climate risk and resilience. Many noted that this type of practice needs to be more consistent across the sector and that a more comprehensive view of the national transition and investment agenda (and what that means for Canada's high emitting sectors) is a necessary source of context in this regard.

Questions:

- *When thinking about the opportunities for low-carbon innovation in the oil and gas sector, what are the most effective and far-reaching early measures?*
- *What is the role of a lender or investor in promoting the sector's transition to a LCE?*
- *Are there specific infrastructure investments*

that can be structured to improve the energy efficiency of Canada's oil and gas industry and aid in its transition? Could the CIB play a role in facilitating and funding such projects?

- *What would have the highest impact in encouraging or financing transition-oriented innovation while enhancing the long-term financeability of the sector and reducing the systemic risk of sector decline (maximized capital cost allowances for related projects? Additional cleantech R&D subsidies? Redirected carbon tax proceeds?)?*
- *Given the diverse landscape of Canada's oil and gas sector, what would incentivize collaboration within the sector, and between the sector and outside partners or stakeholders?*
- *What role would aggregated data play in driving more informed understanding and dialogue on the oil and gas sector?*

4.5 Evolving the Electricity Grid

The LCE transition will require a substantially greater supply of clean electricity to facilitate large-scale emissions reductions in end-use applications such as transportation, industrial energy processes, water processing and pumping, and temperature control for buildings. Most analyses reviewed in Canada's Mid-Century Strategy suggest that domestic electricity demand will double by 2050.[xxxviii] In this context, the PCF outlines two distinct solutions for expanding and optimizing Canada's electrification system:

a) Connecting clean power across Canada through stronger transmission-line interconnections will help reduce emissions and support the move away from coal. Many provinces already trade electricity across their borders, and there is potential to increase these flows, consistent with market rules and fair competition among electricity producers.

b) Modernizing electricity systems will involve expanding energy storage, updating infrastructure, and deploying smart-grid technologies to improve the reliability and stability of electric grids and to allow more renewable power to be added. As a leader in the development and deployment of innovative energy-storage solutions and smart-grid technology, Canadian clean technology producers stand to benefit from increased investments in our electricity systems.[xxxix]

These measures have the potential to deliver abundant low-cost, low-carbon, reliable electricity as well as significant employment growth. They will also be extremely capital intensive. In a well-functioning power market with sufficient certainty around future electricity prices and policy, the necessary investment in infrastructure and cleantech innovation presents substantial opportunity for private and institutional investment.

Canada is statistically one of largest and cleanest electricity generators in the world; however, the energy mix varies considerably from province to province.[xl] As illustrated in Annex III, among G7 countries, only France has a less carbon-intensive electricity grid than Canada (see Table 1). All other G7 countries rely on fossil fuels to generate electricity at triple the rate of Canada. However, as also demonstrated, the distribution of clean power varies considerably across Canada and favours large, populated provinces.

Electricity is primarily provided provincially via monopoly Crown corporations, with limited interprovincial trade. Canada has 34 active major international transmission lines connecting to the US and exports 11% of its generated electricity south of the border.[xli] Yet, within Canada, little power is consumed in a province where it was not generated. Drawing on Canada's experience with international connectivity, investments in inter-provincial transmission lines could have long-term economic and environmental payoffs. A well-connected electricity grid throughout Canada could enhance economic efficiency and system capacity while optimizing domestic distribution of clean energy. In addition to decarbonizing Canada's overall production footprint, it could enable clean energy to flow to rural and indigenous communities with insufficient infrastructure or resources to produce it on their own. Surplus can be exported to the U.S, which still relies heavily on combustible fuels.

Observations

- Given the Panel's remit, discussions in this area focused on financing opportunities and hurdles related to execution of the electricity-related solutions of the PCF. The Panel heard consistent support for the outlined objectives for further electrification as a key means of emissions reduction in Canada as well as an essential source of employment and potentially exportable expertise in service, software, technology, and infrastructure.
- There is a fair consensus that evolving the grid to this magnitude will require integrated energy-system planning at a national level, to prepare for shifts in supply and demand, develop a project pipeline, and identify sources of funding to meet the necessary level of capital investment in infrastructure and value added cleantech solutions.
- There appears to be significant investment opportunity at the local and regional levels, whether through decentralized, renewables-based grids or deployment of digitalization and smart grid technology.[xlii] These smaller, geographically targeted projects may be best supported by provincial green banks or other regionally-centralized bodies that can source, structure and aggregate high potential projects into structured financing vehicles for public/private co-investment.
- Larger, more capital-intensive development projects such as interprovincial transmission lines could be an attractive investment opportunity for major infrastructure investors (such as pension plans and insurers), given the ability to utilize long-term contracts on new transmission lines to provide return stability and duration. Opportunities that would connect these capital providers with transmission line projects could reasonably fall under the CIB's sustainability mandate.
- With respect to cleantech investment, initiatives to advance storage, materials technology, and other solutions will be critical to resolving potential weaknesses in electrification plans arising from line loss in longer transmission lines or grid instability from decentralized and intermittent renewable production.
- While financing is a big part of the solution, the Panel was told that there are structural barriers that require attention as well. Reorientation towards a national system of interlinking provincial grids will require local utilities to significantly change a long-embedded business model and embrace constructive collaboration. Furthermore, some commented that under existing mandates, utilities might have little incentive to promote renewable use or explore opportunities for energy conservation or cheaper distributed energy generation.

Questions:

- *Is there a role for the federal government in bringing provinces and provincial utilities together with capital providers to fund an optimized electricity grid? Could facilitation and funding of large-scale infrastructure initiatives, such as transmission line expansion, be an initial priority for the CIB?*
- *Recognizing that many projects are smaller and more regional in nature, would aggregation mechanisms for smaller local projects be useful in attracting necessary pools of financing? If so, how might they be structured? Would the establishment of regional green banks be effective in promoting, facilitating, or aggregating these more localized investments?*
- *Whose role is it to evaluate and promote the integration of value added innovation and technology in electrification measures?*
- *What financing vehicles would most empower indigenous communities to invest in renewable power?*
- *What types of projects are likely to face difficulty in getting financed and why? What financial structures might enable their execution?*

4.6 Sustainable Asset Management

Asset managers are the professionals and institutions that manage investments on behalf of others, or that provide consultative advice or information regarding investment decisions. The system involves a diverse set of players and influencers whose collective work directs the flow of capital in and out of corporations and other entities through a broad suite of investment products and strategies aimed at achieving a specific investment objective.

These activities might include, for example, an advisor buying or selling stocks or bonds for a client, a pension fund or other institutional investor choosing an asset mix, a life insurer designing the default options for a defined contribution retirement plan, or a retail fund manager offering mutual funds or exchange-traded funds (ETFs) to individuals.

It is assumed that, on average, company valuations will rationally reflect expected future outcomes and relative return on risk, including important issues such as exposure to climate change. However, understanding of the financial materiality of climate and other ESG factors is still evolving in the financial sector, and as a result, these factors are minimally accounted for in asset management practices today. This is subsequently reinforcing status quo corporate strategies**.**

Adding to this, estimates by Mirova indicate that many of the index benchmarks most commonly used to assess asset management performance are compatible with 3.5-5°C scenarios (see Annex IV). Under Mirova's estimates, the TSX60 is consistent with a 4.6°C scenario.[xliii] Undoubtedly there are many assumptions embedded in these estimates; however, directionally it says that the general investment community (even climate-aware investors) may be following or invested in indices that do not align with the target 2 degree outcome.

In a 2017 survey by PRI, when asked how often ESG issues affect share prices in Canadian capital markets, respondents answered "often" or "always" 30% of the time for share prices and 23% of the time for bond yields.[xliv]

This phenomenon is occurring across both passive and active investment practices. Because current market weightings do not yet fully capture systemic climate risk and opportunity, investment in most passive indexed strategies further reinforces these 3.5-5°C scenarios.

Despite some lingering uncertainty about financial materiality and return impact of ESG factors in direct investing, a reassessment is occurring regarding what ESG analysis can show about a potential investment. Leading international investment houses have begun to consolidate and customize their ESG integration strategies, resulting in a growing body of evidence that suggests that focused ESG investing may, in fact, enhance risk-adjusted financial results over time. The *Responsible Investment Association* estimates that nearly $1.5 trillion in assets under management now incorporate ESG integration strategies.[xlv]

ESG Integration is a growing investment practice whereby financial risks and opportunities revealed by the analysis of environmental, social or governance issues is factored into investment analysis.

As the financial materiality of climate change continues to crystalize and evidence of positive performance arising from strategic ESG integration accumulates, it begins to raise questions about the importance of ESG analysis in the context of fiduciary duty.

Observations

- Limited access to reliable, relevant and consistent ESG data was cited as a common barrier to strategic integration, particularly for companies with limited resources.

- Many noted the critical importance of enhanced climate-related financial disclosures in advancing ESG data quality and comparability. Asset owners saw better disclosures by their underlying portfolio companies not only as a key source of decision information but also as an essential input to their own reporting efforts, transition plans, and strategies for managing underlying climate-related financial risks.
- With respect to leveraging the data, conversations indicated a need for wider competency in translating ESG information into pricing and risk decisions and viable forward-looking scenario insights - both by organizations and the broader financial support ecosystem. Organizations say that the avenues they typically turn to for guidance have been slow to build ESG analytical capabilities and expertise.
- Part of the challenge is that, unlike traditional risk management and financial analysis methodologies, climate modeling cannot be calibrated to historical data. Until more proven modeling techniques are in place, analysis requires highly specialized skills and expertise.
- With respect to benchmark data, some stock exchanges and fund managers are beginning to develop sustainable benchmarks and methodologies for improving transparency on the climate or carbon intensity of standard benchmarks. Conversations with these players suggested that while sustainability is a growing focus, implementation and buy-in from issuers remain primary challenges.

Examples of emerging methodologies for measuring the ESG performance of a portfolio include: (i) the Morningstar Sustainability Rating for Funds; (ii) BlackRock's weighted average carbon intensity rating for ETFs; (iii) the Sustainable Stock Exchanges (SSE) Initiative; and (iv) a new global, low-carbon equity index announced by FTSE Russell, which will increase or decrease the amount of capital allocated to listed companies based on their current and future performance on climate-related issues.

- Because of their role as agents, advisors, insurers and investors, Canada's major banks are seen to have a central role in engaging Canadian investors and businesses on their sustainability preferences and communicating the merits of sustainable investment options, including as a default choice in savings plans. This comes back to the need for available data, clear standards, and user-friendly tools for wealth management professionals to efficiently and meaningfully diagnose client preferences on ESG matters.

In France, the market share of responsible investment product in banking and insurance networks is around 3%. In employee schemes, where there is a provision for companies to offer at least one sustainable investment option (which is highlighted by both the company and the union) the market share is closer to 30%.

- Large institutional investors, such as Canada's public pension funds, are global leaders in long-term investment strategy and have an influential voice across virtually every industry. These institutions are seen to have a key role in driving economic transformation in Canada by further integrating ESG issues into their investment practices and dialogue with portfolio companies.
- The few major organizations that have begun incorporating ESG analysis say that it is not yet common practice among peers and that the current state of data and analytical competency makes implementation time- and resource-intensive. Until broader tools or models for integration emerge, many expect efforts to continue to be led by a small class of dedicated major investors.

According to the 2017 PRI survey results, the use of ESG research in investment analysis is mostly done on an ad hoc basis in Canada, with only 8% of portfolio managers and financial analysts saying that they "often" or "always" include ESG issues in their analyses.[xlvi]

- Given the systemic nature of climate risk, there was a shared view that pension beneficiaries should be educated and consulted on the sustainability impact of the investments made on their behalf, and given the opportunity to direct their contributions towards sustainable investments. There was an even stronger view that these plans' boards have a fiduciary duty to establish a long horizon view of which environmental or social factors could materially impact their underlying investments.
- Many say that a sea change in embedded investment practices and strategies will require evolved oversight and governance practices surrounding ESG management. It is expected that wide education will be a key component to a transition of this nature and magnitude.
- Asset owners say they use company engagement and voting as tools to promote important best practices. Many view engagement as a necessary means for institutional investors to address emissions or climate risk issues by their underlying portfolio companies and support the development of robust sustainability strategies.

  Climate resolutions are steadily rising and reached a high in 2017, driven by shareholder calls for reporting of GHG emissions in sustainability reports and disclosures directly linked to the business and financial risks of climate change, with particular focus on GHG emissions and planning for portfolio impacts of a 2-degree climate policy scenario.[xlvii] In 2018, investors with a combined $4 billion of shares in Rio Tinto recorded the largest vote for a climate change-related resolution (without board support) in Australian corporate history.[xlviii]

- However, even sophisticated, well-resourced companies say that engagement is time- and resource-intensive. Perhaps it is for this reason that models like Climate Action 100+ are beginning to pool resources and collectively engage on major issues.

  The Climate Action 100+ is a five-year global initiative with 279 participating investors representing nearly USD $31 trillion in assets under management.[l] These participating investors have committed to active engagement with the 100 largest emitting companies worldwide to improve climate change governance, curb emissions and strengthen climate-related financial risk disclosure and management. So far, the initiative has brought forward results, such as the board of Exxon Mobil agreeing to report on climate-related business risks.

- Insights expressed to the Panel echo the findings of the *CSA Report on Climate Change-Related Disclosure Project* that some companies are challenged by a gap between their stated ambitions for sustainable investing and the ability to execute such objectives on a practical level. Organizations with interest in pursuing sustainable investments expressed desire for a set of best practices to follow to better integrate ESG analysis into the investment process. This desire came with the condition that a longer checklist is not a viable solution.
- When asked what near-term measures are most relevant for asset managers, the most commonly cited combination of actions included: (i) a thorough review and assessment of portfolio and asset management processes, including governance; (ii) reevaluation of fiduciary duties with regard to climate risk and opportunity; (iii) review of the strategic asset mix of long-term investors in the context of the LCE transition and clean growth themes; (iv) evaluation of possible systemic risk arising from current portfolio structures; (v) continued efforts toward stronger, more comparable disclosures through the TCFD framework; (vi) evaluation of benchmarking and labeling practices; (vii) training and capacity building for ESG practices throughout the industry; and (viii) better availability of ESG product and services.

Questions:

- *What would create the necessary imperative for asset managers to objectively evaluate material ESG or transition-related issues in strategic planning, risk management, and investment research?*
- *Are the near-term measures listed in the section above relevant in this regard? Are any of particular importance? Is anything missing?*
- *Does benchmark composition need to capture climate considerations? If so, precisely how? How do we prevent transitioning companies from exclusion?*
- *Should clients, plan constituents and investors be afforded further information or input into their exposures to climate risk and opportunity led by the investment strategy or portfolio composition of their asset managers?*
- *Should defined contribution pension plans be encouraged to offer an ESG alternative as a default fund in their programs?*
- *Would it be feasible or helpful to have a disclosed measure and labeling of carbon intensity and/or climate exposure for institutional investment portfolios, ETFs, and other funds? Should disclosure of such a measure be mandatory for funds that are marketed in Canada?*
- *Is there a leadership role for the Bank of Canada to play along with other central banks in addressing the systemic financial risks associated with climate change?*
- *Are there important barriers or enablers to sustainable finance that are being overlooked?*

4.7 Green and Transition-linked Financial Products

In recent years, "green" bonds and loans have proliferated as a means for public or private institutions to fund sustainability-based projects, and for investors to put money to work in a sustainable manner. Green bonds are similar to standard bonds except that their proceeds are earmarked for environmentally beneficial investments or activities. These products have a number of benefits – they allow companies to fund environmentally beneficial activities in a manner that diversifies and expands their investor base, sets themselves apart from their market competitors, and highlights their commitment to sustainable initiatives. Their required funding rates are similar to (or in some cases lower than) traditional financing.

The European Investment Bank issued the first green bond in 2007. Since then, a wide range of financial and non-financial corporate issuers have turned to the market, including some prominent Canadian issuers such as the Canada Pension Plan Investment Board, TD Bank, Manulife and the Province of Ontario, accelerating growth to its current volume of $3.8 billion in 2017.

Guidelines such as the *Green Bond Principles* and the *Green Loan Principles* are helping to improve comparability and transparency across the green bond and loan markets. These voluntary guidelines are the starting point for most issuers today and are applied by market participants on a deal-by-deal basis. While these standards are an important first step in promoting the integrity of the asset class, they are self-regulated, and their scope may overlook constructive sustainable finance activity and opportunities. The Climate Bonds Initiative estimates over $39 billion in "unlabeled" climate-aligned debt issuances exist in Canada.[xlix]

As a result, there is mounting international focus on developing sustainable finance taxonomies (i.e. classification schemes) to enable proper assessment and accounting of sustainable finance activity. Accurate labeling enables the financial sector to more strategically identify and address sustainable growth prospects with a reasonable view of relative risk and opportunity.

The EU recently released a draft green taxonomy and is exploring complementary adjustments to capital requirements. In an alternative approach, China requires issuers to verify projects against a detailed catalogue of eligible green assets. A key element missing from these emerging frameworks is the notion of transition-oriented activities that

fall outside of standard "green" criteria. This has important implications for Canada's carbon-intensive sectors. It means that potentially productive projects, such as an initiative by a gas company to improve the efficiency or emissions profile of its production process, may be out of scope.

Transition-linked bonds and loans are an emerging category of financial instruments that could help incentivize firms (in any sector) to meet their sustainability targets, by directly tying achievement of such targets to the firms' cost of capital.[6] For example, a transition-linked loan could include covenants that would step down the interest rate paid by the borrowing firm if it successfully reduced its emissions intensity to a pre-specified level. Unlike green bonds, transition-linked products could be available to firms in emissions-intensive industries that are undertaking projects to reduce their carbon footprint, which do not neatly fit within standard green taxonomy. By nature of their step-down covenants, transition-linked instruments could help borrowers obtain lower-cost capital as they work to transition to more sustainable business activities; the financial logic being that in doing so, they are reducing strategic risk to the organization. Transition-linked loans could also be made available to smaller entities which may not yet have the scale required to issue bonds.

From the provider perspective, producing a new stream of transition-linked financial assets could help financial intermediaries to meet growing investor demand for environmentally beneficial investments and act as a means to engage them more productively in discussions surrounding their transition plans and accompanying financial needs.

Examples of other emerging variations of ESG-linked loans and bonds include *Blue Bonds*, which are impact bonds funded by development finance institutions for which proceeds are used to invest in ocean and coastal projects. As a variation on transition bonds, *Resilience Bonds* have roots with established catastrophe bonds and are designed to manage risk from weather-related catastrophes while promoting investment in infrastructure such as flood barriers.

Observations

- During consultations, stakeholders noted that green bonds are useful tools for encouraging sustainable finance and bringing awareness to companies' green activities. However, they also spoke to an array of challenges, such as: (i) nascent taxonomy; (ii) limited liquidity in secondary markets, due to the predominance of buy-and-hold investors in this space; (iii) a high fixed cost of initiating a program and complex governance framework; and (iv) little historical data for investment or market analysis. These drawbacks have led some to believe that, while green bonds can be useful as targeted tools, they are not a panacea for raising mainstream activity in sustainable finance.
- Green bond market participants agreed that transparency, reporting, and verification were the cornerstones of the green bond market. Stakeholders noted that a lack of verification introduces increasing risk of "greenwashing" whereby companies misleadingly present their activities as environmentally beneficial to investors or consumers.
- As a result, transparency from issuers on their use of funds is seen as critical to instilling confidence among investors that proceeds are being used as intended. The emphasis on transparency underscored the important role of third-party accreditors in this space, who assess and sign off on the quality of firms' green bond programs, including their capacity to track and

[6] Transition-linked bonds and loans would be similar in nature to "ESG-linked loans", which are broader in scope but also have their interest rates tied to the achievement of specific outcomes.

monitor use of funds. Stakeholders noted encouraging growth in the availability and capacity of second opinion providers, such as Sustainalytics and Cicero.

- The vast majority of those consulted expressed a desire for a consistent, transparent and practical definition of what qualifies for sustainable finance. Many see it as a precondition to stronger or more accelerated market uptake. There is, however, a divergence in view between issuers and buyers on the optimal definition of "green" as it relates to assessing the environmental credentials of the activities being financed.
- Some buyers noted that a binary standard simplifies the investment process. By contrast, many issuers were proponents of "shades of green" for a more inclusive, outcomes-based approach. Some issuers expressed concern that a binary definition could unduly exclude firms that are moving toward more sustainable business models and practices in carbon-intensive sectors. Excluding these sectors from accessing this investor base could adversely impact such companies' incentive – and potentially their capacity – to undertake necessary investments in resource or production efficiency.
- Several of those consulted suggested that it is important for Canadian representatives to continue to engage in international initiatives on green standards and taxonomies to ensure that key facets of our economy are not unduly excluded from important transition framework. For example, the *International Organization for Standardization* is being encouraged to develop various new standards pertaining to green and sustainability themes.
- While there is positive momentum in the green bond market, it is still relatively small. Growth in both the size and liquidity of the asset class is a likely prerequisite to greater financial innovation and the mainstreaming of specialized funds, ETFs, indices, or hedging activities.
- Many expressed interest in how a market for transition-linked financial products could help bridge a gap between green-focused investors and firms in emissions-intensive industries that are transitioning to more sustainable business processes. Transition-linked covenants could provide green-focused investors assurance that their investments are contributing to tangible progress on climate-related outcomes. At the same time, beyond providing access to lower cost capital, these products help transitioning firms send necessary signals of progress that may help preserve (or expand) their capital bases in the face of increasing investor scrutiny.
- Despite some prominent international examples, transition lending is extremely nascent internationally, and the Panel found little experience with it despite its apparent applicability. There was almost no discussion domestically about alternative structures such as blue bonds or resilience bonds.
- With Canada's financial expertise and public commitment to a low-carbon, climate-resilient economy, many noted a significant strategic opportunity for Canada's financial sector to position itself as an international centre of knowledge and expertise on transition-linked financial products.

Questions:

- *Is there mainstream interest in a green bond market in Canada?*
- *How can private and public players accelerate its development? What supportive mechanisms are required, if any?*
- *Are there other variations on green and transition bonds or loans that would have relevance in the Canadian context?*
- *Would new transition-linked financial structures aide Canada's oil and gas industry in the transition to a LCE? How might they be designed, and how might they intersect with international efforts regarding taxonomy? Are there any other lending innovations that would be helpful?*
- *Are existing taxonomies appropriate in the Canadian context? Do any further conditions or key elements need to be put in place?*

5. CLOSING THOUGHTS

Canada stands as one of 197 nations and territories that have signed the Paris agreement with the goal of limiting global temperature increase to well below 2 degrees Celsius. Our commitment sets us on the global pathway toward low carbon, climate-resilient, socially inclusive activities throughout every sector of the economy. Many of the sectors underpinning the Canadian economy are carbon intensive. Therefore, in order to retain (and enhance) our long-term economic competitiveness and forge a pathway to sustainable, clean, inclusive growth, we must invest in transition.

Canada's financial system has a critical role to play in this transition, by recalibrating investment flows and channeling financial expertise and focus toward more sustainable outcomes. Our financial sector is highly capable of the task, and has reason to be vested in the long-term outcomes and the ample opportunity along the way.

With that said, observable measures and feedback suggest that Canada is approaching sustainable finance reactively, tentatively, and in only a loosely coordinated fashion. For Canada to capture the large market opportunities and influence the rules affecting our financial industry and key economic sectors over the long run, we need to move faster and more decisively. This will require focus on areas that will significantly move the needle both with respect to environmental impact and long-term economic opportunity, including a focus on fostering and leveraging innovation.

The insights and questions herein seek to expand our understanding of how to drive sustainable finance to critical mass. As the Panel moves into further consultations, the intention is to shift from identifying areas that require more attention to developing practical, actionable recommendations. Given that Canada's emissions reduction goals extend to 2030 and beyond, these ideas must endure long beyond the life of the Panel. Therefore, it is essential that the recommendations shed light not only on the challenges and opportunities at hand, but also the practical subtleties that influence decisions and actions. They must account for continued progress and change in the international arena. They must also consider the right mechanisms and platforms to constructively champion and monitor progress on key initiatives over the long term.

In this light, the final question is two-fold: does the scope of this report miss any foundational elements, market opportunities or insights that are important to Canada's climate objectives? For each of the outlined financial markets and products, what public, private or joint bodies might be best suited to jump start action and facilitate ongoing progress and momentum?

The Panel will aim to deliver a final report of findings and recommendations to the Minister of Environment and Climate Change and the Minister of Finance in spring 2019. While the recommendations will speak to the realm of federal jurisdiction, it is difficult within an interconnected system to act alone. Canada's clean growth trajectory is a long play and will involve a broad suite of actions on the parts of governments and businesses, as well as integrated, multi-jurisdictional, multi-sector collaboration.

The Panel extends its gratitude to the Ministers of ECCC and Finance for their foresight in establishing this initiative, and to the many stakeholders that have taken the time to share their insights.

ENDNOTES

[i] Sustainability Accounting Standards Board. (2017). Converging on Climate Risk: CDSB, the SASB, and the TCFD. Retrieved from https://www.cdsb.net/sites/default/files/sasb_cdsb-tcfd-convergingonclimaterisk-091317-web.pdf

[ii] Science Based Targets. (2018). Companies Taking Action. Retrieved from https://sciencebasedtargets.org/companies-taking-action/

[iii] UNFCC. (2017). Canada's 2017 Nationally Determined Contribution Submission to the United Nations Framework Convention on Climate Change. Retrieved from http://www4.unfccc.int/ndcregistry/PublishedDocuments/Canada%20First/Canada%20First%20NDC-Revised%20submission%202017-05-11.pdf

[iv] Environment Climate Change Canada. (2016). Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy. Retrieved from https://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf

[v] Environment Climate Change Canada. (2017). Greenhous Gas Emissions. Retrieved from http://www.ec.gc.ca/indicateurs-indicators/18F3BB9C-43A1-491E-9835-76C8DB9DDFA3/GHGEmissions_EN.pdf

[vi] The New Climate Economy. (2016). The Sustainable Infrastructure Imperative: Financing for Better Growth and Development. Retrieved from http://newclimateeconomy.report/2016/wp-content/uploads/sites/4/2014/08/NCE_2016Report.pdf

[vii] Corporate Knights. (2018). Green firm financing could bring in $110 billion by 2025: report. Retrieved from https://www.corporateknights.com/channels/responsible-investing/green-firm-financing-bring-110-billion-2025-report-15371712/

[viii] Task Force on Climate-Related Financial Disclosures. (2017). Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures. Retrieved from https://www.fsb-tcfd.org/publications/final-recommendations-report/

[ix] Task Force on Climate-Related Financial Disclosures. (2018). TCFD Supporters. Retrieved from https://www.fsb-tcfd.org/tcfd-supporters/

[x] Climate Bonds Initiative. (2017). Bonds and Climate Change: Canada Report. Retrieved from https://www.climatebonds.net/files/files/CBI-SotM-Canada-Nov2017-English-French.pdf

[xi] Responsible Investment Association. (2016). Canadian RIA Trends Report.

[xii] Statistics Canada. (2017). Environmental and Clean Technology Products Economic Account, 2007 to 2016. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/171213/dq171213g-eng.htm

[xiii] KPMG. (2017). Meet the Millennials. Retrieved from https://home.kpmg.com/content/dam/kpmg/uk/pdf/2017/04/Meet-the-Millennials-Secured.pdf

[xiv] Swiss Re. (2018). Global Insured Losses from Disaster Events in 2017 Highest Ever. Retrieved from http://www.swissre.com/media/news_releases/nr20180410_sigma_global_insured_loses_highest_ever.html

[xv] Mirova. (2018). Estimating Portfolio Coherence with Climate Scenarios. Retrieved from http://www.mirova.com/Content/Documents/Mirova/publications/va/Research_paper/EstimatingPortfolioCoherenceWithClimateScenarios2018.pdf

[xvi] Environmental Finance. (2018). Sustainable Banking Principles to be Launched in November. Retrieved from https://www.environmental-finance.com/content/news/sustainable-banking-principles-to-be-launched-in-november.html

[xvii] Carbon Pricing Leadership. Partners. Retrieved from https://www.carbonpricingleadership.org/partners/

[xviii] Environment and Climate Change Canada. (2018). Canadian Centre for Climate Services. Retrieved from https://www.canada.ca/en/environment-climate-change/news/2018/04/canadian-centre-for-climate-services.html

[xix] Task Force on Climate-Related Financial Disclosures. (2018). Task Force on Climate-related Financial Disclosures: Status Report. Retrieved from https://www.fsb-tcfd.org/wp-content/uploads/2018/09/FINAL-2018-TCFD-Status-Report-092618.pdf

[xx] Bloomberg Professional Services. (2018). Deciphering the Task Force on Climate-related Financial Disclosures. Retrieved from: https://www.bloomberg.com/professional/blog/deciphering-task-force-climaterelated-financial-disclosures-tcfd.

[xxi] Canadian Securities Administrators. (2018). Report on Climate Change-Related Disclosure Project.

[xxii] Investment Funds Institute of Canada: Fiduciary Duties and Financial Advisors Frequently Asked Questions and Answers: https://www.ific.ca/wp-content/uploads/2013/08/Fiduciary-Duties-and-Financial-Advisors-Frequently-Asked-Questions-and-Answers-August-2011.pdf/1658/

[xxiii] United Nations Environment Programme. (2017). Global Status Report. Retrieved from http://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf

[xxiv] The Atmospheric Fund. (2017). Money on the Table: Why Investors Miss Out on the Energy Efficiency Market. Retrieved from http://taf.ca/wp-content/uploads/2017/12/TAF_Report_Money_on_the_Table_Web_2017-11-29.pdf

[xxv] The Atmospheric Fund. (2016). Canada Ranks Tenth of 23 Countries in Energy Efficiency. Retrieved from http://taf.ca/canada-ranks-tenth-23-countries-energy-efficiency/

[xxvi] OECD. (2012). Public Investment across Levels of Government: The Case of British Columbia, Canada. Retrieved from http://www.oecd.org/cfe/regional-policy/British%20Columbia_edited.pdf

[xxvii] https://www.budget.gc.ca/aceg-ccce/pdf/infrastructure-eng.pdf

[xxviii] Government of Canada. (2018). Canada Infrastructure Bank. Retrieved from https://www.infrastructure.gc.ca/CIB-BIC/index-eng.html

[xxix] Macquirie (2016, October). Appraisal of private debt opportunities: A holistic approach for UK pension funds. Retrieved from https://static.macquarie.com/dafiles/Internet/mgl/global/shared/sf/pdf/MIDIS_White_Paper_Appraisal_of_Private_Debt_Opportunities.pdf?v=2

[xxx] International Energy Agency. (2015). Energy Policies of IEA Countries: Canada 2015 Review. Retrieved from https://webstore.iea.org/energy-policies-of-iea-countries-canada-2015-review

[xxxi] Statistics Canada. (2017). Environmental and Clean Technology Products Economic Account, 2007 to 2016. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/171213/dq171213g-eng.htm

[xxxii] Working Group on Clean Technology, Innovation and Jobs. (2016). Final Report. Retrieved from https://www.canada.ca/content/dam/eccc/migration/cc/content/6/4/7/64778dd5-e2d9-4930-be59-d6db7db5cbc0/working-20group-20on-20clean-20technology-20innovation-20and-20jobs-20final-20report-20engl....pdf

[xxxiii] Working Group on Clean Technology, Innovation and Jobs. (2016). Final Report. Retrieved from https://www.canada.ca/content/dam/eccc/migration/cc/content/6/4/7/64778dd5-e2d9-4930-be59-d6db7db5cbc0/working-20group-20on-20clean-20technology-20innovation-20and-20jobs-20final-20report-20engl....pdf

[xxxiv] Build in Canada Innovation Program: https://www.tpsgc-pwgsc.gc.ca/app-acq/picc-bcip/ppicc-abcip-eng.html

[xxxv] Natural Resources Canada. (2018). Crude Oil Facts. Retrieved from https://www.nrcan.gc.ca/energy/facts/crude-oil/20064

[xxxvi] Canadian Association of Petroleum Producers. (2018). A Global Vision for Canadian Oil and Natural Gas.

[xxxvii] Bloomberg Terminal data

[xxxviii] Environment Climate Change Canada. (2016). Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy. Retrieved from https://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf

[xxxix] Government of Canada. (2017). Pan-Canadian Framework on Clean Growth and Climate Change. Retrieved from https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf

[xl] Environment Climate Change Canada. (2016). Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy. Retrieved from https://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf

[xli] Natural Resources Canada. (2018). Electricity Facts. Retrieved from https://www.nrcan.gc.ca/energy/facts/electricity/20068#L2

[xlii] Yoldaş, Y., Önen, A., Muyeen, S. M., Vasilakos, A. V., & Alan, İ. (2017). Enhancing smart grid with microgrids: Challenges and opportunities. Renewable and Sustainable Energy Reviews, 72, 205-214. doi:10.1016/j.rser.2017.01.064

[xliii] Mirova. (2018). Estimating Portfolio Coherence with Climate Scenarios. Retrieved from http://www.mirova.com/Content/Documents/Mirova/publications/va/Research_paper/EstimatingPortfolioCoherenceWithClimateScenarios2018.pdf

[xliv] Principles for Responsible Investment. (2018). ESG Integration in The Americas: Markets, Practices, and Data. Retrieved from https://www.unpri.org/download?ac=5397

[xlv] Responsible Investment Association (2016). Trends Report. Retrieved from https://www.riacanada.ca/trendsreport/

[xlvi] Principles for Responsible Investment. (2018). ESG Integration in The Americas: Markets, Practices, and Data. Retrieved from https://www.unpri.org/download?ac=5397

[xlvii] New Climate Economy (2019). Unlocking the inclusive growth story of the 21st Century: Accelerating Climate Action in Urgent Times. Retrieved from: https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE_2018_FULL-REPORT.pdf

[xlviii] Environmental Finance. (2018). Rio Tinto shareholders in largest ever vote for climate resolution. Retrieved from: https://www.environmental-finance.com/content/news/rio-tinto-shareholders-in-largest-ever-vote-for-climate-resolution.html

[xlix] Climate Bonds Initiative. (2017). Bonds and Climate Change: Canada Report. Retrieved from https://www.climatebonds.net/files/files/CBI-SotM-Canada-Nov2017-English-French.pdf

[l] Climate Action 100+. (2018). http://www.climateaction100.org/

Annex I - International Actions on Sustainable Finance

Sustainable finance can refer to many things: integrating environmental, social and governance criteria into business or investment decisions; addressing issues of short-termism; promoting sustainable investment awareness among clients and the financial community; and using public funds to lever private investment in sustainable infrastructure.

While there is yet no universal definition of Sustainable Finance, for the purposes of discussion, the Panel views it as capital flows (as reflected in lending and investment) risk management activities (such as insurance and risk assessment) and financial processes (including disclosures, valuation and oversight) that assimilate environmental and social factors as a means of promoting sustainable economic growth and the long-term stability of the financial system.

A number of countries have also established teams to consult with the private sector and other stakeholders on sustainable finance, including the EU High Level Expert Group on Sustainable Finance, the UK Green Finance Taskforce, the UN Environment Programme, China's Green Finance groups, the G7, the G20, and the OECD.

EU High Level Expert Group on Sustainable Finance

- The EU High-Level Expert Group on Sustainable Finance was established by the European Commission in late 2016 to develop a roadmap on sustainable finance. The HLEG provided recommendations, including:
    - how to integrate sustainability considerations more effectively into the EU's financial policy framework;
    - how to protect the stability of the financial system from risks related to the environment; and,
    - how to mobilize capital to finance sustainable investments and growth.

- The group released its final report on January 31, 2018, recommending the creation of an EU sustainability taxonomy, clarification of investor duties, and upgrading disclosures.[1]

- Following the HLEG, the European Union adopted in March 2018 an Action Plan on Sustainable Growth with the objective of integrating sustainability into the European economy.[2] In support of this Action Plan, on May 24, 2018, the European Commission released its first legislative proposals. The proposals include required integration of sustainability factors into investment decisions, mandatory disclosures on the sustainability of investments, and creating an EU-wide taxonomy.

United Kingdom

- The UK Green Finance Taskforce provided recommendations on a number of environmental and resilience goals, including the delivery of public and private investment needed to meet carbon budgets, and how the UK can maximize its share of the global green finance market.

[1] https://ec.europa.eu/info/sites/info/files/180131-sustainable-finance-final-report_en.pdf
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0097&from=EN

- The Taskforce published its report on March 28, 2018, and provided 30 recommendations under ten themes, including the recommendation for the creation of a Green Finance Institute to consolidate all work relating to the sector.[3]

- In November 2017, the Environmental Audit Committee, launched the Green Finance Inquiry. The Inquiry examined, in two reports, how the UK can mobilize investment in clean energy and sustainable development and how to embed sustainability in financial decision making.[4,5] A report was published on May 23, 2018, recommending an increase in the carbon price and an issuance of a Sovereign Green Bond.

United Nations Environment Programme – Finance Initiative

- The United Nations Environment Programme Finance Initiative (UNEP FI) is a partnership between UNEP and the global financial sector created in the wake of the 1992 Earth Summit with a mission to promote sustainable finance.

- More than 200 financial institutions, including banks, insurers, and investors, work with UNEP to understand today's environmental, social and governance challenges, why they matter to finance, and how to actively participate in addressing them.

- UNEP FI hosts its Global Roundtable every other year and has done so since 1994. This agenda-setting event brings together the sustainable finance community to discuss the most pressing issues.

- In April 2018, 16 leading banks from four continents, including Royal Bank of Canada and TD Bank Group, convened by UNEP FI, published a jointly developed methodology to increase understanding of how climate change and climate action could impact their business.[6] It will inform banks' strategies to contribute to, and benefit from, the low-carbon economic transition and help them engage and support their customers to that effect. The methodology has brought together various functions from within the banks including credit risk, stress testing, sustainability and business development with leading scientists and risk and investment management experts. It is the first publicly available guidance designed specifically for banks to carry out forward-looking, transparent, climate-related risk and opportunity assessments as envisioned by the TCFD.

The Green Finance Committee of the China Society for Finance and Banking

- The Green Finance Committee (GFC) of the China Society for Finance and Banking was established in April 2015. The committee is a non-for-profit professional organization dedicated to research and coordination of green finance initiatives of member institutions.

[3]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/703816/green-finance-taskforce-accelerating-green-finance-report.pdf
[4] https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1063/1063.pdf
[5] https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/617/617.pdf
[6] http://www.unepfi.org/publications/banking-publications/extending-our-horizons/

- On November 11, 2017, the GFC and the European Investment Bank launched a White Paper that provides an international comparison of several green bond standards.[7] The report provides a basis for future international cooperation on improving green finance definitions and standards with a view to facilitating cross-border green capital flows.

The Green Finance Task Force – China

- The Chinese Green Finance Task Force is co-sponsored by the Research Bureau of the People's Bank of China (PBC) and the UNEP Inquiry into the Design of a Sustainable Financial System and was created in 2014. The Task Force brought together leading Chinese financial policy and regulation experts together with experts from the private sector, academia and think tanks, as well as international experts.

- In April 2015, the group published a report on recommendations for establishing a green financial system in China including:
    - creating green banks and funds;
    - implementing compulsory green insurance;
    - creating green equity indices;
    - accelerating the formation of markets for emissions trading;
    - establishing mandatory environmental disclosure requirements; and,
    - clarifying environmental liabilities of banks.[8]

Singapore Institute of International Affairs

- The Singapore Institute of International Affairs (SIIA) is an independent think tank founded in 1961.

- In November 2017, in collaboration with UNEP Inquiry, the SIIA released the Collaborative Initiative for Green Finance in Singapore report.[9] The report aims to mainstream and socialise the idea and opportunities associated with Green Finance, as well as to explore how Singapore as a financial hub can offer Green Finance as additional expertise to better serve the needs of the ASEAN and Asia regions.

Australia and New Zealand

- Approximately 300 financial institutions in Australia and New Zealand with assets over $10 trillion support the Sustainable Finance Roadmaps for Australia and New Zealand.[10]

- The roadmap provides pathways and policies signals and sets frameworks to enable the financial sector to contribute more systematically to the transition to a more resilient and sustainable economy.

[7] http://www.eib.org/attachments/fi/white-paper-green-finance-common-language-eib-green-finance-committee.pdf
[8] http://unepinquiry.org/wp-content/uploads/2015/12/Establishing_Chinas_Green_Financial_System_Final_Report.pdf
[9] http://www.siiaonline.org/wp-content/uploads/2017/11/Collaborative-Initiative-for-Green-Finance-in-Singapore.pdf
[10] http://www.siiaonline.org/wp-content/uploads/2017/11/Collaborative-Initiative-for-Green-Finance-in-Singapore.pdf

Norway

- Finance Norway has produced a sustainable finance roadmap for the Norwegian financial sector, *The Roadmap for Green Competitiveness in the Norwegian Finance Sector*.[11] The roadmap has seven general recommendations, including:
    - establishing a common taxonomy for sustainable finance; aligning climate reporting with the FSB's climate risk disclosure recommendations;
    - increasing climate competence and capacity in the financial sector; including climate risk in the Norwegian financial supervisory authority's mandate;
    - improving collaboration between the financial sector and the authorities;
    - using digitalisation to scale-up the market for climate-smart solutions; and,
    - contributing to innovation and change in other sectors. The roadmap also provides specific recommendations for the core activities of banks, insurers and investors.

Sweden

- The Stockholm Sustainable Finance Centre (SSFC) aims to accelerate and promote the shift in capital investments required to deliver the Sustainable Development Goals (SDGs) and climate targets. The Centre is a collaboration between Stockholm Environment Institute, Stockholm School of Economics, and Stockholm Green Digital Finance.

- The SSFC performs demand-driven research on the implementation of the SDGs, trains and educations professionals to incorporate sustainability into financial decisions, and engages with relevant change agents across the financial sector to deliver solutions and innovations.

Netherlands

- The Dutch Sustainable Finance Platform aims to promote and encourage a dialogue on sustainable finance in the financial sector. The Platform contains six working groups that tackle a specific subject and explore new areas of activity and initiatives.

- One of the working groups aims to develop a methodology to measure the impact of the SDG's. In September 2017, they released a brochure with proposed impact indicators for each of the SDG's.[12]

France

- France's Minister of Ecological and Solidarity Transition and Minister of Economy and Finance commissioned two experts to develop a report on a strategy for Green Finance in France. They released a report in December 2017 with recommendations around four themes for a French strategy to foster green finance, including:
    - incorporating climate-related risks in the finance system;
    - using resources strategically;
    - financing the transition in the developing world; and,

[11] http://www.unepfi.org/psi/wp-content/uploads/2018/06/Roadmap-for-green-competitiveness-in-finance.pdf
[12] https://www.dnb.nl/en/binaries/SDG%20Impact%20Measurement%20FINAL%20DRAFT_tcm47-363128.PDF?2018091317

- consolidating French leadership in green finance.[13]

Italy

- In February 2016, Italy launched a National Dialogue for Sustainable Finance in response to the SDGs and the Paris Agreement in 2015. The dialogue included a series of working groups comprised of leaders in the financial sector and research community, and identified key challenges and policy options.

- A report was published in December 2016 on the outcome of the National Dialogue.[14] Eighteen specific policy options were identified and grouped in four areas, including:
  - policy frameworks;
  - financial innovation;
  - market infrastructure; and,
  - knowledge building.

Network of Central Banks and Supervisors for Greening the Financial System

- In December 2017, eight central banks and supervisors collectively committed to establishing a Network of Central Banks and Supervisors for Greening the Financial System (NGFS). The Network consists of the Banco de Mexico, the Bank of England (BOE), the Banque de France and Autorité de Contrôle Prudentiel et de Résolution (ACPR), De Nederlandsche Bank (DNB), the Deutsche Bundesbank, Finansinspektionen (The Swedish Financial Supervisory Authority), the Monetary Authority of Singapore, and the People's Bank of China.

- The group works on a voluntary basis to exchange experiences, share best practices, contribute to the development of environment and climate risk management in the financial sector and to mobilize finance to support the transition toward a sustainable economy.

- The NGFS held the first International Climate Risk Conference for Supervisors on April 6th, 2018 in Amsterdam, organized by three Network members: ACPR, BOE, and DNB. Representatives from over 30 countries and 50 supervisory organisations took part in discussions to explain how they are engaging or planning to engage with the agenda of sustainable finance.

- To accelerate the mainstreaming of green finance and provide room for discussion, the NGFS and the Council on Economic Policies are jointly organising a conference on "Scaling up Green Finance: The Role of Central Banks". Researchers from academia, central banks, and other institutions are welcome to contribute to the discussion on 8 – 9 November 2018 in Berlin, hosted by the Deutsche Bundesbank.

Sustainable Stock Exchanges Initiative

- The Sustainable Stock Exchanges (SSE) Initiative is a learning platform for exploring how exchanges, in collaboration with investors, regulators, and companies, can enhance corporate transparency and

[13] http://www.climatefinanceday.com/wp-content/uploads/2017/12/EXECUTIVE-SUMMARY-finance-verte-sircom-v3.pdf
[14] http://www.minambiente.it/sites/default/files/archivio/allegati/sviluppo_sostenibile/Financing_the_Future_EN.pdf

performance on environmental, social and corporate governance (ESG) issues and encourage sustainable investment.

- The SSE has 75 partner exchanges, including the London Stock Exchange (LSE), Canada's Aequitas NEO Exchange, and the New York Stock Exchange (NYSE). All partners have signed the SSE commitment letter, but activities in support of green finance vary.

- In November 2017, the group published the SSE Green Finance Action Plan, a voluntary action plan that is offered to guide stock exchanges in the implementation of green finance strategies. It allows an exchange to benchmark their current support for green capital markets, and helps an exchange better visualise what action areas present further opportunities.

- The plan also provides an SSE Green Finance Diagnostic Checklist that can be used as a self-assessment tool to identify areas where stock exchanges can initiate or expand their activities on green finance. The checklist provides 12 action points within four action areas:

    - Promoting green products and services;
    - Greening financial markets;
    - Strengthening the quality and availability of climate-related and other environmental disclosures among issuers and investors; and,
    - Contributing to the growth of dialogue and consensus building on green finance with other capital market participants

G20 Green Finance Study Group (GFSG)

- The GFSG was launched under China's Presidency of the G20 and works to support the G20's strategic goal of strong, sustainable and balanced growth. The group's objective is to identify institutional and market barriers to green finance, and based on country experiences, develop options on how to enhance the ability of the financial system to mobilize private capital for green investment.

- In 2017, the group released an update to the Synthesis Report, which was adopted at the G20 Leaders' Summit in Hangzhou in September 2016.[15] The report identifies seven options for countries to scale up green finance through financial system developments. The 2017 update focuses on applying environmental risk analysis in the financial industry and using publicly available environmental data in financial analysis.

G7

- On June 12, 2017, at the conclusion of the G7 Ministerial Meeting on Environment in Italy, the G7 released a communiqué acknowledging "that scaling up sustainable finance is fundamental to achieve sustainability

[15] http://unepinquiry.org/wp-content/uploads/2017/07/2017_GFSG_Synthesis_Report_EN.pdf

and climate goals".[16] The G7 pledged continued action on the 2030 Agenda for Sustainable Development, resource efficiency, marine litter, green jobs and climate change.

- As part of Italy's G7 Environment programme, Financial Centres for Sustainability report was released, which takes stock of the sustainability agenda that is emerging for financial centres, reviews current practice across leading centres in G7 countries and suggests priorities for further action.[17]

- During the June 2018 meeting in Whistler, the first ever joint meeting of G7 Development and Finance Ministers communicated their commitment to global sustainable development, including mobilizing private capital for sustainable development and building economic resilience against extreme weather events.[18]

OECD

- In 2016, the OECD established the Centre on Green Finance and Investment. The Centre leverages the OECD's policy and economics expertise and enables knowledge exchange among leaders from the private sector, government, regulatory institutions, academia and civil society.

- The Centre regularly releases reports of practical recommendations on mobilizing finance for climate action and the low-carbon transition.[19]

[16] http://www.g7italy.it/sites/default/files/documents/Communiqu%C3%A9%20G7%20Environment%20-%20Bologna.pdf
[17] http://unepinquiry.org/wp-content/uploads/2017/06/Financial_Centres_for_Sustainability.pdf
[18] https://g7.gc.ca/en/g7-presidency/themes/investing-growth-works-everyone/g7-ministerial-meeting/co-chairs-summary-g7-joint-development-finance-ministers-meeting/
[19] http://www.oecd.org/cgfi/resources/bydate/

Annex II - The Pan-Canadian Framework on Clean Growth and Climate Change

The *Pan-Canadian Framework on Clean Growth and Climate Change* (Pan-Canadian Framework) is Canada's collective plan to grow the economy while reducing emissions and building resilience to adapt to a changing climate. This plan was jointly developed with provincial and territorial governments, along with input from Canadians, businesses, non-governmental organizations, and Indigenous Peoples. The Pan Canadian Framework was adopted by most First Ministers in December 2016. The Pan-Canadian Framework includes four main pillars: pricing carbon pollution, complementary actions to reduce emissions, adaptation and climate resilience, and clean technology.[1]

Pan-Canadian Framework Pillar I: Pricing Carbon Pollution

In October 2016, the federal government published a pan-Canadian approach to carbon pricing to ensure that carbon pricing applies to a broad set of emission sources throughout Canada with increasing stringency over time, starting at $10 per tonne of carbon dioxide equivalent (CO_2e) emissions in 2018 and rising to $50 per tonne in 2022. This standard – or benchmark – provides provinces and territories with flexibility to implement their own carbon pollution pricing systems. The federal government also developed a carbon pricing "backstop" system, which will apply in 2019, in provinces or territories that either request it or that do not have a system in place that meets the federal benchmark.

Pan-Canadian Framework Pillar II: Mitigation

The Pan-Canadian Framework outlines over fifty concrete measures to reduce carbon pollution, encourage adaptation and resiliency to climate change, foster clean technology, and create jobs. Through the Low Carbon Economy Fund, the federal government is also making a $2 billion investment to support mitigation action by provinces, territories, municipalities, businesses, as well as non-profit and Indigenous organizations. New actions outlined in the Pan Canadian Framework are listed below by sector.

Electricity

1. Increasing renewable and non-emitting energy sources
    - Accelerated phase out of Coal-fired Generation of Electricity units across Canada, by 2030.
    - Performance standards for natural gas-fired electricity generation.
    - Use of clean electricity across Canada, including through additional investments in research, development, and demonstration activities.
    - Connect clean power with places that need it.
    - Build new and enhanced transmission lines between and within provinces and territories.
2. Modernizing electricity systems
    - Support the demonstration and deployment of smart-grid technologies that help electric systems make better use of renewable energy.
    - Facilitate the integration of energy storage for renewables.
    - Help expand renewable power capacity.

[1] Pan-Canadian Framework on Clean Growth and Climate Change: http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf

3. Reducing reliance on diesel working with Indigenous Peoples and northern and remote communities
    - Improve the energy efficiency of diesel generating units.
    - Demonstrate and install hybrid or renewable energy systems.
    - Connect communities to electricity grids.

Built Environment

1. Making new buildings more energy efficient
    - Adopt increasingly stringent model building codes, starting in 2020, with the goal that provinces and territories adopt a "net-zero energy ready" model building code by 2030.
    - Continue federal investment in research, development, demonstration, and cooperation with industry to reduce technology costs over time.
2. Retrofitting existing buildings
    - Develop a model code for existing buildings by 2022, with the goal that provinces and territories adopt the code. This code will help guide energy efficiency improvements that can be made when renovating buildings.
    - Require labelling of building energy use by as early as 2019. Labelling will provide consumers and businesses with transparent information on energy performance.
    - Retrofit existing buildings by supporting energy efficiency improvements as well as fuel switching, where appropriate, and by accelerating the adoption of high-efficiency equipment.
3. Improving energy efficiency for appliances and equipment
    - Set new standards for heating equipment and other key technologies to the highest level of efficiency that is economically and technically achievable.
4. Supporting building codes and energy efficient housing in Indigenous communities
    - Collaborate with Indigenous Peoples as they move towards more efficient building standards and incorporate energy efficiency into their building-renovation programs.

Transportation

1. Setting emissions standards and improving efficiency
    - Continue to implement increasingly stringent standards for emissions from light-duty vehicles, including fuel-efficient tire standards, and to update emissions standards for heavy-duty vehicles.
    - Work to develop new requirements for heavy-duty trucks to install fuel-saving devices like aerodynamic add-ons.
    - Improve efficiency and support fuel switching in the rail, aviation, marine, and off-road sectors.
2. Putting more zero-emission vehicles on the road
    - Develop a Canada-wide strategy for zero-emission vehicles by 2018.
    - Accelerate demonstration and deployment of infrastructure to support zero-emission vehicles, such as electric-charging stations.
3. Shifting from higher- to lower-emitting modes and investing in infrastructure
    - Enhance investments in public-transit upgrades and expansions.
    - Invest in building more efficient trade and transportation corridors including investments in transportation hubs and ports.
    - Support refueling stations for alternative fuels for light- and heavy-duty vehicles, including natural gas, electricity, and hydrogen.

4. Using cleaner fuels
    - Develop a clean fuel standard to reduce emissions from fuels used in transportation, buildings and industry taking into account the unique circumstances of Indigenous Peoples and northern and remote communities.

Industry

1. Reducing methane and Hydrofluorocarbon (HFC) emissions
    - Achieve the objective of reducing methane emissions from the oil and gas sector, including offshore activities, by 40-45 percent by 2025.
    - Introduced proposed regulations to phase down use of HFCs.
2. Improving industrial energy efficiency
    - Help industries save energy and money, including by supporting them in adopting energy management systems.
3. Investing in technology
    - Continue to invest in research and development and to promote deployment of new technologies that help reduce emissions.
    - Identify demonstration projects for promising pre-commercial clean energy technologies required to reduce emissions from energy production and use in the Canadian economy, including in the oil and gas sector.

Forestry, agriculture, and waste

1. Increasing stored carbon
    - Protect and enhance carbon sinks, including in forests, wetlands, and agricultural lands (e.g. through land-use and conservation measures).
2. Increasing the use of wood for construction
    - Encourage the increased use of wood products in construction, including through updated building codes.
3. Generating bioenergy and bio-products
    - Identify opportunities to produce renewable fuels and bio-products, for example, generating renewable fuel from waste.
4. Advancing innovation
    - Enhance innovation to advance GHG efficient management practices in forestry and agriculture.

Government leadership

1. Setting ambitious targets
    - Demonstrate leadership through commitments to ambitious targets to reduce emissions from government operations.
    - The federal government is committed to reduce its own GHG emissions to 40 percent below 2005 levels, by 2030 or sooner.
2. Cutting emissions from government buildings and fleets
    - Scale up efforts to transition to highly efficient buildings and zero-emission vehicle fleets.
    - The federal government has set a goal of using 100 percent clean power by 2025.
3. Scaling up clean procurement
    - Modernize procurement practices.
    - Adopt clean energy and technologies.

- Prioritize opportunities to help Canadian businesses grow, demonstrate new technologies, and create jobs.

International leadership

1. Delivering on Canada's international climate-finance commitments
   - The federal government will deliver on its historic commitment of $2.65 billion by 2020 to help the poorest and most vulnerable countries mitigate and adapt to the adverse effects of climate change.
2. Acquiring internationally transferred mitigation outcomes
   - Continue to explore which types of tools related to the acquisition of internationally transferred mitigation outcomes may be beneficial to Canada.
   - Advance a robust approach to the implementation of article 6 of the Paris Agreement.
   - Ensure that allowances acquired through international-emissions trading are counted towards Canada's international target.
3. Engaging in trade and climate policy
   - Work with its international partners to ensure that trade rules support climate policy

Pan-Canadian Framework Pillar III: Adaptation

As recognized in the Paris Agreement, adapting, and building resilience, to climate change is also an important part of taking climate action. The federal government is making investments in this respect across a number of priority areas:

- Establishing a Canadian Centre for Climate Services to improve access to relevant climate science and information;
- Investing in climate-resilient infrastructure, including through the $2 billion Disaster Mitigation and Adaptation Fund;
- Implementing measures to mitigate the negative health impacts of climate change;
- Supporting vulnerable regions and populations, including the North and coastal regions, and Indigenous Peoples; and,
- Reducing hazards and disaster risks related to climate (e.g., floods and wildfires).

Pan-Canadian Framework Pillar IV: Clean Technology, Innovation and Jobs

- Developing and deploying clean technologies is an important part of the *Pan Canadian Framework*. Canada has historically performed well in research, but has had challenges commercializing discoveries. Clean technology innovation is affected by two distinct market failures: the knowledge spillover, and the environmental externality market failures.
- In January 2018, the Clean Growth Hub was launched to help clean tech firms access government programs and funds, as well as coordinate clean technology actions. New financing for clean technology firms has been made available through the Business Development Bank of Canada and Export Development Canada. Budget 2017 proposed funding of over $2.3 billion to support work in this area, including almost $1.4 billion in new financing for clean tech firms, and over $800 million to support research, development, demonstration and adoption of clean technologies.

Status of Implementation [2]

- Funding has been mobilized to support many of the new actions included in the Pan Canadian Framework, including significant transfers from federal to provincial and territorial governments, as well as to representatives of Indigenous Peoples and governments. New regulations to cut emissions have been drafted and consulted on, and new policies and programs to build resilience, support clean technologies and reduce emissions are being established and implemented in all jurisdictions. Governance, reporting and oversight structures have been established to track overall progress throughout Canada and ensure success. Actions that have been initiated are detailed below.

Carbon Pricing

- British Columbia, Alberta and Quebec already have a carbon pricing system in place.
- Canada also released the Technical Paper on the Proposed Federal Carbon Pricing Backstop for public comment and published additional guidance on the pan-Canadian carbon pollution pricing.

Mitigation

Electricity

Implemented

- The federal government published draft regulations for the accelerated phase-out of coal-fired power by 2030, as well as natural gas fired electricity performance standards. Preliminary discussions are underway between federal and provincial governments on equivalency.

Funded

- The federal government committed $200 million to deploy emerging renewable energy technologies, and $100 million for smart grid deployment and demonstration.

Built Environment

Implemented

- Federal, provincial, and territorial governments are working together to develop a common framework and online tool for measuring and sharing energy use data.
- The federal government amended the Energy Efficiency Regulations, updating efficiency standards for 37 product categories.

Funded

- The federal government allocated $99 million to develop net-zero energy ready building codes, including funding for RD&D projects, and $82.5 million to support energy benchmarking, standards and labelling.

[2] First Annual Synthesis Report on the Status of Implementation: https://www.canada.ca/content/dam/themes/environment/weather/climatechange/PCF-FirstSynthesis_ENG.pdf

Underway

- Federal, provincial, and territorial Energy and Mines Ministers released a strategy that sets energy performance goals for windows, space and water heating. Roadmaps will be developed for these goals in 2018.

Transportation

Implemented

- The federal government continues to implement emissions standards for new light- and heavy-duty vehicles.

Funded

- The federal government has made significant investments for transportation initiatives, such as in fuel-efficient tire standards, freight best practices, and the National Trade Corridors Fund (NTCF) for infrastructure to help reduce congestion and idling.
- The federal government allocated $62.5 million in Budget 2016 (Phase 1) and $120 million in Budget 2017 (Phase 2) to support the deployment, demonstration, and development of enabling codes and standards for recharging and alternative fuels infrastructure.

Underway

- Canada is also taking action to improve efficiency and support fuel switching in the rail, aviation and marine sectors. This includes voluntary action plans to reduce GHG emissions and increase engine efficiency in the rail and aviation sectors.
- Canada is also working to reduce aviation-related emissions by implementing the internationally agreed carbon dioxide (CO_2) standard.
- A Federal-Provincial-Territorial Steering Group is overseeing the development of a Canada-wide strategy for zero-emission vehicles (ZEVs).
- The federal government published a discussion paper to inform development of a clean fuel standard to reduce emissions from fuels used in transportation, buildings and industry.

Industry

Implemented

- The federal government published regulations to reduce methane emissions from the oil and gas sector, based on close collaboration with provincial and territorial governments on the approach. The federal government has also published regulations on the phase down of hydrofluorocarbons (HFCs).

Funded

- The federal government is investing $50 million in oil and gas sector technologies to reduce GHG emissions, including a $10 million investment in the Alberta Carbon Conversion Technology Centre.

Forestry, agriculture and waste

Funded

- The Low Carbon Economy Fund announced by the federal government supports new and expanded provincial and territorial actions to reduce GHG emissions, including through enhanced carbon storage in forests and agricultural soils.
- Federal, provincial, and territorial governments have made significant investments to increase the use of wood in construction. The federal government is investing $39.8 million over four years in the Green Construction through Wood Program.
- Action has been taken to bring cleaner bioenergy to communities that rely on fossil fuels, including through federal investments of $55 million in support of bioheating as part of the federal Promoting Clean Energy for Remote Communities program.
- The federal government has committed to invest in research and innovation to support the agriculture industry, including $70 million for science and innovation with a focus on climate change and soil and water conservation, funding for the adoption of clean technology by Canadian agricultural producers, $27 million for innovative projects to help farmers mitigate GHG emissions and $2.35 million to attract youth to green jobs within the agriculture and agri-food sector.

Government leadership

- The federal government has committed to reducing its GHG emissions by 40% by 2030, or earlier. Public reporting in July 2017 showed that federal GHG emissions decreased by 19% between 2005-06 and 2014-15.

Funded

- The federal government is investing in actions to reduce its emissions, including $1 billion to modernize heating and cooling plants in the National Capital Region, and $29.7 million for technical support to help federal organizations cut GHG emissions from their buildings and fleets.
- The Government of Canada allocated $29.7 million to offer services supporting greening government operations.

International leadership

- Canada is taking an innovative approach to mobilizing private sector financing and partnering with multilateral development banks to help remove barriers to private investment. In 2017, Canada announced the $200 million second phase of the Canadian Climate Fund for the Private Sector in Asia, administered by the Asian Development Bank.

Adaptation and climate resilience

- The federal government has announced funding and is working with partners to develop the Canadian Centre for Climate Services. The Centre will provide authoritative climate information, data and tools to support adaptation decision-making in Canada.
- The federal government has launched and is working with provinces and territories to develop the Building Regional Adaptation Capacity and Expertise (BRACE) program. It will equip decision-makers

with regionally specific knowledge and information, and provide training and capacity building activities that will enable them to apply available tools and information to take action to adapt to climate change.

- The federal government has launched the Investing in Canada Plan, which will provide $9.2 billion to provinces and territories through Integrated Bilateral Agreements, including projects supporting adaptation and resilience; and $2 billion through the Disaster Mitigation and Adaptation Fund.

Clean technology, innovation and jobs

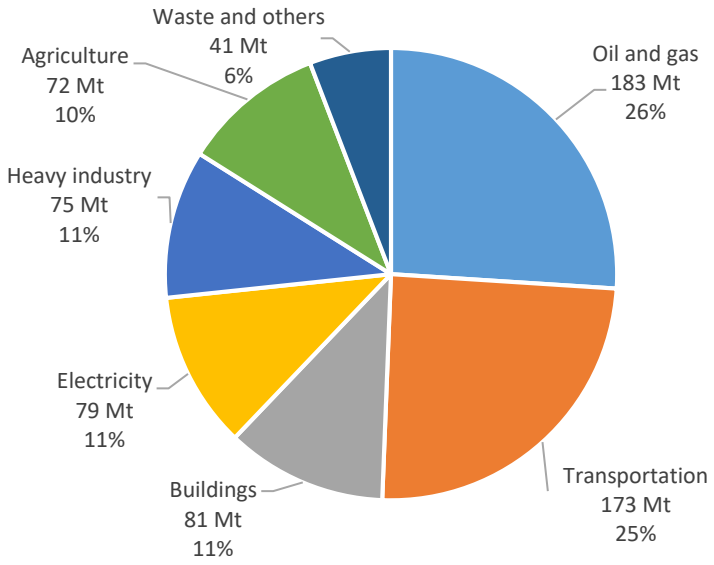
- Federal, provincial, and territorial governments are supporting new approaches to early-stage technology development to advance research in areas that have the potential to substantially reduce GHG emissions and other pollutants. For example, the new Clean Growth Hub announced through Budget 2017 will support several clean technology actions across all stages of the innovation spectrum, including at the early-stage technology development.
- The federal government is preparing to launch Innovative Solutions Canada, a new innovation procurement program announced in Budget 2017. This program seeks novel solutions to challenges issued by federal departments and agencies, which could include enhancing clean technology innovation.

Annex III – Benchmarking Canada's GHG Emissions and Policy Actions

Canada's GHG Emissions

In 2016, Canada emitted 704 million tonnes of carbon dioxide equivalent (Mt $C0_2e$). The largest contribution to emissions was from the oil and gas sector (see Figure 1), which accounted for 26% followed closely by transportation at 25%. Buildings, electricity generation, heavy industry and agriculture each contribute a further 10-11% of Canada's emissions.

Figure 1: Greenhouse Gas Emissions by Canadian Economic Sector (Mt C02e), 2016



Source: ECCC

Canada has committed to reducing its annual emissions to 30% below 2005 by 2030, estimated at 517 Mt $C0_2e$. To estimate progress, Environment and Climate Change Canada (ECCC) prepared projections for Canada's 7th National Communication and 3rd Biennial Report, published in 2017. Canada has also developed a Mid-Century Strategy which illustrates a potential Paris-aligned scenario with emissions at 80% below 2005 by 2050, estimated at 148 Mt $C0_2e$.

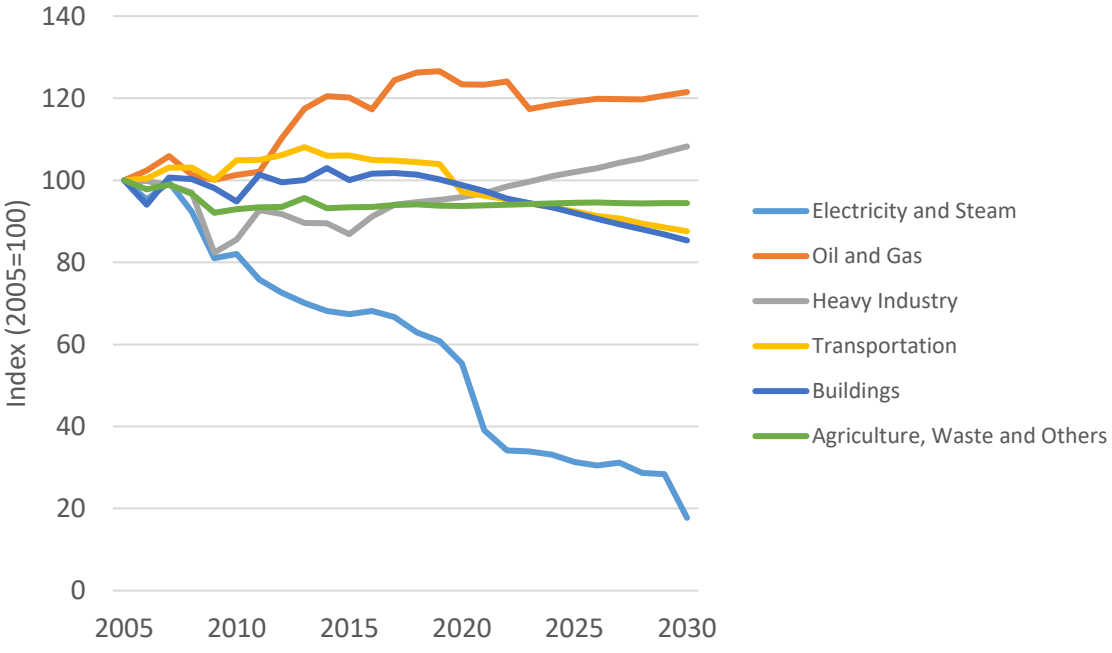
The 'with measures' scenario includes actions taken by governments, consumers and businesses put in place up to September 2017. The 'additional measures' scenario includes additional policies and measures that are under development but have not yet been fully implemented, some of which were announced as part of the Pan-Canadian Framework (e.g., pan-Canadian carbon pricing).

The additional measures scenario includes measures such as the federal backstop carbon pricing, the clean fuel standard, the accelerated coal phase-out by 2030, strategic interconnections in electricity, emerging renewables and smart grids, net-zero energy ready building codes by 2030, post-2025 light-duty vehicle regulations, and Western Climate Initiative credit purchases by Ontario and Quebec.

In the additional measures scenario, emissions are expected to have varying pathways among Canada's various sectors subject to key drivers and policy actions (see Figure 2). Electricity sector GHG emissions are expected to decline substantially from 2005 levels as coal-powered electricity generation is phased out. Other sectors

are expected to decline slightly through 2030, with the exception of oil and gas and heavy industry. The oil and gas industry is expected to have GHG emissions that are 22% higher in 2030 over 2005.

Figure 2 – Sectoral GHG Emissions Indexed to 2005 in the Additional Measures Scenario



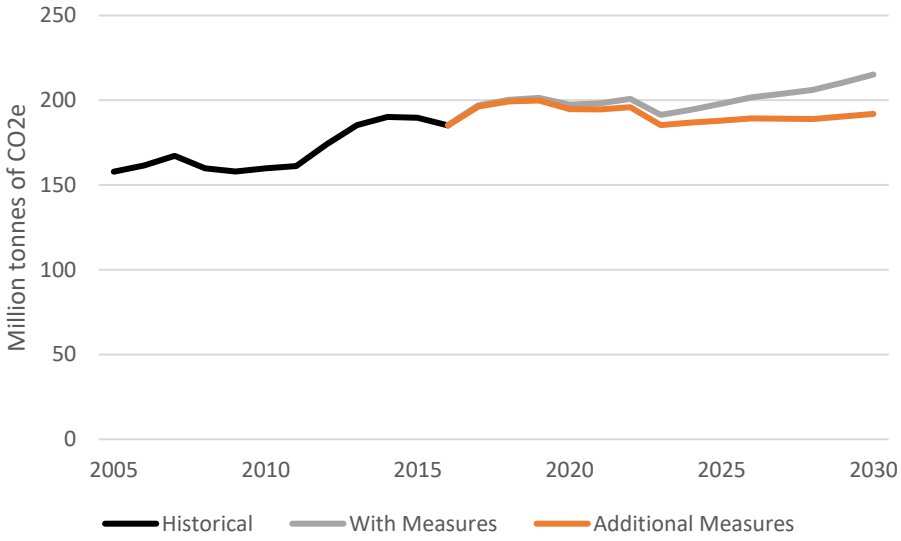
Source: ECCC

Oil and Gas

In 2016, the oil and gas sector produced the largest share of GHG emissions in Canada (26%). Since 2005, GHG emissions in the oil and gas sector has increased as a result of growth in production and evolving technologies in oil sands operations. Government actions, such as regulations on methane emissions in the upstream oil and gas sector, will constrain increases in emissions.

Canada's oil and gas sector emitted 158 Mt of GHGs in 2005, which is expected by ECCC to grow to 215 Mt by 2030 in the 'with measures' scenario, and to 192 Mt by 2030 in the 'additional measures' scenario (see Figure 3). In general, extracting oil from oil sands via an *in situ* method is more emissions-intensive than oil sands mining. The overall emissions intensity has been decreasing over time, with increasingly energy efficient *in situ* operations and flat energy intensity in oil sands mining operations. Production growth is the driving factor in historical and future emission trends in the sector. The increase in emissions going forward is tempered by reductions in emissions intensity as new production is more efficient than legacy production.

Figure 3 – Oil and Gas GHG Emissions



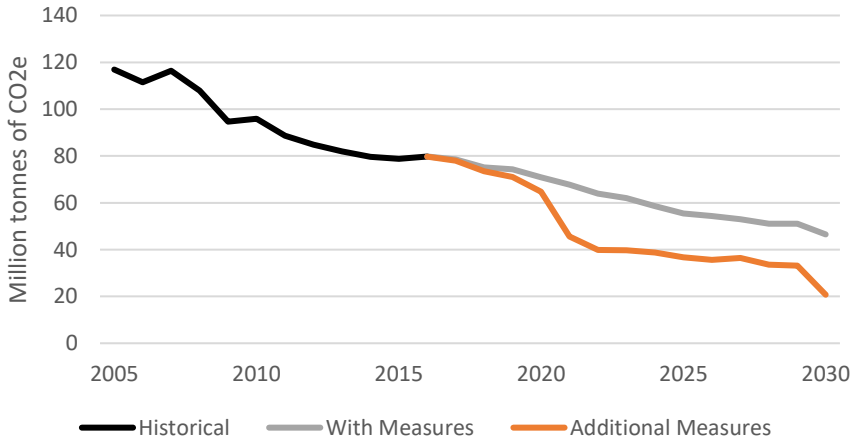
Source: ECCC

Electricity

Since 2005, electricity sector emissions have fallen an average of 4% per year, the fastest of any sector in Canada (see Figure 4). A significant proportion of this decline reflects the closure of coal-fired units and their replacement with lower or non-emitting sources. The mix of sources of energy used to generate electricity vary considerably across the country, depending on regional features such as the availability of hydropower, transmission interconnections, and access to natural gas.

The downward trend in emissions from the electricity sector is expected to continue over the next decade as coal-fired generation continues to be phased out and is replaced by lower and non-emitting sources. Emissions are expected to decline from 79 Mt in 2015 to 46 Mt by 2030 in the 'with measures' scenario and to 21 Mt by 2030 in the 'additional measures' scenario.

Figure 4 – Electricity GHG Emissions



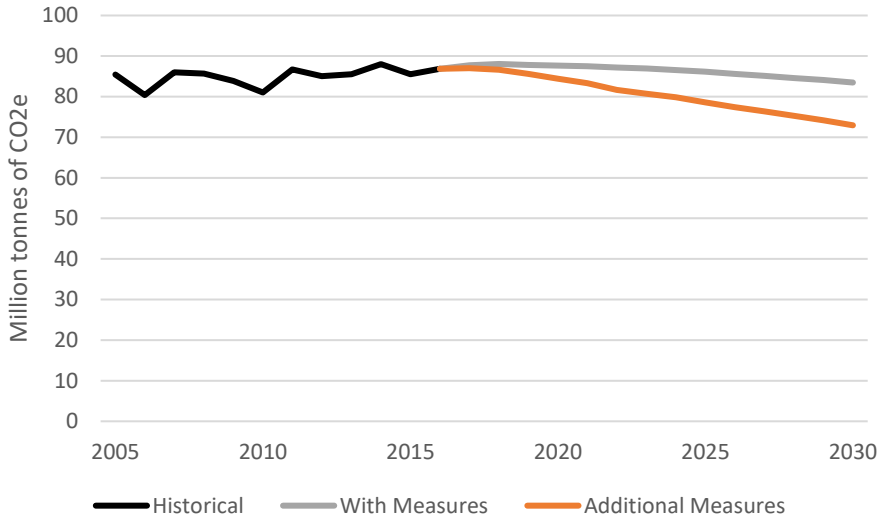
Source: ECCC

Buildings

Over the past decade, emissions from Canada's buildings sector has remained relatively stable despite a growing population and increased building stock. Emissions are expected to decline gradually as projected energy efficiency improvements more than offset continued growth in the building stock (see Figure 5).

Emissions from residential buildings are expected to decline from 45 Mt in 2015 to 42 Mt in 2030 in the 'with measures' scenario, and to 36 Mt in the 'additional measures' scenario. Similarly, emissions from commercial buildings are expected to remain relatively stable at 41 Mt between 2015 and 2030 in the 'with measures' scenario, and decline to 37 Mt in the 'additional measures' scenario.

Figure 5 – Buildings GHG Emissions

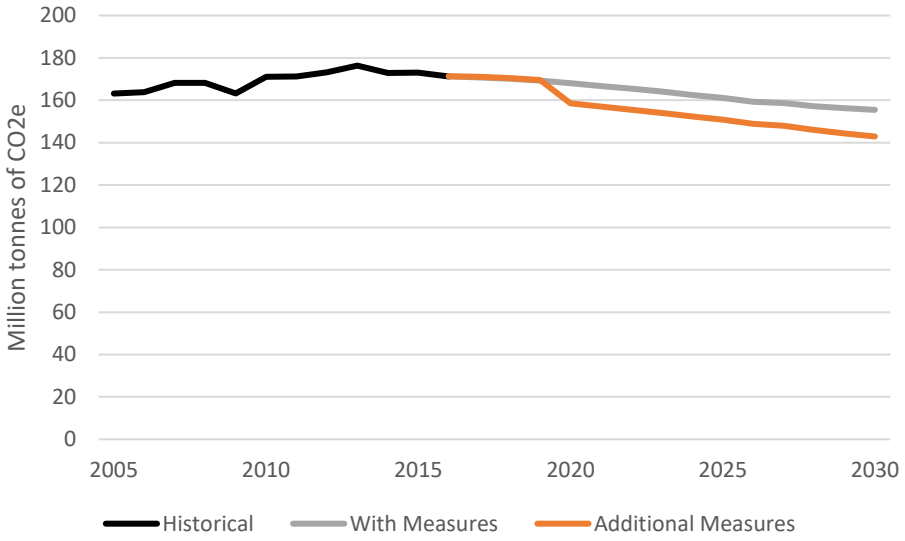


Source: ECCC

Transportation

In 2016, transportation was the second largest contributor to Canada's GHG emissions (24%). Emissions in this sector have increased throughout the historical period due to strong economic growth and low oil prices that influenced the fleet composition and use (e.g. market share shifting from cars to trucks). As the mandated energy efficiency of light and heavy duty vehicles become more stringent, overall emissions are expected to decline (see Figure 6), however this is offset by increases in freight transport activity. Total transportation emissions are expected to decline from 173 Mt in 2015 to 155 Mt in the 'with measures' scenario, and to 143 Mt in the 'additional measures' scenario.

Figure 6 – Transportation GHG Emissions



Source: ECCC

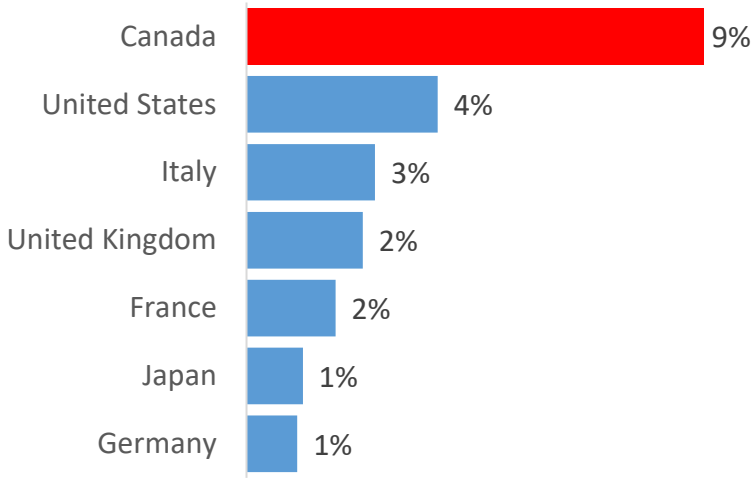
Composition of Canadian Economy

Among the countries in the Organization for Economic Co-operation and Development (OECD), Canada has the eleventh largest economy and a higher contribution to GDP than most from natural resources. In 2017, the agriculture, forestry, fishing and hunting sectors contributed 2% to Canada's GDP, while mining, quarrying, and oil and gas extraction contributed 9% to Canada's GDP (see Figure 7). Between 2015 and 2017, natural resource related sectors were responsible for 42% of Canada's exports by value.

Canada is a substantial supplier to the world of natural resources, especially fossil fuels. Canada was the fourth largest producer of crude oil in 2015, accounting for 5% of global production, and the fifth largest producer of natural gas, also accounting for 5% of global production. Similarly, Canada was the second largest producer of uranium in 2015, accounting for 22% of global production.

According to data from the World Bank, Canada has the largest proportion of GDP from natural resources among G7 countries (see Figure 7). Among other OECD countries, only Chile, Norway, Australia and Mexico have a higher share of GDP from natural resources then Canada.

Figure 7 – Natural Resources (% of GDP)



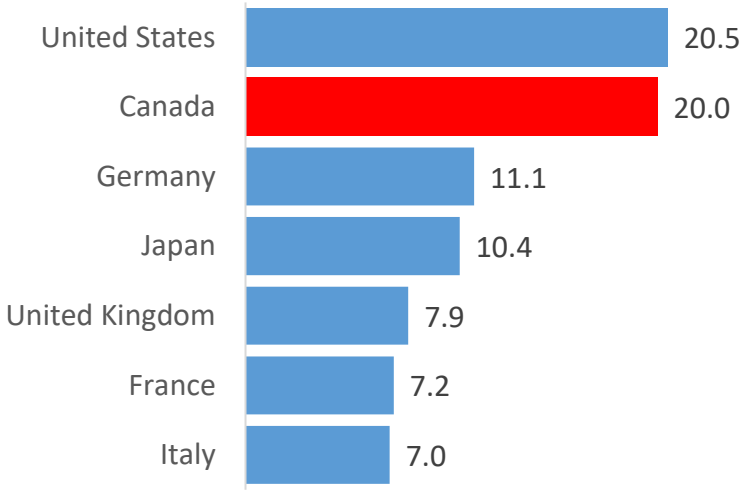
Source: OECD

Emissions Intensity

Besides the United States, which produces more oil and gas than Canada, all other G7 countries are only negligible producers of fossil fuels, while remaining significant consumers. Furthermore, Canada is a large country with low population density in a cold climate, leading to relatively high transportation and space heating requirements. As a result, according to the OECD, Canada is the fourth largest emitter of greenhouse gases (GHGs) in the OECD as well as one of the most carbon-intensive economies.

In 2015, Canada emitted 20 tonnes of CO_2e per capita, the third highest among OECD countries, and second highest among G7 countries (see Figure 8). Only the United States and Australia were higher per capita emitters among OECD countries. Canada's performance was approximately two thirds higher than the OECD average of 12.1 tonnes per capita.

Figure 8 – GHG emissions per capita in G7 countries, 2015



Source: OECD

Within Canada, there is a high degree of variation among provinces, with Saskatchewan emitting 66 tonnes of GHGs per capita and Quebec emitting 9 tonnes of GHGs per capita (see Table 1).

Table 1 – GHG emissions per capita, by province, 2016

Province	Tonnes of CO_2e/capita
Saskatchewan	66.6
Alberta	62.2
Northwest Territories	35.9
Newfoundland and Labrador	20.4
New Brunswick	20.2
Nunavut	18.9
Nova Scotia	16.5
Manitoba	15.9
British Columbia	12.7
Prince Edward Island	12.1
Yukon	10.6
Ontario	11.5
Quebec	9.3

Source: StatsCan

Electricity

Due to substantial hydroelectric resources, Canada has one of the lowest carbon content electricity grids in the G7 at an 18% share. Only France, with its large share on nuclear electricity has a lower carbon content (see Table 2). All other G7 countries have shares of fossil fuel generation in the electricity grid of more than three times Canada's.

Table 2 – Share of electricity generation by fuel and country, 2017

Country	Combustible Fuels	Nuclear	Hydro	Wind/Solar/Other
Canada	18%	15%	61%	6%
France	10%	72%	12%	6%
Germany	64%	13%	4%	19%
Italy	68%	0%	15%	17%
Japan	85%	1%	9%	5%
United Kingdom	62%	20%	3%	15%
United States	66%	20%	7%	7%

Source: International Energy Agency

The average emissions intensity of Canada's electricity is 150 grams of CO_2 per kilowatt-hour, with 10% of generation from coal, 7% of generation from natural gas, 2% of generation from other fuels, and 82% from non-emitting sources (see Table 3). However, the emissions intensity of provincial electricity systems vary significantly. Provinces with substantial hydropower resources have lower emissions intensities, while provinces that rely on coal generation have higher emissions intensities. Alberta has an emissions intensity of 900 grams of CO_2 per kilowatt-hour, with 62% of electricity generation from coal, while Quebec has an emissions intensity of 2 grams of CO_2 per kilowatt-hour, sourcing nearly all generation from hydropower. Emission intensities, especially those in provinces with high shares of coal generation today, are expected to decline over time as coal is phased out by 2030.

Table 3 – Electricity Emissions Intensity and Generation Share, by province, 2016

		Emitting			Non-emitting		
Province	*g CO_2 eq / kWh*	Coal	Natural Gas	Other fuels[1]	Nuclear	Hydro	Other[2]
Alberta	*900*	61.7%	25.0%	0.7%	0.0%	3.6%	8.6%
Nunavut	*760*	0.0%	0.0%	100%	0.0%	0.0%	0.0%
Saskatchewan	*730*	49.4%	33.8%	0.0%	0.0%	13.5%	3.0%
Nova Scotia	*690*	49.6%	12.8%	18.2%	0.0%	8.9%	10.7%
New Brunswick	*350*	14.8%	16.1%	10.8%	31.1%	21.4%	5.9%
Prince Edward Island*	*350*	-	-	-	-	-	-
Northwest Territories	*220*	0.0%	4.0%	23.4%	0.0%	72.5%	0.1%
Canada	***150***	**9.9%**	**7.0%**	**1.5%**	**16.2%**	**60.1%**	**5.3%**
Yukon	*50*	0.0%	0.0%	5.3%	0%	94.5%	0.1%
Ontario	*40*	0.0%	8.3%	0.6%	59.5%	22.8%	8.8%
Newfoundland and Labrador	*40*	0.0%	0.0%	4.4%	0.0%	95.1%	0.5%
British Columbia	*12*	0.0%	1.8%	0.9%	0.0%	95.6%	1.8%
Manitoba	*2*	0.1%	0.0%	0.0%	0.0%	97.5%	2.4%
Quebec	*2*	0.0%	0.0%	0.7%	0.0%	95.5%	3.8%

Source: National Inventory Report, Environment and Climate Change Canada

* Limited data as PEI imports most electricity from New Brunswick.

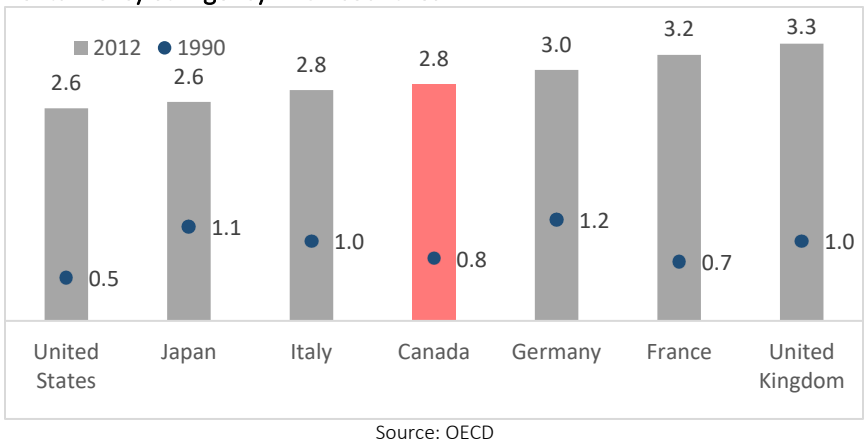
[1] Includes GHG emissions from the combustion of refined petroleum products, petroleum coke, still gas and other fuels

[2] Includes wind, tidal and solar.

Environmental Policies Around the World

The OECD has developed the environmental policy stringency indicator to illustrate the aggregate stringency of a country's environmental policies across different sectors and policy instruments. According to this indicator, environmental policies across the world have generally become more stringent over time, with Canada in the middle of the pack among G7 countries (see Figure 9). The indicator is scored on a 0 to 6 scale, and a higher value represents more stringent policies. The policies covered are environmentally-related taxes, subsidies, performance standards, and information on deposit and refund schemes.

Figure 9: Environmental Policy Stringency in G7 countries



Source: OECD

In December 2015 at COP 21, 196 state parties signed the Paris Agreement. The Parties agreed to combat climate change and to accelerate the actions needed for a sustainable low-carbon economy. The Paris Agreement's central aim is to limit global temperature rise this century by below 2°C, and to pursue efforts to limit the temperature increase to 1.5°C. To date, 180 Parties have ratified the Paris Agreement.

According to the London School of Economics, there are currently 1500 climate laws and policies globally, compared to 72 in 1997. Between 2009 and 2015, 100 to 143 new climate laws were passed each year. This number fell to 64 new laws or policies in 2016 and to 36 in 2017. Since the Paris Agreement, 106 climate laws and policies have been passed. All 197 Parties to the Convention now have at least one law or policy on climate change.[1]

Carbon Pricing

As of July 2018, three Canadian provinces (Alberta, British Columbia and Québec) have carbon pricing systems in place.

As part of the Pan-Canadian Framework (PCF) on Clean Growth and Climate Change, the federal government published an approach to carbon pricing to ensure that carbon pricing applies to a broad set of emission sources throughout Canada with increasing stringency over time, starting at $10 per tonne of carbon dioxide equivalent (CO_2e) emissions in 2018 and rising to $50 per tonne in 2022. This standard – or benchmark – provides provinces and territories with flexibility to implement their own carbon pollution pricing systems. The federal government also developed a carbon pricing "backstop" system, which will apply in 2019, in provinces or territories that either request it or that do not have a system in place that meets the federal benchmark.

The backstop consists of a carbon price that is payable by fuel producers or distributors, and an output-based pricing system (OBPS). The OBPS is a form of an emissions trading system, and allows firms to buy and sell emissions credits in order to meet their targets.

Companies

According to the Carbon Disclosure Project in late 2017, over 600 companies have put an internal price on carbon not only as a risk mitigation tool, but to help reveal carbon-related opportunities into financial terms. Nearly another 800 companies have plans to incorporate an internal price on carbon in the next two years. The sum of these numbers represents an 11% increase from 2016.

Other Jurisdictions

Globally, forty-five national and twenty-five subnational jurisdictions have implemented or are planning to implement a carbon pricing initiative (see Table 4). These initiatives would cover around 20% of global greenhouse gas (GHG) emissions, a 5% increase from 2017. This expanded coverage is primarily due to China's commitment to a national ETS.

Table 4 – Carbon pricing in select jurisdictions

[1] The London School of Economics and Political Science. (2018). *Global trends in climate change legislation and litigation: 2018 snapshot.*

Country	Type of Carbon Price	Other Details
Canada	Cap-and-trade or Carbon tax	In October 2016, the federal government published a pan-Canadian approach to carbon pricing to ensure that carbon pricing applies to a broad set of emission sources throughout Canada with increasing stringency over time, starting at $10 per tonne of carbon dioxide equivalent (CO_2e) emissions in 2018 and rising to $50 per tonne in 2022.
Argentina	Carbon tax: US$10/$tCO_2$ eq	The tax was adopted in December 2017. Starting in January 2019, the full tax rate will apply to most liquid fuels.
Australia	Emissions reduction fund (ERF)	Since 2015, the ERF has funded 438 projects at a cost of A$2.28 billion. Australia repealed its carbon tax in July 2014.
Brazil	Under consideration	Brazil is considering implementing an ETS or a carbon tax.
China	Cap-and-trade	The power sector will be the first sector required to participate in the program starting in 2019.
European Union	ETS	The EU set up the world's first international emissions trading system in 2005. Phase 4 (2021-2030) was approved in February 2018, and seeks to increase the pace of annual reductions in allowances to 2.2% by 2021.
France	Carbon tax: US$55/$tCO_2$ eq	Projected to increase by US$13 every year for the next four years.
Germany	EU's ETS	The Environment Minister is considering a national price on carbon emissions that are not covered under the EU ETS.
India	Carbon tax	India introduced a coal tax in 2010, which is now US$8/$tCO_2$ eq.
Indonesia	Regional carbon taxes	Regional taxes are imposed on transport fuels. The Automotive Fuel Tax is levied at an ad valorem rate of 5%.
Italy	EU's ETS	Italy is only covered by the EU ETS.
Japan	Cap-and-trade	Implemented in 2010, the Tokyo cap-and-trade program is Japan's first and only mandatory ETS.
Mexico	ETS	The ETS was launched in December 2017 and will operate in a pilot phase for 36 months. Official implementation is expected in 2022.
Russia	Specific taxes on energy use	Russia does not have an explicit carbon tax or ETS.
Saudi Arabia	-	Currently, there are no plans for implementing an ETS or carbon tax.
South Africa	Carbon tax	The government is planning to introduce the tax in January 2019.
South Korea	Cap-and-trade	Introduced in January 2015, the ETS covers 69% of national GHG emissions.

Turkey	Carbon tax	Taxes price 68% of carbon emissions from energy use. Tax rates vary across sectors.
United Kingdom	EU's ETS	The UK's participation in the EU's ETS after 2019 will depend on Brexit negotiations.
United States	-	There is no national carbon pricing system. States and cities have implemented initiatives, such as: United States Climate Alliance, Carbon Costs Coalition, and ETSs in California and Massachusetts.

Annex IV – Benchmarking Sustainable Finance in Canada

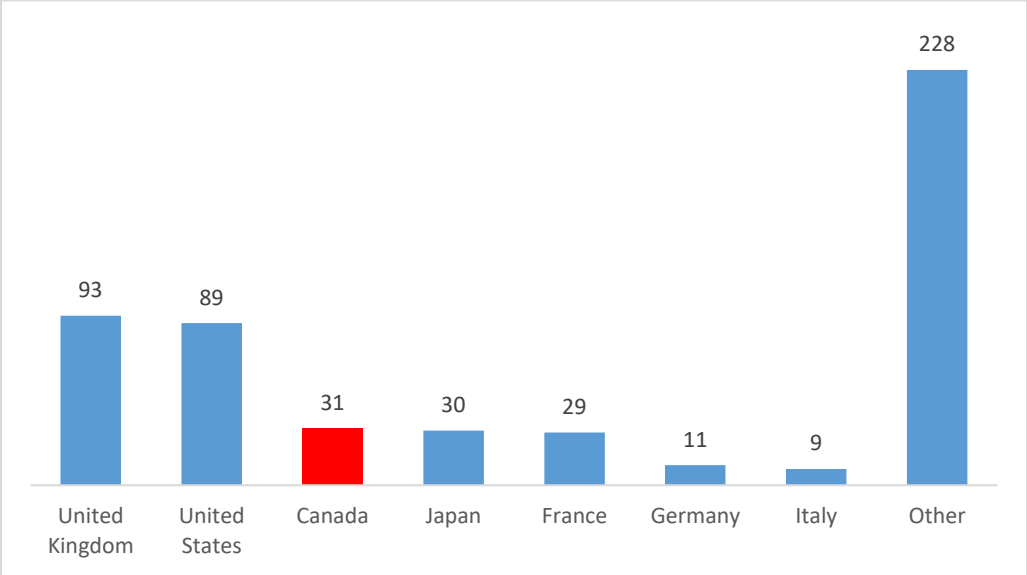
While there is no single measure that represents a country's progress on sustainable finance, a broad set of indicators can be useful for assessing the growth of sustainable finance in Canada and cross-country comparision to our international peers. Although available metrics are not directly comparable across countries, together they provide broad perspective of the state of sustainable finance in Canada. In this spirit, a dashboard of key sustainable finance indicators is presented below to help take stock of Canada's successes and to highlight where more work may be needed. Key benchmarks reviewed here include:

- Engagement on climate-risk disclosures
- Clean energy investment
- Responsible investment
- Green Loans
- Public Firms' Exposures to Green Revenues
- Green bond issuance

Climate Risk Disclosures

The Canadian financial sector has been relatively active in supporting greater climate-related risk disclosure. Canada's five largest banks and six of Canada's eight largest pension funds have officially announced their support for the TCFD. In addition, the Canada Pension Plan Investment Board was represented on the TCFD itself[1], while two of Canada's large banks are working with UNEP FI and a network of global banks to pilot the TCFD's recommendations[2]. Highlighting domestic support for the initiative, Canada ranks third among countries in terms of organizations that have officially announced their support for the TCFD (Figure 1).

Figure 1 – Official TCFD Supporters by Country

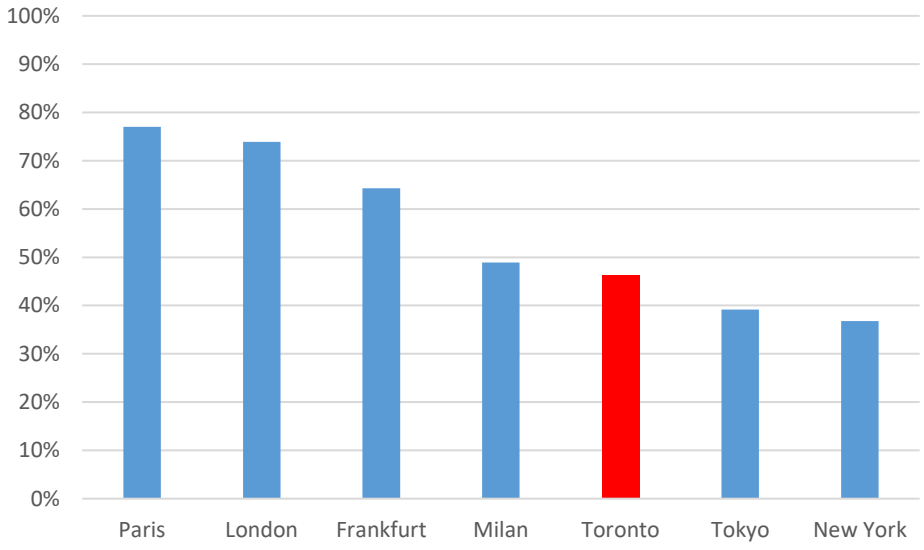


Source: Task Force on Climate-related Financial Disclosures, as of September 26, 2018

[1] Source: Task Force on Climate-related Financial Disclosures. https://www.fsb-tcfd.org/about/#
[2] Source: UNEP FI. http://www.unepfi.org/banking/tcfd/

Corporate Knights also publishes an annual report assessing the disclosure of sustainability-related information by companies listed on the world's main stock exchanges. A key metric they publish measures the extent to which companies disclose seven of the most widely tracked quantitative sustainability indicators. Based on this indicator, companies listed on the Toronto Stock Exchange ranked 26th out of 55 stock exchanges assessed by Corporate Knights in 2017, and 5th among exchanges located in G7 financial centres (Figure 2).

Figure 2 – Corporate Knights Disclosure Score for G7 Stock Exchanges



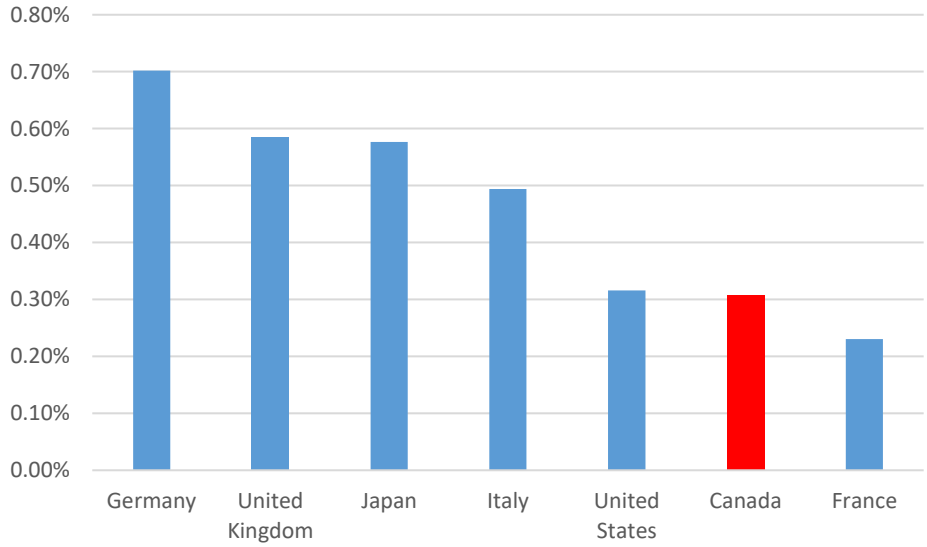
Source: Corporate Knights 2017 – Measuring Sustainability Disclosure.

Clean Energy Investment

This indicator shows the degree to which countries are investing in the kinds of energy solutions that will be required for the transition to a LCE. "Clean energy" in this context includes wind, solar, biofuels, energy smart technologies to increase energy efficiency, and other renewable sources like geothermal and certain hydro projects.

The data in Figure 3 shows that while average clean energy investment in Canada has broadly kept pace with the US since 2010, both countries have generally trailed their European G7 counterparts. Of note, while France scores at the bottom of this list, most electricity production in France is sourced from nuclear power facilities that do not substantially contribute to climate change, but nevertheless do not meet the definition of "clean energy" used here.

Figure 3 – Clean Energy Investment as a Share of GDP (Average: 2010 - 2017)



Sources: Bloomberg New Energy Finance (BNEF), IMF, Finance Canada Calculations

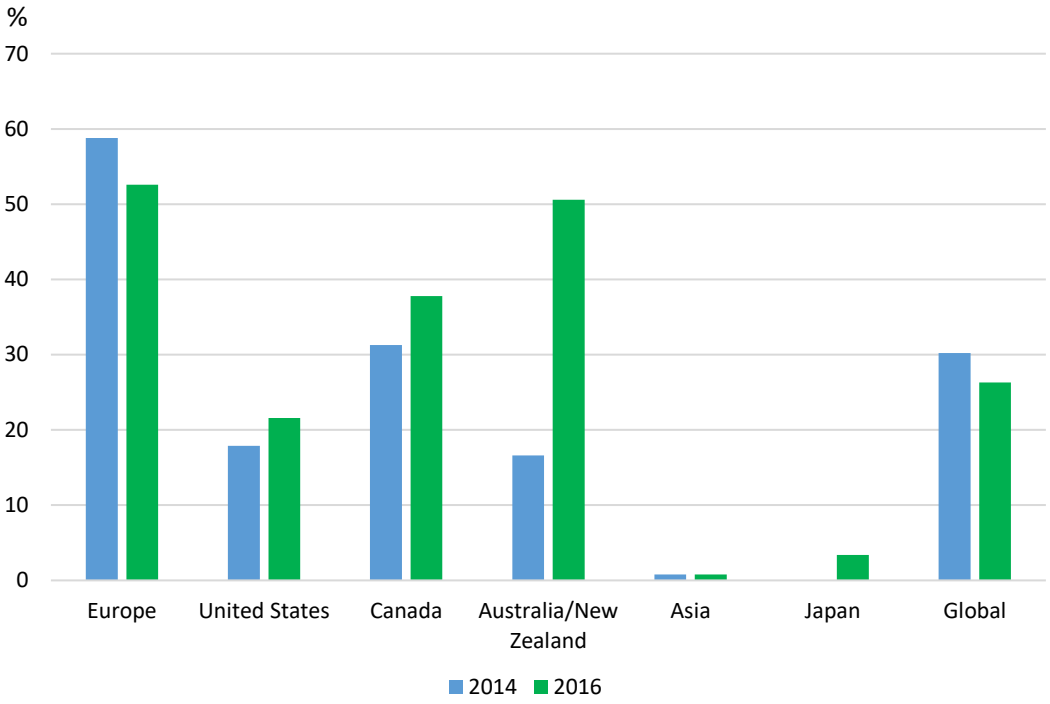
Responsible Investment

The United Nations' Principles for Responsible Investment (PRI) define responsible investment (RI) as an approach to investing that aims to incorporate ESG factors into investment decisions, to better manage risk and generate sustainable, long-term returns.

This approach has grown substantially in popularity over the recent past, from covering 31% of total assets under management (AUM) in Canada in 2014 to 38% in 2016 (Figure 4). Increasing adoption of RI practices by pension funds was the main driver of the rise over this period, accounting for over three-quarters of the increase in AUM.

Canada's adoption of RI practices compares favourably to the US and the global average, but remains below the elevated adoption rates observed in Europe.

Figure 4 – Proportion of RI Assets Under Management Relative to Total Managed Assets



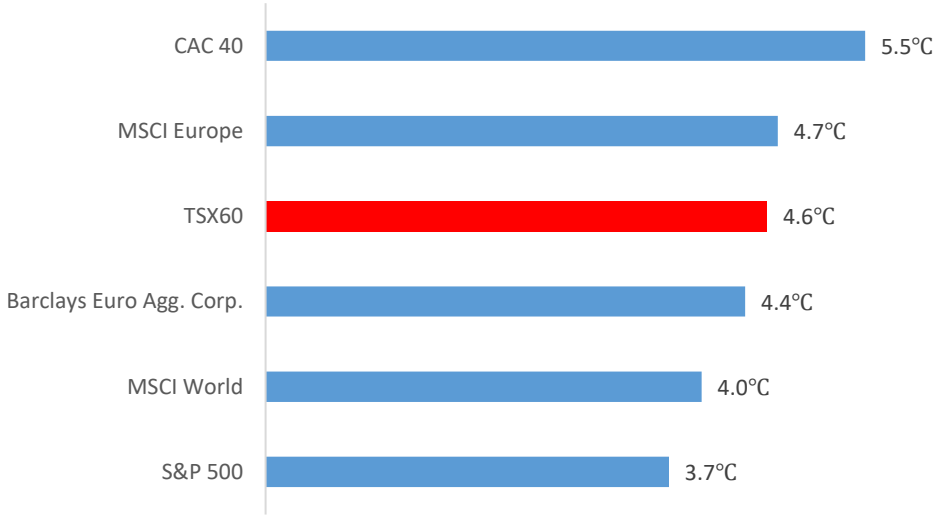
Source: Global Sustainable Investment Alliance

Mirova developed a method to evaluate the coherence of a portfolio with different climate change scenarios using a novel approach that focuses on both "induced" and "avoided" emissions over the lifecycle of a company's products.

A company's induced emissions do not necessarily take into account any of the climate benefits of their products. For example, a company which manufactures cosmetics might have the same induced emissions as a company that manufactures wind turbines. If only "induced" emissions are considered, the cosmetics company and the turbine manufacturer would appear comparable in terms of climate impacts, whereas the turbine manufacturer actually contributes to decarbonisation objectives and the energy transition. To account for these positive climate contributions, Mirova also estimated "avoided" emissions relative to an adaptable, baseline IEA scenario.

Estimates by Mirova indicate that most large indices are usually compatible with scenarios that imply a 3.5-5.5°C increase in average global temperatures, with fossil fuel-heavy indices tending towards a 5-6°C scenario (see Figure 5). Mirova estimates that the TSX60 is consistent with a 4.6°C scenario, making it relatively carbon intensive.

Figure 5 – Mirova's Indices Alignment to Climate Scenarios

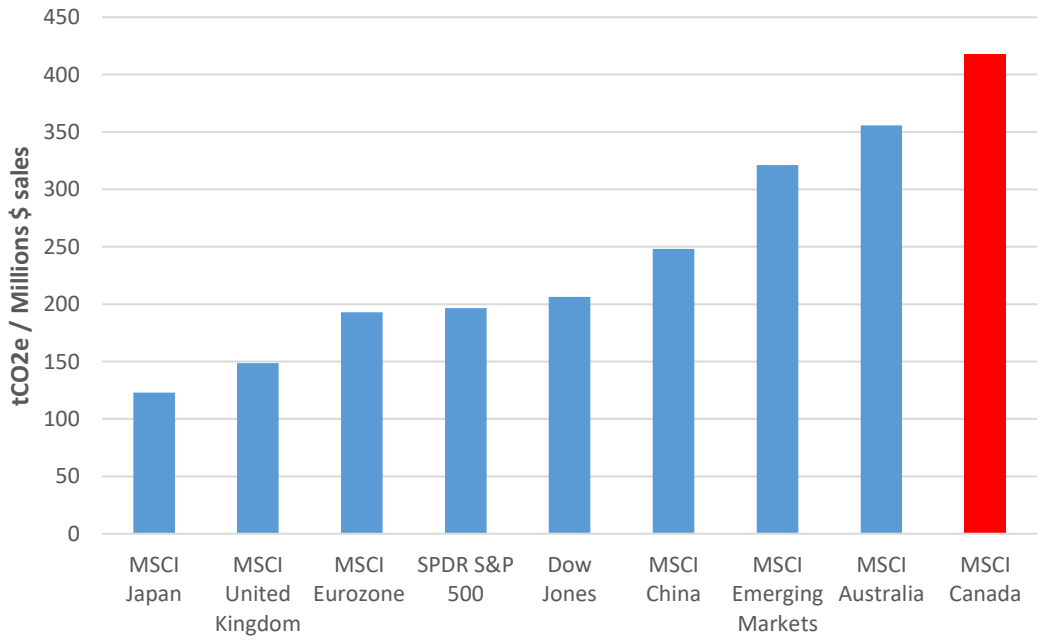


Source: Mirova

BlackRock also provides a measure of the carbon intensity of exchange-traded funds (ETFs), measured in tonnes of CO2 equivalent per by millions of dollars of sales.

Looking at the MSCI Canada index, BlackRock found it to have a higher carbon intensity than most other ETFs they evaluated, due in part to the prevalence of energy and resource sector firms in the Canadian fund (see Figure 6). Australia, a similar resource-based economy, has a slightly lower carbon intensity than that of Canada. There are, however, important limits to direct comparisons between ETFs. The Weighted Average Carbon Intensity can change rapidly based on new data and emissions reported.

Figure 6 – Carbon Content of Exchange Traded Funds



Source: ETF.com (retrieved July 3, 2018)

Green Loans

Information on banks' lending for environmentally beneficial activities is not always made public. Nevertheless, some banks do voluntarily disclose data in this area. Analyzing such disclosures by both Canadian and international banks, Corporate Knights estimates that revenues from "clean" lending activities generated only a small fraction of banks' total revenues in 2017 (See Table 1).[3]

Comparing across countries, the analysis indicates that Canadian banks performed broadly in line with their international counterparts, but trail international leaders in sustainable finance by a substantial margin. A simple average of Canadian banks' revenue shares puts them around the middle of the pack.[4] However, underlying this average is significant variability, with leading banks' green revenue shares being several times higher than many of their peers.

Of note, this data only estimates banks' revenues from direct loans, and therefore omits possible financing for green activities through other business lines, like securities underwriting. Nevertheless, as direct loans often make up the bulk of banks' assets, the data is likely at least indicative of banks' level of engagement in the financing of sustainable activities.

Table 1: Revenues from Clean Loans by Large Domestic and International Banks

Financial Institution	Country	Estimated Revenues from Clean Loans (Millions, $US)	Estimated Share of Total Revenues
Citigroup Inc.	US	$ 2,416.79	3.38%
Bank of America Corp.	US	$ 2,331.86	2.67%
PNC Financial Services Group Inc.	US	$ 306.17	1.87%
Keycorp	US	$ 97.11	1.55%
Bank of Montreal	**Canada**	**$ 196.62**	**1.11%**
Comerica Inc.	US	$ 34.87	1.10%
Commerzbank AG	Germany	$ 129.81	1.04%
BNP Paribas SA	France	$ 359.67	0.61%
Unione di Banche Italiane SpA	Italy	$ 28.12	0.57%
Lloyds Banking Group PLC	UK	$ 250.20	0.51%
Scotiabank (Bank of Nova Scotia)	**Canada**	**$ 110.24**	**0.51%**
US Bancorp	US	$ 93.75	0.43%
Royal Bank of Canada	**Canada**	**$ 99.87**	**0.31%**
Credit Agricole SA	France	$ 75.52	0.30%
Canadian Imperial Bank of Commerce	**Canada**	**$ 31.81**	**0.25%**
Societe Generale SA	France	$ 79.96	0.24%
UniCredit SpA	Italy	$ 51.56	0.19%
Deutsche Bank AG	Germany	$ 27.16	0.08%

[3] Corporate Knights defines clean revenue as "revenue from all goods and services which have clear environmental and - in a limited number of well-defined cases, social - benefits. This includes revenue from clean transition, low-carbon economy and circular economy revenue segments." Revenue data was gathered and categorized by Corporate Knights. Assumptions and calculations are their own, and are available from Corporate Knights upon request.

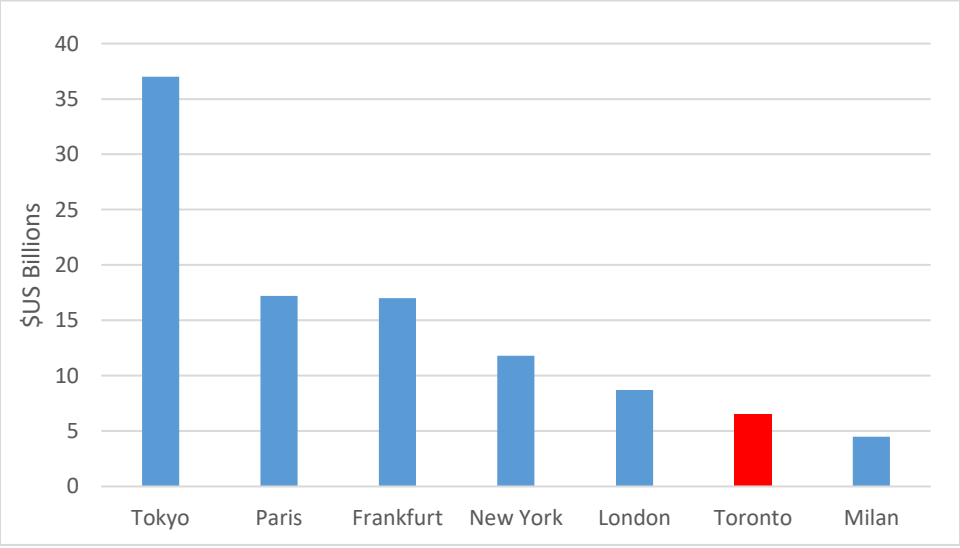
[4] Average is unweighted, excluding banks that did not disclose data on lending in this area.

JPMorgan Chase & Co.	US	$ 48.44	0.05%
Intesa Sanpaolo SpA	Italy	$ 0.18	0.001%
Natixis SA	France	No disclosure	No disclosure
Toronto-Dominion Bank	**Canada**	**No disclosure**	**No disclosure**
National Bank of Canada	**Canada**	**No disclosure**	**No disclosure**
Barclays PLC	UK	No disclosure	No disclosure
HSBC Holdings PLC	UK	No disclosure	No disclosure
Royal Bank of Scotland Group PLC	UK	No disclosure	No disclosure
Wells Fargo & Co.	US	No disclosure	No disclosure
Virgin Money Holdings UK PLC	UK	No disclosure	No disclosure
BB&T Corp.	US	No disclosure	No disclosure
SunTrust Banks Inc.	US	No disclosure	No disclosure
M&T Bank Corp.	US	No disclosure	No disclosure
Northern Trust Corp.	US	No disclosure	No disclosure
Fifth Third Bancorp	US	No disclosure	No disclosure
Standard Chartered PLC	UK	No disclosure	No disclosure
Citizens Financial Group Inc.	US	No disclosure	No disclosure

Source: Corporate Knights

Using an alternate definition of "green lending" which includes only loans for renewable energy, energy efficiency and electric vehicle-related activities, a report by Climate-KIC, I4CE and PwC estimates that Toronto-based banks have issued fewer green loans in recent years than their counterparts based in other G7 financial centres (Figure 8).[5]

Figure 8 – Green Bank Loans by Financial Centre (January 2012 to November 2017)



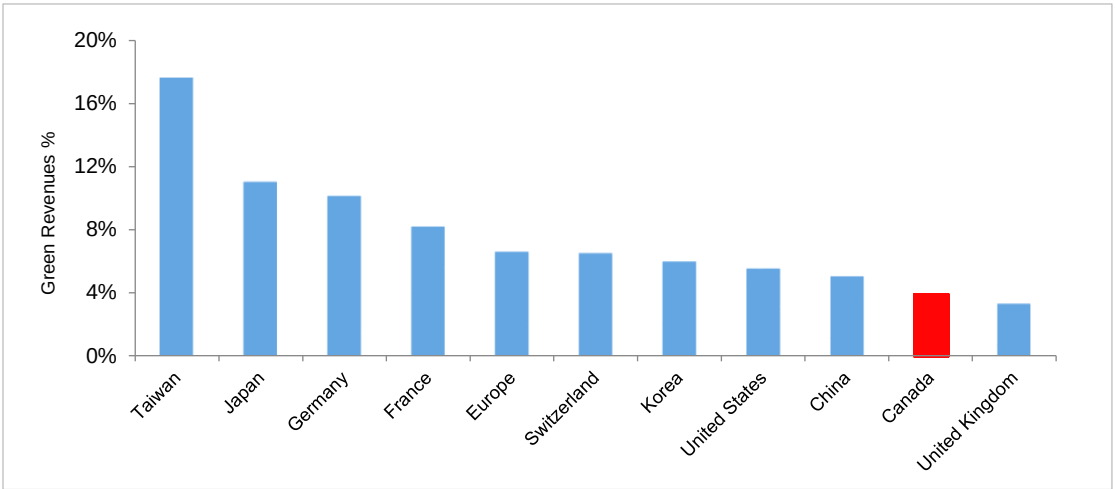
Source: Climate-KIC, I4CE and PwC calculations using Bloomberg New Energy Finance data.

[5] Source: Benchmarking the greenness of financial centres, Climate-KIC, I4CE and PwC. https://www.i4ce.org/wp-core/wp-content/uploads/2017/12/Climate-KIC-I4CE-PwC-benchmak-greenness-financial-centres.Provisional-Version.pdf

Public Firms' Exposures to Green Revenues

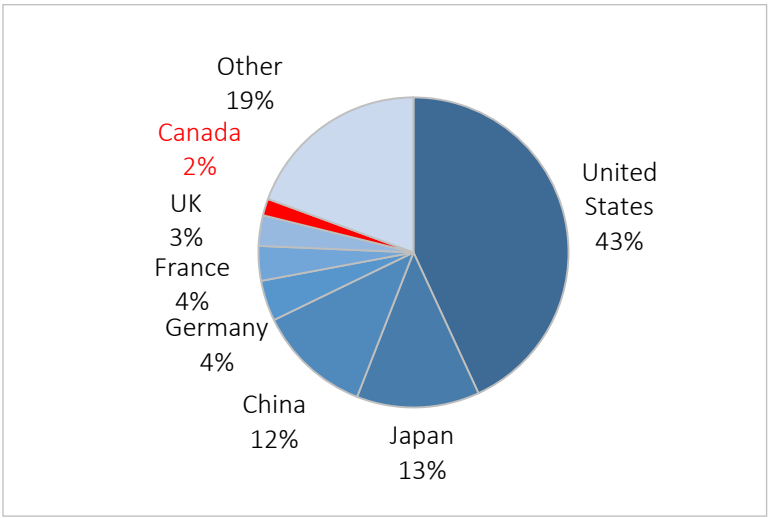
Given the interconnectedness of the Canadian financial system and the Canadian economy, the green exposures of Canada's financial sector players will depend importantly on the business decisions of Canadian firms more broadly. Shedding some light on these broader economic exposures, FTSE Russel research shows that on average about 4% of Canadian public firms' revenues come from green sources[6][7] (Figure 9). This stands below the levels of most other G7 countries. Nevertheless, looking to the broader international context, the research indicates that Canadian firms' share of global green revenues stands at about 2% (Figure 10), which is roughly proportional to Canada's share of the global economy.

Figure 9 – Public Firms' Average Exposures to Green Revenues



Source: FTSE Russell

Figure 10 – Public Firms' Share of the Global Green Economy



Source: FTSE Russell

[6] Source: Investing in the global green economy: busting common myths, FTSE Russel.
[7] Note: FTSE Russell uses a broad definition of "green" in this context, aiming to capture revenues from products and services in renewable and alternative energy, energy efficiency, water, and waste and pollution.

Green Bonds

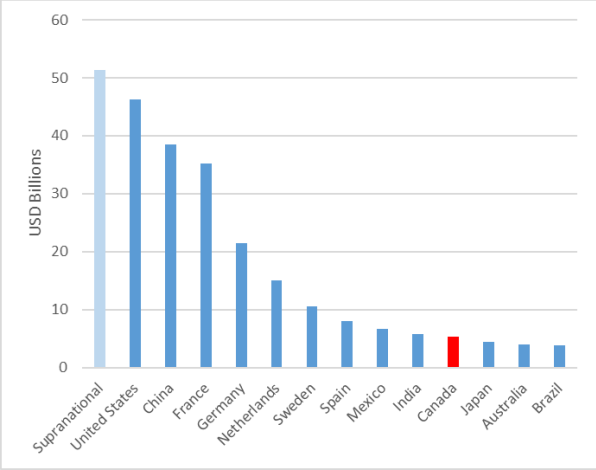
Green bond issuance is a useful metric in part because it highlights the pace and scale at which Canadian entities are willing to adopt new and innovative financing mechanisms to fund their green activities.

From the emergence of the Canadian green bond market in 2014 through to the end of 2017, the largest Canadian green bond issuers were provincial governments (Ontario, Quebec), financial institutions (TD Bank) and federal agencies (Export Development Canada). Largely as a result of repeat issuances from this group, total issuance in Canada accelerated to $3.8 billion in 2017, exceeding the total of all previous years combined. 2018 has also shown some promising developments thus far, with Manulife becoming the first insurer to issue a green bond in the Canadian market, and Canada Pension Plan Investment Board issuing a $1.5 billion green bond – the largest single green bond in Canada to date and the first green bond issuance by a pension fund globally.

According to data from Smart Prosperity Institute and Climate Bonds Initiative, Canada ranked 10th among countries in terms of cumulative green bond issuance to date in 2017 (Figure 11). This rank aligns approximately with the relative size of Canada's debt markets (8th largest globally[8]) but exceeds the relative size of Canada's economy (17th largest globally[9]).

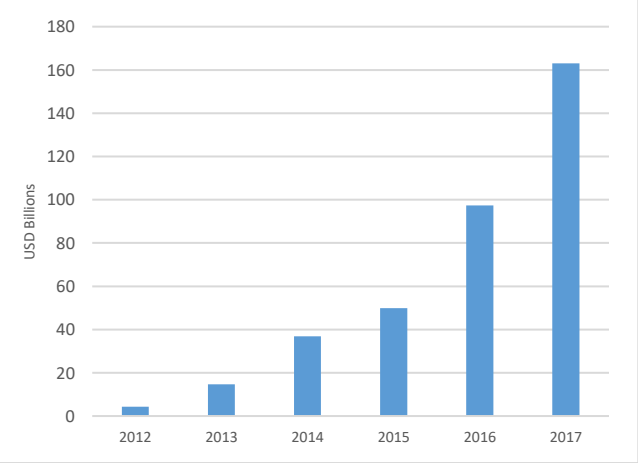
Mirroring the rapid rise in Canada, green bond issuance also accelerated internationally in 2017, with global issuance reaching over US$160 billion (Figure 12). The rise in global issuance was driven primarily by the U.S., China and France, which together were responsible for over half of cumulative global issuances to date at the end of 2017.

Figure 11 – Cumulative Green Bond Issuance by Country (end-2017)



Source: Climate Bonds Initiative and Smart Prosperity

Figure 12: Global Green Bond Issuance by Year



Source: Bloomberg New Energy Finance

[8] Rank based on Bank for International Settlements data on debt securities outstanding at end-December 2017.
[9] Rank based on 2017 share of global gross domestic product at purchasing-power-parity – International Monetary Fund, World Economic Outlook Database, April 2018.

Annex V - Climate Related Financial Disclosure

One area within sustainable finance that has recently received significant attention both domestically and internationally is the disclosure of climate-related financial risks. Relevant, consistent and comparable information is foundational to financial decision-making, especially for effective pricing of risk and capital allocation decisions. As the understanding of climate-related physical and transition risk grows, such risks are becoming of increasing priority in investment, lending and insurance decisions.

Task Force on Climate-related Financial Disclosures

In June 2017, the Financial Stability Board's industry-led Task Force on Climate-related Financial Disclosures (TCFD) released recommendations on how firms can voluntarily disclose climate-related risks in a manner that provides decision-useful information to lenders, insurers, and investors.[1] The TCFD is expected to report back to G20 Leaders on firms' uptake of these recommendations at the G20 Summit in November 2018.

The TCFD developed a set of voluntary guidelines that could serve as the foundation of climate-related risk disclosure reporting. The underlying rationale is that providing stakeholders access to relevant and timely information can improve risk assessment, pricing and management. Financial filings disclosing relevant and comparable climate risk information would enable cross-sectoral and company comparisons.

The TCFD recommends that preparers of climate-related financial **disclosures provide such disclosures in their mainstream annual financial filings**. However, if elements of the recommendations are incompatible with national disclosure requirements for financial filings, the Task Force encourages organizations to disclose those elements in other official company reports that are issued at least annually, widely distributed and available to investors and others, and subject to internal governance processes that are the same or substantially similar to those used for financial reporting.

The TCFD structured its recommendations around four thematic areas that represent core elements of how organizations operate: **governance, strategy, risk management, and metrics and targets**.

One of the TCFD's key recommended disclosures focuses on the resilience of an organization's strategy, taking into consideration different **climate-related scenarios**, including a 2° Celsius or lower scenario. An organization's disclosure of how its strategies might change to address potential climate-related risks and opportunities is a key step to better understand the potential implications of climate change on the organization. The TCFD recognizes the use of scenarios in assessing climate-related issues and their potential financial implications is relatively recent and practices will evolve over time, but believes such analysis is important for improving the disclosure of decision-useful, climate-related financial information.

On May 1, 2018, the TCFD and the Climate Disclosure Standards Board (CDSB) launched the TCFD Knowledge Hub, a platform with tools and resources to help organizations implement the TCFD recommendations. The TCFD Knowledge Hub is the first online platform to provide information on climate-related disclosures in line with the recommendations of the TCFD. The Knowledge Hub website is operated by CDSB, which reviews all resource submissions.

Countries

Over 513 organizations have expressed their support for the TCFD. Among them, the Governments of France, United Kingdom, and Sweden are official supporters of the TCFD. Furthermore, the Belgian Ministry of Finance, Japanese Ministry of Environment, and the Department of Environment and Science of Queensland, Australia are also listed as supporters. Below is a list of Canadian supporters of the TCFD as of September 2018.

[1] https://www.fsb-tcfd.org/

Addenda Capital
AGF Investments Inc.
AIMCO
AlphaFixe Capital
Barrick Gold Corporation
BMO Financial Group
British Columbia Investment Management Corporation
Caisse de dépôt et placement du Québec
Canada Pension Plan Investment Board
Canadian Imperial Bank of Commerce (CIBC)
Chartered Professional Accountants of Canada (CPA Canada)
City of Vancouver
Desjardins Group
Export Development Canada
Manulife Financial Corporation
National Bank of Canada
NEI Investments
Ontario Teachers' Pension Plan
OPTrust
PSP Investments
Royal Bank of Canada
Scotiabank
Sun Life Financial
Suncor Energy
TD Bank Group
Teck
Telus
The Co-operators Group
Toronto Centre
Toronto Financial Services Alliance (TFSA)
Workplace Safety & Insurance Board (WSIB)

Article 173 of the French Energy Transition Law

Article 173 of the French Energy Transition Law came into force on January 1st, 2016. It strengthened mandatory carbon disclosure requirements for listed companies and introduced carbon reporting for institutional investors, defined as asset owners and investment managers. The law was introduced on a "comply or explain" basis and implementation is flexible to allow investors to determine the most appropriate reporting methodologies themselves.

The law sets a requirement for investors to declare the environmental impact of their investment portfolios, including specific reference to impact on climate change. Article 173 requires:

- listed companies to disclose financial risks related to the effects of climate change and measures adopted by the company to reduce them;
- banks and credit providers to disclose the risks evidenced by the stress-tests that are regularly implemented in their mandatory risk reports; and,
- institutional investors to disclose information to beneficiaries on how their investment decision-making process takes social, environmental and governance criteria into consideration (including climate risk), and the means implemented to contribute to the financing of the ecological and energy transition.

Climate Disclosure Standards Board

The CDSB is an international consortium of business and environmental non-government organizations that seeks to advance corporate reporting of sustainability factors. The CDSB works to provide decision-useful environmental information to markets via mainstream corporate reports, and works to create the enabling conditions for material climate change and natural capital information to be integrated into mainstream

reporting. CDSB has developed two frameworks for reporting environmental information/natural capital and climate change-related information in mainstream corporate reports.

The CDSB Climate Change Reporting Framework (CCRF) is a voluntary reporting framework designed to encourage the reporting of climate change-related information in mainstream financial reports. The CCRF seeks to encourage disclosure of the information required to understand how climate change affects companies' financial performance by providing guidelines for reporting environmental information, natural capital, and associated business impacts. Information prepared in accordance with the CCRF enables investors to assess the relationship between specific environmental matters and the organization's strategy, performance and prospects. CDSB participated in the TCFD's consultation process, and CDSB's Framework is extensively referenced in the TCFD Final Report.

The CDP (formerly the Carbon Disclosure Project) is a not-for-profit charity based in the United Kingdom that runs a global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts. The CDP gathers environmental data from companies, cities states and regions, and transforms the data into detailed analysis on critical environmental risks, opportunities and impacts. Investors, businesses and policy makers can then use this data and insights to make better decisions, manage risk, and capitalize on opportunities. In 2017, over 6,300 companies with 55% of global market capitalization disclosed environmental data through CDP.

The CDSB and CDP worked together to provide a complete, reliable and verified system for climate disclosure. Companies and investors can disclose environmental risk information following the CDSB framework through the CDP platform. CDP currently has the most comprehensive collection of self-reported environmental data in the world.

The CDSB framework was updated in April 2018 to align with the recommendations of the TCFD and other key mainstream reporting requirements, helping to streamline the reporting cycle for many organizations.

Sustainability Accounting Standards Board

The Sustainability Accounting Standards Board (SASB) is the independent standards-setting organization for sustainability accounting standards that meet the needs of investors by fostering high-quality disclosure of material sustainability information. The SASB develops and maintains sustainability accounting standards—for 79 industries in 11 sectors—that help public corporations disclose financially material information to investors in a cost-effective and decision-useful format. The SASB's transparent, inclusive, and rigorous standards-setting process is materiality-focused, evidence-based and market-informed.

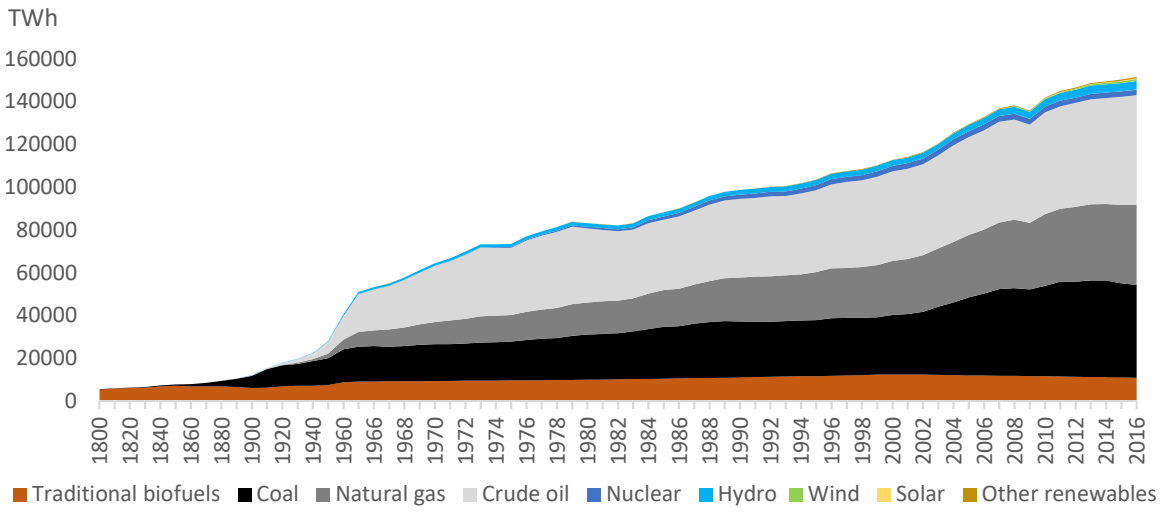
The SASB developed sector-specific Key Performance Indicators (KPIs) to measure performance along major environmental and social dimensions associated with sector impacts for sustainability. KPIs for sustainability rely on three principles— simplicity, materiality, and transparency, and could be useful for regulators, corporations, stakeholders and investors. The objectives of the KPIs are to enable companies to move from a compliance-driven "disclosure" mindset to one of managing and competing on performance on the sustainability issues that matter most.

The SASB and CDSB also put out a paper *Converging on Climate Risk: CDSB, the SASB, and the TCFD* that shows that the CDSB and SASB approaches are well-aligned with the TCFD, but CDSB and the SASB will continue to further their harmonization to deliver a TCFD-ready framework.

Annex VI – Energy Transition

Energy transitions have happened in the past, from traditional biofuels to coal, and from coal to oil and gas (see Figure 1). As new sources of energy become available and as costs for these sources of energy fall, they are added to the energy mix in the absence of policy. A transition to a low-carbon economy will require a significant reduction in the carbon intensity of global energy consumption, either through advancements in carbon capture and storage (CCS) technologies, or displacement with renewable fuels.

Figure 1: Primary Energy Consumption (TWh) from 1800-2016

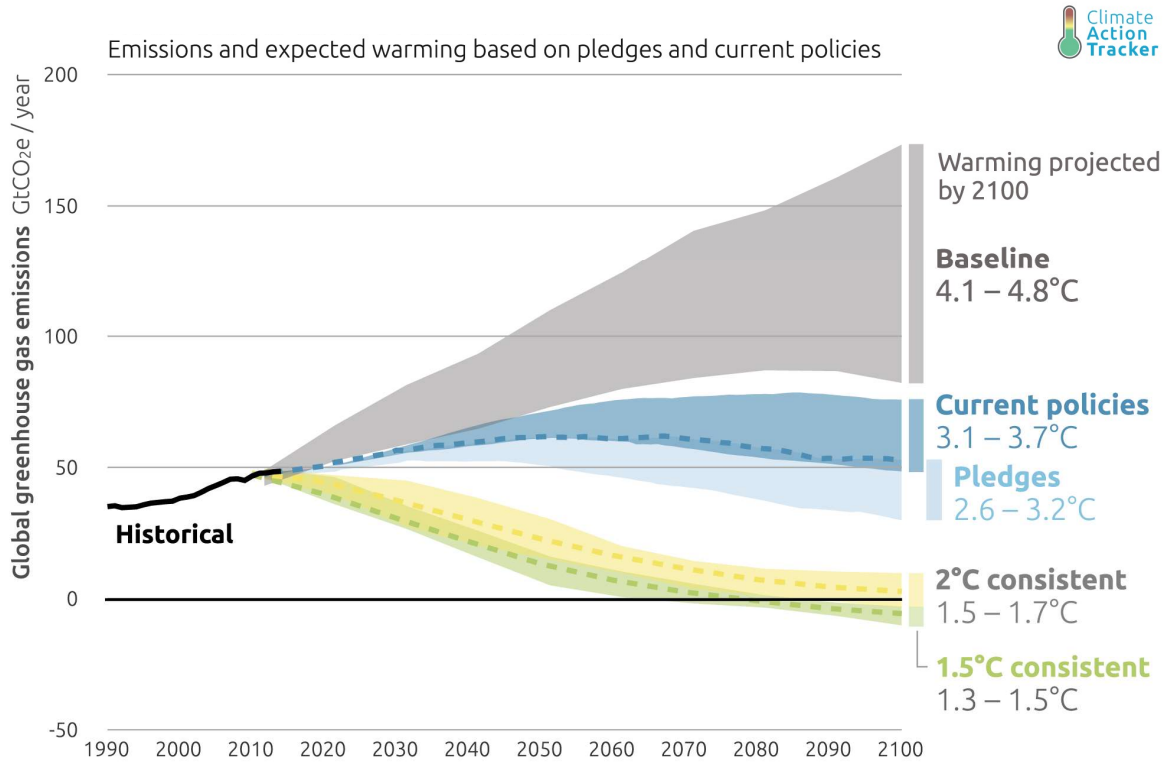


Note: Time not to scale.
Source: Our World in data

In order to reach the Paris Agreement 2°C target, research aggregated by the International Panel on Climate Change (IPCC) estimates that global emissions will likely need to be at negative levels by 2100 (see Figure 2). Depending on how quickly emissions decline in the short-to-medium term, some net-negative emissions scenarios start as early as 2060.

The Climate Action Tracker (CAT) is an independent scientific analysis produced by three research organisations that tracks progress towards the Paris Agreement goal of keeping global warming below 2°C. According to CAT and with research from the IPCC, in the absence of policies, global warming is expected to reach 4.1°C – 4.8°C above pre-industrial levels by the end of the century in the baseline scenario. Current policies presently in place around the world are projected to reduce baseline emissions and result in about 3.4°C warming above pre-industrial levels.

Figure 2: 2100 Warming Projections



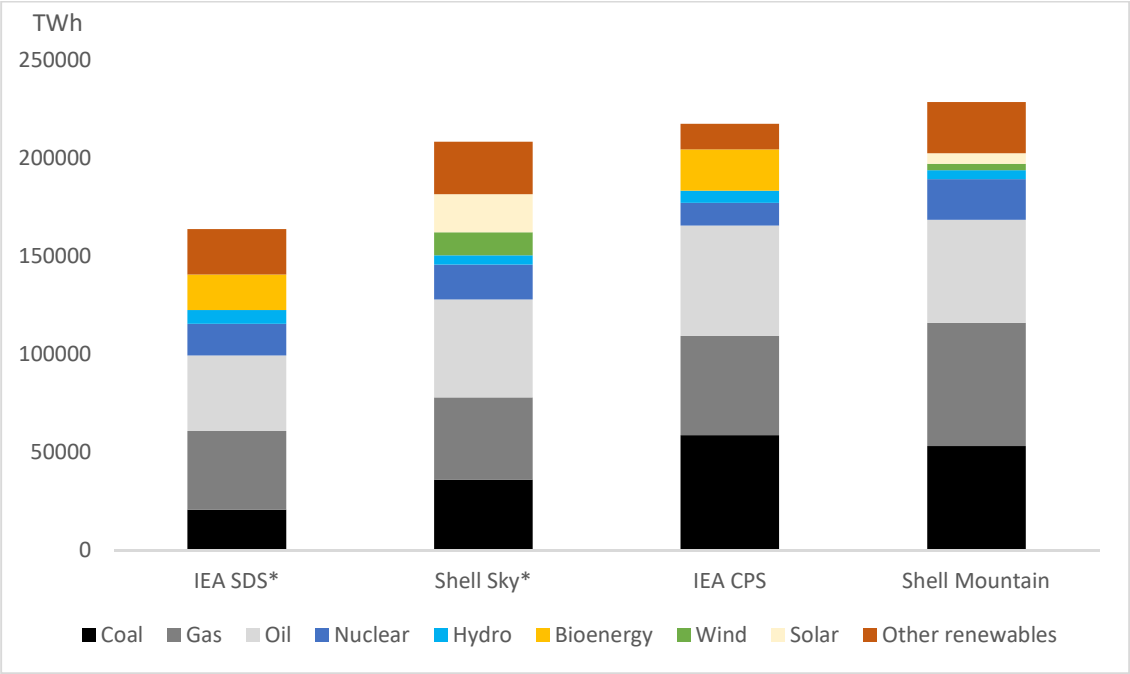
Source: Climate Action Tracker 2017

Multiple agencies have modelled the long-term outlook of energy supply and demand, including: the International Energy Agency (IEA), the Energy Information Administration (EIA), and Royal Dutch Shell (Shell). There are many scenarios and they vary in their assumptions around policy, technology, costs, and CCS deployment among other factors. They also vary in their methodologies and inputs, and are not directly comparable. For example, a scenario that assumes widespread and low-cost CCS deployment would allow for relatively larger shares of fossil fuels in the global energy mix.

This annex presents several forecasts of energy use by source in the medium-to-long term; Figure 3 shows the various scenarios' energy mix in 2040. All scenarios continue to have fossil fuels through 2040, but their share in energy supply declines. The prevalence of fossil fuels is dependent on CCS assumptions about technology and cost. In order to meet growing demand for energy due to population and economic growth projections, renewable energy sources increase both to meet increased demands, and to displace fossil fuels. These are either broken down by source, or referred to as "other renewables" depending on the scenario.

Only the IEA's Sustainable Development Scenario (SDS) and Shell's Sky Scenario are consistent with the Paris Agreement 2°C target, and both project the continued use of fossil fuels. Shell's Sky Scenario illustrates a technically possible pathway consistent with temperature increases of 1.75°C above pre-industrial levels by 2100, but relies on a significantly greater amount of CCS than in the SDS.

Figure 3: Energy by Source in 2040



Note: Scenarios marked with * are Paris-compliant.
Source: Shell Sky Scenario, IEA WEO 2017, EIA IEO 2017, Shell New Lens on the Future 2013

Agencies

IEA

The IEA was founded in 1974 and continues to examine a full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, and demand side management. Through its work, the IEA advocates policies that will enhance the reliability, affordability, and sustainability of energy in its 30 member countries.

The IEA's World Energy Outlook (WEO) is published annually and reports on global energy projections and analysis with the most recent version examining three scenarios.

Shell

Shell is an international energy company and the world's fifth largest oil and gas company. Shell has been developing energy scenarios since the 1970's to explore the future of energy systems. A number of scenarios have been modelled with varying assumptions and outlooks.

Paris-Compliant Scenarios

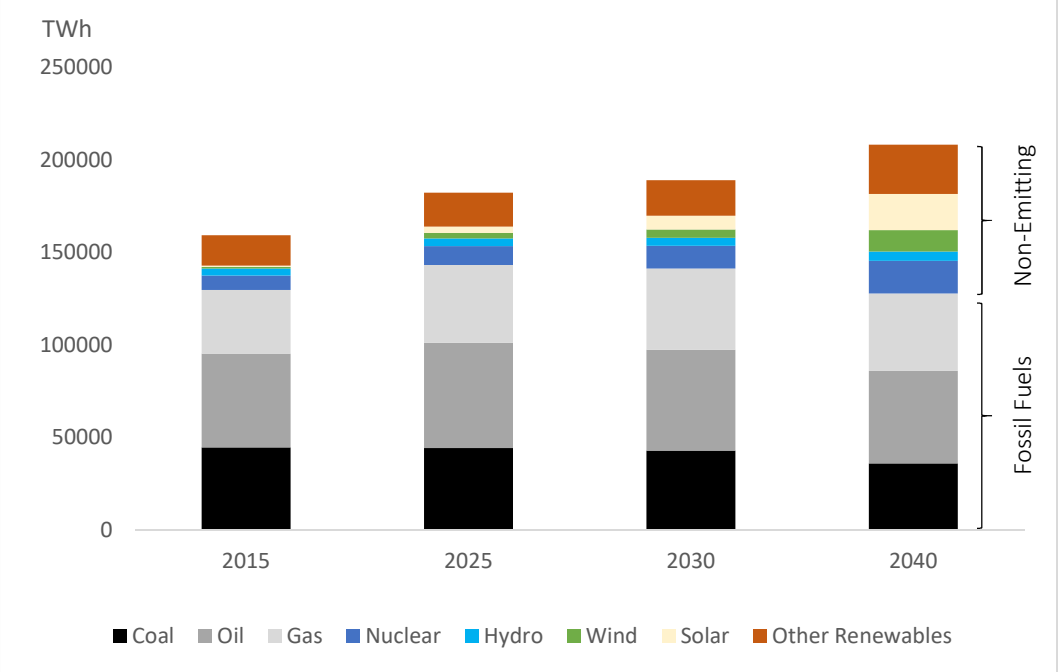
Shell Sky Scenario

The Sky Scenario illustrates a technically possible, but challenging pathway for society to achieve the goals of the Paris Agreement. According to the Massachusetts Institute of Technology, the Scenario is consistent with

temperature increases of 1.75°C above pre-industrial levels, with an 85% probability of remaining below 2°C. The Scenario partly relies on CCS deployment in order to manage CO_2 emissions from ongoing fossil fuel use.

In this scenario, energy use grows by 31% from 2015 to 2040. Oil and gas account for 54% of the energy mix in 2025, 52% in 2030, and 44% by 2040. Coal energy supply declines from 24% in 2025 to 17% by 2040. CCS is assumed to capture 2.16 gigatonnes (Gt) of CO_2 by 2040 (see Figure 4).

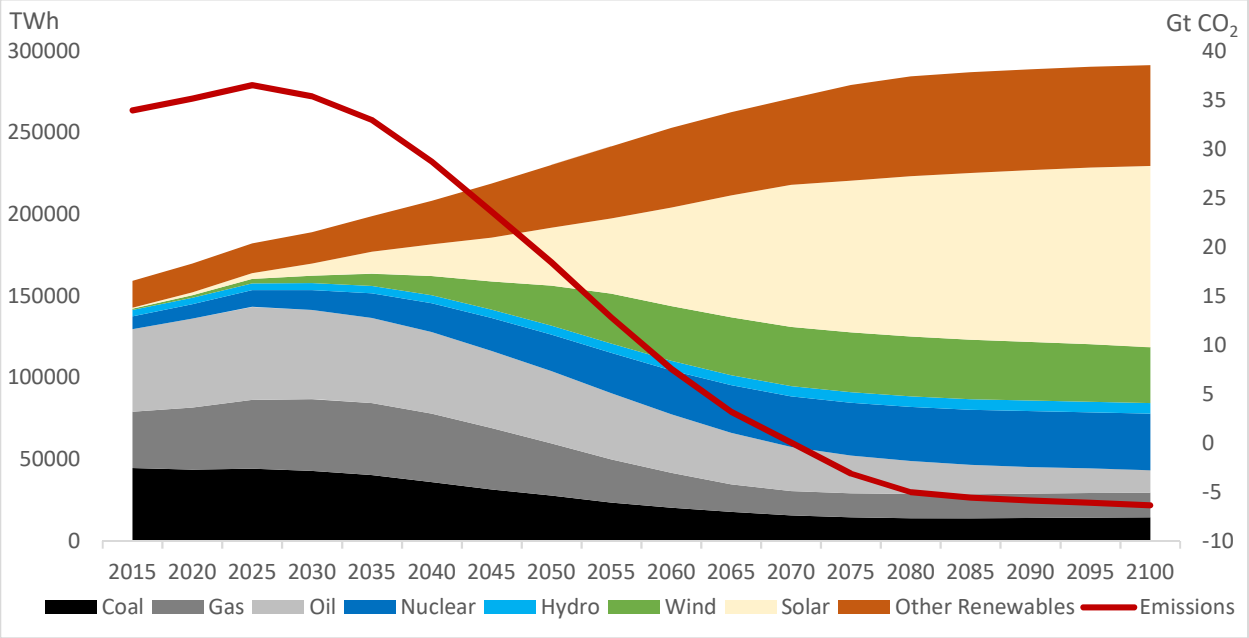
Figure 4: Sky Scenario to 2040 for Energy Use by Source



Source: Shell Sky Scenario 2017

Shell's Sky Scenario forecasts both energy use by source and emissions out to 2100 (see Figure 5). The Sky Scenario is consistent with the Paris Agreement targets, and projects net-negative emissions by 2070. While fossil fuels continue to be used in this projection, they play a limited role in energy supply by the end of the century; coal, natural gas, and oil each account for 5% of energy by 2100. Emissions reach zero around 2070, and become net negative thereafter. Net negative emissions are the result of assumptions about CCS, which captures 11.19 Gt CO_2 by 2100. Energy use in this scenario grows by 83% between 2015 and 2100.

Figure 5: Sky Scenario to 2100 for Energy Use by Source and Emissions



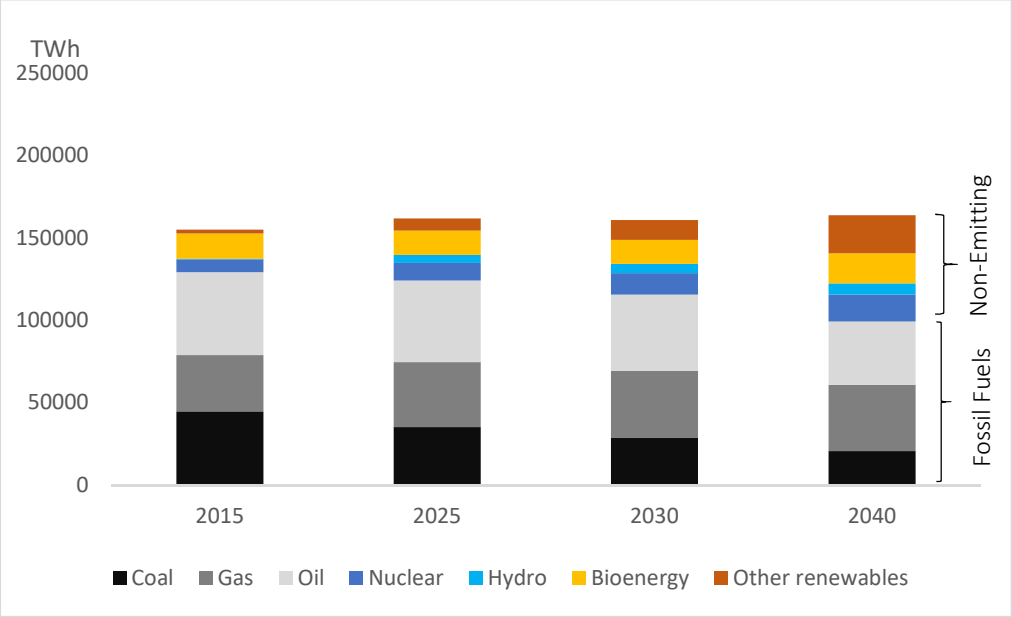
Source: Shell Sky Scenario 2018.

IEA Sustainable Development Scenario

The SDS sets out an energy pathway consistent with achieving internationally agreed objectives on climate change. It is consistent with a 2°C scenario pathway, and assumes further reductions in fossil fuels as well as net-negative emissions by 2100.

In the SDS, energy use grows by 6% from 2015 to 2040. Oil and gas account for 26% of energy in 2025, 23% in 2030, and 20% by 2040 (see Figure 6). Coal energy supply declines to 9% by 2040. Power generation is mostly decarbonised by 2040. Ten percent of all fossil fuels across the economy are equipped with CCS in 2040, including 60% of coal plants.

Figure 6: SDS Energy Use by Source



Source: IEA WEO 2017

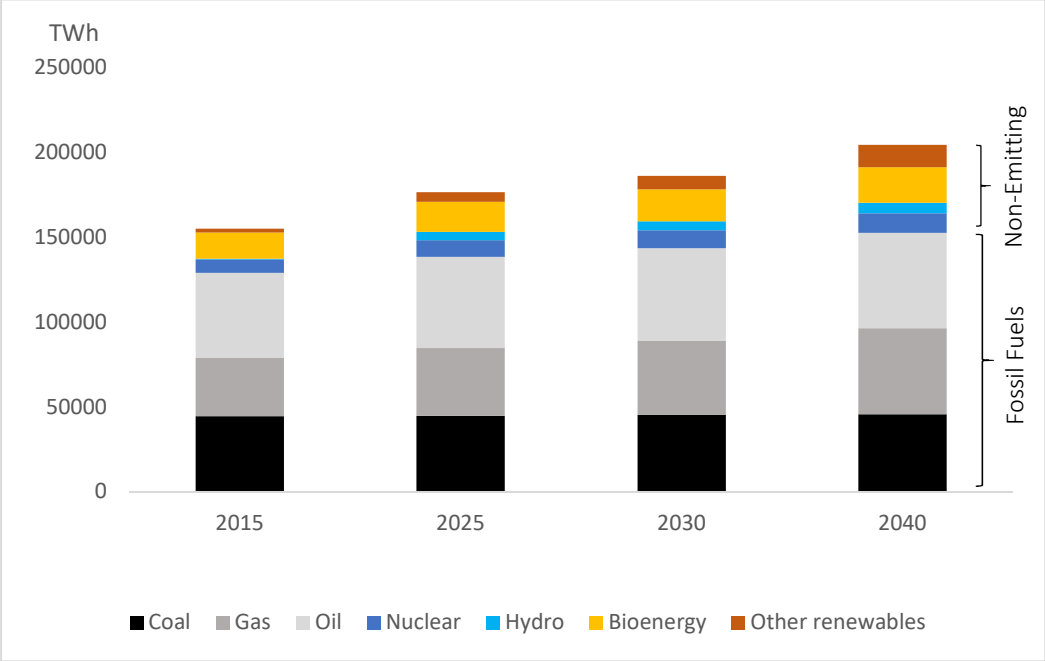
Non-Paris-Compliant Scenarios

IEA Current Policies Scenario

The Current Policies Scenario (CPS) only includes policies in place by the mid-point of the year of the WEO's publication. It does not meet a 2°C target.

In this scenario, energy use grows by 45% from 2015 to 2040. Oil and gas account for 29% of energy in 2025 and 28% in both 2030 and 2040 (see Figure 7). Coal continues to supply 26% of energy in 2040.

Figure 7: CPS Energy Use by Source



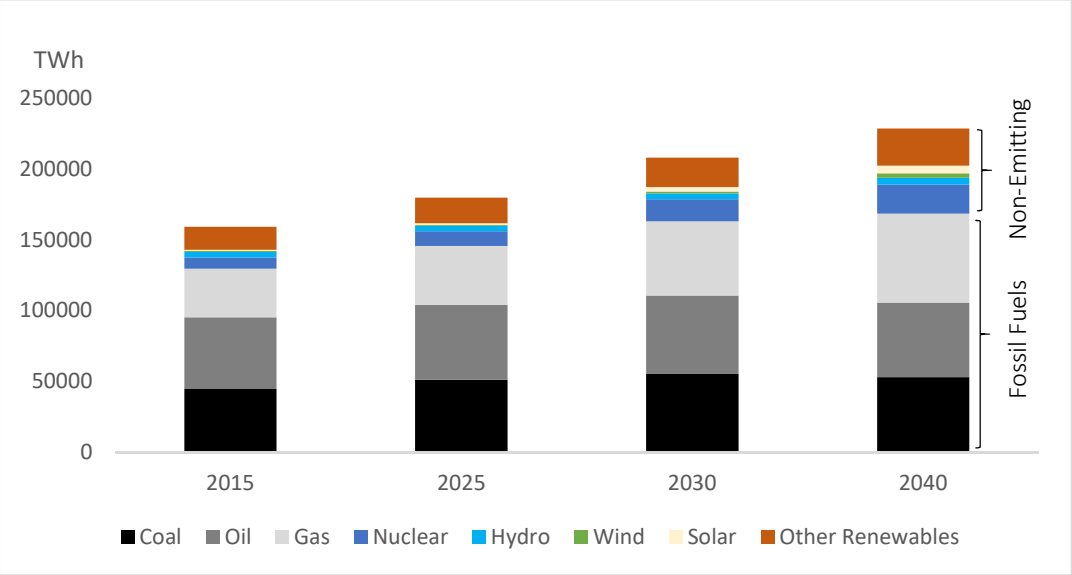
Source: IEA WEO 2017

Shell Mountains Scenario

The Mountains Scenario models a world where current power and institutional structures largely remain in place. Natural gas and carbon capture and storage play an important role to ensure security of energy supply. The Mountain scenario does not meet a 2°C target.

In the Mountains Scenario, energy use grows by 43% from 2015 to 2040. Oil and gas account for 52% of energy in 2020 and 2030, and 51% in 2040 (see Figure 8). Coal supplies 29% of energy in 2020 and declines to 23% by 2040.

Figure 8: Mountains Scenario Energy Use by Source



Source: Shell New Lens on the Future 2013