Equivalency Between IECC Prescriptive Path and IECC Energy Rating Index

Prepared For

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OCTOBER 13, 2016

Report No. 3379-005_20161013

Disclaimer

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INTRODUCTION

This study reports HERS indices for defined configurations of typical houses (Standard Rated Homes) compliant with the 2015 International Energy Conservation Code (IECC) minimum requirements. For all building characteristics not defined in the IECC, the "Methodology for Calculating Energy Use in Residential Buildings"[1] (2012 Methodology) is followed. This Methodology was developed in 2012 by Home Innovation Research Labs (formerly NAHB Research Center) to provide guidance, uniformity, and practical construction and equipment choices for researchers comparing the energy performance difference resulting from code changes.

For this study REM/*Rate*™ v 15.2 (Summer, 2016) is used. REM/Rate produces HERS Indices according to the requirements of the ANSI/RESNET/ICC 301-2014 Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index (Republished January 15, 2016).

APPLICATION OF PREVIOUSLY DEVELOPED METHODOLOGY

Where possible, the baseline assumptions from the 2012 Methodology are followed. The 2012 Methodology assumptions are updated as necessary to meet the specific objectives of this study and the modifications are documented in the discussions for each parameter. The key differences include:

1. REM/Rate is used in lieu of BEopt

2. 2015 IECC prescriptive minimums are applied

ENERGY PERFORMANCE EVALUATION

The 2012 Methodology provides a method for comparing the performance of buildings with different construction and component specifications. The resulting HERS Index calculations for specific house configurations are aggregated by weighting the building characteristics (walls, foundations), energy type (gas, electric), and housing distribution in different climate zones. The bulk of this report outline follows the pattern of the 2012 Methodology for ease of review.

The weighted averages from the 2012 Methodology are applied to the energy results of the more than 300 building simulations in this study.

STANDARD RATED HOMES

Table R405.5.2(1) in the 2015 IECC uses the term "Standard Reference Design" for the code-built house that is used as the basis for comparison of the "Proposed Design" when determining predicted energy savings using the Simulated Performance Alternative. Table 4.2.2(1) in the new ANSI/RESNET/ICC Standard 301-2014 (Standard 301) uses the terms "Energy Rating Reference Home" and "Rated Home,"

[1] *Methodology for Calculating Energy Use in Residential Buildings*, 2012, NAHB Research Center, Upper Marlboro, MD.

respectively. The term “Standard Rated Home” is used in this report to designate the specific configurations being studied.

The original building configuration of the two-story standard rated home, including shape, size, foundation, and wall materials, was developed for the 2012 Methodology using the results of the 2008-2009 Annual Builder Practices Survey (ABPS) conducted by the NAHB Research Center (now Home Innovation Research Labs [HI]). The ABPS is an annual survey that gauges national and regional building practices and material use. Many construction choices related to energy and durability are based on local climate considerations, and material and product choices can be also driven by local availability or preferences. The parameters used in the 2012 Methodology represent the average (mean) values from the survey for building areas and features not dictated by the IECC. If the 2015 IECC includes requirements for these items, they are incorporated in the model as noted in this report.

Building Surroundings

The 2012 Methodology (consistent with the 2006 IECC upon which it was based) assumes no shading. That is also true for the current study. Although many homes do benefit from local shading produced by nearby trees or buildings, this component is so site specific that it cannot be properly accounted for in aggregate. Additionally, this capability as provided for in REM/Rate is imprecise. For these reasons, no bulk exterior shading of any sort is included in the models within this study.

Building Envelope Parameters

The building thermal envelope for all modeled building configurations conforms to the requirements of the 2015 IECC. Table R402.1.2 “Insulation and Fenestration Requirements by Component” is used to make initial assembly choices. As a second step, each assembly is adjusted to match the U-factors in Table R402.1.4 “Equivalent U-Factors.” The agreement with the U-factors is achieved by modifying materials and/or construction parameters in REM/Rate for each assembly.

House Geometry

Three typical house geometries are examined in each of eight climate zones. The Standard Rated Home (2,384 sf above-grade conditioned floor area [CFA]), Figure 1, was developed for the 2012 Methodology. For this study, a larger version (~4,800 sf above-grade) and a smaller version (~1,200 sf above-grade) of the Standard Rated Home are included (Figure 2). As the Methodology notes, these are “not intended to represent a house that has been or would be built; however, [they do] represent the relative averages for the components that affect energy consumption” and they provide a basis for comparison.

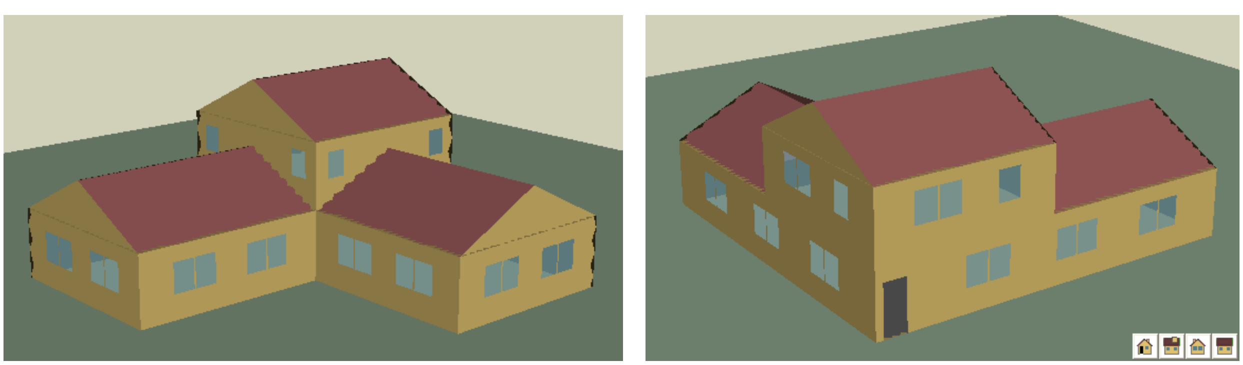

Figure 1. 3-D View of the Medium-Sized Standard Rated Home

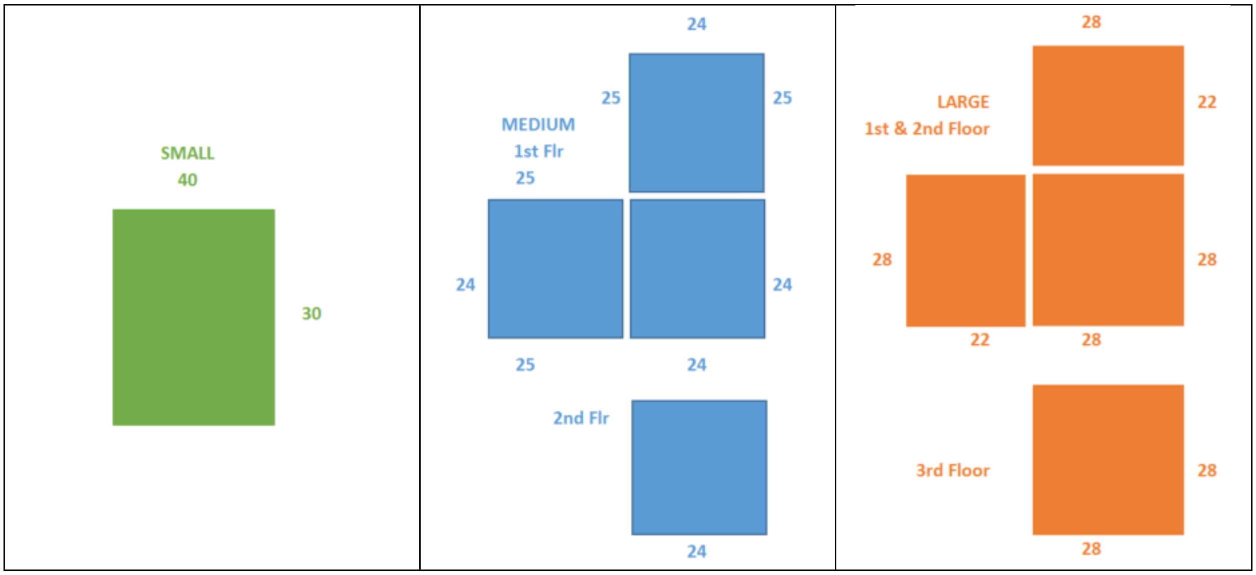

Figure 2. Geometries of the Three Reference Houses

Table 1 lists the various measurements of the Standard Rated Home models. The conditioned floor area (CFA; "Area of Conditioned Space" in REM/Rate) refers to above-grade floor area and is used as the basis for the 15% glazing calculation. For models with conditioned basements the main level plan is replicated below-grade and the total conditioned area is commensurately larger, as is the Volume of Conditioned Space. The CFA of a conditioned basement contributes to the calculated glazing area according to the 2015 IECC formula. Conditioned crawlspaces are not included in CFA because the height is less than 5 ft. Conditioned crawlspaces are included in the Volume of Conditioned Space because they are inside the building's thermal envelope.

The wall areas do not include band (or rim) joist areas which are assumed to be one-foot high and insulated the same as above-grade walls when adjacent to conditioned space. The same 2015 IECC minimum U-values apply to rims as to above-grade walls. REM/Rate includes rim thermal performance in calculating the wall UA and the energy and loads associated with the wall components. Because the attic in each house is ventilated, the gable wall area is not included as part of the thermal envelope.

Table 1. Average Wall and Floor Square Footage

Standard Rated Home Component (2012 Protocol, updated and expanded)	SM SF	MED SF	LG SF
1st Floor CFA	1,200	1,776	2,016
2nd Floor CFA	0	576	2,016
3rd Floor CFA	0	0	784
*Total CFA (w/o Conditioned Bsmt)	1,200	2,352	4,816
Total CFA (w/Conditioned Bsmt)	2,400	4,128	6,832
Vol. of Cond. Space (w/o Cond'd Foundation)	10,800	20,880	35,280
Vol. of Cond. Space (w/Conditioned Crawl)	15,600	27,984	43,344
Vol. of Cond. Space (w/Conditioned Bsmt)	20,400	35,088	51,408
Slab/Bsmt/Crawl Floor Area	1,200	1,776	2,016
Ceiling/Attic Floor Area	1,200	1,776	2,016
1st Floor Wall Area	1,260	1,764	1,908
2nd Floor Wall Area	0	816	1802
3rd Floor Wall Area	0	0	952
Total Above Grade Wall Area	1,260	2,580	4,662
Total Above Grade Wall/Floor Ratio	1.1	1.1	1.0
Bsmt Wall Area (8ft wall ht)	1,120	1,568	1,696
Crawlspace Wall Area (4' wall ht)	560	784	848
Window Area (glazing = 15% of CFA*)	180	353	722
Window Area Cond. Bsmt Confir. (formula*)	283	517	911
Door area	40	40	40
Window area, sf, each direction	45.0	88.2	180.6
Window area, sf, each direction, Cond Bsmt Config.	70.7	129.2	227.7
1st Floor rim area, sf	140	196	212
2nd Floor rim area, sf	0	96	212
3rd Floor rim area, sf	0	0	112

House Shape

The 2012 Methodology pointed out that "most houses are irregular in shape (i.e., not rectangles). Consequently, houses have a higher ratio of wall to floor area as compared to a simple rectangle." The adjustment for the larger version of the reference house maintains this assumption. Because smaller homes tend to be simpler, the small version of the reference house is a basic, single-story, rectangular box. The ratio of wall to volume is therefore slightly different for each size of reference house; the window to CFA ratios follow the same formulas for all three sizes.

Bedrooms

Occupancy is based on number of bedrooms (n + 1) which corresponds generally to the size of the house, as shown in Table 2.

Table 2. Reference Building Size and Occupancy

Size	Above-Grade Conditioned Area	Total Conditioned Area (homes with basements)	Number of Bedrooms	Number of Occupants
Small	1,200	2,400	3	4
Medium	2,352	4,128	3	4
Large	4,816	7,552	5	6

ENERGY MODELING ASSUMPTIONS

Table 3 shows the prescriptive building envelope U-factors by climate zone in accordance with the 2015 IECC for transparent assemblies. The prescriptive equivalent U-values for opaque envelopes are shown in Table 4. These values are used to develop the code reference building. Energy modeling parameters for the Standard Rated Home per the 2012 Methodology are summarized in Table 5. Variations or additions (often based on REM/Rate modeling defaults) are noted in italics.

Table 3. Adapted from IECC 2015 Table R402.1.2 for Transparent Assemblies

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC
1	0.5	0.75	0.25
2	0.4	0.65	0.25
3	0.35	0.55	0.25
4 (except Marine)	0.35	0.55	0.40
Marine 4 & 5	0.32	0.55	0.40[a]
6	0.32	0.55	0.40[a]
7 & 8	0.32	0.55	0.40[a]

[a.] Per 2012 Methodology, and to meet reference house requirements – there is no IECC minimum requirement for these climate zones

Table 4. Baseline 2015 IECC U-Factors for Opaque Assemblies

Climate Zone	Ceiling U-Factor	Light-Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawlspace Wall U-Factor
1	0.035	0.084	0.197	0.064	0.36	0.477
2	0.03	0.084	0.165	0.064	0.36	0.477
3	0.03	0.06	0.098	0.047	0.091	0.136
4 (except Marine)	0.026	0.06	0.098	0.047	0.059	0.065
Marine 4 & 5	0.026	0.06	0.082	0.033	0.05	0.055
6	0.026	0.045	0.06	0.033	0.05	0.055
7 & 8	0.026	0.045	0.057	0.028	0.05	0.055

Table 5. Modeling Specifications for Standard Rated Home

BLDG COMPONENT	PARAMETER	ITEM	REFERENCE[a]
Above-grade Walls and Rim Joists	Type	Wood Frame/Mass	Per Table 1, ABPS
	Frame Walls	U-factor varies with CZ	Per Table 402.1.4 2015 IECC
	Mass Walls	U-factor varies with CZ; insulation is installed on the interior surface of the wall	Per Table 402.1.42015 IECC
	Gross area	Per Table 1, this document Wall areas listed do not include band (or rim) joist areas, which are assumed to be one-foot high and insulated when adjacent to conditioned space.	ABPS
	Solar absorptance/emittance	0.75/0.90 (“medium” colors)	2006 IECC
Basement and Crawlspace Walls	Type	Mass	ABPS
	U-factor	Per Table 402.1.2; Varies w/ CZ, w/insulation on interior side of walls when specified	2015 IECC
	Gross area	Per Table 1, this document	Per Table 3 ABPS
	Height	Bsmt wall 8 ft high, 2 ft above grade Crawlspace 4 ft high, 2 ft above grade	NAHBRC assumption
Above-grade Floors	Type	Wood Frame/Slab, varies by CZ	per Table 3 ABPS
	Gross area	Basement, first, and second floors Per Table 1, this document	ABPS and HI assumptions
	Over unconditioned basement or crawlspace	Per Table 402.1.2; Varies w/ CZ	2015 IECC
Ceilings (adjacent to vented attics)	Type	Wood Frame	
	U-factor	Per Table 402.1.2	2015 IECC
	Gross area	Per Table 1, this document	ABPS
Roofs	Type:	Composition Shingle on Wood Sheathing	
	Pitch:	6 rise 12 run	(Hendron 2008)
	Solar absorptance/emittance	0.75/0.90	2015 IECC
Attics	Type	Vented w Aperture = 1 sf per 300 SF ceiling	
Foundation	Type	Varies by CZ Per Table 3, this document	APBS
Doors	Area	40 SF (Standard IECC Reference design will have same)	2015 IECC
	Orientation	North (Standard IECC Reference design will have same)	2015 IECC
	U-factor	Same as fenestration Table 303.1.2.	2015 IECC
Glazing	2009/2012 IECC - Glazing area	15% of above-grade CFA (per the 2012 Methodology, Note b of Table R405.5.2(1) is not followed.)	2015 IECC
	Orientation	Equally distributed to four cardinal compass orientations (N, E, S & W)	2015 IECC
	U-factor	Varies by CZ, Per Table 402.1.4	2015 IECC
	SHGC	Varies by CZ, Per Table 402.1.2 (if NR, SHGC = 0.40)	2015 IECC
	Interior shade fraction	Summer (all hours when cooling is required) = 0.92-(0.21 x SHGC) per table 402.1.2 Result: CZ 1-3: 0.8675; CZ 4-8: 0.836	2015 IECC
		Winter (all hours when heating is required) = 0.92-(0.21 x SHGC) per table 402.1.2 Result: CZ 1-3: 0.8675; CZ 4-8: 0.836	2015 IECC
	External shading	none	2015 IECC
Skylights	Area	0/2.4/4.8 per Small/Medium/Large house (Standard IECC Reference design will have none)	ABPS and HI assumption
	U-factor	Varies by CZ, Per Table 402.1.4	2015 IECC
	SHGC	Varies by CZ, Per Table 402.1.2 (if NR, SHGC = 0.40)	2015 IECC

BLDG COMPONENT	PARAMETER	ITEM	REFERENCE[a]
Thermally Isolated Sunrooms		None	NAHBRC assumption
Mechanical Ventilation	Minimum fan efficacy	2.8 cfm/watt	IECC 2015 Table R403.6.1
	Annual vent fan energy use	kWh/yr = 0.03942 x CFA + 29.565 x (Nbr + 1), where:	2015 IECC Table R405.5.2(1)
		CFA = conditioned floor area	
		Nbr = number of bedrooms	
	Ventilation rate	Per IRC, varies by size and occupancy, infiltration credit helps meet ASHRAE 62.2 requirements	2015 IRC Table M1507.3.3(1)
Lighting	High efficacy lamps	Min 75% of permanently installed lighting = CFL	2015 IECC
Internal Gains		Building America Benchmark	Hendron 2008, IECC 2015
Internal mass	Furniture and contents	8 lbs per sf of floor area	2015 IECC
Structural Mass	For masonry floor slabs	For masonry basement floors slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air	2015 IECC
	For masonry Bsmt walls	For masonry basement walls with insulation as required by Table 402.1.2 located on the interior side of the wall	2015 IECC
	For all other walls, ceilings, floors	wood framed construction	2015 IECC
Heating Systems	Fuel type	Natural Gas/Electric by climate zone	ABPS
	Efficiencies	80 AFUE/8.2 HSPF	e-CFR August 2016
	Capacity	Sized in accordance w Section M1401.3 of the IRC, calculated and reported by REM/Rate	2015 IECC
Cooling Systems	Fuel type	Electric	
	Efficiency	14 SEER	e-CFR August 2016
	Capacity	Sized in accordance w Section M1401.3 of the IRC	2015 IECC
Service Water Heating	Fuel type	Natural Gas/Electric by climate zone	ABPS: pub date of applicable code
	Efficiency	Gas = 0.675 - (0.0015 x rated storage volume, gal)	e-CFR August 2016 per R403.7
		Electric = 0.96 - (0.0003 x rated storage volume, gal)	
	Tank Size	Gas = 40 Gallon (efficiency varies by size)	Hendron 2008
		Electric = 50 Gallon (efficiency varies by size)	
	Pipe insulation	R-3 as per R403.5.3 Hot water pipe insulation (Prescr)	2015 IECC
	Daily hot water use	Per occupancy; flow fixtures: 2.2 gpm; toilets 1.6 gpf	Hendron 2008, e-CFR August 2016
	Tank temperature	120°F	2006 IECC
Thermal Distribution Systems	Duct location	Per Building America Benchmark	Hendron 2008
	Insulation	Per Section 403.3.1 (only for ductwork located outside the building thermal envelope)	2015 IECC
	Leakage Rate	4 cfm/100 SF	2015 IECC
Thermostat	Type	Manual	2015 IECC
	Cooling temperature set point	75°F (but per IECC Table R405.5.2(1) same as standard reference within performance path compliance simulation)	
	Heating temperature set point	72°F (but per IECC Table R405.5.2(1) same as standard reference within performance path compliance simulation)	

Space Heating and Cooling Systems

This methodology assumes that each house has a central forced-air HVAC system with electric cooling using a single-zone, split-system air conditioner. The heating system is either a natural gas fired furnace or electric air-source heat pump (ASHP) per Table 16. The heating and cooling systems both utilize the same duct distribution system; simultaneous heating and cooling is not possible. Equipment is sized in each case based on the "Equipment Sizing" analysis report generated by REM/Rate. Cooling equipment is sized to meet the sensible load, which generally results in oversizing for latent load. If the latent load could not be met to at least 90% of calculated design load, the equipment was specified at the next step up. ASHPs in cold climates were sometimes sized to meet heating load, resulting in over-sizing for cooling. For each ASHP selected, electric emergency heating coils in increments of 10-kw are modeled relative to the base capacity of the heating equipment and the climate zone.

The large reference house configurations with all-electric conditioning are modeled with two separate split system ASHPs. Although in practice the three-story house would be zoned to combine areas with similar load profiles, REM/Rate is not capable of modeling this efficiency. All other reference configurations utilize a single ASHP, unless the sizing would require non-standard equipment, in which case two smaller units were modeled to avoid excessive over-sizing.

All base systems are compliant with federal minimum efficiency standards as of August, 2016[2]. The modeled efficiencies for the cities included in this study are shown in Table 6 and Table 7. This study also includes a set of high efficiency equipment options for each climate zone, shown in the same tables.

All electric water heaters as well as tankless gas water heaters are modeled with a recovery efficiency (RE) of 1. Gas storage water heaters have an RE of 0.8. The efficiency upgrade for a gas water heater is an on-demand tankless unit; the efficiency upgrade for an electric water heater is a heat pump water heater (HPWH), which accounts for the efficiency factor (EF) greater than one. REM/Rate models the "waste" cool air off the evaporator of the HPWH as an internal heat load.

Table 6. Electronic Code of Federal Regulations (e-CFR) for Heating and Cooling Equipment

CLIMATE ZONE	STATE	CITY	FEDERAL MINIMUM EFFICIENCY			HIGH EFFICIENCY		
			SEER	HSPF	AFUE	SEER	HSPF	AFUE
1	Florida	Miami	14	8.2	80%	16	9	92%
2	Arizona	Phoenix	14	8.2	80%	16	9	92%
3	Tennessee	Memphis	14	8.2	80%	16	9	92%
4	Maryland	Baltimore	14	8.2	80%	16	9	95%
5	Illinois	Chicago	14[a]	8.2	80%	16	9	95%
6	Montana	Helena	14[a]	8.2	80%	16	9	95%
7 & 8	Minnesota	Duluth	14[a]	8.2	80%	16	9	95%

[a] SEER 13 is applied in CZ 5-8 for an electric A/C where gas is used for heating

[2] The 2006 IECC was published in February 2006, the prevailing federal minimum efficiencies at that time were 78 AFUE furnace; 7.7 HSPF heat pump; 13 SEER air conditioner. Heat pump and air conditioner efficiency increases took effect in January 2006.

Table 7. Modeled Domestic Water Heating Efficiencies

CLIMATE ZONE	STATE	CITY	FEDERAL MINIMUM EFFICIENCY, EF		HIGH EFFICIENCY, EF	
			GAS	ELECTRIC	GAS	ELECTRIC
1	Florida	Miami	0.615	0.945	0.90	2.3
2	Arizona	Phoenix	0.615	0.945	0.90	2.3
3	Tennessee	Memphis	0.615	0.945	0.90	2.3
4	Maryland	Baltimore	0.615	0.945	0.90	2.3
5	Illinois	Chicago	0.615	0.945	0.90	2.3
6	Montana	Helena	0.615	0.945	0.90	2.3
7 & 8	Minnesota	Duluth	0.615	0.945	0.90	2.3

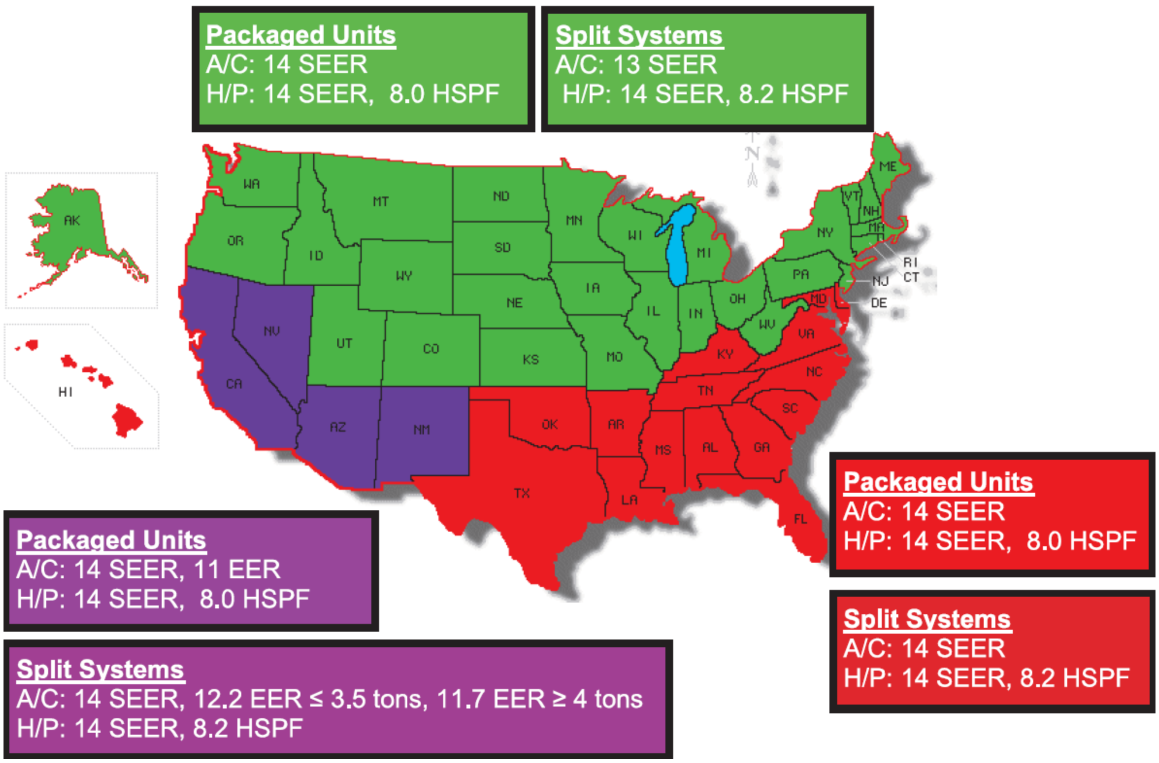

Figure 3. 2015 Federal Minimum Equipment Efficiencies (Illustration: American Standard)

Thermostat Setting

IECC 2015 article R403.1.1 requires a programmable thermostat: "This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55°F (13°C) or up to 85°F (29°C). The thermostat shall initially be programmed by the manufacturer with a heating temperature set point no higher than 70°F (21°C) and a cooling temperature set point no lower than 78°F (26°C)." This code requirement was followed for the modeled Standard Rated Home configurations.

The standard for calculating the ERI (Table 4.2.2(1) of Standard 301) stipulates that the Energy Rating Reference Home (the baseline building) will have a manual thermostat. Setpoint temperatures applied to the Standard Rated Homes are overridden to match the baseline building (75°F for cooling and 70°F for heating), except that (per section 4.3.1) 2°F temperature offsets are applied for prescribed seven-hour periods overnight for heating and mid-day for cooling to account for the programmable thermostat.

Water Heating

The water heater modeling in the analysis includes a gas or electric storage-type water heater per Table 16 with federal minimum energy factors and industry-typical recovery efficiencies. The fuel type of the water heater is the same as that of the space heating fuel. The water heating set point is 120°F and the daily hot water usage is computed internally in REM/Rate to match Table 4.2.2(1) in Standard 301, based on occupancy. No drain water heat recovery is modeled, and all water pipes are insulated as required by IECC 2015. The water heating equipment is modeled in the same location as the air handler (Table 12).

Mechanical Ventilation

Mechanical ventilation in the Standard Rated Homes is modeled according to 2015 code. IRC Table M1507.3.3(1) describes the required continuous fresh air supply rate, based on conditioned square footage and number of bedrooms. For simplicity, the Standard Rated Homes are modeled with a continuous, exhaust-only whole-house mechanical ventilation system. It is assumed that the number of kitchen and bathroom exhaust fans and their incremental flow rates meet or exceed the local exhaust requirements of IRC Table M1507.4. Total fan wattage is entered for each Standard Rated Home to meet the minimum fan efficacy requirements (2.8 cfm/watt) of Table R403.6.1, as shown in Table 8 (without basement), and Table 9 (with basement).

Table 8. Total Fan Wattages for Houses without Basements

	Total Conditioned Area without Basement	Number of Bedrooms	Airflow, cfm	Fan Wattage
Small	1,200	3	45	16
Medium	2,352	3	60	24
Large	4,816	5	105	36

Table 9. Total Fan Wattages for Houses with Basements

	Total conditioned area with basement	Number of Bedrooms	Airflow, cfm	Adjusted Fan Wattage
Small	2,400	3	60	21
Medium	4,128	3	75	32
Large	6,832	5	120	43

As per 4.3.7, "natural ventilation is assumed in both the Reference and Rated Homes during hours when natural ventilation will reduce annual cooling energy use." In REM/Rate the radio button for "Natural Ventilation" is chosen as a "Cooling Season Strategy." REM/Rate determines the number of hours of operation per year which fall into the ASHRAE 55 Thermal Comfort range and simulates shutting off the cooling system and opening windows to take advantage of natural ventilation. This is applied to both the design and reference buildings equally.

Building Air Tightness

The 2015 IECC mandates air leakage rate testing in R402.4.1.2 and requires building infiltration rates of no more than 5 Air Changes per Hour (ACH) for climate zones 1 and 2 and no more than 3 ACH_{50} for all others, measured at a pressure differential of 50 Pascals (0.2 inches w.g.). This translates to the following CFM flows for the three test house geometries:

Table 10. Infiltration for Houses Without Basements

	Total Conditioned Area without Basement	CZ 1 & 2 Infiltration (5 ACH) Airflow in CFM	CZ 3 through CZ 8 Infiltration (3 ACH) Airflow in CFM
Small	1,200	900	540
Medium	2,352	1,740	1,044
Large	4,816	2,940	1,764

Table 11. Infiltration for Houses With Basements

	Total Conditioned Area without Basement	CZ 1 & 2 Infiltration (5 ACH) Airflow in CFM	CZ 3 through CZ 8 Infiltration (3 ACH) Airflow in CFM
Small	1,200	900	540
Medium	2,352	1,740	1,044
Large	4,816	2,940	1,764

Duct System Characteristics

The REM/Rate software program is allowed to estimate the surface area of the duct system, based on the area served. REM/Rate defaults are not used for default leakage. Conditioning equipment and duct locations vary by foundation type and house configuration, per the 2012 Methodology and in accordance with the Building America Benchmark (Table 12).

Table 12. Duct Location for Standard Rated Home

Duct Type	Foundation Type	Small	Medium & Large
Supply duct location	Slab-on-grade	100% attic	76% attic, 24% conditioned space
	Crawlspace	100% crawl	68% crawl, 21% attic, 11% conditioned space
	Basement	100% basement	76% basement, 24% conditioned space
Return duct and air handler location	Slab-on-grade	100% attic	100% attic
	Crawlspace	100% crawl	100% crawl
	Basement	100% basement	100% basement

Unless all ducts and air-handling equipment are entirely within the conditioned enclosure, duct leakage testing is mandatory. For houses with conditioned basements or crawlspaces, the air handler and complete duct system are modeled within the thermal envelope.

For houses over slabs or unconditioned basements or crawlspaces, the air handler and a portion of the ductwork are located outside the building's thermal envelope.

Because leakage to outside affects the results of the energy model, this value is estimated based on other inputs. The 2015 IECC and the 2012 Methodology require that total duct leakage be less than or equal to 4 cfm per 100 sf of conditioned floor area, measured at a pressure differential of 25 Pa (0.1 in. w.g.) and the 2012 Methodology further describes the typical locations of ductwork by percentage. In these cases, the percentages-by-location are applied to the calculated total duct leakage cfm that results from the 4 cfm/100 sf CFA requirement, and modified with the relative exposed surface areas (as estimated by REM/Rate), per the following equation:

$$Q_{25s} \; = \; E_s \; x \; Q_{25t} \; x \; A_s \; x \; (A_s + A_r)$$

Where

$E_{s\ or\ r}$ = Exposure percentage, supply or return (based on the percentage of the duct located outside of the thermal envelope)

$Q_{25,o\ or\ s\ or\ r}$ = Leakage to outside, supply or return

Q_{25t} = Total Leakage measured at 25 Pascals

A_s = Duct surface area, supply

A_r = Duct surface area, return

For configurations with the entire duct system within the conditioned space (a configuration with a conditioned basement or a conditioned crawlspace), the “Exemption – No Test Required” radio button is selected.

The large reference home is modeled with three return grilles, the medium with two, and the small with one. “Estimate Surface Area” is chosen to allow REM/Rate to calculate and model heat loss and gain through the duct wall.

The 2015 IECC requires that air handlers be sealed to maintain leakage at 2% or less than the design air flow rate. REM/Rate automatically computes delivery inefficiency after equipment is selected and then includes the result in the total system energy calculation.

For each configuration with either a basement or crawlspace, the air handler is located there and calculated code-maximum duct leakage is entered as if it were a measured value. Ducts or portions of ducts located within the building’s thermal envelope are permitted to be uninsulated, such as conditioned basements and crawlspaces.

Ducts in attics and unconditioned crawlspaces are considered to be exposed, and insulated per the IECC requirement, to match the Simulated Performance Alternative mandatory requirement R405.2 and article R403.3.1 prescriptive duct insulation requirements: R-6 except for supply ducts in ventilated attics, which are modeled with R-8 insulation.

Lighting and Appliances

The 2006 IECC does not address lighting in its scope; consequently, the 2012 Methodology did not include a baseline for high-efficacy lighting. However, the 2015 IECC requires that 75% of all light fixtures use high efficacy bulbs. These are modeled in REM/Rate as compact fluorescents (CFL). For uniformity, all other RESNET defaults are applied in the REM/Rate lighting and appliances input screen. The fuel for the dryer and the range/oven is modeled as electric, even when heating fuel is gas.

Internal Gains

The 2012 Methodology used Building America Benchmarks (Hendron 2008) for internal gains, based on CFA and number of bedrooms. This meets Standard 301 as well as 2015 IECC Table R405.5.2(1) and is incorporated in the REM/Rate internal calculation.

Window Area

The window area percentage for this study's Standard Rated Homes is 15% according to the 2015 IECC. Standard Rated Home configurations with conditioned basements have a code-minimum window area according to the formula in footnote "h" of 2015 IECC Table R405.5.2(1). Because this designed glazing area ratio is less than 18%, the Energy Rating Reference Home is modeled to match the Rated Home's proposed design.

Since the Standard Rated Homes in this study are intended to represent a nationwide aggregate, the window area is divided equally in all compass directions; this is the required configuration for the Energy Rating Reference Home.

DATA ANALYSIS

The results of this study are HERS indices. The index for each Standard Rated Home configuration is weighted for regional choices according to the 2012 Methodology in order to develop results representative of the market.

Representative Weather Locations

Eight cities representing all of the IECC Climate Zones (Table 13 and Figure 4) were selected in the 2012 Methodology. The HDD and CDD at 65°F developed in the 2012 Methodology have been replaced in this study with REM/Rate defaults for the listed cities (last column). For this study, climate zones 7 and 8 are combined, and modeled in Duluth, MN.

Table 13. Representative Climate Zone Cities

CZ	Type	State	City	HDD(65)	CDD(65)	CDD(74)
				2013 ASHRAE, REM/Rate	2013 ASHRAE	REM/Rate v15.2
1	Moist	Florida	Miami	126	4537	41614
2	Dry	Arizona	Phoenix	923	4626	70375
3	Moist	Tennessee	Memphis	2,898	2253	23361
4	Moist	Maryland	Baltimore	4,552	1261	11735
5	Moist	Illinois	Chicago	5,872	1034	8704
6	Dry	Montana	Helena	7,545	395	5921
7	N/A	Minnesota	Duluth	9,325	210	1785
8	N/A	Alaska	Fairbanks	13,517	72	853

As of v15.0, REM/Rate uses the required historical weather information from the Typical Meteorological Year (TMY3) dataset. In REM/Rate the weather data used is HDD(65) and CDH(74).

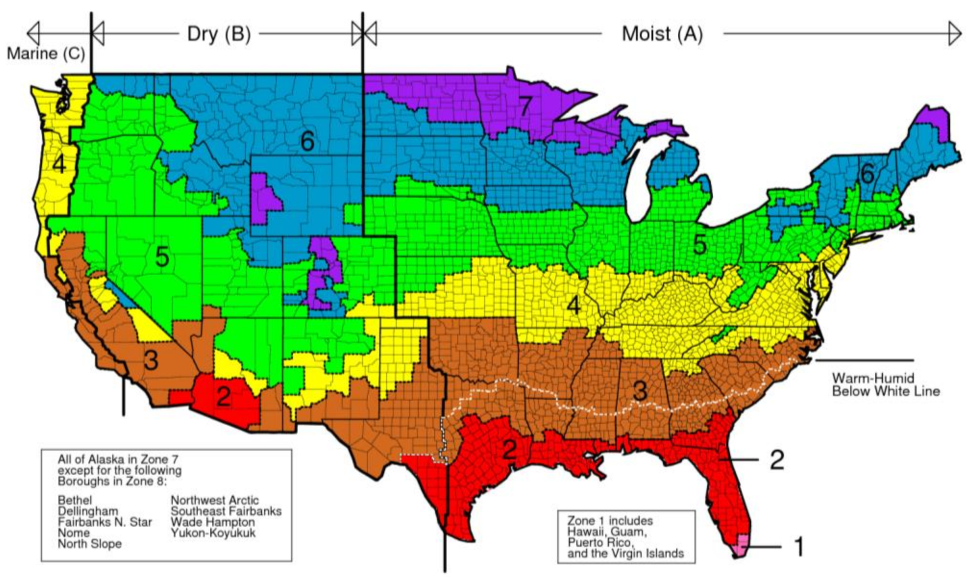

Figure 4. DOE Climate Zone Map

Above-Grade Wall Construction

Residential buildings are predominantly light-framed wood construction or high-mass using cementitious materials; cold-formed steel studs are not common in single family residential construction, and other wall types comprise small portions of the market. The energy code has different insulation requirements for different wall assembly types. The percentage of each of these two most common above-grade wall types varies geographically (e.g., by climate zone, state, county, jurisdiction). Table 14 shows the distribution of light-framed walls and mass walls for all climate zones as determined from the ABPS results and reported in the 2012 Methodology. This distribution has been applied in this study, except that the 5% incidence of mass walls in climate zone 5 has not been modeled.

Table 14. Wall Type Breakdown by Climate Zone

Climate Zone	Light-Framed Walls	Mass Walls
1	35%	65%
2	85%	15%
3	100%	0%
4	100%	0%
5	95%	5%
6	100%	0%
7 & 8	100%	0%

Note: results are rounded to nearest 5%.

Foundations

As per the 2012 methodology, conditioned basements are treated as conditioned floor area. The typical incidence of each foundation type – basement, crawlspace or slab-on-grade – is shown in Table 15 as a unique percentage for each climate zone, due to strong climate dependence.

Table 15. Foundation Type by Climate Zone

Climate Zone	Conditioned Basement (%)	Conditioned Crawlspace (%)	Slab-on-Grade (%)	Unheated Basement (%)	Vented Crawlspace (%)
1 & 2	0	0	90	0	10
3	0	0	75	15	10
4	35	0	25	20	20
5	45	5	10	35	5
6, 7 & 8	75	5	5	10	5

Note: results are rounded to nearest 5%.

Fuel Type

The fuel types used for space and water heating impact the magnitude of the energy savings. Table 16 provides a breakdown of primary heating fuel sources for homes by climate zone. In each model, the fuel type used for space heating is also used for water heating. The 2015 EIA average national price to ultimate customers is used for both fuel types: $10.97 per MCF of natural gas[3], and $12.67 per kWh for electricity[4]. Placeholder service charges of $10.00 per month are included for each climate zone. Demand pricing is not applied.

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[3] http://www.eia.gov/naturalgas/monthly/pdf/table_03.pdf

[4] https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_3

Table 16. Heating Fuel Type by Climate Zone

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zones 7 & 8
Electric Heat	85%	70%	55%	35%	20%	5%	0%
Gas Heat	15%	30%	45%	65%	80%	95%	100%

Note: results are rounded to nearest 5%.

Matrix of Studied Configurations

Figure 5 shows the building characteristics for the full range of Standard Rated Homes studied. This matrix was applied to two fuel types (gas and electric), three building sizes (small, medium and large, as described previously) and two equipment efficiency schemes (federal minimum and high efficiency.) The resulting 360 HERS indices are then weighted according to the climate-specific percentages for each parameter; detailed averages for each climate zone are in Appendix A.

		Climate Zone						
		1	2	3	4	5	6	7&8
Slab								
	Frame	x	x	x	x	x	x	x
	Mass	x	x					
Unconditioned Crawl								
	Frame	x	x	x	x	x	x	x
	Mass	x	x					
Conditioned Crawl								
	Frame					x	x	x
	Mass							
Unconditioned Basement								
	Frame			x	x	x	x	x
	Mass							
Conditioned Basement								
	Frame				x	x	x	x
	Mass							

Figure 5. Simulated Building Configurations

RESULTS: HERS INDICES, SUMMARY BY CLIMATE ZONE

A summary of the weighted-average results for the Standard Rated Homes in each Climate Zone is shown in Table 17.

Table 17. Summary of Results

Climate Zone	Reference House Size	Std Eff	High Eff	Weight (% Building Starts by CZ)	2015 IECC ERI Target per Section R406
CZ 1	Small	75.9	62.4	2%	52
	Medium	72.7	64.0		
	Large	72.0	64.3		
CZ 2	Small	73.9	65.2	19%	52
	Medium	71.1	59.7		
	Large	69.1	61.4		
CZ 3	Small	73.0	63.1	27%	51
	Medium	67.0	58.0		
	Large	63.6	55.6		
CZ 4	Small	75.4	64.3	19%	54
	Medium	70.4	61.6		
	Large	67.7	58.5		
CZ 5	Small	75.8	63.8	27%	55
	Medium	71.1	62.2		
	Large	67.8	57.8		
CZ 6	Small	72.9	60.0	6%	54
	Medium	66.5	59.6		
	Large	62.6	52.6		
CZ 7,8	Small	70.5	57.3	.3%	53
	Medium	63.9	57.7		
	Large	59.8	50.3		

A complete table of HERS indices for all Standard Rated Home configurations is included in Appendix A.

Appendix B contains tables summarizing climate zone-specific weighted averages by building size, foundation type, fuel type and equipment efficiency level.

REFERENCES

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ANSI/RESNET/ICC 301-2014 Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index. (Republished January 15, 2016). Residential Energy Services Network, Oceanside, CA and International Code Council, Washington, D.C.

APPENDIX A: HERS INDICES, ENTIRE DATA SET

The naming convention is shown in Table 18. For example, 4MCBFEC = Climate Zone 4, Medium size, Conditioned Basement, Frame walls, Electric heat, Fed Min equipment efficiencies.

Table 18. Configuration Naming Convention

Parameter	Range	Values
Climate Zone	CZ 1 thru CZ 7/8	1-7
Building Size	SMALL	S
	MEDIUM	M
	LARGE	L
Foundation Type	SLAB	SL
	COND BSMT	CB
	UNCOND BSMT	UB
	COND CRAWL	CC
	VENTED CRAWL	VC
Above-Grade Wall Type	MASS WALL	M
	FRAME WALL	F
Fuel Type	ELEC	E
	GAS	G
Equipment Efficiency	Fed Min EFF (per code)	C
	HIGH EFF	H

The complete HERS data set for all building configurations is shown in Table 19. UA totals for both the 2015 IECC reference building and the design building are also shown, confirming the envelope performance aligns closely with code minimum U-values for each component.

Table 19. HERS Index by Configuration; UA Values Confirm Design Targets

ID	HERS INDEX	2015 IECC Ref UA	Design UA
1LSLFEC	68	887.7	886.6
1LSLFEH	61	887.7	886.6
1LSLFGC	68	887.7	886.6
1LSLFGH	62	887.7	886.6
1LSLMEC	71	1328.7	1328.2
1LSLMEH	63	1328.7	1328.2
1LSLMGC	71	1328.7	1328.2
1LSLMGH	64	1328.7	1328.2
1LVCFEC	69	939.3	937.5
1LVCFEH	60	939.3	937.5
1LVCFGC	68	939.3	937.5
1LVCFGH	61	939.3	937.5
1LVCMEC	72	1380.2	1379.1
1LVCMEH	63	1380.2	1379.1
1LVCMGC	71	1380.2	1379.1

ID	HERS INDEX	2015 IECC Ref UA	Design UA
1LVCMGH	64	1380.2	1379.1
1MSLFEC	71	523.7	523.2
1MSLFEH	62	523.7	523.2
1MSLFGC	70	523.7	523.2
1MSLFGH	63	523.7	523.2
1MSLMEC	74	770.8	770.7
1MSLMEH	65	770.8	770.7
1MSLMGC	73	770.8	770.7
1MSLMGH	66	770.8	770.7
1MVCFEC	70	565.7	564.7
1MVCFEH	61	565.7	564.7
1MVCFGC	69	565.7	564.7
1MVCFGH	63	565.7	564.7
1MVCMEC	73	812.9	812.2
1MVCMEH	64	812.9	812.2
1MVCMGC	72	812.9	812.2
1MVCMGH	65	812.9	812.2
1SSLFEC	75	290.5	290.4
1SSLFEH	65	290.5	290.4
1SSLFGC	74	290.5	290.4
1SSLFGH	67	290.5	290.4
1SSLMEC	77	408.0	408.0
1SSLMEH	67	408.0	408.0
1SSLMGC	76	408.0	408.0
1SSLMGH	69	408.0	408.0
1SVCFEC	72	316.2	315.6
1SVCFEH	62	316.2	315.6
1SVCFGC	71	316.2	315.6
1SVCFGH	64	316.2	315.6
1SVCMEC	75	433.7	433.3
1SVCMEH	64	433.7	433.3
1SVCMGC	73	433.7	433.3
1SVCMGH	66	433.7	433.3
2LSLFEC	69	800.9	799.1
2LSLFEH	61	800.9	799.1
2LSLFGC	68	800.9	799.1
2LSLFGH	61	800.9	799.1
2LSLMEC	72	1117.0	1116.5
2LSLMEH	64	1117.0	1116.5
2LSLMGC	72	1117.0	1116.5
2LSLMGH	64	1117.0	1116.5
2LVCFEC	68	852.5	850.0

ID	HERS INDEX	2015 IECC Ref UA	Design UA
2LVCFEH	60	852.5	850.0
2LVCFGC	68	852.5	850.0
2LVCFGH	60	852.5	850.0
2LVCMEC	72	1168.6	1167.4
2LVCMEH	64	1168.6	1167.4
2LVCMGC	71	1168.6	1167.4
2LVCMGH	63	1168.6	1167.4
2MSLFEC	71	475.3	474.1
2MSLFEH	63	475.3	474.1
2MSLFGC	70	475.3	474.1
2MSLFGH	63	475.3	474.1
2MSLMEC	74	652.4	652.0
2MSLMEH	66	652.4	652.0
2MSLMGC	73	652.4	652.0
2MSLMGH	66	652.4	652.0
2MVCFEC	70	517.3	515.6
2MVCFEH	62	517.3	515.6
2MVCFGC	69	517.3	515.6
2MVCFGH	62	517.3	515.6
2MVCMEC	74	694.5	693.5
2MVCMEH	65	694.5	693.5
2MVCMGC	73	694.5	693.5
2MVCMGH	65	694.5	693.5
2SSLFEC	74	262.5	261.9
2SSLFEH	65	262.5	261.9
2SSLFGC	73	262.5	261.9
2SSLFGH	65	262.5	261.9
2SSLMEC	77	346.7	346.5
2SSLMEH	68	346.7	346.5
2SSLMGC	76	346.7	346.5
2SSLMGH	68	346.7	346.5
2SVCFEC	71	288.2	287.1
2SVCFEH	62	288.2	287.1
2SVCFGC	70	288.2	287.1
2SVCFGH	63	288.2	287.1
2SVCMEC	74	372.4	371.7
2SVCMEH	65	372.4	371.7
2SVCMGC	73	372.4	371.7
2SVCMGH	65	372.4	371.7
3LCBFEC	51	804.9	803.6
3LCBFEH	45	804.9	803.6
3LCBFGC	50	804.9	803.6

ID	HERS INDEX	2015 IECC Ref UA	Design UA
3LCBFGH	44	804.9	803.6
3LSLFEC	64	660.8	660.6
3LSLFEH	57	660.8	660.6
3LSLFGC	64	660.8	660.6
3LSLFGH	55	660.8	660.6
3LUBFEC	61	678.2	676.9
3LUBFEH	54	678.2	676.9
3LUBFGC	61	678.2	676.9
3LUBFGH	51	678.2	676.9
3LVCFEC	65	678.2	676.9
3LVCFEH	57	678.2	676.9
3LVCFGC	63	678.2	676.9
3LVCFGH	55	678.2	676.9
3MCBFEC	51	531.0	530.1
3MCBFEH	45	531.0	530.1
3MCBFGC	50	531.0	530.1
3MCBFGH	47	531.0	530.1
3MSLFEC	68	400.6	400.7
3MSLFEH	59	400.6	400.7
3MSLFGC	67	400.6	400.7
3MSLFGH	58	400.6	400.7
3MUBFEC	65	412.5	411.8
3MUBFEH	56	412.5	411.8
3MUBFGC	64	412.5	411.8
3MUBFGH	55	412.5	411.8
3MVCFEC	67	412.5	411.8
3MVCFEH	58	412.5	411.8
3MVCFGC	66	412.5	411.8
3MVCFGH	57	412.5	411.8
3SCBFEC	53	315.5	315.0
3SCBFEH	46	315.5	315.0
3SCBFGC	53	315.5	315.0
3SCBFGH	46	315.5	315.0
3SSLFEC	74	226.5	226.8
3SSLFEH	64	226.5	226.8
3SSLFGC	73	226.5	226.8
3SSLFGH	63	226.5	226.8
3SUBFEC	72	231.8	231.4
3SUBFEH	62	231.8	231.4
3SUBFGC	70	231.8	231.4
3SUBFGH	61	231.8	231.4
3SVCFEC	72	231.8	231.4

ID	HERS INDEX	2015 IECC Ref UA	Design UA
3SVCFEH	62	231.8	231.4
3SVCFGC	71	231.8	231.4
3SVCFGH	61	231.8	231.4
4LCBFEC	63	742.6	741.2
4LCBFEH	55	742.6	741.2
4LCBFGC	63	742.6	741.2
4LCBFGH	54	742.6	741.2
4LSLFEC	71	592.0	591.6
4LSLFEH	63	592.0	591.6
4LSLFGC	71	592.0	591.6
4LSLFGH	61	592.0	591.6
4LUBFEC	68	670.1	668.7
4LUBFEH	60	670.1	668.7
4LUBFGC	68	670.1	668.7
4LUBFGH	58	670.1	668.7
4LVCFEC	72	670.1	668.7
4LVCFEH	63	670.1	668.7
4LVCFGC	71	670.1	668.7
4LVCFGH	61	670.1	668.7
4MCBFEC	66	473.7	472.8
4MCBFEH	58	473.7	472.8
4MCBFGC	66	473.7	472.8
4MCBFGH	61	473.7	472.8
4MSLFEC	75	337.3	337.3
4MSLFEH	65	337.3	337.3
4MSLFGC	74	337.3	337.3
4MSLFGH	63	337.3	337.3
4MUBFEC	71	405.4	404.5
4MUBFEH	62	405.4	404.5
4MUBFGC	70	405.4	404.5
4MUBFGH	60	405.4	404.5
4MVCFEC	74	405.4	404.5
4MVCFEH	64	405.4	404.5
4MVCFGC	73	405.4	404.5
4MVCFGH	62	405.4	404.5
4SCBFEC	70	274.9	274.4
4SCBFEH	61	274.9	274.4
4SCBFGC	71	274.9	274.4
4SCBFGH	60	274.9	274.4
4SSLFEC	81	181.6	181.7
4SSLFEH	69	181.6	181.7
4SSLFGC	79	181.6	181.7

ID	HERS INDEX	2015 IECC Ref UA	Design UA
4SSLFGH	67	181.6	181.7
4SUBFEC	77	227.0	226.5
4SUBFEH	66	227.0	226.5
4SUBFGC	76	227.0	226.5
4SUBFGH	64	227.0	226.5
4SVCFEC	78	227.0	226.5
4SVCFEH	67	227.0	226.5
4SVCFGC	77	227.0	226.5
4SVCFGH	66	227.0	226.5
5LCBFEC	63	698.8	697.5
5LCBFEH	56	698.8	697.5
5LCBFGC	64	698.8	697.5
5LCBFGH	54	698.8	697.5
5LCCFEC	71	611.9	609.9
5LCCFEH	63	611.9	609.9
5LCCFGC	70	611.9	609.9
5LCCFGH	59	611.9	609.9
5LSLFEC	73	569.1	568.7
5LSLFEH	65	569.1	568.7
5LSLFGC	74	569.1	568.7
5LSLFGH	62	569.1	568.7
5LUBFEC	70	619.0	617.6
5LUBFEH	63	619.0	617.6
5LUBFGC	70	619.0	617.6
5LUBFGH	59	619.0	617.6
5LVCFEC	74	619.0	617.6
5LVCFEH	65	619.0	617.6
5LVCFGC	74	619.0	617.6
5LVCFGH	62	619.0	617.6
5MCBFEC	66	442.9	442.0
5MCBFEH	59	442.9	442.0
5MCBFGC	67	442.9	442.0
5MCBFGH	62	442.9	442.0
5MCCFEC	70	365.0	363.7
5MCCFEH	62	365.0	363.7
5MCCFGC	71	365.0	363.7
5MCCFGH	60	365.0	363.7
5MSLFEC	77	325.5	325.5
5MSLFEH	67	325.5	325.5
5MSLFGC	77	325.5	325.5
5MSLFGH	64	325.5	325.5
5MUBFEC	74	368.7	367.9

ID	HERS INDEX	2015 IECC Ref UA	Design UA
5MUBFEH	64	368.7	367.9
5MUBFGC	74	368.7	367.9
5MUBFGH	62	368.7	367.9
5MVCFEC	77	368.7	367.9
5MVCFEH	67	368.7	367.9
5MVCFGC	77	368.7	367.9
5MVCFGH	64	368.7	367.9
5SCBFEC	70	255.1	254.6
5SCBFEH	62	255.1	254.6
5SCBFGC	72	255.1	254.6
5SCBFGH	60	255.1	254.6
5SCCFEC	69	203.2	202.4
5SCCFEH	60	203.2	202.4
5SCCFGC	71	203.2	202.4
5SCCFGH	59	203.2	202.4
5SSLFEC	84	175.0	175.1
5SSLFEH	72	175.0	175.1
5SSLFGC	83	175.0	175.1
5SSLFGH	69	175.0	175.1
5SUBFEC	80	203.6	203.1
5SUBFEH	68	203.6	203.1
5SUBFGC	79	203.6	203.1
5SUBFGH	66	203.6	203.1
5SVCFEC	81	203.6	203.1
5SVCFEH	69	203.6	203.1
5SVCFGC	81	203.6	203.1
5SVCFGH	68	203.6	203.1
6LCBFEC	60	635.1	639.3
6LCBFEH	54	635.1	639.3
6LCBFGC	61	635.1	639.3
6LCBFGH	51	635.1	639.3
6LCCFEC	67	545.3	549.1
6LCCFEH	60	545.3	549.1
6LCCFGC	67	545.3	549.1
6LCCFGH	56	545.3	549.1
6LSLFEC	70	505.7	508.7
6LSLFEH	62	505.7	508.7
6LSLFGC	70	505.7	508.7
6LSLFGH	59	505.7	508.7
6LUBFEC	66	555.6	557.6
6LUBFEH	59	555.6	557.6
6LUBFGC	66	555.6	557.6

ID	HERS INDEX	2015 IECC Ref UA	Design UA
6LUBFGH	55	555.6	557.6
6LVCFEC	69	555.6	554.0
6LVCFEH	62	555.6	554.0
6LVCFGC	68	555.6	557.6
6LVCFGH	58	555.6	554.0
6MCBFEC	64	408.2	410.3
6MCBFEH	57	408.2	410.3
6MCBFGC	65	408.2	410.3
6MCBFGH	60	408.2	408.4
6MCCFEC	65	327.8	327.6
6MCCFEH	59	327.8	329.7
6MCCFGC	68	327.8	329.7
6MCCFGH	56	327.8	327.6
6MSLFEC	74	291.3	292.3
6MSLFEH	65	291.3	292.3
6MSLFGC	74	291.3	292.3
6MSLFGH	61	291.3	290.2
6MUBFEC	70	334.5	332.6
6MUBFEH	61	334.5	332.6
6MUBFGC	70	334.5	334.7
6MUBFGH	58	334.5	332.6
6MVCFEC	73	334.5	332.6
6MVCFEH	63	334.5	332.6
6MVCFGC	73	334.5	334.7
6MVCFGH	61	334.5	332.6
6SCBFEC	69	239.0	239.9
6SCBFEH	61	239.0	239.9
6SCBFGC	72	239.0	239.9
6SCBFGH	59	239.0	239.0
6SCCFEC	65	185.5	185.3
6SCCFEH	57	185.5	185.3
6SCCFGC	68	185.5	186.2
6SCCFGH	55	185.5	185.3
6SSLFEC	81	159.4	158.5
6SSLFEH	69	159.4	159.5
6SSLFGC	81	159.4	159.5
6SSLFGH	67	159.4	159.5
6SUBFEC	77	188.0	186.6
6SUBFEH	66	188.0	186.6
6SUBFGC	77	188.0	187.6
6SUBFGH	63	188.0	186.6
6SVCFEC	79	188.0	186.6

ID	HERS INDEX	2015 IECC Ref UA	Design UA
6SVCFEH	67	188.0	186.6
6SVCFGC	78	188.0	187.6
6SVCFGH	65	188.0	186.6
7LCBFEC	57	635.1	639.3
7LCBFEH	52	635.1	639.3
7LCBFGC	58	635.1	639.3
7LCBFGH	49	635.1	639.3
7LCCFEC	67	545.3	549.1
7LCCFEH	61	545.3	549.1
7LCCFGC	65	545.3	549.1
7LCCFGH	54	545.3	549.1
7LSLFEC	68	505.7	508.7
7LSLFEH	62	505.7	508.7
7LSLFGC	68	505.7	508.7
7LSLFGH	56	505.7	508.7
7LUBFEC	64	545.5	547.5
7LUBFEH	58	545.5	547.5
7LUBFGC	63	545.5	547.5
7LUBFGH	53	545.5	547.5
7LVCFEC	67	545.5	547.5
7LVCFEH	60	545.5	547.5
7LVCFGC	66	545.5	547.5
7LVCFGH	55	545.5	547.5
7MCBFEC	61	408.2	410.3
7MCBFEH	56	408.2	410.3
7MCBFGC	62	408.2	410.3
7MCBFGH	58	408.2	408.4
7MCCFEC	65	327.8	327.6
7MCCFEH	59	327.8	327.6
7MCCFGC	67	327.8	329.7
7MCCFGH	54	327.8	327.6
7MSLFEC	73	291.3	292.3
7MSLFEH	65	291.3	292.3
7MSLFGC	73	291.3	292.3
7MSLFGH	59	291.3	290.2
7MUBFEC	68	325.6	323.7
7MUBFEH	61	325.6	323.7
7MUBFGC	68	325.6	325.8
7MUBFGH	56	325.6	323.7
7MVCFEC	71	325.6	323.7
7MVCFEH	63	325.6	323.7
7MVCFGC	71	325.6	325.8

ID	HERS INDEX	2015 IECC Ref UA	Design UA
7MVCFGH	58	325.6	323.7
7SCBFEC	66	239.0	239.9
7SCBFEH	60	239.0	239.9
7SCBFGC	69	239.0	239.9
7SCBFGH	56	239.0	239.0
7SCCFEC	63	185.5	185.3
7SCCFEH	56	185.5	185.3
7SCCFGC	67	185.5	186.2
7SCCFGH	54	185.5	185.3
7SSLFEC	80	159.4	158.5
7SSLFEH	69	159.4	158.5
7SSLFGC	80	159.4	159.5
7SSLFGH	65	159.4	158.5
7SUBFEC	76	182.0	180.6
7SUBFEH	66	182.0	180.6
7SUBFGC	75	182.0	181.6
7SUBFGH	62	182.0	180.6
7SVCFEC	78	182.0	180.6
7SVCFEH	68	182.0	180.6

APPENDIX B: HERS INDICES, CONFIGURATION SUMMARIES

The following summaries show the data for each climate zone, grouped by building size and equipment efficiency scheme.

CZ 1 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1LSLFEC	68	Slab	0.9	Frame	0.35	Elec	0.85
1LSLFGC	68	Slab	0.9	Frame	0.35	Gas	0.15
1LSLMEC	71	Slab	0.9	Mass	0.65	Elec	0.85
1LSLMGC	71	Slab	0.9	Mass	0.65	Gas	0.15
1LVCFEC	69	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1LVCFGC	68	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1LVCMEC	72	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1LVCMGC	71	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**70.0**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 1 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1LSLFEH	61	Slab	0.9	Frame	0.35	Elec	0.85
1LSLFGH	62	Slab	0.9	Frame	0.35	Gas	0.15
1LSLMEH	63	Slab	0.9	Mass	0.65	Elec	0.85
1LSLMGH	64	Slab	0.9	Mass	0.65	Gas	0.15
1LVCFEH	60	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1LVCFGH	61	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1LVCMEH	63	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1LVCMGH	64	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**62.4**	**High Efficiency Equipment**					

CZ 1 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1MSLFEC	71	Slab	0.9	Frame	0.35	Elec	0.85
1MSLFGC	70	Slab	0.9	Frame	0.35	Gas	0.15
1MSLMEC	74	Slab	0.9	Mass	0.65	Elec	0.85
1MSLMGC	73	Slab	0.9	Mass	0.65	Gas	0.15
1MVCFEC	70	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1MVCFGC	69	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1MVCMEC	73	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1MVCMGC	72	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**72.7**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 1 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1MSLFEH	62	Slab	0.9	Frame	0.35	Elec	0.85
1MSLFGH	63	Slab	0.9	Frame	0.35	Gas	0.15
1MSLMEH	65	Slab	0.9	Mass	0.65	Elec	0.85
1MSLMGH	66	Slab	0.9	Mass	0.65	Gas	0.15
1MVCFEH	61	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1MVCFGH	63	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1MVCMEH	64	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1MVCMGH	65	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**64.0**	**High Efficiency Equipment**					

CZ 1 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1SSLFEC	75	Slab	0.9	Frame	0.35	Elec	0.85
1SSLFGC	74	Slab	0.9	Frame	0.35	Gas	0.15
1SSLMEC	77	Slab	0.9	Mass	0.65	Elec	0.85
1SSLMGC	76	Slab	0.9	Mass	0.65	Gas	0.15
1SVCFEC	72	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1SVCFGC	71	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1SVCMEC	75	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1SVCMGC	73	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**75.9**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 1 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
1SSLFEH	65	Slab	0.9	Frame	0.35	Elec	0.85
1SSLFGH	67	Slab	0.9	Frame	0.35	Gas	0.15
1SSLMEH	67	Slab	0.9	Mass	0.65	Elec	0.85
1SSLMGH	69	Slab	0.9	Mass	0.65	Gas	0.15
1SVCFEH	62	Vented Crawl	0.1	Frame	0.35	Elec	0.85
1SVCFGH	64	Vented Crawl	0.1	Frame	0.35	Gas	0.15
1SVCMEH	64	Vented Crawl	0.1	Mass	0.65	Elec	0.85
1SVCMGH	66	Vented Crawl	0.1	Mass	0.65	Gas	0.15
Average:	**66.3**	**High Efficiency Equipment**					

CZ 2 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2LSLFEC	69	Slab	0.9	Frame	0.85	Elec	0.7
2LSLFGC	68	Slab	0.9	Frame	0.85	Gas	0.3
2LSLMEC	72	Slab	0.9	Mass	0.15	Elec	0.7
2LSLMGC	72	Slab	0.9	Mass	0.15	Gas	0.3
2LVCFEC	68	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2LVCFGC	68	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2LVCMEC	72	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2LVCMGC	71	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**69.1**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 2 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2LSLFEH	61	Slab	0.9	Frame	0.85	Elec	0.7
2LSLFGH	61	Slab	0.9	Frame	0.85	Gas	0.3
2LSLMEH	64	Slab	0.9	Mass	0.15	Elec	0.7
2LSLMGH	64	Slab	0.9	Mass	0.15	Gas	0.3
2LVCFEH	60	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2LVCFGH	60	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2LVCMEH	64	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2LVCMGH	63	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**61.4**	**High Efficiency Equipment**					

CZ 2 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2MSLFEC	71	Slab	0.9	Frame	0.85	Elec	0.7
2MSLFGC	70	Slab	0.9	Frame	0.85	Gas	0.3
2MSLMEC	74	Slab	0.9	Mass	0.15	Elec	0.7
2MSLMGC	73	Slab	0.9	Mass	0.15	Gas	0.3
2MVCFEC	70	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2MVCFGC	69	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2MVCMEC	74	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2MVCMGC	73	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**71.1**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 2 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2MSLFEH	63	Slab	0.9	Frame	0.85	Elec	0.7
2MSLFGH	63	Slab	0.9	Frame	0.85	Gas	0.3
2MSLMEH	66	Slab	0.9	Mass	0.15	Elec	0.7
2MSLMGH	66	Slab	0.9	Mass	0.15	Gas	0.3
2MVCFEH	62	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2MVCFGH	62	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2MVCMGH	65	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2MVCMEH	65	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**59.7**	**High Efficiency Equipment**					

CZ 2 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2SSLFEC	74	Slab	0.9	Frame	0.85	Elec	0.7
2SSLFGC	73	Slab	0.9	Frame	0.85	Gas	0.3
2SSLMEC	77	Slab	0.9	Mass	0.15	Elec	0.7
2SSLMGC	76	Slab	0.9	Mass	0.15	Gas	0.3
2SVCFEC	71	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2SVCFGC	70	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2SVCMEC	74	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2SVCMGC	73	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**73.9**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 2 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
2SSLFEH	65	Slab	0.9	Frame	0.85	Elec	0.7
2SSLFGH	65	Slab	0.9	Frame	0.85	Gas	0.3
2SSLMEH	68	Slab	0.9	Mass	0.15	Elec	0.7
2SSLMGH	68	Slab	0.9	Mass	0.15	Gas	0.3
2SVCFEH	62	Vented Crawl	0.1	Frame	0.85	Elec	0.7
2SVCFGH	63	Vented Crawl	0.1	Frame	0.85	Gas	0.3
2SVCMEH	65	Vented Crawl	0.1	Mass	0.15	Elec	0.7
2SVCMGH	65	Vented Crawl	0.1	Mass	0.15	Gas	0.3
Average:	**65.2**	**High Efficiency Equipment**					

CZ 3 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3LCBFEC	51	Cond'd Bsmt	0	Frame	1	Elec	0.55
3LCBFGC	50	Cond'd Bsmt	0	Frame	1	Gas	0.45
3LSLFEC	64	Slab	0.75	Frame	1	Elec	0.55
3LSLFGC	64	Slab	0.75	Frame	1	Gas	0.45
3LUBFEC	61	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3LUBFGC	61	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3LVCFEC	65	Vented Crawl	0.1	Frame	1	Elec	0.55
3LVCFGC	63	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**63.6**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 3 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3LCBFEH	45	Cond'd Bsmt	0	Frame	1	Elec	0.55
3LCBFGH	44	Cond'd Bsmt	0	Frame	1	Gas	0.45
3LSLFEH	57	Slab	0.75	Frame	1	Elec	0.55
3LSLFGH	55	Slab	0.75	Frame	1	Gas	0.45
3LUBFEH	54	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3LUBFGH	51	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3LVCFEH	57	Vented Crawl	0.1	Frame	1	Elec	0.55
3LVCFGH	55	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**55.6**	**High Efficiency Equipment**					

CZ 3 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3MCBFEC	51	Cond'd Bsmt	0	Frame	1	Elec	0.55
3MCBFGC	50	Cond'd Bsmt	0	Frame	1	Gas	0.45
3MSLFEC	68	Slab	0.75	Frame	1	Elec	0.55
3MSLFGC	67	Slab	0.75	Frame	1	Gas	0.45
3MUBFEC	65	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3MUBFGC	64	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3MVCFEC	67	Vented Crawl	0.1	Frame	1	Elec	0.55
3MVCFGC	66	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**67.0**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 3 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3MCBFEH	45	Cond'd Bsmt	0	Frame	1	Elec	0.55
3MCBFGH	47	Cond'd Bsmt	0	Frame	1	Gas	0.45
3MSLFEH	59	Slab	0.75	Frame	1	Elec	0.55
3MSLFGH	58	Slab	0.75	Frame	1	Gas	0.45
3MUBFEH	56	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3MUBFGH	55	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3MVCFEH	58	Vented Crawl	0.1	Frame	1	Elec	0.55
3MVCFGH	57	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**58.0**	**High Efficiency Equipment**					

CZ 3 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3SCBFEC	53	Cond'd Bsmt	0	Frame	1	Elec	0.55
3SCBFGC	53	Cond'd Bsmt	0	Frame	1	Gas	0.45
3SSLFEC	74	Slab	0.75	Frame	1	Elec	0.55
3SSLFGC	73	Slab	0.75	Frame	1	Gas	0.45
3SUBFEC	72	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3SUBFGC	70	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3SVCFEC	72	Vented Crawl	0.1	Frame	1	Elec	0.55
3SVCFGC	71	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**73.0**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 3 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
3SCBFEH	46	Cond'd Bsmt	0	Frame	1	Elec	0.55
3SCBFGH	46	Cond'd Bsmt	0	Frame	1	Gas	0.45
3SSLFEH	64	Slab	0.75	Frame	1	Elec	0.55
3SSLFGH	63	Slab	0.75	Frame	1	Gas	0.45
3SUBFEH	62	Unheated Bsmt	0.15	Frame	1	Elec	0.55
3SUBFGH	61	Unheated Bsmt	0.15	Frame	1	Gas	0.45
3SVCFEH	62	Vented Crawl	0.1	Frame	1	Elec	0.55
3SVCFGH	61	Vented Crawl	0.1	Frame	1	Gas	0.45
Average:	**63.1**	**High Efficiency Equipment**					

CZ 4 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4LCBFEC	63	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4LCBFGC	63	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4LSLFEC	71	Slab	0.25	Frame	1	Elec	0.35
4LSLFGC	71	Slab	0.25	Frame	1	Gas	0.65
4LUBFEC	68	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4LUBFGC	68	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4LVCFEC	72	Vented Crawl	0.2	Frame	1	Elec	0.35
4LVCFGC	71	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**67.7**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 4 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4LCBFEH	55	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4LCBFGH	54	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4LSLFEH	63	Slab	0.25	Frame	1	Elec	0.35
4LSLFGH	61	Slab	0.25	Frame	1	Gas	0.65
4LUBFEH	60	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4LUBFGH	58	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4LVCFEH	63	Vented Crawl	0.2	Frame	1	Elec	0.35
4LVCFGH	61	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**58.5**	**High Efficiency Equipment**					

CZ 4 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4MCBFEC	66	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4MCBFGC	66	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4MSLFEC	75	Slab	0.25	Frame	1	Elec	0.35
4MSLFGC	74	Slab	0.25	Frame	1	Gas	0.65
4MUBFEC	71	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4MUBFGC	70	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4MVCFEC	74	Vented Crawl	0.2	Frame	1	Elec	0.35
4MVCFGC	73	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**70.4**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 4 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4MCBFEH	58	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4MCBFGH	61	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4MSLFEH	65	Slab	0.25	Frame	1	Elec	0.35
4MSLFGH	63	Slab	0.25	Frame	1	Gas	0.65
4MUBFEH	62	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4MUBFGH	60	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4MVCFEH	64	Vented Crawl	0.2	Frame	1	Elec	0.35
4MVCFGH	62	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**61.6**	**High Efficiency Equipment**					

CZ 4 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4SCBFEC	70	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4SCBFGC	71	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4SSLFEC	81	Slab	0.25	Frame	1	Elec	0.35
4SSLFGC	79	Slab	0.25	Frame	1	Gas	0.65
4SUBFEC	77	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4SUBFGC	76	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4SVCFEC	78	Vented Crawl	0.2	Frame	1	Elec	0.35
4SVCFGC	77	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**75.4**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 4 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
4SCBFEH	61	Cond'd Bsmt	0.35	Frame	1	Elec	0.35
4SCBFGH	60	Cond'd Bsmt	0.35	Frame	1	Gas	0.65
4SSLFEH	69	Slab	0.25	Frame	1	Elec	0.35
4SSLFGH	67	Slab	0.25	Frame	1	Gas	0.65
4SUBFEH	66	Unheated Bsmt	0.2	Frame	1	Elec	0.35
4SUBFGH	64	Unheated Bsmt	0.2	Frame	1	Gas	0.65
4SVCFEH	67	Vented Crawl	0.2	Frame	1	Elec	0.35
4SVCFGH	66	Vented Crawl	0.2	Frame	1	Gas	0.65
Average:	**64.3**	**High Efficiency Equipment**					

CZ 5 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5LCBFEC	63	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5LCBFGC	64	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5LCCFEC	71	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5LCCFGC	70	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5LSLFEC	73	Slab	0.1	Frame	1	Elec	0.2
5LSLFGC	74	Slab	0.1	Frame	1	Gas	0.8
5LUBFEC	70	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5LUBFGC	70	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5LVCFEC	74	Vented Crawl	0.05	Frame	1	Elec	0.2
5LVCFGC	74	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**67.8**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 5 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5LCBFEH	56	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5LCBFGH	54	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5LCCFEH	63	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5LCCFGH	59	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5LSLFEH	65	Slab	0.1	Frame	1	Elec	0.2
5LSLFGH	62	Slab	0.1	Frame	1	Gas	0.8
5LUBFEH	63	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5LUBFGH	59	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5LVCFEH	65	Vented Crawl	0.05	Frame	1	Elec	0.2
5LVCFGH	62	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**57.8**	**High Efficiency Equipment**					

CZ 5 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5MCBFEC	66	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5MCBFGC	67	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5MCCFEC	70	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5MCCFGC	71	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5MSLFEC	77	Slab	0.1	Frame	1	Elec	0.2
5MSLFGC	77	Slab	0.1	Frame	1	Gas	0.8
5MUBFEC	74	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5MUBFGC	74	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5MVCFEC	77	Vented Crawl	0.05	Frame	1	Elec	0.2
5MVCFGC	77	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**71.1**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 5 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5MCBFEH	59	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5MCBFGH	62	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5MCCFEH	62	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5MCCFGH	60	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5MSLFEH	67	Slab	0.1	Frame	1	Elec	0.2
5MSLFGH	64	Slab	0.1	Frame	1	Gas	0.8
5MUBFEH	64	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5MUBFGH	62	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5MVCFEH	67	Vented Crawl	0.05	Frame	1	Elec	0.2
5MVCFGH	64	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**62.2**	**High Efficiency Equipment**					

CZ 5 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5SCBFEC	70	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5SCBFGC	72	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5SCCFEC	69	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5SCCFGC	71	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5SSLFEC	84	Slab	0.1	Frame	1	Elec	0.2
5SSLFGC	83	Slab	0.1	Frame	1	Gas	0.8
5SUBFEC	80	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5SUBFGC	79	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5SVCFEC	81	Vented Crawl	0.05	Frame	1	Elec	0.2
5SVCFGC	81	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**75.8**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 5 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
5SCBFEH	62	Con'd. Bsmt	0.45	Frame	1	Elec	0.2
5SCBFGH	60	Con'd. Bsmt	0.45	Frame	1	Gas	0.8
5SCCFEH	60	Cond'd Crawl	0.05	Frame	1	Elec	0.2
5SCCFGH	59	Cond'd Crawl	0.05	Frame	1	Gas	0.8
5SSLFEH	72	Slab	0.1	Frame	1	Elec	0.2
5SSLFGH	69	Slab	0.1	Frame	1	Gas	0.8
5SUBFEH	68	Uncon'd. Bsmt	0.35	Frame	1	Elec	0.2
5SUBFGH	66	Uncon'd. Bsmt	0.35	Frame	1	Gas	0.8
5SVCFEH	69	Vented Crawl	0.05	Frame	1	Elec	0.2
5SVCFGH	68	Vented Crawl	0.05	Frame	1	Gas	0.8
Average:	**63.8**	**High Efficiency Equipment**					

CZ 6 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6LCBFEC	60	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6LCBFGC	61	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6LCCFEC	67	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6LCCFGC	67	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6LSLFEC	70	Slab	0.05	Frame	1	Elec	0.05
6LSLFGC	70	Slab	0.05	Frame	1	Gas	0.95
6LUBFEC	66	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6LUBFGC	66	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6LVCFEC	69	Vented Crawl	0.05	Frame	1	Elec	0.05
6LVCFGC	68	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**62.6**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 6 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6LCBFEH	54	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6LCBFGH	51	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6LCCFEH	60	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6LCCFGH	56	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6LSLFEH	62	Slab	0.05	Frame	1	Elec	0.05
6LSLFGH	59	Slab	0.05	Frame	1	Gas	0.95
6LUBFEH	59	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6LUBFGH	55	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6LVCFEH	62	Vented Crawl	0.05	Frame	1	Elec	0.05
6LVCFGH	58	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**52.6**	**High Efficiency Equipment**					

CZ 6 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6MCBFEC	64	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6MCBFGC	65	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6MCCFEC	65	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6MCCFGC	68	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6MSLFEC	73	Slab	0.05	Frame	1	Elec	0.05
6MSLFGC	74	Slab	0.05	Frame	1	Gas	0.95
6MUBFEC	70	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6MUBFGC	70	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6MVCFEC	73	Vented Crawl	0.05	Frame	1	Elec	0.05
6MVCFGC	73	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**66.5**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 6 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6MCBFEH	57	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6MCBFGH	60	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6MCCFEH	59	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6MCCFGH	56	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6MSLFEH	64	Slab	0.05	Frame	1	Elec	0.05
6MSLFGH	61	Slab	0.05	Frame	1	Gas	0.95
6MUBFEH	61	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6MUBFGH	58	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6MVCFEH	63	Vented Crawl	0.05	Frame	1	Elec	0.05
6MVCFGH	61	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**59.6**	**High Efficiency Equipment**					

CZ 6 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6SCBFEC	69	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6SCBFGC	72	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6SCCFEC	65	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6SCCFGC	68	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6SSLFEC	81	Slab	0.05	Frame	1	Elec	0.05
6SSLFGC	81	Slab	0.05	Frame	1	Gas	0.95
6SUBFEC	77	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6SUBFGC	77	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6SVCFEC	79	Vented Crawl	0.05	Frame	1	Elec	0.05
6SVCFGC	78	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**72.9**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 6 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
6SCBFEH	61	Cond'd Bsmt	0.75	Frame	1	Elec	0.05
6SCBFGH	59	Cond'd Bsmt	0.75	Frame	1	Gas	0.95
6SCCFEH	57	Cond'd Crawl	0.05	Frame	1	Elec	0.05
6SCCFGH	55	Cond'd Crawl	0.05	Frame	1	Gas	0.95
6SSLFEH	69	Slab	0.05	Frame	1	Elec	0.05
6SSLFGH	67	Slab	0.05	Frame	1	Gas	0.95
6SUBFEH	66	Unheated Bsmt	0.1	Frame	1	Elec	0.05
6SUBFGH	63	Unheated Bsmt	0.1	Frame	1	Gas	0.95
6SVCFEH	67	Vented Crawl	0.05	Frame	1	Elec	0.05
6SVCFGH	65	Vented Crawl	0.05	Frame	1	Gas	0.95
Average:	**60.0**	**High Efficiency Equipment**					

CZ 7 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7LCBFGC	58	Cond'd Bsmt	0.75	Frame	1	Gas	1
7LCCFGC	65	Cond'd Crawl	0.05	Frame	1	Gas	1
7LSLFGC	68	Slab	0.05	Frame	1	Gas	1
7LUBFGC	63	Unheated Bsmt	0.1	Frame	1	Gas	1
7LVCFGC	66	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**59.8**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 7 - Large		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7LCBFGH	49	Cond'd Bsmt	0.75	Frame	1	Gas	1
7LCCFGH	54	Cond'd Crawl	0.05	Frame	1	Gas	1
7LSLFGH	56	Slab	0.05	Frame	1	Gas	1
7LUBFGH	53	Unheated Bsmt	0.1	Frame	1	Gas	1
7LVCFGH	55	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**50.3**	**High Efficiency Equipment**					

CZ 7 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7MCBFGC	62	Cond'd Bsmt	0.75	Frame	1	Gas	1
7MCCFGC	67	Cond'd Crawl	0.05	Frame	1	Gas	1
7MSLFGC	73	Slab	0.05	Frame	1	Gas	1
7MUBFGC	68	Unheated Bsmt	0.1	Frame	1	Gas	1
7MVCFGC	71	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**63.9**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 7 - Medium		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7MCBFGH	58	Cond'd Bsmt	0.75	Frame	1	Gas	1
7MCCFGH	54	Cond'd Crawl	0.05	Frame	1	Gas	1
7MSLFGH	59	Slab	0.05	Frame	1	Gas	1
7MUBFGH	56	Unheated Bsmt	0.1	Frame	1	Gas	1
7MVCFGH	58	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**57.7**	**High Efficiency Equipment**					

CZ 7 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7SCBFGC	69	Cond'd Bsmt	0.75	Frame	1	Gas	1
7SCCFGC	67	Cond'd Crawl	0.05	Frame	1	Gas	1
7SSLFGC	80	Slab	0.05	Frame	1	Gas	1
7SUBFGC	75	Unheated Bsmt	0.1	Frame	1	Gas	1
7SVCFGC	77	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**70.5**	**Standard Efficiency Equipment (Federal Minimum)**					

CZ 7 - Small		Foundation		Above-grade Walls		Htg/DHW Fuel Type	
ID	HERS INDEX	Type	CZ weighting	Type	CZ weighting	Type	CZ weighting
7SCBFGH	56	Cond'd Bsmt	0.75	Frame	1	Gas	1
7SCCFGH	54	Cond'd Crawl	0.05	Frame	1	Gas	1
7SSLFGH	65	Slab	0.05	Frame	1	Gas	1
7SUBFGH	62	Unheated Bsmt	0.1	Frame	1	Gas	1
7SVCFGH	63	Vented Crawl	0.05	Frame	1	Gas	1
Average:	**57.3**	**High Efficiency Equipment**					

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