



**FLORIDA SOLAR ENERGY CENTER**

*Creating Energy Independence Since 1975*

# *Building Energy Efficiency: The Big Prize*

**Meeting of the Florida Energy Commission**

May 11, 2007

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A Research Institute of the University of Central Florida





## *Bona Fides*



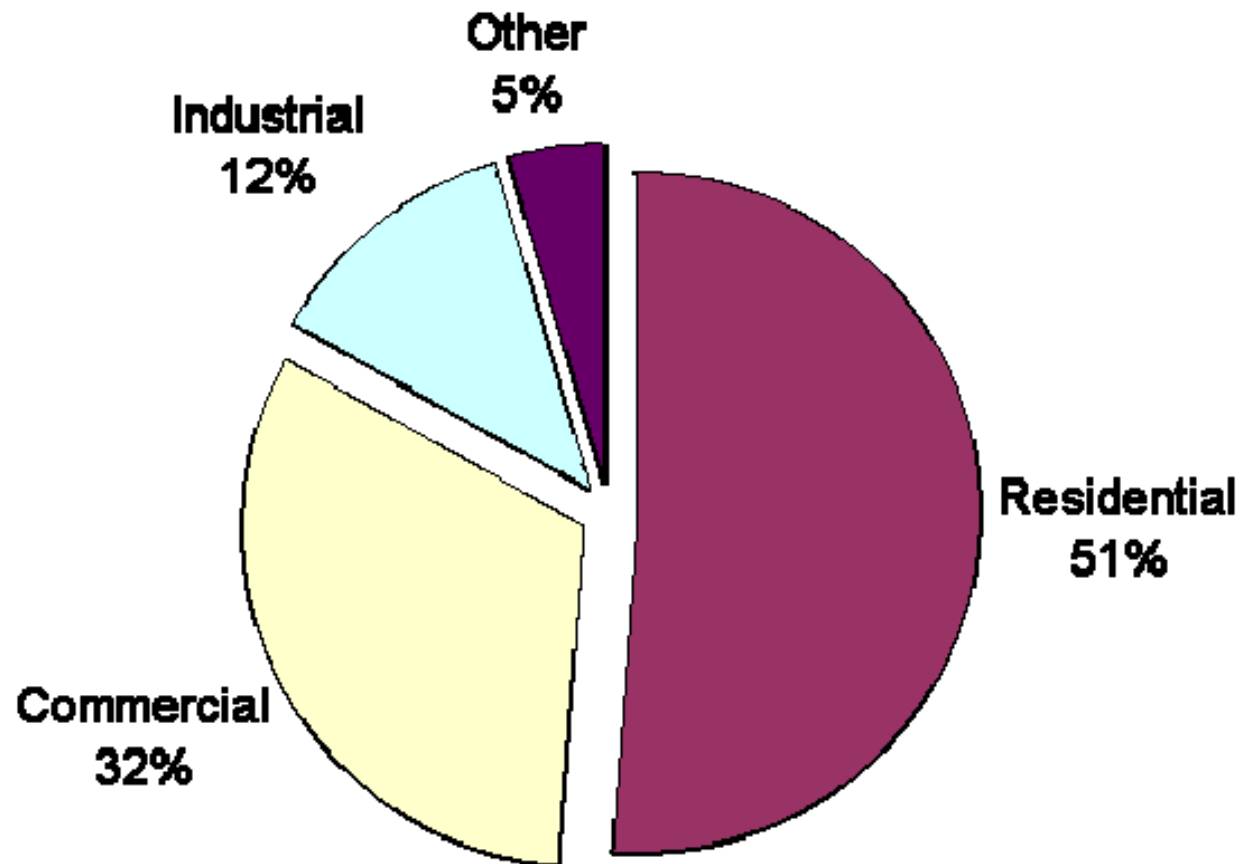
- ❖ 27 years building science research at FSEC
- ❖ Member, Florida Building Commission (FBC)  
Energy Technical Advisory Committee
- ❖ Member, Florida Energy Commission (FEC)  
Efficiency/Conservation Advisory Group
- ❖ Member, Board of Directors & immediate past  
president of RESNET
- ❖ Co-author and FSEC lead, ACEEE Florida  
Report.



# *Buildings = 83% of Total!*



Actual 2004 Electric Use = 233 TWh



Source: <http://www.fsec.ucf.edu/en/publications/html/FSEC-RR-58-06/>



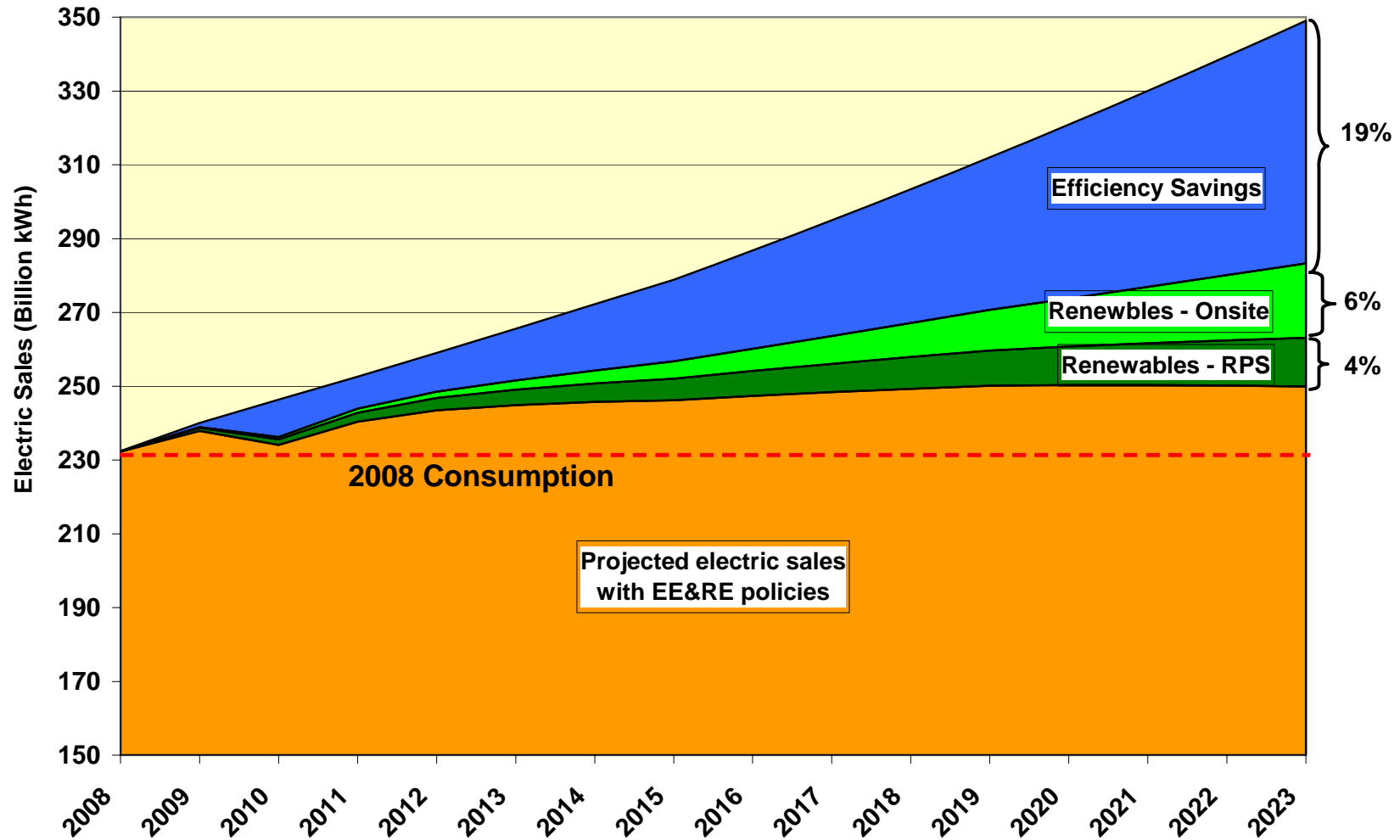
# *ACEEE Florida Report*



- ❖ Building energy efficiency is major player
- ❖ But . . . What's under the hood?
- ❖ Details make the difference
  - Baseline building definitions
  - Cost of improvements
  - Detailed analysis results
- ❖ Report being revised to include many analysis details inadvertently left out of original
- ❖ Overall results not significantly impacted

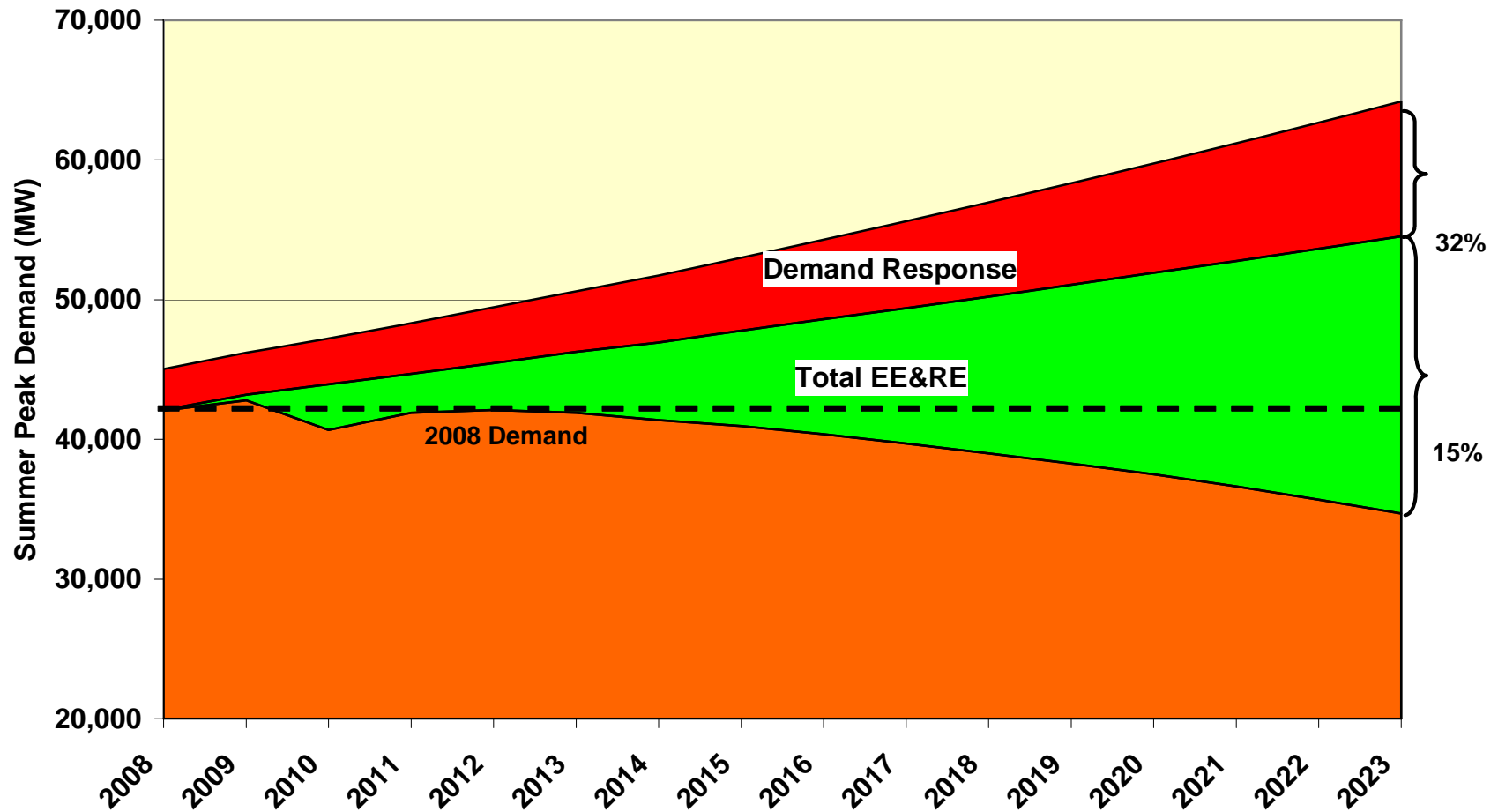


# ACEEE: Energy Savings





# ACEEE: Demand Savings





## *ACEEE: Under the Hood*



- ❖ Existing Home Baseline – Attributes confirmed through major central Florida field monitoring study of more than 200 homes (2002)
- ❖ New Home Baseline – attributes conform with minimum requirements of the 2007 revision of Florida's Energy Efficiency Code
- ❖ Home modeling simulations performed using Florida's EnergyGauge® USA software
- ❖ Important note: Study includes Code as well as non-Code (“Other”) energy savings.



# *EnergyGauge® Software*



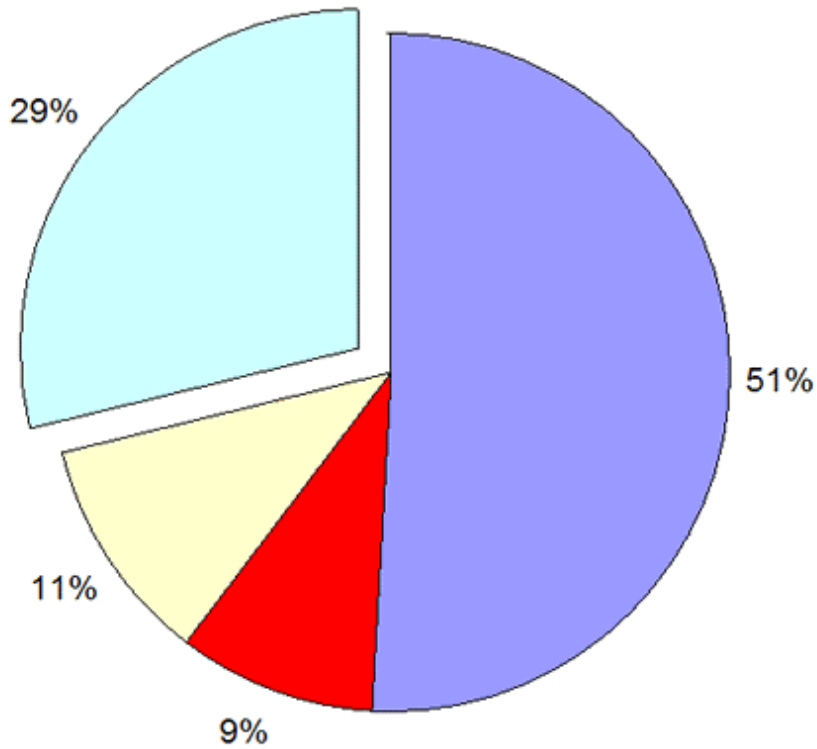
- ❖ Florida's performance-based Code compliance software suite
- ❖ Developed and maintained by FSEC
- ❖ Powerful DOE-2.1E+ simulation engine
  - Special provisions for humidity simulation
  - Improved equipment simulation algorithms
- ❖ Important national software accreditations:
  - RESNET – Home Energy Ratings (residential)
  - IRS – Federal income tax credit qualification (residential and commercial)



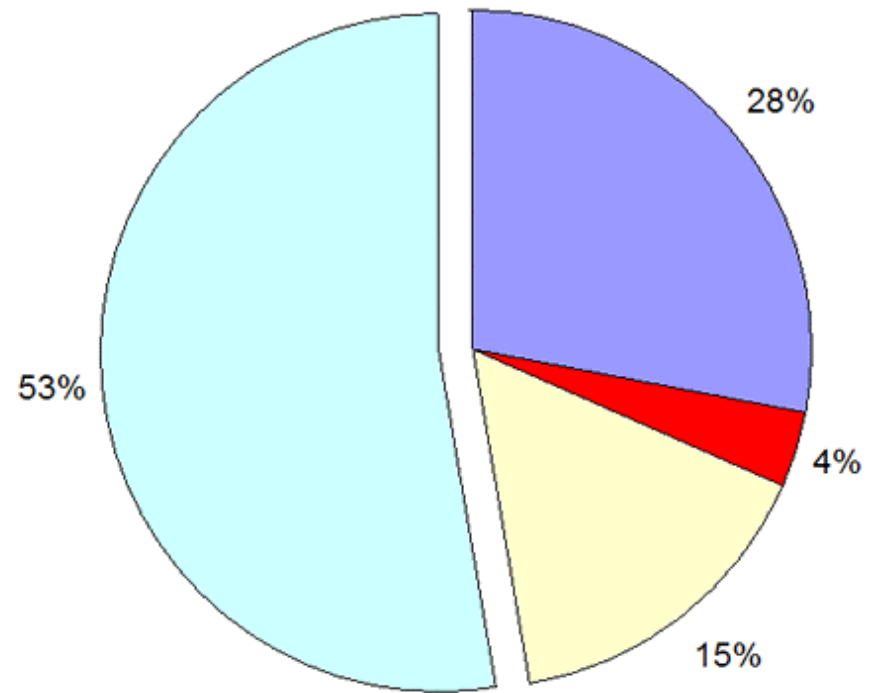
# The Importance of "Other"



1979 Code Home



2007 Code Home



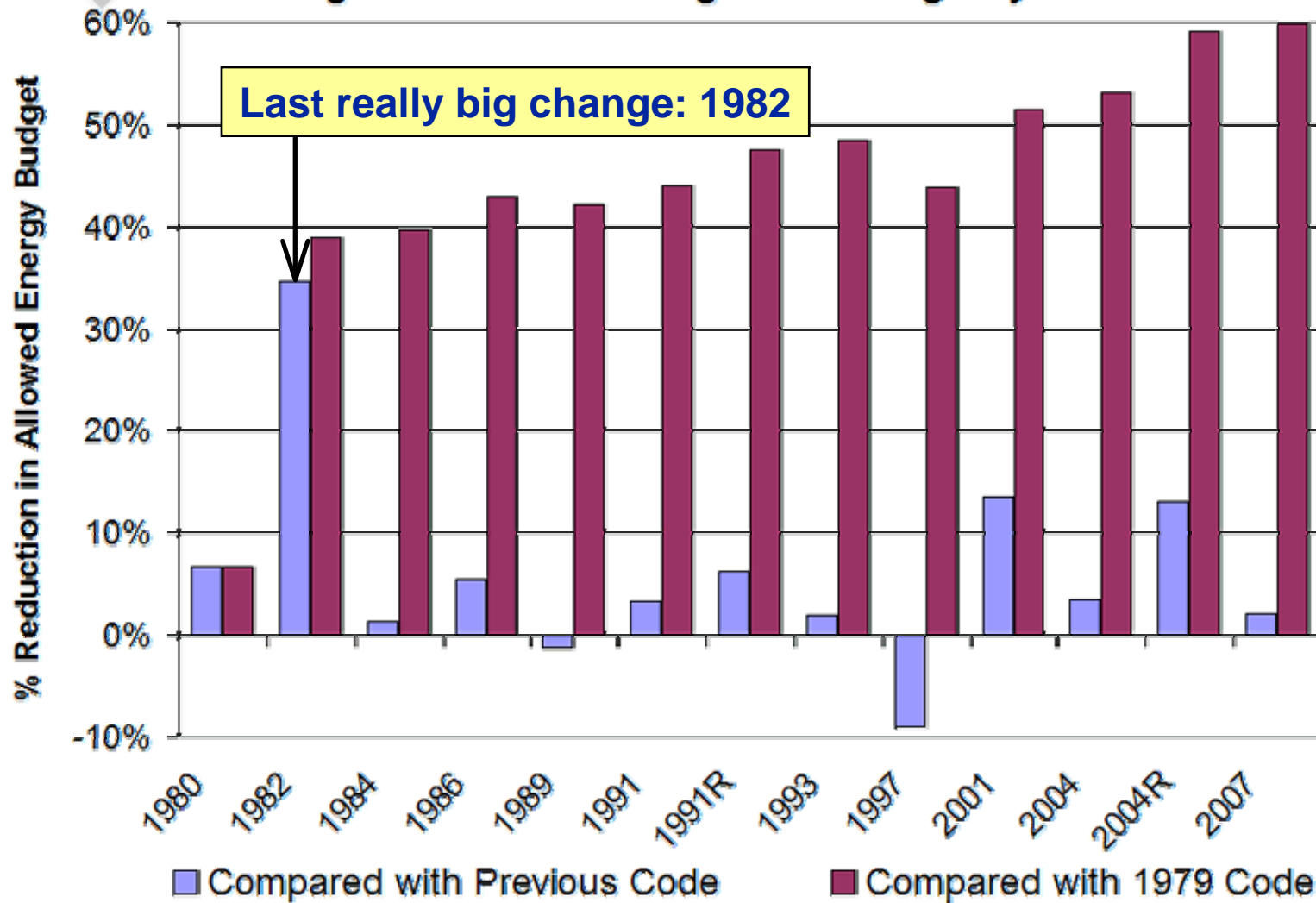
■ Cooling ■ Heating ■ Hot water ■ All Other



# Florida's Energy Code



Change in Florida Building Code Stringency Over Time

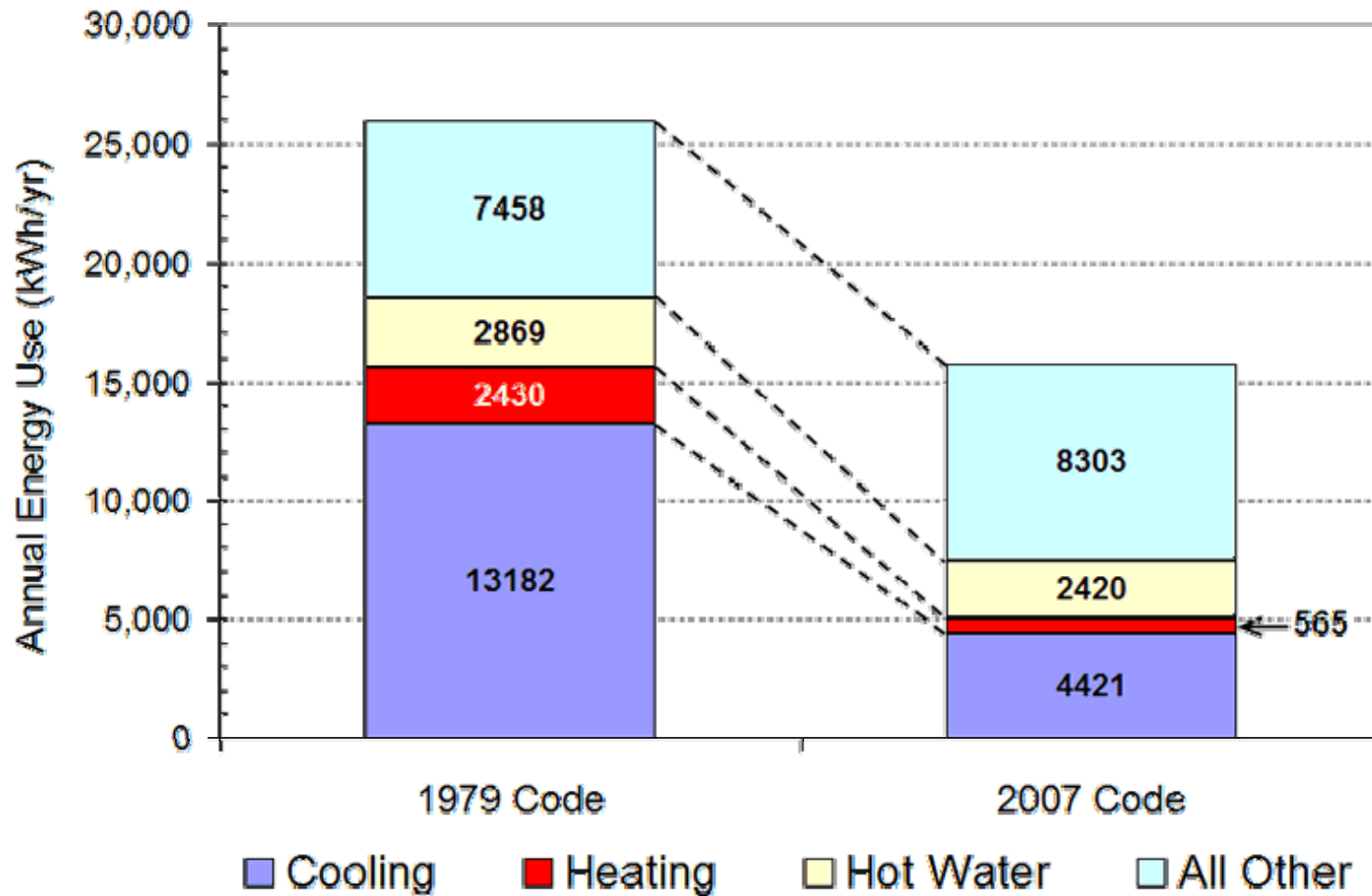




# Overall Code Impact



## Florida Codes & Standards: 1979 - 2007





## *“Beyond Code” Programs*



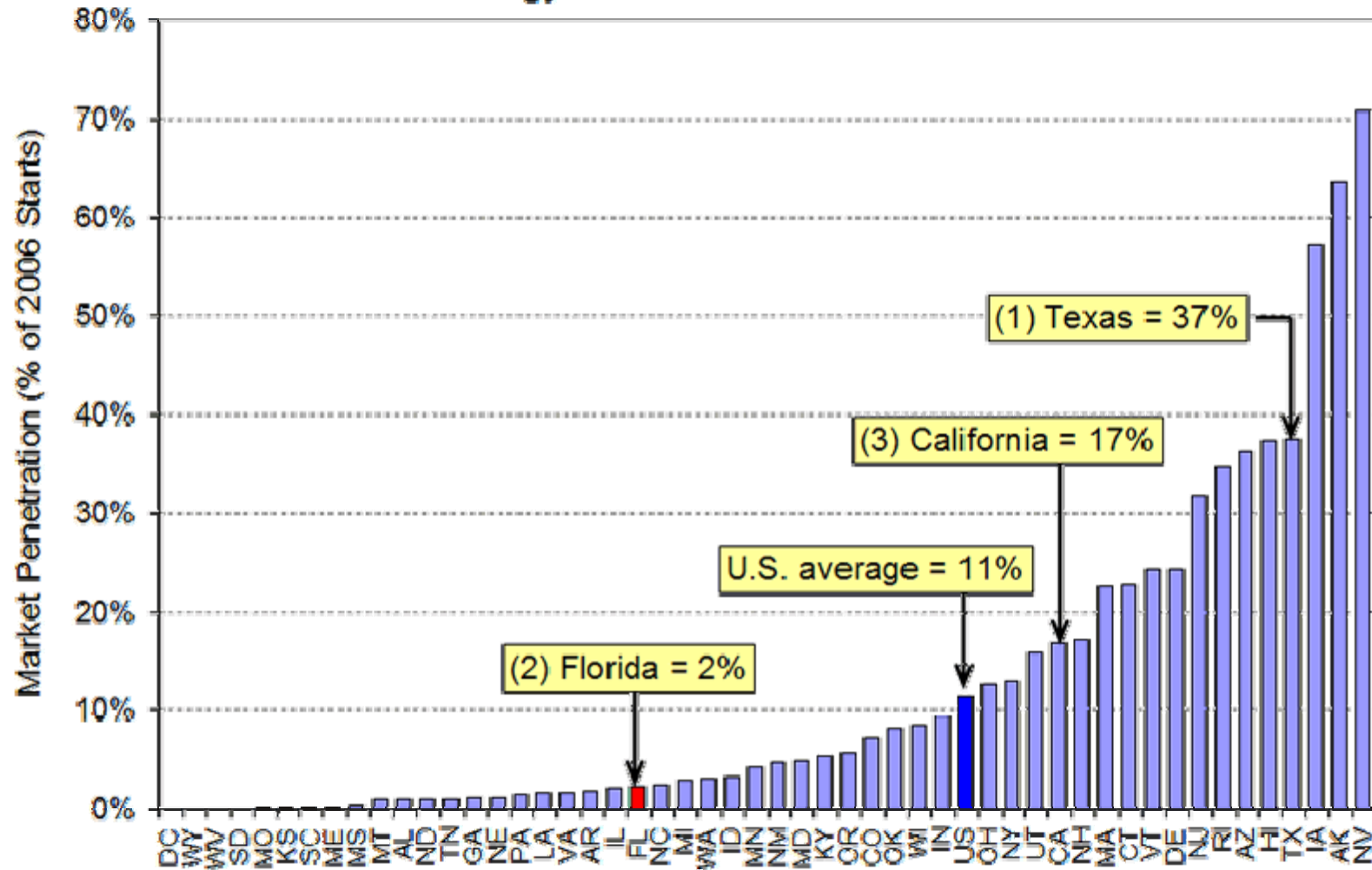
- ❖ **ENERGY STAR® new homes** – U.S. EPA’s “branded” labeling program :
  - Qualification: 15% less whole-home energy use than the “American Standard Home”
  - American Standard Home:
    - Model Code (IECC 2006) envelope attributes
    - NAECA minimum standard equipment
    - RESNET standard lighting and appliances
  - Homes qualify through RESNET-accredited Home Energy Rating Systems (HERS).



# Florida ENERGY STAR



## 2006 Energy Star New Homes Penetration





## *More “Beyond Code”*



- ❖ **EPAct 2005** – Federal income tax credits (IRS Notice 2006-27)
- ❖ \$2000 income tax credit to home builder
- ❖ Qualification: projected heating and cooling energy use 50% less than the American Standard Home
- ❖ Requires RESNET-accredited software to qualify home
- ❖ Requires certified home energy Rater to inspect and test (commission) qualifying homes.



## *“Best Practice”*



- ❖ *Building America* program – U.S. DOE; program aim is to develop technology supporting “Zero Energy Homes” (ZEH)
- ❖ ZEH approach – employ all cost-effective building energy efficiency measures before employing on-site photovoltaic power production
- ❖ This approach used to develop ACEEE “Best Practice” new home package (NH Pkg1).



## *Other “Beyond Code”*



- ❖ Florida utilities new homes programs
  - Approved by FPSC through DSM dockets
  - Usually tiered with significantly less savings than ENERGY STAR at program entry level
- ❖ USGBC LEED certification programs
  - Homes require ENERGY STAR as a mandatory minimum qualification
  - Commercial buildings currently establishing a minimum energy efficiency level
- ❖ Florida Green Building Coalition (FGBC).



## *ACEEE: New Homes*



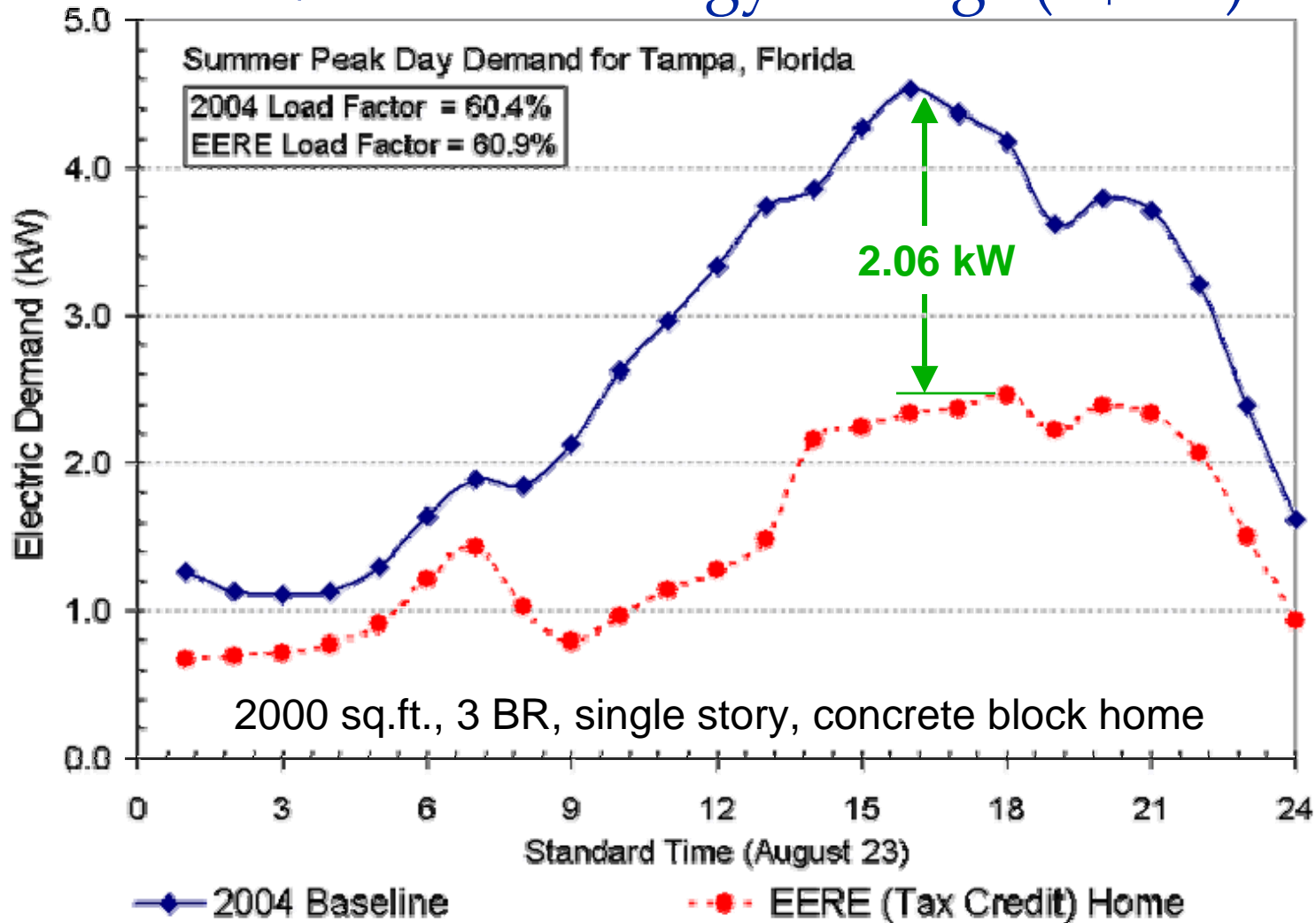
- ❖ Approximately 30 “off-the-shelf” improvement measures evaluated in three Florida climates (Jacksonville, Tampa & Miami)
- ❖ Each individual measure compared against new home Baseline (2007 Code) on whole-home energy use basis
- ❖ Three “packages” developed from results using least-cost analysis methods
  - ENERGY STAR® package (~15% savings)
  - Tax Credit package (~25% savings)
  - “Best Practice” package (~40% savings)



# Off-the-Shelf Technology



40% annual energy savings (~\$630)





## *ACEEE: Costs*



- ❖ Two cost sets developed
  - Baseline feature costs
  - Energy efficient (EE) feature costs
- ❖ Incremental costs = Baseline cost – EE cost
- ❖ Cost source: “2005 RSMeans Residential Cost Data, 24<sup>th</sup> Annual Edition”
- ❖ As modified (normally upward) based on best judgment of authors (i.e. Philip).



## *ACEEE: Economics*



- ❖ Effectively the “Participant Cost Test”
- ❖ Levelized Cost of Conserved Energy (CCE) used as the cost effectiveness metric:

$$\text{CCE} = \text{Net cost of improvement} * \text{CRF}$$

$$\text{where: CRF} = \frac{d \text{ (discount rate = 4.5\%)}}{(1 - (1 + d)^{\text{life in years}})}$$

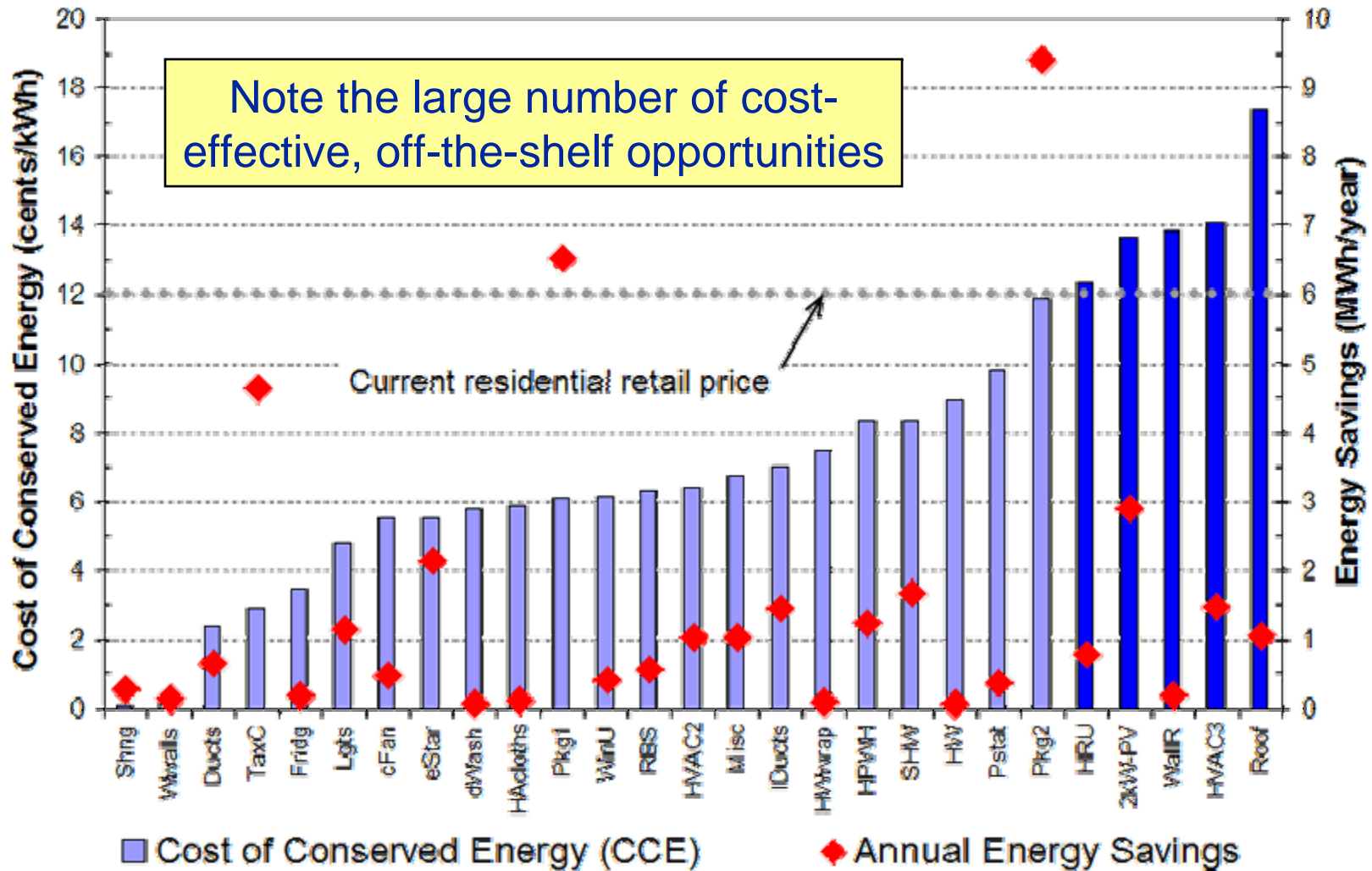
- ❖ Where CCE is less than the retail price of residential electricity, the measure or package of measures is considered cost effective.



# ACEEE: Example Results



EERE Measures for Miami (Sorted by increasing CCE)

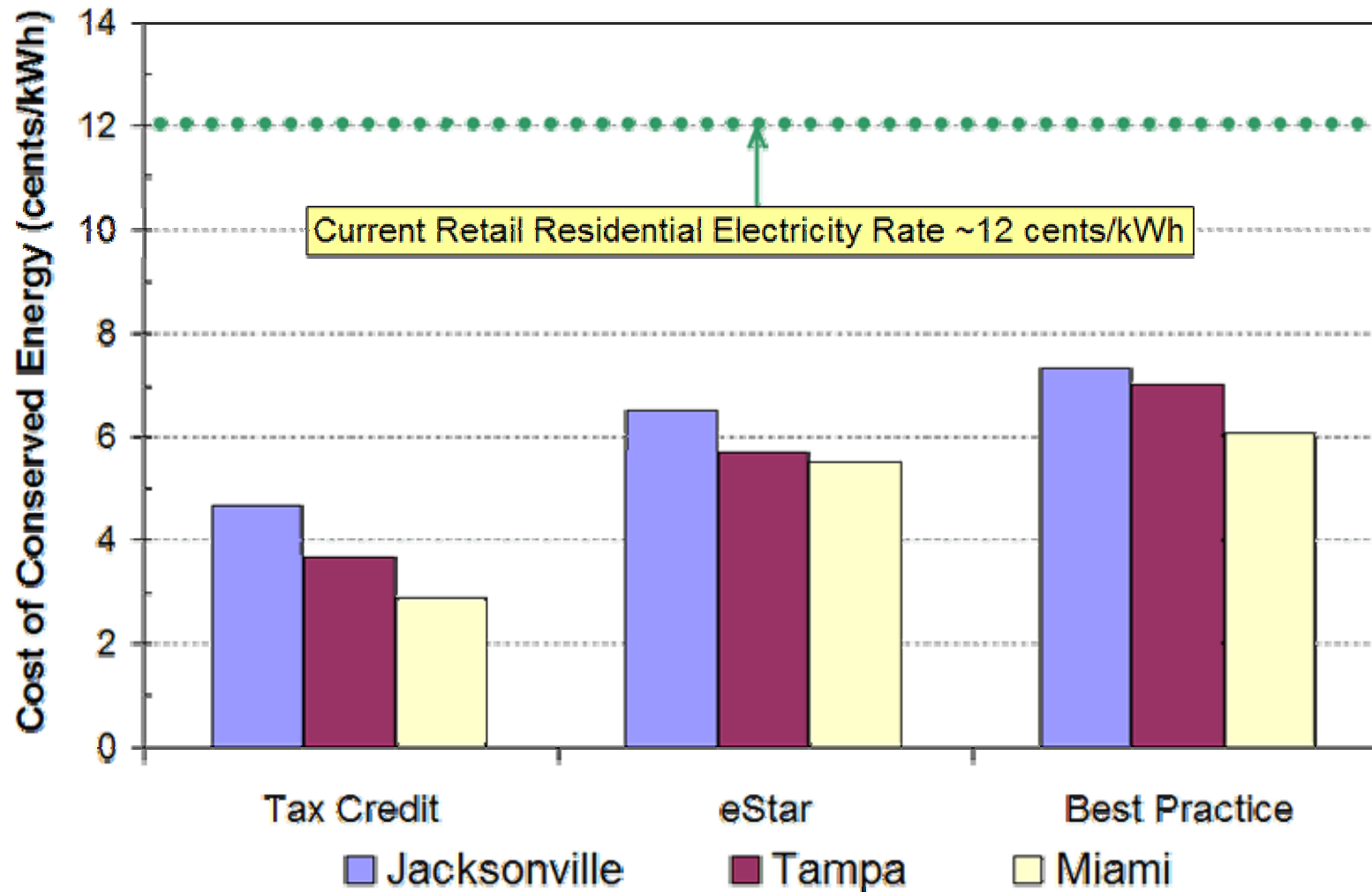




# Cost-Effectiveness



## Levelized CCE for ACEEE Packages in 3 Climates





# *Florida Energy Ratings*



- ❖ *Florida Building Energy Efficiency Ratings Act (§ 553.990 F.S.)*
  - Requires DCA to maintain a statewide, uniform system for rating the efficiency of buildings
  - Administered by FSEC through a no-cost contract with DCA.
- ❖ The method of qualifying for ENERGY STAR homes and Tax Credits homes in Florida
- ❖ FSEC is nationally accredited by RESNET as HERS Provider in Florida for these purposes.



## *What is RESNET?*



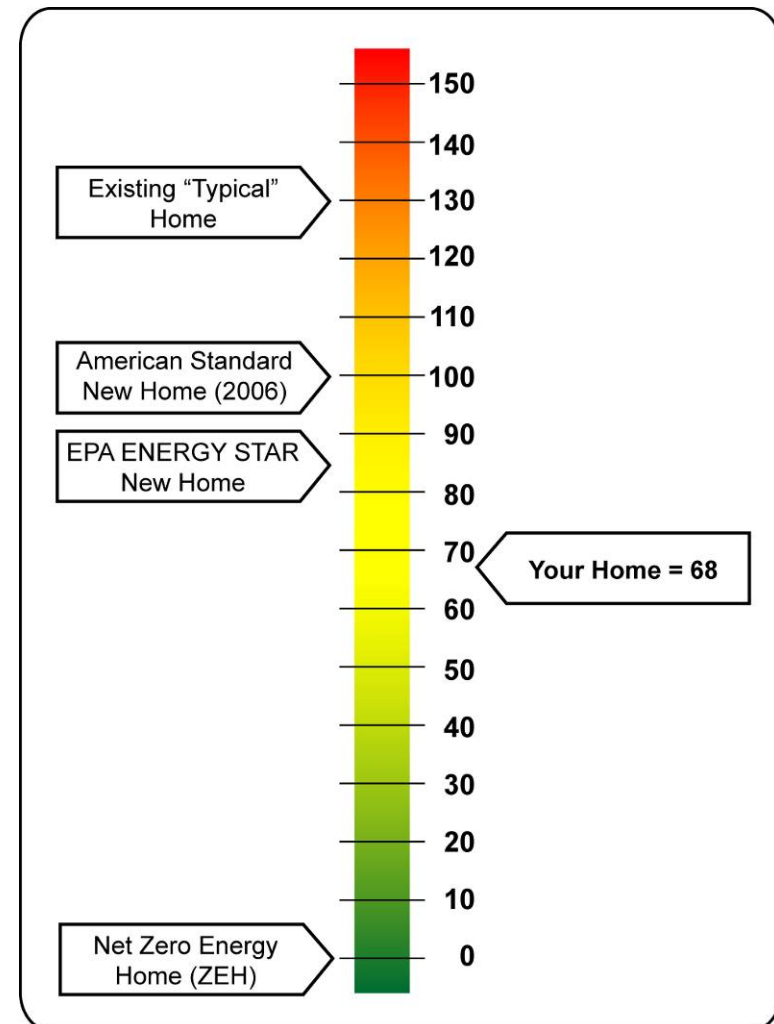
- ❖ Residential Energy Services Network
- ❖ A national, not-for-profit Home Energy Rating Systems (HERS) industry membership corporation [501(c)(3)]
- ❖ The national standards making body for building energy efficiency rating systems
  - HERS Provider Accreditation Standards
  - Training & Certification Standards
  - Quality Assurance Standards
  - Software Verification Standards



# What is the HERS Index?



- ❖ A national energy use index that measures whole-home energy efficiency on a relative scale
  - 100 = The energy use of the “American Standard Home”
  - 0 = No net purchased energy use – the “Zero Energy Home”
- ❖ ENERGY STAR homes have a HERS Index of 85 or lower
- ❖ Widely used in the “Beyond Code” marketplace

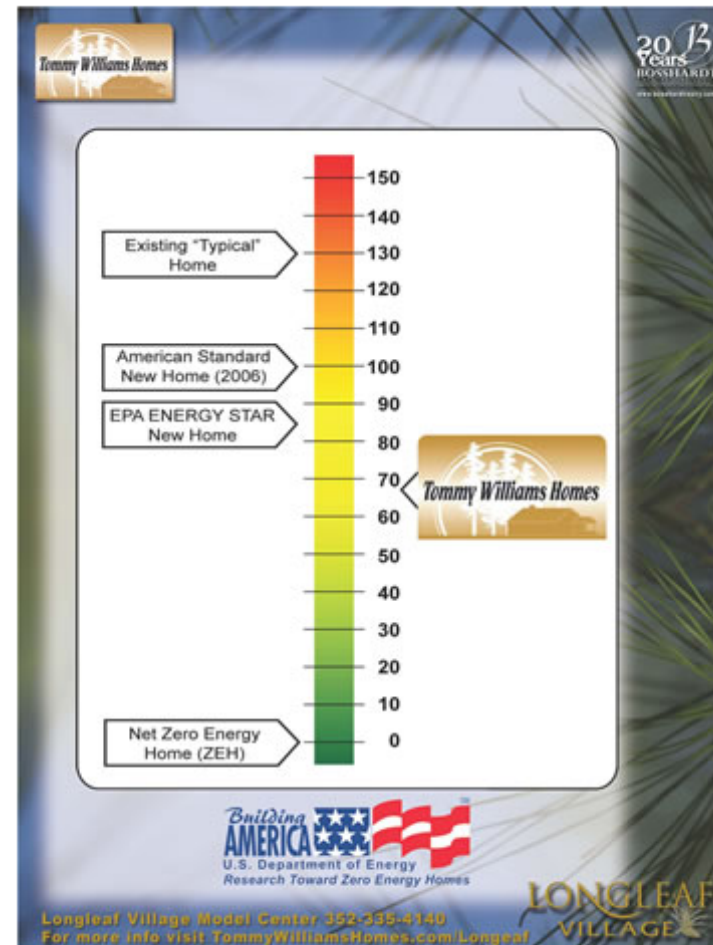




# A Florida Example



- ❖ Two DOE *Building America* program award winners in Florida:
- ❖ G.W. Robinson Builders – more than 300 *Building America* Homes
- ❖ Tommy Williams Homes – more than 100 *Building America* Homes
- ❖ Note the model home counter-top display.





## *HERS Index Importance*



- ❖ It is the national, uniform “yardstick” for home energy performance
- ❖ You know your car’s MPG, why shouldn’t you also know the HERS Index of your largest energy user?
- ❖ **And most important:**

“You can’t manage what you don’t measure.”



## *Where We Stand*



- ❖ Florida's adoption rate of "Beyond Code" building programs is woefully inadequate
  - Only 2% ENERGY STAR home penetration
  - Less than 2% Tax Credit home qualification
- ❖ Good infrastructure capability exists (Florida Energy Efficiency Rating System), but . . .
  - Little to no public awareness due to lack of outreach and public education funding
  - Building industry highly resistant – risk averse
  - Virtually no "push from the top" to encourage "market pull" by consumers.



## *What We Need*



- ❖ “Top down” emphasis on building efficiency
- ❖ Legislation to implement performance-based financial incentive programs for high-efficiency buildings
- ❖ Code revisions that capture “Other” energy uses – could use HERS Index
- ❖ Code revisions that make another “jump” in stringency – e.g. ENERGY STAR level
- ❖ Funding for major consumer outreach and education programs
- ❖ Encourage utility new home programs with higher minimum savings requirements.



# *Web Sites*



FSEC

<http://www.fsec.ucf.edu/>

ENERGY STAR

<http://www.energystar.gov/>

*Building America*

[http://www.eere.energy.gov/buildings/building\\_america/](http://www.eere.energy.gov/buildings/building_america/)

RESNET

<http://resnet.us/>