



Next Generation NetZero Housing in Boulder, Colorado

Case Study



BOSCH

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Geothermal & Water Heater Heat Pumps

Net Zero Home in Washington Village

Project Goals:

- ▶ Sustainable comfort in all-electric homes
- ▶ Heating, cooling and domestic hot water
- ▶ NetZero design with small equipment footprint



Bosch Compress heat pump water heater (right) provides DHW, and geothermal heat pump (left) provides space heating and cooling.

Background

The first Net-Zero energy all-electric single family home was completed on the Washington Village site in Boulder, Colorado. The first prototype Net Zero energy home design was custom tailored for its owners, Darrell & Kathy Icenogle, who wanted a high quality compact home designed for low impact urban living. This is the result of a unique collaboration between a talented and experienced design-build team including Cornerstone Construction, Geos Development, Pel-Ona Architects and Urbanists, Sustainably Built, and Wonderland Hill Development Company (WHDC). Washington Village is expected to be a LEED certified neighborhood project that demonstrates sustainability not only by its green and energy features, but also because its preservation of the historic Washington School building, and its commitment to alternative transportation with a central Boulder location convenient for busing, walking and biking access to all of Boulder's amenities.

Installation Summary

The 3,700 sq ft home features an extremely efficient building envelope and passive solar design that keeps annual heating requirements at 17.6 million Btu and peak heating loads at 15,000 Btu/hr, which is roughly 77% less than if the same home was built to typical building codes. The annual cooling requirements are only 8.2 million Btu (60% better than if built to code) and peak cooling loads are only one ton. By reducing the heating loads to these levels, the house can be conditioned with much smaller equipment, making the overall project more affordable. With ground source heat pump systems, the drilling

cost is typically half of the total installed cost for the system, and that drilling cost is directly tied to the heating and cooling loads. A 1-¼ ton Bosch BP015 water to air heat pump connected to a single 300 foot vertical bore hole utilizing double U-bend pipes provides all of the necessary heating and cooling for the home. A Bosch Compress HP 200 heat pump water heater provides domestic hot water.

“The home has proven extremely comfortable and has far exceeded the expectation of the owners.”

Benefits and Conclusion

Based on Boulder climate data this home is modeled to draw about 4000 kWh annually for ventilation, heating, cooling and DHW combined. With an additional 5000 kWh estimated annually for plug loads, lighting and appliances, the installed 7.5 kW PV system will cover the annual demand, making this home Net Zero. The homeowners are quite happy with the DHW performance and minimal cooling of the mechanical room is noticeable, proving the effectiveness of heat pump water heaters in heating-dominated climates like Colorado.

Similar systems will be installed in 3000 SF homes in the GEOS Neighborhood which break ground in Q4 2013. Smaller homes such as the 2000 SF town homes have peak heating loads as low as 7,000 Btu/hr and will share a vertical ground loop and a single 5 ton water to water heat pump from Bosch for space heating and DHW combined. The home has proven extremely comfortable and has far exceeded the expectation of the owners.



Darrel & Kathy Icenogle in their kitchen.

Project Name:

- ▶ Net Zero home in Washington Village, Boulder, CO

Design/Build Team:

- ▶ Cornerstone Construction, Geos Development, Pel-Ona Architects and Urbanists, Sustainably Built, and Wonderland Hill Development Company (WHDC).

Equipment Installed:

- ▶ Bosch BP015 1-1/4 ton water to air geothermal heat pump and Compress HP 200 heat pump water heater

Installer:

- ▶ Heatmiser, Golden, CO

Completion Date:

- ▶ Dec 2013