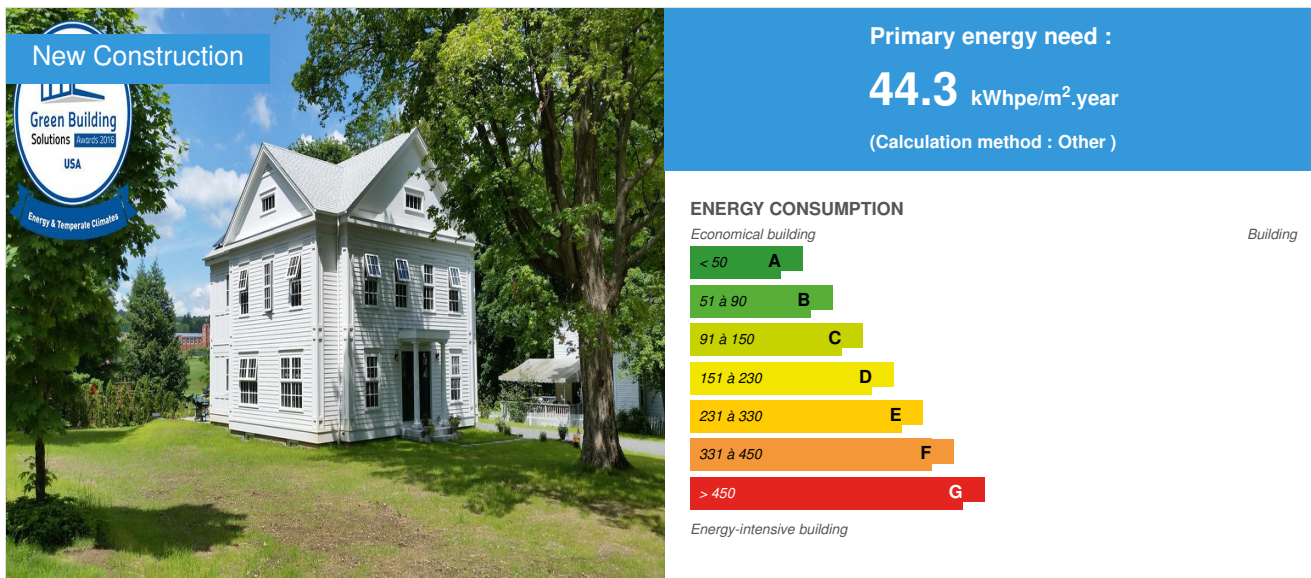


The Taft School Faculty Home

by [Karla Butterfield](#) / 2016-05-10 18:06:57 / International / 12029 / EN



Building Type : Isolated or semi-detached house
Construction Year : 2014
Delivery year : 2015
Address 1 - street : 06795 WATERTOWN, USA
Climate zone : [Dfb] Humid Continental Mild Summer, Wet All Year

Net Floor Area : 361 m² Other
Construction/refurbishment cost : 597 554 €
Cost/m2 : 1655.27 €/m²

Certifications :



General information

This home is an excellent example of design and construction for temperate climates and energy conservation. The Taft School faculty home serves as a high performance residence and learning lab for students. In US climate zone 5, it achieved a HERS 33 excluding PV and with the 13.1 kW the HERS index is -14. Located on a quiet street adjacent to campus the existing, historic home was deconstructed and salvageable materials were donated or reused. Challenged to find high efficiency windows that were historic commission acceptable, the team installed Klearwall awnings or casements over fixed glass (to mimic double hungs) with simulated divided lites (u-values as low as 0.13). A high solar heat gain coefficient (0.58) facilitates the passive solar gain for winter months, while well designed overhangs and pergola shade summer sun. Double stud walls have 2¼" closed cell foam plus 8½" dense pack cellulose for a R-49 cavity. The exterior sheathing is R-6.6 Zip Wall System with taped seams to create the continuous air barrier. Inside the solid concrete foundation is 3" closed cell foam behind 2x4 stud walls and R-32 cellulose in the cavity. Prefabricated TJI joists frame the attic floor, an insulated "room" houses the heat recovery ventilator and ductwork, and blown in cellulose blankets it all in R-86. The house tested 0.6ACH50 proving the effectiveness of its air-tight envelope and attention to air sealing. Heating and cooling is provided by efficient air source heat pumps (9.2 HSPF, 16.5 SEER) and delivered by short duct runs which tested extremely tight. A heat pump

water heater provides domestic hot water and an on-demand switch, with an occupancy sensor at each bath, ensures hot water is delivered fast and efficiently. Low flow fixtures are WaterSense certified, appliances are Energy Star labeled, and all LED lighting. A Zehnder Novus 300 (93.3% efficient) HRV supplies 112 cfm of continuous fresh air ventilation; using only 32 watts of power and runs quietly. The homeowners control the mechanical ventilation through the intuitive wall-mounted control pad to shut off or increase the ventilation. Chemicals and contaminants were reduced by using low VOC and GreenGuard certified sealants, adhesives, primers, and paints. A walk-off mat at the side entry and hardwood floors help control dirt and dust. Storm water runoff from the roof, patio, and driveway is managed by the rain garden and native landscaping is low maintenance. Taft School Director of Environmental Stewardship, Carly Borke has used the design and construction process as a teaching tool for her science classes. With access to the home monitoring system they can virtually access the homes consumption. After 12 months of utility bills the home has produced 9,868 kW more than it's used.

Stakeholders

Stakeholders

Function : Environmental consultancy

The Taft School

Gil Thornfeldt, GilThornfeldt@taftschoool.org

<http://www.taftschoool.org>

Contracting method

General Contractor

Type of market

Realization

If you had to do it again?

The attic air sealing and insulation would have been implemented differently. Spray foam was avoided so the thermal barrier at the attic floor made duct runs and air sealing more difficult.

Building users opinion

<https://www.youtube.com/watch?v=YGIG2LmvEI4>

Energy

Energy consumption

Primary energy need : 44,30 kWhpe/m².year

Primary energy need for standard building : 76,00 kWhpe/m².year

Calculation method : Other

CEEB : 0.0001

Breakdown for energy consumption : Above values are in MMBtu/yr

Heating 5.9 MMBtu/yr,

Cooling 4.9 MMBtu/yr,

Water Heating 3.5 MMBtu/yr,

Lights & Appliances 27.1 MMBtu/yr,

Photovoltaics -58.6 MMBtu/yr

Envelope performance

Envelope U-Value : 0,10 W.m⁻².K⁻¹

More information :

Above Grade Walls U=0.017, Windows U=0.175, Attic U= 0.011

Building Compactness Coefficient : 0,12

Indicator : I4

Air Tightness Value : 0,44

Users' control system opinion : Site Sage Monitoring System

Provides up to 24 electrical circuits to be monitored with web interface; 12 Lutron Radio Ra2 lighting circuits with 2 hybrid keypads; iPad Mini, and in wall docking station. Will act as a central control and monitoring location; Provides temperature and humidly monitoring of HVAC System.

Zehnder Novus 300 is over ridden at central control pad.

Real final energy consumption

Final Energy : -17,20 kWhfe/m².year

Year of the real energy consumption : 2 015

Renewables & systems

Systems

Heating system :

- Heat pump

Hot water system :

- Heat pump

Cooling system :

- VRF Syst. (Variable refrigerant Volume)

Ventilation system :

- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic

Renewable energy production : 142,00 %

Smart Building

BMS :

Since this is a single family residence there is only remote access and monitoring controls through Site Sage and Zehnder

Environment

Urban environment

Located on an existing educational property close to community resources both on campus and in town.

Land plot area : 1 440,00 m²

Built-up area : 100,00 %

Products

Product

Klear Wall Windows

Klearwall Industries

203-689-5404

<http://klearwall.com/newsite/>

Product category : Finishing work / Exterior joinery - Doors and Windows

All our products are engineered with precision and crafted with care to ensure our customers get a superior quality product. Both of the domestic and commercial product ranges are suitable for passive house construction and have been certified by the Passivhaus Institut in Darmstadt, Germany

Combining fixed windows with awnings or casements enabled the team to mimic a double hung and get approval by the local historic commission.



ZIP System Insulated Sheathing

Huber Engineered Woods

andrew.collins@huber.com

<http://www.huberwood.com/contact-us>

Product category : Structural work / Structure - Masonry - Facade

For installation convenience and exceptional, long-term performance, the all-in-one ZIP System® R-Sheathing panel provides a new approach to sealing and insulating the building envelope. One panel delivers thermal, air and moisture resistance, while providing excellent strength and durability.

Double s2x4 studs with 3 1/2" gap already reduced thermal bridging for above grade walls but ZIP System insulated sheathing was chosen for added thermal break plus the long term performance of the sheathing.



Costs

Construction and exploitation costs

Renewable energy systems cost : 50 116,00 €

Total cost of the building : 597 554 €

Subsidies : 7 913 €

Energy bill

Forecasted energy bill/year : 203,00 €

Real energy cost/m² : 0.56

Real energy cost/Dwelling : 203

Health and comfort

Indoor Air quality

Indoor airPlus Certified

Carbon

GHG emissions

GHG in use : -1,20 KgCO₂/m²/year



Methodology used :

REM/Rate Modeling Software CO₂ -1.2 tons/yr, SO₂ -1.7 lbs/yr, NO_x -1.6 lbs/yr

Reasons for participating in the competition(s)

The design and construction can be easily replicated. With an old world charm aesthetic but an open plan and modern amenities it's exciting that this home produces more energy than it uses. As an instructional tool for the environmental science class, the high school students have embraced the process, especially the continued energy monitoring. Occupant use continues to be a challenge; energy monitoring and behavioral changes are part of the solution to living net zero.



Building candidate in the category



Energy & Temperate Climates



Green Building Solutions Awards 2016
powered by  Construction21.org



Users' Choice Award

