



# 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



# DOE Field Validation

- 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

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**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**

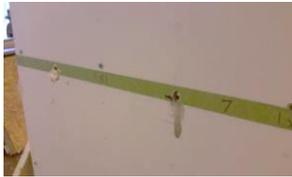


**Some Can't Be Disturbed**



# 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



Repeat 1 to 3 times/cavity

Validate with IR



# 2 Types Of Foam Dispensers

## Low Pressure Proportioner



## Mobile “Talking Rig”



# Advantages Of Pinhole Injection

Minimally  
invasive



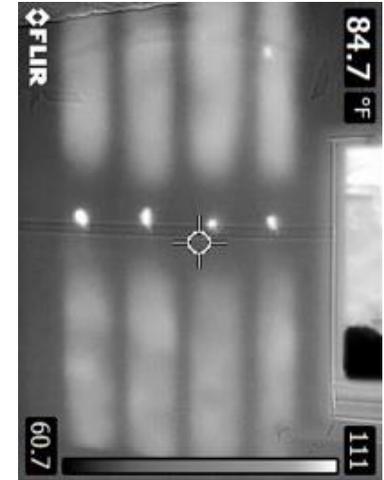
Injects in  
under-insulated  
cavities



Validated fill  
with IR



Minimal  
blowout risk



# APPLICATIONS: Brick or Masonry Veneer Buildings (Especially If Electrically Heated)

Reading Housing Authority



Somerville  
Community Corp



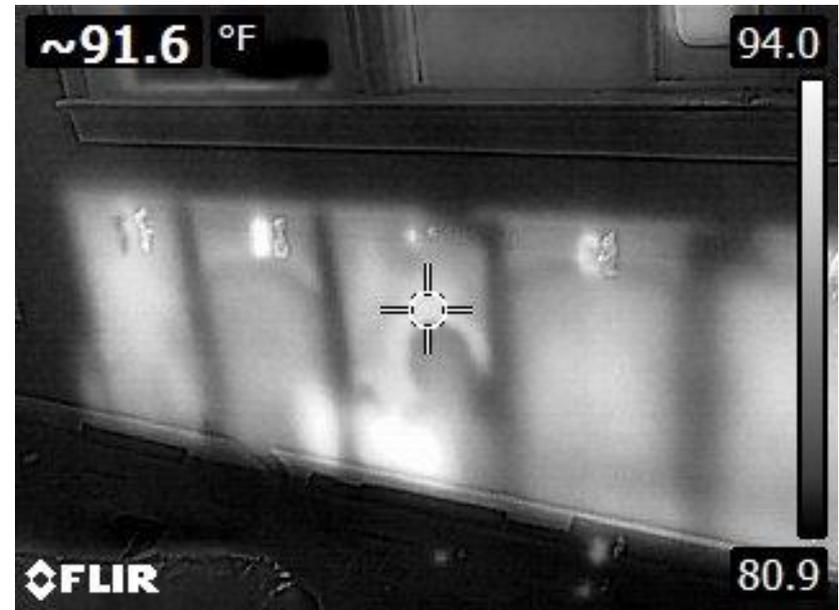
Boston Housing Authority



# APPLICATIONS: Under-Insulated “1950’s” Buildings (i.e. 2” of old fiberglass insulation)



# APPLICATIONS: Row Houses With Empty Wall Cavities (Typically 3/4" strapping over concrete block)



# APPLICATIONS: Historic Buildings (ca. 1980 - 1990)



Oberlin College  
Art Museum



VT History  
Center



Currier Gallery of Art



NH Historical  
Society



Roswell Flower  
Memorial Library



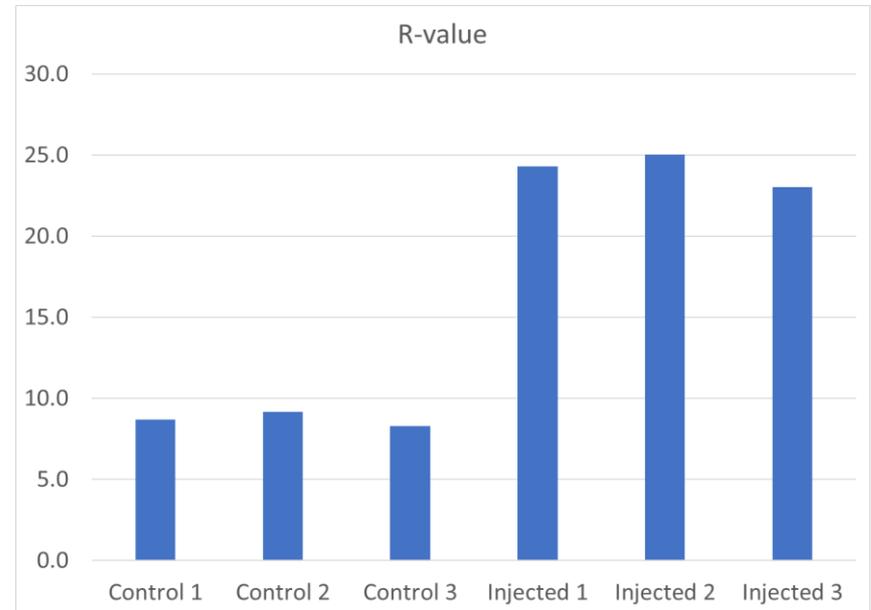
Source:  
Foam-tech website

# LAB TEST RESULTS

## Standard Hot Box



R Value Before = R9  
R Value After = R24



# FIELD TEST RESULTS:

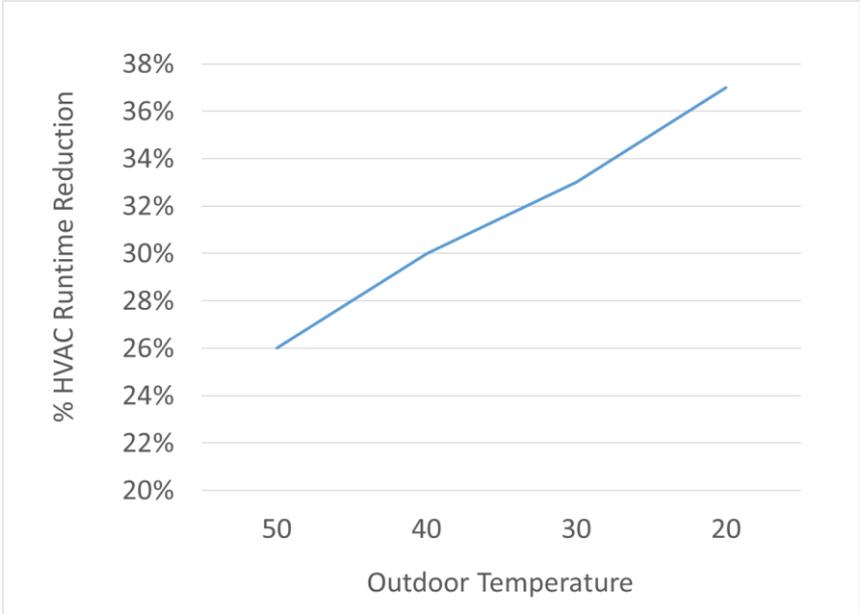
R Value Before = R10. R Value After = R23

Conditions	Instruments	Location	Average Before	Average After
Lab	Conductivity tester ("hot box")	Malvern PA labs	9	24
Lab	Full scale test chamber	Greentown labs	10	25
In-situ	Proprietary QUB technology	Waltham House	10	23
In-situ	Proprietary QUB technology	Worcester House	6	23
In-situ	Heat flux sensors on one surface	Boston Housing Authority	14	20
			<b>9.8</b>	<b>23</b>

# 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!