# Residential New Construction Program

## Protocols

***Whole building*** ***~~Single-Family, Multi-Single and Low-Rise Multifamily Building Shell~~***

~~E~~energy savings due to ~~thermal shell and mechanical equipment~~ improvements in residential new construction and "gut" renovation projects are calculated using outputs from RESNET accredited Home Energy Rating System (HERS) ~~REM/Rate™~~ modeling software[~~1~~]. All program homes are modeled ~~in REM/Rate~~ using accredited software to estimate annual energy consumption for heating, cooling, ~~and~~ hot water and other end uses included within the HERS asset rating. Standards for energy efficient new construction in New Jersey are based on national platforms including IECC 2015, EPA ENERGY STAR® Certified New Homes Program, EPA ENERGY STAR Multifamily High-Rise Program (MFHR), and the DOE Zero Energy Ready Home (ZERH) Program. All of these pathways are based on and incorporate by reference the applicable HERS standards including but not limited to the Mortgage Industry National Home Energy Rating System Standard & Addenda and ANSI/RESNET/ICC Standard 301, the latest versions of which can be found at http://www.resnet.us/professional/standards.

***Single-Family, Multi-Single (townhomes), Low-Rise Multifamily***

The program home is then modeled to a baseline specification using ~~REM/Rate's User Defined~~a program-specific ~~R~~reference h~~H~~ome (refered to in some software as a User Derfined Reference Home or UDRH) feature. The program reference home specifications are set according to the lowest efficiency specified by applicable codes and standards, thereby representing a New Jersey specific baseline home against which the improved efficiency of program homes is measured.

The NJCEP reference home shall be updated as necessary over time to reflect the efficiency values of HERS Minimum Rated Features based on:

- The prescriptive minimum values of the IECC version applicable to the home for which savings are being calculated;
- The Federal Minimum Efficiency Standards applicable to each rated feature at the time of permitting (e.g. minimum AFUE and SEER ratings for heating and air conditioning equipment, etc.);
- An assessment of baseline practice, as available, in the event that either of the above standards reference a non-specific value (e.g. "visual inspection");
- Exclusion of specific rated features from the savings calculation in order to remove penalties for building science based best practice requirements of the program (e.g. by setting the reference and rated home to the same value for program-required mechanical ventilation);
- Other approved adjustments as may be deemed necessary.

**Comment [BA1]:** Unlike the federal energy tax credit (now expired), the program, and the rating protocols on which the program is based, take into account more than just thermal shell and mechanical equipment.

**Comment [BA2]:** Since the NJ protocols were originally written, additional software options have become available and accredited by RESNET. The program should not limit the market to a single named "brand", provided the required output can be delivered in a format acceptable to the program.

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**Comment [BA3]:** "UDRH" is a REM/Rate-specific term. The intent is that the program home is compared with a baseline reference home with specifications set to local code and federal standard minimums, not the HERS reference home which is set at approximately IECC 2006 levels (HERS 100) in order to calculate a score for the home against a baseline that remains consistent over time.

**Comment [BA4]:** The narrative edits as presented and wholesale removal of the UDRH table appear to represent a mischaracterization of the savings calculation methodology as it relates to Residential New Construction. The three standards listed are pathways to *qualifying* the *upgraded* home, *not the baseline home*. REM/Rate terminology aside, the UDRH is the software's mechanism for defining the efficiency of a home built to minimum applicable codes and standards. These specification inherently change over time as national or local codes and standards are updated, so that the program home can be compared with the codes and standards applicable to that home (for this reason, the program administrator must maintain a number of UDRH files representing the baselines in play at any given time).
As presented, the program would realize no savings at all because the text states that the program home would be compared to the same standard used for program qualilfication. Further, while there is merit to removing the UDRH table so that it is not baked into the protocol, some guidance seems necessary for the program administrator to have a mandate under which to set and update the reference home specifications as needed. I offer my suggestions in this regard.

~~[1] Accredited Home Energy Rating Systems (HERS) software, http://www.remrate.com/~~

The RNC program currently specifies three standards for ~~UDRH baseline reference~~program qualification:

- IECC 2015 Energy Rating Index (for ~~specification is for~~ homes permitted on or~~prior to and IECC 2015 for homes permitted~~ after March 21, 2016)
- ENERGY STAR Certified Homes v3.1
- Zero Energy Ready Home &Zero Energy Home + RE

The difference in modeled annual energy consumption between the program and ~~UDRH~~ applicable baseline reference home is the projected savings for heating, hot water, cooling, lighting, ~~and~~ appliances and other end uses included in the HERS Minimum Rated Featues, as well as on-site renewable generation when applicable. Coincident peak demand savings are also derived from ~~REM/Rate~~rating modeled outputs.
~~algorithms that calculate energy and demand savings are as follows:~~

~~Energy Savings = (Baseline home energy consumption – Program home energy consumption)~~

~~table describes the baseline characteristics of Climate Zone 4 and 5 reference homes for single-family, multi-single and low-rise multifamily buildings.~~

**Comment [BA5]:** See previous comment. It is my understanding that the UDRH baseline is a function of the applicable code etc. as decribed above and not the qualification standard.

| ~~REM/Rate User Defined Reference Homes Definition~~<br>~~Applicable to buildings permitted prior to March 21, 2016 – Reflects IECC 2009~~ | | | |
|---|---|---|---|
| ~~Note~~ | ~~Data Point~~ | ~~Climate Zone 4~~ | ~~Climate Zone 5~~ |
| ~~(1)~~ | ~~Ceiling Insulation~~ | ~~U=0.030~~ | ~~U=0.030~~ |
| | ~~Radiant Barrier~~ | ~~None~~ | ~~None~~ |
| ~~(1)~~ | ~~Rim/Band Joist~~ | ~~U=0.082~~ | ~~U=0.057~~ |
| ~~(1)~~ | ~~Exterior Walls – Wood~~ | ~~U=0.082~~ | ~~U=0.057~~ |
| ~~(1)~~ | ~~Exterior Walls – Steel~~ | ~~U=0.082~~ | ~~U=.057~~ |
| | ~~Foundation Walls~~ | ~~U=0.059~~ | ~~U=0.059~~ |
| ~~(1)~~ | ~~Doors~~ | ~~U=0.35~~ | ~~U=0.35~~ |
| ~~(1)~~ | ~~Windows~~ | ~~U=0.35 , SHGC=NR~~ | ~~U=0.35 , SHGC=NR~~ |
| ~~(1)~~ | ~~Glass Doors~~ | ~~U=0.35 , SHGC=NR~~ | ~~U=0.35 , SHGC=NR~~ |
| ~~(1)~~ | ~~Skylights~~ | ~~U=0.60 , SHGC=NR~~ | ~~U=0.60 , SHGC=NR~~ |
| ~~(2)~~ | ~~Floor~~ | ~~U=0.047~~ | ~~U=.033~~ |
| | ~~Unheated Slab on Grade~~ | ~~R-10, 2 ft~~ | ~~R-10, 2 ft~~ |
| | ~~Heated Slab on Grade~~ | ~~R-15, 2 ft~~ | ~~R-15, 2 ft~~ |
| | ~~Air Infiltration Rate~~ | ~~7 ACH50~~ | ~~7 ACH50~~ |
| | ~~Duct Leakage~~ | ~~8 cfm25 per 100ft$^2$ CFA~~ | ~~8 cfm25 per 100ft$^2$ CFA~~ |
| | ~~Mechanical Ventilation~~ | ~~None~~ | ~~None~~ |
| | ~~Lights and Appliances~~ | ~~Use RESNET Default~~ | ~~Use RESNET Default~~ |
| | ~~Thermostat~~ | ~~Manual~~ | ~~Manual~~ |
| | ~~Heating Efficiency~~ | ~~-~~ | |
| ~~(3)~~ | ~~- Furnace~~ | ~~80% AFUE~~ | ~~80% AFUE~~ |
| | ~~- Boiler~~ | ~~80% AFUE~~ | ~~80% AFUE~~ |
| | ~~- Combo Water Heater~~ | ~~76% AFUE (Recovery Efficiency)~~ | ~~76% AFUE (Recovery Efficiency)~~ |
| | ~~- Air Source Heat Pump~~ | ~~7.7 HSPF~~ | ~~7.7 HSPF~~ |
| | ~~Cooling Efficiency~~ | ~~-~~ | |
| | ~~- Central Air Conditioning & Window AC units~~ | ~~13.0 SEER~~ | ~~13.0 SEER~~ |
| | ~~- Air Source Heat Pump~~ | ~~13.0 SEER~~ | ~~13.0 SEER~~ |
| ~~(4)~~ | ~~Domestic WH Efficiency~~ | ~~-~~ | |
| | ~~- Electric stand-alone tank~~ | ~~0.90 EF~~ | ~~0.90 EF~~ |
| | ~~- Natural Gas stand-alone tank~~ | ~~0.58 EF~~ | ~~0.58 EF~~ |
| | ~~- Electric instantaneous~~ | ~~0.93 EF~~ | ~~0.93 EF~~ |
| | ~~- Natural Gas instantaneous~~ | ~~0.62 EF~~ | ~~0.62 EF~~ |
| | ~~Water Heater Tank Insulation~~ | ~~None~~ | ~~None~~ |
| | ~~Duct Insulation, attic supply~~ | ~~R-8~~ | ~~R-8~~ |
| | ~~Duct Insulation, all other~~ | ~~R-6~~ | ~~R-6~~ |
| | ~~Active Solar~~ | ~~None~~ | ~~None~~ |
| | ~~Photovoltaics~~ | ~~None~~ | ~~None~~ |

**~~UDRH Table Notes~~**

| | |
|---|---|
| ~~(1)~~ | ~~U values represent total wall system U value, including all components (i.e., clear wall, windows, doors).~~<br>~~Type A-1 – Detached one and two family dwellings.~~<br>~~Type A-2 – All other residential buildings, three stories in height or less.~~ |
| ~~(2)~~ | ~~All frame floors shall meet this requirement. There is no requirement for floors over basements and/or unvented crawl spaces when the basement and/or unvented crawl space walls are insulated.~~ |
| ~~(3)~~ | ~~MEC 95 minimum requirement is 78 AFUE. However, 80 AFUE is adopted for New Jersey based on typical minimum availability and practice.~~ |
| ~~(4)~~ | ~~Based on the Federal Government standard for calculating EF (50 gallon assumed):~~<br>~~•Gas-fired Storage-type EF: 0.67 – (0.0019 x Rated Storage Volume in gallons)~~<br>~~•Electric Storage-type EF: 0.97 – (0.00132 x Rated Storage Volume in gallons)~~<br>~~•Instantaneous Gas-fired EF: 0.62 – (0.0019 x Rated Storage Volume in gallons)~~<br>~~•Instantaneous Electric EF: 0.93 – (0.0013 x Rated Storage Volume in gallons)~~ |

| ~~**REM/Rate User Defined Reference Homes Definition**~~<br>~~**Applicable to buildings permitted on or after March 21, 2016 – Reflects IECC 2015**~~ | | | |
|---|---|---|---|
| ~~**Note**~~ | ~~**Data Point**~~ | ~~**Climate Zone 4**~~ | ~~**Climate Zone 5**~~ |
| ~~(1)~~ | ~~Ceiling Insulation~~ | ~~U= 0.026~~ | ~~U=0.026~~ |
| | ~~Radiant Barrier~~ | ~~None~~ | ~~None~~ |
| ~~(1)~~ | ~~Rim/Band Joist~~ | ~~U=0.060~~ | ~~U=0.060~~ |
| ~~(1)~~ | ~~Exterior Walls – Wood~~ | ~~U=0.060~~ | ~~U=0.060~~ |
| ~~(1)~~ | ~~Exterior Walls – Steel~~ | ~~U=0.060~~ | ~~U=0.060~~ |
| | ~~Foundation Walls~~ | ~~U=0.059~~ | ~~U=0.050~~ |
| ~~(1)~~ | ~~Doors~~ | ~~U=0.35~~ | ~~U=0.32~~ |
| ~~(1)~~ | ~~Windows~~ | ~~U=0.35 , SHGC=40~~ | ~~U=0.32 , SHGC=NR~~ |
| ~~(1)~~ | ~~Glass Doors~~ | ~~U=0.35 , SHGC=40~~ | ~~U=0.32 , SHGC=NR~~ |
| ~~(1)~~ | ~~Skylights~~ | ~~U=0.55 , SHGC=40~~ | ~~U=0.55 , SHGC=NR~~ |
| ~~(2)~~ | ~~Floor~~ | ~~U=0.047~~ | ~~U=.033~~ |
| | ~~Unheated Slab on Grade~~ | ~~R-10, 2 ft~~ | ~~R-10, 2 ft~~ |
| | ~~Heated Slab on Grade~~ | ~~R-15, 2 ft~~ | ~~R-15, 2 ft~~ |
| ~~(3)~~ | ~~Air Infiltration Rate~~ | ~~7 ACH50~~ | ~~7 ACH50~~ |
| | ~~Duct Leakage~~ | ~~4 cfm25 per 100ft$^2$ CFA~~ | ~~4 cfm25 per 100ft$^2$ CFA~~ |
| | ~~Mechanical Ventilation~~ | ~~Exhaust only~~ | ~~Exhaust only~~ |
| | ~~Lighting~~ | ~~75% efficient~~ | ~~75% efficient~~ |
| | ~~Appliances~~ | ~~Use RESNET Default~~ | ~~Use RESNET Default~~ |
| ~~(4)~~ | ~~Thermostat~~ | ~~Manual~~ | ~~Manual~~ |
| | ~~Heating Efficiency~~ | ~~-~~ | |
| ~~(5)~~ | ~~- Furnace~~ | ~~80% AFUE~~ | ~~80% AFUE~~ |
| | ~~- Boiler~~ | ~~80% AFUE~~ | ~~80% AFUE~~ |
| | ~~- Combo Water Heater~~ | ~~76% AFUE (Recovery Efficiency)~~ | ~~76% AFUE (Recovery Efficiency)~~ |

| | REM/Rate User Defined Reference Homes Definition<br>Applicable to buildings permitted on or after March 21, 2016 – Reflects IECC 2015 | | |
|---|---|---|---|
| | - Air Source Heat Pump | 8.2 HSPF | 8.2 HSPF |
| | Cooling Efficiency | - | |
| | - Central Air Conditioning & Window AC units | 13.0 SEER | 13.0 SEER |
| | - Air Source Heat Pump | 14.0 SEER | 14.0 SEER |
| (6) | Domestic WH Efficiency | - | |
| | - Electric stand-alone tank | 0.90 EF | 0.90 EF |
| | - Natural Gas stand-alone tank | 0.60 EF | 0.60 EF |
| | - Electric instantaneous | 0.93 EF | 0.93 EF |
| | - Natural Gas instantaneous | 0.82 EF | 0.82 EF |
| | Water Heater Tank Insulation | None | None |
| | Duct Insulation, attic | R-8 | R-8 |
| | Duct Insulation, all other | R-6 | R-6 |
| | Active Solar | None | None |
| | Photovoltaics | None | None |

| | |
|---|---|
| (1) | U values represent total system U value, including all components (i.e., clear wall, windows, doors).<br>Type A-1 – Detached one and two family dwellings.<br>Type A-2 – All other residential buildings, three stories in height or less. |
| (2) | All frame floors shall meet this requirement. There is no requirement for floors over basements and/or unvented crawl spaces when the basement and/or unvented crawl space walls are insulated. |
| (3) | Based on New Jersey's amendment making the IECC 2015 requirement for air leakage testing optional, there is no empirical evidence that baseline new construction is achieving the 3 ACH50 tightness level through a visual inspection of checklist air sealing items. |
| (4) | While the code requires a programmable actual programming is an occupant behavior, both the rated home and reference home are set at fixed temperatures of 68 heating and 78 cooling, so that no savings are counted or lost |
| (5) | MEC 95 minimum requirement is 78 AFUE. However, 80 AFUE is adopted for New Jersey based on typical minimum availability and practice. |
| (6) | Based on the Federal Government standard for calculating EF (50 gallon assumed):<br>•Gas-fired Storage-type EF: 0.675 – (0.0015 x Rated Storage Volume in gallons)<br>•Electric Storage-type EF: 0.97 – (0.00132 x Rated Storage Volume in gallons)<br>•Instantaneous Gas-fired EF: 0.82 – (0.0019 x Rated Storage Volume in gallons)<br>•Instantaneous Electric EF: 0.93 – (0.0013 x Rated Storage Volume in gallons |

***Multifamily High Rise (MFHR)***

~~**Protocols**~~

~~***Multifamily High Rise (MFHR)***~~

Annual energy and summer coincident peak demand savings for qualifying MFHR construction projects ~~(4–6 stories)~~ shall be calculated from the Energy Star~~EPA Project Submittal document, 'As-Built~~ Performance Path Calculator~~Calculator'~~ (PPC)[2]~~.).~~ The PPC captures outputs from ~~eQuest~~ EPA approved modeling software. Coincident peak demand is calculated only for the following end uses: space cooling, lighting, and ventilation. Clothes washer data cannot be parsed out of the PPC "Misc Equip' field. RNC coincident factors are applied to the MFHR demand savings.

Energy and demand savings are calculated using the following equations:

Energy Savings = Average Baseline energy (kWh and/or therms) - Proposed Design energy (kWh and/or therms)

Coincident peak demand = (Average Baseline non-coincident peak demand - Proposed Design non-coincident peak demand) * Coincidence Factor

**Comment [BA6]:** This arbitrary and inappropriate restriction should not be baked into the savings protocols – this is a matter of policy not calculation.

**Comment [BA7]:** Again, "brand names" of qualified software should not be baked into this document.

[2] https://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_mfhr_guidance