

## Barriers to deep retrofits: Regulatory solutions from across Canada

Construction or renovation projects featuring new technologies or different construction techniques often face regulatory barriers that may increase the time needed for permits to be issued or preclude the use of certain components. Here we identify some of the regulatory barriers that deep retrofit projects in Canada have faced, and provide some example solutions that might facilitate exemptions for demonstration projects. These examples may also show the way forward for regulatory change to remove such barriers.

Barrier	Description	Project-specific solution	Regulatory solution
<b>Noise bylaws</b> can restrict heat pump installations	Modern well-installed heat pumps have a 45 decibels (dB) sound pressure level (quieter than the average refrigerator) and a 55-60 dB(A) sound power level at a 1-metre distance. Noise can also be further mitigated by locating in the rear yard, away from other houses, and including sound damping strategies.	Where the siting restrictions would make a heat pump infeasible, owners can apply for a zoning variance. For an example of this process, check out the last section of this <a href="#">City of Nanaimo</a> heat pump guide.	The <a href="#">District of Oak Bay</a> is relaxing its noise limits, currently 40 dB, to the mid-50 dB range. Vancouver sets sound pressure tolerance to 45–70 dB and is proposing to streamline heat pump permits for proposals that integrate high-performance equipment with best siting and installation practices.
Heating system design, installation and commissioning is not reviewed under standard plumbing and gas <b>permits and inspections</b>	<a href="#">Technical Safety BC</a> inspects to Gas and Electrical codes, safety standards act and regulations; it does not enforce the building code. Plumbing and heating wholesalers employ heat loss technicians who perform heat loss calculations and recommend system components and layout on behalf of contractors. Some municipalities perform plan checks at time of permit and require a licensed gas fitter/plumber to install the appliance, but the appliance performance is unregulated.	<a href="#">BC Hydro</a> provides building owners with recommendations for selecting heat pumps and installers.  Passive House and other high performance building programs require early co-ordination to optimize system sizing and layout, as well as mid and final construction review and commissioning.	Municipalities, such as the <a href="#">City of Kelowna</a> , have developed heating permits and provide design review.  Under its unique Charter, Vancouver is exploring its authority to require contractor training/certification in heating system design, installation and commissioning. <sup>1</sup>

<sup>1</sup> Phil White, City of Vancouver, personal communication

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Building electrification can drive demand that exceeds <b>neighbourhood grid capacity</b>	Electrification of a building's space and water heating can require electrical panel upgrades for the buildings. In some cases, that additional demand can exceed capacity of the neighbourhood distribution.	The building owner bears the cost of upgrading the local electrical distribution system for the whole block, not just the building. <sup>2</sup>	Programs for neighbourhood-scale electrification should be designed to incorporate potential electrical distribution upgrade costs. They could be combined with other programs that reduce neighbourhood demand, such as the City of New Westminster's Lamppost EV Charging project ( <a href="#">video</a> ) which unlocked capacity by installing LED streetlights.
High-COP heat pumps are available globally but <b>not certified for use in Canada</b> (e.g. coefficient of performance > 4)	High efficiency is key for heat pumps to work in Canada's extreme cold temperatures. New equipment and refrigerants are available for use overseas, but not in North America. Manufacturers need market clarity to justify the time and expense of product certification.	Equipment that is not certified under the local authority can be shown to meet code through variances. A third-party engineer verifies and stamps the product and its use in the design, based on the appropriate certification standard, such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).	One supplier has suggested the European CE Mark could be accepted as equivalent to CSA (Canadian Standards Association) under a short-term waiver to quickly introduce high-COP heat pumps to the Canadian market. Four years would allow time to build industry partnerships, to prove value and market volume potential with initial market projects, and to undergo testing and product modification to meet CSA requirements. <sup>3</sup>

<sup>2</sup> Juan Monterossa, City of Edmonton, personal communication

<sup>3</sup> Albert Rooks, Small Planet Supply, personal communication

Barrier	Description	Project-specific solution	Regulatory solution
<b>Lot line setbacks</b> can limit upgrades with exterior insulation	Exterior envelope retrofits add wall thickness that can encroach on lot line setback limits.	Approval can be granted through a zoning variance on an individual project basis.	The <a href="#">City of West Vancouver Amendment to bylaw 4974</a> permits a 0.15-metre side yard setback reduction to enable installation of exterior insulation or rainscreen assemblies on existing buildings. In considering setbacks, local fire-separation requirements, such as requirements for using non-combustible materials, sprinklers, unprotected openings, and limiting distances, must be observed.
<b>Floor space ratios</b> can disadvantage high-performance wall assemblies	The ratio of floor space to property area is traditionally calculated based on the outer limits of all buildings on the property (e.g. Vancouver zoning bylaw for <a href="#">low-rise residential buildings</a> ); adding thicker insulation and rainscreen reduces the livable space. This barrier typically applies to new construction, but not exclusively.	Approval can be granted through a zoning variance on an individual project basis.	The <a href="#">City of Vancouver</a> and the <a href="#">City of North Vancouver</a> have created floor space exclusions to favour thicker insulation and rainscreens in wall assemblies.
<b>Height bylaws</b> can limit roof insulation	Height restrictions can be triggered at point of retrofit if an existing building stands taller than current bylaw restrictions or if the design calls for adding roof insulation.	Approval can be granted through a zoning variance on an individual project basis.	The <a href="#">City of New Westminster</a> has relaxed height restrictions to allow for additional insulation.

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<b>Building code</b> does not address prefabricated panels	Prefabricated panel construction takes place off-site. Local building departments inspect installed panels and the connections to the existing building at joints and openings.	For the <a href="#">Sundance Co-op Deep Energy Retrofit</a> , the City of Edmonton's safety code office reviewed the application for quality, a structural engineer verified the structural bearing lines of the panels and lateral load capacity of connections, and a building envelope engineer verified the panel assembly and component suitability. The City inspected what was visible in the final installation to close the permit and a third-party engineer signed off on the structural and moisture performance.	Alternate certification paths could be considered to streamline permitting and inspection of prefabricated panels: <ul style="list-style-type: none"> <li>• CSA certification of panel assembly (not just individual components in the assembly)</li> <li>• A277 in NBC (National Building Code) certification of the off-site manufactured panelized process</li> <li>• ISO 9001 2016 certification of the manufacturing plant</li> </ul>
<b>Emerging products/techniques for control barriers</b> (weather resistant, vapour or air) may be rejected	The building code is product-neutral, but the construction industry has long traditions of using certain products, such as 6-mil polyethylene to control vapour. New products are being developed rapidly, which puts pressure on building inspectors to learn how and where they best function in an assembly. For example, an air barrier that is vapour closed could inadvertently create a double vapour barrier if it were used along with a conventional vapour barrier.	An inspector may require third-party inspection documentation for alternatives to typical air, water and vapour management components, including testing results and performance warranties. Some suppliers also provide onsite training. <sup>4</sup>  Providing training for building inspectors in building science principles or specific certification systems, such as Passive House, facilitates adoption of new, often superior, products.	A product matrix that summarizes new materials and their functions could be developed and maintained in collaboration with building material suppliers. For example, the <a href="#">City of Calgary</a> has developed a Sustainable Technologies Permitting Matrix that helps streamline permitting and inspection for proven green technologies, such as solar PV.

<sup>4</sup> Shaun St. Amour, 4-7-5, personal communication

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<b>Emerging products/techniques for directional drilling</b> to install electrical cables may be rejected	Horizontal directional drilling (HDD) allows electrical cable to be installed without trenching. However, building departments can be concerned that the technique will fail to maintain integrity of the cable. In addition, trenchless installation means the cable is not visible for final inspection. Building departments may recommend conduit be used when HDD is employed but that adds time and labour costs.	<a href="#">CSA 22.3 No. 7-2015</a> permits TECK90 cable to be used with HDD when measures to prevent damage are employed. TECK cable with HDD was proposed to upgrade the electrical service for the Sundance Co-op site to save time and cost. The City of Edmonton permitted its use with the expectation that protective measures be employed, for example by back reaming to enlarge the pilot hole and protecting the lead end of the cable and making it available for inspection. <sup>5</sup>	Annex E of the CSA standard suggests common applications in which HDD is the preferable or in some cases only alternative to trenching. Most commonly it is employed by the resource industry, civil infrastructure, and commercial applications, but the Sundance Co-op retrofit illustrates a beneficial residential application and the contractor intends to document the process and outcomes for other projects to reference.
<b>Emerging products/techniques for combining materials</b> in prefabricated panels may be rejected	Section 3.2 Building Fire Safety of the B.C. Building Code defines when combustible construction is or is not allowed, and materials are considered non-combustible if they satisfy CAN/ULC-S101, "Fire Endurance Tests of Building Construction and Materials." The local building department is responsible for interpreting and enforcing the regulations, but that may not be straightforward, particularly when multiple materials are combined into a single product, as in the case of prefabricated panels.	Designers can meet fire code through alternative pathways such as providing third-party combustibility testing or project-specific limiting distance calculations that are based on window and egress openings. These processes can be costly and time-consuming. In some cases, they may also be unnecessary, as was the case for <a href="#">B.C. Building Code Appeal Board (BCAB) decision 1814</a> . The appeal board sided with the designer in an appeal that argued non-combustible cladding requirements only apply to the outside surface, in this case fibre-reinforced cement, not to the wood strapping or other components in the cladding system.	Edmonton is working to align fire codes in the region to increase consistency, but that still leaves interpretation of the codes to the building inspectors who may require additional support. This could include providing them with regular bulletins on appeal board decisions from across Canada, which are not published online by all boards.

<sup>5</sup> Peter Amerongen, Butterwick Construction, personal communication

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<b>Emerging products/techniques for air admittance valves</b> may be rejected	<a href="#">Air admittance valves (AAV)</a> reduce plumbing penetrations that can contribute to stack effect (pressure differentials through the height of the building). Canadian Plumbing Codes expressly allow AAVs for venting sanitary plumbing where traditional installation options are not suitable, but it is up to the local building department to approve them. The primary concern is AAVs are contained within the wall and not available for repair should they fail.	AAVs were approved by the City of Hamilton <sup>6</sup> building department in what will be Canada’s first EnerPHit high-rise multi-unit residential building, through a compliance alternative. This precedent-setting decision required a 100+ page application. The City of Hamilton credits the Passive House training provided to building department staff for facilitating their understanding and openness to the use of AAVs in a high-performance building.	In <a href="#">BCAB Appeal 1801</a> , the appellant successfully argued that only one of the conditions in subclause 2.5.9.2.(1) in the Canadian Plumbing Code needs to be satisfied to justify use of AAVs. B.C. Appeal Board decisions are published online, making them easily accessible precedents for other municipalities and designers to reference.
<b>Slow permitting</b> can be a deterrent to innovation	Complex, unique projects, including deep retrofits, require additional care and consideration which slows the building permit process. However, as local governments increasingly adopt programs to accelerate high-performance construction and retrofits, their building departments will have to deal with such complexities more often.	The City of Edmonton’s <a href="#">Client Liaison Program</a> triages and assigns complex and impactful permit applications to senior permit officers who work with the applicant to ensure project success. While the program is designed for new construction, the Sundance Co-op retrofit project was trialed in the program because it addresses so many of the City’s policy and program goals.  The City of Vancouver assembles an internal advisory group made up of staff from building, urban planning, sustainability, and seismic safety departments to review permits for multi-unit residential building retrofit projects and flag potential problems that need unique approaches.	The City of New York’s <a href="#">Retrofit Accelerator Program</a> provides advisory services — helping the city implement the Climate Mobilization Act and meet its GHG targets.  Edmonton has created an AI system that helps triage low-risk projects according to records of historic failures. It evolves its detection of risk through machine learning. The Edmonton building department stopped inspecting low-risk projects in October 2019, freeing up capacity to focus on more complex projects. The safety code council helped develop the tool and audits 20% of all projects.

<sup>6</sup> Sean Botham, Hamilton CityHousing, personal communication.

For more information

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