PEMBINA Institute

Preparing Alberta's Buildings for Severe Weather

Understanding barriers and supports needed to scale resilient retrofits in Alberta

March 2025

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Alberta Ecotrust Foundation is a charity that leads and catalyzes environmental and climate action projects that enhance the well-being of Alberta's communities. It works collaboratively with diverse partners to deliver, fund, and enable innovative solutions that address pressing environmental challenges in the province. Alberta Ecotrust is a founding member of the Low Carbon Cities Canada network, a national initiative accelerating equitable climate solutions in cities.

The Pembina Institute recognizes that the work we steward and those we serve span the lands of many Indigenous Peoples. We respectfully acknowledge that our organization is headquartered in the traditional territories of Treaty 7, comprising the Blackfoot Confederacy (Siksika, Piikani and Kainai Nations); the Stoney Nakoda Nations (Goodstoney, Chiniki and Bearspaw First Nations); and the Tsuut'ina Nation. These lands are also home to the Otipemisiwak Métis Government (Districts 5 and 6).

These acknowledgements are part of the start of a journey of several generations. We share them in the spirit of truth, justice and reconciliation, and to contribute to a more equitable and inclusive future for all.

Contents

Executive summary

Over the past decade, Alberta has experienced four of Canada's ten most severe and costly weather-related events, highlighting the province's vulnerability to extreme weather risks. With increasing temperature and precipitation changes, the frequency and scale of severe weather events are expected to rise, posing significant threats to buildings and their occupants. This report identifies the key barriers and needed supports to enable deep retrofits for resiliency in Alberta.

The Pembina Institute collaborated with Introba to analyze existing resources for resilient retrofits to multi-unit residential buildings in Alberta and to interview those in the province's retrofit value chain. Around 30 resources were analyzed, and interviews were undertaken with various stakeholders — including government officials, builders, designers, architects, and academics — to identify the primary barriers and incentives for building owners to improve the resiliency of their buildings. The findings yielded several key insights that will guide future research by the Pembina Institute and other organizations working to make resilient communities a reality:

- Multi-unit residential buildings require dedicated resources and financial support for retrofitting.
- Strengthening building codes, providing incentives to go beyond minimum code standards, and integrating climate resiliency measures into policies can drive large-scale retrofits.
- The insurance and real estate industries must be active participants in establishing a holistic business case that fully demonstrates the costs and savings and standardizes the value resilient retrofits add to homes.

With the province's buildings increasingly at risk from severe weather events, this report lays the foundation for creating a new valuation for retrofits that improve building resiliency and mitigate the risks of untenable insured losses. By building on the findings in this report, Alberta can enhance the resiliency and adaptation capacity of its buildings, ensuring a safer and more sustainable future for its residents for decades to come.

1. Introduction

Alberta is at heightened risk from a diverse range of weather events. Over the last decade, four of the ten most severe and costly weather events in Canada have occurred in the province.[1] Multiple actors have started to work on advancing building retrofits for resiliency and adaptation to better protect homes and their occupants. Both buildings and their occupants are vulnerable to the impacts from severe weather, such as wildfire smoke, structural damage from hail and wind and indoor flooding.[2] With changes in temperature and precipitation expected to increase in the province, along with more frequent extreme weather events, the scale of damage is anticipated to rise.[3]

Resilience can be described as the ability to anticipate, prepare for, and respond to hazardous weather.[4] Most of Alberta's existing building stock, which is expected to still be standing by 2050, was built for a time when there were fewer severe weather events. Without stricter standards for deep retrofits, these buildings and their occupants are vulnerable to climate risks.

To better understand what is needed to enable more deep retrofits for climate adaptation, the Pembina Institute, in consultation with international engineering and consulting firm Introba, did a gap analysis, which is summarized in this report.

1.1 Methodology

The Pembina Institute worked with Introba to assess existing resources in Alberta for retrofitting multi-unit residential buildings through a resilience and adaptation lens. This research was done to understand the primary challenges and incentives for building owners looking to improve the resiliency of their buildings.

Introba was selected as a consultant for this work based on a previous collaboration with the Pembina Institute for similar research done in British Columbia. The gap analysis and interview format used in this project, which is detailed below, was modelled after a workshop developed

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[1] Connor May, "Alberta features in Canada's top 10 impactful weather events of 2024", *Discover Airdrie*, December 13, 2024. https://www.discoverairdrie.com/articles/alberta-features-in-canadas-top-10-impactful-weather-events-of-2024

[2] ClimateADAPT, *Key messages*. https://climate-adapt.eea.europa.eu/en/eu-adaptation-policy/sector-policies/buildings

[3] University of Calgary. *Climate Risk Assessment and Adaptation Considerations for Municipal Governance*, 1. https://www.policyschool.ca/wp-content/uploads/2023/03/AUMA-UP44-ResearchPaper.ClimateRiskAssessment.Tyler_.pdf

[4] Center for Climate and Energy Solutions, *Climate Resilience Portal*. https://www.c2es.org/content/climate-resilience-overview/#

by Introba for the Reframed design lab. The Reframed Lab produced tools and workshops to help building designers and owners implement healthy, livable, resilient, energy efficient, low-carbon retrofits for six low-rise, multi-unit residential buildings in southwest B.C.[5] The Pembina Institute carried out a scan of comparable resources in Alberta that could enable resilient retrofits specific to the climate risks faced by the province's homes.

The first step for this report was an analysis of these resources to determine where gaps currently exist. The Pembina Institute also leveraged Introba's extensive experience in the retrofitting space to assemble a comprehensive collection of resources written to help policymakers, building owners, and technical experts implement retrofits. The resources targeted all levels of government and industry members across the retrofit value chain.

Introba provided a series of topics to consider while reviewing the resources, including climate data, resiliency frameworks, applicability to multi-unit residential buildings, building codes and standards, funding opportunities, and resource sharing across peer networks. These themes allowed common strengths and challenges among the resources to be identified. In total, the Pembina Institute reviewed over 30 resources (see Appendix A) and summarized the key strengths and challenges for each theme.

Following the gap analysis, Introba and the Pembina Institute identified government officials, builders, designers, architects, academics, and others across the building value chain to interview about their experiences carrying out retrofits in Alberta.

The gap analysis and interviews were done to better understand several key factors: the availability of future climate forecasts; the consistency of resilient design frameworks; how information is disseminated; challenges with existing building codes; and access to capital funding.

From this understanding, key lessons emerged on what is needed to spur the rate of resilient retrofits. These lessons are outlined in the next steps section of the report.

[5] Agar, Betsy and Rajeev Kotha, *Reframed Initiative: Outcomes and analysis: A study of six best-in-class deep retrofit schematic designs* (Pembina Institute, 2024). https://www.pembina.org/pub/reframed-initiative-outcomes-analysis

2. Benefits of resilient buildings

Alberta is experiencing a growing number of heat waves, fires, floods, and severe storms.[6] Research from the University of Calgary states that current adaptation actions in the province are insufficient to address the social and economic impacts of weather events.[7] Adaptation involves modifying social, economic and environmental practices to reduce the negative impacts of climate change and capitalize on potential opportunities. Upgrading homes to make them more resilient will help protect Albertans and their properties from increasing and more severe weather events.

2.1 Extreme heat

By 2050, it's estimated that Calgary will experience four times the number of days when the temperature exceeds 29 degrees Celsius compared to historical averages[8] and Edmonton could see double the amount of days exceeding 22 degrees Celsius compared to today.[9] Without effective, reliable cooling systems, building occupants face increased risks of heat stroke, as well as the worsening of chronic respiratory, mental and cardiovascular conditions.[10]

Access to cooling technologies remains limited across Alberta. As of 2021, only 37% of Albertan households had access to any type of air conditioner.[11] Even those that do have access to cooling technologies may face challenges with the reliability or inefficiency of the technology. Buildings that are leaky and poorly insulated require more energy to maintain a safe indoor temperature. Strained HVAC systems can wear out faster or break down altogether. Households with cooling systems may find the operating costs during heat waves prohibitively high and may restrict, or forego, their use, exposing themselves to the risk of overheating.[12]

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[6] Edmonton Metropolitan Region Board, *From Risk to Resilience*, 10. https://www.emrb.ca/wp-content/uploads/2024/04/CRVA-From-Risk-to-Resilience-EMRB-Climate-Resilience-Study-2023.pdf

[7] University of Calgary. *Climate Risk Assessment and Adaptation Considerations for Municipal Governance*, 9. https://www.policyschool.ca/wp-content/uploads/2023/03/AUMA-UP44-ResearchPaper.ClimateRiskAssessment.Tyler_.pdf

[8] City of Calgary, "Extreme Heat." https://www.calgary.ca/environment/resources/climate-hazards--extreme-heat.html

[9] Taproot Edmonton, "Chart of the week: Future heatwaves in Edmonton," July 6, 2021. https://edmonton.taproot.news/briefs/2021/07/06/chart-of-the-week-edmontons-heatwave

[10] World Health Organization, "Heat and health," May 28, 2024. https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health

[11] Statistics Canada, "Table 38-10-0019-01: Air conditioners." https://doi.org/10.25318/3810001901-eng

[12] Unlimited Restoration, Inc. "Extreme Heat and Its Impact on Commercial Properties: Risks, Precautions, and Adaptation." https://www.urinow.com/blog/extreme-heat-and-its-impact-on-commercial-properties-risks-precautions-and-adaptation/#

Extreme temperatures can cause physical damage to buildings, such as by weakening siding and roof assemblies. High temperatures can speed up some chemical reactions that can erode and degrade building materials such as steel and concrete. Using lighter-coloured roofing materials, siding and insulation with a high R-value (indicates how well insulation prevents the flow of heat), triple-paned windows, and heat pumps can all help reduce the negative impacts of extreme heat. Passive cooling from architectural shading or trees and green roofs can also help moderate the effects of extreme heat.[13]

2.2 Fires

Fire season in Alberta is lasting longer, with fires burning larger swaths of land.[14] Sparks and embers are the most common ways wildfires spread from surrounding trees and bushes to residential buildings.[15] Roofs are the most vulnerable part of buildings and swapping out flammable roofing materials (e.g., wood shingles) for fire-resistant materials (e.g., metal, fibreglass or concrete) can slow or prevent the spread of a fire.[16] Upgrading doors and windows to ensure that they are adequately sealed to keep wildfire smoke out of the building will help to preserve indoor air quality. Doors and windows must also have properly fitted weather stripping to prevent embers from entering the home.[17]

2.3 Flooding

Flooding in 2023 cost Alberta an estimated $40 million dollars in insured damages.[18] Many regions in the flat, prairie landscape are used to some degree of overland flooding, but more development has occurred near waterways, and those buildings are at greater risk of flooding.[19]

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[13] City of Calgary, *Climate Proof Your Home for Extreme Heat*. https://www.calgary.ca/environment/resources/climate-hazards--extreme-heat.html

[14] Colette Derworiz, "Wildfires in Alberta burned 10 times more area in 2023 than the five-year average," *The Canadian Press*, January 5, 2024. https://www.cbc.ca/news/canada/edmonton/wildfires-in-alberta-burned-10-times-more-area-in-2023-than-the-five-year-average-1.7075263#

[15] FireSmart Canada, *FireSmart Canada Fact Sheet Roof*. https://firesmartcanada.ca/wp-content/uploads/2022/01/FSA_FireSmart-Fact-Sheet_Roof.pdf

[16] Taves Roofing, "Which Roofing Materials Are The Most Fire Resistant?" https://tavesroofing.com/roofing-materials/which-roofing-materials-are-fire-resistant/

[17] FireSmart and the Co-operators, *Home Development Guide*. https://firesmartcanada.ca/wp-content/uploads/2022/01/FireSmart_Canada_Home_Development_Guide.pdf

[18] Stephanie Cram, "Fire, floods, and heat: Alberta saw record-setting weather events in 2023," *CBC News*, December 31, 2023. https://www.cbc.ca/news/canada/edmonton/fire-floods-and-heat-alberta-saw-record-setting-weather-events-in-2023-1.7058530

[19] Carly Peters, "Flooding in Alberta: Why You Need to Be Prepared," *AMA*. https://amainsider.com/flooding-in-alberta-why-be-prepared/

The Institute for Catastrophic Loss has developed an interactive flood hazard and risk map to help Canadians understand their risk of exposure to flooding.[20]

Buildings that have flooded can often have mould, fungi and bacteria that can cause illness.[21] Floods can also damage foundations, weakening overall building integrity.[22] Landscaping to direct water away from the building and proper weather sealing of doors and windows can help prevent water infiltration.

Regularly clearing debris from eavestroughs, drainpipes and perimeter drainage systems can direct water away from the building during rainfall. Property owners can also install backwater valves to prevent wastewater or stormwater from backing up into the home and a sump pump to prevent groundwater from accumulating in basements.[23]

2.4 Hail and windstorms

Canada's existing buildings were built prior to the adoption of robust building codes, and more than three-quarters of them are expected to still be in use by 2050, leaving their occupants vulnerable to weather extremes.

In August 2024, a hailstorm in Calgary caused $2.8 billion in insured losses due to property damage. It is the province's second costliest severe weather event, with only the 2016 Fort McMurray fire costing more.[24] Hail and windstorms are likely to cause damage to roofs, windows, and exterior walls, and can result in water leaks.

Roofs with a steeper slope are likely to sustain less damage from hail,[25] impact and uplift. Resistant roofing materials (e.g., Class 4 shingles) can provide significant protection against hail and winds, as can rubber, metal, clay or plastic roofing. Brick or stone exteriors are the most resilient to hail and wind damage. Similarly, aluminum siding can offer greater protection than

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[20] S. P. Simonovic, M. Mohanti, and A. Schardong, *Web-based Tool for Visualizing Changes in Floodplain Regimes over Canada due to Climate Change – ver 2.0*, open access (Western University Facility for Intelligent Decision Support, 2023). https://floodmapviewer.com/

[21] Canadian Climate Institute, "Fact Sheet: Climate change and flooding," September 24, 2024. https://climateinstitute.ca/news/fact-sheet-climate-change-and-flooding/

[22] Foundation Crack Expert, "How does flooding affect a building's foundation," May 27, 2019. https://foundation-crack-expert.com/flooding-effects-home-foundations/#

[23] Sharp Insurance, "5 Preventative Tips to Flood Proof Your Home in Alberta." https://sharpinsurance.ca/blog/home/5-preventative-tips-to-flood-proof-your-home-in-alberta/

[24] Insurance Bureau of Canada, "August hailstorm in Calgary results in nearly $2.8 billion in insured damage," September 11, 2024. https://www.ibc.ca/news-insights/news/august-hailstorm-in-calgary-results-in-nearly-2-8-billion-in-insured-damage

[25] Institute for Catastrophic Loss Reduction, *Protect Your Home from Hail*, 7, 8. https://www.iclr.org/wp-content/uploads/2021/04/ICLR_Hail-2020_E_2021.pdf

vinyl siding (and can be made with up to 30% recycled materials).[26] Impact-resistant windows made from tempered or laminated glass will better withstand hail or other debris from windstorms.[27]

[26] City of Calgary, "Exterior walls and siding." https://www.calgary.ca/environment/resources/climate-ready-measures--exterior-walls-and-siding.html

[27] City of Calgary, "Windows and doors." https://www.calgary.ca/environment/resources/climate-ready-measures-windows-and-doors.html

3. Alberta retrofit resources

Financial incentives and regulations are the two biggest tools governments can wield to drive climate resilient construction and retrofits. Home and building owners can also benefit from up-to-date climate data, guidance on available retrofits, and access to qualified contractors to assess site-specific climate risks and design for adaptation. Alberta has a strong foundation for stimulating resilient retrofits that can be leveraged to fill in any gaps. Lessons from the gap analysis of retrofitting resources are summarized below by jurisdiction.

3.1 Municipal

Municipalities are on the front lines of impacts from severe weather events to their built environment. Cities in Alberta have shown significant leadership by collecting robust, regional data on climate hazards and producing resources Albertans can use to evaluate risks and plan upgrades. These resources are geared to retrofits for single-family homes. No municipal resources are available that incentivize resilient retrofits specifically for multi-unit residential buildings (MURBs); however, two-thirds of the current retrofit resources have information that can be applied to MURBs.

Resilience measures have not been integrated into the provincial (or national) building codes for new construction. Some municipalities, such as the City of Calgary, are developing tools to understand climate risk and make municipally controlled assets climate resilient. One example of this is the Climate Risk Assessment Framework. The cities of Edmonton and Calgary have published guidebooks for homeowners, building owners and tenants that outline voluntary retrofits that can de done to mitigate the impacts of severe weather events.

The City of Edmonton's popular Home Energy Retrofit Accelerator demonstrated the desire of Albertans to make their homes more comfortable and less costly to heat and cool, although it did not cover retrofits to MURBs. While some retrofit funding exists at the municipal level, these funds are often oversubscribed and often have a small commercial building component that may or may not cover MURBs retrofits. This situation is partly due to the limited funding capacity of municipalities and the lack of top-up funding from other levels of government.

3.2 Provincial

Alberta has a Climate Change Adaptation Framework that was published over a decade ago and was last updated in 2016. The outdated climate data and risk assessment framework means that the resiliency measures contained within are inadequate to address the extreme weather events of today. Resiliency measures to reduce extreme weather impacts are not currently integrated into regulations, such as the building code, or specifically resourced through retrofit programs.

The Clean Energy Improvements Regulation, adopted in 2018 as part of the Municipal Government Act, allows municipalities to provide financing for energy retrofits through the Clean Energy Improvement Program (CEIP).[28] CEIP is administered by a third party, the Alberta Municipal Services Corporation, which was created by Alberta Municipalities. While CEIP does not explicitly finance resilience-focused retrofits, there are qualifying energy efficiency retrofits that also improve resiliency, such as insulation upgrades and heat pump installations.

3.3 Federal

The federal government has made green buildings a major federal priority through three key strategies: the National Housing Strategy, the National Adaptation Strategy and the Canada Green Buildings Strategy. Several cross-departmental tools and programs have been developed under these overarching strategies.

Environment and Climate Change Canada produces high-quality, regionally specific data to aide the development of technical resources like risk assessment tools and standards. The data covers a wide range of climate hazards relevant to Alberta. Climate risk assessment tools and resiliency frameworks have been developed by the National Research Council, Environment and Climate Change Canada, and the Canada Mortgage and Housing Corporation to share best practices across peer networks.

The national model building codes are developed by the Canadian Board for Harmonized Construction Codes (CBHCC), jointly appointed by federal, provincial and territorial representatives. The latest code updates established tiered energy efficiency targets, enhancing transparency of regulatory pathways. This aids industry planning and facilitates faster adoption of the higher (more stringent) tiers by sub-national governments.

National model building codes go into force when provinces and local governments adopt them. Alberta adopted tier one of the 2020 national building code and national energy code for

[28] Alberta Municipalities, “Clean Energy Improvement Program.” https://ceip.abmunis.ca/about/

buildings. While this does not hinder upgrades focused on resiliency, the baseline does not necessarily encourage this work.

Currently, Canadian building codes do not require climate resilience measures and tend to rely on outdated climate data. The CBHCC is beginning the process of integrating resiliency into upcoming revisions. Incorporating resiliency requirements into the national building code would provide a standardized method of preparing buildings for extreme weather events.

For the existing built environment, federal resources like FireSmart and the Climate Lens provide guidance on climate resilience, but they focus on infrastructure and communities rather than individual buildings. The highly anticipated alterations to existing buildings code could provide suitable resilience measures for retrofits, but its publication has been delayed.

The now closed Canada Greener Homes Grant supported the flow of funding for deep retrofits across the country. Although the program was aimed at energy efficiency improvements, many of the eligible retrofit measures, such as installing heat pumps and upgrading windows and door, had associated resiliency benefits. At the time of writing this report, the funding provided through the program had not been renewed, but the Canada Greener Homes loans continue to be available for eligible homeowners interested in retrofits.

The federal government has prioritized providing grants to affordable housing providers through the Canada Greener Affordable Housing program for deep retrofits to affordable housing units. The federal Deep Retrofit Accelerator funds energy efficiency retrofits, but these retrofits can also have resiliency benefits. Like municipal funding, a core challenge with these programs is the lack of clarity around what is eligible, who can access the funding, and who benefits. It is also difficult to determine if accessing the programs is a challenge, and if so, for whom.

The Sustainable Jobs Training Fund provides financial support to train those working on retrofits that save energy and reduce carbon emissions, but does not provide support to those working primarily on enhancing building resiliency.

4. Barriers to scaling resilient retrofits in Alberta

Interviews with those working in the building and retrofit space revealed commonalities among the challenges to scaling up retrofit work across Alberta and confirmed that resources are lacking on retrofitting MURBs. Although the challenges varied across the retrofit value chain, common hurdles were accessing the necessary data on severe weather, being able to demonstrate the full value of a retrofit to building owners, and lack of incentives to build beyond lowest-tier code requirements.

4.1 Limited access to data

In discussing deep retrofits for resilient buildings with those working in this space in Alberta, the general conclusion was that most of them focus on improving efficiency. Retrofits on efficiency are easier to measure than retrofits to improve resiliency, given limits on the availability of climate data, the goal of such retrofits is to improve building efficiency.

Even when the ambition for resilient design is there, challenges remain — particularly around hazards like fires and floods — where reliable, long-term climate predictions are difficult to obtain for smaller cities that lack the capacity to collect and maintain robust data. For large cities like Calgary and Edmonton that have strong data collection, the unpredictability of extreme weather events makes it difficult to understand how these events will change over the lifespan of a building, and hence how to measure building resiliency.

A further, secondary challenge, to determining and measuring metrics on resiliency, is ensuring access to any such data, so that resiliency retrofits can be improved.

4.2 Hard to sell

While industry members showed strong awareness and understanding of the existing financial incentives, what they felt was missing was the broader business case for undertaking deep retrofits for resiliency. They pointed out that while additional funding is always beneficial, a core problem is that most building and homeowners are unaware of the costs that can be avoided by making their structures more resilient. As a result, it has been challenging for architects and builders to convince them to make expensive improvements.

There also needs to be greater inclusion of industry members not currently in the mainstream resiliency space, namely insurance and real estate. Having these two groups actively

demonstrating the financial benefits and expressing the true value of deep retrofits — like reduced insurance premiums and enhanced property values — would help building owners see beyond the high upfront costs. The insurance company the Co-operators has started to incentivize resilient retrofits through their TomorrowStrong program, which provides between $1,000 and $3,000 to prevent recurring damage through roofing upgrades, hurricane protection, and other loss prevention measures, such as installing water leak detectors.[29] This program is a strong example of how greater involvement from the insurance sector can broaden resilient retrofits; however, it does not offer enough to cover the costs for resilient retrofits to MURBs. The typical cost of asphalt shingles, which are generally a Class A roofing material, is approximately $9,000. The cost of an ethylene propylene diene monomer or thermoplastic polyolefin, which are typical roofing materials for MURBs, can cost upwards of $15,000.[30] Asphalt shingles can improve resiliency for single-family homes but are generally not an option for MURBs.

4.3 Lack of incentives

The final point we heard from industry members is that outside of financial supports, there is little incentive to undertake deep retrofits for resiliency. The existing building code in Alberta does not discourage resiliency, but it also does not inspire or reward those who design or do upgrades for resiliency. They felt that implementing a program that standardized resiliency retrofits — similar to how LEED has standardized building efficiency — and rewarded those doing the work would catalyze the uptake of these retrofits. The RELi Resilient Design Guide, a ranking system based on LEED but with greater emphasis on resiliency, could address this gap as it becomes more widely recognized and adopted.

[29] The Co-operators, "What's covered under home insurance?" https://www.cooperators.ca/en/insurance/home/home-insurance-basics/what-is-covered

[30] Reno Assistance, "Roof replacement costs in 2025." https://www.renoassistance.ca/en/residential/resources-inspirations/article/roof-replacement-cost

5. Opportunities for scaling resilient retrofits in Alberta

5.1 Resources for MURBs

In the gap analysis, no resources were found that provided a framework or recommendations for retrofitting MURBs in Alberta. While many of the retrofitting guides aimed at single-family or semi-detached homes had information that could be applied to MURBs, having resources explicitly on improving the resiliency and adaptation capacity of MURBs would be beneficial. Materials for roofing and building exteriors, for example, can go from exacerbating risks to mitigating them if the right materials are used and building owners have access to that information.

Typically retrofit resources and incentives are focused on improving energy efficiency. The upfront costs for these retrofits are high and often cannot be recuperated through energy savings alone. Therefore, the beyond-energy benefits of retrofits, including resiliency, should be more widely communicated, as retrofits can mitigate building damage from severe weather and reduce repair costs. Retrofits can include heat pump installation, envelope upgrades, and ventilation with heat recovery, as well as other measures that improve resiliency while reducing greenhouse gas emissions more than 40%.

Technical frameworks and design guides, such Calgary's Climate Ready Home Program and Edmonton's Climate Resilient Home Guide, can help owners and industry workers prepare existing homes and buildings for future climate impacts. Following them, however, while useful, is voluntary. They do not have the same impact as a mandated requirement within a building code or other regulation. These resources are also not MURB specific, but they do have several elements that are applicable. Similarly, they are not retrofit specific, but they could be leveraged to support retrofits.

Resilient retrofits have clear benefits beyond energy, such as improving occupant health and safety, and reducing expensive repairs from climate-related damage. Establishing a business case that values all the benefits of deep retrofits is essential given high upfront costs and potentially long payback periods. For example, if insurers expanded the funding offered through programs such as TomorrowStrong or provided preferred rates for homes with adaptation retrofits, building owners would be incentivized to make these upgrades and would likely file less insurance claims after severe weather events.

MURBs have the added complexity of needing to account for the needs and wants of tenants while retrofits are taking place. In single-family and semi-detached homes, the homeowner is generally also the occupant and can plan the retrofitting around their living situation. With MURBs, the building owner is responsible for the retrofits taking place but often does not live in the building. Resources designed specifically for retrofitting MURBs could provide information on how to reduce disruptions to tenants during upgrades. Such resources should be developed with input from tenants to ensure their needs and concerns are addressed.

5.2 Incentives for building standards

Many of the interviews that we conducted revealed that the existing building codes do not block designs and retrofits for adaptation and resiliency, but they also do not require or incentivize them. The LEED certification that is often required for buildings throughout Alberta is recognized as having been a driving force for improving energy efficiency in buildings across the province. Many of the interviewees noted that establishing a similar certification standard focused on resiliency, as well as creating awareness of the new resiliency requirements in LEED v5,[31] could help spur and standardize these types of retrofits.

5.3 Business case

Deep retrofits are costly for building owners. For their retrofit funding programs, the Canada Mortgage and Housing Corporation has set $170,000 as the average cost to retrofit a unit in a MURB, according to the corporation. Even with funding, deep retrofits can be prohibitively expensive to the owner of a MURB if non-energy benefits and lifetime cost savings are not included. An example of the latter is the insurance savings that can come from improving the resiliency of a building.

Over the past decade, Alberta has seen the cost of insurable losses increase by 495%, which is unsustainable in terms of cost and availability of coverage.[32] Improving the resiliency of buildings can reduce insurance claims and possibly the price of policies. Research underway suggests that owners of single-family homes who upgrade their roofs with more resilient materials can save on insurance costs through avoided insurance claims.

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[31] LEED v5 provides credits for projects that assess future climate risks and take actions to protect against associated vulnerabilities. United States Green Building Council, “Defining resilience in LEED v5,” November 20, 2023. https://www.usgbc.org/articles/defining-resilience-leed-v5

[32] My Choice Financial, “Climate Change is Responsible for a 379% Increase in Average Annual Insurable Damages in the Last Decade in Canada,” media release, October 16, 2024. https://www.newswire.ca/news-releases/climate-change-is-responsible-for-a-379-increase-in-average-annual-insurable-damages-in-the-last-decade-in-canada-839601217.html

Resilient retrofits can also generate savings to the healthcare system by improving indoor air quality and temperature for building occupants through installing heat pumps and air filters, for instance. The findings on retrofits have shown savings on non-energy-related costs, such as healthcare and insurance, but for single-family homes.[33] Research is still needed on the extent of savings that can be realized from retrofitting MURBs.

Eighty-five per cent of Canadians have indicated that they support resiliency work.[34] Groups such as the Institute for Catastrophic Loss Reduction are producing resources to help them protect their buildings. However, the mainstream real estate sector does not actively promote the value that resilient retrofits can add to properties, unlike it does for other forms of aesthetic improvements.

In the current cost models for deep retrofits, long-term, non-energy-related savings are not incorporated, meaning the full cost savings are not considered against the upfront cost of the work. A more holistic business case is needed that shows the full costs and benefits that come from improving the resiliency of buildings.

5.4 Knowledge mobilization

Existing resources in Alberta cover a wide range of climate disasters; however, it is unclear how most of these resources will be updated to integrate new climate data as it becomes available.

The province has several strong resources that provide guidance to home and building owners on implementing deep retrofits for climate adaptation. However, communication is lacking between organizations and governments that enable deep retrofits for resiliency. The importance of deep retrofits for resiliency, and the knowledge on how to implement them, needs to be brought into the mainstream for this work to happen at the scale that is needed. When establishing funding streams for retrofits, governments should collaborate with those in the non-profit, construction, real estate, insurance, and academic spheres who are doing retrofit work to determine eligibility and funding amounts. In addition, those along the retrofit value chain, ENGOs, government staff, and academics should widely disseminate case studies involving deep retrofits to ensure that best practices are shared across a broad audience.

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[33] Sustainability Victoria, “The Victorian Healthy Homes Program Research findings”, January 30, 2024. https://www.sustainability.vic.gov.au/research-data-and-insights/research/research-reports/the-victorian-healthy-homes-program-research-findings

[34] Insurance Bureau of Canada, “New data shows 85% of Canadians want action on climate adaptation,” November 15, 2022. https://www.ibc.ca/news-insights/news/new-data-shows-85-percent-of-canadians-want-action-on-climate-adaptation

6. Next steps

This analysis is the Pembina Institute's first piece of work on determining what is needed to enable deep retrofits in Alberta that target resiliency. The findings and lessons from the gap analysis will guide the institute's future research and advocacy. Filling knowledge gaps and including sectors such as the insurance industry that have not traditionally been part of the retrofit landscape will be integral to this work.

The Pembina Institute's next pieces of work will be founded on the four key takeaways from the analysis and will lead to specific recommendations for enabling deep retrofits for resiliency. However, other actors, such as industry, academics, and government, will need to take an active or lead role.

- Develop MURB-specific retrofit resources and financial supports.
- Broadly disseminate resources on how to retrofit buildings for resiliency so that best practices and how to overcome barriers are shared widely across governments and industry.
- Incorporate resiliency measures into building codes to standardize measures to give building owners an incentive to go beyond building to the minimum acceptable standards.
- Develop the holistic business case for retrofits that covers the suite of costs and savings, as well as standardizes the value of these retrofits, and include the insurance and real estate industries in the process.

Appendix A. Resources reviewed

Municipal resources

Alberta Municipalities, *Clean Energy Improvement Program*. https://ceip.abmunis.ca/

- This property financing program is open to commercial and residential properties in eligible municipalities in Alberta. It focuses on energy efficiency interventions.

City of Calgary, *Climate Risk Assessment Framework and Process Guide – v4* (2024). https://www.calgary.ca/content/dam/www/uep/esm/documents/Climate-Risk-Assessment-Framework-and-Process-Guide.pdf

- This guide describes the adaptation and resilience framework used by the City of Calgary to evaluate infrastructure projects.

City of Calgary, *Climate Projections for Calgary* (2024). https://www.calgary.ca/content/dam/www/uep/esm/documents/climate-projections-calgary-2024.pdf

- This report projects Calgary's climate in the 2050s and 2080s.

City of Calgary, *Climate Ready Home Guide for Calgarians* (2021). https://www.calgary.ca/content/dam/www/uep/esm/documents/calgary-climate-resilient-home-handbook.pdf

- This guidebook communicates climate risk and household-level adaptation measures to the public in Calgary.

City of Calgary, *Climate Risk Screening Assessment Tool*. https://www.calgary.ca/content/dam/www/uep/esm/documents/Climate-Risk-Screening-Assessment-Tool.xlsx

- This worksheet provides a qualitative framework for evaluating climate risk to infrastructure projects.

City of Edmonton, *Climate Resilient Home Guide*. https://www.edmonton.ca/sites/default/files/public-files/ClimateResilientHomeGuide-web.pdf

- This guidebook communicates climate risk and household-level adaptation measures to the public in Edmonton.

City of Edmonton, *Home Energy Retrofit Accelerator*. https://www.edmonton.ca/programs_services/environmental/energuide-for-homes

- This retrofit accelerator was open to households in Edmonton for energy efficiency upgrades. As of 2025, it has been fully subscribed and is now closed to new applicants.

Municipal Climate Change Action Centre, *A Community Climate Adaptation Planning Guide*. https://mccac.ca/wp-content/uploads/CRE_Planning-Guide_Final.pdf

- This guidebook provides a step-by-step approach to community climate adaptation planning.

Provincial resources

ASHRAE BC, *Building Sustainability and Resilience Guide* (2022). https://www.ashraebc.com/resources#

- This guidebook provides resources for building industry professionals to incorporate both climate mitigation and adaptation considerations into new and existing buildings.

Alberta Infrastructure, *Technical Design Requirements Climate Resilience Study for Alberta Infrastructure* (2018). https://www.alberta.ca/system/files/custom_downloaded_images/tr-tdr-climate-resiliency-study-final-report-2018-04-27.pdf

- This report gives recommendations to enhance climate resilience considerations in Alberta Infrastructure's technical design requirements.

BC Housing, *Climate-ready Housing Design Guide V.01* (2022). https://research-library.bchousing.org/Home/ResearchItemDetails/8686

- This tool for industry professionals highlights best practices and technical standards for climate resilient buildings.

ClimateWest. https://climatewest.ca/about/

- This database contains climate data and climate services pertinent to provinces in western Canada.

Government of Alberta, *Climate Change Adaptation Framework Manual* (2010). https://open.alberta.ca/dataset/8afd8ec2-cb2c-4dc5-94fe-f66f935b51e4/resource/23b3acd1-9a45-458f-bf0a-bdb7fa287d98/download/2010-climatechangeadaptationmanual-apr1-2010.pdf

- This resource provides an adaptation framework for organizations addressing climate risk.

SAIT Applied Innovation and Research Services, Smart Sustainable Resilient Infrastructure Association, and Retrofit Canada, *A Guide to Deep Energy Retrofits* (2023). https://www.ssria.ca/wp-content/uploads/2024/03/FilesDEEP_ENERGY_RETROFIT_GUIDEBOOK_FS02.pdf

- This guidebook supports building industry professionals conducting deep retrofits; however, it was also written to be understandable to homeowners and the general public.

Smart Sustainable Resilient Infrastructure Association, "Innovation Fund." https://www.ssria.ca/programs/innovation-fund/

- This fund supports low-carbon innovation in buildings across Alberta.

Federal resources

Canada Mortgage and Housing Corporation, "Canada Greener Affordable Housing program." https://www.cmhc-schl.gc.ca/professionals/project-funding-and-mortgage-financing/funding-programs/all-funding-programs/canada-greener-affordable-housing-program

- This program supports affordable housing providers in conducting deep energy retrofits.

Government of Canada, "Codes, standards and guidance for climate resilience." https://housing-infrastructure.canada.ca/climate-resilience-climatique/codes-standards-normes-guidances-eng.html#standards

- The federal government has a library of codes and standards for climate resilience that may be used by industry professionals.

Government of Canada, *The Climate Lens: General Guidance* (2023). https://publications.gc.ca/collections/collection_2024/infc/T94-51-2023-eng.pdf

- This resource provides guidance to those applying for federal funding on which Climate Lens is required. The Climate Lens was introduced to advance climate mitigation and adaptation priorities for infrastructure projects.

"FireSmart Canada." https://firesmartcanada.ca/

- FireSmart has a variety of resources and programs that promote resilience against wildfire hazards.

Standards Council of Canada, "Climate and sustainability." https://scc-ccn.ca/areas-work/climate-and-sustainability

- The council has a library of standards for climate resilience that may be used by industry professionals.

Industry resources

Canadian Construction Association, *Strength, resilience, sustainability: Canada's construction sector recommendations on adapting to climate change* (2021). https://www.cca-acc.com/wp-content/uploads/2021/03/Strength-resilience-sustainability-Full-Report-Final.pdf

- This report presents recommendations to key stakeholders, including the federal government, on considering climate change in the Canadian construction sector.

Canadian Construction Association, "Low Carbon Training Program for Construction Professionals." https://www.cca-acc.com/low-carbon-training-program-for-construction-professionals/

- This training program for Canadian construction professionals, held in 2023 and 2024, was on low-carbon-building fundamentals.

"Climate Data for a Resilient Canada." https://climatedata.ca/

- This resource contains future-facing climate data on a spatial interface. Data is available at the municipal scale.

"Canadian Home Builders' Association." https://www.chba.ca/

- The association has various resources on high-performance buildings and deep retrofit initiatives like LEEP (Local Energy Efficiency Partnerships) and the Net Zero Home Labelling Program.

Institute for Catastrophic Loss Reduction, *"Protect your home from" booklets*. https://www.iclr.org/homeowner/

- A variety of booklets targeted for homeowners that set out household-level climate resilience measures.

Intact Centre on Climate Adaptation, *Three Steps to Cost Effective Home Flood Protection*. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2024/05/IntactCentre-Home-flood-pretection-infographic.pdf

- This one pager provides guidance to homeowners on how to mitigate household-level flood risks.

Pacific Climate Impact Consortium, "Design Value Explorer." https://www.pacificclimate.org/analysis-tools/design-value-explorer

- This resource contains historic climate data, as well as climate projections, for Canada displayed spatially.

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