TOOLBOX of a CERTIFIED PASSIVE HOUSE CONSULTANT

PHPP, Solar Pathfinder, WUFI, THERM
2) Shading Analysis, the Solar Pathfinder
3) Moisture/Mold Risk, WUFI-ORNL
4) Thermal Bridge Analysis, THERM
OUR PROJECT
A Passive House = 4.75 kBTU/ft.²/yr
1) The Whitchurch PH Cottage, 4.35 kBTU/ft²/yr

Passive House Verification

Building: Lil' House in the Big Woods
Location and Climate: Montpelier, VT
Street Address: Brook Rd
City, State, Zip: Middlesex, VT
Country: USA
Building Type: Timber Frame
Home Owner(s) / Client(s): Greg and Barb Whitchurch
Street Address: Brook Rd
City, State, Zip: Middlesex, VT
Architect: Greg Whitchurch, Chris Miksic, Indigo Ruth-Davis
Street: 405 Camp Rd. PO box 32
City, State, Zip: Calais, Vermont 05648

Calculation Electricity / Internal Heat Gains
Mechanical System: CERV, by Build Equinox
Building Type: Residential

Year of Construction: 2013
Number of Dwelling Units: 1
Gross Enclosed Volume $V_e$: 21130 ft³
Number of Occupants: 3.7
Interior Temperature: 68.0 °F
Internal Heat Gains: 0.7 BTU/hr.ft²

Energy Demands with Reference to the Treated Floor Area
Treated Floor Area: 1400 ft²

<table>
<thead>
<tr>
<th>Specific Space Heat Demand</th>
<th>Applied: 4.35 kBTU/(ft²yr)</th>
<th>Monthly Method: 4.75 kBTU/(ft²yr)</th>
<th>PH Certificate: Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressurization Test Result:</td>
<td>0.60 ACH₅₀</td>
<td>0.6 ACH₅₀</td>
<td>Yes</td>
</tr>
<tr>
<td>Specific Primary Energy Demand</td>
<td>29.1 kBTU/(ft²yr)</td>
<td>38.0 kBTU/(ft²yr)</td>
<td>Yes</td>
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<tr>
<td>(DHW, Heating, Cooling, Auxiliary and Household Electricity):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Primary Energy Demand</td>
<td>14.5 kBTU/(ft²yr)</td>
<td>38.0 kBTU/(ft²yr)</td>
<td>Yes</td>
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<tr>
<td>(DHW, Heating and Auxiliary Electricity):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Primary Energy Demand</td>
<td>0.0 kBTU/(ft²yr)</td>
<td>38.0 kBTU/(ft²yr)</td>
<td>Yes</td>
</tr>
<tr>
<td>Energy Conservation by Solar Electricity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating Load:</td>
<td>3.64 BTU/(ft²hr)</td>
<td></td>
<td></td>
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<tr>
<td>Frequency of Overheating:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Useful Cooling Energy Demand:</td>
<td>0.82 kBTU/(ft²yr)</td>
<td>4.75 kBTU/(ft²yr)</td>
<td>Yes</td>
</tr>
<tr>
<td>Cooling Load:</td>
<td>2.43 BTU/(ft²hr)</td>
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<td></td>
</tr>
</tbody>
</table>
### Building Information

- **Building:** Lil' House in the Big Woods
- **Location and Climate:** Montpelier, VT, No Standard Climate
- **Street Address:** Brook Rd
- **City, State, Zip:** Middlesex, USA
- **Building Type:** Timber Frame
- **Home Owner(s) / Client(s):** Greg and Barb Whitchurch
- **Street Address:**
- **City, State, Zip:**
- **Architect:** Greg Whitchurch and Chris Miksic
- **Street:**
- **City, State, Zip:**

### Calculation Details

- **Calculation Electricity / Internal Heat Gain:**
  - **Mechanical System:**
  - **Building Type:**
  - **Street Address:**
  - **City, State, Zip:**

### Energy Demands with Reference to the Treated Floor Area

- **Treated Floor Area:** 1403 ft²
- **Pressurization Test Result:**
  - **ACH₅₀:** 3.00

### Specific Space Heat Demand

<table>
<thead>
<tr>
<th>Demand Type</th>
<th>Rate</th>
<th>PH Certificate</th>
<th>Fulfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Space Heat Demand</td>
<td>90.94 kBTU/(ft²yr)</td>
<td>4.75 kBTU/(ft²yr)</td>
<td>No</td>
</tr>
</tbody>
</table>

### Internal Heat Gains

- **Interior Temperature:** 68.0 °F
- **Internal Heat Gains:** 0.7 BTU/hr.ft²

### Planned Number of Occupants

- **Planned Number of Occupants:** 2

### Verification

- **Verification:** Monthly Method
- **Verification:** PH Certificate: Fulfilled
- **Verification:** Specific Space Heat Demand: No
- **Verification:** Specific Primary Energy Demand: No

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*We confirm that the values given herein have been Issued on:* 

**Residential**

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*We confirm that the values given herein have been*
Heating load on coldest days = 5,096 BTU/hr = 1494 Watts = Heating system equivalent to 15, 100W light bulbs
2) Use the solar pathfinder to determine shading conditions at future location of windows.
Proper Orientation
-16 Degrees from magnetic north

The term magnetic declination (also known as magnetic variation) refers to the angle between the magnetic north (MN - compass north) and true north (TN - true north) at any given latitude/longitude. The black contour line shows the imaginary line along which the declination is zero (MN and TN converges). The magnetic declination increases as one moves east or west from this line. The red line shows the negative (west) declination contours and the blue line shows the positive (east) declination contours. The degrees of declination required in order to orient the compass with the map is added east of this line and subtracted west of this line. (e.g., 10 degrees east would indicate that MN lies 10 degrees clockwise from the TN). Magnetic declination gradually changes with time and location. The dotted grey lines show the expected annual change in the magnetic declination in arc minutes. The above map is produced from the World Magnetic Model (WMM 2010) for the year 2010.
3) WUFI Hygrothermal Analysis
WUFI-ORNL, vented roof 7 yr.
WUFI-ORNL, unvented 7 yr.
WUFI Pro
10-Year Initial Dry-out
Shows Over 20% Moisture Content In Winter Of 1st Year
Thermal Bridge Free = <.006 BTU/hr.ft.F

Continuous thermal envelope
4) Thermal Bridge =

2D Thermal transmittance modeled in THERM

minus

1D Thermal Transmittance as modeled in PHPP
Foundation Foam = TB?
Foundation Foam in THERM

Reduction Factor

Internal Temperature

External Temperature

Lowest Surface Temp

Ψe (for PHPP)

Images Of Detail

By Chris West, Eco Houses of Vermont
Window connection Mullion = Giant piece of metal = Giant thermal bridge
Plan View of Window Jointing
Mullion In THERM
Thermal Bridge = 0.16 BTU/hr.ft.F
Temperature = 42.6 F
Thermal Bridge = 0.043 BTU/hr.ft.F
Temperature = 49.4 F
Exterior Trim w/ EPS
Thermal Bridge=.039 BTU/hr.ft.F
Performance based design