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

Building Technologies Program Overview

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October 16, 2009

United States Current Energy Use

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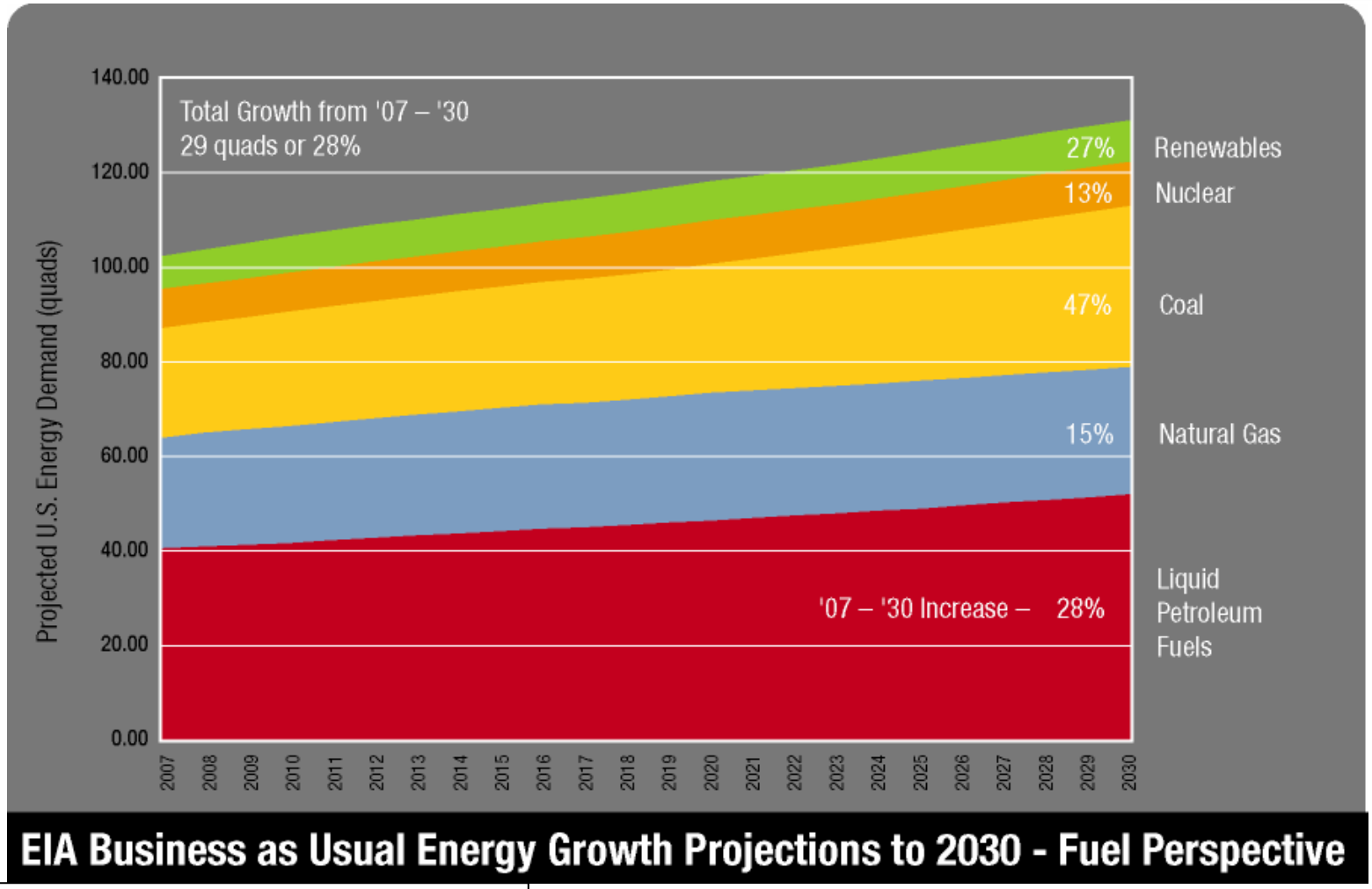

… and where we are going

Buildings Sector Accounts for About 40% of US Energy, 72% of Electric Emissions.

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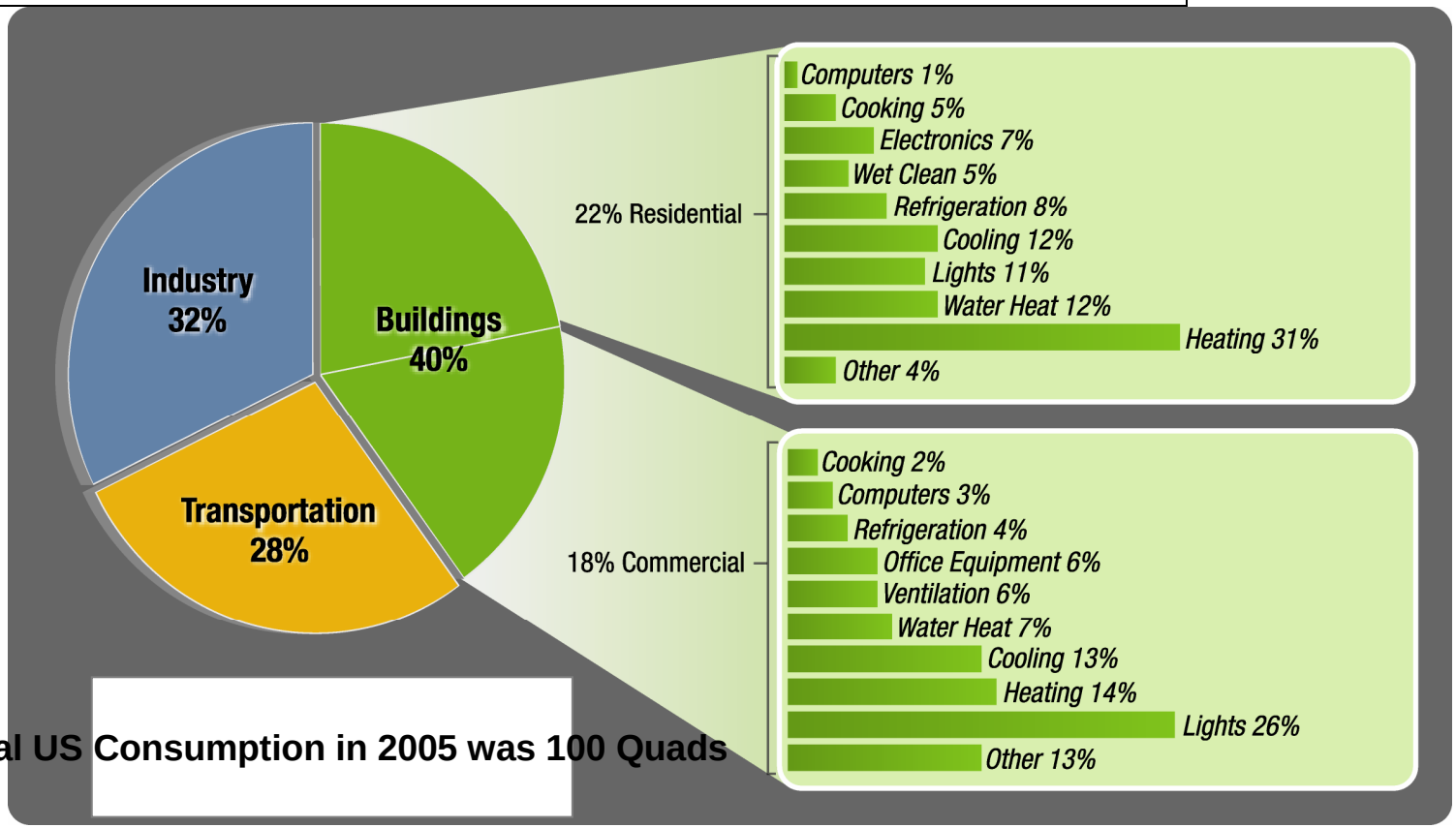

Building Sector construction and renovation accounts for 9% of GDP and employs 8 million people. Energy utility bills total $390B each year.

Source: B*uildings Energy Data Book*, September 2008, Tables 1.1.3, 1.1.6, 3.1.1, 3.3.1, 4.1.5, 5.1.2, 5.3.1

Program Overview: Mission, Vision and Goals

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- **Vision**
  - Realization of marketable net-zero-energy buildings through the development of conservation technologies and practices.
    - Reduce demand in manner that allows successful integration of renewable energy.
- **Mission**
  - Develop technologies, techniques, and tools for making residential and commercial buildings more energy efficient, productive, and affordable. Involves
    - Research, Development, Deployment, and Demonstration in partnership with industry, government agencies, universities, and national laboratories
    - Improve components and equipment, and effective integration into “whole-building”
    - Development of energy codes and equipment standards
    - Integration of renewable energy systems into building design and operation
- **Goal**
  - Create technologies and design approaches that enable net-zero energy buildings at low incremental cost by 2025. A net-zero energy building is:
    - Residential or commercial building with greatly reduced needs for energy through efficiency (60 to 70 percent less energy use)
    - Balance of energy supplied by renewables
    - Efficiency gains will have application to buildings constructed before 2025

BTP is focused on creating the technologies and design approaches that enable net-zero energy buildings at low incremental cost

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- Current goals are:
  - By 2020 for Residential New Construction
  - By 2025 for Commercial New Construction

- Existing buildings require attention
  - 114 million households
    - 2/3 of homes were built before 1980, and modern residential energy codes did not take effect until 1980s
  - Five million commercial buildings
    - More than 74 billion square feet of floor space

Residential Integration: The Building Technologies Program is marching towa

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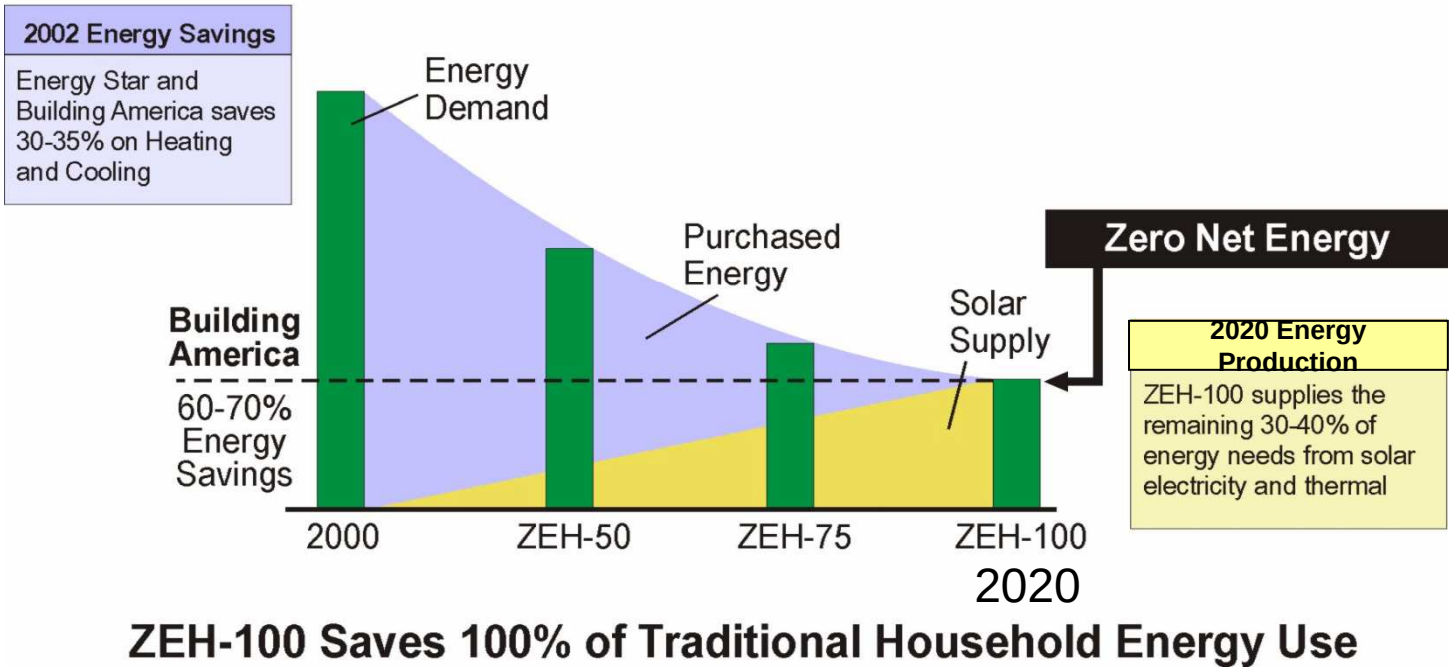
Zero Energy Homes



ZEH-100 Saves 100% of Traditional Household Energy Use

Ultimate goal is a Zero Energy Home using cost effective tools, techniques and integrated technologies, systems and designs for buildings that generate and use energy so efficiently that buildings are capable of generating as much energy as they consume on an annual basis at neutral cash flow.

Research and Development: Integration of Technologies

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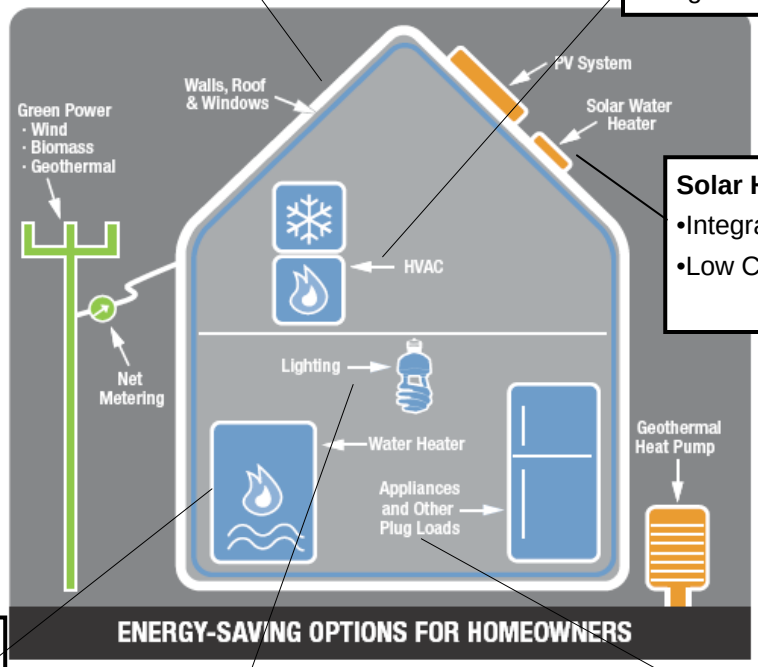
- Residential Integration
- Commercial Integration
- Emerging Technology
  - Solid State Lighting
  - Space Conditioning and Re
  - Solar Heating and Cooling
  - Thermal Envelope
  - Windows
  - Analysis Tools

Thermal Envelope
•High R Walls and Roofs
•Smart Insulation and Vapor Barriers
Windows
•R-10 Dynamic Super Window

Space Conditioning and Refrigeration
•Integrated, low capacity heat pump.



Solar Heating and Cooling
•Integrated Soar Thermal – PV Syster
•Low Cost Solar Water Heaters for Cold Climates

Domestic Hot Water
•Engineered Hot Water Distribution
•Integrated, low capacity heat pump

Lighting
•Solid State Lighting

Appliances and Other Plug Loads
•Whole House Energy Control Standard
•10-30% Misc. Electric Savings

Technology Validation and Market Introduction

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- **Building Codes**
  - Commercial: ASHRAE 90.1-2010 30% improvement goal
  - Residential: IECC Model Code push towards 30% improvement, 2009 IECC 12-17% increase in stringency
- **National Building Rating Program**
  - Help owners to understand the efficiency of homes and buildings
  - Provide a set of cost-effective steps they can take to improve that efficiency
  - Take accountability in measuring the energy savings
- **Targeted Markets**
  - Energy Smart Schools
  - Energy Smart Hospitals
- **Solar Decathlon**
  - Expansion to EU in 2010

Solid State Lighting

The **DOE Solar Decathlon:** university teams compete to design, build, and operate the most attractive and e nergy-efficient solar-powered house.

Appliance Standards Primary Activities

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- **Minimum Energy Efficiency Standards**
  - Framework Document & Meeting
  - Preliminary Analysis Document & Meeting
  - NOPR Document & Meeting
  - Final Rule Document
- **Determinations**
- **Test Procedures**

- Prior to EPACT 2005, DOE completed standards for **11** products
- Since EPACT 2005, DOE completed standards for **9** products
- By 2011, DOE must complete standards for **23** products

Almost all Final Rule activities have statutory deadlines. Backlogged rulemakings due prior to EPACT 2005 also are under consent decree court ordered deadlines.

Some of BTP's recent accomplishments

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- **Residential:**
  - Best practices for 30% energy savings in all climates and 40% savings in Marine and Hot/Mixed-Dry.
  - Signed up 345 Builders Challenge Builder Partners and 5 Program Partners
- **Commercial:**
  - Net-Zero Energy Commercial Building Initiative (as mandated in EISA 2007; congruent with BTP miss
  - Launched Retailer Energy Alliance (Feb 08); Commercial Real Estate Energy Alliance (Apr 09); and Hospital Energy Alliance (Apr 09)
- **Emerging Technologies:**
  - SSL prototypes cool white LED that delivers 107 lm/W.
  - Commercialization of dynamic insulation, cellulose with doped phase change.
- **Building Codes:**
  - 2009 International Energy Conservation Code will improve new home energy efficiency by 15% over 2006 edition.
  - DOE issued the determination that ASHRAE Standard 90.1-2004 would achieve greater energy efficiency in buildings subject to the code, than the 1999 edition,12/30/08
- **ENERGY STAR:**
  - Updated Performance Criteria for Windows, Doors, and Skylights

Upcoming Deliverables/Milestones

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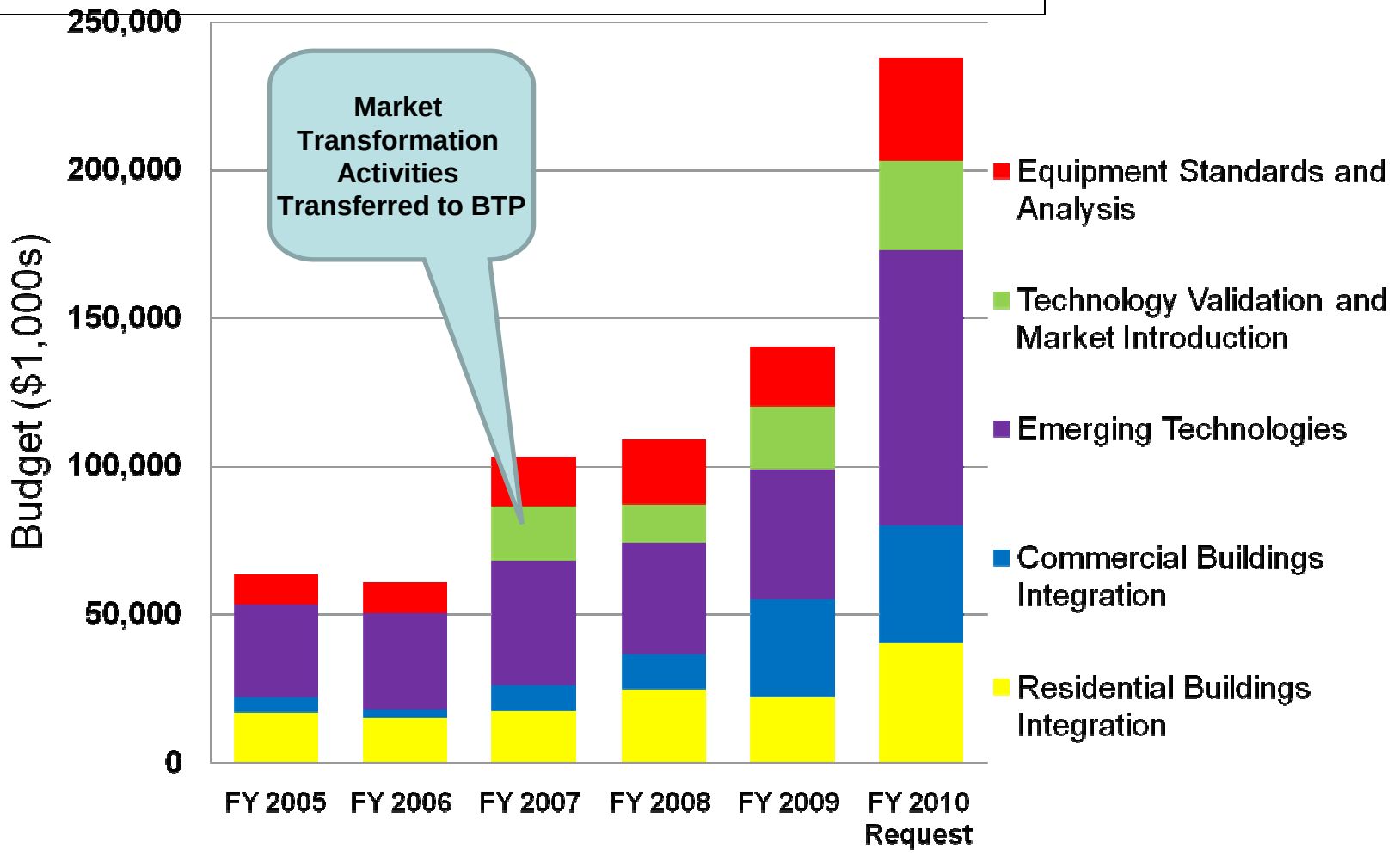
- **Residential:**
  - Best practices for 40% savings in Cold in 2009 and Mixed-Humid and Hot-Humid in 2010.
  - Establish National Building Rating Program for residential buildings and houses
- **Commercial:**
  - Launch Higher Education Energy Alliance; State and Municipal Energy Alliance
  - Establish National Building Rating Program for commercial buildings
- **Emerging Technologies:**
  - EnergyPlus releases: V3.2 (October 2009)
  - Achieve efficiency of “white light” solid-state lighting in a lab device, of at least 113 lumens per Watt in 2010
  - Conduct 2009 Solar Decathlon on the National Mall (Oct 8 – 16, 09)
- **Building Codes:**
  - DOE and stakeholder proposals for 2012 IECC update enough to achieve >30% DOE goal (more than achieved in past 30 years)

Buildings Technologies (BTP) budget has grown over the past 5 years.



Source: U.S. DOE

2009 and 2010 Will Likely See Significant Legislation Related to

- American Recovery and Reinvestment Act
  - Enacted February 17, 2009
  - Provided significant funding for energy efficient building technologies
- Climate & Energy Bill
  - American Clean Energy and Security Act of 2009 was passed by House of Representatives June 26, 2009
  - Senate introduced the Clean Energy Jobs and American Power Act in September 2009
  - Common regulations include:
    - Setting long term targets for reduction of carbon emissions
    - Establishing “cap and trade” system

Recovery Act Funds Accelerates Building Technologies Program Goals & Expands B

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Project	Recovery Act Fundin
Advanced Building Technologies Accelerates building technology RD&D through R&D projects, via national laboratory as well as with the private sector (cro	**$100M**
Residential Buildings (Building America, Builders' Challenge, and Existing Home Retrofits) Complete 15 energy efficient Municipal and Subdivision retrofit projects and 6 Deep Energy Savings retrofit projects. Builders Challenge: Achieve an additional 1.5% market share by September 2010 by working with 750 builder partners wh	**$70M**
Commercial Buildings Initiative Acceleration Partner with major companies that design, build or operate large fleets of buildings and that commit to exemplary energy p	**$53.5M**
Building and Appliance Market Transformation	**$72.5M**
Solid State Lighting Expands building codes adoption and assists states in the implementation of higher level codes Accelerates the pace and scope of Appliance Standard test procedure development Accelerates technical goals to increase the efficacy of state-of-the-art SSL to 113 lm/W of white light from a laboratory LED Improve the efficiency of commercial buildings' operations by developing training curricula	**$50M**
TOTAL	**$346M**

BTP Partners and Stakeholders (not all inclusive)

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- **National Laboratories**
  - Argonne National Laboratory
  - Lawrence Berkeley National Laboratory
  - National Renewable Energy Laboratory
  - Oak Ridge National Laboratory
  - Pacific Northwest National Laboratory
- **Federal Agencies**
  - EPA
  - HUD
- **Industry**
  - Residential Building Industry: 345 Builder Partners
  - Commercial Building Industry
    - Retailer Energy Alliance
      - 32 members, 2.3 billion sq. ft., $720 billion in revenue and 104,727 stores
    - Commercial Real Estate Energy Alliance
      - 39 members, 5.3 billion sq. ft., $650 billion in assets
    - Hospitals (Hospital Energy Alliance)
      - 21 Members, 320 million sq. ft., 817 Hospitals, 167,550 Total Beds
  - Major Equipment and Appliance Manufacturers and Trade Associations
  - Utilities

BTP Partners and Stakeholders Network

Welcome to the 2009 Solar Decathlon

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Technische Universität Darmstadt placed first in the 2007 Solar Decathlon

Technische Universität Darmstadt's entry in the 2009 Solar Decahtlon

Thank You!

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Resources

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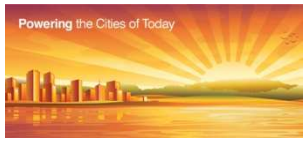
- Energystar.gov
- Energysavers.gov
- Highperformancebuildings.gov
- BuildingAmerica.gov
- Eere.energy.gov/solar



- Eere.energy.gov/geothermal