Thermal Safety in Existing Multi-Unit Residential Buildings

A Policy Toolkit for Local Governments in BC's Lower Mainland

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The contents of this report, including the recommendations, do not reflect the opinions or endorsement of either the individuals noted above or the organizations they represent.

Summary of Acronyms

AIBC	Architectural Institute of British Columbia
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BC	British Columbia
BCBC	BC Building Code
BCCDC	BC Centre for Disease Control
BCIT	BC Institute of Technology
BCNPHA	BC Non-Profit Housing Association
BSSB	Building Safety and Standards Branch
CHOA	Condominium Home Owners Association
CIBSE	Chartered Institution of Building Services Engineers
EGBC	Engineers and Geoscientists BC
EMLI	Ministry of Energy, Mines and Low Carbon Innovation
EPR	Electrical Planning Report
ERV	Energy recovery ventilator
HPSC	Home Performance Stakeholder Council
HRAI	Heating, Refrigeration and Air Conditioning Institute of Canada
HRV	Heat recovery ventilator
LLBC	Landlord BC
MUA	Make-up air unit
MURB	Multi-unit residential building
NRC	National Research Council
NRCan	Natural Resources Canada
SHGC	Solar heat gain coefficient
TECA	Thermal Environmental Comfort Association
TRAC	Tenant Resource and Advisory Centre
TSBC	Technical Safety BC
UDI	Urban Development Institute
ZEBx	Zero Emissions Building Exchange
ZEIC	Zero Emissions Innovation Centre

Contents

Executive Summary

Rising temperatures and the increasing frequency, severity, and duration of extreme heat events are significantly impacting human health and well-being across British Columbia's (BC) Lower Mainland. The 2021 heat dome, which brought record-breaking temperatures and resulted in 619 deaths, highlighted the vulnerability of residents, particularly those with chronic health conditions, in inadequately cooled homes.

Climate projections for the region indicate a continued rise in temperatures, with the hottest days and nights becoming more frequent and severe, and cooling degree days increasing twelvefold by the 2080s. Most multi-unit residential buildings (MURBs) in the Lower Mainland were designed for milder climates and lack mechanical cooling systems, making them susceptible to overheating. Additionally, the growing incidence of wildfire smoke events poses compounding risks to indoor air quality and health. While updates to the BC Building Code in 2024 set maximum indoor temperatures for new buildings, many existing buildings urgently need retrofits to address these challenges and protect public health and safety.

This report outlines a suite of 31 actions that local and regional authorities can take in the short to medium term (i.e. by 2030) to help safeguard the thermal safety of multi-unit residential building occupants in the Lower Mainland. The contents of the report were developed under the guidance of a project team comprising staff from the City of North Vancouver, the City of Vancouver, Metro Vancouver, and Vancouver Coastal Health. The recommendations were derived from a variety of sources, including an extensive literature review, subject matter expertise, industry insights, and practitioner oversight. Recommended actions were designed to support thermal safety primarily, but to align with and support other goals as well, including affordability, energy efficiency, and emissions reductions. Although the primary audience for the report is municipal and regional governments in southern BC's Lower Mainland, many findings and recommendations are relevant for other local governments across the province, health authorities, and the Province of BC.

The report contains three main sections: Section 2 describes how thermal safety is defined and achieved in the context of this report, Section 3 outlines the set of recommended actions for local governments, and Section 4 provides a high-level summary of some additional key considerations.

The table below provides an overview of the recommended actions for local governments. Actions indicated by a star ★ are those that local governments are recommended to explore in the short term.

Awareness & Understanding	Increase owners' and tenants' understanding of thermal safety risks and the measures they can use to reduce them	★	1) Provide educational materials to strata and rental building owners
		★	2) Provide educational materials to building tenants
			3) Work with regional partners to integrate cooling into electrification messaging
			4) Advocate for existing programs for new immigrants and multi-lingual residents to include thermal safety coaching and support
		★	5) Develop a means of signalling which rental buildings have active cooling systems to prospective tenants
			6) Advocate for cooling to be considered in strata depreciation and electrical planning reports
	Increase local authorities' understanding of cooling needs	★	7) Require building owners to report and disclose existence of unit-level cooling
		★	8) Conduct or commission a set of studies designed to identify where cooling efforts should be directed

			9) Collect residents' stories on challenges to installing cooling measures 10) Conduct or commission a set of cooling studies/pilots to better understand the barriers and opportunities to achieving 26°C in one room and/or dwelling-wide 11) Work with provincial partners to better understand active cooling opportunities
Policy & Legislation	Remove legal and legislative barriers to adding cooling measures to existing units and buildings	★	12) Advocate for inclusion of Right to Cool in Strata Property Act 13) Advocate for inclusion of Right to Cool in Residential Tenancy Act 14) Remove any policies or covenants that prohibit cooling measures 15) Review and implement measures to track and facilitate heat pump installation
	Enact measures to foster the adoption of cooling measures in all existing MURB	★	16) Explore the establishment of a Maximum Indoor Temperature Bylaw 17) Promote and support the development of extreme heat plans in rental buildings 18) Adapt/create bylaws and/or development permit areas to support neighbourhood-level cooling 19) Advocate for a consistent definition of thermal safety 20) Advocate for changes to the Canadian Electrical Code 21) Integrate considerations of thermal safety into existing communities of practice focusing on climate adaptation
Funding & Financing	Increase access to and affordability of cooling measures that are most effective at keeping indoor temperatures under 26°C	★	22) Explore and leverage the financial tools within municipal control to help support cooling retrofits 23) Support and expand on existing air conditioner rebate and distribution programs 24) Advocate to senior government for financing measures to reduce the risks of extreme heat 25) Advocate for increased awareness among real estate service providers and their customers on the value of cooling measures. 26) Promote transparency and fair pricing in system installations
Industry & Technology	Improve the ability of industry members to design, install, and maintain cooling measures		27) Advocate for consistency and alignment in cooling assessment methodologies 28) Establish a local renovators' community of practice 29) Host or support thermal safety demonstration projects 30) Provide heat pump guidelines for noise mitigation 31) Identify and fill any equipment and technology gaps for MURBs

This list of recommended actions provides a foundation that local governments can adapt and build off to suit their unique needs and the specific circumstances of their jurisdictions. To help further shape and prioritize these actions for their own jurisdictions, local governments are strongly encouraged to conduct additional engagement with interested and affected parties prior to their implementation. Meaningful community engagement and collaboration with residents and community groups can help ensure that diverse voices are included and empowered through decision-making, thereby informing strategies that are culturally appropriate, helping to remove barriers, and addressing systemic inequities. Creating and/or leveraging partnerships with local organizations, working collaboratively with other scales of government, and building internal staff capacity are also recommended to help support the successful and efficient implementation of key actions.

1 Introduction

1.1 Background

Rising temperatures and increases in the frequency, severity and duration of extreme heat events are having significant impacts on human health and wellbeing across British Columbia's (BC) Lower Mainland. At no time has this trend been more visible than during the summer 2021 heat dome event, which brought some of the highest temperatures ever recorded for the region and resulted in 619 deaths across the province. While the impacts of such events can be felt across our communities, what primarily stood out after this event was that the vast majority of people who died had pre-existing chronic health conditions and died within their own homes.[1]

This trend of increasing temperatures is only expected to rise. Projections for BC's Lower Mainland show that temperatures will increase year-round by approximately 3ºC by the 2050s and by approximately 5ºC by the 2080s[2], with areas further inland experiencing slightly higher increases than those closer to the coast. As the climate warms, we can expect a growing number of extreme heat events. For example, in the lower elevations of Vancouver's North Shore, this warming trend could lead to the hottest days of the year warming up from the historical baseline of 29.3ºC to 33.0ºC in the 2050s and 36.0ºC in the 2080s. The number of days that feel very hot (with humidex above 30ºC, where moderation of outdoor activities is recommended) is projected to spike from 8 days in the past, to 36 days in the 2050s, and 67 days in the 2080s. Heat events can particularly increase the stress on human health when overnight temperatures stay above 18ºC. While the region has not typically experienced these *warm nights*, projections show that we can expect 10 warm nights per year in the 2050s and 51 warm nights in the 2080s. With increased temperatures, the need for space cooling will also grow – from 47 cooling degree days (CDD) in the past, to 278 CDD in the 2050s and 583 CDD in the 2080s – a twelve-fold increase.

As a result, extreme heat and its impacts on the building sector has become a crucial issue for institutions across the region to address to prevent further morbidity and mortality associated with rising summer temperatures. A key dimension of the problem is that many buildings – especially residential buildings – were not designed with these temperatures in mind. In fact, most existing multi-unit residential buildings (MURB) constructed in the Lower Mainland were designed for milder summers and without any mechanical sources of cooling, making them susceptible to overheating when outdoor temperatures rise. In 2021, approximately 36% of households in BC had air conditioning in their homes, compared to 64% nationwide.[3] Within BC, the presence of air-conditioning varies substantially; for example, 84% of households had air conditioning in Kelowna, while only 26% and 19% of households did in Vancouver and Victoria, respectively. With rising temperatures and frequent heat events, more and more homes in the province are now using air conditioning. BC Hydro estimated that its use has grown in the record-breaking summer of 2021 as much as it had over the previous 10 years, and reported that the majority of British Columbians now consider air conditioning a necessity, not a luxury.[4]

Alongside this issue is also the need to address other climate hazards that can impact human health in the built environment, especially the poor indoor air quality associated with the growing incidence of wildfire and wildfire smoke events. When coupled together, extreme heat and air quality issues can compound to form potentially

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[1] Government of Canada. (2022). *Surviving the heat: The impacts of the 2021 western heat dome in Canada.*

[2] Climate indicator projections provided herein are based on the SSP5-8.5 scenario, the values displayed are the median values, and the time horizons include baseline (1971-2000), the 2050s (2041-2070), and the 2080s (2071-2100). Projections were obtained from Climate Data Canada.

[3] Statistics Canada. (2023). *Census 2021 – Air conditioners.*

[4] BC Hydro. (2021). *Info Bulletin: British Columbians are more dependent on A/C than ever before, setting a summer record.*

dangerous conditions for those living with chronic health conditions such as diabetes, heart disease, respiratory disease, and others.

BOX 1: From thermal comfort to thermal safety

The question of thermal comfort has long been a focus in the design and construction of our buildings. Systems designed to keep people comfortable are at the heart of many design decisions concerning building envelopes, windows, and mechanical systems. However, with growing temperatures has come a shift in this focus, to include not just questions of thermal *comfort* but also thermal *safety*. For the purposes of this report, the two terms are defined as follows:

- ***Thermal comfort*** *is a condition in which building occupants generally feel satisfied with the indoor temperature, humidity, and airflow, and is achieved by balancing environmental and personal factors to create a pleasant indoor environment conducive to a range of activities, from working to sleeping.*
- ***Thermal safety*** *is a state in which indoor conditions are maintained within temperature thresholds that prevent adverse health effects under prolonged exposure, protecting occupants' health even if the environment is not comfortable.*

For more details on defining thermal safety, see Section 2.1.

Fortunately, there is a large body of emerging knowledge in the building sector on better ways of designing our homes and buildings to withstand these growing hazards. In recognition of the need to protect BC's residents from the impacts of extreme heat, the BC Building Code was updated in 2024 to include a maximum design temperature limit of 26°C for a single living space in each dwelling unit to reduce the risk to health and safety from overheating.[5] This code only applies to buildings that are built after 2024, meaning that many residents of buildings that were constructed prior to this update will remain at risk of higher summer temperatures unless they are retrofitted to include some combination of mechanical cooling systems and/or passive design measures that can help keep indoor temperatures cool.

[5] Government of British Columbia, Building and Safety Standards Branch. (2024). *Information Bulletin: Protection from Overheating in Dwelling Units.*

1.2 Purpose of this Report

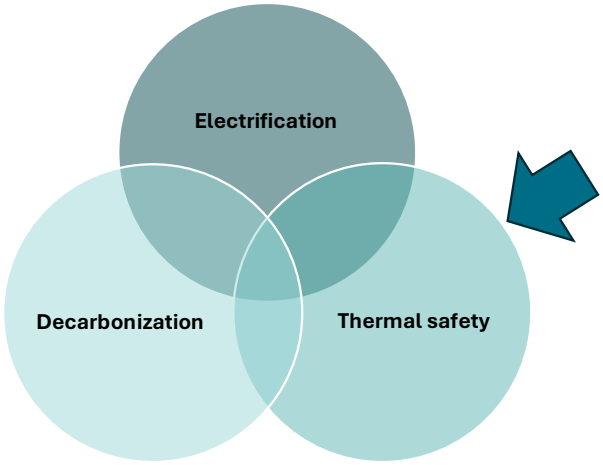
Retrofitting existing buildings to add cooling measures is not as simple as it might sound. There are a myriad of barriers and challenges that owners and tenants can and do encounter when trying to keep their units cool. These range from lack of simple awareness of the problem and opportunities to address it, to the costs associated with upgrading an existing building or unit, to complex decision-making structures, and others (see Section 3.2 for more detail). While various authorities are beginning to explore means of removing some of these barriers and encouraging, incentivizing, or requiring potentially life-saving retrofits, clear direction for local governments on what steps to take remains lacking.

The purpose of this report is therefore to outline a suite of actions that local and regional authorities can take, in the short to medium term (i.e. between now and 2030), to help safeguard the thermal safety of multi-unit residential building occupants in the Lower Mainland. Recommended actions represent the steps that local governments can take towards ensuring that owners and tenants of multi-family buildings in the Lower Mainland have access to the information, technologies and supports needed to safeguard their thermal safety.

Overall, the approach taken in this report is one that seeks to balance a recognition of the scale of the challenge and the knowledge that many policy and legislative changes will take time to be effectively implemented, with the urgency of the problem and the need to protect BC's residents – especially those who are most susceptible to the impacts of extreme heat. As such, recommendations have also been made in an effort to encourage prioritization of buildings and dwellings at higher risk of overheating, recognizing that many actions will eventually protect all units against extreme heat events over a longer time horizon.

1.3 Overlapping Priorities

It is worth noting that many ongoing or proposed actions designed to support the broader electrification and/or decarbonization of the existing building sector may also directly or indirectly support thermal safety, especially in the medium to longer term. This report deliberately avoids duplicating any such actions that have been detailed elsewhere (see Box 2), but instead focuses on **actions that directly support thermal safety that can be deployed within the next five years**. However, actions in this report have also been developed with an eye to either supporting or at least avoiding interference with broader electrification and/or emissions reduction goals.



Other guiding principles guiding this report include the need to:

1. Remove barriers to accessing thermally safe living spaces and contribute to addressing social inequities
2. Consider local grid conditions, avoiding the need for costly electrical service upgrades and/or increases to energy costs wherever possible
3. Align with complementary actions at other scales
4. Seek to ensure ongoing resilience and thermal safety under changing climatic conditions

BOX 2: Relevant Policies and Programs

There are several ongoing or proposed initiatives, policies and programs that are worth noting as they directly or indirectly influence the goal of safeguarding thermal safety in existing buildings in the Lower Mainland. While this is not an exhaustive list, the following provide some insight into the current policy landscape:

- A 2024 **BC Building Code update** introduced a maximum design temperature limit for a single living space in each dwelling unit to minimize the risk to health and safety from overheating. The 26°C indoor design temperature requirement can be met with a combination of either active cooling systems and/or passive design measures.
- **BC Hydro Free Portable Air Conditioners**. The Province of BC provided $10 million to BC Hydro to expand its Energy Conservation Assistance Program to include free, publicly funded portable air conditioners for people who have received a recommendation letter from their regional health authority's Home Care Program. It is anticipated at least 50% of the AC units will be installed in apartments or multi-unit dwellings, with the remaining balance installed in single family dwellings.
- **BC Hydro multi-unit residential building offers** provide MURB owners with rebates and support for upgrades that improve efficiency and reduce emissions. Funding is provided to help cover the costs of an overall assessment of retrofit opportunities and a feasibility study for specific projects, alongside rebates for select equipment upgrades.
- The Province of BC's **Zero Carbon Step Code** (ZCSC) outlines a set of increasingly stringent targets for reducing new buildings' greenhouse gas emissions intensity. While the province-wide implementation timeline of these steps is yet to be released, local governments can voluntarily adopt the standard ahead of schedule. It is anticipated that by 2030, the ZCSC will see a significant uptake of heat pump technologies in new buildings, which can provide both heating and cooling.
- If implemented, the Province of BC's proposed **Highest Efficiency Equipment Standards** would require that beginning in 2030, all new space and water heating equipment sold and installed in B.C. must be at least 100% efficient, significantly reducing emissions compared to current combustion technology. These requirements are likely to result in greater implementation rates of heat pump technologies in existing buildings as well as new construction projects.
- The **BC Building Electrification Roadmap** (2021) outlines a clear pathway of the roles, responsibilities and steps that building industry members can play in effecting a shift towards large-scale building electrification by 2030.
- The **Low-Income and Social Housing Electrification Roadmap** (2023) identifies the barriers and mitigating actions to enable the rapid scale-up of decarbonization and electrification efforts in the affordable housing sector.

This report focuses on actions that can be taken to support the implementation of building retrofits in multi-family buildings (or MURB). It does *not* provide recommendations for other building types, such as commercial buildings or single-family homes, though some recommendations may be relevant for those sectors as well. Additionally, it does *not* provide guidance for local governments interested in safeguarding the health and safety during an actual heat event, as this falls more to the purview of emergency management and response. For information on these kinds of actions, please see:

- **Vancouver Coastal Health**'s Extreme heat webpage introduces key information for residents and resources for service providers and organizations (e.g. heat check-in support framework for NGOs and check-in training videos, cooling spaces guide for community organizations)
- **BCCDC**'s Preparing for Heat Events webpage includes information for residents and additional guidance and resources for service providers, municipalities (guidance for heat response planning) and others
- **BC Housing**'s Extreme Heat and Wildfire Smoke webpage provides resources tailored to non-profit housing providers and building managers (e.g., Extreme Heat and Wildfire Smoke Response Plan guidance, cooling tips for building operators)
- **National Collaborating Centre for Environmental Health**'s Health checks during extreme heat events guidance document for in-person or remote health checks, available in multiple languages.

1.4 Developing this Report

The contents of this report were developed under the advisement of the project team made up of staff from the City of North Vancouver, the City of Vancouver, Metro Vancouver and Vancouver Coastal Health.

Thermal safety retrofit options, barriers and opportunities to their implementation, the current policy landscape and the recommendations themselves were derived from several sources, including:

1. **Literature review**: A review of 85+ documents and reports concerning thermal safety and relevant electrification policies, programs, and options
2. **Subject matter expertise**: External subject matter review of retrofit options and barriers
3. **Industry insight:** Workshops with technical and policy subject matter experts
4. **Practitioner oversight**: Consultant team experience and expertise.

Both project design as well as final recommendations were also subject to the review of an Advisory Committee, made up of local experts (see Acknowledgements).

1.5 Intended Audience and Report Contents

This report is primarily intended for municipal and regional governments in BC's Lower Mainland that fall under the Community Charter. This is because the recommended actions in this report were developed with an eye to exploring the typical jurisdiction and authority of these tiers of government, and with an emphasis on current conditions and characteristics of buildings in the Lower Mainland. However, other local governments across BC (including the City of Vancouver) as well as health authorities and the Provincial Government may take an interest in the report findings, as many actions contained in this report lend themselves to implementation at (or in coordination with) broader scales. Where recommended actions expand beyond the legal authority of local governments, these are described as opportunities for advocacy to other levels of government.

The report is laid out as follows:

- Section 2 explores **how thermal safety is defined and achieved** in the context of this report, including the measures that can be used to help improve it, as well as the typical barriers to their implementation or success
- Section 3 outlines the **set of recommended actions** that local governments (i.e. municipalities and regional districts) can take to help remove or reduce those barriers and increase uptake of thermal safety upgrades
- Section 4 provides a high-level summary of some of the **key considerations** local governments should take into account when designing and implementing these policy and program recommendations.

2 Thermal Safety in Existing MURBs

2.1 Defining Thermal Safety

Thermal safety refers to a set of conditions under which building occupants are protected from the adverse health effects of high indoor temperatures. Thermal safety prioritizes occupant health to prevent heat-related risks, such as heat stress or dehydration, especially for those who experience greatest risk during heat events. Achieving thermal safety involves managing not only indoor temperature but also factors such as humidity and air quality. In Canada, winter thermal safety is commonly understood in the design industry; however, summer thermal safety is an emerging area of study and design and while definitions are converging, there is no widely accepted measurement or limit.

A related concept of **thermal comfort** is more well-known to the building industry, and focuses on providing an environment where most occupants feel comfortable under normal conditions, taking into account factors like temperature, humidity, air movement, and personal clothing and activity levels. Standards such as ASHRAE Standard 55[6] and CIBSE Guide A[7] are used to define these comfort zones. For example, ASHRAE's guidelines suggest that maximum indoor temperatures should stay within a range of 24°C to 27°C in summer for comfort. Similarly, the Canadian Standards Association recommends a temperature range of 23°C to 26°C in the summer for office-based workplaces.[8] Since thermal comfort is subjective and influenced by individual factors, it is important that health-focused indoor temperature guidelines incorporate evidence-based thresholds instead of just comfort.

While there are currently no widely adopted, enforceable standards for thermal safety in Canada, the 26°C indoor temperature threshold represents an important limit for protecting people from heat-related health risks. This threshold is informed by human and environmental physiology research, as well as existing temperature standards, which show that sustained exposure to indoor temperatures exceeding 26°C can negatively impact health.[9] The elderly, individuals experiencing social isolation, individuals with pre-existing health conditions, and other populations are more likely to experience adverse health effects when indoor temperatures exceed this limit for longer periods of time. While higher thresholds, such as 31°C, may suffice for short-term exposure, designing for 26°C ensures greater protection and equity, particularly during extended heat events.[10]

In BC, the 2024 BC Building Code added new indoor design temperature provisions, setting a maximum indoor temperature threshold for newly constructed residential buildings that reflects the emerging understanding of thermal safety. Aligning with international best practices that recommend maintaining safe temperatures in residential and public buildings (such as CIBSE's TM59 and TM52 guidelines), the BC Building Code article *9.33.3.1. Indoor Design Temperatures 2)* states that "*At the outside summer design temperature, required cooling facilities shall be capable of maintaining an indoor air temperature of not more than 26°C in at least one living space in each dwelling unit.*" The living space protected from temperatures above 26°C is intended to be a space where the occupants can gain

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[6] American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). (2023). *ANSI/ASHRAE Standard 55-2023: Thermal Environmental Conditions for Human Occupancy.* ISSN 1041-2336.

[7] Chartered Institution of Building Services Engineers (CIBSE). (2021). *Guide A: Environmental design.* ISBN 9781906846541.

[8] Canadian Centre for Occupational Health and Safety (CCOHS). (2024). *OSH Answers Fact Sheet: Thermal Comfort for Office Work.*

[9] Glen Kenny, Robert Meade, Sarah Henderson. (2022). *Preventing injuries and deaths during extreme heat events*. NCCEH Webinar.

[10] Government of Canada. (2022). *It's getting hot in here! – Protecting the most vulnerable from indoor heat.*

some reprieve from elevated temperatures and continue daily life while avoiding the harmful effects of high temperatures.[11]

2.2 Achieving Thermal Safety

Retrofitting existing buildings to safeguard thermal safety is often not a straightforward or simple task. Each building is unique in its shape and orientation, year and type of construction, existing mechanical systems, and decision-making structures. Even identical units within a building may require more or less attention depending on their location in the building or the characteristics of the occupants. This means that the right retrofit options for improving thermal safety for one building or unit may be very different from another.

However, when looking broadly across multiple building typologies, the retrofit options that have the most potential can generally be broken down into one of the following broad categories of measures:

- **Active cooling measures** that remove the heat and cool the space to achieve the desired indoor temperature using electric heat pumps. These are the most effective measures in providing thermal safety, though performance varies by system type, design and installation.
- **Measures to reduce solar heat gains,** minimizing heat gain from solar radiation by preventing or reflecting solar gains to reduce the demand for cooling. These measures also improve a building or unit's *thermal resilience*[12] and *passive survivability*[13] during power outages.
- **Measures to improve airflow** that promote air movement to dissipate heat when solar and/or internal gains (e.g. from cooking) are present. These also help to improve *thermal resilience* and *passive survivability* during power outages.
- **Interim solutions,** which represent active or passive measures that can temporarily or partially mitigate overheating risk or reduce cooling energy demand while longer-term solutions are being explored. Some

Conducting a "Cooling Audit"

A cooling audit is a process that can help owners identify a building's unique pathway to achieving thermal safety. Broadly speaking, this involves assessing the specific conditions that can create overheating in a building and exploring the opportunities that are available to address it. The primary steps of the cooling audit framework developed as a part of this report include:

1. *Identifying the problem*: What's causing the overheating and to what extent? Who is being affected?
2. *Exploring potential solutions*: What active and passive cooling measures are available, and with what interim and co-benefit solutions?
3. *Determine a path forward:* What are the financial and other barriers to implementation, such as electric capacity? What are the opportunities, such as energy efficient appliances that reduce internal gains and free up electric capacity?

More details on this framework are provided in ***Appendix A.***

[11] Government of British Columbia, Building and Safety Standards Branch. (2024). *Information Bulletin: Protection from Overheating in Dwelling Units.*

[12] *Thermal resilience* refers to the ability of a building to prepare for, withstand, and recover from major disruptions due to extreme weather events or building system disruptions, and maintain a comfortable and safe indoor thermal environment for building occupants.

[13] *Passive survivability* refers to the ability of buildings to maintain habitable conditions, including temperature control, without active mechanical systems during power outages, ensuring occupant safety and comfort. Approaches that promote passive survivability include natural ventilation and cooling, passive solar design, exterior shading, green and cool roofs and high-performance insulation.

examples include adding cooling to a common room in the building or installing cooling in a central makeup air unit serving corridors on all floors.

- **Co-benefit solutions**, or measures that indirectly support indoor thermal safety but are targeted towards improvements in other areas of building performance. Examples of specific measures include enclosure upgrades, improving air sealing, or adding a green or reflective roof.

In addition to the prioritized retrofit options and measures, other solutions were identified through the literature review but did not make the recommended list, including:

- **Small-impact solutions:** offering marginal, temporary relief in reducing interior temperatures but potentially exacerbating overheating or delaying efforts to address the risk, which may lead to increased health risks over time. Examples of specific measures include portable fans and homemade insulation for windows and doors.

A more detailed typology of the five broad categories of recommended retrofit options is provided in Table 1.

While these groups of measures represent those with the greatest potential for safeguarding thermal safety, they of course come with a range of associated benefits and challenges. To explore these potential trade-offs in more detail, each category was explored in further detail according to the following criteria:

- **Effectiveness** in improving thermal safety of multifamily building occupants
- **Air quality benefits** to protect against increased wildfire smoke or other pollutants
- **Decarbonization benefits** to align with other climate action priorities
- **Cost**, including both capital and operating cost implications
- **Equity**, including considerations for tenant disruption or displacement, operating cost impacts on tenants, user responsibility for operation, storage, agency, and potential for co-benefits

Appendix B provides a high-level summary of this evaluation, with additional details by measure provided in a companion Excel document.

As noted in the introduction, there are also several potential barriers that owners or tenants of buildings can face when trying to implement one or more of these upgrades in their building or unit. Table 2 provides a high-level summary of the most common barriers facing multi-family buildings when exploring or implementing one of the retrofit measures described above.

Table 1: Typology of retrofit options for thermal safety

CATEGORY	MEASURE GROUPS	INDIVIDUAL MEASURES
Active Cooling	Central Systems	• Retrofitting central heating-only system with HP or A/C
	Individual Units (heat & cool)	• Split heat pumps • All-in-one heat pumps
	Portable AC Units (cool only)	• Dual hose units
		• Single hose units
		• Portable window AC units
Reduce Solar Heat Gains	Exterior Shading	• Fixed shading
		• Operable shading (manual or automatic)
		• Solar screens
	Windows – reduce SHGC	• Reduce solar heat gain coefficient (SHGC)
Improve Airflow	Windows- add openings	• Natural ventilation
	Mechanical Assist Strategy	• Exhaust fans
	Operational Strategy	• Nighttime ventilation
Interim Solutions	Partial Cooling	• Make-Up Air (MUA) unit (add cooling in corridors)
		• Common room
	Passive Strategies	• Interior blinds (insulated, reflective and ideally paired with operable windows)
		• Thermal mass (e.g. phase change materials)
		• Reduce solar gains (e.g. SHGC window films or dynamic glazing)
		• Reduce internal gains (e.g. efficient appliances)
		• Circulation fans (e.g. ceiling)
Co-benefit Measures	Mechanical	• Heat recovery ventilator (HRV)
		• Energy recovery ventilator (ERV)
	Enclosure	• Upgrade enclosure (walls, roofs, etc.)
		• Upgrade windows (higher U-value)
		• Improve air sealing
		• Green roof
		• Reflective/ high albedo roof
	Other	• Free up electrical capacity (e.g. efficient appliances)
		• Renewables (e.g. solar PV)
		• Trees and vegetated areas near building

Table 2: Typical barriers to thermal safety retrofits

CATEGORY	DETAILS
Awareness and capacity	○ **Access to information.** Building owners and tenants may be unaware of the benefits and necessity of thermal safety retrofits, as well as the retrofit opportunities, available technologies, the retrofit process, rebates, and contractor information. ○ **Time and experience.** Implementing retrofit solutions to enhance thermal safety can involve multiple measures and may be complex to initiate, approve, and manage. Owners and property managers often lack the knowledge, experience, and time required to successfully launch these types of projects.
Policy and regulation	○ **Split incentives.** In the case of rental buildings, owners typically bear the costs of retrofits, but they may not directly benefit from any expected energy savings, reducing the motivation to invest in thermal safety retrofitting. ○ **Decision-making structures.** There are complex decision-making structures for some buildings. Retrofit projects often require consensus from a majority of unit owners, which can delay or even block progress on necessary upgrades. ○ **Clear and consistent policy.** Clear and consistent policies are essential to incentivize and accelerate retrofitting actions, advancing the necessary retrofits to enhance thermal safety in buildings. ○ **Coordinated climate action.** Current bylaws or permitting processes may hinder the implementation of thermal safety improvements in MURBs. Better alignment and coordination with existing plans and programs are often needed, as is a clear understanding of grid capacity to support retrofits.
Equity and affordability	○ **Competing priorities.** Building owners often have to meet many operational needs. Competing priorities can limit the allocation of funds for thermal safety retrofits. ○ **Additive retrofit capital costs.** Depending on a building or unit's characteristics, some retrofit measures require additional assessments or building system upgrades to enable their implementation. This can result in a growing list of upgrades and associated costs, many of which are not covered by existing incentive programs. ○ **Post-retrofit operation costs.** The impact of retrofits on operational costs, including utility and maintenance expenses for newly added cooling, varies depending on the measures adopted. Operational costs are also impacted by fuel prices, the quality of installation, and the proper operation of systems and equipment. ○ **Opportunities for influence.** Tenants often face limited opportunities to advocate for their rights to a safe and comfortable environment and influence decisions on retrofits. Even individual owners tend to have a small voice within a strata. To make upgrades or implement certain measures, they typically need to obtain approval from the property owner or strata corporation. ○ **Impacts to occupants.** Retrofits can be disruptive and may temporarily require occupants to leave their home during construction, for a few hours or longer. There also exists a risk of homes becoming unaffordable to current tenants if rents are increased to cover the cost.
Industry and technology	○ **Industry awareness.** Building professionals and contractors may have low interest and limited knowledge of thermal safety retrofits in MURBs, resulting in lower availability of technology and services, suboptimal retrofit designs, and lower quality installations. ○ **Market availability.** There may be low availability of certain products that are most appropriate for meeting local needs. ○ **Access to qualified installers.** The demand for qualified installers often exceeds the supply, leading to long wait times for retrofits. There is also often a lack of transparency in installation costs, leading to the potential for uncertainty and mistrust in quotes received.

Illustrative Example: A Kitsilano low-rise plans for cooling

This building includes 4 lower-level units (2 lower floors) and 4 upper-level units (2 upper floors), with mostly 2-bedroom units. It underwent a full enclosure upgrade in 2008, with a depreciation report created in 2014. The building is reasonably well-shaded, particularly on the lower units, and there are no windows on the east and west.

Year	1989	**Stories**	4
Ownership	Strata	**Units**	8

Systems Electric baseboards, gas fireplace, exhaust fans & individual electric hot water tanks.

Overheating The two south-facing top units overheat on the upper levels in a typical year, but there are no immediate concerns apart from future heat domes.

Overheating Strategy

The strata council retained an engineer to assess the potential for overheating at the building and develop a building upgrade plan that considers overheating mitigation, energy efficiency, greenhouse gas reductions, and planned upgrades from the mandatory depreciation report and electrical capacity study.

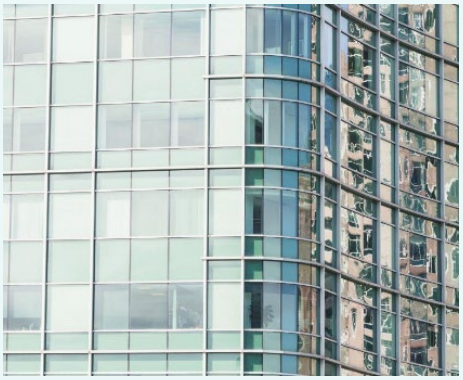
Because immediate overheating risk was found to be fairly low at this building, and the capital reserve fund was insufficient to immediately implement full cooling, the strata council was advised to convene to discuss and approve a roadmap to prepare residents for the necessary upgrades within 5-10 years, ideally planning upgrades within a defined timeframe. By coordinating this in advance, the strata would be able to set a consistent standard for each resident to abide by.

In terms of possible cooling options, options available to the strata were to begin to complete smaller, passive measures on the upper and south floors; for example, starting with the upper floors within 1-2 years, and moving to the lower floors within 3-4 years. This included adding shades to the south façade and the limited windows on the east/west facades, as well as considering additional exhaust fans (i.e. in addition to kitchen and bathroom fans) to drive more ventilation through the deep, narrow units.

Early planning was also recommended to prepare the strata for adding mechanical cooling to each unit. The strata organization was advised to get at least three quotes, evaluate options, and start with the upper south units within 3-4 years, with the lower and north-facing units following suit within 4-6 years.

Since the building is currently heated with electric baseboards, an electrical capacity study may not be necessary. However, as part of the roadmap, the strata was advised to recommend owners to consider replacing appliances (e.g. kitchen, washer/dryer and water heaters) and lighting with more efficient units to free up electrical capacity as demand grows, as well as reduce internal heat gains during hot temperatures.

Illustrative example: Urgent cooling plan needed for a Coal Harbour high-rise



This building is typical of downtown Vancouver's concrete & window wall high-rise towers of this era. Units have 0-3 bedrooms, with hydronic baseboard heaters served by a central hydronic boiler. There are no balconies or exterior shades.

Year	1990s	**Stories**	25
Ownership	Strata	**Units**	175
Systems	Hydronic baseboards with central boiler, bathroom exhaust fans, central DHW		
Overheating	Because of the high glazing area, most of the, south, east and west-facing units overheat every summer, and small units that only face north suffer from lack of airflow. Real estate listings confirm hot temperatures as portable A/C units are present in multiple photos.		

Overheating Strategy

Because overheating is extreme in this building and the budget is limited, the strata organization retained an engineer to develop a building upgrade plan that addressed the immediate issue while intersecting with incoming requirements and planned upgrades. The upgrade plan advised the strata organization to consider interim options to address overheating as soon as possible. These could include: adding cooling to the central rooftop makeup air unit serving corridor and amenity spaces, allowing owners leeway to make certain changes for thermal safety, such as allowing insulated, reflective blinds (even if they contravene strata bylaws surrounding building aesthetics) and portable cooling units, and providing education on night cooling, adding exhaust fans, proper installation and maintenance of portable cooling units, and neighbour check-ins.

While the central boiler system may be challenging to upgrade to include cooling, there are other drivers in Vancouver that will encourage electrical heating in the future, therefore, the assessment should consider whether both more efficient heating and cooling could be addressed together. The assessment should also consider how decisions to support cooling can be included as the building envelope approaches its natural replacement cycle, such as improving glazing performance and/or replacing with opaque panels, adding shading and operable elements, and considering adding ports for permanent heat pumps to be provided.

As part of the roadmap, the strata should recommend that all owners consider replacing appliances (e.g. kitchen, washer/ dryer and water heaters) and lighting as they reach end-of-life with more efficient units to free up electrical capacity as demand grows, as well as reduce internal heat gains during hot temperatures.

3 Recommended Actions

As noted in the introduction, there is already a landscape of policies and programs that are either directly or indirectly attempting to address the barriers to thermal safety that homeowners and tenants experience. Many efforts to increase electrification and/or decarbonization in existing buildings in BC will have the additional impact of helping to improve the energy efficiency of existing buildings and increase the uptake of mechanical systems that provide cooling. However, there remains an important opportunity for local governments (both municipal and regional) to build upon this landscape and explore additional means of accelerating the implementation of retrofits that safeguard the health and safety of their community members.

Based on the process of research and engagement outlined in Section 1.4, the sections below outline a set of actions that are available to local governments interested in supporting the implementation of thermal safety retrofits. They have been organized into four main categories of action that broadly correspond to the four main types of barriers to thermal safety: 1) information and awareness; 2) policy and legislation; 3) funding and financing; and 4) industry and technology. Considerations for helping to ensure that costs and benefits of proposed actions are distributed equitably have been included throughout, with additional guidance provided in Section 4.

Within each category, actions have been listed according to their primary objective. The following details have been provided for each action:

<table>
<tr><th colspan="2">A high-level description of the action</th></tr>
<tr><td>A one-word description of the type of action:
Study, Educate, Coordinate, Advocate, Fund, or Require</td><td rowspan="2">A description of what the action entails.

Helpful Links and Examples:
• Resources, case studies or websites that provide some foundation for the recommended action</td></tr>
<tr><td>Potential Partners:
Example actors who should be consulted and/or involved in the action</td></tr>
</table>

Suggested timelines have not been included for each action as it will be up to each local government to decide on the best approach to implementation, according to their past work and priorities, the data they have available, the existing relationships they have with relevant organizations, and the needs and perspectives of their community members.

However, actions indicated by a star are those that local governments are recommended to explore in the short term, as they represent actions that are both within local government jurisdiction and have the potential to directly increase the number of thermal comfort retrofits in the short term.

3.1 Awareness & Understanding

3.1.1 Increase owners' and tenants' understanding of thermal safety risks and the measures they can use to reduce them

As noted in Table 2, access to information on the need for (and benefits of) thermal safety retrofits is a key barrier to their implementation by both owners and property managers. These and other actors often lack the knowledge and expertise to understand the opportunities to upgrade buildings or units, identify the most suitable measures or technologies, locate available rebates or financing opportunities, and contract with the right professional for their installation. Tenants can similarly benefit from information that can help them advocate and even install measures to help improve their thermal safety.

This section describes the suite of actions designed to address these awareness and information gaps. A key dimension to the successful implementation of these actions is the need to work with other relevant actors to help ensure that information is communicated in a way that is both consistent and tailored to different audiences, whether a strata council, rental building owner, or tenant. Another important consideration is how best to work with and leverage local partners to both shape and broaden the reach of any educational materials.

1) Provide educational materials to strata and rental building owners	
Type of action: Educate	Work with provincial and regional health authorities and institutions to develop consistent but differentiated educational materials for strata and rental building owners to help them understand: • What thermal safety is and the risks associated with high indoor temperatures. • The steps to safeguard occupant health and safety, including passive/active strategies to provide adequate cooling to maintain indoor temperature below 26°C. • The co-benefits of thermal safety upgrades (e.g. for energy efficiency, emissions). • Temporary measures to quickly and impactfully reduce risks of overheating during health emergencies and extreme heat events (e.g. neighbour check-ins). • How to plan for upgrades to meet a building's cooling needs in the long term, and integrate cooling into other upgrades (e.g. asking electrical engineer/ electrician about load switching opportunities, if possible). • Power efficient design strategies that can support efficient use of electricity to enable cooling without triggering suite-level service increases. • How to reduce the need for individual panel upgrades when retrofitting for cooling (e.g. replacing lighting, appliances with more energy efficient equipment to reduce panel load and free up space for cooling). Tailor materials to specific kinds of building owners and speak to a broad range of potential situations. *Helpful Links and Examples:* • Fresco/Landlord BC. MURB Retrofits: Opportunities for Electrification. • BC Housing's BC Energy Step Code Design Guide Supplement S3 on Overheating and Air Quality
Potential Partners: Health authorities, TSBC, BC Housing, Province of BC, CHOA, LLBC	

2) Provide educational materials to building tenants

Type of action:
Educate

Potential Partners:
Ecotrust, health authorities, BC Housing, local community groups, BCNPHA, TRAC, people with lived experience of inequities, social equity advocates/advocacy organizations

Develop targeted information and outreach campaigns for tenants to raise awareness of the measures they can implement to increase their thermal safety.

Reference any existing guidance and include information on available supports and points to raise to landlords/owners to make a case for additional cooling.

Work with community-serving organizations and municipal committees to disseminate and tailor information to diverse segments of the community. Examples of groups that can support information distribution include:

- Neighbourhood centres
- Immigration support services (e.g. North Shore Immigrant Inclusion Partnership)
- Community outreach services (e.g. Lookout Society, Vancouver Coastal Health, Intellectual Disabilities Society)
- Social housing & tenant resource groups (e.g. Tenant Resource and Advisory Centre)

Helpful Links and Examples:

- Residential Tenancy Branch. Air Conditioning (AC) Units

3) Work with regional partners to integrate cooling into electrification messaging

Type of action:
Coordinate

Potential Partners:
ZEBx, ZEIC, BC Hydro, local community groups, health authorities, regional governments

Work with non-profit groups and other regional partners to explore how best to integrate the value of cooling into communications about electrification. Consider exploring:

- Full-scale revisions of narrative and communication methods that "tack on" cooling as a co-benefit, and instead put health and resilience benefits first.
- Regional collaborations for strategic communications campaigns that leverage local community organizations and utilize multi-modal, creative and exciting initiatives.
- Other common touchpoints with homeowners, e.g. utility bills, tax bills, etc.

Helpful Links and Examples:

- Zero Emissions Innovation Centre
- Building to Electrification Coalition
- Zero Emissions Building Exchange

4) Advocate for existing programs for new immigrants and multi-lingual residents to include thermal safety coaching and support

Type of action:
Educate

Potential Partners:
Empower Me, Province of BC

Empower Me hires members of underserved communities to be Energy Mentors, trained to deliver multilingual energy efficiency and home safety education.

- Explore the possibility of leveraging current programs offered by Empower Me to add information and measures around thermal safety in addition to energy efficiency for community members whose primary language is not English.

Helpful Links and Examples:

- Empower Me

5) Develop a means of signalling which rental buildings have active cooling systems to prospective tenants

Type of action:
Educate

Potential Partners:
ZEBx, LLBC, TRAC, affordable housing providers, people renting and/or with lived experience of inequities

Work with industry partners to develop a social media and/or labelling campaign whereby rental building owners can signal that they provide cooling to their tenants.

- Where they exist, leverage existing benchmarking requirements as a starting point (see *Action 7*), building towards mandatory disclosure (including of presence of cooling) in an ongoing way and/or at time of sale or rental.
- In the interim, explore a means of asking owners to voluntarily disclose where MURBs have cooling systems in place. Consider advocating to housing rental platforms to include existence of active cooling as a search field.

Helpful Links and Examples:

- Padmapper

6) Advocate for cooling to be considered in strata depreciation and electrical planning reports

Type of action:
Advocate

Potential Partners:
CHOA, BC Hydro, ZEIC, UBCM, other local governments

Help promote the importance of exploring cooling opportunities alongside general electrification opportunities and capacity upgrades in strata depreciation reports and electrical planning reports (EPRs).

Helpful Links and Examples:

- CHOA. Introduction to Electrical Planning Reports.
- Province of BC. Strata Depreciation Report Requirements.
- FRESCO/CHOA Guidance for the Preparation of Electrical Planning Reports for Strata Corporations in British Columbia (2024)

3.1.2 Increase local authorities' understanding of cooling needs

Owners and tenants aren't the only actors who may lack information on opportunities for thermal safety upgrades. Both local and regional governments often lack reliable information on the buildings within their jurisdictions, including characteristics such as building age, condition, existing systems and available electrical capacity to support active cooling upgrades. Most jurisdictions similarly lack information on which neighbourhoods, buildings or even units could benefit the most from thermal safety upgrades – information that could help target efforts to support thermal safety retrofits where they are most needed. This section outlines actions that local governments can take to improve the understanding of their community's cooling needs, challenges, and opportunities.

7) Require building owners to report and disclose existence of unit-level cooling

Type of action: Coordinate	Work with key partners and stakeholders to establish energy and carbon reporting requirements. Ensure *percent cooled* fields in ENERGY STAR® Portfolio Manager are included among the data points multi-family building owners are required to report to provide a better understanding of where MURB are likely to already have cooling. Alongside this effort, explore the potential of alternative means of identifying where unit-level cooling is already provided, including: • The feasibility of using business licensing as a means of requiring owners to report whether their building provides cooling. • The feasibility of establishing an operating permit that requires owners to demonstrate progress towards full cooling over time, with penalties associated with non-compliance over a certain timeframe. As part of any potential disclosure requirements, build on any existing voluntary programs (see *Action 5*) and work with the real estate sector to add cooling information to new listings. *Helpful Links and Examples:* • ENERGY STAR Portfolio Manager Access Page • Efficiency Canada. How municipalities can leverage benchmarking to building labeling to decarbonize existing buildings. • BC Hydro's Step-by-Step Guide for Supporting Local Governments in British Columbia to Implement Energy Benchmarking (2023) • RentSafeTO mandatory rental registration program • New Orleans' Healthy Homes Program and annual compliance certification
Potential Partners: BC Hydro, FortisBC Electric, TSBC, TRAC, LLBC, Building Benchmark BC, Province of BC, City of Vancouver	

8) Conduct or commission a set of studies designed to identify where cooling efforts should be directed

Type of action: Study	The study (or studies) should: • Leverage existing data wherever possible (e.g. 2021 heat dome emergency services reports). • Seek to develop a quantifiable means of identifying buildings and dwellings at higher risk of overheating by exploring demographic factors (e.g. neighbourhood-level health trends), social factors (e.g. social isolation) or others (e.g. self-identifying, incidences of occupant demand, building orientation). • Explore different approaches to the prioritization of cooling efforts at the neighbourhood scale (e.g. tree canopy, outdoor temperatures), building scale (e.g. age, financial position, location, current HVAC system) or unit scale (e.g. units-at risk of extreme heat).
Potential Partners: BC Housing, health authorities, local academic institutions	

	• Explore the potential to measure in-suite temperatures via data loggers/monitors, possibly as a pilot study. • Explore the potential for a modelling study that could help develop a standardized methodology for assessing whether a given unit or building will exceed 26°C. *Helpful Links and Examples:* • UBCM grant for heat risk mapping • Fraser Basin Council Extreme Heat Mapping • CRD Regional Heat Map • City of Burnaby map of buildings at risk of extreme heat • University Laval vulnerability mapping project • HealthyPlan.City

9) Collect residents' stories on challenges to installing cooling measures	
Type of action: Coordinate	Work with regional partners to collect residents' stories about their challenges in installing cooling measures to lend weight to advocacy efforts to increase access to cooling measures. • As part of this effort, consider how these opportunities could also be used to provide smart thermostats to collect actual temperature data (*see Action 8*). • Make use of these stories in communications campaigns to socialize the use of heat pumps and need for cooling in general. *Helpful Links and Examples:* • Ecotrust Canada. Advancing tenants' rights to retrofits and energy efficiency (2024). • City of Vancouver. Vancouver Indoor HEAT Study, 2021-2023.
Potential Partners: Not-for-profits (e.g. Ecotrust, TRAC), housing authorities, health authorities, disability advocacy groups	

10) Conduct or commission a set of cooling studies/pilots to better understand the barriers and opportunities to achieving 26°C in one room and/or dwelling-wide	
Type of action: Study	The study/pilot should: • Consider focusing on a single building archetype (or set of archetypes) to zero in on the key characteristics relevant to upgrades, minimizing the impact of site- or context-specific circumstances on retrofit costs. • Leverage and integrate with ongoing or planned studies on decarbonization/electrification where possible (e.g. CHOA's MUA cooling monitoring study), and/or deliver "cooling-first" studies using primary data collection. • Seek to identify the most cost-effective strategies across building examples. *Helpful Links and Examples:* • City of Vancouver/BCNPHA's Non-profit resilient retrofit grant program • Landlord BC's Rental Apartment Retrofit Accelerator Program (RARA)
Potential Partners: CHOA, LLBC, ZEIC, regional governments	

11) Work with provincial partners to better understand active cooling opportunities	
Type of action: Coordinate	• Advocate to the BC Ministry of Housing and Municipal Affairs to make data submitted as part of electrical planning reports (EPRs) to be made available to local governments to help in designing supportive programs and policies. • Work with BC Hydro and partners to obtain a better understanding of what data exists to support installation of active cooling (e.g. current electrical capacity at building or neighbourhood scales). *Helpful Links and Examples:* • N/A
Potential Partners: Province of BC, BC Hydro, FortisBC Electric, TSBC	

3.2 Policy & Legislation

3.2.1 Remove legal and legislative barriers to adding cooling measures

Even with the right information and educational resources at hand, several barriers to the implementation of thermal safety retrofits for owners and tenants can remain. Some of these barriers are tied to the current legislative frameworks in use in British Columbia such as the *Residential Tenancy Act* and *Strata Property Act*, both of which have yet to recognize the need to ensure the thermal safety of building occupants in the context of rising temperatures. Others relate more to existing decision-making structures for strata buildings, which can encumber or even prevent owners from moving forward with thermal safety upgrades. Others have more to do with legal, permitting, infrastructural barriers that can prevent owners and local governments alike from moving thermal safety upgrade projects forward.

This section explores the advocacy and policy actions that local governments can explore to remove those barriers for existing MURBs. Of note here are the recent changes to the BC Building Code for new construction, which have set requirements to maintain reasonable indoor design temperatures and protect occupants from overheating as temperature rise. These requirements for new construction can be useful as a reference when advocating for new requirements for existing buildings.[14][15]

12) Advocate for inclusion of Right to Cool in *Strata Property Act*	
Type of action: Advocate	Develop and implement an advocacy strategy to the Provincial government for revisions to the *Strata Property Act* to include the "right to cool". As a part of this effort, consider advocating for: • Allowing individuals to adopt active and passive cooling measures at their discretion, such as installing heat pumps and covering windows to block the sun. • Preventing the ability of strata to restrict and/or disallow passive or mechanical cooling or ventilation measures (i.e. prevent or unreasonably restrict installation). • Providing direction and support to strata on how to ensure principles of equity and fairness are upheld when considering distribution of costs and benefits. Refer to and leverage the BC Building Code's requirements for indoor design temperatures and associated requirements for overheating protection. *Helpful Links and Examples:* • BC Strata Property Act • Zero Emissions Innovation Centre. Strata Regulatory Review: Navigating Barriers for Strata Corporation Energy Upgrades.
Potential Partners: BC Hydro, Ministry of Health, Ministry of Housing and Municipal Affairs, VISOA, CHOA	

[14] BCBC Part 9 – Housing and Small Buildings. Division B. Acceptable Solutions. Section 9.33.3.1 - Indoor Design Temperatures.

[15] BSSB Information Bulletin, Protection from Overheating in Dwelling Units. April 19, 2024.

13) Advocate for inclusion of Right to Cool in *Residential Tenancy Act*

Type of action:
Advocate

Potential Partners:
Provincial Ministry of Health, VCH, Fraser Health, RTB, LLBC, Ecotrust, community organizations, people renting and/or with lived experience of inequities, other local governments

Advocate to the Provincial Government to:

1) Include the "right to cool" as a major health and safety concern into the BC *Residential Tenancy Act*. This should allow renters to make minor/moderate upgrades to implement cooling measures (e.g. fans, window-mounted air conditioners, shades), as well as explore the possibility of requiring landlords to ensure cool spaces (either in the building or the unit).
2) Identify additional means of improving RTA enforcement (e.g. through increased staff capacity) such that the burden of reporting non-compliance does not fall solely to the tenant.
3) Identify a standardized means of ensuring the fair allocation of added (utility) costs between landlords and tenants (e.g. percent reduction in rental costs) where utilities are shifted to the tenant following heat pump installation.
4) Require landlords to register Tenancy Agreements.
5) Require electrical planning reports to be mandatory for rental buildings (i.e. not just strata buildings), and to be publicly disclosed.

Helpful Links and Examples:

- BC Residential Tenancy Act
- Residential Tenancy Policy Guideline. 8. Unconscionable, Unlawful, and Material Terms
- Tenant Rights & Extreme Weather Events: An Analysis of Indoor Temperature Requirements in U.S. and Canadian Landlord-Tenant Law. Written for the Tenant Resource Advisory Centre of British Columbia in conjunction with the Climate Justice Research Collaborative.
- Ecotrust. The Missing Third: Improving Tenants' Rights to Energy Efficient, Climate Resilient, and Safe Housing (2023)

14) Remove any policies or covenants that prohibit cooling measures

Type of action:
Require

Potential Partners:
UDI, AIBC

Work with municipal staff and industry partners to identify any guidelines, bylaws, design covenants, and/or other policies or agreements that conflict with any form of overheating mitigation, such as external shades, heat pumps, and AC units. Once identified, explore means and opportunities to remove them in order to allow their installation.

Refer to and leverage the BC Building Code's requirements for indoor design temperatures and associated requirements for overheating protection.

Helpful Links and Examples:

- BC *Property Law Act*, Section 35, *Court may modify or cancel charges.*
- US Office of Legislative Research, "Solar Rights" Laws in Arizona, California, Florida, Massachusetts, and New York. 2021.

15) Review and implement measures to track and facilitate heat pump installation	
Type of action: Require	Review and implement opportunities to simplify and expedite heat pump adoption. Consider: • A simplified heat pump permit (where applicable) and associated checklist to make it easier for applicants looking to install heat pumps to comply. • An expedited heat pump application process. • Broadening to other passive cooling measures as well (e.g. exterior shading). Alongside this action, explore means of improving compliance with existing requirements (e.g. design options, cost considerations, site inspections, approvals guidance). *Helpful Links and Examples:* • City of Vancouver's heat pump permit • University of British Columbia's 1-Step Residential Heat Pump Permit Application Form and Strata Council Checklist for Heat Pump Installation Projects
Potential Partners: BOABC, TSBC	

3.2.2 Enact measures to foster the adoption of cooling measures in all existing MURB

One of the main challenges for local governments interested in supporting thermal safety upgrades (and upgrades to existing buildings in general) is the lack of clarity around what can actually be required. While there are certain levers at local governments' disposal such as bylaws, development permit areas, and business licensing, there remains a lack of clarity around the best means through which owners can be encouraged and/or compelled to add thermal safety measures to their units or buildings. Furthermore, caution must be used in issuing such requirements, as there is a need to balance firm expectations around the inclusion of life safety measures, with an understanding of the many challenges that owners can face in implementing them. Careful consideration of the downstream effects that can accrue to residents or tenants is necessary, including the implementation of any complementary tenant protection policies. This section outlines the key opportunities that local governments can explore to require owners to improve and showcase the thermal safety of their buildings, as well as the advocacy and collaboration opportunities that they can use to further consistent action across the province.

16) Explore the establishment of a Maximum Indoor Temperature Bylaw	
Type of action: Require	Explore the establishment of requirements for rental building owners to implement measures to safeguard the thermal safety of occupants. As a part of this exploration, consider: • Introducing and/or expanding any current Standards of Maintenance bylaw to include requirements for maximum indoor temperatures, leveraging Section 53(2)(d), Section 63(f), and/or Section 8(3) (g), (i) or (l) [Fundamental Powers] in the *Community Charter.* • Requiring proper maintenance and function of any existing air conditioning units and/or operable windows as a baseline for compliance. • Exploring whether requirements should be tied to the maintenance of indoor temperatures below 26°C in at least one room per unit, to align with current BCBC requirements for new construction. • Exploring the potential role of ongoing monitoring and reporting of indoor temperatures to ensure compliance with established standards.
Potential Partners: Other local governments	

	• Setting fines for non-compliance to encourage action. • Exploring whether an increase in Buildings/Inspections staff capacity for enforcement is necessary to help alleviate the burden of reporting non-compliance from tenants. • Exploring whether requirements can be implemented incrementally/through phased timeframes. • Coordinating with other local governments to improve consistency for owners with portfolios of buildings that cross jurisdictions. *Helpful Links and Examples:* • Community Charter, S.B.C. 2003, Chapter 26, Part 3 — Additional Powers and Limits on Powers • Community Charter, S.B.C. 2003, Chapter 26, Fundamental Powers • Canadian Environmental Law Association. Recommendations for Municipalities. Focus: Extreme Heat and Rental Housing • City of Vancouver's Standards of Maintenance Bylaw • City of Port Moody's Standards of Maintenance Bylaw • City of Mississauga's Adequate Temperature Bylaw • City of Dallas City Code, Chapter 27 • New York City's Int 0994-2024 Tenant's Right to Cooling bill

17) Promote and support the development of extreme heat plans in rental buildings	
Type of action: Fund/Coordinate	In coordination with other levels of government and industry representatives, develop a template for, and support the uptake of, extreme heat plans in rental buildings. Consider using a standardized cooling audit (see *Appendix A*) as the basis for the extreme heat plan and requiring a description of a minimum of the following: • Existing measures already in place to safeguard thermal safety of occupants (e.g. cool rooms, unit-level cooling). • A plan for expanding cooling measures to additional suites, aligned with planned upgrades over time. • Emergency measures in place to further safeguard thermal safety under extreme heat, including means of allowing municipalities, health authorities or other relevant organizations access to residents for wellness checks.
Potential Partners: Province of BC, TRAC, other relevant community organizations	As part of this effort, consider: • Building on existing templates for heat response planning (e.g. Vancouver Coastal Health). • Advocating for a central (i.e. regional or provincial) body to act as the primary host of the template. • Building acceptance among building owners and tenants by incentivizing the completion of an extreme heat plan, and tying receipt of funding to making it accessible to tenants (e.g. posted in the building's common area). • Linking key information embedded within each extreme heat plan to public disclosure programs (*see Action 7*), where possible. *Helpful Links and Examples:* • Vancouver Coastal Health's Heat Response Plan Template • BC Housing's Extreme Heat and Wildfire Smoke (EHWS) guidance

18) Adapt/create bylaws and/or development permit areas to support neighbourhood-level cooling

Type of action:
Require

Potential Partners:
Health authorities

Adapt or create bylaws and/or development permit areas to encourage:

- Strategies that reduce the urban heat island effect, either by enhancing greenery (e.g. trees) close to buildings (i.e. on site) and/or encouraging high albedo roofs and surfaces, and the use of cooling corridors where possible.
- Zero-emissions district-level energy systems that allow mechanical cooling to tie in for energy sharing purposes.
- Space designations that support the installation of cooling equipment in high-density locations where adequate space for new cooling systems may be challenging within a building's footprint.

Helpful Links and Examples:

- Greenbelt Foundation Cooling Corridors: The Role of Green Infrastructure in Building Resilience to Extreme Heat
- City of Phoenix Cool Corridors Program
- Stewardship Centre for BC's Green Bylaws Toolkit

19) Advocate for a consistent definition of thermal safety

Type of action:
Advocate

Potential Partners:
Health authorities, TSBC, NRCan, Province of BC, other local governments

Alongside efforts to implement local policies, advocate to the Provincial Government for a consistent definition of thermal safety in existing buildings and clarity regarding the regulatory mechanisms that can be used to require its achievement. A clear definition is important for right-sizing of equipment by industry; for design professionals, having clear design conditions is a critical step for compliance purposes.

As a part of this effort, consider advocating for:

- A provincially led study to clarify appropriate temperature thresholds and potential requirements for existing buildings, leveraging work completed to inform cooling requirements for new construction recently introduced into the BCBC.
- A coordinated effort to advocate for a nationwide definition and/or standard for thermal safety at the federal level.
- Clarity in the relationship between maximum indoor temperatures and cooling requirements, and the forthcoming *Highest Efficiency Equipment Standards.*
- Standardized language regarding thermal safety and/or maximum indoor temperatures that can be used in municipal Standards of Maintenance bylaws (see *Action 16*).

Note that seeking clear definition should occur concurrently with other actions to avoid inadvertently slowing progress toward thermal safety. In the interim, the BCBC 2024 (9.33.3.1.2) introduction of requirements for one space within a building to be maintained at 26°C can serve as a definition for quantifying thermal safety in existing buildings while consensus is being reached.

Helpful Links and Examples:

- Province of BC Highest Efficiency Equipment Standards

20) Advocate for changes to the Canadian Electrical Code	
Type of action: Advocate	Advocate for changes to the Canadian Electrical Code that will support improved calculation requirements that do not lead to oversizing of electrical capacity in existing building retrofits.
Potential Partners: Other local governments	*Helpful Links and Examples:* • FRESCO MURB In-Suite Electrification – Panel Management and Load Diet. (2023) • Dunsky Energy + Climate Advisors (2025) Proposed amendments to the Canadian Electrical Code, Part 1 (CSA 22.1). Submitted to CSA Group on behalf of the Consortium for Power Efficiency

21) Integrate considerations of thermal safety into existing communities of practice focusing on climate adaptation	
Type of action: Require	Working in collaboration with other municipal and regional partners, explore means of integrating thermal safety in existing buildings (and climate adaptation in buildings more generally) into established communities of practice.
Potential Partners: Other local governments	Examples include cross-jurisdictional municipal working groups such as the Climate Caucus, the Federation of Canadian Municipalities (FCM), the ICLEI Climate Adaptation Knowledge Exchange, and Union of BC Municipalities' climate action initiatives. *Helpful Links and Examples:* • Climate Caucus • FCM's Local Leadership in Climate Adaptation • ICLEI's Climate Adaptation Knowledge Exchange • UBCM Mayors' Council Access for Everyone

3.3 Funding & Financing

3.3.1 Increase access to and affordability of cooling measures that are most effective at keeping indoor temperatures under 26°C

A well-known and significant barrier to the uptake of thermal safety (and other) retrofits is their associated cost. While some lighter-touch measures can be implemented at relatively low cost, many others can incur a substantial price tag. Owners and managers of both rental and strata buildings alike are consistently faced with the need to balance many competing priorities, making thermal safety retrofits one of a long list of potential upgrades or deficiencies to address. Potentially compounding this challenge are rising costs associated with property taxes and insurance, as well as unexpected costs that can arise in implementing retrofit measures, such as hazardous material removal. Tenants themselves may also be unable to afford potential increases in utility costs that can result from thermal safety upgrades.

While there is a growing landscape of incentives, rebates and financing available to building or strata owners, there remains concerns over the overall cost of upgrades, as well as the risk that costs will be passed to tenants, exacerbating issues of affordability. This section outlines a suite of actions that local governments can take to help reduce the cost barrier by increasing the array of available funding opportunities available to building owners, advocating for new means of supporting or financing upgrades, and reducing overall costs.

22) Explore and leverage the financial tools within municipal control to help support cooling retrofits

Type of action: Fund	Explore and define the suite of municipal financing measures that can help reduce costs and household debt for property owners implementing cooling retrofits. Wherever possible, direct financial support to buildings and/or dwellings that are at highest risk of overheating and resulting in thermally unsafe conditions for occupants. Consider: • E.g. Rebates/incentives *Consider offering incentives for the completion of a cooling audit to support owners in identifying retrofit options under a certain timeframe (see Appendix A).* • E.g. Revitalization tax exemptions *Consider exempting properties that implement cooling retrofits from municipal property value taxes for up to 10 years.* • E.g. Blended financing *Seek out opportunities to blend/combine funding sources, leveraging tools through existing municipal financing programs (e.g. FCM green fund).* • E.g. Concessionary financing *Consider the development of loan loss reserve funds, where recipients receive a discounted rate for select measures.* Additionally consider the potential benefit of tying financing to whole building retrofits or to unit-level support. *Helpful Links and Examples:* • District of Saanich's Climate Action Tax Exemption • City of Vancouver's High performance building standards • FCM's Green Municipal Fund • City of Vancouver/BCNPHA's Non-profit resilient retrofit grant program
Potential Partners: Financial institutions, Cana Infrastructure Bank, ZEIC (Retrofit Accelerator Sustainable Finance Committee)	

23) Support and expand on existing air conditioner rebate and distribution programs

Type of action:
Fund/Advocate

Potential Partners:
Health authorities, BC Hydro, Province of BC

Consider "topping up" existing rebates for air conditioners on offer by BC Hydro and/or the Province. Consider additional local distribution of portable air conditioning units to high-risk MURBs for use in common areas.

Alongside these programs, advocate to the Provincial Government and BC Hydro to ensure that:

- AC distribution be viewed as a short-term emergency measure and not a replacement for more holistic and efficient approaches to adding cooling.
- Granular data on AC distribution is provided to local decision-makers.
- Any publicly funded portable air conditioner distribution programs continue to be directed towards people who are medically vulnerable to extreme heat and have meet low-income qualification thresholds.
- Standards and guidelines are in place to ensure only measures that are highly energy efficient, easy to operate and able to provide a consistent indoor temperature of no more than 26°C in at least one room.
- Equipment is scaled based on the size of the household and space needs to ensure effectiveness.
- The program is evaluated for effectiveness using smart thermometers and/or documentation of indoor temperatures in AC recipients' homes.

Helpful Links and Examples:

- BC Hydro's Free Portable Air Conditioner program

24) Advocate to senior government for financing measures to reduce the risks of extreme heat

Type of action:
Advocate

Potential Partners:
Other local governments

Advocate to provincial and federal levels of government to establish appropriate means of financing retrofit measures that reduce extreme heat and to explore funding opportunities for programs that promote equitable access to safe and comfortable indoor environments in their homes.

Advocate to any existing concierge programs to increase owners' access to favourable lending rates and blended financing opportunities.

Helpful Links and Examples:

- ZEIC's BC Retrofit Accelerator
- ZEIC's Strata Energy Advisor Program

25) Advocate for increased awareness among real estate service providers and their customers on the value of cooling measures.	
Type of action: Advocate	Work with and advocate to real estate agents, insurance companies, financial institutions and property appraisers (and/or their representative organizations) to: • Implement measures to increase staff and customer understanding and awareness of the value of cooling measures in existing buildings. Such awareness raising could take the form of heat risk maps (akin to existing examples of flood risk maps). • Advocate for a means of including the risks of *not* having cooling into pricing for insurance rates and financing, taking care not to advocate for measures that would inadvertently increase premiums. Work towards a shift in the appraisal methodology to factor in the value of climate readiness in general, and cooling in particular. *Helpful Links and Examples:* • Insurance Bureau of Canada. Helping to protect Canadians and build resilient communities.
Potential Partners: Ecotrust, ZEIC, Insurance Bureau of Canada, Canadian Mortgage Brokers Association, BC Real Estate Association	

26) Promote transparency and fair pricing in system installations	
Type of action: Coordinate	Work with industry and government partners to identify appropriate and effective means of addressing predatory pricing practices in heat pump and other cooling system installations. Consider providing information on types and ranges of potential costs, as well as guidance for how to select a contractor. *Helpful Links and Examples:* • Nanaimo Climate Action Hub's heat pump cost information
Potential Partners: Industry partners (HRAI, HPSC, TECA), providers of heat pump rebates.	

3.4 Industry & Technology

3.4.1 Improve the ability of industry members to design, install, and maintain cooling measures

There has been significant interest and effort seen over the last several years dedicated to growing the availability of high-efficiency mechanical systems in new and existing buildings, as well as the capacity of the market to install them. This is exemplified in documents such as the BC Building Electrification Roadmap, which has as its primary goal the need to increase energy efficiency and reduce carbon emissions. While these efforts indirectly support an increase in thermal safety (by way of their focus on heat pumps, capable of providing both heating and cooling), they do not address it directly. As a result, there remains a lack of industry awareness of the needs and opportunities associated with thermal safety retrofits, as well as the risk that appropriate equipment or systems may as yet be unavailable on the broader market. This section identifies a set of actions that local governments can take to fill these gaps and support a robust market for thermal safety retrofits in their communities.

27) Advocate for consistency and alignment in cooling assessment methodologies

Type of action:
Advocate

Advocate for agreement among key provincial and federal agencies in cooling assessment methodology and parameters for designers, focusing on:

- Verifying that 26°C in one space of each unit is sufficient
- Clarifying the summer design temperatures to use for system sizing
- Clarifying the climate files to use for energy modelling
- Establishing the primary metric of interest (e.g. dry bulb T, operative T, overheating hours, SETT, etc.)
- Standardizing cooling audit frameworks and electrical load calculations

Potential Partners:
BSSB, NRC, local health authorities, other local governments

Similar to other actions around creating consistency across industry, providing this methodology should occur concurrently with other actions so that it doesn't slow down the movement towards thermal safety.

Helpful Links and Examples:

- City of Vancouver Energy Modelling Guidelines (referenced by BCBC 10.2.3.4)
- EGBC and AIBC's Joint Whole Building Energy Modelling Professional Practice Guidelines
- Dunsky Energy + Climate Advisors (2024) Overview of Power Efficient Design. Prepared for the Consortium for Power Efficiency

28) Establish a local renovators' community of practice

Type of action:
Coordinate

Potential Partners:
HPSC, EGBC, BOABC, BC Housing, CHOA, B2E, TECA

Establish a local renovators' community of practice, working group and/or workshop series to educate designers and contractors on thermal safety risks and key practices for mitigating them. Leverage this group to:

- Develop a set of visual/design guidelines to assist renovators in identifying key strategies to improve thermal safety.
- Disseminate best practices at key touchpoints with industry members (e.g. front counter).

Helpful Links and Examples:

- Pembina's Reframed program
- NRCan's LEEP series

29) Host or support thermal safety demonstration projects

Type of action:
Study

Potential Partners:
LLBC, City of Vancouver, BC Hydro, ZEIC, BCIT

Host or support demonstration projects and develop case studies that foreground the thermal health and safety benefits of adopting cooling strategies, including both passive and active measures. As part of these projects:

- Demonstrate the potential of thermal safety measures by holding events on hot summer days.
- Focus on benefits and risks to occupants of different abilities and preferences.
- Leverage and tie to the results of any cooling studies that have been conducted locally (see *Action 8*).
- Consider building on any ongoing pilot programs to include an exploration of the feasibility and cost of short/medium-term cooling measures in addition to (or alongside) broader electrification.

Helpful Links and Examples:

- Landlord BC's Rental Apartment Retrofit Accelerator Program (RARA)

30) Provide heat pump guidelines for noise mitigation

Type of action:
Require

Potential Partners:
HRAI, TSBC, HPSC

Provide designers and installers with information on how to avoid non-compliance with noise bylaws and ensure systems do not create issues for neighbours.

Explore whether clarifications to existing noise level bylaws may help to avoid inadvertently restricting cooling system selection without increasing noise impacts to neighbouring buildings or units.

Consider advocating to or working with manufacturers to continue to advance noise-reducing cooling technologies.

Examples/Precedents:

- City of Vancouver Mechanical permit guidelines
- Home Performance Stakeholder Council's Heat Pump Best Practices Installation for Existing Homes
- Township of Langley Technical Report - Heat Pumps and Noise Bylaws (2024)

31) Identify and fill any equipment and technology gaps for MURBs	
Type of action: Study	Commission a study to identify equipment and technology gaps for providing thermal safety in MURBs, including policy and other barriers to their access. Use this information to identify a means of increasing (or rendering more accessible) the supply of smaller, lower cost systems and equipment capable of providing both thermal safety and indoor air quality, as well as shading retrofit products suitable for suites and bedrooms within MURBs. Consider a competitive program to identify high-performing units that could help transform the market. *Helpful Links and Examples:* • NYSERDA's Clean Heat for All Challenge • Innovate BC's Innovation Challenges
Potential Partners: BSSB, EMLI	

4 Implementation Considerations

The actions described above are the result of a process of research, preliminary engagement and analysis intended to support local governments interested in increasing the thermal safety of existing MURB in their jurisdictions. While efforts have been made to provide readers with useful details to assist in identifying appropriate courses of action, the list of recommended actions should be seen as a starting point. Local governments will need to launch their own investigations as to what is most feasible and desirable in their specific jurisdictions.

To help prioritize and implement actions, local government may wish to note the following additional considerations:

1. **Engaging with interested and affected parties**

   Engaging with the interested and most affected parties is central to the development of any potential program or policy. While actions presented in this report have undergone some engagement with local interest holders, local governments interested in implementing some or all of these actions should undertake a process of meaningful engagement with owners, property managers, tenants, people with lived experience of inequity, representative associations, non-profit organizations, and other institutions (e.g. health authorities, provincial or regional bodies, professional associations).

2. **Centering equity**

   Both as part of the action planning process, as well as policy direction itself, it is important to focus effort and attention on addressing social and health inequities. Meaningful community engagement and collaboration with residents and community groups can help ensure that diverse voices are included and empowered through decision-making, thereby informing strategies that are culturally appropriate, helping to remove barriers, and addressing systemic inequities. Local governments committed to equitable outcomes should also carefully consider and mitigate any unintentional burdens that might arise from recommended actions. For example, requiring affected occupants to report non-compliance or issues with building thermal safety measures could disproportionately impact those who may face language barriers, have limited time, or fear repercussions from landlords.

3. **Working collaboratively and at scale**

   Several of the actions noted in this report are fundamentally collaborative in nature – they require the perspectives and insights from multiple scales of governments or other local governments working towards the same goals. Working together can not only help to streamline efforts and reduce resources needed for policy design and implementation, but also to increase consistency and straightforwardness for MURB owners and tenants. Wherever educational materials, requirements, or support programs can be made consistent across a broader area, the clearer it will be for owners and tenants to make the thermal safety upgrades they need.

4. **Creating and leveraging local partnerships**

   One of the crucial dimensions of improving thermal safety is ensuring that information on options and strategies reaches those who need it most. This is why local governments interested in pursuing these actions should work with community groups, associations, and others who have a direct connection to owners, property managers, strata councils and tenants. Examples of such organizations include local health authorities, as well as housing authorities, neighbourhood associations, organizations representing typically underserved groups, and others.

5. Building internal capacity

Many of the actions in this report require cross-departmental design and implementation, especially where it concerns new regulatory action. It will be important to work collaboratively with a range of internal departments, from planning to buildings, revenue services and others. It should be noted that the implementation of some of these recommended policies/requirements will likely require a significant increase in monitoring and enforcement capacity, making the involvement of inspections staff a crucial step. It will also be important to seek internal (and sometimes external) legal counsel for some of the proposed actions that have little precedent.

5 Appendix A: Cooling Audits: Identifying the Right Retrofit Options

Background

Because of the complex nature of retrofit measures and each building's unique circumstances, no single measure can simply provide thermal safety for all dwellings across all buildings, in a cost-effective, expedient manner. The cooling audit framework below was designed to help building owners identify what measures and options are best suited to their particular current context, based on the specific conditions that are creating (or could create) overheating in their building, as well as their ability to address it. The intended outcome of the cooling audit is a retrofit pathway that owners can use to guide implementation of different upgrades over time.

Cooling Audit Framework

This simple audit framework has been structured to consider the questions that a professional would use to evaluate the problem, assess possible solutions, and steer them towards upgrade measures that would best fit the building's needs without causing adverse impacts. Solutions are informed by the nature of the problem and the available budget and other building considerations. However, an ideal process for all buildings would assume a passive-first approach to explore where cooling can be improved via the addition of any relatively low-cost options for passive cooling or shading, followed by exploration of active cooling measures.

The key steps of the audit are as follows:

1. **Identify and characterize the problem by asking:**
    a. *How* is the building overheating (e.g. is it common, extreme, prevalent in all units or just some)?
    b. *What* is causing the overheating (e.g. solar gains, internal heat gains, or other)?
    c. *Who* is being affected (e.g. does the building house a particularly vulnerable household or population)?
2. **Explore potential solutions:**
    a. Consider *passive measures* first, to block solar gains and improve airflow to release heat build up.
    b. Explore *active cooling* measures, conducting an electrical capacity study when required, and appropriately selecting and sizing a heat pump or air conditioning unit.
    c. Consider *other options* such as interim cooling measures and co-benefit measures, as needed.
3. **Decide on an approach, considering project constraints and exploring applicable considerations in more detail:**
    a. *Identify the budget:* what is feasible? What can be planned for in the future that is less urgent or coincide with other planned upgrades for cost efficiency?
    b. *Identify the ownership structure*: what is possible and what might require updating to provide equitable cooling options to all residents?
    c. *Explore other considerations*: where can the approach address synergies between planned upgrades (e.g. if windows are due for replacement, can shading or reduced SHGC prevent solar gains where needed, and can additional operability be added), as well as other energy, GHG and resilience needs.

Implementation Pathways

By answering the questions posed above, the cooling audit is intended to highlight the best path forward for the project. While not a full list of options, paths A to D described below were identified as general pathways that should be considered by each building, depending on the severity of overheating and budget availability.

Path A: If overheating is minimal or moderate AND budget permits	Path B: If overheating is significant or severe AND budget permits	Path C: If overheating is significant or severe AND budget is low	Path D: If overheating is significant or severe AND budget is very low
• Start with passive approach (increasing airflow and reducing solar heat gains) for passive resiliency and overall energy efficiency. • Begin planning for & putting aside reserve funds to add heat pumps in the future. • Replace equipment with more efficient performance as it nears end of life / temperatures increase, & load shed.	• Add passive cooling measures and mechanical cooling. • Passive measures will improve passive resiliency, reduce the cooling equipment size and save energy. • Select the type of mechanical cooling based on building needs, conditions and restraints.	• Add heat pumps as soon as possible. • Select the type of mechanical cooling based on building needs, conditions and restraints. • Focus on units with most severe overheating if necessary.	• Add heat pumps in units with the most severe overheating and most vulnerable occupants. • Evaluate other interim options, adding cooling where budget allows

By engaging a professional to undertake a cooling audit, a building-specific roadmap can be provided that will balance the building's overheating challenges, available budget and owner/ occupant needs, while accounting for planned upgrades and other potential synergies.

6 Appendix B: Evaluation of Retrofit Options

RETROFIT OPTION	EFFECTIVENESS IN IMPROVING THERMAL SAFETY	AIR QUALITY BENEFITS	DECARBONIZATION BENEFITS	COST	EQUITY
Active cooling measures	The option is highly effective at providing sufficient cooling to spaces when the system is properly sized, and can be accommodated by other existing building systems.	By allowing windows to remain closed during air quality advisories, indoor air quality can be improved with portable air cleaners or with enhanced in-duct air filtration.	Greenhouse gas (GHG) impacts depend on the original fuel source, fuel usage, heat pump system efficiency, installation quality, and operational practices. In buildings with existing fossil-fuel-based systems, switching to electric heat pumps can lead to significant emissions reductions.	The **initial capital costs** for electric heat pumps include the system itself and any additional expenses the retrofit may incur, such as electrical capacity upgrades and asbestos removal, making it a moderate to high-cost option. **Operating costs** depend on the existing system's efficiency and utility rates. While adding cooling may increase costs, using a dual-purpose heat pump can lower winter heating expenses by replacing less efficient heating systems.	Installing active cooling systems can cause tenant disruption, and those most vulnerable to heat may not be able to afford to operate them. Low-income households, already burdened with housing costs, may avoid using cooling due to high utility bills.
Measures to reduce solar heat gains	Blocking solar heat gains can effectively reduce the risk of indoor overheating, particularly in highly glazed buildings with significant glazing facing south, west, or sometimes east. However, this option is less effective during heat waves, as it does not enhance resistance to conductive heat transfer.	While the option does not directly affect indoor air quality, reducing overheating can reduce the need to open operable windows for airflow cooling, which brings benefits during poor outdoor air quality events.	The option reduces the need for cooling, which lowers the cooling load. Where installed correctly, measures should not reduce solar heat gain in winter (which would have the potential impact of increased energy use and emissions in winter),	The initial capital and operational costs depend on the specific measures implemented. Custom shading devices can reduce overheating, but they can also have significant **capital costs**. Additional expenses may arise from the structural attachments required for the retrofits. For **operational costs**, reducing solar heat gain can lower cooling demand during warmer seasons but may increase heating demand in cooler seasons, resulting in a net impact on energy consumption and utility costs.	Shading installations may cause tenant disruption, but it is typically considered to be modest.

Measures to improve airflow	Adequate air exchanges can effectively reduce overheating hours for much of the year. However, natural ventilation alone is not sufficient to achieve thermal safety during extreme heat events or when outdoor temperatures remain high overnight as the climate warms.	Allowing air exchanges during poor outdoor air quality events, such as wildfire smoke, would worsen indoor air quality.	Improving airflow can reduce cooling needs and, in turn, lower energy consumption and operating GHG emissions related to cooling. While fan-assisted ventilation may increase energy use and GHG emissions, the overall impact is modest.	Replacing fixed windows with operable ones can involve significant **initial capital costs**, but incremental costs are minimal if planned as part of regular asset renewal. The option would result in minimal changes to **operating costs**.	Some tenant disruption is expected during installation, especially for full window upgrades. Additionally, glazing with a lower solar heat gain coefficient (SHGC) may have a more 'tinted' appearance, which some landlords may not permit. A co-benefit of upgrading windows is the potential improvement in moisture issues on interior surfaces or broken seals in older windows.
Interim solutions	The effectiveness of interim solutions in improving thermal safety varies depending on the specific measures adopted. For example, providing cooling in common rooms can offer immediate relief in designated spaces, while retrofitting make-up air units in corridors provides partial cooling to all units. Other measures, such as planning for future cooling needs or reducing electrical loads to free up capacity, often offer lower effectiveness in directly reducing overheating.	Depending on the type of measure—whether active or passive—it provides varying air quality benefits. Active systems can be equipped with enhanced filtration to provide clean indoor air, while passive measures generally have minimal impact on improving air quality.	While the impacts on energy consumption and GHG emissions vary by measure, active interim solutions tend to slightly increase energy use and could very slightly increase related carbon emissions. In contrast, measures that help reduce cooling energy loads have the potential to contribute to decarbonization benefits.	Active interim measures, such as makeup air (MUA) units and cooled common rooms, generally have lower **initial capital costs** compared to individual suite-level cooling systems. Costs for passive measures, however, can vary significantly. For example, dynamic glazing, which adjusts based on solar irradiance to function, requires a high initial investment. Active interim measures may lead to a slight increase in **operational expenses** for the strata or building owners. Other measures could cause low to moderate cost increases, primarily related to utilities and maintenance.	Key equity considerations for interim solutions arise primarily with active measures. MUA units, for instance, can generate some noise complaints from adjacent building occupants. For cooled common rooms, the effectiveness depends on factors such as accessibility, clear communication, and reliable power supply. Tenants with disabilities may face challenges in accessing these spaces, limiting their ability to benefit from this solution.