

Case Study 5

The Meridian Cove – Vancouver

Decentralized, through-wall Air Conditioner & Heat Pump with integrated fan coil

Building Description

Address	2201 Pine Street, Vancouver
Ownership	Condo, Strata Council
Type of Building	Mid-rise multi-unit residential
Year of Construction	1991
Number of units	125

Constructed in 1991, the Meridian Cove is an 11 storey, 125 unit, concrete frame residential building in Vancouver's Fairview neighbourhood. It is a luxurious condo with a faceted, brick veneer facade with bay windows and a terraced roof plan. The building has electric baseboard heating but no air conditioning.



East side of the Meridian Cove

Challenge

Like many condos, the south and west facing units in particular require cooling during the summer; by contrast, the north and east facing units are hard to keep warm in the winter. The Meridian Cove's window frames are badly insulated which encourages air leakage and the development of interior winter window condensation. Window condensation is a common problem that can ruin window-frame finishes, lead to mould growth on windowsills, and low indoor air-quality.

In the fall of 2015, a few Meridian Cove unit owners, who suffered from excess heat, discussed examining the technological evolution of air conditioning units for potential implementation in their suites. Conventional air conditioning units have been unpopular among condos due to lacking outdoor space, noise from the outdoor compressor, and their outside appearance. At the Home Show in the spring 2016, one of the residents came across a new, innovative product that had the potential to provide both cooling and heating needs.

Solution

The Innova 2.0 is a combined air conditioning and heat pump unit that can cool rooms in the summer, heat them in the winter, and dehumidify all year round. It is a unique through the wall product that functions



Innova 2.0 unit installed on an exterior wall at a Meridian Cove condo unit.

Outside duct holes with vent covers and a small drain pipe on the balcony of the condo unit (vent covers not yet painted).

without the need of an outdoor compressor unit, thereby saving money on installation costs. Mounted on an exterior wall, the Innova 2.0 simply requires two duct holes of 162 mm each (6.4 in). To minimize their aesthetic appearance, the duct holes are disguised with vent covers that are available in many different styles and colours to fit the building exterior.



Innova 2.0 unit installed in a condo unit at the Meridian Cove.

Strata Decision Process

The unit owner took the product information back to the Strata Council which consequently organised two informational meetings with the Innova supplier. During the meetings, interested owners received equipment demonstrations to check their cooling effectiveness and operating noise.

During the summer 2016, a few more meetings were held to determine how many unit owners were interested, and discuss installation considerations. The costs and benefits of the Innova product were compared to traditional ductless minisplit air conditioning units.

The Strata Council's biggest concerns were how the appearance of the building would be altered, how to ensure consistent placement and appearance of the duct holes, and how to minimise potential noise impacts on neighbouring units. Instead of mandating unit owners which brands or technologies they had to choose, the Council developed a set of rules that unit owners now have to comply with should they wish to install air conditioning or additional heating:

- Each installation has to be approved by the Council prior to making any modifications; the approval process verifies the choice and placement of the equipment.
- Installations have to be carried out by qualified installers (electricians).
- Proposed equipment is not allowed to significantly affect the exterior of the building and has to stay below specified noise levels.
- Two types of technologies were pre-approved by Council that meet all the specified criteria (Innova 2.0 and ductless minisplits). To avoid reviewing each technology on a case by case basis and expedite the approval process, unit owners can choose from these two technologies.
- The unit owner has the ultimate responsibility to ensure the equipment is correctly installed and take care of potential repairs should there be any damage.

In addition, minor modifications to the Strata bylaws were required. These changes consisted of deleting a bylaw section that stated that no air conditioning units could be retrofitted. Instead, it was specified that installation of air conditioning, or similar apparatus designed to improve the air flow cooling and heating was possible but prior approval by the Strata Council was required. Describing the process to be followed was easier

than specifying the technical requirements. All in all, the consultation and approval process took six months and the bylaw changes were ratified at the Annual General Meeting in September 2016.

Project Details

Technology	Heat Pump & Air Conditioner
Make & Models	Innova 2.0 with integrated fancoil Innova 2.0 Elec with integrated electrical heater Innova 3.0 with condensate vaporizer
Year of Completion	Dec 2016
Equipment Cost	\$ 3,200 - \$ 3,500
Installation Cost	\$ 500-\$ 1,000
Annual Maintenance Cost	\$ 80
Voltage (V)	110 or 220
Maximum Noise (dB)	27
Energy savings (kWh) Q1/2017	609
GHG (kg CO2e) Q1/2017	6.7

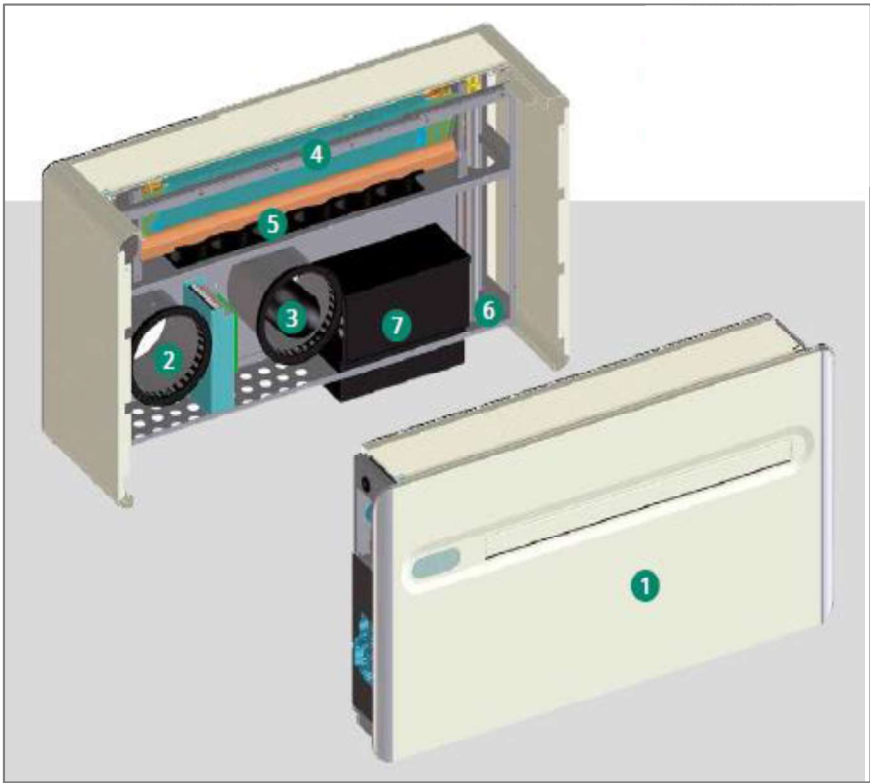
Product Options

Innova 2.0 comes in two different sizes and voltage options: (1) 9,000 BTU for smaller rooms below 700 sq ft; (2) 12,000 BTU for rooms about 700 sq ft. Both sizes are available in 110 or 220 voltage. All 2.0 units are manufactured as heat pump units which includes a drain pipe for condensation. Draining the condensate expelled by heat pumps can sometimes be a problem, particularly in retrofit applications. There are therefore two options, should drainage not be available:

1/ The heat pump function can be deactivated through the control. In this case, the unit will act as a cooling device only; it can still provide heating in the winter through the fan coil, albeit with less efficiency and providing lower energy savings.

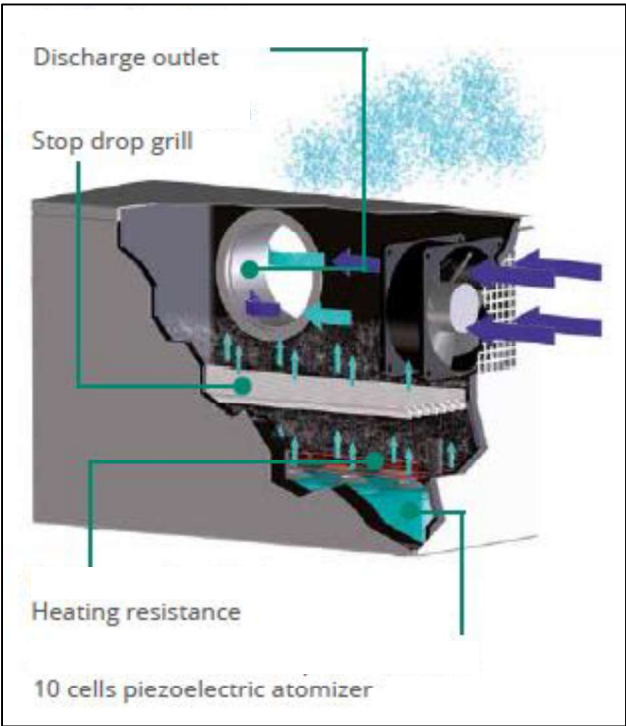
2/ The better solution is to add a condensate vaporizer, “3.0”, to the standard model. In this case, water condensation is brought into the unit and atomized by a system using piezoelectric cells. It is then sprayed out through the exhaust air hole of the unit by a microfan. Such fitting can only be done at the factory and needs to be pre-ordered. The additional 3.0 condensate nebulizer is installed within the unit and requires no additional hole in the wall.

Another product option is the 2.0 Elec that includes an integrated electrical heater for colder climates or in applications where the floor area exceeds 700 sq ft. In this version, the heat pump is integrated with a 1 kW electric resistance heater that intervenes automatically when outdoor temperatures are low (up to -7 °C).



- 1...Innova 2.0 unit
- 2...Air inlet extension 2.0
- 3...Air outlet extension 2.0
- 4...Heating water coil
- 5...Heating fan
- 6...Hydraulic connections
- 7...Condensate vaporizer 3.0

Innova 2.0 cross section diagram.



3.0 Condensate vaporizer.

3.0 Condensate vaporizer cross section diagram.

Electrical Installation

There are two installation options available to connect the unit to the electrical supply:

1/ The appliance is equipped with a power cord and plug that are fully compatible with standard electrical supplies in buildings (applicable to all product options). All that needs to be done is inserting the plug into a nearby socket.

2/ To avoid an external power cord, it is possible to connect the appliance through an existing or new electrical cable inside the wall (recommended for installations in the upper part of the wall).

The average electricity consumption of the Innova 2.0 in heating mode is 720 Watt and 730 Watt in cooling mode which is roughly equivalent to a small microwave oven. The addition of electric resistance in the Innova 2.0 Elec model does not add any electrical consumption. The table below provides a comparative view of approximately how much electricity the Innova units and common household appliances use.

Electrical Appliance Usage Chart		
Appliance	Approximate Wattage	
Innova 2.0 unit sizes	9,000 BTU	12,000 BTU
Innova 2.0 in heating mode	638	720
Innova 2.0 in cooling mode	630	730
Electrical Heater (portable)	1500	
Ceiling Fan	60	
Air Conditioner (portable)	1050-1300	
Clothes Washer	500	
Microwave Oven	600-1000	
Hair Dryer (portable)	1000-1800	
Kettle	1200-1500	

Source Appliance Wattage: Toronto Hydro Appliance Usage Chart, 2017

Costs

Equipment costs are about \$3,200 to 3,500/unit, depending on the size, with an additional \$500-\$1,000 for the installation. Adding the electric resistance heater in the 2.0 Elec model increases the equipment cost by about \$500. In terms of maintenance requirements, users are supposed to wash the air filters on a monthly basis. Chemical cleaning by a professional should be conducted annually at a cost of about \$80.

At the Meridian Cove, condo owners were able to negotiate a discount on the normal equipment price. Residents chose different equipment options: (1) heat pump mode with outside drainage, (2) cooling mode with fancoil only, (3) heat pump with condensate vaporizer. Installations took place in the fall 2016. Out of about 35 interested unit owners, 25 have so far installed the product. Due to the brick walls and the different levels and access to the building, a swing stage was required. This made the installations weather dependent and slightly more complex than at other condos. In some cases, the Innova product replaced electric baseboards, in others they were left in place. No suite required an electrical upgrade; connections from previous baseboards or existing electrical outlets in the walls could be used.

Energy Savings

It is still early to draw conclusions on energy savings that result from the installations at the Meridian Cove since they were only completed six months ago. One of the north facing unit owners, however, who used the

equipment in the heat pump mode all winter, achieved energy savings of 609 kWh in the first quarter of 2017 compared to 2016, despite the cold winter. This resulted in greenhouse gas savings of 6.7 kg of CO₂e and a reduced electricity bill of \$53 for the same period. In this particular suite, the standard Innova 2.0 unit is installed in a large open space (combining living room, kitchen, and hallway); the appliance is therefore heating a larger floor area than it is designed for. Energy savings would likely be higher in an appropriately sized room. Historically, condo owners requiring summer cooling have been using fans and portable air conditioners. The Innova unit therefore does not introduce a new summer cooling load but rather provides a more energy efficient way to chill the suites.

Overall, energy savings were not the primary motivation of the condo owners for the installations of the HRVs but rather improving the comfort of the suites and reducing window condensation. Energy savings will be highest when the appliance is adequately chosen for the room size and in suites that use the appliance in heat pump mode during winter times, thereby reducing the need of electric resistance heating. In suites that did not use air conditioning devices prior to the installation, annual energy savings will likely be diminished by additional cooling loads in the summer.

User Experience & Recommendations

“I would recommend the technology to others if they need cooling in their apartments or better heating. The Innova equipment is certainly worth it. It is quiet and you can run it in cooling mode only, without using the compressor. Removing excess humidity from the air is another big advantage. There are few other options available that are so efficient and that look good,” explains one of the Meridian Cove residents.

So far, the owners have been satisfied with the performance of the equipment and report that the noise level is minimal. In large open spaces a second unit on the opposite side of the room could be beneficial since one unit might not be enough to keep large spaces warm in the winter. Moreover, the small outside drain pipe can freeze should temperatures drop in the winter. The solution is to wrap foam or heat tape around the pipe.

Meridian Cove residents have another piece of advice for other interested condo owners: *“Find the engineers in your building and the people who are interested to form a small committee of leaders who will drive the project forward. Strata Council members will likely not have technical knowledge, so identifying individuals with expertise who act as liaison and advisors is very helpful. Otherwise, it is easy for the Council to get bogged down in daily issues.”*

Applicability

This combined heat pump and air conditioning unit can be widely applied to multi-unit residential buildings, townhouses, single family homes, and hotels. Many condos and apartment buildings in the Lower Mainland suffer from excess heat in the summer and rising heating demands in the winter due to poor windows and insulation. The Innova 2.0 and similar technologies could provide viable retrofit solutions to alleviate these challenges. The space heating savings will have greater greenhouse gas reduction for buildings with gas heating systems.

Limitations

This type of equipment has a number of limitations that might come into play depending on building specificities:

- Sufficient exterior wall space is required which can sometimes be difficult in retrofit applications. In particular, condos with full floor to ceiling windows and balconies might have limited available exterior wall space.
- For the Innova 2.0 to function in heat pump mode a drain is required for condensation. Suites that don't have an existing nearby drain or that don't have a balcony or deck with a drain can add a condensate vaporizer to the standard model.

- Additional electrical lines to the equipment might have to be installed which would add cost to the installation.
- In buildings that previously had no cooling and where units did not already use less efficient cooling methods, energy savings may be diminished by the introduction of additional summer cooling loads.
- While the Innova 2.0 provides a cost efficient technology that is generally cheaper than comparable products, affording the installation may not be financially feasible for all condo unit owners and landlords.