



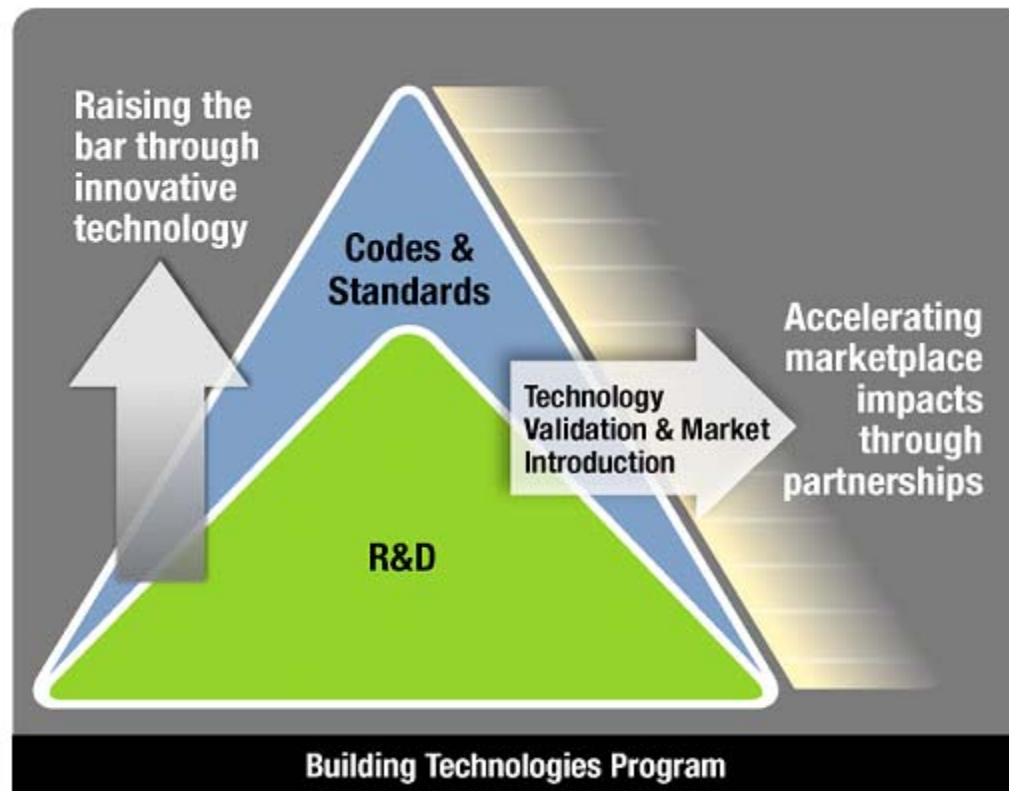
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# DOE Residential Buildings Program RESNET 2009

Edward Pollock  
February 16, 2008

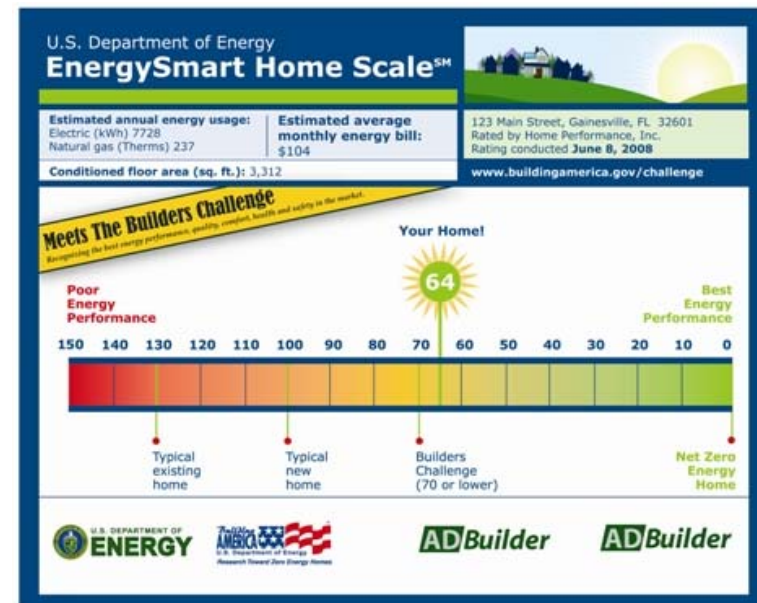
# Building Technologies Mission

Develop technologies, tools, and standards for making residential and commercial buildings and appliances more energy-efficient, productive, and affordable.



# Builders Challenge Progress


- Secretary Bodman announced at the International Builders' Show on February 14, 2008
- Builders commit to constructing homes that rate 70 or less on the EnergySmart Home Scale
- 1000 labeled homes
- Over 200 Homebuilders registered
- 82 Verifiers registered
- 68 Program and Resource Partners registered





# Builders Challenge

U.S. Department of Energy  
**EnergySmart Home Scale<sup>SM</sup>**



<b>Estimated annual energy usage:</b> Electric (kWh) 7728 Natural gas (Therms) 237	<b>Estimated average monthly energy bill:</b> \$104	123 Main Street, Gainesville, FL 32601 Rated by Home Performance, Inc. Rating conducted <b>June 8, 2008</b>
<b>Conditioned floor area (sq. ft.):</b> 3,312		<a href="http://www.buildingamerica.gov/challenge">www.buildingamerica.gov/challenge</a>

**Meets The Builders Challenge**  
*Recognizing the best energy performance, quality, comfort, health and safety in the market.*

**Your Home!**  
64

**Poor Energy Performance** (150 to 100) | **Best Energy Performance** (0 to 10)

150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0

Typical existing home (130) | Typical new home (100) | Builders Challenge (70 or lower) | Net Zero Energy Home (0)

U.S. DEPARTMENT OF ENERGY | Building AMERICA | U.S. Department of Energy | Research Toward Zero Energy Homes | ADBuilder | ADBuilder

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**Drive demand:**  
Help homebuyers recognize that homes that meet the Builders Challenge represent the best energy performance, quality, comfort, health and safety available in the current housing market.



# Quality Criteria List

— Establishes

- Requirements
- Responsibilities

**Builders Challenge**  
Recognizing Energy Leadership in Homebuilding

**Builders Challenge Quality Criteria Guide – Version 1.3**

The Builders Challenge Quality Criteria homeowners alike benefit from reduced energy costs, regardless of compliance path.

This version of the Quality Criteria is updated criteria. Items which are not available on the Builders Challenge website.

**Relationship to Codes & Manufacturers**  
The Quality Criteria are not intended to replace applicable codes. In cases where applicable codes apply, in cases where many of the provisions noted below at Challenge is focusing attention on the code.

Additionally, where a quality provision is not covered by a code, the quality provision is intended to be more stringent than the code.

**Roles and Responsibilities**  
The Quality Criteria require different parties to be responsible for different aspects of the project. Builders must establish the responsibilities for each party. Third-party verifiers must verify that the builder is following the Quality Criteria. QC inspectors for homes quality assurance or employees of an organization) to use building.

**Builders Challenge Quality Criteria V1.3 – June 4, 2008**  
For more information on the Builders Challenge, visit: [www.builderschallenge.com](http://www.builderschallenge.com)

**Builders Challenge**  
Recognizing Energy Leadership in Homebuilding

**Builders Challenge Quality Criteria**

Trade contractors must implement quality practices in accordance with the Builders Challenge website.

**Resources**  
A technical resource guide with background on each of the QC provisions. Links to the Building America Best Practice Guides, as well as other resources.

**Quality Criteria**  
The Quality Criteria are listed in three phases:  
The **Design Phase** requires design, planning and documentation.  
The **Construction Phase** frequently requires the builder/contractor to follow the Quality Criteria.  
The **Verification Phase** requires a third-party verifier to review the project.

Builders Challenge Quality Criteria	Builder Documentation & Verification Requirements	Third-Party Verification Requirements
<p><b>1. Project Documentation – Required</b> Construction/design documentation (e.g., plans, details, specifications, job record books, checklists, and trade scopes of work and/or agreements) will include and quality provisions needed to meet the Builders Challenge criteria.</p>	<p>specification, and drainage space specification (if applicable)</p> <p>include requirements for flashing, foundation details, and wall system in contractor's construction/design documentation.</p>	
<p><b>2. Building Envelope Moisture Management – Design Phase – Required</b> In the design phase, include details for integrating the weather barrier system flashing components in the construction plans. Specify window and door flashing details.</p>	<p>Specify climate appropriate vapor retarder or barrier per locally applicable IECC. (reference IECC Section 402.5)</p> <p>When using water absorbent cladding, including brick, stone (real or manufactured), stucco, and fiber cement, provide a pathway for bulk water that enters the wall assembly from the exterior to drain to the exterior. Typically this involves specifying a drainage space or pathway provided by furring strips, an air gap, contoured house wrap, or other products that create a vertical drainage channel behind the cladding and exit the wall horizontally. Cladding installation per manufacturer's recommendations is also permitted.</p>	
<p><b>3. Material Efficient Framing – Recommended</b> Design building dimensions and layouts to minimize material cuts and waste for wall, floor, and roof system structural components and sheathing. Size all headers for actual structural loads, and insulate to the fullest extent possible. To the extent possible use building systems which minimize on-site waste, such as panelized walls, pre-cut framing packages, and engineered wood products. Incorporate these measures in the framing plans.</p>	<p>Develop framing layout plan and keep in project records.</p>	
<p><b>Builders Challenge Quality Criteria V1.3 – June 4, 2008</b> For more information on the Builders Challenge, visit: <a href="http://www.builderschallenge.com">www.builderschallenge.com</a></p>		

**Builders Challenge**  
Recognizing Energy Leadership in Homebuilding

Builders Challenge Quality Criteria	Builder Documentation & Verification Requirements	Third-Party Verification Requirements
<p><b>4. Construction Waste Management – Recommended</b> Develop, post at the jobsite and implement a Construction Waste Management Plan. The plan should document the diversion pathways for major waste stream components including cardboard, lumber, land-clearing debris, and drywall. The plan should also document efforts to request minimized packaging from suppliers. Goals for waste diversion should be at least 20% (by weight) for construction and land-clearing waste.</p>	<p>Develop Construction Waste Management Plan and keep in project records.</p>	
<p><b>5. Space Conditioning Design – Required</b> Right-size space conditioning system for heating/cooling loads based on ACCA Manual J Version 8 or comparable load sizing analysis (reference 2006 IRC M1401.3, 2006 IECC Section 403.4). The maximum over-sizing limit for cooling equipment is 15%, with the exception of heat pumps in Climate Zones 5 - 8 where the maximum over-sizing limit is 25%. Outdoor temperatures shall be the 99.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home's location or most representative city for which design temperature data are available. Note that a higher outdoor air design temperature may be used if it represents prevailing local practice by the HVAC industry and reflects extreme climate conditions that can be documented with recorded weather data. Indoor temperatures shall be 75 F for cooling. Infiltration rate shall be selected as "tight", or the equivalent term. In specifying equipment, the next available size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ASH standards.</p>	<p>Analyze load-sizing and duct-sizing and keep in project records.</p>	<p>Review the load-sizing and duct-sizing analyses to ensure that sizing criteria stated in the requirements were used for the home.</p>
<p>Identify the whole building ventilation strategy and equipment in the mechanical system design (see the 2 other Quality Criteria: Whole Building Ventilation I and II for requirements).</p>		
<p><b>6. Space Conditioning Design – Recommended</b></p>		

**Builders Challenge Quality Criteria V1.3 – June 4, 2008**  
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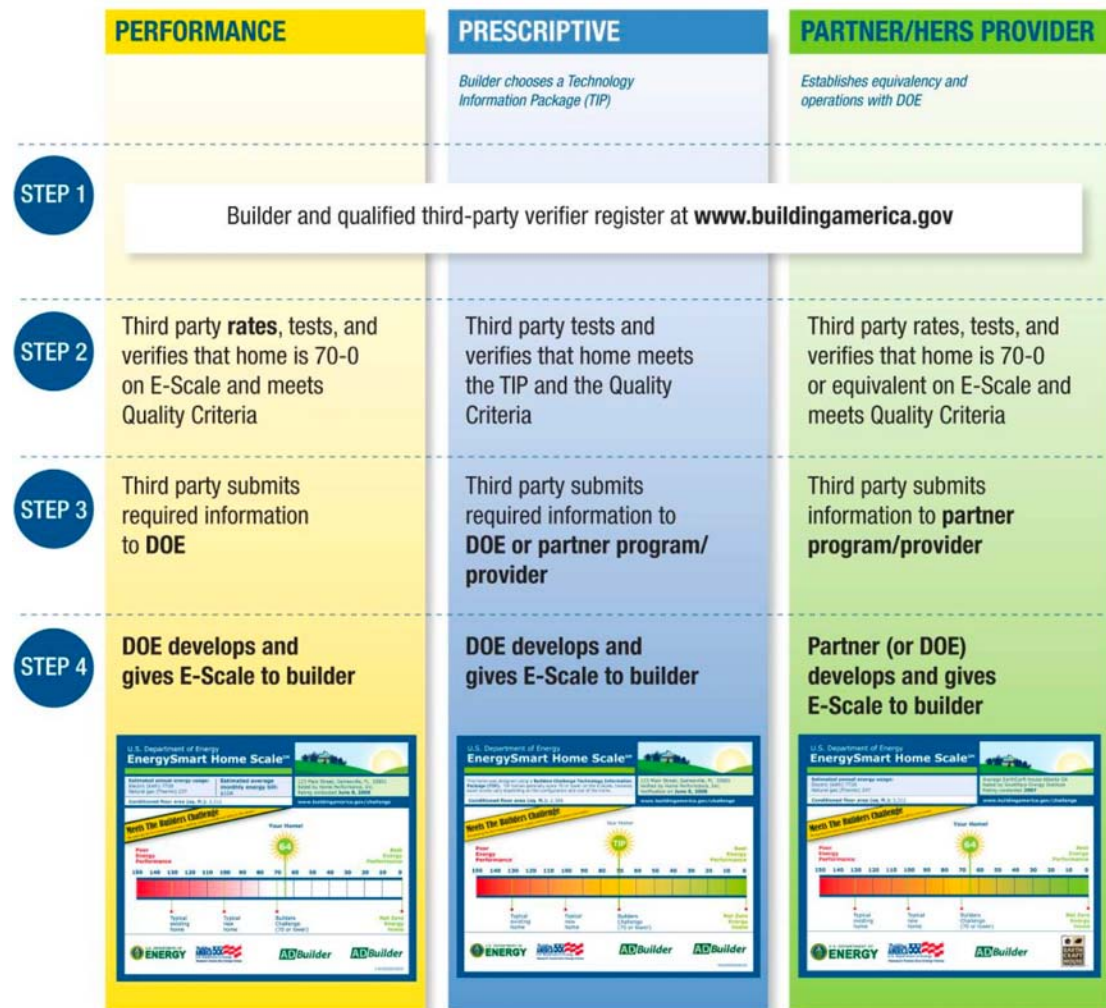
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— 29 criteria

- 15 required, 14 recommended
- Focus on comfort, IEQ, durability
- Organized by design/construction phase
- Developed by industry experts under DOE leadership



# How does it work?





# BC-TIP for Phoenix, AZ

- 7 TIPs available online
- More coming for other systems and cities
- Send us suggestions!

Climate Region: Hot-Dry Location: Phoenix Foundation Type: Slab	Minimum Builders Challenge Level		Premium Efficiency Level	
	Gas	Electric	Gas	Electric
<b>Heating Fuel:</b>	Gas	Electric	Gas	Electric
<b>Insulation</b>				
Walls <sup>1</sup>	2x4 R-15	2x4 R-15	2x4 R-15	2x4 R-15
Roof	R-30	R-30	R-30	R-30
Slab	Uninsulated	Uninsulated	Uninsulated	Uninsulated
<b>Windows<sup>2</sup></b>				
	Double-Glazed, Low-E	Double-Glazed, Low-E	Double-Glazed, Low-E	Double-Glazed, Low-E
U-Factor	0.35	0.35	0.32	0.32
Solar Heat Gain Coefficient	0.35	0.35	0.27	0.27
<b>Lighting</b>				
% Fluorescent Fixtures <sup>3</sup>	90%	90%	100%	100%
<b>Heating</b>				
Furnace, Efficiency Rating, AFUE	82		92.5	
Air-Source Heat Pump, HSPF		8.2		9.2
<b>Air Conditioning</b>				
Efficiency Rating, SEER	14		17	
Air-Source Heat Pump, SEER		14		18
<b>(Builder-Supplied) Appliances</b>				
	ENERGY STAR®	ENERGY STAR®	ENERGY STAR®	ENERGY STAR®
<b>Water Heater</b>				
	Tank/Gas	Tank/Electric	Tankless/Gas	Tank/Electric
Energy Factor, EF	0.59	0.95	0.77	0.95
<b>Air Tightness</b>				
ACH50	5.0	5.0	3.0	3.0
<b>Ducts</b>				
Location	Inside Conditioned Space	Inside Conditioned Space	Inside Conditioned Space	Inside Conditioned Space

<sup>1</sup> Framing factor shall not exceed 23%.

<sup>2</sup> Window area shall not exceed 18% of conditioned, above-grade floor area.

<sup>3</sup> Pin-based fluorescent fixtures or compact fluorescent lamps.



# Technical Resources

The screenshot shows the homepage of the Building America program. At the top, it features the U.S. Department of Energy logo and the text "Energy Efficiency and Renewable Energy". Below this is the "Building Technologies Program" header. The main content area includes a search bar, a "News" section with a "2008 Buildings Energy Data Book is Now Available" announcement, and a "Publications" section listing five "Building America Best Practices Series" guides. A sidebar on the left contains navigation links like "About Building America", "Research Teams", and "Systems Engineering Approach". A "Builders Challenge" section highlights incentives for high-EER homes. At the bottom, it states "41,190 Homes Built in Building America Research Projects" with a map of the United States.

[www.buildingamerica.gov](http://www.buildingamerica.gov)

This collage displays various technical resources from the Building America program. It includes:

- The cover of "Building America Best Practices Series: Volume 1: Builders and Owners Handbook for Improving Home Based Efficiency, Comfort, and Reliability in the Hot and Humid Climate".
- Diagrams for "Better Duct Systems for Home Heating and Cooling" showing air flow patterns.
- A "DUCT SEALING" diagram with sections for "AIR HANDLER", "SUPPLY & RETURN PLenums", "FLEX DUCT", and "BOOTS".
- A "Building Tip" diagram for "AIR SEALING DRYWALL" with a checklist for installation steps.
- The cover of "Building America Performance Test Part 2: Air-Exchange Measurements".
- The cover of "Solar Thermal Photovoltaic Systems".
- A "Technical Report" cover from NREL.

## Buyer-Focused Brochure



### Take Control of Your Energy Future

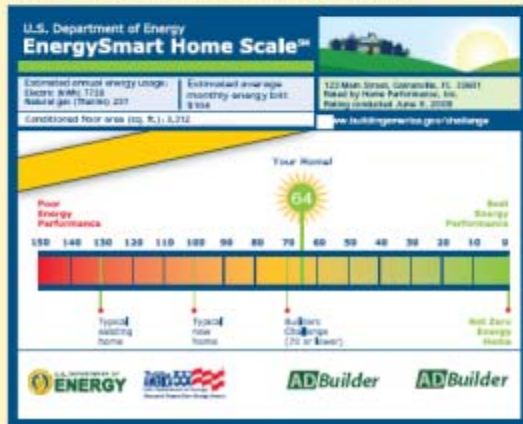
Choosing a new home is all about making the right decisions for you and your loved ones — selecting a neighborhood, a high-quality builder, and the features you value. You compare, ask questions, and make informed decisions about what matters most to you.

But what about energy? Today, more and more buyers value energy efficiency in their new homes — as a way to control their energy bills, reduce carbon emissions, and help preserve our natural environment. Yet, until now, there has been no easy way to compare the energy performance of different homes.

That is where the EnergySmart Home Scale (E-Scale) comes in. Brought to you by the U.S. Department of Energy, the E-Scale lets you compare the energy performance of homes on the market, simply by comparing a number rating. And like your car's MPG, it is a number worth knowing — a number that can put you in control of your energy future.

### Make smart choices with the E-Scale

Look for the EnergySmart Home Scale (E-Scale) to compare the energy performance of home models. The lower the number, the more energy — and energy dollars — you'll save.



## Sample Consumer Ad



### House Proud

Her flowers win awards. His DIY projects are envied. And both are house proud when it comes to energy savings. By choosing a high-performance house between 0 and 70 on the EnergySmart Home Scale (E-Scale), these neighbors enjoy lower energy bills and help the environment.

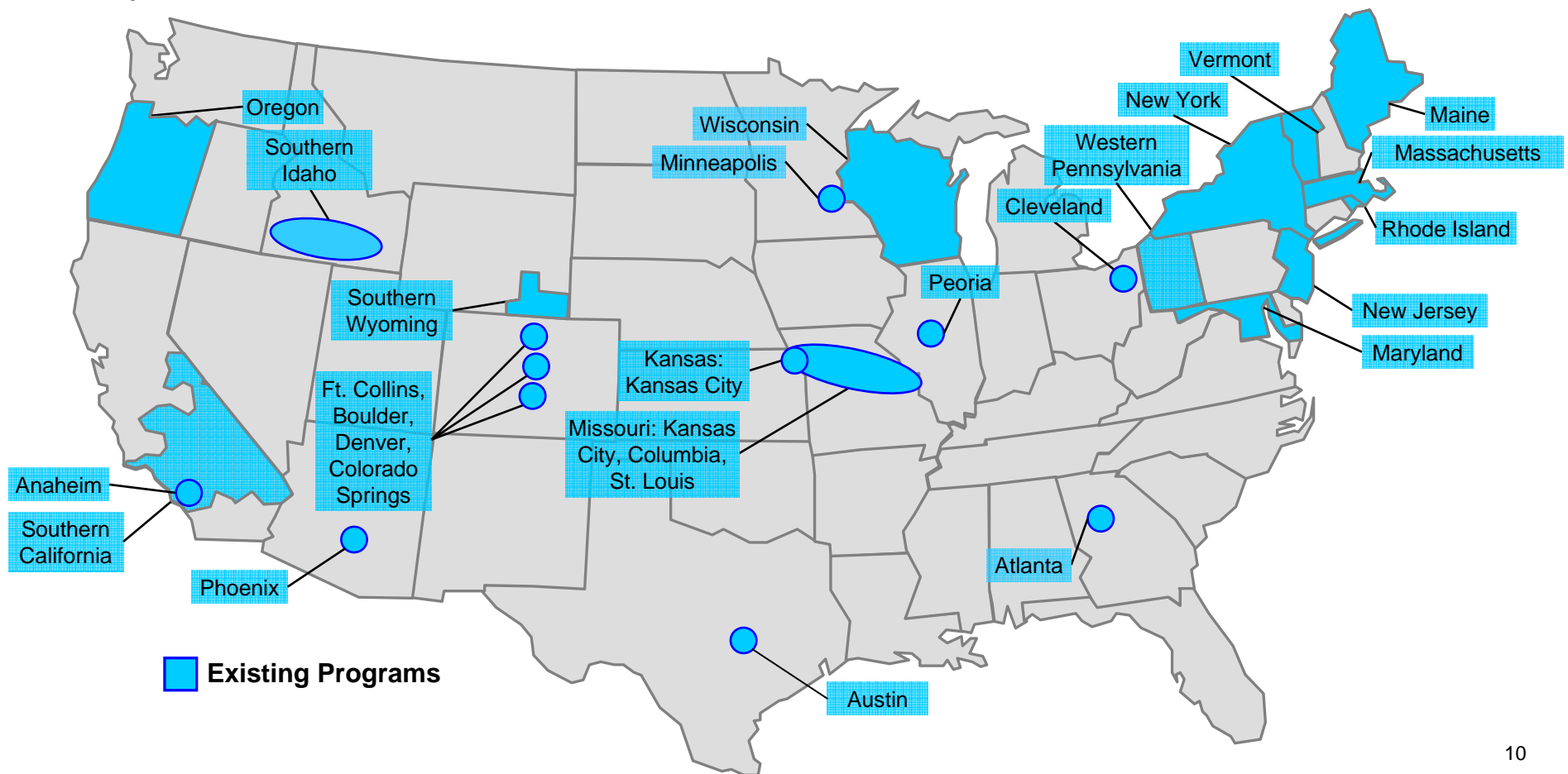
For more about the E-Scale, see <http://www.buildingamerica.gov/challenge>





# Home Performance with Energy Star

- Currently approximately 12,000 homes improved a year





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# Benefits of an Aggressive Residential Energy Efficiency Program

- Goal is to develop the infrastructure to enable retrofit of 5 to 10 million homes a year
- Employ 250,000 to 500,000 well paying green jobs that cannot be exported
  - Train 100,000 contractor/home energy analysts and 200,000 ancillary services trades
- Provide an economic stimulus of \$50 to \$100 billion per year
- Increase savings by 0.25 to 0.50 quads per year (Goal of 3 quads per year by 2020)
- Estimated savings of \$36 billion annually for America's home owners by 2020
- Reduction of carbon emissions by 180 million metric tons compounded annually by 2020



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## Recovery Act of 2009

- \$1,500 tax credit for home retrofit
- \$5 billion for Weatherization Assistance
- \$3.1 billion for State Energy Program
- \$3.2 billion for EE block grants
  - \$2.8 billion based on existing formula
  - \$400 million for competitive awards
- \$6 billion for HUD grants
- \$6 billion for innovative technology loan guarantees
- \$500 million for green job training
- \$2.5 billion for energy efficiency research



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# What can we do to help States use these funds effectively?

- Funds go to States as grants
- Complete work on retrofit standards
- Templates for various approaches
- Guides for establishing a program
- Technical support to the State offices, financial institutions and trades
- Training
- Business development
- Marketing to homeowners
- Most important is a sustainable national program

# BESTEST-EX Objective



- **Test ability of analysis methods with utility bill true-up to predict energy savings.**
  - **Method to be basis for software certification**
- **Compare energy savings predictions based on:**

Approximately-known base-case inputs calibrated to pre-retrofit utility bills

versus

Explicitly-known base-case inputs used to generate “utility bill truth standard”

Where ... to calculate savings predictions, explicitly known inputs for specific energy savings measures are applied to both base cases.



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## Forms at RESNET

- Bestest- EX
  - Monday 6:30 - 9:30p.m., in room Toulouse A
- Recovery Act – metrics, definitions and opportunities
  - Monday 7:30 – 9:00p.m., in room St. Charles B
- Recovery Act – Discussion of ways to help States use grant funds effectively
  - Tuesday 7:30 – 9:00p.m., in room St. Charles B



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# Residential Policy Recommendations

- Increased funding for:
  - Component research
  - Building America research in all climate zones simultaneously
  - Training for designers, builders, trades and marketing
- Policy changes:
  - National change in home assessment to include values of energy savings
  - Energy efficient mortgages
  - EnergySmart Home Scale and other energy efficiency metrics included in Multiple Listing Service
  - Require audits at time of sale to upgrade to minimum efficiency level
  - Direct DOE to do a study on the most effective way to promote and finance energy efficiency in bulk (loan guarantees, tax credits, utility bills, etc.)