ASHPs in Cold Climates

Belmont, Massachusetts

GENERAL INFORMATION

Homeowners: Bonnie Friedman & David Merfeld

Location: Belmont, MA

Year Built: 1890, with additions in 1948, 1964, and 2008

Home Characteristics: Single family, two-story home plus partially-finished basement

Square Footage: 4,700 conditioned square feet

Previous HVAC System: Heating source = Two fuel oil forced air furnace systems. No A/C.

Current HVAC System: Three centrally-ducted air source heat pump systems to service each wing, plus a ductless mini-split heat pump in apartment. No HVAC back-up in place.

PROJECT OVERVIEW

Bonnie Friedman and David Merfeld's historic home in Belmont, Massachusetts is perched high on Belmont Hill, accessible from a steep, single-lane, winding private road adjacent to Belmont Center. Built in 1890, the sprawling 4,700 square foot home is visually stunning both inside and out. The large, open living areas are filled with colorful art and sculptures from the homeowners' many travels, giving the home a charming, eclectic character. The sizable, one-acre lot lends a secluded ambiance to the property, which features walking paths, an enormous (1,768 square foot) wrap-around deck with outdoor kitchen and covered dining area, a treehouse with wood storage, and a large composting area. Perhaps surprisingly given its age and size, the home is exclusively heated and cooled with three centrally-ducted air source heat pump (ASHP) systems and one ductless mini-split ASHP system.

The main part of the home was built in 1890, with two additions completed before Bonnie and David purchased the home in 2002: one in 1948 to add a private suite/in-law apartment, garage and driveway, and another in 1964 to expand the living area. When Bonnie and David purchased the home, it had two fuel oil forced air furnace HVAC systems servicing the original footprint and the 1964 addition, while the 1948 apartment addition was heated with electric resistance units.

In 2008, Bonnie and David designed an addition of their own to add a large upper-level sunroom looking over the Boston skyline and a lower-level recreation room. After evaluating their HVAC needs for the addition, they decided to install a centrally-ducted ASHP system manufactured by Acadia. This decision was driven by their desire to begin moving away from heating with oil, and the unavailability of natural gas on their private street. While ASHPs were not commonly used for heating in the Northeast region in 2008, Bonnie and David had a very good experience with the performance of the Acadia system from the start.

Thanks to this positive experience, the couple decided to install another centrally-ducted ASHP system to service the oldest part of the house when there was irreparable damage to the fuel oil furnace in 2015. Since Acadia had gone out of business by this time, Bonnie and David received multiple quotes for ASHP systems from different manufacturers. Sagewell, an energy consulting company based in Arlington, Massachusetts, helped them evaluate the quotes from an energy efficiency standpoint in order to qualify for available rebates. Ultimately, they installed a centrally-ducted Carrier Greenspeed system, which has worked very well to keep the main part of the house comfortable in all weather conditions. At this time, they also installed a ductless mini-split ASHP system in the 1948 apartment addition (the sole area not served by ducts) and insulated the home with blown-in insulation.

Buoyed by the strong performance of the second ASHP system, Bonnie and David decided to eliminate fuel oil heat entirely. In 2017, they installed a third centrally-ducted ASHP system manufactured by Bryant in the final wing of the house (the 1964 addition). With this retrofit, Bonnie and David were able to dispose of their remaining oil tanks and bring A/C into their bedroom. Their home is now entirely conditioned by ASHP systems without the use of any back-up fossil-fuel HVAC systems. The systems keep up with all but the most extreme weather conditions. The homeowners also enjoy the flexibility of the Wi-Fi controlled thermostats, which allow them to adjust the temperature and humidity while they are traveling, or simply without walking across the home when they are in town.

To help offset their increased electricity needs due to the ASHP systems, Bonnie and David installed a rooftop solar array in the summer of 2016. The solar generation is more than enough to cover their electric needs in the summer, and they are able to sell their excess solar generation back to the grid. The solar generation does not fully meet their winter electric load, but the single electric bill for heating and all of their other electric needs is less costly than the $1,000 per month fuel oil bill plus electric that they paid while heating with oil.

Bonnie and David's home is a great example of how centrally-ducted ASHP systems can successfully and relatively affordably heat and cool even a very large, historic New England home.