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June 17, 2019

Movement of United Professionals
c/o Allevato Quail & Roy, Barristers and Solicitors
405-510 West Hastings St.
Vancouver, BC
V6B 1L8

Attention: Mr. Jim Quail

Dear Mr. Quail

Re: FortisBC Energy Inc. and FortisBC Inc. (collectively FortisBC)

Project No. 1598996

Application for Approval of a Multi-Year Rate Plan for 2020 through 2024 (Application)

Response to Canadian Office and Professional Employees Union, Local 378 (known as Movement of United Professionals or MoveUP) Information Request (IR) No. 1

On March 11, 2019, FortisBC filed the Application referenced above. In accordance with the British Columbia Utilities Commission Order G-64-19 setting out the Regulatory Timetable for the review of the Application, FortisBC respectfully submits the attached response to MoveUP IR No. 1.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.
FORTISBC INC.

Original signed:

Doug Slater

Attachments

cc (email only): Commission Secretary
Registered Parties

1.0 Climate-related Financial Risks

1.1 Please file a copy of the 17 April 2019 "Open Letter on Climate-related Financial Risks" published by the Bank of England, the Bank of France, and the Network for Greening the Financial Service (the "Open Letter"), available online at https://www.bankofengland.co.uk/news/2019/april/open-letter-on-climate-related-financial-risks.

Response:

Please refer to Attachment 1.1.

Reference: Open Letter paragraphs 1 and 2

The catastrophic effects of climate change are already visible around the world. From blistering heatwaves in North America to typhoons in south-east Asia and droughts in Africa and Australia, no country or community is immune. These events damage infrastructure and private property, negatively affect health, decrease productivity and destroy wealth. And they are extremely costly: insured losses have risen five-fold in the past three decades. The enormous human and financial costs of climate change are having a devastating effect on our collective wellbeing.

The impact of climate change has compelled governments to act. Catalysed by the Paris agreement, governments around the world are putting policies in place to limit the global rise in temperatures to 2C, and preferably as close to 1.5C as possible. The actions undertaken by individual countries will deliver a collective transition to a low-carbon economy. But this transition brings its own risks. Carbon emissions have to decline by 45% from 2010 levels over the next decade in order to reach net zero by 2050. This requires a massive reallocation of capital. If some companies and industries fail to adjust to this new world, they will fail to exist.

1.2 Please file a copy of the Bank of Canada's 2019 Financial System Review, available online at https://www.bankofcanada.ca/wp-content/uploads/2019/05/Financial-System-Review%E2%80%942019-Bank-of-Canada.pdf.

Response:

Please refer to Attachment 1.2.

Reference: Financial System Review page 29:

The move to a low-carbon economy involves complex structural adjustments, creating new opportunities as well as transition risk. Investor and consumer preferences are shifting toward lower-carbon sources and production processes, suggesting that the move to a low-carbon economy is underway. Transition costs will be felt most in carbon-intensive sectors, such as the oil and gas sector. If some fossil fuel reserves remain unexploited, assets in this sector may become stranded, losing much of their value. At the same time, other sectors such as green technology and alternative energy will likely benefit.

Both physical and transition risks are likely to have broad impacts on the economy. Moving labour and capital toward less carbon-intensive sectors is costly and takes time. Global trade patterns may also shift as production costs and the value of resources change.

1.3 Does FortisBC agree with this analysis? If not, to what extent does it disagree and for what reasons?

Response:

FortisBC is focusing its comments on those subjects that are germane to the MRPs and those in which the Companies have expertise. In responding to the question, FortisBC will address the following four findings:

- Governments are responsible for climate policy and they are taking significant action;
- The transition to a low-carbon future is complex and the implications are far reaching;
- Companies and industries must adjust to this new world or fail to exist; and
- An orderly transition is essential.

Governments are responsible for climate policy and they are taking significant, immediate action

In Section B1.2 of the Application, FortisBC provides an in-depth discussion consistent with this finding. In its responses to the MoveUP IR 1.3 series, FortisBC provides additional examples of how municipal governments and regions throughout Canada and British Columbia have declared climate emergencies. The City of Vancouver's (CoV) Climate Emergency Response

report and final motion approved unanimously by Council is a recent example that supports the claim that governments are taking significant, immediate action on climate policy.

The transition to a low-carbon economy is complex and the implications are far reaching

The transition to a low-carbon economy will require a myriad of climate action solutions provided in a timely manner. The transition creates both opportunities and challenges for utilities like FortisBC. For example, as discussed in Section B1.2.6.1 of the Application, renewable gases are critical for meeting GHG reduction objectives. As shown in the CleanBC Plan, renewable gas accounts for 75 percent of the reductions expected in the buildings sector. As such, there are considerable opportunities for FortisBC to advance the development of renewable gas and an imperative to pursue them quickly and efficiently.

There are two primary concerns relevant to FortisBC associated with climate policy.

The first would be failure to properly consider the affordability, practicality and province-wide implications of policies such as Big Move #4 proposed by the CoV. FortisBC supports the decision by CoV Council to direct the city staff to conduct engagement with industry and the public as discussed in the response to MoveUP IR 1.3.3. FortisBC has a viable means to achieve meaningful GHG reductions as described in its Clean Growth Pathway to 2050 provided in Appendix A5 of the Application. The Companies will advocate for these solutions in policy arenas such as the CoV's stakeholder engagement process.

The second concern would be inactivity by governments and regulators in sharing responsibility with FortisBC in successfully making this transition. Without favourable policies, financial incentives and streamlined regulatory processes, this transition will be slowed or halted to the detriment of all British Columbians. For example, to rapidly advance the supply of renewable gas and realize the climate benefits in the buildings sector by 2030, initiatives like the Clean Growth Innovation Fund and Targeted Incentives for renewables will be essential. Likewise, the Province must employ every policy lever it has at its disposal to advance renewable gas supply. Finally, the BCUC needs to consider factors like the CoV and many other regions and municipalities declaring climate emergencies in the streamlining of regulatory processes such as the approval of renewable gas supply contracts.

Companies and industries must adjust to this new world or fail to exist

Since the first Provincial climate plan was introduced in 2007, FortisBC has been at the forefront of making the transition to a low-carbon economy by introducing innovative products and services like DSM, renewable natural gas, and compressed and liquid natural gas for on-road and marine markets. FEI has optimized the use of certain assets such as the Tilbury LNG facility to enable this transition. The Companies intend to continue these activities and significantly accelerate their rate of adoption wherever possible.

Failing to adjust would mean that FortisBC's climate solutions become less attractive or irrelevant in the face of other energy choices such as the electrification of the buildings sector. Assets could become underutilized over time if FortisBC failed to offer solutions and consumers were to choose energy delivery means other than FortisBC.

As part of the industry FortisBC operates in, government and the BCUC must also adjust. For example, the Province would suffer economically if it fails to adjust effectively as it relies on employment, royalties and tax revenue associated with the natural gas industry; not to mention as a source of affordable energy for its residents and the economy. Further, if the Province did not advance renewable gas, it would not meet its climate targets. The BCUC also has a role in supporting and facilitating the transition to a lower carbon economy through its consideration of how regulated utilities align with policy direction.

An orderly transition is essential

While being mindful of the urgency of climate action, utilities like FortisBC and industry must transition in an orderly manner. FortisBC agrees with the observation that "Both physical and transition risks are likely to have broad impacts on the economy. Moving labour and capital towards less carbon-intensive sectors is costly and takes time." In addition to being costly and taking time, the transition requires careful, long-term planning for both the electricity and natural gas systems through the Province to ensure the transition is smooth and minimizes cost implications in a time where affordability is a key public consideration. FortisBC noted this important consideration in its Clean Growth Pathway to 2050 submission:

> The unique aspect of the gas system is that it is specifically designed to address heating demand. Seasonal changes in heat demand (referred to as "peak load" or "peak demand") can be up to 400 to 500 per cent greater than FortisBC's average demand. For comparison, peak load in the FortisBC electric system is approximately 40 percent higher than average load. If BC used electricity as the primary source for heat the seasonal variability of heating load would create a huge need for energy storage. Hydropower could meet the storage requirement were it not for the magnitude of heat load in BC. The approximate peak-hour heating load in 2017 in FortisBC's gas system was over 12 GW of electrical capacity equivalent (at a one-to-one unit energy conversion basis). In other words, electrifying heating could require almost a doubling of the existing hydroelectric capacity in BC even before considering the electrification of some part of the transportation fleet or other energy end uses and the additional transmission and distribution requirements. Recognizing this, decarbonizing the gas flowing through the system while maintaining the use of that system is a prudent and low-cost strategy to ensure that BC achieves its climate targets.[1]

[1] Appendix A5, Clean Growth Pathway to 2050, p. 13.

1.4 In the present application, has FortisBC considered the impact of climate change on the future viability of FEI? If so, in what manner does the transition to a low-carbon economy inform the present application?

Response:

FortisBC has considered the impact of climate change related issues in its Application. In particular, this consideration has informed FortisBC's proposed Clean Growth Innovation Fund, its proposed Targeted Incentives to increase renewable gas volumes, grow the natural gas for transportation business and decrease greenhouse gas emissions and its proposed customer engagement including raising awareness for consumers in a low carbon future and the Climate Action Partners program.

1.5 What are the implications of this analysis for the Commission as regulator of FEI in particular?

Response:

As explained in the response to BCUC IR 1.18.7, utilities and regulators should respond to these challenges by taking a proactive role and working in coordination with each other to develop new regulatory and market models that can create new value for consumers and re-align the interests of the utilities with the public interest. The proposed Clean Growth Innovation Fund and Targeted Incentives framework are part of FEI's proactive strategy to respond to these challenges and turn them into BC's economic and environmental advantage. Therefore, the BCUC's approval of these initiatives would assist FEI to expedite the implementation of this strategy.

Further, changes to FEI's business and financial risk profile, including the risks identified in the referenced Bank of Canada's Financial System Review, will be analyzed in future cost of capital applications and reflected in the BCUC's future determinations of authorized ROE and capital structure.

2.0 City of Vancouver 2019 Memorandum of Understanding

2.1 Please file the 2019 Memorandum of Understanding between FortisBC and the City of Vancouver, available online at https://vancouver.ca/files/cov/fortisbc-and-city-of-vancouver-memorandum-of-understanding.pdf.

Response:

Please refer to Attachment 2.1, which includes the press release associated with the Memorandum of Understanding (MoU). For clarification, the MoU was signed in November of 2017 (as opposed to 2019 as indicated in the information request).

2.2 What are the consequences of the MOU in relation to this application and the issues facing FEI during the proposed term of the MRP and beyond?

Response:

The press release provided by FortisBC in response to MoveUP IR 1.2.1 summarizes the objectives of the MoU between FortisBC and the CoV as follows: "…to team up on climate action projects to reduce greenhouse gas emissions (GHG) and increase investment in energy efficiency and renewable energy while maintaining access to natural gas for residents and businesses."

The consequences of the MoU in relation to this Application and the issues facing FEI during the proposed term of the MRP relate to incremental cost pressures, future growth, use per customer, the need for investment in innovation, customer education and targeted incentives.

FortisBC and the CoV have been collaborating on the delivery of energy in the CoV for many decades and the MoU sets the foundation for many more to come. The MoU highlights a range of activities including the following:

- Boosting renewable natural gas supply and use in Vancouver;
- Improving air quality and reducing GHGs in transportation;
- Developing a deep energy retrofit pilot project for a commercial building;
- Increasing access to energy efficiency and conservation rebates for new buildings; and
- Improving safety and efficiency of gas furnace retrofit installations.

MRP guiding principles 1, 3 and 5 outlined in Section C1 of the Application pertain directly to the consequences of the MoU:

Rate Plan Principle	Consequences of the MoU in relation to the Application
Principle 1: The MRP should, to the greatest extent possible, align the interests of customers and the Utility; customers and the utility should share in the benefits of the MRP	FortisBC negotiated the MoU representing the interests of our approximately 110,000 customers that live and operate businesses in the CoV. Further, given FEI's postage stamp rate design, all outcomes of the MoU will not only impact our CoV customers, they will impact FEI's other 900,000+ customers. For example, if FEI's infrastructure in CoV continues to be utilized, whether it be with natural gas or renewable gas, FEI's rates will be positively impacted.
Principle 3: the MRP should recognize the unique circumstances of FortisBC that are relevant to the MRP design	In the MRP, FortisBC is proposing three related initiatives: 1. Funding related to raising awareness for consumers in a low carbon future and climate action partners (Section C2.4.2.3.2) 2. Clean Growth Innovation Fund (Section C6) 3. Targeted Incentives related to renewable gas, natural gas for transportation (NGT), GHG emission reductions for our customers and internal, growth in electric vehicle (EV) transportation (Section C8.3)
Principle 5: The MRP should maintain the utility's focus on maintaining safe, reliable service quality while creating the efficiency incentives to continue with its productivity improvement culture	All of the activities in the MoU are predicated on providing safe, reliable service. For example the safe and efficient retrofit installations of gas furnaces and the deep energy retrofit pilot project.

The three initiatives related to guiding principle 3 have more granular consequences in relation to the Application:

1. Consumer awareness in a low carbon future

As FEI advances the interests of our customers with the MoU, it is essential that our customers and British Columbians in general are aware and understand how FEI and its product and service offerings play a vital role in a low carbon future. In simple marketing terms, in order for a new product to be adopted, consumers and industry must be aware the product exists and understand its merits as a part of the decision making process. In a low carbon future, as described in the MoU, this means that our CoV customers and British Columbians in general would know the myriad of climate solutions FEI offers. This is especially important in relation to the pending stakeholder engagement associated with Big Move #4 (please refer to the response to MoveUP IR 1.3.3 for additional detail). For example, if consumers are aware of the merits of using energy efficiency combined with renewable gas in buildings, they are more likely to support these solutions. Similarly, industry representatives such as potential renewable gas developers are more likely to invest the capital in this sector if they see the pathway to a profitable future.

In addition to raising awareness, as a part of the MoU, FortisBC has committed to provide a Climate Action Partner to the CoV.

2. Clean Growth Innovation Fund

The letter dated April 16, 2019 to FortisBC from the CoV's City Manager, provided in Attachment 2.2, underscores the critical importance of innovation in areas like renewable gas and, future solutions to Big Move #4. In order to successfully represent the interests of our customers, access to predictable funding for the types of innovations necessary to thrive in the CoV, and other regions throughout the Province, are essential.

3. Targeted incentives

All of the proposed Targeted Incentives apply in relation to the MoU including renewable gas, NGT, GHG reductions for our customers and our operations and EVs. Given the CoV's goal of being the greenest city in the world by 2020[2], the CoV represents a challenging operating environment.

[2] https://vancouver.ca/green-vancouver/greenest-city-action-plan.aspx.

3.0 Municipal and Regional Climate Emergency Policies

3.1 Please file the City of Vancouver April 2019 Climate Emergency Response Report (https://council.vancouver.ca/20190424/documents/cfsc1.pdf) and Climate Emergency Response Final Motion (https://vancouver.ca/files/cov/climate-emergency-response-council-amendments.pdf).

Response:

Please refer to Attachment 3.1 for the requested documents.

3.2 Please confirm that Vancouver City Council approved the Final Motion by a unanimous vote.

Response:

Confirmed.

Reference: Climate Emergency Response Final Motion Item "E":

THAT Council adopt the new target that by 2025, all new and replacement heating and hot water systems will be zero emissions, and direct staff to report back by Fall 2020 with a strategy and budget to achieve the target ("Big Move #4").

3.3 What is FortisBC's understanding of the likely processes required, and their likely time-frames, for the City of Vancouver to implement Big Move #4 by 2025?

Response:

FortisBC's understanding of the likely process for the CoV's 6 Big Moves is captured in sections N and O from the Climate Emergency Response Final Motion provided below. Specifically, Council has directed staff to conduct engagement on the 6 Big Moves focusing attention on the implications and impacts (including budgetary) on affordability and/or livability. At this time, no engagement plans have been announced by the CoV nor any time frames for implementation. FortisBC plans to be an active participant in the engagement process advocating for energy solutions that represent the interests of our customers, shareholder and employees.

N. THAT Council acknowledge the necessity of working with partners and stakeholders, including non-profit organizations and industry leaders, to achieve the ambitious targets recommended in the Administrative Report dated April 16, 2019, entitled "Climate Emergency Response" and "6 Big Moves;"

FURTHER THAT Council direct staff to consult with and work with these groups to discuss any implications and impacts, including budgetary; and

FURTHER THAT Council acknowledge the possibility that some of the resources may need to be reprioritized or adjusted and targets recommended in the "6 Big Moves", contained in the above-noted report, to respond to issues including affordability and/or livability in the midst of the City of Vancouver's Emergency Response to the overdose crisis and the housing and affordability crisis.

O. THAT Council direct staff to incorporate robust resident engagement on the Climate Emergency Response framework and its Big Moves components as part of the upcoming City-wide planning process, in order to support livability and vibrant and complete communities.

In anticipation of the implementation of Big Move #4 which recommends that all buildings' space and water heating becomes zero emissions by 2025, FEI understands that many builder /developers with projects in the CoV are considering an earlier switch than 2025 as they believe it will facilitate a more streamlined zoning and permitting approval process. This policy remains under development; however, FEI believes it will place downwards pressure on customer attachments, retention and demand.

3.4 How soon does FortisBC expect that the adoption of this recommendation will begin to influence decisions by project developers in the City of Vancouver with respect to the selection of energy sources for space and water heating?

Response:

Please refer to the response to MoveUP IR 1.3.3.

3.5 Please that confirm that the following municipal or regional governments in British Columbia have passed resolutions since the beginning of the year

recognizing a climate emergency and directing staff to develop response plans: the Capital Regional District, the City of Richmond, the City of New Westminster, the City of Nanaimo, the Regional District of Central Kootenay, the Islands Trust, the City of Powell River, the District of Saanich, and the District of Sooke.

Response:

Confirmed.

3.6 Please confirm that in February 2019 the City of North Vancouver passed a resolution setting accelerated targets for GHG reductions and directing staff to develop plans to achieve these targets.

Response:

Confirmed.

3.7 Please confirm that other cities in Canada, including Ottawa, Montreal, Hamilton, Kingston, and Halifax have also adopted climate emergency resolutions this year.

Response:

Confirmed.

3.8 Does FortisBC anticipate that policies similar to Vancouver's "Big Move #4" will be adopted by other municipalities or regions in British Columbia?

Response:

Please refer to the response to BCUC IR 1.2.1 for a discussion of policies adopted by municipal and provincial governments.

3.9 What is FortisBC's best estimate of the implications of this development – the growing momentum among municipal and regional governments in this province to move away from greenhouse gas-emitting energy sources for heat and hot water – on the prospects for FEI's customer growth and load forecast through the proposed term of the MRP and beyond?

Response:

Please refer to the response to BCUC IRs 1.2.1 and 1.2.3 for discussion of the implications of municipal and provincial polices on load and customer growth.

3.10 What risks does this development pose for FEI and its existing core customers?

Response:

Please refer to the response to BCUC IRs 1.2.1 and 1.2.4 for a discussion of the implications and risk of policy developments to FEI's customers.

3.11 What strategies are being considered by FEI to respond to and mitigate these risks?

Response:

Please refer to the response to BCUC IRs 1.1.1, 1.2.1 and 1.2.4 for a discussion of the response and mitigation of policy-driven risks.

3.12 Recalling the warning from the leaders of global financial institutions in the Open Letter cited above, that companies must act quickly to adapt or they will cease to exist, what are the likely implications of this development in relation to the time-scale within which FEI will need to adapt and achieve transition to a low-carbon future?

Response:

Please refer to the response to BCUC IR 1.2.4 for discussion of the timescale and implications related to the transition to a lower carbon future.

4.0 Evaluation of Current PBR plan

Reference: Section B2.3.1, page B29

In Section B2.3.1 FortisBC provides information on FEI and FBC's O&M expenditures and capital investments over the term of the current PBR.

4.1 Please provide tables, for each of FEI and FBC, showing the utilities' actual or achieved equity rates of return over the PBR term, including if available forecasts for 2019. Please show ESM sharing amounts that flowed to shareholders and customers separately and as part of total equity return.

Response:

The requested tables for FEI and FBC respectively are provided below. To clarify, the sharing amounts shown below are the benefit amounts returned to (or recovered from) customers in each respective year. In the absence of a sharing mechanism, the Utilities would retain all of the earnings benefits.

	FEI ROE		FEI Equity & Sharing		
	Actual Pre-ESM (a)	Actual Post-ESM (b)	Actual Pre-Sharing Equity ($000s) (c)	Actual After-Sharing Equity ($000s) (d)	Sharing Amount ($000s) (e)
2014	9.54%	9.20%	$ 100,645	$ 96,988	$ 3,657
2015	9.51%	9.19%	$ 133,585	$ 128,986	$ 4,599
2016	9.65%	9.28%	$ 136,541	$ 131,379	$ 5,162
2017	9.25%	9.04%	$ 132,711	$ 129,768	$ 2,943
2018	8.99%	8.93%	$ 152,040	$ 151,045	$ 995
2019 *	8.87%	8.89%	$ 153,491	$ 153,983	$ (492)

*2019 amounts are projected assuming $2.0M of O&M savings compared to approved

	FBC ROE		FBC Equity & Sharing		
	Actual Pre-ESM (a)	Actual Post-ESM (b)	Actual Pre-Sharing Equity ($000s) (c)	Actual After-Sharing Equity ($000s) (d)	Sharing Amount ($000s) (e)
2014	9.29%	9.22%	$ 44,789	$ 44,459	$ 330
2015	9.35%	9.26%	$ 46,817	$ 46,336	$ 481
2016	9.52%	9.38%	$ 48,820	$ 48,093	$ 727
2017	9.41%	9.31%	$ 48,597	$ 48,073	$ 524
2018	9.32%	9.29%	$ 49,254	$ 49,121	$ 133
2019 *	9.24%	9.28%	$ 49,615	$ 49,791	$ (176)

*2019 amounts are projected assuming $0.5M of O&M savings compared to approved

4.2 Please provide tables, for each of FEI and FBC, showing total annual capital expenditures, including Major Project expenditures, over the PBR term.

Response:

FortisBC notes that all of the Major Projects were approved through a separate process, and not through the Annual Reviews. Please refer to the table below for FEI's total annual capital expenditures, including Major Project expenditures, over the Current PBR Plan term.

FEI Sustainment, Growth, Other and Major Project Expenditures ($000s)

	2014 Actual	2015 Actual	2016 Actual	2017 Actual	2018 Actual	2019 YEF
Sustainment Capital (Gross)	89,688	92,947	93,468	108,036	115,210	109,187
Other Capital	35,670	24,430	28,977	40,219	43,997	44,693
Net Growth Capital	33,360	48,694	47,947	60,339	84,787	76,877
Major Projects	143,538	196,728	109,927	195,695	191,241	252,535
Total Capital Expenditures	302,256	362,799	280,319	404,288	435,235	483,292

FBC's total capital expenditures over the Current PBR Plan term are provided in the response to BCUC IR 1.51.1.

5.0 Indexing of O&M Expenses – Growth Factor

Reference: Section C 1.4.2, page C-8 to C-10

For the purposes of forecasting O&M expenses, FortisBC has proposed to escalate forecast expenditures in proportion to growth in the number of customers. At page C-9, line 8, the Company says that

> "…the correlation coefficients between the average number of customers and actual formula O&M expenditures for FEI and FBC are calculated at 0.95 and 0.90 respectively. These high correlation coefficient numbers indicate a strong linear relationship between the variable and negate the need for the 0.5 multiplier."

5.1 Please provide workpapers showing the calculations and underlying data that support the referenced correlation coefficients.

Response:

Please refer to the response to BCOAPO IR 1.23.1.

5.2 Is it FortisBC's position that FEI and FBC's O&M expenses (or the portion of those expenses that are accounted for in the index mechanism) are, on an expected basis, directly proportional to the number of customers that each utility has? Why or why not?

Response:

Please refer to the response to BCUC IR 1.17.7, which discusses why the proposal Index-Based formulaic approach is reasonable and appropriate for determining allowed O&M funding for the proposed MRPs.

5.3 Is it FortisBC's position that the "high correlation coefficient numbers" referred to, which evaluate the relationship between (1) Formula O&M expenditures that include an inflation escalation and a 50% growth factor, and (2) customer numbers, demonstrate that O&M expenses are on average directly proportional to customer numbers without taking account of inflation? Why or why not?

Response:

As explained in the Application, the main purpose of the correlation analysis referenced in the preamble was to rebut the statement in the 2014 PBR Decision that the relationships between costs and cost drivers are non-linear. The correlation analysis shows that a reduction to the growth factor is not warranted.

Please also refer to the response to BCUC IR 1.17.7 which discusses why the proposal Index-Based formulaic approach is reasonable and appropriate for determining allowed O&M funding for the proposed MRPs.

5.4 If the response to 5.3 is "yes", please explain in detail, with a numerical example, why that result follows from the correlation coefficient results provided in response to 3.1.

Response:

FortisBC presumes the question is referring to the correlation results provided in response to MoveUP IR 1.5.1. For more information regarding the relationship between the correlation analysis and the proposed growth factor, please refer to the response to BCUC IR 1.17.7 which discusses why the proposal Index-Based formulaic approach is reasonable and appropriate for determining allowed O&M funding for the proposed MRPs.

5.5 Please provide any other studies or analyses the FortisBC has undertaken, obtained from third parties, or otherwise relied on, that support the claim that O&M expenses are directly proportional to customer numbers, either for the FortisBC utilities or for utilities in general.

Response:

As explained in the response to BCUC IR 1.17.6, the jurisdictional review of multi-year plans in other Canadian provinces indicates that all utilities have growth factors that are either embedded in or implicit in their indexing formulas; however, with the exception of Hydro Quebec Distribution's formula, no other jurisdiction applies adjustments to the formulas' growth factor.

Please also refer to the response to BCUC IR 1.17.7.

6.0 O&M Base Funding – Incremental Funding

Reference: Table C2-7, p. C-19 (FEI), Table C2-14, p.C-44 (FBC) and the discussions that follow

In Tables C2-7 and C2-14 FortisBC sets out proposed calculations of 2019 Base O&M expenditures for FEI and FBC, respectively. For FEI Table C2-7 shows total incremental O&M spending of $10.416 million, while for FBC the corresponding figure in Table C2-14 is $0.763 million. These proposed incremental amounts are broken down into various categories and the need for them explained in the remaining sections of sections 2.4 and 2.5.

6.1 The referenced tables show the proposed incremental O&M amounts as adjustments to 2019 Base O&M. Please confirm that the calculation of the proposed "2019 Base O&M" reflected in the tables is intended to establish a notional or theoretical 2019 O&M figure that would serve only as a base from which formula 2020 O&M expenditures would be derived through the application of the escalation formula, i.e. without affecting formula O&M expenditures for 2019.

Response:

The IR incorrectly references Table C2-7 as setting out the proposed 2019 Base O&M calculations for FEI. The correct reference is to Table C2-1 (page C-19).

The 2019 Base O&M in Table C2-1 (FEI) and C2-14 (FBC) represents the appropriate starting point for determining formulaic O&M funding for the MRP, incorporating known and measurable adjustments. The 2019 Base O&M serves as the base on which an escalation formula is applied to determine O&M funding in the upcoming MRP term.

Confirmed that FortisBC's proposed 2019 Base O&M does not affect the 2019 allowed formula O&M expenditures for FEI and FBC for the last year of the Current PBR Plans.

6.2 If the response to 6.1 is "not confirmed", please explain what adjustments to formula O&M are being proposed for 2019.

Response:

Please refer to the response to MoveUP IR 1.6.1.

6.3 Given that FortisBC identified the need for these various incremental O&M expenditures before it filed the Application in late 2018, please provide a description of which new expenditures described in sections 2.4.2.3 and 2.5.2.3 have been or will be commenced in 2019, notwithstanding the fact that Formula O&M for 2019 as already been fixed. Please include an estimate of total new employees or other resources that have been or will be acquired in 2019, the timing of that activity, and an estimate of the total incremental cost that will be incurred in 2019.

Response:

FortisBC notes that it filed the Application on March 11, 2019, not in late 2018.

FortisBC is nearing the end of its Current PBR Plans where much of the focus for O&M has been on achieving cost efficiencies and savings which are shared equally with customers. FortisBC has been a responsible steward in prioritizing and managing its O&M expenditures during the term of the Current PBR Plans. In the proposed MRPs, FortisBC is proposing incremental funding to support initiatives that address future key issues and challenges in its operating environment.

For each area of FEI and FBC's proposed incremental O&M funding, FortisBC provides below an estimate of total new employees or other resources that have been or will be acquired in 2019, the timing of that activity, and an estimate of the total incremental cost that will be incurred in 2019.

FEI Incremental O&M Funding

- **System Operations, Integrity and Security:** FEI expects to increase expenditures by approximately $2 million in 2019 compared to 2018 actuals (refer to Table C2-13), recognizing the importance of continuing to improve its practices to remain in compliance with evolving industry regulations and practices. FEI plans to add approximately 8 new employees as well as consulting resources. These resources will be added over the course of the year to execute the additional scope to keep up with the evolving requirements and the increasing volume of work.
- **Cybersecurity:** FEI expects to increase expenditures by approximately $0.6 million in 2019 compared to 2018 actuals (refer to Table C2-13). FortisBC will continue to strengthen its cyber security activities including supporting patch management activities throughout 2019, using both internal and external resources. FEI plans to add 6

employees (i.e., 3 MoveUP, 3 M&E) related to cyber security in 2019 with the costs for these employees allocated to both O&M and capital expenditures.

FBC Incremental O&M Funding

- **System Operations, Integrity and Security:** FBC expects to increase expenditures by approximately $0.1 million in 2019 compared to 2018 actuals (refer to Table C2-16), recognizing the importance of continuing to improve its practices to remain in compliance with evolving industry regulations and practices. FBC plans to add approximately 4 new employees as well as consulting resources. These resources will be added over the course of the year to execute additional Tree Management and Dam Safety scope and increase the number of apprentices in the Network Operations Apprentice Program.
- **Cybersecurity:** FBC expects to increase expenditures by approximately $0.08 million in 2019 compared to 2018 actuals (refer to Table C2-16). FortisBC will continue to strengthen its cyber security activities including supporting patch management activities throughout 2019, using both internal and external resources. FBC plans to add 5 employees (i.e., 5 MoveUP) related to cyber security in 2019, with the costs for these employees allocated to both O&M and capital expenditures.

Funding for the increased activities in 2019 described above will come from the 2019 allowed formula O&M funding available. The increased activities are expected to contribute to cost pressures in 2019 and lower overall O&M savings shared with customers compared to prior years. FortisBC will also be prioritizing its overall O&M expenditures in 2019 to accommodate the increased spending expected in the areas, while maintaining its focus on overall service quality levels.

For incremental funding requests related to addressing the new operating environment and challenges related to Customer Expectations, Engagement, and Indigenous Relations, FortisBC does not expect to incur significant incremental costs for these items in 2019 compared to 2018. FortisBC's focus in the Current PBR Plan has primarily been on providing safe and reliable operations while achieving cost efficiencies and supporting customer growth as evidenced by the high number of customer additions. As we near the end of the Current PBR Plans, issues have evolved and events have transpired (e.g., CleanBC plan, federal government climate policy framework, Indigenous engagement requirements) that have highlighted the need for FortisBC to focus not only on continuing to operate safely and reliably, but also on these emerging issues that will affect the Companies' operations in the future. FortisBC is now seeking incremental funding to address these challenges that have become priorities for the continued success of its business.

6.4 If the response to 4.3 is that none or only a small portion of the proposed incremental resources have been or will be acquired in 2019, please explain why FortisBC has not implemented these new or expanded programs in 2019, 2018, or earlier, if they in fact are required.

Response:

Please refer to the response to MoveUP IR 1.6.3.

7.0 FEI Growth Capital Proposed Base Unit Cost

Reference: Table C3-3, p. C-61

The referenced table, together with the explanations that follow in section 3.3.1.3.2, show FortisBC's calculation of the proposed Base Unit cost for FEI Growth Capital. The table appears to show and propose an increase in unit cost, relative to the 2016-2018 average, of about 15%.

7.1 The average growth capital unit cost per customer addition of $3,325 shown as the average for the 2016-2018 period appears to reflect annual average inflation-adjusted unit costs of $3,857 in 2018, but only $3,038 and $2,980 in 2017 and 2016, respectively. What is FortisBC's understanding of the reasons for the significant (approximately 28%) increase in inflation-adjusted unit costs from 2016/2017 to 2018?

Response:

Please refer to the response to BCUC IR 1.8.10.

7.2 Please explain FortisBC's rationale for using the three-year average value, rather than, for example, a 2016/17 average or the 2018 value.

Response:

Please refer to the responses to BCUC IR 1.8.13 and CEC IR 1.27.1.

7.3 Where variances arise between the forecast Growth Capital Unit Cost, escalated for inflation, and actual unit costs, so that actual growth capital varies from the formula result even if the annual forecast of gross customer additions is correct, please confirm that the resulting variance between actual and forecast growth capital will be corrected for rate purposes in the subsequent year (on a forecast or actual basis), by restating plant in service to the actual value, but that for the year in which the variance occurs the impact of the variance on return, depreciation, debt cost, and income taxes will be shared between FortisBC and customers through the earnings sharing mechanism. If not confirmed, please

explain why not, and provide a detailed explanation of how such variances will be treated for rate-making purposes, including a numerical example.

Response:

Not confirmed. The unit cost variance in Growth capital will not be trued up over the term of the MRP. As FEI has proposed a true up of the forecast of gross customer additions, if the unit cost were also trued up, then the incentive mechanism for Growth capital would be eliminated.

By letting variances in depreciation, interest and income taxes (stemming from variances in Growth capital until cost) fall to earnings, the Utilities are incented to find efficiencies. Both the Utilities and customers benefit from this mechanism as customers share 50/50 in savings due to any efficiencies achieved. FortisBC has provided a detailed calculation of how variances in Regular capital, including Growth capital, will be treated in Exhibit B-2, BCUC Request 3.

8.0 FEI Sustainment and Other Capital Forecasts; FBC Regular Capital Forecasts

Reference: Section 3.3.2 (FEI) and 3.4.1 (FBC).

In the referenced sections FortisBC sets out its 2020-2024 forecasts for the referenced categories of capital investments, together with descriptions of the various projects and categories of investments that it expects to undertake. At page C-76, line 71, in relation to FEI Sustainment and Other Capital, FortisBC says:

> Accordingly, the timing, scope, and cost of the individual projects and programs within the overall Sustainment and Other Capital forecasts included in rates are subject to change, and FEI may identify different projects and programs that need to be added over the term of the Proposed MRP.

At page C-77, in relation to FEI, and subsequently in similar terms in relation to FBC, FortisBC indicates that, "should FEI deem necessary" it will file an updated 2023-24 forecast in 2022 and ask for approval of the changes.

8.1 Please confirm that, for rate-making purposes, all variances between forecast and actual capital expenditures in the FEI Sustainment and Other categories, and all FBC Regular Capital categories, will be corrected in the subsequent year (on a forecast or actual basis) by restating plant in service to the actual value, but that for the year in which the variance occurs the impact of the variance on return, depreciation, debt cost, and income taxes will be shared between FortisBC and customers through the earnings sharing mechanism. If not confirmed, please explain why not, and provide a detailed explanation of how such variances will be treated for rate-making purposes, including a numerical example.

Response:

Not confirmed. Please refer to the response to BCUC IR 1.64.2 for a discussion of the rationale for the treatment of the capital variances.

FortisBC provided a numerical example at page 5 of Exhibit B-2, which is reproduced below for ease of reference.

Line	Particulars	Forecast	Actual	Difference	Reference
1	Capital Spending	$100,000	$ 95,000	(5,000)	
2	Mid-Year add to Rate Base	$ 50,000	$ 47,500		
3					
4	Depreciation Rate	3.0%	3.0%		No depreciation impact in first year
5	Depreciation Expense	3,000	2,850		however, included in this calculation
6					
7	Debt Ratio	60%	60%		
8	Interest Rate	5.5%	5.5%		
9	Interest Expense	1,650	1,568		Line 2 x Line 7 x Line 8
10					
11	Income Tax Rate	27.0%	27.0%		
12	Income Tax Expense	666	632		Complex calc, therefore estimate
13					
14	**Sum of Depreciation, Interest and Income Tax Expense**	**5,316**	**5,050**	**(266)**	*** Line 5 + Line 9 + Line 12**

* Lower actual expenses than forecast, shown in the Difference column, will result in an increase to the earnings and, correspondingly, an increase in the achieved ROE.

8.2 If the response to 8.1 is "confirmed", what is the purpose, and the value to customers and FortisBC, of proposing 5-year forecasts of capital expenditures in these categories, as opposed to, for example, providing forecasts for each year as part of the annual review process?

Response:

A five-year forecast of Regular capital expenditures (except FEI Growth capital) was selected as it provides:

- Reduced regulatory costs and internal efficiencies associated with a single regulatory process approving the level of capital expenditures to be included in rates;
- Increased ability to manage capital expenditures with a long-term view which permits greater certainty and ability to manage capital efficiently over time (please refer to the response to BCUC IR 1.47.10 and Section C3.2 of the Application);
- Sustained incentive to contain Regular capital spending at the approved level over the term of the MRPs; and
- Responsive to intervener concerns (please refer to the response to BCUC IR 1.19.4).

8.3 Does FortisBC agree that the main impact of providing forecasts on a more frequent basis would be to reduce the annual variances that are subject to the ESM? Why or why not?

Response:

Providing a five-year forecast of capital, with the ability to refresh the forecast for years 2023 and 2024 of the MRP term, provides an appropriate balance between regulatory efficiency and utility/ratepayer risk. Capital efficiencies achieved through the MRP term will flow to the ESM.

9.0 Major Projects Capital for FEI and FBC

Reference: Section 3.3.3 (FEI) and section 3.4.2 (FBC)

In the referenced sections of the Application FortisBC describes various Major Projects that it anticipates will be undertaken by FEI and FBC over the proposed MRP term, without providing details of cost, detailed timing of the investments or their current approval status.

9.1 Please provide an explanation of how capital-related costs for Major Projects for FEI and FBC will be accounted for in the rate-making process under the Proposed MRP. For example, will capital additions associated with on-going Major Projects be forecast annually as part of the Annual Review process? If not, how and when will those costs be recovered in rates? If so, how will variances between forecast and actual Major Project capital expenditures be treated for rate-making purposes, e.g. through a flow-through mechanism, the ESM, or through a mechanism that assigns responsibility for those impacts to shareholders?

Response:

The treatment for Major Projects will be the same under the proposed MRPs as in the Current PBR Plans. Following BCUC approval, capital expenditures remain in Construction Work in Progress until project completion and do not impact rates. Rate base additions occur on January 1 of the year following that in which plant is placed into service. As a result, there are no variances, or only minimal variances, between the forecast revenue requirements components related to CPCN projects and no measurable impact on the ESM.

10.0 Capital Planning Process; Impact of Capital Investments on O&M expenses

Reference: Section 3.2 at page C-52.

In the referenced section FortisBC describes its Capital Planning Process and the Asset Investment Planning (AIP) process that it is in the process of implementing. Figure C3-1 is a diagrammatic representation of the AIP process, and in the box labelled "Financial" it appears that two of the criteria that are relevant to the planning process are "Cost Avoidance – O&M" and "Cost Savings – O&M".

10.1 Has FortisBC estimated the O&M Avoidance and O&M Cost Savings benefits associated with any of forecast FEI Growth Capital, FEI Sustainment and Other Capital, FBC Regular Capital, or Major Project Capital for FEI and FBC? If not, why not? If so, please provide the estimates for each year and category of capital investments, in as much detail as possible and with totals provided by utility, year and category of investment.

Response:

FortisBC considers the impacts of capital expenditures on O&M expense when considering individual capital projects or when deciding between alternatives for a project. Growth capital expenditures are likely to be associated with increases in O&M expense as Growth capital increases the asset base that is required to be maintained. The Companies perform Sustainment capital programs (including the majority of Other capital expenditures) in order to maintain the condition of assets, such that Sustainment capital is unlikely to be associated with any significant increases or decreases in O&M expense.

FEI and FBC estimate O&M impacts explicitly for Major Projects in their CPCN applications. (Please refer to the response to CEC IR 1.29.1). As many of the Major Projects listed in this Application are at preliminary or investigative stages, the O&M impacts, if any, have not yet been determined. The following O&M adjustments related to Major Projects are known and will be included in Annual Reviews as appropriate:

FEI Major Projects:

- **CoV Landfill:** Sustainment O&M associated with this project is primarily driven by landfill gas throughput, cost of electricity and the technology adopted for the upgrade process. O&M is forecast at $1.0 million annually escalated for inflation and comprised of approximately 60 percent electricity, 14 percent labor, 11 percent filter/media replacements & disposal, 11 percent maintenance and 4 percent other costs.
- **Inland Gas Upgrades Project:** The present value of post-project incremental sustainment O&M was used in the evaluation of alternatives for each transmission lateral to choose between the In-line Inspection (ILI), Pipeline Replacement (PLR) and

Pressure Reduction Station (PRS) alternatives. In all cases the ILI and PRS alternatives will result in a net increase in Sustainment O&M costs, while the pipeline replacement has no impact on future Sustainment O&M costs.

FBC Major Projects:

- **Upper Bonnington Old Units Refurbishment:** O&M savings are being realized during the project execution phase. A one-time O&M reduction in forecast O&M expense (outside of formula) of $0.040 million for each of the four units, due to suspending annual unit inspections in the year of refurbishment, was recognized in rates for 2017 through 2019. The final O&M reduction will be recognized in the Annual Review for 2020 Rates. Beginning in 2021 all units will again be subject to annual inspections, the costs of which are included in Base O&M.
- **Corra Linn Spillway Gate Replacement Project:** O&M expense related to the Corra Linn plant is dominated by O&M activity on the generating units themselves and are not materially impacted by the replacement of the gates.
- **Grand Forks Terminal Station Reliability Project:** If approved, this project will see the removal of 44.6 km of transmission lines between Christina Lake and Rossland and an associated reduction of $0.089 million annually for line patrol and right-of-way brushing. These ongoing O&M reductions are expected to commence in 2021 and will be effected by way of a reduction to Base O&M Expense.

10.2 Please explain how, if at all, FortisBC has incorporated the expected impact of forecast capital investments by FEI and FBC, including both Regular and Major Projects capital, on required O&M expenditures over the term of the Proposed MRP, and how those expected impacts have been reflected in the O&M forecasting mechanism described in the Application.

Response:

Please refer to the response to MoveUP IR 1.10.1.

10.3. If the response to 10.2 is that the O&M formulas and various capital forecasts have been developed independently and do not affect one another, please explain why that is a reasonable conclusion, given that the Company's capital

planning process explicitly takes O&M impacts into account in optimizing capital expenditures.

Response:

Please refer to the response to MoveUP IR 1.10.1.

Attachment 1.1

Open letter on climate-related financial risks

Open letter from the Governor of Bank of England Mark Carney, Governor of Banque de France François Villeroy de Galhau and Chair of the Network for Greening the Financial Services Frank Elderson.

BANK OF ENGLAND

Published on 17 April 2019

The catastrophic effects of climate change are already visible around the world. From blistering heatwaves in North America to typhoons in south-east Asia and droughts in Africa and Australia, no country or community is immune. These events damage infrastructure and private property, negatively affect health, decrease productivity and destroy wealth. And they are extremely costly: insured losses have risen five-fold in the past three decades. The enormous human and financial costs of climate change are having a devastating effect on our collective wellbeing.

The impact of climate change has compelled governments to act. Catalysed by the Paris agreement, governments around the world are putting policies in place to limit the global rise in temperatures to 2C, and preferably as close to 1.5C as possible. The actions undertaken by individual countries will deliver a collective transition to a low-carbon economy. But this transition brings its own risks. Carbon emissions have to decline by 45% from 2010 levels over the next decade in order to reach net zero by 2050. This requires a massive reallocation of capital. If some companies and industries fail to adjust to this new world, they will fail to exist.

The prime responsibility for climate policy will continue to sit with governments. And the private sector will determine the success of the adjustment. But as financial policymakers and prudential supervisors, we cannot ignore the obvious risks before our eyes.

That is why 34 central banks and supervisors – representing five continents, half of global greenhouse gas emissions and the supervision of two-thirds of the global systemically important banks and insurers – joined forces in 2017 to create a coalition of the willing: the Network for Greening the Financial System (NGFS).

On Wednesday, this coalition's first comprehensive report seeks to translate commitments to act on climate-related financial risks into concrete action. The four recommendations in the report provide all central banks, supervisors and the financial community with deliverable goals that will help to ensure a smooth transition to a low-carbon economy. We therefore call on policymakers and the financial sector to do the following.

First, integrate the monitoring of climate-related financial risks into day-to-day supervisory work, financial stability monitoring and board risk management. Supervisors are encouraged to set expectations to ensure financial firms are adequately addressing the financial risks from climate change, including by conducting scenario analysis to assess their strategic resilience to climate change policy. Firms are encouraged to take a long-term, strategic approach to the consideration of these risks, and to embed them into their business-as-usual governance and risk-management frameworks.

Second, lead by example, specifically central banks are encouraged to integrate sustainability into their own portfolio management.

Third, collaborate to bridge the data gaps to enhance the assessment of climate-related risks. Public authorities should share and if possible make publicly available any climate-risk data.

Fourth, build in-house capacity and share knowledge with other stakeholders on management of climate-related financial risks. An important element to achieving effective consideration of climate risks across the financial system is to support internal and external collaboration.

The success of these recommendations relies on two important factors, which lead to two broader calls to action on disclosure and classification of climate-related financial risks. First, to support the market and regulators in adequately assessing the risks and opportunities from climate change, robust and internationally consistent disclosure is vital. The market and policymakers must continue to work together to determine the most decision-useful metrics for climate-related financial disclosures.

Second, the NGFS encourages regulators to develop an adequate classification system to identify which economic activities contribute to the transition to a green and low-carbon economy. This will be particularly valuable in supporting financial actors to make sustainable investment and lending decisions.

If the financial community acts on these recommendations we will be two big steps closer to ensuring an orderly transition to a low-carbon economy. We recognise that the challenges we face are unprecedented, urgent and analytically difficult. The stakes are undoubtedly high, but the commitment of all actors in the financial system to act on these recommendations will help avoid a climate-driven “Minsky moment” – the term we use to refer to a sudden collapse in asset prices.

As long as temperatures and sea levels continue to rise and with them climate-related financial risks, central banks, supervisors and financial institutions will continue to raise the bar to address these climate-related risks and to “green” the financial system. We need collective leadership and action across countries and we need to be ambitious. The NGFS is the core of the response of central banks and supervisors. But climate change is a global problem, which requires global solutions, in which the whole financial sector has a crucial role to play.

Attachment 1.2

BANK OF CANADA
BANQUE DU CANADA

Financial System Review—2019

A stable and efficient financial system is essential for sustaining economic growth and raising living standards. In our *Financial System Review*, we identify the main vulnerabilities and risks to financial stability in Canada and explain how they have evolved over the past year.

Browse previous versions of the *Financial System Review*.

Summary

Progress on two key vulnerabilities

The vulnerabilities associated with high household debt and imbalances in the housing market have declined modestly but remain significant.

1. The combined effect of mortgage stress tests and past increases in interest rates has slowed household borrowing and improved the quality of new mortgage lending. The share of Canadians falling behind on their debt payments remains relatively low and steady.
2. Housing resales and price growth have slowed significantly in Toronto and Vancouver over the past two years. Provincial housing measures, mortgage stress tests and past increases in interest rates have helped reduce excesses in these markets. Difficulties in the oil sector continue to weigh on housing markets in oil-producing provinces.

Despite this progress, we need to remain vigilant as the overall level of indebtedness continues to be high, with a large portion of that debt held by highly indebted households.

> New measures have curbed borrowing, reduced speculative behaviour in housing markets and made the financial system more resilient. While the fundamentals in the housing sector remain solid overall and the sector should return to growth later this year, we continue to monitor these vulnerabilities closely.
>
> *Governor Stephen S. Poloz*

See Governor Poloz's opening statement and press conference.

Fragile corporate debt funding emerging as a vulnerability

Across many countries, including Canada, companies have become more indebted. This increase has been concentrated in lower-rated firms. Investor appetite for high-yield bonds and leveraged loans has driven this increase in borrowing, thus making future activity susceptible to shifts in investor sentiment. We will be monitoring this closely.

Other vulnerabilities highlighted in the 2019 *Financial System Review* include the following:

- cyber incidents that could spread across the financial system
- the rapidly changing crypto-asset and fintech sectors
- climate change

Assessing climate-related risks

We want to better understand the risks that climate change poses to the economy and financial system. To do this, we are beginning a multi-year research effort and plan to

- collaborate with domestic and international partners to build our analytical capacity, and
- integrate climate-related risks into financial stability analysis.

The Bank of Canada will publish this work on the Financial System Hub and as part of the *Financial System Review*.

Risk slightly higher, but the system remains resilient

The overall risk to the Canadian financial system has increased slightly since our last assessment in June 2018. This increase is due to a slowdown in economic growth, caused in part by global trade policy uncertainty, last year's oil price decline, ongoing difficulties in the energy sector and expanded risk taking in global financial markets.

The most important risks to Canada's financial system remain a severe nationwide recession, a large house price correction and a sharp repricing of risk in financial markets. A recent stress test conducted by our staff considers these risks and finds that if they materialized, large Canadian banks would be well positioned to manage them, which in turn would mitigate the effects on the wider financial system. At the same time, a second stress shows a scenario in which a material rise in interest rates would result in large redemptions in corporate bond mutual funds, causing a material widening in corporate spreads, which may exacerbate liquidity conditions.

Overall, the financial system remains resilient, and confidence among market participants continues to be high.

> Global uncertainty is rising, and risks to financial stability have edged up in the past year. Still, confidence in the resilience of Canada's financial system remains high, and we are seeing improvements in some of the key vulnerabilities we've been worried about for many years.
>
> *Governor Stephen S. Poloz*

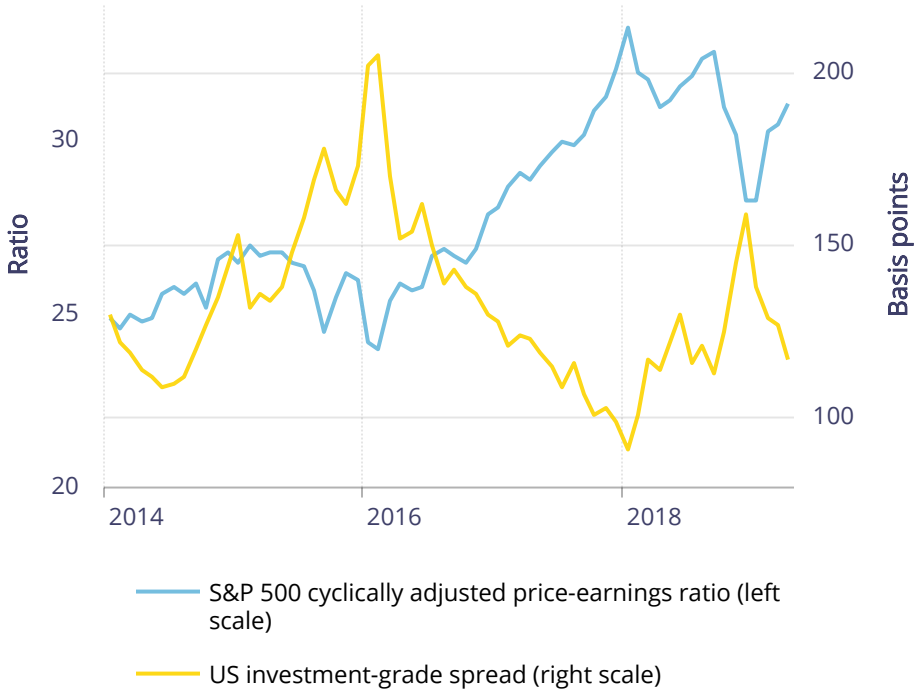
Macrofinancial conditions

» Global financial conditions remain accommodative after a brief tightening at the end of 2018. High leverage leaves the global financial system vulnerable to large adverse shocks.

Global financial conditions have returned to the accommodative levels that prevailed in mid-2018. Low interest rates and optimism about global growth supported risk appetites and asset valuations through much of last year. However, as trade tensions heightened and global growth slowed late in the year, investors became more concerned about the prospects for global economic activity and corporate earnings. In this context, market unease about the pace of monetary policy tightening in some economies also contributed to the deterioration in market sentiment. Equities and other major risky asset classes saw price declines (Chart 1). In the United States, issuance in the leveraged loan and corporate bond markets dropped dramatically as spreads widened, while bond and loan investment funds experienced large outflows. Yields on longer-term government bonds fell (Chart 2).

In early 2019, many major central banks removed the tightening bias in their policy communications in response to growing downside risks to economic growth. Increased uncertainty about trade negotiations and the tightening in market conditions were cited as sources of downside risk. The new tone contributed to a rebound in risky asset prices and further declines in yields on longer-term government bonds. The Government of Canada five-year bond yield fell to levels last seen two years ago. Consistent with this decline, Canadian bank funding costs fell, and rates on five-year, fixed-rate mortgages declined to around 3.2 per cent.

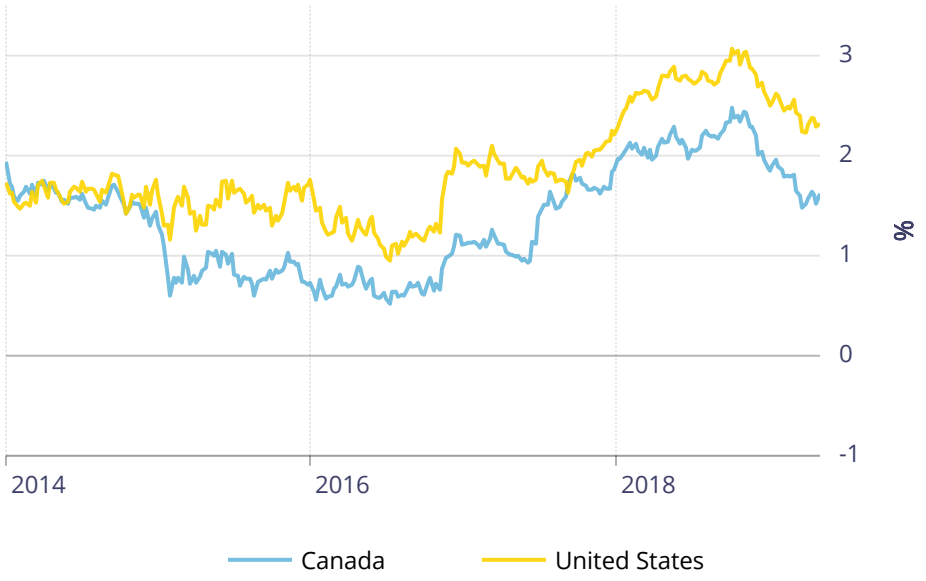
Chart 1: Asset prices and spreads have returned to their levels of a year ago



Sources: Bank of America Merrill Lynch, Bloomberg Finance L.P. and Online Data Robert Shiller
Last observation: April 2019

Chart 2: Five-year government bond yields have declined from recent peaks

Yields to maturity on five-year sovereign bonds



Source: Bloomberg Finance L.P.
Last observation: May 3, 2019

Accommodative global financial conditions support near-term growth but may also allow vulnerabilities to build:

- Aggregate debt relative to gross domestic product (GDP) for non-financial corporations is near historic highs in advanced economies.
- Government borrowing is still elevated following past rounds of fiscal stimulus.
- In many countries, the household sector is heavily indebted.
- Financial risk taking has broadly increased, and the creditworthiness of some borrowers has worsened.

In these conditions, a sudden and sharp repricing of credit risk could put pressure on borrowers. This leaves the global financial system vulnerable to large economic and financial shocks.[1]

Vulnerabilities in the Canadian financial system

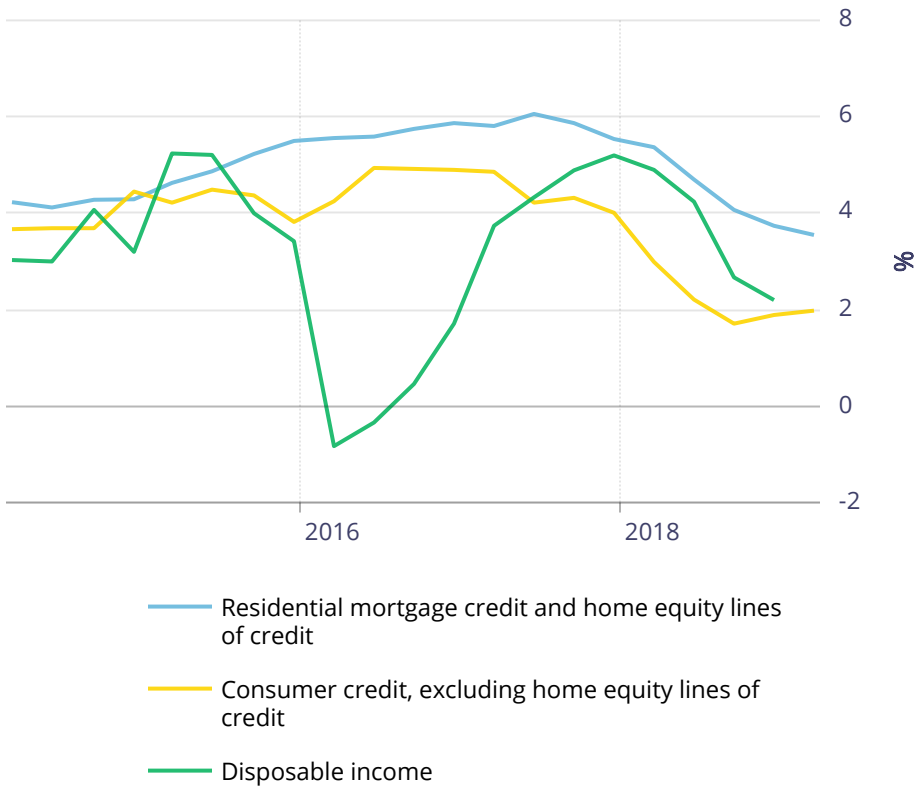
Vulnerability 1: Elevated level of household indebtedness

- Highly indebted households are those that have a lot of debt relative to their income. They have less flexibility to deal with sudden changes, such as a decline in income or in the price of their home. When many households are highly indebted, the effects of negative shocks on the financial system and the economy are greater.
- Overall, the vulnerability associated with high household indebtedness remains significant, although it has declined modestly. As households adjust to changes in mortgage policies and past increases in interest rates, the pace of borrowing has slowed and the quality of new mortgages has improved. Nonetheless, a large amount of debt in Canada is held by highly indebted households.

Credit growth has slowed notably since 2017, bottoming out recently at about 3.3 per cent. The slowdown is evident in both real-estate and consumer lending (Chart 3). Real-estate lending includes home equity lines of credit, which contracted in 2018, according to new data from banks.[2]

Chart 3: Household credit growth has moderated

Year-over-year growth

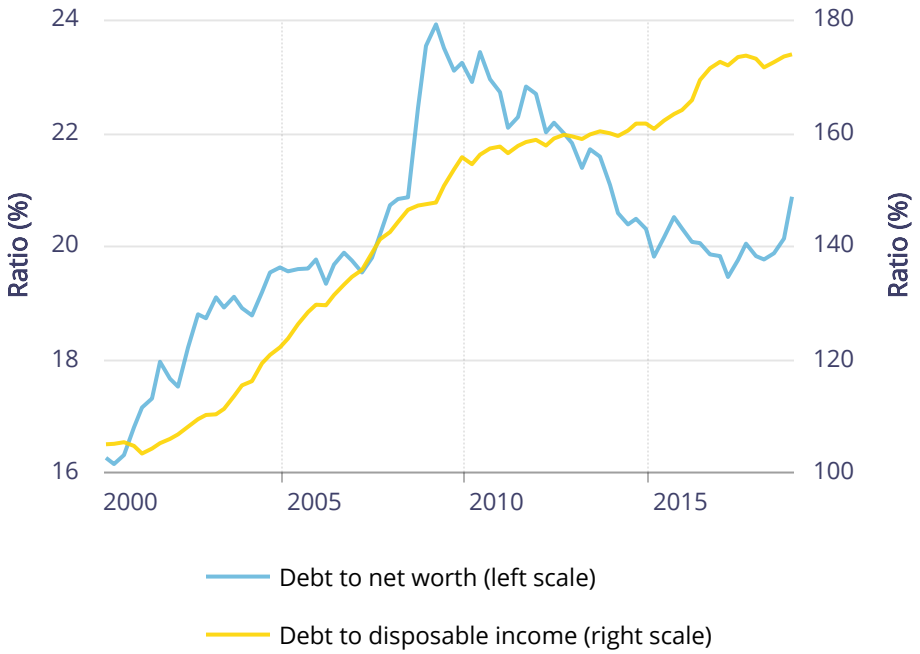


Sources: Statistics Canada and Bank of Canada calculations

Last observations: credit series, 2019Q1; disposable income, 2018Q4

Household indebtedness, as measured by the ratio of debt to disposable income, remains high. It has been relatively stable because income growth has slowed along with credit growth (Chart 4). In contrast, after having declined for nearly a decade, household debt as a percentage of net worth has recently increased due to slower growth in house prices. Box 1 further discusses long-term trends in household net worth, indebtedness and vulnerabilities.

Chart 4: The ratio of debt to disposable income is stable, while debt to net worth has increased recently



Sources: Statistics Canada and Bank of Canada calculations Last observation: 2018Q4

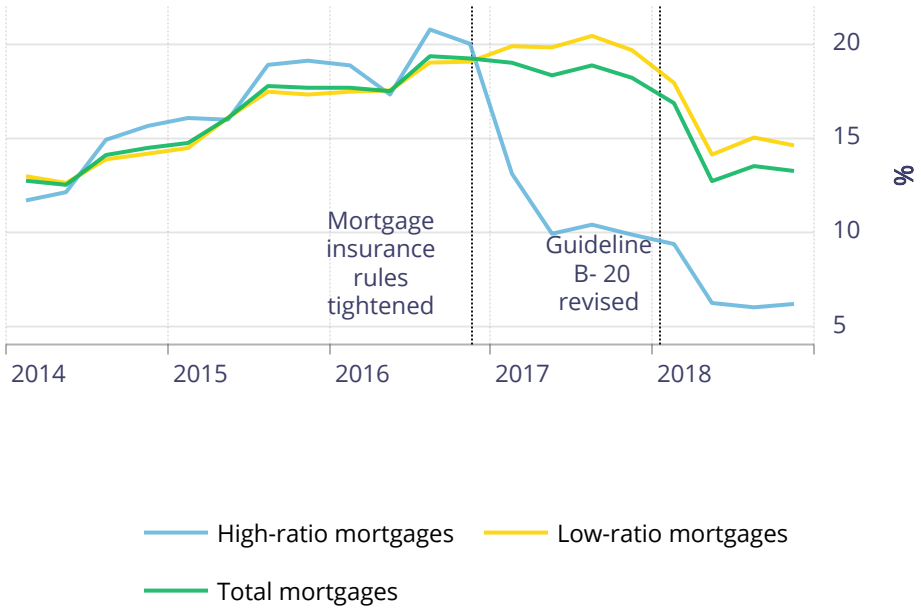
The quality of new mortgage borrowing has improved, but a large amount of debt in Canada is held by highly indebted households. The share of new mortgage lending to households with a loan-to-income ratio greater than 450 per cent fell to a new, lower level (Chart 5). This decline is due in part to tighter mortgage regulations, including a stricter stress test for mortgage interest rates.[3] Some households responded by

- buying a less expensive home,
- delaying their purchases to save more for a down payment, or
- obtaining a loan from a lender that does not apply the stress test.

These regulatory changes increase the resilience of the financial system by making it more likely that new borrowers could handle their mortgage payments even if interest rates rise or their incomes decline. The amount of debt held by highly indebted households, however, remains high and is expected to decline slowly as debt gets paid down and incomes grow.

Chart 5: The share of mortgages going to highly indebted households has stabilized at a lower level

Share of new mortgages with a loan-to-income ratio greater than 450 per cent



Notes: Data include purchases and refinances originated by federally regulated financial institutions. High-ratio mortgages have a loan-to-value ratio greater than 80 per cent and must be insured. Low-ratio mortgages have a loan-to-value ratio of 80 per cent or less. B-20 is the mortgage underwriting guideline for federally regulated lenders.
Sources: Department of Finance Canada, regulatory filings of Canadian banks and Bank of Canada calculations
Last observation: 2018Q4

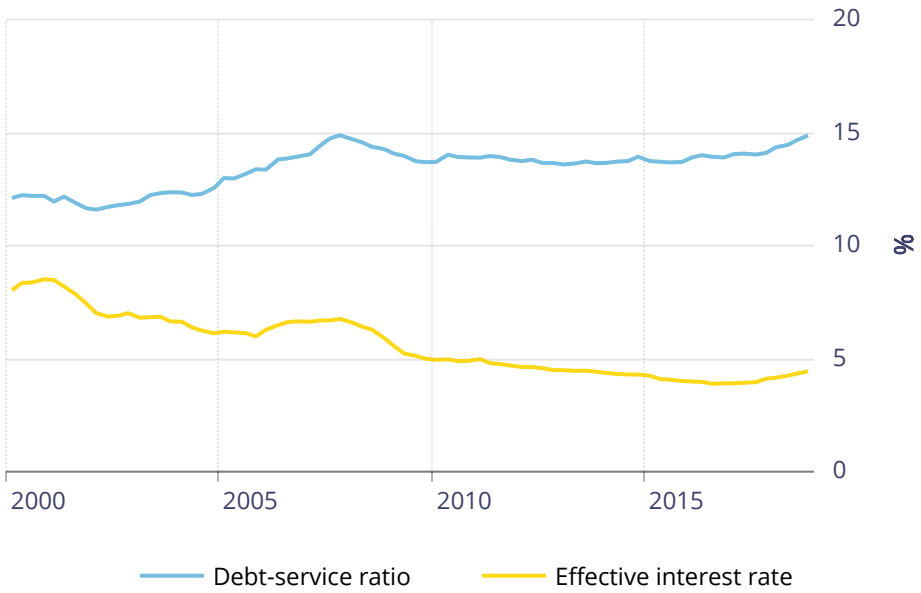
Read more on the Financial System Hub in "The Impact of Recent Policy Changes on the Canadian Mortgage Market"

Households are adjusting to past increases in interest rates. The sensitivity of the economy to higher interest rates has grown because of the rise in household indebtedness and the stricter mortgage interest rate stress tests. As rates rose in 2018, more households were bound by the limits to the debt-service ratio than would have been if the stress tests had not been strengthened.

Until recently, the average debt-service ratio had been relatively stable due to offsetting effects from a steady decline in interest rates and rising indebtedness (Chart 6). Interest rates started to rise in the middle of 2017. The average interest rate for existing debt (the effective interest rate) reached 4.4 per cent by the end of 2018, according to the most recently available data. This led to a rise in the average debt-service ratio, which is at its historic high. Rising interest rates have a more significant impact on highly indebted households, which are already dedicating a greater share of their income to debt payments.

However, since the fourth quarter of 2018, market interest rates on new and renewed loans have declined, leaving Canadians facing less of an adjustment. For example, most borrowers who recently renewed a five-year, fixed-rate mortgage did not see an increase in their mortgage payments.

Chart 6: After being steady for years, the debt-service ratio has recently risen due to higher rates



Note: The debt-service ratio is the ratio of total obligated debt payments divided by disposable income for all households (including those without debt).
Sources: Statistics Canada and Bank of Canada calculations Last observation: 2018Q4

There are ongoing data challenges in assessing vulnerabilities associated with mortgages. For banks and mortgage insurers, the Bank uses extensive loan-level data to assess vulnerabilities. For other mortgage lending, however, it is more challenging to have a complete perspective. Recent improvements, including new data from the Canada Mortgage and Housing Corporation (CMHC) and Statistics Canada, have helped the Bank better understand loans made by credit unions and by mortgage investment corporations (MICs) (Table 1).[4] Despite these improvements, significant gaps remain. For example, the Bank has data on private lending for the Toronto area but not the Vancouver area.

Table 1: Many data sources help assess vulnerabilities in mortgage lending

Source	Coverage	Type of data (all anonymized)
Regulatory filings of Canadian banks	Federally regulated lenders	Loan-level data describing the characteristics of mortgage originations and renewals, including household income and asset values
Mortgage insurers	Insured mortgages from all lenders	Loan-level data as above
Teranet	All lenders, including private lenders, for Ontario properties	Land registry data, including loan sizes, property values and interest rates
	New since the June 2018 *Financial System Review*	
Statistics Canada	Mortgage investment companies	Aggregate national data, currently available until 2017
Canada Mortgage and Housing Corporation	All mortgages from participants in government securitization programs, including uninsured mortgages from credit unions	Loan-level data as above

Federal regulators have tightened underwriting conditions over recent years, including more stringent mortgage interest rate stress tests. This has increased the potential for borrowers to move riskier uninsured mortgages to credit unions and private lenders, including MICs.

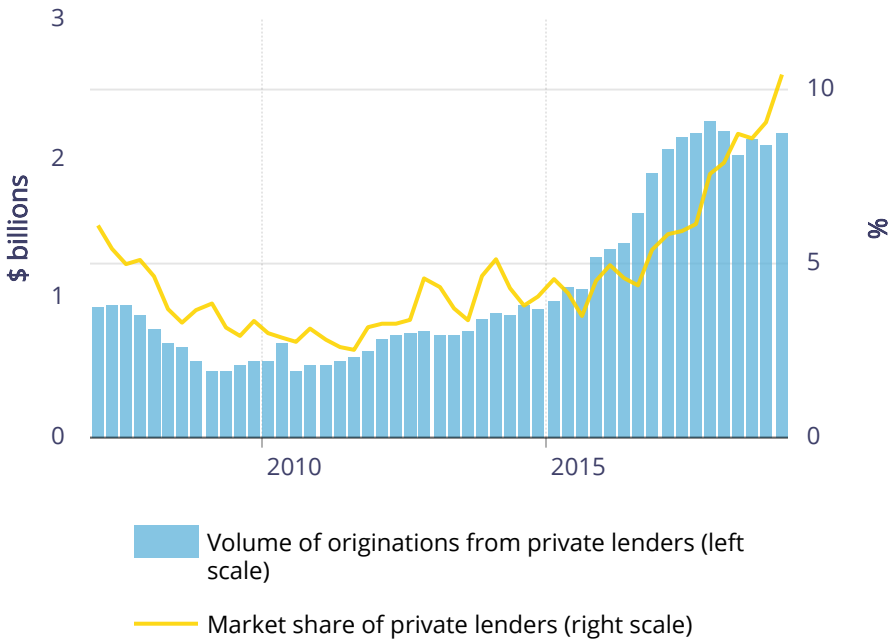
CMHC's initial analysis of its new data does not find significant migration of uninsured mortgages with a high loan-to-income ratio from banks to credit unions.[5] Uninsured mortgages from credit unions represent around 9 per cent of outstanding mortgages in Canada. Roughly half are from caisses populaires in Quebec, which are required to apply a mortgage interest rate stress test that is equivalent to the one applied by banks. Elsewhere, around 60 per cent of five-year, fixed-rate loans from credit unions were subject to a similar mortgage interest rate stress test. For these credit unions, lending to borrowers with a high loan-to-income ratio decreased, as it did for banks.

MICs are a small part of the Canadian residential mortgage market, with a market share of less than 1 per cent of outstanding mortgages.[6] They have, however, grown by about 12 per cent annually over the 10 years ending in 2017, with total assets reaching $13.5 billion. MICs fund their activities primarily through equity offerings. Leverage at MICs is growing but still low, with the equity multiplier (1/equity share) at 1.7, well below their legal limit of between 3 and 6 and much lower than that of the Big Six Canadian banks, at 15 or 16. Furthermore, much of the borrowing is for operating requirements rather than for funding their mortgage portfolios.

MICs are only one type of private lender. Other types of corporations and private individuals make many mortgage loans. Private lending has increased strongly in the Greater Toronto Area, with the volume of new lending doubling between 2015 and 2017. Over the past year, however, it has been relatively stable in contrast to originations by other mortgage lenders, which have declined notably. As a result, the market share of private lenders has continued to rise (Chart 7). This share overstates the importance of private lenders, however, because their loans have shorter terms compared with those of other lenders. As long as their access to capital and leverage remains limited, it will be difficult for private lenders to replace a large portion of the traditional mortgage market.

Chart 7: The market share for private lenders in the Greater Toronto Area continues to grow

Mortgage originations

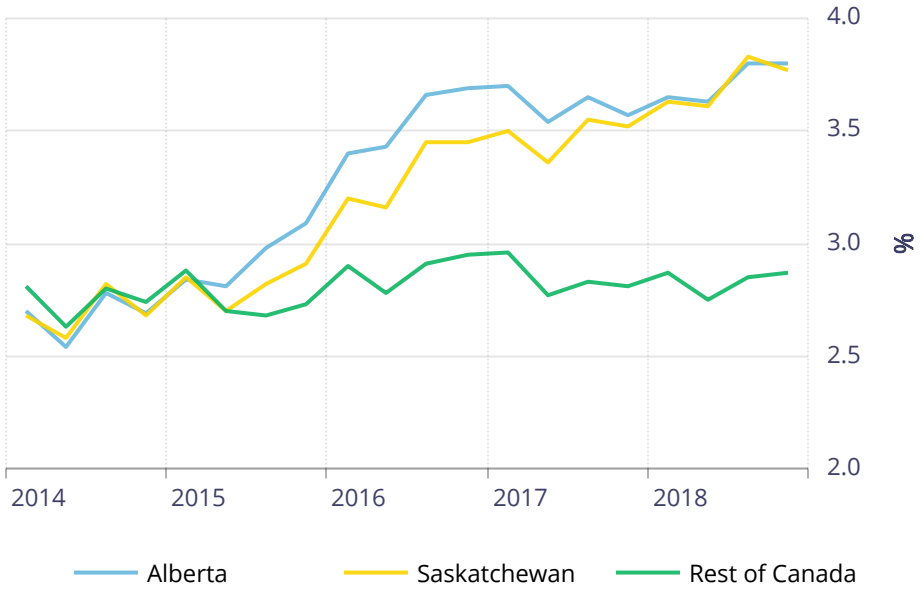


Notes: Originations include purchases, refinances and second mortgages. Mortgage finance companies are not considered private lenders. Volume is seasonally adjusted. Market share is weighted by dollar value.
Sources: Teranet and Bank of Canada calculations Last observation: 2019Q1

The share of Canadians falling behind on debt payments is low and relatively steady. Outside of the oil-producing provinces, the percentage of households that have fallen behind by 60 days or more on at least one of their credit payments remains stable at about 3 per cent.[7] Alberta and Saskatchewan, however, show a small but steady increase beginning in 2015 after the oil price shock (Chart 8). The impact on the Alberta economy of ongoing adjustment in the oil sector is compounding an already difficult situation for some households.

Chart 8: The share of debtors falling behind on payments is up slightly in oil-producing regions

Percentage of debtors behind on any payment by at least 60 days



Sources: TransUnion and Bank of Canada calculations Last observation: 2018Q4

Box 1: Net worth, household indebtedness and the vulnerability of the financial system

The rise of debt as a share of income has been well documented in previous issues of the *Financial System Review*. Most of this debt has been used to purchase assets—especially housing, which has increased in value. This strengthened household balance sheets, boosting the median household net worth from $148,000 in 1999 to $296,000 in 2016, in constant 2016 dollars, based on data from Statistics Canada's Survey of Financial Security.[8]

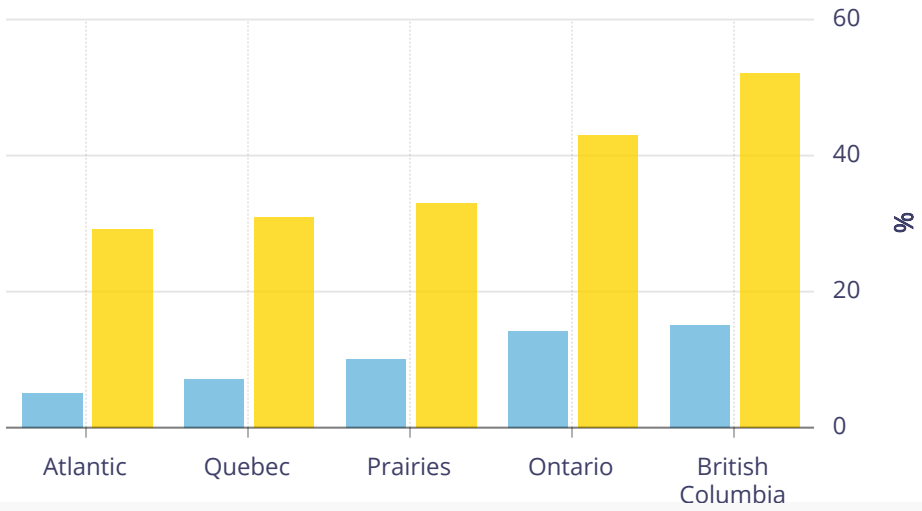
Higher net worth is a sign that the financial position of the median Canadian household has improved. But financial system vulnerabilities can rise even as wealth increases. This is because

- debt and assets are not distributed evenly across households and regions—it matters who holds the debt that finances household assets;
- debt relative to assets does not reflect the ability of households to manage their existing debt obligations within their income; and
- debt endures while asset values fluctuate with market conditions, and the owner might not be able to realize fair value in distressed markets.

While around 30 per cent of Canadian households do not have any debt, about 11 per cent of households have a debt-to-income ratio greater than 350 per cent.[9] As a group, they hold about two-fifths of the outstanding household debt, more than double the share in 1999. The wealth of these households is especially dependent on housing assets. This is evident when comparing financial indicators across regions. Households in British Columbia and Ontario have the highest median net worth, and their net worth is more concentrated in housing (Chart 1-A). These provinces also have the most pronounced imbalances in their housing markets, partially due to investor activity, and are the most indebted as measured by the ratio of household debt to income.

Chart 1-A: Households in British Columbia and Ontario are more indebted, and their net worth is concentrated in housing

2016 Survey of Financial Security



Sources: Statistics Canada and Bank of Canada calculations

In an adverse macrofinancial risk scenario, incomes could come under stress at the same time that house prices decline rapidly. Large debt relative to income diminishes the ability of households to cope financially with a loss in income or rising interest rates. In addition, households with high debt relative to income tend to be younger and more susceptible to job losses during an economic downturn.

Housing assets are a useful buffer against risks only if they can be converted into liquid assets during a period of stress, by refinancing the mortgage or selling the house. But this would be difficult if house prices declined sharply. For example, in a hypothetical national house price decline of 20 per cent, about 42 per cent of borrowers with a debt-to-income ratio greater than 350 per cent would not have enough equity to qualify for refinancing. Selling a house is particularly difficult if many others are doing the same, especially if defaults rise and creditors sell foreclosed homes at distressed prices. This can lead to fire sales with negative effects for the financial system.

Vulnerability 2: Imbalances in the housing market

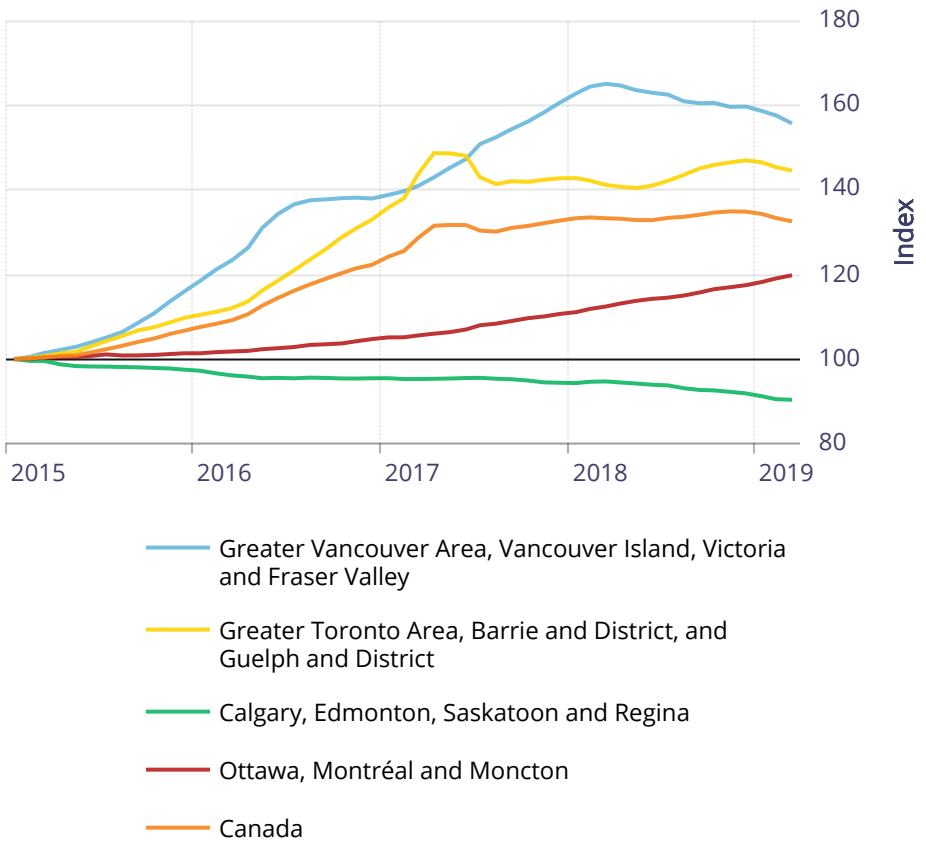
- When house prices grow at a faster pace than can be explained by economic fundamentals, a price correction that leads to financial stress becomes more likely. This can be serious when buyers are highly indebted.
- Overall, imbalances in housing have diminished but remain an important vulnerability. Froth from rising expectations of house price growth has declined in housing markets in the Toronto and Vancouver areas over the past two years. While the Toronto market appears to be stabilizing, prices and resale activity continue to decline in Vancouver. Ongoing difficulties in the oil sector are weighing on housing markets in oil-producing provinces.

Housing resale activity in Canada is down about 20 per cent from its peak in 2016. House price growth has also slowed markedly. For the first time since 2013, it is running below income growth. However, the national data mask diverging regional trends.

Starting in 2015, house prices and resale activity began accelerating in the Toronto and Vancouver areas (Chart 9). This was fuelled, in part, by strong employment and immigration growth, low interest rates and a limited supply of new housing. In turn, expectations of price growth also increased, leading to even stronger demand, including from speculators. At the same time, foreign buyers became increasingly interested in these markets. All this helped reinforce expectations that prices would keep rising rapidly, a situation that was not sustainable.[10]

Chart 9: Regional trends in housing markets continue to differ

Seasonally adjusted benchmark prices (Index: January 2015 = 100)



Note: The lines represent averages of quality-adjusted prices weighted by the population of the corresponding census metropolitan areas as defined by Statistics Canada.
Sources: Canadian Real Estate Association, Statistics Canada and Bank of Canada calculations
Last observation: March 2019

In both markets, expectations have since shifted toward slower price increases and resale activity is lower (Box 2). This coincided with measures introduced by provincial governments to curb the impact of non-resident homebuyers and speculation. Subsequent increases in interest rates and the tightening of mortgage underwriting standards also helped dampen price growth expectations, prices and activity.

The two markets appear to be at different points in their adjustment. After slowing sharply beginning in 2017, the Toronto area appears to be stabilizing, while resales and prices continue to fall in the Vancouver area. Prices in these areas remain 40 to 60 per cent higher than they were four years ago, when prices began to accelerate. This suggests that housing imbalances remain an important macrofinancial vulnerability. But strong fundamentals, including employment growth and supply constraints, support prices.

Previous trends are continuing in other regions. Resales and prices in urban Alberta and Saskatchewan have continued to trend downward. House prices are now about 10 per cent lower than they were at their peak about four years ago, reflecting the regional economic impact of low oil prices.

In contrast, strong employment growth and, according to some reports, increased interest from foreign buyers have contributed to the rise in house prices in the Montréal area. Montréal and several other markets, such as Ottawa and Halifax, remain on solid footing.

The 2019 federal budget introduced new housing affordability measures.[11] The key initiative is the First-Time Home Buyer Incentive. Many of the details have not yet been announced. However, under the three-year, $1.25 billion plan, households with an annual income of less than $120,000 will be eligible for a shared-equity mortgage from CMHC worth 5 per cent of their home price on a resale and 10 per cent for a new build. Mortgage costs are reduced since no interest or principal payments are required on the shared-equity mortgage. When the home is sold, the first-time homebuyer will share their capital gains or losses with CMHC.

Other measures include the following:

- an increase in the maximum amount a first-time homebuyer can withdraw from a registered retirement savings plan to $35,000, up from $25,000;
- an additional $10 billion for the Rental Construction Financing initiative, a program to fund the construction of affordable rental units;
- a Housing Supply Challenge with funding of $300 million; and
- the Expert Panel on the Future of Housing Supply Affordability, jointly established with British Columbia.

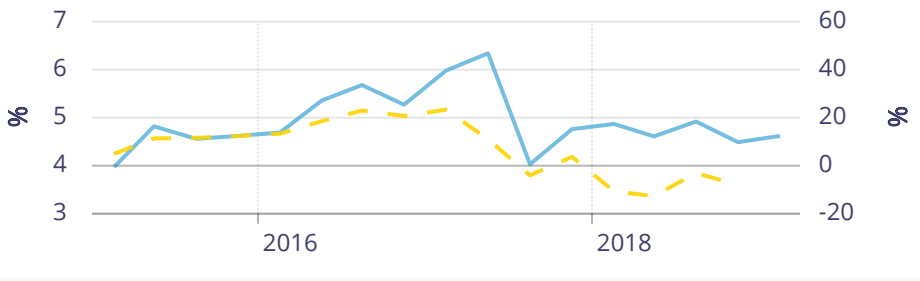
The new measures help address housing affordability and are not expected to significantly affect vulnerabilities. The size and targeted nature of the measures will limit pressures on housing demand, and other elements are designed to boost housing supply. As a result, any increase in prices should be small.[12] The creation of new highly indebted households will be limited by a 400 per cent cap on the allowable loan-to-income ratio. In addition, shared-equity mortgages could act as a modest shock absorber for the economy and the financial system by contributing to the resilience of household balances sheets to a decline in house prices.

Box 2: Housing resales and price expectations in the Toronto area

Rising expectations of house price growth may have increased investor activity and accelerated purchases by consumers with "fear of missing out."[13] Housing resale activity in Toronto in 2015 and 2016 was much stronger than could be explained by economic fundamentals.[14] The unexplained strength is, however, highly correlated with expectations of house price growth, as measured in the Bank of Canada's Survey of Consumer Expectations (Chart 2-A).

Expectations for growth in house prices shifted down beginning in early 2017 due to housing policy changes announced by the Ontario government (including a 15 per cent tax on non-resident purchases). Resale activity in Toronto fell a cumulative 38 per cent in the following three months, despite non-residents accounting for less than 10 per cent of purchases. Higher interest rates followed by changes to mortgage underwriting guidelines also weighed on price expectations and resale activity beginning in mid-2017. A similar relationship between price expectations and housing resales can be seen in the data for British Columbia.[15]

Chart 2-A: Price expectations played a key role in the rise and fall in resale activity in Ontario



Note: Expectations are measured by the interpolated median of expected growth in national house prices over the next 12 months for residents of Ontario. See M. Khan and T. Webley, "Disentangling the Factors Driving Housing Resales," Bank of Canada Staff Analytical Note No. 2019-12.

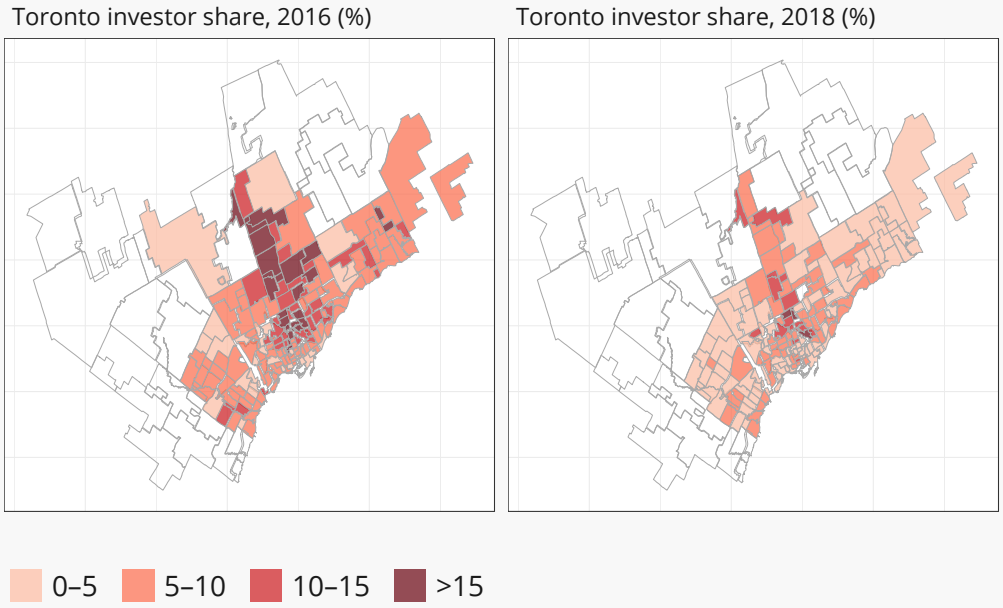
Source: Bank of Canada

Last observations: house price expectations, 2019Q1; deviation of resales, 2018Q4

The period of strong resales in Ontario coincides with an increase in investor activity. Data compiled by Realosophy Inc. on the share of investor purchases (defined as freehold investment properties listed for rent shortly after purchase) in the Greater Toronto Area (GTA) show that in 2016 investors accounted for as much as 1 in 5 resales in certain neighbourhoods and about 1 in 10 resales across the GTA. By 2018, price expectations dropped, investor activity fell significantly, and the share of resales roughly halved (Chart 2-B).

Chart 2-B: The share of investor activity fell markedly in 2018

Share of freehold resales subsequently listed for rent



Source: Realosophy

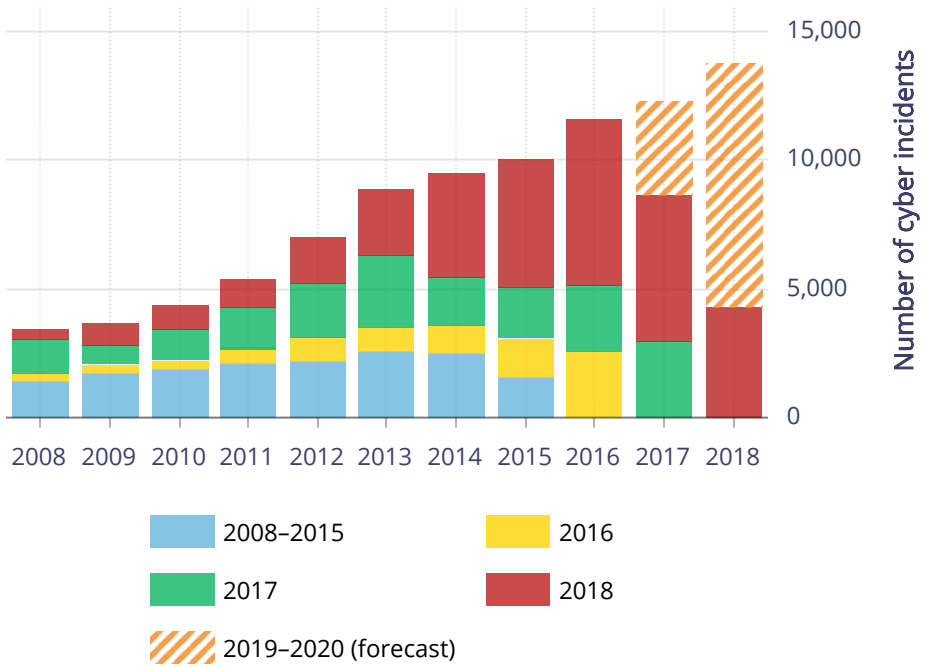
Vulnerability 3: Cyber threats and financial interconnections

- A successful cyber attack or other major cyber incident at a financial institution could spread across the interconnected financial system, interrupting the delivery of crucial financial services and damaging investor confidence.
- Cyber threats remain a key structural vulnerability. Federal authorities and financial institutions are making significant investments to strengthen the cyber resilience of the financial system, including through enhanced coordination, collaboration and information sharing. Continued vigilance is needed to maintain security.

Cyber incidents continue to be identified by market participants as the greatest risk to the Canadian financial system, according to the Bank's Financial System Survey. The number of incidents that have or could have resulted in substantial financial losses has increased steadily over the past decade, according to international data on cyber events collected by Advisen from publicly verifiable sources (Chart 10). The finance and insurance sector is the most affected, with more than one-fifth of incidents.

Chart 10: Cyber incidents are rising but take a long time to be visible to the public

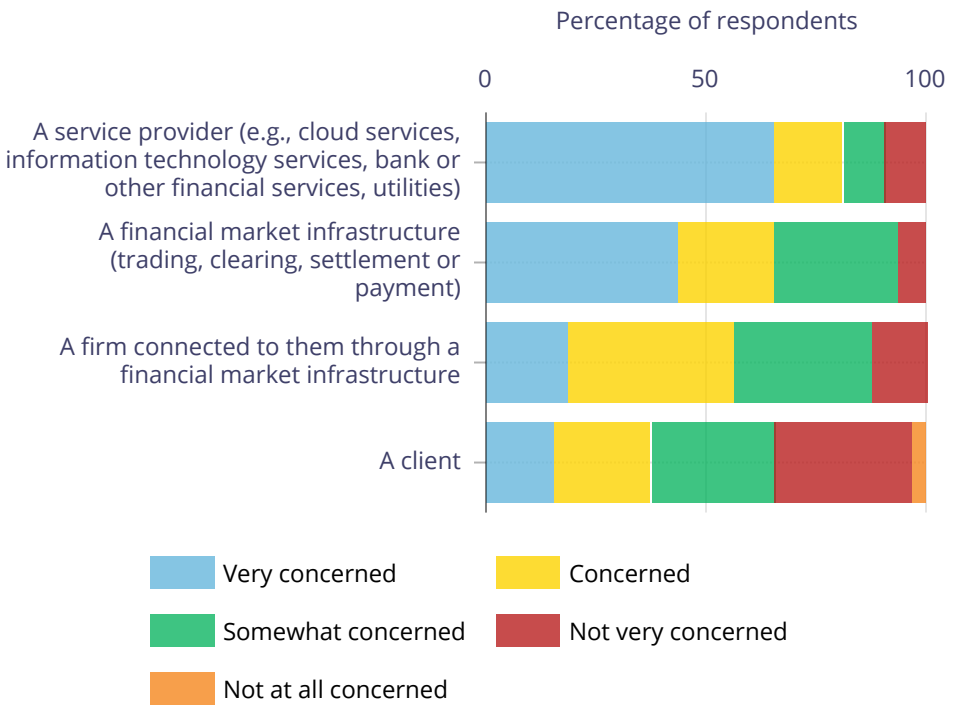
Colours correspond to the date that an incident enters the database



Sources: Advisen and Bank of Canada calculations Last observation: March 2019

Financial system participants are particularly concerned about cyber incidents at third-party service providers (Chart 11). A key factor driving the concern about cyber threats is the high degree of interconnectedness between financial institutions. This interconnectedness extends to crucial services offered by third parties, including cloud services and utilities. When many financial institutions rely on the same third-party service provider, a disabling cyber incident could have systemic effects. The Bank, the Department of Finance Canada and the Office of the Superintendent of Financial Institutions (OSFI) are members of the G7 Cyber Expert Group, whose work includes managing cyber risk from third parties.[16] Separately, the Bank oversees financial market infrastructures, including their risk management practices. This involves, for example, strengthening expectations for third-party risk management and ensuring that risk management standards limit the propagation of risk across the system.

Chart 11: Survey results point to concerns about third-party service providers



Note: Financial System Survey question: "For the following sources of cyber incidents that could indirectly affect your firm: Assuming the incident materializes over the next two years, how concerned are you that it would severely disrupt your critical activities, functions or processes?"
Source: Bank of Canada Financial System Survey Last observation: Spring 2019

Financial institutions, governments and authorities have been making significant investments to address cyber vulnerabilities. The Bank recently updated its cyber security strategy for 2019–21. In addition to measures that strengthen the Bank's own cyber resilience, the strategy includes several initiatives for the broader financial system. For example, the Bank plans to set out more detailed expectations for how financial market infrastructures would meet the Bank's cyber risk management standards. In addition, the Bank continues its partnership with Payments Canada and the Big Six Canadian banks to enhance the resilience of Canada's wholesale payments system to cyber incidents. The federal government has also been taking action. It established the Canadian Centre for Cyber Security, the RCMP National Cybercrime Coordination Unit and two new federal cyber investigation teams. The government will also introduce legislation to strengthen the cyber resilience of Canada's critical infrastructure.

Coordination and information sharing among private and public sector entities are crucial for improving cyber resilience. As Chart 10 shows, it can take several years for a cyber incident to be visible in public sources. This is because firms can be slow to detect incidents, and it can take a long time to assess their effects. Firms are also reluctant to report incidents. Statistics Canada's 2017 Survey of Cyber Security and Cyber Crime revealed that, of finance and insurance businesses suffering a cyber incident, only 29 per cent reported it to police, 21 per cent reported it to the Canadian Cyber Incident Response Centre,[17] and 3 per cent reported the incident to their regulator.

Without a good understanding of current cyber incidents, it is more difficult to establish good strategies to protect and recover from them. Canadian financial sector authorities are clarifying existing reporting requirements and introducing new ones, including for federally regulated financial institutions, marketplaces, clearing agencies and dealers. The Bank is also reviewing its own requirements for cyber reporting for systemically important financial market infrastructures. These changes will allow better monitoring by authorities, including helping protect other financial system participants who might experience similar incidents.

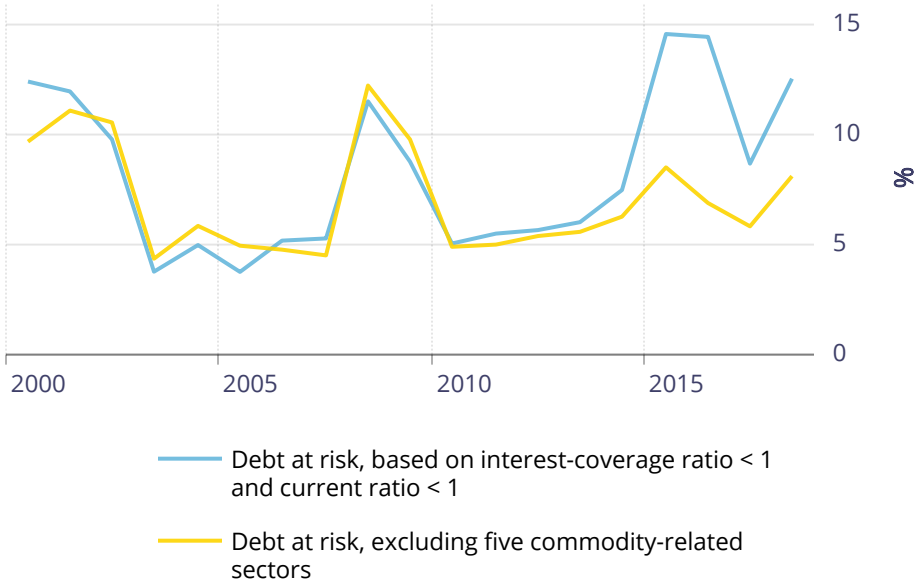
Canadian financial institutions and their authorities are also strengthening relationships with security partners and improving domestic and international communication protocols. One key initiative is the formation of a new public-private partnership in Canada to prepare for and respond to systemic-level operational events, including cyber events. This partnership aims to improve coordination among financial institutions, financial market infrastructures and public authorities. It also provides a forum for collaborating on financial sector-wide resiliency initiatives.

Vulnerability 4: Fragile corporate debt funding from certain markets

- Highly indebted firms with poor debt-service capacity and low holdings of liquid assets have less flexibility to deal with a sudden decline in income or a sharp increase in interest rates. If the providers of this debt are highly leveraged or vulnerable to changing investor sentiment, adverse shocks can lead to important spillovers to the financial system.
- Indebtedness of the Canadian non-financial corporate sector is high, primarily driven by commodity-related sectors. Strong investor demand and deterioration in the creditworthiness of Canadian firms in certain sectors have led to increased reliance on US high-yield bonds and leveraged loans. Borrowers in these markets are increasingly vulnerable to sudden changes in investor sentiment. This emerging vulnerability warrants monitoring.

Corporate indebtedness in Canada is elevated. Non-financial corporate debt relative to income, at 315 per cent in 2018, is well above its historical average.[18] Furthermore, the proportion of outstanding debt owed by firms that have poor debt-service capacity and low liquid asset holdings (debt at risk) is also historically high (Chart 12).[19] A sectoral analysis indicates that the rise in indebtedness and debt at risk has been driven largely by firms in commodity-related sectors, reflecting both higher debt and a sharp decline in income due to lower commodity prices since 2014. At the same time, the average Canadian firm has enough liquid assets and cash to manage a quick rise in interest rates or a sharp decline in income over the near term, suggesting that it has adequate financial flexibility.

Chart 12: Debt at risk is above its historical average due to developments in commodity-related sectors



Sources: Statistics Canada Quarterly Survey of Financial Statements and Bank of Canada calculations
Last observation: 2018Q4

Corporate debt is also rising in many other advanced economies.[20] This trend is taking place in the context of stricter regulatory requirements for banks, which now fund a smaller share of corporate debt. Non-bank credit providers have stepped in, partly motivated by a search for higher returns in the low interest rate environment.[21] In particular, the global market for high-yield debt, which includes high-yield bonds and leveraged loans, has grown significantly and is now larger than it was before the global financial crisis (Box 3). Lending standards have also loosened in recent years, and the quality of corporate debt has deteriorated across many countries.[22] Consequently, investors are more exposed to credit risk and firms are more vulnerable, on average, to a rapid repricing of risk. At the same time, non-bank credit providers have created a more diverse funding pool for firms, which benefits financial stability and efficiency.

Box 3: The global leveraged loan market has grown in size, risk and complexity

Leveraged loans are high-yield syndicated loans provided to non-financial firms, typically with non-investment-grade credit ratings. This market provides funding to riskier firms that otherwise would have difficulty accessing credit on flexible terms. Leveraged loans differ from high-yield bonds in that they are more senior in the firm's capital structure and they generally have floating interest rates.

Banks underwrite most leveraged loans and issue them in US and European markets. They are sold to a wide range of financial system participants (e.g., investment funds and pension funds), and a substantial share is securitized into collateralized loan obligations (CLOs). A CLO is a single security backed by a pool of leveraged loans. CLO structures are subject to tighter regulations than they were before the global financial crisis, including more stringent subordination requirements and restrictions on asset holdings.

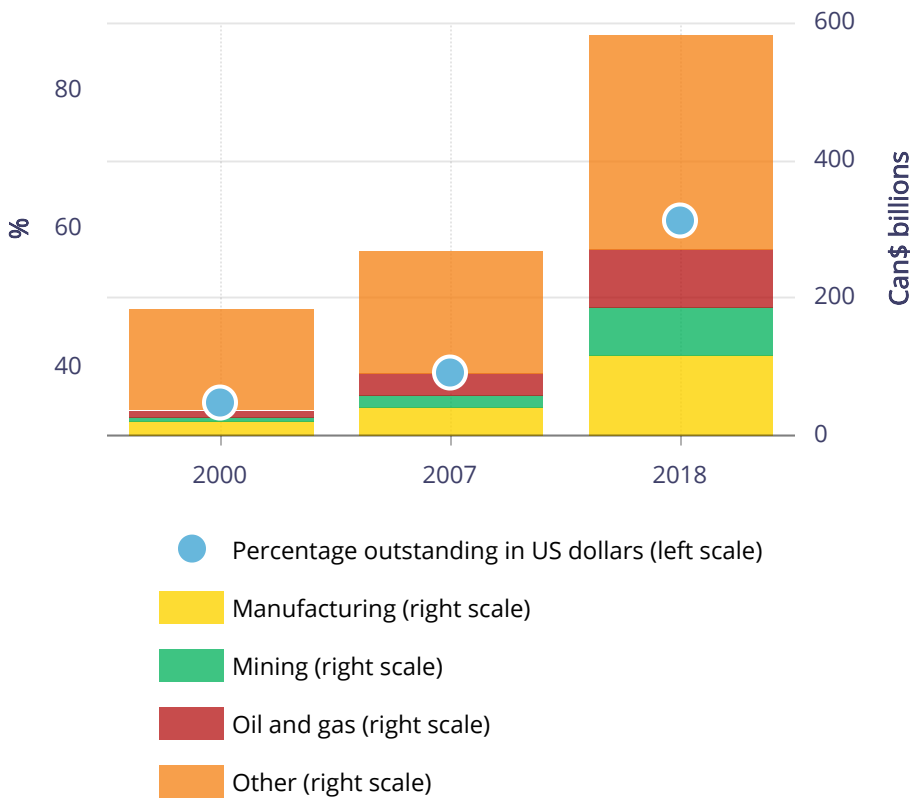
The global leveraged loan market is estimated to have doubled in size between 2011 and 2018.[23] In recent years, credit quality has deteriorated. Covenant-lite loans now represent more than 80 per cent of new loans. These loans contain fewer protections for lenders. This improves flexibility for the borrowers, but it implies that both defaults and losses due to default during a stressed period could be higher than some investors expect based on past performance.

The deterioration of credit quality could contribute to rapid sales by investors in a stress situation. The global leveraged loan market is opaque, with limited information on the ultimate owners of the risk. In addition, most leveraged loans and CLOs are relatively illiquid. If prices drop rapidly, exchange-traded funds and open-ended mutual funds would likely be forced to sell into declining markets because of growing redemptions. Banks could also transmit risk from these markets. Since banks underwrite leveraged loans and may have other exposures to both borrowers and investors, it is important that they incorporate these risks in their risk management frameworks.

Like that in many other countries, the non-financial corporate sector in Canada relies heavily on non-bank credit providers. For example, the amount of bonds outstanding issued by the Canadian non-financial firms increased from $270 billion in 2008 to $580 billion in 2018,[24] with the increase evident across all sectors (Chart 13).

Chart 13: Several sectors have increased their reliance on bond financing

Bonds outstanding, by currency and sector, annual average



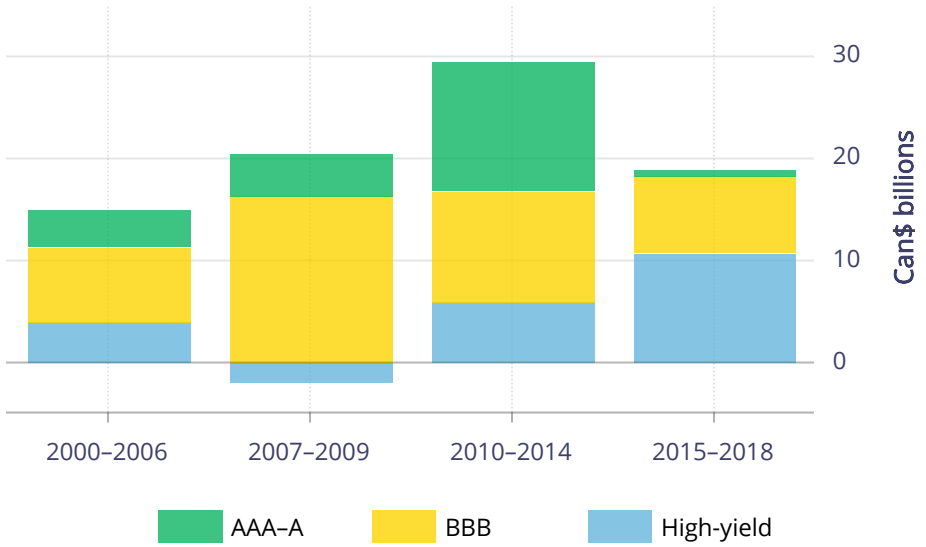
Notes:
1. The data exclude firms in the financial, insurance and management of companies (holding companies) sectors and government-sponsored enterprises.
2. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.
Sources: Refinitiv DataScope Fixed Income data and Bank of Canada calculations

Last observation: 2018Q4

Canadian corporations, particularly firms with a lower credit rating, are increasingly funded in the United States. Over the past four years, the increase in corporate bonds issued by Canadian non-financial corporations has been driven primarily by issuers of lower-quality credit (Chart 14). Because the market for Canadian high-yield bonds is very small, these firms, including many in commodity-related sectors, have issued mainly in the United States. This has helped boost the share of bonds issued in US dollars by Canadian firms from 40 per cent in 2007 to around 60 per cent in 2018.

Chart 14: Increases in outstanding corporate bonds over the past four years have been driven by firms with lower ratings

Annual average



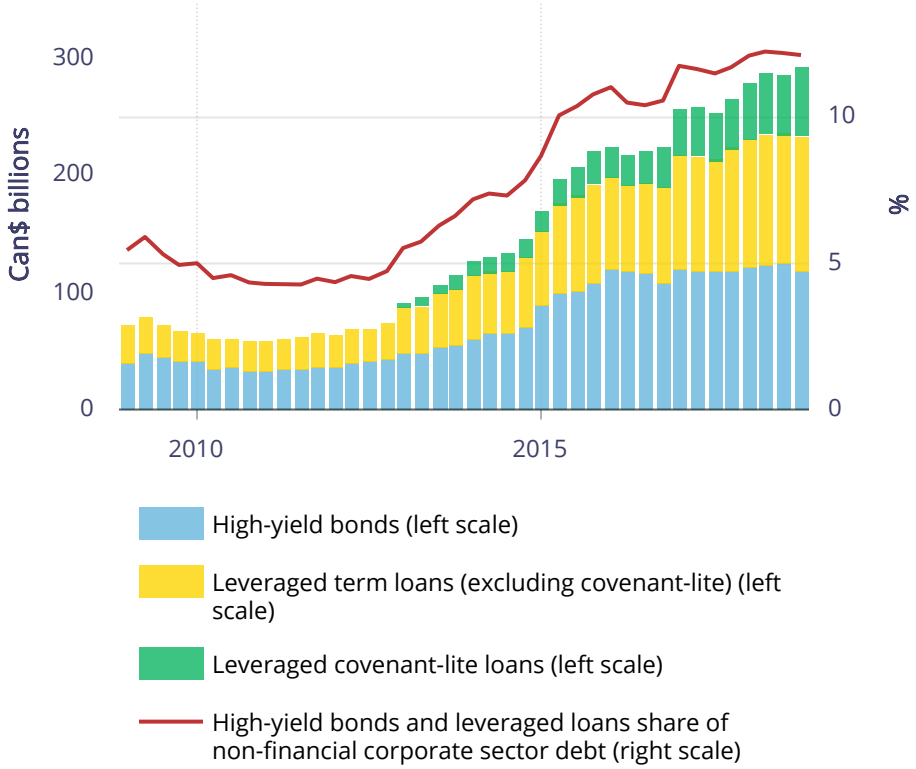
Notes:
1. The data exclude firms in the financial, insurance and real estate sectors and bonds issued in currencies other than US and Canadian dollars.
2. Given that the bond and credit rating data from Refinitiv and Moody's do not cover the entire market, the actual increase in amount outstanding is larger than the estimates provided in the chart.
3. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.
Sources: Bloomberg Finance L.P., Moody's, Refinitiv DataScope Fixed Income data and Bank of Canada calculations Last observation: 2018Q4

An increasing number of Canadian firms in various industries are also relying on the US leveraged loan market. The outstanding amount of leveraged loans to Canadian non-financial firms has increased over the past four years from Can$80 billion to Can$175 billion. About one-third of these leveraged loans are covenant-lite, compared with one-fifth only four years ago. Globally, the increase in covenant-lite loans is even more pronounced.

Together, the funding from leveraged loan and high-yield bond markets accounts for at least 12 per cent of total non-financial corporate debt (Chart 15).[25] This is 6 percentage points higher than a decade ago. Borrowing in US dollars provides a natural hedge to some Canadian firms due to their business activities. For example, oil and gas firms price their products in US dollars.

Chart 15: Canadian firms are increasingly using US high-yield bonds and leveraged loans

Amount outstanding, quarterly



Notes:
1. The data exclude firms in the financial, insurance and real estate sectors and bonds issued in currencies other than US and Canadian dollars.
2. Given that the bond and credit rating data from Refinitiv and Moody's do not cover the entire market, the actual increase in amount outstanding is larger than the estimates provided in the chart.
3. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.
Sources: Bloomberg Finance L.P., Moody's, Refinitiv DataScope Fixed Income data and Bank of Canada calculations Last observation: 2018Q4

Borrowers in leveraged loan and high-yield bond markets are vulnerable to changes in investor sentiment. Large shocks that heighten uncertainty or aversion to risk have the potential to destabilize funding. This is especially true when investors are seeking more risk for higher returns, as may be the case in a low interest rate environment. The December 2018 episode of large and rapid redemptions from loan investment and bond funds provides some evidence that these markets are fragile (see the section "Analysis of financial system resilience" for an examination of this effect in corporate bond funds). This episode resulted in an increase in credit spreads and fewer bonds and loans issued. Moreover, persistent problems in these markets could have broader implications for financial stability in Canada through the macroeconomic effects of a decline in corporate funding availability in the United States. Developments in these markets will be especially important as a greater number of leveraged loans and high-yield bonds mature in 2019 and beyond.

Vulnerability 5: Climate change

- Climate change continues to pose risks to both the economy and the financial system. These include physical risks from disruptive weather events and transition risks from adapting to a lower-carbon global economy.
- The Bank is undertaking a multi-year research plan to better assess the risks from climate change that are relevant to its mandate. This work includes collaborating with domestic and international partners, such as with the Central Banks and Supervisors Network for Greening the Financial System (NGFS).

The Bank of Canada is incorporating climate change risk into its analysis of the Canadian economy and financial system. Economic activity and the environment are intertwined. Most experts agree that the global climate is changing and that this has growing implications for the economy. But the range of possible outcomes is large.

Climate change creates important physical risks both in Canada and globally. According to the Intergovernmental Panel on Climate Change, the average world temperature in 2017 was around 1°C higher than pre-industrial levels and is projected to rise by 0.2°C per decade. One consequence is an increase in extreme weather events such as flooding, hurricanes and severe droughts. Insured damage to property and infrastructure in Canada averaged about $1.7 billion per year from 2008 to 2017, up from $200 million per year from 1983 to 1992.[26] Canada is particularly affected—it is estimated to be warming significantly faster than the rest of the world.[27]

The move to a low-carbon economy involves complex structural adjustments, creating new opportunities as well as transition risk. Investor and consumer preferences are shifting toward lower-carbon sources and production processes, suggesting that the move to a low-carbon economy is underway. Transition costs will be felt most in carbon-intensive sectors, such as the oil and gas sector. If some fossil fuel reserves remain unexploited, assets in this sector may become stranded, losing much of their value. At the same time, other sectors such as green technology and alternative energy will likely benefit.

Both physical and transition risks are likely to have broad impacts on the economy. Moving labour and capital toward less carbon-intensive sectors is costly and takes time. Global trade patterns may also shift as production costs and the value of resources change. The necessary adjustments are complex and pervasive and might lead to increased risk for the financial system. In addition to insurance companies, many other parts of the financial system are exposed to risks from climate change. Banks have loans to carbon-intensive sectors as well as to connected sectors—for example, those upstream or downstream in supply chains. Asset managers hold carbon-intensive assets in and outside Canada. The Government of Canada's Expert Panel on Sustainable Finance is studying these issues.

Limited understanding and mispricing of climate-related risks could potentially increase the costs of transitioning to a low-carbon economy. The risks faced by the financial system from climate change can be managed most effectively when investors and authorities know what exposures firms face and how they are being managed. The Financial Stability Board's (FSB) Task Force on Climate-related Financial Disclosures recommends that firms publish climate-related financial information. However, this practice is not universal. Few firms disclose the financial impact of climate change on their assets and operations. Moreover, there are also inconsistencies in how firms report climate-related risks across industries and regions.

In addition, asset prices may not fully reflect carbon-related risk, which could also raise the cost of transitioning to a low-carbon economy. Mispricing might occur for a variety of reasons. These include a lack of information on carbon exposures or incentives that are not properly aligned. Mispricing can also occur because decision makers find it difficult to account for uncertain and complex events in the distant future. If assets are mispriced, correct incentives will not be in place to manage and mitigate risks. Rapid repricing might cause fire sales and interact with other vulnerabilities—like excessive leverage—destabilizing the financial system. Better transparency could help alleviate this risk.

Through research and collaboration with partners, the Bank is improving its understanding of climate risks as they relate to the Bank's mandate. The Bank is working with members of the NGFS. The NGFS's first comprehensive report, released in April 2019, has four non-binding recommendations related to central banks, including the Bank of Canada:

1. *Integrating climate-related risks into financial stability monitoring and micro-supervision.* The Bank will develop the tools needed to monitor and analyze climate-related risks, leading to a meaningful assessment of these risks. One approach is to use scenario analysis.
2. *Integrating sustainability factors into own-portfolio management.* The Bank is considering how to integrate environmental, social and governance factors into its investment framework for the Bank of Canada pension fund.
3. *Bridging the data gaps.* By participating in the NGFS working groups and other groups, the Bank will help identify data gaps. This will help relevant domestic and international stakeholders focus their efforts to improve the availability of data.
4. *Building awareness and intellectual capacity and encouraging technical assistance and knowledge sharing.* The Bank is building its analytical capacity as part of a multi-year research plan. To accelerate the plan's development, the Bank is collaborating with the NGFS and other groups. The Bank plans to publish its work on the Financial System Hub and as part of the *Financial System Review*.

Two other NGFS recommendations do not fall directly within the mandate of central banks but are important to facilitate their work:

5. *Achieving robust and internationally consistent climate and environment-related disclosure*, and
6. *Supporting the development of a taxonomy of economic activities*.

Vulnerability 6: Rapid change in crypto-asset markets

- Crypto assets are diverse and fast-evolving, posing risk to the financial safety of consumers and investors.
- Crypto assets do not currently represent a significant vulnerability for the Canadian financial system. They lack the size and, most importantly, the connections with the traditional financial system necessary for large shocks to spread or intensify. But because crypto assets have the potential to create changes in the financial system, monitoring by both domestic and international authorities is crucial.

Crypto assets form a diverse landscape, creating a range of risks. Some crypto assets, such as Bitcoin, were originally designed for making purchases. Although they are often referred to as crypto currencies or crypto money, they lack many of the essential characteristics of money because they make poor media of exchange, stores of value and units of account.[28] Another kind of crypto asset, called a security token, allows buyers to take an ownership interest in an asset. For example, initial coin offerings are sometimes designed to allow buyers to purchase equity in a firm. In contrast, utility tokens give holders the right to consume some product or service associated with a platform.

Looking at the underlying economic characteristics of the different kinds of crypto assets helps authorities monitor and manage risks across the landscape. Both internationally and in Canada, authorities are focused on issues related to consumer and investor protection, market integrity, tax evasion, money laundering and terrorist financing. The intergovernmental Financial Action Task Force provides guidance on how its requirements for combatting money laundering and terrorist financing apply to crypto assets.[29] The Basel Committee on Banking Supervision has published expectations for how banks should manage risks from exposure to crypto assets.[30] And the International Organization of Securities Commissions is focusing on trading platforms for crypto assets and investment funds with exposures to crypto assets. In Canada, Canadian Securities Administrators and the Investment Industry Regulatory Organization of Canada are consulting on developing a framework to regulate crypto-asset trading platforms.[31]

Crypto-asset markets continue to pose little threat to the stability of the financial system. A significant fall in crypto-asset prices has shrunk the overall size of these markets, and the use of initial coin offerings to raise funds has declined sharply in the past year. In addition, exposures of financial institutions to crypto-asset markets remain small.

But crypto-asset markets and other uses of the underlying distributed ledger technology continue to change quickly. Implications for financial stability might arise rapidly. The FSB has developed a framework to monitor crypto-asset markets for possible development of financial stability risks.[32] In Canada, federal and provincial authorities have set up a working group to monitor the crypto-asset markets. The group is chaired by the Bank of Canada and includes representatives from the Heads of Regulatory Agencies, the Financial Consumer Agency of Canada, the Financial Transactions and Reports Analysis Centre and the Canada Revenue Agency.[33]

Recent investor losses at crypto companies—in Canada and other countries—reinforce the need for investor awareness and caution. The failure of QuadrigaCX—a crypto exchange—and a fraud investigation targeting an initial coin offering by consulting firm Vanbex are evidence of weak governance. This creates substantial risks for investors in crypto assets. Investors and consumers must take primary responsibility for understanding the full range of risks before participating in these markets.

Read “A Perspective on Crypto ‘Money’” on the Financial System Hub

Other vulnerabilities

The Bank of Canada looks broadly at the financial system to identify, monitor and assess other vulnerabilities. This includes talking to market participants, gathering data and conducting analysis. Vulnerabilities identified in previous issues of the FSR continue to be a focus of attention, including reliance of Canadian banks on foreign funding and the possible effects of exchange-traded funds on the resilience of market liquidity.

Previous issues of the FSR have discussed the funding profile of small and medium-sized banks, focusing on a high reliance on funding from brokered deposits—bank deposits placed by third parties. This type of deposit does not benefit from a strong relationship with the depositor and therefore may be more likely to see withdrawals during times of stress. OSFI has recently revised its Liquidity Adequacy Requirements to require larger liquidity buffers for banks that use deposit funding subject to this kind of risk.[34] The new guideline should help control the vulnerability.

The Bank also pays close attention to developments in financial technologies (fintech). Innovative fintech has the potential to improve financial services, increase competition and boost efficiency. But it can also create new vulnerabilities that can be difficult to understand and assess. In this area, the Bank is helping to examine the merits of a framework for open banking, where consumers can allow access to their banking data to take advantage of new financial products and services.[35] The Bank also participates in the FSB's Financial Innovation Network, which is examining potential risks from large technology companies entering the financial services sector and from increased reliance of financial institutions on cloud computing. This work adds to the monitoring of crypto assets discussed above.

Risks and resilience

» Vulnerabilities can amplify and transmit adverse events. This can harm the economy and threaten financial stability. Systemic risk is analyzed along four dimensions:

1. **Growth at risk**: aggregate downside risk to the real economy associated with financial system vulnerabilities
2. **Key risks to financial stability**: the most important downside risk scenarios
3. **Analysis of resilience**: the financial system's ability to absorb and manage specific risk scenarios
4. **Market views**: participants' perceptions of financial system risks and resilience

- Overall risk to the financial system remains significant and is slightly higher than at the time of the June 2018 FSR.
- A stress test shows the resilience of large Canadian banks. At the same time, bond mutual funds are taking on more risk in a low interest rate environment. Respondents to the Bank's Financial System Survey continue to see the Canadian financial system as highly resilient.

Growth at risk

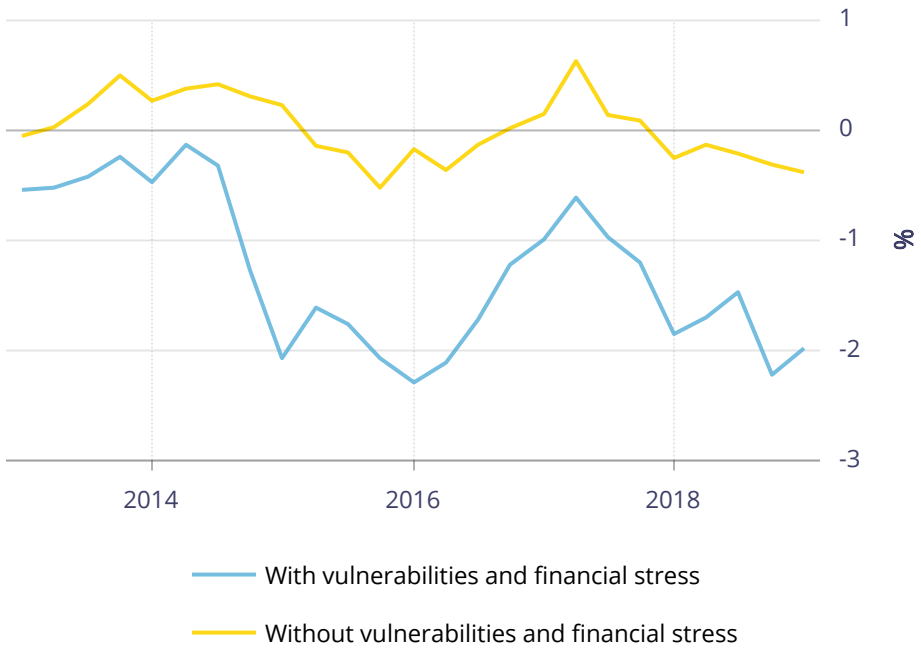
- The growth-at-risk framework quantifies aggregate macrofinancial risks in terms of future economic growth.
- Downside risks to the economy associated with financial vulnerabilities remain significant.

Growth at risk quantifies downside risks to the economy by estimating the rate of future GDP growth that should be exceeded in all but the worst 5 per cent of outcomes.[36, 37] It does not depend on any specific risk scenario but accounts for the effects of financial vulnerabilities and financial market stress on GDP growth outcomes. Because it relies on statistical analysis of aggregate cross-country indicators, growth at risk does not fully capture the evolution of vulnerabilities as analyzed in the sections above. For example, due to limitations in the data, it does not include measures of the quality of debt.

Growth at risk has increased since the June 2018 FSR, mostly because the pace of economic growth has slowed (Chart 16).[38] Financial vulnerabilities and financial market stress magnify the downside risk.

Chart 16: Financial vulnerabilities and stress magnify growth at risk

One-year-ahead forecasts of the 5th percentile of GDP growth



Source: Bank of Canada calculations

Last observation: 2019Q1

Key risks to financial stability

- Beyond the broad assessment of risks measured in growth at risk, Governing Council evaluates the most important downside risk scenarios for the Canadian financial system (Table 2).
- The key risks remain the same as in the June 2018 FSR. Risks have risen slightly over the past year because economic activity in Canada and abroad has slowed and because risk taking has expanded in global financial markets. This expanded risk taking involves some Canadian firms that are relying more on potentially fragile funding sources. The most important risk remains a severe nationwide recession leading to a rise in financial stress.

Table 2: Key risks to the stability of the Canadian financial system

Risk scenarios	Ratings and developments since the June 2018 *Financial System Review*
Risk 1: A severe nationwide recession leading to a rise in financial stress	**Elevated and increasing**
• A large, persistent and negative foreign demand shock affects Canada. Possibilities include a sharp rise in global protectionism (and a disruption in trade and global supply chains) or a severe recession in China and other emerging-market economies. • A foreign demand shock could lead to a severe recession in Canada, with a sharp rise in unemployment nationwide, a correction in house prices and tighter global financial conditions. • Household and housing market vulnerabilities interact to create stress on lenders and the broader Canadian financial system.	• Uncertainty and tensions around global trade arrangements and Brexit have increased over the past year. • Canadian economic growth has slowed, leading to slower growth in incomes. • Credit growth remains soft, and riskier mortgage originations have declined to lower levels. However, a large amount of debt in Canada continues to be held by highly indebted households. • Households are adjusting to higher interest rates with limited signs of stress.
Risk 2: A house price correction in overheated markets	Moderate and decreasing
• Significant house price corrections occur in Toronto, Vancouver and their surrounding areas, with modest direct spillovers to other housing markets. • Residential investment and related consumption fall dramatically in affected regions. • Lender balance sheets deteriorate, and credit conditions tighten.	• Froth has declined in the Toronto and Vancouver area housing markets. While the Toronto market appears to be stabilizing, in Vancouver, declines in prices and activity continue. Prices in the Vancouver area are down 5 per cent for the year ending in March 2019. • Prices remain 40 to 60 per cent higher than at the beginning of 2015, when they began to accelerate. But strong fundamentals support these markets. • Ongoing adjustments in the oil sector are weighing on housing markets in the oil-producing provinces. Prices are down 10 per cent from their peak in 2015. • A quantitative assessment of this risk shows a moderate impact on the banking sector.[39]
Risk 3: A sharp increase in long-term interest rates driven by higher global risk premiums	Moderate and increasing

Table 2: Key risks to the stability of the Canadian financial system

Risk scenarios	Ratings and developments since the June 2018 *Financial System Review*
• A severe disruption in financial markets is triggered by a sharp repricing of credit risk. • Higher global risk premiums could be caused by an overreaction to economic or policy developments, such as an unexpected increase in inflation prospects, escalation in trade tensions or the materialization of geopolitical risks such as a hard Brexit. • Financial contagion affects a wide range of asset classes with adverse effects on the real economy. • The resulting collapse in valuations puts many financial institutions under stress. This is amplified by past risk taking in the non-bank financial sector.	• Geopolitical risks and trade tensions are higher. • Risk taking is elevated, risk premiums are low, and debt levels are higher than a year ago, suggesting markets are in the late stage of the credit cycle. • Strong investor demand and deterioration in the creditworthiness of Canadian firms in certain sectors have led to increased reliance on US high-yield bonds and leveraged loans for funding. • A sudden increase in risk premiums in riskier debt markets in December underlines the vulnerability of corporate borrowers to shifts in market sentiment.

Risk ratings: Low | Moderate | Elevated | High | Very high

Analysis of financial system resilience

» Stress tests can help gauge the possible impact of risk scenarios and the ability of the Canadian financial system to absorb and manage risks.

» A first stress test investigates the impact from an extreme but plausible scenario based on the key risks. In this scenario, the banking system experiences substantial losses, but regulatory capital buffers absorb these losses and help maintain resilience.

» A second stress test looks at how a sharp rise in interest rates affects mutual funds that specialize in corporate bonds. It shows that, with their increasing size and riskier portfolio holdings, these funds would have larger effects on market liquidity than in the past.

A macrofinancial stress test of large banks

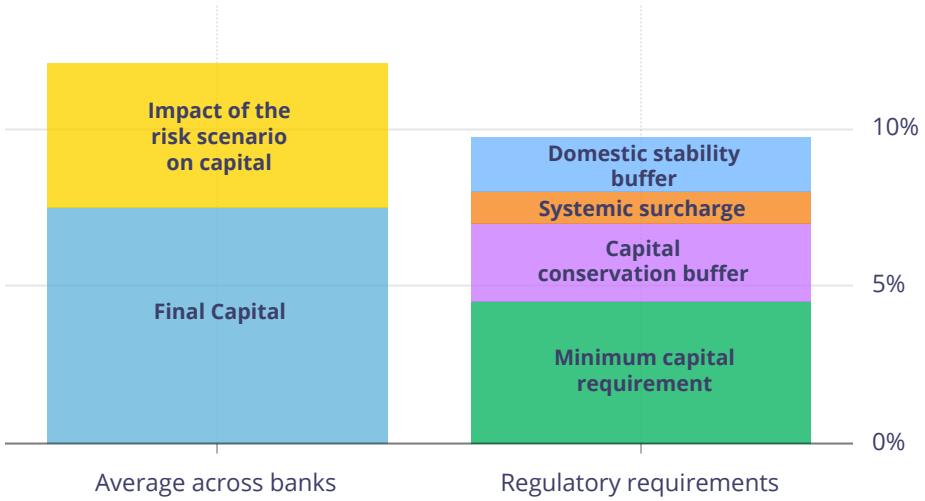
Quantitative analysis of a severe but plausible risk scenario helps assess the resilience of the banking system. The Bank developed the macroeconomic risk scenario in collaboration with the International Monetary Fund.[40] Bank staff assessed the scenario's impact on the banking system.

The risk scenario is a composite of the key risks identified above. It is assumed to be triggered by disruptions in international trade, which would tighten financial conditions, increasing risk premiums worldwide. Inflation would rise in Canada due to disruptions in global supply chains and a large depreciation of the Canadian dollar. Interest rates are assumed to rise initially to stabilize inflation expectations and then fall to address the economic contraction. The effects would be severe enough to also trigger a major recession and a house price correction. The unemployment rate would increase by 6 percentage points, and national house prices would drop by 40 per cent. The severity of this scenario is calibrated based on international experience with financial crises and is much worse than any economic shock in Canada in recent decades.

Large banks would suffer substantial losses in this risk scenario but would remain resilient.[41] The largest losses would come from consumer debt, notably credit cards, and from business loans, both domestic and international. Capital levels would fall materially, driven by these losses as well as by reduced revenues (Chart 17). The scenario would not, however, be severe enough to bring capital below the regulatory minimum or to trigger substantial fire sales, funding liquidity stress or interbank contagion effects.

Chart 17: Regulatory capital buffers help make the banking system resilient

Common equity Tier 1 capital as a percentage of risk-weighted assets



Note: Desjardins Group operates under capital requirements set by the Autorité des marchés financiers, which are somewhat different than the requirements shown here.
Source: Bank of Canada calculations

Banks would weather this storm in part because initial capital levels include substantial buffers to handle losses. These buffers include

- a capital conservation buffer of 2.5 per cent and a surcharge of 1 per cent applied to domestic systemically important banks;
- the new domestic stability buffer, which was introduced in June 2018 and is currently set at 1.75 per cent; and
- additional capital beyond the regulatory requirements held at the discretion of each bank.

OSFI sets the level of the domestic stability buffer twice per year based on monitoring of a range of systemic vulnerabilities done in consultation with the Bank of Canada and other federal authorities.

These buffers are designed to help banks manage the materialization of risks, while minimizing the effects on the financial system. They allow banks the space to take corrective action before their viability is threatened.

The Canadian mortgage insurance system also limits the impact on banks. This system protects banks against losses on some of their riskiest mortgages—those with a high loan-to-value ratio. The losses on insured mortgages instead fall on mortgage insurers. Mortgage insurance is guaranteed by the federal government —fully for CMHC and subject to a 10 per cent deductible for private mortgage insurers.

Significant uncertainties around the results remain. For example, the assumptions of losses on loan portfolios are conservative and may overestimate actual losses. In contrast, extreme economic uncertainty might cause a rise in risk aversion and a loss of confidence in the banks that is greater than that incorporated in the analysis. If that were to occur, bank creditors would withdraw more funding.

There is also uncertainty about how banks would respond. Banks may aggressively cut costs to protect earnings. They may also decide to deleverage more than the scenario assumes. That could protect bank capital but also result in a further tightening of financial conditions, which would exacerbate the negative effects on the economy. In addition, this analysis does not incorporate the effects of interventions by authorities, who have tools they can deploy to support the functioning of the financial system.

Read more about the resilience of the banking system on the Financial System Hub

While the core of the financial system has become more resilient, risks may move elsewhere in the system. The Bank monitors these developments, with a specific focus on non-bank entities engaged in financial intermediation activities that involve a significant amount of maturity, liquidity and credit transformation.

Read “Non-Bank Financial Intermediation in Canada” on the Financial System Hub

A stress test of corporate bond funds

Over the past decade, open-ended fixed-income mutual funds with large holdings of corporate bonds (bond funds) have grown significantly. These bond funds offer daily redemptions to investors, but they hold assets that may be difficult to sell on short notice. If many investors were to withdraw simultaneously, the funds might be forced to quickly sell bonds to honour their commitments, potentially decreasing liquidity in the bond market. A decrease in liquidity could have negative consequences for both bondholders and bond issuers, which could amplify the effect of an adverse shock on the financial system. Asset managers are, however, aware that market liquidity may be less reliable than in the past and have indicated that they are altering their portfolio management strategies to prepare for periods of low liquidity.[42] This should mitigate the impacts of a decline in liquidity on the financial system.

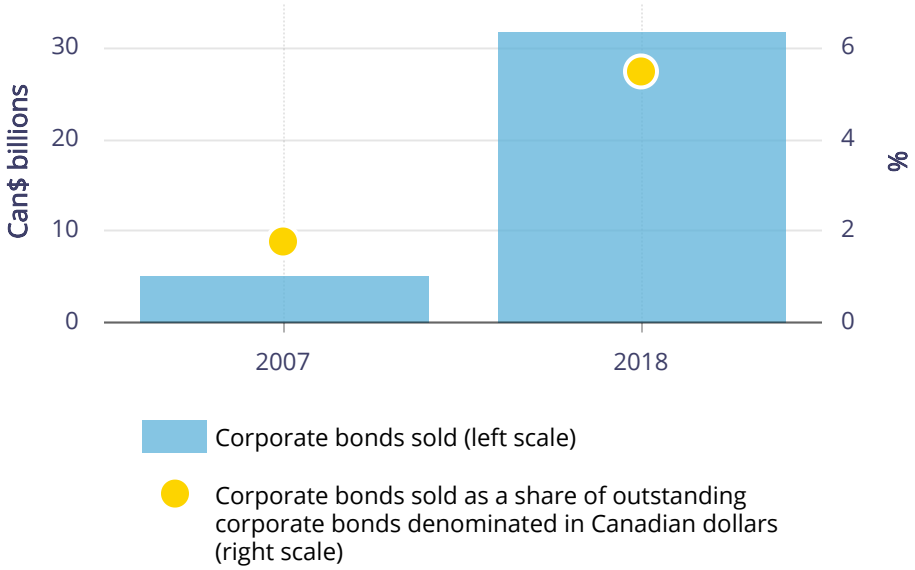
Bank staff analyzed a scenario where both short- and long-term interest rates increase sharply, by 100 basis points over one quarter, using data from the end of 2018. This scenario could be caused by sudden changes in economic or financial conditions outside of Canada, such as in Risk 3. Similar interest rate increases in Canada in the 1980s and 1990s led to increases in market stress.

Bond funds would suffer losses on their investments and face large investor redemptions in this risk scenario. When interest rates increase, the value of bond investments decreases. Based on historical relationships between fund performance and investor demand for redemptions at the fund level, bond funds would experience redemptions estimated at around $70 billion out of a total of around $350 billion in assets under management. How individual bond fund managers would react depends on their investment strategy and risk management practices, which are quite varied. For example, passively managed funds would behave differently than actively managed funds.

In this analysis, bond fund managers are assumed to behave identically and sell assets proportionally to their holdings. Bond funds are estimated to collectively sell more than $30 billion in corporate bonds (Chart 18). The impact on bond prices depends on the willingness of bond buyers such as broker-dealers and long-term investors (including pension funds and insurance companies) to buy from the bond funds.

The sale of corporate bonds by funds would have a larger impact on fixed-income market liquidity than in the past. The liquidity risk premium would increase by an estimated 93 basis points compared with around 40 basis points if it had happened in 2007 (Chart 19). This is because of both demand and supply factors. On the demand side, mutual funds have grown; they hold more corporate bonds, including more bonds with lower credit quality, and they have reduced their cash buffers. On the supply side, post-crisis regulations have increased the cost for broker-dealers to intermediate large and relatively sudden investor flows.[43]

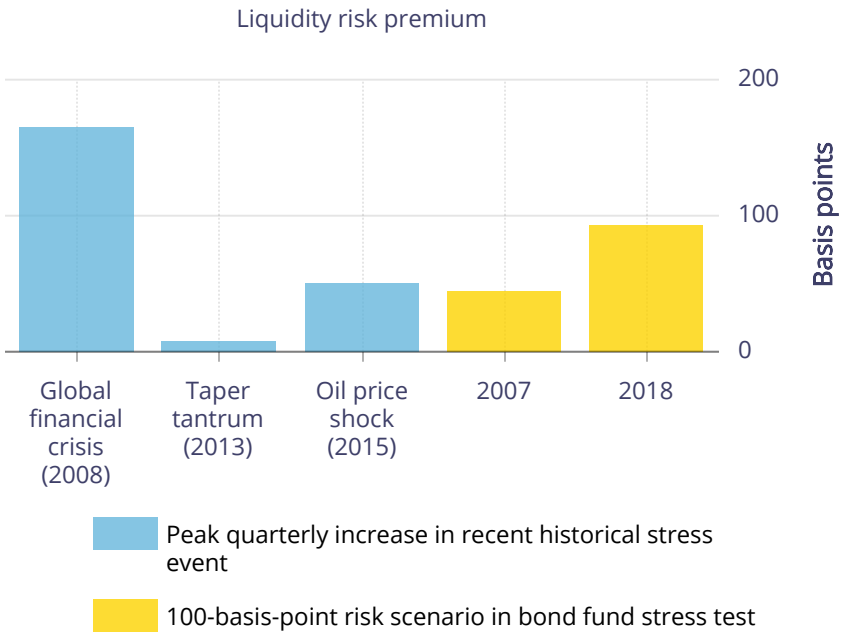
Chart 18: A 100-basis-point increase in interest rates would lead to much larger sales of corporate bonds today than a decade ago...



Sources: Morningstar Direct, Statistics Canada and Bank of Canada calculations

Last observation: 2018

Chart 19: ... resulting in a more pronounced impact on corporate bond price



Note: The liquidity risk premium is the compensation for risk beyond expected default.

Sources: Bloomberg Finance L.P., Morningstar Direct and Bank of Canada calculations

Last observation: 2018

The results depend on several assumptions and are subject to significant uncertainty. For instance, if bond funds were to rely primarily on their holdings of cash and liquid assets to meet redemption demands, the increase in the liquidity risk premium would be lower initially—although the funds would then be less able to deal with future redemptions. In contrast, the increase in the liquidity risk premium would be larger if long-term investors are assumed not to purchase corporate bonds from mutual funds. This illustrates that the countercyclical behaviour of long-term investors can be an important stabilizing force. In addition, as previously mentioned, asset managers are altering their portfolio management strategies to prepare for periods of low liquidity, which should mitigate the impacts on the financial system of a scenario like the one examined here.

Read more on the Financial System Hub in "Could Canadian Bond Funds Add Stress to the Financial System?"

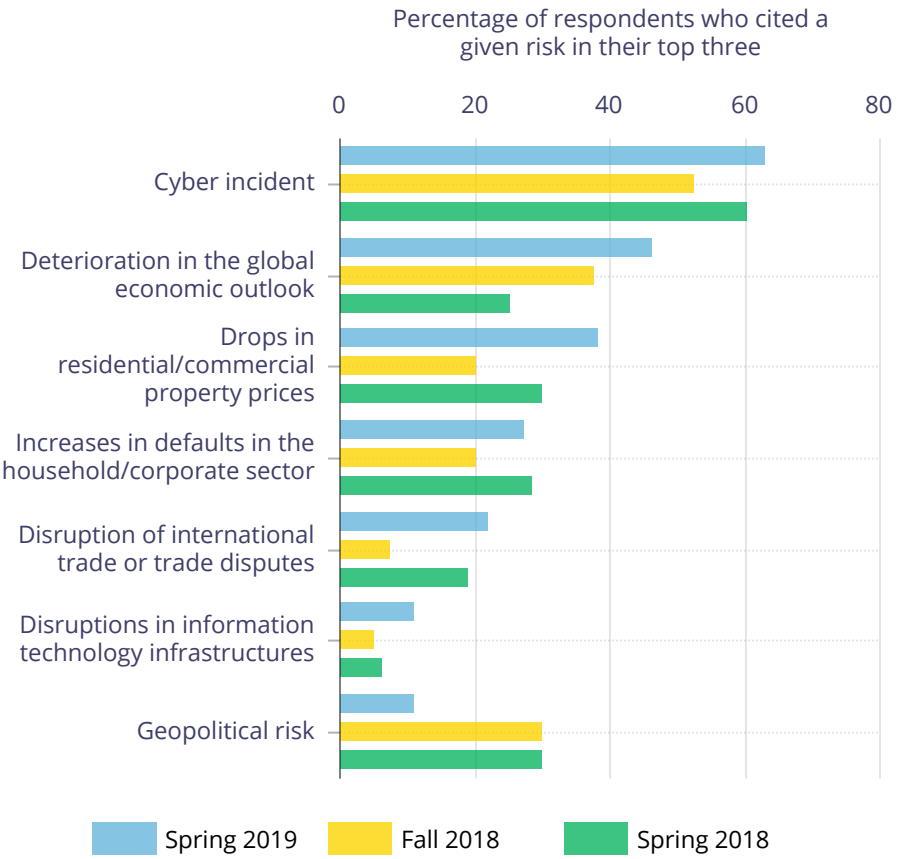
Market views of risk and resilience

- The views of market participants are helpful in identifying financial system risks and assessing the resilience of the system to those risks.
- In the Bank of Canada's semi-annual Financial System Survey, respondents view risks as continuing to rise, but their confidence in the system's resilience remains high. Indicators based on market values of bank equity also show high confidence.

The Bank solicits the views of financial system participants through its Financial System Survey. The survey results are a useful point of comparison for the Bank's views and analytical work. The survey also provides information in areas where the Bank has limited data or experience and helps identify new topics for analysis.

The overall perception of risk has continued to edge higher, but confidence in the resilience of Canada's financial system remains high. Once again, respondents from the Canadian financial system identified a cyber incident as the greatest risk. The perceived risk from a deterioration in the global economic outlook or a drop in residential and commercial property prices increased (Chart 20).

Chart 20: A deterioration in the global economic outlook is increasingly cited as an important risk to the Canadian financial system

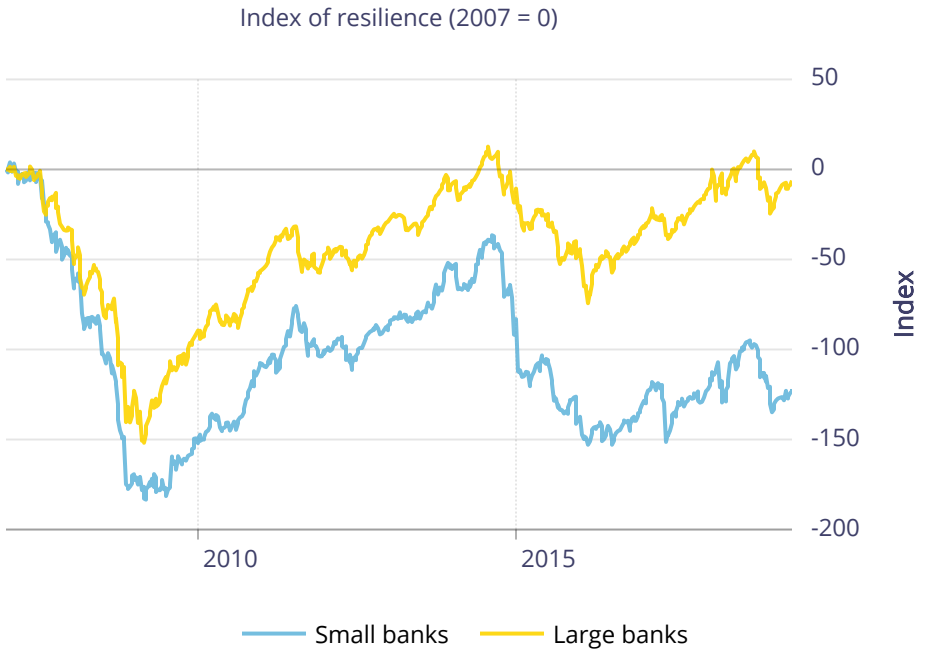


Notes:
1. Financial System Survey question: "Over the next three years, which risks, if realized, do you believe would have the greatest negative impact on the functioning of the Canadian financial system (i.e., can impair the financial system and harm the economy)?"
2. As part of the question, respondents are asked to list their top three risks. The responses are grouped into different types of risks.
Source: Bank of Canada Financial System Survey Last observation: Spring 2019

Read more about the Financial System Survey on the Financial System Hub

Market perceptions of banking system resilience can also be inferred from the information contained in market data, including stock prices. A composite index of market-based indicators suggests the perceived resilience of large banks is close to its highest level since the crisis (Chart 21). Small banks are considered less resilient than they were.[44]

Chart 21: Market perceptions of the resilience of large banks are in line with pre-crisis levels



Note: See C. MacDonald and M. R. C. van Oordt, "Using Market-Based Indicators to Assess Banking System Resilience," Bank of Canada *Financial System Review* (June 2017): 29–41.
Sources: Datastream and Bank of Canada calculations Last observation: April 2019

Safeguarding the financial system

» The Bank of Canada works with other authorities in Canada and internationally to foster a stable and efficient financial system. This includes measures to increase the resilience of financial institutions and financial market infrastructures and measures to keep core funding markets working, even through periods of stress. Policy measures related to the vulnerabilities analyzed above are discussed in those sections. In addition, other notable policy developments contribute to a stable and efficient financial system.

Proposed enhancements should strengthen Canada's interest rate benchmarks. Interest rate benchmarks are used globally to set payments for trillions of dollars of financial contracts, such as variable-rate loans and derivatives. Questions regarding the integrity of some of these rates, especially the London Interbank Offered Rate (LIBOR), have threatened confidence in some financial benchmarks. The resulting uncertainty represents a potentially serious source of systemic risk. Regulators from many countries are therefore reviewing benchmarks to improve their robustness and reliability.

The Canadian Fixed-Income Forum formed the Canadian Alternative Reference Rate Working Group (CARR) to review and improve existing Canadian benchmark rates and assess whether new rates should be developed. Deputy Governor Lynn Patterson discussed this in her speech "Rebooting Reference Rates." Since then, the focus has been on two benchmarks:

- The Canadian Overnight Repo Rate Average (CORRA) is a transaction-based benchmark that measures the cost of overnight repurchase agreement (repo) funding. CORRA is primarily used in the derivatives market for setting payments on overnight indexed swaps. It is currently based on the relatively small number of general collateral repo transactions conducted through interdealer brokers. To make CORRA more robust and representative of the entire market, CARR has proposed broadening the range of transactions considered and modifying the calculation methodology.
- The Canadian Dollar Offered Rate (CDOR) is the primary benchmark rate for financial products denominated in Canadian dollars. It is a term rate that represents the cost for borrowers to draw from their bankers' acceptance facilities.[45] Because CDOR is survey-based, there is a risk that it could be discontinued if respondents stopped providing quotes for its calculation. To guard against this risk, CARR is developing more robust fallback language for certain types of financial contracts referring to CDOR. This would set out which alternative rates could be used for determining payments if CDOR was discontinued permanently. CARR is also investigating the need for a new term risk-free rate to complement CDOR and act as a credible fallback.

Resilience and continuity of the Bank of Canada's market and banking operations will strengthen financial stability. These operations are essential for implementing the Bank's core functions in monetary policy, funds management and the financial system. In early 2019, the Bank officially opened its first parallel operating site in Calgary for its market and banking operations. The Calgary Operational Site will work with Head Office and share day-to-day operational responsibilities. Once fully functional, this site will maintain the Bank's critical market and banking operations in the event of any disruptions in the National Capital Region.

The Bank of Canada has reduced mechanistic reliance on ratings from credit rating agencies. Such reliance can cause rating downgrades to have drastic effects on issuers and asset holders, potentially causing systemic disruptions. For this reason, the Bank of Canada has been implementing, in its own policies, the FSB's principles for reducing reliance on ratings from credit rating agencies. In July 2018, the Bank removed the mechanistic reliance on credit rating agencies from its collateral policy related to the Standing Liquidity Facility.[46]

Progress on modernizing Canada's payment systems continues. Payments Canada continues to make progress toward creating three new payment platforms: a new high-value payment system called Lynx, an enhanced retail system for clearing paper-based and electronic batch payments, and a real-time payment system.[47] An application provider and a vendor to provide hosting and system integration for Lynx have been selected. Design work continues on the retail batch and real-time payment systems. In addition, the Government of Canada proposed in Budget 2019 to require payment service providers to establish sound operational risk management practices and to protect users' funds against losses. The Bank of Canada would oversee compliance with these requirements, which were outlined in the government's consultation paper on the retail payments oversight framework.

Notes

The *Financial System Review* is a product of the Governing Council of the Bank of Canada: Stephen S. Poloz, Carolyn A. Wilkins, Timothy Lane, Lawrence Schembri, Lynn Patterson and Paul Beaudry.

This report includes data received up to May 9, 2019.

1. C. A. Wilkins, "The Age of Leverage" (remarks at the UBC Vancouver School of Economics and CFA Society Vancouver, March 14, 2019), and International Monetary Fund, *Global Financial Stability Report*, April 2019. [←]
2. Previously published data showed strong growth in home equity lines of credit (HELOCs). But isolating HELOCs in data on real-estate-based lending is challenging because they are often offered as part of combined mortgage-HELOC plans. New reporting allows a better breakdown of the different types of real-estate-based lending, as discussed in L. Al-Mqbali, O. Bilyk, S. Caputo and J. Younker, "Reassessing the Growth of HELOCs in Canada Using New Regulatory Data," Bank of Canada Staff Analytical Note No. 2019-14 (May 2019). [←]
3. Mortgage insurance rules and mortgage underwriting guidelines have been tightened several times in recent years. See "Appendix: Mortgage Finance Policy Changes in Canada," Bank of Canada *Financial System Review*, June 2017; Office of the Superintendent of Financial Institutions, "OSFI Is Reinforcing a Strong and Prudent Regulatory Regime for Residential Mortgage Underwriting," Press Release, October 17, 2017; and "Box 1: Mortgage Interest Rate Stress Tests," Bank of Canada *Financial System Review*, June 2018. [←]
4. CMHC, as guarantor, is exposed to risks from *National Housing Act* Mortgage-Backed Securities approved issuers, including credit unions. It mitigates some of these risks by establishing broad requirements for approved issuers, including requirements to provide data on their entire mortgage portfolio. [←]
5. These statements pertain strictly to fixed-rate mortgages with a term of five years or longer that are used to buy homes that will be occupied by the purchaser. This is the key segment of the market affected by changes to mortgage stress-testing practices that took effect in 2018. [←]
6. Read more about mortgage investment corporations on the Financial System Hub in G. Bédard-Pagé, "Non-Bank Financial Intermediation in Canada: An Update." March 26, 2019 [←]

7. This new measure is much broader than measures of mortgage arrears rates, which remain very low at around 0.25 per cent nationally. [←]
8. The indicators reported in this box are based on the 1999 and 2016 Survey of Financial Security (SFS) and use total income before taxes and deductions for debt-to-income calculations. Previous issues of the FSR relied on the Canadian Financial Monitor and used self-reported total household income. [←]
9. The threshold of the 350 per cent debt-to-income ratio matches the threshold estimated in G. Cateau, T. Roberts and J. Zhou, "Indebted Households and Potential Vulnerabilities for the Canadian Financial System: A Microdata Analysis," Bank of Canada *Financial System Review*, December 2015: 49–58. [←]
10. S. S. Poloz, "Risk Sharing, Flexibility and the Future of Mortgages," (remarks at the Canadian Credit Union Association and Winnipeg Chamber of Commerce, Winnipeg, May 6, 2019). [←]
11. See "Budget 2019: An Affordable Place to Call Home." [←]
12. CMHC estimates that the impact on house prices of the First-Time Home Buyer Incentive will be negligible. See CMHC, "Making Housing More Affordable: Canada's First-Time Home Buyer Incentive," April 2019. [←]
13. See previous issues of the *Financial System Review*, including "Box 4: Extrapolative Expectations May Be Driving Investment Activity," Bank of Canada *Financial System Review*, June 2017. [←]
14. M. Khan and T. Webley, "Disentangling the Factors Driving Housing Resales," Bank of Canada Staff Analytical Note No. 2019-12; and T. Webley, "Fundamental Drivers of Existing Home Sales in Canada," Bank of Canada Staff Discussion Paper No. 2018-16. [←]
15. M. Khan and M. Verstraete, "Non-Resident Taxes and the Role of House Price Expectations," Bank of Canada Staff Analytical Note No. 2019-8. [←]
16. G-7, "G-7 Fundamental Elements for Third Party Cyber Risk Management in the Financial Sector." [←]
17. Over the period of the survey, incidents were reported to the federal government through the Canadian Cyber Incident Response Centre. This function has now been taken over by the Canadian Centre for Cyber Security. [←]
18. Based on the Compustat database, which covers 1999 to 2018. Income is measured as earnings before interest, taxes, depreciation and amortization (EBITDA). [←]
19. T. Grieder and C. Schaffter, "Measuring Non-Financial Corporate Sector Vulnerabilities in Canada," Bank of Canada Staff Analytical Note No. 2019-15. [←]
20. The total non-financial corporate debt as a share of GDP is similar for both Canada (75 per cent) and the United States (73 per cent). See International Monetary Fund, *Global Financial Stability Report*, April 2019, and Federal Reserve Board, *Financial Stability Report*, May 2019. See also C. A. Wilkins, "The Age of Leverage" (remarks at the UBC Vancouver School of Economics and CFA Society Vancouver, March 14, 2019). [←]
21. Non-bank credit excludes lending by deposit-taking financial institutions. The share of bonds in total non-financial corporate debt in Canada has been relatively stable over the past decade, at around 40 per cent. But, since leveraged loans are almost all sold to investors they can also be considered part of non-bank credit. This would effectively increase the share non-bank credit by about 10 percentage points. [←]
22. S. Çelik, G. Demirtaş and M. Isaksson, "Corporate Bond Markets in a Time of Unconventional Monetary Policy," OECD Capital Market Series (February 2019). [←]
23. International Monetary Fund, *Global Financial Stability Report*, April 2019. [←]
24. Refinitiv DataScope fixed-income data and Bank of Canada calculations. [←]
25. The bond data from Refinitiv and credit rating data from Moody's do not cover the entire market, and the extent of the coverage of the leveraged loan market from Bloomberg is

uncertain. The actual share of the funding from leveraged loan and high-yield bond markets combined is therefore likely to be larger than the estimate of 12 per cent. [←]

26. Insurance Bureau of Canada, "2018 Facts of the Property and Casualty Insurance Industry in Canada." [←]
27. See *Canada's Changing Climate Report*. [←]
28. T. Lane, "Decrypting 'Crypto'" (remarks at the Haskayne School of Business, University of Calgary, October 19, 2018). [←]
29. Financial Action Task Force, "Regulation of Virtual Assets," October, 19, 2018. [←]
30. Basel Committee on Banking Supervision, "Statement on Crypto-Assets," March 13, 2019. [←]
31. Canadian Securities Administrators, *Proposed Framework for Crypto-Asset Trading Platforms*, Joint Canadian Securities Administrators/Investment Industry Regulatory Organization of Canada Consultation Paper 21-402, March 14, 2019. [←]
32. Financial Stability Board, "Crypto-Assets: Report to the G20 on the Work of the FSB and Standard-Setting Bodies," July 16, 2018. [←]
33. The Heads of Regulatory Agencies is chaired by the Governor of the Bank of Canada and includes the Department of Finance Canada, OSFI, the Quebec Autorité des marchés financiers, the Ontario Securities Commission, the Alberta Securities Commission and the British Columbia Securities Commission. [←]
34. OSFI, "OSFI Promotes Financial Institution Resilience with Revisions to Its Liquidity Adequacy Requirements Guideline," News Release, April 11, 2019. [←]
35. Department of Finance Canada, "A Review into the Merits of Open Banking," Consultation Document, January 2019. [←]
36. Growth at risk is measured as the fifth percentile of year-over-year growth, one year ahead. [←]
37. See T. Adrian, N. Boyarchenko and D. Giannone, "Vulnerable Growth," *American Economic Review* 109, no. 4 (April 2019): 1263–1289; and T. Duprey and A. Ueberfeldt, "How to Manage Macroeconomic and Financial Stability Risks: A New Framework," Bank of Canada Staff Analytical Note No. 2018-11. [←]
38. The growth figures refer to year-over-year percentage change, which differs from the quarter-over-quarter annualized measure of GDP growth underlying growth at risk in Chart 2-B of the June 2018 FSR. [←]
39. T. Duprey, X. Liu, C. MacDonald, M. van Oordt, S. Priazhkina, X. Shen, J. Slive and V. Traclet, "Financial System Resilience and House Price Corrections," Bank of Canada Financial System Hub (November 14, 2018). [←]
40. The International Monetary Fund conducted its work as part of its 2019 assessment of Canada under the Financial Sector Assessment Program and will publish its own analysis later this year. [←]
41. The analysis includes the six banks designated as domestic systemically important banks by the Office of the Superintendent of Financial institutions (Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, National Bank of Canada, Royal Bank of Canada and Toronto-Dominion Bank) and Desjardins Group, which is designated as a domestic systemically important financial institution by the Autorité des marchés financiers in Quebec. [←]
42. Canadian Fixed-Income Forum, "CFIF Survey Results on Liquidity, Transparency and Market Access in Canadian Fixed Income Markets," October 2016. [←]
43. D. Cimon and C. Garriott, "Banking Regulation and Market Making," Bank of Canada Staff Working Paper No. 2017-7. [←]
44. The indicators are described in C. MacDonald and M. R. C. van Oordt, "Using Market-Based Indicators to Assess Banking System Resilience," Bank of Canada *Financial System*

Review (June 2017): 29–41. [←]

45. K. McRae and D. Auger, "A Primer on the Canadian Bankers' Acceptance Market," Bank of Canada Staff Discussion Paper No. 2018-6 (June 2018). [←]
46. "Changes to Assets Eligible as Collateral under the Bank of Canada's Standing Liquidity Facility," Bank of Canada Market Notice, July 23, 2018. [←]
47. Payments Canada, "Modernization," 2019. [←]

Attachment 2.1

News Release

FOR IMMEDIATE RELEASE

City of Vancouver, FortisBC working together to tackle climate change

Deal promotes collaboration to reduce greenhouse gas emissions and improve efficiency while continuing to provide residents and businesses access to natural gas

Vancouver, B.C. – November 24, 2017: FortisBC and the City of Vancouver announced today that they have signed a Memorandum of Understanding (MOU) to team up on climate action projects to reduce greenhouse gas emissions (GHG) and increase investment in energy efficiency and renewable energy, while maintaining access to natural gas for residents and businesses. The MOU supports the City of Vancouver in pursuing its commitment to improving air quality and reducing GHG emissions in the region by 80 per cent below 2007 levels before 2050, which aligns with B.C. and Canada's energy and climate goals. Through this MOU, the City of Vancouver and FortisBC believe they can collectively achieve greater progress towards climate action initiatives by working together.

"At FortisBC, we put our customers first, and we are pleased to continue providing them with affordable, natural gas in the City of Vancouver," said Roger Dall'Antonia, executive vice president customer service and technology, FortisBC. "We understand that Vancouver residents want to shrink their environmental footprints, without impacting affordability. That's why we're working together to seek out new opportunities for Vancouverites to save energy, and reduce their costs."

"Vancouver has a plan to cut carbon emissions by at least 80 per cent before 2050 by improving energy efficiency and boosting clean renewable energy supply," says Mayor Gregor Robertson. "By collaborating on cleaner air, cutting greenhouse gases and increasing renewable natural gas supply, the City and FortisBC are helping the environment, economy, and people's pocketbooks."

The MOU, highlights a range of activities over the next five years designed to reduce GHG emissions, including:

- Boosting Renewable Natural Gas supply and use in Vancouver
- Improving air quality and reducing GHGs in transportation
- Developing a deep energy retrofit pilot project for a commercial building
- Increasing investment in Low Carbon Energy Systems
- Increasing access to energy efficiency and conservation rebates for new buildings
- Improving safety and efficiency of gas furnace retrofit installations

To support the increased investment in energy-efficient buildings and Low Carbon Energy Systems, the City of Vancouver will be making several changes to its Green Building policies. This will include alignment with the B.C. Energy Step Code, which is a new province-wide standard for energy efficient buildings. This enables FortisBC to provide incentives to make new buildings more energy efficient in the City. In addition, the changes will create opportunities for more projects like FortisBC's Marine Gateway low carbon energy system, which uses waste heat recovery to heat homes and hot water in an efficient, low carbon manner.

Together, FortisBC and the City of Vancouver are working to increase the use and supply of Renewable Natural Gas. FortisBC is an industry leader in renewable energy innovation through programs such as the Renewable Natural Gas program. The first of its kind in North America, the program takes organic waste from landfills and farms, extracts the methane, purifies it, then pipes it back into the natural gas system.

The City of Vancouver and FortisBC will also explore opportunities to reduce emissions and improve air quality by using natural gas as a transportation fuel source. Close to half of Metro Vancouver's GHG emissions come from transportation, with a significant portion coming from heavy-duty vehicles. Using natural gas as a transportation fuel has proven to be a cost-effective option that reduces emissions, and virtually eliminates particulates. With vehicles fuelled by Renewable Natural Gas, emissions are eradicated altogether.

This memorandum marks a starting point for FortisBC and the City to work collaboratively on energy initiatives.

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Backgrounder

Memorandum of Understanding – City of Vancouver and FortisBC

Agreement Background

The City of Vancouver is taking climate action by aiming to improve air quality, enhance economic resilience and reduce GHG emissions to at least 80 per cent below 2007 levels before 2050 as part of a Renewable City Strategy.

FortisBC serves a growing number of natural gas and electricity customers in B.C., and is investing in energy efficiency, energy conservation, emissions reductions, and the development of a renewable energy supply. Through this agreement, the City of Vancouver and FortisBC are committing to collaborate on solutions to climate change, which include reducing emissions, and increasing investments in energy efficiency and renewable energy, while maintaining access to natural gas.

Energy Efficiency

- To encourage investment in **energy-efficient buildings**, the City of Vancouver will amend its building energy policies and bylaws to add a compliance pathway in alignment with the B.C. Energy Step Code that achieves equivalent emissions outcomes.
- This agreement also makes it easier for FortisBC to deliver **rebates** to customers to help customers use natural gas more efficiently by aligning its initiatives with the B.C. Energy Step Code, such as incentives to upgrade old, inefficient furnaces.
- The City of Vancouver and FortisBC are teaming up to develop a pilot project to demonstrate a **deep energy retrofit** of a commercial building. The goal is to achieve energy savings, reduce emissions and explore how the project could be replicated in the future. Other partners would be sought to help fund and deliver the project.

Low Carbon Energy Systems and Transportation

- The City of Vancouver will create a **Low Carbon Energy Systems Policy** supporting private investment in highly efficient and low carbon building energy systems. FortisBC will pursue additional investments in these systems in Vancouver, like its investment in the Marine Gateway low carbon energy system, and continue to work with the City to identify and reduce barriers to the development of low carbon energy systems.
- Transportation accounts for almost half of GHG emissions in Metro Vancouver. FortisBC and the City of Vancouver will work together to promote reducing emissions and improving air quality with **low carbon vehicles and infrastructure**, potentially including increased access to the City of Vancouver's compressed natural gas station, and opportunities to use natural gas to fuel medium- and heavy-duty transportation, rail, and marine applications.

Renewable Energy

- FortisBC and the City of Vancouver are working to develop a supply of **Renewable Natural Gas at the Vancouver Landfill** in Delta.
- The parties are also exploring opportunities to **increase the use of Renewable Natural Gas** in City of Vancouver buildings, transportation fleets, and the City of Vancouver Neighbourhood Energy Utility. They will also work collaboratively to identify other Renewable Natural Gas supply and usage projects in Vancouver and throughout the region.

Commitments in the MOU may be subject to City of Vancouver or British Columbia Utilities Commission approval as appropriate.

MEMORANDUM OF UNDERSTANDING

between

FortisBC
(Including FortisBC Energy Inc. ("FEI"), and
FortisBC Alternative Energy Service Inc. ("FAES"),
collectively known as "FortisBC")

-and-

The City of Vancouver
("the CoV")

WHEREAS the CoV has adopted their Renewable City Strategy with the goal of improving air quality and reducing greenhouse gas (GHG) emissions by at least 80% below 2007 levels before 2050, which is consistent with Provincial and Federal climate and energy objectives;

AND WHEREAS the CoV has created plans, policies and bylaws, and has made investments to support the Renewable City Strategy;

AND WHEREAS these strategies, plans, policies, and bylaws require continued investment to support timely transformation in the areas of energy efficiency, energy conservation, emissions reductions and the development of renewable energy supply;

AND WHEREAS FortisBC has a portfolio of investments, programs and initiatives that support timely transformation in the areas of energy efficiency, energy conservation, emissions reductions and the development of renewable energy supply;

AND WHEREAS FortisBC is prepared to increase its portfolio of investments, programs and initiatives in Vancouver in support of the Parties' mutual objectives in energy efficiency, energy conservation, emissions reductions and the development of renewable energy supply;

AND WHEREAS the CoV and FortisBC are committed to climate action initiatives that support innovation, safety, reliability, and affordability;

AND WHEREAS the CoV and FortisBC can collectively achieve greater progress towards climate action initiatives by working together;

THEREFORE, the CoV and FortisBC ("the Parties") will pursue the following within the non-legally binding framework of this memorandum in accordance with the principles set out in section 9 and Appendix A:

1. **Increase access to energy efficiency and conservation investment**
   To enable greater access to energy efficiency investment through FortisBC's demand side management (DSM) programs, greater flexibility for new building

developers, and increased alignment with federal and provincial objectives and policy:

a) FortisBC will develop DSM programs to include, where permitted by Provincial DSM Regulation, energy efficiency rebates in alignment with each step of the BC Energy Step Code, by March 31, 2018, subject to BCUC approval. FortisBC will consult with the CoV and other stakeholders in developing its programs.

b) The CoV will create, subject to Council approval, alternative compliance pathways for all building energy and GHG emissions-related policies and bylaws, as follows:

   i. Alternative pathways will be based on the BC Energy Step Code performance requirements and will not include a GHG intensity target.

   ii. Alternative pathways will adopt the step of the BC Energy Step Code that achieves equivalent emissions outcomes to CoV objectives. The CoV may adopt a lower step in order to reach or accelerate the implementation of its objectives.

   iii. The CoV will maintain prescriptive pathways where they align with the requirements above.

   iv. Consequential amendments to the current Green Buildings Policy for Rezoning and Vancouver Building Bylaw (if any) as a result of this memorandum will be recommended to Council for approval by March 31, 2018.

2. Increase investment in Low Carbon Energy Systems (LCES)

In order to increase investment in LCES:

a) The CoV will follow through on its commitments to create a Low Carbon Energy System (LCES) Policy that supports investment and private ownership of LCES. In addition, the City will update existing policies to remove mandated neighbourhood energy system (NEU) connectivity and use to enable third-party thermal energy contracts with the exception of areas served by district energy systems owned by the CoV. Recommendations on the LCES Policy and changes to NEU connection and use requirements will be recommended to Council for acceptance by December 31, 2017.

b) The CoV and FortisBC will continue to identify and pursue opportunities to reduce barriers for LCES.

c) FortisBC will pursue LCES investment opportunities within Vancouver.

3. Improve safety and efficiency of gas furnace retrofit installations

In order to collaboratively improve the ease, quality and safety of installing high efficiency gas furnaces:

a) The CoV will publish a bulletin clarifying venting requirements for high efficiency space heating appliances, including the application of exterior vertical venting, by October 1, 2017.

b) In consultation with FortisBC, the CoV will host a workshop between city staff, FortisBC, and industry by December 31, 2017 to develop alternatives to the current approach to sidewall venting. The scope of the discussion will include additional flexibility under the current bylaw, industry best practices, and the adoption of an updated bylaw aligned with neighboring jurisdictions.

c) Updates to the bylaw or bulletin will be submitted for approval to Council by March 31, 2018.

d) The CoV will maintain a restriction on sidewall venting for high efficiency space heating installations in new construction. Sidewall venting in other gas appliances will remain unrestricted in new and retrofit applications.

e) FortisBC and the CoV will meet periodically to review opportunities to further mitigate noise, moisture and permitting concerns with furnace sidewall venting applications.

f) FortisBC and the CoV will implement a program to educate stakeholders, including natural gas contractors that operate in Vancouver, about safe, efficient and neighbourly installation, venting, and maintenance of furnaces and hot water tanks.

g) FortisBC will continue to require customers to obtain requisite permitting in order to access DSM rebates.

4. Develop a Deep Energy Retrofit Pilot Project

In support of energy efficiency and conservation efforts, the Parties agree to develop a pilot project to demonstrate and enable a deep energy retrofit in a commercial building. The pilot project will strive to:

- Achieve energy savings;
- Achieve emissions reductions;
- Involve other partners and secure other sources of funding; and
- Explore how the pilot could be replicated in the future.

The Parties agree to create a working group, develop a project scope, cost-benefit analysis, cost-sharing arrangement and targeted energy and emission savings. The working group will submit a viable project to their respective principals for approval and implementation.

5. Development of renewable energy supply and usage

In support of GHG reduction initiatives:

a) The Parties will continue to pursue and attempt to conclude an agreement for the Vancouver Landfill Renewable Natural Gas (RNG) supply project provided they are able to agree on terms that are satisfactory to, and align with the respective policies of, each Party.

b) The CoV will follow through on its commitment to develop an internal corporate carbon pricing policy that will provide a framework to assess the use of RNG, and other low carbon solutions, in CoV buildings, fleets and neighbourhood energy utilities by December 31, 2017 subject to Council approval. The CoV will consult FortisBC and other stakeholders on the development of the policy.

c) The Parties will continue to pursue and attempt to conclude a commercial agreement that allows the CoV to increase the use of RNG in CoV buildings, CoV fleets and CoV neighbourhood energy utility provided they are able to agree on terms that are satisfactory to, and align with the respective policies of, each Party.

d) FortisBC is committed to investing in additional RNG supply projects throughout BC in alignment with Provincial legislation.

e) The Parties will review and identify other potential RNG supply and usage projects in Vancouver.

f) The CoV and FortisBC will work cooperatively in the identification, and development of future RNG supply and usage projects with various governmental bodies.

g) FortisBC and the CoV will develop and implement a workshop for CoV staff on emerging RNG innovations and policy best practices by December 31, 2017. The scope of the workshop could include other gas grid innovations such as hydrogen.

6. Improving local air quality and reducing GHG emissions in transportation

In order to improve local air quality, promote emissions reductions, and promote the adoption of lower carbon energy infrastructure in the transportation sector:

a) FortisBC will assist the CoV in developing its business case for optimizing the use of its compressed natural gas station by October 31, 2017.

b) FortisBC is committed to pursuing the use of natural gas for transportation (NGT) in medium and heavy duty, rail and marine applications in alignment with Provincial legislation.

c) The CoV will support FortisBC in the ongoing development and deployment of NGT with other governmental bodies where the deployment reduces GHG

and local air emissions relative to currently viable alternatives and where the deployment represents a reasonable step towards climate objectives.

d) FortisBC will involve the CoV in existing working groups to assess and support the opportunity to reduce emissions through the use of natural gas for yard tractors, drayage trucks and marine bunkering at the Port of Vancouver and in Vancouver by October 31, 2017.

e) FortisBC and the CoV will develop and implement a workshop for CoV staff on emerging NGT innovations, policy best practices and identifying fleet opportunities at the CoV by December 31, 2017 and may include annual updates as necessary.

7. Ongoing collaboration

In support of this memorandum and in future collaboration:

a) The relationship principles, management structure, and key contacts relating to this memorandum are contained in section 9 and Appendix A.

b) FortisBC commits, under the FortisBC Climate Action Partnership Pilot Project, to fund (or provide, subject to mutual agreement) a two-year, temporary, full time CoV position in order to enable the implementation of initiatives described in this memorandum. The Parties will develop and agree on the work plan for this position.

8. Public Communication

The Parties value transparency and accountability. Accordingly, each Party intends to communicate the benefits of this memorandum publicly and will coordinate all communications in respect of the activities contemplated by this memorandum in accordance with the protocol as set out below:

a) The Parties will identify opportunities to jointly promote this memorandum and the projects flowing from it.

b) The Parties will consult with each other in order to align messaging regarding this memorandum.

c) Except as required by a regulator or by law, neither Party will make public statements about initiatives arising from this memorandum without obtaining express permission of the other party prior to doing so, which will not be unreasonably withheld.

d) Communications activities may include, without limitation, major public events or announcements, or communications products such as speeches, press releases, websites, social and digital media, advertising, promotional material or signage.

e) The Parties agree that joint communications activities marking the signing of this memorandum and other key milestones will involve both Parties in their planning and execution.

f) In addition to joint communications activities, the Parties may include messaging in their own communications products and activities.

g) The Parties will make reasonable efforts regarding the timing of public events to allow for the Parties to plan their involvement.

9. Term, dispute resolution, principles and other conditions

a) This memorandum shall have an initial term of 5 years from the date of its signing; however, it may be revised by written agreement as needed.

b) Each Party recognizes, and is respectful of the fact that, FortisBC's Board of Directors where approval is required and the CoV's City Council have ultimate discretion over any initiative outlined in this memorandum. The CoV also recognizes that some initiatives may be subject to regulatory approval. The Parties recognize that the exercise of discretion above will be guided by, amongst other things, the need to be accountable to their stakeholders, constituents and customers, as the case may be.

c) Should a Party fail to receive approval from its Board of Directors, the regulator or Council, where required, on any items contained in this memorandum, the Parties will meet to discuss alternatives and agree on a revised proposal for submission or alternative resolution for implementation.

d) Specific dates set out in this memorandum are intended as target dates which the Parties will work to achieving, on a commercially reasonable efforts basis.

e) The Parties will design and conduct the activities contemplated by this memorandum in accordance with applicable laws.

f) Should a dispute arise concerning the application of this memorandum, the issue will be resolved through escalation to the executive sponsors.

g) When pursuing an initiative together, the Parties recognize they may need to negotiate and enter into separate legally binding agreements to document the specific terms and conditions of such initiative.

h) With the exception of the terms directly below, this memorandum represents a non-legally binding framework for enhanced collaboration between FortisBC and the CoV.

i) This memorandum is not an exclusive arrangement and does not restrict either Party from pursuing its mandates, either on its own, or in collaboration with any other party.

j) Each Party is to bear its own costs in relation to this memorandum unless otherwise set out in a separate written agreement.

k) This memorandum does not grant any right to either Party to use each other's logos, trademarks or other intellectual property. Any such use will only be permitted through a legally binding written agreement between the Parties.

SIGNED this 22 day of September, 2017

City of Vancouver

Sadhu Johnston, City Manager

FortisBC Energy Inc.

Doug Stout, VP, Market Development and External Relations

FortisBC Alternative Energy Services Inc.

Doug Slater, General Manager

Attachment 2.2

CITY OF VANCOUVER

OFFICE OF THE CITY MANAGER
Sadhu A. Johnston, City Manager

April 16, 2019

Via email:
Douglas Stout (Douglas.Stout@fortisbc.com)
Vice President, Market Development and External Relations
FortisBC
16705 Fraser Highway
Surrey, BC V3S 2X7

Dear Doug,

RE: Working together on Vancouver's climate emergency response

As discussed on our call, the City of Vancouver is strongly committed to working with your team as we continue to develop strategies to align our work with Council's Climate Emergency Motion. While we know this work will be challenging, it is a critically important part of what we can do as a city to effectively respond to climate change.

For some of the actions in the Climate Emergency Response, there is a clear path for how the City and Fortis can continue to collaborate. Examples include the City's continued use of renewable natural gas, transitioning the neighborhood energy utility to 100% renewable energy, and helping to grow the supply of renewable natural gas.

For other actions, identifying the path to collaboration will require both of our organizations to work more creatively and push further outside of our comfort zones. The objectives proposed in Big Move #4 are the clearest example of this need. To achieve our climate targets, we need to enable a rapid transition to zero emissions space and water heating given how significant they are in our emissions inventory. We are cognizant of the enormous challenge for Fortis, given the pace of that change we are proposing.

As we will be describing to Council next week when we present the Climate Emergency response, we want to work with a broad range of partners in figuring out how to deliver on the six Big Moves. From my perspective, Fortis is a critical partner in that effort, and I'm hopeful you'll be willing to take on that challenge with us. In terms of Big Move #4, that must involve determining Fortis' role in transitioning to zero emissions space and water heating and also exploring how the City of Vancouver can enable Fortis to fulfill that role.

I see this as a significant next step in our relationship that is consistent with our initial objectives in developing our MOU two years ago. Please don't hesitate to contact me if I can be of help in navigating this process.

Yours truly,

Sadhu A. Johnston
City Manager
604.873.7627 | sadhu.johnston@vancouver.ca

Attachment 3.1

CITY OF VANCOUVER

ADMINISTRATIVE REPORT

Report Date:	April 16, 2019
Contact:	Matt Horne
Contact No.:	604.673.8331
RTS No.:	12978
VanRIMS No.:	08-2000-20
Meeting Date:	April 24, 2019

TO: Standing Committee on City Finance and Services

FROM: General Manager of Planning, Urban Design and Sustainability and General Manager of Engineering Services

SUBJECT: Climate Emergency Response

RECOMMENDATIONS

A. THAT Council adopt a new City-wide long-term climate target of being carbon neutral before 2050 as a complement to the target of 100 per cent of the energy used in Vancouver coming from renewable sources before 2050.

B. THAT Council adopt the target that by 2030, 90 per cent of people live within an easy walk/roll of their daily needs, and direct staff to report back by Fall 2020 with a strategy to achieve the target (“Big Move #1”).

C. THAT Council accelerate the existing sustainable transportation target by 10 years, so that by 2030, two thirds of trips in Vancouver will be by active transportation and transit, and direct staff to report back by Fall 2020 with a strategy to achieve the target (“Big Move #2”).

D. THAT Council adopt the target that by 2030, 50 per cent of the kilometres driven on Vancouver’s roads will be by zero emissions vehicles, and direct staff to report back by Fall 2020 with a strategy to achieve the target (“Big Move #3”).

E. THAT Council adopt the new target that by 2025, all new and replacement heating and hot water systems will be zero emissions, and direct staff to report back by Fall 2020 with a strategy to achieve the target (“Big Move #4”).

F. THAT Council adopt the target that by 2030, the embodied emissions in new buildings and construction projects will be reduced by 40 per cent compared to a 2018 baseline, and direct staff to report back by Fall 2020 with initial actions to achieve this target including recommendations to remove regulatory barriers to

mass timber construction and initial requirements for embodied emissions reductions (“Big Move #5”).

G. THAT Council adopt the target that by 2030, restoration work will be completed on enough forest and coastal ecosystems in Vancouver and the surrounding region to remove one million tonnes of carbon pollution annually by 2060, and direct staff to report back by Fall 2020 with initial actions to achieve the target, including potential partnership opportunities (“Big Move #6”).

H. THAT Council direct staff to begin implementing the Accelerated Actions as described in Appendix A and report back to Council with an overall progress report by May 2020.

I. THAT Council direct staff to proceed with the development of a carbon budgeting and accountability framework for corporate and city-wide carbon pollution that meets the objectives described in this report.

J. THAT Council direct staff to proceed with the formation of the Climate and Equity Working Group according to the objectives, process, timelines, participants and budget described in this report.

K. THAT Council direct staff to proceed with the development of Vancouver’s next environmental plan, Greenest City 2050, which will incorporate the work from this Climate Emergency Response report, as well as broader environmental sustainability objectives, and report back on the recommended strategy that will be integrated and coordinated with the City-wide Plan.

L. THAT Council direct staff to integrate the six (6) Big Moves in this report into the development of the City-wide Plan recognizing there will be further development and refinement of the Big Moves which will be informed by and coordinated with City-wide planning.

REPORT SUMMARY

In January 2019, Vancouver City Council unanimously approved a motion recognizing the climate emergency that the planet faces; acknowledging that Vancouver needs to do more to reduce carbon pollution in response to that emergency; and asking staff for recommendations on how to ramp up the City’s climate actions in line with efforts to limit global warming to 1.5°C. The 1.5°C limitation is a guiding target in the Paris Agreement, and it represents a level of global warming that would avoid the worst impacts of climate change and avoid overwhelming society’s capacity to adapt.

To ramp up the City’s actions to align with 1.5°C, this report offers two complementary approaches:

1. A set of six (6) “Big Moves” that would guide the City of Vancouver’s work in response to the climate emergency. The Big Moves are intended to direct staff to pursue the City’s key opportunities to meet the objective of limiting warming to 1.5°C. While they are all intended to be technically achievable, they will push the limits of what staff think can be accomplished in the next decade and staff realize that there will likely be political, financial and “pace-of-change” challenges to their implementation. If staff are directed to

pursue the Big Moves, any identified challenges, along with possible solutions, will be included in the reports being brought back for Council's consideration.

Walkable city

Active transportation and transit

Zero emissions vehicles

Heat pumps

Embodied carbon

Negative emissions

If Council endorses the Big Moves, staff will begin the analysis and engagement that is required to understand the challenges and opportunities with each, and to develop a comprehensive implementation and funding strategy. Depending on the nature of the challenges that emerge, and what we learn from our engagement process, staff may explore potential adjustments to the Big Moves, so long as they maintain consistency with the 1.5°C objective.

2. A package of 53 Accelerated Actions that build on the climate action the City has taken to date are also outlined in the report appendices. These are aligned with the Big Moves, as most will help move towards them. The reason for having these accelerated actions is, in part, to have some quick-starts to move forward on while the planning work on the Big Moves proceeds.

   To further align with Vancouver's efforts of limiting warming to 1.5°C, this report also recommends an updated 2050 target and a set of objectives for the City's carbon budgeting and accountability framework. Lastly, this report recommends an approach for a new Climate and Equity Working Group that will help to ensure that equity has a central place in the City's climate emergency and sustainability work.

COUNCIL AUTHORITY/PREVIOUS DECISIONS

On January 16, 2019, Council approved a motion recognizing climate change as an emergency and directed staff to:

- Review the City's climate change targets in the context of the latest research from the Intergovernmental Panel on Climate Change and the objective of limiting global warming to 1.5°C.
- Establish a carbon budgeting approach for the City that is consistent with the 1.5°C objective.
- Establish a Climate and Equity Working Group to provide guidance and support for the City's efforts to respond to the climate emergency.
- Add new actions to reduce carbon pollution that align the City's efforts with the 1.5°C objective.

This report provides the staff response to the January 16, 2019, climate emergency motion.

The recommendations in this report build on a long history of climate planning and action at the City of Vancouver. Highlights include:

- Clouds of Change (1990)
- Transportation Plan (1997)
- The Climate-Friendly City (2005)
- EcoDensity (2008)
- Greenest City Action Plan (2011)
- Transportation 2040 (2012)
- The Strategic Approach to Neighbourhood Energy (2012)
- Healthy City Action Plan (2014)
- The Renewable City Strategy (2015) and Renewable City Action Plan (2017)
- The Zero Emissions Building Plan (2016)
- The Electric Vehicle Ecosystem Strategy (2016)
- The Zero Waste Strategy (2018)
- The Climate Change Adaptation Strategy (developed in 2012 and updated in 2018)

The climate emergency response directly supports the forthcoming Resilient Vancouver Strategy, which recommends objectives and actions to build resilience to major shocks and stresses impacting Vancouver now and in the future. Many of the impacts of those shocks and stresses (e.g., floods and extreme weather) are the result of inadequate mitigation actions.

CITY MANAGER'S/GENERAL MANAGER'S COMMENTS

The City Manager recommends approval of the foregoing.

REPORT

Context

a. The Risks of Climate Breakdown

The threat of climate breakdown has been clearly documented by the world's scientists. Vancouver is already experiencing the impacts of 1°C of warming, including more severe storms, flooding, and forest fire smoke. Every degree of warming will increase those impacts and make it increasingly difficult, and eventually impossible, to adapt.

Even half a degree is significant. The Intergovernmental Panel on Climate Change (IPCC) compared the impacts from climate change in a world with 2°C of warming to one with 1.5°C and found the following:

- As many as 457 million more people exposed to climate risks and related poverty.
- Twice as many people suffering from water scarcity.
- Twice as many plants and three times as many insects losing their habitat.
- An ice-free Arctic every 10 years instead of every 100 years.
- The exposure of 2.6 times as many people to extreme heat at least every five years.
- Double the decline in global fisheries.

The impacts of climate change do not plateau at 2°C, so any warming beyond that would mean even more severe impacts. For context, even if the commitments made by Paris-signatory countries to date were being met, the world would be on track for more than 3°C of warming by the end of this century. That degree of warming would cause a worldwide economic, environmental and social catastrophe.

b. Limiting Global Warming to 1.5°C

The signatory countries to the Paris Agreement (including Canada) have committed to keeping global warming below 2°C, and as close to 1.5°C as possible. In October 2018, the Intergovernmental Panel on Climate Change (IPCC) released a major report making a clear case to strive for 1.5°C. The IPCC report also laid out the actions required to achieve that objective.

To limit global warming to 1.5°C, the necessary changes to global energy and economic systems will be immense and will require an unprecedented degree of technological change and cooperation. Global net carbon emissions will need to be reduced to 45 per cent below 2010 levels by 2030, net zero by 2050, and net negative in the second half of the century.

Cutting carbon pollution that quickly will require rapid and far-reaching transitions in energy systems, land use, transportation and buildings. Fossil fuels will ultimately need to be replaced through significant improvements in energy efficiency and a rapid shift to renewable energy and other zero emissions energy sources. In addition to reducing emissions, large quantities of carbon will need to be removed from the atmosphere (e.g., through reforestation projects, projects that enhance carbon storage in aquatic ecosystems, and projects that capture and store carbon from wood waste combustion).

In addition to reducing and removing emissions (mitigation), governments also need to better prepare for the anticipated impacts of climate change (adaptation). While both mitigation and

adaptation are critical responses, this report is focused on mitigation, as per the guidance in Council's climate emergency motion. Through the course of developing this report, several new priority adaptation actions were identified. They are included in Appendix B and progress will be reported as part of the City's Adaptation Strategy.

c. Growing Number of Climate Emergency Declarations

In Canada and around the world, there is a growing movement of hundreds of local governments recognizing the emergency that climate change represents, accelerating their own actions, and calling on provincial/state and national governments to also ramp up their responses. Given the world's increasingly urbanized population is on the front lines of the fight against climate change, the world's urban population will disproportionately experience the effects of global warming. Collectively we have the ability to influence the directions that senior governments take in responding to the climate emergency. As a leading city within this movement, Vancouver is well positioned to help define next steps for those cities, so that we are all well aligned with the objective of limiting warming to 1.5°C.

For a list of cities declaring a climate emergency see Appendix C.

d. Government of BC Ramping Up Climate Action

In December 2018, BC released its new climate plan, CleanBC. Phase one of the plan is designed to put the province on track for 75 per cent of the reductions it needs to meet its 2030 target (a 40 per cent reduction below 2007 levels). The specific policies in CleanBC are leading examples in North America and globally, and they provide an excellent foundation for Vancouver to align its efforts with.

In launching CleanBC, Premier Horgan emphasized the need to work together to transition away from fossil fuels to renewable energy. With the work Vancouver is doing on buildings, transportation and waste, the City is well positioned to play a leading role in that effort.

To learn more about CleanBC and supportive policies from the Government of Canada, see Appendix D.

e. Local and Regional Governments Ramping Up Climate Action

Metro Vancouver (Metro) is in the process of developing Climate 2050, which is intended to be the regional response to climate change—both in terms of reducing carbon pollution and preparing for the impacts of climate change. Metro is also beginning work on the next phase of the Regional Growth Strategy, and TransLink is embarking on an update of the Regional Transportation Strategy (RTS), which will both guide how people live, work and move around the region. Local governments across the region and province continue to adopt climate policies of their own (e.g., the Energy Step Code and electric vehicle-readiness requirements for new construction).

The updates to those regional plans will continue to impact Vancouver directly through the expectations they set for the City, and indirectly through the expectations they set for other local governments within the region. Vancouver's response to the climate emergency is an opportunity to help take a leadership role and shape that regional picture. The higher the degree of alignment between the City and the region, the more likely the collective regional response to the climate emergency will align with the objective of limiting global warming to 1.5°C.

f. Reducing Carbon Pollution has Multiple Benefits

There is no question that carbon pollution needs to be rapidly reduced and reach net negative levels by the second half of the century to effectively fight climate change. No single jurisdiction can solve the problem on their own, so success depends on everyone contributing to the solution. That said, fighting climate change is not the only reason to reduce carbon, as most of the solutions being pursued in an urban context offer multiple benefits including improved heath and air quality, greater community resilience, economic development and reduced costs. See Appendix E for a more detailed discussion.

Aligning Vancouver Targets with 1.5°C (Recommendation A)

Council's climate emergency motion directed staff to "increase targets and accelerate timelines for actions in line with the IPCC call for 45 per cent reductions in GHG emissions over 2010 levels by 2030, net zero emissions by 2050". This section focuses on aligning the targets.

a. Scope 1 and 2 Emissions

Vancouver's efforts to fight climate change have focused on addressing the sources of carbon pollution the City has the greatest influence over: residential and commercial buildings, the vehicles on our roads, and our landfill. These sources (also referred to as scope 1 and scope 2 emissions) are reported in the City's annual emissions inventory and accounted for 2.6 million tonnes of carbon pollution in Vancouver in 2017 (the latest year for which data is available). The scope of Vancouver's inventory aligns with the priority sectors in the Global Protocol for Cities (a globally recognized carbon accounting standard used by hundreds of cities).

For buildings, transportation and solid waste, the City's current targets for reducing carbon emissions and using renewable energy are as follows:

	2020	2030	Before 2050
Percentage of energy from renewable sources (including hydro power)	No target	55%	100%
Reduction in carbon pollution (relative to 2007)	33%	50%	At least 80%

Vancouver's 2030 carbon target (50 per cent below 2007) is largely consistent with the global reductions needed to limit warming to 1.5°C (45 per cent below 2010). Converting Vancouver's target to the same base year for consistency, the City's 2030 target is equivalent to 49 per cent below 2010 levels. Based on the City's experiences and economic modelling, achieving the 50 per cent target by 2030 is achievable yet very challenging.

For 2050, the IPCC research points to a need for zero net carbon emissions on a global basis. Vancouver's current 2050 carbon target is "at least 80 per cent below 2007". While this looks like a 20 per cent difference from the IPCC research, the actual gap is expected to be smaller because the City will need to exceed the 80 per cent carbon reduction target in order to achieve the 100 per cent renewable energy target. Staff anticipate that transitioning to 100 per cent renewable energy will result in carbon pollution being reduced by approximately 75 per cent in 2040 and more than 95 per cent in 2050.

Staff recommend maintaining the 2030 targets and modifying Vancouver's 2050 target to be "carbon neutral" instead of "at least 80 per cent below 2007 levels". If approved, the actions needed to achieve this revised target would be included within Big Move 6.

b. Beyond 2050 to Negative Emissions

In addition to reaching net zero carbon emissions by 2050, the IPCC research concludes that global net negative emissions will be necessary in the second half of the century. Examples of how negative emissions could be achieved include reforestation projects, projects that enhance carbon storage in aquatic ecosystems, and projects that capture and store carbon from wood waste combustion.

The sixth Big Move in this report (recommendation G) is intended to begin Vancouver's work on negative emissions such that the City is helping to sequester approximately 1 million tonnes of carbon pollution annually by 2060. Based on initial analysis of the IPCCs research, the 1 million tonnes is aligned with the objective of limiting global warming to 1.5°C.

c. Beyond Scope 1 and 2 to Embodied Carbon

The City also bears some responsibility for the emissions that are released through the production and transportation of goods and materials used in Vancouver (referred to as scope 3 emissions). Based on the City's analysis of these additional sources of carbon pollution, priority opportunities include transitioning to lower-carbon building and construction materials, and encouraging residents and restaurants to shift to more plant-based diets, which are less carbon intensive to produce.

To begin addressing Vancouver's scope 3 carbon emissions, Big Move #5 is focused on the embodied emissions in new buildings and construction projects, including a target that by 2030, those sources be reduced by 40 per cent as compared to 2018 typical practice. The Big Move is supported by a number of specific projects in the accelerated actions.

Further, Project 13.b in the table of Accelerated Actions will begin work on the emissions associated with food consumption in Vancouver, and the City's efforts to shift to active transportation and transit will reduce the embodied emissions in vehicles, if the number of vehicles in the City declines. At this point, staff are not recommending targets for other sources of embodied carbon, such as those associated with food and vehicles.

d. Helping Developing Jurisdictions Transition to Renewable Energy

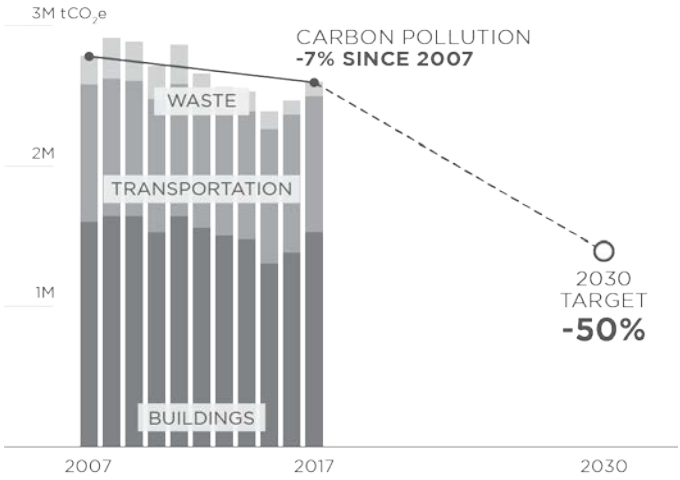
To fully be aligned with 1.5°C, jurisdictions that are wealthy by global standards (including Vancouver) need to support emissions reductions in jurisdictions without the same resources to improve energy efficiency and transition to renewable energy. Without a willingness to provide this support, it is highly unlikely that developing jurisdictions will have the resources to transition fast enough.

The underlying rationale for wealthier jurisdictions providing support is that we continue to have much higher per capita emissions, and we have accumulated a great deal of our wealth through the burning of fossil fuels since the beginning of the last century. Developing jurisdictions have contributed comparatively little to global emissions and are the least equipped to reduce emissions and prepare for its impacts.

What Vancouver's role could be in helping developing jurisdictions transition to renewable energy is not well defined. Project 14.i in the accelerated actions is intended to begin the work of figuring out what that role could be.

Vancouver Needs to Accelerate Progress to Align with 1.5°C

While the City's 2030 target is aligned with the objective of limiting global warming to 1.5°C, our progress towards the target is not. As shown in the following chart, Vancouver's emissions from buildings, transportation and solid waste have declined by an average of 19,000 tonnes per year over the past decade. Though we are moving in the right direction (while accommodating significant population and economic growth), progress needs to be accelerated significantly.



To get on track for the City's 2030 target, Vancouver's emissions need to drop by 1.2 million tonnes. That's an average of 92,000 tonnes per year over the next decade—a five-fold increase from the past decade. For context, approximately 92,000 tonnes of reductions could be achieved individually by each of the examples below:

- Switching 15 per cent of vehicle trips per year on Vancouver's roads to active transportation and transit.
- Replacing 35,000 gasoline cars owned by Vancouver residents with electric cars.
- Replacing 22,000 furnaces with heat pumps.
- Switching the downtown district energy system to renewable energy.

To reduce city-wide carbon pollution by 92,000 tonnes every year, the City will need to pursue all of these opportunities and more. The City actions needed to pursue these opportunities are presented later in the report and are covered by Recommendations B to H.

Ramping Up Vancouver's Actions to Align with 1.5°C

To ramp up the City's actions to align with 1.5°C, this report offers two complementary approaches, a set of six Big Moves and a package of Accelerated Actions. The Big Moves and Accelerated Actions are intended to use the range of tools available to the City, which can be grouped into investment tools, regulatory tools, and advocacy tools:

- *Regulatory Tools*: Where the City uses its authorities under the Vancouver Charter to establish the rules that guide resident and business decisions that support zero emissions outcomes. These would typically have minimal direct cost for the City.

- *Investment Tools*: Where the City invests directly in equipment and infrastructure to reduce carbon pollution, and where the City provides financial incentives to encourage residents and businesses to choose zero emissions options.
- *Advocacy Tools*: Where the City works with other governments and utilities to encourage them to apply their regulatory and investment tools to support zero emissions outcomes.

It is important to consider the full range of tools because the selection will depend on the barrier that is being addressed, and it will have implications for how costs and benefits are distributed. These tools are discussed in Appendix F.

a. The Big Moves (Recommendations B to G)

The Big Moves are intended to pursue the key opportunities where the City's tools will be critical and the reductions are adequate to align the City's work with the objective of limiting warming to 1.5°C. The objectives are also intended to be easier to understand than traditional climate targets like a 50 per cent cut in carbon pollution. They are all intended to be achievable, while pushing to the limits of what staff think can be accomplished in the next decade in partnership with other levels of government.

Big Moves #1 through #4 will accelerate and expand the City's existing work on buildings and transportation, Big Move #5 will begin important work on reducing the embodied emissions from building and construction materials, and Big Move #6 will begin the work of establishing the City's role in pursuing negative emissions.

In terms of the 1.2 million tonnes of reductions targeted for 2030 from buildings, transportation and solid waste, Big Moves #1 through #4 would achieve 1.1 million tonnes.[1] The remaining 0.1 million tonnes plus a 0.1 million tonne buffer would be addressed by two key provincial policies that are reducing the carbon intensity of transportation fuels and the gas grid:

- The Renewable Gas Standard will require 15 per cent of the gas in FortisBC's distribution network to come from renewable sources by 2030, which will help reduce an additional 135,000 tonnes of carbon pollution in Vancouver. Depending on how it is designed, this Standard could also help the district energy systems in Vancouver convert to renewable heating options. The City is helping to support meeting this requirement by using renewable gas in its facilities and looking for opportunities to generate more renewable gas.
- The Low Carbon Fuel Standard will require a 20 per cent cut in the carbon intensity of transportation fuels in BC by 2030, which will help reduce an additional 38,000 tonnes of carbon pollution in Vancouver. The City is helping to support meeting this requirement by using renewable fuels in our fleet, and exploring opportunities to be a producer of such fuels.

If the Big Moves are approved by Council, staff will begin the analysis and engagement that is required to understand the challenges and opportunities with each, and to develop the detailed plans, policies, and funding strategies they will need. As part of that work, staff will assess the costs and benefits in greater detail and develop high-level financial strategies. Depending on the nature of the challenges that emerge and what we learn from our engagement process, staff

[1] The emissions targeted by Big Move #5 are scope 3 emissions, so while they are important contributions, they do not count directly against the 1.2 million tonnes targeted for 2030. Big Move #6 is not expected to be sequestering material amounts of carbon pollution in 2030.

may explore potential adjustments to the Big Moves, so long as they maintain consistency with the 1.5°C objective. All of this information would come back to Council for further consideration.

The following pages describe each Big Move, including the objective staff will work toward, an initial estimate of carbon reduction potential, key actions that will likely be required for the Big Move to be successful, how the Big Move links to existing City work, and which departments will lead the work.

Big Move #1	**A walkable city**  By 2030, 90% of people live within an easy walk/roll* of their daily needs. *(Recommendation B)* **Walking or other pedestrian-scale mobility devices like wheelchairs.*
Carbon Reduction Potential	By making it easier for people to walk/roll instead of driving, 153,000 tonnes/year of carbon pollution could be reduced by 2030 (13% of the targeted reductions).
Description	Success for this Big Move will mean more “complete neighbourhoods” that have daily destinations, such as shops, services, jobs, parks, schools and community centres, within walking/rolling distance of where people live. For context, approximately 45% of residents live within an easy walk/roll of their daily needs today. Achieving this goal will require sensitively introducing more housing choices and essential amenities to neighbourhoods across the city. To create truly walkable neighbourhoods that are livable, compact and complete, the streets and pathways linking these daily needs will need to be safe, comfortable and attractive for walking, rolling and cycling, and supported by good access to frequent transit. Complete neighbourhoods will support local businesses, a diversity of households, healthier lifestyles, more social interaction, and reduced energy use and carbon emissions.
Links to Existing Work	The City has a long history of planning for complete and compact communities where it is easy to walk/roll between home and most daily destinations. Many of our most desirable communities, such as the West End, Southeast False Creek, Kitsilano, and Grandview-Woodlands, provide a rich mix of land uses and safe, connected and comfortable streets and pathways. Upcoming planning initiatives, such as the City-wide Plan, the Broadway Plan and Jericho Lands, provide opportunities to expand our approach to creating and enhancing walkable communities and pilot new strategies to accelerate our transition to a truly walkable city. Walkable and complete communities will also support the City’s resilience work because people can more easily help each other and access resources during emergencies. It also supports and enhances efforts to create more diverse and affordable housing choices.
Responsible Departments	• Led by Planning, Urban Design and Sustainability • Supported by Engineering and Development, Buildings and Licensing

Big Move #2	**Safe and convenient active transportation and transit**
	By 2030, two thirds of trips in Vancouver will be by active transportation and transit, which would be 10 years earlier than currently planned. *(Recommendation C)*
Carbon Reduction Potential	By making it safer and more convenient for people to choose active transportation and transit to move around the city, 141,000 tonnes/year of carbon pollution could be reduced by 2030 (12% of the targeted reductions). This would be in addition to the 153,000 tonnes in Big Move #1.
Description	Success for this Big Move will require a significantly improved transit capacity and efficiency, better-connected active transportation networks city-wide, and continued expansion of high-quality reliable transit across the city and region. Efforts will continue to focus on increasing affordable and safe transportation choices with access for all, and addressing gaps in the network, particularly in underserved areas. Achieving this will necessitate investment in a spectrum of improvements, from local upgrades throughout the city, to completing major projects, such as the Broadway Subway to UBC, 41st Avenue B-Line and the Granville Bridge greenway. Through this work, the number of trips people need to take in cars will decline as will the length of many vehicle trips. New policy tools will also be important with mobility pricing providing a good example because of its ability to encourage fewer vehicle trips during our most congested times of day and to provide the funds needed to expand and improve the transit and active transportation networks. While this Big Move is focused on trips that originate in Vancouver, it will provide an opportunity to engage with partners across the region to help shape Metro Vancouver's Climate 2050 plan and the Regional Transportation Strategy.
Links to Existing Work	The City has a long history of prioritizing active transportation and transit for a mix of reasons, such as enhanced livability, reduced congestion, affordability, improved air quality, more active lifestyles, and reduced carbon pollution. Pursuing this move will build upon Transportation 2040, which was approved in 2012 and has helped the City succeed in seeing 50% of daily trips by active transportation or transit. These efforts reduce needs for cars which can also enhance affordability of daily living in Vancouver.
Responsible Departments	• Led by Engineering • Supported by Planning, Urban Design and Sustainability

Big Move #3	**Pollution-free cars, trucks and buses**  By 2030, 50% of the kilometres driven on Vancouver's roads will be by zero emissions vehicles. *(Recommendation D)*
Carbon Reduction Potential	The rapid transition to electric and other zero emissions vehicles would reduce Vancouver's carbon pollution by 283,000 tonnes per year by 2030 (24% of the targeted reductions).
Description	Success for this Big Move will mean almost all new light-duty vehicles will need to be zero emissions towards the end of next decade. For light-duty fleets where vehicles are replaced more frequently (e.g., taxis, car shares, ride-hailing, etc.), almost all of these vehicles will need to be zero emissions by 2030. The transition for medium- and heavy-duty vehicles will be slower, but rapid progress will still be needed in some key market segments (e.g., in transit, where TransLink has already made a commitment for all new buses to be zero emissions by 2025). To achieve this scale of transition, there are at least three tools the City will likely need to rely on heavily: 1) expanding residential, commercial and public charging infrastructure, 2) parking policies that encourage and eventually require zero emissions vehicles, and 3) zero emissions zones that discourage and eventually ban polluting vehicles from specific areas or corridors. The timing for any zero emissions vehicle requirements and how those would be phased in for different types of vehicles would need to be explored. The City could also require any remaining gas stations to transition to zero emissions charging/fueling stations between 2030 and 2040. As the City considers these types of parking policies and zero emissions areas, it will be important to ensure that all residents and businesses have equitable access to zero emissions transport choices, and convenient and robust charging or fueling infrastructure for vehicles. This Big Move also introduces a challenge for Big Move #2 because it will result in a significant decline in gas tax revenue, which is a primary source of financing transit in the region. The work to support this Big Move will include developing a better understanding and forecasting of this challenge, exploring potential solutions that secure long term transit funding (e.g. congestion charging), and working with senior governments and partners to implement those solutions.
Links to Existing Work	This Big Move would accelerate and expand upon Vancouver's Electric Vehicle Ecosystem Strategy, which has guided investments in public charging infrastructure and ensured that new buildings are ready for electric vehicles. It would also link well to the City's efforts to electrify its own fleet, which has resulted in the largest electric vehicle fleet in Canada. Given that this links to the City's support of TransLink's Low Carbon Strategy towards fossil-free buses, it will be important to consider the people moving capacity of zero emission vehicles and buses as we monitor this Big Move.
Responsible Departments	• Led by Engineering • Supported by Development, Buildings and Licensing; Planning, Urban Design and Sustainability Park Board; and Real Estate and Facilities Management

Big Move #4	**Zero emissions space and water heating**
	By 2025, all new and replacement heating and hot water systems will be zero emissions. *(Recommendation E)*
Carbon Reduction Potential	Ensuring that new and replacement space and water heating systems are zero emissions will reduce Vancouver's carbon pollution by 552,000 tonnes/year in 2030 (46% of the targeted reductions).
Description	Success for this Big Move will mean that by 2025, all space and water heating in new buildings and those replaced in existing buildings would be zero emissions. Heat pumps are expected to be an important solution is this transition. They are over 200% efficient at capturing heat from the air, ground or waste sources. They also cool buildings, which will be especially important as climate change causes hotter summers. The City's Neighbourhood Energy Utility will also need to get 100% of its energy from renewable sources by 2030 (currently 70%). For this Big Move to succeed, the Zero Emissions Building Plan for new construction will need to be sped up. New construction is critical because one quarter of the floor space in 2030 will be built over the next decade. Building that new floor space with zero emissions space and water heating starting as early as 2021 avoids the need to retrofit in the future. For existing buildings, the City will need to develop a Zero Emissions Retrofit Strategy to transition space and hot water heating to zero emissions. Furnaces and boilers last 15–25 years, while hot water heaters last closer to 10 years. Every time they are replaced is an opportunity to upgrade to zero emissions. A successful Retrofit Strategy will include sustained incentives (potentially through a Vancouver Climate Trust) and investments in industry capacity-building to support voluntary adoption of zero emissions space and water heating before 2025. Ultimately, there will need to be regulations that require zero emissions heating equipment when it is replaced (in the same way higher efficiency furnaces are already required when an old one is replaced). While 2025 is the key date to meaningfully bend the emissions reduction curve, moving this quickly will have implications on factors such as costs and business' ability to adapt to new opportunities. Success will depend on understanding where there are concerns and finding effective ways of addressing them. Also critical will be a jobs transition roadmap. In addition, careful consideration and analysis of the use of incentives is required in order to preserve affordability and avoid displacement of existing residents, particularly in aging rental buildings.
Links to Existing Work	Implementation of Zero Emissions Building Plan (2016) is ongoing. The City continues to require energy efficiency upgrades when a building is retrofitted, which help make the switch to zero emissions heating more affordable. The Neighborhood Energy Utility has been providing low-carbon heat and hot water to customer base in Southeast False Creek since 2010, and expansion is underway to parts of Mount Pleasant, North East False Creek and the False Creek Flats. The City has transitioned boilers to heat pumps at a growing number of its own facilities, including City Hall. This Big Move also supports the Vancouver Housing Strategy by ensuring homes are healthier and have lower energy costs.
Responsible Departments	• Led by Planning, Urban Design and Sustainability • Supported by Development, Buildings and Licensing; Engineering; and Real Estate and Facilities Management

Big Move #5	Lower carbon construction materials and designs
	By 2030, the embodied emissions in new buildings and construction projects will be reduced by 40% compared to a 2018 baseline. *(Recommendation F)*
Carbon Reduction Potential	By reducing the embodied carbon emissions in new construction projects, 78,000 tonnes/year of carbon pollution could be reduced by 2030. This reduction does not count against the 1.2 million tonnes the City is targeting because nearly all embodied emissions are not included in the City's current inventory.
Description	Success for this Big Move will mean a shift in construction practices to: use more mass timber and low carbon concrete, rely more on prefabricated and modular construction, eliminate spray foam insulation with high-carbon blowing agents, and use more recycled aggregate and asphalt. Further, a shift in design practices to less underground parking and the retention or re-use of existing materials will also be outcomes of this Big Move. In addition to reducing carbon pollution, these outcomes have the potential to support BC's sustainable forest sector and our economy, improve seismic resilience, and open up more affordable construction options, specifically around mass timber and reduced parking. The first phases of implementation of the Zero Emissions Building Plan have resulted in a significant reduction in operational GHG emissions for new construction. However, the embodied emissions of a new building are significant and can typically be equivalent to (and sometimes two times greater than) the operational emissions from that same building. Initial work towards this Big Move is expected to include removing regulatory barriers to increased mass timber construction and introducing requirements for lower embodied emissions. As with the Zero Emissions Building Plan, the work to achieve the target cannot depend on regulations alone. To recognize the steep learning curve for many designers, developers and building occupants, the work will include incentives for early adopters, industry capacity-building and City leadership. The City will need to work with regional, provincial, national and international partners to improve standards and protocols for embodied emissions accounting in order for this work to be successful.
Links to Existing Work	Embodied carbon in construction is a relatively new area of consideration for the City. The most recent update to the Green Building Policy for Rezoning requires developers to report embodied carbon in their projects and the City has been using lower-carbon concrete and higher rates of aggregate and asphalt recycling.
Responsible Departments	• Led by Planning, Urban Design and Sustainability and Engineering • Supported by Development, Buildings and Licensing; and Real Estate and Facilities Management

Big Move #6	**Restored forests and coasts**  By 2030, restoration work will be completed on enough forest and coastal ecosystems in Vancouver and the surrounding region to remove one million tonnes of carbon pollution annually by 2060. *(Recommendation G)*
Carbon Reduction Potential	Through reforestation and coastline rehabilitation, the materials planted will be capable of removing and sequestering at least one million tonnes of CO2 per year by 2060. The reductions will be minimal in 2030 because ecosystems take time to recover and grow once any planting is complete.
Description	Conserving, restoring, and creating forest and coastal ecosystems will remove large amounts of carbon from the atmosphere and sequester it as vegetation and in the soil as organic matter. Natural shorelines also increase resilience to sea level rise associated with climate change. In addition to carbon sequestration benefits, forests and coastal ecosystems (e.g., eelgrass meadows and salt marshes) play an important role in supporting cultural practices and providing ecosystem services and resilience to people and wildlife, both in Vancouver and in the surrounding areas. Success for this Big Move will mean: • Increasing Vancouver's tree canopy, especially in underserved communities. • Collaborating with the Musqueam, Squamish and Tsleil-Waututh Peoples to restore lands. • Partnering with Environment and Climate Change Canada, Fisheries and Oceans Canada, BC Ministry of Environment, Metro Vancouver, Port of Vancouver, Vancouver Aquarium, and others to conserve and restore coastal ecosystems, such as the eelgrass meadows of Spanish Banks. • Improving water quality of receiving waterbodies to a standard that supports marine life water quality objectives. • Large-scale restoration of shorelines and subtidal zones along False Creek, the Fraser River, English Bay, Burrard Inlet and Trout Lake. • Conservation of large tracts of coastal forest, such as the Coastal Douglas Fir Biogeoclimatic Zone, which is a rare local forest ecosystem.
Links to Existing Work	The City has some experience in these types of carbon sequestration projects through the Greenest City Action Plan, although carbon has never been a primary reason for the projects (e.g., tree canopy goals and the New Brighton Park Shoreline Habitat Restoration Project). The Rain City Strategy, Urban Forest Strategy, Climate Change Adaptation Strategy, Resilient Vancouver Strategy, and Biodiversity Strategy also support actions related to this Big Move. This Big Move would be a significant expansion of scale of the City's work in this field.
Responsible Departments	• Led by Planning, Urban Design and Sustainability • Supported by Park Board and Engineering.

b. The Accelerated Actions (Recommendation H)

The climate emergency will not pause while the Big Moves take time with engagement to develop into robust strategies. In order to respect that urgency, staff have also developed a set of Accelerated Actions that build on existing work and can move forward without delay.

Many of the Accelerated Actions are expected to become important elements in the Big Moves as they develop, but they can be safely initiated concurrent with that work. They may need to be strengthened to adequately support a Big Move and they may need to be complemented with other actions. This work can be seen as ‘no-regrets’ as it is very unlikely that any of the Accelerated Actions would stop making sense even after the Big Moves are developed.

Several of the Accelerated Actions address sources of carbon pollution not covered by any of the Big Moves. Of note are Accelerated Actions 12.a and 13.b, which relate to the emissions from our food system. Growing, processing and transporting our food are material sources of carbon emissions, but at this time, staff do not have a clear enough picture of how much they can be reduced or what the most appropriate roles are for the City to articulate a meaningful Big Move for food consumption. Staff will continue to monitor and pursue this opportunity as these plans are reviewed and updated.

The full list of Accelerated Actions is contained in Appendix A. Each action includes a short description of the action and how it reduces carbon pollution, information on whether the action is a next step or a new action, what the next milestone in the project would be, and which departments are responsible for the action.

Given the large number of Accelerated Actions, the next milestone for most of them is a report back to Council to provide a more thorough opportunity to understand and discuss them. Some of those reports will be for single Accelerated Actions, and in other cases staff will bundle Accelerated Actions into logical groupings or the Big Moves.

Carbon Budgeting (Recommendation I)

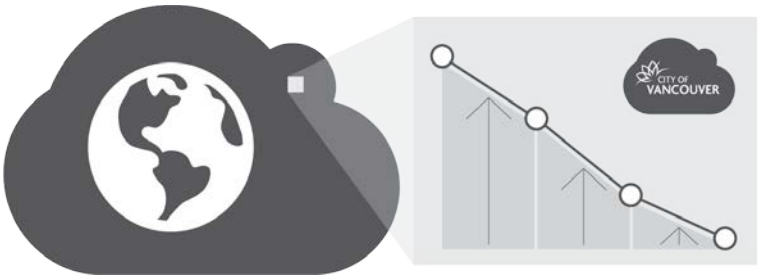
In January 2019, Council directed staff to “establish a remaining carbon budget for corporate and community emissions commensurate with limiting warming to 1.5°C, re-evaluate how to best measure such emissions, and report annually on the expenditure of the City of Vancouver’s remaining carbon budget”.

The field of carbon budgeting is nascent and definitions vary by jurisdictional context. A review of existing national and sub-national carbon budgets showed two main groups of approaches:

a. Remaining Carbon Budgeting

These approaches focus on total present and future GHGs in the atmosphere, rather than reductions from chosen "baselines". They typically look at the remaining amount of carbon “room” left in the atmosphere before there is an unacceptable risk of a global temperature threshold being exceeded. This room is continuously decreasing due to the carbon we emit, leading to approaches that budget the remaining allowable carbon. In practice, a jurisdiction takes a portion of that global room and sets immediate and medium-term multi-year budgets, leading eventually to their maximum allowable carbon limit.

Examples: UK, London, Australia, New Zealand



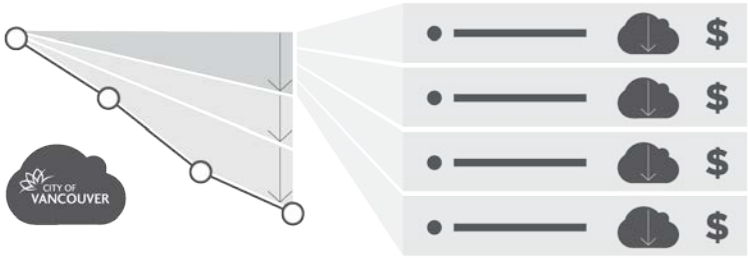
An advantage of multi-year budgets is that they focus on efforts to reduce long-term accumulation of emissions in the atmosphere, rather than fluctuations in the rate of emissions due to near-term factors (e.g., weather; economic and investment cycles).

> *A cumulative multi-year goal is a commitment to reduce, or control the increase of, cumulative emissions over a target period to a fixed absolute quantity. Cumulative multi-year goals are often referred to as "carbon budgets." This type of multi-year goal is framed as a fixed-level goal because it is not defined in reference to a base year or baseline scenario.*
>
> *- Mitigation Goal Standard, World Resources Institute*

b. Carbon Reduction Accounting

These approaches add up carbon-reduction contributions (likened to GHG "spending") to achieve a cumulative reduction against a chosen target. They focus on transparency in investments, programs and policies that lead to emissions reductions.

Examples: Oslo, London, British Columbia (TBD)



To achieve this, they can be broken down by sector or program, and include such information as time period, cost, contributions to carbon goals, and responsibility. Because they are additive, an advantage is that any gap in achieving the necessary reductions against the target becomes visible, demanding a response.

> *[Oslo's] climate budget is a tool to convert a city's climate goals into concrete, annual, measurable action. It establishes a maximum GHG emissions level for the budget year, based on the city's emissions goal. The budget details the city's proposed short-term, emissions-reduction actions to stay within the maximum amount, their projected impact, and cost. It is a distinct part of the city's overall budget and moves through the city's usual budgeting process, from proposal to adoption, implementation, and after-action assessment.*
>
> *- Game Changers Report, Carbon Neutral Cities Alliance*

Overall, carbon targets reframed as maximum "budgets" can help enforce more rigorous approaches to managing carbon. They can list carbon impacts and ownership line-by-line. They can allocate and transfer carbon between different sources to balance out the big picture (see the Improved Accountability section). Reassessed, a carbon budget periodically gives opportunities for course corrections where necessary. Carbon budgets can help clearly communicate the impact of carbon-reduction efforts to the public, the City organization, and stakeholders. While more transparent, any budget requires accountability on implementation, with potentially some form of consequence (and mechanism to redress) if budgets are not met.

Objectives for Vancouver Approach

Staff will work to develop carbon budgets for Vancouver's corporate and community emissions. Final approaches may draw elements from both approaches discussed previously. A carbon budget is only useful if it helps to guide appropriate, agile, and accountable effort to reduce emissions. As such, any shift to a budget approach for Vancouver's City-corporate and community emissions should aim to meet the following objectives:

- Improved Transparency
- Better Data
- Better Forecasting
- CleanBC Alignment
- Improved Accountability

These objectives are detailed in Appendix G, along with sample considerations to be resolved in developing a carbon budget approach.

Next Steps

If approved, an approach for corporate emissions will be developed and implemented first, to confirm the objectives are being met, and to test if it can be replicated for community emissions. Developing the corporate approach now aligns well with the forthcoming Green Operations Plan refresh. If multi-year budgets are set, the first budget cycle (e.g., 2019–2022) can be used to refine carbon budget approaches.

Nearly all City departments will be involved (e.g., Planning, Urban Design and Sustainability; Finance, Risk and Supply Chain Management; Engineering Services; Real Estate and Facilities Management; Technology Services). Staff will report back with an update on the carbon budget approaches to Council, in line with the progress update on climate emergency measures in 2020.

Climate and Equity Working Group (Recommendation J)

Climate change shocks and stresses do not affect all groups in our community equally. Those that have been affected by systemic vulnerabilities and inequity are often at greater risk from the impacts of climate change and often have the fewest resources to respond and adapt. In Vancouver, climate change impacts, such as extreme heat and poor air quality from wildfires, are already being felt disproportionately.

In parallel, we know that it's critical to engage with and support systemically excluded and low-income populations as we transition from fossil fuels to renewable energy. That transition can be

undertaken in ways that improve social equity and affordability, while alleviating issues such as "energy poverty". For example, convenient public transit helps reduce carbon emissions and air pollution while also supporting affordable mobility for all residents.

In the U.S., a growing number of cities are advancing equity in parallel with their climate action work, using input from Climate and Equity Committees. Portland, Seattle, and Washington, D.C., have each applied an equity lens to their climate work, to minimize the impacts of climate change on systemically excluded populations and ensure that new policies do not negatively impact vulnerable populations, while also identifying ways to support greater equity through climate action. Similarly, the Canadian Urban Sustainability Network recently completed a study that identified the significant extent of energy poverty across the country and highlighted the need for equity considerations in climate plans.

Social Policy is currently developing an Equity Framework to formalize the City's equity-focused work and to promote access, inclusion, cultural safety, and public participation for all staff and residents, and across all City areas of business. Creating a Climate and Equity Working Group would provide an early opportunity to use the tools of the Equity Framework to engage with systemically excluded and low-income residents on the City's climate and sustainability work, ensuring that the actions put forward in Greenest City 2050 and ongoing response to the climate emergency improve social equity.

The Climate and Equity Working Group will coordinate with the City-wide Plan effort regarding equity conversations as both programs develop. It will also be an important opportunity to incorporate a gendered intersectional lens into the City's climate actions and the Climate Adaptation Strategy.

More details of the Climate and Equity Work group can be found in Appendix H.

Greenest City 2050 (Recommendations K and L)

Vancouver's current environmental strategy, the Greenest City Action Plan, extends to 2020. All ten of the goal areas are relevant for Vancouver's Climate Emergency Response. The ten goals are:

1. Climate and Renewables
2. Green Buildings
3. Green Transportation
4. Zero Waste
5. Access to Nature
6. Clean Water
7. Local Food
8. Clean Air
9. Green Economy
10. Lighter Footprint

Because of the strong links between the climate emergency and the City's broader sustainability work, the climate emergency response will be most effective if it is embedded within the next phase of the Greenest City Action Plan and integrated with the upcoming City-wide Plan. To enable this coordination, staff are seeking approval from Council to begin the creation of Vancouver's next environmental action plan, Greenest City 2050.

If approved, staff will report back on the Greenest City 2050 in coordination with the City wide Plan reporting structure. Further, staff will integrate the six Big Moves in this report into the development of the City-wide Plan which will address a broad diversity of policy areas including land-use, transportation, economy, social, environment, parks, culture, sustainability, climate change, infrastructure, and place-making/urban design with lenses of reconciliation, resiliency and equity. The City-wide Plan will provide an "umbrella" for integrated, long-range strategic

policy across these areas and a framework to support more detailed implementation strategies in specific areas such as climate change. This framework would enable a coordinated system of progress monitoring, investment, policy review and adaptation over time to achieve community, Council and corporate goals.

Climate Emergency Engagement

Within the 90-day window kicked off by Council's climate emergency motion on January 19, 2019, engagement efforts have focused internally and on organizations where the City has established relationships. The internal engagement included meetings and workshops with staff from Planning, Urban Design and Sustainability; Engineering; Development, Buildings and Licensing; Real Estate and Facilities Management; Social Policy; Park Board; Legal Services; Finance; and Intergovernmental Relations.

The primary external engagement was a half-day workshop on February 25, which was attended by 112 individuals from local businesses, environmental non-governmental organizations, community associations, labour organizations, academia, and other levels of government. During the event, staff collected nearly 900 ideas during sixteen breakout sessions, which focused on new and existing buildings, neighbourhood energy systems, zero emissions vehicles, active transportation and transit, the City's corporate leadership, embodied carbon, and climate equity.

Implications/Related Issues/Risk

Financial

Should Council approve the recommendations of the Climate Emergency Response, staff will report back by the Fall of 2020 with a comprehensive implementation and financial strategy for the recommended Big Moves and Accelerated Actions. When developing the strategy, staff will strive to optimize the City's regulatory, financial and advocacy tools, considering the City's financial and operational capacity within the context of the City's service planning, capital planning and budget framework and the financial impacts (costs and savings) for the City's residents and businesses, utilities, and other levels of government.

If any of the Big Moves is ready for Council's consideration before the Fall of 2020, staff will report back with an implementation and financial strategy that contemplates any links to the Big Moves still under development. Any Accelerated Actions brought forward in advance of the comprehensive implementation and financial strategy will be supported by a similar evaluation, including a consolidated assessment of any initiative proposed as part of the 2020 budget.

Human Resources

The Accelerated Actions can start to be advanced to their next milestones with existing staff capacity. Depending on the proposed next steps at those milestones, there may be staff implications, and staff will include any required staff resource as part of the annual budget process.

Advancing the Big Moves from their current form to robust implementation strategies will be a significant undertaking that transects across departments. It will also require additional engagement with the public, other governments, utilities, business, labour, academia and NGOs to ensure a wide variety of perspectives are reflected as the Big Moves are developed. Additional or reallocated staff will likely be required and as the Big Moves are developed staffing needs will be brought for approval as necessary.

Legal

Staff will engage Legal Services to confirm, if necessary, the legal authority for the City to implement any of the Big Moves, Accelerated Actions or any specific step or activity contemplated in either one. If the City does not have the legal authority under the Vancouver Charter to implement one or more of the foregoing, and if at such time the City still wishes to pursue such action, staff will engage Legal Services to work collaboratively with the Province for the specific legal authority under the Vancouver Charter.

Conclusion

The world is at a tipping point between a climate disaster and a renewable, more equitable future. By choosing to act, Vancouver is choosing optimism and hope over despair and darkness. The transition will take time and will be challenging, but many cities around the world and even some Vancouver neighbourhoods are already thriving as low carbon communities. Through a thoughtful transition Vancouver can continue to move toward a healthier, more communal, more secure, greener and more affordable future and in doing so be a beacon for other cities to follow.

* * * * *

Appendix A – Accelerated Actions

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
1 <u>City-wide Planning</u> Use city-wide planning and quick-start housing actions to advance green buildings and sustainable transportation objectives.	a. Sustainable Mode Splits: Expand policies and actions that lead to communities with very low motor vehicle reliance (e.g., 15–20% of daily trips) by ensuring: a) most daily household destinations are within walking or biking distance and/or within walking distance of rapid transit; b) requirements for parking reflect this; and c) that the allocation of public space supports walking, cycling and transit. Pilot this approach on major development sites and planning areas, such as the Jericho Lands and Broadway Area Plan, by setting neighbourhood-specific mode-split targets and showcasing integrated multi-modal land use and transportation planning that can be learned from and replicated throughout the City.	Compact, livable communities not only produce healthier and happier residents, but reduce costs and greatly reduce dependence on fossil fuels through a reduction in vehicle ownership and kilometres travelled by vehicle.	Next Step	Report back to Council on progress. Target Q4 2020.	PDS, ENG
	b. Infill Pilot Program: Investigate feasibility and details of a pilot program in RS and RT zones to incentivize new types of infill housing that reduce climate change impacts and improve unit accessibility. The pilot will be based on the Character Homes Incentive Program as a model for introducing housing choice and meeting public interest objectives.	To be eligible for incentives, the infill housing would need to be near-zero emissions, and there could also be an opportunity to reduce embodied emissions.	New Action	Study feasibility. Report back to Council with details and process (summer 2019).	PDS
	c. Small Townhouse Pilot Program: Investigate feasibility and details of a townhouse pilot program on large lots in low-density areas to demonstrate construction and design approaches that reduce climate change impacts and improve unit accessibility.	To be eligible for the pilot program, the townhomes would need to be near-zero emissions, and there could also be an opportunity to reduce embodied emissions.	New Action	Study feasibility. Report back to Council with details and process (summer 2019).	PDS

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	d. Barriers to Low Embodied Carbon: Review existing zoning regulations and design guidelines to identify how the existing regulatory framework requires and incentivizes the construction of low-density buildings with high embodied carbon (e.g., lots of concrete), and investigate how those requirements and incentives could be removed to enable low-carbon building construction. Examples include regulations and guidelines that limit above-grade floor area and therefore require or encourage below-grade living space (basements) and underground parking, both of which require more concrete.	The embodied emissions from building materials, such as concrete and foam plastics, can be significant in the overall life-cycle emissions of a building. By identifying and removing incentives for construction with high embodied carbon and enabling construction methods with low levels of embodied carbon, the City can help to reduce those emissions sources.	New Action	Study feasibility. Report back to Council with details and process (summer 2019).	PDS, DBL
	e. City-wide and Area-Specific Plans: At the time of their development or during review, city-wide and area-specific plans should make provisions to advance near-zero emissions buildings. This could include considerations such as articulating access to sunlight for neighbouring buildings at the block scale, allowances for simplified low-carbon building forms, and roof alignment and design allowances to enable solar energy.	Large-scale planning exercises can foster community expectations and create opportunities for low-carbon building forms and features, such as high levels of insulation, mass-timber, and roof top solar. Mass timber may also be a key to more affordable multi-unit residential buildings.	New Action	Report back to Council by Q4 2020.	PDS, DBL

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	f. Expanded Goals for Design Guidelines: Gather data and expand the factors considered in the development of design guidelines so that in addition to livability and neighbourhood impacts, we consider cost, climate change mitigation, and seismic resilience, if/when warranted. Pilot this approach by integrating consideration of data and these other factors into the development of new or revised design guidelines for a specified form/development type. Initially constraining this to a specific set of guidelines will reduce the variables and support higher quality data. The resultant guidelines could include alternate approaches to built form, incentives, or conditional approval paths for projects that are designed to achieve near-zero building standards in addition to livability and affordability outcomes.	Design guidelines for new developments are established to maintain livability for both new and existing residents, but can lead to complex building forms that may have significant implications for construction cost, energy efficiency, and embodied carbon.	New Action	Report back to Council by Q4 2020.	PDS, DBL
2 Zero Emissions Areas Explore zero emissions transformational areas.	a. Zero Emissions Areas: Begin engaging residents and businesses on zero emissions areas, where access by combustion engine vehicles are restricted or deterred, and active transportation and zero emissions transit are encouraged, in order to explore innovative emissions reduction programs. Identify areas of the City where these approaches can be explored, and identify replicable lessons for city-wide implementation.	Zero emissions areas encourage a broader shift to zero emissions vehicles, including for goods movement. They can also be designed to encourage active transportation. The areas also offer air quality, health and noise benefits for residents.	New Action	Report back to Council on initial engagement by Q4 2020.	PDS, ENG, DBL, CEC

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
3 Land Use Incentives for Green Buildings Use land-use tools to encourage zero emissions buildings, zero emissions space/water heating equipment, and low-carbon materials.	a. Time-limited pre-regulatory Density Bonus incentives for Zero Emission buildings: Explore defining buildings that deliver near-zero operational and/or low embodied carbon emissions as an amenity, so that they can be subject to the density bonus provision under Section 165.2(1) of the Vancouver Charter. If Council defines these buildings as an amenity, this would allow staff to explore and report back on specific opportunities to allow time-limited density bonuses for a wider range of green buildings, including zero emissions commercial and institutional buildings, and buildings with low embodied carbon. Incentives would be in place until equivalent regulatory requirements come into effect. Staff would ensure that any recommended short-term bonus programs are aligned with provision of rental and non-market housing and other community goals.	The early stages of transformational change often involve higher costs and uncertainties than continuing with conventional approaches. In order to gain experience and drive down these costs, incentives are temporarily required while new practices and products are normalized. Defining low-carbon buildings as an amenity would allow staff to introduce time-limited pre-regulatory policies and amendments to the Zoning and Development Bylaw that would allow for modest density bonuses for a wider range of green buildings, including zero emissions commercial and institutional buildings and buildings with low embodied carbon.	New Action	Report back to Council (Q2 2019).	PDS, DBL
	b. Deep Emissions Retrofits: Explore land-use tools that help property owners and managers undertake deep emissions retrofits of existing buildings. This could include revised district schedules that would allow increased usable space in existing buildings in exchange for the deep emissions, and possibly for seismic resilience retrofit.	This would better ensure an equitable distribution of the health, comfort, resilience and operational cost savings of low-carbon buildings. Careful consideration and analysis of the use of increases in usable space to encourage retrofits are needed to preserve affordability and avoid displacement of existing residents.	New Action	Report back to Council by Q2 2020.	PDS, DBL

Category		Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
		c. Improved Floor Space Incentives for Zero Emissions: Explore floor space exclusion for near zero emissions detached and small multifamily buildings that is streamlined and enhanced relative to City's current approach. Current wall-thickness and mechanical-space exclusions for near zero emissions buildings require additional work for small builders and staff. Simplifying this with a temporary outright exclusion would simplify the process and would allow for consideration of modest additional floor space for early adopters of near zero emissions design approaches.	The early stages of transformational change often involve higher costs and uncertainties than continuing with conventional approaches. In order to gain experience and drive down these costs, incentives are temporarily required while new practices and products are normalized. While this approach is already being used by other local governments in the region, careful consideration is required to ensure this does not undermine efforts to increase housing supply in traditional single family neighbourhoods.	Next Step	Report back to Council with recommendations by Q4 2019.	PDS, DBL
4	Financial Incentives for Zero Emissions Buildings and Equipment Implement incentives to make it easier and more affordable to advance zero emissions new buildings and zero emissions space/water	a. Financial Incentives for Existing Building Energy Retrofits: Explore options for deep energy retrofits of existing City and private buildings in connection with Council's motion to allocate $5 million of Capital Plan funding. Options will include: 1) accelerate the transition of existing City buildings to near zero and zero emissions; 2) enhance the capacity of for non-profit housing operators to access significant provincial and federal capital improvement funding; and 3) through a new collaborative approach, leverage provincial funding and energy utility administrative capacity to effectively provide additional resources to Vancouver homeowners and building operators to make deep emission reduction retrofits to their buildings. This includes pilot projects in partnership with the provincial government to retrofit affordable market rental housing and non-market housing.	Meaningful energy retrofits of existing buildings are more challenging than implementing similar measures in new construction, necessitating the provision of financial incentives. Measures are in place and will be strengthened to ensure retrofit incentives do not result in the displacement of existing residents.	New Action	Report back to Council by Q2 2019.	PDS, REFM, FIN

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
heating equipment.	b. Climate Trust: Explore the creation of a Vancouver Climate Trust, which would have the objective of providing ongoing investments to reduce emissions from existing buildings. The Trust will continue the work started in 4a and coordinate with the Low Carbon Cities Canada initiative announced in the 2019 federal budget. Staff will evaluate potential funding streams as part of the exploration process, including the possibility of a one-time charge on new developments in the City that would be proportional to their anticipated emissions.	Staff will need to explore the balance of decreasing maximum allowed emissions limits, the introduction of embodied emissions limits, and the impacts of a potential charge to offset any remaining emissions to ensure that existing housing affordability or the viability of new developments is not materially impacted. In addition, staff will need to ensure that any new investment minimizes the displacement of existing residents.	New Action	Report back to Council by Q2 2020 in conjunction with recommended updates to Green Building Policy for Rezoning.	PDS, FIN, DBL
	c. Heat Pump Permits: Make it more affordable and easier to get a permit for heat pumps. Options to explore include reducing the permit fee to a fixed and nominal amount (as is currently done for solar permits), moving to an online permitting system where feasible, allowing heat pumps to be installed in front yards, and publishing a list of heat pumps that meet the City's noise limits. The applicability of successful solutions to other key zero emissions technologies, such as electric vehicle charging and solar panels, will be considered.	Electric heat pumps are typically over 200% efficient, result in almost no carbon emissions due to the nearly 100% renewable electrical grid in BC, and can provide both heating and cooling, thereby increasing resilience to climate changes. Because heat pumps are a new technology for most existing homes, installations and the permitting process can be more complex. Simplifying the process is essential to accelerate the voluntary installation of heat pumps.	Next Step	Report back to Council by Q1 2020 if required.	PDS, DBL

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
5 Zero Emissions Building Standards Accelerate the implementation of the Zero Emissions Building Plan.	a. New Zero Emissions Buildings: Explore opportunities to set lower carbon emissions limits for new construction faster than laid out in the Zero Emissions Building Plan. Any proposed changes to those limits would be based on the appropriate research and consultation, and would work within established timelines for policy and bylaw updates. To continue encouraging the development of Passive House buildings, that standard would continue to be a recognized compliance option.	Every building built to zero emissions today means one less building requiring expensive retrofits in the future. Accelerating this work will save carbon emissions and money.	Next Step	Report back as part of recommended updates to VBBL and Green Building Policy for Rezoning by Q2 2020.	PDS, DBL
	b. Improved Compliance: Develop the tools, processes, and resources to ensure that the carbon emissions limits for new detached and multi-family residential buildings are being complied with and that developers and builders have support to meet them. One key option to be explored is a requirement for a heating permit for new detached homes and low-rise buildings (an approach used in other Lower Mainland municipalities).	The City does not currently review or inspect the sizing, performance specification or quality of installation of many of the mechanical systems that are essential to reducing GHG emissions in new construction. New policy or regulation without compliance only punishes responsible developers and builders.	New Action	Report back as part of recommended updates to VBBL by Q2 2020.	PDS, DBL

Category		Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
6	Neighbourhood Energy Transition the City-owned Neighbourhood Energy Utility to 100% renewable energy and expand the system.	a. Renewable Energy Supply: Transition the Neighbourhood Energy Utility (NEU) to 100% renewable energy before 2030. This could include a mix of expanded sewer heat recovery, waste heat recovered from data centres, thermal energy storage, bio-fuels (e.g., renewable natural gas), hydrogen, or other renewable energy sources. Currently, 70% of the NEU's energy comes from renewable sources, and opportunity exists to transition to a higher blend of renewable energy in future years.	By transitioning to 100% renewable energy, NEU-connected buildings will not need to rely on fossil-based natural gas for space and water heating. Factoring in the long-term growth of the utility, transitioning to a 100% renewable energy target could eliminate an additional ~10,000 tonnes of CO2 per year by the mid 2030s, above and beyond the current 70% renewable energy target for the NEU (current 70% target would net ~24,000 tonnes per year reduction at build-out of the customer base).	Next Step	Adoption of 2030 100% renewable target subject to evaluation using the NEU's existing investment decision framework and competitiveness with other low carbon energy options for buildings	ENG
		b. Expand Service Area: Evaluate feasibility for expansion of the City-owned NEU service area. Opportunity areas include areas of the Central Broadway Corridor adjacent to SE False Creek, Jericho Lands and False Creek South.	To be determined, following establishment of proposed land uses and densities for these areas (needed to inform business case analysis for expansion).	Next Step	Report back to Council in 2021 (timing dependent on timing of area plan completion).	ENG
7	Active Transportation and Transit Infrastructure Accelerate the development of infrastructure to make it easier to choose walking, cycling	a. Improved Bus Service: Accelerate transit priority implementation on key routes, such as 41st Avenue, Georgia Street, Main Street and Hastings Street, as part of the ongoing bus speed and reliability program. A quick win would be further extension of bus lane hours beyond current peak hours.	Enabling improved bus service makes it a more efficient and attractive option for residents. Articulated buses generate 25% of the carbon emissions per person relative to a single occupancy vehicle, which can be improved to 5% with the use of electric buses.	Next Step	Report back to Council on engagement. Target Q2 2020.	ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
and transit.	b. Active Transportation Network: Explore opportunities to accelerate the completion of accessible and equitable active transportation networks, and close key gaps, including the Granville Bridge pathway.	Providing safe, equitable active transportation infrastructure encourages walking and cycling, decreasing reliance on private vehicles and the associated carbon emissions.	Next Step	Report back to Council on opportunities. Target Q3 2020.	ENG
	c. E-Bike Share: Add 500 electric-assist bicycles (e-bikes) and 50 electrified stations to the public bike share (PBS) system. E-bikes have been shown to provide mobility to those with physical limitations that prohibit cycling, increase ridership among currently underrepresented groups and enable longer trips for a greater variety of trip purposes.	Replacing higher carbon (private motor vehicle, taxi, transit) emissions trips with lower emissions ones, like PBS with e-bikes. Currently about 47% of PBS trips replace higher carbon modes. E-bikes have at least doubled the number of rides per bike per day compared to the current system in other cities. Compared to other systems, expected usage will be at least 4.5 rides per bike per day. Average trip distance is expected to be 3.5 km, so 500 bikes are expected to replace over 1,380,000 km of polluting trips annually (conservative estimate, NYC has shown 5x more usage per bike than this estimate).	Next Step	Report back to Council on opportunities. during 2019.	ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
8 <u>Transportation Demand Management</u> Enhanced transportation demand management to support walking, cycling and transit.	a. City-wide Transportation Demand Management Program: Encourage shifting travel behaviour from driving to sustainable modes. Coordinate, track, and monitor existing cross-branch activities (including efforts with School Active Travel, Walk + Bike + Roll promotions, and new developments) to leverage existing infrastructure investments. Complete gap analysis and develop programming to encourage mode shift and address under-targeted markets, such as major employers and institutions.	Encourage behaviour change to travel by sustainable modes. Promote efficient use of existing infrastructure.	Next Step	Report back to Council on progress. Target Q3 2020.	ENG
	b. Support for electric bikes: Explore options to encourage the safe use of electric bikes and electric cargo bikes, especially for longer commutes, steeper terrain and for those with limited physical capacity. As part of this work, staff will explore options of partnering with the provincial government to extend CleanBC incentives for electric vehicles to electric bikes.	A switch to electric bikes or cargo bikes from private vehicle trips reduces gasoline and diesel use. They also make that switch possible for longer trips, trips with kids or a heavy load, and for people who might not be able to travel by a non-electric bike.	New Action	For consideration in service planning for 2020 .	ENG
	c. Transportation Pricing: Undertake a comprehensive City-focused transportation pricing review to explore equitable and comprehensive applications for all modes (e.g., road and curb pricing) that would help curtail vehicle emissions and support zero emissions mobility. To be aligned with regional mobility pricing work.	Pricing road and curb space is a powerful tool for decreasing congestion resulting in high concentrations of emissions and discouraging vehicle travel. Revenue from mobility pricing can also be directed towards supporting sustainable travel.	New Action	Report back to Council on progress. Target Q3 2020.	ENG, PDS

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	d. Parking Requirements: Update the Parking Bylaw to: 1) expand the transportation demand management (TDM) options available to developments outside of the downtown core and allow for elimination or reduction of parking stall requirements in those developments (except for accessible and visitor parking), and 2) explore design standards that enable parking stalls to be repurposed in the future if they aren't needed for parking (e.g., flat floor plates and over-height ceilings). This work would be in addition to the planned monitoring of the effectiveness TDM program for new developments.	How a city prioritizes parking clearly signals its priorities around livability and sustainability. Successful and livable cities support parking and driving for those who need it, and ensure other modes are readily available to the rest. With limited space and money, parking should be a low priority when designing an affordable, green city. Reduced parking also helps to reduce the embodied emissions in new construction if less concrete is needed, and it can also lead to reduced embodied emissions from vehicles as car ownership declines.	Next Step	Report back to Council on progress. Target Q3 2020.	ENG
	e. On-Street Car Share Parking: Update bylaws and create agreements to allow car share vehicles to end trips and have stopovers at on-street metered parking spaces.	It has been estimated that households participating in two-way car share programs (e.g., Modo, Zipcar) reduce their annual vehicle-related GHGs by up to 54% on average. For households participating in one-way car share programs (car2go, Evo), vehicle-related GHG emissions declined by up to 15% on average. Car sharing is also a proven way to reduce vehicle ownership, vehicle kilometres travelled and transportation costs for residents utilizing car sharing.	New Action	Report to Council Q2 2019.	ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
9 <u>Goods Movement and Fleets</u> Reduce carbon emissions from freight and private fleets operating in Vancouver.	a. Urban Freight and Fleets: Develop an urban freight and fleets strategy to identify the needs for regional and longer-distance goods movement, and the opportunities for lower-impact goods movement, deliveries, and servicing in the urban environment. The strategy will also address the transition of private fleets to zero emissions vehicles (including light-, medium- and heavy-duty vehicles). Elements of the strategy could include increasing the use of cargo bikes for freight, provision of logistics hubs, time-of-day and loading zone policies, commercial vehicle licensing policies, and leveraging rail or other modes to reduce truck travel.	Reduces greenhouse gas emissions of goods movement by decreasing the distance travelled by trucks, transitioning to zero emissions vehicles, and supporting modes with lower GHG emissions, such as rail and bikes.	Next Step	Report back to Council on progress. Target Q3 2020.	ENG, PDS
	b. Curbside Zone Management: Update the management and enforcement of on-street curbside zones (e.g., commercial loading zones) so that they more effectively encourage efficient use of street space and encourage the transition to zero emissions commercial vehicles.	Effective pricing of curbside zones would encourage vehicles to load and vacate the space quickly, making it available for the next user. This would reduce greenhouse gas emissions due to circling and reduce congestion caused by double-parking. Curbside management could also be used to directly encourage the transition to zero emissions vehicles by offering preferential access to the zones.	New Action	Report back to Council in Q2 of 2020.	ENG, PDS, DBL

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
10 Electric Charging Network Increase the public charging network for electric vehicles and other needs, such as film and food trucks.	a. Neighbourhood Charging: Develop a neighbourhood charging strategy for vehicles and electric bikes, with a focus on providing charging in areas of the city where residents do not have access to off-street home charging. Possible locations include on-street (including light-pole charging), and lower-use parking areas, such as parks and schools, particularly where overnight access is possible. The neighbourhood charging strategy would also help provide charging options for shared mobility companies helping to accelerate their transition to zero emissions vehicles.	Access to home charging is considered a key enabler for electric vehicle uptake. It also reduces reliance on higher-powered, short-term public charging that is necessarily more expensive to use and operate. For the thousands of Vancouver residents without access to off-street parking, including many renters, this strategy will seek to enable access to convenient, more equitable near-home charging.	Next Step	Report back to Council in Q2 of 2020 with completed strategy. Early actions to also be included for consideration in service planning for 2020.	ENG, PDS
	b. Film, Food Trucks and Special Events: Develop a power supply plan for film, food trucks, and special events to help them transition off of diesel and propane generators, which are also significant contributors to noise and air pollution. Installing power drops for filming at Larwill Park will be one quick-start action. A capital project is currently underway to develop improvements to the public charging network as part of the Electric Vehicle Ecosystem Strategy. The Larwill Park initiative will be funded by the existing capital program. To help finance additional power drops at key areas, staff will implement a diesel generator permit for film and special events.	By enabling film operations, food trucks and special events to connect to the grid at key areas, such as frequent filming locations and farmers markets, they can reduce their reliance on diesel and propane use. These actions also help to reduce local air pollution and noise.	New Action	Report back to Council in Q2 of 2020 with completed plan. Early actions to also be included for consideration in service planning for 2020.	ENG, PDS
	c. Commercial Buildings: Update electric-vehicle readiness requirements for new commercial buildings to close a gap for workplace charging and other commercial uses. In recognition of the range of uses for commercial buildings and parking, the requirements will be based on a points system (similar to the City's TDM approach), where developers can choose from a menu of EV-readiness options.	For many EV drivers, the ability to charge a vehicle at work will allow them to transition to an EV, either by extending their range for long commutes or by having access to charging when not available at their home parking spot.	Next Step	Report back to Council in Q1 2020.	PDS, DBL, ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	d. Fast-Charging Network: Complete phase 1 of the City's DC fast-charging network for electric vehicles by end of 2020, instead of 2021. This will put a fast-charging hub within a 10-minute drive of anywhere in the City.	A 10-minute drive to a fast-charging hub, located at a convenient amenity, was rated by a majority of Vancouver residents as a solution that would make it more likely for them to switch to an electric vehicle.	Next Step	Selection of vendor.	ENG, PDS
	e. Home Charging in Rental Buildings: Explore options to encourage the installation of home charging in existing buildings, with a focus on rental buildings and non-market housing, which have not been as well supported as stratas by existing provincial government programs. Options to explore include providing a top-up to the Government of BC's CleanBC incentives, which were expanded in the 2019 provincial budget.	Access to home charging is a key enabler for switching to electric vehicles. Renters face a significant barrier to adding home charging if their building is not already equipped with charging infrastructure, and cost has been flagged as the greatest barrier to adding charging in multi-family buildings.	Next Step	For consideration in service planning for 2020.	PDS
	f. Electric Tour Buses: Provide charging service for electric tour buses as a pilot project at up to three locations in 2019/2020. This would build on the site identification work already completed, and provide a clear path to getting priority sites up and running to be responsive to industry leaders and help inform the freight and fleets strategy. Access to the charging locations would be determined through a market process. A capital project is currently underway to develop improvements to the public charging network as part of the Electric Vehicle Ecosystem Strategy. The Electric Tour Buses initiative will be funded by the existing capital program.	Private medium- and heavy-duty vehicles are a significant part of transportation emissions, and also significant contributors to local air pollution. Central parking and charging opportunities help reduce the barriers for tour bus operators, who may lose half their range by charging out of the city and driving in.	Next Step	Request for expressions of interest for site access.	ENG, PDS
11 Electric Vehicle Incentives Implement incentives to accelerate the	a. Parking for Zero Emissions Car-Share Vehicles: Update the Transportation Demand Management requirements in the Parking Bylaw to: 1) require all new car-share vehicles to be zero emissions with dedicated level 2 charging if electric, and 2) include points for micro-mobility charging including e-bikes.	Encourages shift to electric vehicles and other sustainable modes of transportation.	Next Step	Report back to Council by Q2 2020.	ENG, PDS

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
transition to electric vehicles.	b. Car Share Parking Rates: For zero emissions vehicles, waive the fee for permits issued to car-share organizations that allow those vehicles to park in areas restricted to residents-only parking. Waivers granted would expire in five years subject to an evaluation of the incentive.	Encourages shift to electric vehicles.	New Action	Report back to Council by Q2 2020.	ENG, PDS
12 Solid Waste Reduce solid waste and use it to reduce fossil fuel use.	a. Reducing Wasted Food: Identify and pursue opportunities to advance community actions to reduce wasted food across Vancouver, in partnership with local food businesses and food industry, with a dual focus to avoid wasted food in the supply chain and divert surplus food to people.	The production, processing and movement of food results in carbon emissions. By reducing the amount of wasted food, those food-related emissions can also be reduced.	Next Step	Identified opportunities to be considered as part of service planning for 2020.	ENG
	b. Renewable Gas Supply: Assess the business case of converting waste organic materials into renewable natural gas at the Vancouver Landfill. This would be additional to the project the City is already advancing with FortisBC to upgrade landfill gas into renewable natural gas.	Renewable natural gas can be directly substituted for fossil natural gas, which eliminates the carbon emissions associated with extracting, processing, transmitting and combusting the fossil gas.	Next Step	Complete business case analysis by 2019 year-end.	ENG
	c. Construction and Demolition Waste: Explore the business case of producing a biofuel from waste construction and demolition materials received at the Vancouver Landfill, which could potentially be used to replace coal for the local production of cement.	Construction and demolition waste can be processed into a biofuel, thereby reducing the emissions associated with mining, transporting and burning coal, for example.	Next Step	Complete business case analysis by 2019 year-end.	ENG
	d. Recycled asphalt and aggregate: Explore the business case of investing in existing infrastructure to enable an increased proportion of recycled asphalt and aggregates in City construction projects.	By increasing the proportion of recycled asphalt and aggregates in City projects, we can reduce the need for new asphalt and aggregate and the emissions associated with producing it.	Next Step	Complete business case analysis by 2019 year-end.	ENG

Category		Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
13	Food and Beverage Reduce emissions from Vancouver's food and beverage industry.	a. Restaurants and Breweries: Engage with local restaurants and breweries to help reduce emissions and transition to renewable energy. The project will work with the food and beverage industry to explore their options to reduce their emissions, as well as the possible roles that businesses and the City can play to accelerate change. Areas of interest include alternatives to standard cooking facilities and patio heaters.	Carbon emissions would be reduced by transitioning off of fossil natural gas and propane to solutions such as renewable natural gas, induction stoves, heat pump water heaters, electric patio heaters and blankets.	New Action	Report back with action plan by end of 2019.	PDS, DBL, ENG
		b. Diets that are Healthy for People and the Planet: Convene a Solutions Lab to accelerate movement toward diets that are healthy for people and the planet. The Solutions Lab will bring together City staff, partners, and community members to understand a complex challenge and rapidly prototype and test solutions. Staff will also investigate the City's potential role in supporting emissions reduction from the food system and identify best practices for ensuring that policy approaches are equity-based.	In Vancouver, 20% of consumption-based carbon emissions come from food (EcoCity Footprint Tool Pilot), therefore food can play an important role in taking climate action. Given that limited food production occurs within city limits, the City's role in supporting food system emissions reduction will likely focus on residents' eating habits and institutional food provision.	New Action	Begin convening Solutions Lab in Q2 2019. Report back with potential actions for consideration in Q1 2020.	PDS, ACCS
14	City Leadership Updating the City's Green Operations Plan to reflect the urgency of the climate emergency.	a. Facilities Capital Maintenance: The City is working towards all City buildings having 100% renewable energy and 100% reduction in carbon emissions by 2040. All new City-owned buildings are being built to zero emissions standards (since 2018). Going forward, all capital maintenance projects on energy using equipment in City buildings will transition from gas to high efficiency electric options where viable. As part of this work, several additional gas-to-electric heat pump projects will be completed in 2019/2020.	The City owns and operates more than 600 buildings and when a major upgrade is required for a boiler, furnace, or domestic hot water heaters it is proposed that zero emissions solutions are used, subject to meeting operational requirements. This action will address carbon reduction opportunities in existing buildings.	Next Step	Ongoing annual reporting.	REFM, PDS

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	b. Embodied Carbon: Adopt a strategy that all new City facilities will explore opportunities for significant reductions in embodied emissions. To support this strategy, staff will continue to develop capacity and metrics, and create simple tools for decision-making and reporting. Staff will also work with private, public and non-profit sector partners to build awareness and encourage leadership commitments in this emerging opportunity.	By shifting materials and construction practices for new buildings to lower-carbon options, the City will be able to reduce the embodied carbon it is responsible for and help private, public and non-profit sector partners achieve similar outcomes.	New Action	Embodied carbon policy defined and included in all City-owned facilities development 2019/20.	REFM, PDS
	c. City Fleet: By 2023, transition all non-emergency City fleet sedans to zero emissions vehicles, replace an additional batch of heavy-duty trucks with electric vehicles, and support additional operational improvements using GPS and telematics.	The identified City fleet projects would reduce carbon pollution by reducing the overall volume of fossil fuels used. It is likely this would be on the order of 1,500 tonnes of CO2e.	Next Step	Detailed analysis will be considered as part of service planning for 2020.	ENG
	d. Fleet Charging: Develop a charging infrastructure strategy for the City's electric vehicles to support the accelerated sedan transition and the addition of medium- and heavy-duty electric vehicles to the fleet.	To support the planned transition to electric, a comprehensive charging strategy will allow for effective and efficient installation of the required charging infrastructure.	Next Step	For consideration as part of service planning for 2020.	ENG
	e. Manitoba Works Yard Energy Hub: As part of the planning process for the redevelopment of the Manitoba Works Yard, set an objective of establishing the yard as a renewable energy hub for the community. This could include solar PV electricity generation, generation of RNG from organic waste, and EV charging and RNG/HDRD refueling for City vehicles and private fleets and vehicles.	Establishing a renewable energy hub would support quicker transition of the City and private fleets to renewable sources, while also increasing demand, driving further maturation of the local market for these energy technologies.	New Action	Detailed plan as part of 2019–2023 Manitoba Works Yard Master Plan.	REFM, ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	f. Small Equipment: Develop a strategy to transition small mobile equipment (e.g., mowers and leaf blowers) to electric or zero emissions technologies. Use that experience to consider city-wide approaches to phase out fossil fuels in that equipment.	A transition of small mobile equipment to electric has the potential to reduce emissions by 800 tonnes of CO2e.	New Action	For consideration as part of service planning for 2020.	ENG
	g. Sustainable Commuting: Update the Sustainable Commuting Program to accelerate long-term shifts towards City staff commuting by walking, cycling, transit, or zero emissions vehicles. A secondary objective will be to provide a leading standard for City facilities as an example to other employers and commercial landlords in Vancouver. The first phase of work will focus on policies to enhance City employee electric vehicle charging and bicycle end-of-trip facilities at City buildings. A second phase will include a comprehensive review of the City's Sustainable Commuting Program and identify additional actions beyond end-of-trip facilities that will accelerate a shift to zero-carbon commuting.	As a leading employer, the City can both enable our own employees to switch to zero emissions options for commuting, as well as influence other employers in applying best practices to encourage zero emissions commuting. Active transportation, transit, electric vehicles and telecommuting all reduce commuting carbon emissions relative to a commute via an internal combustion private vehicle.	Next Step	Complete project charter in Q2 2019; develop first phase of policy by Q3 2019.	PDS, REFM, ENG, HR
	h. Online Services: Explore all available options to provide services online in order to reduce the number of trips that applicants need to make to the Development and Building Services Centre.	The City receives about 45,000 in-person visits a year to the Development and Building Services Centre at 525 W 12th Avenue. Moving more services online helps to reduce the carbon footprint of these trips. In addition, most applicants need to provide multiple printed copies of site plans and construction plans. Moving to online plan submission and review has a further benefit in reducing paper use.	Next Step	Develop detailed implementation plans for online service delivery.	DBL, IT

Category		Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
		i. Support for Cities in Developing Countries: Explore options to help cities in developing countries grow their economies without relying on fossil fuels to the extent that Canada and other developed countries have. Options could include contributing to the UNFCCC's Green Climate Fund, partnering with specific cities in developing countries to support transition to renewable energy, advocating for increased federal and/or private sector contributions, etc.	Cities in developing countries often do not have the financial resources and technical knowledge needed to rapidly transition to renewable energy and adapt to climate change, while also growing their economy. By providing support, wealthier jurisdictions that have long benefited from fossil fuels can help them achieve those objectives.		Report back to Council on options by end of 2020.	PDS, CMO, VEC
15	Intergovernmental Relations and Community Engagement	a. Intergovernmental Relations: Develop a list of policy, legislative, and regulatory changes and investment funding priorities (coordinated with other City corporate priorities) to work with other governments and related organizations in order to implement and support the City's climate emergency work. These include the federal and provincial governments; Metro Vancouver; other municipal governments across BC, Canada and internationally; FCM; UBCM; TransLink; Port of Vancouver; BC Hydro; and FortisBC. Examples of these changes and priorities include mobility pricing (as a tool to limit congestion and raise funds for transit), right-to-charge rules for electric vehicle owners in multi-unit residential buildings, ride-hailing legislation that aligns with zero emissions principles and complements sustainable travel, supporting the All On Board campaign, accelerated transit electrification, a bold vision for the Regional Transportation Strategy, energy performance benchmarking for buildings, counting district energy systems with heat from renewable energy as a contributor towards the targets in BC's new renewable gas standard, and electricity pricing that supports electrification.	As discussed in the report, the City has a number of important tools it can use to reduce carbon pollution. However, achieving the City's objectives will rely on a broader set of tools that require senior levels of government, the region, and utilities moving in similar directions.	Next Step	Report back to Council on recommended priorities by June 2019.	CMO, PDS, ENG

Category	Accelerated Action	How this Action Reduces Carbon Pollution	New Action vs. Next Step	Next Milestone	Department Lead(s)
	b. Community Engagement: Develop and implement an action-oriented community education and awareness strategy to increase residents' literacy on the urgency of climate change, local impacts, and opportunities for individual and collective action. Working with community partners, local businesses, and stakeholders, examples could include campaigns, strategic communication on City assets (fleet and buildings), presence at community events, side events during relevant local conferences—with an emphasis on those groups who are typically harder to engage, including youth and new Canadians.	Based on research conducted by Mustel Group in 2017 and 2018, the City has an opportunity, through trusted partners, to educate on the types of renewable energy, to engage on opportunities to take action, and to address specific concerns and uncertainties voiced by those who participated in the research. This will not only build continued support for climate-related policy and City action, but is foundational for resident action.	Next Step	Complete hiring of new staff and develop strategy.	PDS, CEC, VEC
	c. Partner Engagement: Develop and implement a strategy to further build relationships and expand engagement and collaboration with diverse groups involved in advancing climate action in Vancouver. Examples could include further developing the annual Renewable City stakeholder event, supporting program ambassadors, managing existing and initiating new topic-specific working groups, and coordinating collaboration between partner organizations working toward priority outcomes.	With dedicated capacity and a focused strategy, the City can better coordinate and leverage the efforts of partner organizations. This type of joint action will be essential in successfully delivering many of the actions outlined in this report.	Next Step	Complete hiring of new staff and develop strategy.	PDS, VEC

Appendix B – Adaptation Actions

The adaptation actions in the following table were identified through the process of preparing the climate emergency response.

Action	Description	How this Actions Supports Adaptation	Next Milestone
Pilot clean air shelters	In the summer of 2019, City staff will collaborate to provide "clean air rooms" in up to five (5) cooling centres. Portable HEPA filters—the VCH recommended filtration level—will be used in designated areas and rooms to provide refuge for the public during extended daytime hours during poor air quality days. Level of use, challenges and lessons will be evaluated to inform a more permanent program.	Between 2015 and 2017 there were 27 days of air quality alerts issued for the Lower Mainland due to particulate matter from wildfires burning outside the region and from ground-level ozone. The summer of 2018 also included several extended air quality alerts. Exposure to ozone and fine particulate matter is particularly a concern for infants, the elderly and those who have underlying medical conditions, such as lung disease, heart disease, diabetes or asthma. Feedback from frontline staff throughout the city suggests addressing this impact from climate change is a priority in the short term. This action targets those most vulnerable to poor air quality.	Report back to Council with pilot results and next steps.
Temporary cooling in non-market housing	Provide temporary cooling measures during summer heat to the non-market housing buildings identified as overheating during the last few summers.	As summers have been getting hotter, it is widely recognized that older buildings and certain building designs do not cool down well at night and thermal comfort during the day declines. In Vancouver, a high proportion of vulnerable people reside in areas identified as urban heat islands, and many live in older, poorly ventilated buildings. In 2018, temporary cooling was provided in four cooling rooms in City-owned non-market housing buildings that were found to be overheating. This summer, the effort will be expanded to up to six sites and to provide better cooling results.	See below

Action	Description	How this Actions Supports Adaptation	Next Milestone
Long-term cooling of non-market housing	Recognizing the limitations and costliness of continued temporary cooling in non-market housing, REFM and Non-market Housing Operations (ACCS) are collaborating to investigate options to provide long-term cooling for non-market housing buildings prone to over-heating. A consultant study of specific sites will be undertaken to recommend actions.	Investing in cooling (whether passive or active) where populations most vulnerable to heat illness are identified is a priority step in managing climate change impacts.	Report back to Council with study recommendations and related actions.
Amendment to existing street trees	Provide an amendment to existing tree pits in locations around the city to improve drought and pest tolerance.	The soil amendment will provide improved drought and pest tolerance for street trees as well as improving tree health generally. With warmer winters and summers, increasing pests are anticipated. Hotter summers are already putting stress on our trees. The GCAP goal of increasing tree canopy in the city is important for mitigating urban heat island effect, which is worsening with hotter weather, and also for stormwater benefits.	Report back to Council with results and next steps.

Appendix C – Other Climate Emergency Declarations

Examples of other cities and regions that have declared climate emergencies include:

- In BC: Richmond, New Westminster, Victoria, the Capital Regional District, the Islands Trust Area, and Powell River.
- The BC Assembly of First Nations also passed a motion recognizing the climate change emergency in March 2019.
- Across Canada, the list includes Halifax, Mahone Bay, Moncton, Sackville (NB), Edmundston, Kingston, and Hamilton, and in Québec there are over 200 communities including Québec City and Montréal.
- International cities include London, Edinburgh, Los Angeles, Berkeley, and Oakland.

Appendix D – CleanBC Commitments with Greatest Relevance for Vancouver

The policies and investments in phase one of BC's new climate plan (CleanBC) that are of greatest relevance to Vancouver include:

- A zero emissions vehicle standard that will require an increasing percentage of the light-duty vehicles sold in BC to be zero emissions. The specific targets are 10 per cent of sales by 2025, 30 per cent of sales by 2030, and 100 per cent of sales by 2040. The policy will ensure that there are more electric vehicles available when residents and businesses are ready to purchase a new vehicle.
- A strengthened Low-Carbon Fuel Standard, which will require the carbon intensity of transportation fuels of 20 per cent below 2010 levels by 2030. The current requirement is 10 per cent below 2010 levels by 2020. This policy will support the transition to electric vehicles and increase the supply of renewable diesel and gasoline.
- A renewable gas standard that will require 15 per cent of FortisBC's gas supply to come from renewable sources by 2030 (there is currently less than one per cent renewable content in the gas grid). This policy will help reduce carbon pollution from buildings and some transportation in the city, and will help advance renewable natural gas supply projects.
- The 2019 provincial budget included $902 million to support the implementation of CleanBC from 2019 through 2021. This includes new funding for electric vehicles and charging infrastructure, heat pumps, and building energy efficiency upgrades.

In addition to these provincial actions, the federal government has been in the process of implementing several important climate policies of its own through the Pan-Canadian Framework on Clean Growth and Climate Change. These include the Carbon Pollution Pricing Benchmark, the Clean Fuel Standard and the Coal-Fired Power Phase-Out. All of these policies will help Canada reduce emissions, but in a BC context, they are largely overlapping with provincial climate policies.

Appendix E – Multiple Benefits of Reducing Carbon Pollution

Health and air quality benefits

The vast majority of solutions the City is pursuing to reduce carbon pollution also lead to better health outcomes. Zero emissions buildings have better indoor air quality. Electric vehicles produce less air pollution than their gasoline and diesel counterparts. Walking and cycling are pollution-free and they help people stay active.

Improved resilience

Many of the solutions that help to reduce carbon pollution also help residents and businesses become more resilient. A zero emissions building provides a good example: in addition to emitting no carbon pollution, the improved ventilation helps limit air quality impacts from forest fire smoke, and high levels of insulation mean that it can stay comfortable in hot or cold weather in the event of a power outage and more extreme weather events. A second example is a resilient transportation network, which provides a range of mobility options that can meet diverse daily needs and respond to and recover from changing circumstances.

Reduced costs

The costs of reducing emissions fast enough to limit warming to 1.5°C are much less than the costs that will be incurred if more warming is allowed to happen. That said, it is understandable that many residents and businesses are focused on more immediate cost implications to them as individuals. In some cases, those solutions already represent a net savings for Vancouver residents and businesses (e.g., improved energy efficiency requirements in new buildings, and safer and more convenient active transportation and transit choices).

In other cases, there are currently cost premiums that most residents will not recover through energy savings (e.g., electric vehicles and heat pumps). In these cases, the City (and governments more generally) can play an important role of helping to make those solutions more affordable in the near term and building demand for them so that costs come down.

Based on economic modelling the City commissioned with BC Hydro in 2017, the transition to 100 per cent renewable energy can help achieve modest cost savings for residents and businesses. For example, average per capita expenditures on energy and the associated capital equipment decline by nine per cent between 2015 and 2050.

Economic development

Going “green” is good for business and great for the local economy. This can be measured in a variety of ways, including job creation, job transition, innovation, process efficiencies, increased sales/revenues, etc. In Vancouver, the green economy employs 1 in 15 workers, well above any other North American city and this is growing at 7.8% per year on average for the past three years. The carbon intensity of Vancouver’s economy (tonnes of carbon pollution per dollar of GDP) has fallen by 29 per cent since 2007.

Establishing effective policies that address climate change can accelerate innovation in cleantech, green building technologies, advanced materials, local food, solid waste and transportation options. When Vancouver City Council passed the Zero Emissions Building Plan and the Government of BC established the BC Energy Step Code for new construction, the Vancouver Economic Commission (VEC) identified a $3.3 billion market opportunity for the local green building and construction sector over the next decade.

The environmental ethos and world-renowned recognition of Vancouver as a “green” city has also translated into a US$31.7 billion brand. In a global economy where cities are competing for talent, this is an important quality and advantage that Vancouver possesses to help it attract the best and brightest to Vancouver’s thriving economy in all sectors.

Appendix F – Regulatory, Investment and Advocacy Tools to Reduce Carbon Pollution

The following table lists the primary regulatory and investment tools (with examples) that Vancouver can use to reduce carbon pollution. Advocacy tools are discussed below the table.

Tool	Examples
Land-use planning	• Designing complete and compact communities that allow people to live close to transit and other services and amenities
Allocating public space	• Widening sidewalks • Creating parks and plazas • Dedicating road space for transit • Reserving parking for electric vehicles • Creating protected bike lanes
Regulating buildings and equipment	• Limiting carbon emissions in new construction • Adding electric-vehicle readiness requirements in new construction • Supporting transportation demand management requirements in new construction
Investing in infrastructure	• Improving walking and cycling networks • Increasing public electric vehicle chargers
Supplying renewable energy	• Developing and expanding the Neighbourhood Energy Utility • Providing landfill gas for heat and power generation
Providing financial and land-use incentives	• Topping up Government of BC incentives for heat pumps • Incentivizing carbon reductions in heritage homes • Allowing buildings that are taller or have bigger footprints in exchange for higher environmental performance • Pricing curb space to manage parking demand and reduce congestion
Capacity building	• Partnering with institutional and professional organizations to provide skills training • Establishing the Zero Emissions Buildings Centre of Excellence
Demonstrating corporate leadership	• Transitioning the City's fleet to electric vehicles and renewable fuels • Heating the City's buildings with heat pumps and renewable energy sources

Advocacy Tools
In addition to the regulatory and investment tools that the City directly controls, we can also work with other governments and utilities to use their tools to pursue shared climate objectives. Climate change is too big of a problem to be tackled without close collaboration and learning from other jurisdictions. Examples include:

- The Government of BC's jurisdiction includes critical policies, such as requirements for the percentage of renewable energy in the gas and electric grids. The City continues to actively work with the Government of BC on the development and implementation of its climate plan (CleanBC).
- The amount of renewable energy supplied by BC Hydro and FortisBC, and the rate structures they set to connect to and use their energy influences the business cases for switching to renewable energy, such as electric vehicles, heat pumps and renewable natural gas.
- Metro Vancouver, TransLink and neighbouring local governments have similar tools to Vancouver that can help transform regional markets that make it easier for Vancouver to achieve its targets (e.g., the broader adoption of EV-readiness requirements in new construction will help accelerate EV adoption across the region). Updating transit fare policy and providing additional transit service region-wide can support Vancouver's sustainable transportation goals.
- Vancouver is also an active member in a number of regional, national and international networks of cities working collaboratively to reduce carbon emissions. Examples include the Union of BC Municipalities (UBCM) and Federation of Canadian Municipalities (FCM), the EV Peer Network, the BC Energy Step Code Peer Network, Carbon Neutral Cities Alliance, C40 Cities, and 100 Resilient Cities.

Appendix G – Carbon Budgeting Objectives

Improved Transparency

A carbon budget should be accessible to the public. It should show:

- The components ("sub-budgets") that add up to the overall budget (e.g., energy use reductions in buildings, transportation; waste management).
- The links to anticipated carbon reductions.
- The links to financial budgets to show that they are funded.
- The City departments responsible for development and implementation.
- Any remaining carbon reductions necessary to achieve targets, but not currently attributable.

How targets for the "sub-budgets" are equitably set, and mechanisms for rebalancing between them if necessary, remains a question. Cost-effective, impactful technologies and reduction pathways may be available to different sectors and departments at different times. There is also the issue of evaluating program efficacy. Initiatives with manifold or indirect effects may be especially complicated, and the ability to measure, estimate, or forecast carbon impacts varies greatly.

Other considerations include delayed carbon reduction impacts and the permanence of those impacts. In these instances where the carbon impact may not be clear, secondary metrics within a forthcoming indicators framework for the Renewable City Action Plan can help track progress. Finally, any gaps between indicated components and reduction targets will inform additional carbon reduction or removal programs as required to meet the budget targets. Underpinning all of these is the need to improve data quality.

Better Data

The carbon budget should track our emissions with enough accuracy and precision to properly assess our progress.

Better data helps us better determine whether we have the right current and planned measures to achieve our targets. Calculating Vancouver's community emissions to date has relied on estimates, which has been enough to show overall trends in total emissions. A carbon budget requires more detailed, "policy-sensitive" data to show clear links between program impacts and measured emissions.

As an example, reported transportation emissions have relied partially on fuel-sales data. This can show an overall trend in vehicle activity, but it is influenced by too many external factors to directly show the impact of Vancouver's progress of mode split, resident vehicle-distances driven, and active transportation initiatives. Another example is methane emissions from the natural gas distribution system and the Vancouver Landfill. A number of studies have pointed to scientific uncertainty regarding the amount of methane released from these sources, and efforts to reduce that uncertainty help the City make better decisions about programs and policies.

Better Forecasting
The carbon budget should allow us to forecast emissions with reasonable confidence, and course-correct as necessary.

Better data also allows improved forecasting for future budgets. Budget levels should be adjusted as progress is made (or not), as costs and availability of carbon-reduction and removal technologies change, and as global climate projections are updated. Regular budget-adjustment milestones should be set: four-year periods would align with Council terms and fulfil Council's directive to "create interim four-year targets and goals".

CleanBC Alignment
The carbon budget should align with the Government of BC's CleanBC plan where appropriate.

A new CleanBC accountability framework is currently in development. The CleanBC report mentions carbon budgets with respect to maintaining a "commitment to transparency on use of carbon tax revenue", undertaking an "independent review of proposed climate action against climate budgets", and tabling "an annual report of GHG spending, program results and anticipated reductions in GHG emissions". These all point to similar objectives around transparency already discussed above. Vancouver's data analysis and forecasting approaches can align where possible with provincial approaches, to ensure similar measures are accounted for, as long as carbon measurements continue to be policy-sensitive at the city level.

Improved Accountability
The carbon budget should enable some mechanism for addressing exceedances.

Targets may be missed. Carbon budgeting approaches can help drive analysis into the causes of exceedance, which drives the development of ways to address them. Tracking carbon expenditures within a budget also allows accounting processes to be applied, such as the ability to carry forward budget surpluses to future years, to borrow surplus "room" if overspent, or to accrue carbon-removal impacts to the years they actually come into effect. Frequent budget reporting (Council direction is for annual reporting) decreases the risk of complacency and delayed action.

Likewise, accountability can lead to the notion of carbon "debt": if a carbon budget is missed in one year, does that incur a deficit that should be addressed in the following year? Meanwhile, at this time, no common approach exists for consequences. For example, New Zealand's Emissions Trading Scheme allows exceedances to be offset with carbon removals. The District of Saanich's Carbon Fund makes departments accountable by requiring them to pay into a fund for corporate-emissions reduction projects, based on their emissions levels. Staff will continue to research and develop an approach in consultation with City departments.

Appendix H – Carbon and Equity Working Group

Objectives and Process

The objectives of Vancouver's Climate and Equity Work Group will be to:

1. Help City staff to better centre the voices of Vancouver black, Indigenous, and people of colour in climate and sustainability work, and to understand systemic discrimination and climate-related risks faced by low-income residents.
2. Review proposed Greenest City 2050 actions over a number of goal areas, including this Climate Emergency Response, to identify potential impacts (positive and negative) and opportunities where implementation could benefit systemically excluded populations.
3. Propose new relevant actions to be considered for inclusion in climate plans, including the City's Climate Change Adaptation Strategy.

An ancillary objective of the Climate and Equity Working Group will be to serve as a potential model for meaningfully engaging with black, Indigenous, and people of colour, as well as low-income communities, using the tools and guidance provided by the City's Equity Framework. The Climate and Equity Working Group will be a learning experience and one that could build trust and capacity for other City-led initiatives. It will also be an important opportunity to incorporate a gendered intersectional lens into the City's climate actions and the Climate Adaptation Strategy.

In terms of process, it is anticipated that the Climate and Equity Working Group participants will attend a series of 2–3 hour workshops over the course of 12–18 months, starting in the fall of 2019. To avoid power imbalance, the workshops will be facilitated by a non-City staff person with a depth of experience in equity. The workshops will be organized and attended by staff from Sustainability working in collaboration with Social Policy. Other City staff will attend based on the topic area of discussion at each meeting. The working structure of the group will be co-created with working group participants, to ensure that it delivers meaningful outcomes while building trust amongst participants and City staff.

Participants

The group will consist of 10–15 representatives from local community-based organizations (or their citizen designates). An intersectional approach will be used. The working group will include Indigenous representation and the City will strive to include a diversity of racial and ethnic backgrounds, ages, gender identities, and sexual orientations. The City will strive to ensure the group has a majority of black, Indigenous, and people of colour among participants. Applicants who identify as black, Indigenous, people of colour, and LGBTQ2S+ who may also identify as gender non-binary will be strongly encouraged to apply. A public call for applications for organizations that are willing to participate will be made.

Budget

The proposed budget to create the Climate and Equity Working Group is $50,000, which will cover up to eight workshops with an external facilitator and includes compensation for working group participants at Vancouver's living wage, provision of childcare during meetings, and transportation costs. The proposed budget would also enable the facilitator to do a high-level scan of the City's climate and sustainability plans (e.g., GCAP 2020) to identify equity gaps and opportunities. Staff have identified funding for the creation of this group from within existing budgets and may bring back a budget proposal for an ongoing working group for Council's consideration.

CLIMATE EMERGENCY RESPONSE
FINAL MOTION AS APPROVED

A. THAT Council adopt a new City-wide long-term climate target of being carbon neutral before 2050 as a complement to the target of 100 per cent of the energy used in Vancouver coming from renewable sources before 2050.

B. THAT Council adopt a "complete communities" target that by 2030, 90 per cent of people live within an easy walk/roll of their daily needs, and direct staff to report back by Fall 2020 with a strategy and budget to achieve the target ("Big Move #1").

C. THAT Council accelerate the existing sustainable transportation target by 10 years, so that by 2030, two thirds of trips in Vancouver will be by active transportation and transit, and direct staff to report back by Fall 2020 with a strategy and budget to achieve the target ("Big Move #2"), including a plan to work toward cheaper or free transit for lower income people as council agreed to in the All on Board motion.

D. THAT Council adopt the target that by 2030, 50 per cent of the kilometers driven on Vancouver's roads will be by zero emissions vehicles, and direct staff to report back by Fall 2020 with a strategy and budget to achieve the target ("Big Move #3").

E. THAT Council adopt the new target that by 2025, all new and replacement heating and hot water systems will be zero emissions, and direct staff to report back by Fall 2020 with a strategy and budget to achieve the target ("Big Move #4").

F. THAT Council adopt the target that by 2030, the embodied emissions in new buildings and construction projects will be reduced by 40 per cent compared to a 2018 baseline, and direct staff to report back by Fall 2020 with initial actions and budget to achieve this target including recommendations to remove regulatory barriers to mass timber construction and initial requirements for embodied emissions reductions ("Big Move #5").

G. THAT Council direct staff to report back by fall 2020 with 2030 GHG emission reductions targets that can be achieved by the "negative emission" restoration of natural forest and coastal ecosystems in the City of Vancouver. That the report also indicate opportunities to work with local First Nations, Metro Vancouver and other local municipalities to set a GHG emission reductions target and budgets for 2060 to "remove the appropriate amount of carbon pollution annually to deal with the regional negative emission requirements as per the IPCC report" ("Big Move #6").

H. THAT Council direct staff to begin implementing the Accelerated Actions as described in Appendix A of the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response”, and report back to Council with an overall progress report by May 2020; and

FURTHER THAT City staff be directed to engage with the City of Vancouver’s respective Union Locals, who represent our 10,000 plus employees, to work jointly on industry best practices for accelerated actions under ‘Sustainable Commuting’ in the immediate and medium term.

I. THAT Council direct staff to proceed with the development of a carbon budgeting and accountability framework for corporate and city-wide carbon pollution that meets the objectives described in the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response”.

J. THAT Council direct staff to proceed with the formation of the Climate and Equity Working Group according to the objectives, process, timelines, participants and budget described in the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response”.

K. THAT Council direct staff to proceed with the development of Vancouver’s next environmental plan, Greenest City 2050, which will incorporate the work from the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response”, as well as broader environmental sustainability objectives, and report back on the recommended strategy that will be integrated and coordinated with the City-wide Plan.

L. THAT Council direct staff to integrate the six (6) Big Moves as described in the Administrative Report dated April 16, 2019, entitled “Climate Emergency

Response” into the development of the City-wide Plan recognizing there will be further development and refinement of the Big Moves which will be informed by and coordinated with City-wide planning.

M. THAT Council direct staff to develop local renewable energy targets and accelerated actions, including for solar hot water and photovoltaic solar panels that can reduce energy costs of heat pumps and mitigate risks of hydro-electricity outages.

N. THAT Council acknowledge the necessity of working with partners and stakeholders, including non-profit organizations and industry leaders, to achieve the ambitious targets recommended in the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response” and “6 Big Moves;”

FURTHER THAT Council direct staff to consult with and work with these groups to discuss any implications and impacts, including budgetary; and

FURTHER THAT Council acknowledge the possibility that some of the resources may need to be reprioritized or adjusted and targets recommended in the “6 Big Moves”, contained in the above-noted report, to respond to issues including affordability and/or livability in the midst of the City of Vancouver’s Emergency Response to the overdose crisis and the housing and affordability crisis.

O. THAT Council direct staff to incorporate robust resident engagement on the Climate Emergency Response framework and its Big Moves components as part of the upcoming City-wide planning process, in order to support livability and vibrant and complete communities.

P. THAT Council direct staff to share the Administrative Report dated April 16, 2019, entitled “Climate Emergency Response” and recommendations with Metro Vancouver, the Vancouver Park Board and Vancouver School Board for the purpose of asking them to formally express support for the strategy, and consider ways that the respective bodies can support the Big Moves and recommendations.

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