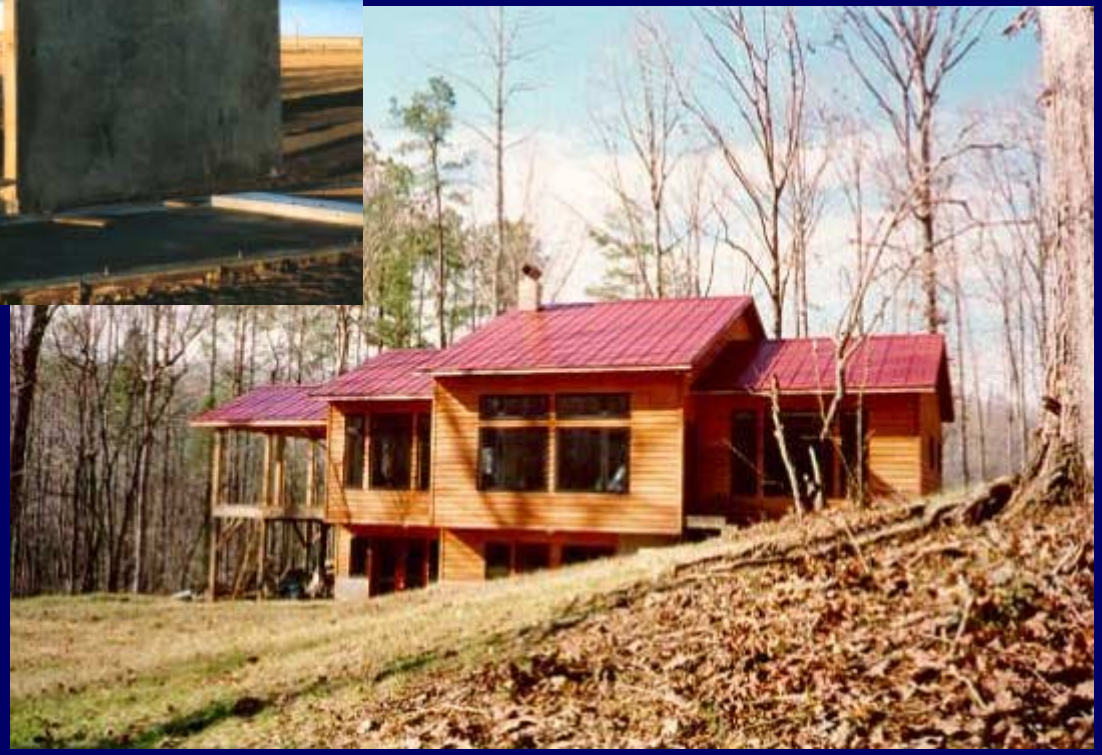
Building America Update

DOE Office of Building Technology
State and Community Programs



Dr. Ren Anderson

Building America Integration Meeting
April 10-11, 2001

Building AMERICA
U.S. Department of Energy

NREL Building Energy Technology

Building America Results

Cost/benefit trade-offs improve whole building performance without increasing cost

- Reduced utility bills
- Healthy, comfortable homes
- Accelerated adoption of new technologies
- Reduced warranty and callback issues
- Improved sales

Key Technical & Programmatic Challenges

Transition of new systems from niche to broad markets requires "bomb proof" integration

Market, Policy, & Other External Barriers

System innovations require substantial private sector cost share driven by sustainable markets

Strategic Approach

Limit the risk associated with development and integration of innovative and emerging energy systems in residential buildings

Strategic Approach

Industry Teams

DOE Buildings Program

Technology Centers

Team Members Include:

- **Lead Builders**
- **Equipment Manufacturers**
- **Material Suppliers**
- **Designers**
- **Developers**
- **Utilities**

Building AMERICA
U.S. Department of Energy

NREL *Building Energy Technology*

Strategic Approach

Energy

- Reduce energy use by 30-70%

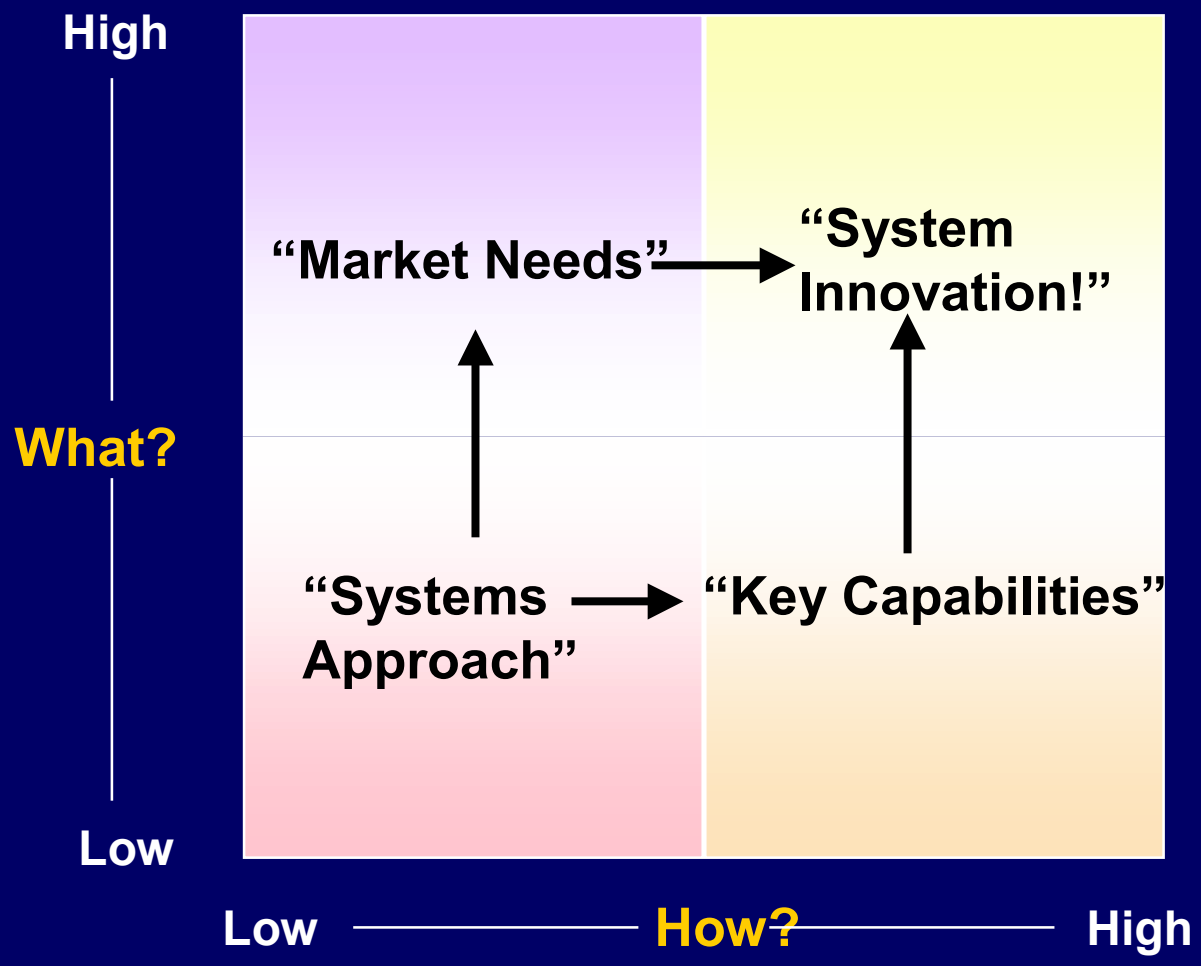
Quality

- Increase durability and maintainability

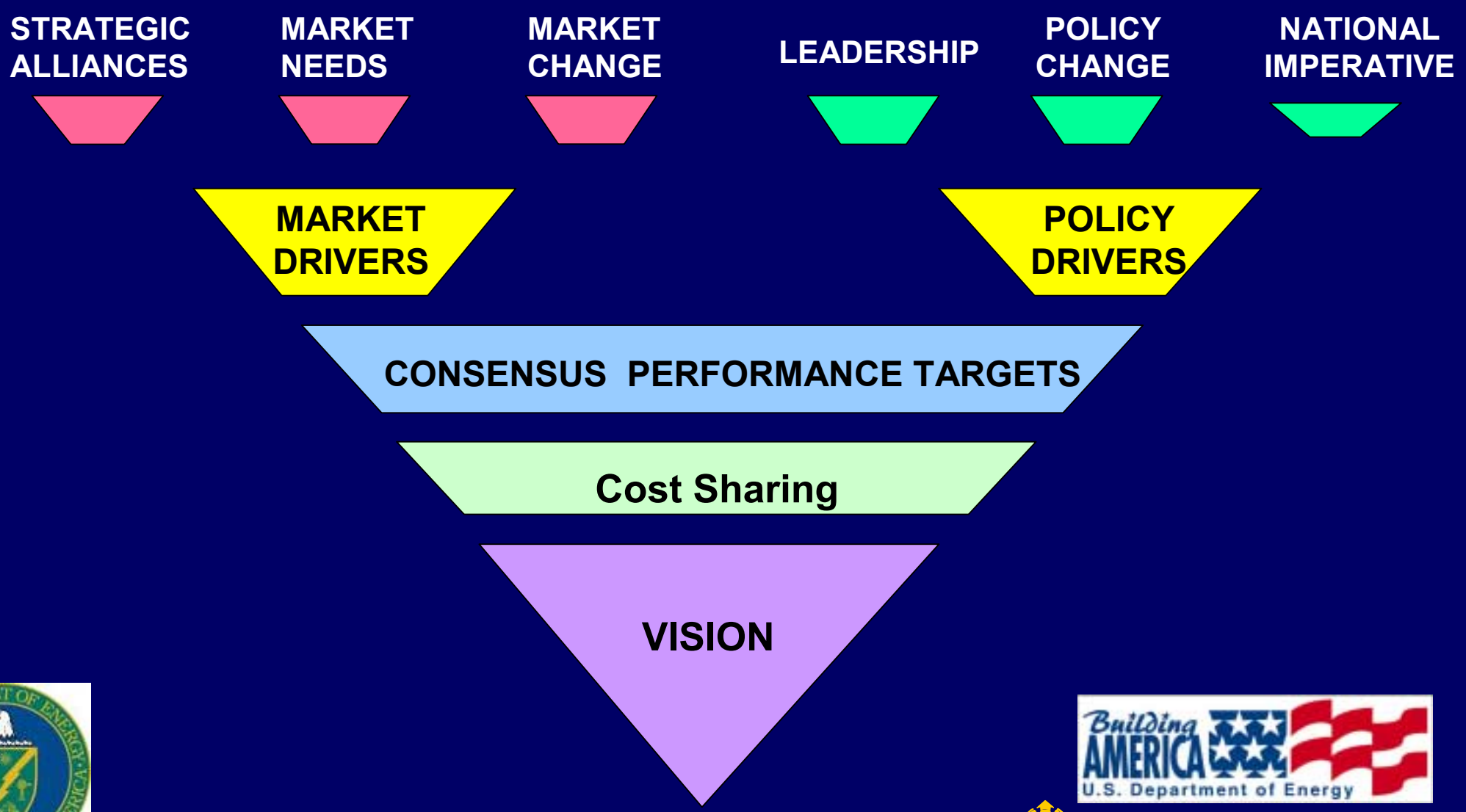
Resource Use

- Reduce construction waste and increase productivity

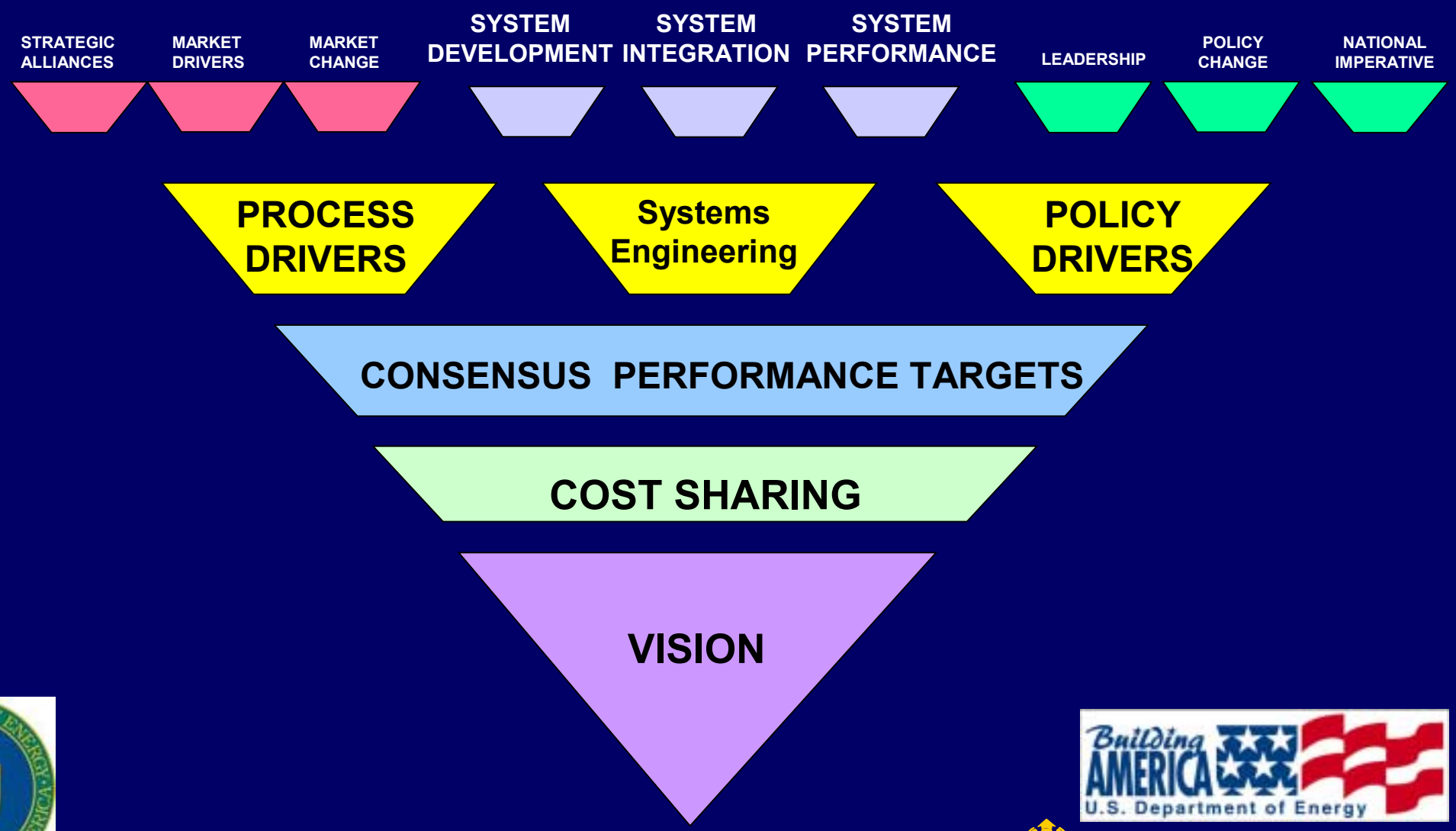
Strategic Approach



Building America's Partners Contribute



Building America Contributes



Building America Innovation Goals

- Develop and Transfer major systems innovations to community-scale developments
- Support upstream system engineering with industry team members to fill advanced system needs including
  - -residential ventilation and dehumidification
  - -low cost, efficient water heaters
  - -durable foundation insulation
  - -onsite power systems

Innovation is Accelerated by Limiting Risk

Industry Sector

"Standard Practice" "Best Practice" "Lead Builder" "Early Adopter"

Development Status

"Expected" ← "Proven" ← "Emerging" ← "Innovative"

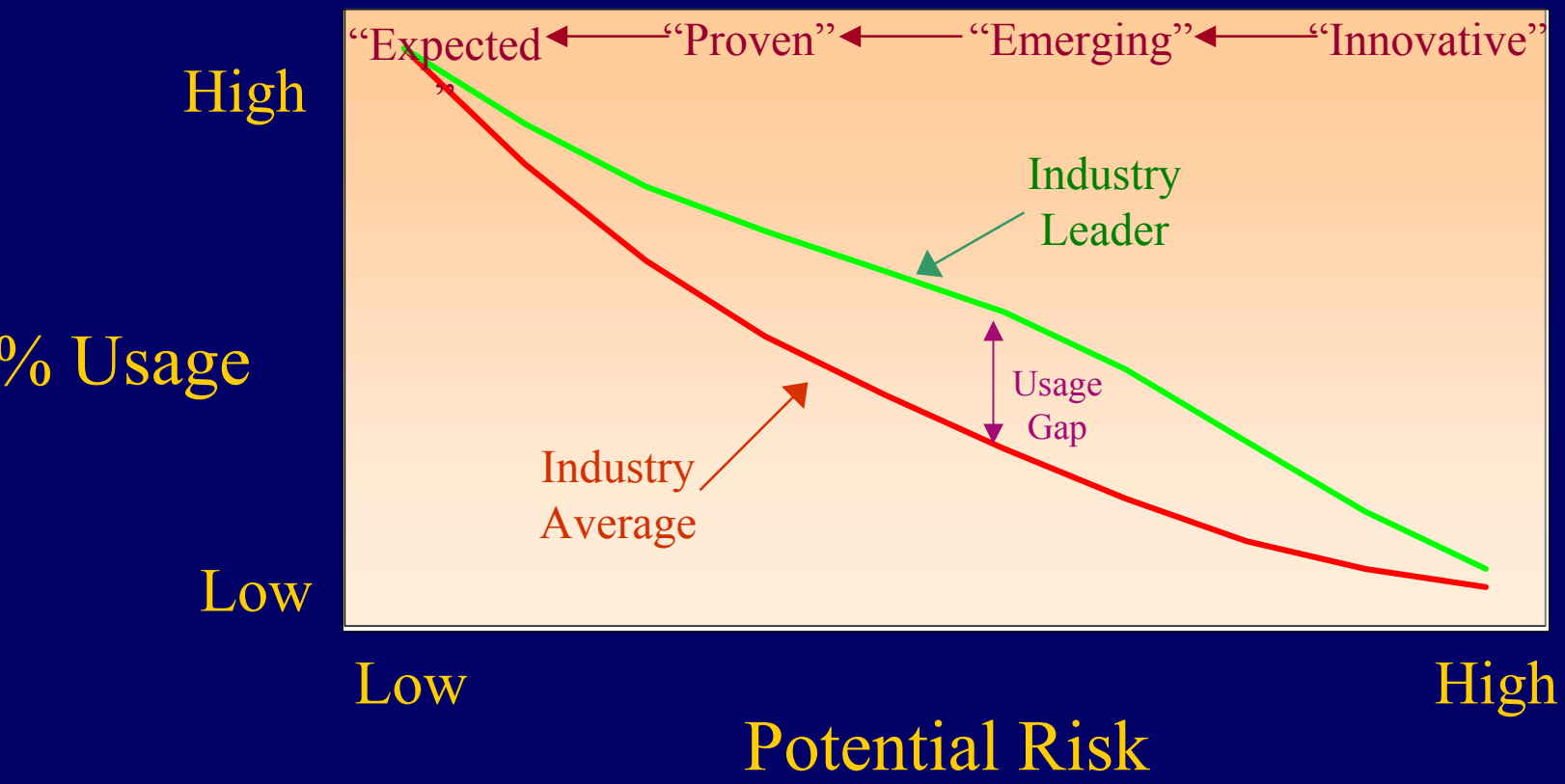
"Low" → "High"

Potential Risks and Rewards

Innovation Reward Vs. Risk

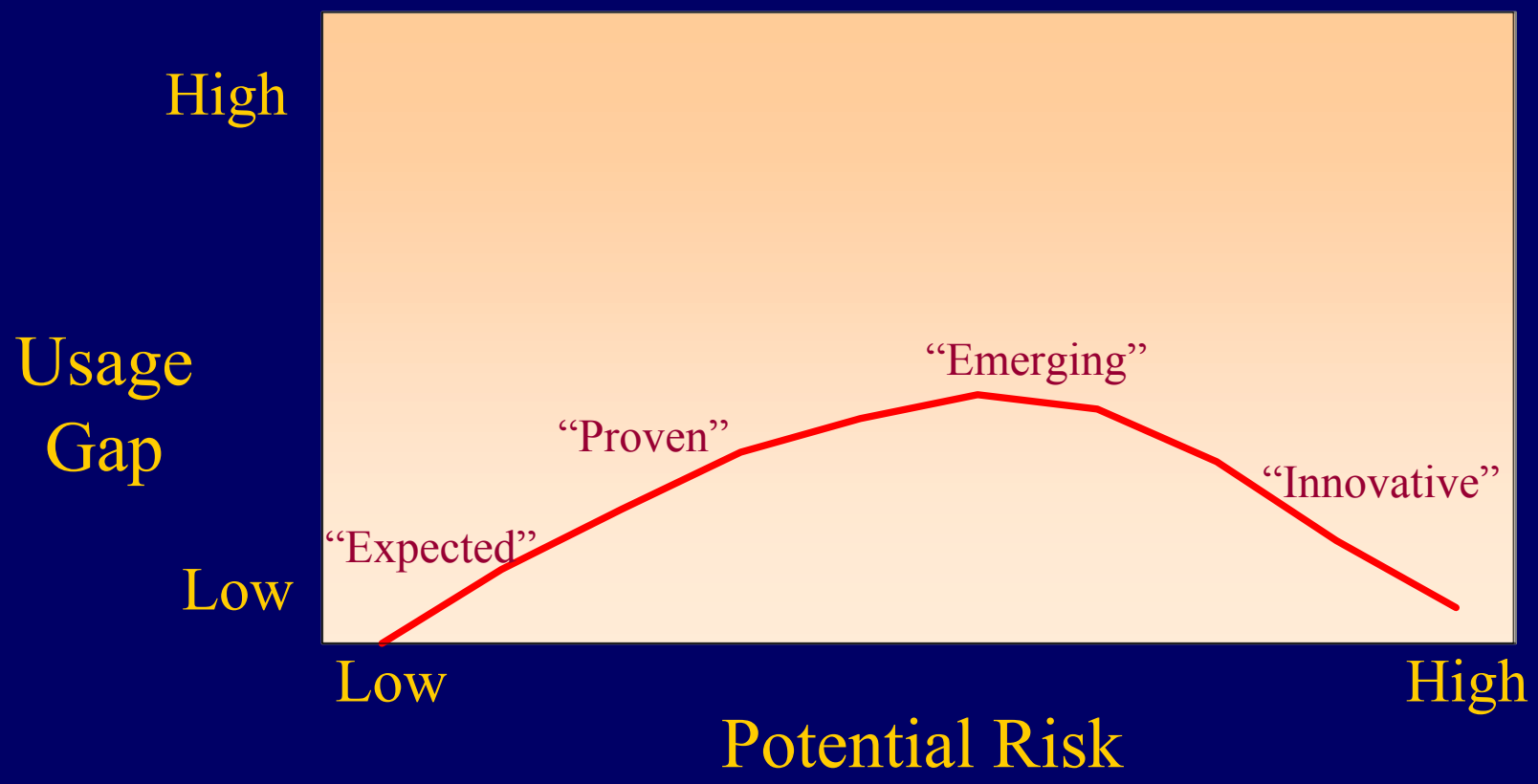
Industry Leaders

Usage Vs. Risk

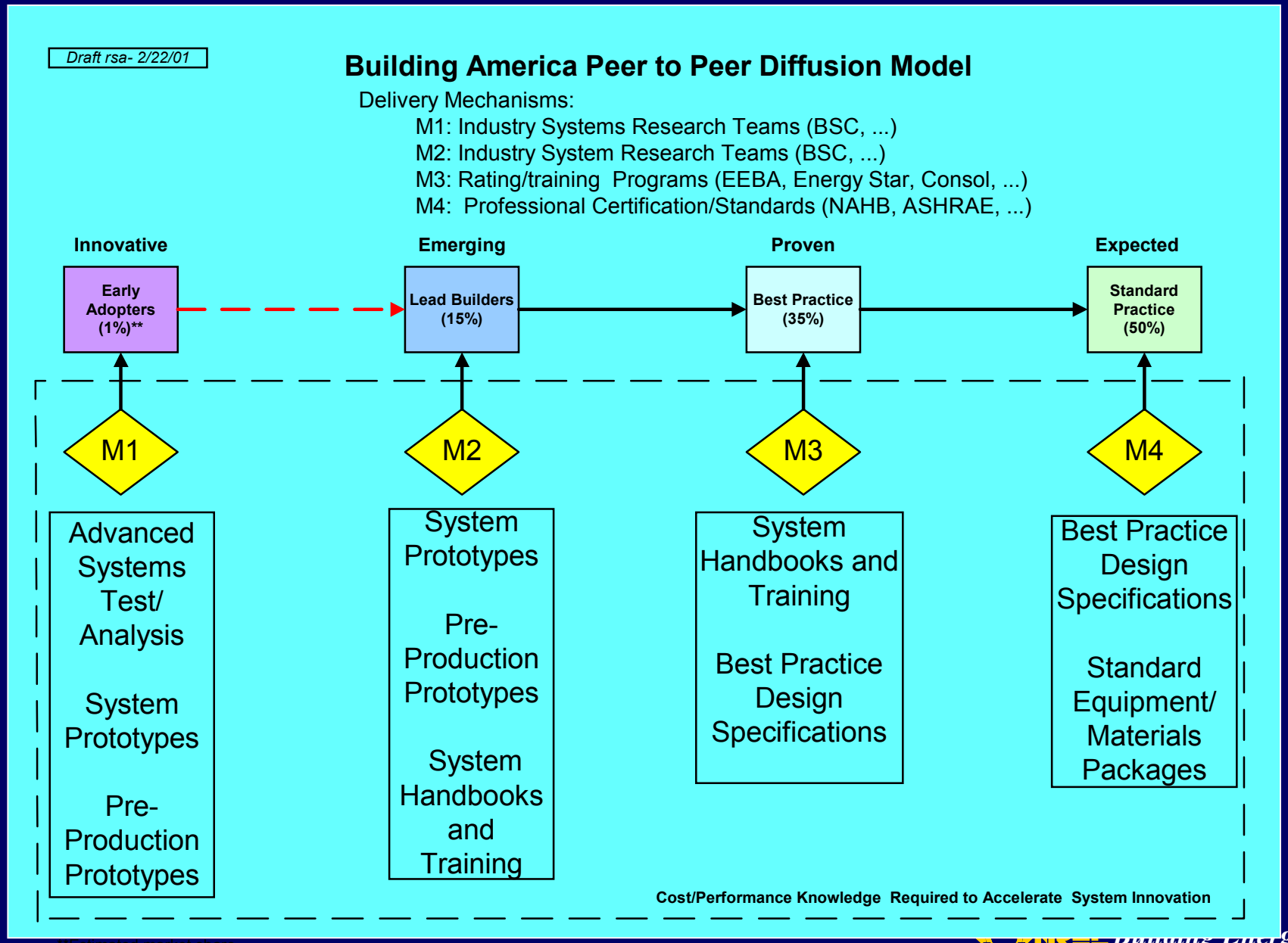


Balanced Portfolio Accelerates Innovation by Managing Risk

Usage Gap Vs. Risk

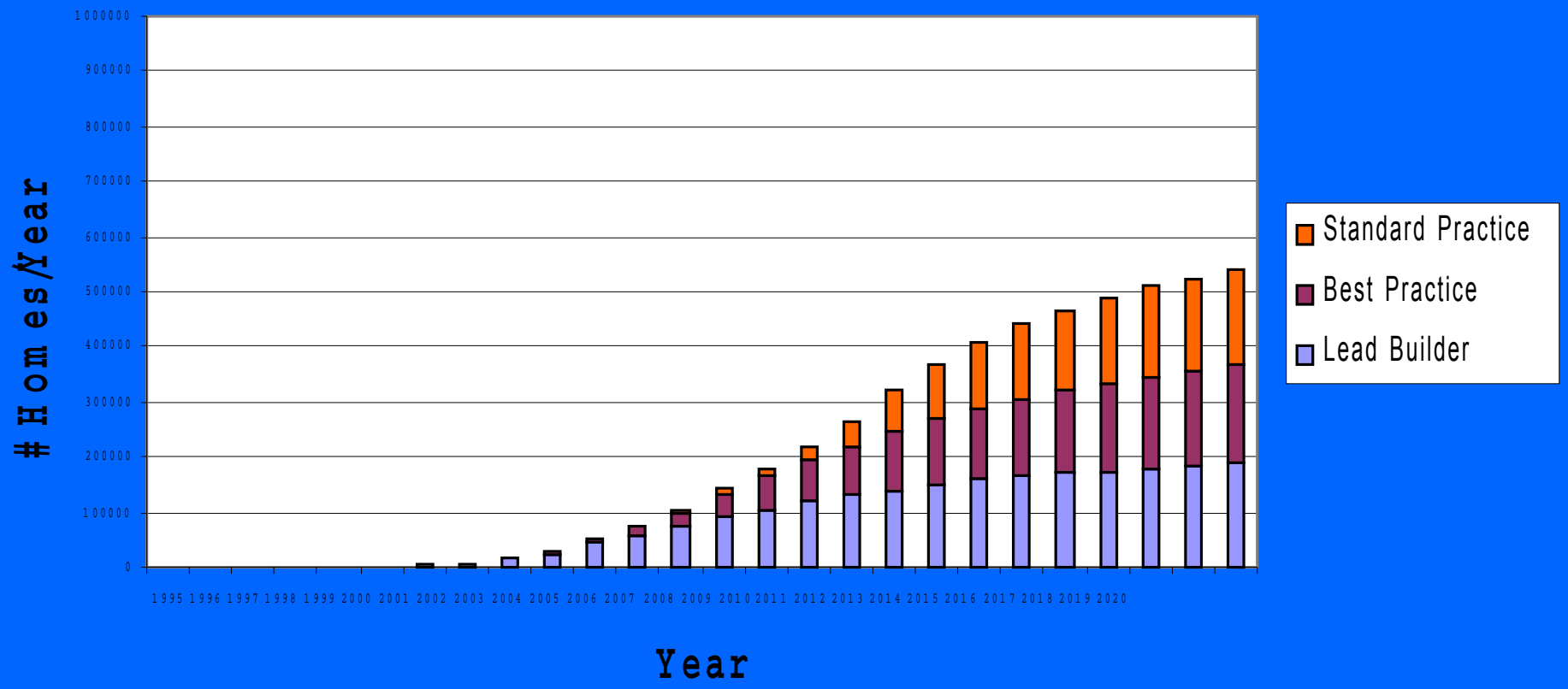


Peer to Peer Diffusion

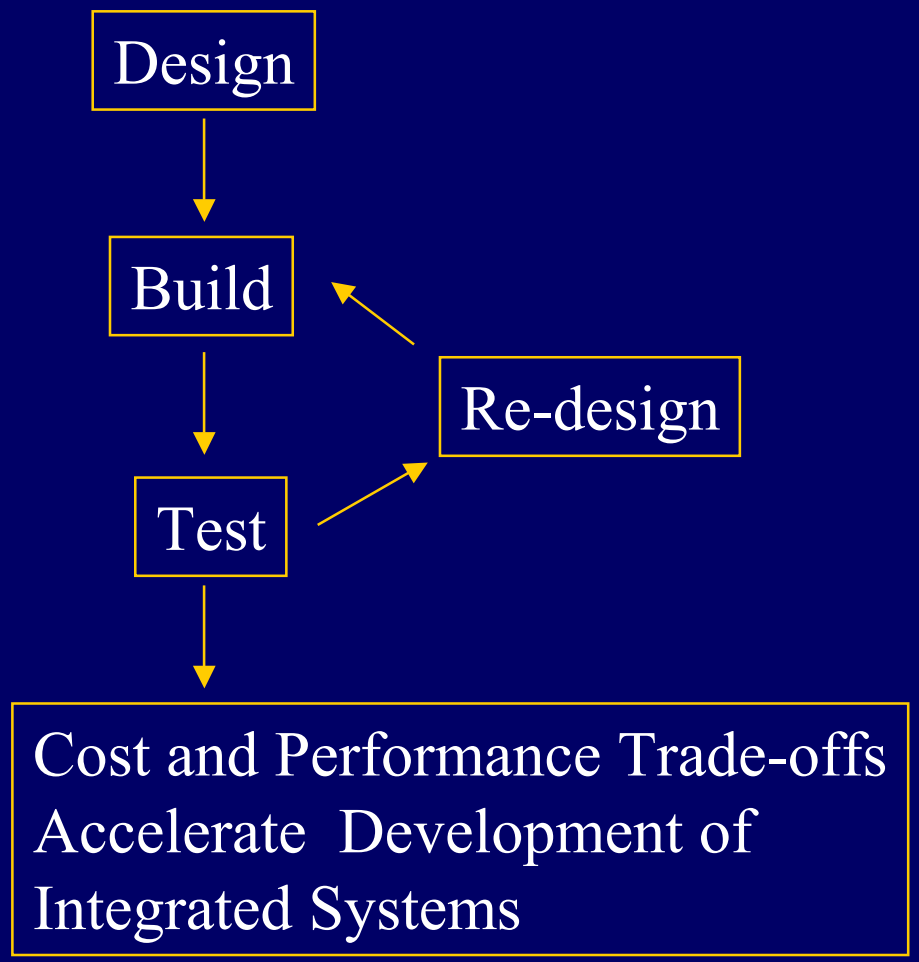


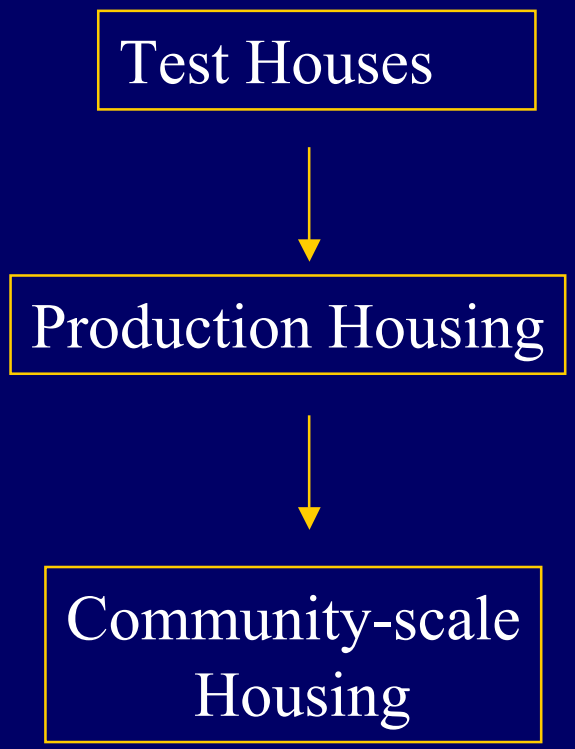
**Estimated market share

Peer to Peer Diffusion



Systems Engineering Process





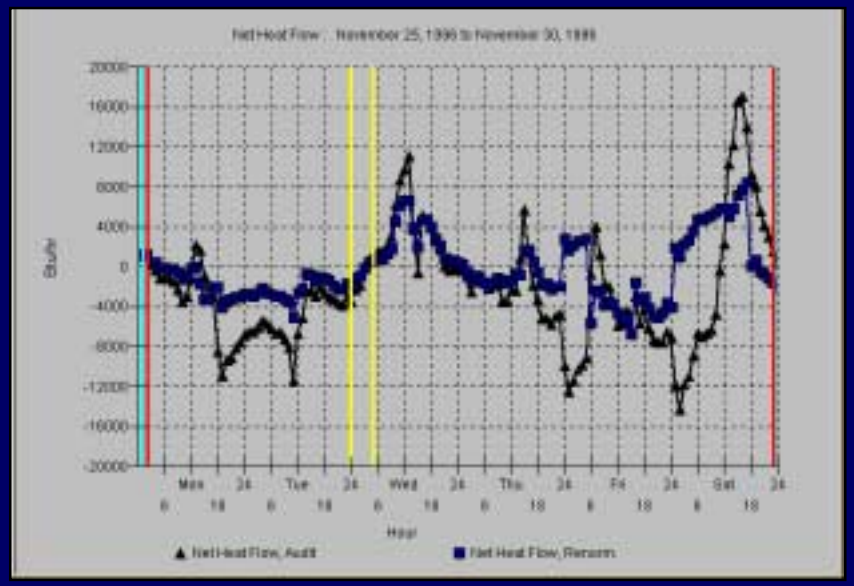
System Performance Feedback

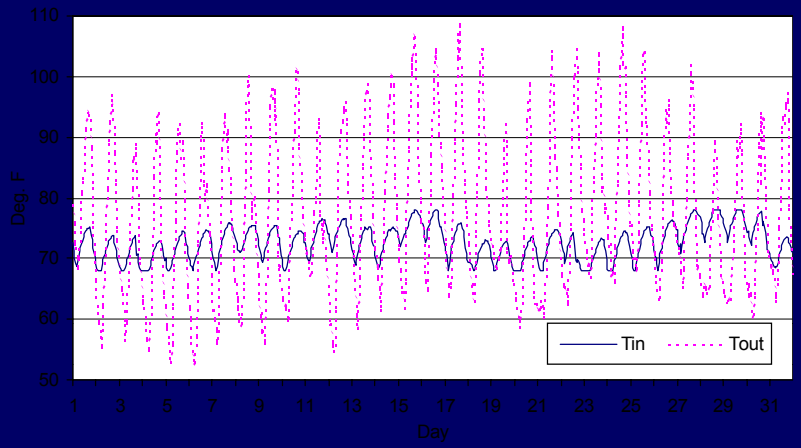
Long Term Testing

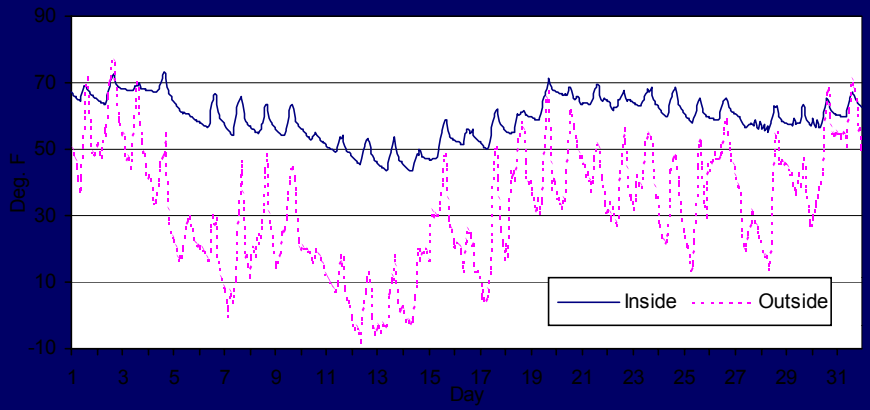
- Weather data
- Room Temperatures
- Energy Consumption

Short Term Energy

- Tracer Gas
- Co-heating/co-cooling
- Calibrated Energy Analysis
- System Diagnostics

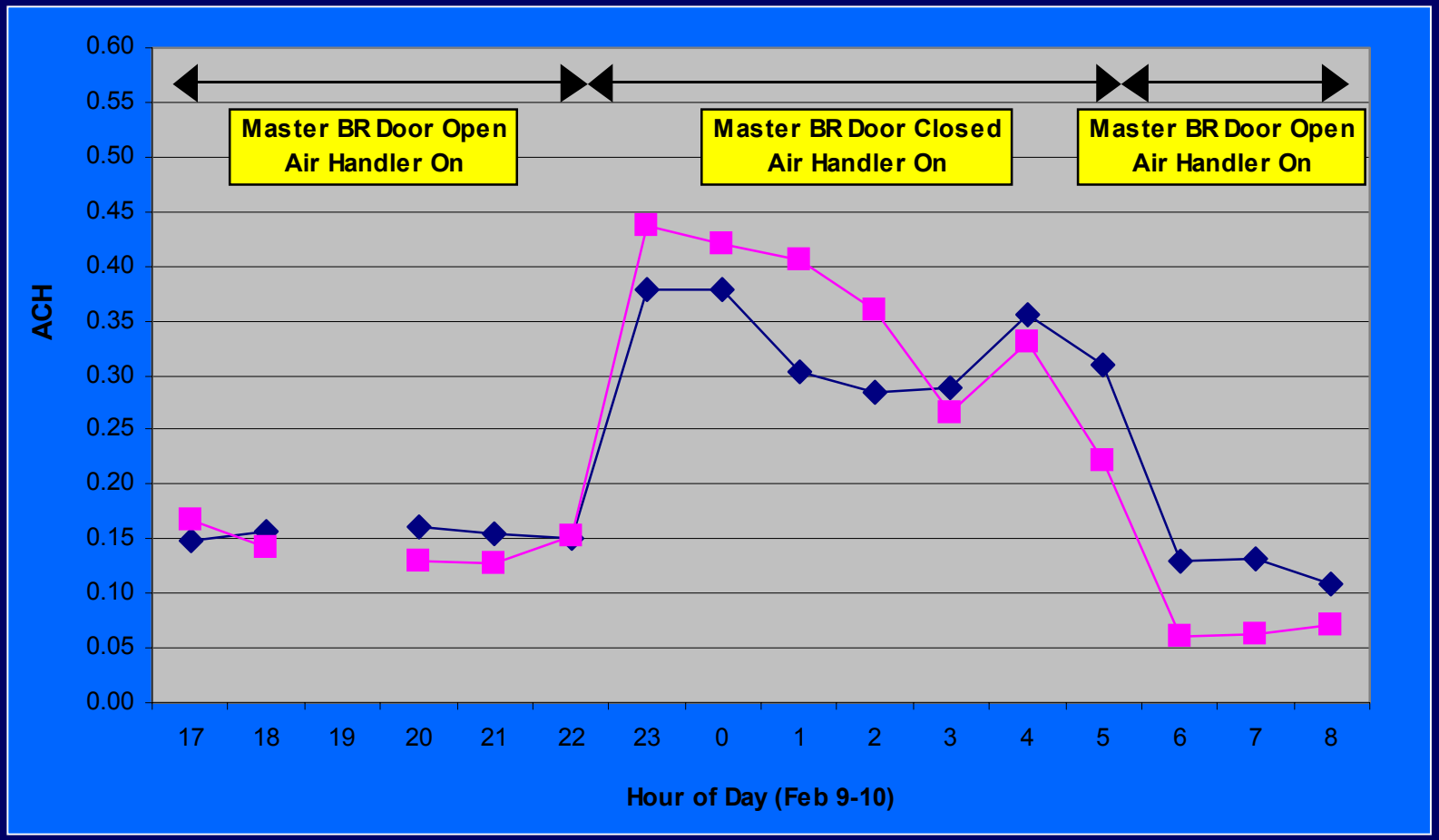






Co-heating and Co-cooling

Tracer Gas Diagnostics



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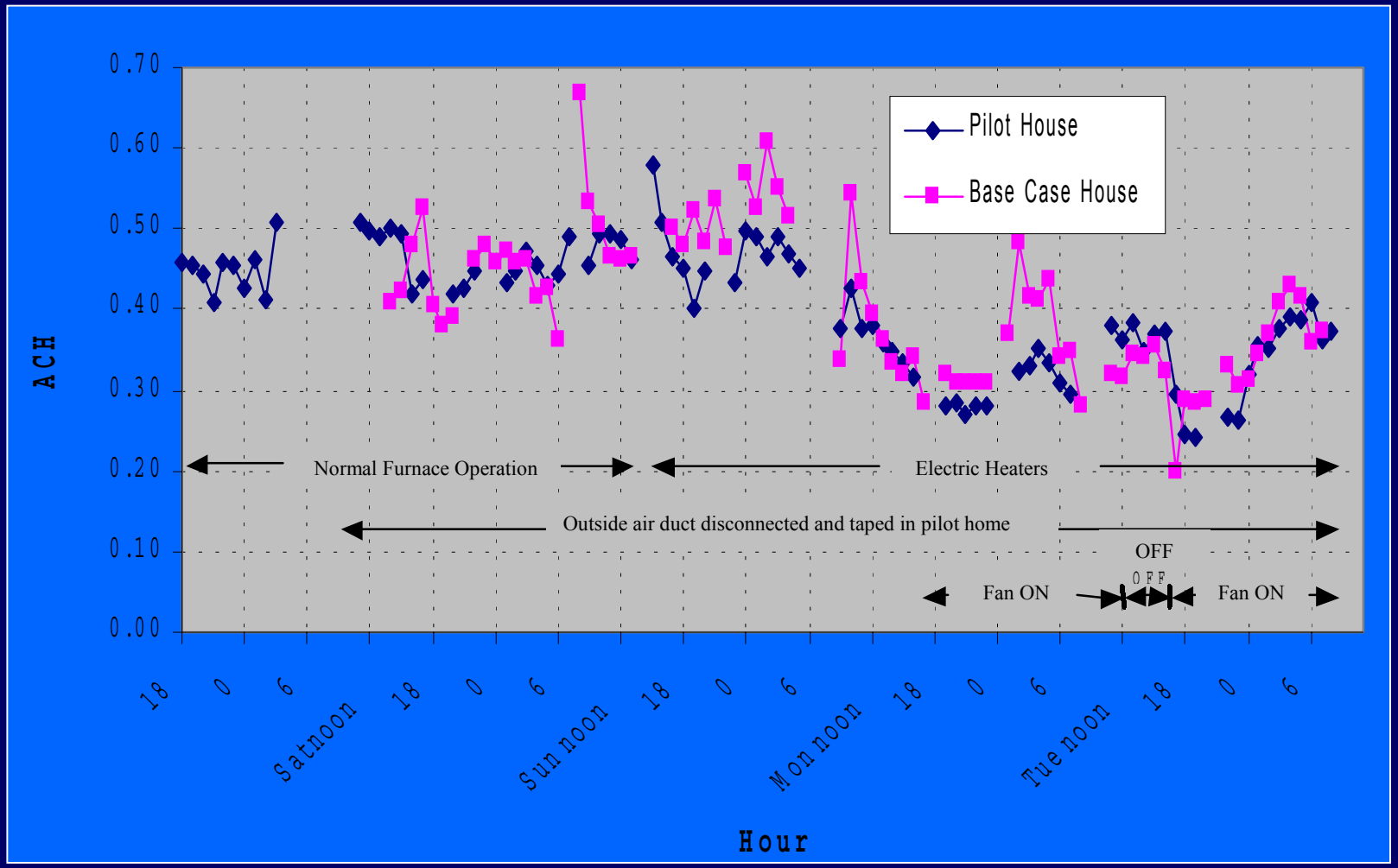


BUILDING AMERICA PROGRAM

Building Science Consortium

Village Green: A Sustainable Energy Community Sylmar, California

FEATURES

- 186 single family 3 or 4 bedroom homes from 1400 sq. ft. to 1700 sq. ft. with garages
- Advanced framing system: 2 x 6 24 inch on center walls, single top plates and stacked framing members
- Ducts moved into the conditioned space eliminating duct leakage to the outside and reducing thermal gradient at the ducts
- Spectrally selective window units, such as PPG Sungate 1000s, increase comfort, reduce the cooling load from solar gain and reduce UV damage
- Downsized 3-ton Robur gas powered absorption cooling systems
- 1.5kW photovoltaic systems with net metering
- Estimated 40% reduction in heating, cooling and hot water costs over standard code construction; carbon emissions reduced by over 1000 pounds per year

PARTNERS

- U.S. Department of Energy
- Building Science Consortium
- PATH (Partnership for Advanced Technology in Housing)
- The Lee Group
- Braemar Urban Ventures
- Van Tilburg Banvard & Soderbergh Architects
- Esco Structural Engineers/ CERL Army Corp of Engineers
- Los Angeles Department of Water and Power
- Southern California Gas Company
- Fannie Mae
- B. P. Solar
- Robur Corporation

Van Geet Residence

- 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 by photovoltaics

Mercedes Homes

- CARB project in Rockledge, FL
- Second set of prototypes
- Four prototypes and one control tested
- Ducts in conditioned plenum truss
- Cast-in-place concrete walls
- Single pane, low-e windows

Standard Practice

Michelle Isle Prototype

Lora Isle Prototype

BUILDING AMERICA PROGRAM

IBACOS® Consortium

RGC uses reduced energy cost and energy efficient mortgages to qualify buyers and sell more homes

The Community of Civano
Tucson, Arizona

DESCRIPTION

- 240 single-family homes optimized from the on-set for efficiency in design and construction
- Progressive community standards promote energy efficiency, water conservation, waste management and clean air
- Models complete and tested to exceed high community performance standards; 1200-1800 square feet

FEATURED TECHNOLOGIES

- ✓ Structural Insulated Panels (SIPs) for the walls and roof construction
- ✓ Open-web, wood floor truss over crawlspace for mechanicals distribution
- ✓ Insulated Concrete Forms (ICFs) for the foundation
- ✓ Centrally located air-handler within the conditioned space minimizes duct runs and static pressure loss
- ✓ High-performance windows with reduced shading coefficient
- ✓ Hydronic heating system

HIGHLIGHTS

- Tested results demonstrate reduced energy consumption of 54% below MEC95
- Tested results demonstrate air tightness of .17 air changes per hour under natural conditions (ACHn) versus the community requirement of .35 ACHn

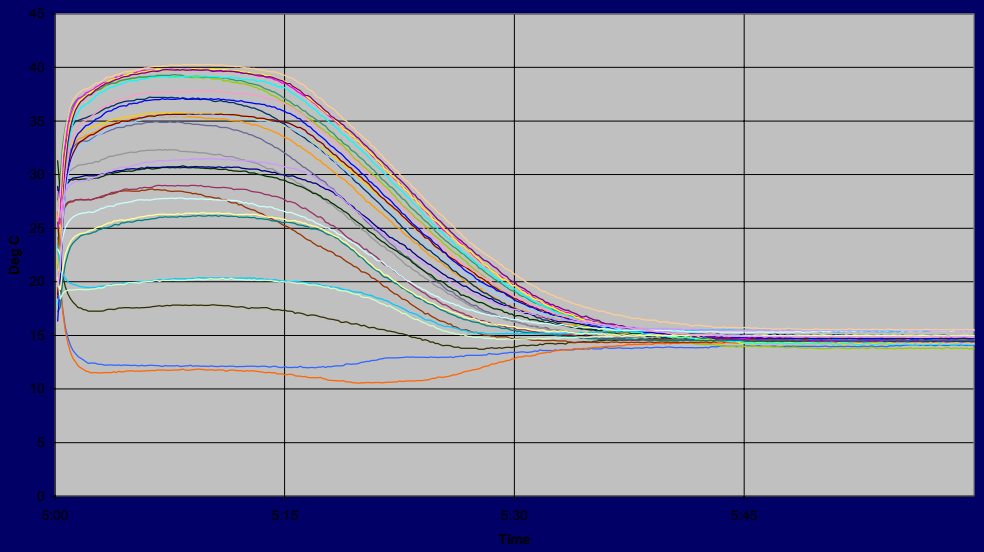
PARTNERS

- U.S. Department of Energy
- RacoreActions Group of Companies (RGC)
- EGA Landmark Communities
- National Renewable Energy Laboratory

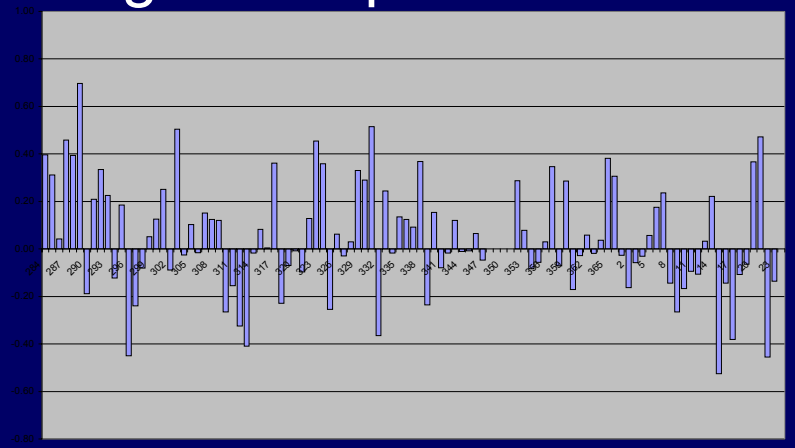
Civano ICS Solar Water Pre-Heater Study

Question: What is the energy contribution of the solar water heaters in the Civano community?

- Instrumented system on model home with remote control of draw pattern
- Instrumented systems on eight occupied homes



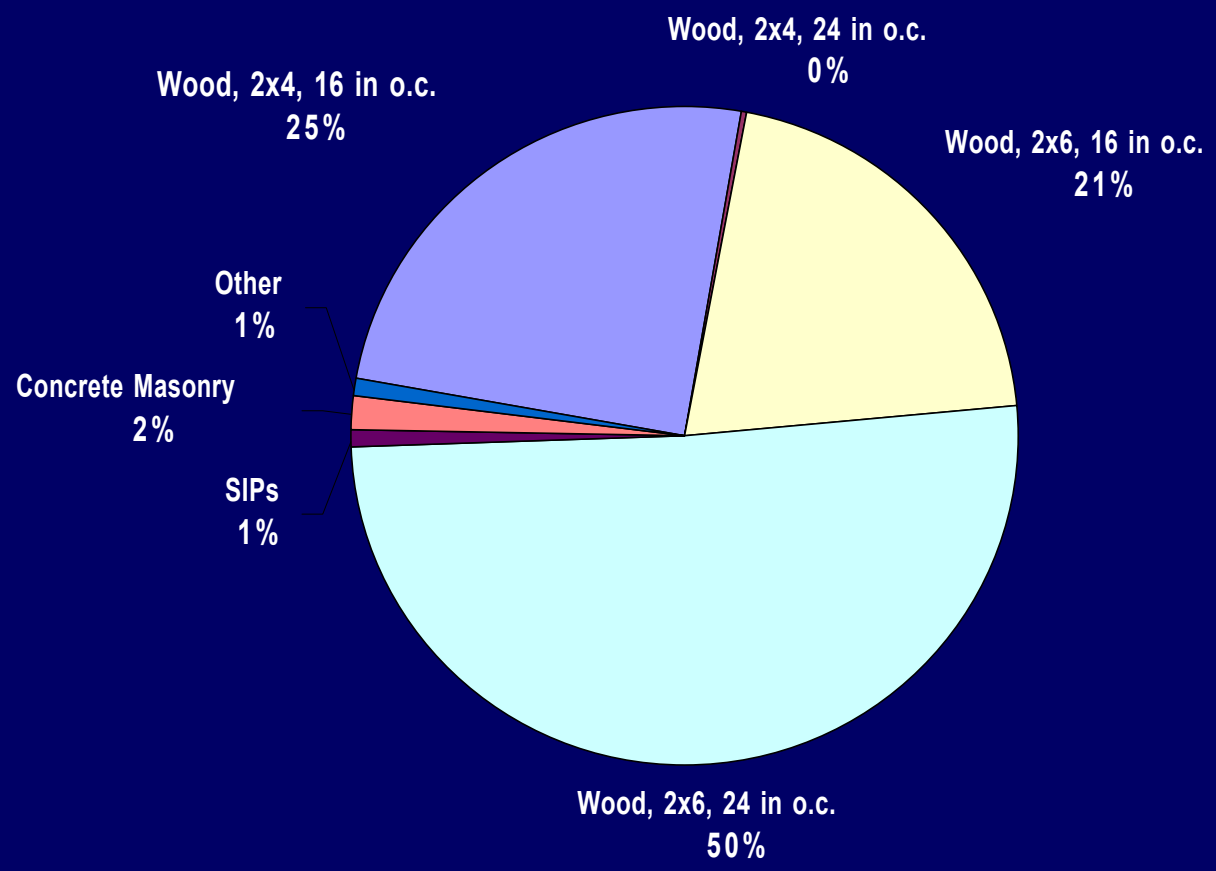
Water temperature from collectors during daily evening draws



Daily Solar Fraction, Home 7

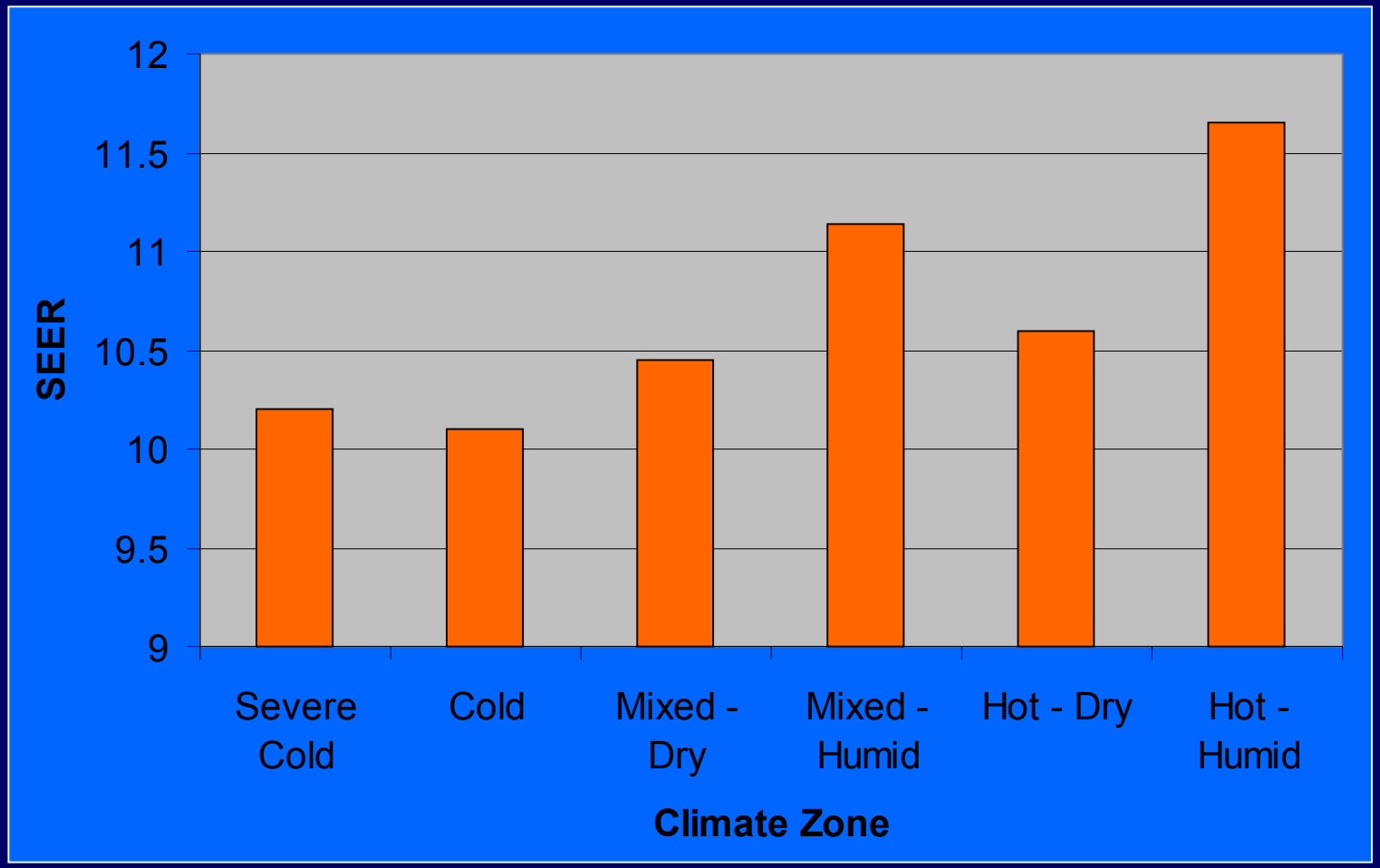
Building America Database

Types of Wall Construction used in Building America Houses



Building America Database

Average SEER for cooling systems in Building America Houses



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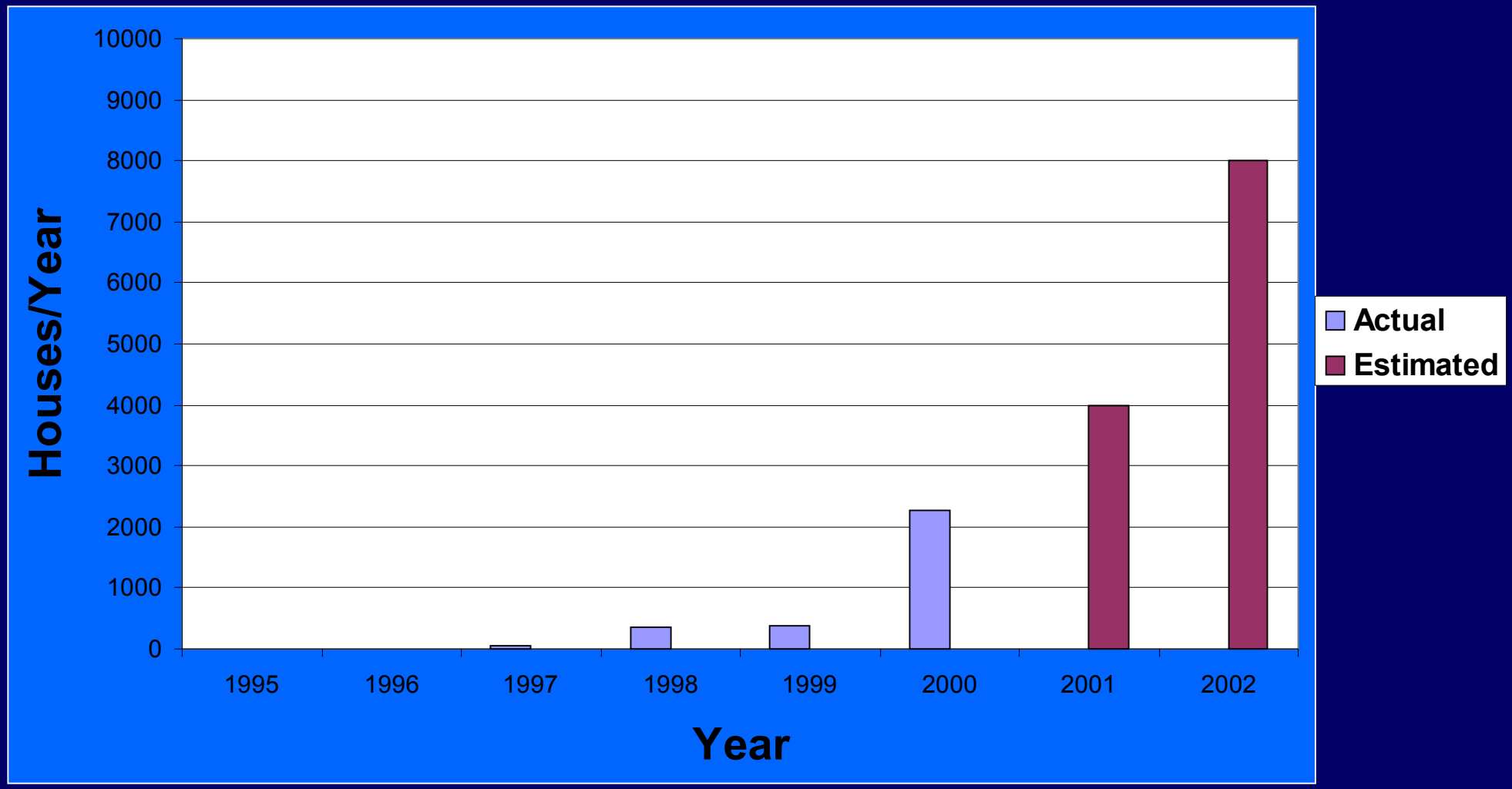

New NREL BA Publications

- New BA Overview
- ACEEE Paper – Shading and Glazing
- ASES Paper – Tierra Home Analysis
- Four NREL Technical Reports:
  - BA House Performance Analysis Procedure (draft)
  - Ventilation in BA homes (draft)
  - Tierra Homes Analysis
  - Habitat Denver Analysis (draft)

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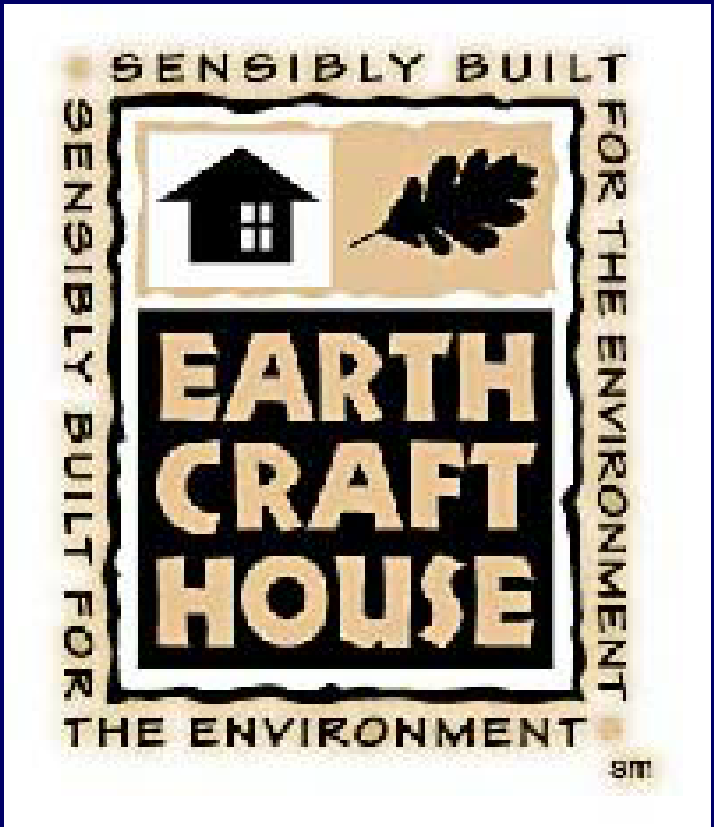
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EARTH CRAFT HOUSE
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Bob Hendron

Paul Norton

Michael Smith

Paul Torcellini

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