AIVC TightVent Workshop on Building and Ductwork Tightness – April 18, 2013

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U.S. DOE Perspective On Building Energy and Performance

Building Technology Office
U.S. Department of Energy

Eric Werling
Building America Coordinator
Building America U.S. Department of Energy

My Building Tightness Heroes?

Tony Woods

Sam Rashkin

How We Use Energy in the U.S.

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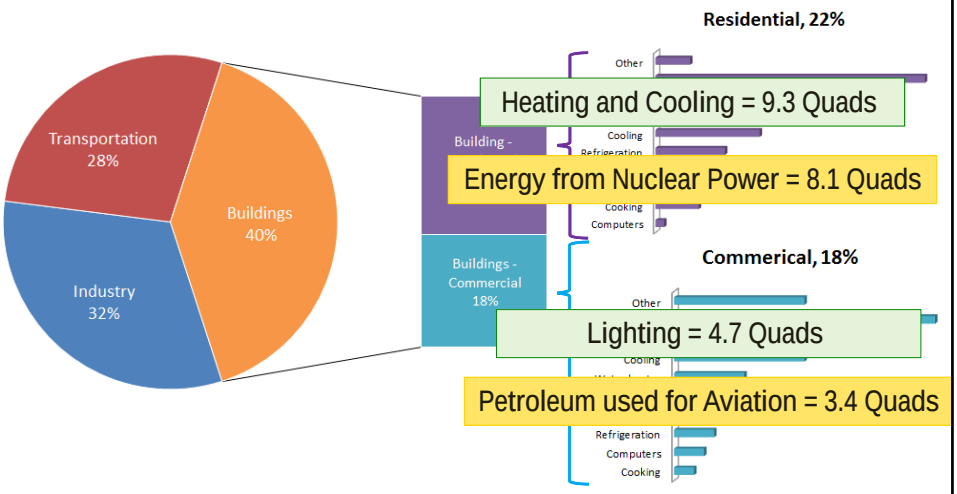

Sources: LBNL EETD 2009, LLNL, 2010

Commercial & Residential Building Primary Energy End Use (Quads)

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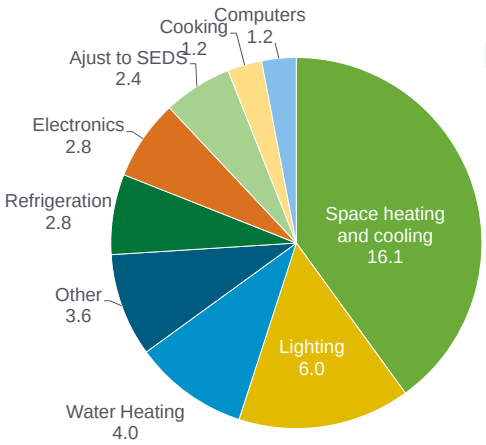

Heating and Cooling 16 Quads (40%)

(16% Total Energy)

Source: Building Energy Data Book, http://buildingsdatabook.eren.doe.gov/

How Important is Air Leakage?

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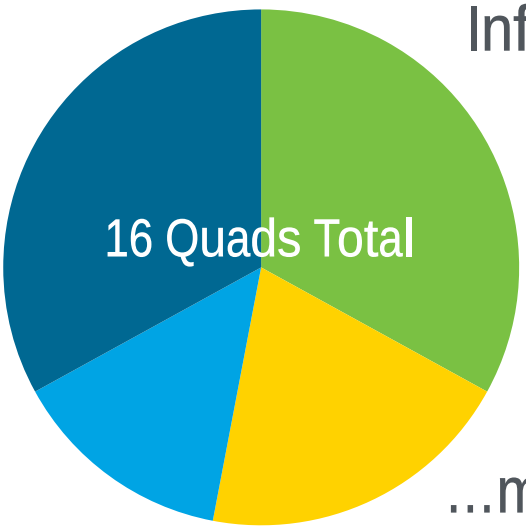

Infiltration costs…

- Convection?
- Conduction?
- Radiation?
- Efficiency?

…maybe 5 Quads?!

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What U.S. DOE is doing to help …

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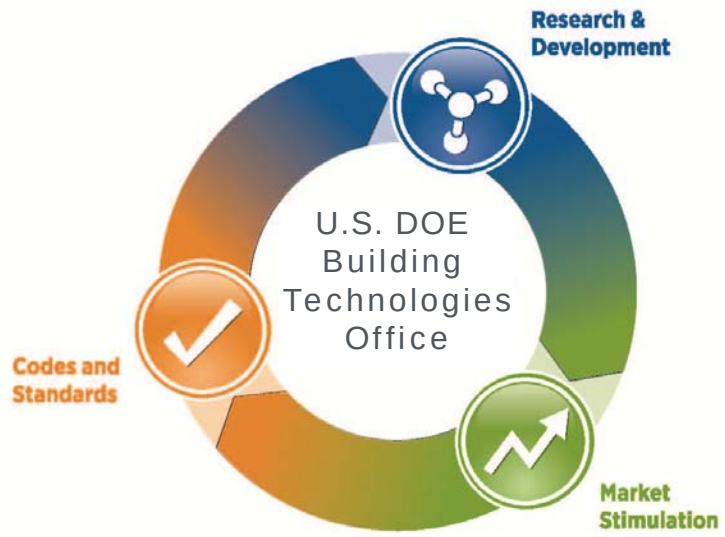

DOE Residential Integration Program

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Research → Implementation tools → Programs

- Building America U.S. Department of Energy
- National Labs Research
- Better Buildings Grant Program
- Building America Solution Center
- BetterBuilding Solution Center
- Challenge Home
- U.S. Department of Energy Solar Decathlon
- Better Buildings Neighborhood Program
- Home Performance with ENERGY STAR
- IECC Codes

The basis for the residential program is grounded on technology and programmatic research. This research is translated into implementation tools to make research accessible to practitioners. Finally, specific programs identify homes, contractors, and builders that use this knowledge successfully to help transform the market

Residential Integration Business Case

Housing Underinvests in R&D

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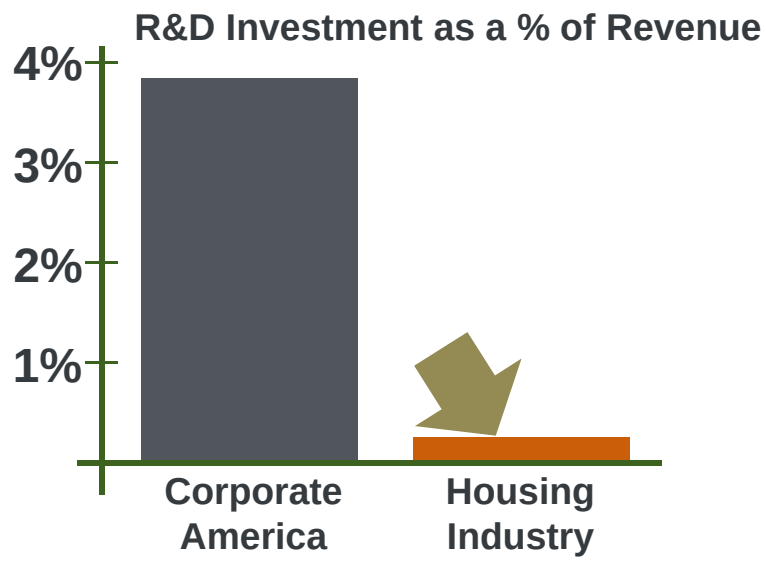

Residential Integration Business Case

Home Energy Economic Impa(N3

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~$2,200: Average Annual Household Energy Bill

>113,000,000: DOE Housing Units in America

>$240 Billion: Amount spent on home utility bills per year.

>$120 Billion: Available to the economy

if we make our houses 50% more efficient

Slide 10

N3 Benefit Discussion

= 1100 x 116 million x 0.1 = $1276000000

If 1% of homes reach this level of energy consumption reduciton each year, then something around a benefit of $63 to $1 (consumer savings vs
funding, need to account for cost of improvements as well)
NCI, 24/01/2013

How to Get 50% Energy Savings

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1. Engineer Efficiency

- Thermal Enclosure ("Envelope")
- Low-Load HVAC
- Efficient Components

2. Ensure/Sell Performance

- Comfort
- Health
- Durability
- Renewable Readiness/Integration
- Water Conservation
- Disaster Resistance

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Building America Goal

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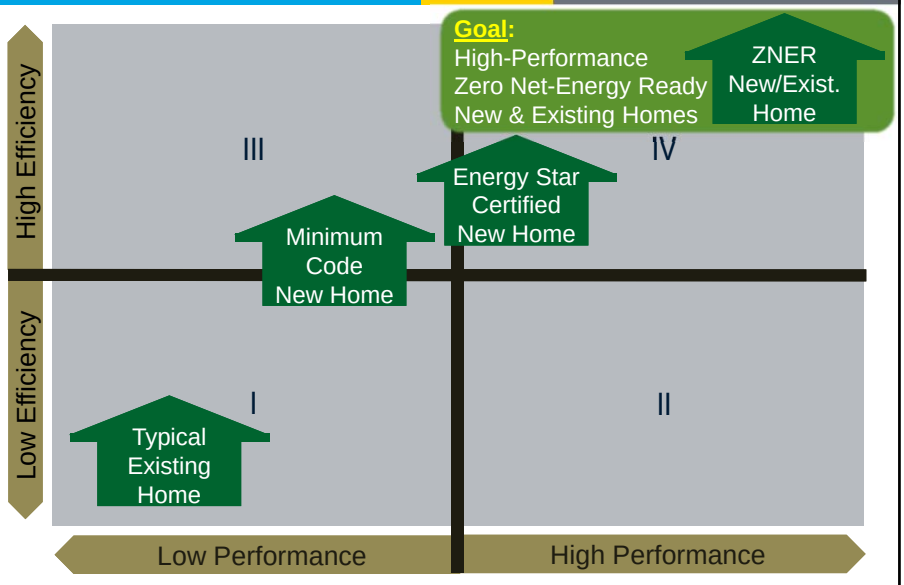

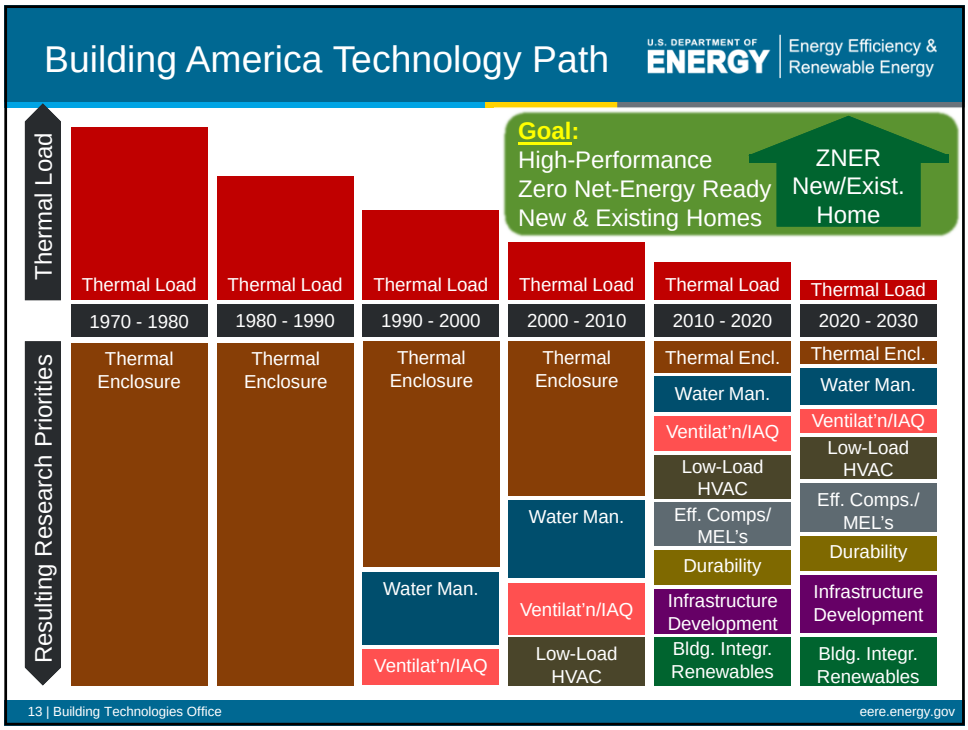
Building America Technology Path
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Thermal Load
Resulting Research Priorities
Goal:
High-Performance
Zero Net-Energy Ready
New & Existing Homes
ZNER
New/Exist.
Home
Thermal Load
1970 - 1980
Thermal Enclosure
Thermal Load
1980 - 1990
Thermal Enclosure
Thermal Load
1990 - 2000
Thermal Enclosure
Water Man.
Ventilat'n/IAQ
Thermal Load
2000 - 2010
Thermal Enclosure
Water Man.
Ventilat'n/IAQ
Low-Load HVAC
Thermal Load
2010 - 2020
Thermal Encl.
Water Man.
Ventilat'n/IAQ
Low-Load HVAC
Eff. Comps/ MEL's
Durability
Infrastructure Development
Bldg. Integr. Renewables
Thermal Load
2020 - 2030
Thermal Encl.
Water Man.
Ventilat'n/IAQ
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Eff. Comps./ MEL's
Durability
Infrastructure Development
Bldg. Integr. Renewables
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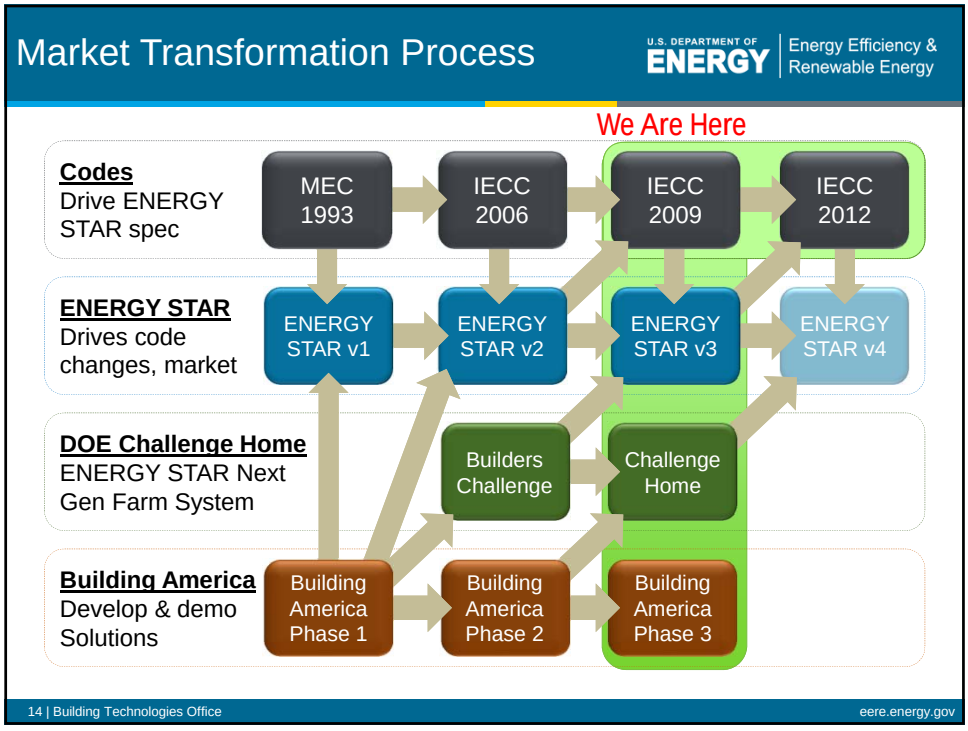
Market Transformation Process
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We Are Here
Codes
Drive ENERGY STAR spec
MEC 1993
IECC 2006
IECC 2009
IECC 2012
ENERGY STAR
Drives code changes, market
ENERGY STAR v1
ENERGY STAR v2
ENERGY STAR v3
ENERGY STAR v4
DOE Challenge Home
ENERGY STAR Next Gen Farm System
Builders Challenge
Challenge Home
Building America
Develop & demo Solutions
Building America Phase 1
Building America Phase 2
Building America Phase 3
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Building America Market Delivery of Proven Innovations

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World Class Building Systems Research

Building America Solution Center
BASC.energy.gov

At Your Fingertips!

http://www1.eere.energy.gov/buildings/residential/ba_solution_center.html

Progress Toward the 50% Goal

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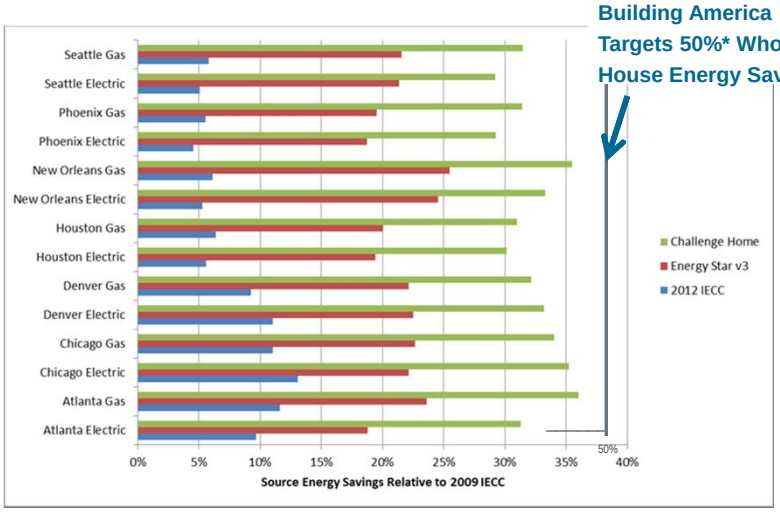
*Goal: **50% energy savings in new and existing homes**.*

Building America Targets 50%* Whole House Energy Savings



Residential Integration Example: Duct System Innovation

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Ducts in Conditioned Space:

Building America provided proven solutions for locating ducts in conditioned space that are being adopted by builders across the country.

- ~8 – 15% savings on air conditioning bills
- 1,000's of homes

Residential Integration Example: Market Solutions

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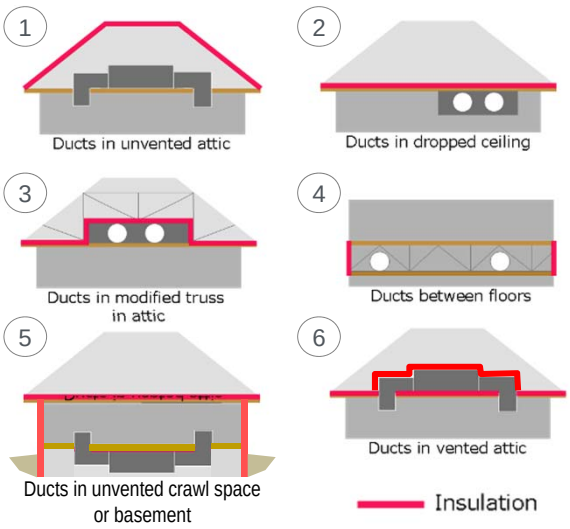
Ducts in Conditioned Space:

Building America developed and demonstrated 6 different cost-effective solutions for locating ducts inside conditioned space. All are being adopted by builders across the country.



Residential Integration Example: What's Next?

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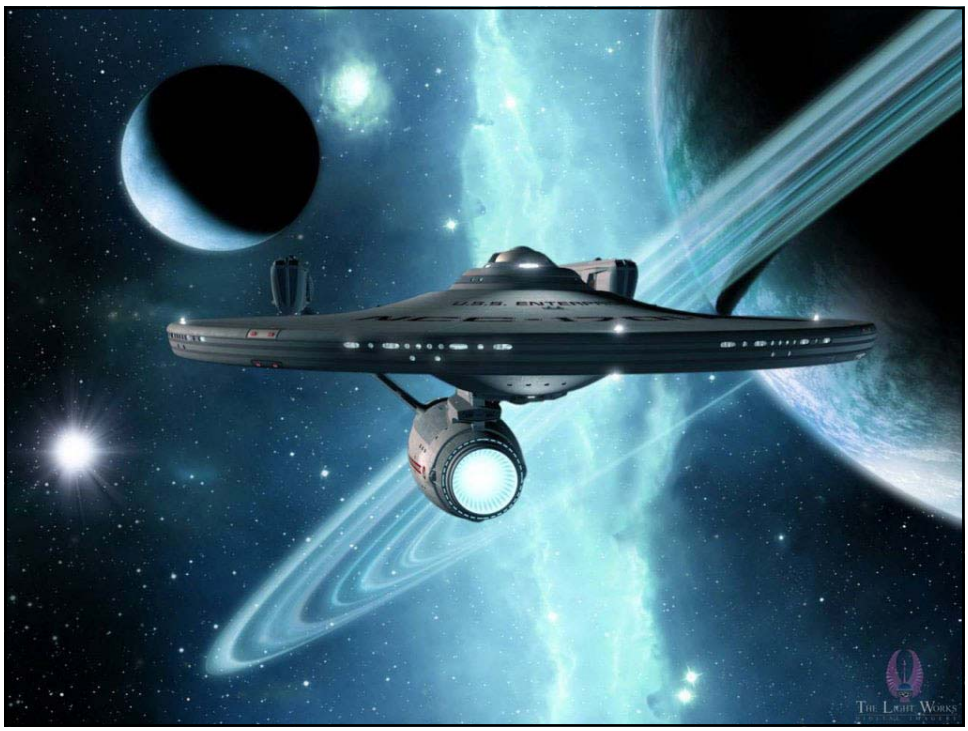
Figure 20. Ductwork well-sealed to sheetrock with ccSPF

Figure 21. Rigid insulation inserted under ductwork to serve as a substrate and provide insulating value

Figure 22. Varying thickness of ccSPF and interference from cross bracing

Figure 23. Varying application thicknesses shown on rectangular (left) and round (right) ducts



The Next Frontier …

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Retrofit

100,000,000

Existing Homes

What Building Science Innovation Can Do to Help?

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- **Lower cost** efficient technologies
- **Lower risk** of system failures (moisture, durability)
- **Easier installation** methods/systems (fewer steps, fewer materials, less training)
- **Easier performance measurement** methods/systems (fewer steps, less training, higher error tolerance)

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Question for You:

How can your work help achieve **Lower Installation Costs, Lower Business Risks, and Easier Performance Measurement?**