Attic Retrofits Using Nail-Base Insulated Panels – May project update

Energy Modeling Summary (REM/Rate v15.1) (shading indicates final design)

<table>
<thead>
<tr>
<th>Location</th>
<th>Estimated annual load savings compared to baseline house</th>
<th>Heating</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Michigan</strong></td>
<td>7.5” main panel (R-34), 4.5” addition panel (R-20), 9.26 ACH50 (actual)</td>
<td>16.1%</td>
<td>14.6%</td>
</tr>
<tr>
<td>2.</td>
<td>Same panels as 1, with 7.4 ACH50 (about 20% improvement)</td>
<td>20.8%</td>
<td>13.6%</td>
</tr>
<tr>
<td>3.</td>
<td>9.5” panel (R-43), 4.5” addition (R-20), 7.4 ACH50</td>
<td>21.5%</td>
<td>14.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Georgia</strong></th>
<th>Estimated annual load savings compared to baseline house</th>
<th>Heating</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3.5” panel (R-16), 17.8 ACH50 (actual)</td>
<td>7.0%</td>
<td>8.3%</td>
</tr>
<tr>
<td>2.</td>
<td>3.5” panel (R-16), 14.0 ACH50 (about 20% improvement)</td>
<td>12.6%</td>
<td>11.8%</td>
</tr>
<tr>
<td>3.</td>
<td>5.5” panel (R-25), 14.0 ACH50</td>
<td>13.8%</td>
<td>12.8%</td>
</tr>
<tr>
<td>4.</td>
<td>Same as 2, compared to baseline w/ R13 walls, R19 floor</td>
<td>20.2%</td>
<td>14.2%</td>
</tr>
<tr>
<td>5.</td>
<td>Same as 3, compared to baseline w/ R13 walls, R19 floor (not in report)</td>
<td>21.0%</td>
<td>15.3%</td>
</tr>
</tbody>
</table>

House leakage testing
- Michigan: 29% improvement after installation (6.61 ACH50 test-out vs. 9.26 ACH50 test-in)
- Georgia: 12% improvement (15.69 ACH50 test-out vs. 17.82 test-in).
  - Georgia note: it turns out the walls and floors are very leaky; if the house was a more typical 8.9 ACH50 at test-in (half of actual), the same effort would have provided a 24% improvement.

Feedback
- Overall feedback from the contractors and homeowners is positive
- Preliminary homeowner feedback, GA: house feels warmer; HVAC system operates less
- Preliminary homeowner feedback, MI: house feels warmer and more comfortable

Next steps
- Estimate energy savings – compare this winter to last winter using energy bills and compare to energy modeling results
- Evaluate monitored data – compare measured data to moisture analysis predictions
- Assess detailed homeowner feedback based on survey/questionnaire
- Prepare case studies

Retrofit panel installation: Michigan (left) and Georgia (right)
Additional Georgia photos:
Monitored Data

**Georgia: Moisture conditions at retrofit panels** (sensors installed within panels at OSB skin)
- MC well below 10% (our moisture analysis predicted less than 10% MC in all cases)
- One outlier, within inches of ridge, went to 15% during the winter but then dried

**Georgia: Moisture conditions at original roof deck** (sensors inside attic)
- MC at or below 10% (our moisture analysis predicted less than 10% MC in all cases)
- Outlier (sensor is low, near ceiling): got wet during installation (rained overnight); dried quickly
Georgia: Relative humidity (RH) indoor, outdoor, and attic
- Attic RH (red) tracks indoor RH (blue), particularly during winter months
- Indicates moisture conditions are similar within conditioned space and the now unvented attic

Michigan: Moisture conditions at retrofit panels (sensors installed within panels at OSB skin)
- MC at or below 10% MC (our moisture analysis predicted less than 15% MC in all cases)
- Outliers (two, same panel): panel clearly was wet during installation, then dried
- Note: ventilation mat was not installed; shingles were left on 3 of 4 roof orientations