Results of the Electronic Vote of the RESNET Board of Directors on Results of Electronic Vote on A Procedure for Conducting and Documenting Worst-Case Analysis

The following are the results of the electronic ballot of the RESNET Board on the Results of Electronic Vote of Board on A Procedure for Conducting and Documenting Worst-Case Analysis :

1. Shall the RESNET Board of Directors adopt the Attached August 24, 2006 draft of A Procedure for Conducting and Documenting Worst-Case Analysis To Develop Acceptable Efficiency Packages that Meet or Exceed Residential Energy Efficiency Program Thresholds submitted by the RESNET Technical Committee?

Yes (16)	No (3)	Abstain (0)	Not Voting (2)
Ben Adams	Eric Borsting	`	Ken Fonorow
Steve Byers	Michael Holtz		Thomas Hamilton
Richard Faesy	Gayle Sampson		
Philip Fairey			
David Goldstein			
Bruce Harley			
Mark Jansen			
Galo LeBron			
C.T. Loyd			
Joe Lstiburek			
Greg Nahn			
Lee O'Neal			
Kelly Parker			
Doug Walter			
Daran Wastchak			
David Wilson			

The motion passed.

**A Procedure for Conducting and Documenting Worst-Case Analysis
To Develop Acceptable Efficiency Packages that Meet or Exceed
Residential Energy Efficiency Program Thresholds**

**A Proposal to RESNET Board From the Technical Committee
Bruce Harley, Chair**

This document defines a procedure, known as worst-case analysis, that Certified Home Energy Raters can use in performing analyses to demonstrate threshold compliance with a specified residential energy efficiency program consistent with the *2006 Mortgage Industry National Home Energy Rating Systems Standards (RESNET Standards)*. This worst-case analysis procedure can be used to develop energy efficiency measure packages, applicable to homes that share common architectural characteristics and climates.

Definitions:
 Package (or Package) – A comprehensive set of specifications for energy efficiency features and architectural characteristics that will ensure threshold compliance with a specified residential energy efficiency program level of energy performance.

Energy Efficiency Features – Components of a home that can be defined independently of house architectural characteristics, including but not limited to component insulation values and installation grades, equipment efficiencies, window U-values and Solar Heat Gain Coefficients (SHGCs), infiltration and mechanical ventilation system rates, duct leakage and insulation values, thermostat types, and lighting and appliance efficiency levels.

Architectural Characteristics – The basic definition of a home's physical configuration such as number of stories, foundation type, perimeter, conditioned floor area, window area and distribution, orientation, wall and ceiling type and area.

Section 1 -   Efficiency Package Development Guidelines
    A. Packages shall be developed using software that has been accredited by RESNET to meet the requirement of RESNET Publication No. 06-002, *Procedures for Verification of RESNET Accredited Software Tools*. These software are listed at www.resnet.us/programs/software/directory.htm.

    B. In general, any limitations that are applied to building designs or climate during modeling shall be specified as limitations to the applicability of the Package(s).

    C. Each individual Package of energy efficiency features shall be developed using the following architectural characteristics:
            1. Window glazing distribution shall be 50% on the Front Elevation, 25% on the Back Elevation, 12.5% each for Left and Right Elevation (as a default). This distribution may be altered to represent a less

advantageous case, provided it is specified in the Package criteria, and justified by a sensitivity analysis of the specified glazing distribution limits.

2. The aspect ratio (length to width) of the modeled structures shall be 2:1 (although other ratios may be used in addition), and the interior ceiling height shall be 8 feet above the finished floor.

3. Front elevation shall face the orientation that results in the greatest energy use among north, northeast, east, southeast, south, southwest, west and northwest orientations.

4. For Packages that apply to a specified range of window to floor area ratios, the largest allowed window to floor area ratio shall be modeled. If skylight area is allowed by the Package, then the maximum allowable skylight area shall be explicitly modeled. In all cases, skylight area shall count towards the maximum allowable window area in the Package.

5. The climatologically most representative TMY2 or equivalent weather data shall be used, which may be interpolated between climate sites if interpolation is established or approved by RESNET and is consistent for all HERS providers operating within a state or region. Because a Package is designed for use within a specified geographic area, at a minimum, every available TMY2 site (as noted above) represented within this area shall be used for the analysis. (See http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/State.html for a listing of TMY2 sites).

6. For Packages that apply to a range of house sizes, at least three house sizes shall be modeled: the smallest size allowed (but not less than 750), the largest size allowed and the mean of these two sizes..

7. For Packages that apply to both single story and multi-story applications shall be modeled using both one- and two-story house configurations.

8. For Packages that apply to multiple foundation types (e.g., vented crawlspace, unvented crawlspace, unconditioned basements, conditioned basements, and slab on grade) all applicable foundations shall be modeled.

9. For Packages that apply to multiple wall types (e.g., 2x4 wood frame, 2x6 wood frame, concrete, steel studs, structural insulated panels [SIPs], insulated concrete forms [ICFs]), all applicable wall types shall be modeled, including framing depth, framing factor and insulation grade.

10. For Packages that apply to multiple ceiling or roof types (e.g., wood frame or truss, steel frame, SIP) all applicable ceiling types shall be modeled. For Packages that specify reduced nominal R-values for cathedral ceiling areas, the maximum square footage (or surface area percentage) of cathedral ceilings as applicable shall be modeled, including framing depth, framing factor and insulation grade.

11. Ventilation Systems – if systems are required by programs, applicable building codes, or specified in the efficiency Package, they must be included in the modeling, including type (exhaust or supply only, or heat or energy recovery with minimum specified recovery efficiencies.) The type of system required by the Package that results in the greatest energy use shall be used.

All applicable architectural characteristics listed above must be modeled with the proposed Package of energy efficiency features. For every configuration, the calculated energy use must be equal to or less than the specified program threshold. If the threshold is not met, the energy efficiency features must be improved or the architectural characteristics must be further constrained until every modeled configuration meets the specified threshold.

Section 2 -   Minimum Parameters to be Defined For A Package

All Packages must define the following parameters:
- Energy efficiency features:
    - Maximum window U-value
    - Minimum and maximum window SHGC
    - Maximum allowance for decorative glass, expressed as a % of floor area
    - Minimum nominal insulation R-value for full attics, cathedral ceilings, exterior walls, floors over unconditioned/exterior spaces, exterior doors, and rim joists; and required insulation grade, framing dimensions, and framing factor (as applicable) for all of those assemblies.
    - Required equipment types and fuel types for heating and cooling equipment.
    - Minimum equipment efficiencies for heating equipment and cooling equipment
    - Maximum allowed infiltration rate shall be defined in measured leakage units normalized to building size (generally ACH50, CFM50 per square foot of floor or envelope area, or as specific leakage area [SLA – leakage area per square foot conditioned floor area]).
    - Maximum allowed duct leakage rate to the outside shall be defined in measured leakage units normalized to conditioned floor area (CFA) as cfm25/CFA..
    - Minimum duct insulation R-value
    - If applicable, the required location of ducts and/or mechanical equipment
    - If applicable, the required use of a radiant barrier.
    - If applicable, active ventilation equipment type and efficiency.
    - If applicable, Lighting and appliance efficiency requirements, (if minimum efficiency levels are specified, use program minimums; otherwise use the RESENT HERS defaults).
    - If applicable, HVAC sizing limitations.
    - In general, all features of the home that are considered in the rating procedures, shall be specified in the Package (as modeled); for any feature

that is not specified, the modeling shall include the characteristics of that feature that results in the greatest energy use.

- Limitations on Architectural Characteristics:
  - o Applicable foundation types
  - o Applicable number of stories
  - o Maximum window area
  - o Maximum percent of window area that can be located on adjacent walls (e.g., 62.5% if default worst case orientation is used in the analysis in C.1. above)
  - o Minimum and maximum square feet of conditioned space
  - o Maximum square feet of cathedral ceiling area
  - o Wall type

- A list of the geographical locations for which the Package is applicable.

Section 3 -   Package Submittal and Review Procedure
Any party may prepare an efficiency Package using the procedures described in Section 1 and 2. If the proponent is a program administrator or sponsor, or other regional entity intending to offer compliance across multiple rating providers, it may submit the following documentation to RESNET for review:

A. The name and affiliation of the party submitting a Package for review.
B. The software name and version that was used to complete the analysis.
C. The proposed Package parameters, as defined in Section 2.
D. A spreadsheet that clearly identifies the scenarios tested and the results for each simulation, with the worst performing scenario and compliance threshold parameter (e.g. HERS index or code compliance result) highlighted.

For a fee, the RESNET Software Exceptions committee will review the documentation and determine compliance with the submission guidelines, and recommend acceptance or rejection to the RESNET Board, which will make the final determination.

Additional information, supporting documentation, or source files may be requested by the committee if needed to determine whether the application is complete. Depending on the purpose of the compliance Package, a statement or disclaimer may be required on the part of the submitting party in order to use the Package (for example, for the purpose of code compliance).

RESNET will inform the submitting party of the acceptance of the Package; may request additional information; or, if the Package is rejected, will provide an explanation of the reasons for rejection. The Package and all submittal information will be available to RESNET for posting to a public website.