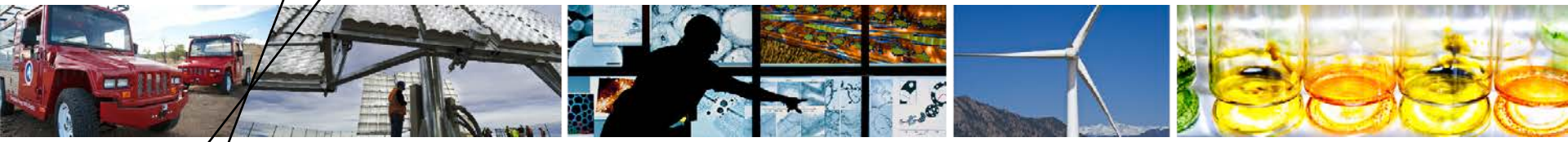
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Building America: The Advanced Whole-Home Efficiency Program



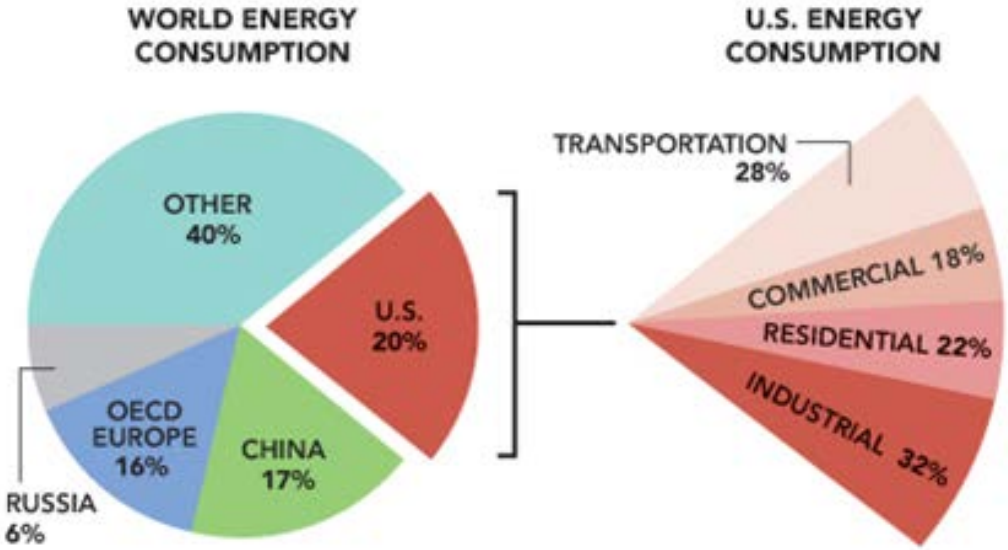
Woman to Woman: Connecting Global Science and Technology Leaders

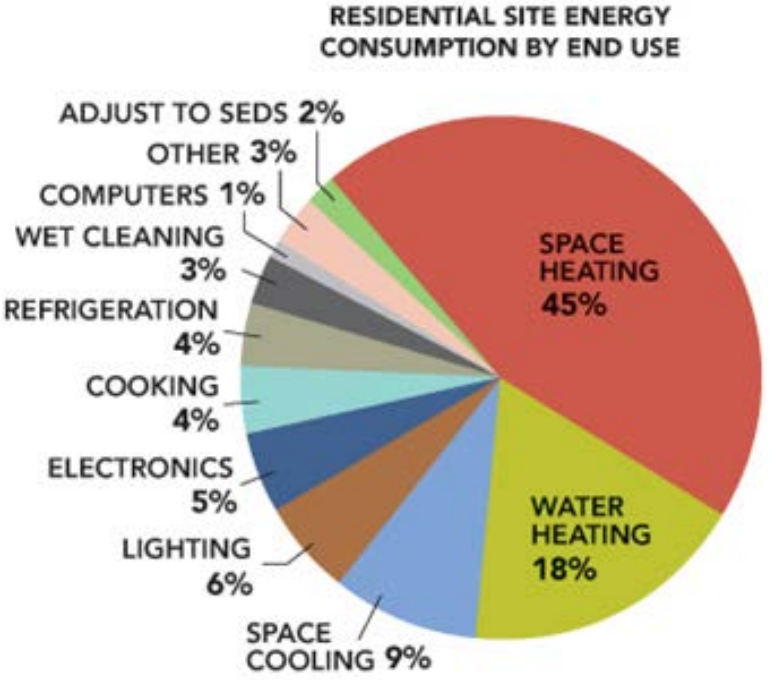
Cheryn Engebrecht

February 29th, 2012

NREL/PR-5500-54333

Why should you care about residential energy efficiency?

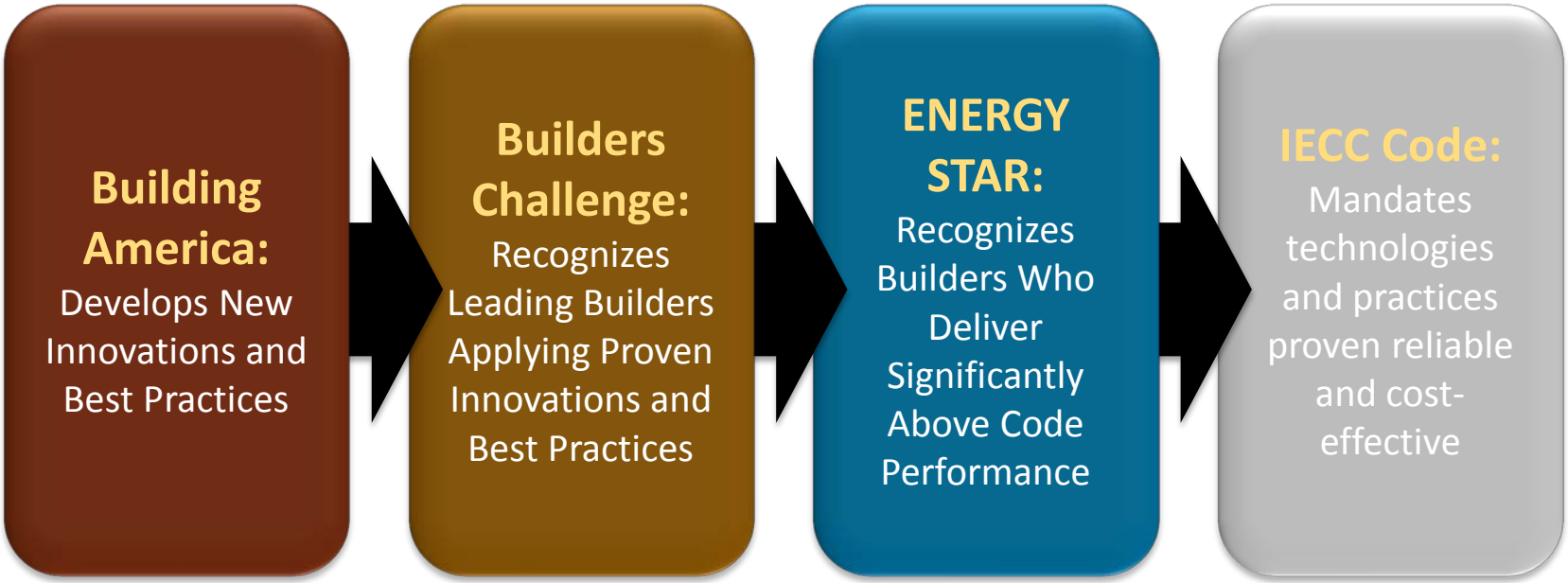




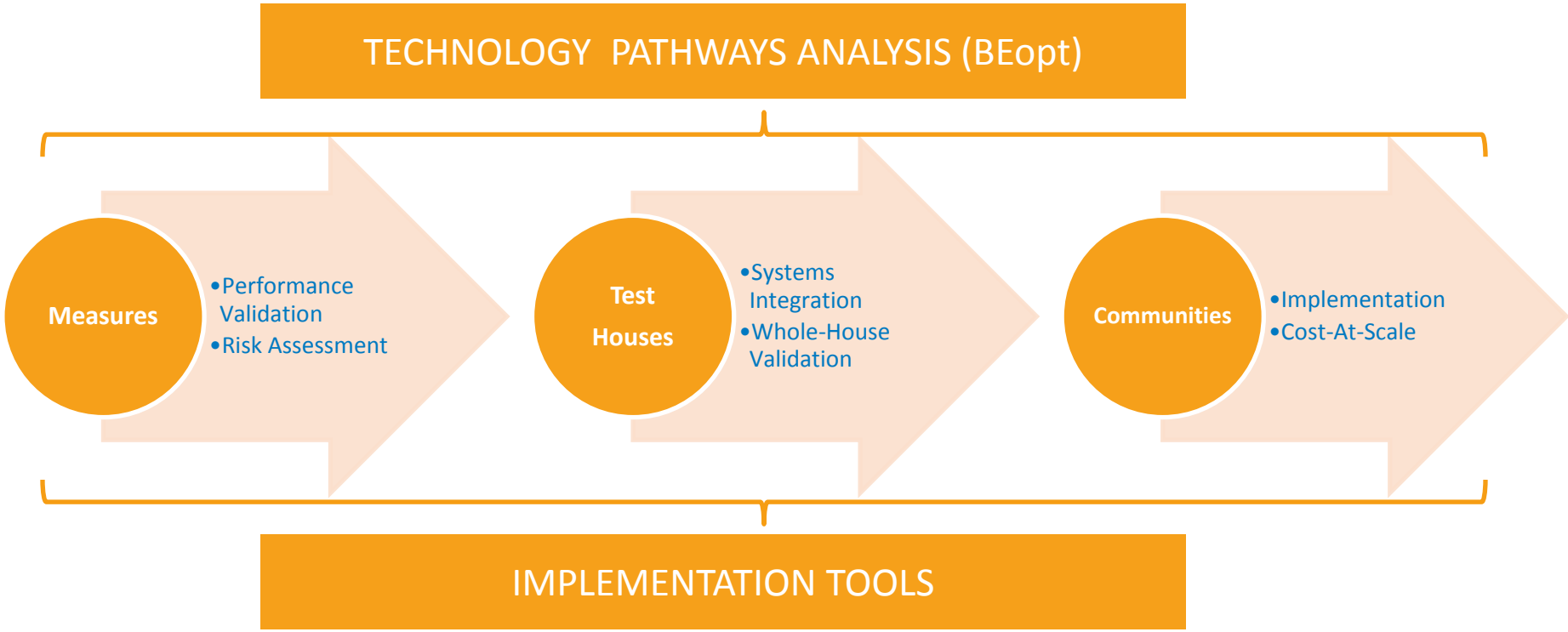
What is Building America ?

- **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



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Building AMERICA U.S. Department of Energy

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

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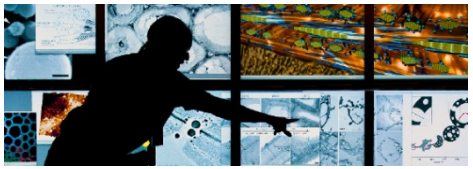
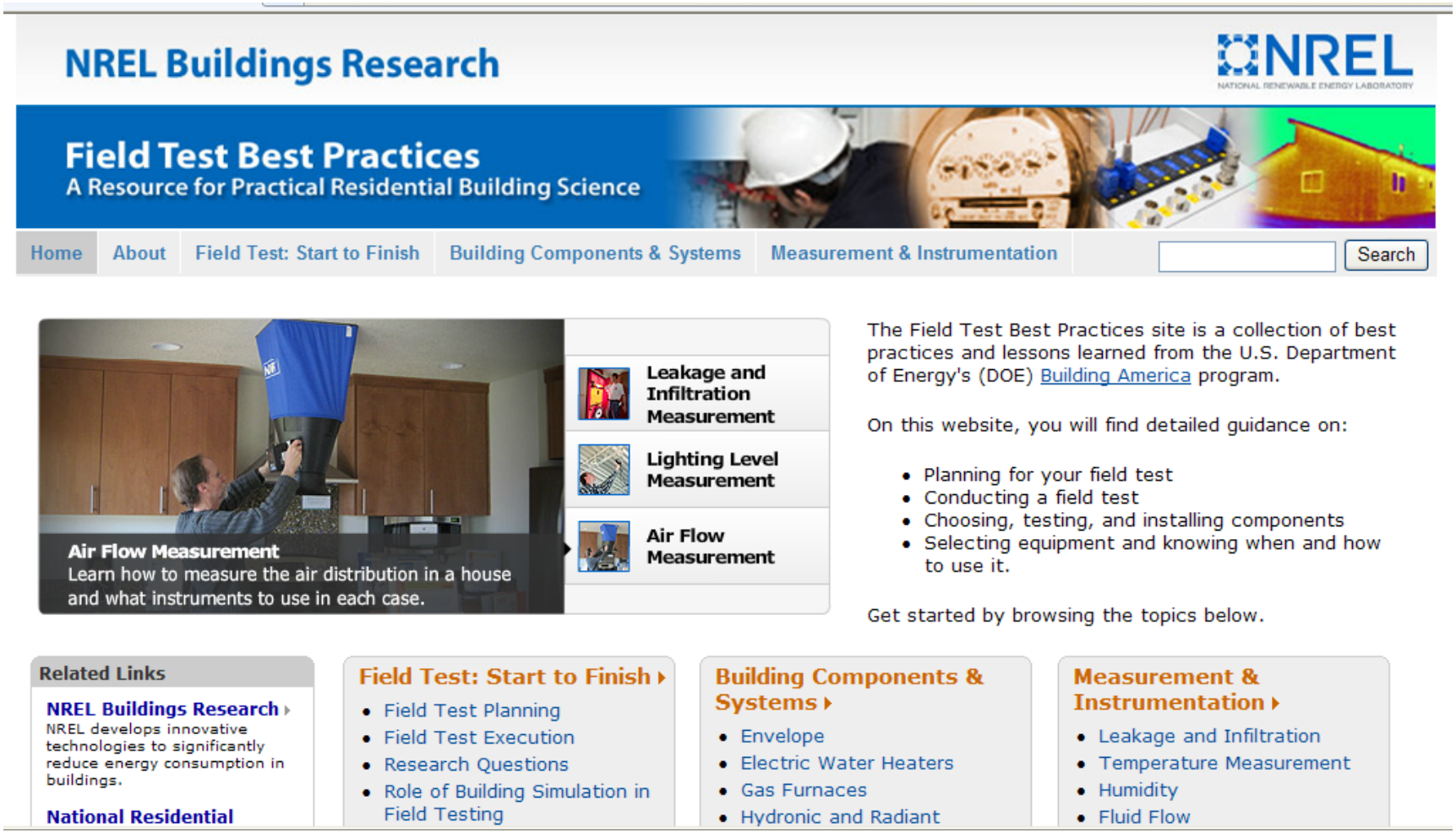


Hot Topics

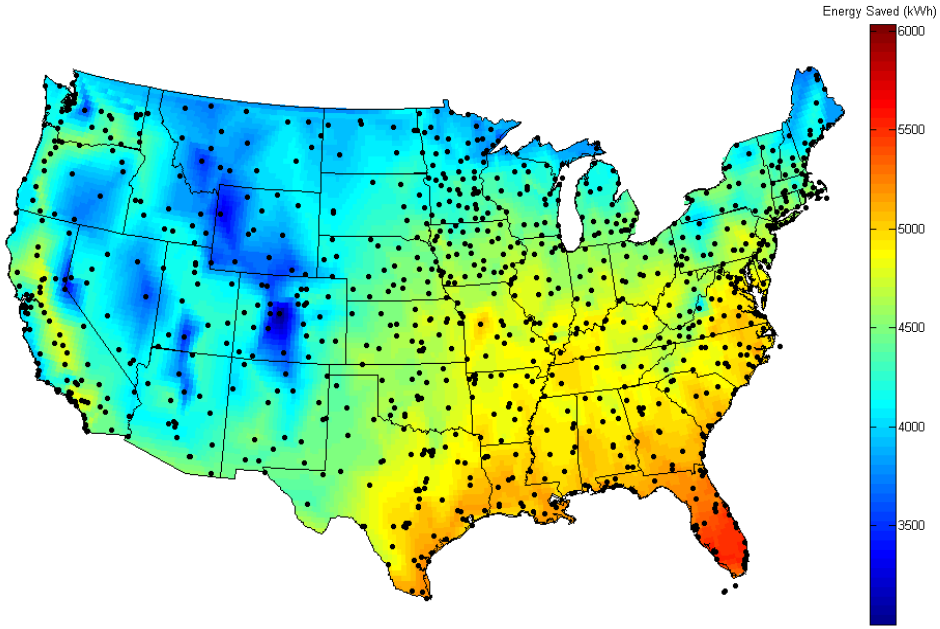
Hot Topics – Field Testing Best Practice



Hot Topics – Heat Pump Water Heaters

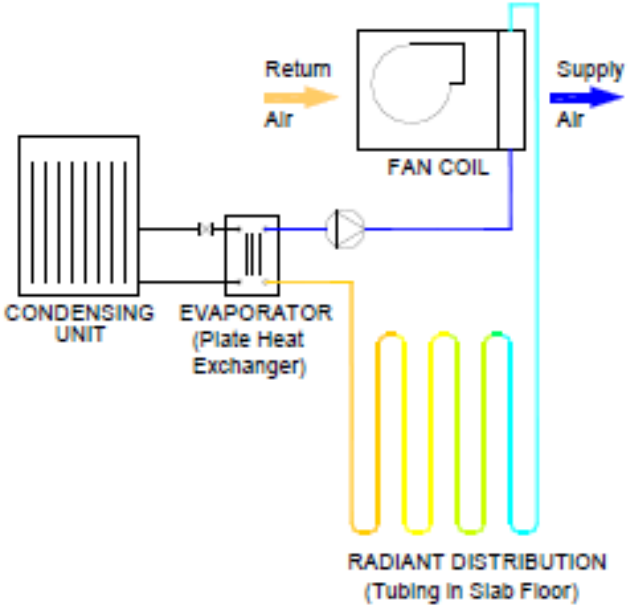
- HPWH technology will save source energy in any region of the U.S. when replacing an electric resistance water heater.
- Energy savings is location dependent, but positive in all climate zones.

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

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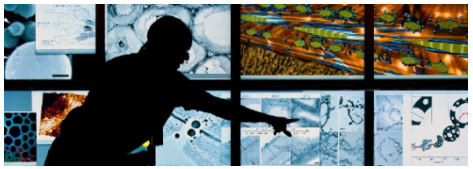
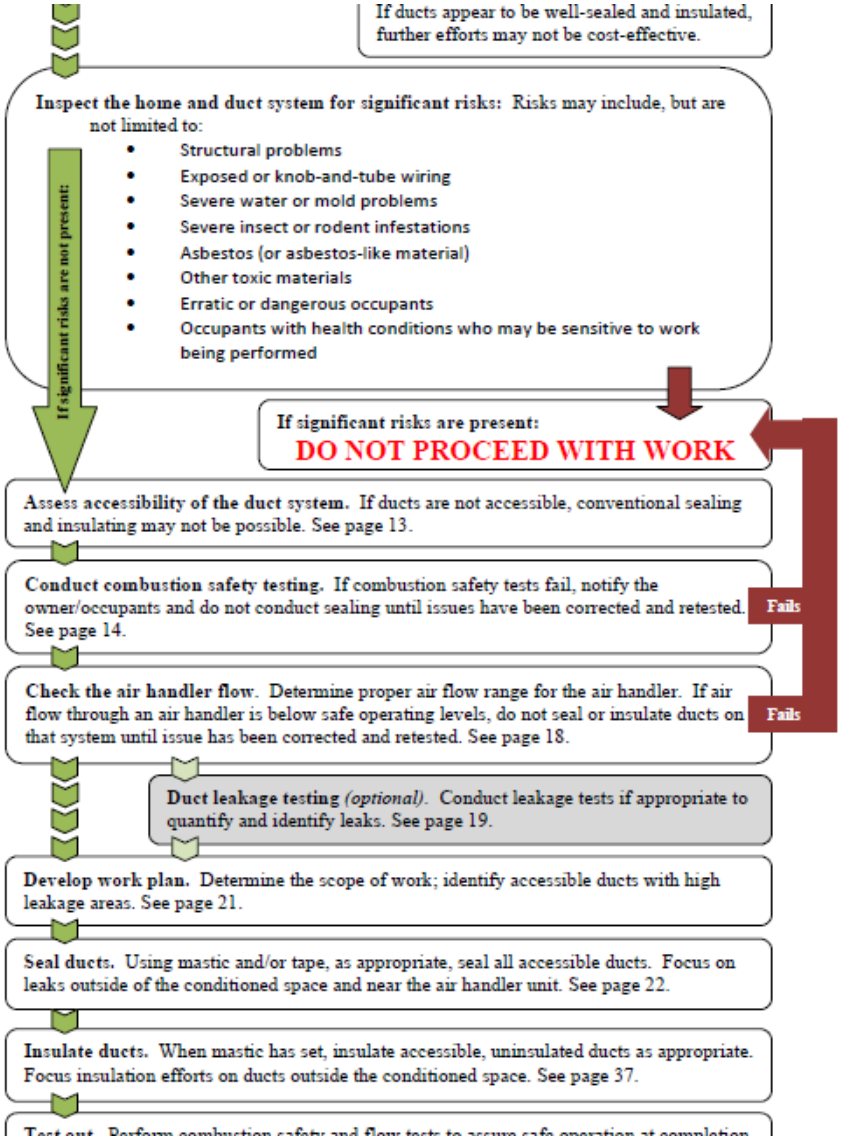


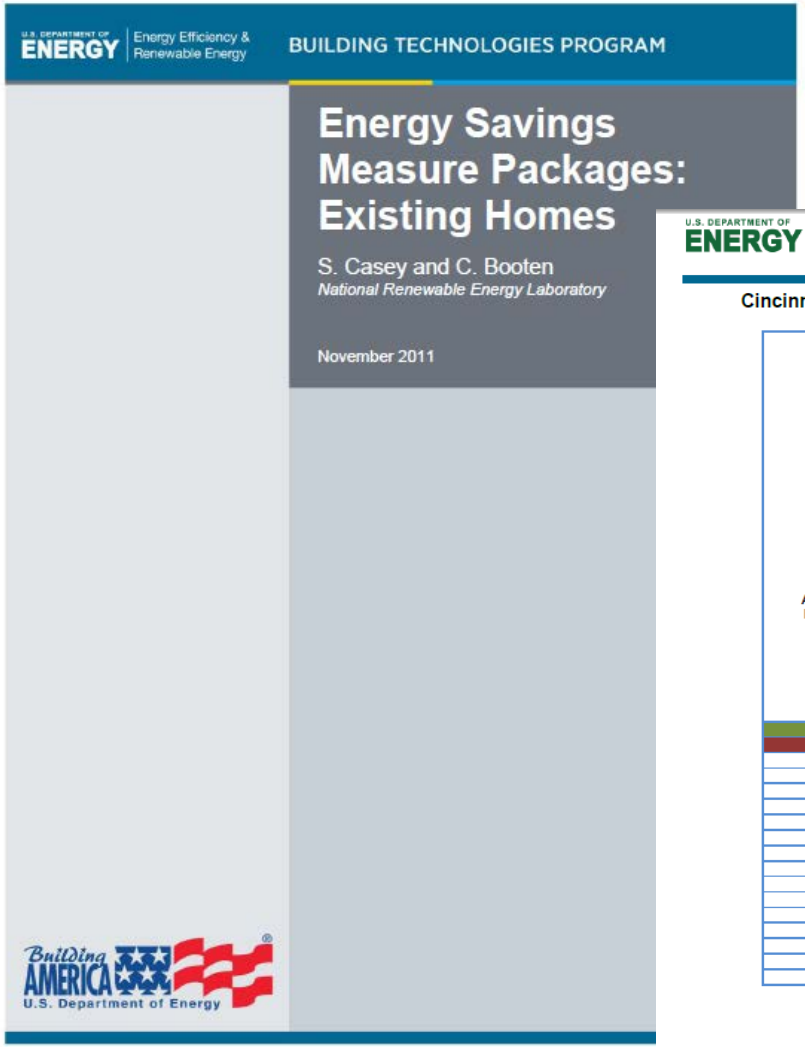
Products

Building America Products: Guidelines

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



Building America Products: Technical Reports



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											
46	499	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							
49	474	X		X		X	X		X	X	X	X		X						
50	459	X		X		X	X		X	X	X	X		X	X					
50	452	X		X		X	X				X	X		X	X	X	X			
52	418	X		X		X	X				X	X		X	X	X	X	X		
53	387	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

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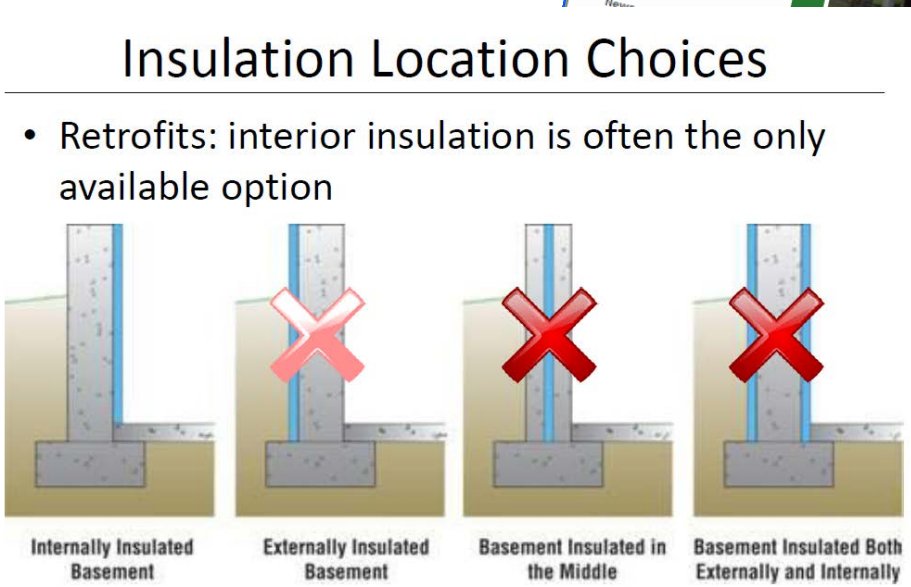
Building America Products: Case Studies

Other Outreach Avenues

- **Website**
- **Webinars**
- **Presentations**



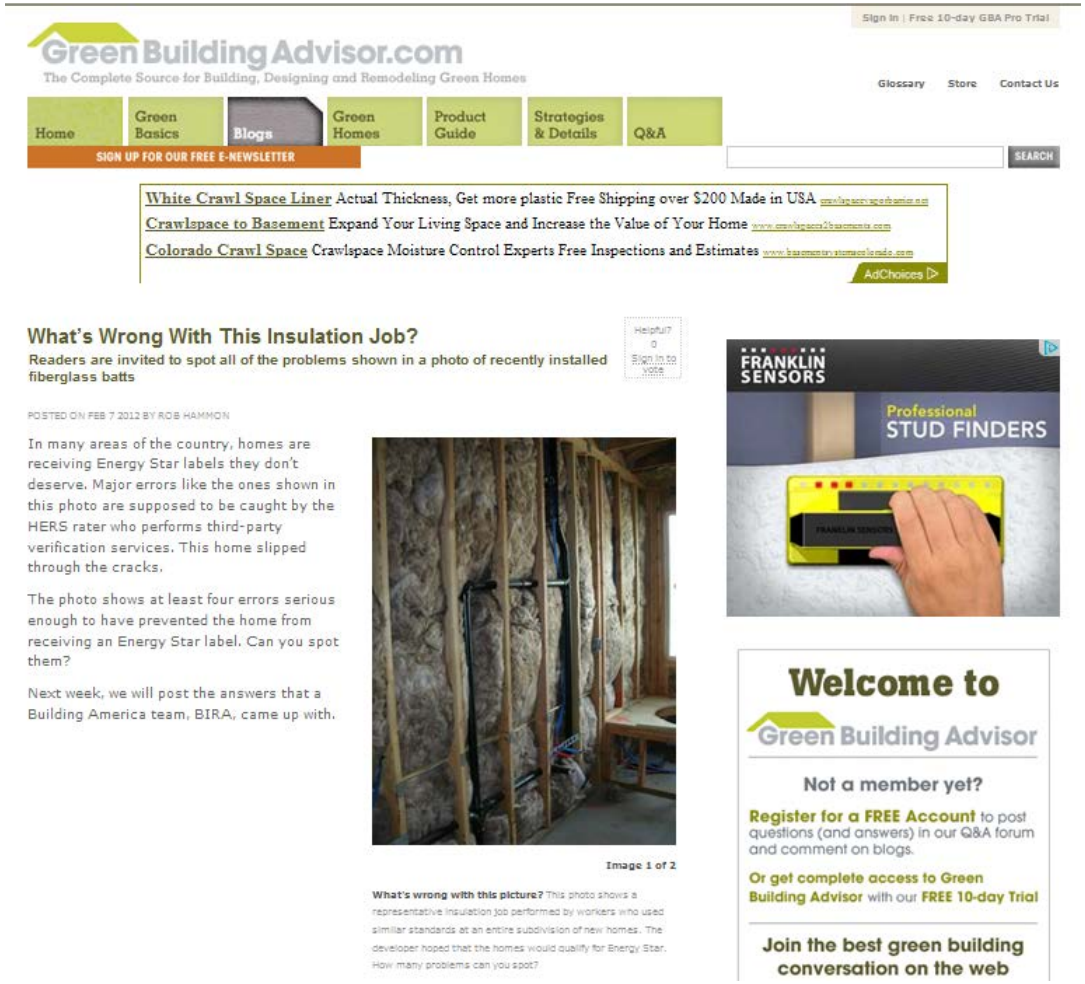
Question for you:

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)**

Take Advantage of Your Opportunity!



Questions?