

### Three Years of Evaluating HERS Ratings in the Lone Star State

### The TXU Electric Delivery ENERGY STAR<sup>®</sup> Homes Program's Quality Assurance and Quality Control Process

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## Today's Agenda

TXU Electric Delivery ENERGY STAR Homes Program (TXU ED ESHP):

- A. Background
- B. History

### QAQC Program:

- A. Planning
- B. Implementation
- C. Analysis and Results
- D. Corrective Action Plan
- E. Corrective Action Plan at Work
- F. Trends
- G. Challenges
- H. Conclusions



## **TXU ED ESHP: Background**

Passion. Expertise. Results.

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Program Year	Significant Events	
2001	<ul> <li>Introduced pilot program</li> </ul>	
2002	<ul> <li>Created competitive, market-based HERS rating infrastructure</li> </ul>	
2003	<ul> <li>Achieved rapid expansion of program and rating industry</li> </ul>	
2005 - 2006	<ul> <li>Expanded program into other regions</li> </ul>	
	<ul> <li>Strengthened market for ENERGY STAR qualified homes and HERS industry</li> </ul>	





#### Annual Delivery of ENERGY STAR Certificates and Partner Participation







Overview of HERS Rating Infrastructure:

- More than 5 years old
- Rapid growth during four year period (1 to 15 companies)
- Many new to the home energy rating business

Success of program and rapid growth of rating infrastructure lead to certain questions:

- How are raters performing?
- Are they following RESNET standards?
- Are the homes truly meeting ENERGY STAR performance specifications?





#### Program responses:

- Established Texas Home Energy Rating Organization (Texas HERO):
  - Non-profit, industry association
  - Facilitates discussion on standards and best practices
  - Provides continuing education/training
  - Represents interests of HERS rating companies in TX
- Implemented QAQC Process



### **QAQC** Process: Goals



## **Goals of the QAQC Process**

- 1. Validate the accuracy of the information reported to the Program by participating HERS Raters;
- 2. Confirm the data used by TXUED to calculate predicted kW and kWh savings reported to the PUCT; and
- 3. Help strengthen the ENERGY STAR for homes brand and the integrity of the HERS rating industry in the region.



### **Objectives to Achieve Goals**

- A. Verify RESNET standards for home ratings are being followed by accredited HERS Raters;
- B. Identify areas of inconsistencies and misinterpretations;
- C. Establish continuous feedback loop and facilitate corrective actions; and
- D. Encourage Texas HERO and RESNET to adopt best practices and industry standards.



### **QAQC** Program: Implementation





- A systems approach to verify quality and assurance
- Based on:
  - 1. Deming model of Plan, Do, Check, Act
  - 2. ISO 14000: Environmental Management Systems





## Methodology

- 1. Determine acceptable variances;
- 2. Generate sampling protocol;
- 3. Collect necessary data from actual building plans and on-site inspections of tested and batched homes;
- 4. Generate *worst-case* QAQC results and compare to data generated and reported by HERS Raters;
- 5. Identify discrepancies and conduct further analysis to determine cause(s);
- 6. Share results with Texas HERO, rating providers and EPA and RESNET when necessary; and
- 7. Develop corrective action plans to achieve continuous improvements in HERS rating process and industry.



Methodology

Acceptable variances for the QAQC program (as agreed to by TXU ED, Texas HERO, and ICF):

HERS score +/- 0.5 point
IECC score +/- 3%

Note: Dual metric for ENERGY STAR for homes in Texas during 2004 – 2006 due to adoption of IECC in 2003.



## **Sample Generation**

- Includes all raters participating in the Program (midyear entries not included)
- Priorities:
  - 1<sup>st</sup>: proportionate to rater participation
  - 2<sup>nd</sup>: proportionate to builder participation
- Sample goal: 300 homes (~2% of total homes delivered to Program each year.)
  - 50% batched
  - 50% tested



**Data Collection** 

Data collected from HERS rating providers:

- Final *REM/Rate* files with "confirmed" HERS score; and
- Building plans.



### Implementation: Data Collection

Data collected by third party during on-site verification of *tested* and *batched* homes:

- Home location
- Number of stories
- Foundation type
- Home orientation
- Predominant exterior wall color
- Total duct leakage
- Duct leakage to the outside
- Whole house infiltration value from blower door test
- Blower door metric used

- Presence of radiant barrier
- Presence of p-stat
- Predominant window frame type and number of panes in windows
- HVAC coil and condenser brand, model, and serial number
- Qualitative assessment of attic insulation installation and HVAC installation quality
- Photograph of front orientation

Note: On-site verification was performed at least 72 hours after raters' final test



# QAQC Process: Analyses and Results



## **Analyses and Results**

### **ENERGY STAR Performance Verification:**

- A. HERS Score Analysis
- B. Percent Savings Above IECC Analysis

### Additional Analyses Conducted:

- A. SEER Analysis
- **B.** Attic Insulation Analysis
- C. Number of Stories Comparison
- D. Square Footage Comparison
- E. HERS Score Comparison



HERS Score Analysis compares the QAQC verified HERS score, *REM*/Rate file HERS score, and the HERS score submitted to the Program via online system

Discrepancy: any home which failed to reach an acceptable HERS score as verified by the QAQC Program

- Score of 86 in 2004-2005
- Score of 87 in 2006 (only paid incentives on HERS score of 87 or above)

<u>Failure</u>: any Discrepancy outside the acceptable +/- .5 HERS score variance



### **Results : HERS Score Analysis**

	Discrepancies	Failures	Passing Rate
2004	18	16	94.50%
2005	3	1	99.70%
2006	16	4	98.70%



### Analyses : Percent Savings Above IECC Score Analysis

### Percent Savings Above IECC Analysis compared the QAQC verified IECC score, *REM*/Rate file IECC score, and the online system IECC score

<u>Discrepancy</u>: any home which failed to reach a score of 15% more efficient than IECC as verified by the QAQC Program

<u>Failure</u>: any Discrepancy outside the acceptable +/- 3% IECC variance



### Results : Percent Savings Above IECC Score Analysis

	Discrepancies	Failures	Passing Rate
2004	31	22	92.40%
2005	7	2	99.30%
2006	9	2	99.40%



### **Results: ENERGY STAR Performance Verification**

	Number of homes that did not meet ENERGY STAR qualifications	Passing Rate
2004	22	92.40%
2005	2	99.30%
2006	4	98.70%



### Analyses and Results: SEER Analysis

# **SEER Analysis** compared the ARI SEER to the online system SEER

	Non ARI Matches	Average ARI SEER	Average Rater Reported SEER	Average Difference
2004	n/a	11.76	11.79	-0.03
2005	36	12.23	12.02	0.21
2006	78	12.7	12.3	0.4



### Analyses and Results: Attic Insulation Analysis

Attic Insulation Analysis tracked the number of homes that did not have attic insulation at the time of inspection

	Homes with no Attic Insulation	Percent Flag Rate
2004	14	4.84%
2005	2	0.68%
2006	1	0.30%



### Analyses and Results: Number of Stories Comparison

- Included during the 2006 QAQC Process
- Number of stories were gathered from the following sources:
  - QAQC verified value
  - Onsite verification
  - Raters' REM/Rate file
  - Online system
- Number of homes with inconsistent number of stories: 26 or 9.85%. For 18 of the homes, all values were consistent except for the value reported in the online system.
- Difference between average QAQC verified number of stories (1.318) and average online system reported number of stories (1.337) is: -.019 stories



### Analyses and Results: Square Footage Comparison

- Included during the 2006 QAQC Process
- Square footage was gathered from the following sources:
  - QAQC verified value
  - HERS raters' REM/Rate file
  - Online system
- Number of homes with different floor areas in *REM*/Rate file and the Program online system: 90 or 34.1%
- Number of homes with 100 ft<sup>2</sup> or greater discrepancy between *REM*/Rate file and QAQC verified value: 5.8%
- Difference between average QAQC verified square footage (1953.0) and average online system reported square footage (1964.9) is: 11.9 square feet



### Analyses and Results: HERS Score Comparison

- Included during the 2006 QAQC Process
- HERS scores were gathered from the following sources:
  - QAQC verified value
  - Raters' REM/Rate file
  - Online system
- Number of homes with different HERS scores in the *REM*/Rate files and the Program's online system : 163 or 61.7%



## QAQC Process: Corrective Action and Continuous Improvements



### **Corrective Action Plan**

- 1. Present initial findings and observations to Texas HERO and stimulate dialogue to clarify assumptions used by rating providers;
- 2. Identify rating providers with the greatest inconsistencies based on the QAQC process results;
- 3. Meet with rating providers individually to review results, discuss causes of inconsistencies, and develop a corrective action plan;



### **Corrective Action Plan**

- 4. Monitor rating providers' progress concerning specific inconsistencies;
- Present final results and recommendations to TX HERO and encourage the adoption of industry standard or best practices; and
- 6. Discontinue accepting certificates for ENERGY STAR qualified homes from rating providers who continuously deliver inconsistent results, even after intervention.



## **Corrective Action Plan at Work**

2004	8% of homes failed to meet ENERGY STAR qualifications		
Issue	Action Taken	Result	
14 homes lacked attic insulation at time of inspection	<ul> <li>Discussed findings with TX HERO</li> <li>Improved home verification scheduling (72 hour window)</li> </ul>	The issue has virtually disappeared	
Roughly one third of the homes used inconsistent climate zone for analysis	<ul> <li>Discussed findings with RESNET, TX HERO</li> <li>Increased the awareness of climate zone usage and the selection of correct weather files to use in plan analysis and software modeling</li> <li>Track rating providers' climate zone usage</li> </ul>	<ul> <li>Standard practices were established by TX HERO and RESNET clarified language in specifications</li> <li>No longer an issue</li> </ul>	
Result		Passing rate increased from 92% in 2004 to 99% in 2006	



## **Corrective Action Plan at Work**

2005	1% of homes failed to meet ENERGY STAR qualifications		
Issue	Action Taken	Result	
Many raters did not enter valid coil and condenser data for HVAC systems	<ul> <li>Discussed findings with TX HERO</li> <li>Discussed with raters and providers with greatest failure rates</li> </ul>	<ul> <li>Issue has somewhat improved</li> <li>However, still a minor issue</li> </ul>	
There was a discrepancy between HERS scores reported online and final REM/Rate files	<ul> <li>Discussed findings with TX HERO</li> <li>Discussed with raters and providers with greatest failure rates</li> </ul>	<ul> <li>Issue has somewhat improved</li> <li>However, still a minor issue</li> </ul>	



## **Corrective Action Plan at Work**

2006	2% of homes failed to meet ENERGY STAR qualifications		
Issue	Action Taken	Result	
Many homes did not have a valid ARI SEER match	<ul> <li>Discussed findings with TX HERO</li> <li>Redesigned online system to require ARI reference number upon submission of home</li> </ul>	TBD	
A large percentage of homes had a different floor area reported in the REM file, online system and the QAQC calculated floor area	<ul> <li>Discussed findings with TX HERO</li> <li>Working with TX HERO to establish acceptable variance for floor area</li> <li>New RESNET standards should address</li> </ul>	TBD	



# QAQC Process: Trends and Challenges



## **Trends & Challenges**

### For the Rating Industry:

- Raters are generally following RESNET standards.
  - Discrepancies typically result when there are ambiguities in standards that lead to misinterpretations.
- The efficiency of equipment is <u>NOT</u> being verified in the field.
  - However, efficiency levels used in ratings are almost always conservative.
- There seems to be a difference between the actual number of stories of a completed home and the stories used in energy modeling.
  - Need to evaluate more to determine cause.
- The EPA sampling protocol is working.
  - Batched homes are meeting ENERGY STAR specifications.



### **Trends & Challenges**

### For Sponsors of Regional Programs:

- Almost all raters participating in the utility sponsored program enter homes at the last minute.
  - This makes it very difficult to evaluate homes and implement timely corrective actions.
  - Also, leads to.....
- Often times the REM/Rate files used to generate the final home energy rating does not match the data submitted the Program.
  - Important to streamline data collection process to reduce potential for data reporting errors.
  - Look for ways to encourage and reward frequent transfer of data and reporting by raters to the program.
  - Important to use conservative energy savings estimates.



### Conclusions

# The Systems-Based QAQC Process Has Been Effective In:

- Validating information reported by HERS Raters;
- Verifying peak energy demand and savings;
- Strengthening the HERS rating industry;
  - Improving the quality of home energy ratings;
  - Influencing positive changes in the national RESNET guidelines;
  - Establishing industry standards and best practices; and
- Improving the design and implementation of the TXU Electric Delivery ENERGY STAR Homes Program.



# Thank You.

# **Questions?**