

Air-Tight Home — Jeffery Residence

Project Data:

Home Owner & Builder: Kent Jeffery

Location: Wabasha, MN

Style: 1.5 Story w/ Full Basement

Size: 5 bd, 5,558 sq ft

Climate Zone: IECC 6

Completion: May 2017



Overview:

Smart and patient. This home was built with as much thought as one should be putting into their dream home. Built by the home's owner, Kent Jeffery, every detail was thoroughly researched and implemented over a period of a few years. The end result was an extremely air-tight and energy efficient home.

When asked what the overall goal was for the construction of the home, Kent replied, "Make my wife happy." His other main goal was to build a home that would be low maintenance with a low utility cost.

The most notable aspect of this home is its air tightness with an astounding 0.32 ACH50. Testing was done at the insulation stage to identify areas for improvement, which was able to drop the CFM50 results by almost 50% going from 551 CFM50 to 302 CFM50 tested at the home's completion!

Planning & Design

The building's design is very much custom and quite appealing aesthetically, something that high performance homes can sometimes compromise in order to appease energy efficient practices. The home was designed entirely using Google Sketchup, a 3D modeling software, which allowed Kent to use the sun's orientation and latitude and longitude. While most homes face the street directly, the home was oriented 13 degrees from the street to maximize passive solar design principles. Some of these principles include south-facing windows with higher solar heat gain coefficients to enhance heat gain in the winter and south-facing overhangs to reduce heat gain in the summer.

Takeaways

Thermal imaging was HUGE — Using a Thermal Imaging Camera while the Blower Door Test was running made it easy to find places with air infiltration or "leakage". Kent bought two dozen cans of spray foam to apply after insulation was complete to add to deficient areas or areas that got missed, such as the triple truss location and a geometrically convoluted area. Attention to detail made this home exceptionally air-tight, especially through use of acoustic sealant and multiple cans of spray foam.

Due to exceptional air sealing and insulation, Kent noted that his favorite thing about the home is the consistent indoor temperature and that the home is quiet and comfortable.

Modeled Performance Data:

| | |
|----------------------------|-------------------|
| HERS Index Score | 29 |
| Blower Door Results | 0.32 ACH50 |
| | 302 CFM50 |

Estimated Energy Use:

| | |
|----------------------------|------------------------|
| EUI | 13.8 kBtu/SF/yr |
| Total Annual Energy | 76.7 MMBtu |

51.4% Natural Gas Cost Savings

37.6% Electric Cost Savings

Compared to the 2017 MN EE Code Baseline

Envelope:

Wall assembly features a double plate wall to allow for a combination of closed-cell spray foam and blown fiberglass in both wall cavities and continuously in the space between the walls, thus minimizing all thermal bridging. Foundation walls were built using Insulated Concrete Forms, and attics consist of blown fiberglass insulation with blown insulation at sloped ceilings.

Heating & Cooling

This home relies on our Earth for heating and cooling, utilizing a WaterFurnace brand geothermal system. The geothermal system heats and cools the home through forced air distribution and provides a portion of the hot water for the home.

Although a Natural Gas Furnace was installed as a supplemental heating source for extreme winter conditions, it has yet to be utilized after the first full winter the home was occupied.

Water Heating

An indirect tank connected to the geothermal system pre-heats the water to 105-110 degrees, which then circulates to the second tank, an electric water heater. However, the electric water heater is the sole source for water heating in the summer, leading to higher electric bills in the summertime.

Ventilation

A Venmar HRV handles bringing all the necessary fresh air into the home. Due to sizing requirements, Kent sets his HRV to run only 25% of the time.

Other Takeaways

If Kent could do it all over again, he would install a natural gas water heater rather than electric to lower his water heating cost. He would also add more zones for heating and cooling. The home has three zones, one for each level, but he would prefer to have a zone for roughly every 1,000 square feet of space.



Key Features

| Building Shell | |
|--------------------|---|
| Floors | Slab: R-25.3 Edge, R-10 Under R-27 Cantilever |
| Walls | R-25 Above Grade Walls R-25.2 Foundation Walls |
| Roof | R-50 Ceiling Flat R-54.9 Vaulted Ceiling |
| Windows | Double pane U-Value: 0.29 – 0.32 SHGC: 0.24 – 0.46 |
| Mechanical Systems | |
| Heating & Cooling | Ground-Source Heat Pump WaterFurnace 5 Series 4.5 COP 20.4 EER w/DSH Natural Gas Furnace 96.1 AFUE Programmable Thermostat |
| Water Heating | Energy Saver Electric Residential Water Heater 0.95 EF, 50 Gal. |
| Ventilation | HRV Venmar AVS E15 ECM HRV 117 cfm, 50 watts |
| Miscellaneous | |
| Appliances | Energy Star Appliances Induction Stove |

Published by:

XRG Concepts
Energy Rater
(507) 258-6500
info@xrgconcepts.com
www.xrgconcepts.com

