LOCAL
GOVERNMENT

LOW CARBON BUILDING **POLICY TOOLKIT**

MARCH 2021

PROJECT FUNDED BY:

BC Hydro
Power smart

PREPARED BY:

DEVON MILLER
Origin Sustainable Design + Planning

ORIGIN
SUSTAINABLE DESIGN + PLANNING

BRENDAN MCEWEN
McEwen Climate & Energy

MCEWEN CLIMATE & ENERGY

ACKNOWLEDGMENTS

The authors would like to express their sincere thanks to all interviewees, Working Group members, and Advisory Committee members, as well as to Josh Power and Robyn Wark of BC Hydro for their project guidance.

WORKING GROUP MEMBERS

- MAGGIE BAYNHAM, *District of Saanich*
- ROBYN WEBB, *City of Victoria*
- TAO JIANG, *City of Surrey*
- AMBER ZIRNHELT, *City of Campbell River*
- LARISA LENSINK, *City of North Vancouver*
- BRADY FAUGHT, *City of Vancouver*
- ANASTASIA LUKYANOVA, *City of Powell River*
- NAYEL HALIM, *City of New Westminster*
- KEVIN RAMLU, *Township of Langley*

ADVISORY COMMITTEE

- ZACHARY MAY, Director of Strategic Policy, *Building and Safety Standards Branch, Ministry of Municipal Affairs and Housing*
- TYLER WIGHTMAN, Executive Director, *Building Officials' Association of BC*
- JESSICA BROOKS, Executive Director, *Planning and Land Use Management, Ministry of Municipal Affairs*
- MARK BERNHARDT, President, *Canadian Home Builders' Association - Vancouver Island chapter*
- DEREK PATTERSON, Vice President, *Regulatory Leadership & Corporate Secretary, Technical Safety BC*
- CORAL BUITENHUIS, Leader, *Climate Action & Sustainability, Technical Safety BC*

CONTENTS

INTRODUCTION + OVERVIEW

INTRODUCTION + OVERVIEW

Local governments have numerous development policies and bylaws designed to achieve specific outcomes and goals that sometimes conflict with the requirements of cost effective, low carbon buildings. While many local governments have adopted the BC Energy Step Code and developed ambitious climate plans, many local governments also have policies and bylaws that do not support, and in some cases inhibit, uptake of low carbon buildings.

PURPOSE OF THE TOOLKIT

The purpose of this Toolkit is to provide local governments with recommended policies, guidelines and bylaws in order to support the transition to low carbon buildings in their communities as soon as possible. The intent is for this Toolkit to be of relevance and value to local governments of all sizes across BC. It is also designed to be of utility for those local governments which are interested in taking climate action, but that do not have the time or resources to identify areas where their policies may need revisions, or where new policies can be made. The goal is to reduce redundancy and increase adoption of low carbon building policy across BC.

While premised on removing barriers to low carbon buildings, the recommendations found in the Toolkit also represent sensible policy changes that local governments can consider to improve overall development processes and achieve multiple policy goals. The recommended changes therefore present an opportunity for local governments to take proactive action to prepare for a future that will increasingly see applications for low carbon, high performance buildings.

Note - this Toolkit does not address **requirements** for low carbon building systems. There is other ongoing work addressing this, such as the recent ***Low Carbon Building Systems in Energy Step Code Requirements*** report, led by AES Engineering, which includes guidance for including low carbon energy systems as part of Step Code requirements.

HOW THE TOOLKIT WAS DEVELOPED

The Toolkit was developed between August 2020 and January 2021, supported by a Working Group made up of local government staff, as well as an Advisory Committee made up of government and industry association representatives.

BACKGROUND AND BEST PRACTICE RESEARCH

A background and best practice review was conducted to understand the policy barriers to low carbon buildings as well as some leading municipal responses to removing these barriers. As part of this research phase, bylaws and policies from 13 municipalities across BC were reviewed (see sidebar) for insights regarding:

+ OCP Climate Action Policy best practices;
+ Common Development Permit Form & Character guidelines and potential conflicts with high performance design strategies;
+ Common floor area ratio, building setback, and building height limit definitions in zoning bylaws (including best practices with respect to exemptions);
+ Noise bylaws and interpretation related to heat pumps; and
+ Heat pump permitting processes.

WORKING GROUP AND ADVISORY COMMITTEE

The Working Group and Advisory Committee provided key insights to the development of the Toolkit to ensure it was comprehensive and user-friendly, and to ground truth findings and recommendations to ensure maximum applicability. Members of the Working Group and Advisory Committee are listed below.

WORKING GROUP MEMBERS	ADVISORY COMMITTEE MEMBERS
+ MAGGIE BAYNHAM, *District of Saanich*	+ ZACHARY MAY, Director of Strategic Policy, Building and Safety Standards Branch, *Ministry of Municipal Affairs and Housing*
+ ROBYN WEBB, *City of Victoria*	+ TYLER WIGHTMAN, Executive Director, *Building Officials' Association of BC*
+ TAO JIANG, *City of Surrey*	+ DEREK PATTERSON, Vice President, *Regulatory Leadership & Corporate Secretary, Technical Safety BC*
+ AMBER ZIRNHELT, *City of Campbell River*	+ JESSICA BROOKS, Executive Director, *Planning and Land Use Management, Ministry of Municipal Affairs*
+ LARISA LENSINK, *City of North Vancouver*	+ MARK BERNHARDT, President, *Canadian Home Builders' Association - Vancouver Island chapter*
+ BRADY FAUGHT, *City of Vancouver*	+ CORAL BUITENHUIS, Leader, *Climate Action & Sustainability, Technical Safety BC*
+ ANASTASIA LUKYANOVA, *City of Powell River*	
+ NAYEL HALIM, *City of New Westminster*	
+ KEVIN RAMLU, *Township of Langley*	

MUNICIPAL POLICY REVIEW

+ City of Vancouver
+ City of Victoria
+ District of Saanich
+ Township of Langley
+ City of Surrey
+ City of New Westminster
+ City of Kelowna
+ City of Prince George
+ City of Kimberley
+ City of Powell River
+ District of Squamish
+ City of Abbotsford
+ City of Nelson

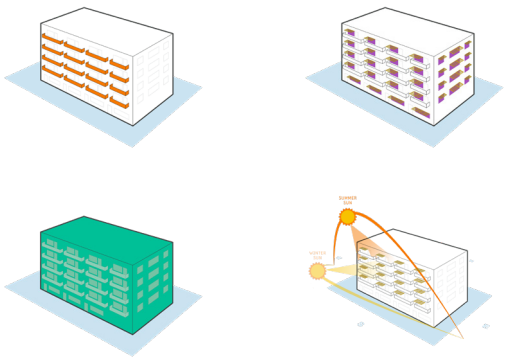
LOW CARBON TECHNOLOGIES + STRATEGIES

TECHNOLOGIES + STRATEGIES THAT ARE CRITICAL TO REDUCE GHGS IN THE BUILDING SECTOR

ENERGY EFFICIENT BUILDING FORM

Affordably achieving high levels of energy efficiency requires the flexibility to design buildings differently. Some design features, often required in Development Permit (DP) Form & Character design guidelines, may have an impact on affordably achieving building performance.

In addition to DP Form & Character Guidelines, zoning bylaw definitions related to floor area ratio, setback requirements, and building height limits can inadvertently penalize high performance design strategies such as the use of thicker wall and roof assemblies. As the BC Energy Step Code moves toward net-zero energy ready construction by 2032, it is increasingly important that local government bylaws and guidelines support high performance design strategies.



HEAT PUMPS

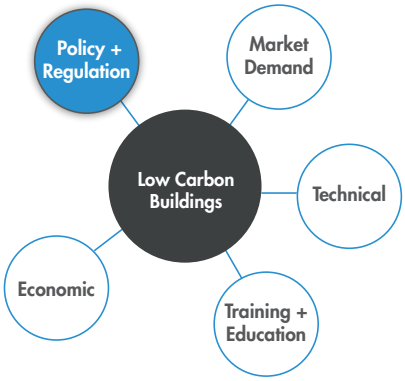
Heat pumps are efficient electrical devices that extract heat from a source (e.g. the outdoor air) and transfer that heat to an end use in a building (e.g. space heat, or hot water heating). Many heat pumps can also provide space cooling. Air source heat pumps typically feature an outdoor unit containing a fan to move air across a coil containing refrigerant, and a compressor; the refrigerant transfers heat to indoor equipment. A heat pump takes heat energy from one place and moves it to another – just like a refrigerator. In summer, it moves heat out of the house, and in the winter it moves heat into the house – even if it's cold outside. Heat pumps are able to transfer heat using a process of evaporation and condensation of a substance called refrigerant that cycles between the indoor and outdoor units.

Implementation of heat pumps are a key component of building electrification, which is widely recognized as necessary to decarbonize both new and existing buildings (see the BC Building Electrification Roadmap, or BERM). The capacity of heat pumps to provide cooling also provide an important climate change adaptation function in preparing buildings for anticipated warmer weather caused by climate change. It is important that local government bylaws and permitting processes support heat pump adoption.

SCOPE AND APPLICATION

While there are multiple barriers to widespread market transformation to low carbon buildings (e.g., market demand, economic and technical barriers), this Toolkit is specifically focused on addressing and removing municipal policy and regulatory barriers in BC. Moreover, it is not focused on providing guidance regarding incentives that local governments can use to encourage low carbon buildings such as density bonusing, removing parking minimums, and so forth.

The recommendations found in the Toolkit generally apply to both large (Part 3) as well as small (Part 9) buildings, with a focus on small (Part 9) buildings for the recommendations related to heat pumps. Additionally, recommendations are primarily focused on new construction, but several of the recommendations are also applicable to existing building electrification efforts and other energy upgrades. See table below for a summary of the scope and application of each recommendation found in the Toolkit.



BARRIERS TO MARKET TRANSFORMATION

	BUILDING TYPE		TYPE OF WORK	
RECOMMENDATION	SMALL (PART 9)	LARGE (PART 3)	NEW CONSTRUCTION	RETROFIT
Supportive Climate Action Policies in Official Community Plans (Page 11)	●	●	●	●
⫻ **Development Permit Guidelines aligned with high performance design strategies (Page 15)**	●	●	●	
Floor Area Ratio calculations that do not discourage thicker wall assemblies or the use of low carbon mechanical equipment (Page 24)	●	●	●	
Building Setback requirements that do not discourage thicker wall assemblies, exterior heat pump siting, or exterior shading devices (Page 27)	●	●	●	
Building height limits that do not discourage thicker roof assemblies or rooftop mechanical and renewable energy systems (Page 29)	●	●	●	
Noise bylaws & interpretation that do not inappropriately penalize heat pumps (Page 32)	●	●	●	●
⫻ **Heat pump permitting processes that optimize heat pump uptake (Page 36)**	●	●	●	●

⫻ *Indicates that an additional project process is likely required in order to implement*

HOW TO USE THE TOOLKIT

It is understood that climate action projects are undertaken in various ways and by different departments depending on the local government context. The Toolkit is designed to be used by climate action specialists, development and community planners, permits & inspection staff, and any others that may be responsible for implementing the changes. It is acknowledged that for local governments that have dedicated climate action staff, it will likely fall to these individuals to 'quarterback' the implementation of actions, using the Toolkit as a guide and sending to the relevant staff in their municipality. It is recommended that undertaking the changes recommended in this Toolkit be supported by engagement with local industry representatives.

ORGANIZATION OF THE TOOLKIT

The Toolkit is designed to be able to be broken down into individual PDF sections for easier targeted distribution.

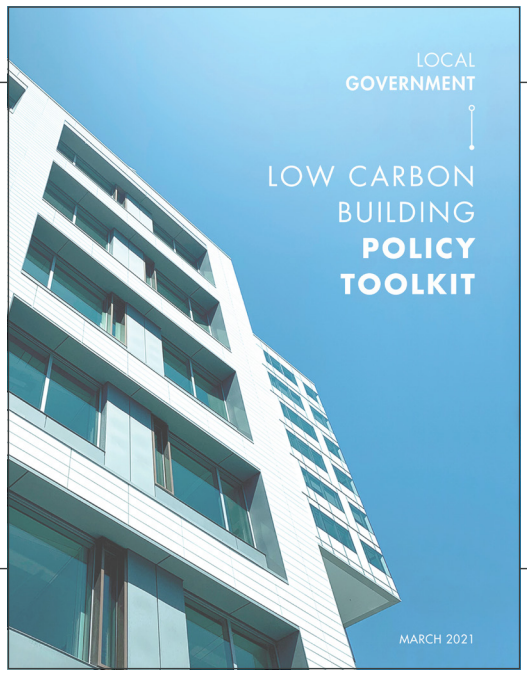
For example, Section 04 related to heat pump permitting can be pulled out and sent to Permits & Inspections staff as a standalone document for guidance on removing barriers to heat pump uptake.

01

ENABLE LOW CARBON BUILDINGS AT PROPOSAL/REZONING STAGE

02

SUPPORTIVE GUIDELINES AND REGULATIONS AT DESIGN DEVELOPMENT STAGE



03

NOISE BYLAWS

04

APPROVALS - BUILDING, HVAC, GAS & ELECTRICAL PERMITTING

STRUCTURE OF EACH SECTION

The Toolkit is structured similarly in each section to enhance usability. A Summary of the Issue is presented succinctly at the beginning of each section (with some supportive illustrative diagrams in some cases), followed by Recommendations based on best practices that addresses the issue. Where appropriate, Recommendations include model bylaws relevant to each section.

Each section includes:

+ One or two **concept diagrams** to help communicate the issue;
+ A **Summary of the Issue**; and
+ A series of **Recommendations** for addressing the issue and removing the barrier.

SAMPLE SECTION STRUCTURE

Icons

Describe the scope and application of the recommendations.

Concept diagram

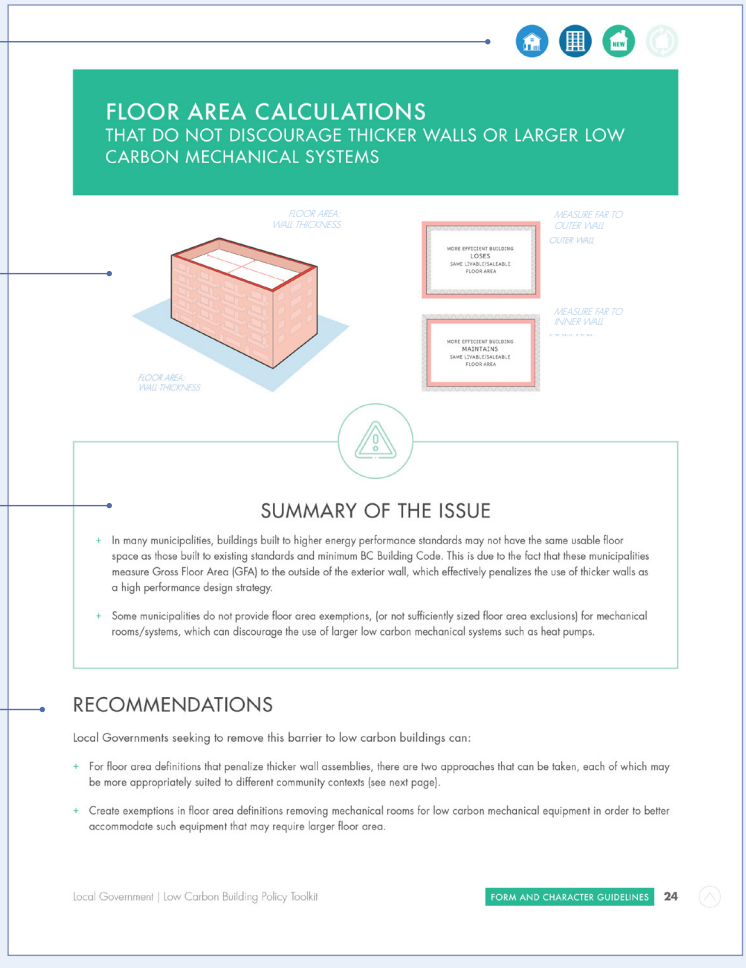
To help communicate the issue.

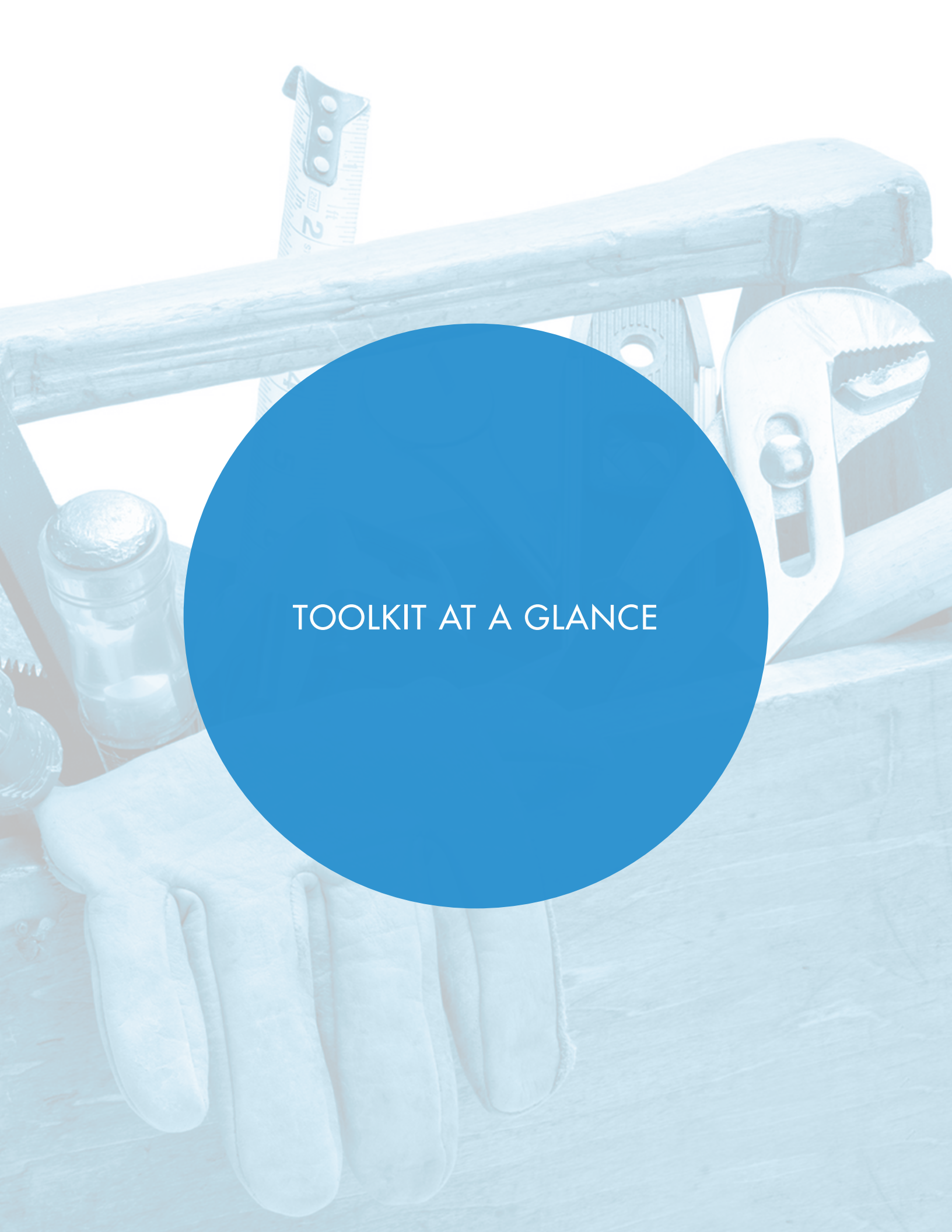
Summary of the Issue

The "what' and the 'why'.

Recommendations

For detailed guidance, including model policies/bylaws and linkages to best practices.



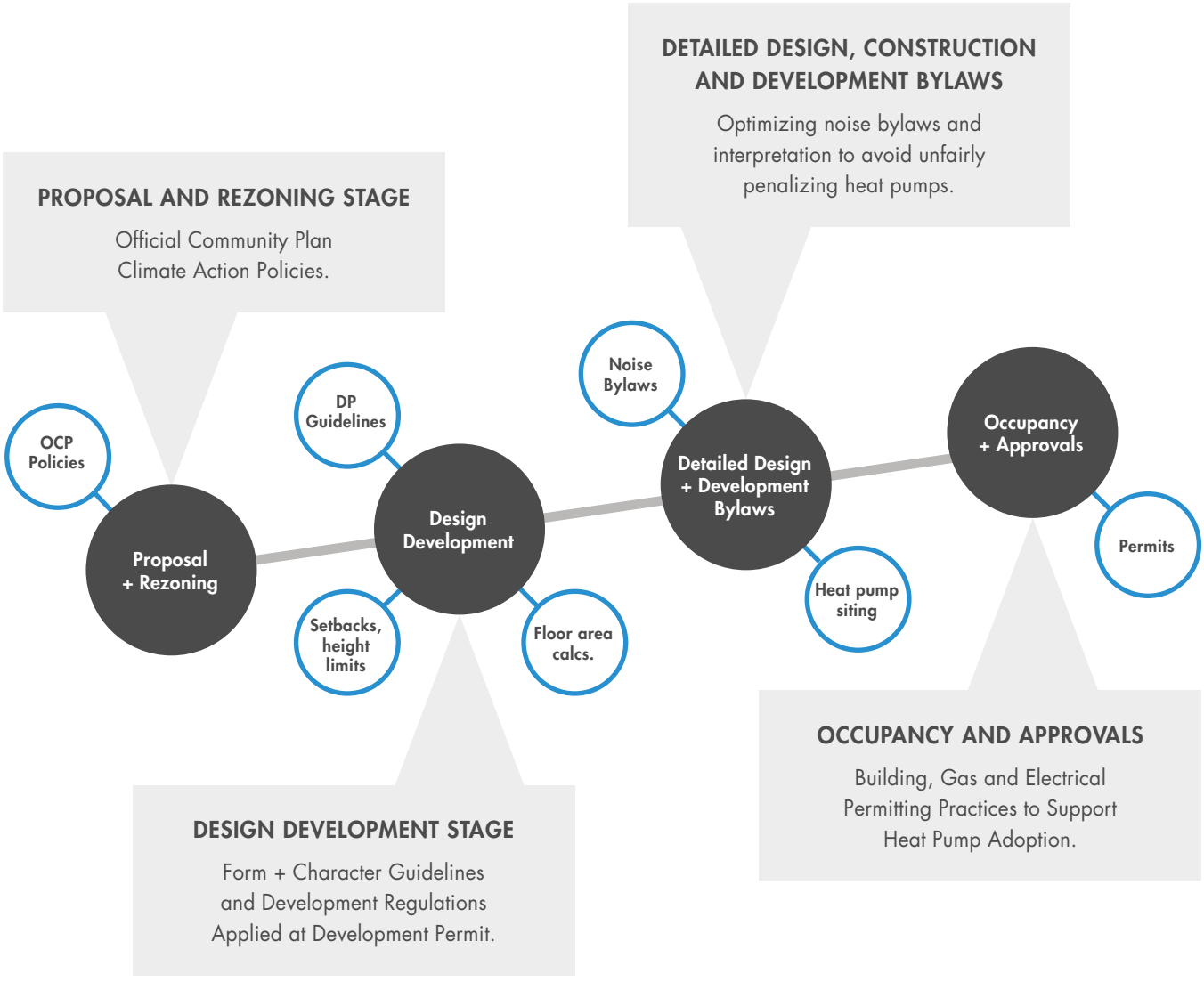


TOOLKIT AT A GLANCE

BUILDING ON THE STEP CODE

9 policy changes local governments can make to remove barriers and enable low carbon buildings in their communities.

The Toolkit includes recommended actions organized into four areas, reflective of key stages in the development approvals process. As such, the Toolkit provides guidance for identifying and removing barriers to low carbon buildings that are present at various stages of the development approvals process, from proposal and rezoning stage through to permitting and construction.



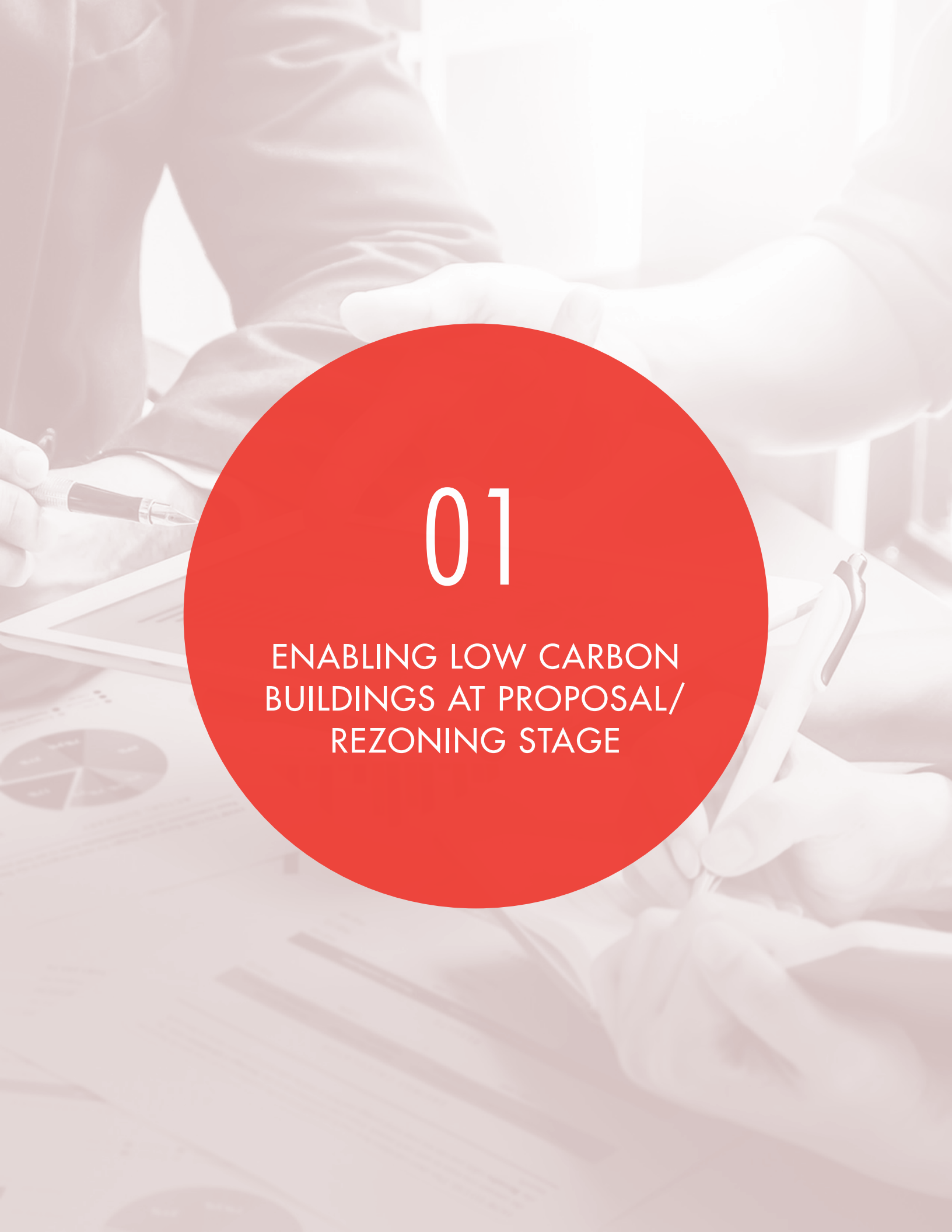
TYPICAL DEVELOPMENT APPROVALS PROCESS

SUMMARY POLICY CHECKLIST

The checklist below is intended to help municipal staff track progress towards removing barriers to low carbon buildings.

9 policy changes local governments can make to remove barriers and enable low carbon buildings in their communities.

- ☐ The Official Community Plan includes policies that support climate action and low carbon buildings
- ☐ Development Permit Form and Character Guidelines do not inhibit high performance design strategies, and include language that supports:
  - ☐ Simplified massing, limited articulation & good form factor
  - ☐ Lower overall window to wall ratio (with allowances for higher WWR at grade)
  - ☐ Optimized orientation to balance solar gains and losses
  - ☐ Exterior shading devices on building facades
  - ☐ Balcony strategies that limit thermal bridging
- ☐ Floor Area Ratio definitions that do not discourage thicker wall assemblies
- ☐ Building Setback requirements that do not discourage thicker wall assemblies
- ☐ Building Setback requirements that do not limit heat pump siting
- ☐ Building height limits that do not discourage thicker roof assemblies
- ☐ Building height limits that do not discourage rooftop mechanical and renewable energy system installations
- ☐ Noise bylaws & interpretation that do not inappropriately penalize heat pumps
- ☐ Heat pump permitting processes that optimize heat pump uptake



01

ENABLING LOW CARBON BUILDINGS AT PROPOSAL/ REZONING STAGE

SUPPORT LOW CARBON BUILDINGS IN OFFICIAL COMMUNITY PLANS

SUMMARY OF THE ISSUE

OCPs are important planning documents that set out the vision and supportive policies for guiding growth and change in communities. By their nature, they are high level documents in that they capture the goals and directions for the entire municipality. Many municipalities across BC are in the process of updating their Official Community Plans, and it is vital that these updates capture latest best practice for supporting low carbon buildings. Because OCPs are adopted by Bylaw, they provide necessary 'teeth' to policies in terms of providing support and direction for future climate action related plans or strategies.

RECOMMENDATIONS

OCP Climate Action sections typically have 6 categories of policies. Each of these policy categories are outlined below with example policy text for each. Please note they are not organized in order of importance. As communities undertake OCP processes, it is recommended to consider using these policy categories as a framework for identifying potential climate action policies and directions in OCPs.

RECOMMENDED POLICY CATEGORY 1

Continuing to support other levels of government and other organizations working on climate action (e.g., neighbouring municipalities, other levels of government, utilities)

Climate change is of course an issue that extends beyond municipal boundaries, and it is therefore important to identify partnerships and support from neighbouring municipalities and other levels of government. For some municipalities, there are networks of support for climate action from neighbouring municipalities and regional governments. This policy category identifies opportunities to formalize partnerships with other levels of government, such as Regional Governments and the Province, to continue to make progress on these issues.

An example policy to demonstrate this category is: *Continue to work with the [Insert Name] Regional District and Provincial government on coordination and integration of regional and local mitigation and adaptation planning.*

RECOMMENDED POLICY CATEGORY 2

Setting up future climate action projects (e.g., Climate Action Plans, EV Strategies).

Because OCPs are high level documents, they cannot include all of the information that would be included in other municipal policy documents. Instead, they can provide an important policy support and direction for undertaking projects that will set the municipality up for success in climate action. The OCP can point to the important elements that should be included in future projects, while also providing flexibility to that future process.

An example policy to demonstrate this category is: *Provide direction for climate change mitigation and adaptation planning and actions through the development and regular update of a Climate Action Plan that includes recommended implementation actions and timelines.*

RECOMMENDED POLICY CATEGORY 3

Drawing connection to other OCP policies, sections and directions that support climate action (e.g., linking compact land use framework to lower per capita transportation emissions)

It is important to draw linkages between climate action outcomes and other directions in the OCP, to create a holistic document that speaks to an integrated approach to sustainability and climate action. Doing so also provides the opportunity to highlight such linkages to community members and Council, as they may not be widely understood.

An example policy to demonstrate this category is: *Continue to promote the reduction of community greenhouse gas emissions through: the development of a compact land use framework that supports walkable and complete centres and villages; supporting transit-oriented development; and, developing active mobility networks.*

RECOMMENDED POLICY CATEGORY 4

Supporting low carbon building policy adoption (e.g., BC Energy Step Code)

Because OCPs guide growth and change in a community, they present an important document for providing a framework and creating linkages to development policies and building bylaws.

An example policy to demonstrate this category is: *Develop an implementation strategy for the BC Energy Step Code as it relates to land use designations permitting Part 3 and Part 9 buildings, including consideration for the inclusion of low carbon energy systems.*

RECOMMENDED POLICY CATEGORY 5

Linking to GHG reduction and renewable energy targets (e.g., 50% GHG reduction by 2030 and 100% renewable by 2050)

While a detailed GHG emissions inventory and long-term targets should be undertaken separately as part of a Climate Action Plan or Community Energy and Emissions Plan, OCPs should include high level GHG reduction targets in order to commit the municipality and community to achieving those targets. Given that OCPs are enacted as a bylaw and Climate Action Plans typically are not, including such targets provide a stronger commitment to such targets.

An example policy to demonstrate this category is: *The following target should inform the plan's climate change and energy objectives: that greenhouse gas emissions within [Community Name] are reduced by a minimum of 50% below the 2007 levels by 2030 and 100% by 2050.*

RECOMMENDED POLICY CATEGORY 6

Apply a climate lens to all local government decision making

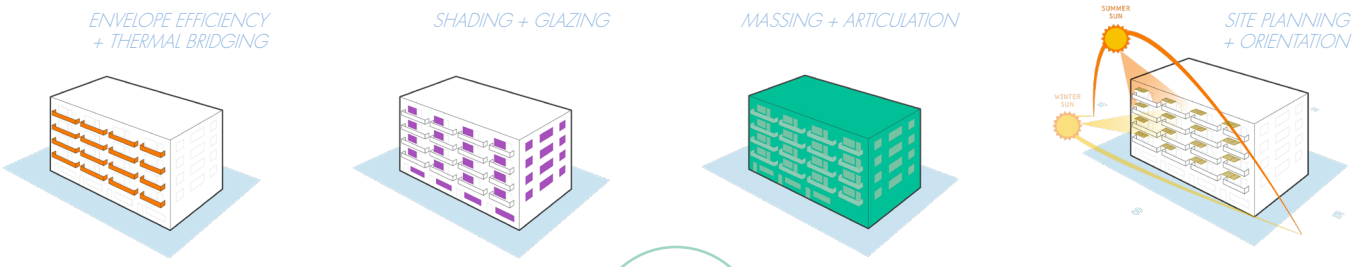
The implementation and application of a climate lens is an emerging approach to operationalize and normalize local government planning and actions to reduce greenhouse gases and strengthen efforts to adapt to a changing climate. The application of a climate lens can include the consideration of greenhouse gas mitigation and adaptation requirements in all decision making, including budgeting, and the lens can be applied to existing and new local government objectives.

An example policy to demonstrate this category is: *Implement a climate lens to all local government decision making in order to operationalize greenhouse gas mitigation efforts and build adaptation requirements across all municipal programs, projects and services.*

02

SUPPORTIVE GUIDELINES + REGULATIONS AT DESIGN DEVELOPMENT STAGE

FORM & CHARACTER GUIDELINES
THAT ALIGN WITH AND SUPPORT LOW CARBON BUILDING DESIGN AND TECHNOLOGIES



SUMMARY OF THE ISSUE

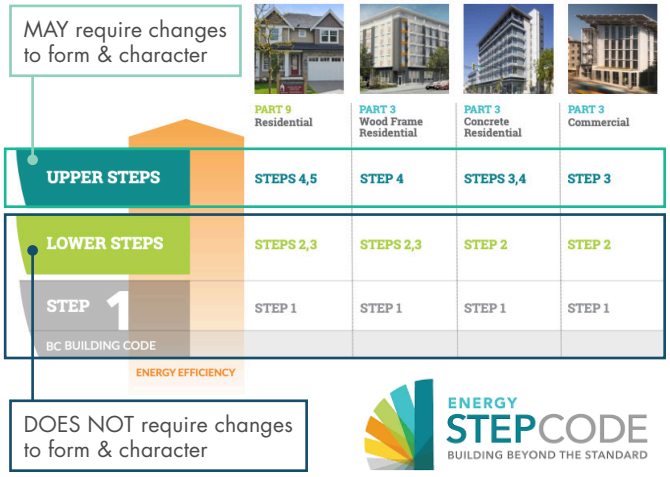
+ Affordably achieving high levels of energy efficiency requires the flexibility to design buildings differently. Some design features, often required in Development Permit Form & Character design guidelines, may have an impact on affordably achieving building performance.

+ Many municipalities have adopted accelerated approaches to Step Code, seeking to require the Upper Steps of the code in advance of the 2032 timeline set out by the province. This means that Planning departments will be increasingly seeing development applications for buildings that may conflict with current design guidelines.

INTRODUCTION

Step Code and Form & Character

Changes to form and character are generally not required to meet the performance requirements of the Lower Steps of the Step Code, but may be required to meet the requirements of the Upper Steps.



Understanding the purpose of the BC Energy Step Code Design Guide and Form & Character Guidelines

BC ENERGY STEP CODE DESIGN GUIDE

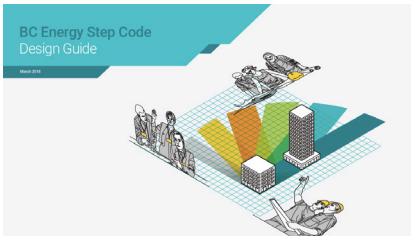
BC Housing's Energy Step Code Design Guide is an excellent resource that provides detailed guidance to industry on how to design Part 3 buildings to achieve the performance requirements of the higher steps of the Step Code. While it provides some guidance on form & character strategies (particularly related to orientation, siting, and glazing and shading), it focuses more on active or technical approaches to reducing energy demand, including mechanical system design, envelope detailing and air tightness strategies.

It is also worth noting that the Design Guide doesn't cover Part 9 buildings that may be subject to DP Form & Character Guidelines in certain communities (e.g., townhouses and other 'missing middle' typologies).

DEVELOPMENT PERMIT FORM & CHARACTER GUIDELINES

The role & purpose of Development Permit (DP) Form & Character Guidelines is to translate community values and goals (as captured and reflected in Official Community Plans) into design outcomes. The focus is typically on the interaction between buildings and open spaces, and to ensure a high quality public realm and improve liveability. A key area of focus is where buildings meet the street, encouraging human scale design that supports pedestrian activity. DP Guidelines are also focused on the 'exterior' of the building, and have minimal influence over mechanical systems or other interior design elements.

The differences in purpose and intent between these two documents is summarized below.



How to design a building to achieve performance requirements

Focused on active and technical approaches to reducing energy demand:

+ Mechanical system design
+ Envelope detailing
+ Air tightness strategies
+ Some form & character (e.g., orientation, siting, window to wall ratio)
+ Addresses larger (Part 3) projects ✓
+ Doesn't address smaller 'missing middle' (Part 9) projects ✗

Community DP Form & Character Guidelines

What is acceptable from an exterior design perspective

Focused on passive and form-based approaches to design. Strategies related to reducing energy demand include:

+ (Simplified) massing and articulation
+ Window-to-wall ratio
+ Site planning and orientation
+ Envelope design strategies to minimize thermal bridging
+ Addresses larger (Part 3) projects ✓
+ Addresses smaller 'missing middle' (Part 9) projects ✓

RECOMMENDATIONS

Local Governments seeking to remove this barrier to low carbon buildings can review their DP Form & Character Guidelines for potential conflicts with high performance design strategies. Recommendations for improving Guideline alignment with high performance design strategies are organized into four sections on the following pages, representing common guideline areas that conflict with high performance design strategies.

RELEVANT PROJECTS + RESOURCES

+ Some of the Form & Character content in this Toolkit is related to and aligned with recommendations from a current BC Hydro funded project for the City of Victoria led by Integral, Origin Planning, and HCMA Architecture + Design.

+ The City of Surrey has produced *Designing for Energy Efficient Buildings: A Reference for Planners and Designers*, a BC Hydro funded project led by Integral.

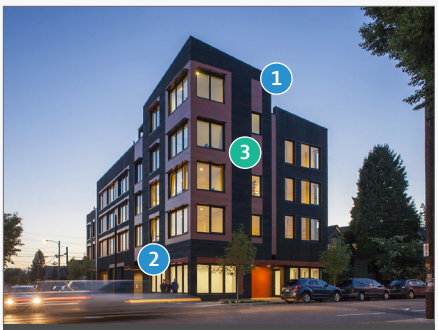
HIGH PERFORMANCE BUILDINGS CAN ALSO MEET URBAN DESIGN PRINCIPLES AND OBJECTIVES

High performance buildings can be designed to be aesthetically pleasing and to achieve urban design best practices. Typically, high performance buildings have a more simple, pure form, lower window-to-wall ratio, and employ strategies to reduce thermal bridging. The precedent photos below demonstrate some best practices in high performance building design in common building typologies. All projects shown are designed to meet or exceed the equivalent performance requirements of the highest Step of the BC Energy Step Code.

As the precedents illustrate, designers can use a wide variety of strategies – such as exterior colours, textures, and simple shifts in massing – to create aesthetically pleasing high performance buildings. Urban design best practices such as achieving a strong relationship to the street and a unified architectural expression need not be sacrificed.

TOWNHOUSE

1. Simplified massing
2. Low overall window-to-wall ratio (WWR)
3. Articulated individual units with semi-private outdoor space

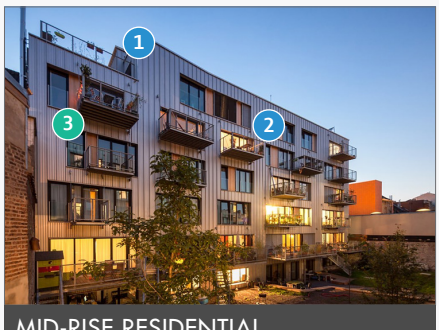


MID-RISE MIXED USE

1. Simplified massing
2. Low overall window-to-wall ratio (WWR)
3. Use of colour/materiality to enhance visual interest

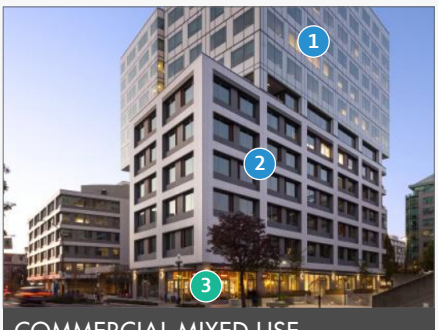
MID-RISE MIXED USE

1. Simplified massing
2. Shading devices on south elevation
3. Active frontage (>75% WWR) .



MID-RISE RESIDENTIAL

1. Simplified massing
2. Low overall window-to-wall ratio (WWR)
3. Private outdoor space on (thermally broken) balconies



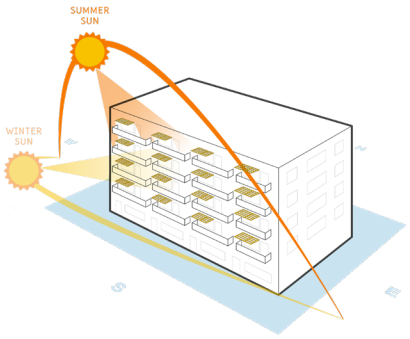
COMMERCIAL MIXED USE

1. Simplified massing
2. Low overall WWR
3. Active frontage (>75% WWR) .

HIGH PERFORMANCE DESIGN STRATEGY

ALIGNMENT WITH URBAN DESIGN BEST PRACTICE

SITE PLANNING AND ORIENTATION



HIGH PERFORMANCE DESIGN CONSIDERATIONS

+ Considering solar orientation for effects of passive heating potential and possible overheating potential;
+ Considering existing and possible future shading from off site as the context may change over time; and
+ Considering solar orientation to accommodate solar thermal or photovoltaic panels.

COMMON CONFLICTS BETWEEN GUIDELINES AND HIGH PERFORMANCE DESIGN STRATEGIES

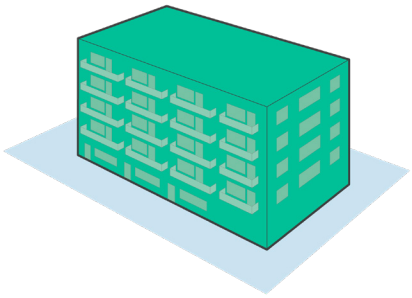
COMMON FORM + CHARACTER GUIDELINE	POTENTIAL CONFLICTS WITH HIGH PERFORMANCE DESIGN REQUIREMENTS	RECOMMENDED GUIDELINE IMPROVEMENTS
Urban Design best practice commonly calls for building towers to be oriented in a north-south direction in order to ensure maximum solar access for public rights of way (e.g., to limit shading on sidewalks) **Illustrative Guideline:** *Building mass should generally be oriented in a north-south direction for portions of building above the established base building.*	Towers oriented in a N-S orientation sets up a condition where majority of windows face east and west, which is less desirable for occupants due to low sun angles (glare and overheating), and also reduces orientation for passive solar gain.	Include language that supports optimizing solar orientation for high performance. Remove N-S orientation requirement and simply state that intention to maximize solar access on adjacent streets and public spaces, allowing flexibility in approach. **Example improved guideline:** *Building mass should be oriented to maximize solar access to adjacent streets and public spaces, while also considering optimizing for solar orientation to improve energy performance and occupant comfort.*

COMMENTARY + RATIONALE

BUILDING SITE CAN DICTATE ORIENTATION – FLEXIBILITY IMPORTANT

+ Optimizing for solar orientation (e.g., balancing gains in the winter and minimizing gains in the winter) is a strategy for improving building energy performance, but is not required in all projects. In some cases, the building site will dictate building orientation, which may make it more challenging for buildings to optimize for solar orientation. Guidelines should provide flexibility for projects pursuing an approach to orientation that maximizes solar orientation, without dictating or strongly encouraging.
+ Optimizing for solar orientation can be more easily achieved in large master planning type projects (e.g., townhouse complexes, mixed use community developments) as opposed to infill projects in established neighbourhoods (because site dictates orientation).

MASSING AND ARTICULATION



HIGH PERFORMANCE DESIGN CONSIDERATIONS

+ Consider energy performance when developing building massing and articulation, using strategies such as:
    - » simple massing to limit thermal bridging – fewer complex junctions helps to minimize building envelope heat loss; and
    - » a compact building with a small form factor.
+ More complex massing can be considered where it is shown to reduce overheating potential (e.g. use of operable windows, opportunities for cross-ventilation) and improve daylighting.

COMMON CONFLICTS BETWEEN GUIDELINES AND HIGH PERFORMANCE DESIGN STRATEGIES

COMMON FORM + CHARACTER GUIDELINE	POTENTIAL CONFLICTS WITH HIGH PERFORMANCE DESIGN REQUIREMENTS	RECOMMENDED GUIDELINE IMPROVEMENTS
Guidelines often call for using a variety of strategies to articulate buildings to break up massing and achieve more of a 'human scale' design. Such strategies include stepping back or extending forward a portion of the building facade, providing a stepped roof, repeating window patterns, and providing cornice details. **Illustrative Guideline:** *Articulate facades by stepping back or extending forward a portion of the facade to create a series of intervals or breaks.*	High performance buildings typically have simple massing to limit thermal bridging, as fewer complex junctions helps to minimize building envelope heat loss.	Add a new guideline to consider the impact of massing and articulation on building performance. **Example improved guideline:** *Consider the impact of massing and articulation on energy performance. Consider designing buildings with a pure form, simplified massing and fewer complex junctions to minimize building envelope heat loss.*
Some guidelines for missing middle typologies (townhouse and duplex in particular) strongly encourage the use of pitched roofs as a means of reflecting neighbourhood character.	Although pitched roofs can be accommodated in high performance buildings, it may impact the economic efficiency of the project.	Address guidelines that strongly encourage the use of pitched roofs, and consider adding new language noting allowances for flexibility to cost effectively deliver energy performance.

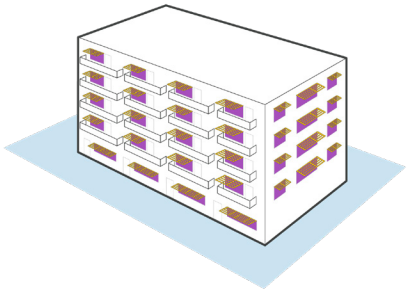
COMMENTARY + RATIONALE

SIMPLIFIED FORM CAN STILL BE AESTHETICALLY PLEASING

+ There are a number of strategies that can be used to articulate buildings to break up massing, including change in materiality/colour and simple shifts in massing, that can be undertaken to improve visual appeal without sacrificing high performance.
+ Guidelines interpretation can in some cases lead to over-articulation of building facades, and should be reviewed and improved to remove areas that may conflict with simplified approaches to building massing and articulation to support high performance building design.
+ On Part 9 projects, pitched roofs can be accommodated in high performance projects, but there are associated cost increases with such an approach.

Example of well-designed high performance building with very simple form (Brixton Flats, Vancouver BC - Passive House. GMC Projects).

SHADING AND GLAZING



HIGH PERFORMANCE DESIGN CONSIDERATIONS

+ Energy performance should be considered when developing facades and establishing window-to-wall ratio (WWR). A common industry best practice target is for an overall WWR of 40% to reduce heat gain and loss through the building envelope by increasing the area of insulated wall. Additional considerations include:
    - » WWR can be lower on north-facing facades than south-facing facades to account for lower solar gain potential
    - » Glazing location and size can be a more important consideration for smaller (Part 9) projects than for larger (Part 3) buildings
+ The use of exterior shading devices can be helpful to block unwanted solar gains in warmer months. Additional considerations include:
    - » Prioritize horizontal shading on southern elevation; not necessary on north-facing elevations
    - » Vertical fins are a good option for western elevations

COMMON CONFLICTS BETWEEN GUIDELINES AND HIGH PERFORMANCE DESIGN STRATEGIES

COMMON FORM + CHARACTER GUIDELINE	POTENTIAL CONFLICTS WITH HIGH PERFORMANCE DESIGN REQUIREMENTS	RECOMMENDED GUIDELINE IMPROVEMENTS
Guidelines often encourage the extensive use of glazing at grade to promote eyes on the street and create an active frontage. In some cases they encourage the use of extensive glazing above the ground floor as a strategy to reduce the perceived bulk of the building massing. **Illustrative Guideline:** *Locate and design windows, balconies, and street-level uses to create active frontages and 'eyes on the street', with additional glazing and articulation on primary building facades.*	Lower WWR is a common high performance design strategy (40% overall WWR considered a best practice target to reduce heat gain and loss through the building envelope by increasing the area of insulated wall).	In larger mixed use buildings, higher WWR can be accommodated at grade to promote at-grade transparency while accommodating the 40% WWR in the building overall. Guidelines should accommodate higher WWR allowance at grade for active frontage, but Guidelines encouraging extensive glazing above grade should be removed. **Example improved guideline:** *For larger buildings, consider targeting an overall window-to-wall ratio (WWR) of 40% to reduce heat gain and loss through the building envelope by increasing the area of insulated wall. Additional considerations include:* + *higher WWR ratios can be accommodated at grade to promote at-grade transparency while accommodating the 40% WWR in the building overall; and* + *lower WWR ratios can be accommodated on north facing facades to account for lower solar gain potential.*

COMMON FORM + CHARACTER GUIDELINE	POTENTIAL CONFLICTS WITH HIGH PERFORMANCE DESIGN REQUIREMENTS	RECOMMENDED GUIDELINE IMPROVEMENTS
Guidelines commonly reference the use of exterior building ornaments such as awnings and cornices, but rarely note the use of exterior shading devices.	The use of exterior shading devices can be helpful to balance solar gains throughout the year to minimize energy use for heating and cooling and maximize occupant comfort.	Guidelines should be reviewed to ensure that they accommodate and support the use of exterior shading devices. **Example improved guideline:** *Consider the use of appropriately designed exterior shading devices to block unwanted solar gains in warmer months while welcoming solar gains from lower winter sunlight.*

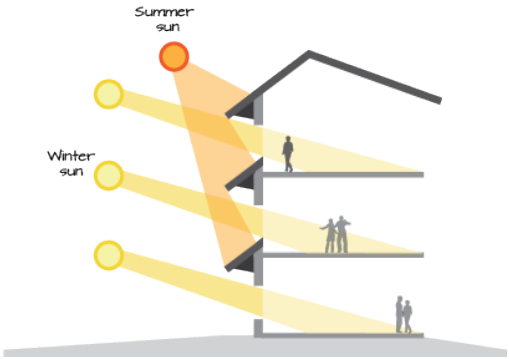
COMMENTARY + RATIONALE

WWR AND SHADING DICTATED BY ENERGY MODEL – ACCOMMODATING A VARIETY OF APPROACHES IS HELPFUL

+ High performance buildings can achieve an active/transparent frontage at grade (e.g., higher WWR) while achieving a lower overall WWR as a high performance design strategy

+ Window size and location, as well as the use of exterior shading, is unique on every project depending on site and location. Having guidelines that accommodate lower WWR and the use of exterior shading devices provide flexibility to designers who are using such approaches to meet energy performance requirements.

While retaining at-grade transparency, targeting lower window-to-wall ratios on building elevations can significantly reduce energy demand.

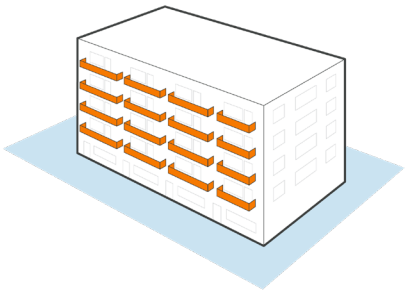


Exterior shading devices can be integrated into building facades to block unwanted solar gains and keep indoor temperatures comfortable in warmer months

Example of a building with an active frontage and low overall WWR.

Example of the use of exterior shading devices to limit solar gain and overheating potential (The Clive, Victoria BC).

ENVELOPE EFFICIENCY AND THERMAL BRIDGING



HIGH PERFORMANCE DESIGN CONSIDERATIONS

+ Minimizing thermal bridging in elements such as protruding balconies and beams that run from the building's interior to exterior
    - » Select balcony strategies can reduce thermal bridging potential (e.g. juliet balconies, externally supported balconies, structural thermal breaks for balcony connections)
+ Natural ventilation - including operable windows to provide ventilation and help reduce mechanical heating and cooling requirements
+ Cool roofs to reflect solar gains and minimize urban heat island effect

COMMON CONFLICTS BETWEEN GUIDELINES AND HIGH PERFORMANCE DESIGN STRATEGIES

COMMON FORM + CHARACTER GUIDELINE	POTENTIAL CONFLICTS WITH HIGH PERFORMANCE DESIGN REQUIREMENTS	RECOMMENDED GUIDELINE IMPROVEMENTS
The use of balconies is often encouraged in order to provide private outdoor space in multi-unit residential buildings. **Illustrative Guideline:** *Incorporate and design balconies and other private outdoor amenity spaces to be an extension of interior living space to maximize usability.*	Some balcony designs and detailing can lead to extensive thermal bridging that limits the ability to meet Step Code TEDI targets.	Add language supporting balcony design strategies that limit thermal bridging (e.g., exterior supported, structural thermal breaks in slabs) as well as language noting potential energy performance challenges associated with balconies. **Example improved guideline:** *Incorporate and design balconies and other private outdoor amenity spaces to be an extension of interior living space to maximize usability and comfort, while balancing the significant potential for heat loss through thermal bridge connections which could impact energy performance.*

COMMENTARY + RATIONALE

BALCONIES CAN BE ACCOMMODATED IF DESIGNED CORRECTLY

+ Balconies are an important source of private outdoor space for occupants. Because of the potential for extensive thermal bridging (and associated implications for meeting Step Code TEDI targets), careful consideration of balcony design approaches should be communicated and accommodated in Guidelines.
+ Externally supported balconies look differently than cantilevered balconies due to the external supports, and Guidelines should acknowledge/accommodate this.
+ There are building products designed to create structural thermal breaks for balcony connections. These do add cost to building design, but limit thermal bridging and should be accommodated in Guidelines as a strategy to consider.

There are building products available that limit thermal bridging in common balcony designs (Source: Schöck Balcony Products).

OPTIONS FOR IMPLEMENTATION

HIGH PERFORMANCE DESIGN CONSIDERATIONS

There are three main different approaches that have been taken to implement these changes, each of which may lend itself to different municipal contexts. The three approaches don't necessarily need to be considered mutually exclusive, and there could be a phased approach whereby the municipality starts with one approach in the short term then moves toward another more comprehensive approach (e.g, update a few select guidelines, then move more comprehensive, or start with a supplemental, then move to a set of design exemptions).

1) PROVIDE DESIGN EXEMPTIONS/ALLOWANCES

Provide design exemptions and allowances for demonstrated high performance buildings for certain strategies (e.g,. balconies, articulation, floor plate size). In this approach, an applicant describes what form & character guidelines their project needs to be exempted from with a rationale as to why, and Director of Planning makes the decision to allow or not.

Example: City of Vancouver's Zero Emissions Building Catalyst Policy

PROS OF THE APPROACH

+ Provides flexibility to the development applicant
+ Less time intensive approach than reviewing and updating all Guideline documents in the municipality for potential conflicts

CONS OF THE APPROACH

- May be viewed as additional process to a development applicant.
- Requires buy in/prioritization of high performance buildings by Council (which may not always be the case)
- Requires internal capacity/ability for staff to review and confirm the strategies are legitimate high performance strategies, or have that be outsourced (resourcing considerations)

2) REVIEW AND UPDATE GUIDELINE DOCUMENTS

Reviewing existing Form & Character Guidelines and/or writing new Design Guidelines to better align and harmonize high performance design strategies with urban design best practices

Examples: City of Victoria and Township of Langley currently conducting a review; City of Kelowna incorporated a "Achieving High Performance" section of new DP Guidelines

PROS OF THE APPROACH

+ Comprehensive and thorough

CONS OF THE APPROACH

+ Fairly administratively onerous (DP Guideline updates tend to trigger OCP Amendments, which include Council sign off and in some cases community engagement requirements)

3) CREATE STANDALONE / SUPPLEMENTAL GUIDELINES

Creating a standalone or supplemental set of Guidelines for high performance buildings (e.g., Passive House, Step 5)

Example: City of Surrey's Designing for Energy Efficient Buildings: A Reference for Planners and Designers

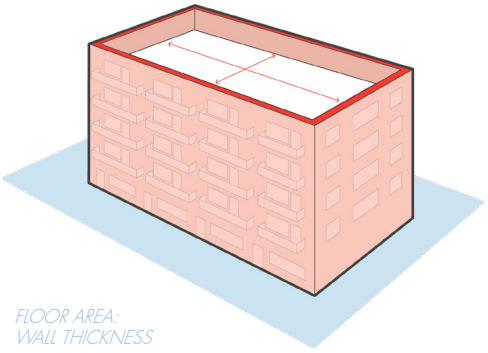
PROS OF THE APPROACH

+ Simpler, less time intensive approach than reviewing and updating all Guideline documents

CONS OF THE APPROACH

+ May be viewed 'as another layer of guidelines' and more complex for development planners and/or development industry to interpret and administer

FLOOR AREA CALCULATIONS
THAT DO NOT DISCOURAGE THICKER WALLS OR LARGER LOW CARBON MECHANICAL SYSTEMS



FLOOR AREA: WALL THICKNESS

MEASURE FAR TO OUTER WALL

MEASURE FAR TO INNER WALL

SUMMARY OF THE ISSUE

+ In many municipalities, buildings built to higher energy performance standards may not have the same usable floor space as those built to existing standards and minimum BC Building Code. This is due to the fact that these municipalities measure Gross Floor Area (GFA) to the outside of the exterior wall, which effectively penalizes the use of thicker walls as a high performance design strategy.

+ Some municipalities do not provide floor area exemptions, (or not sufficiently sized floor area exclusions) for mechanical rooms/systems, which can discourage the use of larger low carbon mechanical systems such as heat pumps.

RECOMMENDATIONS

Local Governments seeking to remove this barrier to low carbon buildings can:

+ For floor area definitions that penalize thicker wall assemblies, there are two approaches that can be taken, each of which may be more appropriately suited to different community contexts (see next page).

+ Create exemptions in floor area definitions removing mechanical rooms for low carbon mechanical equipment in order to better accommodate such equipment that may require larger floor area.

FLOOR AREA + THICKER WALLS: TWO OPTIONS FOR IMPLEMENTING

For floor area definitions that penalize thicker wall assemblies, there are two approaches that can be taken, each of which be more appropriately suited to different community contexts.

1) UPDATE FLOOR AREA DEFINITION

Change the definition of Gross Floor Area in the zoning bylaw so it states that it is measured to the interior face of exterior walls, rather than the extreme outer wall surface.

This approach may be most appropriate to: rural or suburban municipalities with larger lots where side yard setback conflict with thicker wall assemblies are less of a concern.

Communities that have adopted such an approach include City of Victoria and Regional District of Nanaimo.

Example Zoning Bylaw Definition:

"**Area**" when used in reference to a floor of a storey of a building means the entire area which in plan is enclosed by the **interior face of the exterior walls** of the storey at floor level plus the area enclosed by any cantilevered element that is within that storey and that is above floor level.

2) PROVIDE FLOOR AREA EXEMPTIONS

Provide a floor area exemption in the zoning bylaw for thicker wall assemblies in support of high performance buildings.

This approach may be most appropriate to: urban municipalities with smaller lots where side yard setback conflict with thicker wall assemblies are a potential concern.

Communities that have adopted such an approach include City of Vancouver, North Vancouver, New Westminster.

Example Zoning Bylaw Definition:

"**Gross Floor Area**" means the total area of all the floors in each Building on a Lot, measured to the extreme outer limits of each Building, including all suites or Dwelling Units, commercial areas, recreational areas, and all areas giving access thereto, such as corridors, hallways, landings, foyers, staircases and stairwells, including any area under staircases and stairwells mezzanines, elevator shafts and Accessory Buildings, but excluding:

+ **Exterior Wall thickness in excess of 0.165 metres (6.5 inches) up to a maximum exclusion of 0.305 metres (12 inches) provided that the wall thickness is utilized for the provision of insulating materials and/or protection against wind, water and vapour;**

EXAMPLE FLOOR AREA LOSS CALCULATION

Thicker wall assemblies can add up to a significant loss of useable/saleable floor area.

As an illustrative example, the addition of 6 extra inches of insulation to the perimeter of a typical 2,400 ft² house could lead to a loss of 160 ft² of useable/saleable floor area.

LOW CARBON MECHANICAL EQUIPMENT ROOMS:

For floor area definitions that penalize larger sized mechanical rooms needed to accommodate low carbon mechanical equipment, the following approach is recommended to remove this barrier.

PROVIDE FLOOR AREA EXEMPTIONS

Provide a floor area exemption in the zoning bylaw for mechanical rooms to incentivize sufficiently-sized and accessible mechanical rooms and low carbon technology.

Communities that have adopted such an approach include City of Vancouver, North Vancouver.

Example: City of North Vancouver Zoning Bylaw - Definitions

"**Gross Floor Area**" means the total area of all the floors in each Building on a Lot, measured to the extreme outer limits of each Building, including all suites or Dwelling Units, commercial areas, recreational areas, and all areas giving access thereto, such as corridors, hallways, landings, foyers, staircases and stairwells, including any area under staircases and stairwells, mezzanines, elevator shafts and Accessory Buildings, but excluding:

+ (17) Green Building Systems*, provided that:
+ (a) any portion of a floor containing an in-suite Heat Recovery Ventilator, up to a maximum of 1.39 square meters (15 square feet) for each dwelling unit, provided that the system be located in an accessible location within each dwelling unit, having a minimum headroom clearance of 2.0 meters (6.5 feet), and be designed and tested to meet the CSA Standard CAN/ CSA-F326; or
+ (b) any portion of a mechanical room containing a Green Building System not used as the primary source of domestic hot water or space heating, up to a maximum of 9.29 square meters (100 square feet) for each building, provided that the system be located in an accessible location within the building, having a minimum headroom clearance of 2.0 meters (6.5 feet);

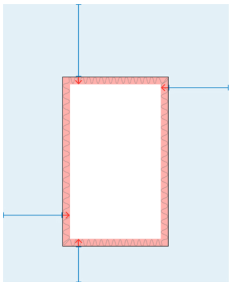
* *"Green Building System" means: [Bylaw 8391, October 27, 2014]*

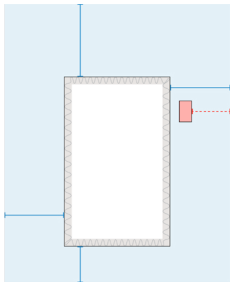
(1) Equipment that converts, stores, transfers (or combination thereof) energy from a renewable energy source. This includes equipment used to support Solar Collectors, Small Wind Energy Systems, heat pump systems, waste heat recovery systems and biomass systems; [Bylaw 8391, October 27, 2014]

2) Equipment that stores and treats (if necessary) rainwater, grey water or both

BUILDING SETBACKS
THAT DO NOT DISCOURAGE THICKER WALLS OR OUTDOOR LOW CARBON MECHANICAL SYSTEMS

SETBACKS DO NOT LIMIT WALL THICKNESS





SETBACKS DO NOT LIMIT SIDE YARD HEAT PUMPS

SUMMARY OF THE ISSUE

- Similar to the floor area calculation outlined in the previous section, building setbacks can inadvertently penalize thicker wall assemblies.
- Building setbacks can also present barriers to the implementation of exterior shading devices, as they may require a variance if they extend into the setback.
- Some communities do allow heat pump outdoor units in side yards. In some cases, these locations are most appropriate, and it can be expensive or not technically possible to located units in back or front yards.
    - Likewise, some communities communicate that multiple outdoor units are not allowed/encouraged.

RECOMMENDATIONS

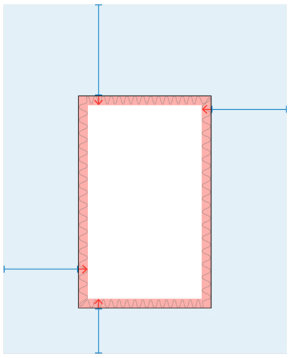
Local Governments seeking to remove this barrier to low carbon buildings can:

- Update policies to allow outdoor heat pump units to be allowed in any location, and providing guidance related to siting best practices and noise attenuation. Use noise bylaw to avoid noise issues.
- Allowing variances to building setbacks for thicker wall assemblies provided that the applicant demonstrates they will achieve a predetermined high performance standard (e.g., Passive House, Step 5, etc.)
- Allow variances to building setbacks for the use of exterior shading devices

Removing this barrier will mean that development industry representatives do not need to lose potential floor area/ density if using a thicker roof assembly, and will face fewer barriers if considering installing a heat pump.

THICKER WALL ASSEMBLIES

SETBACKS DO NOT LIMIT WALL THICKNESS



ALLOW SETBACK VARIANCES

Provide a setback exception in the zoning bylaw for thicker wall assemblies in support of high performance buildings.

Communities that have adopted such an approach include City of Vancouver, North Vancouver.

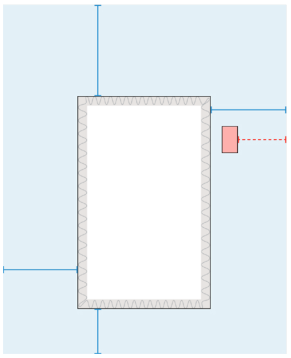
Example: City of North Vancouver Zoning Bylaw

For developments in the RS-4B, RG-2, RG-3, RG-4 and RM-2 zones, the following siting exceptions shall apply:

+ (a) where Exterior Wall thickness is in excess of 0.165 metres (6.5 inches) provided that the wall thickness is utilized for the provision of insulating materials and/or protection against wind, water and vapour, the minimum distance to an abutting Lot Line as permitted elsewhere in this Bylaw may be reduced by 0.25 metres (9.8 inches)

HEAT PUMP SITING

SETBACKS DO NOT LIMIT SIDE YARD HEAT PUMPS



DO NOT INCLUDE HEAT PUMP OUTDOOR UNITS IN SETBACK REQUIREMENTS

Update policies and setback requirements to allow the locating of heat pump outdoor units in any location by:

+ not counting heat pump units as a "structure" in the setback definition;
+ not including any heat pump specific limitations in the setback requirement.

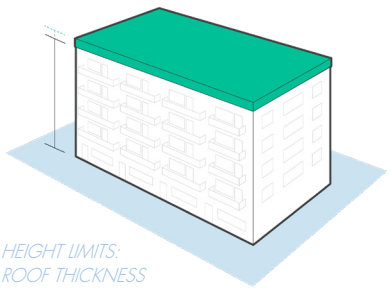
EXTERIOR SHADING

DO NOT INCLUDE EXTERIOR SHADING IN SETBACK REQUIREMENTS

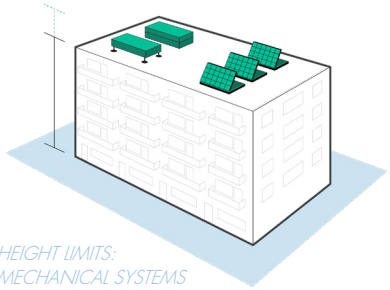
Update policies and setback requirements to not count exterior shading devices as part of the setback limits by:

+ not counting shading devices as part of the "structure" in the setback definition;
+ adding exception / variances to setback definitions for exterior shading devices

HEIGHT LIMITS
THAT DO NOT DISCOURAGE THICKER ROOFS, SOLAR ARRAYS, OR LOW CARBON MECHANICAL EQUIPMENT



HEIGHT LIMITS: ROOF THICKNESS



HEIGHT LIMITS: MECHANICAL SYSTEMS

SUMMARY OF THE ISSUE

+ In some municipalities, rooftop mechanical equipment and renewable energy systems (e.g., solar photovoltaic arrays) are counted as part of building height limits. This effectively penalizes the use of such systems as it can reduce the amount of usable floor space in a building (as the usable/built area would need to be built to a lower height to accommodate the roof systems).

+ Also, height limits in some municipalities penalize the use of thicker (more insulated) roof assemblies by counting it towards building height.

RECOMMENDATIONS

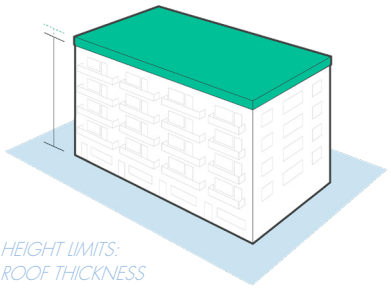
Local Governments seeking to remove this barrier to low carbon buildings can:

+ Create exemptions for low carbon mechanical equipment (e.g., rooftop heat pump condensing units) and renewable energy systems (e.g., rooftop solar PV systems) from height limit calculations in support of low carbon, high performance buildings.

+ Create exemptions for thicker roof assemblies from height limit calculations in support of high performance buildings

Removing this barrier will mean that development industry representatives do not need to sacrifice building height (and potential floor area/density) if using a thicker roof assembly or implementing low carbon rooftop mechanical and/or renewable energy equipment.

THICKER ROOF ASSEMBLIES



PROVIDE HEIGHT LIMIT EXCEPTIONS

Provide a height limit exception in the zoning bylaw for thicker roof assemblies in support of high performance buildings.

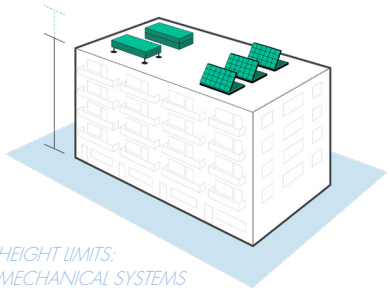
Communities that have adopted such an approach include City of Vancouver, North Vancouver.

Example: City of North Vancouver Zoning Bylaw - Height Exceptions

The Heights of Buildings and Structures permitted elsewhere in the Bylaw may be exceeded for:

+ (6) Roof thickness in excess of 0.3 metres (1 foot) provided that the excluded roof thickness is required to achieve compliance with the BC Energy Step Code, Passive House energy standard or other enhanced energy performance standard [Bylaw 8642, July 23, 2018].

ROOFTOP EQUIPMENT



PROVIDE HEIGHT LIMIT EXCEPTIONS

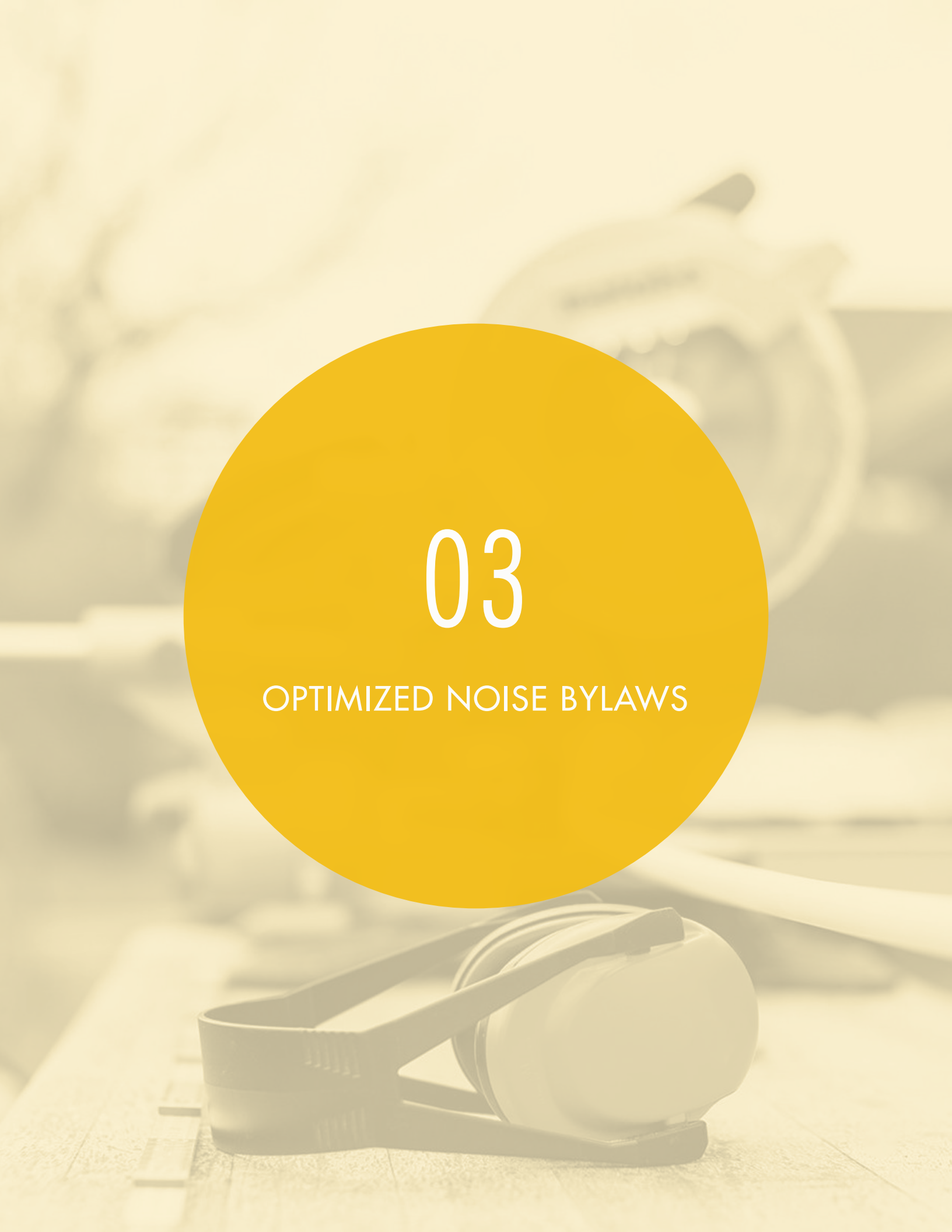
Provide a height limit exception in the zoning bylaw for low carbon rooftop mechanical and renewable energy equipment in support of high performance buildings.

Communities that have adopted such an approach include City of Vancouver, North Vancouver.

Example: City of North Vancouver Zoning Bylaw - Height Exceptions

The Heights of Buildings and Structures permitted elsewhere in the Bylaw may be exceeded for:

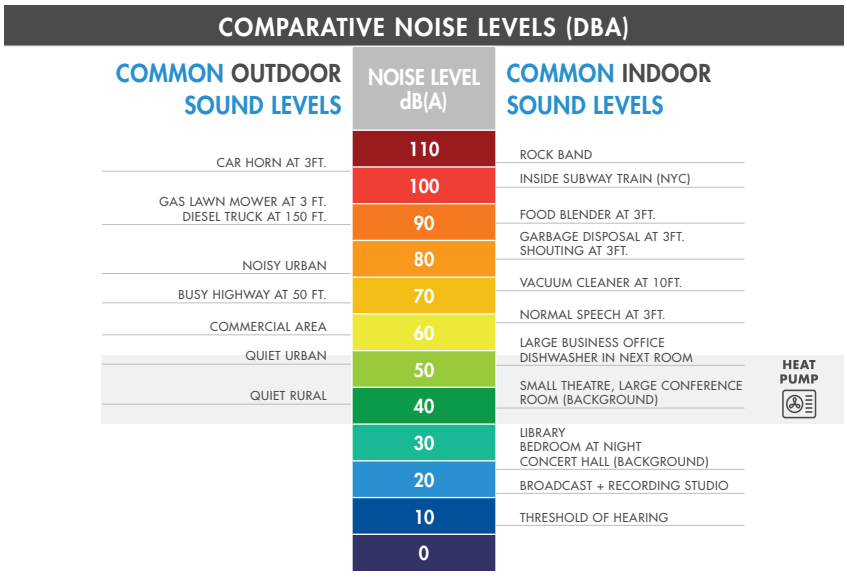
+ (7) Solar Collectors to a maximum of:
+ (a) 1.2 metres (4 feet) for Buildings for One-Unit Residential Use, Townhouse Residential Use and Ground-Oriented Residential Use provided that the installation:
+ (i) does not shade an existing Solar Collector or properties on January 21st, at noon, any more than would a structure built to the maximum permitted elsewhere in this Bylaw;
+ (ii) projects no greater than 1.2 metres (4 feet) above a flat roof; and
+ (iii) projects no greater than 0.3 metres (1 feet) above a pitched roof.



03

OPTIMIZED NOISE BYLAWS

OPTIMIZED NOISE BYLAWS
AND INTERPRETATION THAT AVOID UNFAIRLY PENALIZING HEAT PUMPS



HEAT PUMPS AND NOISE

Most modern residential heat pumps have lab tested sound power rating of 40 to 60 decibels when the system is operating at full capacity (typically, the system will operate at lower capacity for most of the year, and be quieter; full capacity usually occurs on the coldest days of the year). Heat pump's rated noise levels are usually measured from 3 feet away.

Comparative noise level table adapted from Source: US Federal Aviation Administration. https://www.faa.gov/regulations_policies/policy_guidance/noise/basics/

SUMMARY OF THE ISSUE

+ Noise bylaws are intended to limit noise pollution. Most municipal noise bylaws set maximum noise limits at the point of reception, which can be conservatively interpreted as at the property line for equipment located on private property. Of the municipalities reviewed, decibel (db) limits were in the following ranges:
    - » Day time - 50-70 db.
    - » Night time - 40-70 db.
+ Noise bylaw enforcement is usually on a complaint basis. However, development approvals, building approvals, and bylaws staff may also communicate to building owners, designers and heat pump contractors about the noise bylaw - e.g. during inquiries, building permitting or inspections.
+ There are many common misconceptions about heat pumps, including misconceptions about noise levels. Frequently people assume the current generation of heat pumps are noisier than they really are (this may be a product of experience with previous generations of heat pumps, some of which were noisy, and/or equipment that was installed improperly).

SUMMARY OF THE ISSUE, CONT'D

- Heat pumps' outdoor units can be noisy if improperly designed or installed; less efficient models are also often noisier. However, many newer high efficiency models are quiet and avoid noise issues when installed correctly.
- However, municipal noise bylaws, and interpretation and enforcement of these bylaws, can unfairly target heat pumps and lead to misconceptions about the noise level of heat pumps. Stakeholder interviews suggested the following issues:
  - Noise limits are sometimes enforced by disallowing or discouraging heat pump location in side yards or front yards, despite there being no limitations in the noise bylaw or other regulations (e.g. setbacks) that would limit their placement in these locations. For some properties these locations may be the most cost-effective, preferred by homeowner, only technical possible or best location (furthest from neighboring properties). Multi-unit "missing middle" housing may particularly require that units' heat pumps be located in front or side yards.
  - Some inspectors may use the decibel rating of the heat pump unit, rather than a calculation or measurement of decibel ratings at the property line to determine if the heat pump surpasses noise bylaw thresholds. This practice is inappropriate, because the decibel rating is usually measured at 3 feet (operating at full capacity), while the "point of reception" as defined in noise bylaws will often be considerably further away, allowing noise to dissipate.
  - A few municipalities (e.g., District of Saanich) have specific noise bylaw clauses regarding exterior heat pump condensing units and do not include noise restrictions for other mechanical equipment. This explicit focus on heat pumps could dissuade residents, businesses, builders or developers from including them in new construction or retrofits. Similarly, some communities may communicate more regarding heat pump noise versus other equipment, which again can dissuade builders from implementing heat pumps.

RECOMMENDATIONS

Local Governments seeking to remove this barrier to low carbon buildings can:

ENSURE NOISE BYLAW PROVISIONS ARE APPROPRIATE

Review, and if necessary amend, noise bylaws to ensure:

- There are no provisions particular to heat pumps. Noise bylaws should treat all mechanical equipment in an equivalent manner, with no provisions particular to heat pumps.
- Reasonable provisions for noise levels from mechanical equipment. To better ensure consistent application, consider quantifiable limits (e.g. decibel ratings at the property line). Cities should consider whether common sources of noise meet defined limits, and if so whether noise limits should be increased.

ENSURE REASONABLE AND CONSISTENT ENFORCEMENT PRACTICES

Engage with bylaws, plan checking, inspections and other relevant staff to ensure reasonable and consistent enforcement practices. Good practice includes:

+ Ensure staff understand what a heat pump is, the basics of how they work, and the many consumer benefits of heat pumps, including their importance to adapting to a warmer climate and there critical role in achieving GHG reduction targets.
+ Educate building officials staff about heat pumps and noise so they can advise homeowners and contractors on best practices to determine an optimum outdoor location, select a quiet heat pump system, properly maintain a heat pump, and control and prevent noise travel.
+ Any enforcement of noise bylaw provisions should not use equipment's lab-rated full capacity noise levels, as sound will attenuate with distance. Instead, calculate the noise level at the property line (or other point of reception as specified in Noise Bylaw).
+ Not imposing blanket restrictions in heat pump outdoor units (e.g. in front or side yards). Instead, allow heat pump outdoor units to be located anywhere on the property, provided Noise Bylaw provisions can be achieved. Refer contractors, designers, and homeowners to best practice guides (see below) for placement and sound attenuation of heat pumps.

Summarize noise management best practices and City requirements in a guide and/or bulletin

Following review of bylaws and engagement with relevant staff, summarize noise bylaw implications for all building mechanical systems, including heat pumps. Consider adapting the City of Vancouver's Heat Pumps & Noise: A Neighbourly Installation Guide.

04

APPROVALS - BUILDING, HVAC, GAS & ELECTRICAL PERMITTING

STREAMLINED PERMITTING
PROCESSES FOR HEAT PUMP RETROFITS

SUMMARY OF THE ISSUE

+ There can be confusion among City staff regarding what policies or regulations apply to heat pump implementation, and necessary permits. To encourage heat pump implementation, it is important that contractor and consumer experience is clear, simple, low cost and consistent. Likewise, it is important that front desk, building approvals and other relevant staff understand the importance of the transition to heat pumps to achieving climate objectives and targets.
+ Technical Safety BC conducts electrical and gas permitting in most municipalities, while local governments typically conduct building permitting. However, 10 municipalities are delegated portions of the Safety Standards Act to issue electrical and/or gas permits and to perform assessments. Technical Safety BC notes the following jurisdictions that perform electrical or gas permitting:
    - City of Burnaby (Electrical and Gas)
    - City of Kelowna (Gas only)
    - City of Maple Ridge (Electrical and Gas)
    - City of North Vancouver (Electrical and Gas)
    - District of North Vancouver (Electrical and Gas)
    - City of Richmond (Gas only)
    - City of Surrey (Electrical only)
    - City of Vancouver (Electrical and Gas)
    - City of Victoria (Electrical only)
    - District of West Vancouver (Electrical only)
+ As heat pump implementation involves electrical work, and can involve removal of gas equipment or service, local electrical and gas permitting processes could impact heat pump retrofit economics.
+ Heat pump retrofits typically involve penetrations in building envelopes to install refrigerant lines; some local governments may require building permits to be implemented in these circumstances, while others do not. In local governments where gas and electrical permitting is performed by Technical Safety BC, there may be no local permitting required for heat pump implementation.

RECOMMENDATIONS

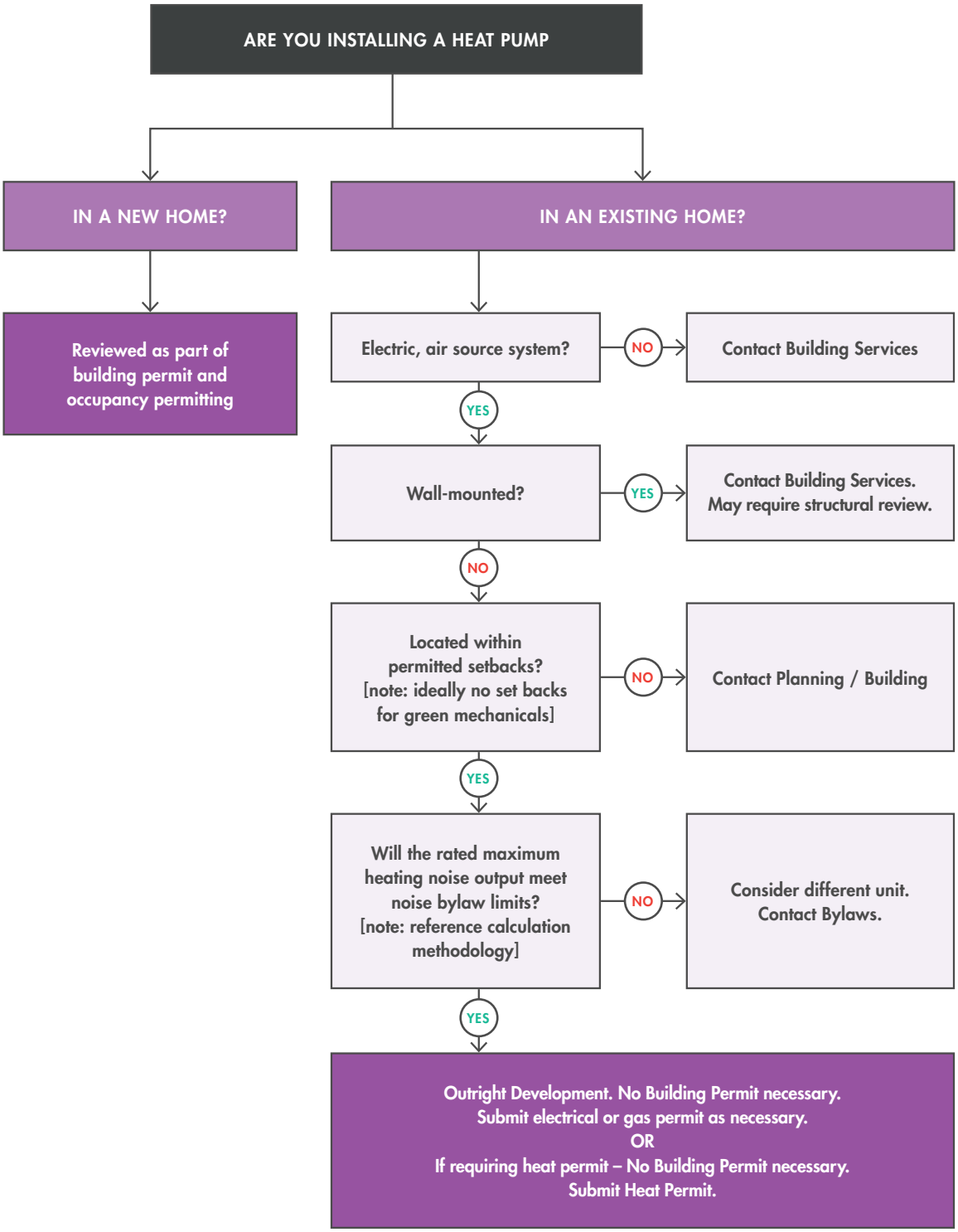
CLARIFY AND OPTIMIZE PERMITTING PROCESSES

A city staff champion to optimize heat pump permitting can:

+ Engage development approvals, building approvals, and any gas or electrical permitting staff, regarding what are current expectations for heat pump permitting. Review:
    - » Whether implementing a heat pump retrofit triggers any permit requirements;
    - » What setback or noise requirements (see section 3 above) apply to heat pump outdoor equipment siting. This should include whether these considerations are established in provincial regulations, codes, local bylaws or formal policies, versus more discretionary or ad hoc policies.
    - » Permit fees.
+ Ensure City staff understand the importance of supporting heat pump adoption to reduce GHG emissions and achieve climate change adaptation.
+ Seek to ensure that any permitting requirements are justified in appropriate bylaw, code or formal policy requirements, and that further restrictions without such justification are not being communicated to applicants (e.g. limitation on outdoor unit location are not informally communicated).
+ Develop flow chart illustrating permitting requirements. **An example flow chart is provided on the next page**, derived from City of Vancouver's Heat Pumps for Ground Oriented Dwellings Bulletin (variations reflect additional good practices).
+ Develop a bulletin establishing clear expectations, guidance on compliant installations, and permit requirements. Include flow chart noted above.
+ Inform staff why this process is being undertaken, ensure all relevant staff are familiar with the regime and ask staff to provide any new ideas for optimizing the heat pump permitting process.

EXAMPLE FLOW CHART FOR HEAT PUMP BULLETIN

NOTE: A similar flow chart could be established for natural gas systems - It could specify for contractors that heat load calculations and quality installation provisions be performed, and reference any heating or thermal conditioning permit (see next section).



RECOMMENDED FUTURE WORK: ENSURING QUALITY HEATING SYSTEM INSTALLATIONS

ENSURING QUALITY HEATING SYSTEM INSTALLATIONS
THAT MEET ENERGY PROVISIONS OF THE BC BUILDING CODE AND/OR LOCAL ENERGY STEP CODE REQUIREMENTS

SUMMARY OF THE ISSUE

+ Proper HVAC system implementation, particularly heat pump implementation, is technically complicated. It requires technical expertise, quality design and implementation.
+ Improper heat pump installation can result in excess noise; inefficient, expensive operations; and shorter equipment life. Because electricity is more expensive than natural gas, heat pump operating costs can be more significantly impacted by improper sizing or installation than with natural gas systems. However, improper gas equipment installations result in excess unnecessary emissions, and added cost; notably, gas heating systems in Part 9 buildings are frequently over-sized and often not installed to best practices, resulting in inefficient operation and significantly impacting the ability of stakeholders to meet greenhouse gas emission reduction targets.
+ Most local governments do not enforce all components of the BC Building Code and relevant standards relating to heat load calculations, equipment sizing and installations. Exceptions include:
    - » The District of North Vancouver has a Heating Permit to install or alter forced air heating or hydronic heating systems.
    - » The City of Kelowna has a Heating Permit which applies to any new space conditioning equipment.
    - » The City of North Vancouver reports being in the process of exploring such a permit.
+ Likewise, Technical Safety BC regulates with regards to safe installation of equipment, and does not enforce BC Building Code provisions regarding the the quality mechanical equipment installation (e.g. sizing, efficiency, etc.).
+ The lack of any entity regulating to ensure compliance with the provisions for efficient design and installation of Part 9 mechanical systems can create a "race to the bottom" and allow for inadequate installation of heating equipment.
+ More thorough permitting systems could better design and installation practices of space heating, cooling and domestic hot water equipment, both gas and electric. However, it is important that such processes not create unnecessary barriers to heat pump adoption.

AREAS TO EXPLORE

CONSIDER ADOPTING A THERMAL CONDITIONING PERMIT (I.E. HEATING PERMIT)

+ A thermal conditioning permit would apply to all space heating, cooling and domestic hot water equipment in new and existing buildings. It would support proper heat load calculations, mechanical design, and installation.

+ Adequate staffing and resourcing is essential to ensure the successful implementation of such a permit. It is recommended that local government champions engage their building departments and mechanical industry to determine the appropriate provisions. Opportunities include:

    » Requiring installers have certification with industry association programs (e.g. TECA Quality First, etc.) that include quality control of certified contractor installations.

    » A heating permit could also be used to build stakeholder (contractor, consumer, building official) awareness about the greenhouse gas implications of installing different types of heating systems. A sliding scale permit fee could be applied based on the relative increase in emissions. For example, in a retrofit scenario a switch from electricity to gas heating would result in a higher permit fee and a switch from natural gas to a heat pump could be free.

EXPLORE SOME PROVINCIAL OR REGIONAL-SCALE AUTHORITY TO DELEGATE THERMAL PERMITTING

+ Local governments, the Province, Technical Safety BC, and industry stakeholders should explore the possibility of establishing some authority responsible for regulation and enforcement of efficiency and functioning provisions of the Building Code and other requirements in buildings. Such an entity could operate in a similar manner as Technical Safety BC.

INITIATE A PROGRAM TO PROACTIVELY CONDUCT HEAT LOAD CALCULATIONS

+ Heat load calculations are important to good mechanical design, and specified by the CSA F-280 standard referenced in the BC Building Code. However, mechanical contractors rarely conduct such calculations - They can be time consuming, adding to costs for contractors when assessing prospective clients' homes.

+ Local governments and other partners could initiate a program to proactively conduct heat load calculations of homes that are candidates for retrofits. Stakeholders should be convened to determine the best approach for conducting heat load calculation for retrofit applications. When EnerGuide Rating System home energy evaluations are performed a heat load calculation can be produced. Such heat loss calculations could dovetail with other municipal services involving visits to residents homes (e.g. water efficiency direct install programs, etc.).

RESOURCES

A variety of resources provide guidance on good practices for proper design and installation of mechanical systems in Part 9 buildings. Notably:

+ The Home Performance Stakeholder Council recently published a Heat Pump Best Practices Installation Guide for Existing Homes.

+ The Thermal Environmental Comfort Association of BC (TECA) has Quality First courses and certified contractors. TECA reports it is in the process of developing a course for heat pump implementation.

+ CSA Group is in the process of developing a Guidance Document on Best Practices to the Design, Installation and Verification of Mechanical Systems in New (& Existing) Homes

LOCAL GOVERNMENT

LOW CARBON BUILDING POLICY TOOLKIT

MARCH 2021

ORIGIN
SUSTAINABLE DESIGN + PLANNING

MCEWEN CLIMATE & ENERGY