## The BESTEST Method for Evaluating and Diagnosing Building Energy Software

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## The RESNET Guidelines

- HERS BESTEST is the method cited for certifying HERS software.
- HERS BESTEST is part of a suite of software verification methods.
- ASHRAE is adopting these methods as ANSI/ASHRAE Standard Methods of Test.

## HUH?!

- There are hundreds of building energy modeling programs.
- HERS Providers have difficulty knowing which programs are reliable and best suited for their needs.
- Lenders want assurance that predicted energy savings will be achieved.
- DOE/NREL and IEA maintain a research effort in this area to increase industry confidence in simulation.

# What is HERS BESTEST?

- A set of carefully defined test cases with simplified geometry.
- Tests the results from any HERS model against DOE-2.1E, BLAST & SERIRES.
- These are the most advanced public domain whole-building energy simulation programs in the US.
- They have been subjected to a number of validation studies through the IEA.

## Capabilities of the BESTEST Procedures

Comparative Test Procedure	Algorithms Tested Bldg. Mech.		Appropriate Software Type	
	Env.	Equip.	Detailed	Simplified
IEA BESTEST	Yes	Limited	Yes	Limited
ASHRAE Standard 140P	Yes	Limited	Yes	Limited
HERS BESTEST	Yes	No	Yes	Yes
Florida – HERS BESTEST	Yes	No	Yes	Yes
HVAC BESTEST	No	Yes	Most	No

Validation Test Matrix For SMOT140				
	Envelope Tests	HVAC Tests		
Analytical	- RP 1052 (TC4.7) - IEA22	- RP 865 (TC4.7) - HVAC BESTEST		
Comparative (BESTEST)	- SMOT 140P/IEA BESTEST - HERS BESTEST	- HVAC BESTEST		
Empirical Data Sets	- BRE/DMU - EDF/BRE - Empirical BESTEST - PASSYS	. IEA22/lowa ERS		



## **HERS BESTEST Test Features**

#### • Tier 1 (General)

 Infiltration; Wall and ceiling R -values; Window properties, area orientation and shading, Internal gains; Exterior surface color; Energy hog case; Crawl space; Insulated and uninsulated slabs and basements.

### • Tier 2 (Passive Solar)

- Solar gains; Mass variation; Window area, orientation and shading with high mass.

#### Input equivalence as in IEA BESTEST





## NRCan & FSEC BESTEST CONCLUSIONS

### NRCan (HOT2000)

- Fixed: Allowable thermostat inputs, mass/internal gains
  interaction
- Use IEA BESTEST for detailed diagnostics
- HERS BESTEST is part of NRCan standard procedure for checking revisions to HOT2000

#### FSEC (EnGauge)

- Fixed Raised Wood Floor and slab Multipliers
- Developing "EnergyGauge" with DOE2 engine
- FSEC/FEO recommend incorporating BESTEST into Florida's building code and HERS

## **HVAC BESTEST Test Features**

- Direct testing of sensitivity to:
  - Indoor Drybulb Temperature
  - Outdoor Drybulb Temperature
  - -Internal Gains (Sensible, Latent)

### • Systematic variation of internal gains tests:

- -Part Load Ratio
- -Sensible Heat Ratio
- Wet and Dry coils
- Full-load test at ARI rating conditions

## **Conclusions & Recommendations**

- BESTEST approved as ASHRAE SMOT, and adopted by IEA
- BESTEST adopted by RESNET Guidelines
- BESTEST helping to improve software throughout the world
- BESTESTing a program is relatively easy
- Software used for approving houses for tax credits should be certified in accordance with the RESNET Guidelines (based on BESTEST)