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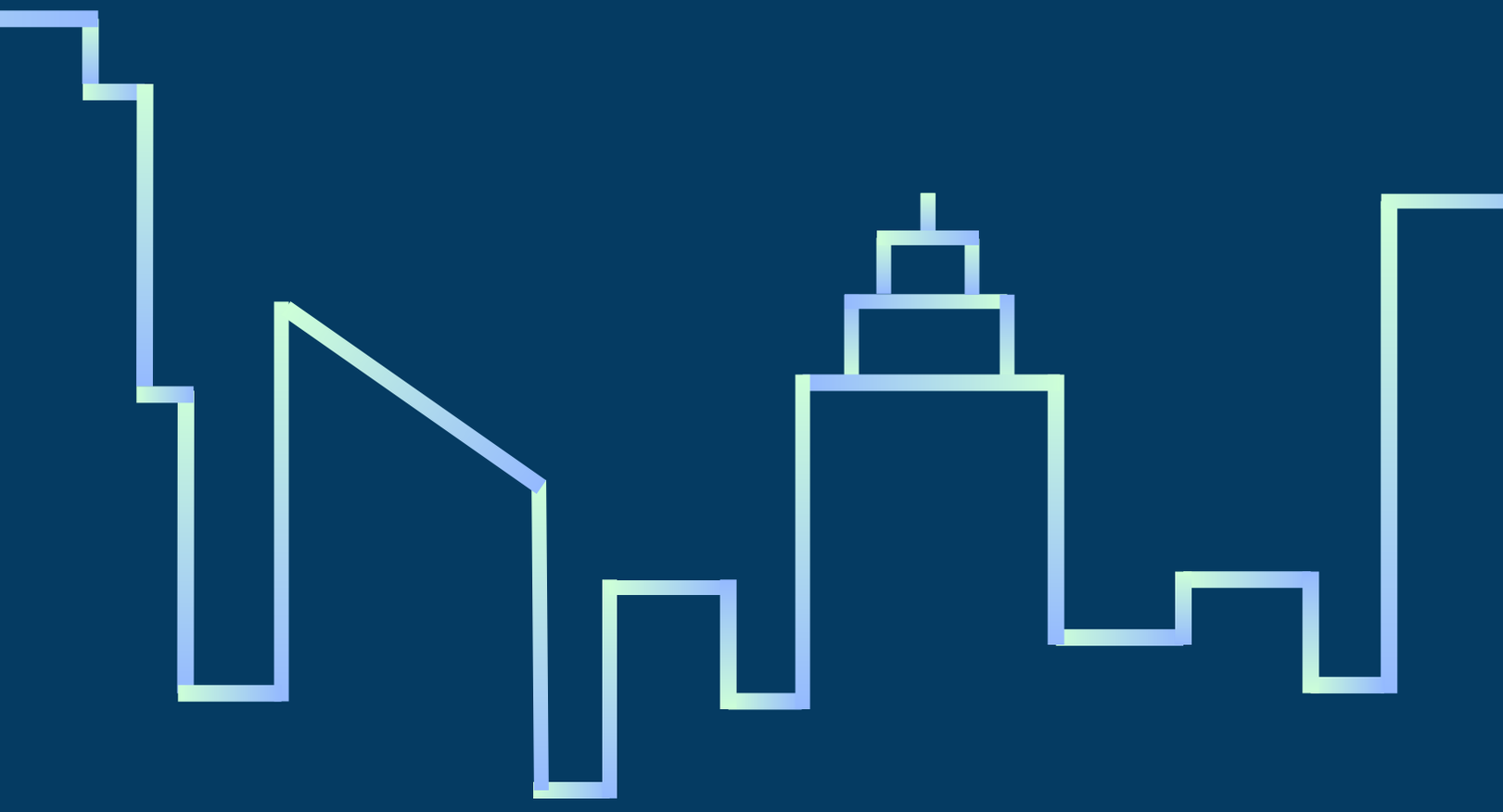

CASE STUDY

First in BC: Window-Mounted Heat Pump (WMHP) Pilot

Testing Window Replacement and Heating & Cooling in a Single-Room Micro-Suite in Vancouver, BC

Case Study

Window-Mounted Heat Pump in a Micro-Suite in Vancouver

Vancouver, BC

Retrofit Overview

Window-mounted heat pumps (WMHPs) are a promising suite-level solution to improve energy efficiency, reduce overheating risk, and support decarbonization in BC's multi-unit residential buildings.

This building was selected because it is representative of a common rental building archetype in BC: it features micro-suites, electric resistance heating, does not have vertical-sliding ("sash") windows, and has documented overheating issues. This project will evaluate the technology's effectiveness to replace electric resistance heating in a small suite while improving comfort and resilience and reducing tenant heating bills.

WMHP, exterior unit

WMHP exterior unit, side view

Project Highlights

The pilot involved the installation of a custom window assembly and Midea WMHP. Following electrical pre-work and same-day window removal, the new window assembly was installed and the heat pump was mounted, sealed, and tested. Performance monitoring is now underway.

Heat pumps: Installed 1 Midea packaged window heat pump.

Windows: Designed, engineered, tested, and installed 1 high-performance custom window assembly.

Electrical: Installed a new 20A-1P breaker and dedicated circuit from existing hallway panel to WMHP installation location, including a 20A, 120V receptacle for the WMHP.

Existing baseboards: Disconnected by electrical contractor but left in place to preserve the owner's ability to revert to the original heating system or retain the WMHPs following the pilot.

Other enabling work: Building permit (triggered by window replacement work) and street permit for the City of Vancouver. Boom lift access.

Time to install: 1 day + electrical pre-work.

Building Details

Year built: 1906

Building size: 13,108 sq ft

# of units and floors: 51 units, 4 floors

Suite type: Student housing micro-suite

Existing heating: Electric baseboards

Existing cooling: None

Existing windows: Non-vertical sliding

Location: Vancouver, BC

Non-Energy Benefits & The Business Case for WMHPs

WMHPs provide important benefits beyond energy savings including adding cooling and mitigating suite overheating, improved comfort, more efficient use of electricity, and improved window performance where older windows are replaced. They also help owners prepare for future regulations around temperature, cooling, energy, and GHG emissions.

Such benefits are especially important in rental housing, where the business case for a retrofit is driven by tenant comfort and safety, asset value, and regulatory readiness as much utility savings.

up to 61.5% energy savings from cooling compared to a traditional window air conditioner*

** Calculated by Midea, with comparison based on the Coefficient of Energy Efficiency Ratio of a 9K traditional window AC with DOE standard and a 9K WMHP. Heating energy savings being quantified post-project.*

Anticipated Future Costs and Pilot Costs

Future project costs are expected to be lower than first-of-its-kind pilot costs. For a whole-building retrofit of micro-suites, custom window costs could be ~60% lower. Savings would come from standardized designs, larger orders, and spreading access, engineering, and transportation costs across more windows. A standalone single-suite retrofit could achieve a ~5–10% reduction in window costs.

Cost Category	Anticipated: Per Micro-Suite Cost *Whole Building Retrofit*	Pilot: Per Micro-Suite Cost *Single Suite Retrofit*
WMHP equipment	$1,900	$1,900
Window design & installation	~$3,135	$7,835
Electrical work	Building-specific	$2,660
Abatement	Building-specific	$0
Permits	Building-specific	$540
Total Cost per Micro-Suite	**~$8,235**	**$12,935**

Pilot costs are shown for transparency and include first-of-kind delivery impacts and small-batch window fabrication. Pilot-specific cost categories (e.g., building envelope review, metering equipment) are not included. Anticipated costs are preliminary estimates, not quotes. Anticipated total cost calculated using anticipated window cost and holding other pilot costs constant. Future electrical, permit, and abatement costs will vary by building.

Key Takeaways from the Pilot

1. **WMHPs are a promising retrofit solution, but they are not universally applicable.** Feasibility and cost depend on window type and characteristics, electrical capacity, façade conditions, abatement needs, and permitting requirements.

2. **WMHPs support priority or phased implementation.** They allow owners to prioritize suites or rooms most at risk of overheating or where conventional heat pump retrofits are difficult. WMHPs can support practical, phased approaches to thermal comfort, life safety, energy efficiency, and regulatory compliance.

3. **Planned window upgrades are a practical pathway for scaling WMHPs.** Many apartment buildings in BC have horizontal sliders, casements, or fixed glazing not directly compatible with standard WMHP installations. Integrating standardized WMHP assemblies into whole-building window projects could reduce micro-suite window costs by ~60% compared with this pilot, while improving feasibility & reducing installation challenges.

Building-Specific Insights

4. **WMHP projects may involve municipal approvals when window modifications and exterior access are required.** A building permit and street-use permit (for boom lift access) were required for the window replacement work in the City of Vancouver.

5. **WMHPs may be well suited to compact suites.** This pilot tested a single WMHP in a small micro-suite, where one room-scale unit may be able to provide sufficient heating and cooling. This would make WMHPs especially relevant for compact suites, student housing, or similar layouts.

Window Mounted Heat Pumps

Packaged, plug-in heat pumps designed to mount within a vertical (“sash”) window opening. WMHPs provide heating and cooling using standard household electrical service (typically 120V). All refrigeration components are sealed in a single unit with integrated condensate management, avoiding refrigerant handling and building penetrations. Especially where a window replacement isn’t needed, installation is typically minimal and non-invasive.

Technical Specifications: Midea WMHP

Power requirements: 120VAC / 12A / 60Hz
Capacity: ~9,000 Btu/h heating and cooling
Cooling capacity @ 95°F / 35°C: 9,000 Btu / 12.04 EER
Heating capacity @ 47°F / 8°C: 9,000 Btu / 3.80 COP
Heating capacity @ 17°F / –8°C: 9,000 Btu / 2.50 COP
Heating capacity @ 5°F / –15°C: 9,000 Btu / 2.00 COP
Minimum operating temperature: –13°F / –25°C
Maximum sound level: 51 dB(A)
Dimensions, indoor unit: 25" x 8.8" x 20.9"
Weight: ~130 lbs
Warranty: Compressor: 10 years. Core Parts: 7 years.
Window width: min 26" - max 38" (must open 15")
Wall thickness depth: min 6.5" - max 16.5"

Project Partners & Funders

This retrofit was a collaboration between partners, funders, building owners and tenants.

FRESCo developed the pilot, provided technical leadership, coordinated implementation and installation, led participant engagement and reporting, and is evaluating performance.

LandlordBC provides leadership & advocacy in the rental housing sector. Pilot buildings were supported through the *Rental Apartment Retrofit Accelerator (RARA™) program*, a free one-stop concierge program.

Cascadia Windows & Doors engineered a custom, high-performance window to enable an energy-efficient fit for the WMHP, and installed window assemblies and WMHPs.

RDH Building Science reviewed and approved the window design and tested performance.

Midea Canada and **North American HVAC** supplied the WMHPs and product support.

Supported by **BC Hydro** *Power Smart Innovations Team* and **B2E** *Innovation Fund*.