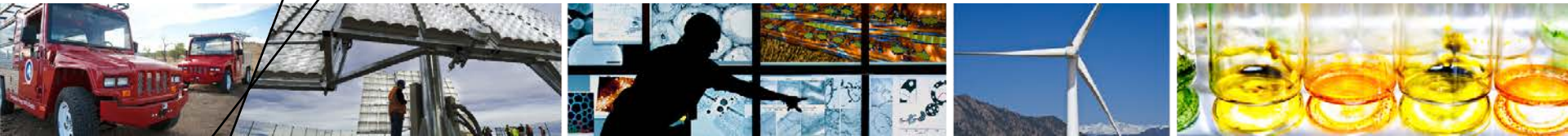


Building America: The Advanced Whole-Home Efficiency Program



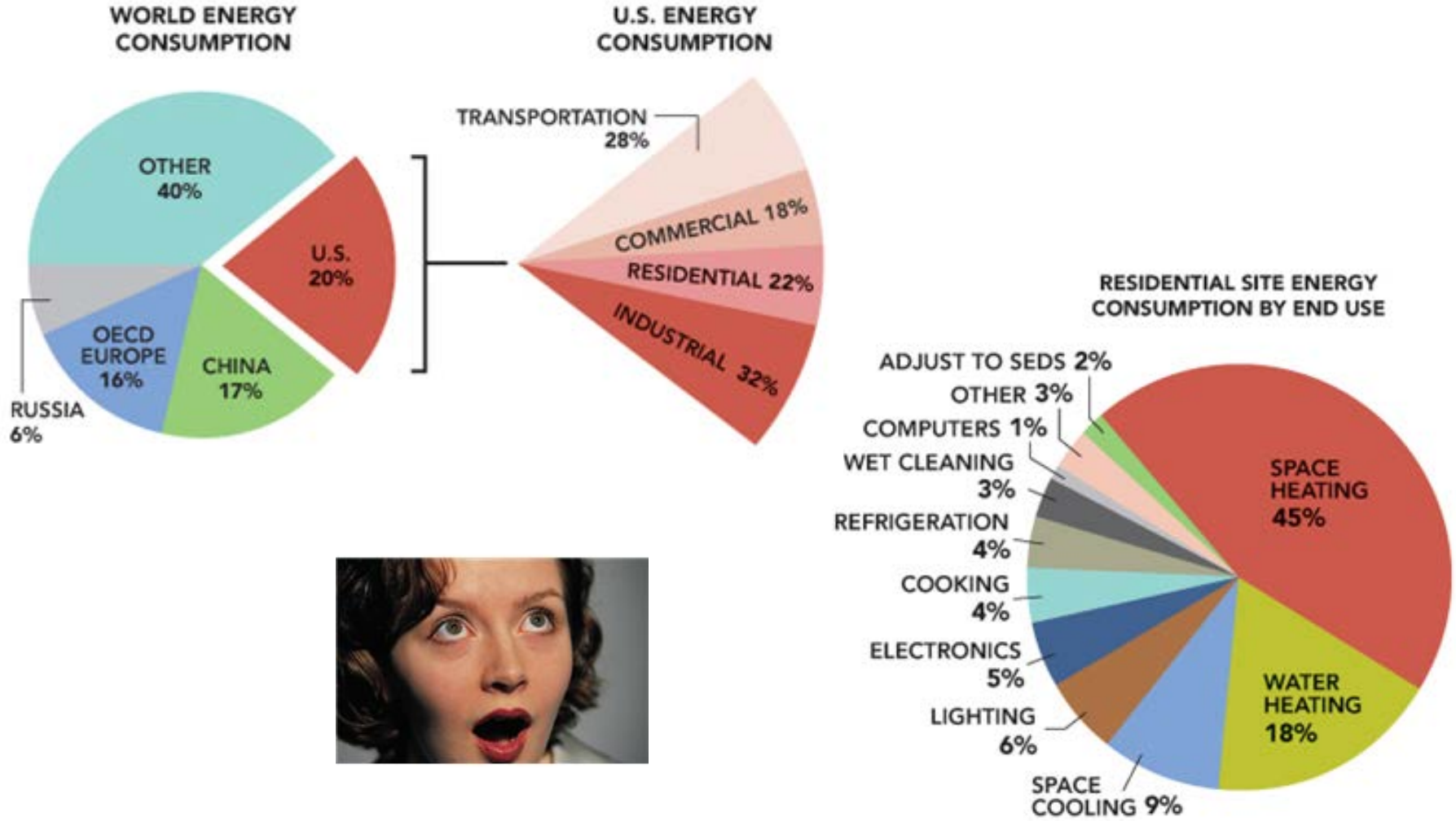
**Woman to Woman: Connecting Global
Science and Technology Leaders**

Cheryn Engebrecht

February 29th, 2012

NREL/PR-5500-54333

Why should you care about residential energy efficiency?



What is ?

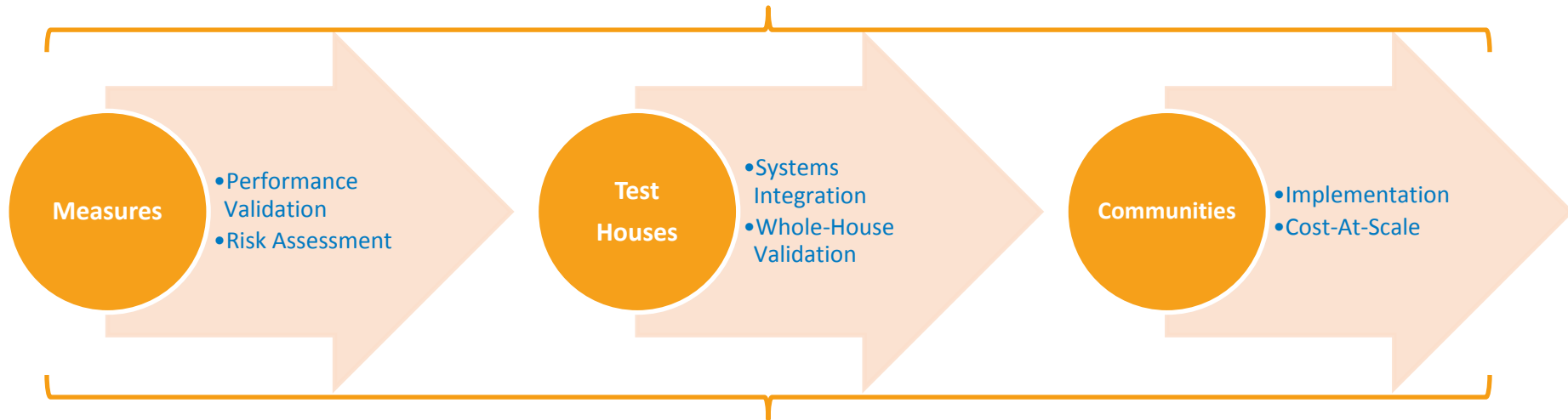
- **Funded by the Department of Energy**
- **10 industry/research teams, 4 labs**
 - Lead by private companies, universities, and consulting firms
 - Team members include industry experts, utilities, manufacturers, research centers, builders, remodeling contractors, community organizations,
- **Managed by the National Renewable Energy Lab**
- **Focus on building/retrofitting highly energy efficient homes**

Government-As-A-System



Multi-Scale Systems Integration Research

TECHNOLOGY PATHWAYS ANALYSIS (BEopt)



IMPLEMENTATION TOOLS

SM



Building America: Current Goals

Source Energy Savings	Mixed/Hot-Dry and Marine	Mixed-Humid and Hot-Humid	Cold (Includes Cold, Very Cold, and Subarctic)
Current "best in class" (15% or above)	2011	2011	2011
30%	2012	2013	2014
50%	2015	2016	2017

Source Energy Savings	Mixed/Hot-Dry and Marine	Mixed-Humid and Hot-Humid	Cold (Includes Cold, Very Cold, and Subarctic)
Current "best in class" (20% or above)	2010	2011	2011
30%	2011	2012	2013
50%	2014	2015	2016

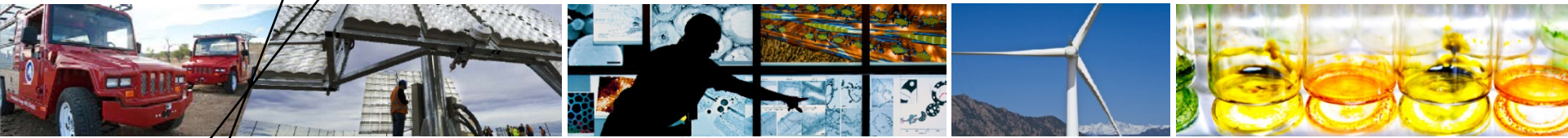
Building America goals relative to BA HSP (about 2009 IECC)

General Non-Energy Requirements

- **Cost effective**
 - Marketable to the general public
 - Comparable in price to other homes in the area
- **Healthy**
 - Keep workers and homeowners free from sickness
- **Durable**
 - Moisture damage resistant
 - Quality construction

Research Topics Include

- **Space Conditioning**
 - Ventilation
 - Heat Pumps
 - Distribution
 - Multifamily
 - Combination units
 - New Technologies
- **Hot Water Heating**
 - Heat Pump Water Heaters
 - Multifamily
 - Distribution
- **Automated Home Energy Management**
 - Technical barriers
 - Controls
- **Enclosures**
 - Moisture Management
 - Foundations
 - Advanced wall systems
 - Masonry retrofits
 - Windows
 - Roof/Attic
- **Implementation**
 - Connection to training
 - Interaction with deployment programs
 - Relation to other programs
- **Analysis Methods/Tools**
 - Residential Simulation Accuracy
 - Benchmarking



Hot Topics

Hot Topics – Field Testing Best Practice

NREL Buildings Research



Field Test Best Practices

A Resource for Practical Residential Building Science



Home About Field Test: Start to Finish Building Components & Systems Measurement & Instrumentation Search



Air Flow Measurement

Learn how to measure the air distribution in a house and what instruments to use in each case.



Leakage and Infiltration Measurement



Lighting Level Measurement



Air Flow Measurement

The Field Test Best Practices site is a collection of best practices and lessons learned from the U.S. Department of Energy's (DOE) [Building America](#) program.

On this website, you will find detailed guidance on:

- Planning for your field test
- Conducting a field test
- Choosing, testing, and installing components
- Selecting equipment and knowing when and how to use it.

Get started by browsing the topics below.

Related Links

[NREL Buildings Research](#) ▶

NREL develops innovative technologies to significantly reduce energy consumption in buildings.

[National Residential](#)

[Field Test: Start to Finish](#) ▶

- [Field Test Planning](#)
- [Field Test Execution](#)
- [Research Questions](#)
- [Role of Building Simulation in Field Testing](#)

[Building Components & Systems](#) ▶

- [Envelope](#)
- [Electric Water Heaters](#)
- [Gas Furnaces](#)
- [Hydronic and Radiant](#)

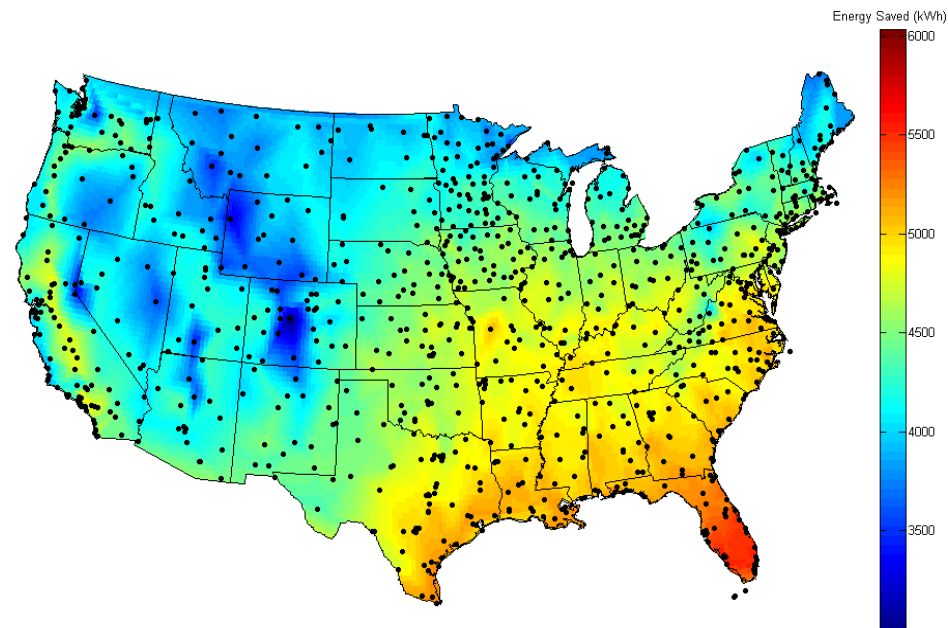
[Measurement & Instrumentation](#) ▶

- [Leakage and Infiltration](#)
- [Temperature Measurement](#)
- [Humidity](#)
- [Fluid Flow](#)

Hot Topics – Heat Pump Water Heaters

- HPWH technology will save source energy in any region of the U.S. when replacing an electric resistance water heater.
- Energy savings is location dependent, but positive in all climate zones.

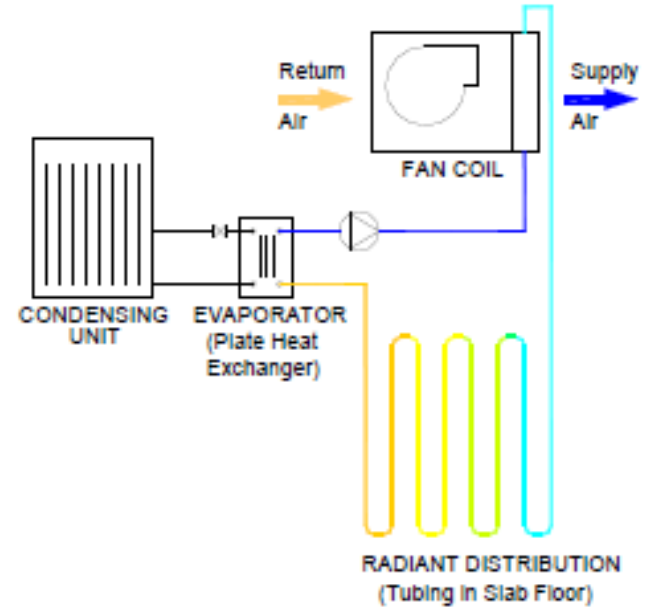
Annual Source Energy Savings HPWH vs. Electric Resistance WH		
Location	Conditioned Space	Unconditioned Space
Houston, TX*	64%	53%
Atlanta, GA	52%	44%
Chicago, IL	39%	25%
Helena, MT	30%	17%



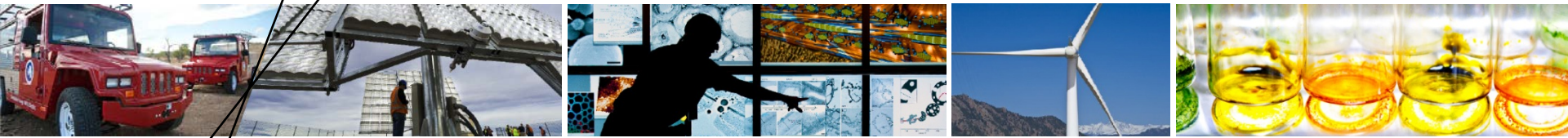
Hot Topics – Space Conditioning for Low Load Homes



Mini-Split Heat Pumps








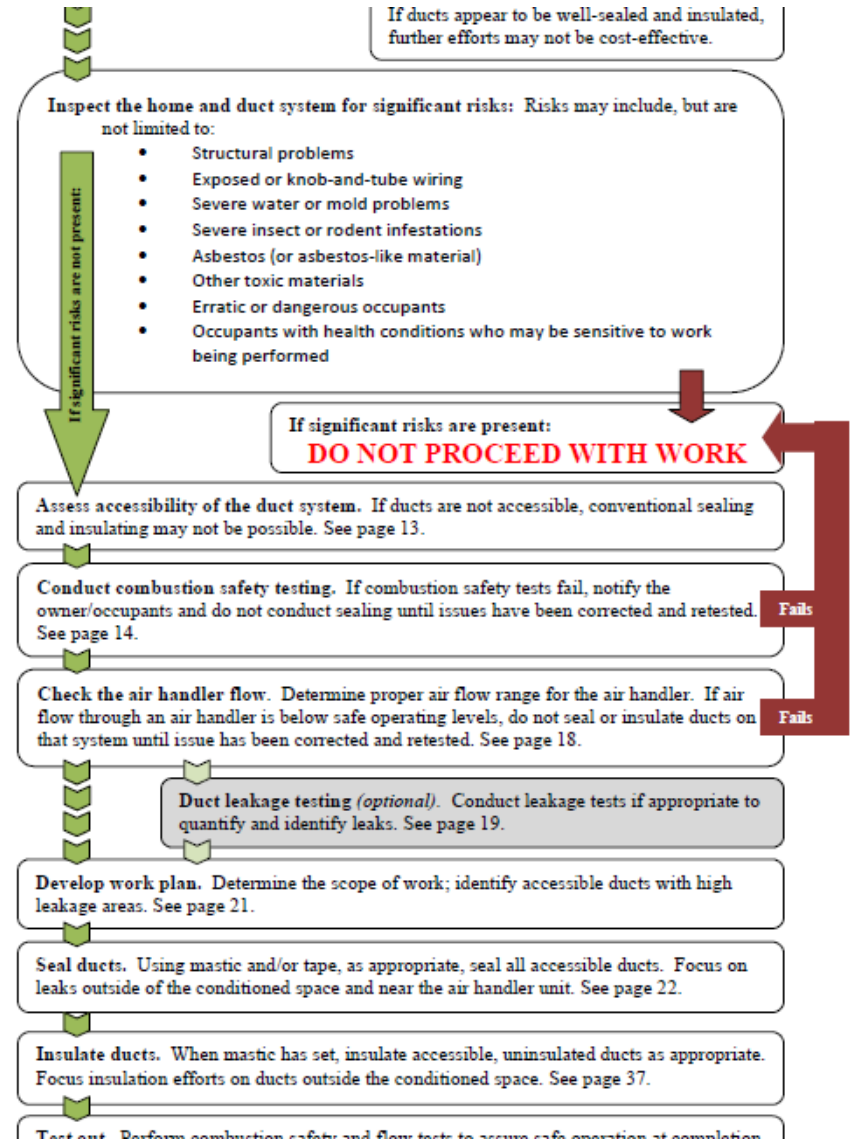
Radiant Floor Cooling



Products

Building America Products: Guidelines

<p>2. Apply mastic directly to the collar <i>(best practice, but optional).</i></p>	
<p>3. Slide the inner flex liner over the collar to embed into mastic.</p>	
<p>4. Secure with a compression band (draw band, zip tie) over the collar.</p>	
<p>5. Apply additional mastic to seal the seam between the inner liner and collar.</p>	
<p>6. Pull the insulation back over the inner liner and secure this joint with another compression band.</p>	




Building America Products: Technical Reports

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy | BUILDING TECHNOLOGIES PROGRAM

Energy Savings Measure Packages: Existing Homes

S. Casey and C. Booten
National Renewable Energy Laboratory

November 2011



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Cincinnati, Ohio (Mixed Fuel)

		Energy Savings Levels																		
		15%							30%											
Average Source Energy Savings (%)	Average Annual Savings (2011 \$)	Lighting: Replace 60% of Bulbs with CFL	Crawlspace Wall: Insulate with R-5	Exterior Walls: Drill and Fill from Uninsulated to R-13	Ceiling: Insulate from R-11 to R-38	Infiltration: 20% Reduction	Water Heater: Install Gas Tankless (0.82 EF)	Crawlspace Wall: Insulate with R-10	Crawlspace Wall: Insulate with R-15	Windows: Replace with Double Pane, Low-e, high SHGC	Clothes Washer: Replace with ENERGY STAR	Ducts: Insulate to R-6	Ceiling: Insulate from R-11 to R-49	Ceiling: Insulate from R-11 to R-60	Water Heater: Install Gas Tankless Condensing (0.96 EF)	Crawlspace Wall: Insulate with R-20	Windows: Replace with Double Pane, Low-e, standard SHGC	Infiltration: 40% Reduction	Windows: Replace with Quad Pane	Refrigerator: Replace with ENERGY STAR
15	211	X	X																	
30	373	X	X	X																
35	447	X	X	X	X															
37	465	X	X	X	X	X														
39	483	X	X	X	X	X	X													
40	491	X		X	X	X	X	X												
41	493	X		X	X	X	X	X	X											
46	499	X	X	X	X	X	X	X	X											
47	498	X	X	X	X	X	X	X	X											
48	488	X	X	X	X	X	X	X	X	X										
49	480	X	X	X	X	X	X	X	X	X	X		X							
49	474	X	X	X	X	X	X	X	X	X	X			X						
50	459	X	X	X	X	X	X	X	X	X	X			X	X					
50	452	X	X	X	X	X	X	X	X	X	X			X	X	X				
52	418	X	X	X	X	X	X	X	X	X	X			X	X	X	X			
53	387	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X		
53	367	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X

Building America Products: Case Studies

Building America Efficient Solutions for New Homes Case Study: Cool Energy House, Windermere, FL

KEY ENERGY-EFFICIENCY MEASURES

HVAC:

- Two high-SEER two-ton air-source heat pumps. 18 SEER, 9.2 HSPF
- Existing ducts re-sealed and placed in conditioned unvented attic. Both air-handlers located in interior closets. Duct leakage to outside is negligible.
- Compact high-efficiency whole-house ventilation system with integrated dehumidification.
- Two 50-gallon heat pump water heaters replacing two electric resistance tanks. Each unit is located close to hot water users to reduce distribution time and wasted water.

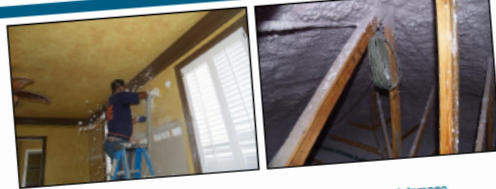
Envelope:

- R-30 closed-cell spray polyurethane foam insulation in attic (unvented)
- Blown-in fiberglass insulation added to wall cavities
- Double-pane, low-e, vinyl windows U = 0.28, SHGC = 0.21
- Tightly sealed house, ACH50 = 2.5

Lighting, Appliances, and Other:

- 75% (high-efficiency) lighting package
- ENERGY STAR® appliances
- Variable speed pool pump

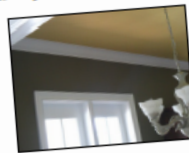
For more information, please visit:
www.buildings.energy.gov



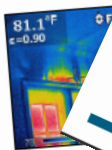
Left: Blown-in fiberglass insulation was added to the walls with minimal damage to the existing home. Right: Closed-cell spray foam insulation was applied directly to the roof deck to create a non-vented attic. Closed-cell foam was also applied to the band joint areas.

Lessons Learned

- Insulating and air sealing brick veneer covered walls can be done from the interior with minimal disturbance to interior surfaces and finishes. However, only stud bay cavities can be accessed in this manner. Partition tees, 3-smud corners, and heavily blocked areas remain inaccessible.
- Performing a comprehensive energy audit before work begins is critical to understanding energy uses and selecting improved specifications. Analyzing the prospective improvements against the cost and practicality of application can yield unique opportunities.
- Achieving very significant energy savings (50% in this case) can be obtained through relatively unobtrusive methods.
- Aligning the research and development goals of the sponsor, in this case the efficacy of blowing additional insulation into already insulated wall cavities, with the scheduling interest of the contractor and subcontractor, who did not count on research development issues, can be challenging.



Left: To the naked eye, no air sealing problems are apparent. Right: An camera diagnostic exposes significant air leakage around the doors, decreasing the comfort of the home and increasing energy costs.



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency & Renewable Energy

EERE Information Center
1-877-EERE-INFO (1-877-337-3463)
eere.energy.gov/informationcenter

Publication # and date

For information on Building America visit buildingamerica.gov. The website contains expanded case studies, technical reports, and best practices guides.

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING TECHNOLOGIES PROGRAM

Builders Challenge
Recognizing Energy Leadership in Homebuilding

High Performance Builder Spotlight
Cobblestone Homes
Saginaw, Michigan

Cobblestone Homes of Freeland, Michigan, achieved a HERS Index of 37 without photovoltaics or -4 with PV on this Builders Challenge-certified home in Bay City, Michigan.



BUILDER PROFILE

Builder: Cobblestone Homes, LLC
Freeland, Michigan
www.cobblestonehomes.com
Melissa Wahl, Vice President
989-692-0940, info@cobblestonehomes.com

Homes founded: 2001

Homes built: 40 in 2009, average 28/yr

Average Price: \$180-240,000

This Home: The Vision Zero, completed June 2010, 3,504 sq. ft., 1 story plus basement, \$154k, FL



Cobblestone Homes' quest to understand building science led to construction DOE Builders Challenge certification and achieved a HERS index of -4 with photovoltaics and 37 without PV. Built as a learning project for Cobblestone Homes, the 3,504-sq-ft home located in Bay City, Michigan, also serves as the Vision Zero Home open for a year for public tour and seminars for builders associations, educators and colleagues. Over 60 educational displays have been set up throughout the home. "Essentially, the home is a living building science museum," said Melissa Wahl, vice president for Cobblestone Homes.

For wall insulation, on the north, east, and south walls of the home Cobblestone used two 1-inch layers of styrofoam with tongue and groove joints that are staggered and taped at the seams over OSB. The remaining sheathing is applied without OSB. Wall cavities are filled with 5 inches of sprayed urethane foam for an R-30 insulation value. The rim joints are also filled with urethane spray foam. In the attic, 2 inches of blown cellulose foam is sprayed over the ceiling deck and topped with 14 inches of urethane foam for a combined R value of R-62. The poured concrete base and outside walls are insulated inside with 1.5 inches of Dow Chemical Thermax and outside with 2 inches of Dow Chemical Permaband and waterproofing. The rigid foam is taped at the seams and serves as an air and vapor barrier. Air sealing is further enhanced by gluing drywall to framing, foaming around door and window frames, gluing and taping the subfloor to floor trusses, and gasket sealing electrical boxes.

A ground-source heat pump located in the conditioned basement provides heating and cooling. A desuperheater on the ground-source heat pump preheats domestic hot water. The water is further heated by a solar thermal water heater and stored in a 50-gallon holding tank that has an electric backup heater if needed. Cobblestone chose to install both the desuperheater and the solar thermal system to try out both technologies in this demonstration home; in a typical application the two would not be installed together.

An energy recovery ventilator provides conditioned ventilation. ENERGY STAR appliances and lighting, including 11 LED fixtures, add to the energy savings.

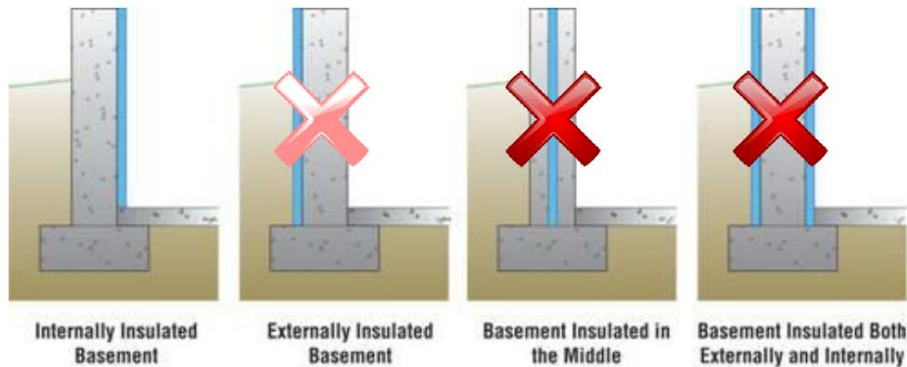
Other Outreach Avenues

- Website
- Webinars
- Presentations



Insulation Location Choices

- Retrofits: interior insulation is often the only available option



Question for you:

How would you share such vast knowledge with the relevant industry?

Residential Buildings:

A Unique Industry, A Unique Opportunity

- **Technical Journals (ex: American Society of Heating, Refrigeration and Air-conditioning Engineers Journal – ASHRAE Journal)**
- **Trade Journals (ex: Home Energy Magazine)**
- **Trade websites (ex: GreenBuildingAdvisor.com)**
- **Trade magazines (ex: Energy Design Update)**
- **High profile media (ex: HGTV)**

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AdChoices

What's Wrong With This Insulation Job?

Readers are invited to spot all of the problems shown in a photo of recently installed fiberglass batts

POSTED ON FEB 7, 2012 BY ROB HAMMON

In many areas of the country, homes are receiving Energy Star labels they don't deserve. Major errors like the ones shown in this photo are supposed to be caught by the HERS rater who performs third-party verification services. This home slipped through the cracks.

The photo shows at least four errors serious enough to have prevented the home from receiving an Energy Star label. Can you spot them?

Next week, we will post the answers that a Building America team, BIRA, came up with.



Image 1 of 2

What's wrong with this picture? This photo shows a representative insulation job performed by workers who used similar standards at an entire subdivision of new homes. The developer hoped that the homes would qualify for Energy Star. How many problems can you spot?

Helpful? 0
Blog to top



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Questions?

