RESNET Annual Conference – Orlando, FL

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

Building America Top Innovations

SAM RASHKIN &

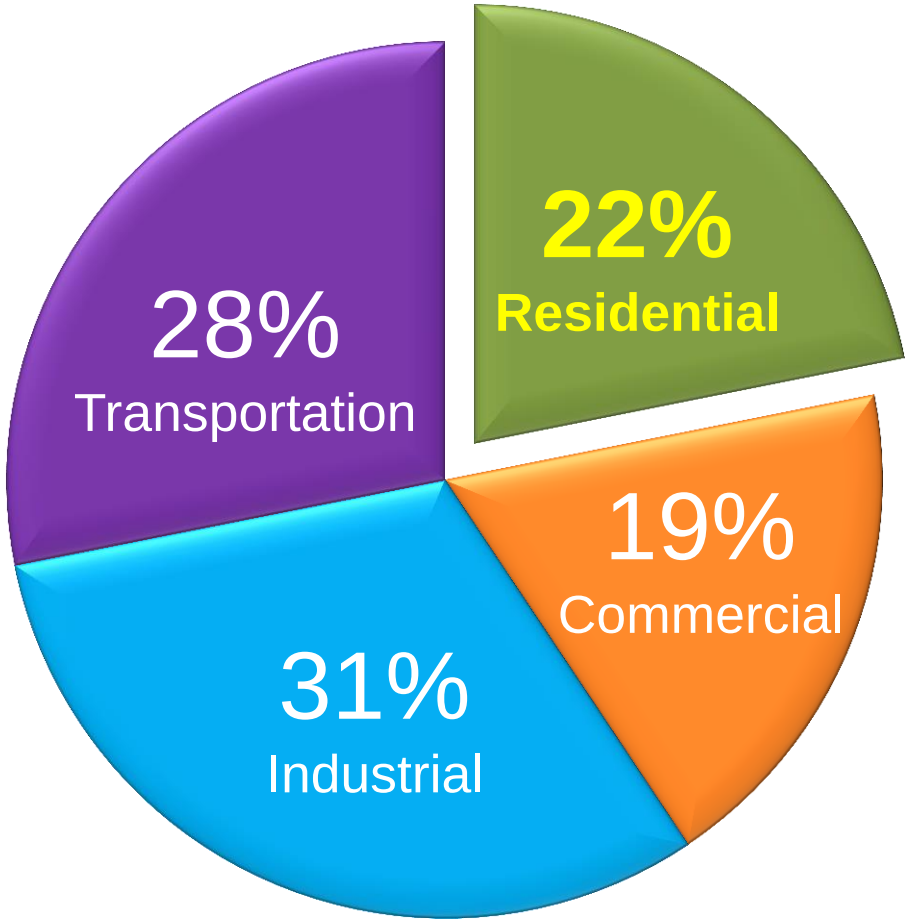
ERIC WERLING

Building Technology Office

Business Case

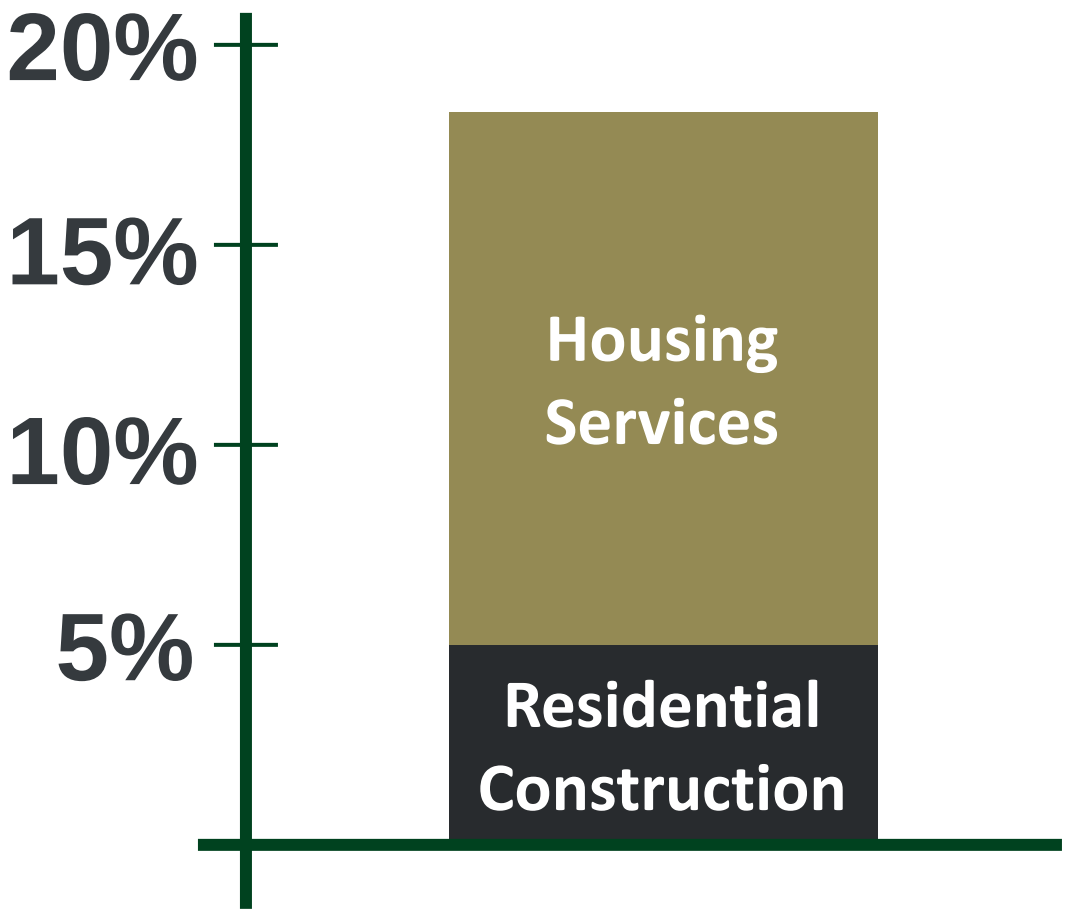
Why Building America

Residential Energy Use Significant



U.S. Energy Consumption

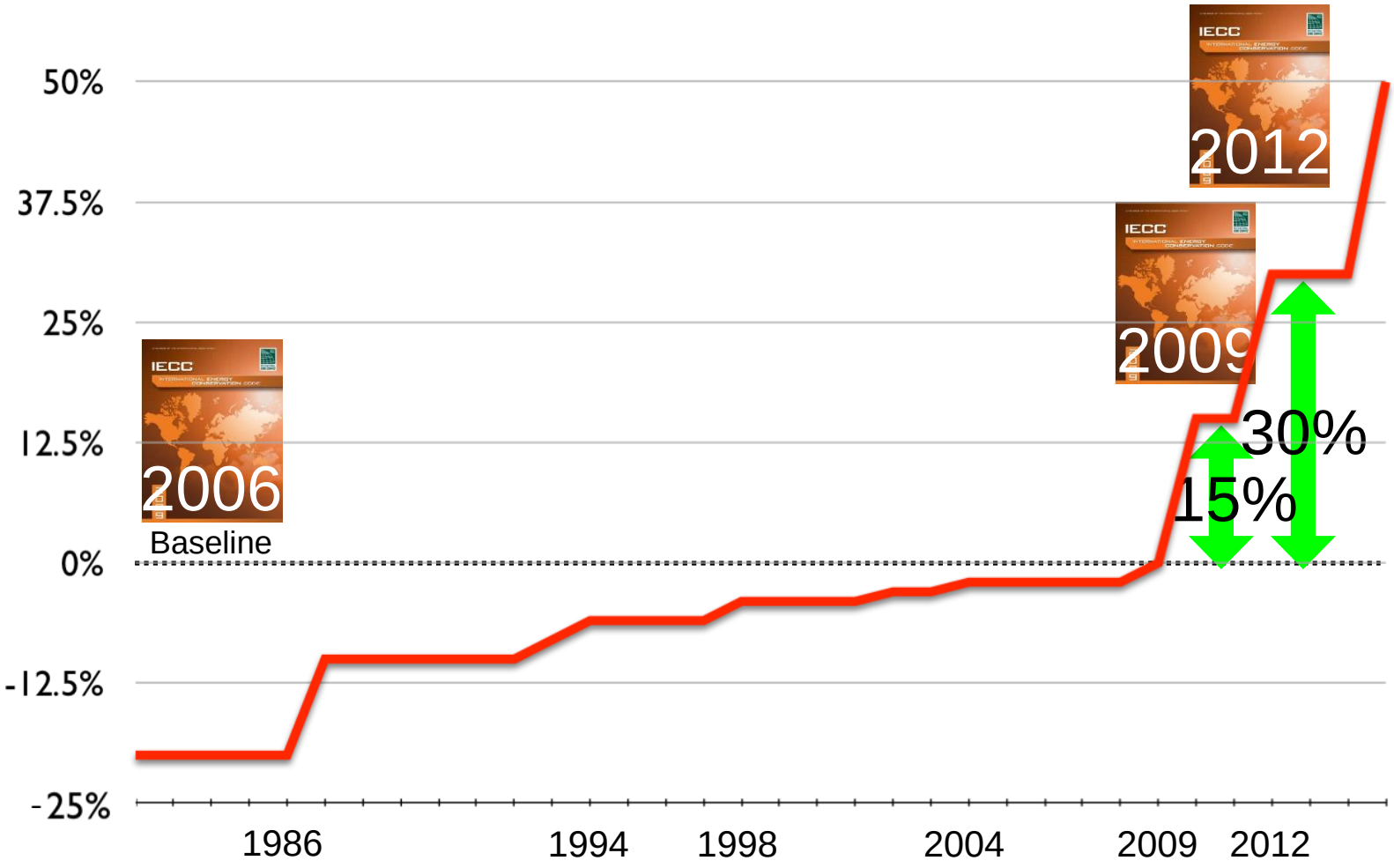
Residential Economic Impact



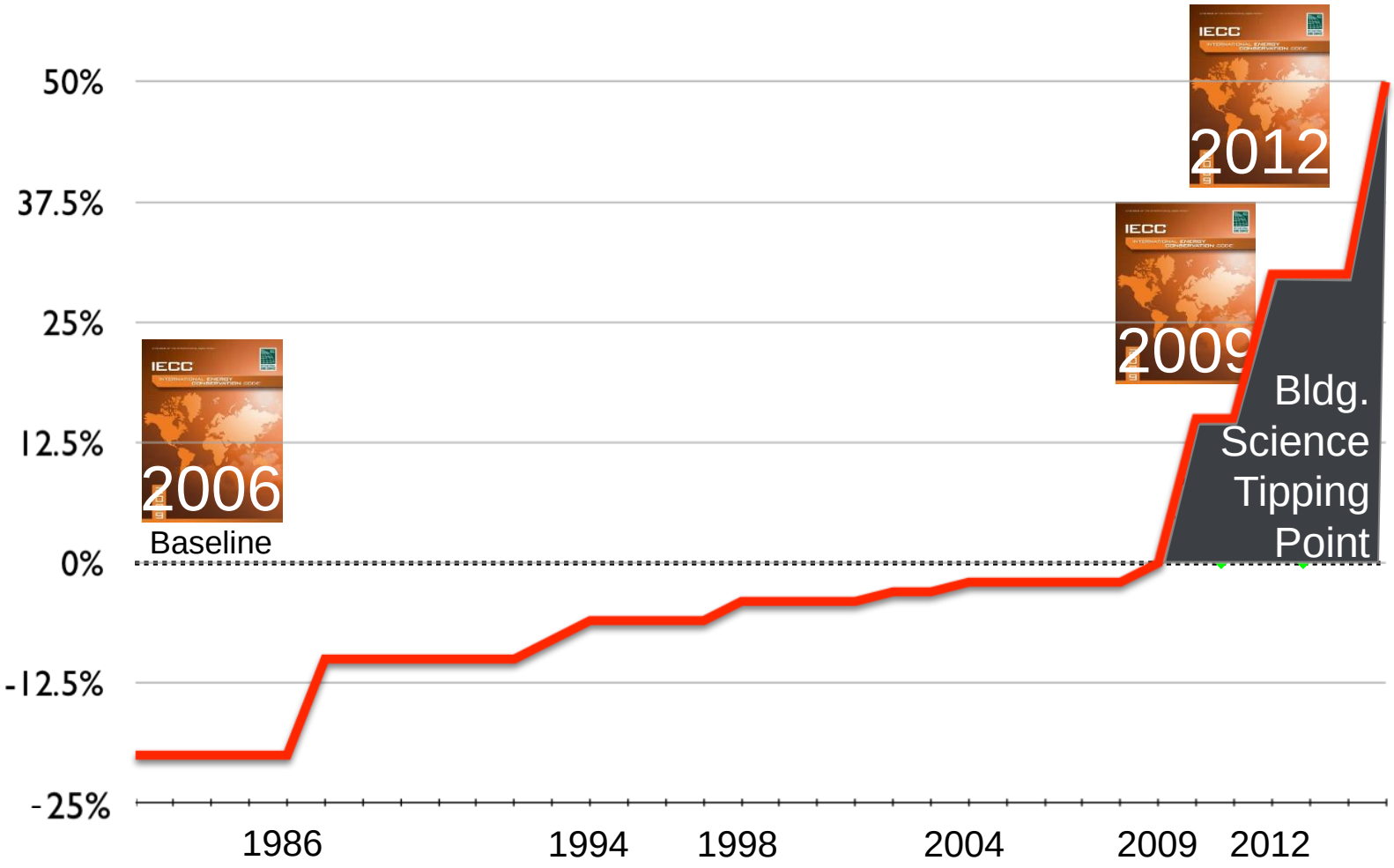
Housing Sector Percent of GNP

Source: NAHB data through Q1 2012

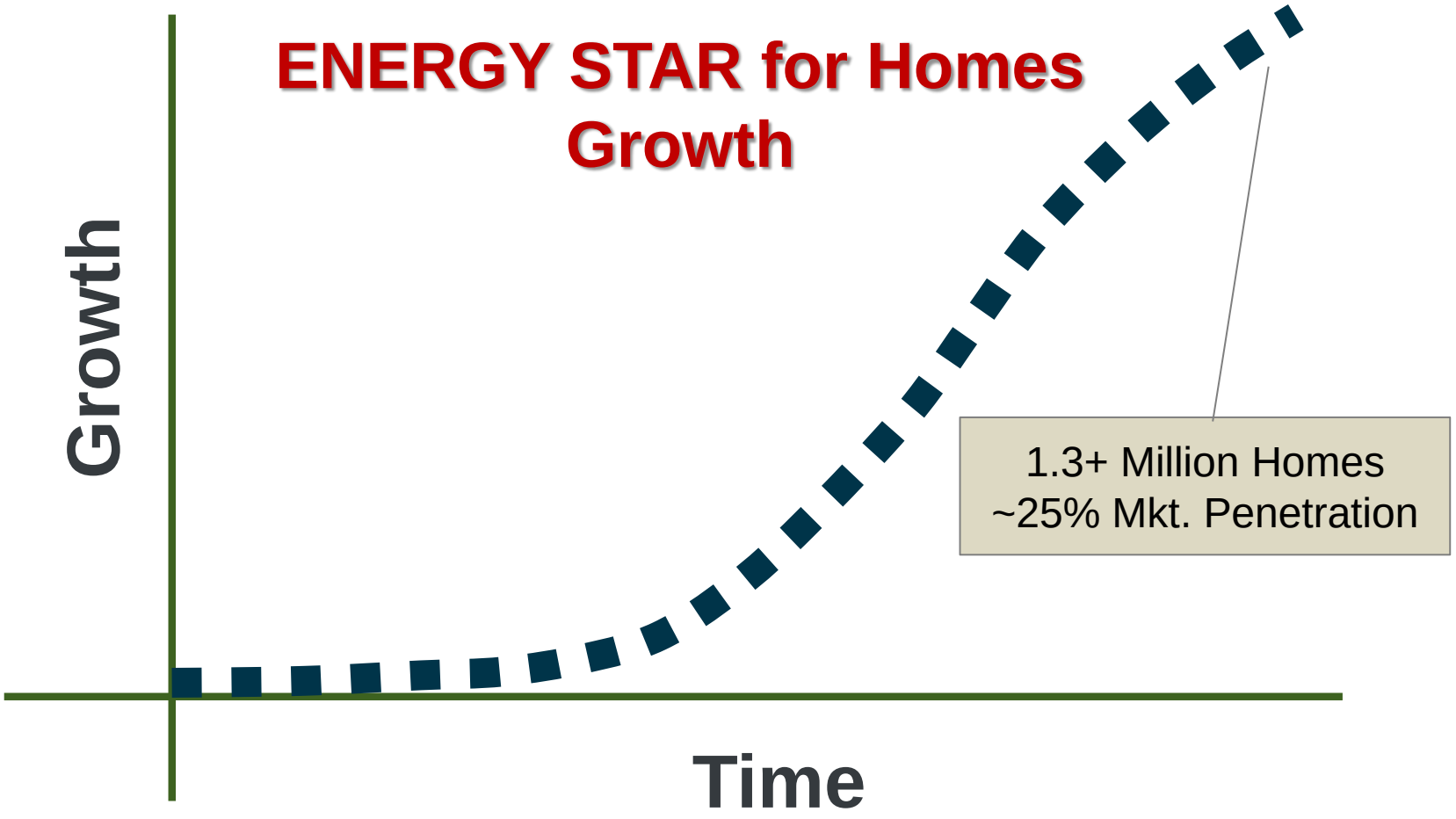
Building Science Imperative



Building Science Imperative



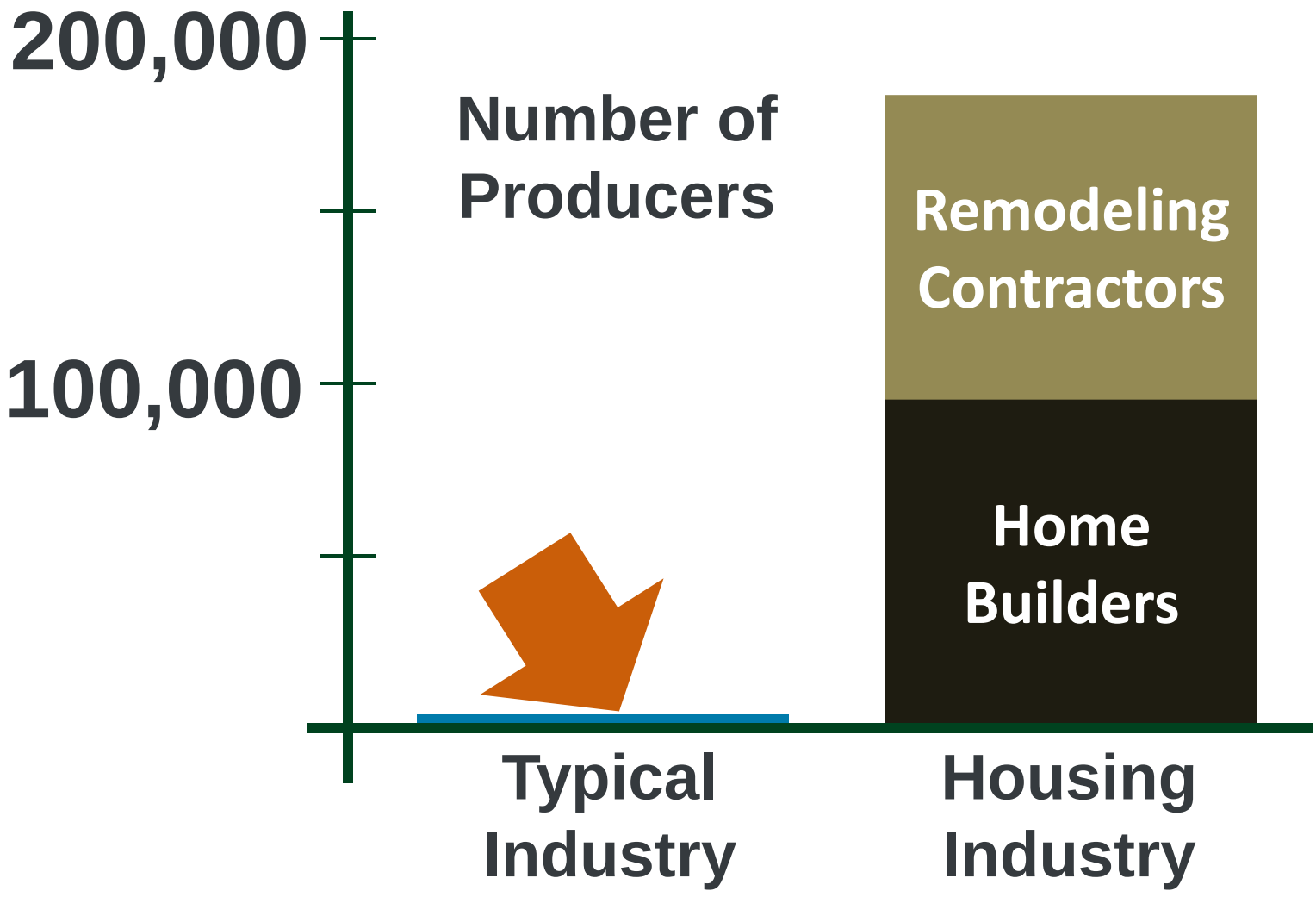
Home Performance Imperative



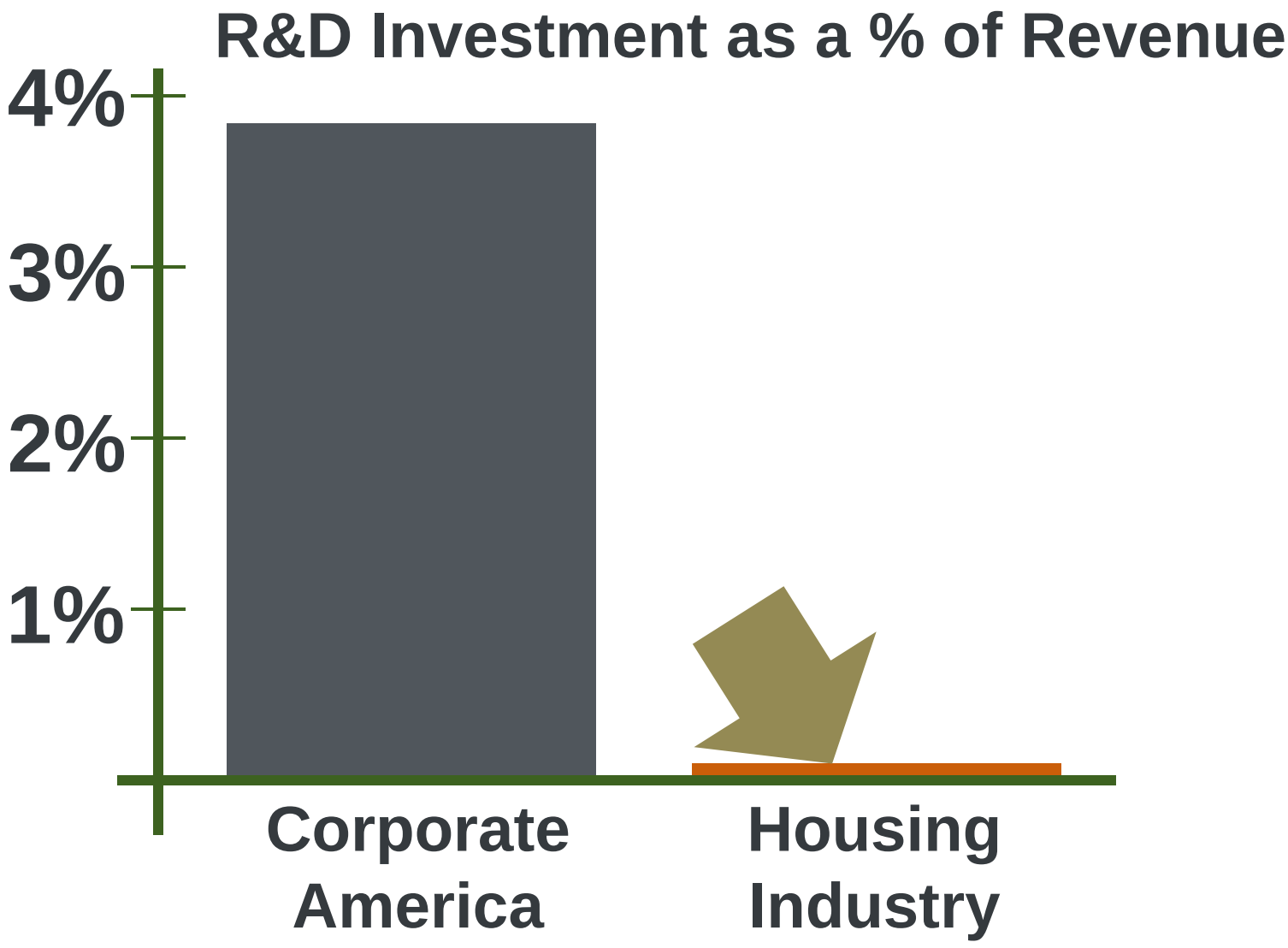
High-Performance Home Opportunity

- Jobs
- Clean Air
- Energy Independence
- Stronger Communities
- Healthier Households

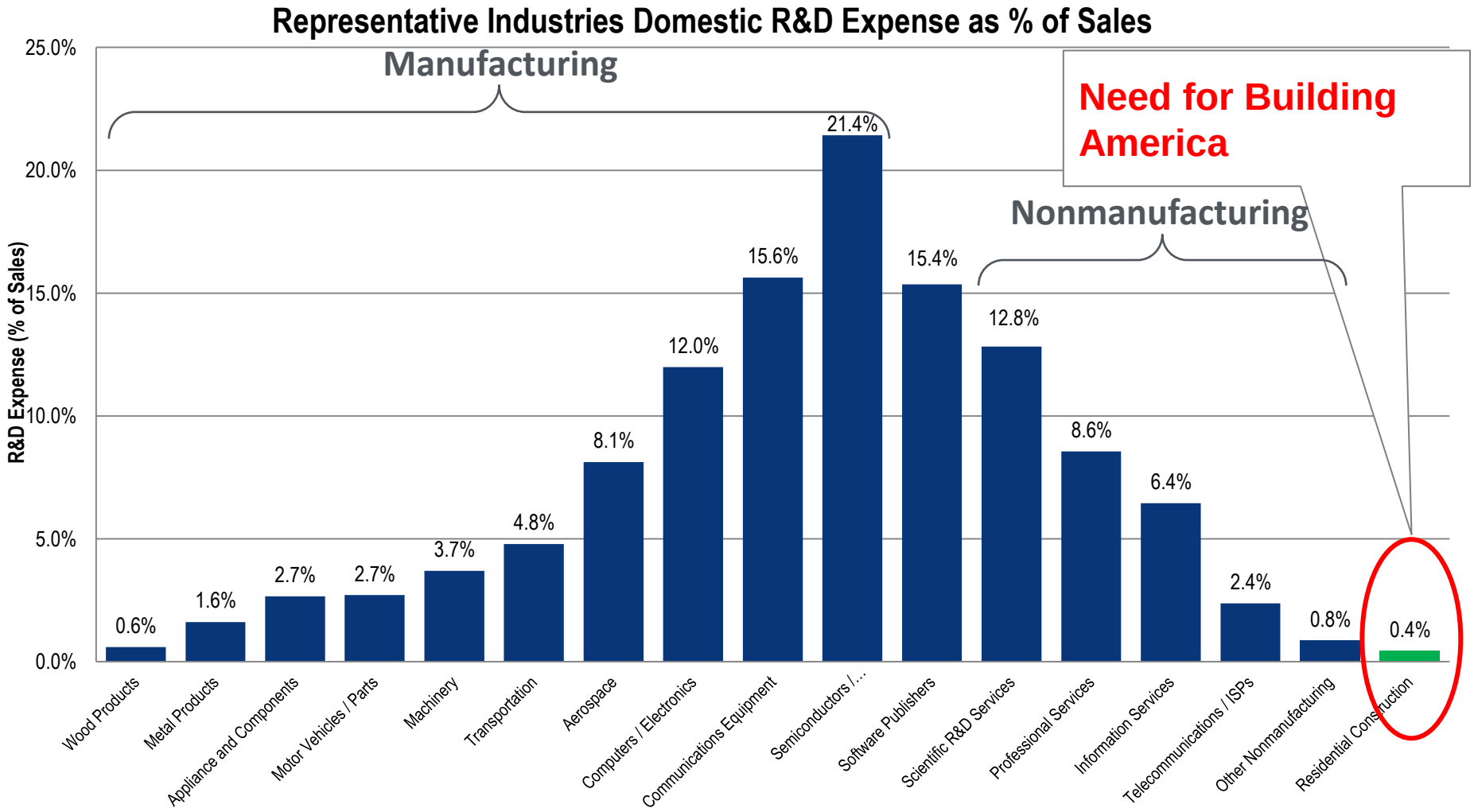
Disaggregated Housing Industry



Lack of Housing R&D



Industry Underinvests in R&D



Source: National Science Foundation/Division of Science Resources Statistics, Business R&D and Innovation Survey: 2008

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

Building America Fills Market Need for a

High-Performance Home

HUB of Innovation

Building America® U.S. Department of Energy

Business Goals

Building America Strategy

1.Efficiency

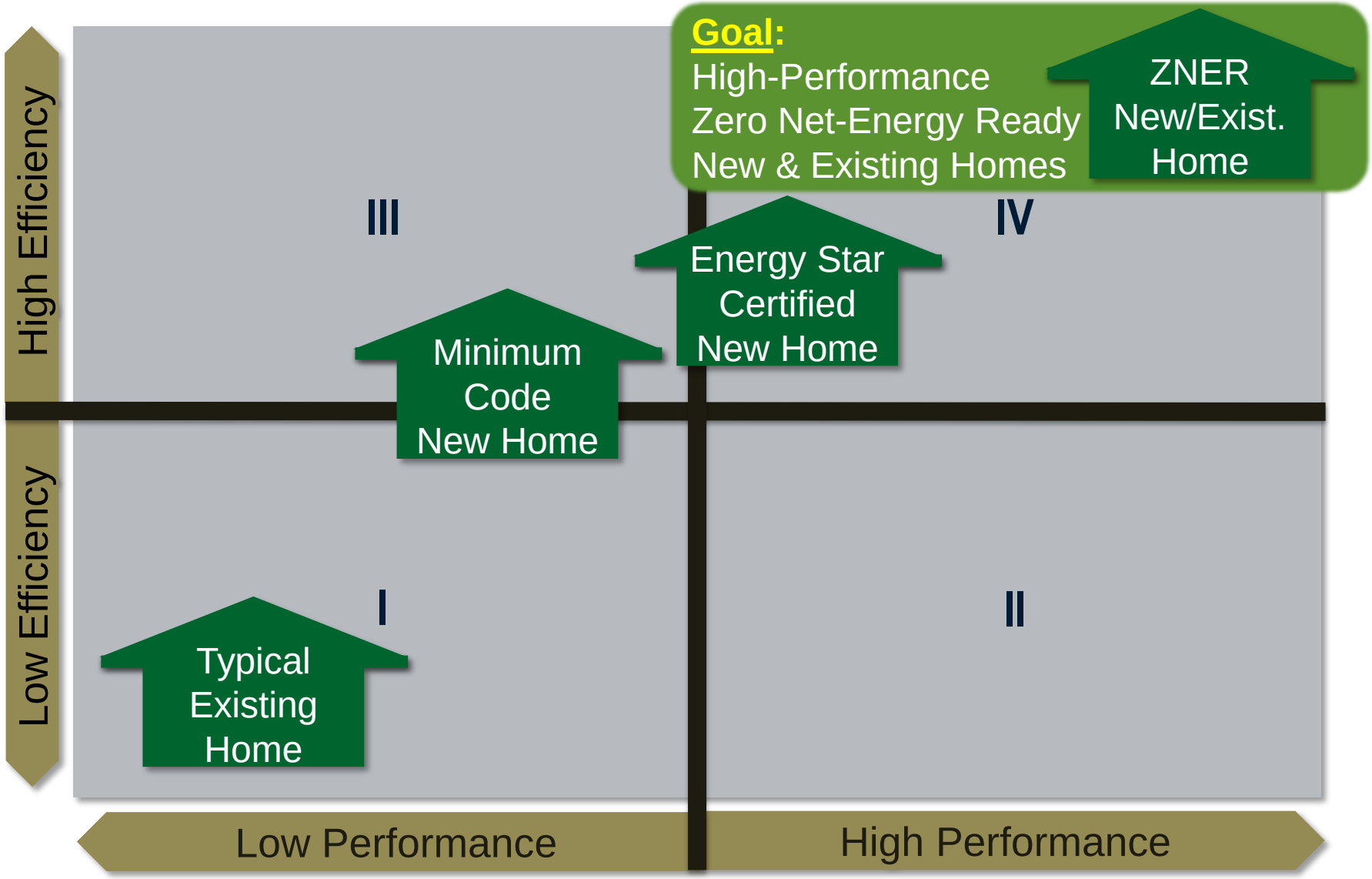
- Enclosure
- Low-Load HVAC
- Components

2.Performance

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

Building America Goal

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

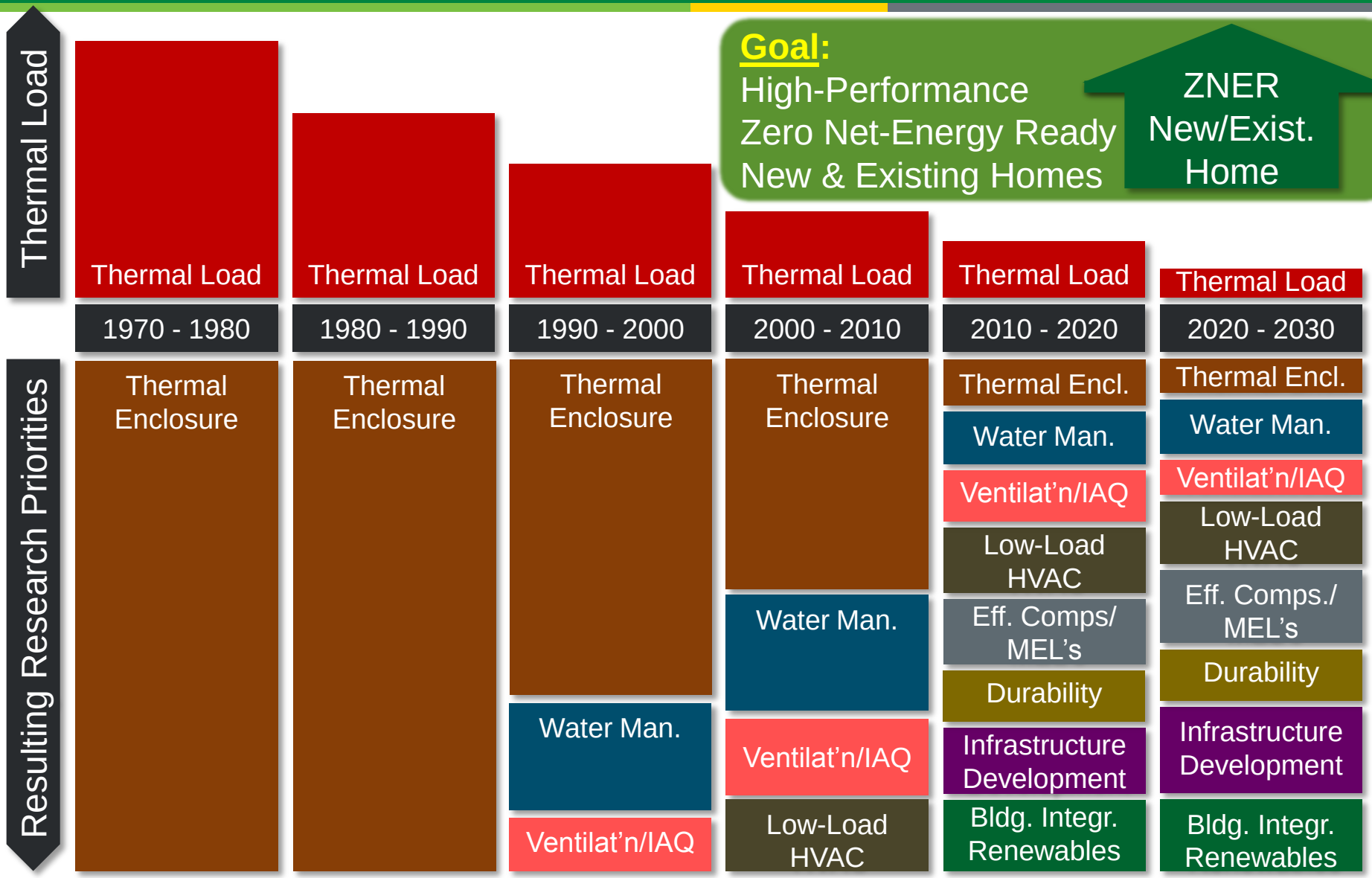


Building America Path

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

Goal:
High-Performance
Zero Net-Energy Ready
New & Existing Homes

ZNER New/Exist. Home



Building America Process

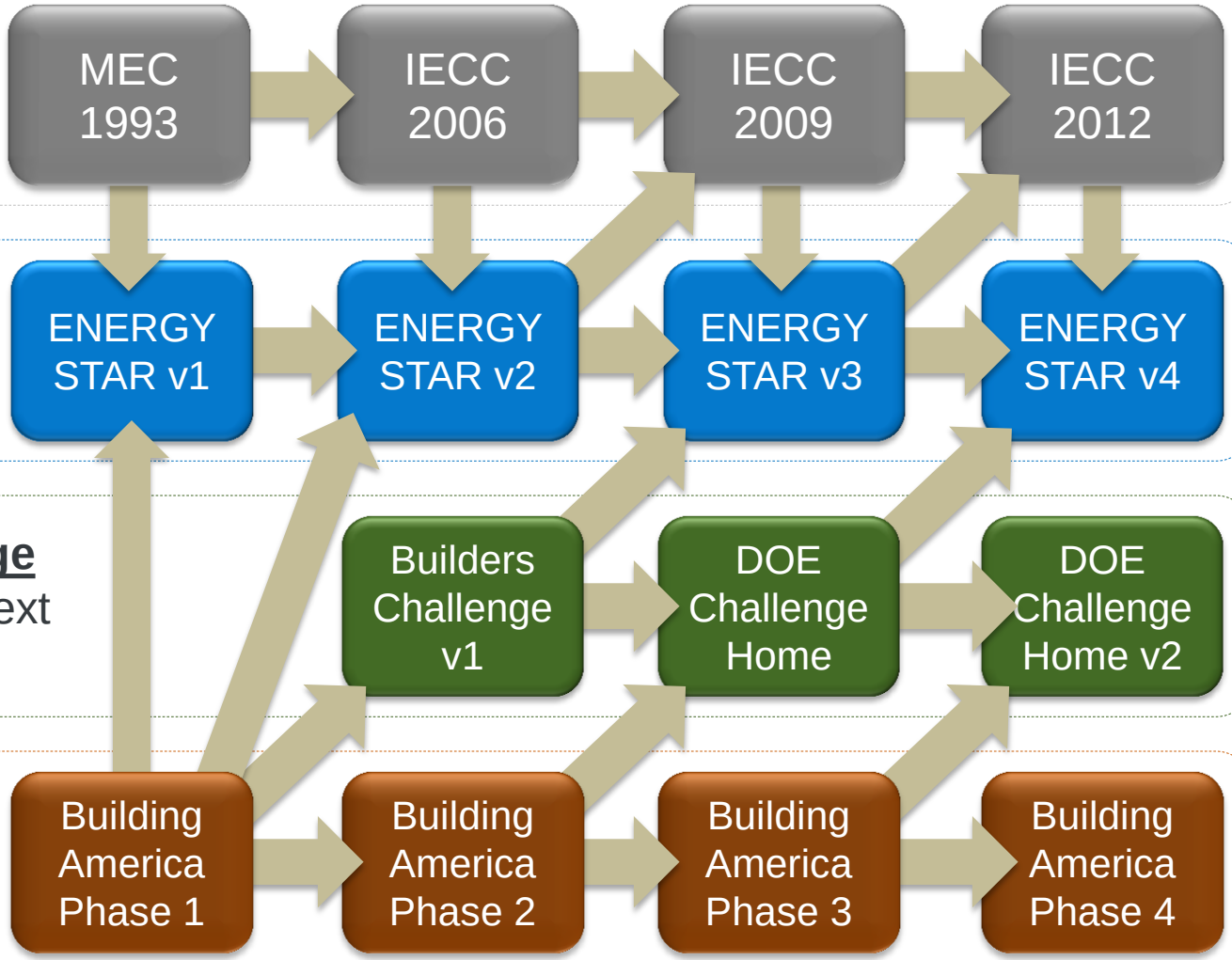
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Codes
Drive ENERGY STAR spec

ENERGY STAR
Drives code changes, market

Builders Challenge
ENERGY STAR Next Gen Farm System

Building America
Develop & demo Solutions



Progress

Top Innovations

Top Innovations Process

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

- Determine Criteria

Top Innovations Process

- Determine Criteria

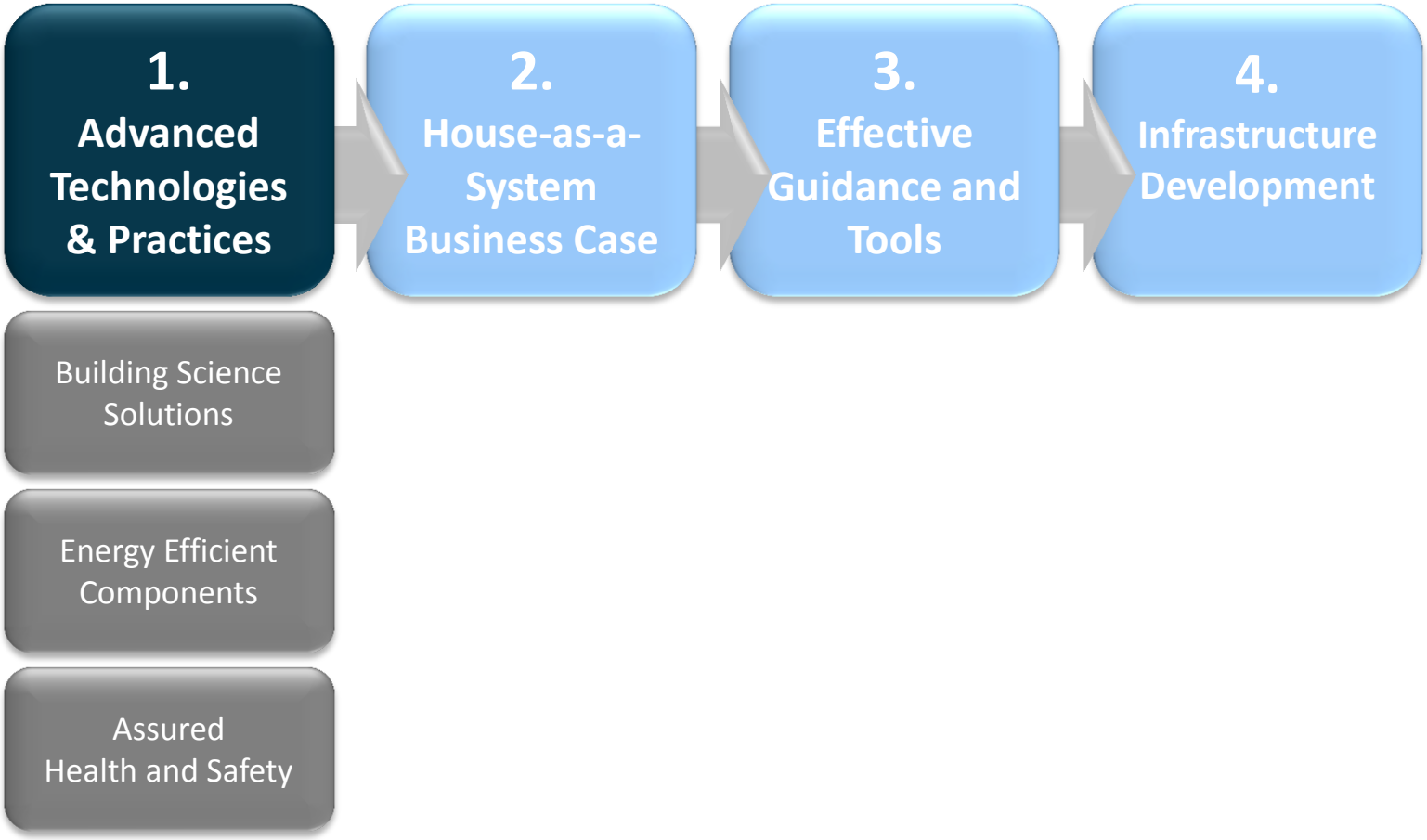
- Building America played a primary role
- Significant real or potential impact:
  - solving critical problem
  - capturing significant opportunity

Top Innovations Process

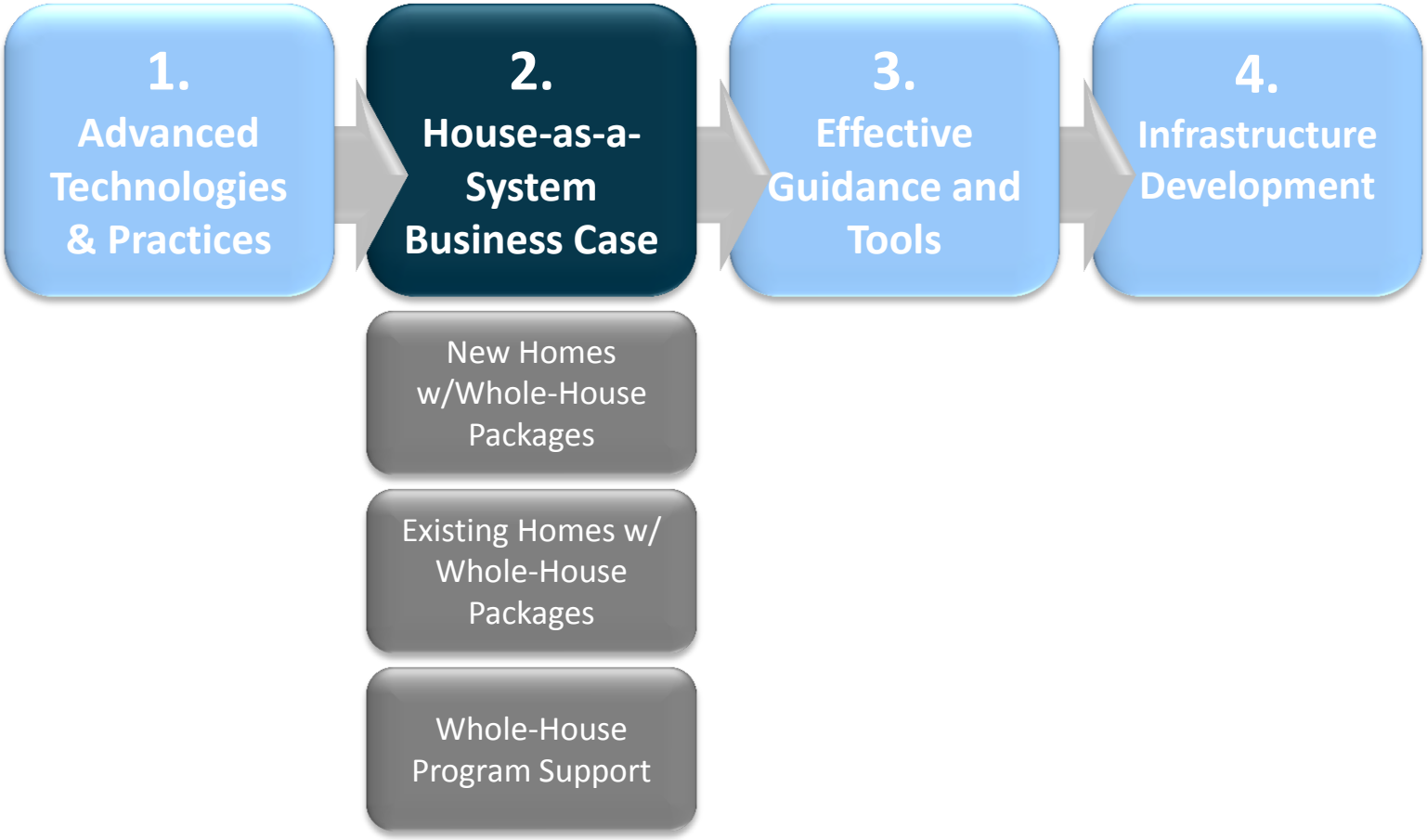
- Determine Criteria
- Solicit Nominations
- Research Past Documents
- Compile Complete List of BA Innovations
- Identify Story (Innovations Categories)

Building America Story

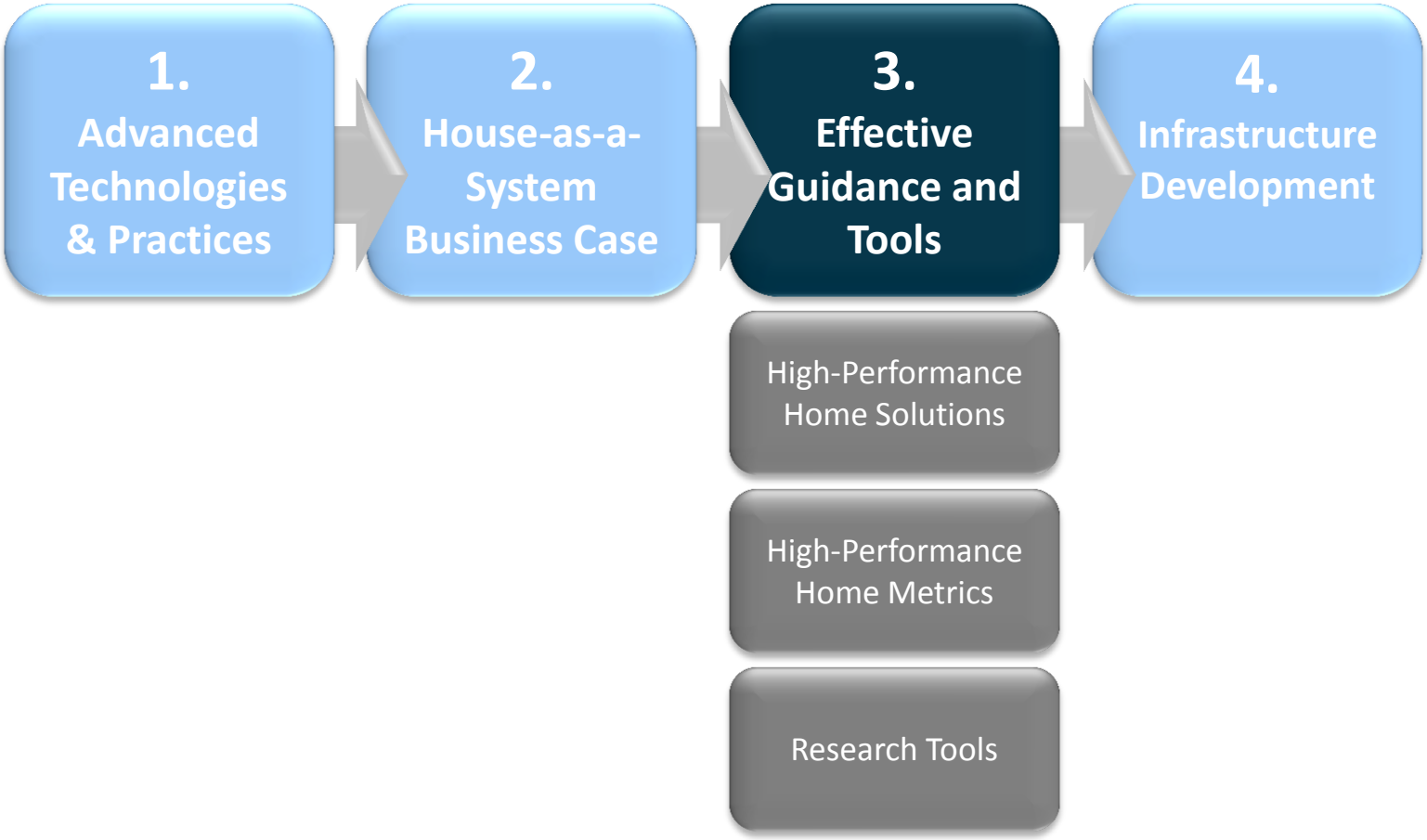
Building America Story



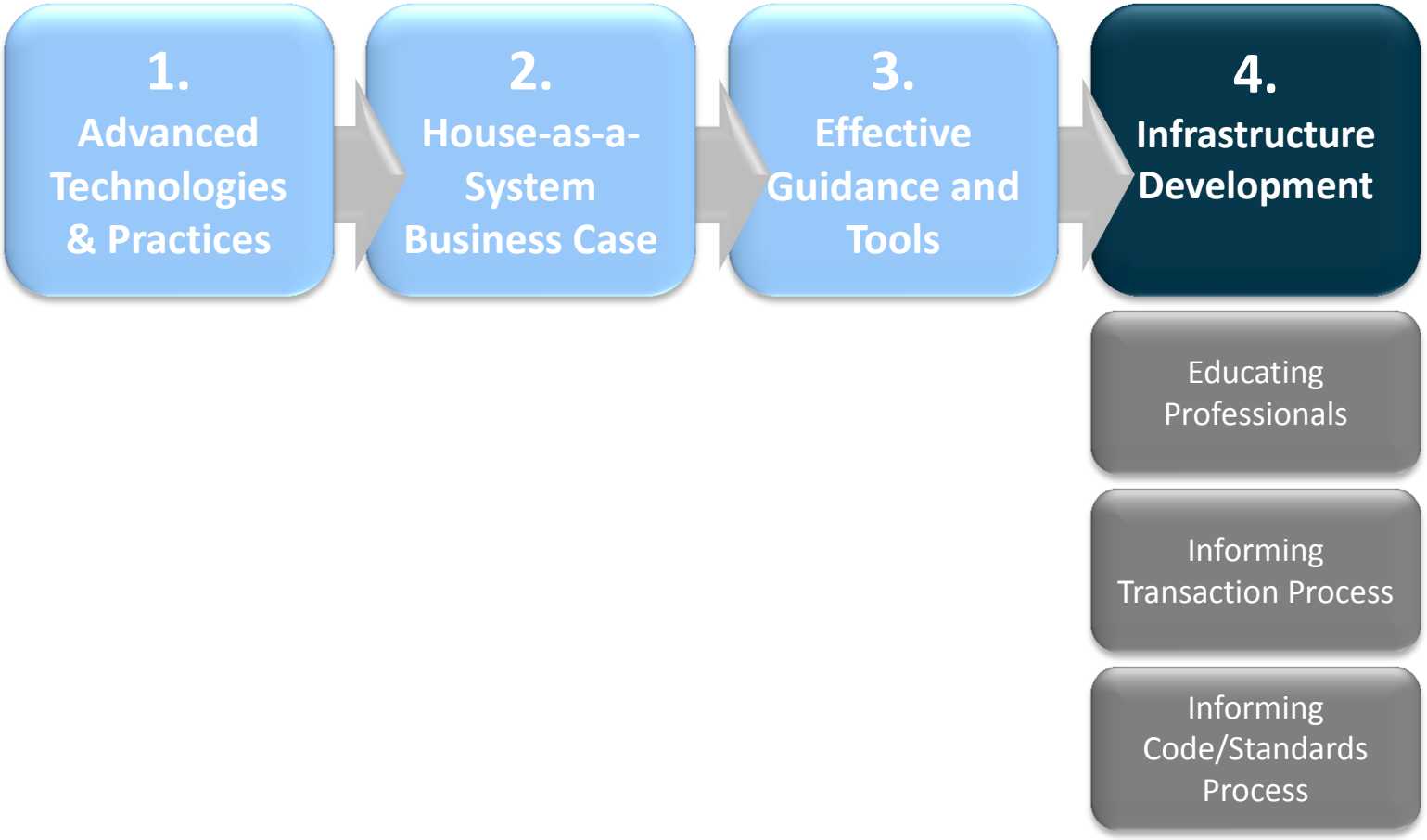
Building America Story



Building America Story



Building America Story



Building America Story

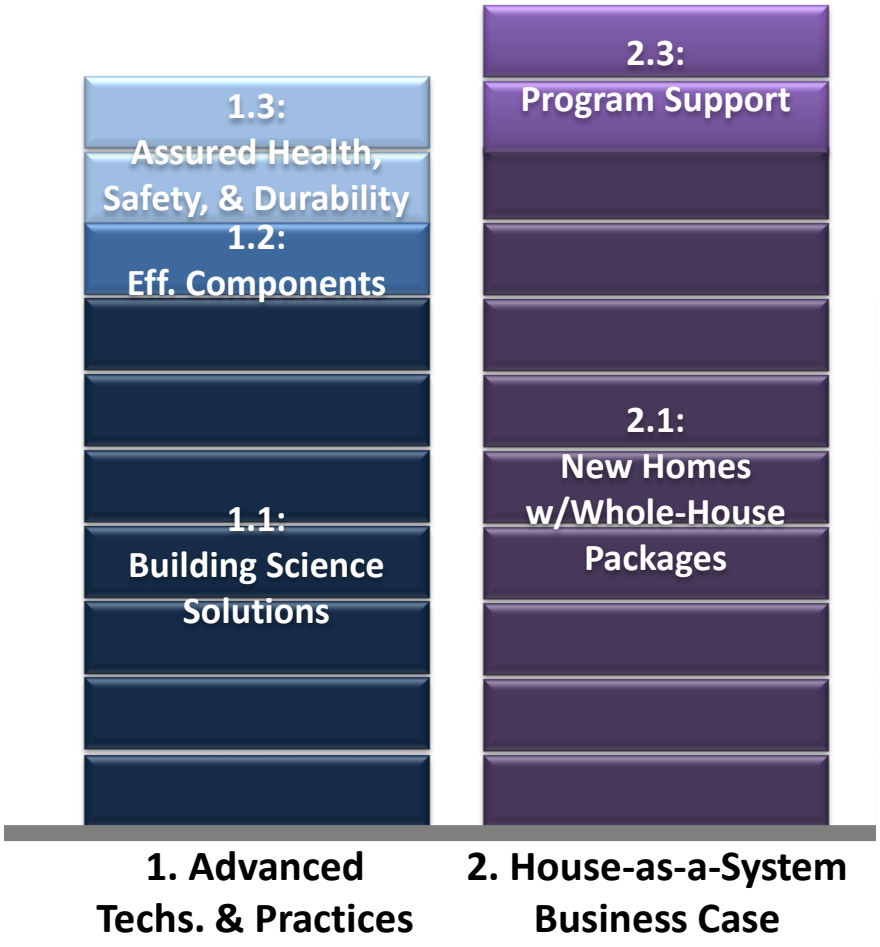
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Top Innovations Process

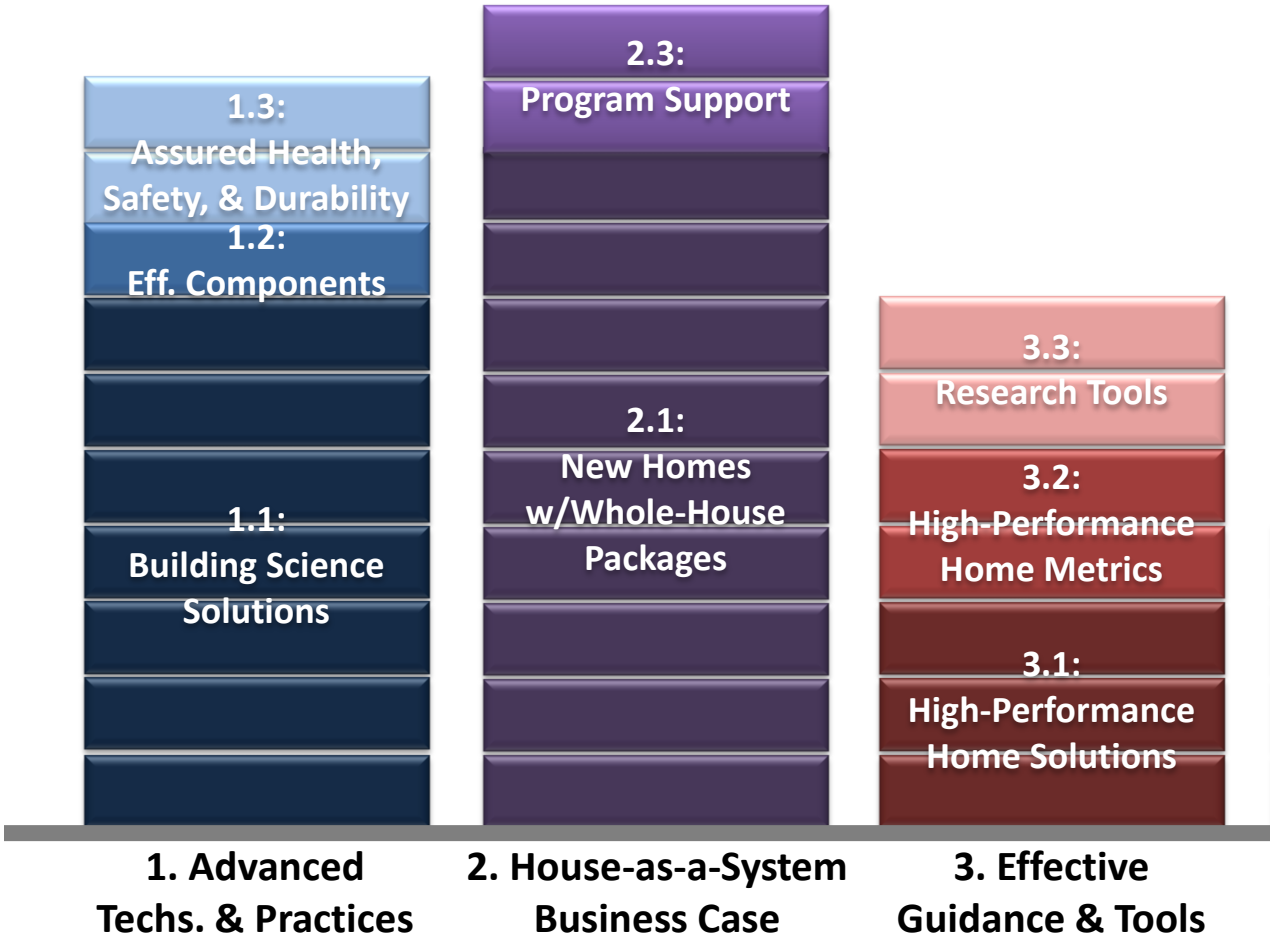
- Determine Criteria
- Solicit Nominations
- Research Past Documents
- Compile Complete List of BA Innovations
- Identify Story (Innovations Categories)
- Sort Nominations
- Select Top Innovations per Criteria

Top Innovations

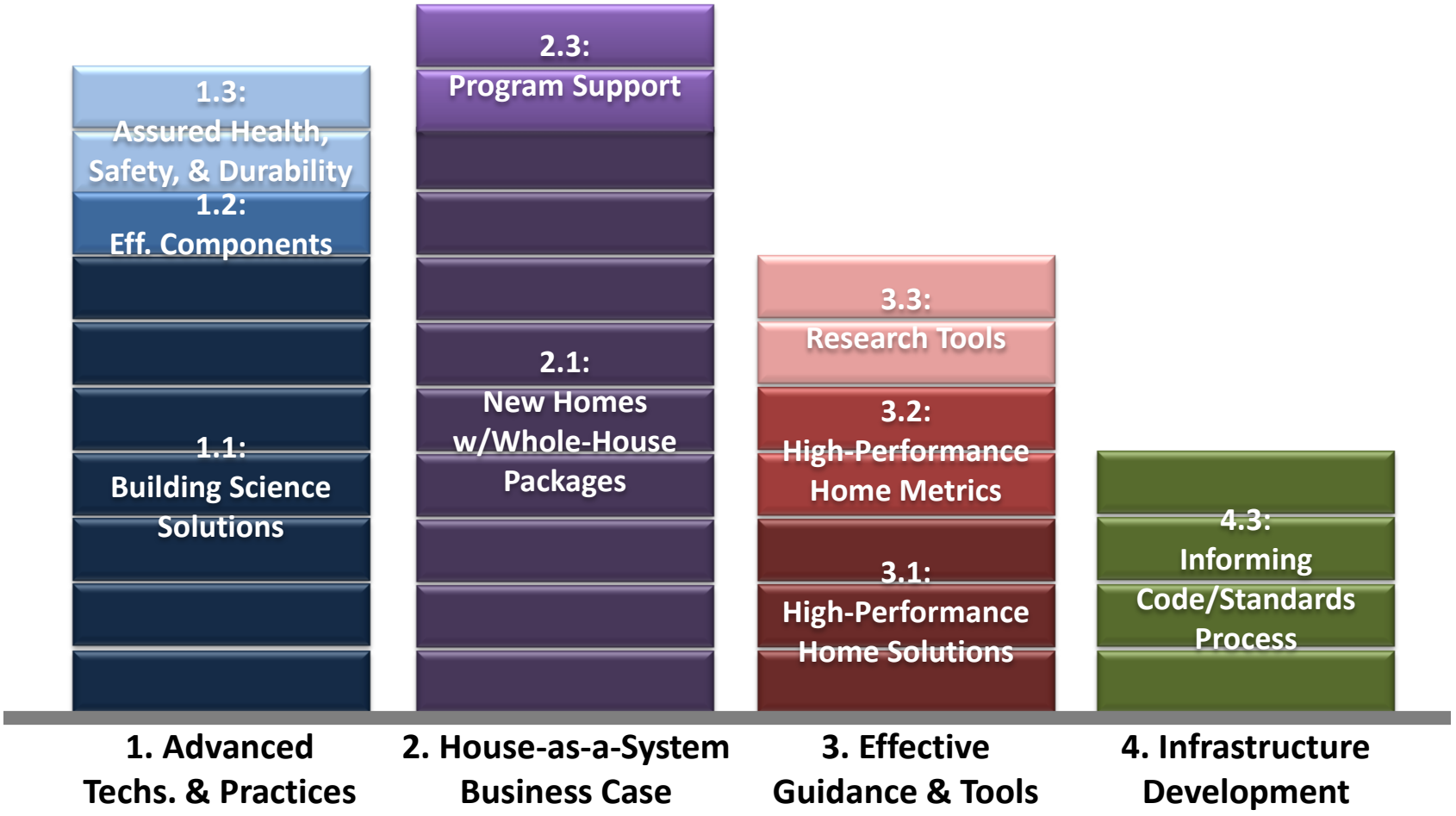
Top Innovations



Top Innovations

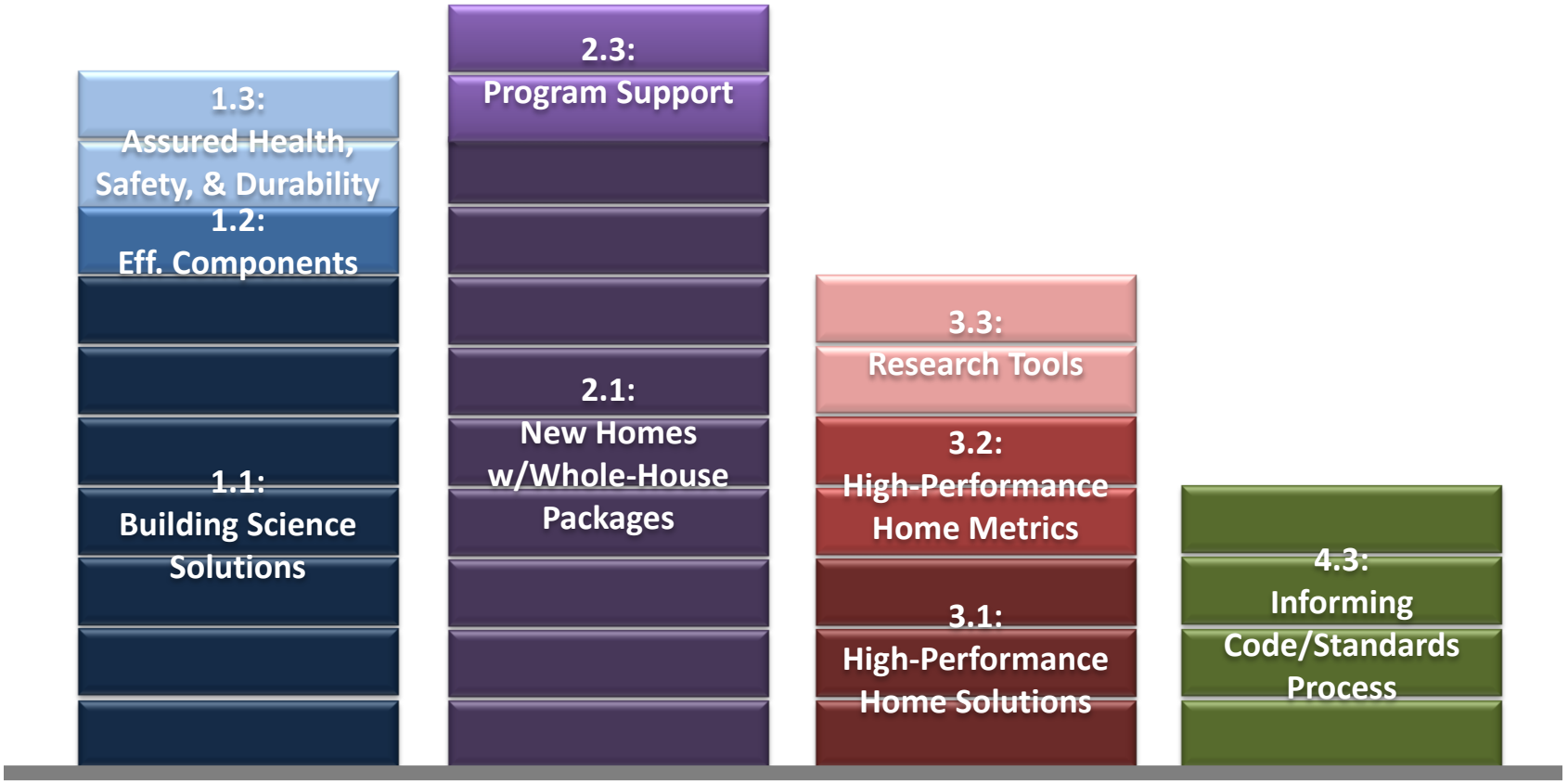


Top Innovations



Top Innovations

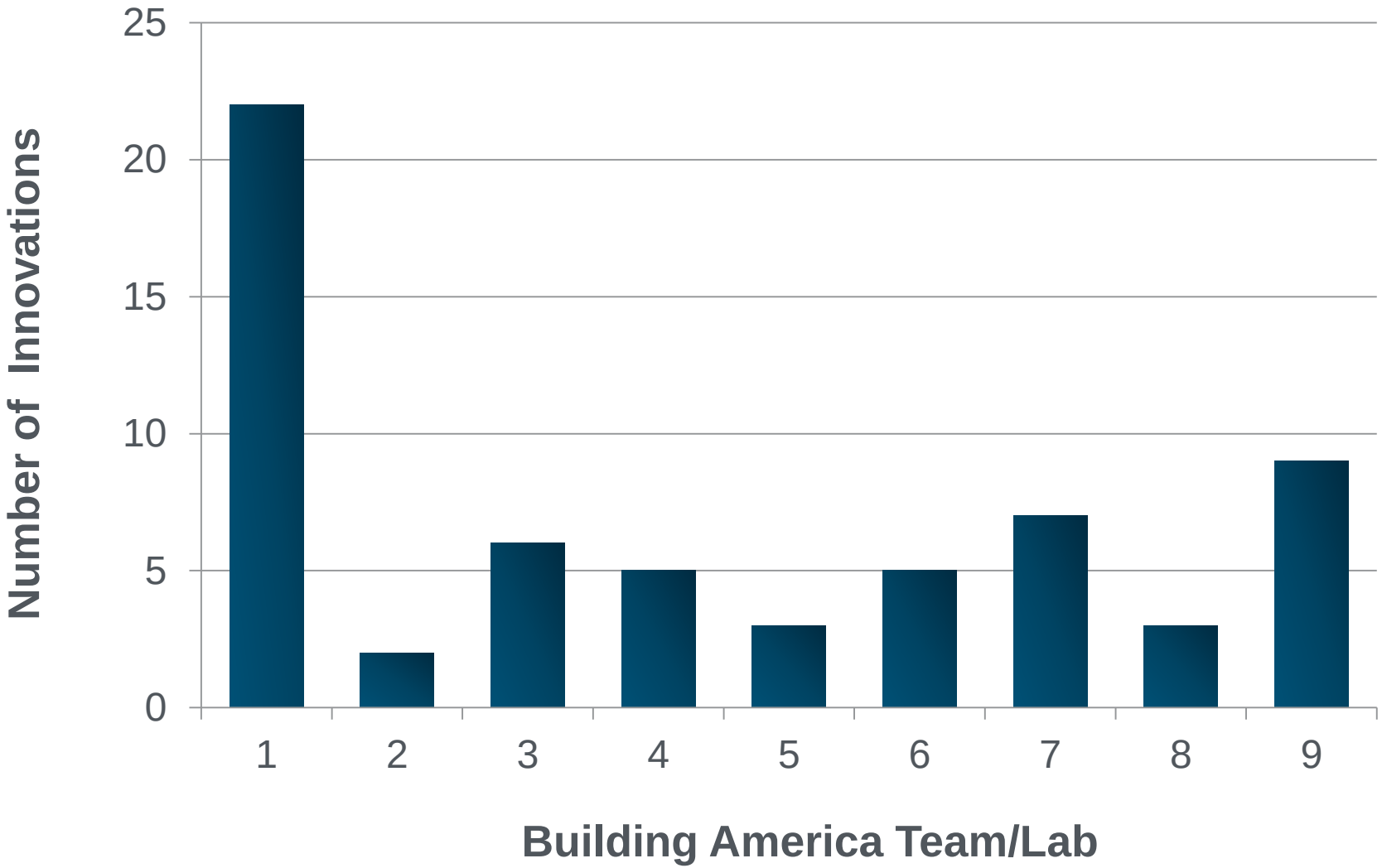
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Gaps:

- 2.2: Existing Homes w/ Whole-House Pkgs.
- 4.1: Educating Professionals
- 4.2: Recognize Value in Transaction Proc.

Top Innovations Asset Evaluation



Top Innovations Process

- Determine Criteria
- Solicit Nominations
- Research Past Documents
- Compile Complete List of BA Innovations
- Identify Story (Innovations Categories)
- Sort Nominations
- Select Top Innovations per Criteria
- Tell the Story – Top Innovation Profiles

Top Innovations Profiles

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

Research by Building America diagnosed the causes and prescribed a cure that dramatically reduced moisture problems in manufactured housing in Florida.

Duct leakage was a key factor in moisture damage in manufactured homes in humid climates.

Building America researchers visited 24 manufactured home factories between 1996 and 2003 and tested duct leakage in 190 units: 132 with mastic-sealed ducts and 58 with taped ducts. The target duct leakage goal was ≤ 6% total duct leakage—68% of the homes with mastic-sealed ducts achieved this target while only 34% of the homes with taped ducts achieved this.

BUILDING AMERICA TOP INNOVATIONS

Recognizing Top Innovations in Building Science – The U.S. Department of Energy's Building America program was started in 1995 to provide research and development to the residential new construction and remodeling industry. As a national center for world-class research, Building America funds integrated research in market-ready technology solutions through collaborative partnerships between building and remodeling industry leaders, nationally recognized building scientists, and the national laboratories. Building America Top Innovation Awards recognize those projects that have had a profound or transforming impact on the new and retrofit housing industries on the road to high-performance homes.

Research by Building America diagnosed the causes and prescribed a cure that dramatically reduced moisture problems in manufactured housing in Florida.

In the late 1990s, Building America researchers at the Florida Solar Energy Center (FSEC) worked with manufactured home builders to diagnose moisture problems in homes in Florida. Moisture issues were so severe that in some homes researchers could push their fingers through the saturated drywall. Using a whole-house diagnostic approach, researchers determined that the prim[illegible]

Between 1996 and 2003 researcher[illegible] code home manufacturers interested in improving [illegible] homes. Researchers measured total duct leakage and/or duct leakage [illegible] outside in 101 houses representing 190 floors (some homes were double wide which equals two floors). Most homes had mastic-sealed ducts but one-third of the duct systems were sealed with tape. Results of the studies showed that the duct leakage goal of ≤ 6% total duct leakage was achieved by a much higher percent of homes with mastic-sealed ducts than with tape-sealed ducts. The researchers observed that mastic provided a much more durable seal than did tape.

The researchers identified several issues with duct installation at the factories: leaky supply and return plenums, misalignment of ducts and openings, sloppy free-hand cutting of holes in duct board and sheet metal, insufficient connection area at joints, mastic applied to sawdust-covered surfaces, insufficient or missing mastic, loose tie straps on flex duct connections, incomplete tabbing of fittings, and improperly applied tape.

"Based on research with Building America, Palm Harbor Homes implemented duct system testing and increased return air pathways from bedrooms to 50 inches² per 100 cfm of supply air company wide. Since this implementation started, Palm Harbor has manufactured 35,000 homes and has had no incidents of moisture-related issues in homes installed in hot-humid climates. Additionally, air flow issues have been all but eliminated."

Bert Kessler, Vice President of Engineering, Palm Harbor Homes

BUILDING AMERICA TOP INNOVATIONS 'HALL OF FAME' PROFILE

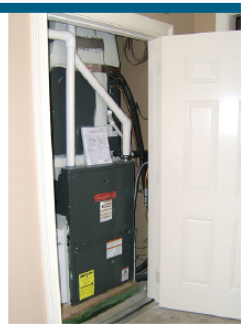
The researchers made several recommendations regarding the ducts: set a duct tightness target of ≤ 6% total duct leakage or ≤ 3% duct leakage to the outside, seal all joints with mastic, accurately cut holes and fully bend all tabs at collar and boot connections, tighten strap ties with a strap-tightening tool, and provide return air pathways from bedrooms to main living areas. Researchers also provided the manufacturers with recommendations regarding HVAC system efficiency, improved windows, adding insulation, and air sealing especially at the marriage line of double-wide units.

When the recommendations were implemented in two homes in a demonstration of four homes, the two homes that were mastic sealed had less than half the air leakage of those sealed with tape.

Duct Tightness Results in Demonstration

Home	CFM25 Total
Control Home	118
Control Home	126
Energy Home	51
Healthy Home	79

In addition to providing these research findings and recommendations, Building America followed through with the manufacturers,



FSEC shared the lessons learned in

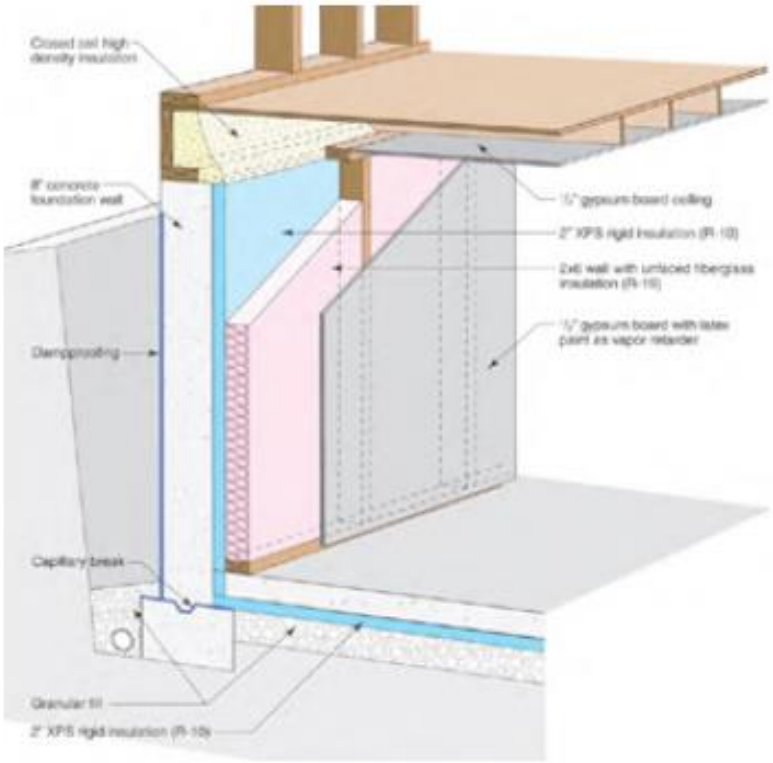
Building America researchers visited 24 manufactured home factories between 1996 and 2003 and tested duct leakage in 190 units: 132 with mastic-sealed ducts and 58 with taped ducts. The target duct leakage goal was ≤ 6% total duct leakage—68% of the homes with mastic-sealed ducts achieved this target while only 34% of the homes with taped ducts achieved this.

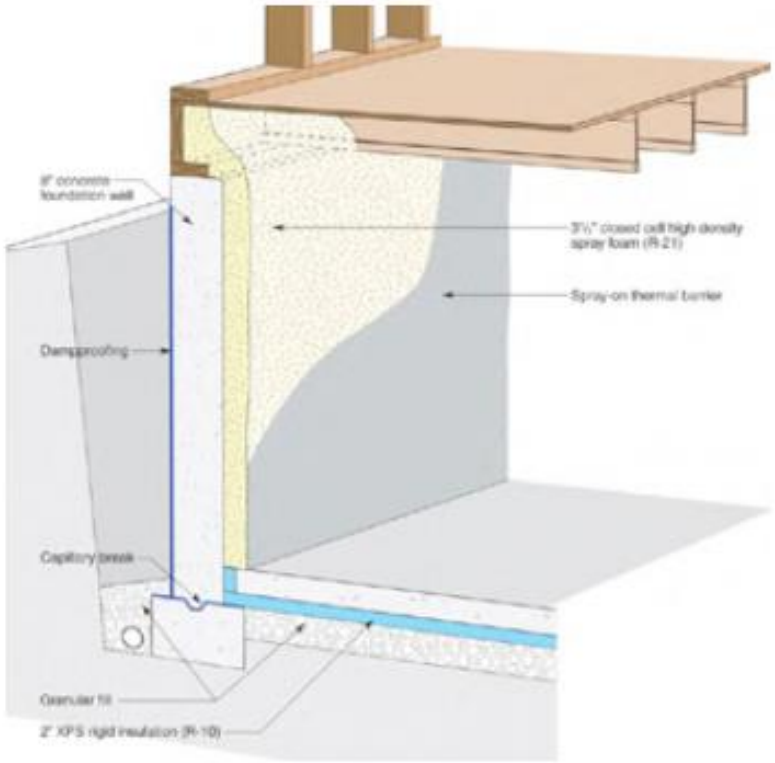
Basement Insulation Systems

Building America research has provided essential guidance for one of the most challenging assemblies in cold-climate high-performance homes.

- Basements 10% to 30% of total heat loss.
- Significant moisture problem risks due to extensive cold surfaces at walls and slab.

Basement Insulation Systems





Unvented Conditioned Attics

Research has demonstrated unvented, conditioned attics can substantially improve energy performance while allowing builders to continue locating HVAC systems in attic space.

- Unconditioned attic duct heat loss/gain increases heating/cooling energy use 10%.
- Further losses attributed to duct leakage commonly exceeding 20% of air flow.
- Code acceptance since 2006
- 10,000's of homes

Unvented Conditioned Attics

Unvented Conditioned Crawlspaces

In most climates, this innovation saves energy while improving comfort, health, and durability. This research has encouraged adoption by builders and codes.

- 15 – 18% less heating/cooling energy use
- 20+% less humidity
- 2009 and 2012 IRC changes allowing conditioned crawlspaces influenced.
- 1,000's of homes

Unvented Conditioned Crawlspaces

High-R Walls

Research has provided proven high-R wall options that cost-effectively control both thermal and moisture flow. This innovation is critical to high-performance homes.

- Measured R-value is almost always lower than the rated whole-wall R-value.
- Potential for condensation occurs 15 – 95% of the time with several high-R wall types.
- Thus, high-R wall research is critical to efficiency and durability goals.

High-R Walls

Evaluation of Three Common High-R-Value Wall Assemblies

(Aldrich et al. 2010)

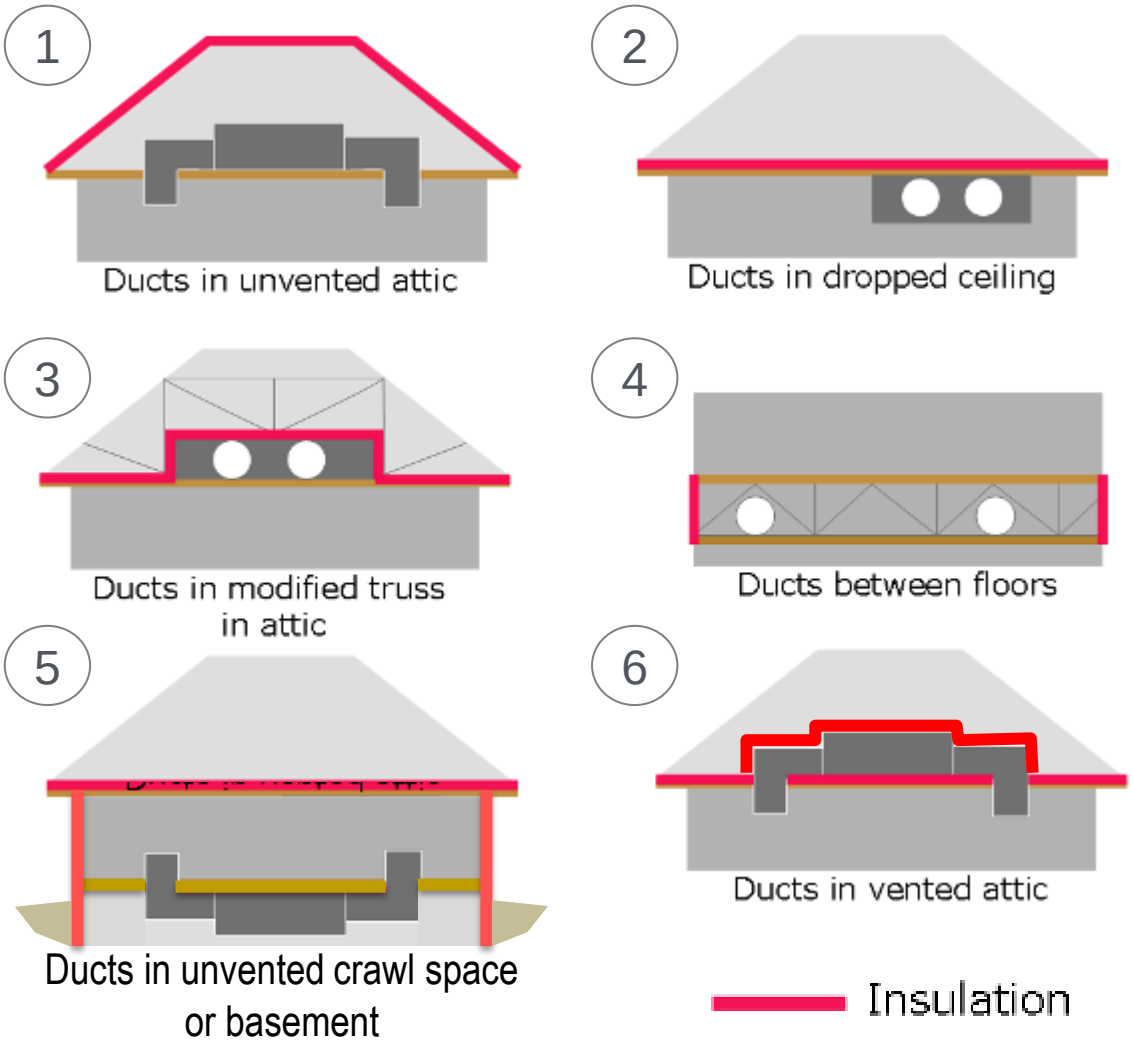
Wall Type	Cost*	Advantages	Challenges
Double framed walls with blown or sprayed insulation	$1,500 - $2,500	Similar methods to traditional stick construction	Complex designs can double time and cost
2x4 or 2x6 insulated, framed walls with exterior rigid foam insulation	$3,000 - $3,500	Reduced condensation potential, good drying potential	Increased cost for XPS, furring, for finishing doors and windows
Structural insulated panels 8-1/4" SIP 10-1/4" SIP	 $1,500 $2,250	Speed of assembly, inherent air-tightness	Requires special training
Incremental cost when comparing 800 ft² of this wall to 800 ft² of a baseline 2x6 wall			

HVAC Ducts in Conditioned Space

Building America has 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

Ducts in Conditioned Space - New



Buried & Encapsulated Ducts

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

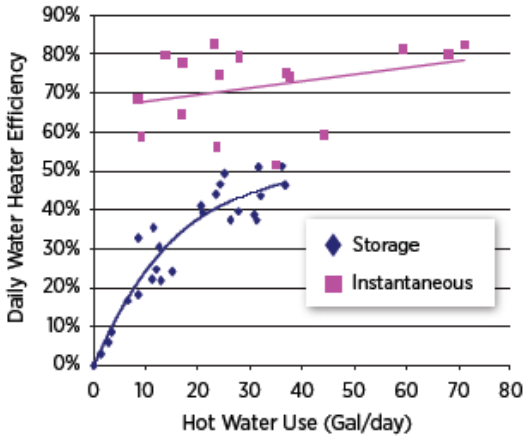
Tankless Gas Water Heater Perf.

Water heating continue to grow in importance as improved thermal enclosures dramatically reduce heating and cooling loads. Building America has provided important insight regarding one of the most significant options.

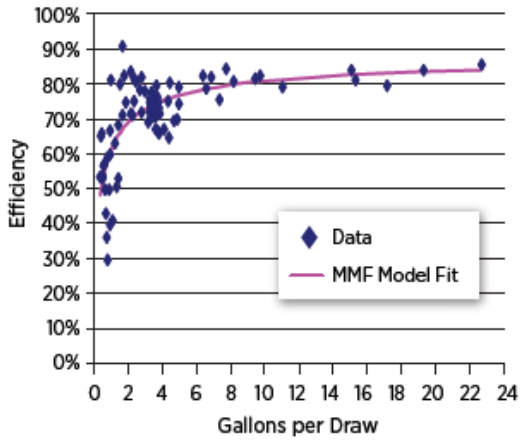
- Potential for 33% savings
- Actual savings vary significantly based on individual draw and volume.
- Effic. approaches rated EF > 10 gallons/draw.
- Greatest savings occur at 50 gal./day use.

Tankless Gas Water Heater Perf.

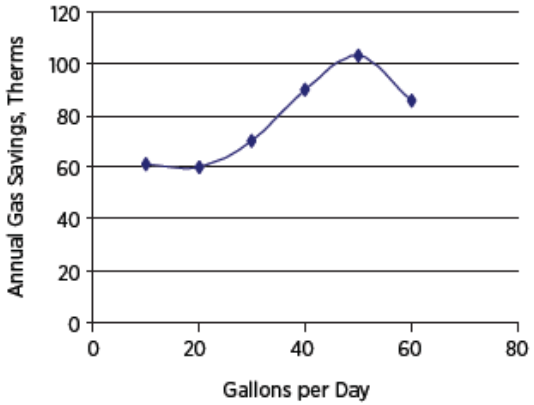
Measured Performance of Storage and Tankless Gas Water Heaters as a Function of Daily Hot Water Use



Performance of a Tankless Gas Water Heater as a Function of Draw Volume



Approximate Annual Energy Savings as a Function of Daily Hot Water Use



REFERENCES

CARB. 2009. *Tankless Water Heater*, Prepared by Steven Winter Associates, Inc. for the U.S. Department of Energy Building America. http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/tankless_water_heaters.pdf

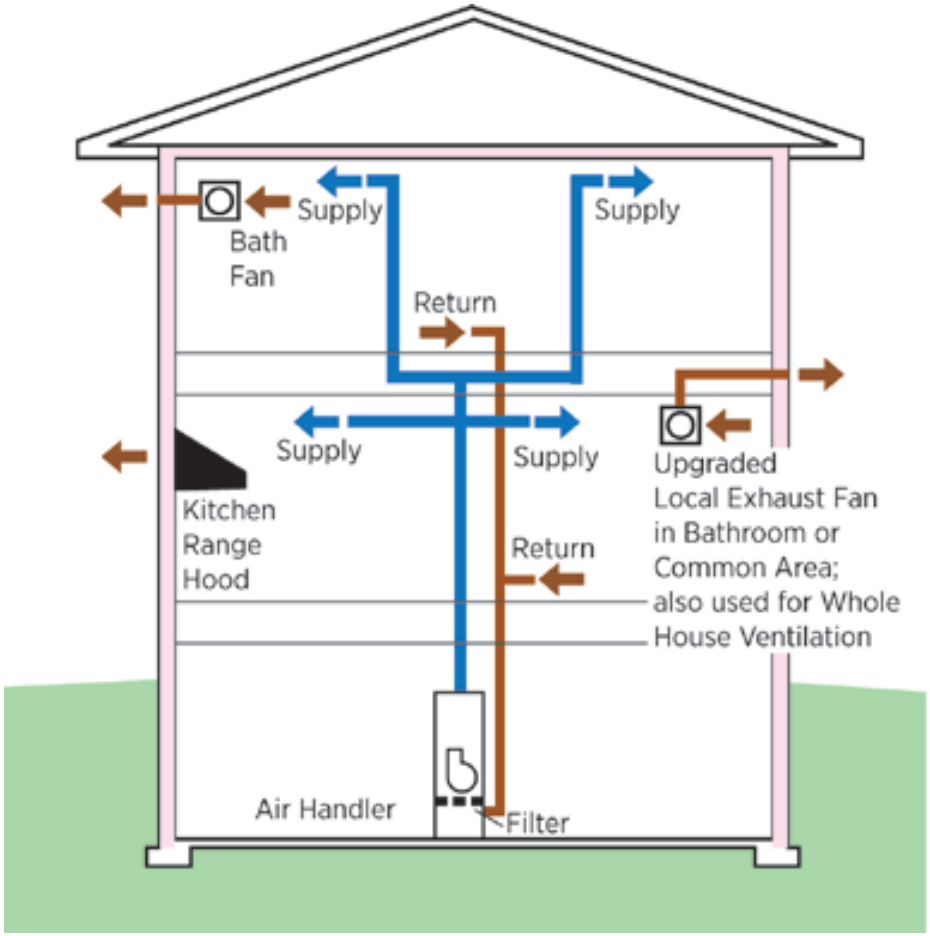
NREL. 2006. *Building America System Research Results: Innovations for High performance Homes*, NREL/TP-550-39024, Prepared by the National Renewable Energy Laboratory for the U.S. Department of Energy Building America.

Simplified, Low Cost Ventilation

High-performance homes require attention to good indoor air quality. Building America has effectively influenced our nation's home builders to embrace whole-house ventilation with low-cost options that adapt well to their production processes.

- Simple whole-house ventilation systems cost less than $350 to install
- 1,000's of homes using these systems

Simple, Low-Cost Ventilation



Cost Performance Trade-Offs

Added Costs & Cost Reductions of Energy-Efficiency Measures – Hot-Dry Climate Example	
Unvented Roof	+ $750
NOT Installing Roof Vents	- $500
High-Perfomance Windows	+ $300
Controlled Venticaltion System	+ $150
Downsize Air Conditioner 2 Tons	- $1,000
Sealed Combustion Furnace	+ $400
TOTAL PREMIUM	**+ $100**

Added Costs & Cost Reductions of Energy-Efficiency Measures – Severe Cold Climate Example	
Advanced Framing	- $250
High-Perfomance Windows	+ $250
Controlled Venticaltion System	+ $150
Power Vented Gas Water Heater	+ $300
Simplified Duct Distribution	- $250
Downsize Air Conditioner 1 Ton	- $350
TOTAL ADDED COST	**- $150**

Affordable High-Perf. with HFH

High-Performance w/o Added Cost

Urbane's first home, built for $36 per ft^2 in 2008, incorporated both energy efficiency and strategies to reduce building costs. Homebuyers began seeking out the builder for energy-efficient, high-quality homes.

Urbane Homes, Louisville, KY

Hot-Humid Moisture Control

Green Coast Communities, New Orleans, LA

Community Scale w/SDHW

Pulte Homes worked with Building America's IBACOS team to develop a suite of energy efficiency measures, including solar water heating, that cut energy use more than 50% on more than 1,000 homes in Tucson, Arizona.

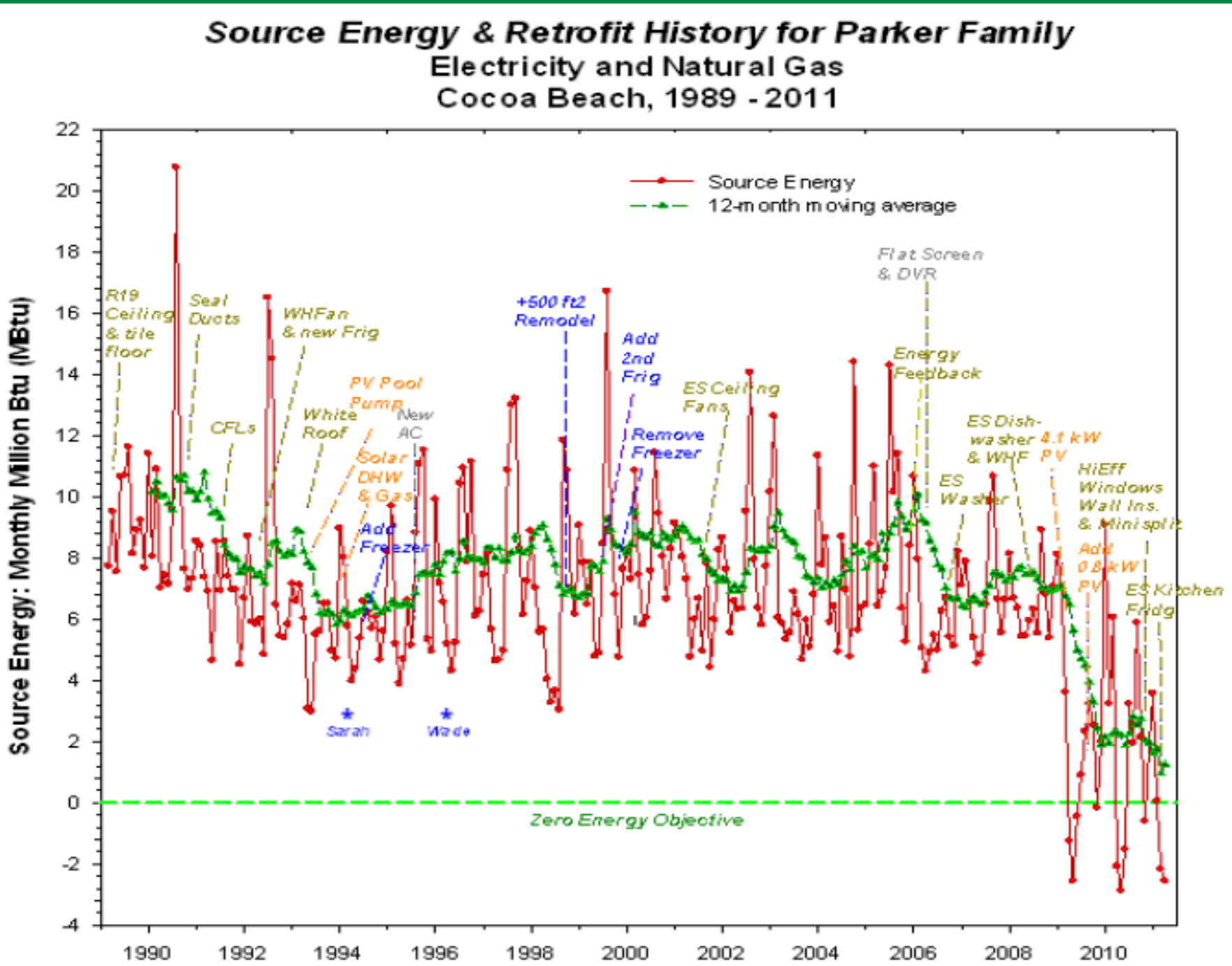
Pulte Homes at Civano in Tucson, AZ

Zero Net-Energy Retrofit

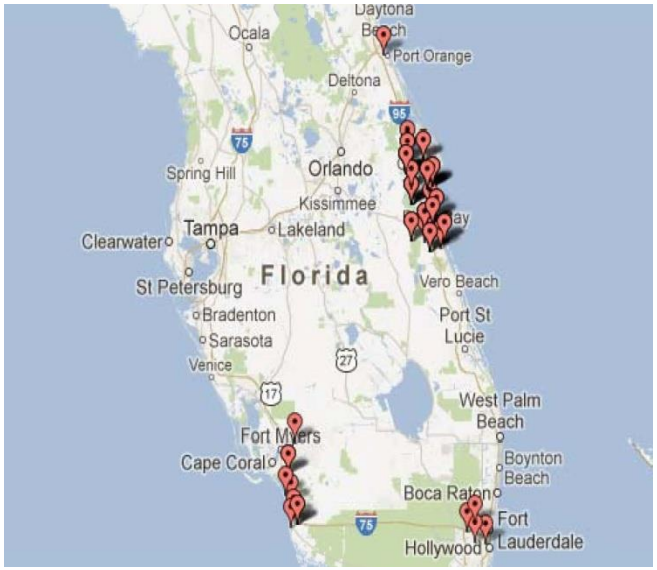
FSEC: Parker Residence

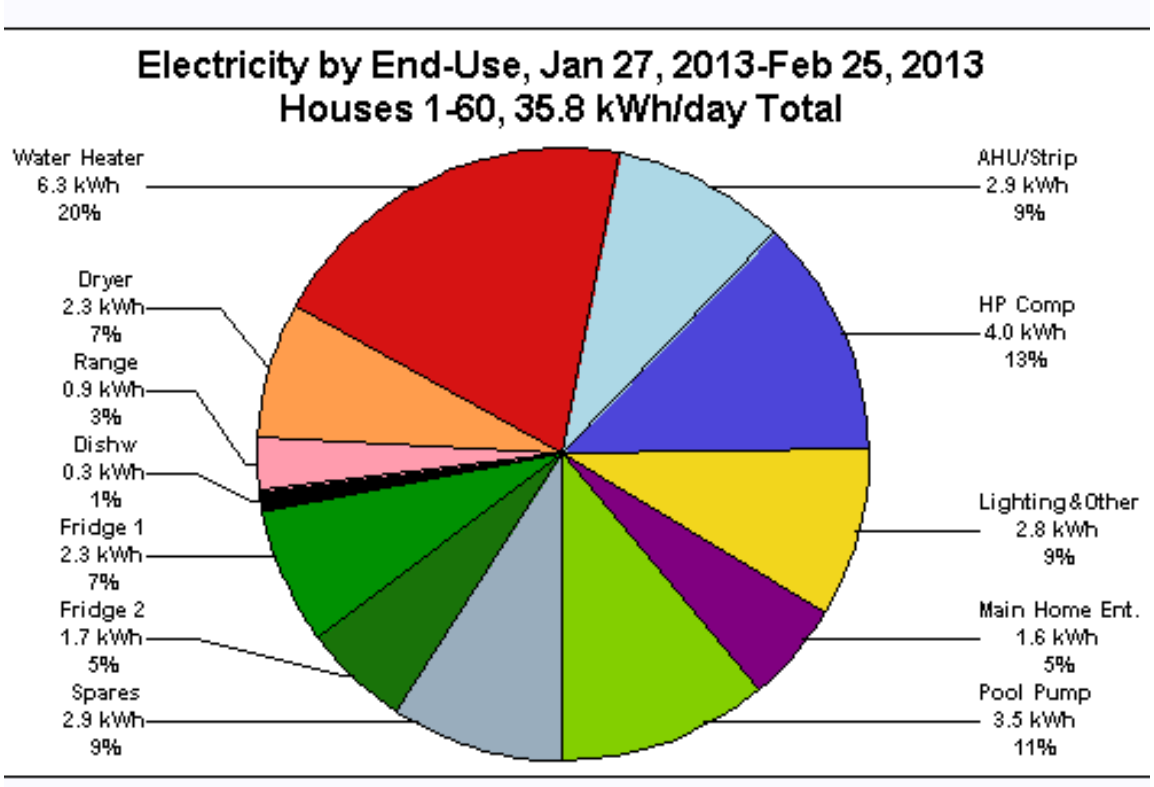
Increasing evidence that Phased Deep Retrofit (PDR) approaches can lead to cost-effective DER, even ZNE. This case study and research report describes details of a cost-effective PDR that achieved Net positive in 2012.

Parker Residence, Cocoa Beach, FL


Source Energy & Retrofit History for Parker Family
Electricity and Natural Gas
Cocoa Beach, 1989 - 2011
Source Energy: Monthly Million Btu (MBtu)
Source Energy
12-month moving average
R19 Ceiling & tile floor
Seal Ducts
CFLs
WHFan & new Frig
White Roof
PV Pool Pump
New AC
Solar DHW & Gas
Add Freezer
Sarah
Wade
+500 ft2 Remodel
Add 2nd Frig
Remove Freezer
ES Ceiling Fans
Flat Screen & DVR
Energy Feedback
ES Dish-washer & WHF
ES Washer
4.1 kW PV
HiEff Windows Wall Ins. & Mini split
Add 0.8 kW PV
ES Kitchen Fridg
Zero Energy Objective
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

Phased Deep Retrofit Need: Averages don't tell all (FL Example)

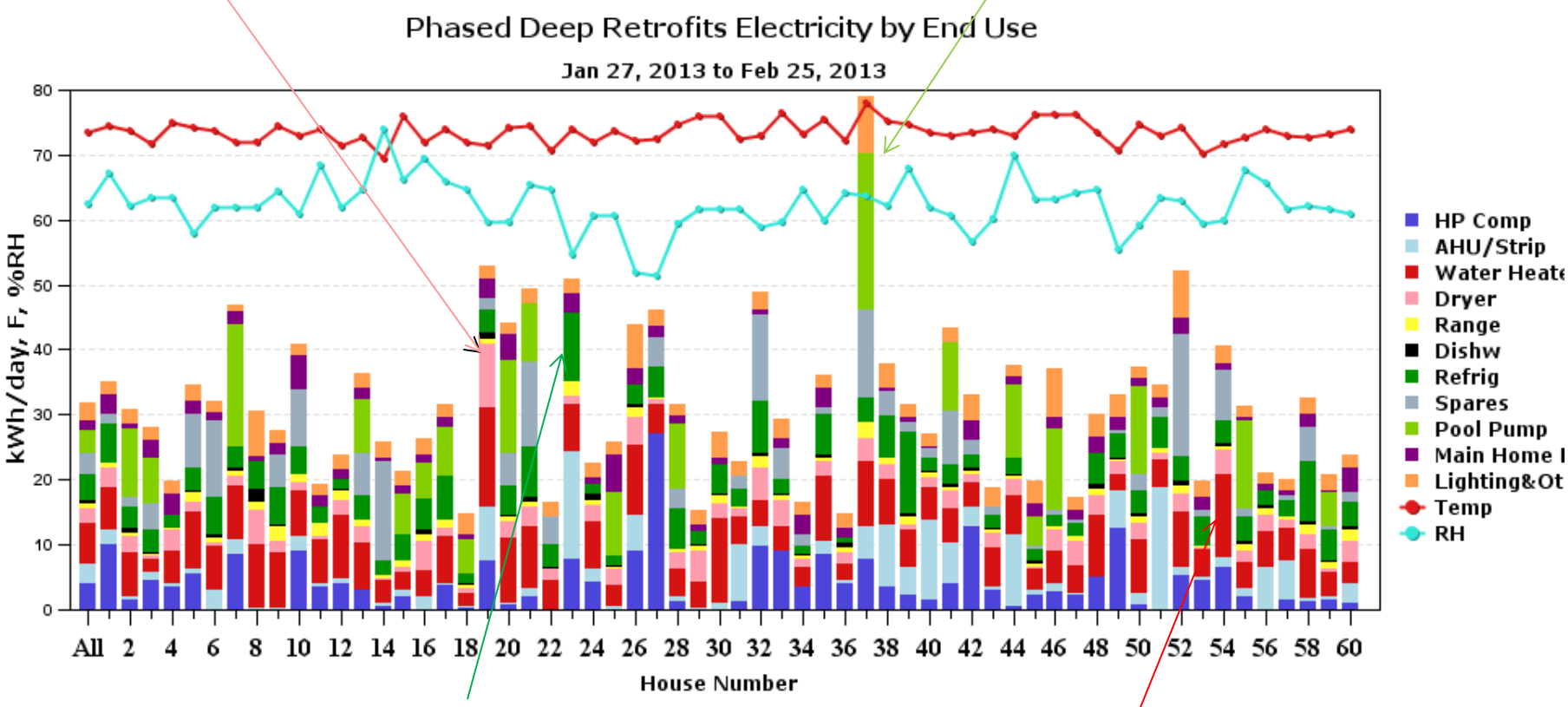




Phased Deep Retrofits in Florida

10 kWh/d: clothes drying

24 kWh/d for pool pumping



10 kWh/d: refrigerators

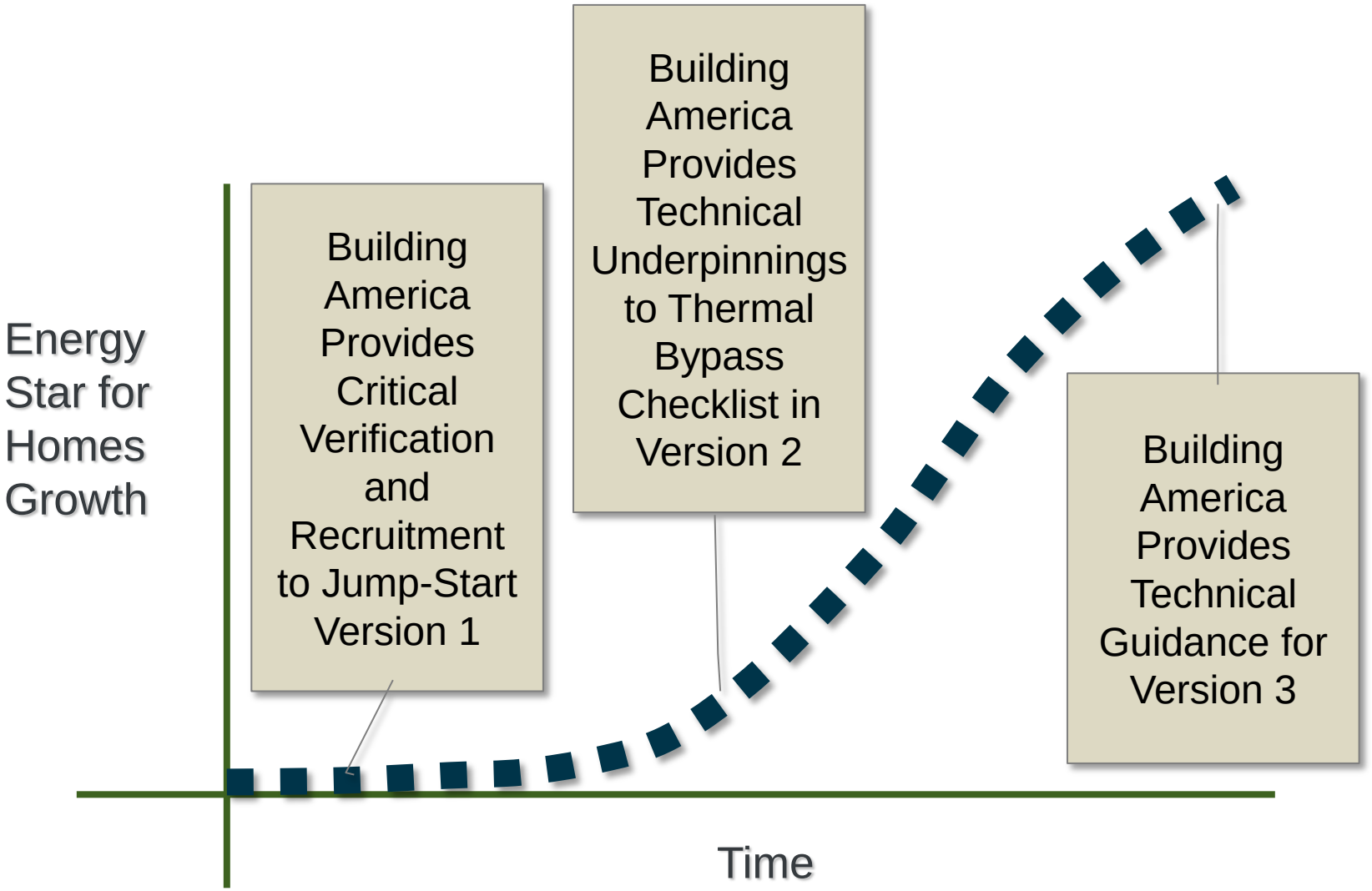
13 kWh/day: water heat

ENERGY STAR for Homes Support

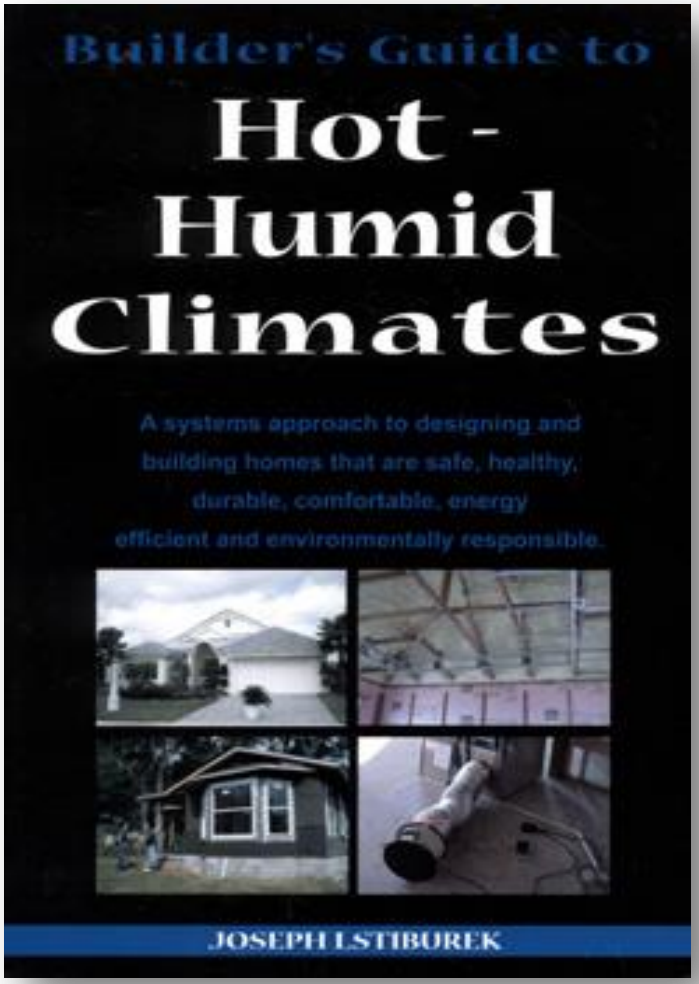
ENERGY STAR for Homes with critical support from Building America has helped transformed the U.S. housing industry to high performance along with a national HERS infrastructure.

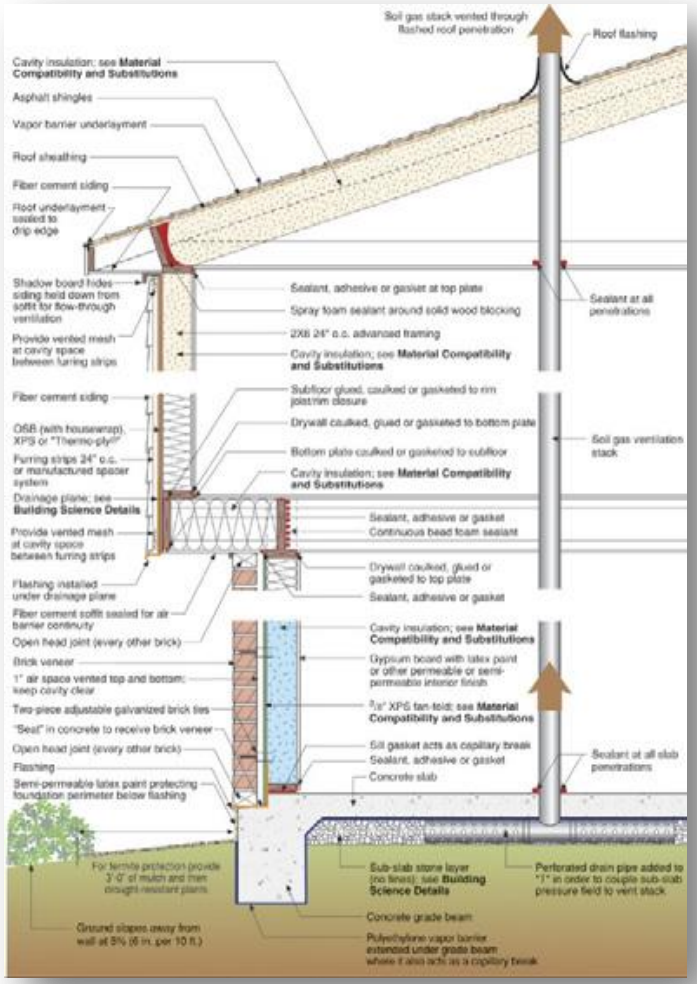
- ~25% of all homes constructed in 2011
- Over 1.3 million certified homes
- ~$23 billion energy cost savings
- ~210 million tons of avoided GHC emissions

ENERGY STAR for Homes Support

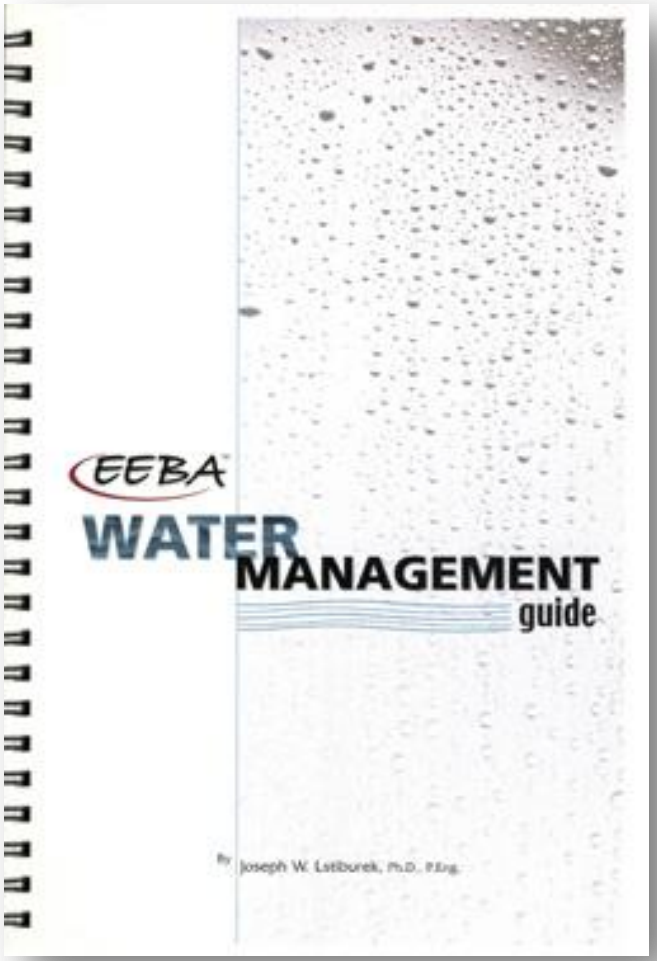


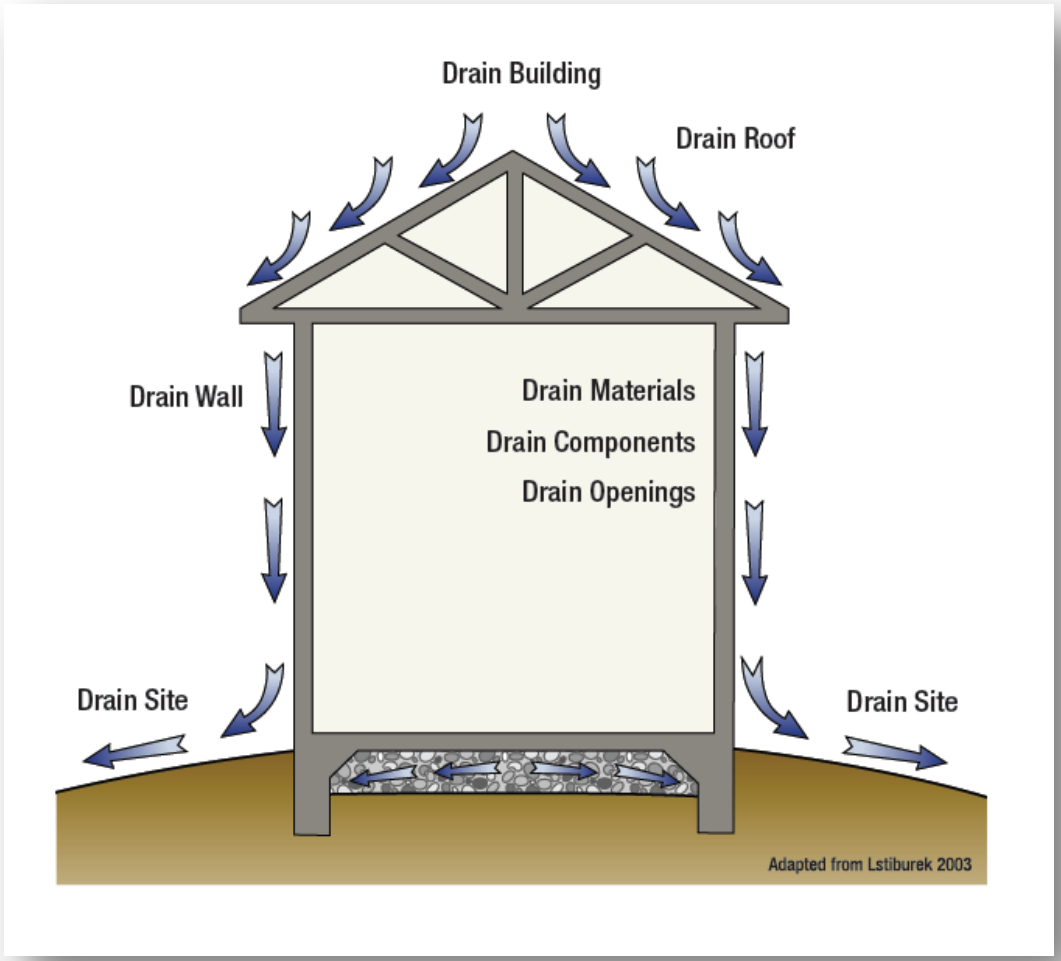
EEBA Builder Guides



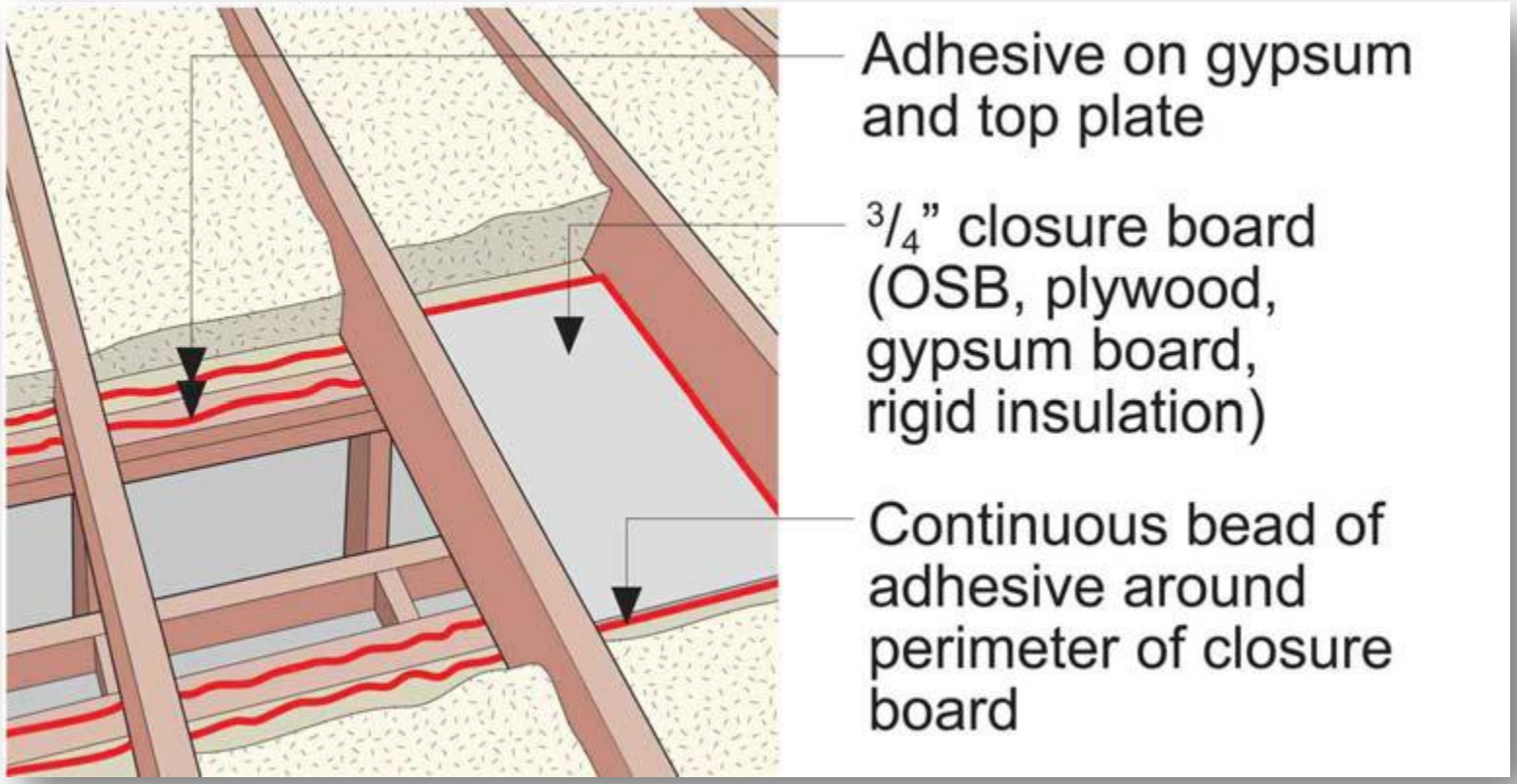


EEBA Water Management Guide





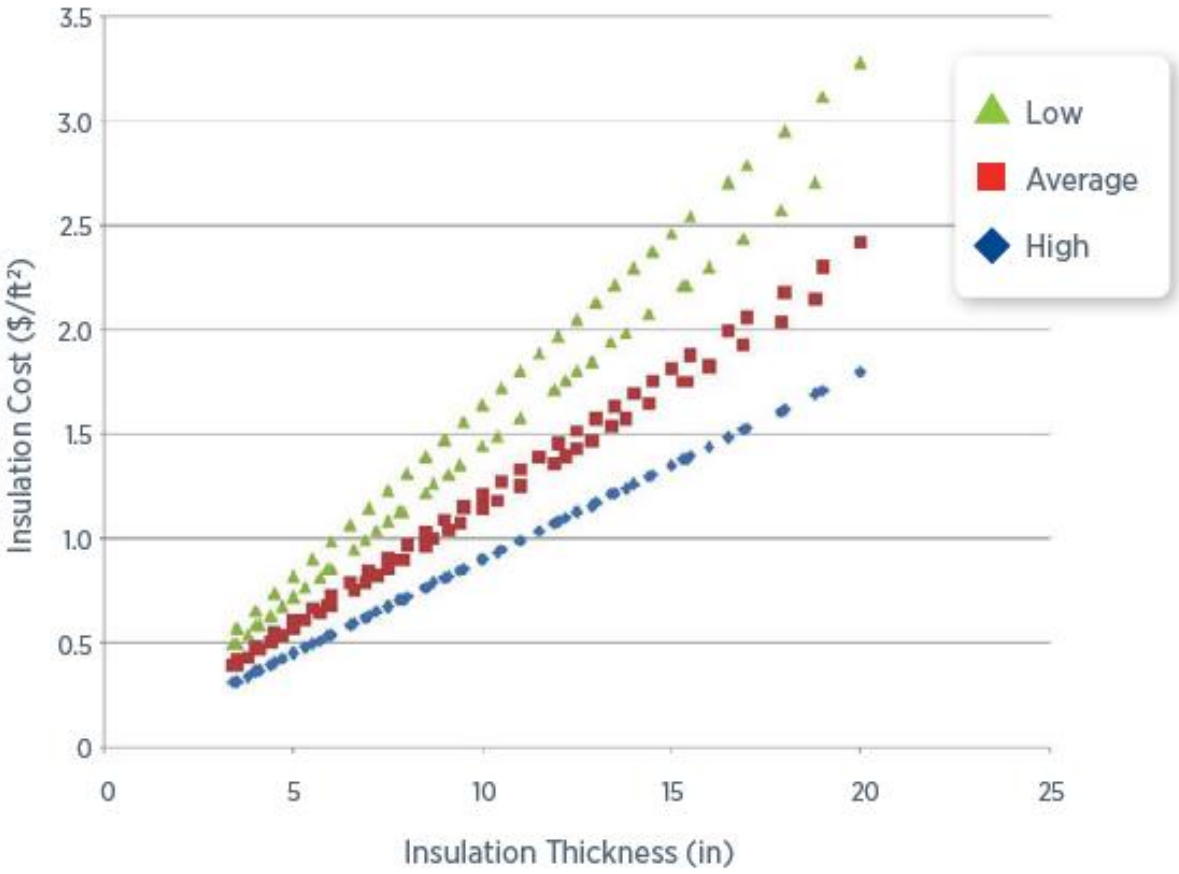
Attic Air Sealing Guidelines



Efficiency Measures Database

Insulation Thickness & Cost

The database provides the ability to visualize data for quality assurance.



House Simulation Protocols*

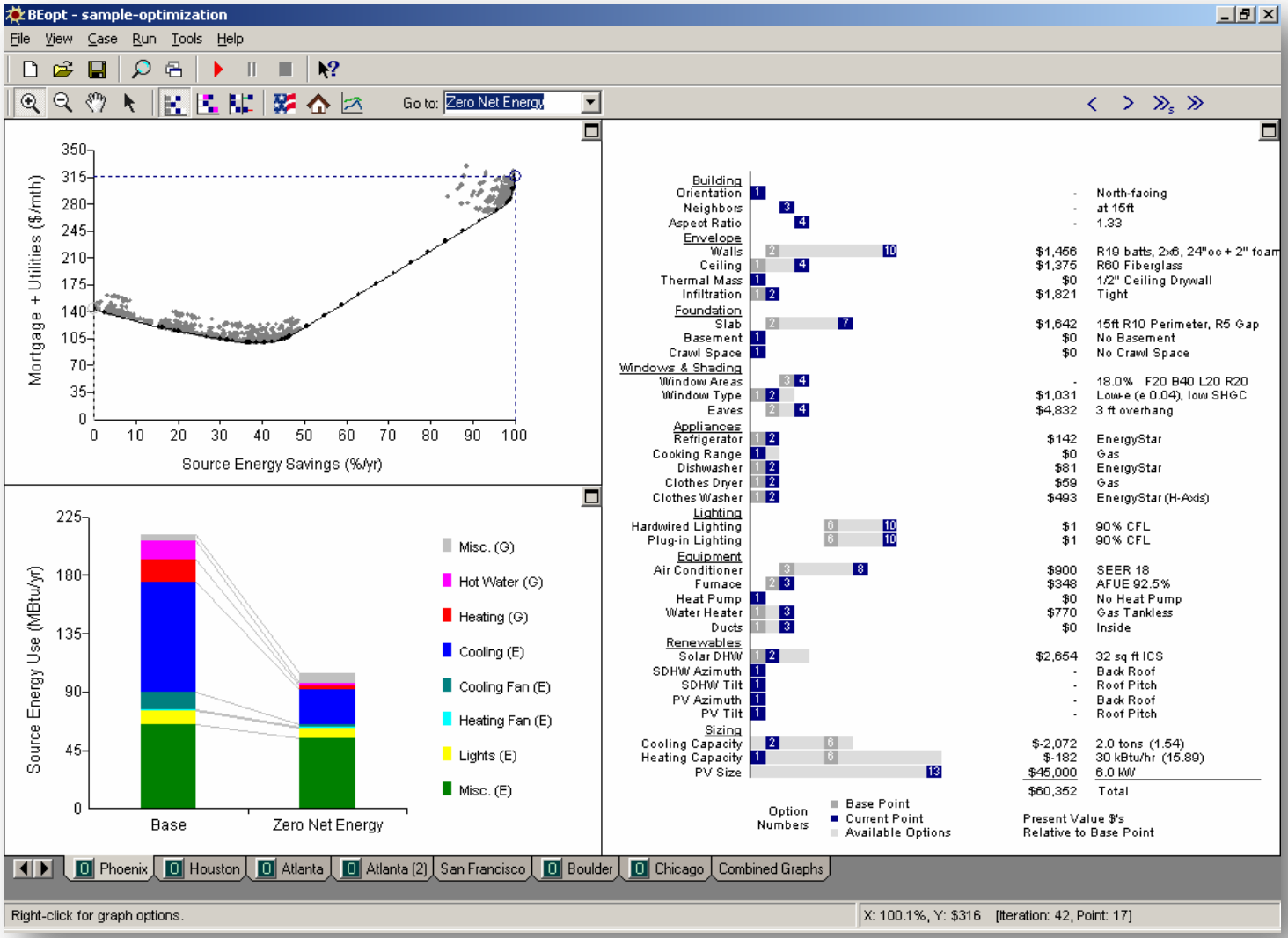
Default R-Values for Common Insulation Types

The table shows default R-values for common insulation types used in analysis for retrofit homes. NREL derived the values from several sources (Henderson and Egebrecht 2010).

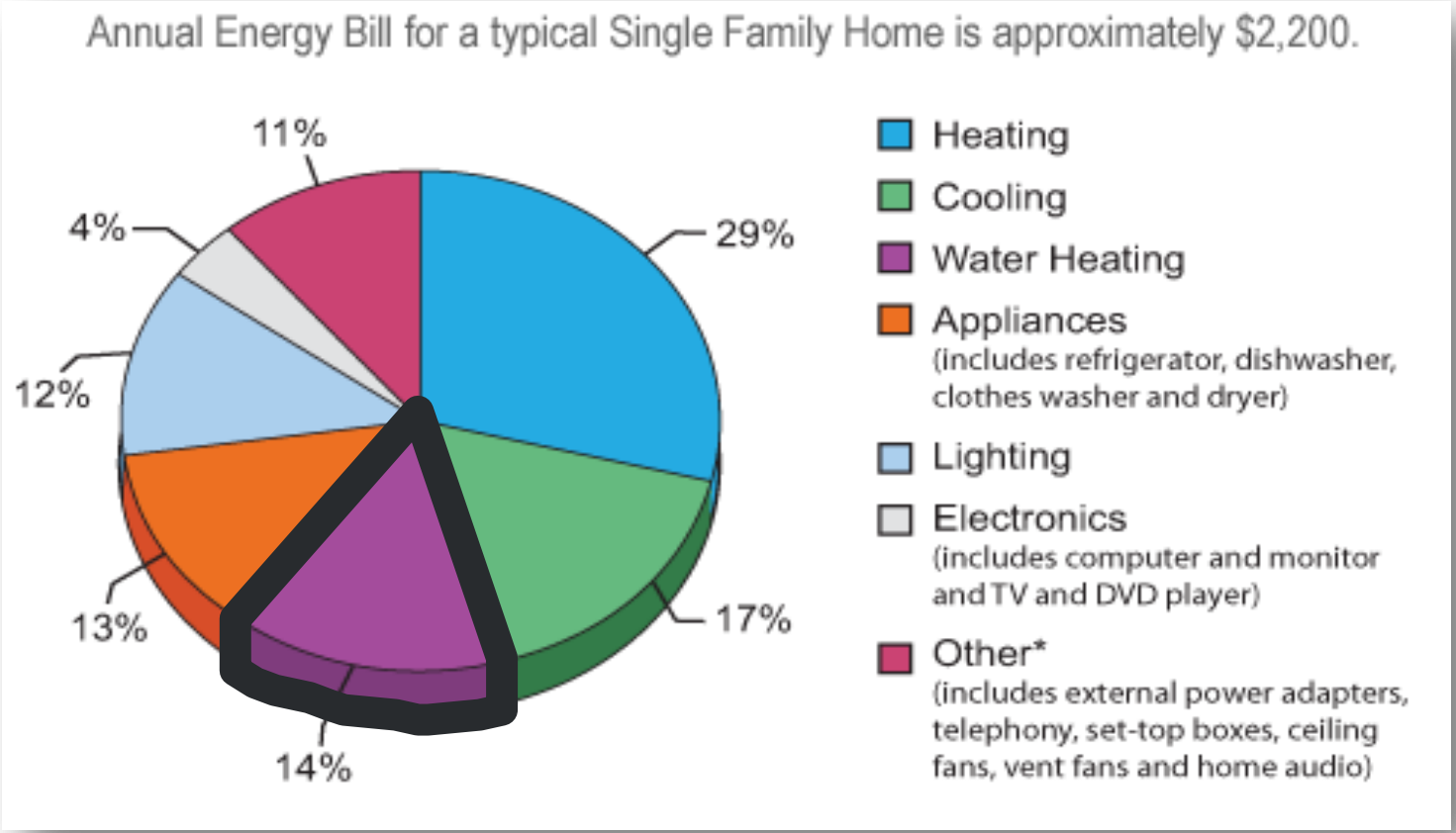
Insulation Material	Nominal R-Value/in.
High-density fiberglass batt	3.8/in.
Low-density fiberglass batt	3.1/in.
Loose-fill fiberglass	3.2/ in.
Cellulose	3.7/in.
EPS	4.0/in.
XPS	5.0/in.
Open-cell polyurethane foam	3.6/in.
Closed-cell polyurethane foam	6.5/in.
Rigid polyisocyanurate	7.2/in.

* the Building America Benchmark

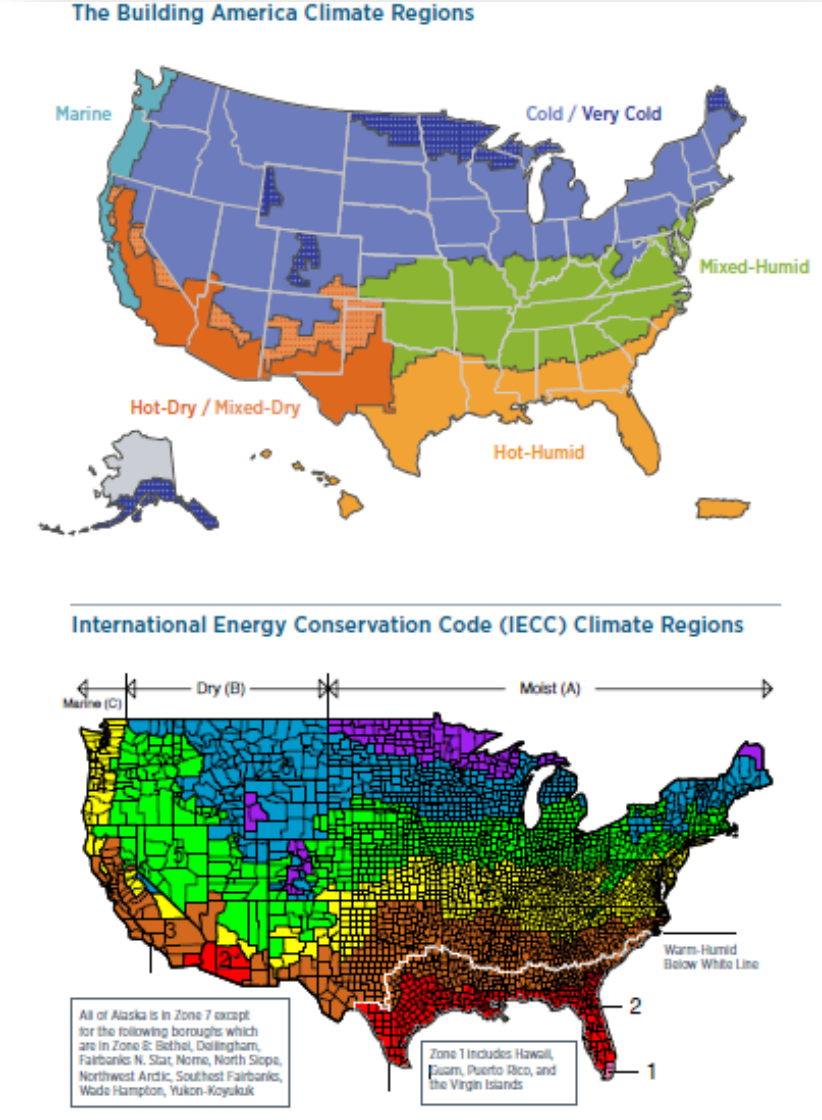
BeOPT Software



Model Simulating Real DHW Use



Building Science Climate Maps



Vapor Retarder Classification

Vapor Retarder Definitions

The 2009 IRC R601.3 gives the following definitions and examples for vapor retarder classes:

Class	Definition	Examples
I	≤ 0.1 perm	Sheet polyethylene, sheet metal, non-perforated aluminum foil, foil-faced insulation sheathing
II	> 0.1 to < 1.0 perm	Kraft-faced fiberglass batts or low-perm paint, unfaced expanded polystyrene, fiber-faced polyisocyanurate
III	> 1.0 perms	Latex or enamel paint

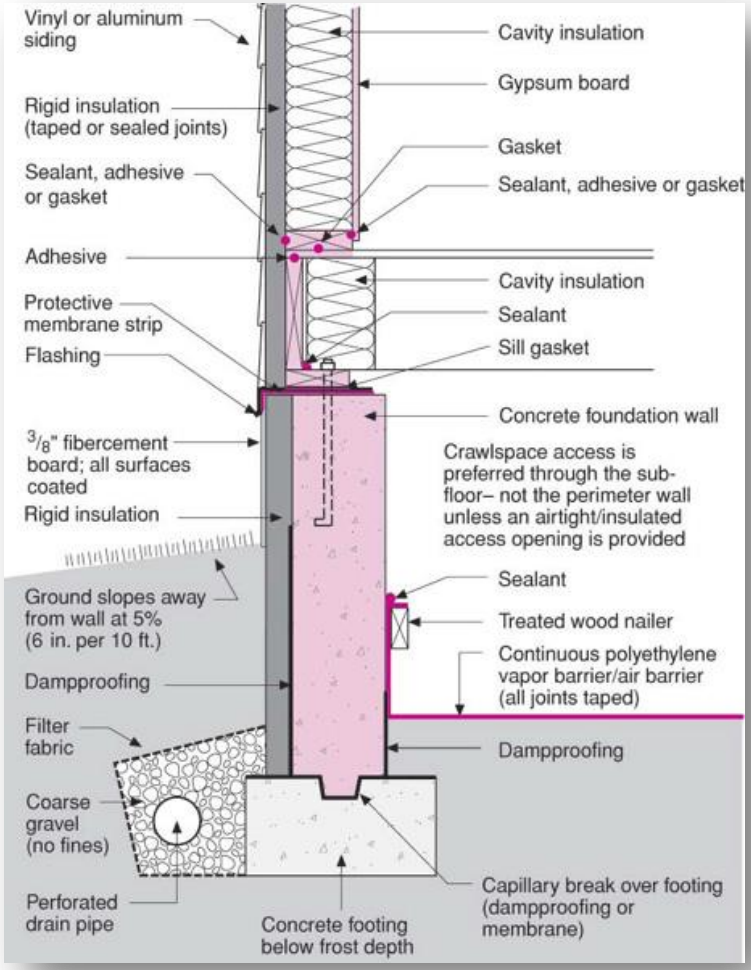
Class III Vapor Retarders

Zone	Class III vapor retarders permitted for:
Marine 4	• Vented cladding over OSB • Vented cladding over plywood • Vented cladding over fiberboard • Vented cladding over gypsum • Insulated sheathing with R-value ≥ R-2.5 over 2x4 wall • Insulated sheathing with R-value ≥ R-3.75 over 2x6 wall
5	• Vented cladding over OSB • Vented cladding over plywood • Vented cladding over fiberboard • Vented cladding over gypsum • Insulated sheathing with R-value ≥ R-5 over 2x4 wall • Insulated sheathing with R-value ≥ R-7.5 over 2x6 wall
6	• Vented cladding over fiberboard • Vented cladding over gypsum • Insulated sheathing with R-value ≥ R-7.5 over 2x4 wall • Insulated sheathing with R-value ≥ R-11.25 over 2x6 wall
7 & 8	• Insulated sheathing with R-value ≥ R-10 over 2x4 wall • Insulated sheathing with R-value ≥ R-15 over 2x6 wall

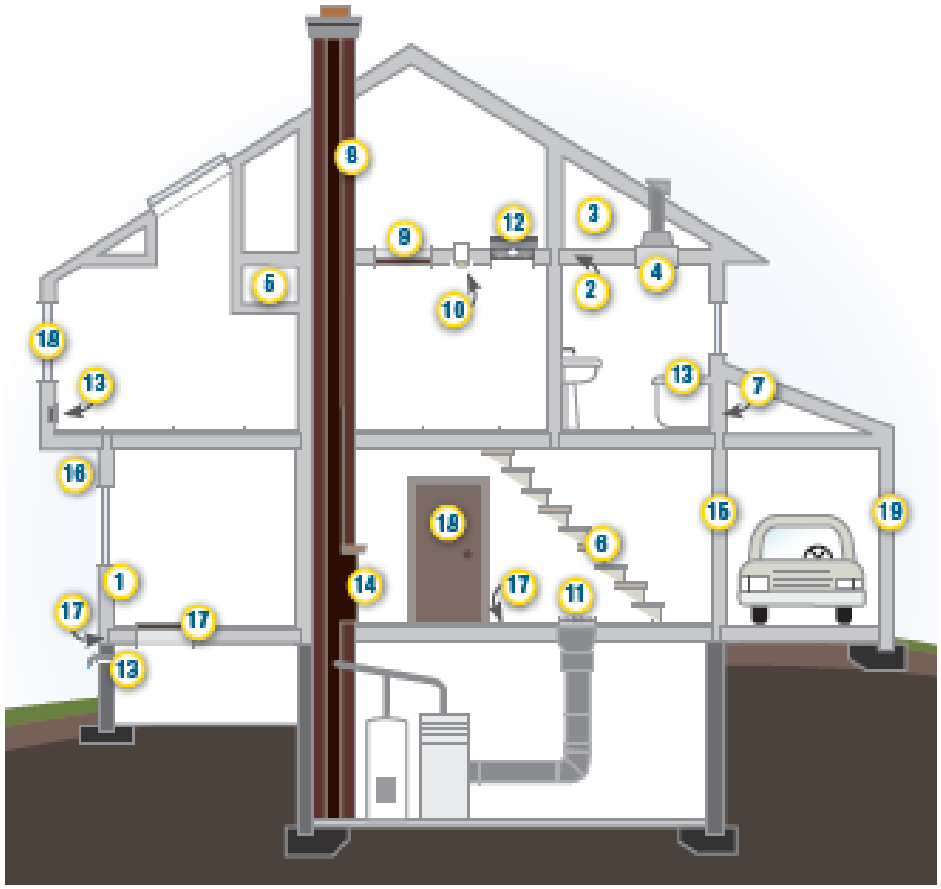
According to the 2009 IRC: "For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent vent area shall be permitted."

1. Vinyl lap or horizontal aluminum siding applied over a weather-resistive barrier as specified in Table R703.4 of the *2009 International Residential Code*.
2. Brick veneer with a clear airspace as specified in Section R703.7.4.2 of the *International Residential Code*.
3. Other approved vented claddings.

Unvented Crawlspace I-Code



Thermal Bypass Air Barriers in IECC



Air Sealing Trouble Spots

(Baechler et al. 2010)

1. Air Barrier and Thermal Barrier Alignment
2. Attic Air Sealing
3. Attic Kneewalls
4. Shaft for Piping or Ducts
5. Dropped Ceiling/Soffit
6. Staircase Framing at Exterior Wall
7. Porch Roof
8. Flue or Chimney Shaft
9. Attic Access
10. Recessed Lighting
11. Ducts
12. Whole-House Fan
13. Exterior Wall Penetrations
14. Fireplace Wall
15. Garage/ Living Space Walls
16. Cantilevered Floor
17. Rim Joists, Sill Plate, Foundation, Floor
18. Windows & Doors
19. Common Walls Between Attached Dwelling Units

Top Innovations Process

- Determine Criteria
- Solicit Nominations
- Research Past Documents
- Compile Complete List of BA Innovations
- Identify Story (Innovations Categories)
- Sort Nominations
- Select Top Innovations per Criteria
- Tell the Story – Top Innovation Profiles
- Annual Event Announcing Top Innovations

Top Innovations Summary

- Building America Hub of Innovation
- Document Legacy Innovations
- Major Event Announcing Latest Innovations
- Tool for Identifying Program Gaps
- Tool for Managing Program Assets
- Tool for Promoting Program Results

Building America

Innovations Project Portfolio

Building America Project Portfolio Management

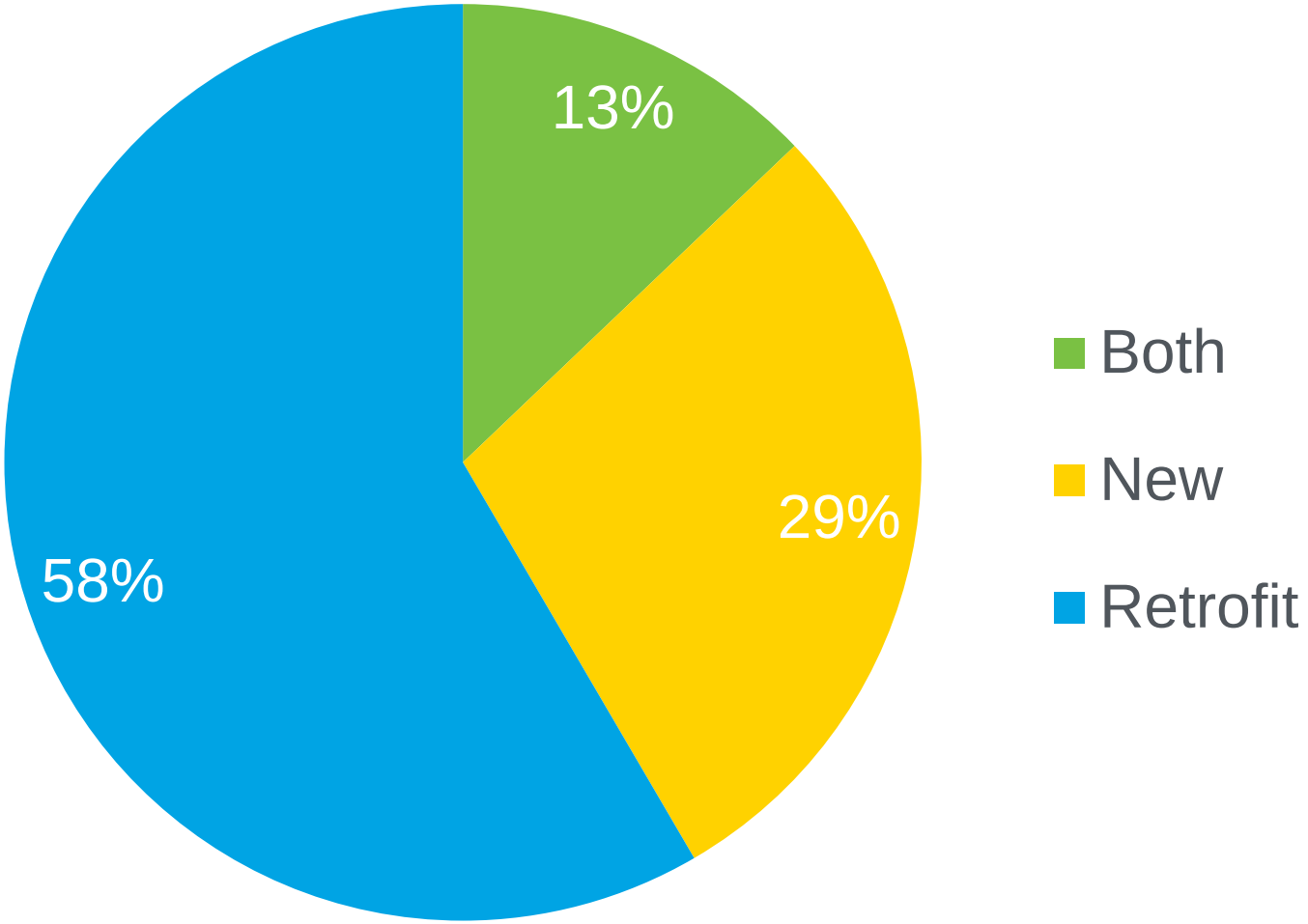
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Proposals ➡ Projects ➡ Results ➡ Innovations

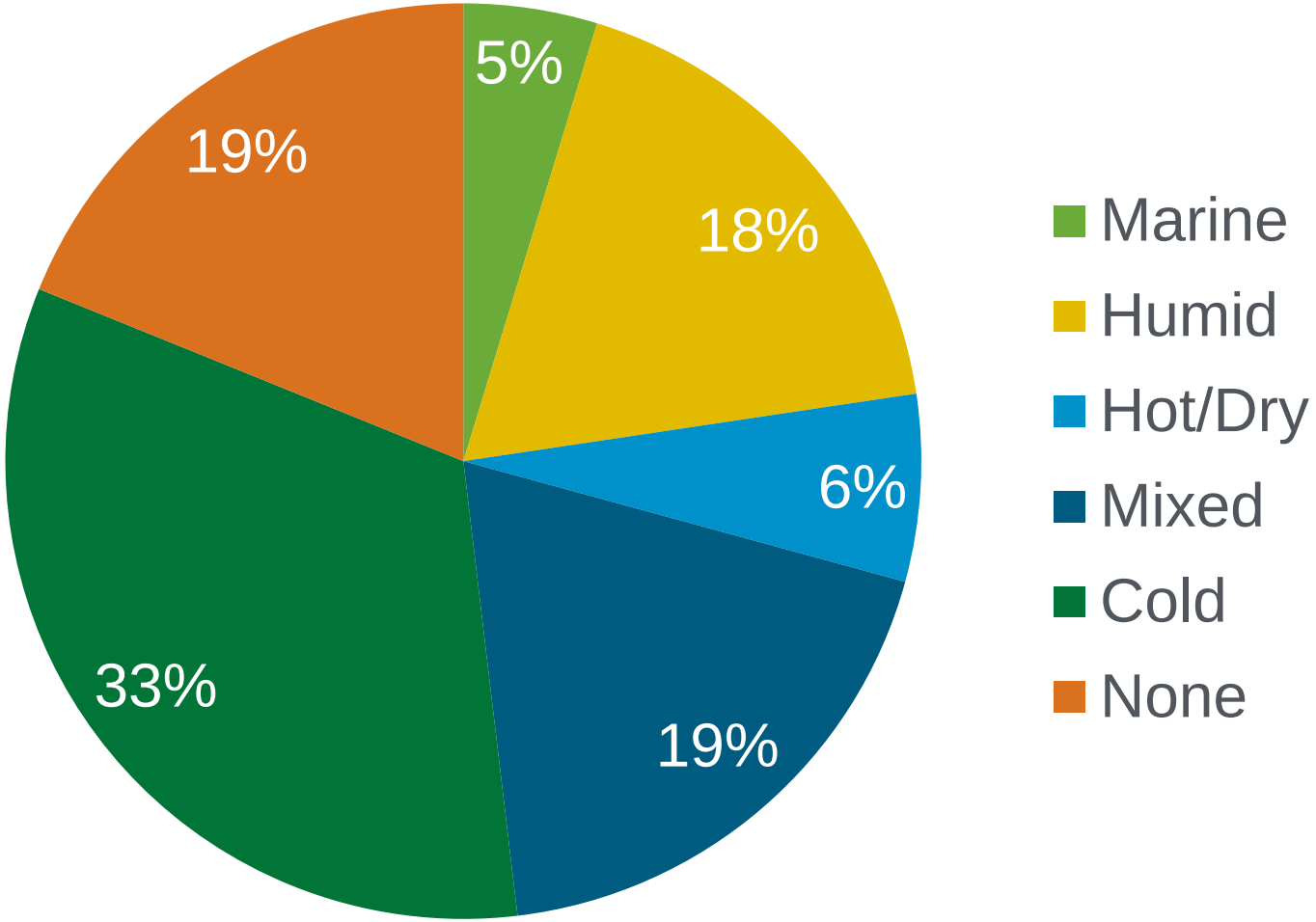
Building America Team Research - FY12

Team	Facility Name	Period: Yr	Period: of	Task	Subtask	Project Title & Link to Plan (Sharepoint)	Sector: Sector	Sector: Deployment Path #	Building: Type	Building: # of Units/Yrs	Climate: Cold	Climate: Mixed Mixed	Climate: Hot-Dry	Climate: Hot-Humid	Climate: Marine	STC (highest priority)	Innovation	Technology: Wall Package	Technology: Enclosure	Technology: HVAC	Technology: Water Heating	Technology: Components	Process	Deliverables (#): Report	Deliverables (#): Guide	Deliverables (#): Research	Deliverables (#): Case Study	Deliverables (#): Other
ARBI (DEG)		**2012**																										
ARBI (DEG)		2012				Hybrid Air-to-Water Heat Pump Evaluation																						
ARBI (DEG)		2012				West Village Central Heat Pump Water Heater Evaluation																						
ARBI (DEG)		2012				West Village Multifamily Housing Performance Verification																						
ARBI (DEG)		2012				Neighborhood Outreach Evaluation																						
ARBI (DEG)		2012				Marine Climate Deep Energy Retrofit																						
ARBI (DEG)		2012				Hot-Dry Climate Deep Energy Retrofit																						
ARBI (DEG)		2012				Water Heating Field Data Evaluation and Model Validation																						
ARIES (Levy)		**2012**																										
ARIES (Levy)		2012				Advanced Envelope Design for New Factory-Built Homes																						
ARIES (Levy)		2012				Evaluation of Overheating in Multifamily Buildings																						
ARIES (Levy)		2012				Hydronic Heating Control Retrofits for Low-Rise Multifamily Buildings																						
ARIES (Levy)		2012				Reducing Water Heating Energy Waste in Existing Homes																						
ARIES (Levy)		2012				Reducing Deep Energy Retrofit Costs through Off-site Construction																						
ARIES (Levy)		2012				Fuel Oil Field Measurement																						
BAPRC (FSEC)		**2012**																										
BAPRC (FSEC)		2012				SEER 21 Heat Pump System Evaluation, Phase 3 150k																						
BAPRC (FSEC)		2012				Hot Water Systems Evaluation 125k																						
BAPRC (FSEC)		2012				Site Built Test Homes																						
BAPRC (FSEC)		2012				Northwest Energy Efficient Manufactured Housing Program (NEEM) – High Performance Home Prototyping and Construction Process Development																						
BAPRC (FSEC)		2012				Hot-humid climate New Construction 30% Communities																						
BAPRC (FSEC)		2012				Side-by-Side labs to Evaluate Retrofit Measures																						
BAPRC (FSEC)		2012				Evaluation of "30%" and "Deep" Level Retrofits and Risk Minimization Strategies in Multi-Family Housing Energy Retrofits																						
BAPRC (FSEC)		2012				Tracking and Documenting Scalability of High Performance Residential Retrofits at the Community Scale																						
BAPRC (FSEC)		2012				Pilot Demonstration of Phased Deep Retrofits in Existing U.S. Homes																						
BAPRC (FSEC)		2012				Multi-family Energy Retrofits - Cascade Homes																						
BARA (BMI)		**2012**																										
BARA (BMI)		2012				Intro to Building America Innovations Video																						
BARA (BMI)		2012				Knowledge Tools for Building Science Experts & Market Leaders																						
BARA (BMI)		2012				Effective Links Between BA Innovation Results and Market Leader/Building Science Experts and Outreach Leaders																						
BARA (BMI)		2012				Outreach for Building America through Effective Communication of Breakthrough Innovations in a Whole-house and Laboratory Based project																						
BSC		**2012**																										
BSC		2012				Dehumidification Study with Project Home Again																						
BSC		2012				Application of Spray Foam Under Roof Sheathing																						
BSC		2012				Guidance on Moisture Management for High-R Walls for New Construction																						
BSC		2012				Task 4: Transformations Massachusetts																						
BSC		2012				Cladding Attachment Over Thick Exterior Insulating Sheathing																						
BSC		2012				Guidance on Taped Insulated Sheathing Drainage Planes																						
BSC		2012				Moisture Management with Highly Permeable Sheathing Insulations over Existing Walls w/Permeable Cavity Insulation																						
BSC		2012				Ventilation System Effectiveness and Distribution																						
BSC		2012				Guidance on Interior Retrofits for Load-bearing Masonry Structures																						
BSC		2012				Task 9: Ionova, PA																						
BSC		2012				Task 9: Merrimack Valley Habitat for Humanity																						
BSC		2012				Task 9: National Grid Deep Energy Retrofit																						
BSC		2012				Task 4: City of Wyandotte, Michigan																						
BSC		2012				Guideline on Humidity Control for Humid Climates																						

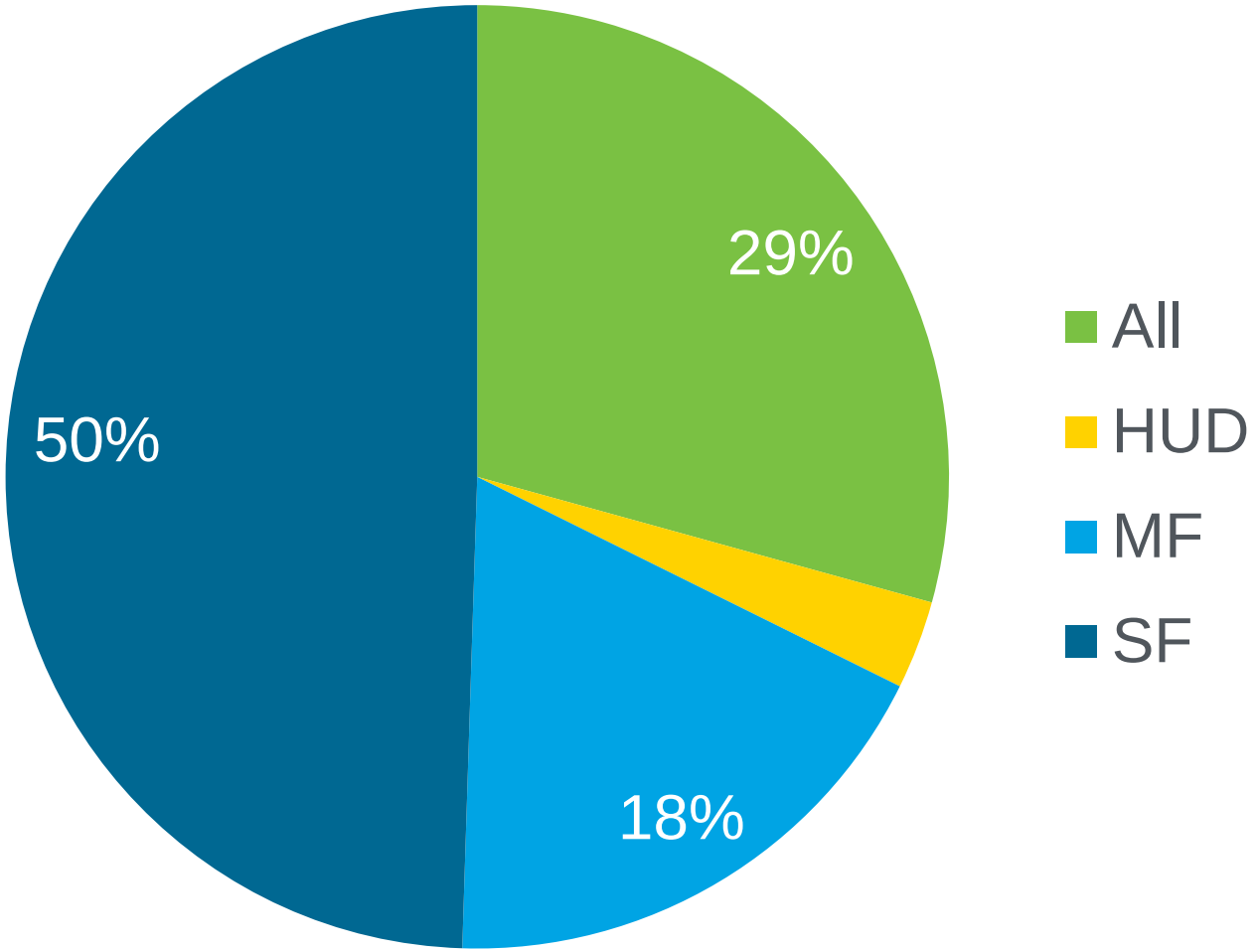
2012 Projects by Sector



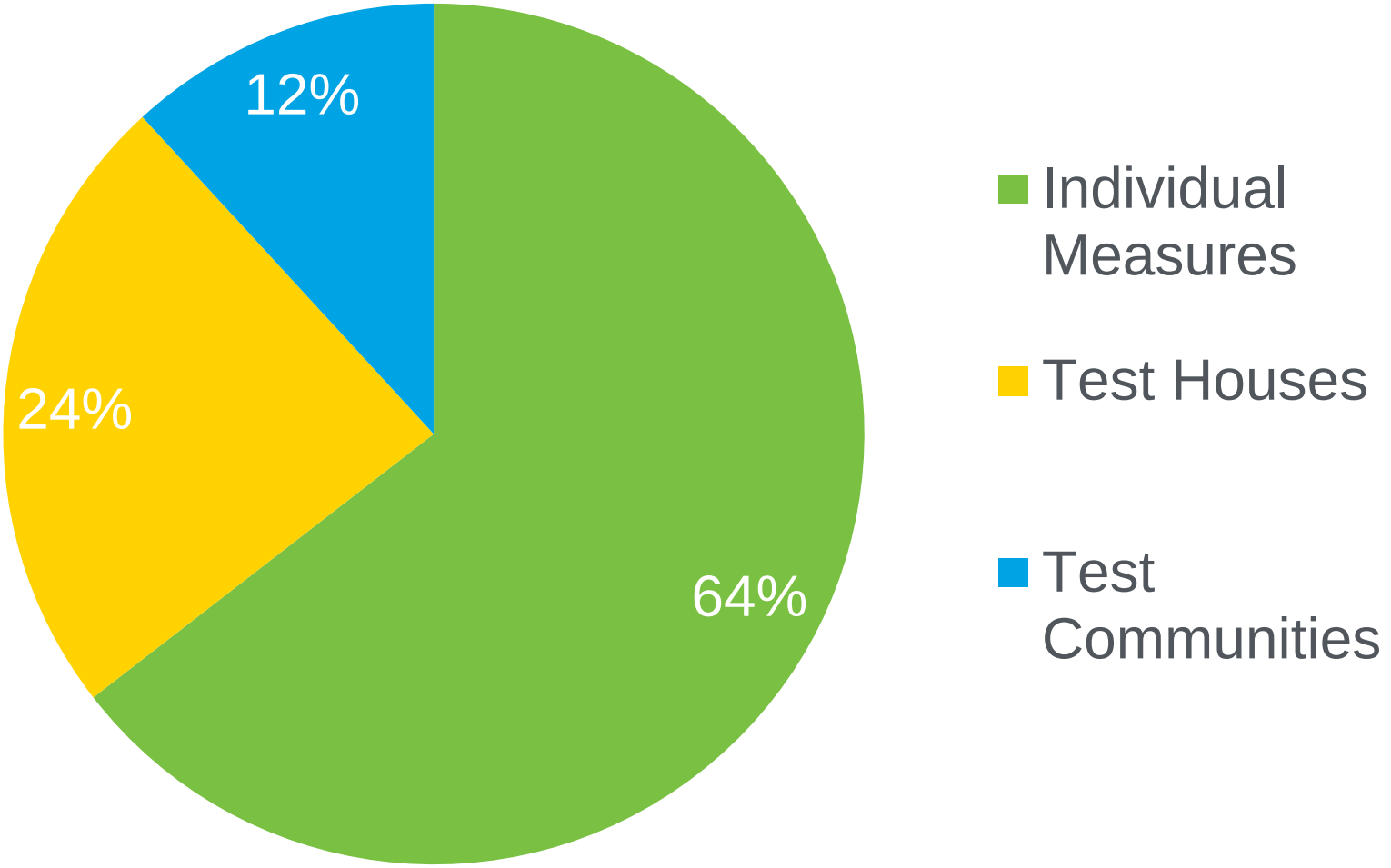
2012 Projects by Climate



2012 Projects by Building Type



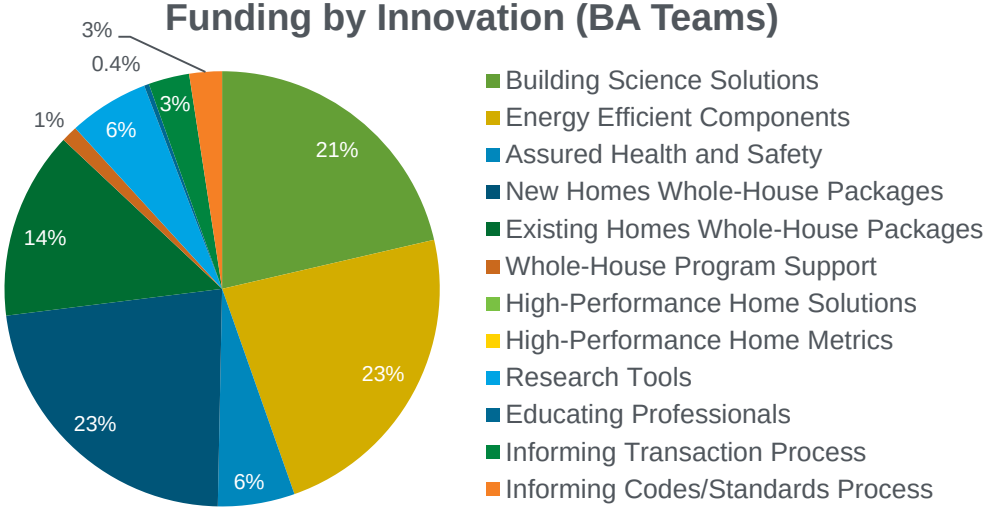
2012 Projects by Scale



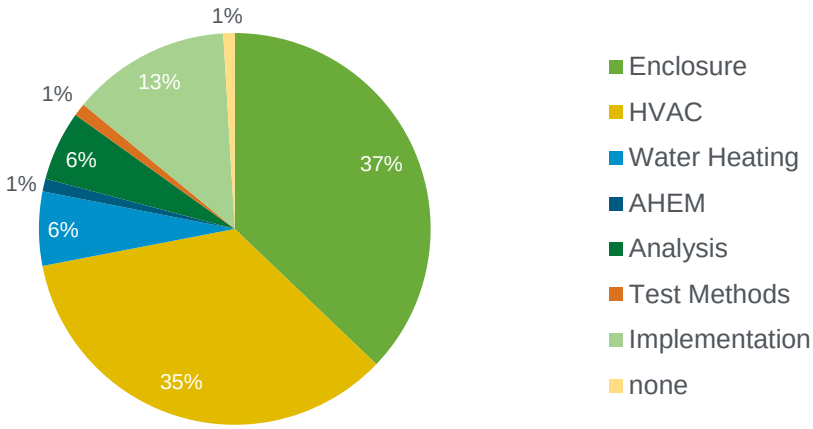
2013 Projects by Innovation - INITIAL

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

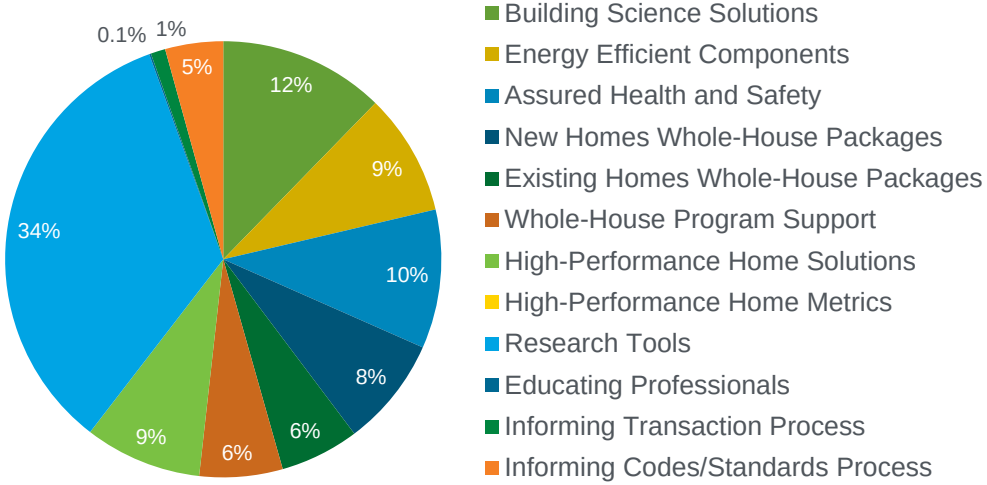
Funding by Innovation (BA Teams)



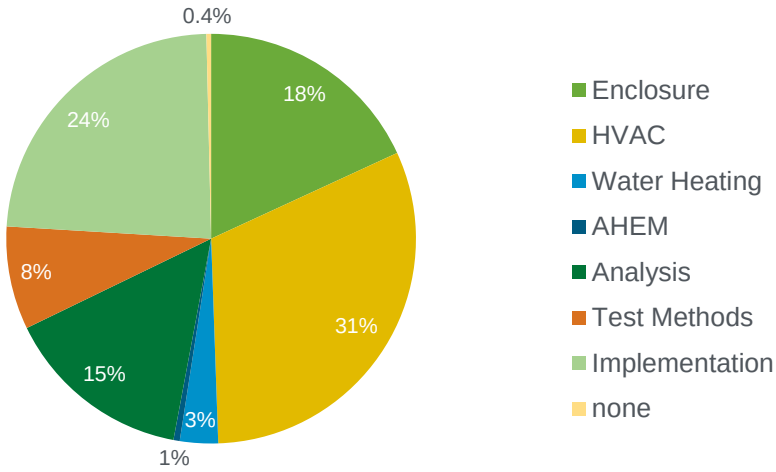
Funding by STC (BA Teams)



Funding by Innovation (Lab & BA Teams)

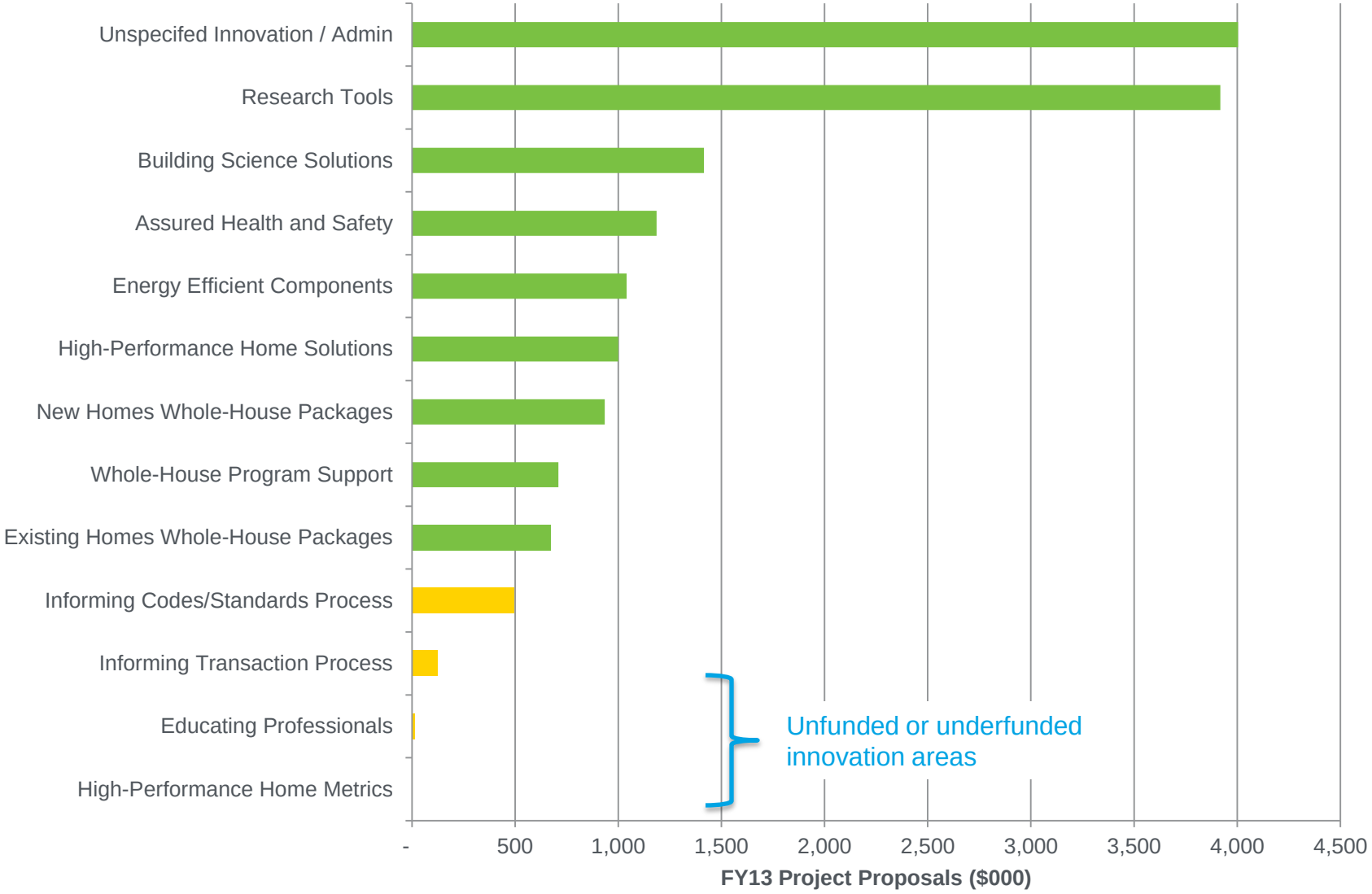


Funding by STC (Labs & BA Teams)



Targeted Innovation Gaps - 2013

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



Building America

Advanced Retrofit Technology & Demonstration Projects

Current BA Retrofit Projects:
Advanced Retrofit Enclosure Technology

- Side-by-Side Lab House Retrofit Performance Studies
- Cladding Attachment for Thick Exterior Insulating Sheathing (2)
- High-R Roof Retrofit Techniques
- Moisture Performance Field Testing of Retrofits
- Cold Climate Foundation Wall Insulation, including “Excavation-less”

Current BA Retrofit Projects:
Advanced Retrofit HVAC Technologies

- Pressure Regain Supply Outlets for Retrofits
- Advanced Combined Heating/Hot Water Systems (2 projects)
- Buried & Encapsulated Attic Duct Retrofits
- Hydronic Primary Loop Temperature Controller
- Side-by-Side Lab House Retrofit Performance Studies (21 SEER vs. 13 SEER)
- Cold Climate Roof Retrofit Applications

Current BA Retrofit Projects:
Advanced Retrofit Technologies for MF

- Central HW System Control for MF
- Hydronic Heating Control Retrofits for MF (2)
- Optimized Air Distribution Retrofit Strategies for MF
- Mini-Split Applications for Retrofits for MF

Current BA Retrofit Projects:
Advanced Retrofit IAQ & Ventilation

- Ventilation System Effectiveness Study
- Space Conditioning Impacts of Retrofits Study
- Improved Combustion Safety Testing Procedures
- Low-Cost Radon Reduction in Retrofits/WAP

Current BA Retrofit Projects:
Guidance & Tools for WH Retrofits

- Phased Deep Retrofit Process Development: 60 FL Homes (FSEC)
- Energy Use Analysis of DER Homes (BSC, LBNL, NREL)
- Measure Guidelines from Advanced Technology Projects (planned)
- Building America Solution Center content from BA Innovations (planned)

Current BA Retrofit Projects:
Community-Scale Advanced Retrofit Demos

- Marine Climate DER Process: CA (DEG)
- Public Housing Approach: NC (ARIES)
- Las Vegas, NV Retrofit Program (BARA)
- Lend Lease Community Scale Retrofit Process: 800 units in SC (IBACOS)
- Multifamily DER: 2 MA Apartment Demonstration Projects (SWA)
- Greenbelt, MD HPwES Advanced Retrofit Demonstration Project (NAHBRC)
- Community Scale Attic Retrofit Approach: 100 CA homes (DEG)

Current BA Retrofit Projects: Program Support

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

- Home Performance w/Energy Star: 13 Projects (BSC, FSEC, IBACOS, NAHBRC, PARR)
- Better Buildings Neighborhood Partnership grantees: 3 projects (FSEC)
- Better Buildings Challenge: 6 projects (IBACOS)
- Home Energy Score Pilots: 5 projects (DEG, FSEC, IBACOS)
- Weatherization Assistance Program: 3 projects (DEG, UMN)

Thank You

Questions?

For More Information:

just Google “Building America”