



ASHPs in Cold Climates

South Hero, Vermont

GENERAL INFORMATION

Homeowners : The Bartle Family: Matt & Kristen, Cameron, Milo & Elizabeth

Location: South Hero, VT

Year Built: 2018

Home Characteristics: Single family home with views of Lake Champlain

Square Footage: 3,500 conditioned square feet

HVAC System in Previous Home: Fuel oil with hydronic baseboards

New ccASHP System:

- Outside condensing unit (42,000 BTU)
- Three one-way ceiling cassettes (12,000 BTU)
- One indoor compact ducted unit (12,000 BTU)
- KUMO cloud on all 4 units.

however, had a traditional fuel oil and hydronic baseboard heating system. In 2015, Matt took a zero net energy building class, and he and Kristen decided to implement what he learned a few years later when building their new home that would better accommodate their growing family of five.

PROJECT OVERVIEW

In 2018, Matt and Kristen Bartle began construction on a new, super insulated, high performance house on their beautiful lakeside lot in South Hero, Vermont. Their goal was zero net energy.

South Hero is a town of 1,700 people located on South Hero Island in Lake Champlain. It is predominantly an agricultural community, with a long history of dairy farms and apple orchards. South Hero's picturesque location in Northwest Vermont also makes it a popular summer tourist destination. The beautiful summers are complemented by bitterly cold winters, with average low temperatures in the teens during January and February. The Bartle family's new home utilizes a cold climate air source heat pump (ccASHP) system to keep the home comfortable despite the frigid winter temperatures.

Before building their current home, the Bartle family lived in nearby Colchester, Vermont. In that home, the family got on the path towards lower energy use and greenhouse gas emissions (GHG) by participating in a third party-owned solar energy system that offset their electric costs. The home,



Matt and Kristen built their new home to be extremely well-insulated, with several inches of rigid foam insulation under the home's slab, slab edge and basement walls, plus dense pack cellulose and loose fill insulation throughout the house. They also kept a keen eye on air sealing during construction. To allow for a healthy, breathable interior in such a tight home, the homeowners installed an Energy Recovery Ventilation (ERV) unit that collects heat and moisture while ventilating the home.

Thanks to the insulation and thorough air sealing, the home has a lower heating and cooling load than typical for a 3,500 square foot home. This, combined with lower cost and fewer GHG emissions than fuel oil, made a ccASHP system the perfect fit to meet the home's entire load for both heating in the winter and cooling in the summer. The homeowners added a wood stove as a back-up heating source in case of winter power outages, and for comfort and ambiance. The homeowners have confidence, however, that the ccASHP system could keep the house comfortable on its own even with temperatures below zero, and expect to burn just one cord of wood this year.

The Bartle's ccASHP system includes a 42,000 BTU outdoor condensing unit, plus three ductless ceiling-mounted units and one compact ducted unit upstairs. The compact ducted unit is hidden in the master bedroom closet and supplies all three of the home's bedrooms. The compact ducted unit in the closet required only a 10 inch ceiling drop, and the ceiling-mounted units are unobtrusive. Matt and Kristen are able to control all of the units with the Mitsubishi KUMO cloud system. The family also installed a Sanden heat pump water heater with an outdoor condensing unit that is very efficient and doesn't add to the cooling load inside the building envelope. Installation costs for the ccASHP system were about \$25,000, with Efficiency Vermont providing a rebate of \$400 per head.



The Bartle family shared that in their first year with the ccASHP system, there was no shortage of heat in the winter, and the dehumidify mode kept the house comfortable even during the dog days of summer. To take another step on their path towards zero net energy, the family installed a roof top solar array that is on track to generate about 1.1 MWh of electricity this year. This should more than meet the home's annual electric needs, even with an HVAC system that solely uses electricity.



With their new home's insulation and air sealing, ccASHP HVAC system, and solar panels, the Bartle family's new home is an excellent example of how a dream of zero net energy living can become reality, even in northern Vermont's harsh winter climate.