

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Product: ENERGY STAR New Homes

Algorithms:

Bundled measures savings (Customer kW)	= The higher of the summer or winter peak kW savings from REM/Rate model for each house with adjusted baseline by locations seen in Table 1 (below).
Bundled measures savings (Customer kWh)	= Total kWh savings from REM/Rate model for each home with adjusted baseline by locations seen in Table 1 (below).
Bundled measures savings (Gross Dth)	= Total Dth savings from REM/Rate model for each home with adjusted baseline by locations seen in Table 1 (below).
Clothes washer natural gas savings (Dth) and electric energy savings (kWh)	Energy savings for the clothes washer were based on the ENERGY STAR Clothes Washer Savings Calculator: http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers . This assumed a gas water heater home, so savings are generated for gas and electric. Savings is 1.27 Dth and 77 Kwh.
Dishwasher natural gas savings (Dth) and electric energy savings (kWh)	Energy savings for the dishwasher were based on the ENERGY STAR Dishwasher Savings Calculator: http://www.energystar.gov/index.cfm?c=dishwash.pr_dishwashers . This assumed a gas water heater home, so savings are generated for gas and electric. Savings is 0.88 Dth and 26 kWh.
Refrigerator electric energy savings (kWh)	Energy savings for the refrigerator were based on the ENERGY STAR Refrigerator Savings Calculator: http://www.energystar.gov/index.cfm?c=refrig.pr_refrigerators . Savings is 93 kWh.
Net Dth	= Gross Dth x NTG
Electrical Energy Savings (Gross Generator)	= Customer kWh / (1-TDLF)
Electrical Demand Savings (Gross Generator)	= Customer kW x CF / (1-TDLF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG
HERS_ICC_Adj_Factor	= Incremental Capital Cost Adjustment Factor for Envelope HERS Index based Measures = $1 + -0.649 \times \ln(\text{Home_Size}) + 5.2228$
As-built_HERS_ICC/SF	= As-built Incremental Capital Cost per Square Foot for Envelope HERS Index based Measures. As-Built_HERS_ICC/SF = $(0.001617 \times \text{HERS}^2 - 0.25839 \times \text{HERS} + 10.32437) \times \text{HERS_ICC_Adj_Factor}$
Baseline_HERS_ICC/SF	For areas requiring IECC 2009 compliant homes: Baseline_HERS_ICC/SF = \$0.00. For areas requiring better than Code Reference Home HERS Indices <= 80 : Baseline_HERS_ICC/SF = $(0.001617 \times \text{Baseline_HERS}^2 - 0.25839 \times \text{Baseline_HERS} + 10.32437) \times \text{HERS_ICC_Adj_Factor}$ For Reference Home HERS Indices > 80: Baseline_HERS_ICC/SF = $(-0.02168 \times \text{Baseline_HERS} + 1.718067) \times \text{HERS_ICC_Adj_Factor}$
HERS_ICC/SF	= As-built HERS_ICC/SF - Baseline_HERS_ICC/SF

Variables:

Home_Size	Home Size in Square Feet for use in calculating ICC_Adj_Factor. Provided by vendor for each home.
HERS	This is generically a score provided by a House Rater to characterize the home's efficiency with respect to a comparable home built to IECC 2004 standards. = $(\text{Home's energy use in MMBTU}) / (\text{IECC2004 compliant home energy use in MMBTU})$ The HERS Index Score for use will be used in calculating Incremental Capital Costs. The HERS Index Score will be Provided by vendor for each home.
Baseline_HERS	HERS Index Score based on local code requirements. For areas requiring IECC 2009 compliant homes: Baseline_HERS = 80. For areas requiring Better Than Code homes: Baseline_HERS = 70. = $(\text{Ref_Home_MMBTU}) / (\text{IECC2004_MMBTU}) \times 100$
As-Built_HERS	As-Built Home's HERS Index Score calculated by the Home Rater using the REMRate software modeling tool. = $(\text{As-Built Home MMBTU} / \text{IECC2004 MMBTU}) \times 100$

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As-Built_Home_MMBTU	As-Built Home's annual energy use calculated by the Home Rater using the REMRate software modeling tool, in units of MMBTU
IECC2004_MMBTU	HERS Index Scores are all based on the IECC 2004 code and assumes that a home built to IECC2004 receives a score of 100. = As-Built_Home_MMBTU / (As-Built_HERS / 100)
TDLF	Transmission Distribution Loss Factor = 7.7%, the percentage loss of electricity as it flows from the power plant to the customer.
CF	Coincidence Factor = the probability that peak demand of the lights will coincide with peak utility system demand from Table 2 (below).

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NTG	Net-to-Gross Factor as listed in Table 2.
O&M savings	Operation and Maintenance savings = We will assume water savings of \$58.19 per year for Clothes Washers and \$3.59 per year for Dishwashers.

Table 1. Baseline HERS Values

Location	Baseline HERS	HERS for Rebate Eligibility
Jurisdictions Requiring Better Than Code HERS Index Scores	70 See New Calculation	65
Jurisdictions Requiring Code Compliant HERS Index Scores	80 See New Calculation	75

- As-built HERS Index must be less than the maximum allowed by local code to qualify for a rebate
- Rebate levels, incremental costs and baseline HERS values will be adjusted as appropriate to account for local codes requiring better than IECC 2009 compliant HERS Indices.
- No rebates will be given for homes with a Baseline HERS Index of 60 or lower

Table 2. Measure Life, Cost and Net to Gross (NTG)

Type of measure:	Measure life:	Incremental cost:	Coincidence factor:	NTG (elec):	NTG (gas):
Envelope Measures	20 years (Reference 1)	Incremental costs for envelope measures will be determined based on location, size of house, and HERS index as seen in Table 3.	Coincidence factor will be determined for the bundled measures of each house by taking the actual Summer peak kW reduction and multiplying by 0.9 to account for probability that the house peak occurs at the same time as the system peak.	92%	92%
Energy Star V3 Home	20 years (Reference 1)	Incremental Capital Cost is the SUM of the Incremental Capital Costs for each of the following measures: HERS based Envelope Measure (see Table 3), Energy Star V3 Paper work = \$1,155.63 Energy Star Clothes Washer, Energy Star Dishwasher, and Energy Star Refrigerator.	Coincidence factor will be determined for the bundled measures of each house by summing the actual Summer peak coincident kW reduction already calculated for each measure.	92%	92%
Energy Star Clothes washer	11 years (Reference 16)	\$200 (Reference 14)	4.47% (Reference 14)	92%	92%
Energy Star Dishwasher	11 years (Reference 15)	\$30 (Reference 14)	2.45% (Reference 14)	92%	92%
Energy Star Refrigerator	13 years (Reference 14)	\$30 (Reference 14)	100.00%	92%	N/A

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Table 3. HERS Envelope Measure Incremental Capital Cost per Square Foot of Efficient Home Referenced to a Baseline of 80 HERS (Reference 17)

HERS Range for forecast	HERS Value	Home Size (Sq. Ft.)										
		1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
For Baseline HERS Cost/SF calculation Only	95	\$ (0.59)	\$ (0.50)	\$ (0.44)	\$ (0.39)	\$ (0.35)	\$ (0.32)	\$ (0.29)	\$ (0.26)	\$ (0.24)	\$ (0.22)	\$ (0.20)
	94	\$ (0.56)	\$ (0.47)	\$ (0.41)	\$ (0.37)	\$ (0.33)	\$ (0.30)	\$ (0.27)	\$ (0.24)	\$ (0.22)	\$ (0.20)	\$ (0.18)
	93	\$ (0.52)	\$ (0.44)	\$ (0.39)	\$ (0.34)	\$ (0.31)	\$ (0.28)	\$ (0.25)	\$ (0.23)	\$ (0.21)	\$ (0.19)	\$ (0.17)
	92	\$ (0.48)	\$ (0.41)	\$ (0.36)	\$ (0.32)	\$ (0.28)	\$ (0.26)	\$ (0.23)	\$ (0.21)	\$ (0.19)	\$ (0.18)	\$ (0.16)
	91	\$ (0.44)	\$ (0.38)	\$ (0.33)	\$ (0.29)	\$ (0.26)	\$ (0.24)	\$ (0.21)	\$ (0.19)	\$ (0.18)	\$ (0.16)	\$ (0.15)
	90	\$ (0.41)	\$ (0.34)	\$ (0.30)	\$ (0.27)	\$ (0.24)	\$ (0.22)	\$ (0.20)	\$ (0.18)	\$ (0.16)	\$ (0.15)	\$ (0.13)
	89	\$ (0.37)	\$ (0.31)	\$ (0.27)	\$ (0.24)	\$ (0.22)	\$ (0.20)	\$ (0.18)	\$ (0.16)	\$ (0.15)	\$ (0.13)	\$ (0.12)
	88	\$ (0.33)	\$ (0.28)	\$ (0.25)	\$ (0.22)	\$ (0.20)	\$ (0.18)	\$ (0.16)	\$ (0.15)	\$ (0.13)	\$ (0.12)	\$ (0.11)
	87	\$ (0.29)	\$ (0.25)	\$ (0.22)	\$ (0.19)	\$ (0.17)	\$ (0.16)	\$ (0.14)	\$ (0.13)	\$ (0.12)	\$ (0.11)	\$ (0.10)
	86	\$ (0.26)	\$ (0.22)	\$ (0.19)	\$ (0.17)	\$ (0.15)	\$ (0.14)	\$ (0.12)	\$ (0.11)	\$ (0.10)	\$ (0.09)	\$ (0.08)
	85	\$ (0.22)	\$ (0.18)	\$ (0.16)	\$ (0.14)	\$ (0.13)	\$ (0.12)	\$ (0.11)	\$ (0.10)	\$ (0.09)	\$ (0.08)	\$ (0.07)
	84	\$ (0.18)	\$ (0.15)	\$ (0.13)	\$ (0.12)	\$ (0.11)	\$ (0.10)	\$ (0.09)	\$ (0.08)	\$ (0.07)	\$ (0.07)	\$ (0.06)
	83	\$ (0.14)	\$ (0.12)	\$ (0.11)	\$ (0.09)	\$ (0.08)	\$ (0.08)	\$ (0.07)	\$ (0.06)	\$ (0.06)	\$ (0.05)	\$ (0.05)
	82	\$ (0.10)	\$ (0.09)	\$ (0.08)	\$ (0.07)	\$ (0.06)	\$ (0.06)	\$ (0.05)	\$ (0.05)	\$ (0.04)	\$ (0.04)	\$ (0.03)
	81	\$ (0.07)	\$ (0.06)	\$ (0.05)	\$ (0.04)	\$ (0.04)	\$ (0.04)	\$ (0.03)	\$ (0.03)	\$ (0.03)	\$ (0.02)	\$ (0.02)
	80	\$ 0.01	\$ 0.01	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	79	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00	\$ 0.00
	78	\$ 0.02	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01
	77	\$ 0.03	\$ 0.03	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01	\$ 0.01
	76	\$ 0.05	\$ 0.04	\$ 0.04	\$ 0.03	\$ 0.03	\$ 0.03	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.02
75 - 71	75	\$ 0.07	\$ 0.06	\$ 0.05	\$ 0.05	\$ 0.04	\$ 0.04	\$ 0.04	\$ 0.03	\$ 0.03	\$ 0.03	\$ 0.02
	74	\$ 0.10	\$ 0.09	\$ 0.08	\$ 0.07	\$ 0.06	\$ 0.06	\$ 0.05	\$ 0.05	\$ 0.04	\$ 0.04	\$ 0.03
	73	\$ 0.14	\$ 0.12	\$ 0.10	\$ 0.09	\$ 0.08	\$ 0.07	\$ 0.07	\$ 0.06	\$ 0.06	\$ 0.05	\$ 0.05
	72	\$ 0.18	\$ 0.15	\$ 0.13	\$ 0.12	\$ 0.11	\$ 0.10	\$ 0.09	\$ 0.08	\$ 0.07	\$ 0.07	\$ 0.06
	71	\$ 0.23	\$ 0.19	\$ 0.17	\$ 0.15	\$ 0.13	\$ 0.12	\$ 0.11	\$ 0.10	\$ 0.09	\$ 0.08	\$ 0.08
70 - 66	70	\$ 0.28	\$ 0.24	\$ 0.21	\$ 0.19	\$ 0.17	\$ 0.15	\$ 0.14	\$ 0.12	\$ 0.11	\$ 0.10	\$ 0.09
	69	\$ 0.34	\$ 0.29	\$ 0.25	\$ 0.22	\$ 0.20	\$ 0.18	\$ 0.16	\$ 0.15	\$ 0.14	\$ 0.12	\$ 0.11
	68	\$ 0.40	\$ 0.34	\$ 0.30	\$ 0.27	\$ 0.24	\$ 0.22	\$ 0.19	\$ 0.18	\$ 0.16	\$ 0.15	\$ 0.13
	67	\$ 0.47	\$ 0.40	\$ 0.35	\$ 0.31	\$ 0.28	\$ 0.25	\$ 0.23	\$ 0.21	\$ 0.19	\$ 0.17	\$ 0.16
	66	\$ 0.55	\$ 0.47	\$ 0.41	\$ 0.36	\$ 0.32	\$ 0.29	\$ 0.26	\$ 0.24	\$ 0.22	\$ 0.20	\$ 0.18
65 - 61	65	\$ 0.63	\$ 0.53	\$ 0.47	\$ 0.41	\$ 0.37	\$ 0.34	\$ 0.30	\$ 0.28	\$ 0.25	\$ 0.23	\$ 0.21
	64	\$ 0.72	\$ 0.61	\$ 0.53	\$ 0.47	\$ 0.42	\$ 0.38	\$ 0.35	\$ 0.31	\$ 0.29	\$ 0.26	\$ 0.24
	63	\$ 0.81	\$ 0.69	\$ 0.60	\$ 0.53	\$ 0.48	\$ 0.43	\$ 0.39	\$ 0.35	\$ 0.32	\$ 0.29	\$ 0.27
	62	\$ 0.91	\$ 0.77	\$ 0.67	\$ 0.60	\$ 0.53	\$ 0.48	\$ 0.44	\$ 0.40	\$ 0.36	\$ 0.33	\$ 0.30
	61	\$ 1.01	\$ 0.86	\$ 0.75	\$ 0.66	\$ 0.60	\$ 0.54	\$ 0.49	\$ 0.44	\$ 0.40	\$ 0.37	\$ 0.33
60 - and below	60	\$ 1.12	\$ 0.95	\$ 0.83	\$ 0.74	\$ 0.66	\$ 0.60	\$ 0.54	\$ 0.49	\$ 0.45	\$ 0.41	\$ 0.37
	59	\$ 1.23	\$ 1.05	\$ 0.91	\$ 0.81	\$ 0.73	\$ 0.66	\$ 0.60	\$ 0.54	\$ 0.49	\$ 0.45	\$ 0.41
	58	\$ 1.35	\$ 1.15	\$ 1.00	\$ 0.89	\$ 0.80	\$ 0.72	\$ 0.65	\$ 0.59	\$ 0.54	\$ 0.49	\$ 0.45
	57	\$ 1.48	\$ 1.26	\$ 1.10	\$ 0.97	\$ 0.87	\$ 0.79	\$ 0.71	\$ 0.65	\$ 0.59	\$ 0.54	\$ 0.49
	56	\$ 1.61	\$ 1.37	\$ 1.19	\$ 1.06	\$ 0.95	\$ 0.86	\$ 0.78	\$ 0.71	\$ 0.64	\$ 0.59	\$ 0.53

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55	\$ 1.75	\$ 1.48	\$ 1.30	\$ 1.15	\$ 1.03	\$ 0.93	\$ 0.84	\$ 0.77	\$ 0.70	\$ 0.64	\$ 0.58
54	\$ 1.89	\$ 1.61	\$ 1.40	\$ 1.24	\$ 1.12	\$ 1.01	\$ 0.91	\$ 0.83	\$ 0.76	\$ 0.69	\$ 0.63
53	\$ 2.04	\$ 1.73	\$ 1.51	\$ 1.34	\$ 1.20	\$ 1.09	\$ 0.98	\$ 0.90	\$ 0.82	\$ 0.74	\$ 0.68
52	\$ 2.19	\$ 1.86	\$ 1.63	\$ 1.44	\$ 1.29	\$ 1.17	\$ 1.06	\$ 0.96	\$ 0.88	\$ 0.80	\$ 0.73
51	\$ 2.35	\$ 2.00	\$ 1.75	\$ 1.55	\$ 1.39	\$ 1.25	\$ 1.14	\$ 1.03	\$ 0.94	\$ 0.86	\$ 0.78
50	\$ 2.52	\$ 2.14	\$ 1.87	\$ 1.66	\$ 1.49	\$ 1.34	\$ 1.22	\$ 1.11	\$ 1.01	\$ 0.92	\$ 0.84
49	\$ 2.69	\$ 2.28	\$ 1.99	\$ 1.77	\$ 1.59	\$ 1.43	\$ 1.30	\$ 1.18	\$ 1.07	\$ 0.98	\$ 0.89
48	\$ 2.87	\$ 2.43	\$ 2.13	\$ 1.89	\$ 1.69	\$ 1.53	\$ 1.38	\$ 1.26	\$ 1.15	\$ 1.04	\$ 0.95
47	\$ 3.05	\$ 2.59	\$ 2.26	\$ 2.01	\$ 1.80	\$ 1.62	\$ 1.47	\$ 1.34	\$ 1.22	\$ 1.11	\$ 1.01
46	\$ 3.24	\$ 2.75	\$ 2.40	\$ 2.13	\$ 1.91	\$ 1.72	\$ 1.56	\$ 1.42	\$ 1.29	\$ 1.18	\$ 1.07
45	\$ 3.43	\$ 2.91	\$ 2.54	\$ 2.26	\$ 2.02	\$ 1.83	\$ 1.66	\$ 1.51	\$ 1.37	\$ 1.25	\$ 1.14

The table values were calculated using the algorithms for As-Built_HERS_ICC/SF = (0.001617 x HERS^2 - 0.25839 x HERS + 10.32437) x HERS_ICC_Adj_Factor

Incremental Capital cost of As-built home may be calculated from the algorithms or selected from the above table which adjusts for home size.

The assumed Baseline_HERS for the table is 80. For homes with Baseline_HERS = 80: HERS_ICC/SF = As-built HERS_ICC/SF - 0.00

Revise methodology to use the actual (calculated) Baseline Home HERS to calculate the incremental cost rather than deeming the Baseline HERS.

Baseline Home HERS is calculated from the Reference Home MMBTU / IECC2004 MMBTU . See Algorithm above.

For homes with Baseline_HERS = 70: HERS_ICC/SF = As-built HERS_ICC/SF - Baseline_HERS_ICC/SF

Incremental Cost to achieve Energy Star V3 rating includes Envelope of HERS 60 or better, Energy Star Lighting, Energy Star Clothes washer, Energy Star Dishwasher, and Energy Star Refrigerator (and \$1,155.63 for paperwork)

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Provided by Vendor:

REM/Rate output file including IECC 2009 and as built kW, kWh, and Therms
Location and size of house
Thermal Enclosure Checklist
As-Built HERS index
Code maximum HERS Index
Which of the three bundled measures (dishwasher, clothes washer, refrigerator) were installed?

Assumptions:

No CFLs exist in the home (new home) and that CFLs and any other efficient lighting will be included in the REMRate models for HERS Index development.
Energy Star V3 Tier only available to Combo Gas & Electric customers with HERS 60 or better rated home with Energy Star Lighting, Energy Star Clothes washer, Energy Star Dishwasher, Energy Star Refrigerator, and Energy Star V3 paperwork/checklists
Incremental costs to achieve the As-built HERS rating will be adjusted by as-built square footage.
~~For Homes with Baseline HERS = 80 the Baseline HERS ICC/SF = \$0.00~~

Reference Home and As-Built Home have the same IECC2004 HERS Index baseline as a denominator which is represented as a HERS Index of 100.

A HERS index is defined as the ratio (Home's consumption in MMBTU / Home's IECC2004 code compliant consumption in MMBTU) x 100.

Changes From 2013:

Calculate Baseline HERS and use in calculation of incremental Cost.

References:

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3. American Housing Survey for Denver - US Census Bureau
4. Xcel Energy CO DSM Potential 2006 - prepared by Kema
5. National Energy Efficiency Best Practices Study - Residential Single-Family Comprehensive Weatherization Best Practices Report from December 2004.
6. RS Means Repair and Remodeling 2007 at a cost of \$0.028 per square foot per increase in R-value.
7. National Energy Audit Tool (NEAT) and Frontier estimates.
8. EEBP web site - Tacoma Residential Weatherization program.
9. US Lighting Market Characterization Study performed for the Department of Energy in 2002
10. MEEA/ES
11. Xcel Energy estimate
12. Draft Technical Support Document: Energy Conservation Standards for Residential Furnaces and Boilers, Efficiency Standards for Consumer Products Prepared for US DOE, September 2006
13. California Energy Commission's Database for Energy Efficient Resources (DEER)
14. www.energystar.gov
15. DOE 2007
16. Appliance Magazine, September 2007
17. Incremental cost data are estimates from Residential Science Resources