



Paving the Way for Equitable Decarbonization of British Columbia's Residential Homes

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Disclaimer

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Executive summary

In 2007, British Columbia (BC) passed the ambitious *Climate Change Accountability Act*, committing to reducing provincial greenhouse gas (GHG) emissions by 80% below 2007 levels by 2050¹. Further targets of 30% reduction by 2030 and 60% by 2040 were set as part of the CleanBC climate plan in 2018. To support a renewed effort to reach net zero emissions economy-wide by 2050, the province updated their climate objectives again in 2021, including a sectoral emissions reduction target for buildings and communities of 59-64% below 2007 levels by 2030². However, progress toward these targets has so far been minimal, with emissions from buildings and communities declining by only 9.9% between 2007 and 2020³.

The provincial government must take significantly stronger actions to achieve the required decarbonization of the building sector. Retrofitting existing buildings will be the key in this effort since most of the buildings that will be in place by mid-century have already been constructed. Supporting energy-efficient retrofits and fuel-switching is particularly important in residential homes. In addition to emissions reduction, it may aid in combating energy insecurity, which is currently experienced by over a quarter million British Columbians⁴ — a number that is likely to rise due to increasing costs of living.

This study examined the policies and programs implemented by the public and private sectors, as well as civil society organizations, to promote energy-efficiency retrofits and fuel-switching in residential homes across British Columbia, with a particular focus on effectiveness and equity. We find that while a seemingly large number of policies and programs have been implemented, existing efforts have failed to encourage the rate of retrofits compatible with provincial decarbonization targets. Moreover, these efforts have been insufficient to scale up retrofits in low-income households, rental properties, and non-profit households and to address energy insecurity.

The following summary outlines several shortcomings of existing efforts and identifies policy pathways toward equitable decarbonization of the building sector in British Columbia.

Shortcomings of the existing policies and programs

Existing policies and programs in British Columbia fall short of effectively promoting the necessary rates of energy-efficiency retrofits in residential buildings. This report identified the following shortcomings in the current efforts:

- **Unpredictable outcomes.** Existing policies largely rely on financial incentive programs, such as rebates or low-interest loans. The uptake of these programs is challenging to predict since high-retrofit costs, albeit important, are usually not the sole barrier to retrofitting.

- **Free ridership.** Retrofit incentive programs that are not restricted to low- or moderate-income households tend to suffer from high rates of free ridership, hence undermining the cost-effectiveness and equity of the program.
- **Limited retrofit drivers in multi-unit residential buildings (MURBS).** Large MURBs face challenges accessing capital for energy-efficient retrofits.
- **Rebates on fossil gas equipment.** FortisBC Energy Inc. continues to incentivize fossil gas equipment and connection, which leads to carbon lock-in due to the long lifespan of the equipment.
- **Continued expansion of fossil gas infrastructure.** The BC Utilities Commission continues to approve new connections to fossil gas despite the absence of a clear pathway to sustainably and affordably meet gas demand through low-carbon fuels such as renewable natural gas (RNG).
- **Insufficient emissions reduction.** Between 2007 and 2020, emissions from buildings and communities in British Columbia declined by only 9.9%, which falls far short of the 59-64% reduction target for this sector by 2030. While this target encompasses emissions from both residential and non-residential buildings, the residential sector alone has seen even smaller reductions of only 5% during the same period. The lack of significant and consistent reduction in residential greenhouse gas emissions jeopardizes BC's ability to meet its legislated targets.

The limitations of existing initiatives in effectively promoting energy-efficient retrofits in residential buildings are compounded by a failure to ensure equitable decarbonization of the residential sector. This report identified several shortcomings with regard to **equity**:

- **Failure to encourage retrofits in rental properties.** Existing incentive programs fail to address the split-incentive problem hampering retrofit uptake in rental properties. This particularly impacts low-income households, who, due to financial constraints, tend to rent older and less energy-efficient properties.
- **Insufficient funding support for retrofits in non-profit, social, and low-income housing.** Financial support for energy-efficient improvements in non-profit, social, and low-income housing is often inadequate to cover the upfront costs of retrofits, which makes it challenging for these providers to afford the necessary investments.
- **Lock-in of fossil gas systems may exacerbate future energy insecurity.** Higher rebate amounts are offered for the installation of fossil gas space and water heating equipment to low-income residents, which may exacerbate energy insecurity as fossil gas heating becomes more expensive due to rising carbon taxes and commodity prices.

- **Failure to consider equity in climate adaptation.** Homes with poor energy efficiency and fossil fuel heating are more vulnerable to extreme heat and poor air quality, leading to disproportionate public health impacts among households that lack the resources to complete retrofits.
- **Low-ambition policy and a lack of accountability is unjust to equity-deserving groups, developing nations and future generations.** Legislated provincial targets may not constitute an equitable contribution to mitigating global climate change under the Paris Agreement. In addition, the province is not on track to achieve its existing emissions reduction targets for the residential sector, with disproportionate impacts to lower-income British Columbians.

Policy pathways

Our review of policies and programs in jurisdictions across North America and Europe has uncovered several best practices for promoting equitable decarbonization of residential buildings, which British Columbia could benefit from. We synthesized these practices into six main policy pathways:

- **Fossil gas phase-out and zonal electrification.** The provincial government must take a proactive approach to phase out fossil gas in the residential sector, including (1) *immediately* banning incentives on new fossil gas appliances and connections; (2) banning new installations of all fossil gas heating systems, including hybrid heat pumps; (3) requiring FortisBC and BC Hydro to consider electrification as a primary goal of their planning processes and to pursue zonal electrification. These actions will aid in preventing fossil gas lock-in and ensure that limited renewable gas resources will be reserved for hard-to-electrify industrial sectors.
- **Enhanced support for lower-income and rental households.** The provincial government must address energy insecurity in low-income households and promote equitable decarbonization of the residential sector. The *Utilities Commission Act* should be updated to enable and require utilities to dedicate a significant portion of their funds toward energy-efficient programs specifically targeting low-income residents. Low-income households, including income-qualified renters, should be provided with free installation of high-impact energy-saving measures, such as electric heat pumps and insulation.
- **Energy-efficiency standards and retrofit requirements.** To ensure that residential retrofit rates align with provincial decarbonization objectives, mandatory energy efficiency requirements for existing residential homes should be introduced. Initially, this may be achieved by updating the provincial *Residential Tenancy Act* to mandate rental housing to meet a reduced level of carbon intensity. Eventually, mandatory standards should apply to all existing buildings and should progressively increase until reaching net-zero emissions

levels. During the transitional period, owners of inefficient buildings can be required to pay higher property taxes. These actions should be accompanied by targeted initiatives aiding lower-income residents in meeting the requirements, such as free installation programs for low-carbon upgrades like heat pumps.

- **Provision of comprehensive one-stop-shop (OSS) services.** The provincial government should establish a comprehensive OSS service, administered either by a Crown corporation or an independent third-party organization. OSS should provide informational services, a consolidated rebate application system, and assistance throughout the renovation process. To ensure equitable decarbonization despite limited governmental resources, free-of-charge and all-inclusive OSS services should be provided to low-income households, while higher-income households could receive a lower degree of support or offered the same services for a fee.
- **Expansion of retrofit financing options for moderate- and high-income households.** To support greater retrofit uptake, the provincial government should enable financing options that are attached to a property or a meter. Utilities should be required to offer on-bill tariff programs and Property Assessed Clean Energy (PACE) financing options should be available to homeowners.
- **District energy expansion.** Developing district energy systems can greatly facilitate equitable decarbonization of the building sector in urban areas because of their high energy efficiency, ability to incorporate waste heat sources, and great reliability. While district heating is widespread in Europe, it has not yet gained significant momentum in Canada. To encourage district heating development, the provincial government could require local governments to consider district energy in their planning processes and require buildings undergoing renovation to connect to district heating, if available in the area.

Introduction

British Columbia has legislated a greenhouse gas (GHG) emissions reduction target of 40% below 2007 levels by 2030 and 80% by the middle of the century¹. To support the achievement of these objectives, in 2021, the provincial government also established an emissions reduction target for individual sectors. For buildings and communities, the target has been set at 59-64% below 2007 levels by 2030¹. Former BC Premier John Horgan additionally pledged to legislate a "net-zero emissions by 2050" target², which would require even further emissions reduction from the buildings sector.

With only seven years left before the end of the decade, progress toward these targets has been limited, with emissions from buildings and communities only declining by 9.9% between 2007 and 2020³. To ensure the achievement of provincial decarbonization objectives in the coming years, drastic decarbonization of the buildings sector needs to be achieved.

While the provincial government committed to incorporating zero-carbon requirements for new buildings by 2030⁴, the majority of the buildings that will be in place by then, and even by the midcentury, have already been constructed. The Pembina Institute has estimated that even if all new constructions were to be zero-carbon by 2032, it would only contribute a third of the emissions reductions needed from the building sector by mid-century⁵. Therefore, retrofits of existing buildings will be essential in achieving these targets.

Simultaneously, it is crucial to ensure that policies and programs for the decarbonization

of residential buildings do not disproportionately impact disadvantaged population groups and actively contribute to repairing the harms caused by historical, cultural, and institutional injustices. Following these principles, decarbonization of the residential sector must address the issue of energy insecurity, which impacts approximately 250,000 households across British Columbia⁴, impairing their quality of life and jeopardizing health.

Often, however, low-income residents do not benefit from commonly deployed energy-efficiency and decarbonization policy tools, such as rebates and tax incentives, as they tend to require upfront investments and/or certain levels of income. Furthermore, low-income households often live in rental properties and might lack the agency and future certainty necessary to make energy-efficient improvements. Recognizing these issues, this report aims to:

1. Review the main programs and policies supporting energy-efficiency retrofits in British Columbia;
2. Assess the effectiveness and equity of these programs and policies;
3. Review energy-efficiency policies and programs that have been implemented in other jurisdictions worldwide that can aid in advancing equitable decarbonization of the residential sector;
4. Propose provincial-level policy changes that may contribute to equitable decarbonization of the residential sector.

Overview of existing programs and policies supporting energy efficiency retrofits in British Columbia

Regulations

Provincial regulations

British Columbia has yet to introduce any regulation requiring energy retrofits in existing residential buildings. However, some existing provincial legislation, such as the *Carbon Tax Act* and *Energy Efficiency Act*, indirectly contribute to decarbonization and energy efficiency improvements in the residential sector.

In 2008, British Columbia introduced a tax on greenhouse gas emissions from fossil fuels purchased and used within the province. The tax rates have increased over time, currently standing at \$50/tCO₂e. In the *Roadmap to 2030* climate plan, the province pledged to set its carbon tax at the rate that matches or exceeds "any federal carbon price requirements for 2023 and beyond"⁵. Hence, at the very least, the BC carbon tax can be expected to increase by \$15 annually until reaching \$170 in 2030⁶. This creates the certainty that prices for fossil fuels will continue to rise. Meanwhile, BC Hydro's electricity, which supplies 95% of the BC population⁷, consists of 98% of clean, renewable sources, predominantly hydropower⁸. Moreover, the provincial government committed to ensuring

that 100% of BC Hydro's electricity comes from clean and renewable sources by the end of this decade⁵.

Financial considerations are key in the homeowner's decision to switch from fossil-fuel powered to electric heating systems. The current carbon tax rate does not significantly impact prices of fossil gas — the most common source of residential heating in British Columbia — due to its relatively low GHG emissions rate compared to other fossil fuels, such as oil. However, since 2020, fossil gas prices have been on the rise due to global market trends, such as rebounding demand for energy following the COVID-19 pandemic and geopolitical consequences of Russia's invasion of Ukraine^{9,10}. In the meantime, heat pump technologies have been advanced in recent years to perform better in the colder Canadian climate¹¹⁻¹³. While, despite recent cost spikes, fossil gas may still be price competitive with electric baseboard heating, it is no match to highly efficient electric heat pumps^{14,15}, presenting a compelling financial case for homeowners to switch.

Another provincial legislation that helps to advance energy efficiency in the residential sector is the *Energy Efficiency Act*, which sets energy performance requirements for devices that use, control, or affect the use of energy. This includes, among others, heating and cooling systems, lighting, household appliances, and windows. The province continuously amends the regulation, raising energy efficiency standards¹⁶. In the Roadmap to 2030, the BC government committed to raising the performance standards for space and cooling equipment to at least 100% efficiency by 2030, which would essentially only allow for the sale of electric resistance heating and heat pumps, including hybrid gas-electric heat pump systems and high-efficiency gas heat pumps⁵ in addition to more typical electric air and water-source heat pumps.

An important regulatory change that the BC government has committed to introducing is an Alterations Code for existing buildings by 2024, which would require buildings undergoing alterations to meet specified standards for energy efficiency and greenhouse gas emissions and to implement climate change adaptation measures¹⁶. Furthermore, the provincial government is working on implementing energy efficiency labels for buildings listed for sale^{5,16}. Having to disclose energy efficiency would incentivize owners to undertake retrofits, as it may affect the future salability of the property⁵.

The City of Vancouver's regulations

The City of Vancouver has introduced several regulations addressing the existing buildings' energy efficiency and greenhouse gas emissions. In 2022, a bylaw update was passed mandating that starting in January 2023, "all permanently installed new air condition systems in existing detached homes must function to provide both low-carbon heating and cooling"¹⁷. The rationale for this update was to take advantage of the increasing rates of air conditioning installations in Vancouver to decarbonize space heating without significant changes in the cooling system costs^{17,18}. Furthermore, the bylaw update requires that homes undergoing renovations exceeding \$250,000 in value must electrify their existing space and water heating systems, except for renovations carried out by lower-income households making under \$50,000 annually¹⁷.

In 2022, the City also approved a regulation applicable to commercial and multi-family buildings, which requires annual energy and carbon reporting and introduces mandatory greenhouse gas intensity and heat energy limits that will lower over time^{19,20}. The municipality committed to offering support for the owners of commercial and multifamily buildings to ensure the success of the regulation²⁰.



Rebates, grants, loans, and informational resources

Support available to individual homeowners and renters

Although British Columbia does not require homeowners to undertake energy efficiency retrofits, several programs are in place to encourage the uptake of energy-efficient appliances and the electrification of heating systems. These programs provide homeowners and, in some cases, renters interested in undertaking retrofits with financial and informational support in the form of incentives, rebates, and low-interest loans. The following section provides an overview of the key programs currently available in BC.

Home Renovation Rebate and CleanBC Better Home Rebate Program

One of the most comprehensive rebate programs available to homeowners is the Home Renovation Rebate and CleanBC Better Home Rebate Program, co-administrated by CleanBC, BC Hydro, and FortisBC²¹. The program offers a number of post-retrofit rebates for improving the external

envelope of the building, switching from fossil fuel or inefficient electric space or water heating to a heat pump, as well as purchasing energy-efficient home appliances²¹. The program, however, also continues to incentivize the installation of new fossil-fuel-powered heating equipment, as fossil gas customers of FortisBC are offered a rebate for upgrading fossil gas furnaces and boilers to more efficient models without switching fuel sources (see Box 1)²¹.

Program participants who implement two or more retrofits are rewarded with additional bonuses²¹, which encourages homeowners to undertake more comprehensive energy-efficient improvements in their homes. Furthermore, the program offers higher rebate amounts for remote communities in the BC Hydro service area, as well as in Northern communities²¹, where energy-efficiency upgrades are particularly impactful in terms of cost and emissions savings. Some municipalities also provide top-up rebates for

residents converting from fossil fuel space heating to a heat pump²². Additional incentives are also offered for the installation of heat pumps by groups of homeowners through the Heat Pump Group Purchase Rebate Program²³, which further incentivizes retrofit uptake within communities.

Canada Greener Homes Grant and Loan Program

Homeowners in British Columbia can also receive financial incentives in the form of grants and an interest-free loan for home evaluations and retrofits through the federal Canada Greener Homes Initiative²⁴. Grants are available to partially offset the costs of EnerGuide evaluations, upgrades of the external envelope, installation of heat pumps and photovoltaic systems, as well as resilience measures aimed to protect the house from environmental damages, such as floods²⁵. While the program provides grants to replace fossil-fuel-burning boilers and furnaces with more efficient models without fuel switching, they are restricted solely to Northern and off-grid communities^{25,26}, where widespread electrification may be challenging. Moreover, residents of Northern and off-grid communities are eligible to receive higher grant amounts on most retrofits²⁶.

To participate in the program, homeowners are required to undertake EnerGuide evaluation prior to and after the retrofits²⁷. Grants are paid after retrofits have been installed and post-retrofit evaluation has been undertaken. In addition to grants, the program offers interest-free loans of up to \$40,000, which can be repaid over 10 years to help homeowners undertake major retrofits²⁸. However, this loan program only offers 15% of funds upfront, making it challenging to access

Box 1. Fossil gas incentives

Outside of the Home Renovation Rebate Program, FortisBC offers multiple rebate programs on fossil gas equipment for individuals, multi-unit residential buildings, as well as non-profit, social, and low-income housing providers. These rebates are not discussed in detail in this report, as they encourage lock-in of customers to fossil fuels and hinder decarbonization of the building stock.

for many households who are unable to “bridge the gap” between paying a contractor for retrofits and receiving grant and loan funds to cover the expense.

Low-interest financing programs

British Columbia residents interested in retrofitting their homes may also be eligible to receive low-interest financing to help fund the upgrades. For example, homeowners switching from fossil fuel heating to a heat pump may be eligible to receive a \$1,000 - \$40,000 loan at a 0% interest rate with a 5-year amortization period as part of the **CleanBC Better Homes Low-Interest Financing** program²⁹. While program participants are disqualified from receiving a heat pump rebate from the CleanBC Better Homes program, they remain eligible for municipal top-up rebates, heat pump group purchase rebates, and electrical service upgrade rebates²⁹. The heat pump also counts toward a two-upgrade bonus and a

home energy improvement bonus²⁹. Moreover, homeowners can receive interest-free loans of up to \$40,000 to undertake the retrofits through the federal Greener Homes Initiative²⁸.

FortisBC also offers its electricity to customers who are upgrading their electric furnace or baseboard heating to a heat pump can also apply for a low-interest rate (1.9%) loan of up to \$6,500 with a 10-year amortization period³⁰. The loan cannot be combined with FortisBC Heat pump rebates³⁰.

Residents interested in undertaking home renovations can also take advantage of **Vancity’s Planet-Wise Home Renovation Loans**, which can be used for upgrades to the building envelope, installation of low-carbon heating and cooling systems, renewable energy systems, as well as energy-efficient appliances and devices³¹. Borrowers can choose from three options: Term loan, Creditline, or Creditline mortgage³¹. The term loan offers a maximum borrowing amount of \$50,000, while the Creditline mortgage can reach up to 65% of the borrower’s home equity³¹. Vancity members can additionally receive an additional \$400 rebates for EnerGuide Home Evaluations and free energy advice from City Green³¹.

The **Royal Bank of Canada (RBC) Energy Saver Loan** is another option for residents purchasing energy-efficient products and services or installing renewable energy systems³². The loan offers either a 1% reduction in the interest rate or a \$100 rebate on a home energy audit³².

Programs for low-income households

Several rebate and incentive programs in British Columbia are specifically designed to assist

low-income households in improving the energy efficiency of their homes. For example, **CleanBC Better Homes Income Qualified Program** offers income-qualified households upfront rebates to reduce the cost of home retrofits³³. The retrofits may include insulation, windows, doors, space and/or water heat pump heating, electrical service upgrades, bathroom fans, heat recovery ventilators, as well as health and safety improvements for the issues discovered during the installation of other upgrades³⁴. Rebate coverage ranges between 60-95% of the home upgrade costs, depending on the household income, up to a maximum rebate amount (see Appendix **Table 1** for more information)³³.

Low-income households that are customers of FortisBC electricity may also be eligible for a rebate to upgrade their existing electric space heating, such as baseboards or an electric furnace, to a heat pump³⁵.

Income-qualified residents may also take advantage of the **Energy Conservation Assistance Program**, administered by FortisBC and BC Hydro³⁶. The program offers a free home energy use assessment, personalized energy-saving advice, and installation of energy-saving products, as well as furnace filter coupons (for FortisBC customers)³⁶. Some homes may also qualify for an energy-efficient fridge, insulation in the walls, attic, and/or crawlspace, or a high-efficiency gas furnace³⁶.

Another support available to income-qualified customers of FortisBC, BC Hydro, and PNG is the **Energy Savings Kit**, which includes energy efficiency products, such as LED light bulbs, kitchen and bathroom faucet aerators, and water-efficient showerheads³⁷⁻³⁹. The program is open to individual residents of multi-unit apartment

buildings, and it is available to both homeowners and renters without requiring the latter to obtain consent from their landlords.

The **Empower Me program** is another equity-oriented initiative assisting BC's homeowners and renters with improving the energy efficiency of their homes. This program is targeted at newcomers to Canada and offers free, multilingual energy-efficiency education, recommendations on energy-efficiency upgrades, and, in some cases, the installation of energy-saving measures such as faucet aerators, low-flow showerheads, and draft proofing measures^{40,41}.

Starting early this year, low- and median-income households will also be able to apply for the federal **Oil to Heat Pump Affordability (OHPA) grant**. The grant is set to provide eligible households with up to \$5,000 to help cover the costs associated with switching from oil to electric heating, including the purchase and installation of a heat pump, oil tank removal, and required electrical updates⁴². The funds will be paid prior to the installation, which will help offset the upfront costs that may otherwise preclude low-income households from making the switch⁴². However, due to the small prevalence of oil heating in the province, few British Columbians will be able to benefit from the grant⁴³.

Support available to multi-unit residential housing

As it has been noted earlier, residents of multi-unit residential buildings (MURB) are not eligible for most of the rebate and incentive programs, except for the Energy Savings Kit. Even in the absence of financial barriers, individual MURB residents have limited decision power over heating, cooling, or building insulation. Some financial support is, however, available for MURB owners and operators. Low-rise MURBs under 600m² in the area may also be eligible for grants and interest-

free loans to undertake energy retrofits under the federal **Canada Greener Homes Grant Initiative**⁴⁴.

Owners and operators of MURBs may also be eligible to apply for commercial retrofit programs if they have a commercial utility account. This may include MURBs that have a single meter for water and space heating for the entire building, which receives energy at commercial rates. In this case, the entire building may be eligible for commercial retrofit incentives. MURBs may also have commercial accounts if the energy used in common areas of the building is received at commercial rates. In this case, commercial incentive programs would only cover retrofits of the common spaces but not individual apartments. Some of the programs that MURBs may be eligible for include, but are not limited to:

- **CleanBC Custom-Lite**⁴⁵ and **CleanBC Custom**⁴⁶ programs provide owners and operators of MURBs in the BC Hydro service

For more details about rebate and grant programs incentivising energy-efficiency retrofits among individual homeowners, renters, multi-unit residential buildings, as well as social, non-profit, and local housing, see [Appendix Tables 1-3](#).

area financial support for undertaking an energy study, as well as capital funding for the implementation of the retrofits.

- **CleanBC Commercial Express Program**⁴⁷ offers eligible MURBs in a BC Hydro service area funding to install rooftop air-to-air heat pump make-up air units with gas or electric backup.
- **CleanBC Small Building Energy Coach**⁴⁸, which offers free of charge coaching service to assist owners and operators of buildings under 75,000m² that use fossil gas for space or water heating with reducing their GHG emissions through electrification, as well as making use of CleanBC Custom-Lite and CleanBC Commercial Express programs.

- **FortisBC Custom Efficiency Program**⁴⁹ provides MURBs in the FortisBC service area with funding to conduct an energy study, retrofit implementation incentive, as well as an implementation bonus.
- **FortisBC Rental Apartment Efficiency Program**⁵⁰ offers purpose-built rental buildings free-of-charge energy assessment, installation of energy- and water-saving products, as well as support throughout the implementation of other energy upgrades.

Support available to non-profit, social, and low-income housing

Several rebates and incentives are available for non-profit housing providers, housing co-ops, municipal housing authorities, and other low-income housing providers (including municipal government, Indigenous organizations, and bands) to help with the costs of energy-efficiency retrofits. These include the **Social Housing Retrofit Program**⁵¹, **Social Housing Incentives Program**⁵², **BC Housing Energy Efficiency Retrofit Program**⁵³, **Sustainable Affordable Housing Program**⁵⁴, as well as **FortisBC Commercial Product Rebate Program for non-profit and charitable organizations** (see [Appendix Table 2](#) for more details about these programs)⁵⁵. These programs provide support throughout the retrofit process, including an energy study and project planning assistance, capital grants and financing, and retrofit rebates. However, the available financial support is often not enough to offset the

upfront costs of the retrofits making it difficult for these housing providers to afford the investments.

Non-profit housing providers and housing co-operatives can also receive BC Housing's nonprofit **Capital Renewal Funding**, which can be used for capital projects that maintain or improve building conditions, including improvements in energy performance⁵⁶. The province committed to dedicating \$400 million of the \$1.1 billion fund toward improvements in energy efficiency⁵⁷.

Non-profit, social, and low-income housing providers may also be eligible to apply for the programs for multi-unit-residential buildings provided they meet the qualification requirements (see [Support available to multi-unit residential housing](#) or [Appendix Table 3](#)).

Support available to local governments and Indigenous communities

Local governments or regional districts within BC Hydro's service areas may be eligible to receive up to 50% salary support to hire community energy managers to develop and implement community energy efficiency and emissions reduction plans and projects⁵⁸. Moreover, BC Hydro offers up to 50% salary support for local governments to hire co-op students and interns to work on energy-efficiency projects at the community level⁵⁸.

Indigenous communities located in BC Hydro

or FortisBC's service territory are also eligible to take part in the **Indigenous Community Conservation Program**, which provides free-of-charge energy-saving products along with salary support to hire individuals to install these products, free training to conduct energy retrofits, as well as rebates for energy retrofits, including, but not limited to, upgrades of space and water heating, insulation, windows and doors, refrigerators, and chest freezers⁵⁹⁻⁶¹.

Upcoming programs

British Columbia has announced its plan to develop **Property Assessed Clean Energy (PACE) financing**, which will provide financing for the upfront costs of building energy retrofits that are repaid through an addition to the property tax^{5,16}. PACE loans are attached to the property rather than the individual, so when the property is sold the remaining balance is transferred to the new owner⁵. By offering financing for the upfront costs of building energy retrofits that are repaid through an addition to the property tax, the PACE program makes it easier for property owners to make energy-efficient improvements, regardless of their plans to stay in the property long-term. However, progress appears to have stalled in implementing PACE financing in British Columbia.

Tax incentives

Starting in April 2022, British Columbia has introduced two tax incentives to support energy retrofits and decarbonization of the residential sector: the **Clean Buildings Tax Credit** and **PST Exemption on Heat Pumps**. The former is meant to encourage owners (corporations or individuals) of MURBs with four or more units and long-term care facilities to undertake retrofits to improve

energy efficiency^{62,63}. Eligible owners are provided with refundable income tax credits amounting to 5% of qualifying retrofit expenses^{62,63}. The latter policy raises provincial sales tax (PST) on fossil fuel combustion systems from 7% to 12% and eliminates PST on heat pumps, which provides a price signal to the consumers, encouraging the purchase of heat pumps⁶⁴.

Limitations of existing policies and programs

Assessing the effectiveness of existing policies and programs

Policies for decarbonizing existing residential buildings currently in place in BC focus primarily on providing financial incentives to support building retrofits, including rebates, free energy-efficiency products, low-interest loans, and tax incentives. Informational tools and services are also available to help homeowners and renters reduce their energy use (e.g., Empower Me) or take advantage of the rebate programs. Regarding regulatory tools for existing buildings, the Energy Efficiency Act so far constitutes the only policy that directly restricts consumers' choice of products installed, and it currently still allows for the installation of fossil-fuel-fired equipment, such as furnaces and boilers.

Relying primarily on financial incentives to encourage energy efficiency and decarbonization retrofits has several benefits.

Financial incentives, such as rebates, lower prices of otherwise expensive retrofits (e.g., installation of a heat pump), hence driving up the demand. This, in turn, supports market readiness for the technology, leads to the development of industry capacity, as well as increases the number of contractors working with the technology. Moreover, more installations raise the public's awareness of, and trust in, the technology, further contributing to the demand. As a result, rebate programs contribute to the decline in technology prices and increase market competitiveness of the products.

Despite these benefits, existing policies and programs aimed at spurring energy efficiency retrofits and decarbonization of residential homes in BC have several significant limitations:

1 Unpredictable outcomes

Predicting rates of uptake of retrofit incentives is challenging, since high retrofit prices, albeit important, are usually not the sole barrier for retrofit implementations. In addition, informational and decision-making barriers and split incentive problems between landlords and tenants can also hinder the decision to undertake retrofits. As a result, it is not uncommon that the actual uptake rate of incentive programs differs significantly from what was anticipated. For

example, FortisBC Energy Inc. (FEI) has seen a 34% lower-than-anticipated uptake of the Rental Apartment Efficiency Program in 2021⁶⁵. While this discrepancy may partially be attributed to program design, it could also be a result of other barriers that the program does not aim to address. Hence, financial incentives alone cannot guarantee the achievement of specific emissions reduction targets set by the provincial government.

2 High risk of free riding

The effectiveness of financial incentive programs, such as rebates or tax credits, is also often reduced due to free ridership, which, in the context of energy policy, refers to a phenomenon where program participants receive financial incentives, such as rebates, for taking actions that they would have taken even in the absence of the program⁶⁶. As a result, free ridership lowers the cost-effectiveness of the programs. On the other hand, the programs may also result in spillovers, which are additional improvements in energy efficiency as a result of the program and may not be directly linked to program participation⁶⁷. Identifying the exact rates of free ridership and spill-over effect is extremely difficult, and the numbers may vary depending on the methods used⁶⁶.

FortisBC Energy Inc. (FEI) estimates the rate of free ridership in the Residential Home Renovation Program to range between 3% and 39% in 2023 depending on the retrofit measure⁶⁸. Moreover, the evaluation of FortisBC Residential Heat Pump program between 2017 and 2020 revealed a 36% free ridership rate on heat pumps⁶⁹.

High rates of free ridership in the context of home retrofit programs have also been found in jurisdictions across the world. For example, a survey of recipients of energy-efficiency retrofit subsidies in Switzerland has shown that 50% of the program participants were free riders⁷⁰. Another study found a free-ridership rate of 40-85% on tax credits for home insulation in France⁷¹.

A high percentage of free riders in retrofit subsidy programs have also been found in Canada. A University of Ottawa study revealed that 50% of the participants in the federal and provincial retrofit programs between 2007-2011, who received an incentive to purchase fossil gas-forced air furnaces, would have acquired the same equipment even without the incentive⁷². Another problem that has been found was that the programs encouraged some participants to move forward with their planned replacement earlier than they would have⁷². Interestingly, midway through the program's duration, the minimum energy-efficiency standards for fossil gas furnaces produced and imported to Canada were raised, reducing the efficiency gap between high-

efficiency furnaces subsidized by the program and the lower-efficiency products available on the market⁷². As a result, the study found that had the participants replaced the furnace at the end of its lifespan, 80% of them would have chosen the same high-efficiency model⁷².

Other studies found significantly lower rates of free ridership. For example, a Norwegian study, which followed the same methodology as the previously mentioned Swiss study, found only a 10% free-riding prevalence in their household energy retrofit subsidies — significantly less than the 50% prevalence found in Switzerland⁷³. They attributed the relatively low levels of free ridership to a high threshold for receiving subsidies in Norway, as compared to Switzerland⁷³. An Irish study also found a relatively low overall free-riding

rate of 7% for energy-efficiency upgrades⁷⁴. They also revealed evidence for partial free ridership, i.e., that 8% of the participants would have undertaken the retrofits with a lower subsidy⁷⁴. Interestingly, the free-ridership rate varied by retrofit measures, which may be explained by the differences in the level of investments needed for different retrofits, as more expensive retrofits are less likely to occur without subsidies⁷⁴.

Collectively, these studies demonstrate that free ridership can be a significant problem, reducing the cost-effectiveness of financial incentive programs. The findings also suggest that the prevalence of free ridership may depend on the policy design, although some authors suggest cultural differences may play a role⁷³.

3 Limited drivers of energy-efficiency retrofits in multi-unit residential building

Apartments in multi-unit residential buildings (MURBs) account for 42.4% of private dwellings in British Columbia. These properties face unique challenges with regard to energy-efficiency retrofits since individual residents have limited decision power over heating, cooling, or building insulation.

While low-rise MURBs under 600m² in can receive grants and interest-free loans for energy retrofits through the federal Canada Greener Homes Initiative, larger MURBs may face greater challenges in accessing funding. The latter may be eligible for commercial retrofit programs, but only provided they have a commercial utility account.

The owners of MURBs that undertake retrofits to improve energy efficiency may be eligible to

receive refundable income tax credits (Clean Buildings Tax Credit) amounting to 5% of qualifying retrofit expenses. While beneficial, this incentive is unlikely to spur the rates of MURB retrofits needed to decarbonize the residential sector.

MURBs located within the city of Vancouver are subject to new municipal regulation, which requires annual energy and carbon reporting and introduces mandatory greenhouse gas intensity and heat energy limits that will lower over time^{19,20}. British Columbia's government should consider introducing a similar regulation to encourage energy-efficiency retrofits in MURBs across the province.

4 Rebates on fossil gas equipment

To meet its decarbonization goals, British Columbia will have to see a decline in the percentage of households relying on fossil gas as their primary heating system, which currently stands at a staggering 58%⁴³. While FortisBC has announced plans to replace 75% of the fossil gas it delivers with renewable gases by the middle of the century, a recent study by Pembina Institute suggests that supplying all the existing customers with renewable gas will not be feasible⁷⁵. Pembina found that the amount of renewable gas that can be generated in the province using existing technologies will not be sufficient to meet the current demand for fossil gas, while acquiring renewable gases from outside the province will become increasingly challenging as other regions decarbonize⁷⁵. Therefore, renewable gases should be reserved for economic sectors that are difficult to electrify, such as cement production and aluminum smelting, while electric heating systems should be used to meet the base heat load in the building sector.

Similarly, the *Canadian Energy Outlook 2021* report shows that in the scenario compatible with achieving net-zero emissions by mid-century in 2050, 97% of the energy consumption in the residential and commercial sector Canada-wide will come from electricity⁷⁶. Fossil gas (2%), bioenergy (0.2%), and hydrogen (0.1%) will play a rather minor role in the sector⁷⁶. Meanwhile, considerable amounts of bioenergy, hydrogen, and fossil gas will go toward the industrial

sector⁷⁶, which is hard to electrify. While not BC-specific, these projections further demonstrate that achieving net-zero emissions will require a rapid electrification of the residential sector.

The importance of building electrification is highlighted in the *Roadmap to 2030*, in which the BC government committed to placing “more emphasis on electrification”⁷⁵ in the building sector. The document states that “instead of seeing incentives for conventional gas-fired heating equipment such as furnaces and boilers, consumers will see more support for . . . all kinds of high-efficiency heat pumps – electric, gas and hybrid”⁷⁵. However, almost 1.5 years later, British Columbians can still access FortisBC’s fossil gas furnace and boiler rebates as part of the CleanBC Better Homes and Home Renovation Rebate Program⁷⁷. The fossil gas heating system upgrades continues to count toward the Two Upgrade Bonus and Home Energy Improvement Bonus Rebate.

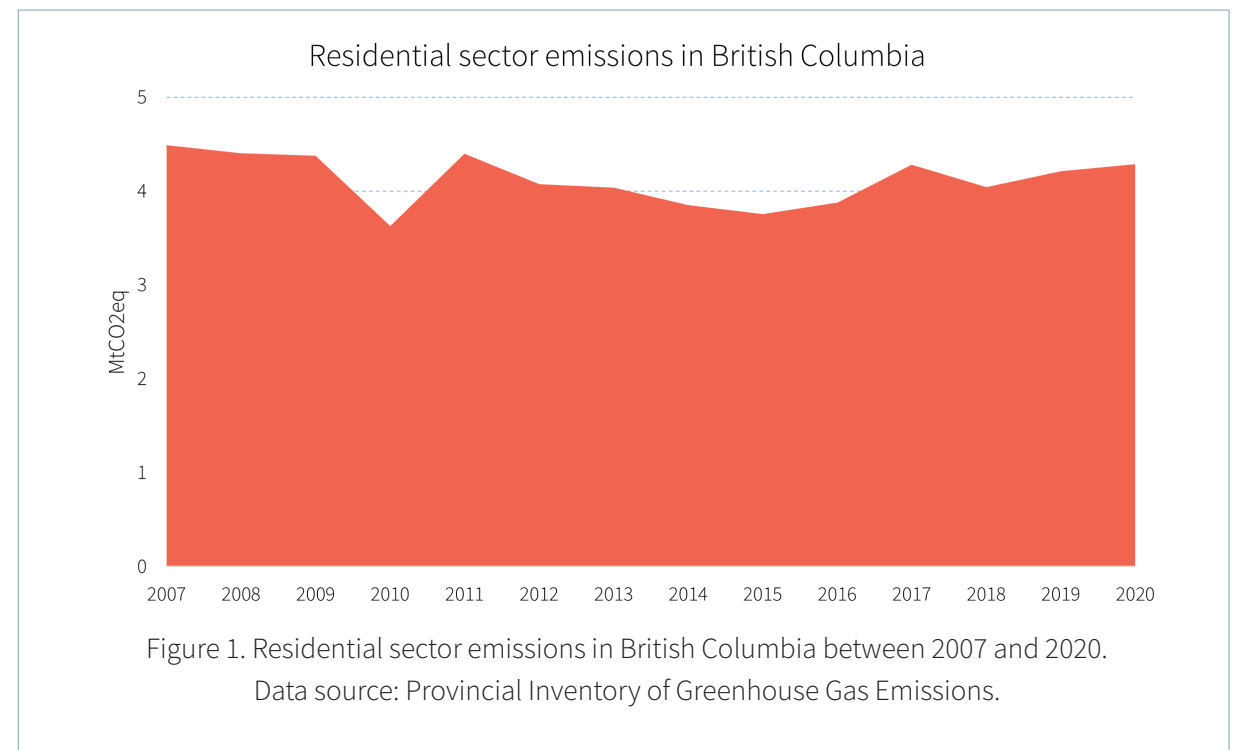
Furthermore, on the FortisBC website, British Columbians can find rebates of up to \$3,700 in rebates for customers who replace oil or propane space heating systems with fossil gas furnaces, boilers, or a combination of heating and hot water systems⁷⁸. While this switch does result in GHG reduction, it also results in locking in fossil gas heating systems, which have up to a 20-year lifespan.

5 Insufficient emissions reduction

To support the achievement of its legislated GHG emissions reduction goal of 80% below 2007 levels by 2050, the provincial government has set an emissions reduction target for buildings and communities at 59-64% below 2007 by the midcentury². Former BC Premier John Horgan has also pledged to legislate net-zero emissions by 2050⁷⁹. While this has yet to happen, an even further emissions reduction from the building sector may be required if the province wants to pursue this ambition. As of 2020, the provincial residential sector has seen only a 5% emission decrease since 2007⁸⁰. However, when considering shorter-term trends, between 2018 and 2020, emissions from residential homes increased by 7%⁸⁰. This suggests that at least until 2020, the policies and programs have not yet yielded a

significant and consistent reduction in residential greenhouse gas emissions.

In line with this, an analysis by Pembina Institute shows that current provincial funding for CleanBC programs for residential buildings falls short of the levels required to meet provincial GHG emissions targets⁸¹. They estimate that \$1.6 billion annually is needed to achieve the target⁸¹. Assuming the province contributes a quarter of this amount, with the remaining three quarters coming from the federal government and utilities, \$400 million annually must be allocated for CleanBC programs for residential homes⁸¹. This is considerably more than the \$11 to \$24 million annually the province plans to spend on these incentives in the next three years, as appears from the provincial 2022 budget⁸¹.





Assessing current policies and programs from the justice lens

Alongside effectiveness, it is crucial to ensure that policies and programs aimed at increasing energy efficiency and reducing emissions from residential homes are designed to follow principles of justice, including, distributive, procedural, recognitional, restorative, cosmopolitan, and transgenerational justice (see Box 2). The policies should ensure that benefits and burdens are distributed fairly across the population and that people in greatest need are served first and to the largest extent^{82,83}. Moreover, it is important that policies are designed with recognition of historical, cultural, and institutional injustices in society and are actively contributing to repairing the harm caused by these injustices⁸²⁻⁸⁴. Policies should also follow principles of sustainable development, ensuring that future generations do not bear unfair burdens^{82,85}. Finally, the policy development and implementation should involve meaningful, inclusive, and accessible community engagement^{82,86}.

Following principles of justice, policies and

programs aimed at increasing energy efficiency and reducing emissions from residential homes should be designed in a way that addresses energy insecurity, especially among low-income households and otherwise disadvantaged population groups. Energy insecurity occurs when a household experiences a lack of affordable access to adequate levels of essential energy services – such as heating, cooling, lighting, cooking, washing, etc^{87,88}. A threshold commonly set for energy insecurity is having to spend double the median share of energy cost to household income^{88,89}. According to this definition, in British Columbia, a household is considered to experience energy insecurity if more than 6% of its income goes toward energy bills⁹⁰. This is the experience of at least 250,000 households in the province⁴.

While medium- and high-income residents can experience energy insecurity, it tends to disproportionately affect lower-income Canadians⁹¹. Not only do low-income households

Box 2. Dimensions of justice

Achieving equitable decarbonization requires considering multiple dimensions of justice throughout the policymaking process, including:

- **Distributive justice.** The benefits and burden associated with the decarbonization policies must be allocated equitably among the population^{82,96}.
- **Procedural justice.** The process of policy development and implementation should involve meaningful, accessible, and inclusive engagement and representation of the stakeholders, including marginalized population groups^{82,96,97}.
- **Recognitional justice.** Policymakers should identify and acknowledge marginalized and vulnerable population groups that can be disproportionately impacted by policies due to their unique needs and challenges^{98,99}, such as Indigenous communities, peoples with disabilities, impoverished households, etc.
- **Restorative justice.** Decarbonization policies should contribute to repairing harms caused by historical, cultural, and institutional injustices⁸⁴.
- **Cosmopolitan justice.** Principles of justice, such as distributive and procedural, should be applied to all human beings equally, and not only the members of a particular nation^{96,97}.
- **Transgenerational justice.** Policies should ensure that future generations do not bear an unfair burden of decarbonization actions and in-actions^{82,100}.

have limited financial resources and have to allocate a larger share of their income to energy bills as compared to high-income households, but they also tend to reside in older buildings with poor insulation and low-efficiency appliances^{92,93}. Moreover, low-income households often lack the financial resources to invest in home retrofits that would help to improve energy efficiency and bring down energy bills⁹⁴. These households are also more likely to be renters, who have limited ability to affect the energy efficiency of their homes. Landlords are usually the ones who purchase components that may affect energy use in rental homes – such as insulation, windows, doors, or

household appliances⁹⁵. If energy bills are covered by tenants, landlords are incentivized to provide these components at the lowest cost even if this will result in low energy efficiency and high energy bills⁹⁵. Meanwhile, renters may not know for how long they will be residing at their current home, which makes high up-front investment for energy retrofits risky⁹⁵.

Having to bear the burden of high energy costs can compromise comfort, quality of life, and health^{92,93}. Low-income residents facing energy insecurity may underheat their homes in an attempt to reduce energy costs, which may put



them at risk of cardiovascular and respiratory health problems due to increased condensation and dampness that create a favourable environment for the growth of mould⁹². Moreover, energy-insecure households may utilize improvised heating alternatives, such as ovens and space heaters, which can increase exposure to toxins and other hazards⁹³.

Hence, policies and programs that aim to improve the energy efficiency of residential homes must be designed in a way that does not put additional financial pressure on low-income households facing energy insecurity and that actively supports energy-efficiency improvements in these households that can reduce their energy bills.

Existing policies and programs in British Columbia exhibit several strengths in this regard. Specifically, several programs are in place to support retrofits among low-income households. For example, CleanBC Better Homes Income Qualified Program provides up-front rebates on a number of home retrofits, including insulation, windows, doors, space and water heating systems, fans and ventilators, as well as health and safety improvements for pest, asbestos, and/or mould issues discovered during the installation

of other retrofits³³. The rebate coverage depends on household income and ranges between 60-95% of the home upgrade costs up to a maximum rebate amount³³. Fortis BC also offers income-qualified heat pump rebates for its customers wishing to upgrade their existing electric heating systems³⁵. The rebate, however, is paid as a reimbursement of the retrofit costs. As a result, households that cannot afford the up-front heat pump costs are not able to take advantage of the program.

Low-income households are also eligible to receive a Free Energy Saving Kit, which contains several energy- and water-conservation products³⁷⁻³⁹. Moreover, income-qualified households can participate in the Energy Conservation Assistant Program, which offers free-of-charge in-home visits from an energy coach, installation of energy- and water-conservation products, and, in some cases, energy-efficient appliances and insulation³⁶. This program may particularly benefit seniors and people with limited mobility, who may have a compromised ability to install the products on their own.

Despite these strengths, however, significant equity issues remain.

1 Existing incentive programs are unlikely to encourage rental property retrofits

Many retrofit incentive programs specifically target homeowners at their primary residence. They hence cannot be accessed by either the renters or the landlords seeking to improve the energy efficiency of a rental property. Those programs that provide retrofits to renters often require the landlord to commit to keeping the property as a rental for income-qualified tenants for at least the next year and sometimes require a financial contribution from the landlord. While in theory, this stipulation helps to ensure that landlords do not pursue retrofits to evict the tenants or increase rent, in the current housing climate, it is likely to deter potential participants. Since the provincial rent control is tied to the lease and not the unit, soaring rents provide a strong financial incentive for landlords to evict tenants, which would allow them to rent the unit at the higher market rate. Hence, it is naïve to assume that many landlords would give up on potential profits and commit to keeping rents affordable for the low-income population. Furthermore, if renters are the ones paying the energy bill, there is no incentive for the landlords to pursue energy-efficiency retrofits or even to contribute a certain amount in addition to available rebates.

Even if a financial incentive for retrofits were accessible to renters, unless the entire or close to the entire cost is covered, it would be unlikely to encourage retrofits. Even if the tenants can afford energy-efficiency retrofits, it is a risky investment, considering renters often cannot predict for how long they will be residing at their current home.

Energy Savings Kit and Empower Me are the only free-of-charge programs that are available to renters without having to obtain landlord consent^{39,101}. However, products offered through these programs are low-impact measures, such as LED lightbulbs, that make a very small difference in energy costs compared to upgrades such as efficient space and water heating, windows, doors, or insulation.

FortisBC offers a Rental Apartment Efficiency Program that targets the owners of purpose-built rental buildings, providing free energy assessment and installation of energy and water-efficient products, such as water-efficient showerheads, kitchen and bathroom faucet aerators, and LED bulbs⁵⁰. The program, however, results in limited improvements in energy efficiency, especially compared to more significant retrofits, such as efficient heating systems or insulation. Moreover, the program has seen a 34% lower than anticipated uptake in 2021⁶⁵, suggesting that landlords are either not aware of the opportunity or not interested in investing the time in applying and participating.

Overall, these downsides suggest that financial incentives, such as rebates, are not sufficient to encourage comprehensive energy efficiency and decarbonization retrofits in rental apartments.

2 Insufficient support for non-profit, social, and low-income housing

While several rebate and incentive programs are available for non-profit housing providers, housing co-ops, municipal housing authorities, and other low-income housing providers, the available financial support is often insufficient to offset the upfront costs of the retrofits, making it difficult for these housing providers to afford the investments. Moreover, provincial investment in the Capital Renewal Fund has so far been insufficient to achieve high rates of energy-efficiency retrofits in non-profit housing.

Despite the financial limitations, efforts are underway to scale up retrofits of multi-family

buildings, with a particular focus on social housing. In 2020, the Pembina Institute, BC Non-Profit Housing Association, and City of Vancouver launched the Reframed Initiative, aimed at creating a model for deep retrofits in multi-unit residential buildings that can be adapted and implemented in various projects, thereby enabling renovations to be scaled up^{102,103}. The Initiative, in partnership with BC Housing and Metro Vancouver Housing Corporation, has commissioned deep retrofit design for six social housing buildings across British Columbia (see [BC Government News Release](#) for more details).

3 Lock-in of fossil gas systems may exacerbate future energy insecurity

FortisBC Energy Inc. (FEI) continues to offer multiple programs that incentive the installation of fossil gas space and water heating systems. Importantly, FEI offers higher rebates on fossil gas furnaces, boilers, and water heaters for low-income population

groups¹⁰⁴. Encouraging fossil gas uptake among low-income households does not only contribute to carbon lock-in but also can potentially exacerbate energy insecurity as fossil gas heating becomes expensive with the rising carbon tax.

4 Low policy ambition level is unjust to developing nations and future generations

As discussed earlier, the provincial government legislated a 2050 emissions reduction target of 80% compared to the 2007 level². Former BC Premier John Horgan also pledged to increase the ambition of the target to net zero⁷⁹, and, in the foreword to the *CleanBC Roadmap to 2030*, claimed that measures outlined in the plan should put the province on track to meet Canada's nationally determined contributions

under the Paris Agreement and achieving net-zero emissions by 2050⁵. These targets, however, may not represent an equitable contribution to mitigating climate change.

The "net zero by 2050" has emerged from the IPCC Special Report on Global Warming of 1.5°C, released in 2018, which established with high confidence that "limiting warming to 1.5°C implies reaching net zero CO₂ emissions globally

around 2050 and concurrent deep reductions in emissions of non-CO₂ forcers, particularly methane"¹⁰⁵. However, based on Article 2 of the Paris Agreement, climate actions implemented by the Parties of the agreement should "reflect equity and principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances"¹⁰⁶. Based on this principle, some countries may have to reach net-zero emissions prior to 2050.

It has been argued that an equitable contribution to solving climate change ensures that (1) the needs of the poorest countries to pursue sustainable development and poverty eradication are prioritized, which would mean that these countries might reach net-zero emissions later, (2) the degree to which the parties have contributed to climate change is reflected in their obligations to address the issue, and (3) those who have greatest financial resources should contribute more to climate change mitigation than those lacking the resources¹⁰⁷. Modelling shows that in

the most cost-effective scenario that would limit the warming to under 1.5°C, Canada should reach net-zero GHG emissions (including land use) around 2045¹⁰⁸. However, if setting targets based on equity principles, developed countries would need to phase out GHG emissions earlier¹⁰⁸. A similar equity principle may be translated to the provincial level, where different provinces and territories may have differential responsibilities for addressing climate change. To my knowledge, no studies have so far addressed this issue and, hence it remains beyond the scope of this report.

Besides the low ambition of the existing target, as discussed earlier, British Columbia does not even appear to be on track to meeting its target for the residential building sector. This raises concerns regarding intergenerational injustice. If the province fails to meet its climate change commitment, hence contributing to dangerous degrees of climate change, the future generation will be the ones to bear the consequences.



Best-practices for equitable decarbonization of the residential sector

Fossil gas phase-out and zonal electrification

Achieving BC’s decarbonization objectives will require widespread electrification of the households that currently rely on fossil fuel systems, including 58%⁴³ BC households that use fossil gas for heating. The Canada Energy Regulator (CER) projects that fossil gas demand in the residential sector will decline by 23% by 2030 and by 60% by the end of the century compared to 2022 levels, assuming that decarbonization efforts in Canada and worldwide will continue to increase at the rate similar to recent history^{109,110}. CER, however, also notes that this scenario will likely not be sufficient to achieve net-zero emissions by mid-century¹¹⁰. Greater policy ambition in line with legislated and international climate commitments will require an even more significant decline in fossil gas usage for the residential sector.

Even FortisBC Energy Inc.’s (FEI) own modelling study acknowledges that fossil gas usage in the residential sector will decline as BC works toward its decarbonization targets¹¹¹, particularly in their

“deep electrification” scenario, which is the most clearly compatible with provincial climate goals.

If not approached strategically, the widespread electrification of the building sector needed to achieve decarbonization objectives could impose new burdens on low-income fossil gas customers. As fossil gas usage decreases, maintaining the fossil gas infrastructure may fall on a smaller group of remaining customers, leading to higher fossil gas heating prices (see Figure 2)^{112,113}. As fossil gas prices rise, even more customers will be motivated to electrify¹¹³, in what is known as a “utility death spiral.” This raises significant equity concerns, as the burden of maintaining an expensive fossil gas system would disproportionately impact low-income residents, who may not have the financial means to electrify their homes¹¹³, especially without adequate utility or provincial programs to support the transition, such as the direct installation of heat pumps in low-income households.

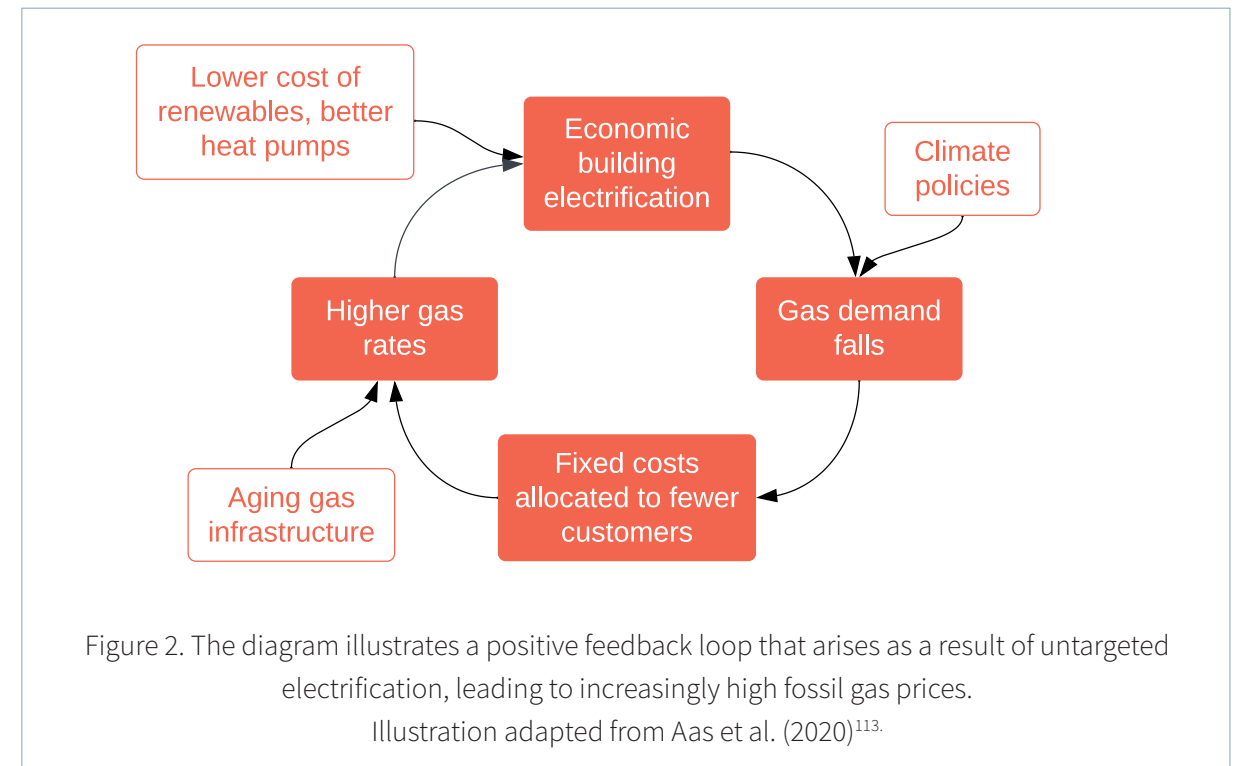


Figure 2. The diagram illustrates a positive feedback loop that arises as a result of untargeted electrification, leading to increasingly high fossil gas prices. Illustration adapted from Aas et al. (2020)¹¹³.

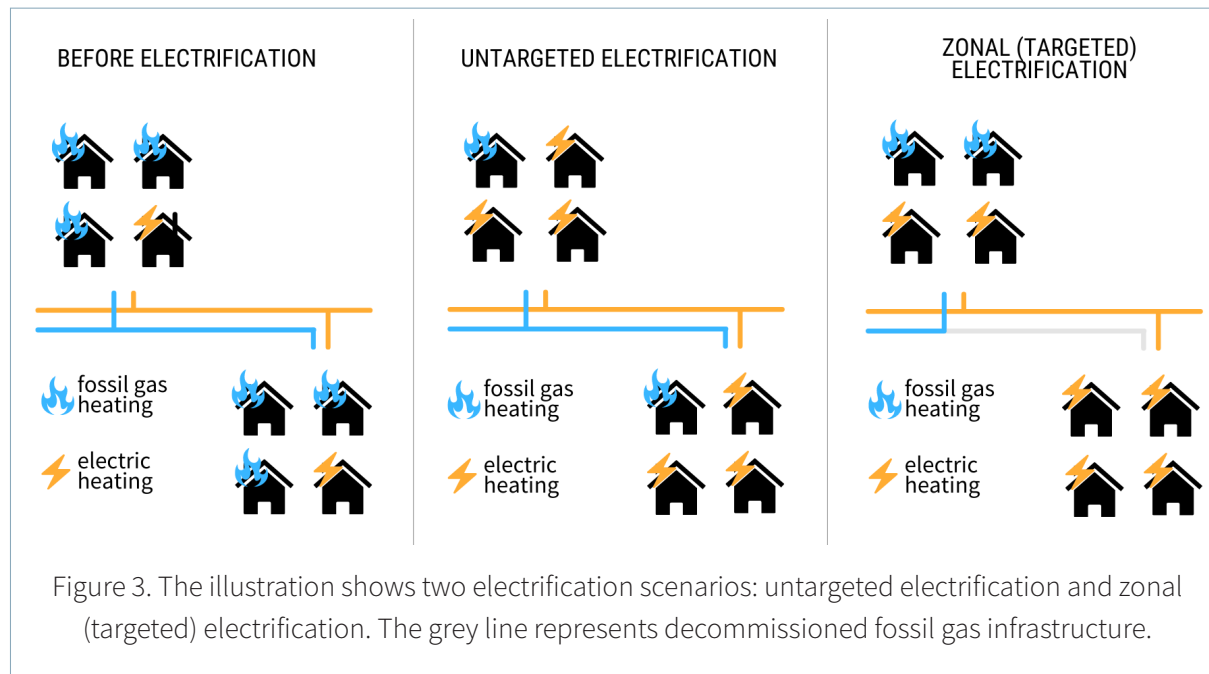
Zonal electrification

One approach that can be taken to address this issue is through zonal or targeted electrification, in which targeted areas or communities are fully transitioned to electric heating and cooling systems¹¹³. Zonal electrification allows for a coordinated effort to minimize disruptions to customers and can potentially reduce operating costs for the fossil gas system. This solution has been gaining increasing attention in California, where decarbonization policies are expected to spur widespread electrification of residential buildings, the majority of which are currently heated using fossil gas¹¹⁴. In particular, this approach has been explored by Pacific Gas and Electric (PG&E) Company – an investor-based California utility which serves 5.5 million customers, making it one of the largest combined gas and electric energy utilities in the United States (U.S.)¹¹⁵. Since 2018, PG&E has been conducting targeted small-scale electrification

projects to reduce the operating costs of the gas system and avoid gas capital expenditures¹¹². The utility committed to considering electric alternatives in its gas planning process and it is actively pursuing electrification projects that are both feasible and cost-effective¹¹². The company is planning to conduct zonal electrification pilots in three to five communities in California, particularly focusing on vulnerable communities that would be impacted by future rises in fossil gas costs¹¹².

Fossil gas lock-in prevention

To prevent carbon lock-in and potential costs of decommissioning fossil gas infrastructure before the end of its life, it is crucial to ensure that the installation of new fossil gas equipment and expansion of fossil gas lines are not incentivized. Recognizing this, in 2022, California Public Utilities



Commission eliminated all line subsidies for new fossil gas connections¹¹⁶.

Similarly, it is important to eliminate incentives on individual fossil gas appliances, especially those targeting low-income population groups. Low-income residents would not only face the greatest challenges affording increased fossil gas costs, they would also be less likely to be able to afford the costs of switching to new heating systems before the end of the system's life or its failure. While in the *Roadmap to 2030*, the BC government promised to phase out fossil gas incentives⁵, customers can still find some fossil gas rebates on the CleanBC rebate search tool and many more on the FortisBC webpage.

In 2021, the BC government announced that by 2030 it would be banning the sale and installation of new space and water heating equipment that is less than 100% efficient⁵. This would eliminate the installation of new fossil fuel boilers and furnaces but will, unfortunately, still allow for the installation of fossil gas and hybrid heat

pumps. Cold-climate electric heat pumps have demonstrated their feasibility and effectiveness in almost all climate zones, and electric resistance heat can be a reasonable backup option for extremely cold days^{117,118}. Allowing the use of hybrid heat pumps is unnecessary and counterproductive, as it leads to further lock-in and continued expenditures on fossil gas infrastructure maintenance.

While the high efficiency of fossil gas-powered heat pumps will mean less fossil gas will be required to heat premises, reducing GHG emissions associated, it still necessitates the maintenance of fossil gas infrastructure. Moreover, the installation of gas-powered heat pumps can lead to carbon lock-in by either continuing reliance on fossil gas for heating or diverting renewable gases from hard-to-decarbonize sectors. The announced efficiency standard will also not require that existing fossil fuel equipment be removed by 2030, which further jeopardizes BC's ability to meet its legislated goals.

Fossil gas phase-out: Policy recommendations

To progress toward the provincial carbon reduction targets, British Columbia should decrease its dependence on fossil gas in residential buildings. To achieve this, the following measures should be implemented:

1. **Establish a provincial strategy for renewable gas utilization.** Considering the constraints on the amount of renewable gas available, the provincial government should develop a strategy for the use of renewable gas, taking into account the commercial viability and cost competitiveness of renewable gas sources compared to other fuels. The strategy should prioritize renewable gas for economic sectors and end-uses that are hard to electrify, such as industrial activities. In the residential sector, which is easier to electrify, renewable gas can be used for peak heating demand. The *Utilities Commission Act* should be reformed to ensure that the utilities business model and planning processes align with these objectives and BC's climate targets more broadly.
2. **Ban incentives for fossil gas appliances and connections.** To prevent carbon lock-in and potential costs of decommissioning fossil gas infrastructure before its end of life, the province should ban incentives on individual fossil gas appliances and new connections.
3. **Require FortisBC to evaluate electric alternatives and pursue zonal electrification projects.** FortisBC should be required to consider electric alternatives in its planning processes and pursue zonal electrification projects in its electric service area. Zonal electrification is essential to ensure equitable decarbonization. As fossil gas usage decreases, maintaining the fossil gas infrastructure may fall on a smaller group of remaining customers, leading to higher fossil gas heating prices for remaining customers. This can disproportionately impact low-income residents, who may not have the means to electrify their homes. Zonal electrification can help address this issue by lowering the operating costs of fossil gas infrastructure.
4. **Energy efficiency and decarbonization programs should prioritize the direct installation of electric heat pumps in low-income households.** Full cost coverage and installation support should be offered to income-qualifying households receiving an electric heat pump, following the example being set by provinces, such as [PEI](#) and [Nova Scotia](#). This will ensure that fossil gas price increases as a result of decarbonization policies and potential geopolitical pressures will not exacerbate energy insecurity.



Supporting energy-efficiency in low-income households

Investments in energy-efficiency improvements in low-income and otherwise disadvantaged households are essential to address energy insecurity and ensure that decarbonization efforts in the residential sector follow principles of distributional and restorative justice (see [Box 2](#))¹²⁰. Low-income households tend to allocate a larger share of their income towards energy bills and often reside in older buildings with poor insulation and outdated appliances^{92,93}. Additionally, many low-income residents lack the funds to finance the initial cost of energy retrofits, making it difficult to undertake home improvements, even if post-installation rebates are available.

An effective way to address these challenges is by offering **free-of-charge home energy improvement for low-income households**. It is crucial that these programs offer comprehensive home improvements including high-impact measures such as insulation and installation of electric heat pumps.

One example of a successful free installation program is Efficiency Nova Scotia's *HomeWarming* program, which provides low-income homeowners with free energy assessment and, if recommended during the assessment, installation of the upgrades to improve home comfort and reduce energy costs¹²¹. The upgrades may include draft-proofing, insulation, or other measures¹²¹. Low-income households that use oil for heating are eligible for free installation of a heat pump and necessary electrical panel upgrades^{121,122}. The program has been offered since 2015 and receives funding from the provincial government, as well as donations from Nova Scotia Power¹²³. As of 2020, it assisted over 10,000 households, with an average annual energy savings of \$750 per participant¹²⁴.

Similarly, Prince Edward Island offers low-income homeowners free installations of heat pumps, insulation, and/or electric hot water heaters¹²⁵⁻¹²⁷. To qualify, the property value must not exceed \$300,000, and the household income should be below \$55,000 for insulation and electric hot

water heater, and below \$75,000 for a heat pump. Free installation programs are beneficial not only because they address the financial barrier to retrofit installation but also eliminate the stress and effort associated with finding contractors and managing the renovation process which may preclude residents from undertaking home improvements.

A common issue that may arise with free installation programs is that low-income households tend to reside in older houses, often with high rates of deferred maintenance, which necessitates home repairs prior to energy-efficiency retrofit installation. For example, program managers of U.S. *Weatherization Assistance Program*, which provides free-of-charge home weatherization services to low-income residents across the country, noted that about 50% of the income-eligible houses do not receive assistance because they require repairs before the weatherization improvement can be made¹²⁸. The most common issues noted by the program managers include mold and moisture problems, knob-and-tube electric wiring, poor roof quality, or asbestos issues¹²⁸. Program managers noted that they often had to avoid major costly repairs, because it would prevent them from achieving the production targets and reduce the funds available for other households¹²⁸.

To ensure that households in the greatest need are able to participate in the free installation programs, it is essential to provide support for the home repairs necessary prior to the installation of energy-efficient measures. The costs of these repairs should be accounted for during the fund allocation process, target setting, and program evaluation. The repairs can also be supported by leveraging funds from other government-funded or philanthropic poverty-reduction programs.

Another approach to promoting equitable decarbonization while preventing free ridership is to offer **varying levels of incentives depending on income levels**. For instance, the French government offers grants to pursue energy retrofits through *MaPrimeRénov'* program, which is available to homeowners, landlords, as well as owners of co-ownership properties¹²⁹. Depending on the household income, participants can be eligible for different grant amounts, as well as different types of renovation, with low-income households having the greatest coverage¹²⁹. The program distinguishes four categories of households depending on the household income: very modest, modest, average, and high¹²⁹. This approach can help to reduce free-ridership rates and tailors support to the needs of different income levels. It is important to note, however, that the program has important limitations: some retrofit measures, such as air-to-air heat pumps, are not covered; the grant amount may be insufficient for lowest-income residents; and the grants are paid as a reimbursement following the installation.

To further support retrofits in low-income households, the French government introduced a mortgage loan called *Prêt Avance Rénovation*¹³⁰. The loan can finance energy improvements such as insulation, window and door replacements, and heating system upgrades¹³⁰. The capital is repaid when the property is sold or inherited¹³⁰. The repayment of interest on the loan is determined by the borrower's age, with those under 60 years old responsible for paying the interest during the loan term, and those over 60 having the interest repaid at the time of sale or inheritance¹³⁰.

California is another example of a jurisdiction that prioritizes energy retrofits in low-income

communities. California's Public Utility Commission requires electrical and gas utilities to provide weatherization services to low-income customers in their service area if the commission determines that there is a need for these services¹³¹. The commission assesses the need based on considerations of cost-effectiveness

of energy efficiency measures, as well as the goal of alleviating the difficulties faced by low-income households¹³¹. The weatherization service could include upgrades to building envelopes, insulation, energy-efficient appliances, and/or educational services¹³¹.

Supporting energy-efficiency in low-income households: Policy recommendations

The provincial government must take action to address energy insecurity in low-income households and promote equitable decarbonization of the residential sector, including:

1. Expanding existing income-qualified free-installation programs to include high-impact retrofit measures. The current low-income energy-efficiency programs, such as Energy Conservation Assistance Program and Energy Savings Kit, offer low-impact measures that are unlikely to make a significant difference in the home's energy performance. These programs should be expanded to include high-impact retrofit measures, such as the free installation of heat pumps and insulation. To reach low-income residents of immigrant backgrounds, the programs should be offered in different languages. This can be achieved by partnering with a third-party organization which has experience administering multilingual energy efficiency programs targeting newcomers.
2. Free-installation programs should support repairs that are required prior to the retrofits, such as removal of mold, asbestos, roof repairs, electrical panel upgrades, etc. The costs of these improvements should be accounted for when allocating funds and setting goals for these programs.
3. The *Utilities Commission Act* should be updated to enable and require utilities to dedicate a significant portion of their funds towards energy-efficiency programs specifically targeting low-income residents.
4. To prevent free-riding, rebate programs should differentiate between various levels of income. Low-income households should be provided with the greatest incentives (up to 100% coverage), moderate-income households should receive lower incentives, and high-income households should only be eligible for minimal to no funding.
5. British Columbia should consider enabling a mortgage loan for energy-efficient upgrades for low-income residents, which can be repaid upon the sale or inheritance of the property. This would remove financial barriers that tend to preclude low-income homeowners from pursuing energy-efficiency upgrades.

District energy systems

Expansion of district heating and cooling is another way to improve energy efficiency and facilitate the decarbonization of existing buildings. District heating is a system that provides thermal energy to multiple buildings through a network of pipes^{132,133}. During the summer, the district heating grid can be used to provide district cooling.

District heating systems are flexible and adaptive: They can rely on a number of heat sources and allow for the incorporation of different heat sources over time¹³⁴. Sustainable district heating networks usually source power from renewable sources (such as solar thermal, geothermal, or ground-source heat pumps), and/or waste heat sources, including heat from industrial processes, wastewater, and data centers^{133,134}. Modern district heating systems also include elements such as combined heat and power (CHP), thermal storage, and decentralized energy production¹³⁵.

District heating systems are most cost-effective in densely populated areas. However, it is not just large urban centers that can utilize district energy: some medium-sized Canadian cities, such as Hamilton or London, and First Nations communities have small district energy systems¹³⁴. Since British Columbia has one of the highest percentages of urban dwellers in Canada¹³⁶, district heating can be a viable solution to enhance building decarbonization in the province.

Benefits of district heating

District heating can play an important role in meeting decarbonization goals. The systems are characterized by high energy efficiency, which can (1) lower average heating costs¹³⁷, (2) reduce GHG emissions in the systems that still partially

rely on fossil fuels, or, (3) in the systems powered by renewable energy, reduce demand on the limited renewable thermal energy sources, such as renewable gas¹³⁸. District heating can also help to reduce peak demand by aggregating loads and using thermal energy storage to shift peak demand¹³⁸. Furthermore, since district heating systems can serve a diverse range of customers, including commercial, industrial, residential, and institutional, they are likely to see lesser demand spikes¹³⁷.

Another benefit of district heating is that it allows the use of heat sources that would otherwise be wasted, such as waste heat from industrial processes, electricity generation, or wastewater^{133,137,138}. This helps to reduce pressure on limited clean energy sources, such as renewable gas. Moreover, even if initially district heating derives some of its heat from fossil fuels, centralized heating and cooling systems are easier to decarbonize in the future than replacing individual equipment in a large number of homes¹³⁴.

The benefits of district heating also extend beyond its potential to aid in decarbonization efforts. District heating offers greater reliability: if the system consists of multiple heat sources, the potential for disruptions in service due to maintenance or equipment failure is minimal¹³⁷. Furthermore, industrial-grade equipment used to provide district heat is more robust than building-level installations¹³⁸. District heating systems can also help lower building costs by removing the need for installation of individual heating systems, free up space in the buildings that would otherwise be used by heating equipment, as well as ensure easier building operation and maintenance^{137,138}.

District energy implementation in Europe

Nordic countries are among the leaders in the deployment of district heating. For example, in **Sweden**, about 55% of residential and service sector buildings receive heat from district heating¹³⁹. The development of district heating in Sweden started as early as the late 1940s and has been initiated by municipalities that started developing CHP plants to gain independence from major power suppliers¹³⁹. In the late 1960s and 1970s, a significant expansion in district heating occurred due to the introduction of the million homes program, resulting in a rapid expansion of housing stock, which was immediately connected to district heating systems¹³⁹. Furthermore, the two oil crises in the 1970s prompted the government to introduce a national energy policy that incentivizes district heating development to reduce oil dependencies¹⁴⁰. For example, prospective homeowners purchasing new houses in the area with existing district heating could only receive state loans if the house was connected to the system¹⁴⁰. Moreover, the local managing authorities could receive subsidies for the expansion of district heating to new customers¹⁴⁰. Finally, the introduction of the carbon tax and grant programs for new biomass CHPs in the 1990s have also contributed to district heating expansion¹³⁹.

Currently, Sweden has about 500 district heating systems¹³⁹. While the majority of these are concentrated in dense urban areas, smaller-size systems are also present in small towns and villages¹³⁹. Overall, Swedish district heating systems meet 89% of domestic heat demand from multi-family residential houses and 17% of heat demand from single-family residential houses¹³⁹.

When first district heating systems were established in Sweden, they were mostly supplied by fossil fuels¹³⁹. Since then, however, the systems were decarbonized and diversified. Currently, the primary heat source in Swedish district heating systems is biomass (46%), particularly wood waste from forestry management, and waste incineration (24%)¹³⁹.

Denmark is another successful case of district heating implementation, with more than 65% of heat delivered to buildings across the country being supplied by district heating. Similar to Sweden, the international oil crises of the 1970s played an important role in promoting district heating development in Denmark¹⁴¹. In 1979, the country adopted the *Danish Heat Supply Act*, which provided a legal framework for large-scale collective heat infrastructure planning, leading to the integration of CHPs into the energy system¹⁴¹. This allowed district heating to expand dramatically to reach its current market share.

Similar to Sweden, district heating systems in Denmark initially relied mainly on fossil fuels¹⁴¹. Currently, however, the systems source the majority of heat from biofuels and waste¹⁴¹. Unlike Sweden, Denmark imports biomass from other countries, including Russia, and North and South America, which have raised concerns with regard to energy security, as well as the sustainability of biomass supplies. The country, however, claims that biomass is a temporary solution, which will be phased out over time in favor of more sustainable (both economically and environmentally) heat sources¹⁴².

A distinctive aspect of Denmark's district heating is that it supplies both high-density urban areas, as well as low-density rural areas¹⁴¹. In fact, approximately 40% of single-family homes in the country are connected to district heating systems¹⁴³. The difference between district heating provision in low-density areas between Sweden and Denmark may be attributed to the latter having almost 6 times greater overall population density¹⁴⁴.

Another way in which European jurisdictions are promoting district energy development is through building codes. For example, Finland and Germany set requirements for a specific share of energy use in buildings to come from renewable sources¹³⁵. District heating based on CHP, surplus heat, and/or renewable energy is considered to automatically meet this requirement¹³⁵.

District heating is also promoted on the **European Union (EU)** level by a legally binding *EU Energy Efficiency Directive*¹⁴⁵. The Directive requires Member States to conduct a comprehensive assessment of the national potential for high-efficiency cogeneration and district heating and cooling. If Member States identify cost-effective opportunities, they should take “adequate measures” to ensure that these opportunities are developed¹⁴⁵. Additionally, *EU Energy Performance of Buildings Directive* requires Member States to “enable and encourage architects and planners to properly consider the optimal combination of improvements in energy efficiency, use of energy from renewable sources and use of district heating and cooling when planning, designing, building and **renovating** [emphasis added] industrial or residential areas”¹⁴⁶.



Image shows Amager Bakke, also known as Amager Slope or Copenhill, which is a combined heat and power waste-to-energy plant located in Copenhagen, Denmark. The plant features a roof park and year-round ski slope. Photo by Lars Plougmann, licensed under CC BY-SA 2.0.

District heating can play an important role in advancing equitable decarbonization, as its' high efficiency leads to lower heating costs. Moreover, the systems are able to provide both heating and cooling, which would particularly benefit low-income households that tend to reside in areas more prone to urban heat.

The role of national/provincial governments

While specific decisions associated with district heating development need to be made by municipalities and local governments that have in-depth knowledge of the local context and available heat sources, the provincial government can play an important role in supporting district energy development. A report by United Nations Environment Programme on District Energy in Cities conducted a review of successful cases of district energy implementation in cities across the world and determined several ways in which national governments can support district energy development¹³⁵:

- **Incorporation of district energy into building efficiency standards and labels.** Energy efficiency metrics in buildings should extend beyond simply the use of energy and account for efficiency in energy supply. The standards should also encourage a reduction in fossil fuel share in primary energy consumption.
- **Devolving authority.** Transferring decision-making power from the national level to local authorities enables district energy systems to capitalize on local knowledge and the involvement and action of local authorities. Devolving authority may include creating a regulatory framework that enables local governments to mandate connection, undertake energy master planning and

mapping, provide energy service, and change building codes.

- **Requiring local governments to consider district energy in their planning.** National governments may encourage or mandate local authorities to develop cost-effective energy and heat plans that require cities to consider district heating and cooling systems. This approach has been taken by the European Union in its Energy Efficiency Directive.
- **Providing financial and capacity support.** National governments should ensure that local governments have access to financial and capacity support at the early stages of projects (such as energy mapping, project planning, etc.).
- **Leveling the playing field.** National governments should implement financial and regulatory measures to ensure that the pricing regime takes into account the benefits of district energy systems and does not disadvantage their development through subsidizing other technologies. This may include a tax on non-recycled waste heat, biomass CHP feed-in tariffs, regulations requiring that a certain percentage of heat in buildings come from renewable heat, regulations mandating that a certain percentage of energy must be recovered from waste incineration, etc.
- **National regulations on tariffs.** Tariffs can be regulated so that district energy is priced at the cost of alternative technologies, or they can be indirectly regulated by controlling the profits of district energy companies or the costs they can pass on to consumers. This is particularly important if mandatory connection policies have been introduced.

District energy expansion: Policy recommendations

Developing district energy systems can be an effective solution to foster equitable decarbonization in densely populated areas. Since British Columbia has one of the highest percentages of urban dwellers in Canada¹³⁶, district heating can be a viable solution to enhance building decarbonization in the province.

A number of policies can support the development of district heating systems. Firstly, British Columbia should require local governments in larger urban areas to consider district energy in their planning processes. District heating can then be further encouraged through the building codes. For example, similarly to Finland and Germany, new constructions could be required to obtain a certain share of energy from renewable sources. District energy systems based on biomass CHP, ground-source heat pumps, waste heat, and/or renewable fuels can automatically be considered to fulfill the requirements. Alternatively, these provisions can be incorporated into the BC Energy Step Code.

District energy system connections do not have to occur during construction and can help to decarbonize existing building stock, as switching to district energy can occur during major renovations¹³⁴. In Canada, an estimated 40% to 80% of major equipment in buildings will need to be renewed between 2017 and 2030¹³⁴. This may offer an opportunity to scale up district heating in the existing building stock¹³⁴. Once more district energy systems have been developed, the province should consider requiring buildings undergoing renovations to connect to district heating systems, if available in the area and fueled by renewable sources, as part of the Alterations Code for Existing Buildings. Alternatively, connection to the district energy system, if available, can be required at the time of the replacement of the heating and/or cooling equipment.

Overall, district energy systems development requires time. However, with the right policies in place, British Columbia can follow in the footsteps of the jurisdictions that have successfully scaled up district energy systems in urban areas, such as Nordic countries.





One-stop-shop services

Another way in which jurisdictions across the world facilitate energy-efficiency improvements and decarbonization of existing residential homes is by offering One-Stop-Shop (OSS) services. OSSs provide homeowners with a single point of contact, which helps guide them through the entire retrofit process, hence reducing the time, effort, and energy that the homeowners need to invest in retrofitting their premises¹⁴⁷⁻¹⁴⁹.

OSS model can help overcome a range of barriers that commonly hamper retrofit uptake, including:

- **Informational barriers.** Decisions on whether to undertake energy-efficiency retrofits are often affected by informational barriers, such as incorrect beliefs regarding one's energy use and uncertainties or misperceptions of the benefits associated with energy-efficiency retrofits¹⁴⁹. The one-stop-shop model can help address these barriers, for example, by providing homeowners with personalized energy assessment and advice, raising awareness of the available energy-efficiency retrofit options and associated benefits, or transferring risks from the homeowners to OSS by providing guarantees of the energy

savings¹⁴⁹. Retrofit uptake can also be hampered by a lack of trust in the contractors and uncertainties regarding the quality of their work¹⁴⁹. OSS can address this by maintaining a network of reliable service providers, taking responsibility for contractor performance, and/or providing additional training or certification to contractors¹⁴⁹.

- **Decision-making barriers.** Retrofit uptake is often hampered by decision-making barriers, such as high cognitive burden associated with information and contractor search, anticipated stress and disturbance, lack of strong social norm for retrofitting, or tendency to maintain status quo^{149,150}. OSS can help address these barriers by reducing the complexity of the retrofit project, relieving participants of the burden of having to navigate a fragmented supply chain, and speeding up the retrofit process^{149,150}. As a result, OSSs also reduce stress and disruption accompanying retrofitting process¹⁵⁰. Quality assurance that some OSS model offer improves homeowners' trust in the offered retrofit solutions and reduces perceived risks associated with the adoption of new

One-Stop-Shop Services in Ireland

Since March 2022, Irish homeowners can benefit from one-stop-shop services provided by the national Sustainable Energy Authority of Ireland (SEAI). SEAI is a governmental body, which strategic objectives include improving energy efficiency, facilitating the development and adoption of low-carbon energy sources, as well as spurring innovation and integration to achieve a low-carbon future¹⁵⁴.

SEAI currently offers two all-inclusive one-stop-shop programs: *One Stop Shop Service* and *Fully Funded Energy Upgrade*¹⁵⁵. One Stop Shop Service is partially funded with SEAI grants and requires partial investment from homeowners¹⁵⁵. The retrofit process is entirely managed by SEAI, including home energy assessment, grant application, project management, contractor work, and follow-up building energy rating¹⁵⁵. The Fully Funded Energy Upgrade program provides homeowners who receive certain welfare benefits with free of charge and fully manage retrofit services, including home survey, contractor selection, contractor work, and follow-up building energy rating¹⁵⁵.

If homeowners do not wish to use SEAI's OSS service, they may choose to apply for individual grants, in which case they are responsible for contractor selection, grant application, contractor work, and follow-up building energy assessment¹⁵⁵.

technologies¹⁵⁰. This increases the uptake of the technology, hence enhancing its market maturity level.

- **Financial barriers.** OSS can help overcome financial barriers to home retrofits by providing homeowners with support in accessing grants, loans, or other financial solutions¹⁴⁹. This may include, for example, providing information on the financing options available or even managing the funding applications. Moreover, by creating an economy of scale¹⁴⁹, OSSs may contribute to the decrease in the costs of retrofits.
- **Split incentive between landlords and renters.** A common barrier to retrofit uptake in rental housing is a split incentive problem: A landlord may not be interested in making

energy-efficiency improvements, because they are not the ones who would benefit from resulting energy bill reduction or enhanced comfort⁹⁵. Tenants, on the other hand, may be not have the agency to undertake retrofits or may be reluctant to invest in the improvements due to uncertainties on investment return shall the lease be discontinued in the future⁹⁵. OSS model can address this problem by acting as a mediator between the landlord and the tenant. OSSs can help to develop solutions that would align costs and benefits more fairly to both the parties¹⁴⁹.

The benefits of the OSS model also extend to the supply side: OSSs provide opportunities for suppliers to extend their offerings and enter new market segments or value chains¹⁴⁹. Furthermore,

One-Stop-Shop Services in Nova Scotia

In Nova Scotia, one-stop-shop services are offered by Efficiency Nova Scotia (ENS), a provincial energy efficiency utility that delivers a range of programs to help residents increase their home's energy efficiency¹⁵⁶.

Income-qualified homeowners can access one-stop-shop services through the *HomeWarming* program, which offers free-of-charge energy assessment and energy efficiency upgrades, such as draft proofing, insulation, and replacement of existing oil heating with a heat pump including any required electrical panel upgrades¹²¹. This program helps to overcome a range of barriers that would preclude households from pursuing energy-efficiency retrofit, including financial, decision-making, and information barriers. It also improves comfort and reduces the energy bills of the lower-income population experiencing or at risk of energy insecurity.

For residents who are not income-qualified, ENS offers the *Home Energy Assessment (HEA) program*. The participants firstly register for Home Energy Assessment, during which Registered Energy Advisor expects the home, assesses sources of heat loss, suggests potential retrofits, and shares the lists of rebates the homeowner is eligible for. The homeowner is then responsible for managing the retrofit process, arranging a follow-up Home Energy Assessment, and applying for rebates. Thanks to the partnership between ENS and the federal Canada Greener Homes Grant initiative, HEA program participants who meet Canada Greener Homes eligibility requirements are automatically considered for federal grants and can apply for an interest-free loan.

The benefit of the HEA program is that it offers comprehensive information services and simplified funding applications by consolidating federal and provincial rebates. The downside, however, is that program participants are still responsible for acquiring contractors, which may preclude homeowners from undertaking retrofit due to the high cognitive burden and stress associated with managing the retrofit process.

ENS also offers comprehensive one-stop-shop services to Indigenous communities as part of the *Mi'kmaw Home Energy Efficiency Project*, which involves free of charge energy assessment and upgrades, including draft proofing, insulation, and installation of heat pumps¹⁵⁷. To carry out this program, ENS partners with delivery agents, who provide all-inclusive one stop-shop services including arranging energy evaluation, suggesting improvements, recruiting and managing local contractors, and maintaining communication with housing managers¹⁵⁷. ENS estimates that the program has so far prevented about 1,000 tons of CO2 equivalent emissions¹⁵⁷.

Overall, Nova Scotia is a great example of equitable energy-efficiency policies, as it provides comprehensive and free-of-charge OSS services to disadvantaged and equity-seeking population groups.

by integrating the supply side, it contributes to the transfer of knowledge, skills, and innovation among the key market players¹⁴⁹. Unsurprisingly, this solution has been widely endorsed in the European Union. An EU Directive from 2018 states that “to support the mobilization of investments into the renovation ... Member States shall facilitate access to appropriate mechanisms”, including “accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services”¹⁵¹.

Despite these benefits, OSSs may also be associated with certain limitations. First, this model can reduce the ability of homeowners to choose preferred suppliers and having a single point of contact increases the potential for biases throughout the process¹⁵⁰. If issues arise between homeowners and the OSS, the entire project is jeopardized, rather than a single element as in the case of a more traditional approach¹⁵⁰. Furthermore, the analysis of existing OSSs suggests that while the model may ensure more comprehensive retrofits, it may not be sufficient on its own to motivate homeowners who are unsure or are not planning to pursue retrofits¹⁴⁷. This suggests that OSSs should be paired with regulatory mechanisms (for example, energy performance or greenhouse gas emissions standards for existing buildings or rental properties) or financial signals (for example, high carbon taxes).

The benefits and limitations associated with OSSs often depend on their design. OSSs can

vary in their comprehensive and level of support provided to the homeowner. European Union-funded INNOVATE program^a distinguishes the following four business models for OSS^b:

- **Facilitation:** OSS focuses on raising awareness of the benefits of energy retrofits and provides general information and advice on optimal retrofits and existing financing options¹⁵².
- **Coordination:** OSS offers comprehensive one-stop-shop services, assisting homeowners with the coordination of suppliers and managing the renovation works¹⁵². OSS also assists homeowners with the development of a customized financing plan and preparing documents necessary to access financial resources¹⁵². While OSS oversees the entire renovation process, it does not take responsibility for the results of the retrofits¹⁵².
- **All-inclusive model:** OSS offers a full renovation package, including advice, coordination of the renovation work, preparation of a customized financial plan, and all documents needed to access financial resources¹⁵². In this model, OSS bears responsibility for the results of renovation work¹⁵².
- **ESCO-type:** Similarly to the all-inclusive model, OSS provides a full renovation package¹⁵². Additionally, OSS bears responsibility for the results of renovation work and guarantees energy savings to

a INNOVATE project, which operated between 2017 and 2018, was a cross-national cooperation between 13 organization, aimed at developing and providing one-stop-shop services for homeowners of single-family houses and condominiums¹⁵².

b More information on the services provided under each of the models, as well as their respective advantages and downsides can be found in the following report by the INNOVATE program: https://energy-cities.eu/wp-content/uploads/2020/07/INNOVATE_guide_FINAL.pdf

homeowners¹⁵². OSSs operating under this model may cover part of the up-front costs, which are paid for through the energy savings achieved¹⁵² (for example, [EnergieSprong](#)). While this may be helpful for OSS to recover retrofit costs, it should be utilized with caution in low-income households, where relieving financial pressure associated with energy bills should be prioritized.

The ability of the OSSs to address the previously mentioned retrofit barriers depends on the comprehensiveness of the program. A study

analyzing OSSs across Europe found that the most successful cases are those that implemented an all-inclusive model, providing support for the consumers throughout the entire process¹⁴⁸.

OSSs may also vary in the type of ownership and can be public, private, or mixed^{148,153}. Research shows that public OSSs tend to be preferable, as they tend to operate smoother in the renovation market, offer more comprehensive services, and are able to provide better access to financing than their private counterparts¹⁵³.

One-Stop-Shop: Policy recommendations

Implementing a one-stop-shop (OSS) solution in British Columbia can help address a range of non-financial barriers that currently hinder the uptake of home retrofits. Existing retrofit incentives in BC are administered by several different organizations, including utilities, provincial, and federal governments. Each administrator has varying eligibility requirements and/or application procedures, making the process confusing and time-consuming for residents. By centralizing the incentives into a single platform, the OSS streamlines the process and facilitates access to retrofit incentives. In British Columbia, OSS services could be offered through CleanBC or an independent energy-efficiency utility established by the provincial government.

Furthermore, to overcome decision-making barriers and simplify the retrofit process, provincial OSS can go beyond simply providing informational service and consolidated rebate application system. Ideally, the OSS should offer residents assistance throughout the renovation process, including advice, coordination of the renovation work, and help with accessing funding. To ensure equitable decarbonization despite the limited resources, free-of-charge and all-inclusive OSS services could be provided to low-income households. Higher-income households could receive a lower degree of support or can be offered services such as coordination of contractors and renovation work at a cost.

OSS services can also be offered in combination with on-bill tariffs. In this model, OSS would cover some or all of the up-front costs of the retrofits and the investment would be repaid through the customer's utility bill.



Energy efficiency utility

Energy efficiency programs play a crucial role in reducing energy use and emissions in existing residential buildings, especially in the absence of regulatory tools mandating such improvements. There are three main models of delivery of such programs – through utilities, governmental agencies, or third parties (independent, non-governmental organizations). The latter approach was adopted by Nova Scotia, where energy efficiency and decarbonization programs are delivered by the energy efficiency utility *Efficiency Nova Scotia*, the first agency of its kind in Canada.

This delivery model can offer multiple advantages over the utility- and government-driven programs that are currently prevalent in British Columbia. Utility-run energy efficiency programs usually focus on either building envelope improvements or upgrades to heating systems that do not involve fuel switches, as utilities are not interested in losing customers¹⁵⁸. Investor-owned utilities also face a conflict of interest between the utility's profit-making mandate and the goal of reducing energy consumption¹⁵⁸. The existence of multiple

separate utility-run programs can also lead to administrative redundancies resulting in higher costs and may create confusion among customers and market actors¹⁵⁸.

Government-driven programs do not suffer from conflict of interest or single-fuel focus; however, these programs are vulnerable to political pressures, and funding fluctuation due to potential changes in political priorities^{128,158}. Furthermore, government agencies cannot receive financial performance incentives to ensure the achievement of the mandate¹⁵⁸.

A third-party model, such as that adopted in Nova Scotia, offers unique advantages that can overcome these challenges. Similar to government-run programs, they can focus on multiple fuels and do not have a conflict of interest¹⁵⁸. However, non-governmental organizations can receive performance incentive and can avoid fluctuation in funding due to government appropriation of funds¹⁵⁸.

Efficiency Nova Scotia: First in Canada Energy Efficiency Utility

Nova Scotia offers a successful implementation example of the third-party model for administering energy efficiency programs. Prior to 2009, demand-side management programs in the province were administered by Nova Scotia Power Inc. (NSPI), a provincial electric utility that owns over 95% of the province's electricity system^{159,160}. Stakeholder consultation at the time revealed concern about the NSPI having a dual role as both a regulated monopoly in charge of selling electricity and administrator of energy efficiency programs that aim to reduce customers' energy consumption, as it seemed to create a potential conflict of interest¹⁶⁰.

This prompted Nova Scotia Legislature to establish Efficiency Nova Scotia Corporation as an independent administrator of energy efficiency and conservation measures, including but not limited to electric DSM programs¹⁶¹. In 2014, the Efficiency Nova Scotia Corporation was resolved and replaced by the Efficiency Nova Scotia (ENS) franchise, which is owned by the provincial government and awarded to the franchise holder for a period of 10 years by the Minister of Energy^{160,162,163}. Since then, a non-profit organization Efficiency One has been the holder of the franchise¹⁶⁰.

Nova Scotia government requires NSPI to carry out reasonably available and cost-effective energy efficiency and conservation programs by entering into an agreement with ENS, which must be approved by the provincial regulator, the Utility and Review Board¹⁶². NSPI's investment in these programs is recovered through utility rates, treating energy efficiency as a system resource¹⁶⁰. Additionally, NSPI voluntarily funds low-income energy efficiency programs for electrically heated homes^{164,165}.

Besides DSM programs, ENS also provides services that promote non-electric efficiency and decarbonization, which are funded by the Province of Nova Scotia¹⁶⁵. Other sources of funding for ENS programs include the Federation of Canadian Municipalities, endowment, operating funds, Natural Resources Canada, as well as agreements with Nova Scotia Power beyond the DSM funds¹⁶⁵.

The third-party model implemented in Nova Scotia has proven to be effective in promoting energy efficiency and supporting the growth of the industry. Since its DSM programs are funded through utility rates, ENS enjoys greater stability of funding as compared to a Crown corporation. This creates certainty about the future of the programs and contributes to the development of supporting industries. Moreover, having a single administrator for energy efficiency programs, including the federal Canada Greener Homes initiative, reduces customer confusion and simplifies the application process.



Energy Efficiency Utility: Policy recommendations

To enhance energy efficiency efforts, British Columbia may consider establishing an energy-efficiency utility administered either by an independent third party or a Crown corporation. Having a single administration of energy efficiency program independent of utilities can reduce administrative redundancies, prevent conflict of interest, effectively support fuel switching, and simplify application processes for customers. The provincial government, through the CleanBC initiative, already manages energy-efficiency programs and could expand its role to become the sole administrator of these programs.

The third-party model, as seen in Nova Scotia, offers additional advantages, as it generates greater trust from participants and contractors, spurs the development of the local industry, and benefits from the greater stability of funding than government-run programs.

Regardless of the model adopted, the utilities operating in British Columbia could be required to provide funding to the OSS administrator to carry out energy-efficiency programs. The funding may additionally be supplemented by the provincial government.

Financing

On-bill financing

Another promising solution to encourage energy efficiency retrofits is to introduce on-bill programs, which allow customers to repay the costs of energy efficiency improvements through a fixed additional charge on their monthly utility bill^{166,167}.

There are two main models for on-bill programs: **on-bill repayment** (OBR) and **on-bill financing** (OBF). In the on-bill repayment model, a third-party lender provides capital to cover up-front costs of energy efficiency retrofits, which is repaid by the property owner through the utility bill^{167,168}. These loans are commonly tied to the property owners and tend to not be transferable in case the property has been sold¹⁶⁹.

In the on-bill financing model, the utility company itself provides the capital for energy efficiency upgrades¹⁶⁹. These programs are usually funded through the ratepayers' funds or dedicated public funds¹⁶⁸. Utility companies typically evaluate the creditworthiness of the potential borrower based on their bill payment history, which may enable capital access for low-to-moderate-income customers who may face difficulties obtaining credit from traditional lending institutions¹⁶⁹.

OBF can take a form of a loan or a tariff^{166,168}. In the case of an **on-bill loan**, the payments are added to the customer's monthly utility bill and continue until the loan is repaid¹⁶⁹. Unlike in the OBR model, utilities have the option to include renters

and transfer the debt to the new property owners if the property is sold¹⁶⁹.

Alternatively, the utilities may offer an **on-bill tariff** (OBT). In this case, utility companies invest in energy efficiency improvements, which are recognized as a system reliability investment¹⁶⁷. The utility company then recovers the investment by adding tariffs for these systems on the customer bill¹⁶⁷. Unlike OBR and OBF, an on-bill tariff is not considered a loan and does not add to the customer's debt profile¹⁶⁷. The tariffs usually link financial responsibility to a property (usually, a meter), rather than an individual, which allows the costs incurred from the upgrades or investments to be passed on to future owners or renters^{166,167}. This solution allows renters and property owners to make energy-efficiency improvements without incurring any out-of-pocket expenses or acquiring debt¹⁶⁷.

On-bill programs can be an effective tool to promote equitable decarbonization of residential buildings. By enabling customers to repay the cost of retrofits over time through an additional charge to the bill, they remove the financial barrier associated with the high upfront costs of the retrofit, making home improvements more accessible to low- and middle-income households. On-bill programs also often allow customers to combine on-bill financing with other financial incentives, such as rebates, hence further reducing retrofit costs. Moreover, by leveraging existing relationships between the utility company and its customers, on-bill programs can save the time and effort that customers need to invest in finding a financial institution to provide loans on retrofits¹⁶⁶.

Furthermore, on-bill programs can be designed to be bill-neutral, where the reduction in the

energy costs as a result of the retrofit equals or exceeds the loan payments ("Pay As You Save" model), which helps to ensure that low-income households are not disproportionately burdened by the costs of energy-efficiency improvement¹⁷⁰. However, it is worth noting that this bill neutrality may not always be guaranteed because property residents may opt for a more comfortable environment, which can increase energy consumption¹⁷⁰. In low-income households, it is important to prioritize direct and free installation of energy efficiency measures that would immediately result in lower energy bills.

While on-bill schemes, in general, have multiple advantages, on-bill tariffs are particularly promising solution to support equitable decarbonization. OBT programs tend to take into consideration customer bill payment history, rather than their credit score, when deciding on the investment, which may enable traditionally credit-constrained customers to access funds for energy-efficiency retrofits¹⁶⁶. Additionally, by tying the financing to the property, on-bill tariffs and loans can provide access to funding for energy efficiency improvements for traditionally underserved markets, such as rental and multifamily buildings, addressing the split-incentive problem¹⁶⁶. For an on-bill program to be equitable, however, it is crucial to include strong consumer protection in the program design. Program administrator should ensure that customers are not facing undue financial strain, particularly when the program is targeted at low-income households and non-payment of the charge could result in utility shut-off¹⁶⁶.

Besides its potential to foster equitable decarbonization, on-bill financing programs are an attractive policy option to the utility or the government as, unlike rebate programs, it enables

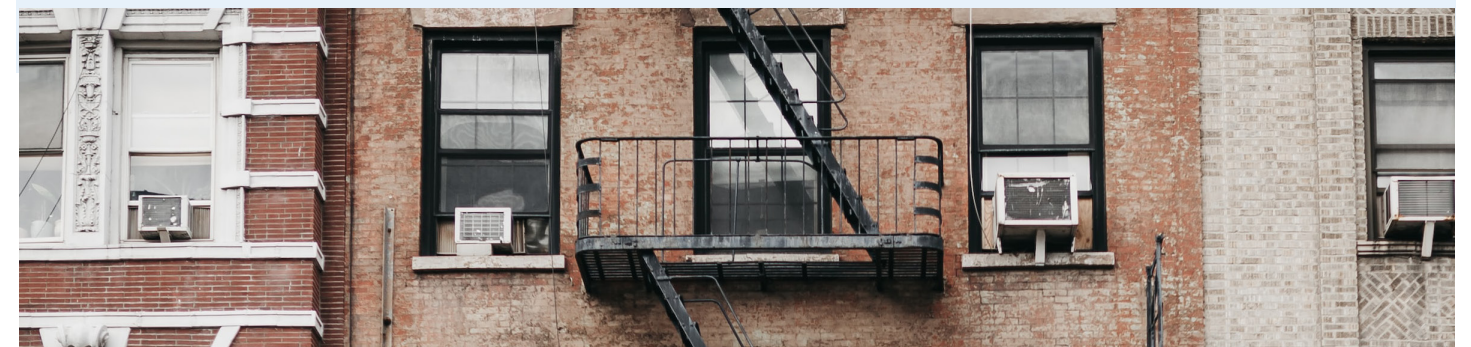
On-bill financing in New York

In 2011, the New York State enacted a *Power NY Act* requiring utilities to offer billing and collection services to support on-bill recovery charges for the Green Job-Green New York program¹⁷³. The program, administered by the New York State Energy Research and Development Authority (NYSERDA), provides residents with free home energy audits, installation services, low-interest financing options, and training opportunities for green-collar workers¹⁷⁴. NYSEDA is a public-benefit corporation whose primary goal is to promote energy efficiency and increase the use of renewable energy in the state of the state¹⁷⁵. The programs offered by the corporation are funded through a variety of public fund sources, including system benefits charge added to the electric utility bills, clean energy credit sales, and carbon emission allowances sales, which are leveraged to access private sector funding¹⁷⁶.

As a result of the 2011 legislation, NYSEDA has been administering on-bill financing in partnership with utilities since 2012¹⁷⁷. The corporation offers on-bill loans to finance energy efficiency and renewable energy improvements, with loan amounts ranging from \$1,500 to \$25,000 and repayment terms of 5, 10, or 15 years^{177,178}. The program is set up to be bill-neutral, i.e. monthly loan payments under the program do not exceed the estimated average monthly energy savings¹⁷⁸. The loan is tied to the meter, which means that if the property is sold, the balance is transferred to the new owner^{177,178}. The loan has variable interest rate, and lower rates are available for qualifying low-income residents¹⁷⁸. The loan may also be combined with existing incentive programs¹⁷⁸.

The loan approval criteria include a combination of credit score, debt-to-income ratio, mortgage payment history, outstanding collections, prior loans, and other relevant financial history¹⁷⁸. Although residents with low credit scores may qualify for the loan, provided they meet the specified debt-to-income ratio requirements, this may not remove barriers for all traditionally credit-constrained population groups. Some low-income residents with high debt-to-income ratios may still be disqualified. Therefore, programs that evaluate the creditworthiness of potential borrowers based on their utility bill payment history tend to be more equitable. Additionally, since the program is set as a loan, rather than a tariff, it adds to the consumer's debt profile, which may discourage low-income participants who do not want to accrue more debt.

For more information on the financing programs promoting home energy efficiency in other Canadian provinces and the United States, see [Community Efficiency Financing](#) report (particularly, pp. 27, 113-115)



them to recover funds invested in the energy retrofit measures. This may potentially enable achieving greater rates of retrofit within the existing funding constraints.

On-bill financing pilots have been carried out by BC Hydro in the City of Colwood and FortisBC in the Regional District of Okanagan-Similkameen in 2012. The programs were unsuccessful at attracting participants, leading the utilities to avoid offering further on-bill financing mechanisms. The report by the Pacific Institute for Climate Solutions revealed multiple shortcomings in the design of the pilots, which likely lead to its failure¹⁷¹. However, the utilities have not conducted further pilots addressing these limitations. Currently, in BC, on-bill financing programs are only offered by municipal utilities (such as [Penticton](#) and [Nelson](#))¹⁷².

The role of government in promoting on-bill financing

The provincial legislators and regulators can play a crucial role in promoting province-wide on-bill financing by:

- Mandating utilities to offer on-bill financing program¹⁶⁶;
- Directing utilities to conduct on-bill financing studies and pilots¹⁶⁶;
- Providing financial support for the programs by setting up revolving loan funds and/or loan loss reserves to attract private sector capital¹⁶⁶;
- Implementing energy efficiency resource standards (EERS), which provides utilities with an incentive to reduce barriers to energy-

efficiency improvements¹⁶⁶. Regulators can additionally promote the implementation of the on-bill schemes by providing EERS credits to utilities that offer these programs¹⁶⁶.

PACE financing

An increasing number of jurisdictions are offering PACE financing, also known as Property Assessed Clean Energy financing, to encourage energy efficiency and renewable energy improvements among homeowners. This financing allows property owners to pay for the up-front cost of the retrofits with lien-secured loan bonds offered by municipal governments, with the loan repaid through an annual assessment on the property tax bill over a period of 15 to 20 years^{179,180}.

PACE assessments are attached to the property rather than the owner¹⁸⁰, which makes it an attractive option for homeowners who may be planning to sell the property in the future. PACE programs are also often secured by a senior lien on the property, making it more attractive for financiers and detaching the lender's ability to recover their investment from the borrower's creditworthiness¹⁷⁹. The disadvantage of PACE financing, however, is that it is only available for homeowners and does not address the split incentive problem facing rental properties.

PACE-style programs are already offered to residential homeowners in multiple jurisdictions across the United States and Canada, including California, Florida, Missouri, Nova Scotia, Ontario, and Alberta¹⁸¹⁻¹⁸³.

Retrofit financing: Policy recommendations

At present, British Columbians cannot access financing for energy efficiency upgrades that would be attached to the property or a meter, rather than the individual. This hinders retrofit uptake in rental properties or among homeowners who may want to sell their property in the future.

To address this issue, the provincial government should require utilities to implement an on-bill tariff program. The government can support these programs by establishing revolving loan funds and loan loss reserves to attract private-sector capital. Ideally, the on-bill tariff program should be designed to be bill-neutral for the end consumer. Additionally, the BC government should ensure that homeowners can benefit from Property Assessed Clean Energy financing to support energy-efficiency improvements and fuel switching.

Mandatory standards for rental housing

In efforts to improve energy efficiency in rental housing and overcome a split-incentive problem, some jurisdictions implement mandatory minimum standards for rental properties, including:

- **Minimum Housing Quality Standards**, which set general quality requirements for rental units. These standards may cover a range of areas, such as plumbing and drainage, ventilation, insulation, and heating.
- **Prescriptive Standards**, which require certain building elements, such as insulation, to meet minimum design requirements with regard to energy efficiency, resilience, and health. These policies usually set specific “trigger points”, at which buildings must be retrofitted to comply with the standards. This may

For more information on mandatory standards in rental housing and their effects on energy insecurity, see Maya Korbynn's 2023 report “[The Missing Third](#)”, for Ecotrust Canada.

- include updating multiple building systems, selling the units, or major renovations.
- **Performance Standards**, which set requirements on the overall energy efficiency or carbon intensity of a building or a unit. If rental housing fails to comply with the standards, it can no longer be rented out and the landlord may be fined.

Policy recommendations

Mandatory energy-efficiency requirements for residential housing in B.C. can be introduced by updating the provincial *Residential Tenancy Act*. The Act should require rental housing to meet certain levels of carbon intensity, hence requiring least efficient properties to undertake comprehensive retrofits including energy-efficiency improvements and fuel switching.

In the preparation for this policy change, the government should enforce Energy Efficiency Ratings and Energy Efficiency Disclosure for rental properties mandating landlords to undertake energy audits and disclose the information on the energy-efficiency performance of the unit to the prospective tenant. This may incentivize landlords to pursue energy-efficient retrofits since better-performing properties are likely to be more desirable to renters.

However, relying on voluntary retrofits is unlikely to address energy poverty, since more efficient properties will likely command a higher rent, making them unaffordable to lowest-income households. Hence, the mandatory requirements should be enacted shortly after.

Green leases

Green leases are voluntary agreements between landlords and tenants to undertake measures to improve energy efficiency^{95,184}. In this arrangement, the costs of the upgrades incurred by the landlord are offset through the rent increase over a limited period of time, which the tenant has agreed to in advance in exchange for long-term energy savings^{95,184}. Green leases have the potential to reduce costs to both parties: The tenant benefits from lower energy costs and improved home comfort. Meanwhile, the landlord may benefit from the enhanced value of their property and ensure compliance with future energy efficiency requirements, if energy-efficiency standards for existing buildings have been announced.

While green leases are voluntary, the government may play a role in encouraging their uptake in

the residential sector. In this regard, lessons may be learned from Australia, which is considered the world leader in green leases¹⁸⁵. Australian government developed a standardized Green Lease Schedule to be used by government agencies when leasing or renting new or significantly renovated properties¹⁸⁵. In September 2006, the Australian government passed *Energy Efficiency in Government Operations Policy* which required public institutions to enter into the Green Lease Schedule every time a new building lease is signed¹⁸⁵. This policy has spurred interest in green leases in the residential sector, as occupants in privately rented buildings began to demand green leases¹⁸⁴.

While green leases may address split-incentive issues hampering decarbonization of the rental properties, it is unlikely to contribute to



alleviating energy insecurity in the lowest-income households. The increase in rent associated with the green lease will likely preclude low-income households from entering this agreement, particularly if no guarantee can be provided that the energy savings achieved through the retrofits will fully offset the rent increase. Additionally, since low-income households facing energy insecurity may resort to extreme energy conservation to reduce expenses, improvements in energy efficiency may lead to a rebound effect. For example, the installation of more efficient heating systems may prompt households that have been underheating their homes to increase heating to a comfortable temperature. This may further decrease the probability that energy savings achieved through retrofits in

these households would exceed additional rent charges.

While not appropriate for lowest-income households, green leases may spur energy improvements in moderate-to-high-income rental households, particularly if mandatory energy-efficiency requirements are introduced in the existing rental properties. This may free public funds that are currently spent on incentivizing moderate-to-high-income households to pursue energy-efficiency retrofits, which can be invested to provide comprehensive retrofit support for low-income households, such as direct installation of energy-efficient measures and heat pumps (see [Supporting energy-efficiency in low-income households](#)).

Integration of poverty-reduction programs

Integrating poverty alleviation initiatives and offering comprehensive services has been shown to be an effective approach to maximizing the benefits of equity-focused programs. Program administrators of the U.S. *Weatherization Assistance Program*, which provides free weatherization of low-income homes, found

that providing holistic services (for example, combining energy efficiency improvements, childhood education, and financial literacy initiatives) have been shown to produce better outcomes for both households and the agency, as compared to more conventional single-service approach¹²⁸.

Recognizing multiple benefits of energy-efficiency policies

While climate policy discussions have long considered the co-benefits of the proposed policy solutions, framing policy in terms of ‘multiple benefits’ might be a more effective approach to gaining greater policy support. The ‘multiple benefits’ frame allows for a more comprehensive view of the range of issues that can be solved by the policy, rather than emphasizing any single benefit^{186,187}. This may aid in gaining the support of the policymakers and the public who may have different priorities and concerns¹⁸⁶. Furthermore, different policy rationales may be more relevant in different times¹⁸⁷, depending on the political

priorities, and more effective with different audiences¹⁸⁸.

Energy-efficiency policies are associated with a variety of benefits including economic growth, decarbonization, public health improvements, and reduction in energy insecurity^{186,187}. These benefits can be leveraged to gain greater support and justify increased funding for energy-efficiency programs, particularly those targeting disadvantaged population groups, which require a considerable increase in funding in order to achieve equitable decarbonization.

Promoting energy literacy

Another approach to encourage decarbonization in the building sector is through comprehensive outreach and education, which can raise awareness about energy-saving possibilities and the associated cost reductions and benefits¹⁸⁹. This may address a variety of informational barriers that commonly hinder energy-efficiency retrofits, such as incorrect beliefs regarding one’s

energy use and uncertainties or misperceptions of the benefits associated with the retrofits, hence empowering households to improve their energy efficiency. Informational tools should be utilized in addition to policies that address other major barriers, such as financial, decision-making, and split incentive issues.

Energy literacy can be promoted through a range of mediums, including brochures, leaflets, handbooks, or seminars targeting homeowners and tenants^{190,191}. Informational services may be carried out by publicly funded local energy centers¹⁹⁰, which can also serve as one-stop-shops providing comprehensive retrofit support to homeowners. User-friendly energy efficiency calculators should also be widely available to make it easier for people to calculate their energy usage and identify areas for improvement¹⁹⁰. Comprehensive energy audits (such as EnerGuide) should be available to low-income households at no charge to identify areas for improvement and encourage the adoption of energy-saving measures¹⁹¹.

Energy utilities can also play a role in promoting energy literacy among homeowners¹⁹¹. British Columbia Utilities Commission could require

utilities operating in the province to include information on energy-efficiency measures and the variety of benefits that they can provide (including health benefits and reduced energy costs) in the consumer’s energy bills.

Opportunities to participate in degree and non-degree training programs in energy efficiency and decarbonization of the residential sector should also be provided to professionals that may incorporate this information in their work and provide informational services to the consumers (e.g. contractors, builders, architects)¹⁹¹. Additionally, proficiency in energy efficiency should be made a requirement to obtain qualification as an architect or town planner¹⁹⁰.

Higher tax rates for inefficient properties

Another financial policy tool that may aid in the decarbonization of the residential sector is energy-inefficient property tax¹⁹⁰. The tax rate is determined by considering the property’s energy performance level and size¹⁹⁰. If a property lacks

an energy performance certificate, it is subject to the highest tax rate for its size¹⁹⁰. To ensure that the policy upholds principles of distributional equity, **low-income homeowners should be exempt from the tax**¹⁹⁰.

Retrofit requirements for existing buildings

United Nations Economic Commission for Europe (UNECE) suggests that mandatory energy standards for existing buildings should be introduced and progressively increased until they reach net-zero emissions level¹⁹⁰. A system of public subsidies for low-income and other

vulnerable groups should be implemented to ensure they are not negatively impacted¹⁹⁰. Financial support should also be provided to public and social housing to support its compliance with mandatory energy standards¹⁹⁰.



Greater incentives and stricter regulations in colder climates

Energy-efficiency efforts are particularly crucial in cold climates, where large amounts of energy are dedicated to heating premises. UNECE suggests introducing differentiated energy standards for buildings depending on the climatic region, with stricter requirements for cold regions¹⁹⁰. Moreover, cold climatic areas should be provided with greater funds to help with the capital investment into energy efficiency¹⁹⁰.

As a first step, the British Columbia government should consider increasing the threshold of energy-efficiency improvements required in cold regions to qualify for retrofit rebates. **Free-installation programs for low-income residents** may also initially prioritize cold areas, where the greatest impact can be achieved. To achieve deep and equitable decarbonization, however, all low-income residences should eventually be retrofitted.



Conclusions

In conclusion, our analysis revealed that existing initiatives for the decarbonization of residential buildings in British Columbia are failing to achieve sufficient emissions reductions, and are not supporting an equitable decarbonization of homes and buildings. Energy-efficiency improvements and fuel-switching measures provide an opportunity not only to combat climate change, but also to combat concerning rates of energy insecurity in British Columbia. Currently, these opportunities remain largely unrealized, as existing initiatives are insufficient to achieve climate targets and do not provide sufficient support for retrofits in low-income households.

As climate change continues to gain momentum, it has never been more urgent to accelerate provincial decarbonization efforts. Simultaneously, there is an imperative need to address energy insecurity and climate resilience, especially as British Columbians suffer from extreme weather events and rising costs of living, undermining many households' ability to pay for life's essentials and be healthy and comfortable in their homes.

In this report, we reviewed policies implemented in jurisdictions across North America and Europe, as well as those recommended in gray and academic literature, to advance an equitable decarbonization of the residential building sector. The results of our analysis revealed six main policy changes that can aid British Columbia in achieving equitable decarbonization of residential homes that is compatible with provincial climate targets:

1. Fossil gas phase-out and zonal electrification;
2. Enhanced support for lower-income and rental households, including free installation of heat pumps and insulation;
3. Energy-efficiency standards and retrofit requirements;
4. Provision of comprehensive one-stop-shop (OSS) services;
5. Expansion of retrofit financing options for moderate- and high-income households;
6. Expansion of district energy;

These policy changes represent an opportunity for British Columbia to both advance its climate mitigation goals and address concerning rates of energy insecurity.

Appendix

Table 1. Rebates and assistance programs available to individual homeowners and/or renters

Program	Provider/Administrator	Target population	Eligible types of residential buildings	Retrofits/services covered	Rebate/Funding Provided
CleanBC Better Homes and Home Renovation Rebate Program ^{a21}	Province of British Columbia, BC Hydro, FortisBC ^{77,192}	Homeowners or renters for their primary year-round residence ²¹ Landlords (Utility Account Holder Consent required)	Single-family home, Secondary suite in a single-family home, Permanently fixed mobile homes, Duplex, Triplex, Row house, Townhouse ²¹	Insulation	Rebate maximum ranges between \$900 and \$1,200 per category (depending on the location of upgrades) ²¹ BC Hydro-served remote communities: Rebate maximum ranges between \$1,500 and \$2,000 per category (depending on the location of upgrades) ¹⁹³
				Windows and doors	\$100 each, up to \$2,000 per house (the City of Vancouver residents not eligible) ¹⁹⁴ BC Hydro-served remote communities: \$200 each, up to \$4,000 per house ¹⁹³
				Converting from fossil gas, propane, or oil to a heat pump	up to \$6,000 ²¹ + \$3,000 top-up for homes in Northern Regions ²¹ + municipal top-ups between \$350-\$6,000 ²² + electric service update rebate of \$500 ²¹
				Air source heat pump (convert from electricity)	up to \$2,000 ²¹
				Air source heat pump (convert from wood)	up to \$2,000 ²¹
				Fossil gas furnace	\$800-\$1,000 + \$150 for connected thermostat ²¹
				Fossil gas boiler and combination heating and hot water system	\$1,200 + \$300 two upgrade bonus ²¹
				Fossil gas water heater	\$200 - \$1,000 ²¹
				Electric heat pump water heater	\$1,000 ²¹
				Fossil gas fireplace	\$300 each ²¹
				Appliance rebates on refrigerators, clothes washers, and dryers (seasonal)	\$100 for eligible refrigerators ¹⁹⁵ and clothes washers ¹⁹⁶ \$100-\$250 for clothes dryers ¹⁹⁶
				Two-upgrade bonus (for installing two bonus-eligible upgrades)	\$300 ²¹
				Home energy improvement bonus	\$750-2,000 depending on the achieved improvement in EnerGuide rating ²¹

a Rebates eligibility and amount depend on the primary heating source pre-retrofit, and the utility company that the participant receives the energy from.

Program	Provider/Administrator	Target population	Eligible types of residential buildings	Retrofits/services covered	Rebate/Funding Provided
Empower Me	Kambo Energy Group ¹⁰¹	Newcomers to Canada (homeowners and renters) in the Lower Mainland ^{40,197} Services provided in 16 languages ¹⁹⁷	No restriction	Multilingual energy efficiency education ^{40,41}	Free of charge
				Installation of energy-saving measures, such as faucet aerators, low-flow showerheads, and draft proofing	
				Recommendations for energy efficiency upgrades ⁴¹	
CleanBC Heat Pump Group Purchase Rebate	Province of British Columbia, BC Hydro, FortisBC, in collaboration with City Green Solutions Society ¹⁹⁸	Homeowners or renters for their primary year-round residence ²¹ Landlords (Utility Account Holder Consent required) Must be customers of FortisBC, BC Hydro, or municipal utilities within the BC Hydro and FortisBC service territory ²³	Single-family home, Secondary suite in a single-family home, Permanently fixed mobile homes, Duplex, Triplex, Row house, Townhouse ^{23,199} Only homes heated by oil, propane, and fossil gas are eligible ²³	Installation of heat pumps by a group of 2-30 homes ²³	\$200 - \$500 paid to each participant (depending on the size of the group) ²³
Sagen Energy-Efficient Housing Program	Sagen™ (private mortgage insurance provider) ^{200,201}	Sagan-insured mortgage holders ²⁰²	No restrictions	Up to 25% Mortgage Insurance Premium refund when making energy-efficient improvements or when purchasing an energy-efficient home ²⁰¹	
Clean BC Better Homes Income Qualified Program ^b	Province of British Columbia	Homeowners for their primary year-round residence, Renters (with landlord consent) ³⁴ Must be an income-qualified household	Single-family home, Secondary suite in a single-family home, Permanently fixed mobile homes, Duplex, Triplex, Row house, Townhouse ³⁴	Insulation	Up to \$5,500 ³⁴
				Windows and doors	\$950 per window or door up to \$9,500 per home ³⁴
				Heat pump (convert from fossil fuels)	Up to \$9,500 + up to \$3,500 electrical service upgrade ³⁴
				Heat pump (convert from electric)	Up to \$5,000 ³⁴
				Heat pump water heater	Up to \$3,500 + up to \$3,500 electrical service upgrade if converting from fossil fuel water heating system ³⁴
				Combined space and water heat pump (convert from fossil fuels)	Up to \$13,000 + up to \$3,500 electrical service upgrade ³⁴
				Combined space and water heat pump (convert from electric)	Up to \$8,500 ³⁴
				Health and safety (removal of pest, asbestos, and/or mold issues found during installation of other upgrades covered by the program)	Up to \$800 ³⁴
Installation of a bathroom fan or a heat recovery ventilator	Up to \$1,600 ³⁴				

b Rebate coverage depends on household income and ranges between 60-95% of the home upgrade costs up to a maximum rebate amount.

Program	Provider/Administrator	Target population	Eligible types of residential buildings	Retrofits/services covered	Rebate/Funding Provided
Heat pump rebate – income-qualified	FortisBC	Income-qualified FortisBC customers for their year-round primary residence; income-qualified renters are eligible.	Single-family, duplex, triplex, row home, townhouse or manufactured/mobile home on a permanent foundation ³⁵ The home must be a year-round primary residence that is at least 10 years old and under 3,500 ft ² (~325 m ²) ³⁵ Existing primary and back-up space heating must be electric. ³⁵	Air source heat pump	\$5,000 + counts towards a two-upgrade bonus of \$300 (see Home Renovation Rebate and Clean BC Better Home Rebate) ³⁵
Energy Savings Kit	FortisBC, BC Hydro, PNG	Homeowners and renters living in an income-qualified household ³⁹	No restrictions	The kit includes free: – water-efficient showerhead, – kitchen and bathroom faucet aerators, – weather-stripping, window film, – outlet and switch plate sealers, – a refrigerator/freezer thermometer, – an LED night light and four LED light bulbs, – a furnace filter coupon (for FortisBC gas customers), – installation guide. ³⁹	Free of charge (no more than once every 5 years) ^{37,38}
Energy Conservation Assistance Program	FortisBC, BC Hydro	Homeowners and renters living in an income-qualified household Renters are required to obtain landlord consent ^{203,204}	Detached house, Duplex, Townhouse, Manufactured/mobile home ^{205,206}	– in-home visit of an energy coach to review the home energy use and provide personalized energy-saving advice ³⁶ – installation of free energy-saving products, including LED light bulbs, high-efficiency showerheads, and weather-stripping to reduce drafts. ³⁶ – Fortis BC customers are eligible for a \$25 furnace filter coupon. ³⁶ – Some homes may also qualify for an energy-efficient fridge, insulation in walls, attic, and/or crawlspace, and/or a high-efficiency gas furnace. ³⁶	Free of charge (no more than once every 10 years) ^{204,207}
Oil to Heat Pump Affordability Grant ^{c42}	Government of Canada	Income-qualified homeowners	Homes heated by oil	– Purchase and installation of cold climate air source heat pump – Electrical upgrades required for the heat pump – Oil tank removal	\$5,000 (paid prior to heat pump installation)

c The program is set to become available in 2023.

Table 2. Selected rebates and assistance programs available to non-profit housing providers, social housing, and Indigenous communities

Program	Provider	Eligibility requirements	Eligible types of housing	Retrofits/Services covered	Rebate/Funding Provided
Indigenous Communities Conservation Program	BC Hydro, FortisBC	Indigenous communities (Band) located in BC Hydro's or FortisBC's service territory ⁶⁰		Energy-saving products (such as LED lights, fridge thermometers, high-performance showerheads, insulation materials, etc.) ^{59,60,208}	Free of charge
				Salary support to hire individuals to install the product ^{59,60}	
				Training to conduct basic upgrades (such as installation of energy-efficient lighting, high-performance faucets and showerheads, and basic draft proofing) and advanced energy upgrades (e.g., insulation and air sealing, ventilation, heat pump installation) ^{59,60}	Free of charge
				Training to apply for rebates to reduce the costs of the upgrades ^{59,60}	
				Health and safety upgrades (removal of pests, asbestos, radon, mold issues, etc.)	Up to \$1,000 per premise ^{61,209}
				Insulation and draft proofing	Up to \$2,000 per area ^{61,209}
				Windows and doors	\$200 per door/window; up to \$4,000 per premise ^{61,209}
				Bathroom fan system	Up to \$1,200 ^{61,209}
				Programmable thermostat	BC Hydro service territory: \$100 per thermostat, up to \$600 per premise ²⁰⁹ Fortis BC service territory: \$150 per thermostat, up to \$600 per premise ⁶¹
				Baseboard heaters, if required for compatibility with thermostat	\$25 per baseboard heater, up to \$150 per premise ^{61,209}
				Refrigerator	Up to \$1,000 per premise ^{61,209}
				Chest freezer	Up to \$400 per premise ^{61,209}
				Air source heat pump	BC Hydro service territory: up to \$2,000 per system ²⁰⁹ Fortis BC service territory: up to \$4,000 per system ⁶¹
				Electric heat pump water heater	Up to \$1,000 per premise ^{61,209}
				Fossil gas boilers*	\$2,000 per premise ⁶¹
				Fossil gas furnaces*	Up to \$3,000 per premise ⁶¹
Fossil gas water heater*	Storage tank: \$500 per unit ⁶¹ Condensing tankless water heater: \$2,500 per unit ⁶¹				
Two-upgrade bonus (for installing two bonus-eligible upgrades) [clarify if FortisBC only]	\$300 ⁶¹				

Program	Provider	Eligibility requirements	Eligible types of housing	Retrofits/Services covered	Rebate/Funding Provided
Social housing retrofit support program (SHRSP)	BC Hydro, FortisBC	Registered charities that provide assistance to low-income persons OR Housing providers that are local governments, housing societies, housing co-operatives, or a governing body of an Indigenous band, provided the housing is primarily for low-income households ²¹⁰	Multi-unit residential buildings (minimum nine units) ²¹⁰	Energy study (optional)	Up to \$5,000 ²¹⁰
				Project implementation support (optional)	Up to \$7,000 ²¹⁰
				Fossil gas boilers*	Up to \$75,000 per boiler ²¹¹
				Commercial fossil gas kitchen equipment*	Rebates vary depending on the equipment ²¹¹
				Commercial electric kitchen equipment	Rebates vary depending on the equipment ²¹¹
				Commercial fossil gas water heaters*	Storage tank water heater: \$3,750 per unit ²¹¹ Hot water supply boiler: up to \$75,000 per boiler ²¹¹ High-efficiency tankless water heater: \$2,500 per unit ²¹¹
				Solar hot water	\$27,000 per unit ²¹¹
				Water and heating pipes insulation	\$4 per linear foot ²¹¹
				Mechanical systems and controls	Multiple rebates are available with different rebate amounts ²¹¹
				Insulation	Roof: \$0.15 x R-value x square feet Walls: \$0.16 x R-value x square feet ²¹¹
				Windows	\$50 per unit/square feet ²¹¹
				Commercial refrigeration equipment	Display cases: up to \$220 per linear foot ²¹¹ Electronically commutated motor systems: up to \$77.50 per unit ²¹¹ Refrigerators: up to \$500 per unit ²¹¹
				Heat pump	Up to \$600 per ton ²¹¹
				Heat pump water heater	\$1,000 per water heater ²¹¹
LED lighting and controls	Multiple rebates are available with different rebate amounts ²¹¹				
Variable speed drive	Up to \$140 per motor horse power ²¹¹				
Social Housing Incentives ^d	Administered by BC Housing with support from the BC Non-Profit Housing Association ²¹² Funded by the Province of British Columbia and the Government of Canada ²¹²	Non-profit housing societies, housing co-operatives, and municipal housing authorities ²¹²	Multi-unit residential buildings ²¹²	Energy study	Up to \$5,000 ^{212**}
				Project implementation support	Up to \$7,000 ^{212**}
				Retrofit incentive	Performance-based incentive at the rate of \$70/tCO ₂ e of lifetime emissions up to 75% of the project's incremental cost ²¹² The incentive is capped at \$200,000 ²¹² .
BC Housing Energy Efficiency Retrofit Program	BC Housing	Housing providers that are non-profit housing societies, housing co-operatives or municipal housing authorities, Indigenous organizations, or First Nations ⁵³	Multi-unit residential buildings (should be eligible for utility incentive program ⁵³)	Capital grants to cover the difference between project costs and the utility incentive program funding ⁵³	Up to \$100,000 ⁵³

^d CleanBC Social Housing Incentives Program is complementary to the Social Housing Retrofit Support Program (SHRSP) offered by BC Hydro and FortisBC. Energy study and project implementation funding are available to projects that do not qualify for the full SHRSP rebate. The total combined funding from the two programs cannot exceed \$5,000 for the energy study and \$7,000 for the project implementation.⁵²

Program	Provider	Eligibility requirements	Eligible types of housing	Retrofits/Services covered	Rebate/Funding Provided
Sustainable Affordable Housing Program	Federation of Canadian Municipalities ⁵⁴ Funded by the federal government ⁵⁴	Municipal governments, municipally owned corporations, non-profit affordable housing providers, housing co-operatives ⁵⁴	Not specified	Planning grant (may support costs associated with project initiation, needs and financial assessments, stakeholder engagement, walk-through energy audits, identification of energy performance targets, finding and engaging of consultants, engineers, and contractors) ⁵⁴	Up to 80% of eligible costs Up to a maximum of \$25,000 ⁵⁴
				Grant to conduct a study assessing approaches to project implementation ⁵⁴	Up to 50% of eligible costs Up to a maximum of \$175,000 ⁵⁴
				Pilot project grant ⁵⁴	Up to 80% of eligible costs Up to a maximum of \$500,000 ⁵⁴
				Retrofit capital project financing and grant ⁵⁴	Financing for up to 80% of eligible costs up to a maximum of \$10 million ⁵⁴ Grants are available for 25–50% of total financing and equal to the percentage of anticipated energy savings (projects yielding over 50% of energy reduction will receive grants of 50% of total financing) ⁵⁴
Heat Pump and Electric Water Heater for Non-Profit Organizations	FortisBC	Registered charities that provide assistance to low-income persons, or housing providers that are local governments, housing societies, housing co-operatives, or a governing body of an Indigenous band, provided the housing is primarily for low-income households Must be a commercial electricity customer of FortisBC or selected municipal utilities	Not specified	Heat pump water heater	\$1,000 per water heater (up to a maximum of 75% of the purchase cost before tax) ²¹³
				Cold climate heat pump	\$500 per ton (up to a maximum of 75% of the purchase cost before tax) ²¹³
				Packaged Terminal Heat Pump	\$80 per unit (up to a maximum of 75% of the purchase cost before tax) ²¹³
				Variable Refrigerant Flow Heat Pump	\$600 per ton (up to a maximum of 75% of the purchase cost before tax) ²¹³
				Room occupancy sensor	Up to \$90 per packaged terminal heat pump (up to a maximum of 75% of the purchase cost before tax) ²¹³
				LED lamps	\$2.50 - \$30 per lamp ²¹⁴
				LED interior luminaires	\$24 - \$200 per luminaire ²¹⁴
				LED exterior luminaires	\$55 - \$220 per luminaire ²¹⁴
				LED streetlights and exterior pole / arm-mounted luminaires	\$60 - \$220 per luminaire ²¹⁴
				LED refrigeration case lighting	\$4 per linear foot ²¹⁴
				LED backlit signage	\$12 per linear foot ²¹⁴
				Lighting controls	\$24 - \$35 per control ²¹⁴
				Refrigeration Equipment for Non-Profit Organizations	FortisBC
Display cases	\$1.5 - \$73 per linear foot ²¹⁵				
Electronically commutated motor systems	\$75 - \$77.50 per motor ²¹⁵				
Floating head pressure controls	\$175 per unit ²¹⁵				
Ice machines	\$85 - \$260 per machine ²¹⁵				
Refrigeration controls	\$75 per door and \$115 per evaporator fan controllers ²¹⁵				
Vending machine controllers	\$200 per controller ²¹⁵				

Program	Provider	Eligibility requirements	Eligible types of housing	Retrofits/Services covered	Rebate/Funding Provided
Variable Speed Drive for Non-Profit Organizations	FortisBC	Registered charities that provide assistance to low-income persons, or housing providers that are local governments, housing societies, housing co-operatives, or a governing body of an Indigenous band, provided the housing is primarily for low-income households Must be a commercial electricity customer of FortisBC or selected municipal utilities	Not specified	Variable speed drive	\$112 - \$140 per motor horsepower ²¹⁶
Foodservice and Laundry for Non-Profit Organizations				Commercial clothes washers	\$75 per unit ²¹⁷
				Demand controlled ventilation for kitchen exhaust	\$800 - \$6,600 per unit ²¹⁷
				Electric commercial cooking equipment	\$250 - \$2,800 per unit ²¹⁷
				Electric commercial dishwashers	\$400-1,600 per unit ²¹⁷
Non-profit Capital Renewal Funding (CRF)	BC Housing	Buildings owned and operated by a non-profit housing provider or housing co-operative ⁵⁶ Land owned or under a long-term lease by the non-profit ⁵⁶		Funding for capital projects that improve building's energy performance ⁵⁶	Varies

*Fortis BC service territory only

Table 3. Selected rebates and assistance programs available to multi-unit residential buildings^e

Program	Provider	Eligibility requirements	Retrofits/Services covered	Rebate/Funding Provided
Rental Apartment Efficiency Program ^f	FortisBC	Purpose-built rental apartment building with nine or more units ⁵⁰ Must be a commercial natural gas and/or electricity customer of FortisBC or municipal electricity of Grand Forks, Penticton, Summerland, and Nelson Hydro ²¹⁸	Building energy assessment ⁵⁰	Free of charge ⁵⁰
			Installation of energy- and water-saving products, including water-efficient showerheads, kitchen and bathroom faucet aerators, and LED bulbs ⁵⁰	
			Support throughout the implementation of energy efficiency upgrades (including findings contractors and applying for available rebates) ⁵⁰	
Clean BC Small Building Energy Coach	Administrated and Delivered by City Green Solutions ²¹⁹ Funded by the Province of British Columbia and the Government of Canada ²¹⁹	Buildings under 75,000m ² that use natural gas for space or water heating ⁴⁸	Energy coaching services assisting building owners and operators with reducing their GHG emissions through electrification, as well as with applying for CleanBC's Custom-Lite and CleanBC Commercial Express programs. ⁴⁸	Free of charge ⁴⁸
CleanBC Custom-Lite Program*	Administered by BC Hydro ²¹² Funded by the Province of British Columbia and the Government of Canada ²¹²	Building owners and operators of multi-unit residential buildings who are planning retrofits that have a demonstrated potential to reduce the building's lifetime GHG emissions by 500 – 1,200tCO ₂ e ²¹² Buildings must be in the BC Hydro service territory, incl. New Westminster ²¹²	Energy Study	Up to 50% of the cost of the study, up to \$2,000 ⁴⁵
			Capital Funding	\$40/tCO ₂ e of lifetime GHG savings, up to \$48,000 per project ⁴⁵ Heat pump rooftop units: \$60/tCO ₂ e up to \$72,000 per project ⁴⁵ Northern customers: additional \$10/tCO ₂ e of up to \$84,000 per project (on top of the regular funding) ⁴⁵ The incentive is capped at under 50% of the project's incremental cost ²¹²

e The table presents only incentive and rebate programs whose eligibility requirements explicitly list multi-unit residential buildings (MURBS). Some MURBS may additionally be eligible for commercial retrofit programs if they have commercial utility accounts.

f Program is available to the first 200 approved buildings⁵⁰

Program	Provider	Eligibility requirements	Retrofits/Services covered	Rebate/Funding Provided
CleanBC Custom Program*	Administered by BC Hydro ²²⁰ Funded by the Province of British Columbia and the Government of Canada ²²⁰	Building owners and operators of multi-unit residential buildings who are planning retrofits that have a demonstrated potential to reduce the building's lifetime GHG emissions by at least 1,200tCO ₂ e ²²⁰ Buildings must be in the BC Hydro service territory, incl. New Westminster ²²⁰	Energy Study	Up to 50% of the cost of the study, up to \$20,000 ²²⁰
			Capital Funding	\$40/tCO ₂ e of lifetime GHG savings, up to \$200,000 per customer ²²⁰ Heat pump rooftop units: \$60/tCO ₂ e ²²⁰ Northern customers: additional \$10/tCO ₂ of up to \$250,000 per project (on top of the regular funding) ²²⁰ The incentive is capped at under 50% of the project's incremental cost ²²⁰
FortisBC Custom Efficiency Program*	FortisBC	Owners or long-term leaseholders of multi-unit residential buildings or facilities ²²¹ Must be a customer of FortisBC or municipal electricity customer of Grand Forks, Penticton, Summerland, and Nelson Hydro ²²¹ The proposed project must have the potential to save at least 1,000 GJ of fossil gas or 50,000 kWh of electricity annually. ²²¹	Energy study	Up to 75% of the cost of the study ²²¹
			Implementation incentive (to offset the incremental cost of the implementation of energy retrofits measures identified in the energy study)	Lesser of: <ul style="list-style-type: none"> \$3/GJ over the lifetime of the project \$0.02/kWh over the lifetime of the project 75% of the project costs \$500,000²²¹
			Implementation bonus (paid after at least one FortisBC-funded energy conservation measure has been implemented) ^{49,221}	Up to 25% of the approved energy study cost ²²¹
Clean BC Commercial Express Program*	Funded by the province of British Columbia and the Government of Canada ²²² Administered by BC Hydro ²²²	Multi-unit residential building exceeding 600m ² in building area or over three stories in height ^{222,223} Must be a BC Hydro commercial customer ⁴⁷	Rooftop Air-to-Air Heat Pump Make Up Air Unit with Gas or Electric Back-up ²²²	Up to \$100,000 per customer project ²²² Northern customers: additional \$10/tCO ₂ e of lifetime GHG savings of up to \$125,000 per project (on top of the regular funding) ²²²

* Payment following the completion of the project

Table 4. Other rebates and incentive programs

Program	Provider/ Administrator	Target population	Eligible types of residential buildings	Retrofits/services covered	Rebate/Funding Provided
Canada Greener Homes Grant	The Government of Canada	Homeowners, Representatives of Indigenous governments or organizations ²²⁴	<ul style="list-style-type: none"> – Single and semi-detached houses, – Row housing, – Townhomes, – Mobile homes on a permanent foundation, – Permanently-moored floating homes, – Mixed-use buildings (residential portion only), – Low-rise multi-unit residential buildings (three stories or less with a footprint of 600m² or less)²²⁴ 	Pre- and post-retrofit Energy Guide evaluations	Up to \$600 ²²⁵
				Insulation	Up to \$5,000 ²²⁵
				Air-sealing	<ul style="list-style-type: none"> – Up to \$1,000^{26,225} – Northern and off-grid communities: up to \$1,300²⁶
				Windows and doors	<ul style="list-style-type: none"> – Up to \$250 per rough opening for windows and up to \$125 per rough opening for doors²²⁵ – Northern and off-grid communities: up to \$325 per rough opening for windows and up to \$162.50 per rough opening for doors²⁶ – Up to \$5,000 total^{26,225}
				Programmable or smart/adaptive thermostat	<ul style="list-style-type: none"> – \$50²²⁵ – Northern and off-grid communities: \$65²⁶
				Ground source heat pump*	<ul style="list-style-type: none"> – Installation: \$5,000²²⁵ – Replacement of heat pump unit: \$3,000²²⁵ or \$3,900 for Northern and off-grid communities²⁶
				Air source heat pumps and cold climate air source heat pumps*	Up to \$5,000 ²²⁵
				Replacing existing fossil-fuel burning equipment (Northern and off-grid communities only)*	Up to \$3,500 ²⁶
				Heat pump water heater*	<ul style="list-style-type: none"> – \$1,000²²⁵ – Northern and off-grid communities: \$1,300²⁶
				Photovoltaic system installation	<ul style="list-style-type: none"> – \$1,000 per kW up to \$5,000²²⁵ – Northern and off-grid communities \$1,300 per kW up to \$5,000²⁶
Resilience measures	<ul style="list-style-type: none"> – Batteries connected to PV system: \$1,000²²⁵ or \$1,300 for Northern and off-grid communities²⁶ – Roofing membrane: \$150²²⁵ or \$195 for Northern and off-grid communities²⁶ – Basement wall waterproofing: \$875²²⁵ or \$1,300 for Northern and off-grid communities²⁶ – Moisture proofing of 100% crawl space floor, walls, and headers: \$600²²⁵ or \$780 for Northern and off-grid communities²⁶ 				

References

1. *Climate Change Accountability Act*. (2007). *Government of British Columbia* <https://news.gov.bc.ca/releases/2021EMLI0049-001343> (2021).
2. Ministry of Environment and Climate Change Strategy, Government of British Columbia. Climate action legislation. *Government of British Columbia* <https://www2.gov.bc.ca/gov/content/environment/climate-change/planning-and-action/legislation>.
3. Government of British Columbia, CleanBC. *2022 Climate Change Accountability Report*. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2022-ccar/2022_climate_change_accountability_report.pdf (2022).
4. Heerema, D. A vision for ending energy poverty in British Columbia. *Ecotrust Canada* <https://ecotrust.ca/priorities/energy/a-vision-for-ending-energy-poverty-in-british-columbia/> (2021).
5. CleanBC. Roadmap to 2030. (2021).
6. Environment and Climate Change Canada. Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030. *Government of Canada* <https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html> (2021).
7. BC Hydro. About us. <https://www.bchydro.com/toolbar/about.html>.
8. Energy Mines and Low Carbon Innovation. BC Hydro Review sets path for electrifying economy, supporting CleanBC | BC Gov News.
9. Steacy, L. Gas bills are about to go up. Here's what British Columbians should know. *CTV News Vancouver* <https://bc.ctvnews.ca/gas-bills-are-about-to-go-up-here-s-what-british-columbians-should-know-1.5943243> (2022).
10. FortisBC Energy Inc. Cost of gas rates remain steady for majority of FortisBC customers. *Cision* <https://www.newswire.ca/news-releases/cost-of-gas-rates-remain-steady-for-majority-of-fortisbc-customers-808379855.html> (2022).
11. Gartman, M. & Shah, A. Heat Pumps: A Practical Solution for Cold Climates. *RMI* <https://rmi.org/heat-pumps-a-practical-solution-for-cold-climates/> (2020).
12. BC Hydro. How heat pumps measure up against cold climates in B.C. *BC Hydro* <https://www.bchydro.com/news/conservation/2022/cold-weather-heat-pumps.html> (2022).
13. McDevitt, C. Do Heat Pumps Work in Cold Climates? *EnergySage* <https://news.energysage.com/heat-pumps-cold-climates/> (2022).
14. BC Hydro. Report: Cost correction - It is now both cheaper and greener to heat with electricity. *BC Hydro* https://www.bchydro.com/news/press_centre/news_releases/2022/report-heating-costs.html (2022).
15. BC Hydro. Heat pump cost calculator. *BC Hydro* <https://www.bchydro.com/powersmart/residential/tools-and-calculators/heat-pump-cost-calculator.html>.
16. CleanBC. *2021 Climate Change Accountability Report: Supporting Material*. https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/2021_accountability_report_supporting_materials.pdf#nameddest=Mitigation (2021).
17. City of Vancouver. *Climate Emergency - Bylaw Upgrades Applicable to Existing Detached Homes*. <https://council.vancouver.ca/20220517/documents/R1b.pdf> (2022).
18. Kenneth Chan. City of Vancouver to require air cooling in new homes starting in 2025 | Urbanized. *Daily Hive* <https://dailyhive.com/vancouver/vancouver-building-home-air-conditioning-requirement> (2022).
19. City of Vancouver. Carbon pollution limits and reporting for existing large commercial and multi-family buildings. *City of Vancouver* <https://vancouver.ca/green-vancouver/green-large-commercial-and-multi-family-buildings.aspx>.
20. General Manager of Planning, Urban Design and Sustainability. Annual Carbon Pollution Limits for Existing Large Commercial and Multifamily Buildings. (2022).
21. CleanBC Better Homes, Fortis BC, & BC Hydro. Home Renovation Rebate Program and CleanBC Home Efficiency Rebates: Terms and conditions—rebate eligibility requirements.
22. CleanBC Better Homes. Municipal Top-ups on The Home Renovation Rebate. <https://betterhomesbc.ca/municipal-offers/>.
23. CleanBC Better Homes. The CleanBC Heat Pump Group Purchase Rebate Incentive. <https://betterhomesbc.ca/rebates/gpr/>.
24. Natural Resources Canada. All about the Canada Greener Homes Initiative. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/start-your-energy-efficient-retrofits/all-about-the-canada-greener-homes-initiative/23476> (2022).
25. Natural Resources Canada. Eligible retrofits and grant amounts. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/start-your-energy-efficient-retrofits/plan-document-and-complete-your-home-retrofits/eligible-grants-for-my-home-retrofit/23504> (2021).
26. Natural Resources Canada. Grants for Canadian homeowners living in the North and off-grid communities. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/how-the-grant-process-works/step-3-retrofit-your-home/grants-for-canadian-homeowners-living-the-north-and-grid-communities/23502> (2022).
27. Natural Resources Canada. How the grant process works. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-initiative/canada-greener-homes-grant/how-the-grant-process-works/23443> (2021).
28. Natural Resources Canada. Canada Greener Homes Loan. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-initiative/canada-greener-homes-loan/24286> (2022).
29. CleanBC Better Homes. CleanBC Better Homes Low-Interest Financing Program. *CleanBC Better Homes* <https://betterhomesbc.ca/rebates/financing/>.
30. FortisBC. Heat pump loan. *FortisBC* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.

31. Vancity. Planet-Wise Home Renovation Loan. *Vancity* <https://www.vancity.com/borrow/loans-lines-of-credit/planet-wise-renovation/>.
32. Royal Bank of Canada. RBC Energy Saver Loan - RBC Royal Bank. *RBC* <https://www.rbcroyalbank.com/personal-loans/energy-saver-loan.html#>.
33. CleanBC Better Homes. CleanBC Income Qualified Program. <https://betterhomesbc.ca/rebates/income-qualified/>.
34. Government of British Columbia & CleanBC Better Homes. CleanBC Better Homes Income Qualified Program: Rebate Eligibility Requirements.
35. FortisBC. Heat pump rebate – income qualified. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.
36. CleanBC Better Homes. Energy Conservation Assistance Program. <https://betterhomesbc.ca/rebates/energy-conservation-assistance-program/>.
37. BC Hydro. Free energy saving kit. <https://www.bchydro.com/powersmart/residential/rebates-programs/savings-based-on-income/free-energy-savings-kit.html>.
38. FortisBC. Free Energy Saving Kit. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.
39. CleanBC Better Homes. Energy Saving Kits. <https://betterhomesbc.ca/rebates/energy-saving-kits/>.
40. Empower Me. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/saving-energy-in-your-home/empower-me>.
41. Empower Me. Energy Efficiency Education BC. *Empower Me* <https://empowerme.ca/education-bc/>.
42. Natural Resources Canada. Oil to Heat Pump Affordability Grant. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-initiative/oil-heat-pump-affordability-grant/24775> (2022).
43. Canada Energy Regulator. What is in a Canadian residential natural gas bill? <https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/natural-gas/report/canadian-residential-natural-gasbill/index.html> (2022).
44. Natural Resources Canada. Multi-Unit Residential Buildings (MURBs). <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/start-your-energy-efficient-retrofits/learn-about-the-initiative/multi-unit-residential-buildings-murbs/23588> (2022).
45. CleanBC Better Homes. CleanBC Custom-Lite Program. <https://betterbuildingsbc.ca/incentives/cleanbc-custom-lite-program/>.
46. CleanBC Better Homes. CleanBC Custom Program. <https://betterbuildingsbc.ca/incentives/cleanbc-custom-program/>.
47. CleanBC Better Homes. CleanBC Commercial Express Program. <https://betterbuildingsbc.ca/incentives/cleanbc-commercial-express-program/>.
48. CleanBC Better Homes. CleanBC Small Building Energy Coach. <https://betterbuildingsbc.ca/incentives/cleanbc-small-building-energy-coach/>.
49. FortisBC. Custom Efficiency Program. *www.fortisbc.com* https://www.fortisbc.com/rebates/business/custom-efficiency-program?utm_campaign=cemcom&utm_source=collateral&utm_content=custom.
50. FortisBC. Energy efficiency for rental apartments and accommodations program: Terms and conditions.
51. BC Hydro. Social housing retrofit support program. <https://www.bchydro.com/powersmart/business/programs/shrsp.html>.
52. CleanBC Better Homes. Participants Guide: CleanBC Social Housing Incentives. (2019).
53. BC Housing. Energy Efficiency Retrofit Program: Program Framework. (2021).
54. Federation of Canadian Municipalities. Sustainable Affordable Housing: Application Guide. (2021).
55. FortisBC. Commercial Product Rebate Program for non-profit and charitable organizations terms and conditions.
56. BC Housing. Capital Planning & Repairs. <https://www.bchousing.org/projects-partners/asset-management-redevelopment/capital-planning-repairs>.
57. CleanBC. 2020 Climate Change Accountability Report: Supporting Material. (2020).
58. BC Hydro. Community energy managers, internships and co-op students. *BC Hydro* <https://www.bchydro.com/powersmart/business/programs/sustainable-communities/community-energy-managers--internships-and-co-op-students.html>.
59. CleanBC Better Homes. Indigenous Communities Conservation Program. <https://betterhomesbc.ca/rebates/indigenous-communities-conservation-program/>.
60. BC Hydro. Indigenous Communities Conservation Program.
61. FortisBC. Indigenous communities conservation program: Terms and conditions.
62. Government of British Columbia. Clean buildings tax credit. *Government of British Columbia* <https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/clean-buildings#certifying>.
63. Government of British Columbia. Building owners will reduce energy, save money with 5% tax credit | BC Gov News. *BC Government News* <https://news.gov.bc.ca/releases/2022FIN0024-001094> (2022).
64. Ministry of Finance, Government of British Columbia. Provincial Sales Tax Notice: Provincial Sales Tax on Fossil Fuel Combustion Systems and Heat Pumps. (2022).
65. FortisBC Energy Inc. *Natural Gas Demand-Side Management Programs: 2021 Annual Report*. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/220331-fei-2021-dsm-annual-report-ff.pdf?sfvrsn=a6df526a_0 (2022).
66. Klass, A. B. Regulating the Energy ‘Free Riders’. *Boston University Law Review* **100**, 581–649 (2019).
67. Violette, D. M. & Rathbun, P. Chapter 21: Estimating Net Savings - Common Practices. in *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific*

Measures (National Renewable Energy Laboratory, 2017).

68. FortisBC Energy Inc. *2023 Demand Side Management Plan*. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/gas-utility/220705-fei-2023-dsm-expenditures-plan-application-ff.pdf?sfvrsn=c0ef272c_2 (2022).

69. FortisBC. *Electricity Demand-Side Management Programs 2020 Annual Report*. https://www.cdn.fortisbc.com/libraries/docs/default-source/about-us-documents/regulatory-affairs-documents/electric-utility/210331-fbc-dsm-2020-annual-report.pdf?sfvrsn=69328a5a_2 (2021).

70. Studer, S. & Rieder, S. What Can Policy-Makers Do to Increase the Effectiveness of Building Renovation Subsidies? *Climate* **7**, 28 (2019).

71. Nauleau, M.-L. Free-riding on tax credits for home insulation in France: An econometric assessment using panel data. *Energy Economics* **46**, 78–92 (2014).

72. Rivers, N. & Shiel, L. Free Riding on Energy Efficiency Subsidies: The Case of Natural Gas Furnaces in Canada. *The Energy Journal* **37**, 239–366 (2022).

73. Egner, L. E., Klöckner, C. A. & Pellegrini-Masini, G. Low free-riding at the cost of subsidizing the rich. Replicating Swiss energy retrofit subsidy findings in Norway. *Energy and Buildings* **253**, 111542 (2021).

74. Collins, M. & Curtis, J. Willingness-to-pay and free-riding in a national energy efficiency retrofit grant scheme. *Energy Policy* **118**, 211–220 (2018).

75. Kasteel, C. & Frappé-Sénéclauze, T.-P. *Regulating Gas in B.C. to Achieve 2030 and 2050 Climate Goals: Recommendations on the GHG Reduction Standard, DSM Regulation, and FortisBC's revised renewable gas program*. <https://www.pembina.org/reports/regulating-gas-in-bc.pdf> (2022).

76. Langlois-Bertrand, S. *et al. Canadian Energy Outlook 2021 - Horizon 2060*. <https://iet.polymtl.ca/en/energy-outlook/> (2021).

77. CleanBC Better Homes and Home Renovation Rebate Program. *CleanBC Better Homes* <https://betterhomesbc.ca/rebates/cleanbc-better-homes-and-home-renovation-rebate-programs/>.

78. FortisBC. Connect to natural gas: space and water heating rebates. www.fortisbc.com <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.

79. BC NDP. Horgan to legislate net-zero carbon emissions by 2050. *BC NDP* <https://www.bcndp.ca/releases/horgan-legislate-net-zero-carbon-emissions-2050> (2020).

80. Ministry of Environment and Climate Change Strategy, Government of British Columbia. Provincial greenhouse gas emissions inventory. *Government of British Columbia* <https://www2.gov.bc.ca/gov/content/environment/climate-change/data/provincial-inventory>.

81. Billy, T. & Frappé-Sénéclauze, T.-P. *Actions Needed to Electrify British Columbia's Buildings*. **8** (2022).

82. Curti, J., Andersen, F. & Wright, K. *A guidebook on equitable clean energy program design for local governments and partners*. (2018).

83. Willand, N., Moore, T., Horne, R. & Robertson, S. Retrofit Poverty: Socioeconomic Spatial Disparities in Retrofit Subsidies Uptake. *Buildings and Cities* **1**, 14–35 (2020).

84. Hazrati, M. & Heffron, R. J. Conceptualising restorative justice in the energy Transition: Changing the perspectives of fossil fuels. *Energy Research & Social Science* **78**, 102115 (2021).

85. World Commission on Environment and Development, United Nations. *Our Common Future*. <https://www.are.admin.ch/are/en/home/media/publications/sustainable-development/brundtland-report.html> (1987).

86. Fritze, J., Williamson, L. & Wiseman, J. *Community Engagement and Climate Change: Benefits, Challenges and Strategies*. <https://silo.tips/download/community-engagement-and-climate-change-benefits-challenges-and-strategies> (2009).

87. CUSP. Energy Poverty in Canada: a CUSP Backgrounder. <https://energypoverty.ca/backgrounder.pdf> (2019).

88. Thomson, H., Bouzarovski, S. & Snell, C. Rethinking the measurement of energy poverty in Europe: A critical analysis of indicators and data. *Indoor and Built Environment* **26**, 879–901 (2017).

89. Riva, M., Kingunza Makasi, S., Dufresne, P., O'Sullivan, K. & Toth, M. Energy poverty in Canada: Prevalence, social and spatial distribution, and implications for research and policy. *Energy Research & Social Science* **81**, 102237 (2021).

90. EcotrustCanada. Rethinking energy bill protections in British Columbia. [https://ecotrust.ca/wp-content/uploads/2020/08/Rethinking-](https://ecotrust.ca/wp-content/uploads/2020/08/Rethinking-Energy-Bill-Protections-in-British-Columbia.pdf)

[Energy-Bill-Protections-in-British-Columbia-August2020_updated_WEB.pdf](https://ecotrust.ca/wp-content/uploads/2020/08/Rethinking-Energy-Bill-Protections-in-British-Columbia.pdf) (2020).

91. Tardy, F. & Lee, B. Building related energy poverty in developed countries – Past, present, and future from a Canadian perspective. *Energy and Buildings* **194**, 46–61 (2019).

92. Lee, M. & Owen, J. *Fighting Energy Poverty in the Transition to Zero-Emission Housing: A Framework for BC*. https://policyalternatives.ca/sites/default/files/uploads/publications/BC%20Office/2011/09/CCPA-BC_Fighting-Energy-Poverty.pdf (2011).

93. Hernández, D. Sacrifice Along the Energy Continuum: A Call for Energy Justice. *Environmental Justice* **8**, 151–156 (2015).

94. Benneer, L. S. Energy Justice, Decarbonization, and the Clean Energy Transformation. *Annu. Rev. Resour. Econ.* **14**, 647–668 (2022).

95. Bird, S. & Hernández, D. Policy options for the split incentive: Increasing energy efficiency for low-income renters. *Energy Policy* **48**, 506–514 (2012).

96. Dall-Orsoletta, A., Ferreira, P. & Gilson Dranka, G. Low-carbon technologies and just energy transition: Prospects for electric vehicles. *Energy Conversion and Management: X* **16**, 100271 (2022).

97. McCauley, D. *et al.* Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research. *Applied Energy* **233–234**, 916–921 (2019).

98. Sovacool, B. K., Martiskainen, M., Hook, A. & Baker, L. Decarbonization and its discontents: a critical energy justice perspective on four low-

carbon transitions. *Climatic Change* **155**, 581–619 (2019).

99. McCauley, D. & Heffron, R. Just transition: Integrating climate, energy and environmental justice. *Energy Policy* **119**, 1–7 (2018).

100. Brundtland Commission. *Report of the World Commission on Environment and Development: Our Common Future*. <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> (1987).

101. Empower Me. Who We Are. *Empower Me* <https://empowerme.ca/who-we-are/>.

102. Reframed Initiative. About the Reframed Initiative. <https://reframedinitiative.org/about/>.

103. Tneguzzi, M. Reframed Initiative seeks retrofit model for thousands of buildings. *SustainableBIZ Canada* <https://sustainablebiz.ca/reframed-initiative-seeks-retrofit-model-for-thousands-of-buildings> (2021).

104. FortisBC. Furnace and boiler rebates – income qualified. www.fortisbc.com <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.

105. Rogelj, J. *et al.* Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. in *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (2018).

106. Paris Agreement, December 12, 2015, United Nations Treaty Series. (2015).

107. Dooley, K. *et al.* Ethical choices behind quantifications of fair contributions under the Paris Agreement. *Nat. Clim. Chang.* **11**, 300–305 (2021).

108. van Soest, H. L., den Elzen, M. G. J. & van Vuuren, D. P. Net-zero emission targets for major emitting countries consistent with the Paris Agreement. *Nat Commun* **12**, 2140 (2021).

109. CER. Canada’s Energy Future Data Appendices. (2016) doi:10.35002/ZJR8-8X75.

110. Canada Energy Regulator. Scenarios and Assumptions. <https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2021/scenarios-and-assumptions.html> (2022).

111. FortisBC. *2022 Long-Term Gas Resource Plan*. https://docs.bcuc.com/Documents/Proceedings/2022/DOC_66503_B-1-FEI-2022-LongTermGasResourcePlan.pdf (2022).

112. PG&E Corporation. *PG&E Climate Strategy Report*. https://www.pge.com/pge_global/common/pdfs/about-pge/environment/what-we-are-doing/pge-climate-goals/PGE-Climate-Strategy-Report.pdf (2022).

113. Aas, D. *et al.* *The Challenge of Retail Gas in California’s Low-Carbon Future*. (2020).

114. Distribution of residential heating fuel consumed in California in 2020, by type. *Statista* <https://www.statista.com/statistics/1231025/residential-heating-fuel-distribution-in-california/>.

115. PG&E. Company profile. https://www.pge.com/en_US/about-pge/company-information/profile/profile.page.

116. California Public Utilities Commission. CPUC Decision Makes California First State in Country to Eliminate Natural Gas Subsidies.

<https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-decision-makes-ca-first-state-in-country-to-eliminate-natural-gas-subsidies> (2022).

117. Natural Resources Canada. Heating and Cooling With a Heat Pump. <https://natural-resources.canada.ca/energy-efficiency/energy-star-canada/about/energy-star-announcements/publications/heating-and-cooling-heat-pump/6817> (2022).

118. CleanBC Better Homes. What is a cold climate heat pump? *CleanBC Better Homes* <https://www.betterhomesbc.ca/products/what-is-a-cold-climate-heat-pump/>.

119. Dylan Heerema, John Youn, Yasmin Abraham, & Areef Abraham. Comments on proposed changes to the DSM Regulation. (2022).

120. Lewis, J., Hernández, D. & Geronimus, A. T. Energy efficiency as energy justice: addressing racial inequities through investments in people and places. *Energy Efficiency* **13**, 419–432 (2020).

121. Efficiency Nova Scotia. HomeWarming. <https://www.homewarming.ca/>.

122. Government of Nova Scotia. Free Heat Pumps for Low-Income Households, More Support for Others. *Government of Nova Scotia* <https://novascotia.ca/news/release/?id=20221213002> (2022).

123. Gaede, J., Haley, B., Abboud, M. & Nassar, M. *The 2021 Provincial Energy Efficiency Scorecard*. <https://cacea.ca/wp-content/uploads/2021/12/2021-Energy-Efficiency-Policy-Scorecard-English-Final.pdf> (2021).

124. EfficiencyOne. HomeWarming program adapts criteria to help even more Nova Scotians. *EfficiencyOne* <https://www.efficiencyone.ca/>

homewarming-program-adapts-criteria-to-help-even-more-nova-scotians/ (2020).

125. Government of Prince Edward Island. Free Heat Pump Program. <https://www.princeedwardisland.ca/en/service/free-heat-pump-program>.

126. Government of Prince Edward Island. Free Home Insulation Program. <https://www.princeedwardisland.ca/en/service/free-home-insulation-program>.

127. Government of Prince Edward Island. Free Electric Hot Water Heater Program. <https://www.princeedwardisland.ca/en/service/free-electric-hot-water-heater-program>.

128. Raissi, S. & Reames, T. G. “If we had a little more flexibility.” perceptions of programmatic challenges and opportunities implementing government-funded low-income energy efficiency programs. *Energy Policy* **147**, 111880 (2020).

129. Agence de l’environnement et de la maîtrise de l’énergie. *Rénovation: Les aides financières en 2022 [Renovation: Financial aid in 2022]*. <https://france-renov.gouv.fr/aides/mpr> (2022).

130. Agence Nationale pour l’Information sur le Logement. Le prêt Avance rénovation [Advance renovation loan]. *ANIL* <https://www.anil.org/pre-avance-renovation-travaux-economie-energie/>.

131. Hueso, B. *Home weatherization services for low-income customers. Public Utilities Code* (2021).

132. Federal Ministry for Economic Affairs and Climate Action of Germany. What exactly is ‘district heating’? *Federal Ministry for Economic Affairs and Climate Action* <https://www.bmwi-energiewende>.

de/EWD/Redaktion/EN/Newsletter/2021/03/Meldung/direkt-account.html (2021).

133. Mazhar, A. R., Liu, S. & Shukla, A. A state of art review on the district heating systems. *Renewable and Sustainable Energy Reviews* **96**, 420–439 (2018).

134. Pollution Probe. *What Does the Future Hold for Natural Gas? Considering the role of natural gas and the gas system in Canada's low-emissions future*. <https://www.pollutionprobe.org/wp-content/uploads/Future-of-Natural-Gas-November-2019.pdf> (2019).

135. Riahi, L. *District energy in cities: Unlocking the potential of energy efficiency and renewable energy*. https://www.enwave.com/pdf/UNEP_DES_District_Energy_Report_V%C3%98JNC122.pdf (2015).

136. Statistics Canada. Population growth in Canada's rural areas, 2016 to 2021. <https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-x/2021002/98-200-x2021002-eng.cfm> (2022).

137. Hargraves, M. J. *District Energy: An Overview of Legal Issues*. <https://www.sms.bc.ca/wp-content/uploads/2015/03/District-Energy-Final2.pdf> (2012).

138. U.S. Department of Energy, Office of Energy Efficiency & Renewable energy. Combined Heat and Power Technology Fact Sheet Series: District Energy. (2020).

139. Werner, S. District heating and cooling in Sweden. *Energy* **126**, 419–429 (2017).

140. Wickman, K. The energy market and energy policy in Sweden 1965–1984. *Energy* **13**, 83–96 (1988).

141. Johansen, K. & Werner, S. Something is sustainable in the state of Denmark: A review of the Danish district heating sector. *Renewable and Sustainable Energy Reviews* **158**, 112117 (2022).

142. Dan Jørgensen. Dan Jørgensen: Vi vil sikre, at biomasse bliver en bæredygtig overgangsløsning [Dan Jørgensen: We want to ensure that biomass becomes a sustainable transition solution]. <https://www.information.dk/debat/2020/09/dan-joergensen-sikre-biomasse-baeredygtig-overgangsloesning> (2020).

143. Østergaard, D. S. & Svendsen, S. Theoretical overview of heating power and necessary heating supply temperatures in typical Danish single-family houses from the 1900s. *Energy and Buildings* **126**, 375–383 (2016).

144. World Bank. Population density (people per sq. km of land area) - Denmark, Sweden. <https://data.worldbank.org/indicator/EN.POP.DNST?locations=DK-SE>.

145. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance. (2012).

146. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. (2020).

147. Bjørneboe, M. G., Svendsen, S. & Heller, A. Using a One-Stop-Shop Concept to Guide Decisions When Single-Family Houses Are Renovated. *J. Archit. Eng.* **23**, 05017001 (2017).

148. Biere-Arenas, R., Spairani-Berrio, S., Spairani-Berrio, Y. & Marmolejo-Duarte, C. One-Stop-Shops for Energy Renovation of Dwellings in

Europe—Approach to the Factors That Determine Success and Future Lines of Action. *Sustainability* **13**, 12729 (2021).

149. Bertoldi, P., Boza-Kiss, B., Della Valle, N. & Economidou, M. The role of one-stop shops in energy renovation - a comparative analysis of OSSs cases in Europe. *Energy and Buildings* **250**, 111273 (2021).

150. McGinley, O., Moran, P. & Goggins, J. Key Considerations In The Design Of A One-Stop-Shop Retrofit Model. (2020).

151. Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. (2018).

152. Jana Cicmanova, Miriam Eisermann, & Thibaut Maraquin. *How to set up a one-stop-shop for integrated home energy renovation? A step-by-step guide for local authorities and other actors*. https://energy-cities.eu/wp-content/uploads/2020/07/INNOVATE_guide_FINAL.pdf (2020).

153. Pardalis, G., Mahapatra, K. & Mainali, B. Comparing public- and private-driven one-stop-shops for energy renovations of residential buildings in Europe. *Journal of Cleaner Production* **365**, 132683 (2022).

154. Scheer, J., Clancy, M. & Gaffney, F. *Ireland's Energy Targets: Progress, Ambition & Impacts*. (2016).

155. Sustainable Energy Authority of Ireland. Plan your home energy upgrade. <https://www.seai.ie/home-energy/home-upgrades/plan-upgrades/>.

156. Efficiency Nova Scotia. About Efficiency Nova Scotia. <https://www.energycyns.ca/about-us/>.

157. Efficiency Nova Scotia. Mi'kmaw Home Energy Efficiency Project. *Efficiency Nova Scotia* <https://www.energycyns.ca/residential/residential-services/mikmaw-home-energy-efficiency-project/>.

158. Dunskey Energy Consulting. *Integrating energy efficiency into the utility system: A review of delivery and funding models*. <https://open.alberta.ca/dataset/29e6a6d6-f961-42f6-adc9-77015129d74b/resource/a6d2e50c-78eb-44d8-b887-30fd5888dd17/download/aep-eea-integrating-energy-efficiency-utility-system-review-of-delivery-funding.pdf> (2018).

159. Nova Scotia Power, An Emera Company. Emera Inc. subsidiary Nova Scotia Power reaches settlement agreement on General Rate Application, including fuel and non-fuel rates for 2023 and 2024. *Nova Scotia Power, An Emera Company* <https://nspower.ca/about-us/press-releases/2022/11/25/emera-inc.-subsidiary-nova-scotia-power-reaches-settlement-agreement-on-general-rate-application-including-fuel-and-non-fuel-rates-for-2023-and-2024> (2022).

160. MacDonald, S. Nova Scotia. in *Canadian Energy Efficiency Outlook: A National Effort For Tackling Climate Change* 105–121 (River Publishers, 2018).

161. Efficiency Nova Scotia Corporation Act, Bill No. 49, 1st Session, 61st General Assembly, Government of Nova Scotia. (2009).

162. Electricity Efficiency and Conservation Restructuring (2014) Act, Bill No. 41, 1st Session, 62nd General Assembly, Government of Nova Scotia. (2014).

163. Public Utilities Act, Government of Nova Scotia. (1989).
164. Government of Nova Scotia. Using Less Energy: Nova Scotia's Electricity Efficiency and Conservation Plan. <https://energy.novascotia.ca/sites/default/files/Using%20Less%20Energy%20-%20Nova%20Scotia%2527s%20Electricity%20Efficiency%20and%20Conservation%20Plan%20.pdf> (2014).
165. EfficiencyOne. 2021 Financial Analysis and Discussion. <https://ens-efficiency-one-prod-offload-647701102377-ca-central-1.s3.ca-central-1.amazonaws.com/wp-content/uploads/2022/04/20140401/2021-financial-analysis.pdf>.
166. Bell, C., Nadel, S. & Hayes, S. On-bill financing for energy efficiency improvements: A review of current program challenges, opportunities, and best practices. (2011).
167. Public Utilities Commission of the State of California. Order Instituting Rulemaking to Investigate and Design Clean Energy Financing Options for Electricity and Natural Gas Customers. (2020).
168. Bianco, V., Sonvilla, P. M., Gonzalez Reed, P. & Villoslada Prado, A. Business models for supporting energy renovation in residential buildings. The case of the on-bill programs. *Energy Reports* **8**, 2496–2507 (2022).
169. Southeast Energy Efficiency Alliance. On-Bill Finance. *Southeast Energy Efficiency Alliance* <https://www.seealliance.org/initiatives/low-income-financing/>.
170. Bardhan, A., Jaffee, D., Kroll, C. & Wallace, N. Energy efficiency retrofits for U.S. housing: Removing the bottlenecks. *Regional Science and Urban Economics* **47**, 45–60 (2014).
171. Efe, S., Raheem, I. ur, Wan, T. & Williamson, C. *Cheaper Power Bills, More Jobs, Less CO2: How On-Bill Financing Done Right can be a Quick Win for British Columbia*. (2015).
172. City of Powell River & EcotrustCanada. *Community Efficiency Financing: City of Powell River Feasibility Study*. <https://ecotrust.ca/wp-content/uploads/2022/08/CEF-Feasibility-Study-City-of-Powell-River-FINAL.pdf> (2022).
173. Cahill. *The Power NY Act of 2011*. (2011).
174. State of New York. Green Jobs - Green New York. *State of New York* <https://www.nyserderda.ny.gov/researchers-and-policymakers/green-jobs-green-new-york>.
175. State of New York. About NYSERDA. *State of New York* <https://www.nyserderda.ny.gov/about>.
176. State of New York. Funding. *State of New York* <https://www.nyserderda.ny.gov/About/Funding>.
177. Henderson, P. *On-bill financing: Overview and key considerations for program design*. (2013).
178. State of New York. Residential Financing Programs. *State of New York* <https://www.nyserderda.ny.gov/All-Programs/Residential-Financing-Programs>.
179. Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B. & Todeschi, V. How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. *WIREs Energy Environ.* **10**, (2021).
180. Kirkpatrick, A. J. & Bennear, L. S. Promoting clean energy investment: An empirical analysis of property assessed clean energy. *Journal of Environmental Economics and Management* **68**, 357–375 (2014).
181. Kennedy, M., Frappé-Sénéclauze, T.-P. & Agar, B. *Property Assessed Clean Energy in Canada: Design considerations for PACE programs and enabling legislation*. <https://www.jstor.org/stable/pdf/resrep25476.5.pdf> (2020).
182. PACENation. PACE Programs. *PACENation* <https://www.pacenation.org/pace-programs/>.
183. Government of Nova Scotia. PACE Programs. *Nova Scotia PACE* <https://novascotiapace.ca/pace-programs/>.
184. Ástmarsson, B., Jensen, P. A. & Maslesa, E. Sustainable renovation of residential buildings and the landlord/tenant dilemma. *Energy Policy* **63**, 355–362 (2013).
185. Hinnells, M. *et al.* The greening of commercial leases. *Journal of Property Investment & Finance* **26**, 541–551 (2008).
186. European Council for an Energy Efficient Economy. *What we will gain from more ambitious energy efficiency goals in the EU*. <https://www.ecee.org/static/media/uploads/site-2/policy-areas/2030-policy-framework/benefits-report.pdf> (2014).
187. Kerr, N., Gouldson, A. & Barrett, J. The rationale for energy efficiency policy: Assessing the recognition of the multiple benefits of energy efficiency retrofit policy. *Energy Policy* **106**, 212–221 (2017).
188. Bain, P. G., Hornsey, M. J., Bongiorno, R. & Jeffries, C. Promoting pro-environmental action in climate change deniers. *Nature Clim Change* **2**, 600–603 (2012).
189. Hernández, D. & Bird, S. Energy burden and the need for integrated low-income housing and energy policy. *Poverty & public policy* **2**, 5–25 (2010).
190. *Action plan for energy-efficient housing in the UNECE region*. iii–v <https://www.un-ilibrary.org/content/books/9789210055055c001> (2011) doi:10.18356/9789210055055c001.
191. Ugarte, S. *et al.* *Energy Efficiency for low-income households*. https://upcommons.upc.edu/bitstream/handle/2117/100956/IPOL_STU%282016%29595339_EN.pdf (2016).
192. BC Hydro. Rebates for home renovations. <https://www.bchydro.com/powersmart/residential/rebates-programs/home-renovation.html>.
193. BC Hydro. Free upgrades for non-profit housing providers and Indigenous communities. <https://www.bchydro.com/powersmart/residential/rebates-programs/savings-based-on-income/non-profit-indigenous-housing-upgrades.html>.
194. Windows and Doors Replacement Rebate. *Better Homes BC* <https://betterhomesbc.ca/rebates/window-and-door-replacement-rebates/>.
195. FortisBC. Refrigerator rebate. *FortisBC* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.
196. FortisBC. Clothes washer and dryer rebates. *FortisBC* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.
197. Empower Me. Empower Me Program Canada. *Empower Me* <https://empowerme.ca/home-ab/>.

198. CleanBC Group Purchase Rebate: Terms and Conditions.
199. CleanBC Better Homes. Is my home eligible for rebates or an EnerGuide home evaluation? <https://betterhomesbc.ca/faqs/home-eligibility/>.
200. Sagen. We bring it all home. *Sagen* <https://www.sagen.ca/>.
201. Sagen. Energy Efficient Housing Program. *Sagen* <https://www.sagen.ca/products-and-services/energy-efficient-housing/>.
202. Sagen. Energy-Efficient Housing Program Refund Application. https://www.sagen.ca/wp-content/uploads/2020/11/EEHP_FORM_EN.pdf (2020).
203. FortisBC. Energy Conservation Assistance Program Landlord consent.
204. BC Hydro & FortisBC. Energy Conservation Assistance Program (ECAP) Landlord consent.
205. BC Hydro. Free product installation and energy coaching. <https://www.bchydro.com/powersmart/residential/rebates-programs/savings-based-on-income/free-product-install-and-advice.html>.
206. FortisBC. Free home energy evaluation and upgrades. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details>.
207. FortisBC. Energy Conservation Assistance Program application.
208. BC Hydro. Indigenous Communities Conservation Program: Product installation guide. <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/residential/programs/indigenous-communities-conservation-program-product-install-guide.pdf#page=6>.
209. BC Hydro. Indigenous Communities Conservation Program: Rebates for home energy upgrades. <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/residential/programs/indigenous-communities-conservation-program-rebate-table.pdf>.
210. BC Hydro & FortisBC. Social Housing Retrofit Support Program for Multi-Unit Residential Building - terms and conditions.
211. FortisBC. Rebates for social housing retrofit support program. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-business/rebates-for-social-housing-retrofit-support-program>.
212. BC Hydro & CleanBC Better Homes. Participants guide: CleanBC Custom-Lite Incentives. (2022).
213. FortisBC. Heat pump and electric water heater rebates for non-profit organizations. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details-business>.
214. FortisBC. Commercial lighting rebates for non-profit organizations. *www.fortisbc.com* <https://www.fortisbc.com/rebates-and-energy-savings/rebates-and-offers/rebates-details-business>.
215. FortisBC. Refrigeration equipment rebates for non-profit organizations. *www.fortisbc.com* <https://www.fortisbc.com/rebates/business/>

- refrigeration-equipment-rebates-for-non-profit-organizations.
216. FortisBC. FortisBC Variable Speed Drive for Non-Profit Organizations. *Better Buildings* <https://betterbuildingsbc.ca/incentives/fortisbc-variable-speed-drive-for-non-profit-organizations/>.
217. CleanBC Better Homes. FortisBC Foodservice and Laundry for Non-Profit Organizations. <https://betterbuildingsbc.ca/incentives/fortisbc-foodservice-and-laundry-for-non-profit-organizations/>.
218. FortisBC. Energy efficiency for rental apartments and accommodations. *www.fortisbc.com* [tisbc.com/rebates/business/energy-efficiency-for-rental-apartments-and-accommodations](https://www.fortisbc.com/rebates/business/energy-efficiency-for-rental-apartments-and-accommodations).
219. CleanBC Better Homes. CleanBC Better Buildings and Energy Coach Terms of Use. <https://betterbuildingsbc.ca/terms-and-conditions/>.
220. BC Hydro & CleanBC Better Homes. Participants guide: CleanBC Custom Incentives. https://betterbuildingsbc.ca/wp-content/uploads/2022/06/CS-2230-CleanBC_Custom_June-2022.pdf (2022).
221. FortisBC. Participant guide: Custom Efficiency Program. https://www.cdn.fortisbc.com/libraries/docs/default-source/rebates-and-energy-savings-documents/rebates-for-business/custom-efficiency-program-participant-guide41ea8e52146944649ad258e6e006c6c0.pdf?sfvrsn=d83caf6_1 (2022).
222. BC Hydro & CleanBC Better Homes. Participants guide: CleanBC Commercial Express Program. (2022).

223. The Government of British Columbia, Office of Housing and Construction Standards. Understanding B.C.'s Building Regulatory System. (2015).
224. Natural Resources Canada. Eligibility criteria. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/start-your-energy-efficient-retrofits/eligibility-criteria/24450> (2022).
225. Natural Resources Canada. Eligible retrofits and grant amounts. <https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/start-your-energy-efficient-retrofits/plan-document-and-complete-your-home-retrofits/eligible-grants-for-my-home-retrofit/23504> (2022).



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