RESNET
Residential Energy Services Network

Setting the STANDARD for QUALITY

"Ensuring National Consistency"
Federal Tax Credits

2005 RESNET Building Performance Conference
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FLORIDA SOLAR ENERGY CENTER®
Creating Energy Independence

Working in Partnership

- U.S. Department of Energy – Funding
- National Renewable Energy Laboratory (NREL) – Technical lead
- Pacific Northwest National Laboratory (PNNL) – Codes expertise
- Residential Energy Services Network (RESNET) – Consensus building process
- Florida Solar Energy Center (FSEC) – Verification test suites development
- 16-member RESNET Software Verification Committee – Consensus vehicle

Objectives

- Develop software test suites that can be used to accredit software tools used for tax credit qualification
- Create a viable “rule set” – fill the gaps and holes in the IECC 2003 Standard Design specification (Chapter 4)
- Make recommendations to U.S. Department of Energy
  - Test suites and verification criteria
  - Accreditation procedures
  - Exception process

Software Verification Committee

16 Committee Members

Steve Baden
Patrick Bailey
Dennis Barley
Philip Fairey
Dean Gamble
Tom Hamilton
Michael Holtz
Ron Judkoff
Maria Karpman
Ken Nittler
Danny Parker
Paul Reeves
Dave Roberts
Ian Shapiro
Todd Taylor
Bruce Wilcox

Tax Credit “Rule Set”

Numerous “specificity gaps” in Chapter 4, IECC 2003, including:

- Envelope component types, solar absorptance and far-infrared emittance
- Sunroom treatment
- Envelope air exchange rates
- Mechanical ventilation
- Natural ventilation to offset cooling
- Structural mass
- Electric heating systems
- Thermal distribution systems
- Vented crawlspaces

Window Area

Window areas for multifamily homes and homes with conditioned basements are ill-specified by IECC 2003:

- "Strict" interpretation (18% CFA) results in excessive Standard Design window area for homes with conditioned basements
- Proposed conditioned basement window area specification is same as RICC, where window area is discounted by 50% of underground wall area
- Proposed multi-family window area specification is same as HERS standard, where window area is discounted by common wall area.

Air Exchange Rates

- “Build tight and ventilate right” principles
- No testing – must accept default air exchange rate (same as Reference home – nL = 0.57)
- No mechanical ventilation – must maintain minimum annual average natural infiltration rate = 0.35 ach in Rated home
- With mechanical ventilation – may reduce exchange rate to ASHRAE 62.2 minimum for ventilation

$$cfm_{vent} = 0.01 * CFA + 7.5 * (N_{br} + 1)$$

- Ventilation fan energy use budget included in Reference home specification.

“Rule Set” Example (IECC)

Table 404.5.2(1) Specifications for the Standard Reference and Proposed Designs

Component	**Standard Reference Design**	**Proposed Design**
Above grade walls:	Type: wood frame	As proposed
	Gross Area: same as proposed	As proposed
	U-Factor: from Table 402.1.2	As proposed
	Solar absorptance = 0.75	As proposed
	Emittance = 0.90	As proposed

Components Specified

- Above grade walls
- Basements and crawlspace walls
- Above grade floors
- Ceilings
- Roofs
- Attics
- Foundations
- Doors
- Glazing
- Skylights
- Sunrooms
- Air exchange rates
- Mechanical ventilation
- Internal gains
- Internal mass
- Structural mass
- Heating systems
- Cooling systems
- Service hot water
- Thermal distribution systems

New IECC Requirements

- Improved compliance guidance provided for code officials
  - Minimum standard compliance report elements specified
  - Computer generated field inspection checklist required
  - Software tool documentation required
  - Improved software tool specification

Other IECC Requirements

- Computer generation of standard reference design – no user modification allowed
- Calculation of equipment sizing for standard reference design
- Generation of official inspection checklist listing each of the proposed design component characteristics
- Calculations that account for effects of climate and equipment sizing on system performance.

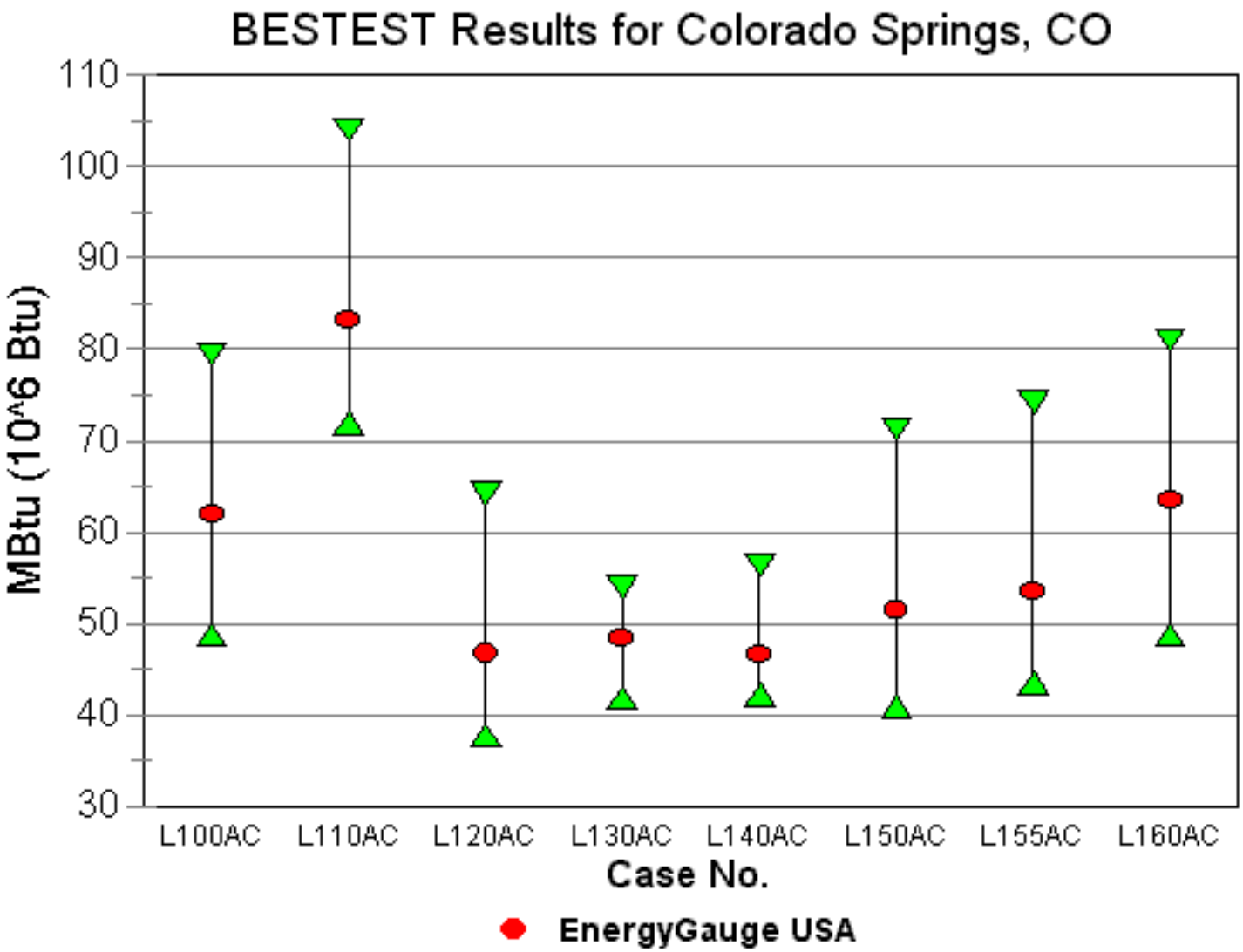
Trends

- Required software tool verification & certification
  - California codes and standards
  - RESNET home energy ratings
  - ASHRAE Standard 90.1 (ECB method)
  - Proposed federal tax incentives
- Required control of user input and required output formats
  - IECC 2004 performance compliance
  - California and Florida codes
  - RESNET home energy ratings

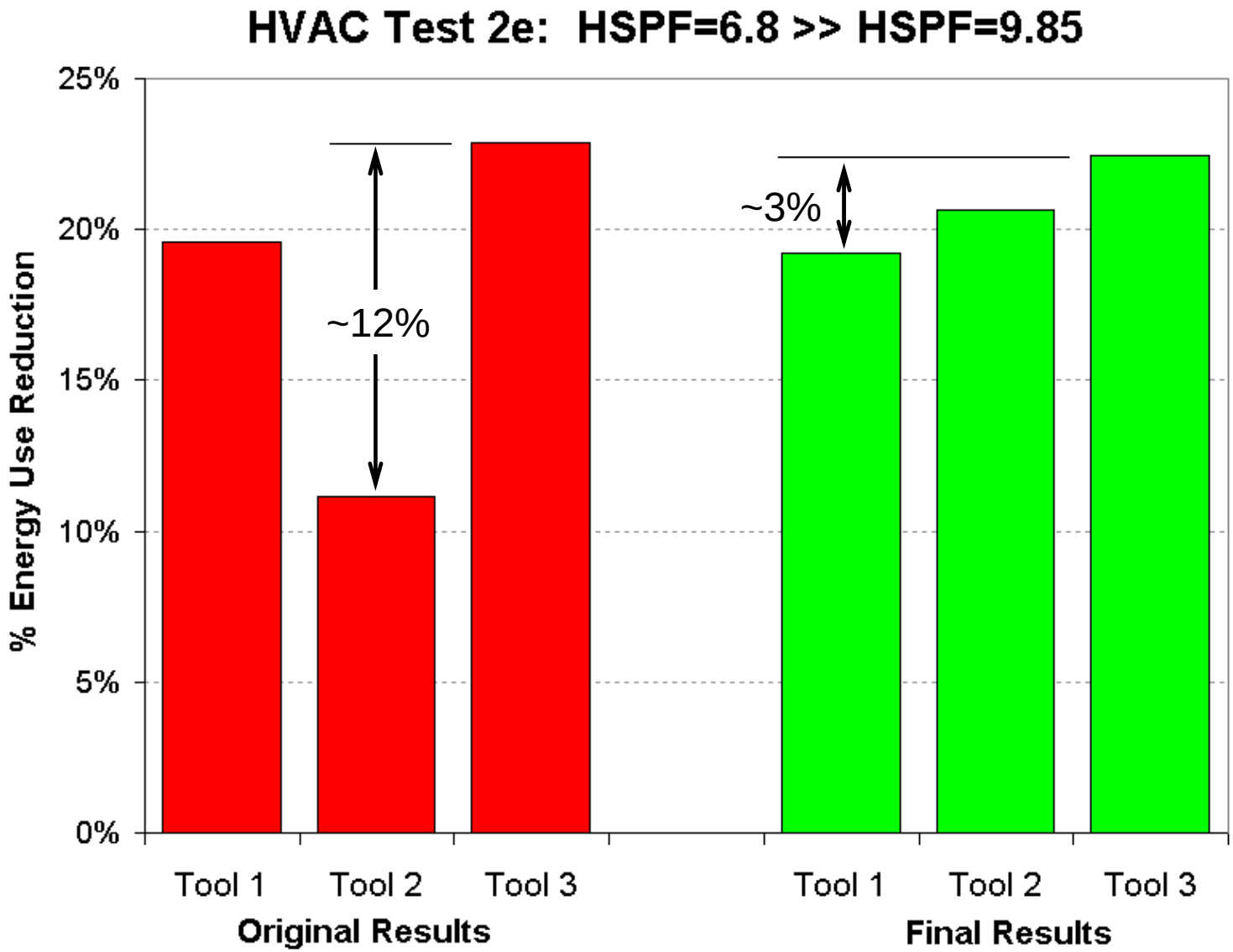
Software Verification

- ASHRAE/ANSI Standard 140
  - IEA BESTEST
  - HVAC BESTEST
  - HERS BESTEST (proposed)
- California Alternative Compliance Manual (ACM) – Title 24 specific
- RESNET – HERS BESTEST plus
  - Reference home auto-generation (required)
  - HVAC performance (proposed)
  - Distribution system efficiency (proposed)
  - Scoring method (proposed)

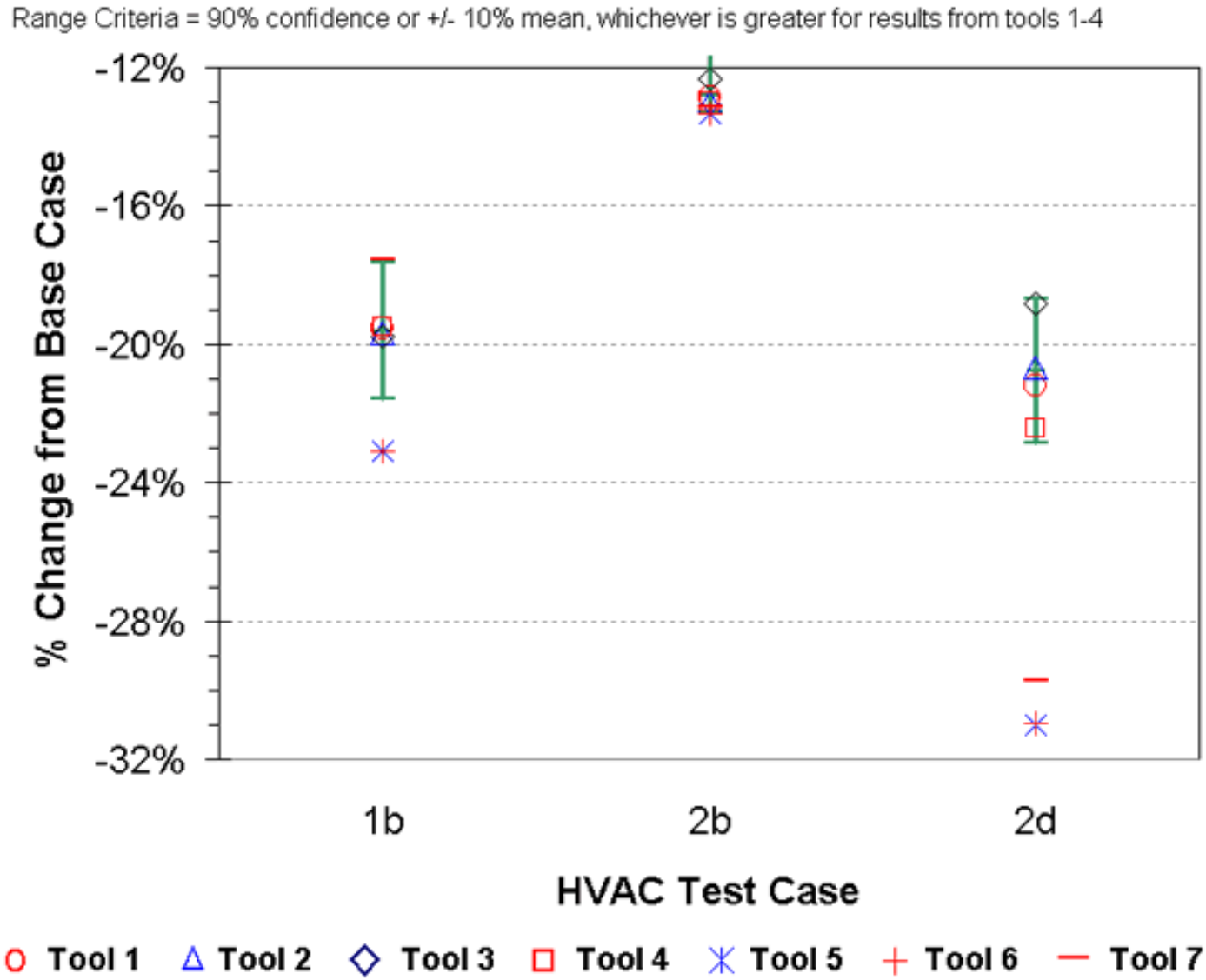
HERS BESTEST



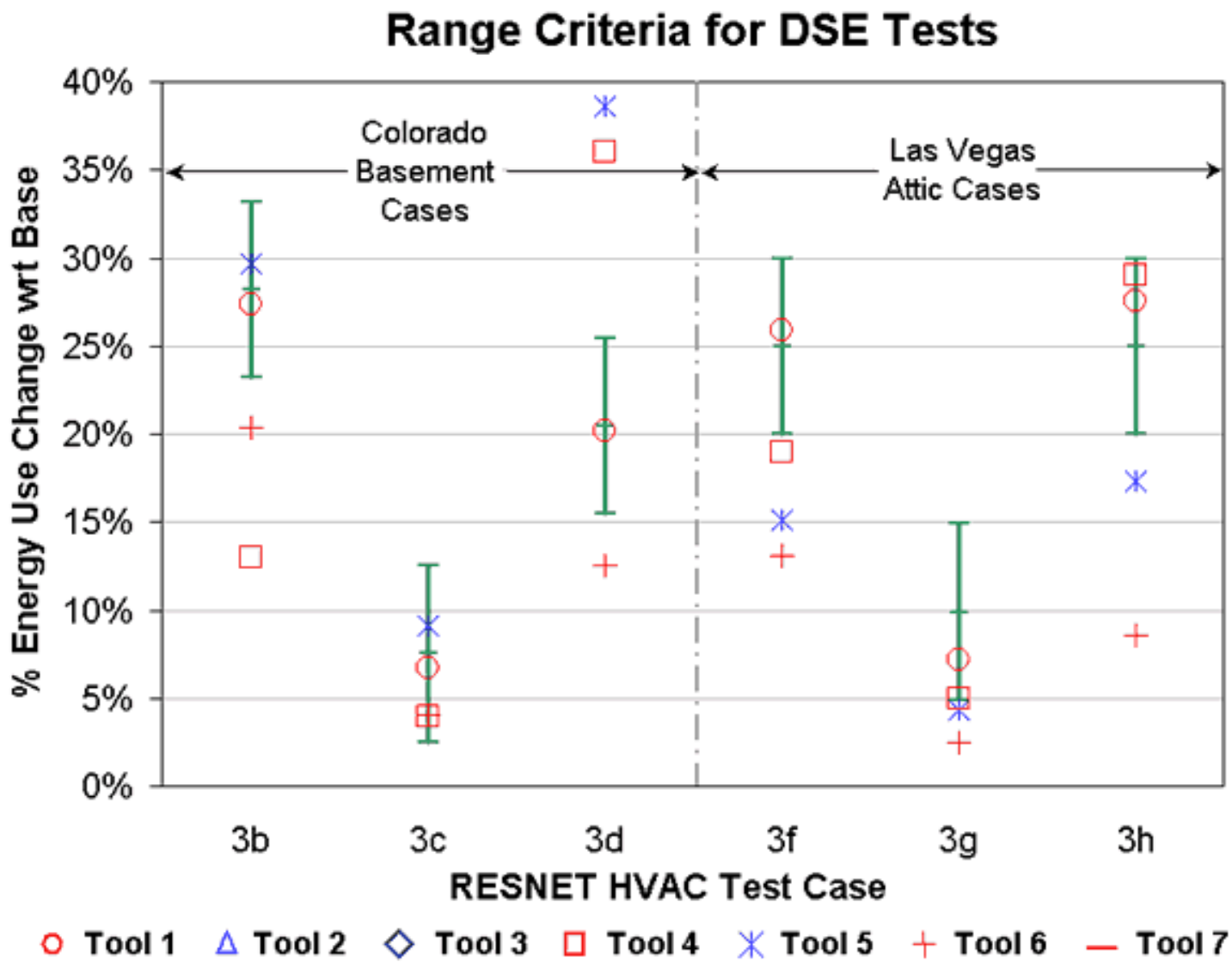
HVAC Tests – Then and Now



HVAC Tests


Range Criteria = 90% confidence or +/- 10% mean, whichever is greater for results from tools 1-4
-12%
-16%
-20%
-24%
-28%
-32%
% Change from Base Case
1b
2b
2d
HVAC Test Case
Tool 1
Tool 2
Tool 3
Tool 4
Tool 5
Tool 6
Tool 7

DSE Tests


Range Criteria for DSE Tests
Colorado Basement Cases
Las Vegas Attic Cases
% Energy Use Change wrt Base
40%
35%
30%
25%
20%
15%
10%
5%
0%
3b
3c
3d
3f
3g
3h
RESNET HVAC Test Case
Tool 1
Tool 2
Tool 3
Tool 4
Tool 5
Tool 6
Tool 7