metrovancouver



Buildings

Discussion paper to Support *Climate 2050* and *Clean Air Plan*

Reducing emissions and increasing climate resilience for buildings in the Metro Vancouver region over the next 10 to 30 years

December 2019

SERVICES AND SOLUTIONS FOR A LIVABLE REGION

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Table of Contents

Introduction 1

Planning for the Future 1

Meeting Long-term Targets for the Region 2

Climate Change Targets 2

Air Quality Targets 3

We Need Your Feedback 3

Regional Buildings Emissions and Air Quality 5

Emission Sources and Trends 5

Current Actions to Reduce Buildings Emissions 6

Our Emissions Reduction Opportunity 9

Discussion: Reducing Buildings Emissions 10

Proposed Long-term Goal for Buildings Emission Reductions 10

Example Buildings Emission Reduction Targets 10

Example Building Emission Reduction Actions 11

Potential Big Ideas for Buildings Emission Reductions 12

Regional Buildings Adaptation to Climate Change 14

Expected Climate Hazards and Impacts 14

Current Actions to Adapt Buildings to Climate Change 14

Our Adaptation Opportunity 15

Discussion: Adaptation 16

Proposed Long-term Goal for Buildings Adaptation 16

Example Buildings Adaptation Metrics 16

Example Buildings Adaptation Actions 16

Potential Big Ideas for Buildings Adaptation 18

Feedback and Engagement Process 19

Participation Opportunities 19

How Feedback Will Be Used 19

Glossary 20



Residential wood smoke

Introduction

Planning for the Future

Climate 2050 and the *Clean Air Plan* will be the key climate change and air quality planning documents for Metro Vancouver to support a transition to a carbon neutral and resilient region, while continuing to improve air quality to protect public health and the environment.

Climate 2050 is an overarching long-term strategy that will guide our region's policies and collective actions to transition to a carbon neutral and resilient region over the next 30 years. Metro Vancouver is implementing *Climate 2050* through 10 issue area *Roadmaps* (see Figure 1 on next page), which will describe how the region can reduce greenhouse gas emissions and adapt to climate change impacts. Implementation of the *Roadmaps* will be driven by Metro Vancouver's management plans and other policies, including the *Clean Air Plan*.

Underlined words are key concepts and are defined in the Glossary on page 19.

Key questions for feedback are marked with ?

The *Clean Air Plan* is the near-term action plan that will set Metro Vancouver's direction for air quality and greenhouse gas management for the next 10 years. The Plan will outline actions to reduce emissions of air contaminants, including greenhouse gases, from all regional sources. The *Clean Air Plan* will primarily be organized around six issue areas (see Figure 1 on next page).

This discussion paper is about the **buildings** sector, and is intended to promote discussion and enable feedback that will be used in the *Clean Air Plan* and the *Climate 2050 Buildings Roadmap*. The feedback will also inform other planning documents such as *Metro 2050* (the update to the regional growth strategy) and Metro Vancouver's corporate operations. (More information on the relationship between the *Clean Air Plan*, *Climate 2050* and the associated discussion papers is available in the *Clean Air Plan Backgrounder*.[1])

[1] Visit www.metrovancouver.org and search "Clean Air Plan Backgrounder."

Meeting Long-term Targets for the Region

Metro Vancouver, together with its member jurisdictions, has been taking action on air quality and greenhouse gases for decades. But actions must be accelerated to reduce our impacts on global climate change, and to protect public health and the environment. The region also needs to adapt to the anticipated impacts from a changing climate.

There is significant overlap between the sources of greenhouse gases and common air contaminants, so actions that address emissions reductions to protect public health can often (but not always) reduce greenhouse gases, and vice versa. Metro Vancouver aims to maximize co-benefits by focusing on policies and programs that reduce both greenhouse gases and common air contaminants.

Climate Change Targets

Climate change is directly associated with greenhouse gases, primarily carbon dioxide. While emissions are global, we all have a shared responsibility to take local action. The major sources of greenhouse gases in this region are transportation, buildings and industry, with smaller contributions from waste and agriculture. Climate change projections for this region by the year 2050 include longer, hotter and drier summers, warmer and wetter fall and winter seasons with decreased snowpack, and more extreme weather.

Metro Vancouver has adopted the following regional climate change targets:

1. reduce regional greenhouse gas emissions by 45% from 2010 levels by 2030;
2. become a carbon neutral region by 2050; and
3. ensure our infrastructure, ecosystems, and communities are resilient to the impacts of climate change.



Figure 1: Issue areas for *Climate 2050* and *Clean Air Plan*; overlapping issue areas are highlighted in blue.

Although the region has made progress over the past 15 to 20 years, we need to accelerate our climate actions to meet these targets and avoid dangerous impacts of climate change. More information on climate change in our region is available on the *Climate 2050* website.[2]

We need to accelerate our climate actions to meet these targets and avoid dangerous impacts of climate change.

Air Quality Targets

Health researchers have found that there are no known safe levels for some common air contaminants, including fine particulate matter, ground-level ozone and nitrogen dioxide. Health Canada estimates that at least 1,600 British Columbians die prematurely every year due to common air contaminants and many more live with the associated health effects.[3]

As part of the *Clean Air Plan*, Metro Vancouver has proposed two new regional air quality targets for 2030:

1. ambient air quality in the region meets or is better than ambient air quality objectives and standards set by Metro Vancouver, the BC Government and the Government of Canada; and

2. increase the amount of time that visual air quality is classified as excellent.

Please consider if these are the right air quality targets for the region.

Residents in the region generally experience good air quality, but additional emission reduction actions are needed to continue protecting human health and the environment.

More information on the health and environmental impacts of air contaminants is listed in the *Glossary* (page 19) and on the Metro Vancouver website.[4]

Additional emission reduction actions are needed to continue protecting human health and the environment.

We Need Your Feedback

The purpose of this buildings discussion paper is to enable feedback on the key air quality and climate change issues facing buildings in the region and the ways in which we can reduce emissions and adapt this region's buildings sector to a changing climate. This discussion paper is intended for the public, stakeholders and other governments, including First Nations.

The goals, metrics, targets, and actions identified herein are considered potential opportunities for the region's buildings sector. We must take action to reduce building emissions and ensure buildings are resilient to a changing climate, and we need your help to figure out the best way forward.

[2] *Climate 2050* website. http://www.metrovancouver.org/climate2050
[3] Health Canada, 2019. Health Impacts of Air Pollution in Canada. http://publications.gc.ca/site/eng/9.874080/publication.html
[4] Visit www.metrovancouver.org and search "Air Quality and Climate Change Basics."



Brock Commons, University of British Columbia
Photo courtesy of www.naturallywood.com

Climate change and degraded air quality impact some neighbourhoods, households and individuals more than others. Also, some households are better able to prepare for and protect themselves from climate change and air quality impacts. A priority of both the *Clean Air Plan* and *Climate 2050* is to incorporate the voices and needs of a full range of communities into program and policy design to ensure that fairness and equity are reflected in the actions that Metro Vancouver implements or advocates for. Policies and programs that reduce emissions should support an equitable distribution of benefits and costs, such as increased economic opportunities in a low emission and carbon neutral economy, affordable housing and more diverse transportation options. Issues of intergenerational equity will also be considered.

Specific opportunities to provide feedback are described under *Feedback and Engagement Process*, on page 18.

Linkages to Other Issue Areas

There are many linkages between buildings and other issue areas. Metro Vancouver is exploring which linkages must be considered when developing policies and actions. Some of the related issue areas for buildings include:

- **Waste** – consideration of embodied emissions and final disposal of building materials;
- **Land-use and growth management** – policies that determine the form and location of buildings in the region influence emissions and resilience of buildings;
- **Energy** – availability of clean, renewable energy for use by buildings; and
- **Industry** – emissions produced in the construction and demolition of buildings.

These issues will be explored in discussion papers of their own. As papers are developed, they will be made available on the Metro Vancouver website.[5]

[5] Visit www.metrovancouver.org and search “Clean Air Plan” and “Climate 2050.”

Regional Buildings Emissions and Air Quality

Emission Sources and Trends

The energy we use to heat and cool our buildings is the source of roughly one quarter of the greenhouse gas (see Figure 2) and fine particulate matter emissions and 9% of the emissions of nitrogen oxides in this region.[6] Emissions from buildings occur when space and water heating appliances burn fuels such as natural gas, wood and fuel oil. Emissions are generally higher from older equipment, and from buildings with less insulation, older windows and no draft protection.

The main source of greenhouse gas and nitrogen oxides emissions from buildings in the region is natural gas heating (see Figure 3 on next page), which is projected to increase in the future. Fine particulate matter emissions are largely from wood burning in homes. There are also greenhouse gas emissions associated with the generation of electricity used in buildings.[7]

The most effective approaches to reduce emissions from buildings are improving energy efficiency and transitioning to clean, renewable energy sources to heat our new and existing buildings.

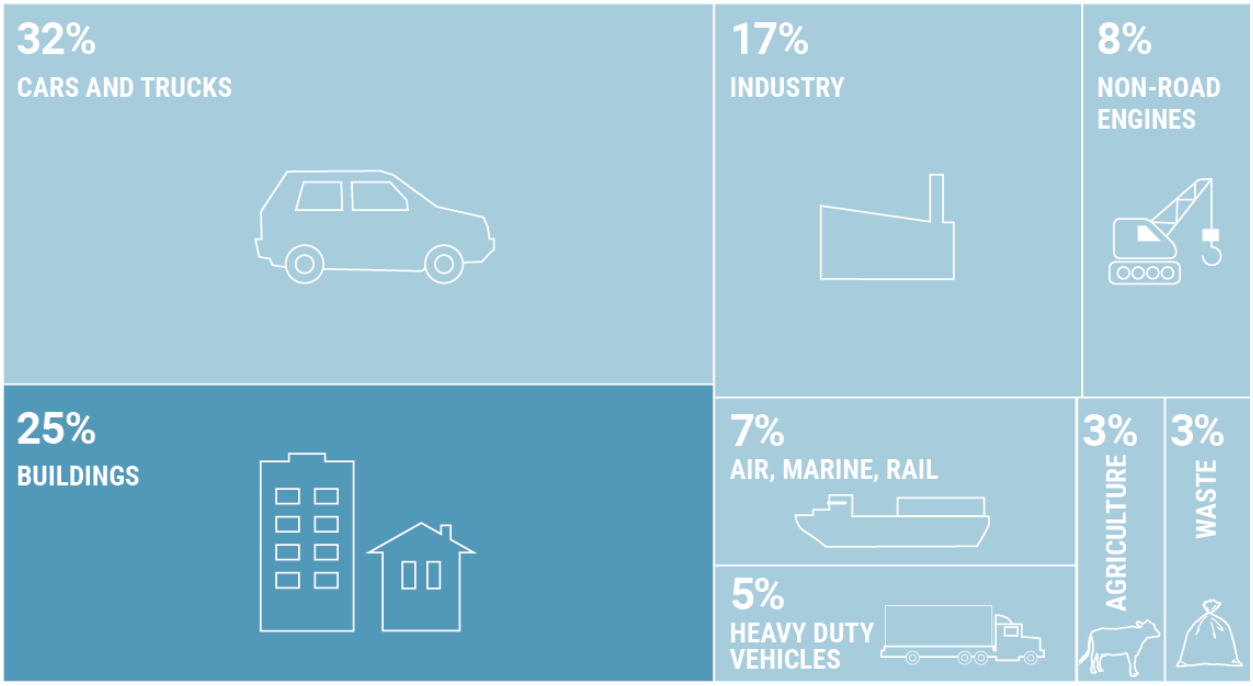


Figure 2: Contribution of different emission sources to total regional greenhouse gas emissions. Emissions from buildings are shown in dark blue.

[6] Emission estimates are from Metro Vancouver's 2015 regional emissions inventory, completed in 2017, which describes the types and amounts of air contaminants, including greenhouse gases, emitted in the region. http://www.metrovancouver.org/services/air-quality/emissions-monitoring/emissions/emission-inventories

[7] Electricity emissions are not currently captured in the regional emissions estimates because the emissions are not generated within our region.

Current Actions to Reduce Buildings Emissions

Metro Vancouver, with its member jurisdictions and other regional partners, has been taking action to reduce emissions from buildings for more than a decade. Some key current actions on buildings in our region are outlined below.

(Additional information on the actions are listed in the web links shown.)

1. The **BC Energy Step Code** allows local governments to set increasingly stringent energy efficiency requirements for new construction, leading to net-zero energy ready buildings by 2032 (BC Government, adopted by over half of Metro Vancouver's municipalities).

2. **Sustainable Infrastructure and Buildings Policy** sets stringent sustainable design and construction standards to make Metro Vancouver's infrastructure and buildings among the most sustainable in the region (Metro Vancouver).

3. **Net Zero Council** supports members' voluntary adoption of net-zero energy homes (Canadian Home Builders Association).

4. **Passive House and BC Energy Step Code training** and **outreach** to the construction and renovation industries through effective partnerships with the local and BC governments, utilities, non-profits and interest-groups (local governments, industry associations, academic institutions and non-profits).

5. **CleanBC Better Homes** and **Better Buildings** programs provides information and energy coaching for residents and businesses to access available incentives and rebates for energy efficient, low emission products and services like heat pumps, windows, insulation and home energy evaluations (BC Government).

6. ***Boilers and Process Heaters Emission Regulation*** regulates common air contaminant emissions from larger boilers used for space and water heating (Metro Vancouver).

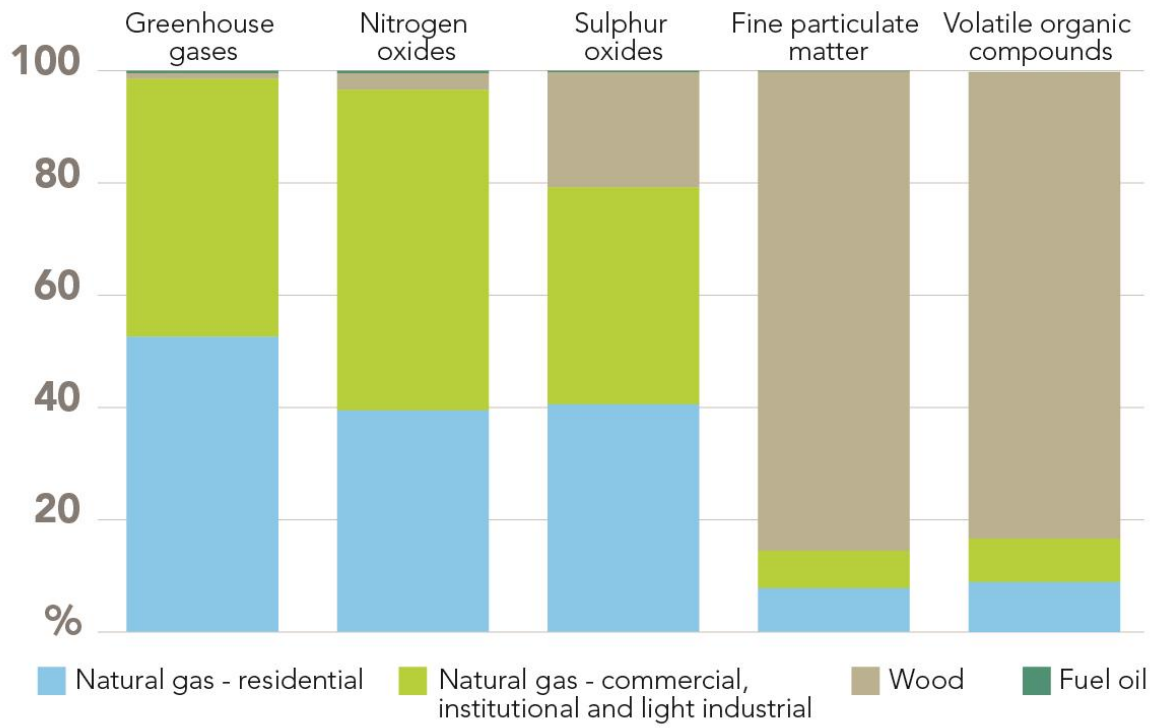


Figure 3: Contribution of building and fuel types to different air contaminants.

7. **RateOurHome.ca** and **Strata Energy Advisor** provide education, outreach and information to residents, realtors and builders on the value of home energy labelling and building retrofits, which reduce emissions (Metro Vancouver).

8. **Disclosure of home energy labels** to local governments is required for new home construction in some local municipalities to help ensure that existing buildings are performing at or above minimum requirements (Burnaby, Richmond, Surrey, New Westminster, Vancouver).

9. **Large scale retrofits** or retro-commissioning and optimization of building controls of major facilities (District of North Vancouver, Vancouver, Surrey).

10. **Energy and emissions retrofits for affordable housing**, including the installation of 32 high efficiency heating and cooling systems in Metro Vancouver Housing properties since 2016, to reduce fossil fuel consumption, energy costs and emissions (Metro Vancouver).

11. **Wood Stove Exchange Program** offers rebates to replace older wood burning appliances with cleaner, high efficiency appliances (Metro Vancouver and partners).

12. **Restrictions on emissions from wood burning appliances** prohibit open masonry fireplaces in new construction and set emissions limits for new residential wood burning appliances, to reduce wood smoke (Vancouver).

13. ***Solid Fuel Burning Domestic Appliance Regulation*** specifies the type of wood burning appliances that can be sold in BC, to reduce wood smoke (BC Government).

Roles and Responsibilities in Buildings Emission Reductions

Metro Vancouver is responsible for managing and regulating air contaminants in the region under authority delegated by the BC Government in the *Environmental Management Act*. Under its delegated authority, Metro Vancouver manages air quality and greenhouse gases in the region, including emissions from buildings.

Metro Vancouver has additional roles in the region that impact emissions from buildings.

- *Metro Vancouver 2040: Shaping our Future*, the regional growth strategy, includes a goal to create compact, complete communities that include building types (e.g., townhouses and apartments) that typically emit less greenhouse gases and common air contaminants per dwelling unit.
- Metro Vancouver Housing provides more than 3,400 safe and affordable housing units to individuals and families across the region.
- Metro Vancouver's utilities (Water Services, Solid Waste and Liquid Waste), Regional Parks and Metro Vancouver Housing work to continue reducing emissions from their buildings.

Air quality management and climate action requires close coordination between all levels of government, businesses, utilities, institutions and residents. The roles of key partners in reducing buildings emissions are outlined below.

- **Government of Canada** and **BC Government** set building codes, including energy performance requirements, and emission standards for home heating appliances.
- **Local First Nations** operating under a Treaty or Land Code can set land use and buildings policies that influence the type and location of homes and buildings constructed in their communities.
- **Municipalities** set zoning requirements that influence the type and location of homes and buildings constructed in their communities, and enforce building codes.
- **Energy utilities** and all levels of government provide incentives to owners to reduce emissions and energy consumption, and training to industry to improve construction, installation and building operation practices.
- **Academic institutions, non-profits** and other organizations provide education, training and advocacy to individuals, trades and others.
- **Local businesses** develop and deliver many of the services and solutions to reduce emissions from the buildings sector.
- **Metro Vancouver residents** heat and cool their homes, and make decisions about energy upgrades and where to live, all of which impacts emissions.

Our Emissions Reduction Opportunity

Buildings can last a long time—50 years or more—so decisions that we make now about design, construction, retrofit and operation will determine the amount of emissions they create for decades. At the community scale, zoning and land-use decisions that increase density can reduce buildings emissions since multi-unit buildings usually require less energy per occupant to heat and cool, which reduces emissions. However, increasing building density will occur over decades.

New building construction techniques lead to better insulated and sealed buildings, which improve comfort and health while also reducing emissions of greenhouse gases and common air contaminants. These buildings can also provide better protection against the effects of wildfire smoke and heat waves.

Ultimately, improving energy efficiency and transitioning to clean, renewable energy sources to heat our new and existing buildings are the most effective ways to reduce our emissions and achieve regional greenhouse gas and air quality targets.

Transitioning to Clean, Renewable Energy

Achieving significant emission reductions will mean switching from fossil fuels to clean, renewable energy, which is low or zero emission energy that is replenished over days or years.

In Metro Vancouver, clean, renewable energy will be primarily electricity from renewable sources such as hydro or solar power. Other forms of renewable energy, such as wood waste, biofuels, and renewable natural gas, have a lower carbon footprint than comparable fossil fuels and are expected to support a transition to a carbon-neutral region. However, they still produce emissions of common air contaminants, which have potential negative impacts for public health and the environment.

Discussion:
Reducing Buildings Emissions

The following sections outline proposed goals, example targets, example actions, and potential Big Ideas to reduce buildings emissions.

Proposed Long-term Goal for Buildings Emission Reductions

Long-term goals describe a desired future state for low emission and carbon neutral buildings, with expected achievement in 2050 and beyond. Long-term goals will help identify and prioritize new actions to achieve the deep emissions reductions required from the buildings sector.



Please consider the following long-term goal proposed for buildings in our region. Will this goal help us reach our vision for the region?

1. **All buildings are zero emissions from heating and cooling.**

Example Buildings Emission Reduction Targets

Near-term targets are milestones to support achievement of the long-term goal and will be included in the *Climate 2050 Buildings Roadmap* and the *Clean Air Plan.*



Please consider the following near-term targets from other jurisdictions. Are any of these the right milestones to help us reach our long-term goal? What should our near-term targets look like?

(Additional information on the targets is listed in the web links shown.)

By 2025:

1. All new replacement heating and hot water systems will be zero emissions (Vancouver)

By 2030:

2. Zero net greenhouse gas standards in all new buildings (Vancouver, Toronto, Montreal and 22 other cities around the world)
3. 40% reduction in greenhouse gas emissions from large buildings (New York City)
4. 30% reduction in energy use of all buildings built before 2010 (Boulder)

By 2050:

5. Zero net greenhouse gas standards in all buildings (Vancouver, Toronto, Montreal and 22 other cities around the world)
6. 75% reduction in energy use of all buildings built before 2010 (Boulder)
7. All buildings are powered by renewable energy (Victoria, Vancouver)

Example Building Emission Reduction Actions

Actions are the policies and programs, including regulations, incentives and educational outreach campaigns, that will lead to emission reductions. Actions will be included in the *Clean Air Plan* and the *Climate 2050 Buildings Roadmap*. In addition to existing actions (see page 6) we need new actions to address the many opportunities we have to further reduce emissions and meet our near- and long-term targets.



Please consider the following actions from other leading jurisdictions, which show a range of actions that could be implemented to reduce emissions. Could any of these help us further reduce emissions to reach our goal? What should new, additional actions look like?

(Additional information on the actions is listed in the web links shown.)

1. **Mandatory home energy labelling** and disclosure at point of listing or sale to protect homebuyers and drive energy retrofits of existing buildings (Portland, Austin).

2. **Solar panel bulk buy** reduces renewable energy installation costs for community members (Sunshine Coast).

3. **Warm Homes on Prescription** provides energy upgrades to homeowners to improve health conditions and reduce hospital and doctor visits, funded by health care providers and government (United Kingdom).

4. **Performance requirements** for ultra-low nitrogen oxides emissions from boilers (Texas, New Jersey).

5. **Mandatory building energy operation and maintenance "tune-ups"** to reduce energy and emissions (Seattle, New York).

6. **Strategic financing tools** for building energy and emission retrofits accessible to households and building owners, including rental properties (Alberta, California).

7. **Tokyo Cap-and-Trade Program** requires large buildings and some industrial facilities to meet greenhouse gas emission reduction targets or purchase credits from others (Tokyo).

8. **Winter Spare the Air Program** restricts wood burning during degraded air quality periods (San Francisco area).

9. **Incentives for replacing wood burning appliances** for low-income households (Washington, Montana).

Potential Big Ideas for Buildings Emission Reductions

To achieve a cleaner, healthier, more equitable future, we need to think big and act quickly. Metro Vancouver has identified several **Big Ideas** to accelerate emission reductions. The Big Ideas were selected for different reasons, including potential for significant reductions of air contaminant emissions (including greenhouse gases), ease of implementation or their foundational nature (i.e., they are needed to support other actions). The Big Ideas are generally examples from other leading jurisdictions around the world.

Please consider the following Big Ideas. Could any of these help us drive significant emission reductions to reach our goal? What other Big Ideas should Metro Vancouver consider?

Big Idea 1: *Electrify buildings to achieve zero emissions*

The BC Energy Step Code (see page 6) and municipal requirements could be utilized to further limit greenhouse gas and common air contaminant emissions from heating systems by requiring electric heat instead of natural gas. BC's clean hydroelectric power produces significantly less greenhouse gases than natural gas, as shown in Figure 4.

For example, a single family home constructed to Step 5—using natural gas for heating—would achieve a 50% reduction in greenhouse gas emissions. By using electricity for heating, even a Step 1 home would achieve at least a 90% reduction in greenhouse gas emissions and completely eliminate common air contaminant emissions.[8]

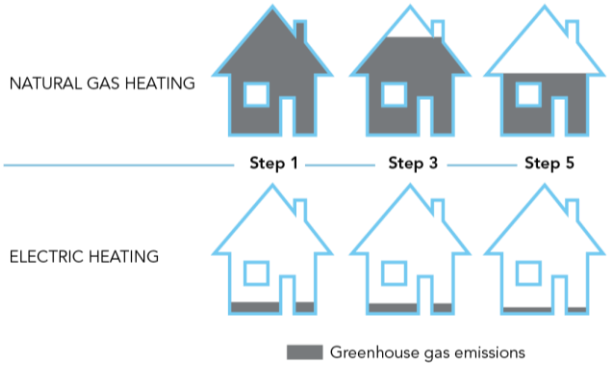


Figure 4: Greenhouse gas emissions by heating type and energy step.

Some local governments have taken steps to provide builders with optional low carbon Step Code pathways, but zero emission new buildings must become business as usual for this region to become carbon neutral. Together with the BC Government, member jurisdictions and other interested parties, Metro Vancouver will explore the best approaches to accelerate the transition to electric heating in new buildings in the region.

The BC Government has started a process to develop and implement a retrofit code for existing buildings, which should be completed by 2024. Similar to the Step Code, the retrofit code is a critical opportunity to drive greenhouse gas emission reductions in existing buildings through increased electrification of space and water heating.

[8] BC Housing, 2018. 2018 Metrics Research. www.energystepcode.ca/app/uploads/sites/257/2018/09/2018-Metrics_Research_Report_Update_2018-09-18.pdf Greenhouse gas emissions derived assuming medium single-family dwelling in Metro Vancouver, comparing natural gas against electric resistance heating.

***Big Idea 2**: Restricting residential wood burning to protect human health*

Wood burning in a fireplace may feel cozy and romantic, but indoor residential wood burning is responsible for more emissions of fine particulate matter than any other single source in the region.

Following extensive public consultation, Metro Vancouver is developing a regulation to minimize the contribution of residential wood smoke to regional fine particulate matter emissions and reduce localized exposure risks.

***Big Idea 3:** Reducing emissions from existing buildings through benchmarking and performance requirements*

Building benchmarking and performance requirements are effective approaches to reduce emissions and are used in more than 30 jurisdictions across North America.

Through these programs, building owners report energy use and emissions information at a building level. Publicly available information on buildings allows owners, residents and businesses to make more informed decisions around buying, renting, and managing existing buildings based on the energy and emission costs and impacts.

Performance requirements go a step further than just reporting energy use – buildings must meet energy performance targets, which can be tightened over time. In April 2019, New York City adopted requirements for buildings over 25,000 square feet to cut greenhouse gas emissions by 40% by 2030 and more than 80% by 2050. This is the most ambitious carbon reduction requirement for buildings in North America.

Metro Vancouver will study these world-class initiatives further. With a clear market signal about benchmarking and performance objectives in this region, Metro Vancouver could work constructively with the public, stakeholders and other levels of government, to make our large buildings low carbon and resilient.



Edmonds Town Centre, Burnaby

Regional Buildings Adaptation to Climate Change

Expected Climate Hazards and Impacts

Buildings provide spaces for shelter, comfort, productivity and recreation. They are where we spend most of our time. The location and design of new homes, businesses and institutions influences exposure to the hazards associated with climate change. In 2050, low carbon and resilient buildings will be standard practice. Today, many of our buildings will require changes to adapt to the following climate hazards (and associated impacts):

- **severe wildfire seasons** are expected to increase, leading to elevated levels of fine particulate matter (and other air contaminants) and periods of degraded air quality that contribute to negative health impacts;
- **heat waves** are expected to increase in frequency, duration and intensity that will disproportionately impact the region's most vulnerable populations, in addition to increasing cooling energy demands for buildings;
- **severe weather** such as more intense rainfall and storms, which can lead to localized flooding, power failures and service disruption;
- **seasonal water shortages** are expected to increase in frequency due to rising temperatures and changes in precipitation and snowfall; and
- other hazards include **flooding**, **sea level rise** and **storm surges**.

Current Actions to Adapt Buildings to Climate Change

Metro Vancouver and its member jurisdictions have been working toward reducing the region's vulnerability to climate change hazards through adaptation actions. Some proposed, planned and current adaptation actions for buildings in this region are listed below.

(Additional information on the actions are listed in the web links shown.)

1. **Extreme weather response shelters** to reduce safety and health risks of vulnerable populations due to severe weather (Vancouver).
2. **Accounting for climate vulnerabilities and risks in capital planning and asset management** to ensure all new and retrofitted infrastructure is adapted to future climate conditions to the end of its expected lifespan (City of North Vancouver, Vancouver, Metro Vancouver).
3. **Establish respite areas** equipped with portable high-efficiency particulate air (HEPA) filters for the public to access during periods of degraded air quality due to wildfires (Vancouver).
4. **Expand district energy systems** in order to advance energy self-sufficiency within the community (Surrey, Richmond, Burnaby, City of North Vancouver).
5. **Education and incentive programs** to encourage more resilient choices for the design, maintenance, and renewal of buildings (District of North Vancouver).
6. **Advocate that the BC Government** ensure the BC Building Code adequately accounts for current and projected climate conditions (Surrey).
7. **Reduce per capita water use in buildings** through water efficient fixtures, water metering, rain barrels and other greywater use (City of North Vancouver).

8. **Update design standards** to include passive design strategies to maintain occupant comfort and minimize energy use (Vancouver).

9. **Update** flood level standards for buildings to reflect increasing risk in flood-prone areas (various local municipalities).

10. **Support the development of the** Lower Mainland Flood Management Strategy led by the Fraser Basin Council (various local municipalities).

Roles and Responsibilities in Buildings Adaptation to Climate Change

Across the region, many different organizations are taking early action to understand and act upon key areas of vulnerability, but everyone has a role to play in preparing for a changing climate. Regional adaptation initiatives will require the cooperation and support of all levels of government, as well as residents, landlords, property managers and related businesses. As the regional government, Metro Vancouver can act as a regional forum in facilitating collaboration with local municipalities and other organizations to create efficiencies and improve alignment of adaptation strategies and actions.

Metro Vancouver also owns and operates a wide variety of buildings, including administration buildings at wastewater and water treatment plants, rental housing units, nature centres and heritage buildings at regional parks, and our head office building. Metro Vancouver is actively undertaking climate adaptation projects within its own operations to ensure we maintain critical services during severe weather and other significant disruptions.

Our Adaptation Opportunity

By proactively adapting our buildings to climate change and incorporating climate risk into land use planning, we can significantly reduce the health and safety risks, as well as severe financial losses. When planned effectively, certain adaptation actions can also reduce greenhouse gas emissions thereby reducing the amount of future adaptation needed. Greenhouse gas reduction and adaptation can and should be planned simultaneously to fully realize co-benefits and create efficiencies. Several examples are outlined below.

- As temperatures rise, adopting passive design standards that maximize orientation and natural ventilation can help maintain thermally comfortable homes while also reducing energy costs – ultimately making residents more resilient to utility grid disruptions and rising energy prices.

- By facilitating access to local and clean, renewable energy, buildings will be less vulnerable to power disruptions from severe weather. Decentralized energy systems can also ensure that, following severe weather, essential services are not disrupted and communities receive the support they need to recover.

- By retrofitting a range of public buildings to be clean air refuge areas in neighbourhoods across the region, residents will have access to safe and healthy indoor spaces during periods of degraded air quality due to wildfires. This will be particularly important for residents who face barriers to retrofitting their own homes.

Discussion: Adaptation

The following sections outline proposed goals, example targets, example actions, and potential Big Ideas to adapt to climate change impacts.

Proposed Long-term Goal for Buildings Adaptation

Long-term goals describe a desired future state for climate resilient buildings, with expected achievement in 2050 and beyond. Long-term goals will help identify and prioritize new actions to achieve the adaptations required from the buildings sector.



Please consider the following long-term adaptation goal proposed for our region's buildings sector. Will this goal help us ensure the region is resilient to climate change?

1. **All buildings are resilient to high temperatures, harmful outdoor air quality, flood and drought conditions.**

Example Buildings Adaptation Metrics

To support achievement of the long-term adaptation goal, it is important to measure progress towards climate resilient buildings. How climate resiliency is measured is an emerging field of research and our region will be learning alongside other local jurisdictions. Adaptation metrics will be included in the *Climate 2050 Buildings Roadmap*.



Please consider the following adaptation metrics from other leading jurisdictions. Could any of these help us track progress toward reaching our long-term goal? What should adaptation metrics look like for our region?

(Additional information on the metrics is listed in the web links shown.)

1. **Number of buildings** implementing Core Flood Resiliency Measures (New York City).
2. **Square feet of residential and non-residential buildings** implementing building-level adaptation measures (New York City).
3. **Enable the delivery** of 100,000 m^2 of new green roofs by 2012, from 2008/09 baseline (London, UK).
4. **Average distance to cooling centres** from known hot spots/vulnerable population location (Vancouver).
5. **Proportion of buildings** with green or cool roofs (Vancouver).

Example Buildings Adaptation Actions

Actions are the policies and programs, including requirements, incentives and educational outreach campaigns, that will lead to more climate resilient buildings. Actions will be included in the *Climate 2050 Buildings Roadmap*. In addition to existing actions (see page 13) we need new actions to address the many opportunities we have to increase resilience and meet our long-term goals.



Please consider the following proposed, planned or current actions from other leading jurisdictions. Could any of these help us increase resilience to reach our goal? What should new, additional actions look like?

(Additional information on the actions is listed in the web links shown.)

1. **Establish air quality refuge areas** in public buildings using advanced filtration systems to serve large populations during periods of degraded air quality due to wildfires (Seattle).

2. **Mandatory cool roofs** on new and existing buildings use materials and coatings to reflect sunlight away from cities, decreasing building cooling requirements and urban heat island effect (California).

3. **Launch a resilient housing design competition** to encourage development of new, cost-effective housing types to replace vulnerable stock (New York City).

4. **Evaluate mobile power plants** for low-income housing properties (Calgary).

5. **Offer subsidies for the installation of green roofs** to improve rainwater retention, increase biodiversity, and reduce extreme temperatures and urban heat island effect (Hamburg).

6. **Mandatory wet flood-proofing** for any residential building in high risk flood areas. This technique is designed to allow floodwaters to enter and leave a structure through flood openings or vents preventing structural damage to the building (New York City).

7. **Sales tax abatement program** for climate resiliency costs in buildings (New York City).


Steveston Village, Richmond

Potential Big Ideas for Buildings Adaptation

To respond to the accelerating impacts of climate change, we need to think big and act quickly. Metro Vancouver has identified two **Big Ideas** to improve regional buildings resilience. The Big Ideas were selected for different reasons, including potential to significantly advance climate resilience of the building sector. The Big Ideas are generally examples from other leading jurisdictions around the world.



Please consider the following Big Ideas. Could they help us to significantly advance climate resilience for buildings? What other Big Ideas should Metro Vancouver consider?

Big Idea 1: *Develop a regional vulnerability assessment and adaptation action inventory for public buildings*

Metro Vancouver and other public organizations have completed vulnerability assessments of specific buildings and infrastructure, which provide a wealth of information so property owners can take actions to reduce risks from specific hazards. However, these assessments and recommendations may not be shared across agencies. An inventory of existing vulnerability assessments for public buildings could significantly reduce the duplication of efforts across similar building types. This could save many building owners time and money and allow them to take action much faster to adapt their buildings, thereby reducing the risks posed to both the buildings and their occupants.

As a regional government, Metro Vancouver is well-positioned to coordinate and collaborate with various organizations to develop an inventory of building-level vulnerability assessments. Metro Vancouver and interested partners could map key assessment methodologies and outcomes across a broad range of building types and geographical areas, cataloguing hazard-specific adaptation actions and making them available through accessible online search tools and guidance documents.

Big Idea 2: *Establish a building adaptation design and retrofit support centre for common building types and connect building owners to solutions*

Property owners in vulnerable neighbourhoods are increasingly concerned with understanding how to retrofit their buildings to be prepared for future extreme weather, but it is difficult to know where to start, and how to plan for investment.

Metro Vancouver could work with the building centres of excellence, academic institutions and other expert organizations to create a program that assists property owners and the building industry in determining the right adaptation design solutions for new construction and retrofit projects, and connect them to available resources, programs and funding.

Feedback and Engagement Process

Metro Vancouver invites feedback from diverse viewpoints to help shape *Climate 2050* and the *Clean Air Plan* and will carefully consider all input. Feedback is welcome by email at CleanAirPlan@metrovancouver.org or Climate2050@metrovancouver.org, or by telephone at 604-432-6200.

To ensure your comments are considered please provide feedback by April 30, 2020.

Participation Opportunities

Metro Vancouver will provide a variety of engagement opportunities to hear input on this discussion paper. The public, stakeholders, and other levels of government can participate via the following:

- online public survey;
- open comments to a dedicated email account;
- public dialogue or forum;
- public webinars; and
- direct feedback to Metro Vancouver staff

Details about events will be posted on the *Clean Air Plan* and *Climate 2050* websites (see blue box on this page).

Feedback on any part of this discussion paper is welcome at any time through the engagement period. Initial events will focus on proposed goals and example targets, and initial identification of potential actions. Later events will include consideration of the potential emissions pathways need to reach our regional climate change and air quality targets.

To ensure your comments are considered please provide feedback by April 30, 2020.

How Feedback Will Be Used

With revisions, content from this discussion paper will form the basis of the building section of the *Clean Air Plan* and the *Climate 2050 Buildings Roadmap*, both of which will be available for comment and feedback before they are finalized. (Note that actions identified in the final *Clean Air Plan* and any of the *Climate 2050 Roadmaps* that could result in significant changes to existing air emission regulations or new regulations may require an independent public engagement process before any regulations or amendments are adopted.)

Comments and suggestions will be compiled into a summary report for consideration by the Metro Vancouver Board, and will be made publicly available in 2020.

Metro Vancouver staff will treat personal information with confidentiality; please note that comments you submit may be provided to a third party if a freedom of information request is made under the *Freedom of Information and Protection of Privacy Act*. If you have any questions or comments regarding the consultation process, please call 604-432-6200.

Thank you for taking the time to provide your valuable feedback.

For more information, visit www.metrovancouver.org and search "Clean Air Plan" or "Climate 2050", or call 604-432-6200.

Glossary

Air contaminants are any substances emitted into the air that do or could a) harm public health (including material physical discomfort) and property, b) damage the environment, including the climate, c) impede normal business operations, or d) impair visual air quality.

Ambient air quality objectives and standards are health-based targets which define the acceptable outdoor concentration of key air contaminants. Metro Vancouver and the federal and provincial governments adopt objectives and standards that become more stringent over time, to drive continuous improvement in air quality.

Carbon neutral region is a region that has achieved the deepest greenhouse gas emissions reductions possible across all economic sectors, and removes or captures sufficient carbon dioxide to balance any remaining regional greenhouse gas emissions.

Climate change adaptation means anticipating, planning for and responding to the adverse effects of climate change and taking appropriate action to prevent or minimize the damage it can cause, or taking advantage of opportunities that may arise. It has been shown that well planned, early adaptation action saves money and lives later.

Climate resilience describes the capacity of ecosystems, infrastructure, economies, and communities to absorb the impacts of climate change while maintaining essential services and functions needed to support health and well-being. In some cases, climate resilience involves changing services and functions so they are more sustainable.

Common air contaminants are air contaminants that can harm public health and reduce residents' quality of life and life expectancy by causing heart and lung diseases, cancer, asthma, and other impacts. Some air contaminants have odorous characteristics. Common air contaminants include fine and coarse particulate matter, diesel particulate matter, ground-level ozone, nitrogen dioxide, sulphur dioxide and volatile organic compounds.

Embodied emissions are the greenhouse gas emissions associated with the construction of a building, such as building materials and the transport of building products to the work site.

Fine particulate matter ($PM_{2.5}$) is made up of tiny solid or liquid particles that float in the air and can penetrate deep into the lungs and even into the bloodstream. Fine particulate matter can damage people's health by aggravating existing lung and heart diseases, increasing the risk of cancer and reducing life expectancy.

Greenhouse gases are air contaminants that trap heat and are the cause of climate change. Greenhouse gases include carbon dioxide and nitrous oxide, as well as short-lived climate forcers such as methane, halocarbons, black carbon and ozone. Limiting or preventing greenhouse gas emissions and removing these gases from the atmosphere is critical to avoiding catastrophic climate change (sometimes referred to as climate change mitigation).

Ground-level ozone (O_3) can have harmful impacts on everyone, especially children, seniors, and people with lung and heart conditions. It is primarily formed when nitrogen oxides and volatile organic compounds react in the air on hot and sunny days.

Hazard refers to a dangerous phenomenon, substance, human activity, or condition. In this context, hazards are caused or made worse by climate change. Examples include rainstorms, extreme weather, wildfires, storm surges, and landslides.

Net-zero energy ready buildings are designed and built to achieve net-zero energy performance, by producing as much energy (e.g., from renewable energy technologies such as solar panels) as they consume.

Nitrogen dioxide (NO_2) can damage people's health by aggravating existing lung diseases like asthma and bronchitis, and reducing immunity to lung infections. It is formed during high-temperature fuel combustion.

Nitrogen oxides (NO_X) are a group of gases, which includes nitrogen dioxide, that are produced during high-temperature fuel combustion, and can contribute to the formation of ground-level ozone and fine particulate matter.

Sulphur dioxide (SO_2) is emitted during the combustion of sulphur-containing fuels. Exposure to high levels of sulphur dioxide can damage people's health by aggravating asthma and increasing respiratory symptoms.

Sulphur oxides (SO_X) are a group of gases, which includes sulphur dioxide, that are emitted during the combustion of sulphur-containing fuels. They can also react with other substances in the air to form particulate matter.

Urban heat island effect describes urban areas that are hotter than nearby rural areas, driven by changes in the land surface by urban development. Urban heat islands can affect communities by increasing air conditioning costs, air quality impacts and greenhouse gas emissions, heat-related illness and mortality, and water pollution.

Visual air quality is how clear the air looks to the average observer. Metro Vancouver and its partners measure visual air quality on a scale from "very poor" to "excellent" at five sites in the Lower Fraser Valley.

Volatile organic compounds (VOC) are compounds that easily become vapours or gases; they are emitted during fuel combustion and from many consumer products. They have direct and indirect impacts on human health and contribute to the formation of ground-level ozone.

Vulnerability is the degree to which ecosystems, economies, infrastructure and communities are susceptible to, or unable to cope with, the adverse effects of climate change. Vulnerability varies based on exposure, sensitivity and adaptive capacity. Geographic location, socio-economic conditions, and other factors can impact susceptibility to harm and adaptive capacity.

Vulnerability assessments identify areas or populations most likely to be impacted by projected changes in climate and build an understanding of why these areas are vulnerable, including the interaction between climate change, non-climatic stressors and cumulative impacts. Assessments evaluate the effectiveness of previous coping strategies and target potential adaptation measures.

Metro Vancouver is a federation of 21 municipalities, one Electoral Area and one Treaty First Nation that collaboratively plans for and delivers regional-scale services. Its core services are drinking water, wastewater treatment and solid waste management. Metro Vancouver also regulates air quality, plans for urban growth, manages a regional parks system and provides affordable housing. The regional district is governed by a Board of Directors of elected officials from each local authority.

Member jurisdictions of Metro Vancouver include:

- Village of Anmore
- Village of Belcarra
- Bowen Island Municipality
- City of Burnaby
- City of Coquitlam
- City of Delta
- Electoral Area A
- City of Langley
- Township of Langley
- Village of Lions Bay
- City of Maple Ridge
- City of New Westminster
- City of North Vancouver
- District of North Vancouver
- City of Pitt Meadows
- City of Port Coquitlam
- City of Port Moody
- City of Richmond
- City of Surrey
- Tsawwassen First Nation
- City of Vancouver
- District of West Vancouver
- City of White Rock


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