

# ADOPTING AND PROMOTING A 100% RENEWABLE ENERGY TARGET

VANCOUVER, CANADA



Reducing heat consumption in buildings is seen as a pivotal first step

Vancouver is Canada's third largest city, with an estimated 631 486 inhabitants within its municipal boundaries (City of Vancouver, 2017a) and more than 2.5 million in the greater metropolitan area (BC Stats, 2016). As a major economic and cultural hub, the City of Vancouver sees approximately 400 000 additional people travel through it each day (City of Vancouver, 2015a).

The City of Vancouver has adopted strategies and plans to reduce greenhouse gas emissions and promote renewable energy deployment.

Vancouver has  
committed to  
using exclusively  
renewable  
energy by 2050

Two key documents are the Greenest City 2020 Action Plan adopted in 2011, and the Renewable City Strategy for 2050, launched in 2015 and updated in September 2017 (City of Vancouver, 2017c). In its Greenest City 2020 Action Plan, Vancouver adopted a city-wide GHG emissions reduction target of 33% by 2020 (against 2007 levels).

## The challenge of promoting 100% renewables, particularly in buildings and transport

In 2014, Vancouver sourced 31% of its energy from renewable sources and 69% from fossil fuels. The renewable portion consisted of 25% large hydro, 2% run-of-river hydro, 3% biomass, and less than 1% solar and wind power. On the fossil fuel side, natural gas contributed 45% (primarily for heating buildings) and transportation fuels (gasoline and diesel, but also bio-fuels) accounted for the remaining 24%. In 2015, total energy use was 59.3 million gigajoules (GJ), a 4% reduction from the 62 million GJ in 2007 (City of Vancouver, 2015a).

The Renewable City Strategy committed Vancouver to a city-wide target of 100% renewable energy use by 2050, as well as city-wide GHG emissions reductions of at least 80% from 2007 levels. In pursuit of these targets, steps have been taken to implement a Zero Emission New Building Strategy, reduce demand for motorised transportation and increase the use of renewables in transportation. The Renewable City Strategy has also been designed to link up with existing municipal strategies which focus on sustainable transportation, health and economic development. It achieved an 11% GHG reduction as of 2016 (City of Vancouver, 2016b).

District energy is believed to have the potential to contribute 37% of the total GHG emissions reductions required to make all municipal buildings carbon neutral by 2040 (City of Vancouver, 2017b). Potential energy sources identified by the city include sewage heat recovery, wood chips, geothermal energy and heat recovery from industrial processes. The most suitable sources are selected on a project-by-project basis, depending on availability, site conditions, technical considerations, environmental impact and potential risk factors.

District energy  
is suitable  
for densely  
populated  
areas

Whereas district energy is suitable for densely populated areas, low-density areas characterised by single family homes and low-occupancy apartments require either grid-supplied renewable electricity or on-site renewable energy generation. The most likely sources are solar PV or solar thermal, heat pumps which utilise grid-supplied electricity, or on-site wind power.

However, using electricity for building heating and hot water is expensive in comparison to natural gas, which – similar to hydroelectric power – is also provided by a single provincial utility. The municipality emphasises increased density, partly in order to make district energy increasingly viable. Projections indicate that only 10–15% of households in Vancouver will be single family homes in 2050, compared to about 80% of the land area in Vancouver currently dedicated to single-family housing (Zuehlke, 2017).





The Renewable City Strategy commits Vancouver to 100% renewable energy use by 2050

## Actions taken

The City of Vancouver adopted six priorities, including both energy efficiency and renewable energy, in the implementation of its strategy. Integration with building mandates and public engagement activities also play important roles in promoting renewable energy deployment.

### Establishing a strategy

The Renewable City Strategy sets a goal for Vancouver to achieve 100% renewable energy by 2050. Achieving the strategy will require reducing total energy use by 35% compared to 2015, to 38.3 million GJ by 2050. The projected energy mix will comprise 60% renewable electricity, 15% district energy, 14% biofuels, 10% bio methane and 1% hydrogen (City of Vancouver, 2015a).

The strategy adopts a cross-sectoral approach including both renewable energy deployment and stepped-up energy efficiency. It also highlights six strategic priorities:

- » reducing energy use;
- » increasing the use of renewable energy;
- » increasing the supply of renewable energy;
- » reducing motorised transportation demand;
- » increasing the use of renewable transportation options; and
- » increasing the supply of renewable transportation fuels.

Each of these priorities is subdivided into areas for action. For example, a priority in reducing energy use is ensuring that any building constructed in the city as of 2030 produces zero emissions. In 2014, building heating in the city accounted for 45% of total energy use, while approximately 56% of GHG emissions in Vancouver were produced by buildings (City of Vancouver, 2015a; 2016a).

Besides the Renewable Energy City Action Plan released in November 2017, the Renewable City Strategy is also designed to link-up with other sectoral implementation plans and actions. Some of these are already in place, such as the 2016 Zero Emissions Building Plan and the 2012 Neighbourhood Energy Strategy that enables frameworks for district heating. In other cases, complementary strategies are in place but need to be converted to policy. One example is the Transportation 2040 Strategy that promotes sustainable transportation infrastructure and encourages increased walking, bicycling and public transit use. Other strategic priorities, such as increasing the supply of renewable energy and building renewable infrastructure, still need to be scaled up.

City authorities acknowledge that there are sectors where Vancouver lacks the jurisdiction to make comprehensive changes and needs to engage with partners. For example, this concerns the city's desire to raise the renewable content of heating fuels, which are provided by a provincial utility and at present are principally derived from natural gas. Private automobile choice, vehicle efficiency, and pollution standards are other areas in which the city does not have direct jurisdiction. However, the city can encourage the uptake of electric vehicles (EV) by providing preferred parking places. It has already launched an Electric Vehicle Ecosystem Strategy which sets out 32 actions intended to increase the number of EV charging spots in homes, workplaces and public spaces in the period from 2016 to 2021 (City of Vancouver, 2017c).

### Promoting renewables

The city has identified solar PV, solar thermal, biogas and biomass as the on-site renewables capable of achieving up to 6% of the total GHG emissions reductions required to make all municipal buildings carbon neutral by 2040 (City of Vancouver, 2017b). Solar thermal installations have so far been installed on four civic buildings, while solar PV panels are in place on two. In addition, the city sees establishing solar energy systems in high-profile public spaces as a catalyst for sparking discussion about the transition from fossil fuels to renewable energy.

The Renewable City Strategy – in conjunction with the Zero Emissions Building Plan – aims to reduce emissions from new buildings by 70% by 2020, 90% by 2025 and 100% by 2030, phasing in changes to building standards that allow the construction industry to adapt over time.



Photograph: Shutterstock

Complementary strategies are in place to increase renewables and cut emissions



The plan primarily focuses on incrementally lowering GHG intensity (GHGI), measured in kilogrammes of carbon dioxide equivalent (kgCO<sub>2</sub>e) per square metre (m<sup>2</sup>) per year, and thermal energy demand intensity (TEDI) in kilowatt hours (kWh)/m<sup>2</sup> per year, through municipal rezoning and incentive tools such as waived permit fees, expedited permitting, design prizes and increases to buildable area (City of Vancouver, 2016a). The city has identified reducing building heating requirements as the pivotal first step in achieving its 100% renewable energy target.

The plan mandates that from 2018 forward, all new buildings will either be built to a zero emissions standard or be connected to a renewably-powered district energy system. Interim targets are to be achieved through a combination of measures, including improved insulation, higher door and window performance standards, further deployment of renewable energy and other measures. New high-rise residential buildings will reduce emissions by installing heat recovery ventilation systems and eliminating exposed concrete and balconies.

Vancouver has introduced a series of initiatives to reduce the share of natural gas in its energy mix. District energy – referred to as ‘neighbourhood energy’ in Vancouver – can be powered by renewables and it is viable in densely-settled parts of the city where capital and operating costs can be recovered at rates that are competitive with natural gas.

### Engaging the community

Vancouver has organised several activities (including a ‘Bright Green Summer’ festival and a ‘100% RE Talk’) to introduce the public to strategy planning and implementation, collect feedback, and build dialogue between the public and the municipal government. ‘Bright Green Summer’ was organised in 2015 to celebrate the mid-point of the Greenest City 2020 Action Plan. A series of stakeholder consultations, question and answer sessions, and educational workshops were organised to discuss both the Greenest City 2020 programme and the Renewable City Strategy.

‘100% RE Talks’ encouraged groups of ten or more people to fill out an online form and made city sustainability staff available for one to two hour meetings during which they would answer questions about the Renewable City Strategy and what it will mean for buildings, transportation and day-to-day life in the city.



‘100% RE Talks’ encouraged people to ask questions about the Renewable City Strategy

## Results to date

Under this ambitious strategy, Vancouver has been promoting district heating, solar photovoltaic installation, biofuels and electric vehicles, as well as green job creation.

### Demonstration of renewables for district heating

The Renewable City Strategy prioritised the development of building and renewable energy supply policies to support district energy expansion and conversion, and the implementation of new systems after having realized that in high heat-demand density areas district heating is typically more cost-effective than single-building solutions in reducing greenhouse gas emissions. This is mostly due to the economies of scale that are enabled (ICLEI, 2016a). In renewable district energy priority areas, new buildings will be required to connect to the system, avoiding costly investment in the building envelope and energy system (ICLEI, 2016b).

Vancouver has established guidelines for the conversion of existing district energy systems

The Southeast False Creek (SEFC) Neighbourhood Energy Utility represents the city's first major renewable district energy system and acts as a demonstration project. The facility, which is housed in a certified LEED gold-rated building, utilises sewage heat recovery and avoids 60% of GHG emissions. In 2016, it produced 38 029 megawatt hours and has expanded to connect to 28 buildings and 4 576 residential suites. The utility is owned-and-operated by the city and has proven to be cost-effective while providing rates to customers that are competitive with natural gas. Plans are in place to expand the SEFC infrastructure to serve further new and existing developments (City of Vancouver, 2015b; 2016b). In addition to the extension of SEFC, future activities include the development of new district energy systems and the conversion of existing district energy systems which currently rely on natural gas.

A top priority for the city is the conversion of two privately-owned district energy systems in the central business district which rely on steam generated from natural gas. The municipality is collaborating with the owner of the systems to convert them to be powered by a low carbon energy source. Locally sourced wood waste has been identified as a viable option. The projected annual CO<sub>2</sub> reduction from the two conversions is 95 000 tons (City of Vancouver, 2012). The two conversions also have the power to supply energy to other neighbourhoods in the area.

Vancouver has established Energy Centre Guidelines for the conversion of existing district energy systems and for newly proposed systems. The Guidelines set standards, guide municipal evaluation and approval of projects, and establish the responsibilities of the municipality and other regulatory authorities. Key criteria include climate protection and air quality, sustainability of fuel source(s), aesthetics that are a good fit with the surrounding neighbourhood, and an effective community engagement process.

### On-site renewable power generation initiated

In 2016, 30% of energy in Vancouver was from renewable sources (City of Vancouver, 2017f). Vancouver is launching various solar projects through the collaborative Solar Now initiative. This consortium consists of Clean Energy Canada (a project of the Centre for Dialogue at Simon Fraser University), the North Growth Foundation, the Great Climate Race, Bullfrog Power, the Community Energy Association and the City of Vancouver. An initial Solar Now installation of 60 solar PV panels will provide 15 300 (kWh) of electricity per year (Clean Energy Canada, 2017). A second project, scheduled for completion in 2018, is a 15–20 kW solar installation integrated into the 8 000 square-foot public rooftop garden of Vancouver Public Library at Library Square, Vancouver’s most prominent public library.

### Bio-methane and landfill capture increasing

Vancouver expects bio-methane captured through municipal landfill gas recovery systems to contribute up to 11% of the total GHG emissions reductions required to make all municipal buildings carbon neutral by 2040 (City of Vancouver, 2017b). Bio-methane is regarded as an interim solution for building heating that can be phased out as more and more buildings are refurbished. In the long term, bio-methane can be a fuel source for renewable transportation. In order to ensure that bio-methane is captured and thus not released into the atmosphere – where it can further exacerbate climate change – Vancouver is upgrading its landfill gas recovery system. In 2017, 74% of the bio-methane generated in municipal landfills was captured, up from 3% in 2015 (City of Vancouver, 2017c).

### New building codes help to achieve low carbon targets

Vancouver aims to derive 100% of the energy used in all municipal buildings from renewable sources by 2040. The municipality owns, leases or operates a total of 598 buildings. To make this target achievable, renewable power generation and heating/cooling applications must be incorporated in conjunction with measures to improve energy efficiency.



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**Strategic partnerships are key to achieving 100% renewables**



Twenty of the 75 largest GHG-emitting municipal buildings will be retrofitted to a zero emissions standard over the next 25 years. This measure will contribute 20% of the GHG emissions reductions required to make all municipal buildings carbon neutral by 2040.

Energy retrofits and optimisation projects are expected to contribute to achieving 10% of the carbon-neutral facilities target and upwards of 60 projects are already underway. Several dozen city owned buildings could potentially be connected to neighbourhood renewable energy systems. Powered from sewage heat recovery, wood waste biomass and bio-methane, these deliver 37% of the city's GHG emission reduction target and are expected to be 100% renewable by 2040 (City of Vancouver, 2017b).

Retrofit projects to reduce heating and cooling needs (and associated energy bills) will focus on improvements to the building envelope and to building energy systems. The building envelope consists of the walls, roof, windows and doors, while building systems include heating, cooling, ventilation and water heaters (City of Vancouver, 2015c).

To encourage the retrofit of privately-owned buildings, Vancouver has launched a trial thermal imaging programme to help single-family homeowners detect sources of heat loss. In January 2017, thermal images were taken in five neighbourhoods and participants in the trial received information on energy saving options. An update of the Vancouver Building By-Law (VBBL) came into effect in March 2018. This is expected to enable a 40–55% reduction of emissions over the previous VBBL standards. This will make significant contributions to the 2030 zero emission buildings target, as 82% of new development square footage in Vancouver is residential, and low-rise multi-family housing stock represents a steadily growing segment of this growth area (City of Vancouver, 2017d, 2018a).

To encourage the transformation of private building stock, the City Council approved an amendment to the Green Building Policy for Rezoning in late 2016. The amendment states that any building that applies for rezoning must be constructed in line with a higher energy standard which reduces CO<sub>2</sub> emissions by a minimum of 50% and meets new limits for heat loss and energy use. An estimated 30 to 60 projects will qualify for the new rezoning standard annually (City of Vancouver, 2017c).

In 2015, the city achieved one of the two building-focused targets set out in the Greenest City 2020 Action Plan, namely to reduce energy use and GHG emissions in existing buildings city-wide by 20% against 2007 levels. In seeking to require all buildings constructed from 2020 onward to be carbon neutral in operations, indicated by kilograms of CO<sub>2</sub>e per m<sup>2</sup> of newly built floor area, the city has achieved a 43% reduction against the 2007 baseline of 20.7 kgCO<sub>2</sub>e per m<sup>2</sup> (City of Vancouver, 2017c).





Land-use planning and the enhancement of pedestrian and cycling infrastructure have been key tools

## Transportation

The transportation-focused goals of Vancouver's Renewable City Strategy largely reflect the Transportation 2040 Vision that was adopted in 2012. It articulates a hierarchy of preferred mobility options, from walking, cycling and public transit to the use of shared vehicles and, finally, private automobiles. Land-use planning and the enhancement of pedestrian and cycling infrastructure have been key tools in advancing this hierarchy.

Vancouver achieved its Greenest City 2020 Action Plan goal of having over 50% of trips made by walking, cycling or public transit five years early, in March 2015. With the help of the Mobi bicycle sharing programme, cycling is Vancouver's fastest-growing mode of transport. The city exceeded its target of reducing the average annual distance driven per resident by 20% relative to 2007 levels, having already overachieved a reduction of 32% (City of Vancouver, 2017e).

Meanwhile, the city is committed to building electric vehicle charging infrastructure that can support growing demand. Because Vancouver's electricity is almost exclusively generated from hydropower, electrification can reduce personal vehicle emissions by up to 97%. Projections show that by 2050 approximately 25% of personal vehicles in Vancouver could be fully electric vehicles, with another 45% comprising plug-in hybrids using a combination of renewable electricity and bio-methane, and the remainder being conventional hybrid vehicles running on bio-methane (City of Vancouver, 2015c). The city has already incentivised electric vehicle use and car-sharing by providing preferred parking spots in busy parts of the city for these modalities.

## Vancouver's green economy

The Greenest City 2020 programme set out to double the number of green jobs – which includes sectors such as green buildings, clean technology, recycling and local food production in Vancouver. Green jobs have increased by 49% against a 2010 baseline of 16 700 jobs (City of Vancouver, 2017e). Vancouver is also showing steady growth in renewable energy employment; of a total 14 100 renewable energy-based jobs in the province of British Columbia, 23% are concentrated in Vancouver (Pembina Institute, 2016).

In partnership with the Vancouver Economic Commission, the city launched the Green and Digital Demonstration Program (GDDP) to accelerate the pace of innovation, commercialisation and job growth in Vancouver's clean technology and digital sectors. Through the GDDP, participants are granted temporary access to municipal assets – such as buildings, streets or vehicles – for commercial demonstrations and technology trials.

## Lessons for other cities

A **well-defined roadmap** demonstrates strong political commitment and can help stakeholders in the community understand the vision at a deeper level. The case of Vancouver illustrates ways to bring together different stakeholders and unify their outlook to support ambitious renewable energy targets. As the city's experience to date suggests, promotional initiatives can be crucial in identifying and raising awareness about shared objectives that benefit everyone. Moreover, early stakeholder engagement is vital.



Community consultations and awareness campaigns require time



**A broad range of supporters** is needed across the community. Consultations with neighbours, communities, businesses, investors and others can be pivotal in the pursuit of ambitious urban energy and climate goals that require both supply-side and demand-side interventions. Ensuring that citizens, businesses and other parties are informed is necessary for building broad and lasting support. Stakeholders who may not immediately see benefits for themselves have to be made aware of the potential for win-win scenarios in changes to energy infrastructure.

**Community consultations and awareness campaigns** require time. The original planning phase of the SEFC indicated that biomass would be the fuel source used. However, there was significant public pushback from the community against biomass, given the ecological impact associated with biomass wood sourcing and the transportation costs for the fuel. Ultimately, the community decided on sewage heat recovery, despite the likelihood of higher tariffs (City of Vancouver, 2015b).

**Strategic partnerships** are key to achieving a city-wide 100% renewable energy goal. The city has control over its own building stock and can influence other structures through building standards. It also has control over land use, bio-methane gas capture and road network planning. However, it needs to collaborate with other governmental authorities in the region on major public transportation improvements and waste management. The city will also need to coordinate with provincial and federal governments on various other issues where its own regulatory and policy-making authority is limited, including power generation and distribution, carbon pricing, vehicle efficiency and pollution standards.



Retrofitting buildings will reduce heating and cooling needs



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