Minimally Invasive Insulation Field Validation Opportunities

Building Envelope Materials & CertainTeed
With additional field testing by PNNL/University of Minnesota
Building America Program, DOE Building Technologies Office
Addresses the lack of objective performance and cost data that inhibit some technologies from finding their customer base.

DOE helps to identify, install and monitor technology performance in real world installations and then communicates the results to the public via case studies.
Demonstration Objectives

Validate the potential of Selected technology

*Technical Examples*
- Verify energy reduction, associated utility cost savings, peak demand reductions
- Verify occupant satisfaction & installation process feasibility

*Market Adoption*
- Investigate applicability to different building types, sizes and end use systems
- Verify the cost-effectiveness
Host Site Role vs Lab Role

- **Site Role**: Identify candidate buildings, conduct installation, provide information for M&V scope development and during M&V process

- **Lab Role**: Develop M&V Scope, conduct rigorous M&V
Proposed Field Validation Schedule

- Site selection (1-3 months)
  - Interested sites submit candidate building info
  - Building Envelope Materials/CertainTeed site evaluation/selection recommendations
  - DOE & Lab(s) follow up for any additional information
  - Lab(s) finalize site selection and M&V plan

- Technology installation (1-2 months)

- Testing and evaluation (6-12 months)
Benefits of Participation

- Engage in low-risk pilot with installation and deployment managed by others
- Receive independent M&V and an evaluation of benefits, conducted by a DOE National Laboratory.
- Inclusion in a well-supported, high-visibility DOE-funded demonstration program
- Gain insights regarding this technology’s fit for your portfolio
Technology Overview

Minimally Invasive Insulation (Pinhole Injection Foam) for High-R Building Envelope Retrofits
Problem #1: Deep Energy Retrofits Are Too Expensive

Typical Cost > $100K

1. Remove siding
2. Reconstruct eaves
3. Reframe windows
4. Install air barrier
5. Install rigid foam
6. Tape foam
7. Replace siding
8. Repaint

Typical Time = Months
Problem #2: Deep Energy Retrofits Are Too Invasive

Some Can’t Relocate

Some Can’t Be Disturbed
Solution: The Pinhole Injection Foam System

Step 1: Site-Prep
Find studs, measure, mark, drill

Insert tube or needle

Step 2: In Wall Metering
Inject known volume

Use IR camera to determine fill rate

Step 3: Injection
Inject pre-determined volume

Validate with IR

Repeat 1 to 3 times/cavity
2 Types Of Foam Dispensers

Low Pressure Proportioner

Mobile “Talking Rig”
Advantages Of Pinhole Injection

- Minimally invasive
- Injects in under-insulated cavities
- Validated fill with IR
- Minimal blowout risk
APPLICATIONS: Brick or Masonry Veneer Buildings
(Especially If Electrically Heated)

Reading Housing Authority

Somerville Community Corp

Boston Housing Authority
APPLICATIONS: Under-Insulated “1950’s” Buildings (i.e. 2” of old fiberglass insulation)
APPLICATIONS: Row Houses With Empty Wall Cavities (Typically ¾” strapping over concrete block)

Oberlin College Art Museum

VT History Center

Currier Gallery of Art

NH Historical Society

Roswell Flower Memorial Library

Source: Foam-tech website
LAB TEST RESULTS

Standard Hot Box

R Value Before = R9
R Value After = R24
### FIELD TEST RESULTS:
R Value Before = R10. R Value After = R23

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Instruments</th>
<th>Location</th>
<th>Average Before</th>
<th>Average After</th>
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<tbody>
<tr>
<td>Lab</td>
<td>Conductivity tester (&quot;hot box&quot;)</td>
<td>Malvern PA labs</td>
<td>9</td>
<td>24</td>
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<td>Lab</td>
<td>Full scale test chamber</td>
<td>Greentown labs</td>
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<td>Proprietary QUB technology</td>
<td>Waltham House</td>
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<td>23</td>
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<tr>
<td>In-situ</td>
<td>Heat flux sensors on one surface</td>
<td>Boston Housing Authority</td>
<td>14</td>
<td>20</td>
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</tbody>
</table>

**Total:** 9.8 and 23
88 Unit Rhode Island Apartment Building: Demonstrated 25% to 35% Thermal Energy Use Reduction

Aaron Briggs Manor
Providence, RI

Validated By Cadmus Engineering
Site Requirements

- **Required characteristics**
  - Initial target building type: Brick or Masonry Veneer buildings (system works in all but Mass Masonry), with:
    - Under-insulated fiberglass cavities, and/or
    - Uninsulated shallow cavities (<1”), e.g., strapping over concrete block
    - Electric heated buildings preferred (highest savings potential)
    - No single pane windows preferred
  - Cold climate
  - Access or ability to install smart meters for additional analytics and sub-metering
  - Monthly whole building gas use, electric use, and peak demand. Interval whole building electricity usage and gas data (hourly or sub-hourly)
  - Historical baseline electrical (interval) and gas (monthly) data for 12 months
Site Considerations

- Test Site Owner Responsibilities
  - Building envelope retrofit projects, ideally with:
    - High utility bills
    - Energy Efficiency improvement incentive program
  - Submit program participation application
    - Building characteristics & historical energy bills
    - Upgrades may be paid for up-front or financed (see program participation requirements)
  - Participate in ~1 year-long monitoring study
    - At least 1 heating season
    - On-site diagnostics (air-tightness testing)
Next Steps

- If you are interested in hosting the technology validation in your facilities, please contact the DOE team

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Thank You!