"Reaching for the Stars"
Building America's Performance Criteria

RESNET Conference
February 25, 2003

George S. James
Building America[SM] Program
U.S. Department of Energy

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ornl
Oak Ridge National Laboratory

The Program

The U.S. Department of Energy (DOE) Building America[SM] 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

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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

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Approach

Building America[SM] has teams of leading experts in building science and system engineering that offer production home builders free technical assistance:

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

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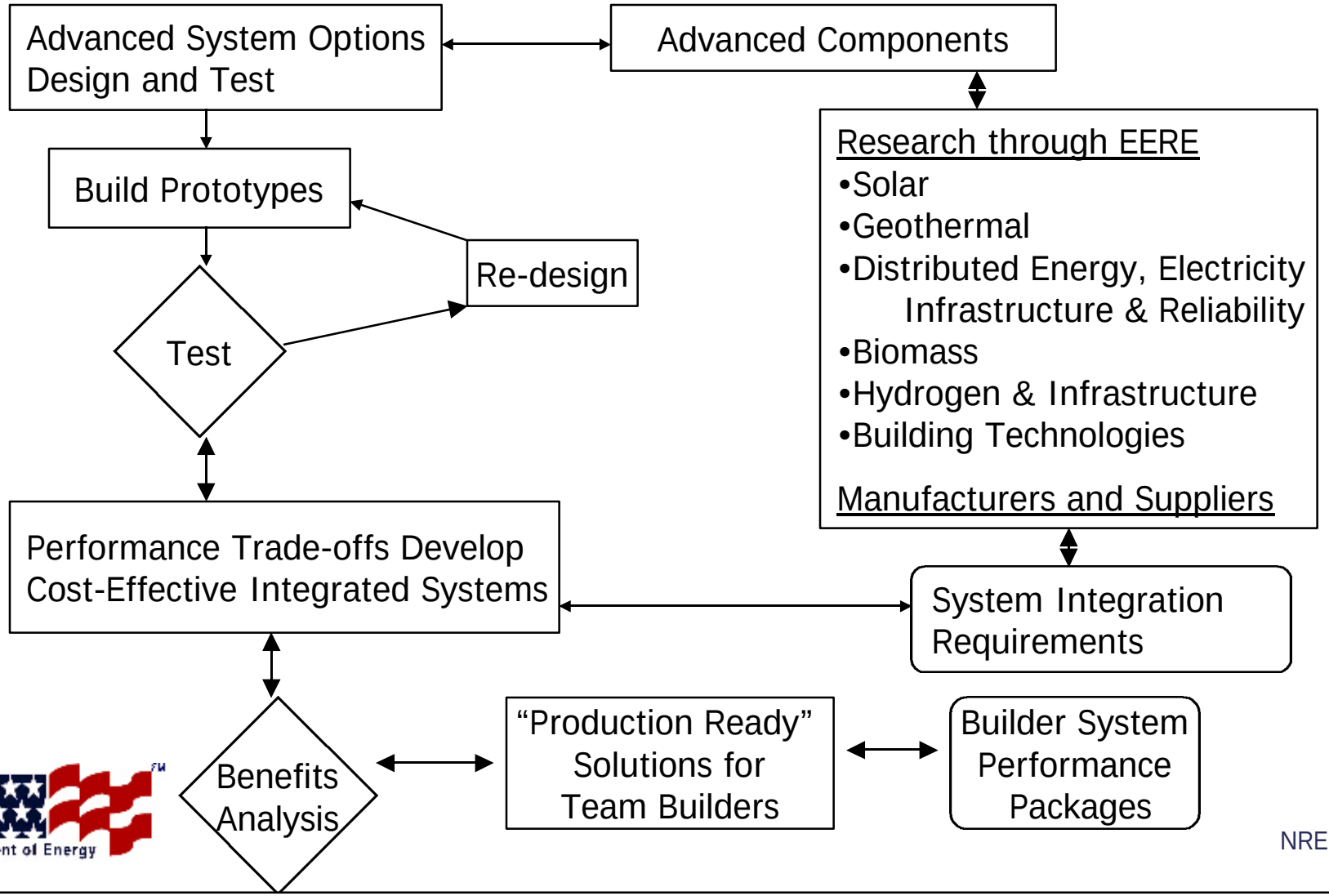
Building America[SM] Industry-Driven Systems Engineering Research



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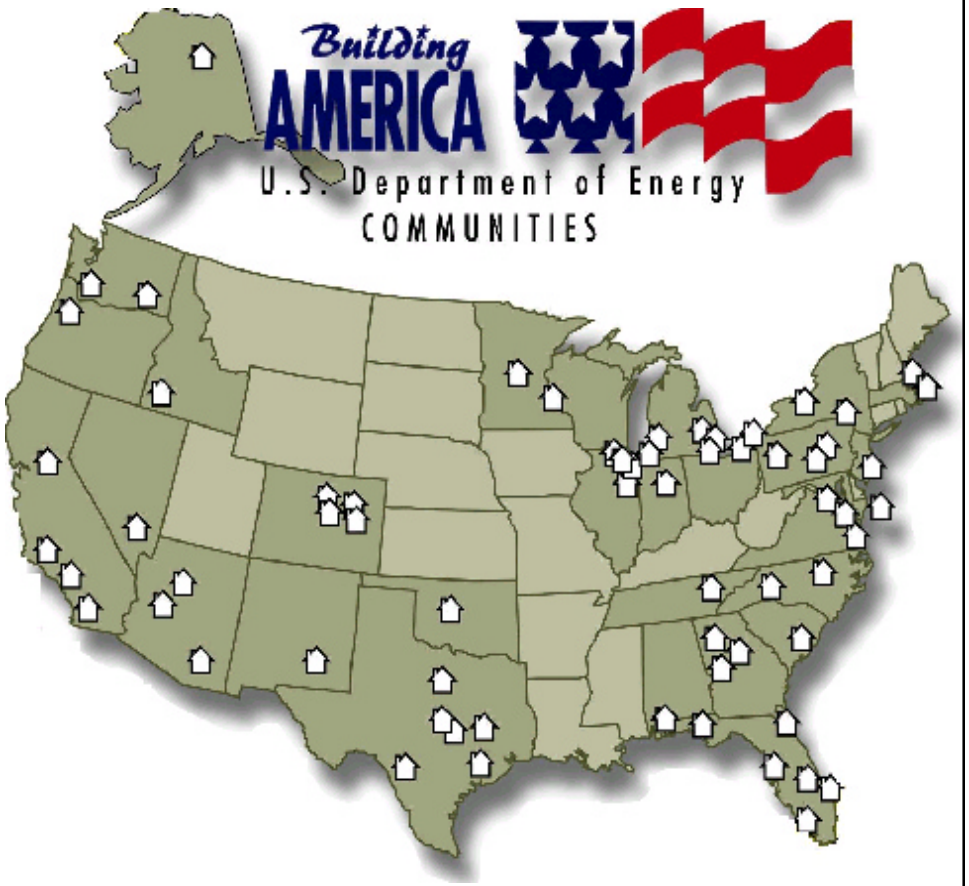
Building America℠ Communities

- Over 270 builders and manufacturers
- More than 14,000 energy-efficient houses
- In 29 states



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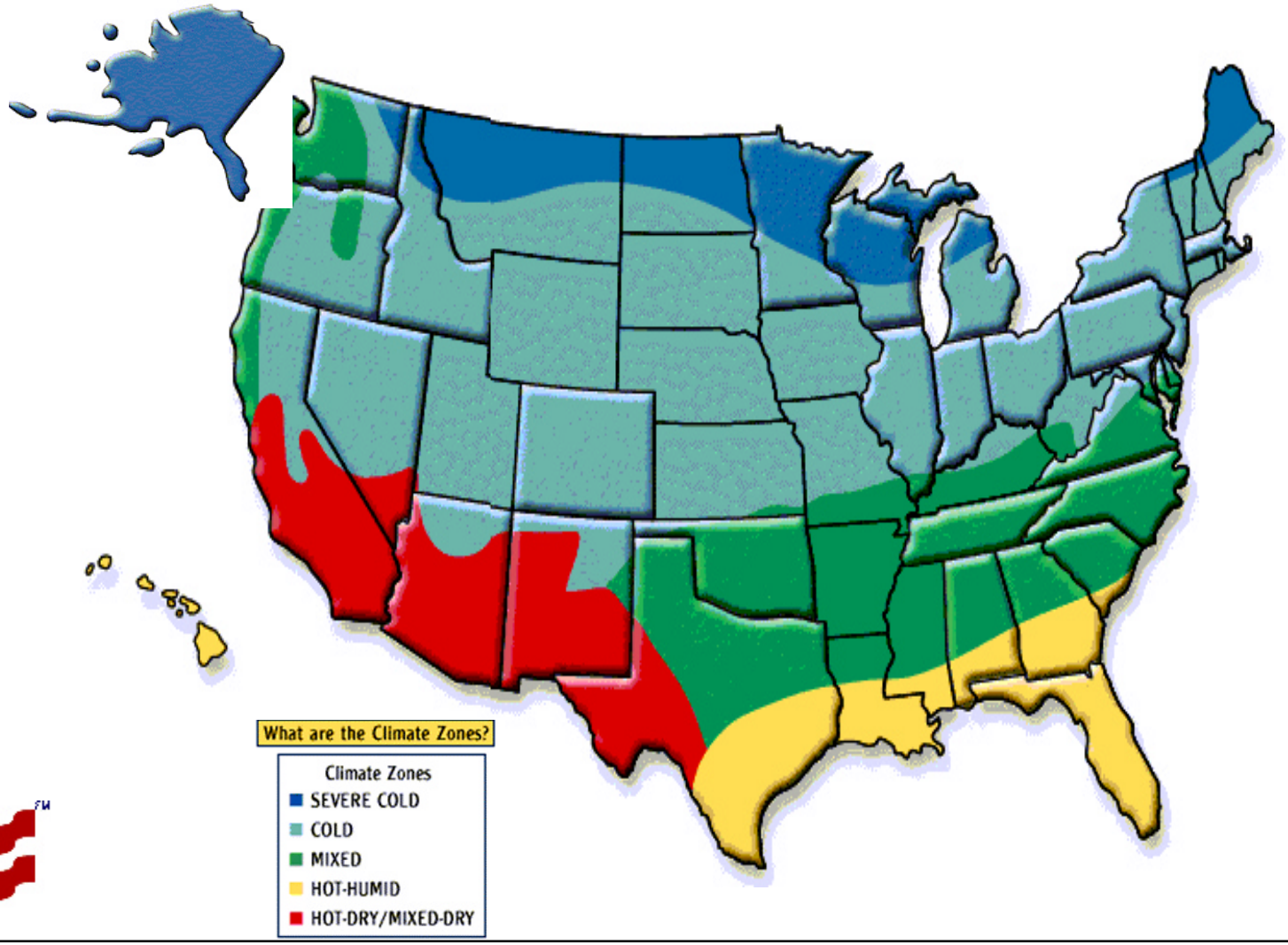
Systems Engineering Research Considers Moisture and Thermal Climate Zones



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Systems Research Leverages Scarce Resources

Scarce private and public R&D dollars can be leveraged through industry systems engineering research partnerships which effectively target high priority R&D efforts.

The United States is under-investing in R&D required to accelerate technology adoption in the building sector.

- U.S. homebuilding spends 0.25% of sales on research
- U.S. contractors spend 0.00125% of sales on research

Building America[SM] is establishing cost-sharing agreements with industry partners to leverage private and public R&D investments.

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Systems Engineering Research

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

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Typical Research Goals

Develop Super-Efficient Hot Water/Space Heating Systems

- Minimize overall increase in super-efficient system cost by combining loads
- Decrease number of open combustion appliances
- Maximize water heating efficiency
- Maximize space heating efficiency
- Increase overall durability and comfort

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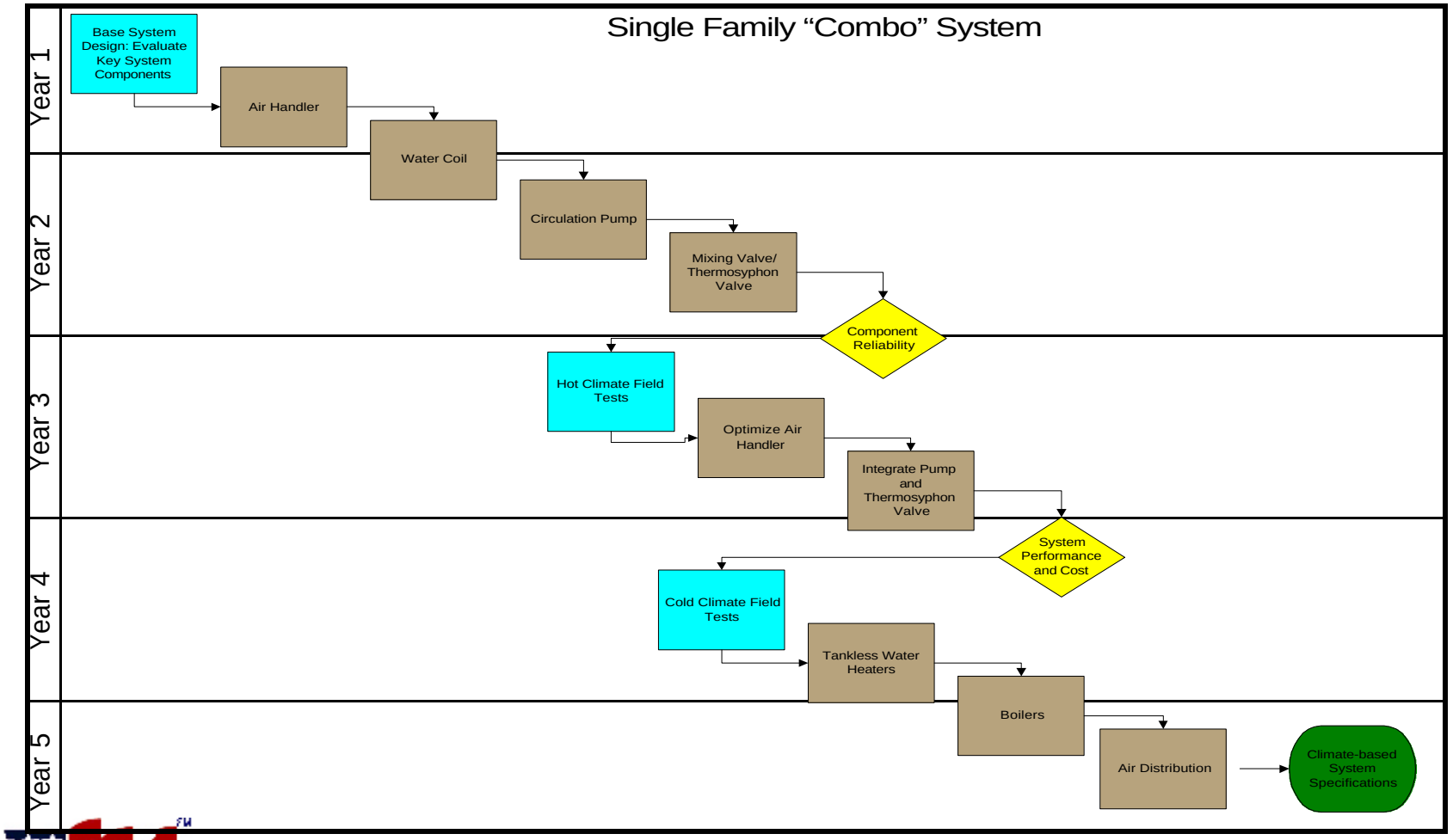
Develop Super-Efficient Hot Water/ Space Heating Systems



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ENERGY STAR® vs. Building America℠

Similarities

	ENERGY STAR®	Building America℠
Wall insulation level	X	X
Ceiling insulation level	X	X
Slab/Foundation insulation	X	X
Glazing performance (U-value, SHGC, shading)	X	X
Building envelope leakage	X	X
Duct leakage	X	X
Duct insulation level	X	X
Duct location	X	X
Heating system efficiency (AFUE, HSPF, COP, % eff.)	X	X
Cooling system efficiency (SEER)	X	X
DHW system efficiency (EF)	X	X

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ENERGY STAR® vs. Building America℠

Building America℠ Requirements

	ENERGY STAR®	Building America℠
Climate-appropriate, whole-building design		X
Pressure balancing (transfer grille and jump duct sizing)		X
Improved indoor air quality (controlled mechanical ventilation)		X
Combustion safety (appliance venting, CO detectors)		X
Air handler and duct location (not in unconditioned space and especially not in garage)		X
Rain control (drainage plane, flashings)		X

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BSC

ENERGY STAR® vs. Building America℠

Often done in Building America℠, but not always a rule	ENERGY STAR®	Building America℠
Improved comfort control (no drafts, better MRT, longer system runtimes, periodic mixing)		X
Cooling and heating system sizing		X
Duct sizing		X
Project-specific items		
Moisture control (no mold or condensation, unvented attics and dehumidification separate from cooling in hot-humid climate)		X
Reduced drywall defects (advanced framing)		X

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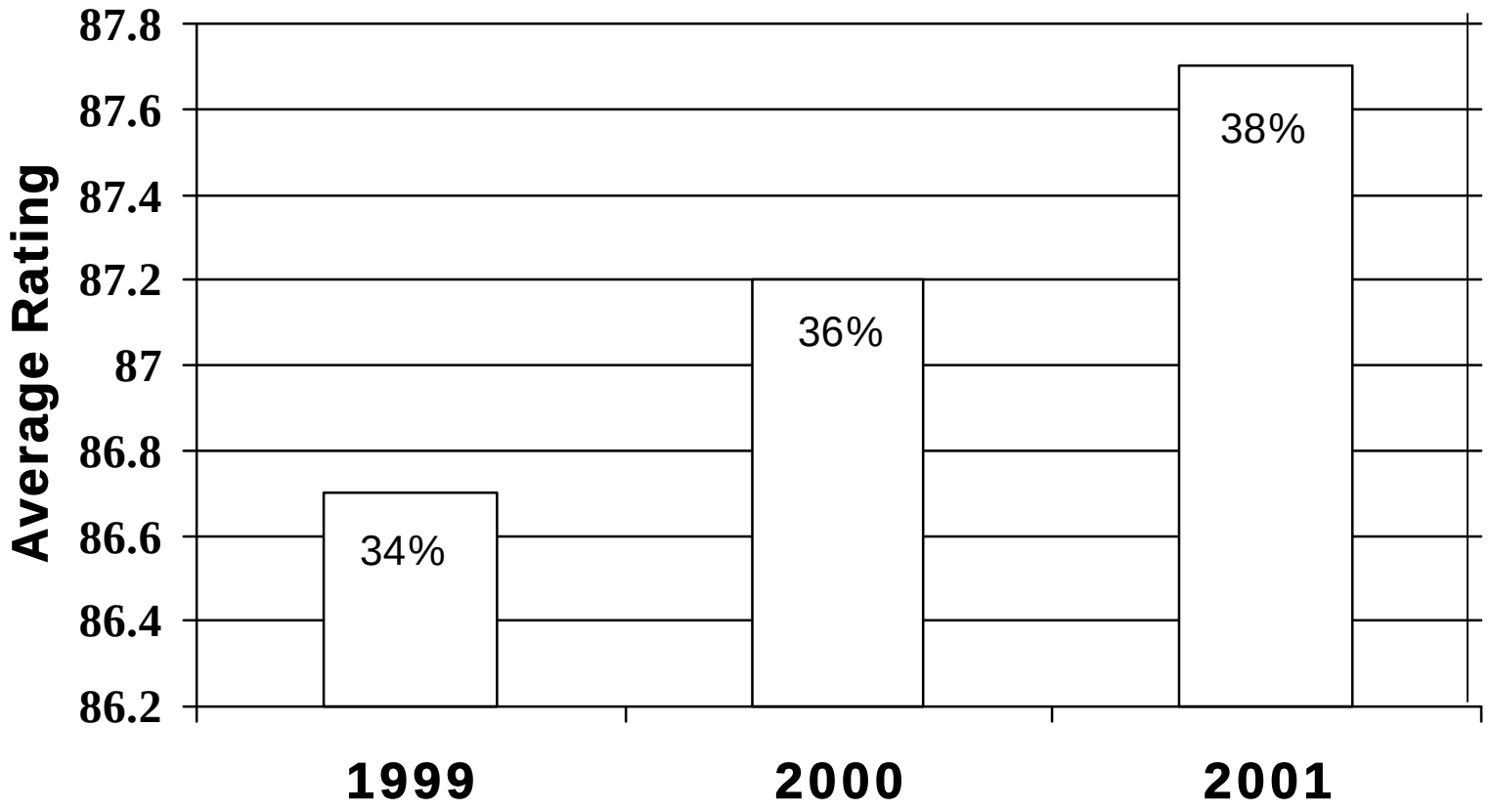
Average Energy Savings at Pulte - Tucson



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Teams and Lab Contacts

Building Science Consortium	**Betsy Pettit**
CARB	**Steven Winter**
Hickory Consortium	**Mark Kelley**
Industrialized Housing Partnership	**Subrato Chandra**
IBACOS Consortium	**Brad Oberg**
NREL, Technical Support	**Ren Anderson**
ORNL, Outreach & Research Implementation	**Pat Love**

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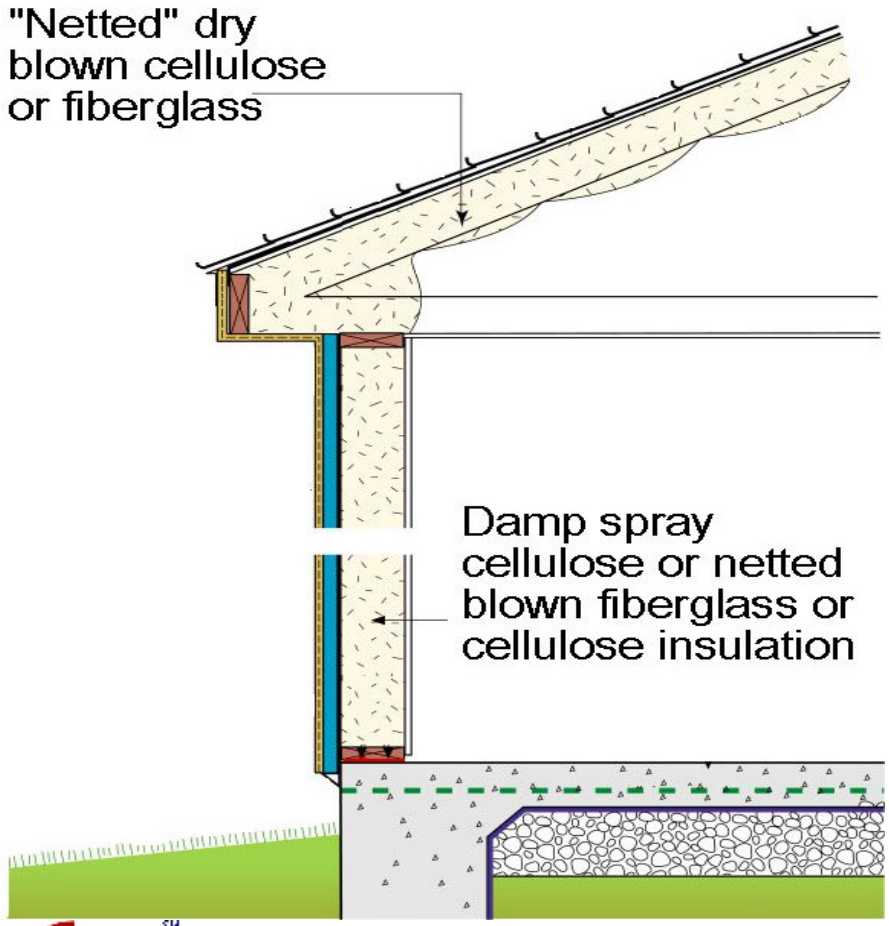
Unvented Attics



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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**
TOTAL PREMIUM	**+ $ 100**

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Resisting the Lateral Loading of Earth-quakes Alternate Wood Shear Wall Panels

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

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.

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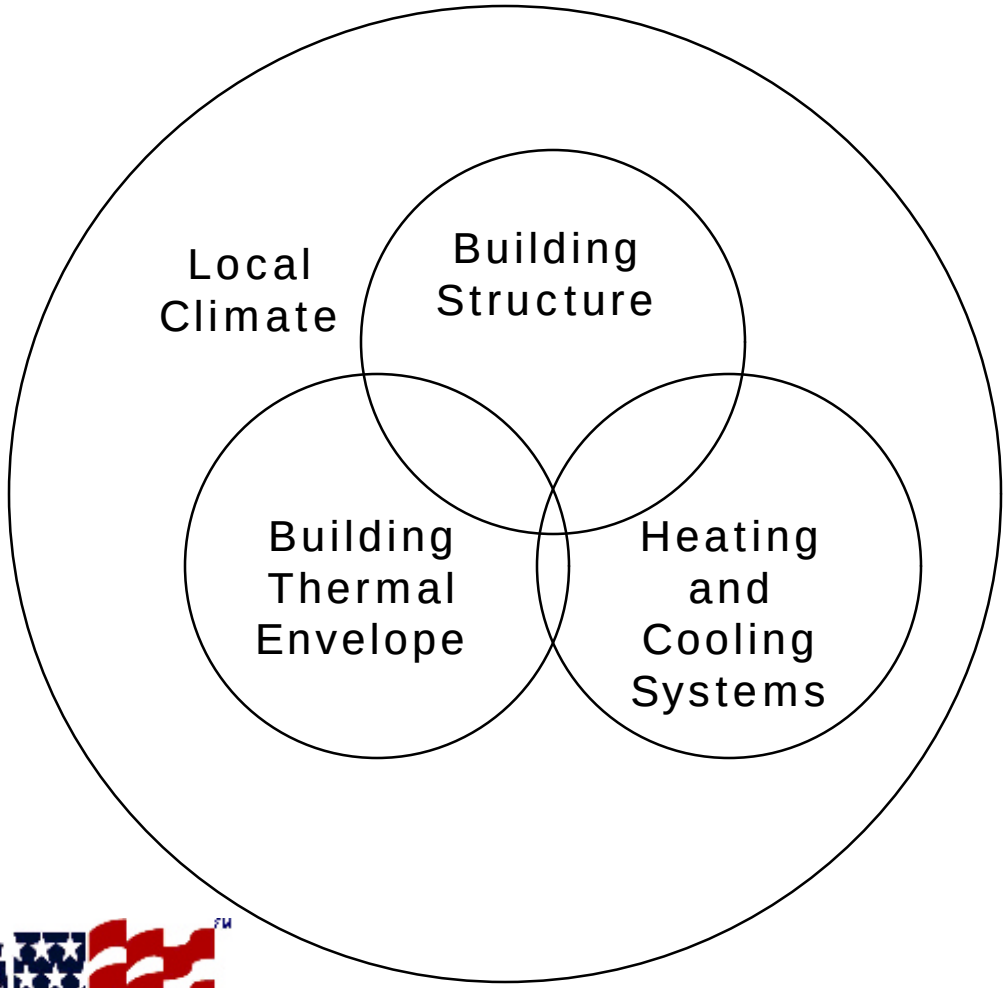
Whole-House Approach



Building America[SM] considers performance and interactions of all building systems.

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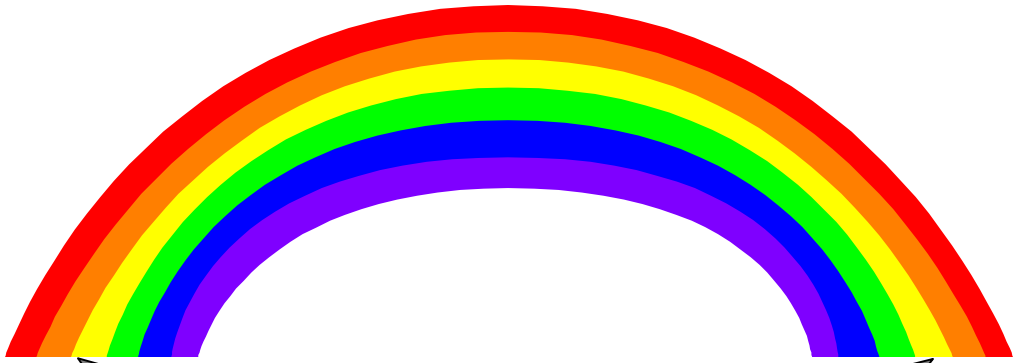
Advanced Systems Target



Advanced Building Components R&D

Existing Buildings

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Cost-Effective, Zero Energy Solar House

- Advanced Industry-Driven System Engineering Research
- Technical Support Through Industry Consortia
- Accelerated Development of "Production Ready" Housing Systems

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Building Science Consortium

Copper Moon

1,618 sq. ft.

Tucson, **Arizona**

Features:

- Unvented cathedral attic
- Low-E^2 spectrally selective windows
- Sealed ducts with mechanical ventilation
- Stack framing
- Blown cellulose wall and ceiling insulation

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CARB

Beazer Homes “PowerHouse”

2,300 sq. ft.

Sacramento, California

Features:

- 3.3 kW integrated photovoltaic array
- R-17 walls
- R-38 ceiling
- Insulation buried ducts
- Mastic-sealed ducts
- Vinyl-frame, low-E windows
- SEER 14 air conditioner

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Hickory Consortium
Erie-Ellington Community

50 units ranging from 700 to 1,450 sq. ft.

Boston, Massachusetts

Features:

- High efficiency HVAC system and appliances
- Programmed exhaust ventilation
- Panelized construction
- Energy-saving windows
- Durable, high quality, low impact materials

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IBACOS Consortium
New American Home 2002

3,337 sq. ft.

Las Vegas, Nevada

Features:

- Airtightness: 4.0 ACH as 50 Pa
- Low-E, solar-control windows (U=0.33, SHGC=0.35)
- Spray foam insulation
- Housewrap weather barrier and building paper
- Heat recovery ventilator
- Fresh air supply distribution ventilation system
- Ductwork leakage at 25 Pa
- Heat Pump Water Heaters have an energy factor of 2.4

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Industrialized Housing Partnership
DREAM Home

2,300 sq. ft.

Central Florida

Features:

- High-efficiency HVAC system and appliances
- Window shading
- Humidity-controlled ventilation
- Inside house, sealed duct system
- Solar water heater

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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

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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

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Net Zero Energy Habitat for Humanity

1,067 sq. ft.

Lenoir City, Tennessee

Features:

- Grid-connected 2 kW photovoltaics
- SIPS, air-tight construction
- Energy-saving windows
- High efficiency HVAC system and appliances
- Heat pump water heater
- Waste heat recovery system

- Building Science Consortium
- Industrialized Housing Partnership
- Oak Ridge National Laboratory

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ORNL

Builders System Performance Packages

Near Term | Mid Term | Long Term

Builders System Performance Packages → 30% Load Reduction → 50% Load Reduction → 70%* Load Reduction

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*Overall building load

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Building America℠ FY 2002 SEP Awards DOE State Energy Program

- ALASKA
  Cold Climate Research Center
  (Building Science Consortium [BSC])

- MARYLAND
  Maryland Energy Commission
  (Consortium for Advanced Residential Buildings [CARB])

- NEBRASKA
  Nebraska State Home Builders Association
  (Consortium for Advanced Residential Buildings [CARB])

- GEORGIA
  Southface Energy Institute
  (Building Science Consortium [BSC])

- VIRGINIA
  Virginia Housing and Environment Network
  (Building Science Consortium [BSC])

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