

Building America

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U. S. Dept. of Energy

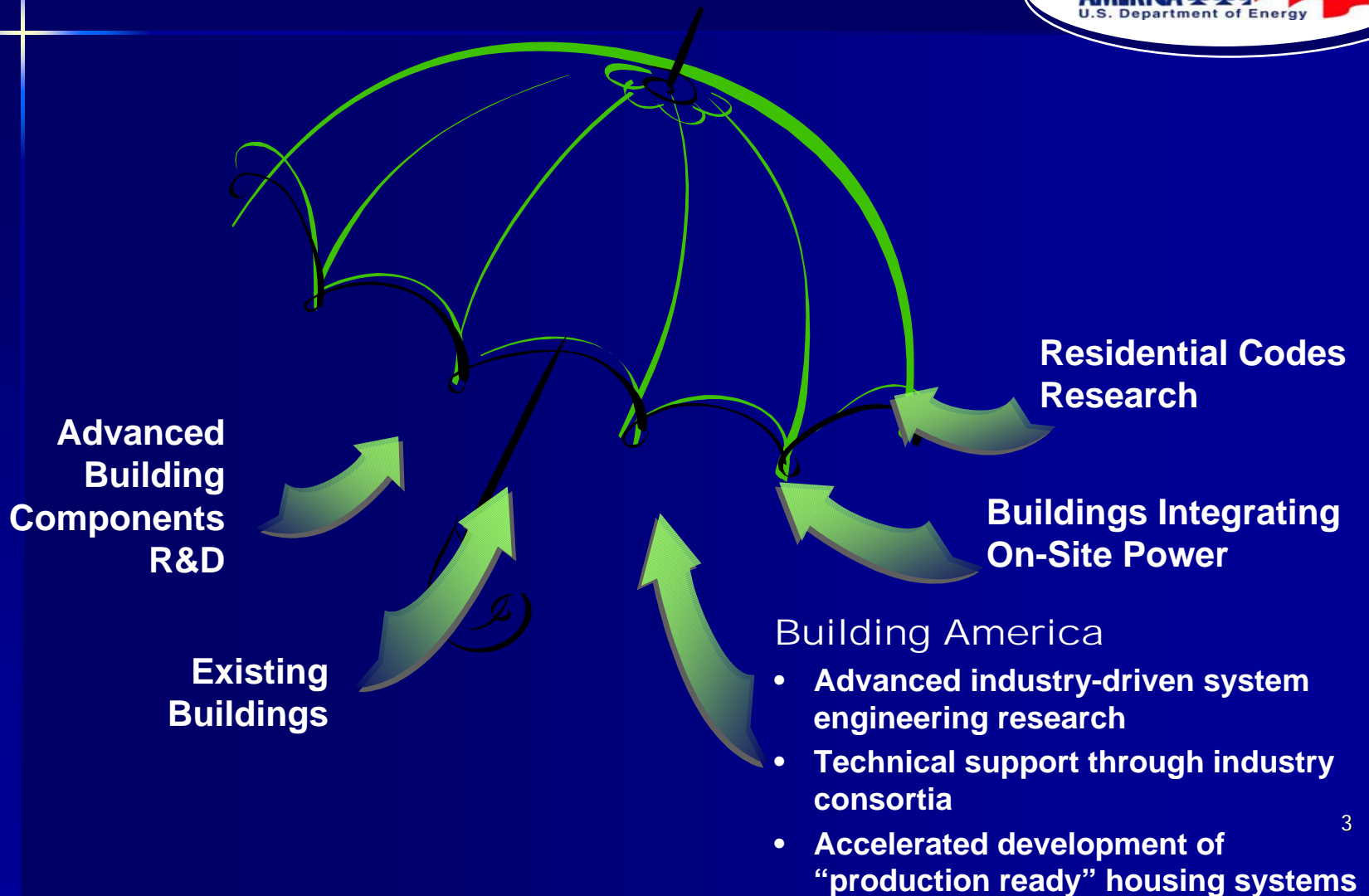


NEMS/AEO Conference
March 2004

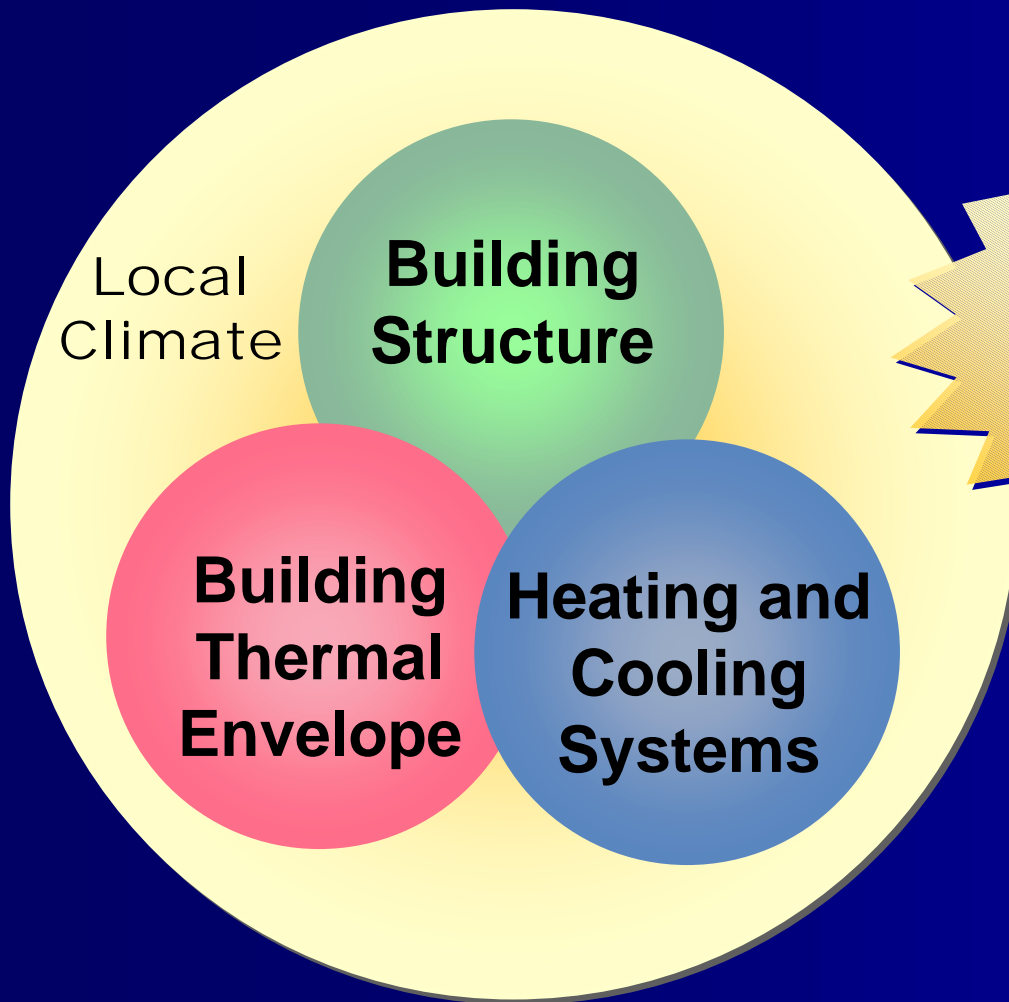
BUILDING TECHNOLOGIES GOALS

- Marketable Zero Energy Homes by 2020
- Marketable Zero Energy Commercial Buildings by 2025
- Strategies for 20% reduction in energy use in both Residential and Commercial existing buildings by 2025

Advanced Systems Target



Whole-house Approach

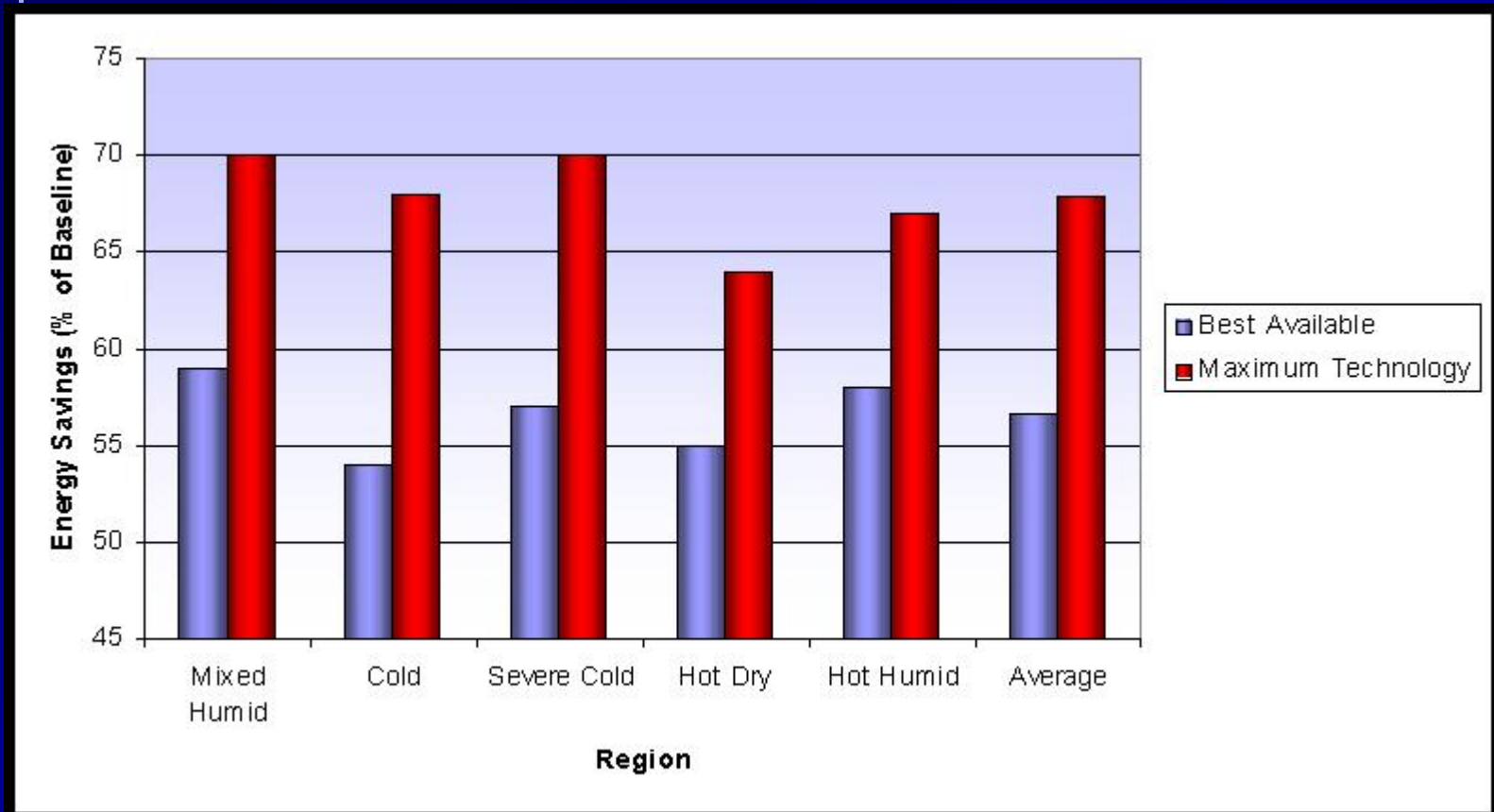


Building AmericaSM
considers performance
and interactions of all
building systems

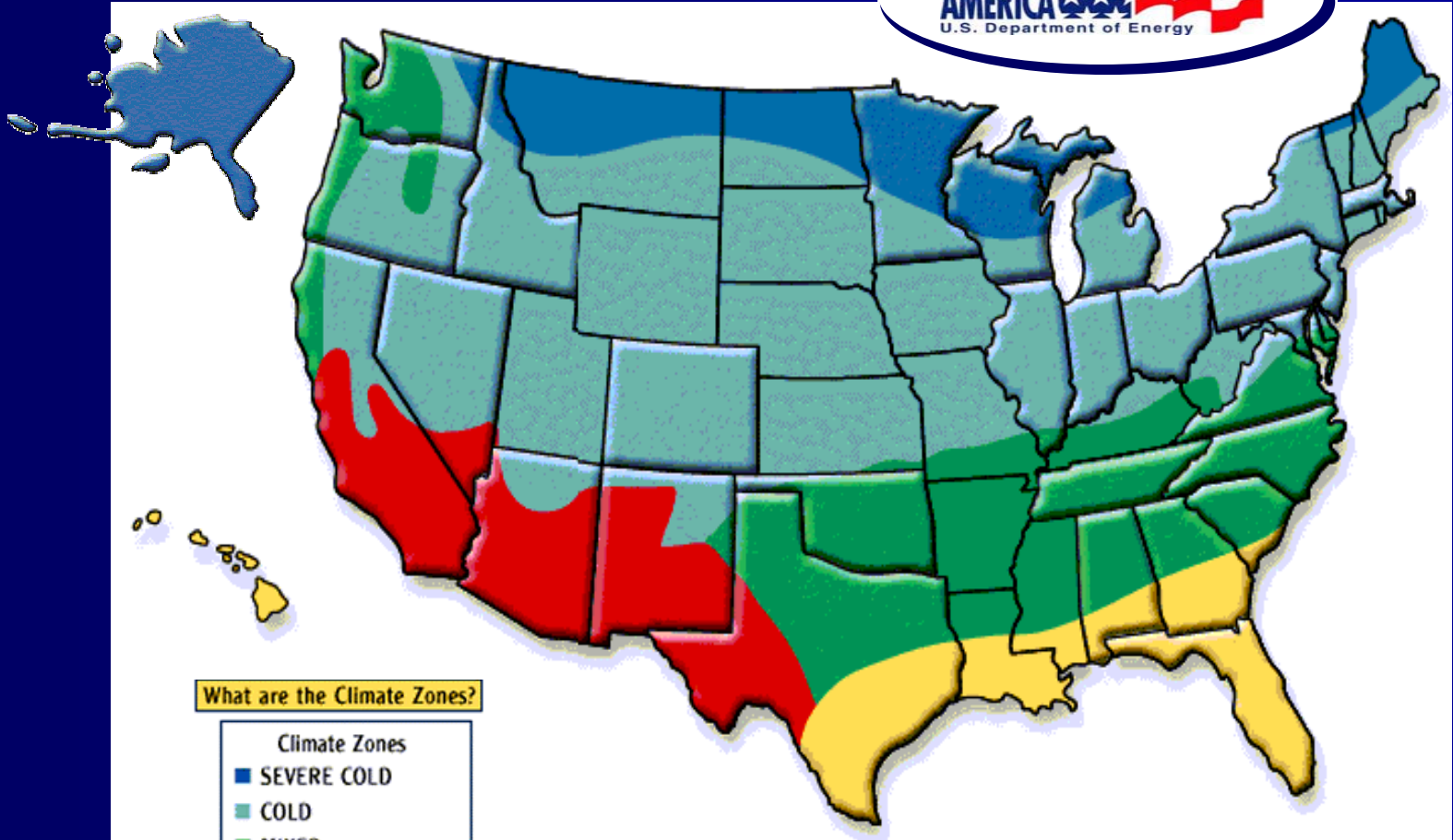


Residential Optimization Model New Results

For all five regions, the average energy reduction attainable was 57% with best available technologies and 68% with maximum technologies.



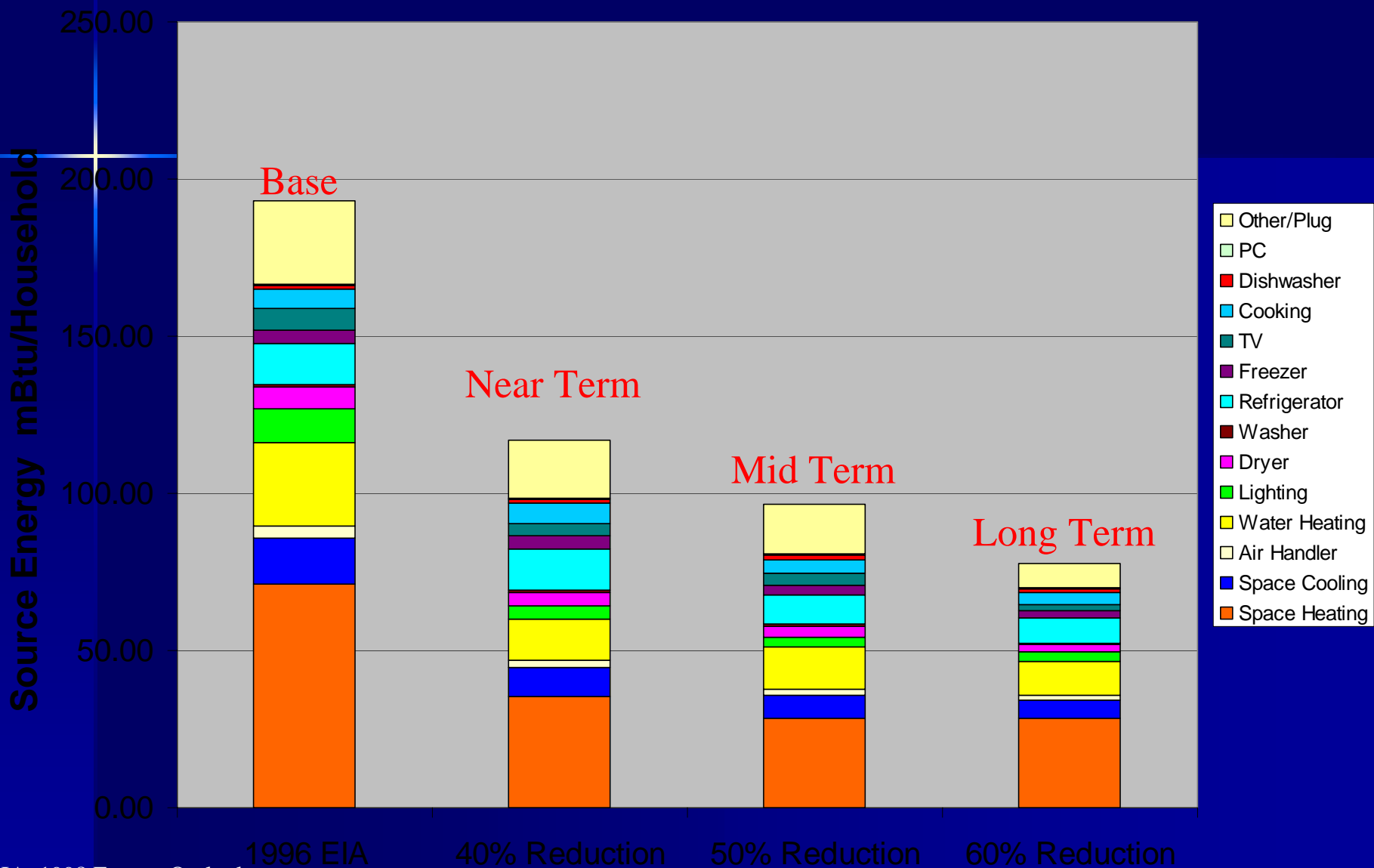
Systems Engineering Research Consider Moisture and Thermal Climate Zones



What are the Climate Zones?

- Climate Zones
- SEVERE COLD
- COLD
- MIXED
- HOT-HUMID
- HOT-DRY/MIXED-DRY

Building America National Energy Use Reduction





The Program

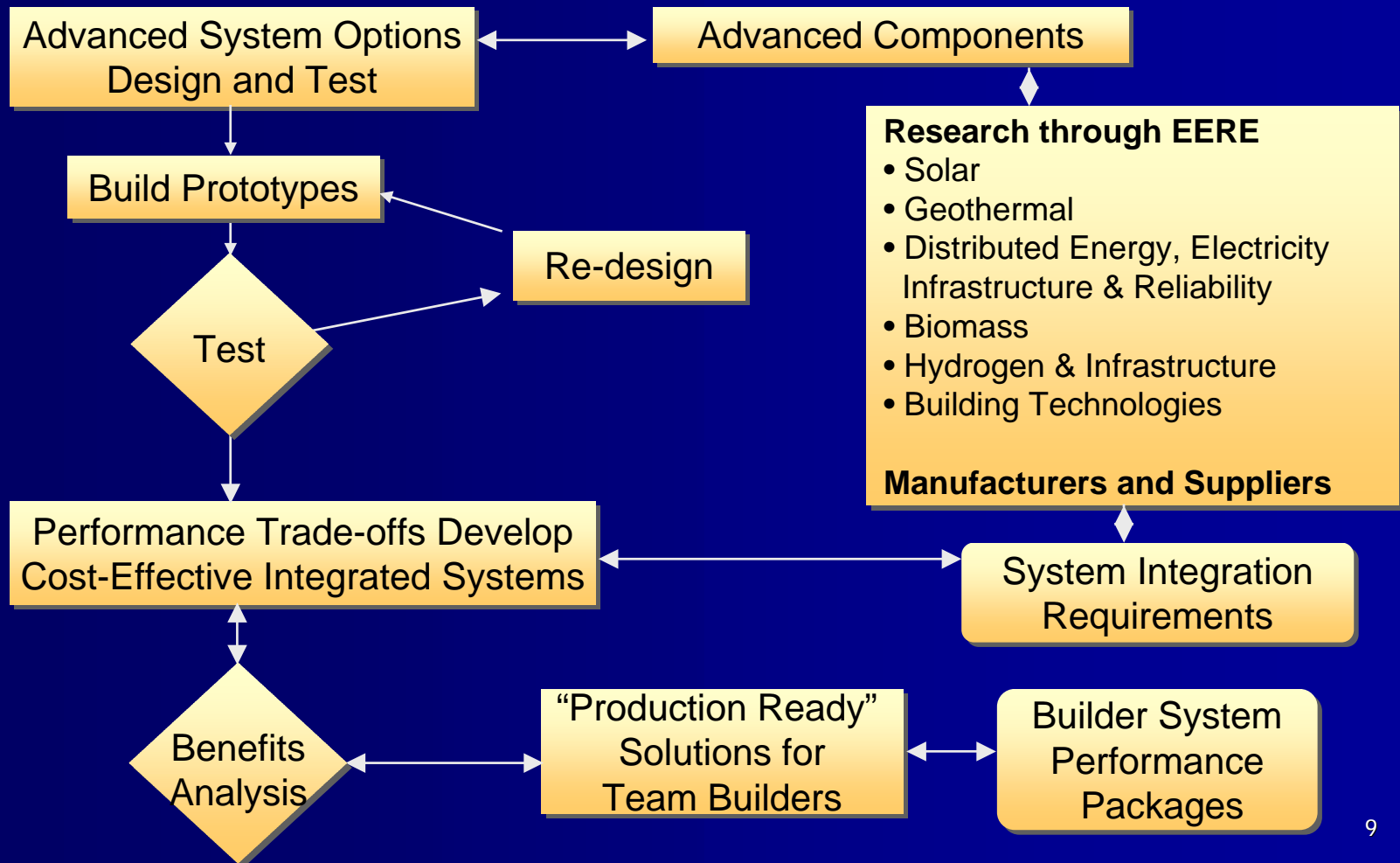
The U.S. Department of Energy (DOE) Building America Program is:

- Research
- Development
- Technology implementation
- Cost-shared, technical support

This process develops:

- System engineered, sustainable, innovative building methods; and
- Integrated, cost-effective, advanced technologies

Building America Industry-Driven Systems Engineering Research





Benefits

Through research, Building America helps builders

- Lower customers' energy bills by 30–70%
- Improve comfort and indoor air quality
- Reduce construction costs and waste
- Reduce callbacks and warranty claims
- Offer cost-saving building system trade-offs
- Stand out in the marketplace
- Provide new product opportunities
- Learn from other builders



Approach

Building America has teams of leading experts in building science and system engineering that offer production home builders, remodelers, and home builders integrating on-site power systems free technical information

- Design reviews
- Energy modeling
- Performance specification writing
- Training and workshops
- On-site consulting
- Access to Building America research

About 20,000 high performance production homes, but how?

- **In general, we focused on:**
 - **Identifying break points & creating meaningful cost trade-offs**
 - **Solving builder warranty & liability problems**
 - **Creating market differentiation**
- **Applied building science was the engine driving this train**

System Trade-offs Summary

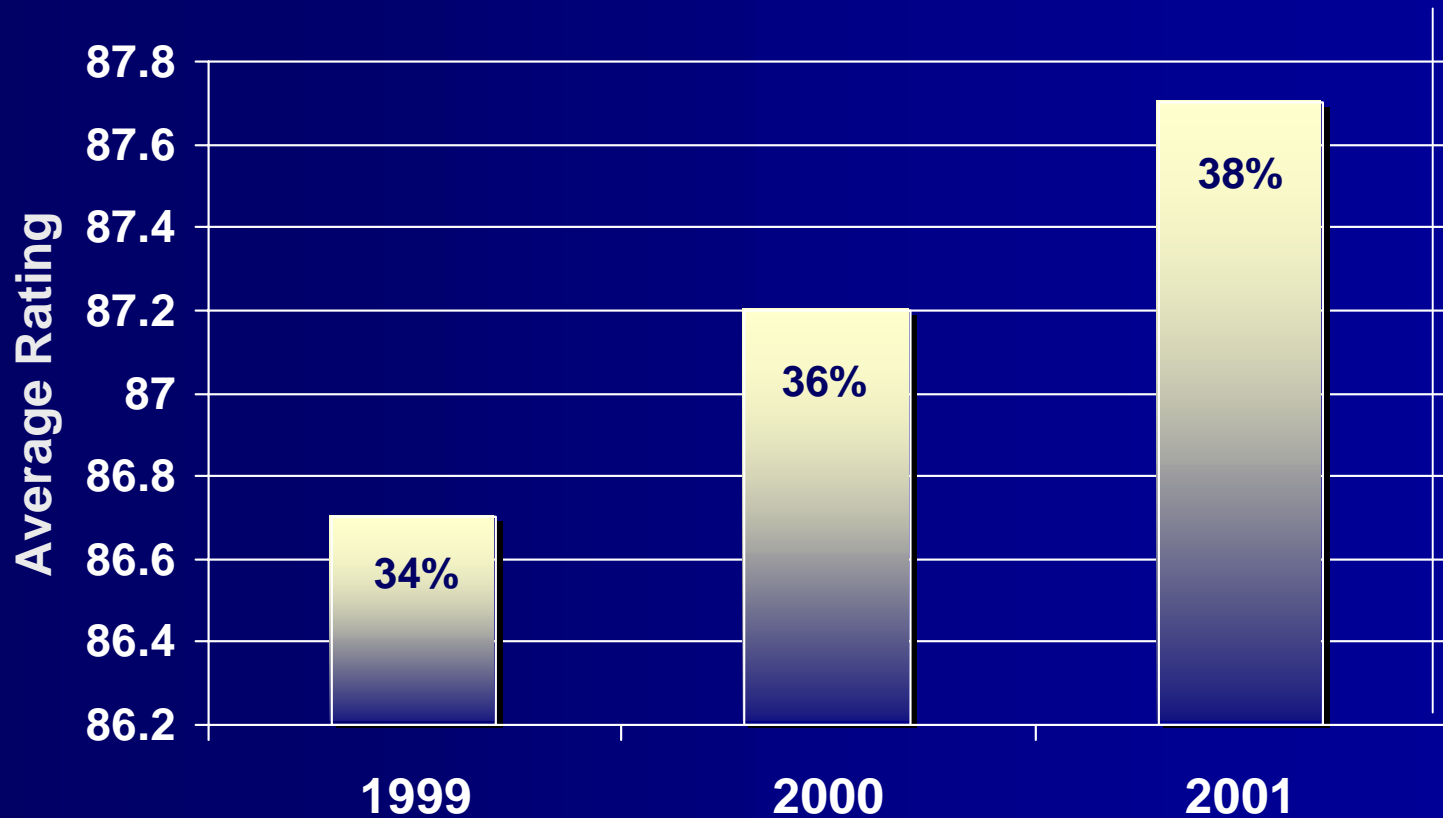
- HVAC downsizing (driven by right sizing, simplified ducts, and reduced loads of better windows) “finance” better windows
- Advanced framing lumber savings “finance” increased levels of insulation and air sealing
- These trade-offs are often, but not always, about cost neutral
- When they are not, what drives the approach?

Reduced warranty & liability:

- Relating to comfort (draft stopping, air pressure differentials, tight ducts) that **also saved energy**
- Relating to mold (air pressure differentials, tight ducts) and was the result of:
 - energy conservation (more insulation and tight construction)
 - misplaced/mis-used vapor barriers
 - lack of ventilation
 - lack of water management
- Related to quality (performance metrics and testing) that **also saved energy**
- Related to material efficiency (drywall callbacks) that **also saved energy**

NOTE: The same approach used to convince the builder of the practicality of risk reduction worked for energy and comfort--building science applied to engineering the home as a system

Average Energy Savings at Pulte-Tucson



Resisting the Lateral Loading of Earthquakes Alternate Wood Shear Wall Panels

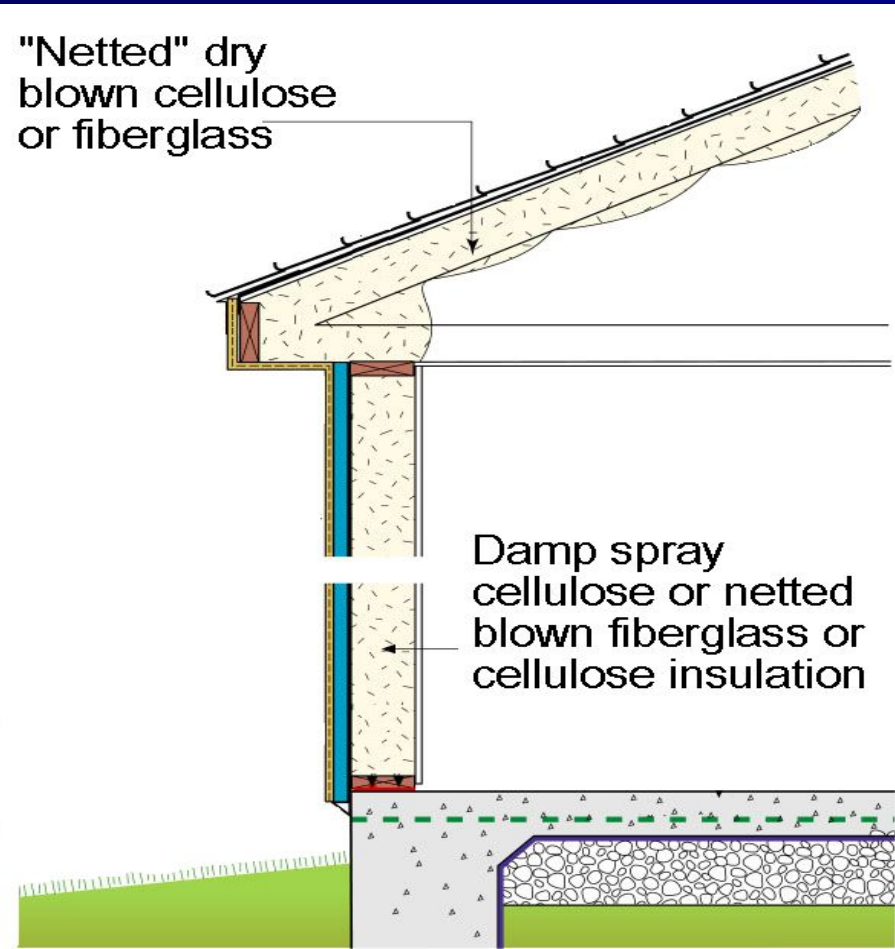


Pulte Homes used the basic panel configuration, first proposed by Building Science Consortium, to provide lateral resistance that did not interfere with the insulation sheathing.

The City of Tracy, CA, approved the use of 2x4 stud wall panels set inside a 2x6 frame to provide effective seismic resistance performance.



Unvented Attics



Building Science Consortium

Copper Moon

1,618 sq ft



Tucson, Arizona

Features

- ▣ Unvented cathedral attic
- ▣ Low-E² spectrally selective windows
- ▣ Sealed ducts with mechanical ventilation
- ▣ Stack framing
- ▣ Blown cellulose wall and ceiling insulation

Cost Summary for Building America Metrics—Copper Moon, Tucson, AZ

Unvented roof	+ \$ 750
NOT installed roof vents	– \$ 500
High performance windows	+ \$ 300
Controlled ventilation system	+ \$ 150
Downsize air conditioner by 2 tons	– \$ 1000
Sealed combustion furnace	+ \$ 400
<i>TOTAL PREMIUM</i>	+ \$ 100

System Trade-offs: Pulte MN case study

Advanced framing	-\$250
High performance windows	+\$250
Controlled ventilation system	+\$150
Power vented gas water heater	+\$300
Simplified duct distribution	-\$250
Downsize air conditioner by 1.0 ton	-\$350
TOTAL PREMIUM	-\$150

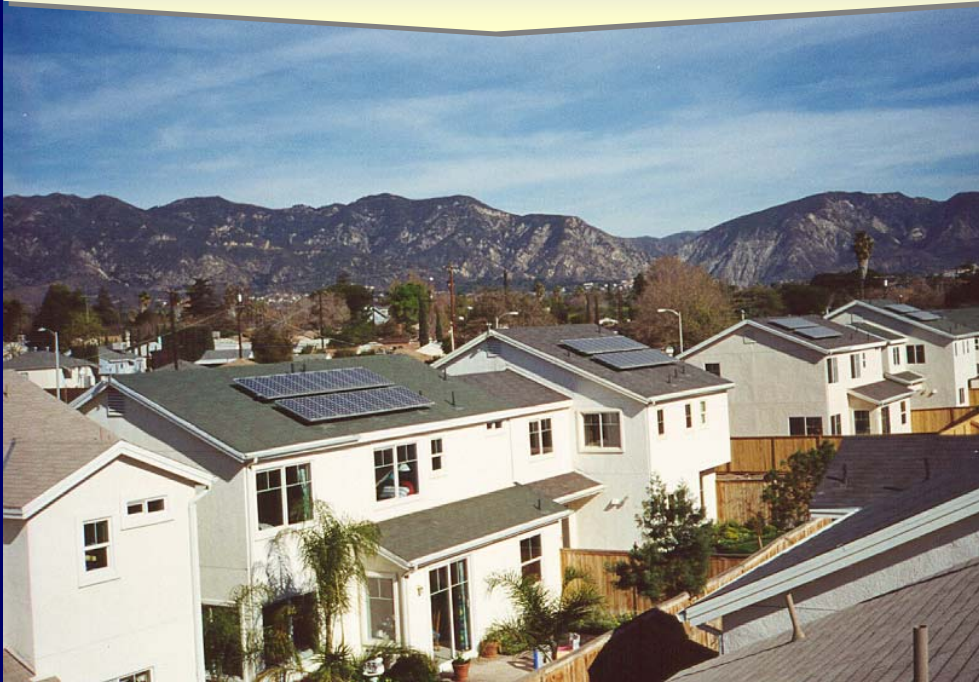
System Trade-offs: Pulte CA case study

High performance windows	+\$ 750
Sealed combustion furnace	+\$ 400
Jump ducts/fresh air ventilation	+\$ 250
Unvented conditioned attic	+\$ 750
Total Premium	+\$2,150

Building Science Consortium

Village Green Community

74 units of 1,700 sq ft



Sylmar, California

Features

- ▣ Solar control glazing
- ▣ Integrated ventilation system
- ▣ High efficiency framing
- ▣ Gas cooling to minimize electric load
- ▣ Grid-connected
- ▣ 1.4 kW photovoltaics

National Renewable Energy Laboratory

Van Geet Residence

3,176 sq ft



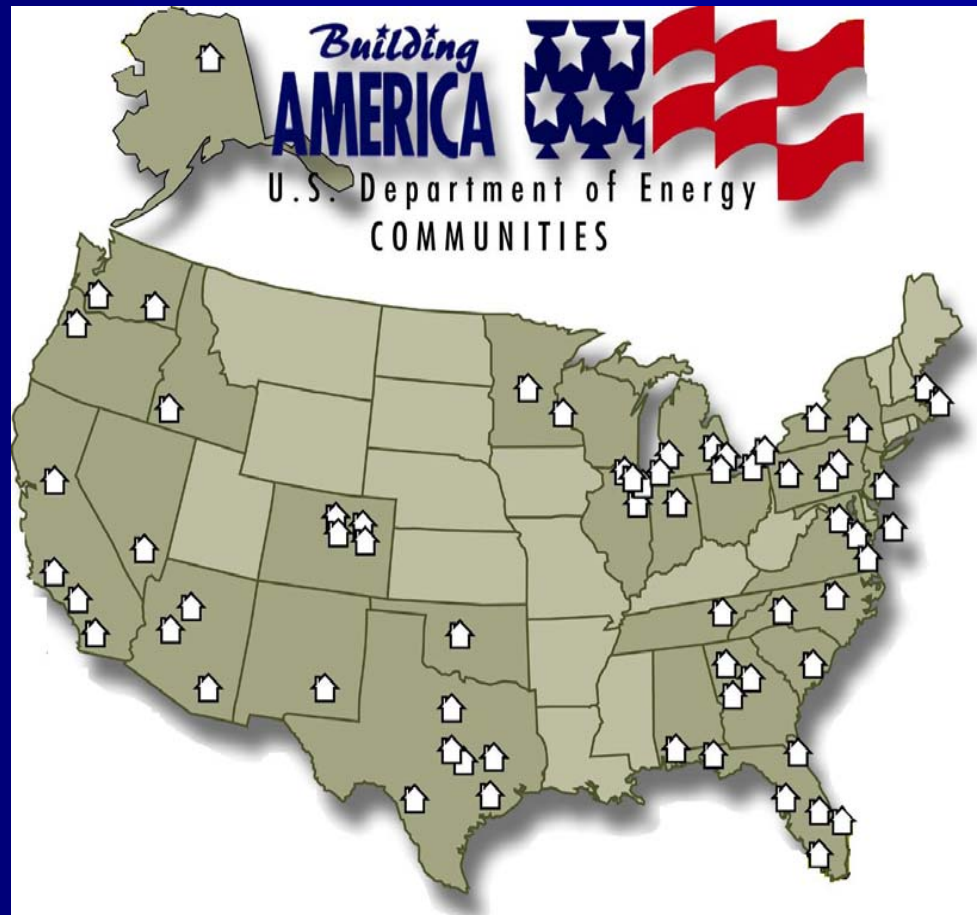
Idaho Springs, Colorado

Features

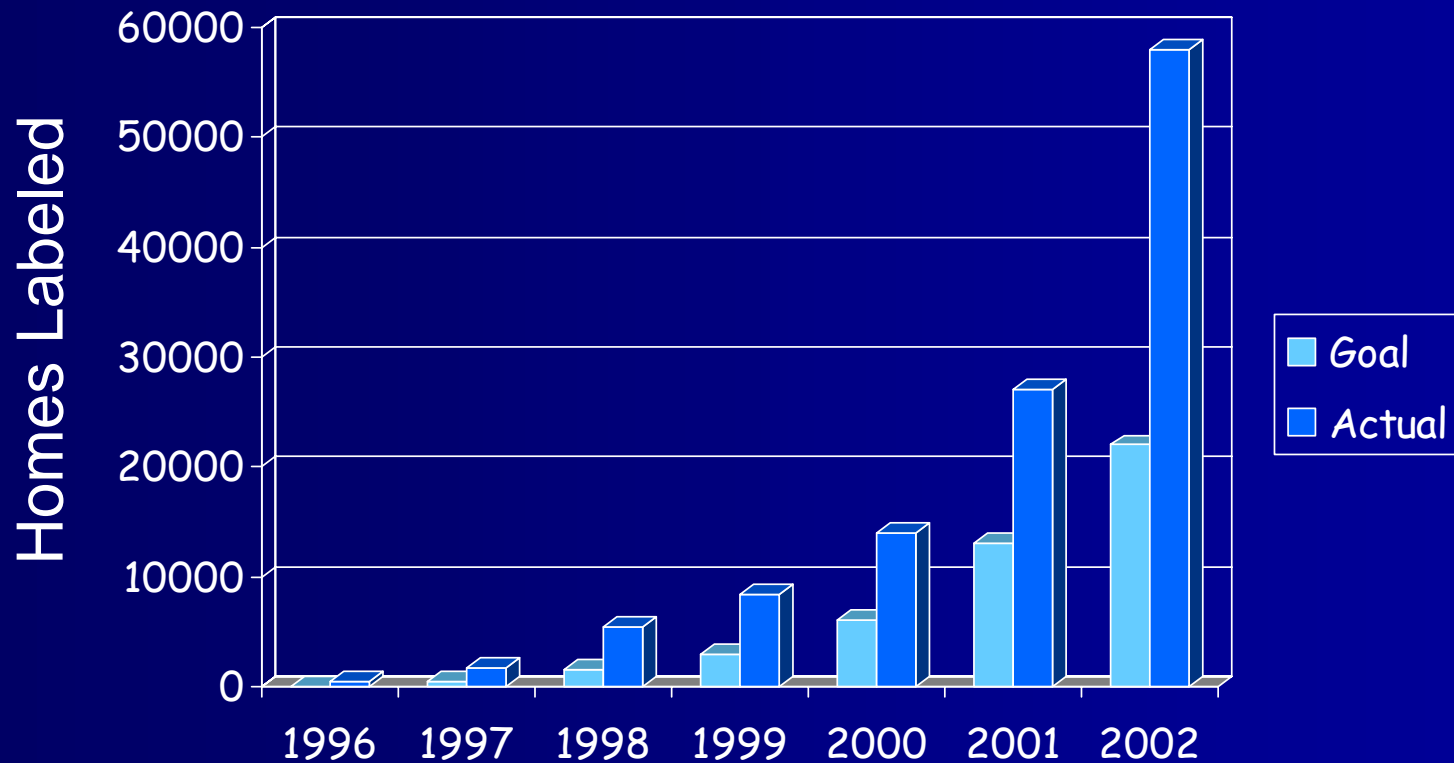
- High mass construction
- Integrated mechanical system
- High efficiency appliances and lighting
- Active solar hot water system for DHW and radiant space heating
- Propane backup heat and generator
- Off-grid powered 1.2 kW photovoltaics

Building America Communities

- Over 270 builders and manufacturers
- More than 20,776 energy-efficient houses
- In 31 states



ENERGY STAR HOMES RESULTS: HOMES LABELED



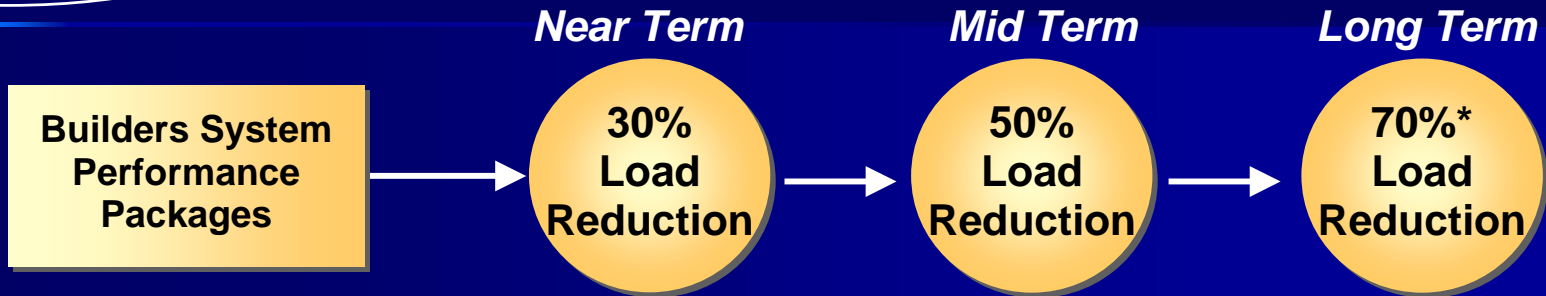
Systems Engineering Research

Phase I	Phase II	Phase III
30% Heating and cooling energy reduction	50% Heating and cooling energy reduction	70% Heating and cooling energy reduction
R&D	R&D	R&D
Demonstration	Demonstration	Demonstration
Deployment	Deployment	Deployment

Note: A callout arrow labeled '2004' points to the transition between Phase I and Phase II.



Builders System Performance Packages



**Overall building load*

EEBA
Energy & Environmental Building Association
Builder's Guide
COLD CLIMATES

A systems approach to designing and building healthy, comfortable, durable, energy efficient and environmentally responsible homes.

Builder
THE MAGAZINE OF THE NATIONAL ASSOCIATION OF HOME BUILDERS
FEBRUARY 2002

Hidden Costs Series
Insurance: Sealing premises may put you out of business.

SPEC SHEET
BUILD AMERICA AND EARTH-CRAFT SPECS

- Double-paneled low-E insulated glass windows and doors: Paschtree Doors & Windows. NCHI, IBS booth no. 7070. Circle no. 134.
- Housewrap: Tyvek by DuPont. NCHI, IBS booth no. 6140. Circle no. 141.
- HVAC ducts and insulation: Owens Corning Corp. NCHI, IBS booth no. 4540. Circle no. 987.
- HVAC system: Lennox Industries. NCHI, IBS booth no. 7738. Circle no. 988.
- Insulation and quiet zone sound: Owens Corning Corp. NCHI, IBS booth no. 4540. Circle no. 142.
- Pre-cast walls: Superior Walls of America. NCHI, IBS booth no. 6762. Circle no. 144.
- PVC plumbing: Norcon. NCHI, IBS booth no. 7814. Circle no. 145.
- Ridge thingles, ridge vents, and felt: GAF Materials Corp. NCHI, IBS booth no. 1636. Circle no. 146.
- Roofing shingles: GAF Materials Corp. NCHI, IBS booth no. 1636. Circle no. 992.
- Steam humidifier, heating element, fresh air exchanger, germicidal UV light mold and bacteria killer, air cleaners, air filtration, HVAC humidifier, home controller, webcam, Web pad, indoor air quality system: Honeywell. NCHI. Circle no. 991.
- TechShield radiant barrier: LP. NCHI, IBS booth no. 5640. Circle no. 990.

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KEY ACTIVITIES AND MILESTONES								
I. 20% Energy Savings Level								
Develop system retrofit strategies that reduce total energy use in existing homes by 20%								
Initiate system retrofit studies to evaluate best approaches to 20% total energy savings goal								
Initiate expanded field studies focusing on most promising system retrofit approaches								
Expand research partnerships with system-based community-scale retrofit pilots								
Complete development of system retrofit strategies that reduce total energy use by 20%								
Complete technical handbooks for community-scale home retrofit strategies								
II. 30% Energy Saving Level								
Complete knowledge base for new residential homes that produce 30% space conditioning and hot water savings.								
Initiate system retrofit pilot studies to evaluate best approaches to 30% total energy savings								
III. 40% Energy Saving Level								
Design and test research houses that have the goal of producing total energy savings of at least 40%.								
Initiate the design and test of research houses that have the goal of producing total energy savings of at least 40%.								
Case Studies Report: Initial results from research houses that produce total energy savings of at least 40%.								
Complete fact sheets and design handbooks for homes that deliver total energy savings of 40%.								
IV. 50% Energy Saving Level								
Conduct research on the most promising advanced systems for total energy savings of 50% in new homes.								
Initiate the evaluation of advanced systems required to produce total energy savings of 50% in new homes.								
Technology Update: System requirements for total energy savings of 50% in new homes.								
System Specifications Report: Advanced systems required for total energy savings of 50% in new homes.								
Design and test research houses that have the goal of producing total energy savings of at least 50%.								
Initiate the design and test of research houses that have the goal of producing total energy savings of at least 50%.								
Case Studies Report: Initial results from research houses that produce 50% energy savings.								
Complete fact sheets and design handbooks for homes that deliver total energy savings of 50%.								
V. 70% Energy Saving Level								
Conduct research on the most promising advanced systems for total energy savings of 70% in new homes.								
Initiate the evaluation of advanced systems required to produce total energy savings of 70% in new homes.								
Technology Update: System requirements for total energy savings of 70% in new homes.								
System Specifications Report: Advanced systems required for total energy savings of 70% in new homes.								
VI. Onsite Power Systems								
Conduct research on renewable energy systems required for homes that produce as much energy as they consume.								
Complete designs for renewable energy supply systems that cut utility costs by 50%								
Issue RFP for home-integrated solar thermal and solar electric concepts								
.....								
..... , etc								

Visit Our Website



www.buildingamerica.gov

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Thank You

