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Policy Supporting Energy Efficiency and Heat Pump Technology

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The U.S. Energy Big Picture…

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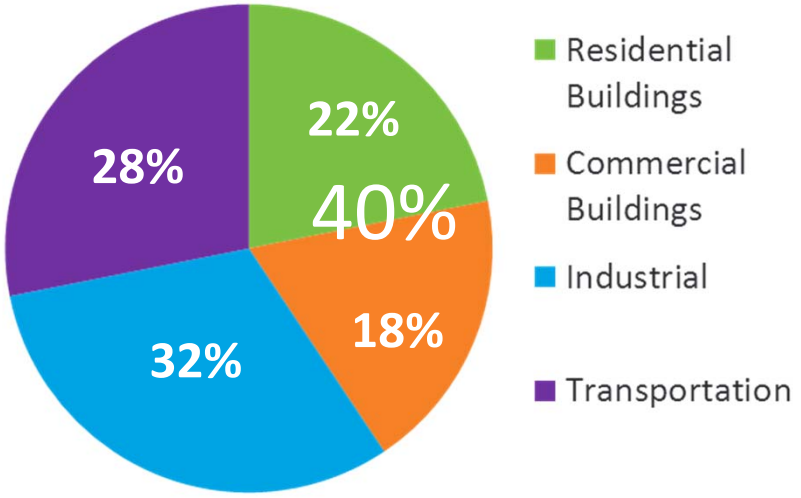
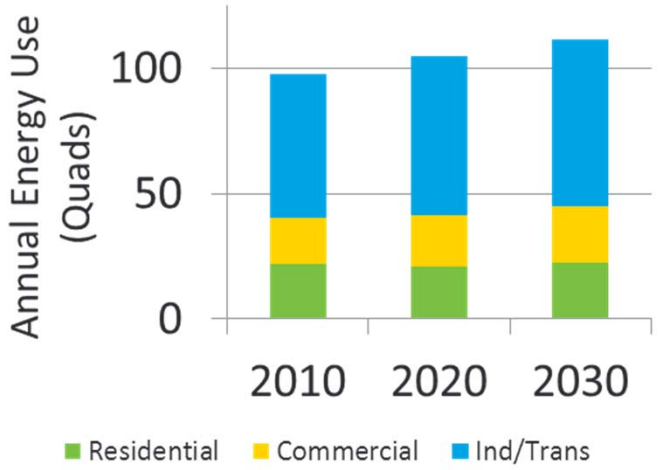
U.S. Primary Energy Consumption



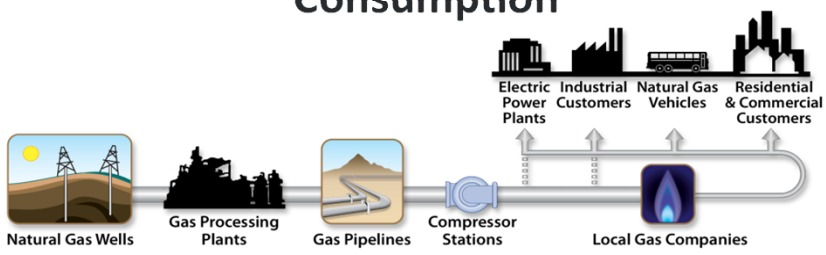
Total U.S. Energy Consumption



Quad = 1.055 exajoule (EJ)

Buildings represent 73% of U.S. Electricity Consumption

and 55% of U.S. Natural Gas Consumption



DOE Building Technologies Program (BTP) Pursues an Overarching Goal

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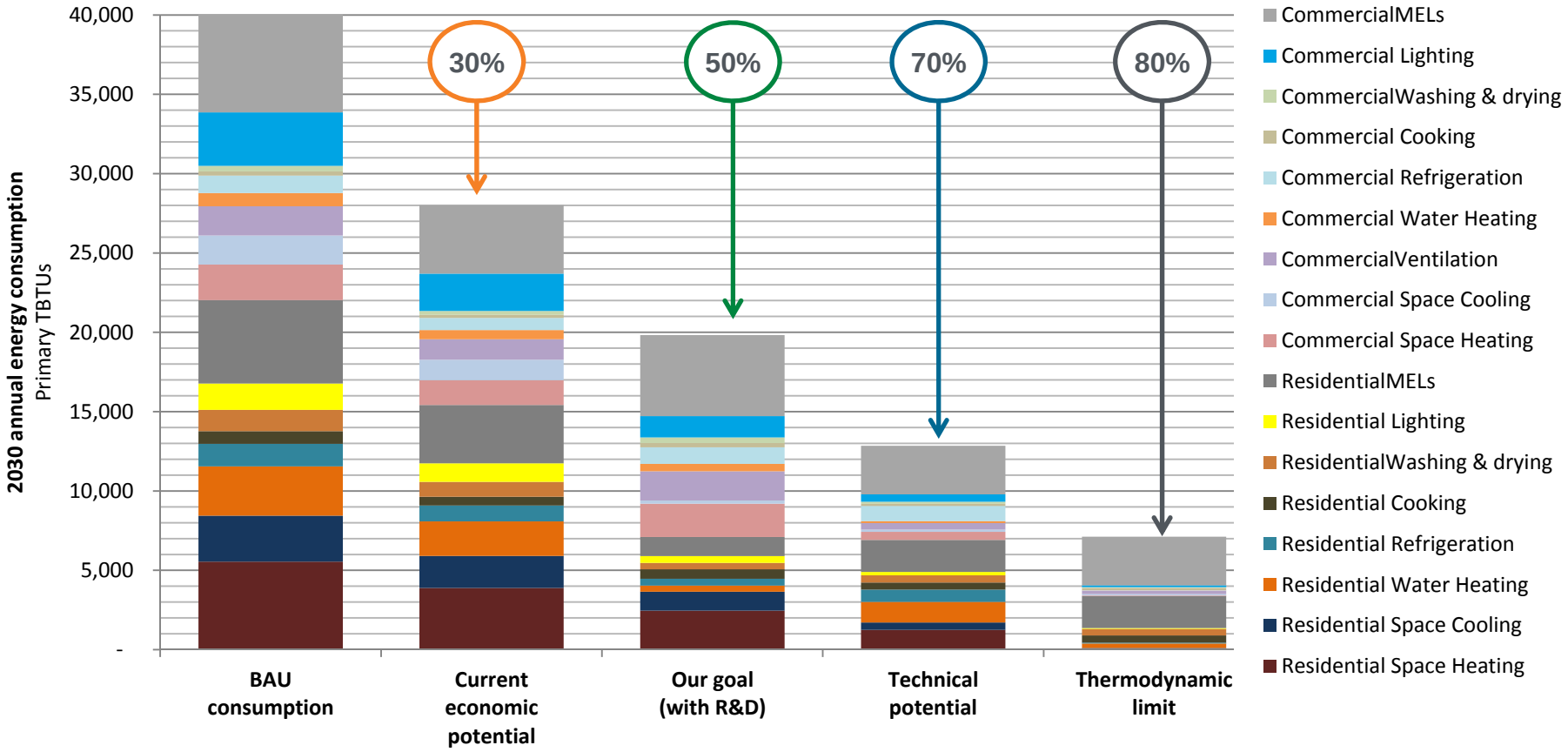
Reduce Building-Related Energy Use 50% by 2030



Source: BTP Prioritization tool, NAS, McKinsey.

The Building Technologies Program (BTP) uses an Integrated Approach to Deliver Savings

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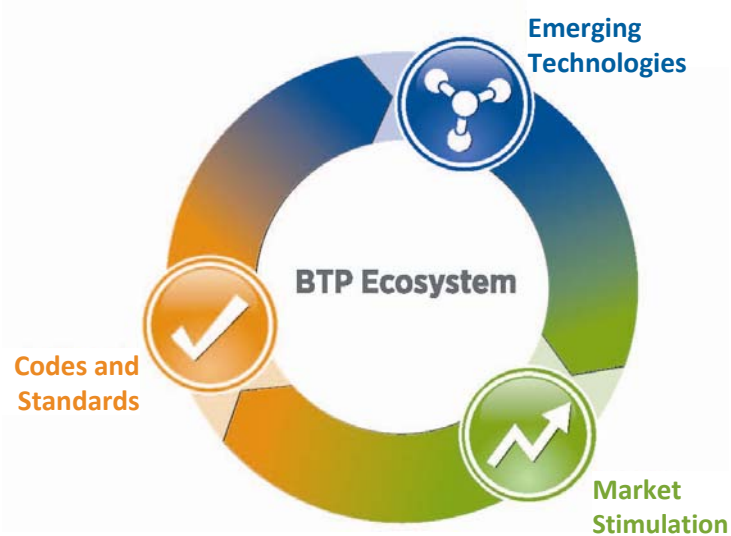
Research & Development

- Develop technology roadmaps
- Prioritize opportunities for DOE
- Solicit and select innovative technology solutions
- Collaborate with researchers and market performers
- Solve technical barriers and test innovations to prove effectiveness
- Measure and validate energy savings



Market Stimulation

- Identify barriers to "speed and scale" adoption
- Develops solutions to policy, adoption, and financial barriers
  - Collaborate with industry partners to improve market adoption
  - Increase usage of products and services
  - Communicate the importance and value of energy efficiency
  - Provide technical assistance
  - Support development of workforce training and certification

Codes and Standards

- Establish minimum energy use in a transparent public process- raise the efficiency bar
- Protect consumer interests
- Reduce market confusion
- Enhance industry competitiveness and profitability
- Expand portfolio of energy efficient appliances and equipment

Overview of United States Building Efficiency Policies and Programs

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- **New Buildings**
  - Mandatory state and local codes, plus labels, design, technology, information
- **New Appliances and Equipment**
  - Mandatory efficiency performance standards (MEPS), plus labels, technology, incentives, information
- **Existing Residential Buildings**
  - Audits/information, labels, incentives/grants, financing, technology
- **Existing Commercial Buildings**
  - Audits/information, labels, incentives/grants, financing, technology

Examples….

- Mandatory efficiency performance standards (MEPS)
- Working with Industry to Drive Innovation (non R&D)
- Advanced Energy Design Guides
  - Offer designers and contractors the tools needed for achieving energy savings over minimum requirements of Standard 90.1-2004
- Home Labels: Home Energy Score Tool
- Incentives/grants/rebates
  - Better Buildings Neighborhood Program
  - State Energy Efficient Appliance Rebate Program (SEEARP)

Appliance Standards and Test Procedures is DOE's Most Effective Energy Saving Program

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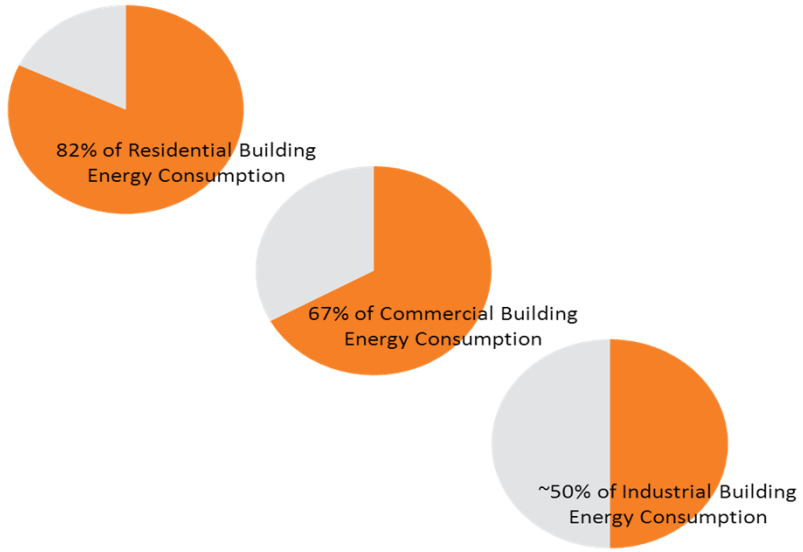
- Energy saved since first 1987 standards = construction of ~31 power plants avoided or the amount of electricity consumed annually by Spain
- 1988 – 2006 standards est. cumulative energy savings = **39 quads by 2020** and **63 quads by 2030**
- Cumulative consumer benefit*:
  - $64 billion at the end of 2005
  - $150 billion as of 2010
  - $241 billion by 2030
  - $269 billion by 2045
- Annual carbon savings will reach 38 million tons by 2020
- Cumulative carbon savings by 2045 is estimated at 1,200 million tons

- <$650 in net savings for every federal dollar spent
  - Consumers and businesses are saving $15 billion a year as of 2010 and this is expected to nearly double by 2025
- Over 50 products covered:



Quad = 1.055 exajoule (EJ)

*Net present value

Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps

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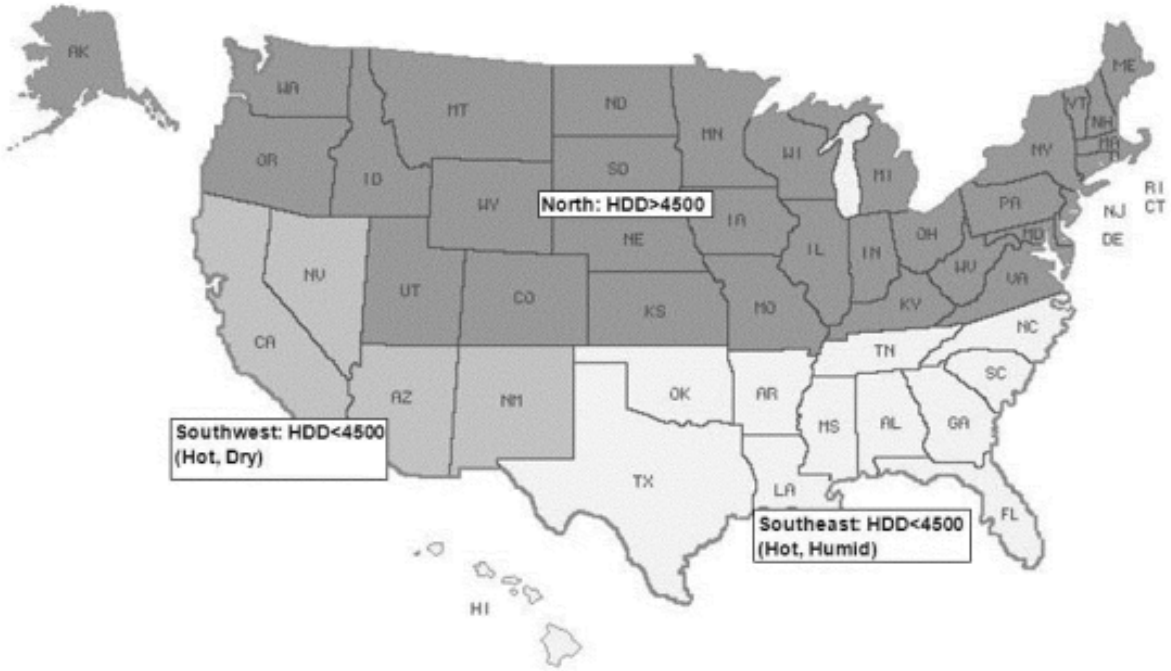

Figure III.2 Map of Preliminary Analysis Proposed Regions for Central Air Conditioner and Heat Pump Standards

Heat Pumps: Starting January 1, 2015, the new minimum efficiency standard for split system heat pumps is 14 SEER and 8.2 HSPF.

Source: http://www.gpo.gov/fdsys/pkg/FR-2011-06-27/pdf/2011-14557.pdf

***HDD**: Heating degree days*

Energy Conservation Standards for Residential Furnaces and Residential Central Air Conditioners and Heat Pumps

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TABLE I.1—AMENDED ENERGY CONSERVATION STANDARDS FOR FURNACE, CENTRAL AIR CONDITIONER, AND HEAT PUMP ENERGY EFFICIENCY

Product class	National standards	Northern Region ** standards
Residential Furnaces *		
Non-weatherized gas	AFUE = 80%	AFUE = 90%.
Mobile home gas	AFUE = 80%	AFUE = 90%.
Non-weatherized oil-fired	AFUE = 83%	AFUE = 83%.
Weatherized gas	AFUE = 81%	AFUE = 81%.
Mobile home oil-fired ‡‡	AFUE = 75%	AFUE = 75%.
Weatherized oil-fired ‡‡	AFUE = 78%	AFUE = 78%.
Electric ‡‡	AFUE = 78%	AFUE = 78%.

Product class	National standards	Southeastern Region †† standards	Southwestern Region ‡ standards
Central Air Conditioners and Heat Pumps †			
Split-system air conditioners	SEER = 13	SEER = 14	SEER = 14. EER = 12.2 (for units with a rated cooling capacity less than 45,000 Btu/h). EER = 11.7 (for units with a rated cooling capacity equal to or greater than 45,000 Btu/h).
Split-system heat pumps	SEER = 14 HSPF = 8.2	SEER = 14 HSPF = 8.2	SEER = 14. HSPF = 8.2.
Single-package air conditioners ‡‡	SEER = 14	SEER = 14	SEER = 14. EER = 11.0.
Single-package heat pumps	SEER = 14 HSPF = 8.0	SEER = 14 HSPF = 8.0	SEER = 14. HSPF = 8.0.
Small-duct, high-velocity systems	SEER = 13 HSPF = 7.7	SEER = 13 HSPF = 7.7	SEER = 13. HSPF = 7.7.
Space-constrained products—air conditioners ‡‡	SEER = 12	SEER = 12	SEER = 12.
Space-constrained products—heat pumps ‡‡	SEER = 12 HSPF = 7.4	SEER = 12 HSPF = 7.4	SEER = 12. HSPF = 7.4.

* AFUE is annual fuel utilization efficiency.
** The Northern region for furnaces contains the following States: Alaska, Colorado, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming.

Future: Cold Climate Heat Pumps….

Source: http://www.gpo.gov/fdsys/pkg/FR-2011-06-27/pdf/2011-14557.pdf

Working with Industry to Drive Innovation: The RTU Challenge

- Package units like RTUs use ~ 50% of the cooling energy in commercial buildings
- ~40,000 ten ton RTUs sold/year in the U.S.
- Challenge U.S. manufacturers to build and deliver innovative, competitively priced, energy-saving RTUs that meet high-performance specifications:
  - Efficiency from baseline 11.0 EER to 18 IEER
  - Decrease air flow by specifying variable over constant air volume
  - Increase fan efficiency from 45% to at least 60% with variable volume or multi-stage operation capability

TARGET

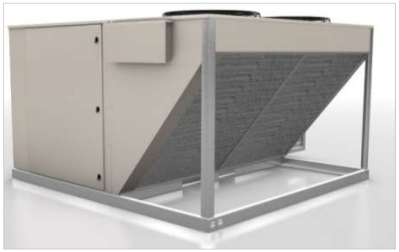
Walmart

LOWE'S

THE HOME DEPOT

McQuay International
a member of DAIKIN group

Carrier
A United Technologies Company



50% Advanced Energy Design Guides Series

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Two AEDG series:

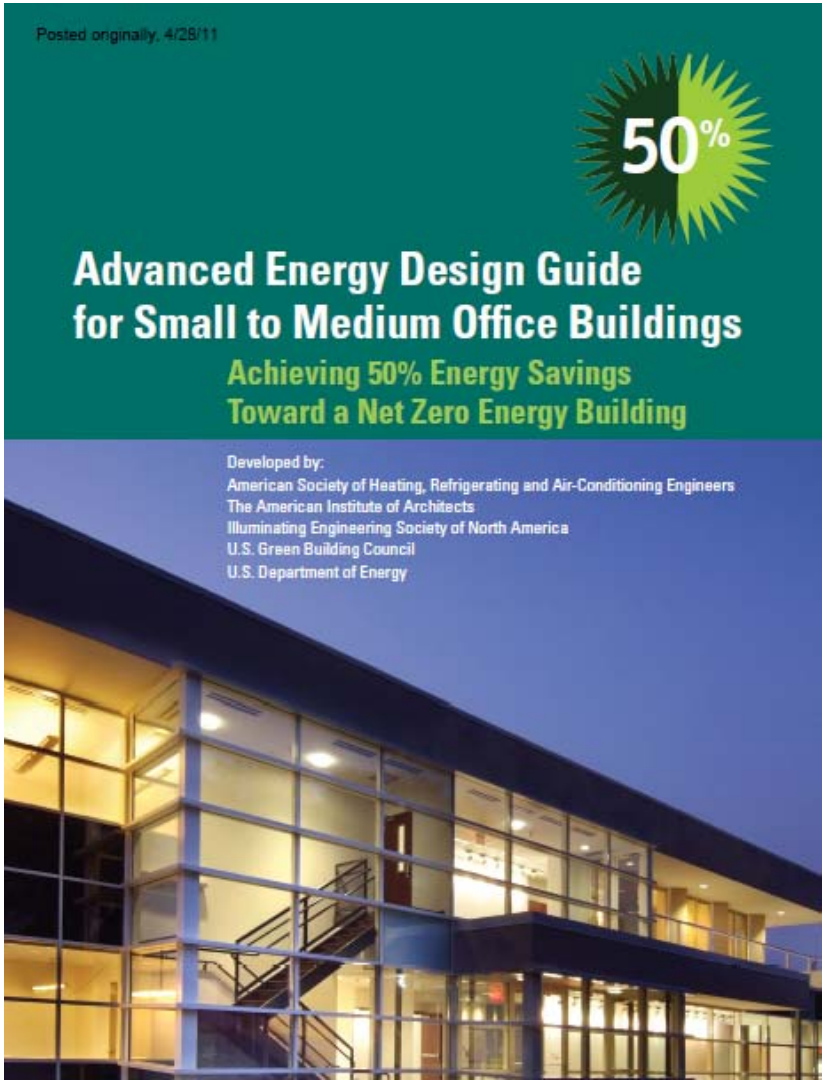
- 30% energy savings
- **50% energy savings**

50% energy savings over *ASHRAE Standard 90.1—2004*

50% AEDG Building Types:

1. Small to Medium Office Buildings
2. K-12 Schools
3. Medium to Big Box Retail
4. Large Hospitals

Free download:
www.ashrae.org/technology/page/938



Home Energy Score Provides Accessible Information to Homeowners

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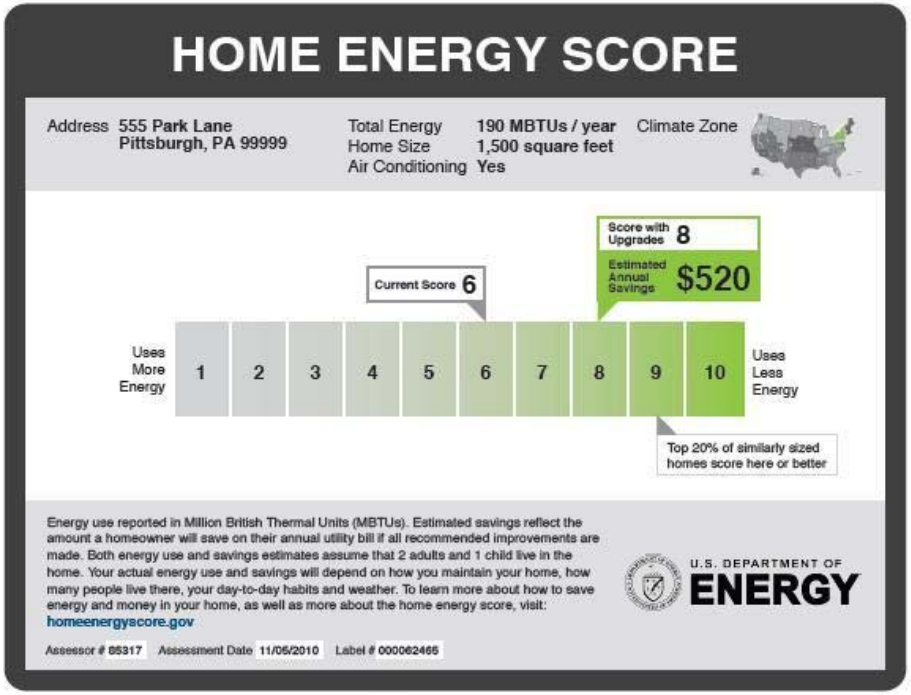
A Reliable, Easy to Understand Tool

- DOE is testing the program through 10 pilots across the U.S.
- Specific interest in assessing the following:
  - Efficacy of the scoring tool and methodology
  - Homeowner understanding and response
  - Assessor feedback
- Based on findings, DOE will refine the tool and the program



Better Buildings Neighborhood Program

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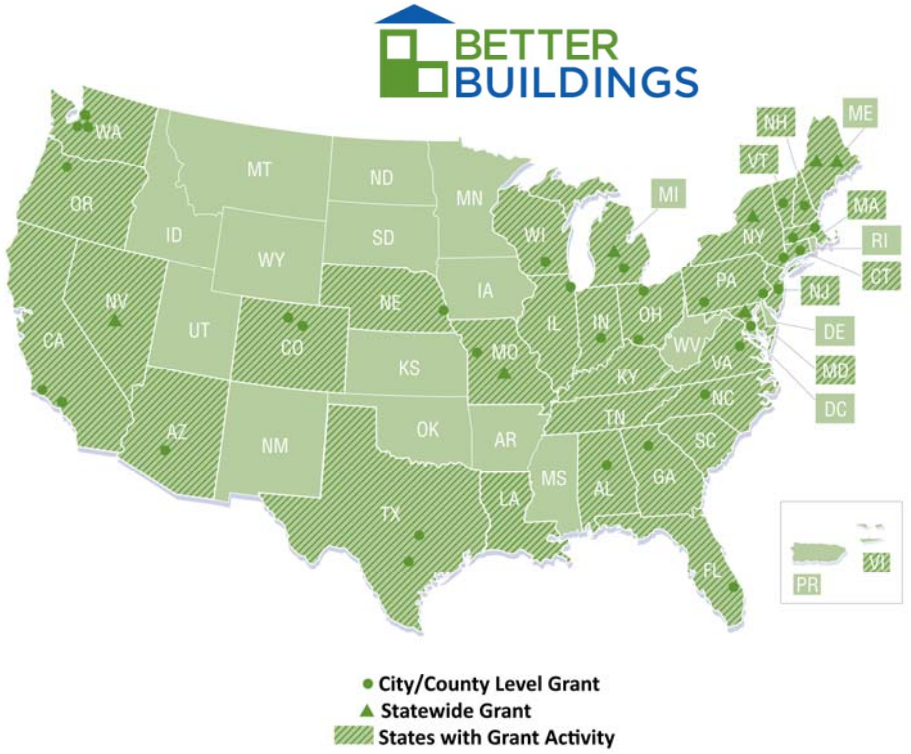
Goals

- Retrofitting 150,000 buildings (residential and commercial)
- Using over $500 million in grants to leverage over $3 billion in additional resources
- Creating or retaining approximately 30,000 jobs
- Reducing the cost of retrofit program delivery by 20% or more
- Achieving 15-30% energy savings from energy efficiency upgrades
- Saving consumers approximately $65 million per year on energy bills
- Developing sustainable energy efficiency retrofit programs.



Accomplishments

- Thousands of building efficiency upgrades have already been completed through the Better Buildings program

The State Energy Efficient Appliance Rebate Program (SEEARP) Impact

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Created under the Energy Policy Act of 2005 and received funding through the American Recovery and Reinvestment Act (ARRA) in February 2009: ***$300 million in funding, 1.6 million rebates issued***