2006 RESNET Annual Board Meeting Minutes

Sunday, February 26, 2006
9:00 – 5:15 p.m.
Marriott Plaza San Antonio
Cavalier Room

Members Attending
Ben Adams
Eric Borsting
Steve Byers
Megan Edmunds
Richard Faesy
Philip Fairey
Ken Fonorow
David Goldstein
Thomas Hamilton
Bruce Harley
Michael Holtz
Mark Jansen
C.T. Loyd
Greg Nahn
Lee O'Neal
Kelly Parker
Douglas Walter
Daran Wastchak
David Wilson

Members Absent
Joseph Lstiburek
Gayle Sampson

Staff Present
Steve Baden
Claudia Brovick
Kathy Spigarelli
Randy Martin

Call to Order

Residential Energy Services Network (RESNET) President Philip Fairey called the meeting to order at 9:05 a.m. CST. There was a quorum of members present. The members were notified of the meeting by e-mail on October 23, 2005.

Approval of the Agenda

David Wilson moved that the proposed agenda be approved. Kelly Parker seconded the motion. The motion passed.

Treasurer's Report

Tom Hamilton presented the RESNET Financial Report compiled by Davis and Dash, certified public accountants.

Ben Adams requested that the Executive Director keep track of expenses associated with quality assurance monitoring work in 2006.

Megan Edmunds moved to receive the financial report. Mark Jansen seconded the motion. The motion passed.

HERS Software Test Suite

Philip Fairey explained the Procedures for Verification of Accredited HERS Software Tools (Draft). There were several editorial recommendations from the Board.

Richard Faesy made a motion to approve the substance of the document, with any non-substantive changes to be submitted to Philip Fairey by March 15, 2006. Kelly Parker seconded the motion. The motion passed. Eric Borsting abstained.

The document is attached as Attachment I, as edited.

Vote on Adoption of Staff QA Monitoring Non-Disclosure Agreement

Previously the Board adopted a resolution that staff enter into a non-disclosure agreement regarding their rating provider quality assurance monitoring. A drafting committee composed of representatives of nation's highest volume providers was recruited to draft a non-disclosure agreement for staff. Steve Baden presented the draft to the board (Attachment II).

Board members agreed that a set of similar procedures are needed for RESNET Board members.

David Goldstein moved that the document be adopted with the addition of the RESNET President's signature and that the following items be referred to the Quality Assurance and Ethics Committee for further review:

- Consideration of similar agreements for situations other than quality assurance monitoring
- Review of item 2 in the current non-disclosure agreement
- Potential exposure of "confidential" information released to the Ethics Committee
- Potential of provider's request that staff sign the provider's own nondisclosure agreement prior to conducting the monitoring

David Wilson seconded the motion. The motion passed.

Evaluation of the RESNET Executive Director

The Board went into executive session to discuss the evaluation of the RESNET Executive Director. Mark Jansen moved that the RESNET Board of Directors accept the recommendation by the Executive Committee for the bonus for 2005 for Steve Baden. David Wilson seconded the motion. The motion passed.

Nominations Report

Michael Holtz reported that the following individuals were nominated by the RESNET Nominations Committee:

Kelly Parker for President
David Goldstein for Vice President
Bruce Harley for Secretary
Tom Hamilton for Treasurer

There were no additional nominations from the floor.

C.T. Loyd moved that the slate of candidates be voted on and accepted simultaneously. Mark Jansen seconded the motion. The motion passed.

Kelly Parker assumed his new position as RESNET Board President.

Technical Committee Report

1. Duct Testing Procedures:

RESNET Technical Committee Chair presented a proposed interpretation of duct testing procedures adopted by the committee (Attachment III, as edited).

Philip Fairey moved to approve as modified. Michael Holtz seconded the motion. The motion passed. Daran Wastchak and Greg Nahn abstained.

2. Infiltration and Ventilation Interpretation:

RESNET Technical Committee Chair Bruce Harley presented a proposed interpretation of ventilation fan requirements adopted by the committee (Attachment IV).

Philip Fairey moved adoption of the interpretation. David Wilson seconded the motion. The motion passed. Eric Borsting abstained.

3. Notification to Client on Indoor Air:

Bruce Harley presented a proposal from the RESNET Technical Committee on notification of rater clients on the home's indoor air quality.

David Wilson moved that the proposal be referred to staff for further evaluation and review and a report returned to the Board. Philip Fairey seconded the motion. The motion passed. Tom Hamilton abstained.

4. Review process for approving prescriptive process for tax credit application:

Philip Fairey moved:

"The RESNET Board of Directors assign the RESNET Technical Committee the task of creating a set of guidelines that specify worst case analysis criteria leading to the creation of prescriptive packages."

C.T. Loyd seconded the motion. The motion passed.

Appointment of New Chair of the RESNET Training and Education Committee

Tom Hamilton moved that David Wilson be appointed as the new Chair of the Training and Education Committee. Mark Jansen seconded the motion. The motion passed. David Wilson abstained.

Strategic Planning Framework

Steve Baden and Kathy Spigarelli presented the proposed RESNET Strategic Planning Framework (Attachment V, as edited).

David Goldstein made a motion to reword the Vision Statement as follows:
"RESNET's vision is of a world that encourages and rewards minimum building energy use through independent, performance-based building certification." Philip Fairey seconded the motion. The motion passed.

Richard Faesy made a motion to reword the Mission Statement as follows: "RESNET's mission is to ensure the success of the building energy performance certification industry, set the standards of quality and increase the opportunity for ownership of high performance buildings." Mark Jansen seconded the motion. The motion passed.

Daran Wastchak made a motion to accept the current order and wording of statements in bold print under "Services Provided". C.T. Loyd seconded the motion. The motion passed.

C. T. Loyd made a motion to amend the "Strategic Opportunities" section as follows:

- Add a new opportunity called "Diagnosis and Remediation" as item X.
- Change the heading of item II. to "Business Development".
- Change the heading if item IV. to "Sustainable/Green Building Movement".

Daran Wastchak seconded the motion. The motion passed.

David Wilson made a motion to remove "Rank Ordered" from both the "Services Provided" and "Strategic Opportunities" sections. Megan Edmunds seconded the motion. The motion passed.

David Wilson made a motion to reword Goal 1. as follows: "By 2010, the RESNET uniform standard for measuring and comparing a building's energy performance will become the accepted national standard for measuring the energy performance of buildings." Philip Fairey seconded the motion. The motion passed.

Bruce Harley made a motion to reword Goal 2. as follows: "By 2015, the RESNET standards will be internationally acknowledged as standards for quality in the verification of building performance and the certification of pollution savings". David Wilson seconded the motion. The motion passed.

David Wilson made a motion to reword Goal 3 as follows: “By 2010, rater services will be valued by the national marketplace without regard to subsidies.” Bruce Harley seconded the motion. The motion passed.

Michael Holtz made a motion to eliminate Goal 4. David Wilson seconded the motion. The motion failed. Megan Edmunds voted yes. David Goldstein abstained.

David Wilson made a motion to incorporate Goal 4 and its objectives into Goal 3. Megan Edmunds seconded the motion. The motion passed. Steve Byers voted no.

David Wilson made a motion to reword Goal 5 as follows: “By 2010, RESNET will be a financially self-sustaining organization.” Philip Fairey seconded the motion. The motion failed. 8 voted yes, 9 voted no, 1 abstained.

Richard Faesy made a motion to eliminate Goal 5 and have staff incorporate its objectives into other goals. Bruce Harley seconded the motion. The motion passed.

Daran Wastchak moved that by May 10, 2006, staff formulate timelines for Appendix B. Ben Adams seconded the motion. The motion passed.

David Wilson moved adoption of the Strategic Planning Framework as amended. Mark Jansen seconded the motion. The motion passed.

Proposed 2006 RESNET Priorities

Steve Baden presented staff’s proposed priorities for RESNET in 2006 (Attachment VI).

Michael Holtz made a motion that the Board adopt the top 6 priorities as recommended by staff. Bruce Harley seconded the motion. The motion passed.

Daran Wastchak made a motion to accept the remaining priorities and track them. Michael Holtz seconded the motion. The motion passed.

Richard Faesy made a motion that staff work to develop a framework for how to proceed with the “Draft of Proposed RESNET Energy Audit/Survey” document developed by TEXAS HERO, in accordance with Priority 6. Steve Byers seconded the motion. The motion passed. Doug Walter abstained.

Proposed 2006 RESNET Budget

Previous to the meeting the RESNET Executive Committee compared the Western Residential Energy Services contract rates to similar non-profit organizations and found it to be reasonable.

David Goldstein moved to approve the Proposed 2006 RESNET Budget with the following modifications:

- Remove parenthesis from the grant amounts
- Clarify the Professional Services category to reflect appropriate contractual relationships
- Add Building Performance Institute (BPI) grant of $34,000 in the Projected Income category
- Replace “Misc.” under Proposed Budget with “Conference Contingency”

David Wilson seconded the motion. The motion passed. The approved 2006 RESNET Budget is attached as Attachment VII (as edited).

2007/2008 RESNET Conferences

David Goldstein moved to approve staff's proposal that the 2007 and 2008 RESNET Conferences be held at the Sheraton San Diego Hotel and Marina in San Diego, California. Ben Adams seconded the motion. The motion passed.

Adjournment

David Wilson moved that the meeting adjourn. Philip Fairey seconded the motion. The motion passed and the meeting was adjourned at 5:40 p.m. CST.

Respectfully Submitted
Bruce Harley, Secretary

RESNET
Residential Energy Services Network

Procedures for Verification of RESNET Accredited HERS Software Tools

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March 2006

1 Introduction

With the support of the U.S. Department of Energy, the National Renewable Energy Laboratory (NREL) and the Florida Solar Energy Center (FSEC), RESNET created a software verification committee to serve as an advisory group to develop a rule set for tax credit qualification purposes and to develop test suites for software to be used for verification of tax credits, home energy ratings, and the IECC. The committee was composed of representatives of National Renewable Energy Laboratory (NREL), Pacific Northwest National Laboratory (PNNL), Florida Solar Energy Center (FSEC), RESNET accredited rating software program providers, ICF Consulting, and individuals who were instrumental in development of the California ACM. Members of the committee include:

- Steve Baden, RESNET
- Patrick Bailey, GeoPraxis (Developer of the EnergyCheckup rating tool software)
- Dennis Barley, NREL
- Philip Fairey, Florida Solar Energy Center (developer of the EnergyGauge® rating tool software)
- Dean Gamble, ICF Consulting
- Thomas Hamilton, California Home Energy Efficiency Rating System
- Michael Holtz, Architectural Energy Corporation (developer of the REM/Rate rating tool software,)
- Ron Judkoff, NREL
- Maria Karpman, Taitem Engineering (developer of the TREAT rating tool software)
- Ken Nittler, EnerComp (Developer of the MicroPass rating tool software)
- Danny Parker, Florida Solar Energy Center
- Paul Reeves, E-Star Colorado (developer of the E-Star rating tool software)
- Dave Roberts, Architectural Energy Corporation
- Ian Shapiro, Taitem Engineering
- Todd Taylor, Pacific Northwest National Laboratory
- Bruce Wilcox, Berkeley Solar Group

2 Procedures for Accreditation of Computerized HERS Rating Tools

Because Home Energy Rating Systems (HERS) are based on comparative performance analysis (Rated Home as compared with the HERS Reference Home), computer software modeling is required. In order to ensure the accuracy and comparability of HERS tools, software vendors seeking RESET accreditation shall comply with the following procedures:

2.1 National Standard

The *2006 Mortgage Industry National Home Energy Rating System Standards,* hereinafter referred to as "the Standard," shall be the national standard for the development and use of HERS software tools. Chapter 3 of the Standard provides the technical basis for the development of HERS software tools that comply with the Standard. This document describes the verification tests that are required for RESNET accreditation of HERS software tools.

2.2 Software Verification Test Suite

The RESNET Software Verification Committee has defined a suite of software tests for use in verifying HERS software tool accuracy and comparability. The RESNET Board of Directors has adopted this test suite as the verification tests that shall be used by RESNET to accredit computerized HERS rating tools. The RESNET software verification test suite includes the following tests:

2.2.1 Tier one of the HERS BESTEST – HERS BESTEST was developed by the National Renewable Energy Laboratory (NREL) for testing the building load prediction accuracy of simulation software. (See Section 3.1.)

2.2.2 HERS Reference Home auto-generation tests – These tests verify the ability of the software tool to automatically generate the HERS Reference Home. (See Section 3.2.)

2.2.3 HERS method tests – These tests verifies that software tools can accurately calculate the HERS Index that is used as the numerical indicator of relative performance for a home. (See Section 3.3.)

2.2.4 HVAC tests – These tests verify the accuracy and consistency with which software tools predict the performance of HVAC equipment, including furnaces, air conditioners, and air source heat pumps. (See Section 3.4.)

2.2.5 Duct distribution system efficiency tests – These tests verify the accuracy with which software tools calculate air distribution system losses. ASHRAE Standard 152 results are used as the basis for the test suite acceptance criteria. (See Section 3.5.)

2.2.6 Hot water system performance tests – These tests determines the ability of the software to accurately predict hot water system energy use. (See Section 3.6.)

2.3 Process for Accrediting Software Programs

The RESNET accreditation process provides a suite of verification tests to certify that rating software tools conform to the verification criteria for each test. The software developer shall be required to submit the test results, test runs, and the software program with which the tests were conducted to RESNET. This information may be released by RESNET for review by any party, including competing software developers. This process is expected to result in compliance without a costly bureaucratic review and approval process.

2.4 Process for Exceptions and Appeals

RESNET has established an appeals process that software developers may use if their software is so unique that they cannot be accurately tested through the RESNET software testing procedures. The elements of this appeal process are:

- The software provider's documentation of how the software or qualification program meets or exceeds the criteria established in the RESNET software verification procedures.
- The software developer's justification and documentation as to why the software is so unique that it cannot comply with the RESNET software tool testing protocols.
- Independent evaluation of the software tool by RESNET in collaboration with independent experts. Based upon the results of the evaluation, RESNET may certify that the software tool meets or exceeds the performance criteria of RESNET's software tool verification procedures.

3 Test Suite Specifications and Acceptance Criteria

3.1 HERS BESTEST

Specifications, instructions and acceptance criteria (Tables 4-1, 4-2 and 4-4 of Volume 2 of the document) for the HERS BESTEST are found in the following document:

Judkoff, R. and J. Neymark, 1995. "Home Energy Rating System Building Energy Simulation Test (HERS BESTEST)," Vol. 1 and 2, Report No. NREL/TP-472-7332, National Renewable Energy Laboratory, Golden, Colorado 80401-3393. (Also available online at http://www.nrel.gov/publications/.)

Since the home configurations from this test suite are used for most of the other HERS software verification tests, it is highly recommended that this set of tests be completed prior to conducting the other verification tests prescribed by this procedure.

3.2 HERS Reference Home Auto-Generation Tests

This section contains the Reference Home auto-generation test suite for HERS rating tools. The test cases in this proposed test suite are designed to verify that software tools automatically generate accurate Reference Homes given only the building information from the Rated home.

3.2.1 Minimum Reporting Requirements

Software tools applying for verification shall provide evidence that their software meets the requirements of this test suite. The software tool provider or software vendor is responsible for producing the documentation needed to show that the software has been verified through this test suite. In some cases, the data needed to verify accuracy is of no interest or value to the end-user of the software, but in any case, the software tool must generate it. At a minimum, software tools applying for accreditation must report the following values for the Reference Home:

1. Areas and overall U-factors (or R-values in the case of slab-on-grade construction) for all building components, including ceilings, walls, floors, windows (by orientation) and doors.
2. Overall solar-heat gain coefficient ($SHGC_o$)[1] of the windows during heating.
3. Overall solar-heat gain coefficient ($SHGC_o$) of the windows during cooling.
4. Wall solar absorptance and infrared emittance
5. Roof solar absorptance and infrared emittance
6. Total internal gains to the home (Btu/day)
7. Specific leakage area (SLA) for the building, by zone or as SLA_o[2], as appropriate
8. Attic net free ventilation area (ft^2)
9. Crawlspace net free ventilation area (ft^2), if appropriate
10. Exposed masonry floor area and carpet and pad R-value, if appropriate
11. Heating system labeled ratings, including AFUE, COP, or HSPF, as appropriate.
12. Cooling system labeled ratings, including SEER or EER, as appropriate.
13. Thermostat schedule for heating and cooling
14. Air distribution system characteristics, including locations of all supply and return ducts and the air handler units, supply and return duct R-values, and supply and return duct air leakage values (in cfm_{25}).[3]

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[1] The overall solar heat gain coefficient ($SHGC_o$) of a fenestration is defined as the solar heat gain coefficient (SHGC) of the fenestration product taken in combination with the interior shade fraction for the fenestration.

[2] SLA_o is the floor-area weighted specific leakage area of a home where the different building zones (e.g. basement and living zones) have different specific leakage areas.

15. Mechanical ventilation kWh/yr, if appropriate

Software tools must have the ability to recreate or store the test case Reference Homes as if they were Rated Homes such that they also can be simulated and evaluated as Rated Homes.

3.2.2 Auto-generation Test Descriptions

Test Case1. HERS BESTEST case L100 building configured as specified in the HERS BESTEST procedures, located in Baltimore, MD, including a total of 3 bedrooms and the following mechanical equipment: gas furnace with AFUE = 82% and central air conditioning with SEER = 11.0.

Test Case 2. HERS BESTEST case L100 configured on an un-vented crawlspace with R-7 crawlspace wall insulation, located in Dallas, TX, including a total of 3 bedrooms and the following mechanical equipment: electric heat pump with HSPF = 7.5 and SEER = 12.0.

Test Case 3. HERS BESTEST case L304 in Miami, configured as specified in the HERS BESTEST procedures, located in Miami, FL, including a total of 2 bedrooms and the following mechanical equipment: electric strip heating with COP = 1.0 and central air conditioner with SEER = 15.0.

Test Case 4. HERS BESTEST case L324 configured as specified as in the HERS BESTEST procedures, located in Colorado Springs, CO, including a total of 4 bedrooms and the following mechanical equipment: gas furnace with AFUE = 95% and no air conditioning.

Test Case 5. Recreate or store the Reference Homes created in Tests 1 through 4 as Rated Homes and simulate and evaluate them.

3.2.3 Acceptance Criteria

3.2.3.1 Test Cases 1 – 4.

For test cases 1 through 4 the values contained in Table 3.2.3.1 shall be used as the acceptance criteria for software tool accreditation. For Reference Home building components marked by an asterisk (*), the acceptance criteria may include a range equal to ± 0.05% of the listed value. For all other Reference Home components the listed value is exact.

[3] cfm_{25} = cubic feet per minute of air leakage to outdoors at a pressure difference between the duct interior and outdoors of 25 Pa.

Table 3.2.3.1 Acceptance Criteria for Test Cases 1 – 4

Reference Home Building Component	Test 1	Test 2	Test 3	Test 4
Above-grade walls (U_o)	0.082	0.082	0.082	0.060
Above-grade wall solar absorptance (α)	0.75	0.75	0.75	0.75
Above-grade wall infrared emittance (ε)	0.90	0.90	0.90	0.90
Basement walls (U_o)	n/a	n/a	n/a	0.059
Above-grade floors (U_o)	0.047	0.047	n/a	n/a
Slab insulation R-Value	n/a	n/a	0	0
Ceilings (U_o)	0.030	0.035	0.035	0.030
Roof solar absorptance (α)	0.75	0.75	0.75	0.75
Roof infrared emittance (ε)	0.90	0.90	0.90	0.90
Attic vent area* (ft^2)	5.13	5.13	5.13	5.13
Crawlspace vent area* (ft^2)	n/a	10.26	n/a	n/a
Exposed masonry floor area * (ft^2)	n/a	n/a	307.8	307.8
Carpet & pad R-Value	2.0	2.0	2.0	2.0
Door Area (ft^2)	40	40	40	40
Door U-Factor	0.40	0.65	1.20	0.35
North window area* (ft^2)	69.26	69.26	69.26	102.63
South window area* (ft^2)	69.26	69.26	69.26	102.63
East window area* (ft^2)	69.26	69.26	69.26	102.63
West window area* (ft^2)	69.26	69.26	69.26	102.63
Window U-Factor	0.40	0.65	1.20	0.35
Window $SHGC_o$ (heating)	0.4675	0.34	0.34	0.4675
Window $SHGC_o$ (cooling)	0.385	0.28	0.28	0.385
SLA_o (ft^2/ft^2)	0.00048	0.00048	0.00048	0.00048
Internal gains* (Btu/day)	66,840	66,840	62,736	107,572
Labeled heating system rating and efficiency	AFUE = 78%	HSPF = 7.7	HSPF = 7.7	AFUE = 78%
Labeled cooling system rating and efficiency	SEER = 13.0	SEER = 13.0	SEER = 13.0	SEER = 13.0
Air Distribution System Efficiency	0.80	0.80	0.80	0.80
Thermostat Type	Manual	Manual	Manual	Manual
Heating thermostat settings	68 F (all hours)	68 F (all hours)	68 F (all hours)	68 F (all hours)
Cooling thermostat settings	78 F (all hours)	78 F (all hours)	78 F (all hours)	78 F (all hours)

3.2.3.2 Test Case 5.

Test case 5 requires that each of the Reference Homes for test cases 1-4 be stored or recreated in the software tool as a Rated Home and simulated as any other rated home would be simulated. If the resulting Rated Home is correctly configured to be identical to its appropriate Reference Home, rating calculations arising from normal operation of the software tool should produce virtually identical scoring criteria for both the Reference Home and the Rated Home for this round of tests. For test case 5, the modified loads e-Ratio shall be calculated separately from the simulation results, as follows:

e-Ratio = (Total normalized Modified Loads) / (Total Reference Loads)

Acceptance criteria for these calculations shall be ± 0.5% of 1.00. Thus, for each of the preceding test cases (1-4), the e-Ratio resulting from these software tool simulations and the subsequent e-Ratio calculations shall be greater than or equal to 0.995 **and** less than or equal to 1.005.

3.3 HERS Method Tests

The HERS Method tests are intended to determine the ability of HERS tools to accurately calculate the HERS Index given a set of Reference Home End Use Loads (REUL), Reference Home End Use Energy Consumptions (EC_r), Rated Home End Use Energy Consumptions (EC_x) and the applicable manufacturers equipment performance ratings (MEPR).

3.3.1 Minimum Reporting Requirements.

At a minimum, all software tools must report the following values:

3.3.1.1 Reference Home End Use Loads (REUL) to the nearest 0.1 MBtu
- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot water (MBtu)

3.3.1.2 Reference Home End Use Energy Consumption (EC_r) to the nearest 0.1 MBtu
- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

3.3.1.3 Rated Home End Use Energy Consumption (EC_x) to the nearest 0.1 MBtu
- i. Heating (MBtu)
- ii. Cooling (MBtu)
- iii. Hot Water (MBtu)

3.3.1.4 Manufacturer's Equipment Performance Ratings (MEPR)

i. Heating system (HSPF, COP, AFUE, or CAFUE)
ii. Cooling system (SEER, EER or COP)
iii. Hot Water system (EF or CEF)

3.3.2 Test Description

Home Energy Ratings for the following cases, located in Colorado Springs, CO, shall be computed, reporting the values listed above.

3.3.2.1 Case L100A-01: Using the HERS BESTEST L100 case, create a 3-bedroom Rated Home containing the following equipment:
i. Heating system – electric HP with HSPF = 6.8
ii. Cooling system – electric A/C with SEER = 10.0
iii. Hot Water – 40 gal electric with EF = 0.88
iv. All the equipment are to be located inside the conditioned space and heating and air conditioning ductwork are to be located in the conditioned space and have zero (0) air leakage.

3.3.2.2 Case L100A-02: Identical to Case L100A-01 except that the hot water heater is changed to a 40 gal natural gas with EF = 0.54.

3.3.2.3 Case L100A-03: Identical to Case L100A-01 except that the space heating system is changed to a natural gas furnace with AFUE = 78%.

3.3.2.4 Case L100A-04: Identical to Case L100A-01 except that the space heating system is changed to a high efficiency HP with HSPF = 9.85.

3.3.2.5 Case L100A-05: Identical to Case L100A-01 except that the space heating system is changed to a natural gas furnace with AFUE = 96%.

3.3.3 Acceptance Criteria.

Using the calculation spreadsheet provided by RESNET (method_check-2006_form.xls), software tools shall demonstrate the following:

3.3.3.1 That reported Reference Home End Use Loads (REULs) vary by less than 0.2% across all cases.

3.3.3.2 That the difference between the HERS Indices calculated by the software tool and those calculated by the calculation spreadsheet provided with this Test Standard is less than 0.5% of the index reported by the software tool for all cases.

3.4 HVAC Tests

3.4.1 Required Capabilities

Tools must be capable of generating HVAC results using system type and efficiency as inputs. Additional efficiency information is allowable, but must not be required to operate the tool. Tools must also account for duct leakage, duct insulation levels and the presence of a programmable thermostat.

3.4.2 System Types.

The following system types that must be supported by all tools:

1. Compressor based air conditioning system
2. Oil, propane or natural gas forced air furnaces
3. Electric resistance forced air furnaces
4. Air source heat pump

Optional system types that may be supported include:

1. Evaporative cooling, direct, indirect or IDEC
2. Ground or water source heat pumps
3. "Dual fuel" systems that utilize an electric air or ground source heat pump for primary heating and fuel for backup heating. An example of this would be an electric air source heat pump with a gas furnace as a supplement or backup.
4. Radiant heating systems including but not limited to hot water radiant floor systems, baseboard systems and ceiling cable systems.
5. Hydronic systems.
6. Combo systems in which the system supplies both domestic hot water and space heating.
7. Active solar space heating systems

Capability tests do not currently exist for the above optional system types. The following table lists the efficiency metrics that are reported by manufacturers, which shall be used for each system type.

Table 3.4.2 HVAC Equipment Efficiency Metrics

HVAC Equipment Type	Heating Efficiency Metric	Cooling Efficiency Metric	Comments:
Gas or Fuel Furnaces	AFUE		Includes wall furnaces, floor furnaces and central forced air furnaces.
Electric Resistance Furnace	COP		Use COP of 1.0, an HSPF of 3.413 may be equivalent and acceptable for some tools.
Air Source Heat Pump <65 kBtu/h	HSPF	SEER	

HVAC Equipment Type	Heating Efficiency Metric	Cooling Efficiency Metric	Comments:
Air Cooled Central Air Conditioner <65 kBtu/h		SEER	
Air Cooled Window Air Conditioner		EER	PTAC units are included in this category

3.4.3 Detailed Default Inputs

Where tools use detailed modeling capabilities for HVAC simulation like DOE-2, the following values should be used as default values in the simulation tool to achieve the best results.

Table 3.4.3 Default Values for use with Detailed HVAC Simulation Tools

DOE-2 Keyword:	Description (units)	Value
HEATING-EIR	Heat Pump Energy Input Ratio compressor only, (1/cop)	0.582*(1/(HSPF/3.413))
COOLING-EIR	Air Conditioner Energy Input Ratio compressor only, (1/cop)	0.941*(1/(SEER/3.413))
DEFROST-TYPE	Defrost method for outdoor unit, (Reverse cycle)	REVERSE-CYCLE
DEFROST-CTRL	Defrost control method, (Timed)	TIMED
DEFROST-T (F)	Temperature below which defrost controls are activated, (^{o}F)	40^o
CRANKCASE-HEAT	Refrigerant crankcase heater power, (kW)	0.05
CRANK-MAX-T	Temperature above which crankcase heat is deactivated, (^{o}F)	50^o
MIN-HP-T (F)	Minimum temperature at which compressor operates, (^{o}F)	0^o
MAX-HP-SUPP-T	Temperature above which auxiliary strip heat is not available, (^{o}F)	50^o
MAX-SUPPLY-T (heating, heat pump)	Maximum heat pump leaving air temperature from heating coil, (^{o}F)	105^o
MAX-SUPPLY-T (heating, natural gas furnace)	Maximum gas furnace leaving air temperature from heating coil, (^{o}F)	120^o

DOE-2 Keyword:	Description (units)	Value
FURNACE-AUX	Natural gas furnace pilot light energy consumption, (Btu/h)	100
MIN-SUPPLY-T (cooling)	Minimum cooling leaving air temperature from cooling coil, (^{o}F)	55^{o}
SUPPLY-KW	Indoor unit standard blower fan power, (kW/cfm)	0.0005
SUPPLY-DELTA-T	Air temperature rise due to fan heat, standard fan, (^{o}F)	1.580
SUPPLY-KW	Indoor unit standard blower fan power, high efficiency fan, (kW/cfm)	0.000375
SUPPLY-DELTA-T	Air temperature rise associated due to fan heat, high efficiency fan, (^{o}F)	1.185
COIL-BF	Coil bypass factor, (dimensionless)	0.241
Other parameters:		
Part load performance curves	Compressor part load performance curves	Henderson, et.al.[4]
Heating system size	Installed heat pump size, (kBtu/h)	Determined by Manual J (specified)
Coil airflow	Indoor unit air flow, (cfm)	30 cfm/(kBtu/h)
Cooling system size	Installed air conditioner size, (kBtu/h)	Determined by Manual J (specified)

3.4.4 Test Description and Acceptance Criteria

The following test suites represent tests that tools must pass to be accredited. All tests are to be performed using the L100 building case described by the HERS BESTEST procedures.[5]

For each test case, acceptance criteria are provided. These criteria are based on reference results from 6 tools, which are capable of detailed hourly building simulation and HVAC modeling computations.[6] The criteria are established as the greater of the 90% confidence interval using the student t-test criteria or 10% of the mean results for the 6 sets of reference results. In order to pass a specific test, tools

[4] Henderson, H.I., D.S. Parker and Y.J. Huang, 2000. "Improving DOE-2's RESYS Routine: User Defined Functions to Provide More Accurate Part Load Energy Use and Humidity Predictions," Proceedings of 2000 Summer Study on Energy Efficiency in Buildings, Vol. 1, p. 113, American Council for an Energy-Efficient Economy, 1001 Connecticut Avenue, Washington, DC.

[5] Judkoff, R. and J. Neymark, 1995. "Home Energy Rating System Building Energy Simulation Test (HERS BESTEST)," Vol. 1 and 2, Report No. NREL/TP-472-7332, National Renewable Energy Laboratory, Golden, Colorado 80401-3393. (Also available online at http://www.nrel.gov/publications/.)

[6] Two DOE-2.1E tools, two DOE-2.2 tools, Micropas version 6.5 and TRNSYS version 15.

must predict percentage energy use changes for the specified heating and/or cooling system tests that falls between the upper and lower acceptance criteria for that test.

Tools that do not model the performance of HVAC equipment in detail must provide for climate adjusted equipment performance factors in order to fall within the acceptance criteria for these tests. Methods of adjusting the manufacturer's nameplate ratings to account for climate dependent performance have been reported.[7]

3.4.4.1 Test Suite 1 – Air conditioning systems:

Test to ensure that there is the proper differential electrical cooling energy consumption by cooling systems when the efficiency is varied between SEER 10 and a higher efficiency unit, taken to be SEER 13. For the purposes of this test assume zero duct leakage and all ducts and air handlers are in conditioned space.

Table 3.4.4.1 (1) Air Conditioning System Test Specifications

Test #	System Type	Capacity	Location	Efficiency
HVAC1a	Air cooled air conditioner	38.3 kBtu/h	Las Vegas, NV	SEER = 10
HVAC1b	Air cooled air conditioner	38.3 kBtu/h	Las Vegas, NV	SEER = 13

Table 3.4.4.1 (2) Air Conditioning System Acceptance Criteria

Test #	Average Change From Base Case	Low Acceptance Criteria	High Acceptance Criteria
HVAC1a	Base case	---	---
HVAC1b	-19.3	-21.2%	-17.4%

3.4.4.2 Test Suite 2 – Heating Systems:

Test to ensure that there is differential heating energy consumed by heating systems when the efficiency is varied between a code minimum heating and a higher efficiency unit. The tests will be carried out for both electric and non-electric heating systems. For the purposes of this test assume zero duct leakage and all ducts and air handlers in conditioned space.

[7] Fairey, P., D.S. Parker, B. Wilcox and M. Lombardi, "Climate Impacts on Heating Seasonal Performance Factor (HSPF) and Seasonal Energy Efficiency Ratio (SEER) for Air Source Heat Pumps." ASHRAE Transactions, American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Atlanta, GA, June 2004. (Also available online at http://www.fsec.ucf.edu/bldg/pubs/hspf/)

Table 3.4.4.2 (1) Gas Heating System Test Specifications

Test #	System Type	Capacity	Location	Efficiency
HVAC2a	Gas Furnace	56.1 kBtu/h	Colorado Springs, CO	AFUE = 78%
HVAC2b	Gas Furnace	56.1 kBtu/h	Colorado Springs, CO	AFUE = 90%

Table 3.4.4.2 (2) Gas Heating System Acceptance Criteria

Test #	Average Change From Base Case	Low Acceptance Criteria	High Acceptance Criteria
HVAC2a	Base case	---	---
HVAC2b	-12.9%	-13.3%	-11.6%

Table 3.4.4.2 (3) Electric Heating System Test Specifications

Test #	System Type	Capacity	Location	Efficiency
HVAC2c	Air Source Heat Pump	56.1 kBtu/h	Colorado Springs, CO	HSPF = 6.8
HVAC2d	Air Source Heat Pump	56.1 kBtu/h	Colorado Springs, CO	HSPF = 9.85
HVAC2e	Electric Furnace	56.1 kBtu/h	Colorado Springs, CO	COP =1.0

Table 3.4.4.2 (4) Electric Heating System Acceptance Criteria

Test #	Average Change From Base Case	Low Acceptance Criteria	High Acceptance Criteria
HVAC2c	Base case	---	---
HVAC2d	-22.9%	-29.0%	-16.7%
HVAC2e	61.3%	41.8%	80.8%

3.5 Duct Distribution System Efficiency (DSE) Tests (Suite 3)

Distribution System Efficiency (DSE) tests are designed to ensure that the impact of duct insulation, duct air leakage and duct location are properly accounted for in software. Tables 1 and 2 below describe the test specifications and the bounds criteria for these tests.

3.5.1 Test Description

For all tests, assume that the air-handling unit is in conditioned space. If the software tool being tested has the ability to modify inputs for duct area, assume that the supply duct area is equal to 20% of the conditioned floor area and the return duct area is equal to 5% of the conditioned floor area. The duct leakage shall be 250 cfm_{25} for cases 3d and 3h with the return and supply leakage fractions each set at 50%. All tests assume a natural gas forced air furnace and forced air cooling system with

efficiencies of 78% AFUE = 78% for the heating system and SEER = 10 for the cooling system.

Furnace and air conditioner heating and cooling capacities shall be modified for each of the duct system efficiency test cases according to the values provided in Tables 1a and 2a. Similarly, the specified heating and cooling coil airflow (cfm) shall be altered by case using a value of 360 cfm/ton (30 cfm/kBtu) of capacity. Also, the exterior air film resistance of the duct system should be added to the specified duct R-values given in Tables 1a and 2a to obtain agreement for duct conductance. For non-insulated sheet metal ducts (R-0) the air film has a resistance of approximately R=1.5 ft^2-^oF-hr/Btu and for insulated ducts (R=6) the air film has a resistance of R=1.0 as shown by test results obtained by Lauvray (1978) at a typical residential duct airflow rate of 530 fpm.[8] These values are currently established for the purposes of duct design calculations by ASHRAE within the Handbook of Fundamentals (2001, p. 34.15). Thus, unless the software undergoing test accounts for these film resistances, the uninsulated sheet metal duct (R=0 in Tables 3.5.3(1) and 3.5.4(1)) shall be entered as R=1.5 while the insulated ducts (R=6 in tables) shall be entered as R=7.

For the heating comparison test cases (Table 3.5.3(1)), which assume a basement, use the HERS BESTEST Case L322 home. The basement shall be unconditioned, have a floor area equal to the main floor area (1539 ft^2) and have R-11 insulation in the floor joists of the main floor with a framing fraction of 13%. The basement case has no basement wall insulation. For the cooling comparison test cases (Table 3.5.4(2)), use the HERS BESTEST case L100 home.

3.5.2 Acceptance Criteria

The acceptance criteria for these tests were established using ASHRAE Standard 152-04, using the spreadsheet tool constructed for the U.S. DOE *Building America* program by Lawrence Berkeley National Laboratory (LBNL).[9] In all cases, the input values for the Standard 152 calculations assumed the following:

- Single story building
- Single speed air conditioner/heating system
- System capacities as specified in Tables 1a and 2a
- Coil air flow = 360 cfm per 12,000 Btu/h
- Ducts located as specified in Tables 1a and 2a
- Supply duct area = 308 ft^2
- Return duct area = 77 ft^2
- Supply and return duct insulation of R=1.5 and R=7 for uninsulated (R=0) and insulated (R=6) ducts, respectively

[8] T.L. Lauvray, 1978. "Experimental heat transmission coefficients for operating air duct systems," ASHRAE Journal, June, 1978.

[9] See http://www.eere.energy.gov/buildings/building_america/benchmark_def.html

- Supply and return duct leakage = 125 cfm each, where so specified in Tables 1a and 2a.

Following the ASHRAE Standard 152 analysis, the resulting DSE values were converted to a percentage change in heating and cooling energy use ("Target Delta" in Tables 3.5.3(2) and 3.5.4(2)) using the following calculation:

$$\% \text{ Change} = 1.0 - (1.0 / \text{DSE})$$

Acceptance criteria were then established as this target delta plus and minus 5% to yield the values given in Tables 3.5.3(2) and 3.5.4(2) for heating and cooling test minimum and maximum acceptance criteria, respectively.

3.5.3 Heating Energy Tests

Table 3.5.3 (1) Heating Energy DSE Comparison Test Specifications

Test #	Location	System Type	System Capacity (kBtu/h)	Duct Location	Duct Leakage	Duct R-val*
HVAC3a (base case)	Colorado Springs, CO	Gas Furnace	46.6	100% conditioned	None	R=0
HVAC3b	Colorado Springs, CO	Gas Furnace	56.0	100% in basement	None	R=0
HVAC3c	Colorado Springs, CO	Gas Furnace	49.0	100% in basement	None	R=6
HVAC3d	Colorado Springs, CO	Gas Furnace	61.0	100% in basement	250 cfm_{25}	R=6
* Duct R-value does not include air film resistances. For uninsulated ducts, this film resistance is approximately R=1.5 and for insulated ducts it is approximately R=1.0. If software does not consider this air film resistance in detail, then these air film resistances should be added.						

Table 3.5.3 (2) Heating Energy DSE Comparison Test Acceptance Criteria

Test #	Target Delta* Heating Energy Relative to HVAC3a	Minimum Delta* Heating Energy	Maximum Delta* Heating Energy
HVAC3a	Base case	---	---
HVAC3b	26.4%	21.4%	31.4%
HVAC3c	7.5%	2.5%	12.5%
HVAC3d	20%	15%	25%
* Delta = % Change in energy use = ((alternative – base case) / (base case)) * 100			

3.5.4 Cooling Energy Tests

Table 3.5.4 (1) Cooling Energy DSE Comparison Test Specifications

Test #	Location	System Type	System Capacity (kBtu/h)	Duct Location	Duct Leakage	Duct R-val*
HVAC3e (base case)	Las Vegas, NV	Air Conditioner	-38.4	100% conditioned	None	R=0
HVAC3f	Las Vegas, NV	Air Conditioner	-49.9	100% in attic	None	R=0
HVAC3g	Las Vegas, NV	Air Conditioner	-42.2	100% in attic	None	R=6
HVAC3h	Las Vegas, NV	Air Conditioner	-55.0	100% in attic	250 cfm_{25}	R=6
* Duct R-value does not include air film resistance. For uninsulated ducts, this film resistance is approximately R=1.5 and for insulated ducts it is approximately R=1.0. If software does not consider this air film resistance in detail, then these air film resistances should be added.						

Table 3.5.4 (2) Cooling Energy DSE Comparison Test Acceptance Criteria

Test #	Target Delta* Cooling Energy Relative to HVAC3e	Minimum Delta* Cooling Energy	Maximum Delta* Cooling Energy
HVAC3e	Base case	---	---
HVAC3f	31.2%	26.2%	36.2%
HVAC3g	11.5%	6.5%	16.5%
HVAC3h	26.1%	21.1%	31.1%
* Delta = % Change in energy use = ((alternative – base case) / (base case)) * 100			

3.6 Hot Water System Performance Tests

Hot water system tests are designed to determine if HERS software tools accurately account for both the hot water usage rate (gallons per day) and the climate impacts (inlet water temperatures) of hot water systems. The tests are limited to standard gas-fired hot water systems and cannot be used to evaluate solar hot water systems, heat pump hot water systems, hot water systems that recover heat from air conditioner compressors (heat recovery or de-super heater systems), or other types of hot water systems. In addition, distribution losses associated with hot water distribution systems are not covered by this test.

3.6.1 Test Description

The following table provides summary specifications for the six required hot water tests. The tests are segregated into two sets of three tests – one set of cold climate tests (Duluth, MN) and one set of hot climate tests (Miami, FL).

Table 3.6.1 Summary Specifications for Standard Hot Water Tests

Test Number	System Type	Climate Location	System Efficiency	Number of Bedrooms
DHW-MN-56-2	40 gal, gas	Duluth, MN	EF = 0.56	2
DHW-MN-56-4	40 gal, gas	Duluth, MN	EF = 0.56	4
DHW-MN-62-2	40 gal, gas	Duluth, MN	EF = 0.62	2
DHW-FL-56-2	40 gal, gas	Miami, FL	EF = 0.56	2
DHW-FL-56-4	40 gal, gas	Miami, FL	EF = 0.56	4
DHW-FL-62-2	40 gal, gas	Miami, FL	EF = 0.62	2

Additional specifications used in the creation of the reference results that establish the hot water system test acceptance criteria are as follows:

3.6.1.1 Hot Water Draw Profile

The hot water draw profile is as specified by Table 3, ASHRAE Standard 90.2, as given in Table 3.6.1.1 below:

Table 3.6.1.1 Hourly Hot Water Draw Fraction for Hot Water Tests

Hour of Day	Daily Fraction	Hour of Day	Daily Fraction	Hour of Day	Daily Fraction
1	0.0085	9	0.0650	17	0.0370
2	0.0085	10	0.0650	18	0.0630
3	0.0085	11	0.0650	19	0.0630
4	0.0085	12	0.0460	20	0.0630
5	0.0085	13	0.0460	21	0.0630
6	0.0100	14	0.0370	22	0.0510
7	0.0750	15	0.0370	23	0.0510
8	0.0750	16	0.0370	24	0.0085

3.6.1.2 Inlet Mains Temperature

The cold-water inlet mains temperatures to the hot water system are calculated in accordance with the following formula:[10]

$$T_{mains} = (T_{amb,avg} + offset) + ratio * (\Delta T_{amb,max} / 2) * \sin (0.986 * (day\# - 15 - lag) - 90)$$

where:

T_{mains} = mains (supply) temperature to domestic hot water tank (ºF)
$T_{amb,avg}$ = annual average ambient air temperature (ºF)
$\Delta T_{amb,max}$ = maximum difference between monthly average ambient temperatures (e.g., $T_{amb,avg,july} - T_{amb,avg,january}$) (ºF)

[10] NREL, "Building America Research Benchmark Definition." National Renewable Energy Laboratory, Golden, CO, December 29, 2004. May be found online at: http://www.eere.energy.gov/buildings/building_america/pa_resources.html

0.986 = degrees/day (360/365)
day# = Julian day of the year (1-365)
offset = 6°F
ratio = 0.4 + 0.01 ($T_{amb,avg}$ – 44)
lag = 35 – 1.0 ($T_{amb,avg}$ – 44)

3.6.1.3 Additional TRNSYS Simulation Parameters

Additional inputs for TRNSYS reference result simulations are as follows:

- Rated Power 40,000 Btu/hr
- Recovery efficiency: 0.78
- Tank UA for EF=0.56 system: 10.79 Btu/hr-F
- Tank UA for EF=0.62 system: 7.031 Btu/hr-F
- Tank set point temperature: 120 F
- Tank space temperature ("loss temp"): 75 F
- Tank stratification: 15 equal nodes
- Simulation time step: 1/16th hour

3.6.2 Acceptance Criteria

In each of the two sets of three test cases, the first test listed (DHW-xx-56-2) is the base case and the other two cases are the alternative cases. The metric used for acceptance criteria is the % change in energy use for the alternative cases with respect to the base case, which is determined as follows:

% Change = (alternative - base) / (base) * 100

The acceptance criteria given in Table 3.6.2 below are determined from reference results from three different software tools – TRNSYS version15, DOE-2.1E (v.120) as used by EnergyGauge USA version 2.52, and RemRate version 12. Minimum and maximum acceptance criteria are determined as the 90% confidence interval for these reference results using the student t-test. Also shown in the table are the % changes determined from a simplified calculation that uses only the labeled energy factor (EF) for the system as well as the mean value determined by the reference results.

Table 3.6.2 Acceptance Criteria for Hot Water Systems Tests

Test Number	Per EF Calculation	Reference Mean	Minimum Criteria	Maximum Criteria
DHW-MN-56-2	Base case	---	---	---
DHW-MN-56-4	40.0%	29.3%	28.1%	30.5%
DHW-MN-62-2	-9.7%	-9.3%	-10.4%	-8.3%
DHW-FL-56-2	Base case	---	---	---
DHW-FL-56-4	40.0%	24.1%	22.0%	26.2%
DHW-FL-62-2	-9.7%	-13.6%	-16.0%	-11.1%

Attachment II

Residential Energy Services Network
Staff Quality Assurance Monitoring Nondisclosure Agreement

I agree to use the information revealed during the rating provider quality assurance monitoring reviews only for RESNET assessment purposes and to treat the information which is confidential in nature in confidence.

If, in the course of a quality assurance review of a rating provider, I do acquire or have access to any information, data, or material which the rating provider identifies as confidential, proprietary, or otherwise privileged (collectively, ""Information""), I agree that such Information will not be divulged to any person or any organization or utilized for my own private purposes or in any manner whatsoever, other than in the performance of a quality assurance review without the prior written permission of the disclosing rating provider, unless the Information:

1. is or becomes known to the public from a source other than me, or
2. is already known to me or my employer as shown by prior records, whichever event shall first occur, or
3. is required to be disclosed through a subpoena or other court ordered disclosure.
4. I agree to report any disclosure (authorized or inadvertent) to the Rating Provider where the information disclosed was discovered.

I recognize that an unauthorized disclosure of above information may lead to termination of my position as a Staff Quality Assurance Monitor.

(Signature)	(Signature)
_____	_____
(Name) Printed or Typed	Kelly Parker, Board President
_____	_____
(Date)	(Date)

Attachment III

RESNET Formal Interpretation 2006-002
Approved by the RESNET Board of Directors, February 26, 2006

Proponent:
RESNET Standing Technical Committee

Applies to:
2006 Mortgage Industry National Home Energy Rating Systems Standards
Table 303.4.1.(1), under "Thermal distribution systems"; footnote (n); and Appendix A, under "Air leakage (ducts)":

Interpretation: RESNET Duct Testing Procedure

Background
Table 2 in this document comprises a summary of a test procedure intended for use by Certified Raters in performing required field testing of the leakage of forced-air thermal distribution systems as part of a Confirmed Rating.

The *2006 Mortgage Industry National Home Energy Rating System Standards* specifies the use of ASHRAE Standard 152, with some exceptions (stated in Appendix A), for testing ducted distribution systems. The procedures outlined below and summarized in Table 2 are deemed by RESNET to be an approved implementation of the leakage testing procedures in ASHRAE 152 for the purpose of field testing of homes by Certified Raters to complete a confirmed HERS rating.

Rationale
The leakage testing procedures of ASHRAE Standard 152 were not necessarily designed for the practical application to field ratings, and some simplifications and default assumptions were necessary. There are requirements in 152 that, although appropriate for research purposes, can not always be met when testing homes in a production setting.

Buffer zones
For example, 152 requires that when pressurizing a house to 25 Pa, any unconditioned spaces containing ducts must be within 10 Pa of outside pressure. If this requirement isn't met, holes must be added between the space and outside until the requirement is met. This often can't be done in real houses. In addition it is not always possible to even measure the pressure in these spaces without cutting holes through finished surfaces. For

these reasons it was decided that, whenever possible, these spaces should be opened to outside, but when not possible they should be left "as is" and no pressure measurement of these spaces would be required.

Plenum Pressure Measurements

The leakage to outside test procedure in ASHRAE 152 (Annex B) attempts to estimate the amount of duct leakage to outside and unconditioned spaces under normal operating conditions. This is done by first attempting to measure the leakage with a uniform pressure of 25 Pa across all the leaks to outside and unconditioned spaces. This leakage at 25 Pa is then adjusted for the fact that the pressure difference between the ducts and unconditioned spaces was different than 25 Pa during the test (if it was). It is also adjusted to estimated actual operating conditions by measuring the supply and return plenum pressures and assuming that the effective leakage pressure is one half of the operating plenum pressures.

In the field, measuring plenum pressures is often problematic. It is common to get very different readings at different locations in the plenums due to turbulence. It is also sometimes impossible to get to the plenums, such as in a mobile home with down flow air handler and an evaporator coil directly between air handler and the floor; in these cases, there really is no supply plenum to measure in. There are also cases where the supply plenum really is a large diameter insulated flex duct that would have to be penetrated to make a measurement.

For these reasons, it is deemed acceptable to simplify Annex A by assuming that the effective leakage pressure is 25 Pa. Although there is not adequate data nation-wide to say that this is absolutely the best number to use, there is enough experience to say that it is reasonable. Because leakage flow is roughly proportional to the square root of the leakage pressure, a 20% error in the leakage pressure only causes about 10% error in the leakage flow.

Supply and Return Leakage

ASHRAE 152 specifies that the leakage of the supply and return sides of the system are measured separately. Splitting the system to measure supply and return leakage separately is often problematic. The "2006 Mortgage Industry National Home Energy Rating System Standards" allows testing the entire system for leakage and then includes a procedure for splitting this leakage between supply and return in two different ways, calculating the efficiency both ways, and using the lower of the two resulting efficiencies, as a conservative default. The procedure outlined in Table 2 uses this approach.

Although there are some differences between a strict interpretation of ASHRAE 152 testing requirements and the requirements in Table 2, we believe that it is reasonable for RESNET to deem the requirements of Table 2 as their interpretation of ASHRAE 152 testing for the purpose of determining a home energy rating.

Table 1, below, helps to explain where in the "2006 Mortgage Industry National Home Energy Rating System Standards" the various testing requirements come from. They

originate in paragraph 303.4.1.2, which contains the specifications for the HERS Reference and Rated Homes used in the Calculation of the Rating. This section on thermal distribution systems specifies that the rated home should either use values from a default table, Table 303.4.1(3), which has some testing requirements; or use a calculation according to ASHRAE 152 (or equivalent verified computation), with testing conducted according to ASHRAE 152.

The Rating Methods 1, 2, and 3 in Table 1 are not designated as such in the actual standard, but are designated as such here because they have different requirements for testing. Method 2 (using "reduced leakage" defaults) is typically only used in calculating a Projected Rating, or may be used *when confirmed by the required duct tests,* if software uses simplified methods of determining duct system efficiency. At least one of the commonly used software tools, REM/Rate™, may use the default in the Projected Rating, but typically uses a calculated distribution system efficiency based on duct leakage testing for the Confirmed Rating, which puts the Confirmed Rating in the Method 3 category.

Method 1 (No Testing):	❑ Software uses "non-reduced leakage" values in Default Table 303.4.1(3) to determine duct efficiency. ❑ No duct leakage testing required by RESNET standards.[11] ❑ No air handler flow measurement is required.
Method 2 (Reduced Leakage):	❑ Software uses "reduced leakage" values in Default Table 303.4.1(3) to determine duct efficiency. This method is not typically used for confirmed HERS ratings. ❑ Outside Duct Leakage ≤ 3 CFM25 / 100 ft^2 of conditioned floor area. **And** ❑ Total Duct Leakage ≤ 9 CFM25 / 100 ft^2 of conditioned floor area.[12] ❑ No air handler flow measurement is required.
Method 3 (ASHRAE 152):	❑ Software uses ASHRAE 152-2004 (or verified equivalent computations) to calculate duct efficiency. ❑ Outside Duct Leakage is measured. **Or** ❑ Total Duct Leakage is measured. ❑ Air handler flow measurement is required **or** default value used.[13]

Table 1. Rating Methods for Determining Duct Efficiency

[11] ENERGY STAR now has its own mandatory duct leakage testing requirements unless all ducts are inside conditioned space and the building envelope is ≤ 3 ACH50 (or 0.25 CFM50 / ft^2 envelope area). ENERGY STAR requirements are: ≤ 4 CFM25 / 100 ft^2 conditioned floor area Outside Duct Leakage for BOP, or ≤ 6 CFM25 / 100 ft^2 conditioned floor area Outside Duct Leakage for Performance Path.

[12] If Total Duct Leakage is ≤ 3 CFM25 / 100 ft^2 conditioned floor area, then Outside Duct Leakage does not need to be measured.

[13] Some rating software (REM/Rate™) does not require an air handler flow estimate.

Duct Testing Procedures	The following procedures are deemed by RESNET to meet ASHRAE 152 duct testing requirements for the purpose of HERS ratings.
Outside Duct Leakage Test Procedure:	❑ This procedure is used to measure the duct leakage rate to outside of the building only, when the duct system is subjected to a uniform test pressure (25 Pa). During this procedure a blower door fan is used to pressurize[14] the building to the test pressure (with reference to outside), while a duct testing fan is used to pressurize the duct system to the same pressure as the building. ❑ Unconditioned zones containing ducts shall be opened to the outside, while conditioned zones containing ducts shall be opened to the building. If duct zones can not be opened to inside or outside as specified above, the duct system shall be tested with the building envelope in an "as is" (blower door) test condition. ❑ Measurement of duct buffer zone and duct plenum pressures is not required. Leakage pressures during system operation will be assumed to be 25 Pa if duct zone and plenum pressures are not measured. ❑ Separate measurement of supply and return leakage rates is not required. Leakage distribution will be assumed based on the method in Appendix A of the 2006 RESNET standards if the supply and return leakage are not separately measured. ❑ If the test is performed without the register grilles installed, then 2.5% of the air handler flow shall be added to the measured leakage rate. For purposes of this calculation, use either the measured air handler flow, or the default value found in Appendix A. If a final visual inspection determines that register boot to drywall and floor connections have been sealed, then this adjustment to the measured leakage may be omitted.
Outside Duct Leakage Test Procedure (Exception #1):	❑ If the following criteria are met, the measured outside duct leakage rate will be deemed to be 0 CFM25 for each duct system that meets the criteria. – 100% of the ducts and air handler are inside the conditioned space boundary; the ducts are 100% visible; and 100% of the ducts are not located in an enclosed space, such as a chaseway, interior or exterior roof, floor or wall cavity.

Table 2a. Leakage to Outside Test

Duct Testing Procedures	The following procedures are deemed by RESNET to meet ASHRAE 152 duct testing requirements for the purpose of HERS ratings.
Total Duct Leakage Test Procedure:	❑ This procedure is used to measure the total duct leakage rate (including outside duct leaks and inside duct leaks), when the duct system is subjected to a uniform test pressure (25 Pa). During this procedure, a duct testing fan is used to pressurize the duct system to the test pressure. <u>For purposes of duct efficiency calculations, all leakage measured with this procedure will be considered as Outside Duct Leakage.</u> ❑ Unconditioned or conditioned zones containing ducts shall be opened to

[14] The term "pressurize" or "pressurization" throughout these procedures may be used equally to refer to either "pressurization" testing or "depressuriazation" testing of the duct system and/or the house.

either the outside or the inside, and at least one door or window between the conditioned space and outside shall be opened. If any duct zone(s) can not be opened to inside or outside as specified above, the duct system shall be tested with the buffer zone(s) in an "as is" test condition.

- Measurement of duct zone pressures and duct plenum pressures is not required. Leakage pressures during system operation will be assumed to be 25 Pa if duct zone and plenum pressures are not measured.
- Separate measurement of supply and return leakage rates is not required. Leakage distribution will be assumed based on the method in Appendix A of the 2006 RESNET standards if the supply and return leakage are not separately measured.
- If the test is performed without the air handler installed, then add 2.5% of the air handler flow to the measured leakage rate. For purposes of this calculation, use either the measured air handler flow, or the default value found in Appendix A.
- If the test is performed without the register grilles installed, then add 2.5% of the air handler flow to the measured leakage rate. For purposes of this calculation, use either the measured air handler flow, or the default value found in Appendix A. If a final visual inspection determines that register boot to drywall and floor connections have been sealed, then this adjustment to the measured leakage may be omitted.

Attachment IV

RESNET
Residential Energy Services Network
Setting the STANDARD for QUALITY

Proposed by:
RESNET Standing Technical Committee

Applies to:
RESNET Standard – Table 303.4.1.(1), under "Building Component--Mechanical Ventilation":

Interpretation:
"None, except where a mechanical ventilation system is specified by the rated Home, in which case: Annual vent fan energy use: …"

Shall be deemed to mean:

"None, except where a mechanical ventilation system is specified in the rated Home. Where mechanical ventilation is specified, the total air exchange rate for the reference home shall be as specified in "air exchange rate" above and annual ventilation fan energy use shall be included in the reference home as follows:"

Explanation:
This is required to clarify that the air flow from a ventilation system shall not be added to the reference home when a ventilation system is included in the rated home. This applies generally to software providers.

Attachment V

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

Residential Energy Services Network's Strategic Planning Framework

I. Introduction

In the four years that RESNET has been incorporated the organization has witnessed a dynamic growth in terms of accomplishments, financial stability, staffing, and credibility. Because of this growth, in 2005 the RESNET Board of Directors directed staff to take stock of these accomplishments and develop a strategic planning framework for the organization.

Strategic planning does not guarantee correct decision making. It only ensures that decisions will be made with foresight. The framework is designed to be a process rather than a static document. The framework should serve as the foundation for the organization's:

- Priorities
- Budget
- Evaluation

This framework should be seen as a road map. This road map is necessary because as the adage goes, "*If you don't know where you are going, any road will get you there.*" It must be stressed that this strategic planning framework is designed to be a guide for the board and staff to make decisions and is not a static document. The important element of strategic planning is not the development of a plan but planning. It is strategic thinking and acting that are important and not the plan itself.

It must be remembered that the building performance industry is a dynamic field with many unforeseen opportunities and threats. RESNET will always need the flexibility to meet changing circumstances. This planning creates an anticipatory organization whose members work toward common goals while being able to seize unexpected opportunities and cope with unexpected challenges.

RESNET's staff approached this strategic planning effort as a process of examining the organization's mission, services, goals and opportunities. The goal of the framework is not only to create a consensus around a vision for the future to allow the organization to build a sense where it is heading; but also, to

allow everyone, not just the leaders, to understand the direction being taken by the organization.

Building Performance Planning Focus Group

The first critical step in the planning process was to develop a "large picture from 30,000 feet" of the status of the rating industry. To achieve this, staff convened an industry focus group to define the long term strengths, weaknesses, opportunities, and threats to our organization and industry. The focus group was composed of representative experts of the rating industry and its stakeholders.

The focus group was facilitated by David Meisegeier of ICF Consulting. Its members were:

- Mike Baker, TXU Electric Delivery
- Steve Cowell, Conservation Services Group
- Megan Edmunds, E-Star Colorado
- Philip Fairey, Florida Solar Energy Center
- David Goldstein, Natural Resources Defense Council
- Thomas Hamilton, CHEERS
- Stephanie Harmon, Progress & Associates
- Michael Holtz, Architectural Energy Corporation
- David Lee, Environmental Protection Agency
- Joseph Lstiburek, Building Science Corporation
- Kelly Parker, Guaranteed Watt Saver Systems
- Edward Pollock, U.S. Department of Energy
- Bill Prindle, American Council for an Energy Efficiency Economy

Residential Energy Services Network's Strategic Planning Framework

Vision Statement

"RESNET's vision is of a world that encourages and rewards minimum building energy use through independent, performance-based building certification."

Mission

"RESNET's mission is to ensure the success of the building energy performance certification industry, set the standards of quality and increase the opportunity for ownership of high performance buildings."

Services Provided

I. The Uniform National Standard of Measuring and Comparing a Building's Energy Performance

The creation of a uniform definition of a reference building, by which all buildings can be compared, creates a platform in which programs, the housing industry, lending institutions, and consumers can measure the energy performance of buildings and calculate energy and pollution savings. This allows programs such as ENERGY STAR, energy efficient mortgages, tax credits, state energy codes, and utility programs to set a marker on the rating scale for a building's energy performance. The rating method does not pre-select which measures should be applied but rather gives the rater and the builder the option of selecting what makes the most sense for their market.

II. National Standards and Infrastructure for Accreditation, Certification, and Quality Assurance

RESNET sets the standard for quality for performance based building certification. RESNET has created standards for the training and certification of raters and other building performance professionals, the procedures for ensuring the quality of rating services, and the technical specifications of rating software programs. The RESNET standards are recognized by the mortgage industry; state energy codes; utility public benefit programs; the U.S. Environmental Protection Agency (EPA); the U.S. Department of Energy (DOE); the U.S. Department of the Treasury and Congress, for proposed federal tax credits.

III. Recognition in the Market Place of the Added Value of Building Performance and Rating Certification Services

Since rating and building performance certification services are voluntary and private sector based, they must be profitable in the market place. RESNET provides the national market differentiation and business development framework for raters to market their building performance certification and consulting services to the national building industry.

IV. The National Information Source for Building Performance

A key service of RESNET is to provide reliable information on the value of high performing buildings to building performance professionals, the housing industry, government agencies, and consumers. RESNET employs a highly sophisticated combination of communication channels including a web site, an Internet Blog, e-mail communications, periodic news letters, and an annual conference to provide this service.

V. Recognition of the Value of High Performance Homes in the Mortgage Process

A home that has higher energy performance is a more affordable and of higher quality. RESNET works with the mortgage industry to recognize and monetize the value of a high performance home in mortgage loans. This increases the opportunities for more families to afford a mortgage loan and a higher quality home.

Strategic Opportunities

I. RESNET Financial Sustainability

Currently, RESNET is financially dependent upon one-time-only grants and contracts for its annual budget. In order to meet the needs of its members in a rapidly emerging market amid government agency budget reductions, it is not realistic to depend on such year-to-year sources of revenue. In addition, RESNET does not have a reserve fund to cover the organization in case an expected revenue source does not become a reality or if a new opportunity emerges. As a membership organization of the rating industry, the rating industry must provide the support for RESNET. RESNET must set a realistic accreditation fee structure and develop service value pricing. As part of the RESNET strategic planning framework, a proposed plan for service value pricing will be included. The plan will address reserve funds, define the value of the services

provided by the organization, the pricing structure that reflects the value, and how the organization will communicate this value to its members.

II. Business Development

RESNET has two interrelated elements in its mission: setting the standards of quality for rating and building performance certification services and providing tools for raters to be profitable enterprises. RESNET's focus for the past three years has been to enhance the national rating standard. The focus needs to shift to include rating business development. RESNET must develop tools to assist those raters who have the opportunity for success and are willing to take advantage of the tools to succeed as profitable enterprises.

III. Federal Tax Credit Verification

After five years of hard work and advocacy, tax incentives for increasing the energy efficiency of buildings is law. The tax incentives address new homes, existing homes, and commercial buildings. The incentives are only slated to exist for two years. All of the tax incentives offer business opportunities to raters to expand their services. The goal of the incentives is market transformation. RESNET must assist in developing a coalition of governmental agencies, energy advocacy groups, utilities, and the private sector to develop a comprehensive market transformation effort that will maintain the demand for services after the tax incentives expire.

IV. Sustainable/Green Building

More than energy efficiency, builders are interested in green buildings. The National Association of Home Builders Association (NAHB) is aggressively pursuing its green builder program. Surveys also show that consumers show preference for products that are labeled as environmentally friendly. A home's energy performance is part of all green building program qualification criteria. This is an opportunity for RESNET to partner with national green building programs, such as NAHB and the U.S. Green Building Council on having home energy ratings provide the verification of a home's energy performance. The green building movement also presents an opportunity for raters to expand the services they offer to verify non-energy criteria.

V. Energy Codes

There is a national trend for building departments to recognize third-party inspections of homes. This is due to such factors as limited budget resources; the addition to the code of non-structural and non-life and safety requirements, such as energy efficiency; and the growing popularity

of a performance path option. This presents a dynamic opportunity for the rating industry to expand its services to include verification of energy code compliance.

This trend will only increase as builders move toward performance compliance. Builders are discovering that they are able to meet the energy performance thresholds of the code more economically through the performance option. When presented with a realistic option, builders will choose building performance. This is best demonstrated in the ENERGY STAR Homes Program. Over 90% of builders use the home energy rating certification over the prescriptive Building Option Package. The knowledge base, tools, and time required for performance inspections are beyond most building department's resources. It is envisioned that building departments will increasingly privatize the testing and inspections for builders using the performance option of code compliance.

When presented with an opportunity, builders will choose a dynamic performance compliance option over a restrictive prescriptive path. This trend will increase with the adoption of a dynamic performance path in the 2006 International Energy Conservation Code (IECC).

The RESNET standards, with its quality assurance provision, will increase the confidence of code officials in the integrity of ratings. Fourteen states already allow home energy ratings as an energy code verification option. RESNET needs to continue to advocate revising the IECC to explicitly include ratings as a compliance mechanism so that more states will be comfortable recognizing home energy ratings as a viable compliance option.

VI. Multi-Family and Commercial Buildings

Increasingly, there is growing interest by developers and utility sponsored programs to expand ENERGY STAR into multi-family buildings that are larger then three stories. With Congress passing tax incentives for commercial buildings that require performance verification, a business opportunity for raters has been created. Currently, there are no national standards for commercial buildings such as RESNET's residential standards. Working with commercial energy efficiency programs such as the Building Commissioning Association and the New Buildings Institute, RESNET should expand its residential standards to address the verification of energy performance of commercial and multi-family buildings. A National ENERGY STAR Multi-Family Working Group has been formed that has developed protocols for rating of multi-family buildings. This effort is currently being piloted in New York, Oregon and Wisconsin.

VII. Residential Pollution Reduction Verification Protocol

Achieving international recognition of energy ratings as the protocol for verification of pollution emission reduction is the greatest long-term opportunity for RESNET. Because of economic and political constraints, improving the energy efficiency of buildings presents the largest and most cost-effective near term strategy for carbon reduction. The European Union, the G-8 and the U.S. Department of Energy recognize this in their climate change strategies. Residential energy efficiency is also being viewed as a strategy for meeting the Environmental Protection Agency's mitigation of regulatory requirements for clean air in non-attainment areas. The State of Texas is an example of this trend.

Because the U.S. has not entered into the Kyoto Accord or adopted a carbon cap and trade protocol, America will not drive the procedures for verification of carbon savings – rather it will likely be led by the European Union (EU). Beginning in 2006, all EU member states must require ratings on all buildings at the time of sale and change of occupancy. For this reason, RESNET will need to aggressively create a dialogue with the EU, Canada, and other nations developing building rating programs.

VIII. Affordable Housing

Energy efficiency is a key factor for affordable housing. Affordable housing programs are making energy efficiency a higher priority. Energy ratings can play a key role in this trend. Already through the Building America program, dynamic partnerships are being developed between raters and Habitat for Humanity Affiliates. The U.S. Department of Housing and Urban Development (HUD) is encouraging public housing authorities to have their existing homes rated and have new developments built to the ENERGY STAR specifications. RESNET's efforts in this arena should be expanded.

IX. Building Performance Diagnostics and Remediation

As building performance experts, RESNET members are engaged in assessing the design, operation/maintenance and performance of building systems, including architectural, mechanical and electrical systems. As a consequence, RESNET members will diagnose operational and performance problems and will recommend approaches to remediate there problems. A market opportunity is growing in both the residential and commercial building sectors to offer building performance diagnostic and remediation services which RESNET can assist its members by developing methods and standards for building performance diagnostics and certifying knowledgeable building performance diagnosticians.

Goals

1. By 2010, the RESNET uniform standard for measuring and comparing a building's energy performance will become the accepted national standard for measuring the energy performance of buildings.

A key priority of RESNET is to maintain the uniform method of measuring comparing and certifying a building's energy performance. This is the essence of RESNET's mission as an organization. The creation of a uniform definition of a reference building by which all buildings can be compared creates a national platform by which programs, the housing industry, lending institutions, and consumers can quantify the energy performance of buildings and calculate energy and pollution savings.

2. By 2015, the RESNET standards will be internationally acknowledged as standards for quality in the verification of building performance and the certification of pollution savings.

RESNET sets the standards for quality in rating services. We have created the standards for training and certification of raters, the procedures for rating providers to ensure the quality of rating services, and the technical specifications for rating software programs. The RESNET standards are recognized by the mortgage industry; state energy codes; public utility benefit programs; EPA; DOE; HUD; and the U.S. Department of the Treasury, for tax credits.

As part of its plan to comply with the Kyoto Protocol on global climate change, the European Union (EU) has passed a law that mandates all member nations to enact a building energy performance rating program that requires all buildings be energy performance rated at the time of sale or change of occupancy. The U.S. and the European Union should adopt complementary rating standards, such that energy ratings are an internationally recognized tool for verifying carbon savings. RESNET should actively work to develop international (ISO) standards that support this objective. The number of buildings in Europe that will be rated because of the EU directive will result in a much larger market for interested parties to invest in energy efficiency and renewable energy.

3. By 2010, rater services will be valued by the national marketplace without regard to subsidies and will be expanded to include the other features of a building's performance.

Since rating and building performance services are voluntary and private sector based, they must be profitable in the market place. Currently many rating providers are successful because of program subsidies. Many

raters do not have the business skills necessary to branch out into other sectors. RESNET needs to provide raters with the tools for success in new markets by defining market differentiation, various business models and value propositions.

Through the expansion and diversification of rating services, not only, will existing partnerships be strengthened, but also, new partnerships will be forged. With the tools provided by RESNET, raters will be able to take advantage of strategic opportunities that will expand their services beyond energy features. They will become vital partners in maintaining a building's performance in the areas of comfort, durability, health and safety, and environmental impact.

Process Objectives

Goal 1. By 2010, the RESNET uniform standard for measuring and comparing a building's energy performance will become the accepted national standard for measuring the energy performance of buildings.

Objective 1a. To develop procedures and have the federal government adopt those procedures for the verification of tax credits for new homes based upon the RESNET standard.

Objective 1b. To have EPA adopt RESNET's whole-building energy use procedures for verification of ENERGY STAR Homes.

Objective 1c. To have RESNET verification procedures adopted by the U.S. Green Building Council and the National Association of Home Builders for the energy efficiency elements of their green building programs.

Objective 1d. To have DOE adopt the RESNET reference home as the basis for the Building America benchmark.

Objective 1e. To incorporate RESNET's standards into existing homes programs such as EPA's Home Performance Through ENERGY STAR and the Building Performance Institute.

Objective 1e. To assist Fannie Mae in adopting new energy mortgage products that will include manufactured homes, multi-family buildings, and energy improvement mortgages that can go into effect after closing based upon RESNET standards.

Objective 1f. To advocate that the U.S. Department of Housing and Urban Development adopts the RESNET standards for its affordable housing initiatives.

Objective 1g. To advocate that the International Energy Conservation Code explicitly recognizes the RESNET standard for verification of the performance compliance option.

Objective 1h. To establish the RESNET standard as the verification mechanism for measuring residential pollution savings.

Objective 1i. To make the HERS Index into a national brand recognized by consumers as "the" metric for assessing building energy performance.

Goal 2. ***By 2015, the RESNET standards will be internationally acknowledged as standards for quality in the verification of building performance and the certification of pollution savings.***

Objective 2a. To be the premier U.S. organization known for verification and labeling of building energy performance

Objective 2b. To have the European Union's Building Performance Directive acknowledge the RESNET standard as complementary to the European Union's standard (CEN) for building performance verification.

Objective 2c. To have Canada acknowledge the RESNET standard as complementary to that nation's standards for building performance.

Objective 2d. To have the International Energy Agency acknowledge the RESNET standard as complementary to its G-8 building efficiency effort for building performance verification.

Objective 2e. To coordinate with Canada, the European Union, and the International Energy Agency to incorporate the RESNET standard and their complementary standards into a formal international (ISO) standard.

Objective 2f. To work with Asia, Australia and New Zealand to have their building performance verification standards complement the RESNET (and European) standard.

4. ***Goal 3. By 2010, rater services will be valued by the national marketplace without regard to subsidies and will be expanded to include the other features of a building's performance.***

Objective 3a. To develop and deliver business and marketing development training to RESNET rater members

Objective 3b. To expand the definition of rating services to include energy code compliance, green building verification, affordable housing, and verification of improvements to existing homes by building performance contractors

Objective 3c. To develop business models for raters to provide services to commercial and multifamily facilities

Objective 3d. To develop business models for raters to provide verification of building pollution savings as a service

Objective 3e. To provide the national information resource for trusted information on building performance

Objective 3f. To adopt optional building performance specialty certifications for raters who are trained in comfort, durability, health and safety, and environmental impact fields.

Objective 3g. To develop a certification standard for building performance specialists

Objective 3h. To establish a linkage between certified energy raters and Building Performance Institute certification

Objective 3i. To establish a linkage between certified energy raters and green building inspectors

Objective 3j. To incorporate comfort, durability, heath and safety, and environmental impact into RESNET rating standards.

Objective 3k. To develop rating expertise and certification services that foster the privatization of building code inspection and home inspection services.

Attachment VI

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

2006 RESNET Priorities

I. Develop and Implement Accreditation Process for Federal Tax Credit for Energy Efficient Homes Verification — In 2005 Congress passed and President Bush signed the 2005 Energy Policy Act that provides for a federal tax credit for builders who build energy efficient homes. The U.S. Department of Treasury rules recognize RESNET for accrediting software programs that are used to verify a home''s energy performance for the tax credit. In 2006 RESNET will need to develop an application form and a process for reviewing applications and posting software programs that are accredited.

II. Conduct Rating Provider Quality Assurance Monitoring — Beginning on April 1, 2005 accredited rating providers were required to implement the new rating quality assurance procedures. In 2005 RESNET staff initiated a pilot effort to monitor rating provider''s implementation of the new procedures. In 2005 six providers were monitored in the states of Florida, Georgia, Indiana, Minnesota, and Nevada. This effort will be expanded in 2006.

III. Provide national outreach in support of federal tax credits –– Revise and update the Builder Resources and Consumer Resources pages of the RESNET web site to provide detailed information to builders and consumers on qualifying for the federal tax credits. Provide a service that will link interested builders and consumers with certified rater members and ""registered"" builders in their region who are willing to provide detailed assistance. Require certified raters and interested builders to "sign up" for this list and provide opportunities for training in tax credit qualification.

IV. Revise RESNET National Energy Rater Test — In 2005 RESNET began administering on-line tests for raters, rater trainers, and rating provider quality assurance designees. The tests were developed from questions that accredited rater training providers had been using in their individual training programs. In 2006 the test will be revised including modifying questions to be ANSI compliant.

V. Advocate for Extension of New Homes and Commercial Buildings Energy Efficiency Tax Incentives and for a Performance Based Existing Homes Credit — The tax incentives for new homes and commercial buildings passed by Congress in 2005 are set to expire on December 31, 2007. This is simply not enough time for large builders to change their production

schedules and commercial building owners to prepare to take advantage of the tax incentives. Since the purpose of the tax incentives is transform the market RESNET must advocate that the two incentives be extended.

The tax credit for homeowners to improve the energy performance has several serious flaws: (1) it is a cost based credit and (2) the amount is simply too small to motivate a homeowner to do something. There are several bills being drawn up to address these issues. RESNET must advocate for an effective and responsible tax credit for existing homes.

VI. Develop National Standards for Energy Audits of Existing Homes — With spiraling energy costs media and consumer interest in energy audits of homes is increasing. Currently there are no national standards that define what a home energy audit includes and the skills and knowledge the individual who conducts the inspection and testing for an energy audit. In 2006 RESNET will develop a national standard.

VII. Advocate with the U.S. DOE that they adopt a specific, nationwide qualification for a "Zero Energy Home" labeling program. As a means of expanding on the Energy Star initiative of EPA, advocate with DOE that they adopt a similar labeling program that goes a large step beyond the Energy Star program by establishing a specific HERS Index that will qualify a home as a DOE "Zero Energy Home."

VIII. Implement Sampling Provider Accreditation Application Process –– In 2005 the RESNET Board of Directors adopted a sampling provider accreditation standard. The Environmental Protection Agency has adopted the RESNET standard for the ENERGY STAR for Homes Program. In 2006 RESNET staff will develop an application and application review process to accredit rating providers to conduct sampling.

IX. Develop and Implement Information Campaign to Inform the Rating Industry of the Technical Changes that will go into Effect on July 1, 2006 — A number of technical enhancements to the national home energy rating standards will go into effect on July 1, 2006. The most significant are the change from a rating score to a rating index, the aligning of the reference home with the 2006 International Energy Conservation Code, the expansion of the rating method to rate lighting, appliances, and on-site energy production, and insulation quality installation inspection. RESNET will undertake a concerted effort to educate the rating industry on these changes.

X. Adopt Test Suite for Approving Software to Calculate Compliance to the International Energy Conservation Code — The U.S. Department of Energy has provided funding to RESNET through the National Renewable Energy Laboratory to develop a test suite for approving software programs to be recognized by code officials for calculating compliance to the International

Conservation Code. The RESNET Software Verification Testing Task Force has almost completed its recommendations on the test suite. In 2006 the RESNET Board of Directors will need to adopt the test suite and staff work with the Department of Energy in having the test suite endorsed by the Department of Energy. The goal is to make it easier for code officials to recognize software programs to calculate a home''s energy performance for meeting code.

XI. Continue Dialogue with the European Union on an International Protocol for Energy Ratings - The European Union (EU) has targeted building energy performance as a major component of meeting its obligations under the Kyoto Climate Accord. The EU has enacted legislation, ""The Energy Performance of Buildings Directive"" that member states must enact requirements for rating buildings at time of sale or change of occupancy. This action has a dramatic potential impact on setting up a protocol for carbon reduction trading and building energy savings. Clearly there are advantages to developing a dialogue between the US and Europe on building performance and energy ratings. The RESNET Board adopted the development of such a dialogue as one of the top priorities for RESNET for 2005.

To set up such a dialogue, Steve Baden and Philip Fairey were invited to present the experience of the U.S. rating effort to the European Union''s Energy Performance of Buildings Directive Conference in Brussels, Belgium in September. Through RESNET''s participation in the conference a dialogue has been established between RESNET and its European counterparts. This needs to be followed up on in 2006.

In addition RESNET''s representatives met with the International Energy Agency (IEA). It was agreed that there needs to be more cooperation between the U.S. and Europe on improving the energy efficiency of existing buildings. As the first step, it was agreed that RESNET and the IEA would co-host a side meeting on improving the energy efficiency of existing buildings at the 2006 ACEEE Summer Study on Energy Efficiency in Buildings in August 2006. In addition, it was agreed that RESNET and the IEA would write a paper on Monetizing Energy Efficiency that would be submitted to the ACEEE for publishing and be posted on the RESNET web site.

XII. Implement New Categories of Certification for Raters - In 2005 the task force developed and the RESNET Board adopted a set of specifications and definitions of knowledge base, skill sets and experience for the following categories of rater certification:

. Rating Field Assessor

. Certified Rater

. Senior Certified Rater

A formal recognition of rater''s certification in related fields was also adopted. In 2006 RESNET will create the application and implement the new categories of certification.

XIII. Host the 2006 RESNET Building Performance Conference — The RESNET Building Performance Conference is the premier national forum on energy ratings and building performance. The 2006 conference will take place on February 27 — March 1, 2006 in San Antonio, Texas. The theme of the 2006 RESNET Building Performance Conference is "Embracing the Future". The energy rating and building performance industries are at a critical crossroads. There are a number of changes that will take place over the next year that will impact the rating industry. While these events will change the way the ENERGY STAR Homes are labeled and how ratings are conducted, they also present new opportunities. The 2006 RESNET Building Performance Conference will review the changes in the rating industry, discuss their implications, and explore how to position a rating business to profit from the new opportunities.

XIV. Implement the North Carolina ENERGY STAR Homes Program — RESNET has received funding from the North Carolina Energy Office to form a dynamic partnership with the energy office, the North Carolina Fannie Mae Partnership Office, the state''s rating industry and the state''s housing industry to jump start the demand for ENERGY STAR homes, home energy ratings and energy mortgages in the state. The project will be completed in 2006.

XV. Implement Building America Project — With funding from the U.S. Department of Energy''s Building America Program the Florida Solar Energy Center will subcontract with RESNET to complete the following in 2006:

- Work with Fannie Mae to extend the energy efficient mortgage to manufactured homes that are built to the Building America systems engineering specifications.
- Recruit certified home energy raters to participate in the Habitat for Humanity''s Building America effort.
- Work with Building America team members in setting up an infrastructure of energy raters that provide on-going support after the teams complete the project.

XVI. Incorporate Energy Raters Into Building Performance Institute''s Certification — RESNET has entered into a partnership with the Building Performance Institute (BPI) to incorporate certified raters into BPI''s building performance contractor certification. It is already been agreed that certified home energy raters who have passed the RESNET National Rater Test will not have to take the BPI CORE test. In 2006 RESNET and BPI will come to agreement on how certified raters can be certified as BPI Professional Analysts and incorporate home energy raters into BPI''s building performance contractor quality assurance process.

XVII. Establish Linkage Between Certified Home Energy Raters and Green Building Programs - The U.S. Green Building Council (USGBC) realizes that engaging the RESNET community is crucial to the success of LEED for Homes. For this reason they have entered into a Memorandum of Understanding with RESNET. The USGBC has used RESNET accredited rating providers for the pilot LEED for Homes projects. In 2006 RESNET will work with the USGBC on incorporating certified home energy raters in the on-going LEED for Homes effort. RESNET will also work with the National Association of Home Builders on how to link certified raters into their green homes program.

XVIII. Deliver Business and Marketing Plan Development Training for RESNET Rater Members — RESNET has two visions for success of the rating industry. The first is setting standards for quality of rating services thereby enhancing the credibility of the entire industry. The second is to help raters succeed in being profitable businesses. RESNET believes that the raters'' success is everyone''s success. For the past three years RESNET''s emphasis has been setting the standards for quality. Beginning in 2006 the emphasis will be expanded to include rating services business development. In 2005 RESNET staff developed a plan of action that, if implemented, will provide raters with a myriad of tools and resources to increase their business opportunities. RESNET staff began with the premise that raters who use the resources available to them through RESNET will significantly increase their chances of success in our industry. In 2006 RESNET will post a web site with resources to develop marketing strategy for rating services and pilot a series of regional workshops for raters on developing an effective marketing plan.

XIX. Develop Prioritized List of Potential New Services for Home Energy Raters — A key goal of the RESNET Strategic Planning Framework is expanding the services that certified raters provides other than the rating of homes. RESNET has already taken the first step in developing new opportunities through verification for the new federal tax credit, rating of homes for the USGBC LEED for Homes Program, and providing analysis and quality assurance services for BPI. In 2006 RESNET staff will develop a listing of potential new services that certified raters can move into.

XX. Continue and Enhance RESNET''s Strategic Planning Framework — In 2005 RESNET staff completed a comprehensive strategic planning effort for the organization. As a result of this effort the RESNET Board of Directors was presented a RESNET Strategic Planning Framework. Since strategic planning is not an event but rather is an on-going process, in 2006 staff will continue to update and enhance the strategic planning framework.

XXI. Advocate to the U.S. Department of Energy that the Building America Benchmark Align with the RESNET Home Energy Rating Reference Home – – At the 2001 RESNET Conference participants adopted a set of policy priorities for the organization. This included having home energy ratings serve as the base

for verification of a home''s energy performance for federal programs. Currently the U.S. Department of Energy has adopted a research benchmark that is still based upon the Model Energy Code. The Building America Program has changed its emphasis to being the path that leads to zero energy homes. With the whole energy use rating method that RESNET has adopted it just makes sense that the Building America Program adopt the RESNET reference home as its research bench mark. In 2006 RESNET will advocate to the U.S. Department of Energy that its Building America research bench mark be based upon the RESNET reference home.

XXII. Develop Plan to RESNET Board on Value Based Pricing Policy for Charging for RESNET's Services — A key goal of RESNET is to be financially self-sustaining. The organization can not achieve this by being solely reliant on accreditation fees. It must develop a definition of services it can charge for, define the value of these services to the rating industry, and develop a pricing structure to reflect this value. RESNET staff will work with RESNET''s treasurer and present a plan of action to the RESNET Board.

XXIII. Co-Write Paper on Monetizing Energy Efficiency with the International Energy Agency — The greatest long term sustaining incentive for improving the energy performance of buildings is to monetize the savings in the market place. In the European Union this is done by a number of member states. A first step has been made in the U.S. with the fledgling carbon reduction trading market. In 2006 RESNET and the International Energy Agency will co-author a paper on this opportunity. It will be presented to the American Council for an Energy Efficient Economy's Summer Study on Buildings and posted on the RESNET web site.

XXIV. Coordinate 2006 RESNET Rating Industry Leadership Awards Program - To recognize leadership in the rating industry the RESNET Board of Directors established Rating Industry Leadership Awards. There are three categories of the award:

Market Transformation Leadership Award
Innovation Leadership Award
Program Leadership Award

In 2005 applications were solicited. Applications have been submitted for every category of the award. The winners will be announced at the 2006 RESNET Building Performance Conference.

RESNET Residential Energy Services Network — Setting the STANDARD for QUALITY

2006 Projected Income and Approved Budget

Projected Income

Accreditation Fees	$281,000	
RESNET Conference	$125,000	
Testing Fees	$ 41,000	
Grants	$189,000	
EPA (new)		$30,000
PNNL (new)		$50,000
NREL (carry forward)		$25,000
N Carolina (carry forward)		$50,000
BPI (carry forward)		$34,000

Total Projected Income $636,000

Approved 2006 Budget

Professional Services	$300,000	
Western Residential Energy Services (Steve Baden, Claudia Brovick, Randy Martin, Kathy Spigarelli)		
Conservation Services Group		
Florida Solar Energy Center		
Accounting	$ 15,000	
Davis & Dash		
Travel	$ 65,000	
Supplies	$ 3,000	
Other	$210,000	
Banking Service Charge -		$6,000
Rater Member Subscriptions to Home Energy -		$ 5,000
Internet Service -		$ 1,000
Postage & Delivery -		$ 2,500
Telephone -		$ 5,500
Insurance -		$ 2,500
Copying & Printing -		$ 3,500
Conference Contingency -		$95,000
Conference Food & Beverage -		$89,000

Total Approved Budget $593,000