



City of Richmond

Report to Committee

To: General Purposes Committee **Date:** February 27, 2019
From: John Irving, P.Eng. MPA **File:** 10-6000-00/Vol 01
 Director, Engineering
Re: **Accelerating Local Action on Climate Change:
 Community Energy & Emissions Plan (CEEP) Renewal**

Staff Recommendation

That the public consultation program defined in the report entitled “Accelerating Local Action on Climate Change: Community Energy & Emissions Plan (CEEP) Renewal” from the Director, Engineering dated February 27, 2019, to gain feedback from residents and stakeholders regarding the recommended revised greenhouse gas (GHG) reduction target and revised climate action strategies and measures, be endorsed.

John Irving, P.Eng. MPA
 Director, Engineering
 (604-276-4140)

Att. 7

REPORT CONCURRENCE		
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER
Building Approvals	<input checked="" type="checkbox"/>	
Development Applications	<input checked="" type="checkbox"/>	
Emergency Programs	<input checked="" type="checkbox"/>	
Parks Services	<input checked="" type="checkbox"/>	
Policy Planning	<input checked="" type="checkbox"/>	
Transportation	<input checked="" type="checkbox"/>	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: 	APPROVED BY CAO

Staff Report

Origin

This report responds to a referral from the September 11, 2018 General Purposes Committee Meeting, which requested:

“That staff evaluate the City’s medium-term GHG reduction targets in light of the new provincial targets, and bring back options for consideration.”

This report responds to a referral from the January 29, 2019 Parks, Recreation & Cultural Services Committee, which requested:

“That staff report back by fall of 2019 with a State of the Environment report, encompassing all the City's environmental sustainability initiatives including a review on the City's objectives, targets, timelines, and actions.”

This report responds to a referral from the February 11, 2019 Council Meeting, which requested:

“That the matter be referred back to staff to report back on: (1) the definition of a climate emergency; (2) what constitutes a climate emergency; (3) whether Richmond is experiencing a climate emergency; and (4) the ramifications of declaring a climate emergency.”

Background

Sustainability Reports to Council

Over the past 20 years, staff have prepared a series of reports to Council regarding environmental sustainability issues and the implementation status of actions taken in these areas. The following list is a summary of the reports and plans developed by staff and presented to Council:

- City Staff produced a series of *State of Environment* reports in 1998, 2001 and 2005.
- Council approved the Richmond Sustainability Framework in 2010.
- Staff presented the *Sustainability Progress Report* to Council in 2014.
- Council adopted the *Community Energy & Emissions Plan* (CEEP) in 2014, and there have been update reports to Council regarding CEEP implementation in 2015 and 2017. The next CEEP update report is scheduled for the end of 2019.
- Council adopted the *Ecological Network Management Strategy* (ENMS) in 2015, and Council received the *ENMS Update* report in January 2018.
- Council also receives annual solid waste and drinking water quality reports.

The combined effect of the reporting between 2014 and 2018 has been to update Council and the community with more detailed and timely information on the City's progress in implementing the wide range of community sustainability initiatives now underway. A diagram of the City's environmental, energy efficiency and climate action strategies, plans and implemented measures is included as Attachment 1 to this report.

City of Richmond Climate Action Leadership – Reducing GHG Emissions

In January 2014, Council adopted the *Community Energy and Emissions Plan* (CEEP). The City has since implemented a wide range of greenhouse gas (GHG) emission reduction initiatives targeting both corporate activities and city-wide (community) sources. Examples of City's initiatives that have reduced corporate and community GHG emissions include the following:

- **Land Use Planning:** The CEEP is informed by the 2009 City Centre Area Plan (2009), enabling high-density development to be effectively supported by low-carbon rapid transit. The CEEP is also congruent with city-wide OCP priorities for the redevelopment of neighbourhood centres and Arterial Road Development (i.e. along TransLink's frequent transit network), reinforcing the land use – transportation link.
- **District Energy:** Since 2011, buildings in City Centre are required to be "District Energy-Ready" (i.e. using a hot water-based heating system, or connected to the City's Lulu Island Energy Company (LIEC) infrastructure for space heating¹ and hot water services). The City's DEU systems already provide more than 3.6 million ft² of residential and commercial floor space with energy-efficient and cost-effective energy services. LIEC's Alexandra District Energy System uses a renewable geo-exchange system to provide heating and cooling for new buildings in the area, including the first Walmart in North America to be connected to a civic thermal energy utility, and Richmond Fire Hall #3. LIEC's plan is to access the sewer heat resource of the Gilbert Road sanitary forcemain to generate energy for the Oval Village District Energy Utility.
- **Energy Efficient New Development:** The City Centre Area Plan established a policy, in effect from 2009 to 2018, that new developments greater than 2000m² achieve a LEED Silver-equivalent level of performance as a consideration of rezoning. In September 2014, Council adopted the City's Townhouse Energy Efficiency and Renewable Energy policy, in effect until 2018, which required that all new townhouse units resulting from rezoning applications be designed and built to achieve an "EnerGuide 82" energy efficiency performance rating or better, and comply with the BC Solar Hot Water ready regulation, or alternatively, connect to a renewable energy system. In 2018, both policies were superseded by more stringent Energy Step Code requirements for new development (see below). New detached homes are also required to meet the requirements of the BC Solar Hot Water Ready regulation.
- **Electric Vehicles:** As of February 2019, the City has installed 10 public L2 EV charging ports at five different locations in Richmond, with the installation of 6 additional ports (including 2 L3 ports and a sixth location) planned. A new Richmond requirement that

¹Cooling is also provided in some cases.

100% of new residential parking spaces be supplied with EV charging infrastructure is a North American first and an increasingly influential precedent for other local governments.

- **Energy Efficient Existing Buildings:** EnergySave Richmond (www.energy.richmond.ca) has offered a suite of programs for residents, businesses and developers:
 - Building Energy Challenge: A friendly competition between building owners to promote energy performance and reporting of energy use (2015-2017);
 - ClimateSmart: Energy efficiency and GHG reduction coaching for local businesses (2016-2018);
 - Richmond Carbon Market: Program for purchasing carbon credits from Richmond-based GHG reduction projects (since 2015); and
 - Targeted incentives for Energy Star clothes washers (since 2010), replacement restaurant hot water spray-valves (2016), and “smart” thermostats (2016-2017).
 - The website also hosts on-line registration forms for the City of Richmond Airtightness Training Program that supports local builders and construction trades workers in building successfully to the City’s Energy Step Code requirements.

- **Active Transportation and Walkability:** Since 2010, the City has issued Building Permits for 4,773 new City Centre building units within a 5-minute walk of Canada Line stations (including 2,292 units near the planned station at Capstan Way), with many more to come. New transit shelters, crosswalks, bike lanes and other cycling facilities have been installed throughout Richmond to encourage low-carbon active transportation. Between 2006 and 2016, the transit mode share for journey to work trips increased from 11.8% to 19.1%, and vehicle trips declined from 82.2% to 74.2%. The City has also supported the introduction and expansion of car-share services and is currently piloting a public bike-share system.

- **Civic Buildings:** New civic buildings have been built to LEED Gold levels of environmental performance, including the City Centre Community Centre, Fire Hall No.1 and the new Minoru Centre for Active Living, while Fire Hall #3 and the attached ambulance station are connected to the Alexandra DEU. The City reduced GHGs from City buildings by 25% between 2007 and 2017 by implementing energy efficiency and fuel-switching initiatives. Council has approved a target of reducing corporate GHG emissions to 65% below 2007 levels by 2020.

- **City Fleet:** Through implementation of the City’s *Green Fleet Action Plan*, Richmond was the first local government to achieve an E3 Fleet² “Platinum” rating.

- **Parks Services:** Staff are assessing the carbon storage capacity of the North East Bog Forest to advance the City’s carbon neutrality efforts as well as the Ecological Network; if the assessment shows promising results, staff intend to assess the carbon stored within the Garden City Lands.

² E3 Fleet: “Energy, Environment, Excellence”: <https://www.e3fleet.com/>

- **Waste Diversion:** Richmond achieved 78% diversion of organic wastes from single family homes in 2016, greatly reducing GHG emissions from anaerobic decomposition. Also in 2016, Council adopted the *Demolition Waste and Recyclable Materials Bylaw*. The City is aiming for 80% waste diversion by 2020.
- **Carbon Neutral Operations:** Building on GHG emission reductions achieved through the City's waste diversion, parks, civic building and city fleet initiatives (see above), the City has additionally purchased locally-generated GHG offsets through its innovative Richmond Carbon Marketplace program to achieve carbon neutral corporate operations every year since 2013, and plans to maintain this success going forward.
- **Solar energy:** Staff developed the Solar Friendly Richmond framework in 2016, proposing corporate and community-focused policies and programs. City facilities with solar energy generation installed include:
 - South Arm Community Centre and Hamilton Fire Hall (solar air pre-heating)
 - Steveston Fire Hall No 2, South Arm Outdoor Pool, and the old Minoru Aquatic Centre (solar hot water).
 - Planned solar PV installations at the new Fire Hall No 1.
 Staff are currently assessing a solar policy for new development per the referral from the December 18, 2018, Planning Committee meeting, and intend to bring a report to Council in spring 2019.
- **BC Energy Step Code:** From 2016 through to the present, the City has played a key role in both developing and implementing the Province's new Energy Step Code (ESC), a new set of "better-than-code" energy efficiency standards available for voluntary adoption by local governments in British Columbia. Richmond became the first municipality in BC to announce its intent to begin stakeholder consultations on local adoption of the ESC. Richmond's approach to ESC targets sets out differentiated Step Code targets that incent the use of "low-carbon energy systems" including District Energy. See Attachment 2 for a table of current and proposed ESC requirements for new construction in Richmond, consistent with achieving net-zero energy ready construction for new developments as soon as 2025.
- **Civic Leadership and Advocacy:** The City regularly calls on senior levels of government to take greater action on sustainability and climate change issues. Within recent years, Council has provided input to the development of the 2015 BC *Climate Leadership Plan* and the recent *CleanBC* plan (see below), and has successfully championed resolutions on building energy benchmarking and the right to a clean environment through the Union of BC Municipalities (UBCM). Richmond has also consistently taken a leadership position among local governments, pioneering new EV charging requirements for residential development, and leading research on incentives for heat pump technology. Richmond's leadership in adopting the Energy Step Code has already inspired many other local governments in BC to follow suit, and the City's Energy Step Code targets, regulatory procedures and well-regarded stakeholder consultation process are all being widely cited as best practice by both industry and government.

City of Richmond Climate Action Leadership – Climate Change Adaptation

Over the last decade, Richmond has implemented a series of strategies and plans that in combination respond to many of the impacts of climate change projected for Richmond over the coming century. The following initiatives have reduced risks and vulnerabilities for Richmond's residents, businesses and the local environment:

- Establishing the Drainage and Diking Utility reserve fund in 2003;
- Adopting the *2008-2031 Richmond Flood Protection Strategy*, and the *Flood Plain Designation and Protection Bylaw* in 2008;
- Working with waterfront developers to construct wide “superdikes”;
- Developing and implementing the *Dike Master Plan*; and
- Ongoing improvements to the City's flood protection system;
- Adopting the *Invasive Species Action Plan*;
- Development of an urban forest management strategy; and
- Implementing clean air cooling stations as a rapid response to the summer 2018 heat wave and smog event.

More information on these climate adaptation measures is included as Attachment 3.

Declaring a “State of Local Emergency”

The concept of a “climate emergency” was discussed at the February 11, 2019 Council Meeting. Staff were asked to inform Council on the implications of declaring an “emergency” related to the impacts of climate change.

Local governments have a mandate to declare a “State of Local Emergency,” which enables local authorities the power to exercise emergency powers as listed in the *Emergency Program Act*. In the context of the declaration, the term “Emergency” is defined as a present or imminent event or circumstance that a) is caused by accident, fire, explosion, technical failure or the forces of nature, and b) requires prompt coordination of action or special regulation of persons or property to protect the health, safety or welfare of a person or to limit damage to property. A “climate emergency” does not appear to meet the requirements of this definition.

When a State of Local Emergency is enacted (by order of the head of the local authority, by resolution or by bylaw, and by the submission of a Declaration Order form to the Province), the jurisdiction gains a legal mandate to:

- a) Acquire or use any land or personal property considered necessary to prevent, respond to or alleviate the effects of an emergency or disaster;
- b) Authorize or require any person to render assistance of a type that the person is qualified to provide or that otherwise is or may be required to prevent, respond to or alleviate the effects of an emergency or disaster;
- c) Control or prohibit travel to or from any area of British Columbia;

- d) Provide for the restoration of essential facilities and the distribution of essential supplies and provide, maintain and coordinate emergency medical, welfare and other essential services in any part of British Columbia;
- e) Cause the evacuation of persons and the removal of livestock, animals and personal property from any area of British Columbia that is or may be affected by an emergency or a disaster and make arrangements for the adequate care and protection of those persons, livestock, animals and personal property;
- f) Authorize the entry into any building or on any land, without warrant, by any person in the course of implementing an emergency plan or program or if otherwise considered by the minister to be necessary to prevent, respond to or alleviate the effects of an emergency or disaster;
- g) Cause the demolition or removal of any trees, structures or crops if the demolition or removal is considered by the minister to be necessary or appropriate in order to prevent, respond to or alleviate the effects of an emergency or disaster;
- h) Construct works considered by the minister to be necessary or appropriate to prevent, respond to or alleviate the effects of an emergency or disaster;
- i) Procure, fix prices for or ration food, clothing, fuel, equipment, medical supplies or other essential supplies and the use of any property, services, resources or equipment within any part of British Columbia for the duration of the state of emergency.

According to the Province's *Declaring a State of Local Emergency In British Columbia* guidelines, "these powers infringe on civil liberties of citizens and should only be drawn upon by local authorities when no other reasonably achievable options are available to protect the community." The guidelines also note that a declaration of a State of Local Emergency is not required "to implement part or all of a local emergency response plan, as long as access to emergency powers are not required."

Local government "Climate Emergency" declarations

In response to the IPCC *Special Report on Global Warming of 1.5°C*, a number of local initiatives are now underway seeking local government declarations of a "Climate Emergency". As of February 16, 2019, the following local government jurisdictions are listed as having adopted "Climate Emergency" declarations³:

- United Kingdom: 29 councils (including London, Bristol and Oxford) representing 14 million people.
- United States: 9 councils representing almost 6 million people
- Australia: 8 councils representing 650,000 people

³ <https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/>

Within Canada, as of the writing of this report, 288 councils representing over 7 million people have adopted a climate emergency declaration. Aside from Halifax, Vancouver and the Capital Regional District, all of these councils are from Quebec⁴, where local governments have adopted the *Déclaration citoyenne universelle d'urgence climatique (DUC)*.⁵

While there is no standard text for these Climate Emergency declarations (aside from the DUC document cited in Quebec, noted above), many appear to have the following common elements:

1. A public statement that a disparity between the potential impacts of climate change, and current efforts to prevent or adapt to these impacts;
2. A call for the development of, or adoption of, more stringent GHG reduction targets in line with those set out by the IPCC report;
3. A call for the implementation of, or the development of, action plans containing measures sufficient to achieve the new GHG reduction targets adopted;
4. A call for other local governments and for senior levels of government to do likewise; and
5. A call for senior levels of government to provide Council with expanded mandates and resources to facilitate climate action at the local level.

New Provincial GHG reduction targets and *CleanBC* plan

In May 2018, the Province updated their greenhouse gas (GHG) emissions reduction targets. In line with the recommendations of the Climate Leadership Team, the Province repealed the 2020 emission reduction target, and added the following new targets for 2030 and 2040:

- By 2030 and for each subsequent calendar year, BC greenhouse gas emissions will be at least 40% less than the level of those emissions in 2007; and
- By 2040 and for each subsequent calendar year, BC greenhouse gas emissions will be at least 60% less than the level of those emissions in 2007.

In December 2018, the Province released *CleanBC*, which is intended to serve both as a climate action strategy and an economic development plan. The key strategies articulated in the plan are to seek emission reductions from industry, the transportation sector, and from buildings and urban form. Several of the measures outlined in the plan will provide new incentives that are supportive of the City's existing climate action priorities. New measures proposed in the plan include:

- Implementing a zero-emission vehicle mandate starting in 2025 (10% of new cars) that ramps up to 100% by 2040;
- Supporting investments in public EV charging;
- Gradually increasing minimum energy efficiency requirements in the BC Building Code, in line with Energy Step Code targets, so that all construction is net-zero energy ready by 2032;
- Adopting energy efficiency requirements for existing buildings by 2024;
- Providing incentives for high-efficiency low-carbon heat pumps in existing buildings;
- Requiring building energy labelling and reporting; and
- Achieving 95% diversion of organic wastes.

⁴ <https://montrealgazette.com/opinion/columnists/allison-hanes-heat-is-on-to-make-climate-a-priority-in-quebec>

⁵ http://www.cssante.com/sites/www.cssante.com/files/duc_couleur.pdf

Additional measures address the waste sector, the need for skills training and for reporting measures. Additional information on the *CleanBC* plan can be found in Attachment 4.

IPCC Special Report on Global Warming of 1.5°C

In October 2018, the Intergovernmental Panel in Climate Change (IPCC) approved the *Special Report on Global Warming of 1.5°C*. This report follows from Article 2 of the Paris Agreement, which states that:

This Agreement ... aims to strengthen the global response to the threat of climate change ... by ... holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change ...

Global average warming is predicted to be 4°C above pre-industrial levels by 2100 if current trends continue. This report projects global climate change impacts assuming that the international community is successful in achieving the overall goal of limiting global climate change to 2°C or to 1.5°C of global warming (i.e. the lowest magnitude of human-caused climate change considered achievable at this time). The report finds that the projected impacts of climate change are significantly greater with 2°C rather than 1.5°C of global average warming, especially during the latter half of the current century. Under the 1.5°C scenario many projected climate change impacts actually peak and begin to decrease slightly after 2050, while under the 2°C scenario most projected impacts continue to increase until 2100.

The IPCC report also states that while limiting global average warming to 1.5°C is still possible, GHG emissions need to be rapidly reduced to net zero.⁶ This in turn calls for GHG emission reduction targets that are considerably more aggressive than have been have yet been adopted by most jurisdictions. The summary of the IPCC report is included as Attachment 5 to this report.

Based on projections of local climate impacts resulting from 1.5°C and 2°C of global average warming, and the capacity of Richmond's current infrastructure plans, staff are confident that the City will remain resilient to 1.5°C or 2°C of global climate change out to 2100. More information on the projected local impacts of 1.5°C and 2°C climate change is included as Attachment 6. Information on the climate adaptation measures the City is already implementing in response to these projected impacts is included as Attachment 3.

Analysis

Richmond Community Energy & Emissions Plan (CEEP)

In 2010, Council adopted targets included in Richmond's Official Community Plan to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below

⁶ The report states that "All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of carbon dioxide removal," in which annual carbon sequestration totals would exceed GHG emissions into the atmosphere. p.19

2007 levels by 2050. These targets were aligned with the Province's own GHG emission reduction targets, adopted in 2007.

The City's initial CEEP, adopted in 2014, included a list of measures that, in combination with policies already adopted by the Province and the federal government, were projected to reduce community-wide GHG emissions to 6% below 2007 emission levels by 2020, and 25% below 2007 levels by 2050, even with continued population and economic growth over this time. The 2014 CEEP recognized that deep emission reductions could not be achievable by City action alone; rather, these would require supportive utility, provincial and federal regulations and funding, market innovation, and increased carbon pricing. Beyond this, the CEEP also recognized that the City's community emissions reduction targets would only be achieved if "big breakthroughs" (relative to the situation in 2012-2013) were made in the following areas:

- That by 2041, there would be near complete conversion of the passenger vehicle fleet to electric cars;
- That by 2025 all new buildings would "net zero" carbon emitters⁷; and
- That by 2050 all existing buildings would have had a major renovation that dramatically reduces their external energy needs and carbon emissions.

When the CEEP was adopted in 2014, none of these measures were considered to be implementable given the policy tools and product availability available at that time. Five years later, staff consider that it would now be practical to plan the implementation of any or all these measures.

GHG Emissions Trend in Richmond: 2007 to 2015

Actual community-wide reductions in GHG emissions to 2016 were significantly better than projected in the 2014 CEEP. Implementation of all emission reduction measures in the CEEP were projected to result in an absolute reduction in 2015 of 1% below 2007 levels, and a decrease of 10% from a "business as usual," scenario in which no GHG reduction actions were implemented. A recent analysis of available data indicates that total community-wide emissions (including large industry) within the City of Richmond actually totalled an estimated 977,972 tonnes (in CO₂ equivalent emissions, or CO₂e) in 2015, having declined 12% from 1,116,832 tonnes CO₂e in 2007.⁸ Available data further indicates that community wide emissions declined by 8% between 2007 and 2010, and that a further 4% decline took place between 2010 and 2015. See Attachment 7 for a graph of this data.

Staff expect emission reductions to continue as adopted policies (e.g. Energy Step Code requirements) become more fully implemented and low-carbon technologies are adopted by increasing numbers of Richmond residents and businesses.

Between 2007 and 2015, GHG emissions in Richmond's residential sector⁹ declined by an estimated 16%. Total residential and commercial consumption of electricity declined by 0.5%,

⁷ Now referred to as "net zero energy ready": a building so energy efficient that on-site zero-carbon energy generation (e.g. solar PV) would be sufficient to offset the building's energy consumption.

⁸ As indicated on the graph, community-wide GHG emission reductions between 2007 and 2015 were minimally affected by including large industrial emissions within the scope of the emission inventory.

⁹ i.e., GHG emissions from light-duty vehicles, and residential electricity and natural gas accounts.

and residential natural gas consumption declined by a remarkable 17%, despite ongoing economic expansion and an estimated 12% increase in population during this time.¹⁰

The provincial government reports that BC's GHG emissions declined by only an estimated 2.1% during 2007 – 2015, while the federal government assesses that Canada's overall GHG emissions declined by 2.2% between 2005 and 2015.¹¹

Emission reductions achieved at the local level are a product of local municipal actions as well as policies enacted by senior governments and utilities. The Province implemented a carbon tax and low carbon vehicle fuel standards in 2008. Vehicle fuel economy standards and the provision of increased public transit service (notably including the opening of the Canada Line in 2009), have led to reductions. Ongoing implementation of the City's urban densification, energy efficiency, GHG reduction, district energy and transportation initiatives have also had a cumulative impact on local emission trends, and should increasingly drive emissions reductions relative to "business as usual" as the City continues to grow.

Community GHG Emission Reduction Target

As noted above, the findings of the IPCC 1.5°C report make it clear that the City's existing GHG emission reduction targets are not consistent with the global emission reductions that must be achieved to limit global average warming to 1.5°C. In as much as the City's existing targets do not require local GHG emissions to be reduced to net zero at any date in the future, they are also inconsistent with limiting global average warming to 2°C. The province's GHG reduction targets, although recently revised, were adopted based on the recommendations of the Climate Leadership Team in 2015, and are not reflective of the new findings in the IPCC report.

The City's climate adaptation actions now underway will provide effective protection against climate change impacts currently projected for 1.5°C of global average warming. While additional local adaptation measures would be necessary if "positive feedback" processes (e.g. collapse of the Greenland ice cap) were to occur, the chances of this occurring would be minimized by achieving emissions reductions consistent with the 1.5°C target.

Staff recommend that for the purposes of consultation, that staff seek feedback on revising the City's GHG reduction target to align with emissions reduction trajectory consistent with "no or limited overshoot of 1.5°C" as set out by the IPCC in the 1.5°C report,¹² as stated below:

- Reduce Richmond's community-wide¹³ GHG emissions by:

¹⁰ Richmond's population was 185,818 in 2007 and 208,229 in 2015.

https://www.richmond.ca/shared/assets/Population_Hot_Facts6248.pdf

¹¹ GHG emission estimates for the City of Richmond are constrained by a lack of comprehensive transportation sector emissions data disaggregated to the local government level. These totals include emissions from natural gas consumption by industrial facilities within City boundaries. In 2007 and 2010 (years for which disaggregated data is available) industrial natural gas emissions were 104,806 and 78,462 tonnes respectively, or 9.4% and 7.6% of total emissions). Metro Vancouver as a whole appears to have achieved an equivalent 12% emissions reduction between 2007 and 2015.

¹² https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_High_Res.pdf p.14

- At least 40% below 2007 levels by 2030¹⁴; and
- Achieve net zero GHG emissions by 2050.

This is more stringent than the Province's targets of reducing GHG emissions 30% by 2030 and 80% by 2050.

While there are clear benefits – both at the global and local scale - to limiting global average warming to 1.5°C, achieving the emission reductions targets that needed to achieve these benefits will require a considerable increase in the scope and intensity of the City's emission reduction efforts. There is considerable value in raising public awareness both about the challenges that climate change poses for our community, and the practical options now available for reducing local emissions.

Community Energy & Emissions Plan (CEEP) Renewal

The 2014 CEEP acknowledged that while significant actions by all levels of government and the community are required, the identified actions could achieve significant reductions in energy use and GHG emissions" while continuing to accommodate population growth and economic development. The plan also stated that "it is anticipated that other actions may be identified in the future based on opportunities that present themselves during implementation," and "could be identified through a plan review 5 to 7 years following adoption."

Some of the most promising GHG reduction initiatives that the City has begun to implement within the last five years have been achieved in these "big breakthrough" areas that were not considered feasible at the time the CEEP was originally developed. These measures include:

- Development and adoption of an aggressive "beyond-code" energy efficiency building standard applicable to most types of new development (Energy Step Code);
- Incenting low-carbon building energy systems within new developments outside of DEU service areas by means of innovative policy tools enabled through the Energy Step Code and the Lulu Island Energy Company (LIEC); and
- Development and adoption of a electric vehicle charging infrastructure requirement for all new residential parking stalls, at a time when electric vehicles have reached 15% of all new passenger car sales in BC - and climbing.¹⁵

Staff now have a better understanding of how the City can achieve deep GHG emissions reductions over the next 15 to 30 years through implementation of practical measures. With a

¹³ Consistent with the City's previous GHG reduction targets, these targets exclude "large final emitters" (i.e. large industrial operations) situated within Richmond because of the Council's limited mandate to secure emission reductions from these sources.

¹⁴ Based on the City's GHG emission inventory above, this is consistent with the IPCC's recommended target of a 45% reduction below 2010 levels by 2030. Given that Richmond's GHG emissions in 2007 were 109% of 2010 levels, the 2030 target equals $1.09 \times 0.55 = 0.6$ of 2007 emissions. As previously, this target excludes "large final emitters" (i.e. large industrial operations) because of the City's limited mandate to secure emission reductions from these sources.

¹⁵ EVs (plug-in hybrids and battery electric vehicles) were 15.5% of new passenger car sales in BC in Q3 2018. <https://www.fleetcarma.com/electric-vehicles-sales-update-q3-2018-canada/> Accessed 180124.

strategic land use plan in place, and new technologies and new policy tools now available, achieving deep GHG reductions within the next generation now appears to be technically feasible:

- **Neighbourhoods and Buildings:** Residential buildings accounted for 17.9% of total community-wide GHG emissions within Richmond during 2015.
 - Continued development of a liveable, compact City Centre, and the intensification of development of the city’s neighbourhood centres – in line with policy directions set out in the existing OCP - can deliver large-scale GHG reductions through low-carbon district energy systems, by allowing for high-amenity public transit services, and enabling residents to access a greater proportion of their travel destinations via low-carbon public transit or zero-carbon active transportation modes like walking and cycling.
 - Continued expansion of “low-carbon energy systems” for new development.
 - Greenhouse gas intensity targets could be added to the province’s existing energy efficiency targets under the Energy Step Code.
 - Benchmarking and reporting requirements for building energy performance would be a powerful means of incenting voluntary and cost-effective energy efficiency upgrades of existing buildings.¹⁶
 - The energy and emissions performance of Richmond’s existing building stock could be improved by upgrading insulation and windows, installing more energy-efficient mechanical systems, and by successfully incenting a switch to low-carbon heat pumps.
 - Facilitating the installation of EV charging infrastructure in or adjacent to existing residential buildings would further reduce barriers to EV ownership for Richmond residents.
 - Advancing green roofs within the City Centre area and urban forest management throughout Richmond would address urban heat island effects, improve stormwater management, create liveability and increase carbon sequestration.

- **Mobility and Access:** Light duty vehicle gasoline use contributed 42.6% of total GHG emissions.
 - Continue to support TransLink’s ongoing implementation of expanded transit service across the city. Provision of transit and active transportation amenities may be accelerated, depending on opportunities arising through redevelopment, any new Federal or Provincial funding, or potential reallocation of funds through the capital planning process.
 - Richmond’s public EV charging stations could be accelerated and/or expanded, as described within the City’s recent Smart Cities Challenge funding proposal.
 - Community GHG emissions could be reduced by accelerating the transition to EVs by local residents, and by encouraging the use of new low-carbon ride-sharing technologies.

¹⁶ Implementing both energy efficiency and fuel switching (from natural gas to low-carbon electricity) measures in existing buildings are key to achieving deep GHG reductions.

- **Resilient Economy:** Commercial and industrial buildings accounted for 29.8%, with heavy duty vehicle gas and diesel use adding a further 7.2% to total community GHG emissions.
 - The range of buildings covered by the Energy Step Code could be expanded to cover additional types of commercial and industrial buildings¹⁷, with staff working with builders and the Province to ensure the full realization of these energy efficiency requirements.
 - The City could encourage early adoption of electric trucks and other service vehicles as these become available, in part by encouraging the installation of EV charging infrastructure at commercial and industrial developments.

- **Sustainable Infrastructure and Resources:** GHG emissions from the decomposition of organic wastes totalled 2.5%. Existing City plans and programs to divert compostable waste could be broadened and accelerated by using a “circular economy”¹⁸ approach.

As with responses to other, more acute types of “emergency,” a local government response commensurate to the challenge posed by climate change will require a significant investment of resources. Projects will often need to be implemented over a compressed time period relative to “business as usual,” and shall likely affect all Richmond residents to a greater or lesser degree. The proposed consultation program will help the community understand the scale of the response required.

To fully achieve any of these targets, policy changes will be required at senior levels of government, and the City will need to implement additional measures.

Community and Stakeholder Engagement

Staff recommend that Council endorse an engagement program to develop options for new GHG emission reduction measures reflective of the scale of the GHG emissions reductions needed under a new City’s target commensurate with limiting global average warming to 1.5°C.

Engagement events would highlight the essential challenges and opportunities for Richmond posed by climate change, and gain feedback on actions that the City could take on GHG emissions reduction and adaptation to the impacts of climate change. The engagement program will ultimately assess community and stakeholder support for the types of policies and programs outlined above.

Staff propose community and stakeholder engagement with the following groups using the following methods:

1. Leveraging the City’s social media tools such as the Let’s Talk Richmond platform and Richmond Energy Save website;

¹⁷ As the Province adopts new sets of Energy Step Code targets, (e.g. for hotels).

¹⁸ i.e. an economic system aimed at making the most use of resources, minimising waste, and regenerating products and materials at the end of their service life.

2. Holding community workshops and focus group events targeting local stakeholders, e.g.:
 - Non-governmental organizations;
 - Local Business Improvement Areas / Chamber of Commerce;
 - Urban Development Institute (UDI);
 - Richmond Home Builders Group;
 - North American Chinese Construction Contractors Association – BC Chapter (NACCCA);
 - Architectural Institute of British Columbia (AIBC);
 - Engineers and Geoscientists BC (EGBC);
 - Richmond School Board and students;
 - Richmond Advisory Committee on the Environment;
 - Richmond Advisory Design Panel;
 - Richmond Economic Advisory Committee; and
 - Richmond Community Services Advisory Committee.

3. Hosting open houses with presentations by thought leaders to engage the public.

Staff will notify Council via memorandum when dates and venues are booked for public events.

Following this consultation process, staff would provide recommendations regarding the scope and ambition, and general content of a renewed CEEP in the fall of 2019.

Financial Impact

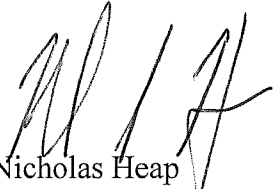
None.

Conclusion

For over a decade, the City of Richmond has been a leader in actively implementing climate change mitigation and adaptation measures. Climate adaptation measures now being implemented will protect Richmond from current projections of climate change impacts out to 2100.

Richmond has been successful in reducing community-wide GHG emissions by an estimated 12% between 2007 and 2015, and energy efficiency and GHG reduction measures now being implemented at scale by the City should drive additional GHG emission reductions going forward. The strong support provided by Council for local climate action has resulted in Richmond becoming a leader in implementing climate action: best practices pioneered here have increasingly been cited and adopted by other local governments, magnifying the effectiveness of the City's climate actions.

Despite this, the new IPCC findings indicate that Richmond's GHG reduction targets are not consistent with limiting global average warming to 1.5°C. Noting that new policy tools and new technologies are creating new opportunities for deep GHG emission reductions, staff recommend that the City seek input on the adoption of a new GHG target consistent with the IPCC's findings, and that staff commence a consultation process regarding the scope, and content of a revised CEEP outlining actions capable of meeting the City's GHG emission reduction targets.



Nicholas Heap
Sustainability Project Manager
(604-276-4267)

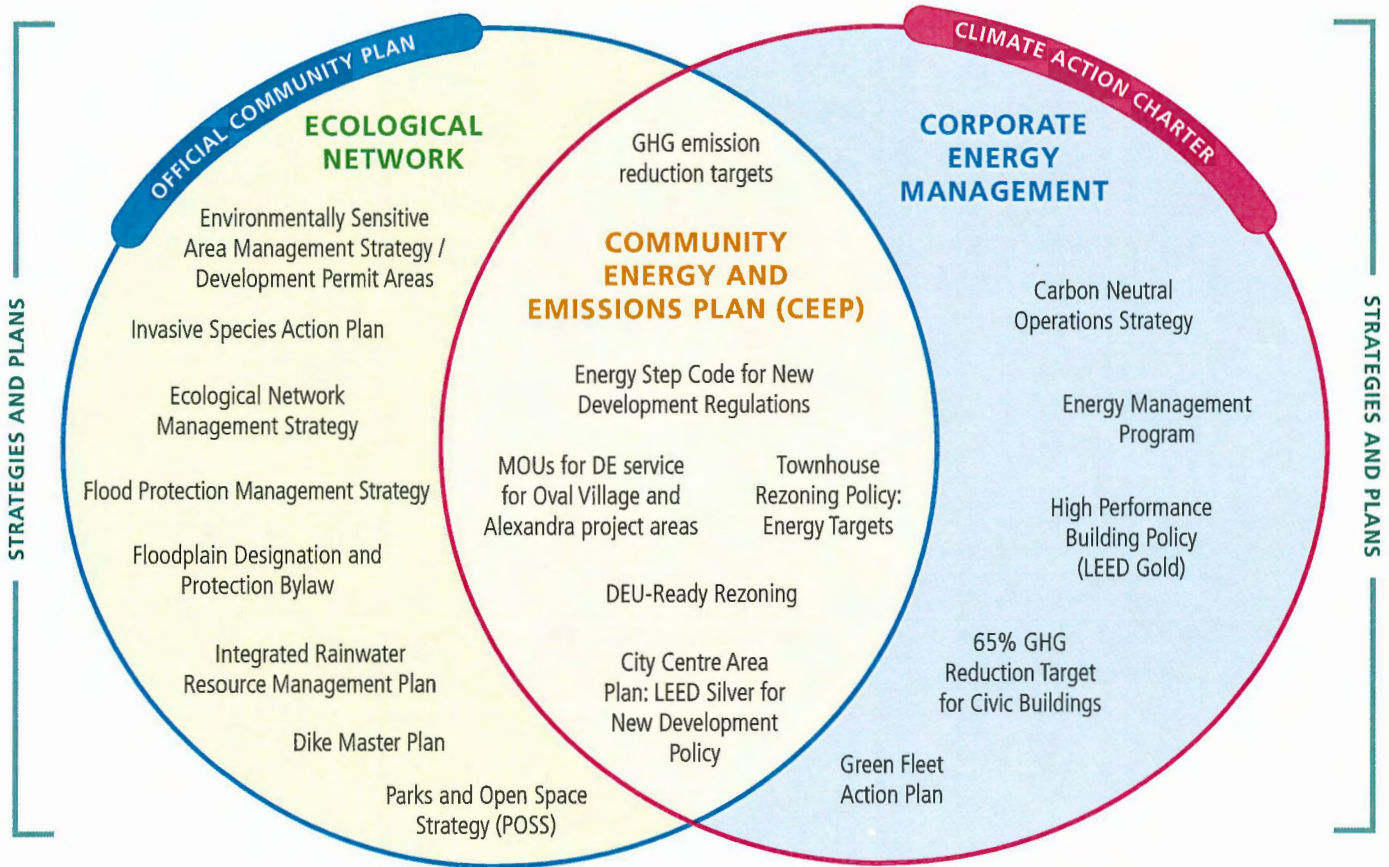


Peter Russell
Senior Manager, Sustainability &
District Energy
(604-276-4130)

- Att. 1: State of the Environment: Sustainability Framework diagram
- Att. 2: Existing and proposed BC Energy Step Code requirements for the City of Richmond
- Att. 3: City of Richmond action on climate change adaptation
- Att. 4: *CleanBC* plan
- Att. 5: IPCC *Special Report on Global Warming of 1.5 °C*
- Att. 6: Global and local projected impacts of climate change
- Att. 7: Estimated Richmond community GHG emissions: 2007 – 2016

SUSTAINABILITY FRAMEWORK

STATE OF THE ENVIRONMENT



FEATURE PROJECTS

- Pollinator Pastures
- Riparian Management Area (RMA) network
- Bath Slough Revitalization
- North East Bog Forest
- Capital Funding for Knotweed Treatment
- Terra Nova Rural Park
- Railway Greenway
- Garden City Lands Park

LULU ISLAND ENERGY CO.

Alexandra District Energy Utility (ADEU)

Oval Village District Energy Utility (OVDEU)

City Centre District Energy Utility (CCDEU)

FEATURE PROJECTS

- Building Energy Challenge
- Residential Smart Thermostat Pilot
- Active Transportation (walk/cycle)
- Business Water and Energy Efficiency Initiatives
- Airtightness Training Program
- Public EV Charging Stations
- Promote BC Hydro, FortisBC, and Metro Vancouver Efficiency Incentives

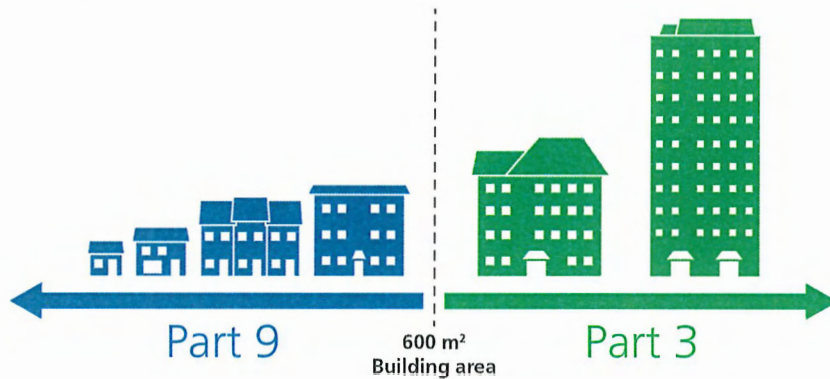
FEATURE PROJECTS

- Minoru Centre for Active Living
- Richmond Fire Halls
- Energy Retrofits to Existing Civic Buildings
- Recommissioning / optimization of existing building energy systems
- Zero Waste programs
- Expanding EV Fleet
- LED Streetlight Program
- Resilient Pump Station Pilot
- Gateway Theatre Sewer Heat Recovery

← COMMUNITY FOCUS → ← CORPORATE FOCUS →

Attachment 2: Richmond’s existing and proposed BC Energy Step Code requirements

Part 9 and Part 3 Buildings



Current Energy Step Code requirements and proposed timetable for higher Steps

Building Permit Application

	Required	Timetable for Future Consideration as identified in the Official Community Plan		
		Sept 1 2018 ¹	Jan 2020	Jan 2022
Smaller Part 9 Residential				
Townhomes and apartments	Step 3	Same as 2018	Step 4	Step 4 or Step 5
Single family, duplex and other residential	Step 1	Step 3	Step 3 or Step 4	Step 4 or Step 5
Larger Part 3 Developments				
Residential Concrete	Step 3 or Step 2 & LCES*	Same as 2018	Step 3	Step 4
Residential Woodframe Low/Mid Rise	Step 3	Same as 2018	Step 4	Step 4
Office & Retail Buildings	Step 2	Same as 2018	Step 3	Step 3

*LCES: Low-carbon energy systems

¹ Projects with “in-stream” DP applications will have until December 31, 2019, to submit an acceptable Building Permit under previous requirements.

Attachment 3: City of Richmond action on climate change adaptation

Over the last decade, Richmond has implemented a series of strategies and plans that in combination respond to many of the impacts of climate change projected for Richmond over the coming century. Staff continue to actively monitor projections of climate change impacts as new analyses become available to ensure that potential vulnerabilities are appropriately addressed in a timely manner. The following initiatives have reduced risks and vulnerabilities for Richmond's residents, businesses and the local environment:

Richmond action on sea level rise and river freshet impacts

- The City's drainage and flood protection system is currently valued at an estimated \$1.5 billion, comprising 581 km of drainage pipes, 61 km of culverts, 165 km of watercourses, 39 pump stations and 49 km of dikes. Staff are continuously upgrading and improving the City's flood protection system to accommodate the impacts of infrastructure age, growth and climate change.
- In 2003, Council established a Drainage and Diking Utility reserve fund to ensure sustainable funding for dike improvements by the City. Since then the Drainage and Diking Utility has annually increased from \$0.6 million to its current level of \$11.9 million. The total capacity of the City's drainage pump stations over the last 10 years has increased by 22%. Since Council endorsement of the reserve fund, the City has rebuilt eleven of its thirty nine drainage pump stations and has performed significant upgrades on a further four.
- In 2008, Council adopted the *2008-2031 Richmond Flood Protection Strategy*, which provided the City with "a framework for developing appropriate adaptation responses." The *Strategy* identified the need to "begin to address climate change implications specific to Richmond" relating to flood protection," and called on the City to "prepare and implement a comprehensive dike improvement program." This resulted in the development of the *Dike Master Plan* (see below).
- The City is actively pursuing opportunities to construct superdikes, where land supporting development behind the dike is filled to the same elevation as the dike crest. This eliminates visual impacts of a raised dike structure on waterfront views while providing an enhanced flood protection structure for the City. Construction of a section of superdike east of the Richmond Olympic Oval was recently completed, and a section of superdike will be constructed through development by 2021 between Capstan Way and Sea Island Way.

Dike Master Plan

- The *Dike Master Plan* sets a goal of increasing the height of Richmond's dike system to 4.7 m. This 4.7m dike elevation is derived from:
 - The 200-year flood elevation (at Steveston) of 2.9m. This is the projected height of a freshet flood equalling flows during the Fraser River's 1894 flood of record, taking the river's current hydrography into account.¹

¹ Fraser Basin Council, *Lower Fraser Hydraulic Model-Summary of Results*. November 14, 2006.

- Provincial requirements for a freeboard of 0.6m above the 200-year flood elevation standard.
- An allowance for up to 1m of sea level rise as well as 0.2m of geologic subsidence through the year 2100, in line with the Province’s 2011 guidance regarding sea dikes.²

○
The Dike Master Plan further requires that the structural design of these upgraded dikes be able to facilitate a further raising to 5.5 m to accommodate possible additional sea level rise in future years.

- In April 2018, Council directed staff to consult with the public and stakeholders with regard to the *Dike Master Plan – Phase 2 Report*, which sets out dike infrastructure improvements resilient to the projected climate change impacts to 2100 from West Dike at Williams Road to North Dike at No. 6 Road.
- Currently funded dike improvement projects include over 2.5 km and \$11 million in upgrades.

Other climate adaptation initiatives

- In January 2016, Council adopted the Invasive Species Action Plan in order to “reduce the economic and environmental risks of invasive species in Richmond, which are caused, in part, by climate change and associated ecological shifts that influence the proliferation of invasive species.
- City staff are developing an urban forest management strategy to maximize the multiple benefits that trees provide for Richmond, including local shading and cooling effects that counter urban heat island effects.
- During the August 2018 heat wave and smog event resulting from wildfires in the BC Interior, the City encouraged the use of Richmond community centres, community centres, pools, water parks, libraries and arenas, as clean air cooling stations for residents vulnerable to heat stress and/or respiratory conditions.

² BC Ministry of Environment. *Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use Sea Dike Guidelines* 27 January 2011.

Attachment 4: CleanBC plan

Summary list of CleanBC plan initiatives

CleanBC initiatives by sector

INITIATIVE	DESCRIPTION	GHG Mt In 2030
CLEANER TRANSPORTATION		
Bring down the price of clean vehicles	Just over 20 years from now, every new car will be a zero-emission vehicle	1.3
	<ul style="list-style-type: none"> Mandate 100% of new cars to be zero-emission vehicles (ZEVs) by 2040; 30% ZEV by 2030 and 10% ZEV by 2025. 	
	Help people to afford cleaner cars and save money on gas bills with zero-emission vehicle (ZEV) incentives	0.3
Speed up the switch to cleaner fuels	Make it easier to charge an electric car or fuel a hydrogen car	4.0
	<ul style="list-style-type: none"> Expand the charging network with home, work and public fast-charging stations and additional hydrogen fueling stations Enable private investment in charging and hydrogen fueling infrastructure to get more stations faster 	
	Phase in more renewable fuels for the gas we use	
Get to work on getting rid of gridlock	<ul style="list-style-type: none"> Make our fuel cleaner by increasing the low carbon fuel standard to 20% by 2030 Increase the supply of cleaner fuels by ramping up new production in B.C. of 650 million litres of renewable gasoline and diesel by 2030 Make vehicles run cleaner by increasing tailpipe emissions standards for vehicles sold after 2025 	0.4
	<ul style="list-style-type: none"> Help people get around with a long-term strategy to increase active transportation and look at better commuting solutions. 	
	subtotal	6.0
IMPROVE WHERE WE LIVE AND WORK		
Better Buildings	Make every building more efficient	0.5
	<ul style="list-style-type: none"> Improve the BC Building Code in phases leading up to "net-zero energy ready" by 2032 Adopt the model National Energy Code for existing buildings by 2024 Increase efficiency standards for heating equipment and windows Encourage the development of innovative and cost-effective low-carbon building solutions 	
Support for Better Buildings	Focused investments in public housing to use less energy at home	1.5
	<ul style="list-style-type: none"> \$1.1 B for Capital Renewal fund for public housing to improve living conditions, energy efficiency, and reduce emissions Incentives to make heat pumps affordable and make homes more comfortable through building envelope upgrades Retrofits for public buildings so they use less energy Improve building energy information available to buyers and renters Make residential natural gas consumption cleaner by putting in place a minimum requirement of 15% to come from renewable gas 	
Support for Communities	<ul style="list-style-type: none"> Help remote communities reduce their dependence on diesel Support public infrastructure efficiency upgrades and fuel switching to biofuels with the CleanBC Communities Fund 	
	subtotal	2.0

INITIATIVE	DESCRIPTION	GHG Mt In 2030
CLEANER INDUSTRY		
Ramp up the clean growth program for industry	• Direct a portion of B.C.'s carbon tax paid by industry into incentives for cleaner operations	2.5
Improve air quality by cutting air pollution	• Clean up air pollution in the lower mainland with a pilot project to test options to switch 1,700 freight trucks to natural gas and low or zero-carbon fuel by 2030 • Make heavy-duty vehicles more efficient with fuel efficiency improvements, education on best driving practices	
Reduce emissions from methane	• Reduce methane emissions from upstream oil and gas operations by 45%	0.9
Industrial electrification	• Provide clean electricity to planned natural gas production in the Peace region	2.2
	• Increase access to clean electricity for large operations with new transmission lines and interconnectivity to existing lines	1.3
Carbon capture and storage	• Ensure a regulatory framework for safe and effective underground CO ₂ storage and direct air capture	0.6
Cleaner fuels for industry	• Make industrial natural gas consumption cleaner by putting in place a minimum requirement of 15% to come from renewable gas	0.9
	subtotal	8.4
REDUCE WASTE		
Reduce waste and turn it into a clean resource	• Help communities to achieve 95% organic waste diversion for agricultural, industrial, and municipal waste – including systems in place to capture 75% of landfill gas • Waste less and make better use of it across all sectors of our economy, like forestry, agriculture, and residential areas, including renewing the B.C. Bioenergy Strategy and building out the bioenergy and biofuels cluster	0.7
	subtotal	0.7
HELPING PEOPLE GET THE SKILLS THEY NEED		
Make sure British Columbians can lead the clean transition	• Develop programs like Energy Step Code training and certification, and Certified Retrofit Professional accreditation • Expand job training for electric and other zero-emission vehicles	
MEASURING OUR PROGRESS		
Establish credible targets and a strategy to meet them	• Roll-out associated programs and enabling legislation for CleanBC	
Stay accountable	• Coordinate implementation and reporting for CleanBC	
Carbon pricing	• Grow the carbon tax \$5.00 per year 2018 to 2021 to encourage lower emission alternatives, with rebates for low and middle income British Columbians and support for clean investments	1.8
	subtotal	1.8
2018 CleanBC TOTAL REDUCTIONS		18.9
<i>The legislated target for 2030 is a reduction of 25.4 Mt GHG from a 2007 baseline</i>		

* Policy line items represent individual reduction potential estimates. Subtotals and totals are derived from combined modeling and may be lower than the sum of policies because of policy interactions (two policies contribute to the same reduction)

Download the *CleanBC Summary Report* (16 pages) here:

https://cleanbc.gov.bc.ca/app/uploads/sites/436/2018/12/CleanBC_Highlights_Report.pdf

Attachment 5: IPCC Special Report on Global Warming of 1.5 °C

Abstract

Ninety-one authors and review editors from 40 countries prepared the IPCC *Special Report on Global Warming of 1.5°C* in response to an invitation from the United Nations Framework Convention on Climate Change (UNFCCC) when it adopted the Paris Agreement in 2015. This report highlights a number of climate change impacts that could be avoided by limiting global average warming to 1.5°C rather than 2°C or more. The report also states the global emission reduction targets necessary to limit average global warming to 1.5°C above pre-industrial levels.

The IPCC report states that the world has already warmed by 1°C since pre-industrial times due to human activity. Global average warming is likely to increase past the 1.5°C mark between 2030 and 2052, even if decisive action is taken on limiting GHG emissions. Continental land masses are warming faster than the oceans and the Arctic is warming at 2-3 times the global average rate.

The IPCC report states that the world is already committed to further warming and sea level rise because of the significant lag between the emission of greenhouse gas emissions and their effect on the climate. The IPCC also notes that total GHG emissions *to date* are unlikely to tip temperatures over the 1.5°C threshold, and that there is a small remaining GHG emission “reserve” that can still be expended even if the global community is to achieve a 1.5°C target, but global GHG emissions will need to reach net zero by 2050 and remain at (or below) net zero levels if we are to stabilise temperatures at the 1.5°C target. The amount of warming is ultimately determined by how long it takes to get to net zero. Given the limited time and remaining GHG “reserve” now available, reducing net GHG emissions to zero will likely involve removing carbon dioxide from the air and sequestering it.

The IPCC has produced global GHG emissions scenarios, differentiated by the level of additional human-caused GHGs emitted. The IPCC’s “RCP2.6” scenario results in approximately 1.5°C of warming by mid-century, with most global climate change impacts either stabilizing or declining slightly after this time. The “RCP4.5” scenario results in approximately 2.0°C of global average warming with temperatures stabilizing by 2100, although the magnitude of climate change impacts continues to increase to the end of the century. The impact of possible positive feedback effects such methane releases from melting permafrost, increased forest and/or peatland wildfire, and ice shelf and/or ice cap collapse are not captured in these scenarios.

Download the IPCC *Special Report on Global Warming of 1.5 °C – Summary for Policymakers* (26 pages) here: https://cleanbc.gov.bc.ca/app/uploads/sites/436/2018/12/CleanBC_Highlights_Report.pdf

Attachment 6: Global and regional projected impacts of climate change

The IPCC *Special Report on Global Warming of 1.5 °C* includes descriptions of climate change impacts projected to result from 1.5°C and 2°C of global average warming. These projections are inherently generalized, whereas the specific impacts of climate change impacts in a given location will be influenced by local geography.

In 2016 the Pacific Climate Impacts Consortium (PCIC) at the University of Victoria completed the *Climate Projections for Metro Vancouver* report for the Metro Vancouver Regional District. This PCIC report documents the results produced by “downscaled” climate models that translate the outputs from the IPCC’s low-resolution global-scale climate models into high-resolution projections at the local scale, providing insight into possible local impacts of the global warming scenarios referenced by the IPCC report. The PCIC report provides regional projections of climate change impacts derived from the IPCC’s 1.5 °C, 2 °C and 4 °C scenarios of global average warming, for both the 2050s and the 2080s. All results are compared against actual 1970-2000 averages for the Metro Vancouver region. The impacts of possible positive feedback effects are not included in these findings.

Heat waves

Projected global impacts: The IPCC report projects that globally there will be worse heat waves at 2°C compared to 1.5°C.

Projected regional impacts: Within Metro Vancouver, PCIC projects the following:

- During 1971-2000, an average of 22 summer days had daytime maximum temperatures above 25°C. In the 1.5 °C global average warming scenario, this increases to an average of 40 days during the 2050s, as compared with 53 days (i.e. seven and half weeks) above 25°C during the 2050s under the 2 °C scenario.
- Under the 1.5 °C scenario, the 1-in-20-year hottest day is projected to increase by 2.1 °C to 36.1 °C, and by 2.5 °C to 36.6 °C in 2050s and 2080s respectively. Under the 2 °C scenario, the net gain increases by about 50%, so that 37.3°C and 38.1°C are projected for the 2050s and 2080s respectively.
- “Tropical nights,” in which nighttime low temperatures remain above 20 °C (and opening windows at nighttime becomes ineffective as a means of cooling off), are also projected for the region. On average, Metro Vancouver experienced less than one regional average nighttime low above 20°C during 1970-2000. However, the region is projected to have 20 tropical nights on average by the 2050s even under the 1.5°C scenario, although this frequency declines somewhat by the 2080s as the climate re-stabilizes. Under the 2°C scenario, 28 tropical nights are expected in our region by the 2050s, climbing to 34 nights (i.e. more than a month’s worth) in the 2080s.

Drought

Projected global impacts: The IPCC report projects that globally there will be worse drought at 2 °C compared to 1.5 °C.

Projected regional impacts: Within Metro Vancouver, PCIC projects the following:

- The regional climate projections indicate a modest increase in total annual precipitation under both 1.5°C and 2.0°C scenarios. Both scenarios show a shift towards wetter fall-spring periods, which is partially offset by dryer summers. Precipitation increases mostly during the fall for both the 1.5 °C and 2.0 °C scenarios. The biggest declines in summertime precipitation are forecast for the 2 °C scenario.
- The projected average duration of summertime dry spells will increase from the 1971-2000 average of 21 days. Under the 1.5 °C global average warming scenario, the average summertime dry spell lengthens modestly to 25 days in 2050s and 24 days in 2080s. Under the 2°C warming scenario, the average length of dry spells increases dramatically to 37 days in the 2050s and 42 days in 2080s. In combination with projections of reduced snowpack in the mountains (not modelled by PCIC for these scenarios), these precipitation trends suggest that Metro Vancouver drinking water supplies will face increased pressures during the summer months for all climate scenarios. The most severe drought impacts are projected for the 2 °C global average warming scenario.

Precipitation

Projected global impacts: The IPCC report projects that around the globe, there will be increased flooding with 2 °C of global average warming compared to 1.5 °C.

Projected regional impacts: Within Metro Vancouver, PCIC projects that there is likely to be a shift towards an increased intensity, duration and frequency of precipitation events. Depending on topography, these shifts can result in increased flooding risk. Within the drinking water supply areas of Metro Vancouver, increased rainfall intensity can exacerbate landslides and turbidity events in the reservoirs.

Richmond's drainage system is designed to accommodate a 1-in-10-year storm event. While there have been some minor instances of surface ponding in low-lying properties caused by flooding during heavy rainstorms that exceeded 1-in-10-year storm events, the flat topography of Richmond has helped to protect the City during these extreme precipitation events, as there is no rapid concentration of above-ground stormwater flow into "flash floods". Extreme precipitation events observed to date have been highly localized, affecting only a portion of the City's stormwater collection system. New drainage pump stations are designed such that there is adequate stormwater pumping capacity on a city-wide basis to respond to these events. With continued capital improvements supported through the City's diking and drainage utility, capacity within Richmond's stormwater system (and particularly in Richmond's open watercourses) will continue to protect local residents from flooding impacts for the coming century under either the 1.5 °C or 2.0 °C climate future.

Sea Level Rise and Freshet Flooding

Projected global impacts: The IPCC report projects a global average rise in sea level of 0.26 to 0.77 m by 2100 (relative to average sea levels in 1986-2005) with 1.5°C of global warming. This is 10cm less that would be experienced with 2 °C of global average warming. The report also states that “sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (high confidence).” Text in the full IPCC report suggests that if destabilization of polar ice sheets is avoided, global average sea levels could regain equilibrium after a rise of “0.5–1.2 m and 0.6–1.7 m in 1.5°C and 2°C warmer worlds, respectively.”¹ However, “marine ice sheet instability in Antarctica and/or irreversible loss of the Greenland ice sheet could result in multi-metre rise in sea level over hundreds to thousands of years,” and that “these instabilities could be triggered at around 1.5°C to 2°C of global warming (medium confidence).”²

Projected regional impacts: The *Climate Projections for Metro Vancouver* report does not include a downscaled projection of sea level rise for Metro Vancouver, but in 2018 the Washington Coastal Hazards Resilience Network produced sea level rise projections to 2150 for more than 100 locations on the coast of Washington State, for both the 2°C global average warming and 4°C global average warming scenarios.³ The projections for Point Roberts (the closest modelled location to Richmond) show mid-range sea level rise estimates of 1.3 ft. (40 cm) and 1.8 ft. (55 cm) by 2100 under the 2°C and 4°C scenarios respectively, with 3% and 9% respective probabilities of sea level rise exceeding 0.91 m (3ft).⁴

As noted in Attachment 4 below, the City is implementing the *Dike Master Plan*, which provides full protection against 1 metre of sea level rise, and can accommodate up to 1.7 metres of sea level rise. As such, work already underway is sufficient to protect Richmond against projected local sea level rise out to 2100. If climate change is successfully limited to 1.5 °C of global average warming, no further adaption to sea level rise should ever be needed beyond ongoing maintenance of the adaptation already underway.

Climate change is also projected to result in a more rapid snowmelt period earlier in the year, producing an increased risk of flooding during freshet of the Fraser River. This potential impact is also explicitly addressed through the Richmond’s *Flood Protection Strategy* and *Dike Master Plan*.

¹ IPCC, *Impacts of 1.5°C of Global Warming on Natural and Human Systems*. Chapter 3, p.271

² IPCC, *Global warming of 1.5°C. Summary for Policymakers*. B2.2, p.9

³ i.e. downscaled projections of the IPCC’s RCP4.5 and RCP8.5 scenarios respectively. This work did not include projections based on the RCP2.5 scenario that results in 1.5 oC of global average warming.

⁴ Under the 2°C scenario, the same study estimates the 1% and 0.1% risk of sea level rise as 1.43m and 2.44m respectively, implying that sea level rise in 2100 at the 0.5% or 1-in-200 risk level would be (somewhat less than) 1.93m, likely exceeding the maximum 1.8m increase in dike levels currently allowed for. However, if this magnitude of sea level rise was experienced by 2100, sea level rise would almost certainly continue at a similar pace after 2100, making any additional raising of dike levels useful only for a limited period of time.

Attachment 7: Estimated Richmond community GHG emissions: 2007 – 2016

