

Heat Pump Awards 2026

Application submission

**Innovative Combined HVAC & DHW All-Electric Solution for Net Zero
Ready Affordable Housing**

Peel Passive House Consulting Ltd. | Innovation Award

1. Application overview

Award category	Innovation
Title of the project	Innovative Combined HVAC & DHW All-Electric Solution for Net Zero Ready Affordable Housing
Organisation Name	Peel Passive House Consulting Ltd.
Exact address of the project	Multiple (5) projects implementing this system. Can use the following: 102 Donlands Ave. Toronto, ON M4J 3P1
Funding	Public
Organisations involved in the project	Equipment: EcoForest (heat pumps), Swegon (ventilation units), Geosmart Energy (heat pump supplier), Alnor (ducts and coils), COLD (coils) Funding: Canada Mortgage and Housing Corporation (CMHC), Smart Sustainable Resilient Infrastructure Association (SSRIA) Project/building owners: Windsor Essex Community Housing Corporation, , Skeetchestn Natural Resources Corp., private building owners: Graeme Verhulst, Heather Armson, Andrew Peel, Mike Darmitz Technical collaborators: Passive House Institute (PHI)
Project ending date	31/03/2028
Project website	https://www.peelpassivehouse.ca/cmhc-hsc
Sector of application	Residential

2. Applicant & EHPA contact details

Full name	Dave Fraser
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Phone number	15194002354
EHPA member involved	EcoForest
Role of EHPA member	Manufacturer of the heat pumps installed in the 5 buildings.

3. Project description and benefits

Project description (goal, problem addressed, and solution provided by the heat pump)

Peel Passive House's Cold Air Distribution (CAD) project aims to simplify and right-size mechanical systems in ultra-low-energy housing, making Passive House and Net Zero Ready construction more affordable and scalable. Passive House buildings have exceptionally low heating and cooling loads, yet conventional HVAC design practices can result in oversized equipment, redundant systems and unnecessary cost. CAD addresses this mismatch by using

ventilation air already required for indoor air quality to also deliver space heating and cooling, eliminating separate terminal equipment within each dwelling. The enabling technology is an Ecoforest R290 air-to-water heat pump with an unusually broad production temperature range. It can generate approximately 2°C chilled water, allowing ventilation air to meet cooling loads without substantially increasing airflow, while also providing space heating and domestic hot water above 65°C. Five Canadian pilot projects are implementing CAD alongside a two-year technical monitoring program. Thermal energy, electrical loads, indoor and duct conditions, airflow states, and on-site weather conditions are being monitored to establish real-world performance and load data for Canadian ultra-low-energy buildings. This evidence will help validate design assumptions, optimize future systems, and demonstrate a scalable, low-GWP, heat-pump-enabled approach to high-performance housing.

Expected or achieved benefits

CAD's primary expected benefit is simplification: one versatile heat-pump plant provides all space heating, cooling and domestic hot water, while the ventilation system becomes the heating and cooling distribution network. This can eliminate conventional in-suite fan coils, heat pumps and associated fans, piping, controls and electrical infrastructure—reducing equipment, mechanical space, capital cost and long-term maintenance. The Ecoforest heat pump is central to this approach: its broad operating envelope allows approximately 2°C chilled water for CAD cooling, space heating and high-temperature domestic hot water from the same plant. R290 refrigerant, with its very low Global Warming Potential, further reduces the system's climate impact. A second major benefit extends beyond the five pilot buildings. Each project is instrumented for two years of detailed performance monitoring. Heat meters measure heating, cooling and DHW energy; electrical circuit monitors characterize internal loads; sensors monitor indoor and duct conditions; system data records airflow operating states; and on-site weather stations record the outdoor conditions driving building loads. Together, these measured data will create a valuable Canadian dataset linking actual weather, internal gains, system operation and delivered energy. This evidence can improve load assumptions, equipment sizing and HVAC design—helping replace conservative oversizing with systems based on measured real-world performance.

Obstacles/barriers encountered during development

One of the project's fundamental barriers is a lack of measured Canadian data for HVAC design in Passive House and other very-low-load buildings. Conventional load calculations and design practices can significantly overpredict demand, yet designers have limited local performance data with which to confidently reduce equipment capacity. CAD also presents a technical challenge: sufficient heating and cooling must be delivered using the relatively low airflow already required for ventilation. Cooling is particularly demanding because simply increasing airflow increases fan energy and duct sizes. The solution therefore requires very cold chilled water, careful coil selection, and management of supply-air temperature, mould and condensation risk. Finding heat-pump technology capable of meeting these competing requirements was another barrier. The selected Ecoforest R290 air-to-water heat pumps provide the unusually broad operating envelope required for very-low-temperature chilled water, space heating and high-temperature domestic hot water from a common plant. To address these uncertainties rather than simply design around them, each pilot has been extensively instrumented. Two years of monitoring will allow measured heating, cooling and DHW demand and loads, internal electrical gains, airflow states and indoor conditions to be correlated with on-site weather data. This will enable actual building and heat-pump performance to be compared directly with design assumptions and inform future low-load HVAC practice.

Why should this project win an award?

What is surprising about Cold Air Distribution is not simply that a heat pump heats and cools a Passive House—it is how much of the conventional HVAC system the right heat pump can make unnecessary. The Ecoforest R290 air-to-water heat pump can produce approximately 2°C chilled water for cold-air cooling, provide space heating, and generate domestic hot water above 65°C. This unusually broad operating range allows ventilation air already required for healthy indoor conditions to become the building's heating and cooling distribution system. Instead of adding equipment, CAD asks how much can be removed. But the project is also designed to answer a bigger question: how much HVAC capacity do ultra-low-energy buildings actually need? Five Canadian pilot buildings are becoming living laboratories. For two years, heat meters, electrical circuit monitors, indoor and duct sensors, airflow operating data and on-site weather stations will measure what is happening inside the buildings, how the systems respond, and the real outdoor conditions driving those loads. This creates something still lacking in Canada: detailed real-world data connecting weather, occupancy-related internal loads, HVAC operation and actual heating and cooling loads in Passive House buildings. This project therefore combines heat-pump innovation with evidence—not just demonstrating a new system, but generating the knowledge needed to design simpler, smaller and more affordable heat-pump-based mechanical systems at scale.

4. Technical specifications

Capacity of unit(s)	3-unit multifamily building (Toronto, ON): single 1-7kW unit 3-unit multifamily building (Windsor, ON): single 1-7kW unit 3-zone single family house (Calgary, AB): single 1-7kW unit single family house (Savona, BC): single 1-7kW unit 4-unit multifamily building (Victoria, BC): single 3-18kW unit.
Energy sources used	All installations run on electricity.
Coefficient of Performance (COP)	Seasonal COPs across the 5 projects, as modelled by the PHPP energy modelling software. Includes impact of project specific buffer capacity, monthly average temperatures and actual building loads. Heating COP: 3 to 3.4 Cooling COP: 4.5-6.6
Service provided	Heating, cooling, and domestic hot water.
Refrigerant type	R-290

Heat pump details (compressor technology, heat exchanger, system configuration)

Compressor technology: Inverter-driven variable-speed scroll compressor System configuration: Single-stage vapour-compression cycle, reversible air-to-water monobloc heat pump with continuously modulating compressor and active cooling Heat exchanger: Integrated refrigerant-to-water condenser/evaporator and outdoor air-to- refrigerant heat exchanger; construction/materials to be confirmed by manufacturer Project configuration: All five projects have a single outdoor unit paired with a single indoor unit. The indoor unit houses the brains and distribution flow control (3-way valve for switching from heating/cooling to DHW, heat exchanger for separate anti-freeze concentrations, circulator).

5. Renewable energy integration and grid response

Integration of renewable energy sources

N/A

Response to energy demand / smart grid integration

The Cold Air Distribution system is designed to respond dynamically to the exceptionally low and variable loads of Passive House buildings. Ecoforest ecoAIR+ PRO heat pumps use inverter-driven scroll compressors, allowing output to modulate with demand rather than relying on simple on/off or fixed-stage operation. Heating and cooling delivery through the ventilation system is also demand-responsive, with airflow adjusted between operating states as space-conditioning requirements change. The system architecture also creates opportunities to shift thermal demand rather than requiring heat-pump operation to coincide exactly with building demand. Domestic hot water storage provides inherent thermal storage, while one pilot project extends this concept by pairing the Ecoforest heat pump with a Sunamp phase change thermal battery. Heat can therefore be generated and stored for later use, separating the timing of electricity consumption from the timing of hot-water demand. This provides a foundation for future demand-response and smart-grid strategies. Heat-pump and thermal-storage operation could be scheduled around electricity prices, grid carbon intensity, renewable-energy availability or peak-demand periods while maintaining occupant comfort. The five-project monitoring program will provide detailed data on thermal loads, electrical loads, weather conditions and system operating states, helping quantify how much flexibility low-load buildings can offer and informing future load-management strategies.

6. Innovation, monitoring and replicability

General (all awards)

Why the project is innovative *(all awards)*

The innovation is not a single new component, but a new way of combining existing technologies around the unique characteristics of ultra-low-energy buildings. Cold Air Distribution challenges the conventional approach of providing separate ventilation, space-heating, space-cooling and domestic-hot-water systems. Instead, ventilation air already required for indoor air quality becomes the heating and cooling distribution medium. This can eliminate conventional in-suite terminal equipment and associated piping, fans, controls and electrical infrastructure. The Ecoforest R290 air-to-water heat pump is the enabling technology. Its unusually broad operating envelope allows the same heat-pump plant to produce approximately 2°C chilled water for cold-air cooling, provide space heating, and generate domestic hot water above 65°C. Its natural R290 refrigerant also has exceptionally low global-warming impact. The project combines this technology with highly efficient Passive House envelopes, demand-responsive airflow and, in one pilot, phase change thermal-battery storage. Equally innovative is the project's approach to validation. Five Canadian buildings are being used as living laboratories through a two-year monitoring program. Rather than simply demonstrating that CAD can work, the project is generating the measured load and operating data needed to refine the concept, validate design assumptions and develop a repeatable approach to right-sized HVAC systems for future low-energy buildings.

Monitoring approach (performance, cost, and carbon targets) *(all awards)*

Each of the five pilot projects is instrumented for two years of detailed performance monitoring, allowing the complete heat-pump and CAD system to be evaluated under real operating conditions. Heat meters measure delivered energy for space heating, cooling and domestic hot water, while dedicated electrical monitoring records system electricity consumption and internal building loads. Together, these measurements allow actual whole-system seasonal COP to be calculated rather than relying on laboratory-rated heat-pump performance. Indoor and duct temperatures, IAQ conditions, airflow operating states and on-site weather conditions are also

continuously monitored. Combining these data streams allows energy use and seasonal efficiency to be correlated with actual weather, internal gains, building loads and system operating modes. With five projects in different Canadian climates, the study can also evaluate how system performance changes with climate and operating conditions. The resulting dataset will be used to verify energy, cost and carbon targets, optimize controls, compare measured loads against design assumptions, and improve equipment sizing. More broadly, it will provide much-needed measured performance data to support better HVAC design for future Canadian Passive House and low-load buildings.

For Large Heat Pump or Building Solutions Award

Why the project serves as a model for others *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Potential for expansion to other locations/industries *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Barriers to replication elsewhere *(Large Heat Pump or Building Solutions Award)*

No answer provided.

Business opportunities for expansion, licensing, or commercial production *(Large Heat Pump or Building Solutions Award)*

No answer provided.

For Innovation Award

Technology/technique developed solely for this project *(Innovation Award only)*

Yes. The Cold Air Distribution (CAD) approach and its controls integration have been developed and refined specifically through this project. Rather than developing a new heat pump, the innovation is the system-level integration of an R290 air-to-water heat pump, ventilation-based heating and cooling distribution, DHW production, and demand-responsive controls for ultra-low-load buildings. The five pilots are being used to test and refine this approach for broader application.

Differentiation from state-of-the-art solutions & market maturity *(Innovation Award only)*

Conventional high-performance buildings typically use separate systems or terminal equipment for ventilation, heating and cooling. CAD instead uses the ventilation system for space-conditioning distribution, enabled by the Ecoforest heat pump's unusually broad production-temperature range. The project is currently at the pilot/early commercial deployment stage, with five real-world installations across Canada. Two years of monitoring and operational experience will be used to validate performance, refine controls and design practices, and develop a more standardized, repeatable solution for future projects and scaling.

Regional benefits (energy savings, emissions, jobs, infrastructure) *(Innovation Award only)*

The project supports the transition to efficient, all-electric buildings by demonstrating a potentially lower-cost and less complex approach to Passive House HVAC. Benefits include reduced energy demand, emissions reductions, elimination of on-site fossil-fuel combustion, very-low-GWP R290 refrigerant, and potentially lower construction and operating costs. The five Canadian pilots also generate locally relevant performance data across different climates and building types. This knowledge will benefit designers, contractors, housing providers and

policymakers by improving HVAC sizing and design practices for future Canadian low-energy buildings.

Commercial potential *(Innovation Award only)*

The commercial potential lies in turning CAD from a custom design approach into a repeatable HVAC solution for Passive House and other ultra-low-load multifamily buildings. The concept uses commercially available heat pumps and ventilation equipment, reducing the need for entirely new manufacturing infrastructure. Data and lessons from the five pilots can support standardized design methods, controls strategies and equipment configurations that reduce engineering effort and facilitate wider adoption. The greatest opportunity is scaling the approach to larger multifamily developments, where eliminating distributed terminal equipment and consolidating mechanical systems could provide significant capital, space and maintenance savings.