DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Product: Residential Heating - CO

Description:

Residential natural gas customers receive a cash rebate for purchasing high-efficiency heating equipment. Residential electric customers can receive an additional cash rebate for purchasing an electronically commutated motor (ECM) furnace fan with their heating system.

Equations:

New Furnace Savings (Gross Dth)	= ((BTUH x EFFp / EFFb) - BTUH) x Hours / 1,000,000
ECM Furnace Fan Efficiency Electric Demand Savings (Gross kW saved at Customer)	= ECM_Baseline_kW - ECM_Proposed_kW
ECM Furnace Fan Efficiency Electric Demand Savings (Gross Generator kW)	= ECM_Customer_kW * Coincidence_Factor
ECM Furnace Fan Efficiency Electric Energy Savings (Gross Annual kWh Saved at Customer)	= ECM_Customer_kW x ECM_Operating_Hours
ECM Heating O&M Penalty	= ECM_Heating_Penalty

Variable ID	Value	Description
BTUH	Customer Input	Rated new furnace or boiler Input BTUH nameplate data provided by customer on rebate form.
EFFb	80%	Efficiency of baseline code minimum furnace (Reference 1)
EFFp	Customer Input	Efficiency for higher efficiency furnace will be provided by the customer on the rebate form.
Hours	1,159	Equivalent Full Load Heating Hours assumed for installed high efficiency furnace equipment
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btuh
ECM_Baseline_kW	See Table 2	Average PSC furnace fan kW (Reference 3, 4)
ECM_Proposed_kW	See Table 2	Average ECM furnace fan kW (Reference 3, 4)
ECM_Operating_Hours	See Table 2	ECM furnace fan hours of operation
ECM_Heating_Penalty	See Table 2	O&M Dollars spent in additional gas use to offset heating done by fan during winter
Coincidence_Factor	See Table 3	Percentage of Customer_kW savings that will coincide with peak summer kW savings
NTG	See Table 1 & 3	Net to Gross

Inputs:	Verified during M&V:
Furnace Efficiency	Yes
Furnace Nameplate Capacity of new unit at sea level (BTUH, Input)	Yes
Was ECM furnace fan motor provided	Yes
Does residence have central air conditioning	Yes

Table 1	Measure Life (Reference 2)	Incremental Cost (Reference 4)	NTG (Reference 6)
Furnace	18	$ 922.38	86%

Table 2	ECM_Baseline_kW	ECM_Proposed_kW	ECM_Operating_Hours	ECM_Heating_Penalty
New ECM w/ AC	0.651	0.457	4,186	$ (10.15)
New ECM w/o AC	0.571	0.364	3,338	$ (10.15)
Retrofit ECM w/ AC	0.638	0.387	2,319	$ (6.06)
Retrofit ECM w/o AC	0.571	0.334	2,046	$ (6.06)

Table 3	Measure Life	Incremental Cost	Coincidence _Factor	NTG
New ECM w/ AC	18	$212.00	79%	94%
New ECM w/o AC	18	$212.00	30%	94%
Retrofit ECM w/ AC	7	$212.00	61%	94%
Retrofit ECM w/o AC	7	$212.00	26%	94%

References:

1. US Department of Energy; Residential Furnaces and Boilers; http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72

2. 2015 ASHRAE Handbook - HVAC Applications; Comparison of Service Life Estimates; Page 37.3, Table 4
3. ECM Furnace Impact Assessment Report https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf
4. California Energy Commission's Database for Energy Efficient Resources (DEER) http//www.energy.ca.gov/deer
5. Cost information from "2010 - 2012 W0017 Ex Ante Measure Cost Study Final Report.", Itron, May 2014.
6. 2017 CO Res Heating Program Evaluation

Changes from Recent Filing:

1. Updated furnace incremental cost
2. Updated for 80% furnace efficiency baseline
3. Incorporated model results into analysis for EFLH hours for both furnaces and ECM motors.
4. Added ECM Furnace Retrofit measure

Electric Product Detailed Technical Assumptions

Measure Description	High Efficiency Product Assumptions			Baseline Product Assumptions			Economic Assumptions				
Electric Measure Description	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount ($)	Average Baseline Product Cost ($)	Incremental Cost of Efficient Product ($)	Assumed Energy Cost ($/kWh)
EC Fan Motor on new Residential Furnace with AC	ECM Furnace Fan	457	4,186	Non-ECM Fan	651	4,186	18.00	$100	$236	$212	0.10289
EC Fan Motor on new Residential Furnace no AC	ECM Furnace Fan	364	3,338	Non-ECM Fan	571	3,338	18.00	$100	$236	$212	0.10289
EC Fan Motor on existing Residential Furnace with AC	ECM Furnace Fan	387	2,319	Non-ECM Fan	638	2,319	7.00	$100	$0	$212	0.10289
EC Fan Motor on existing Residential Furnace no AC	ECM Furnace Fan	334	2,046	Non-ECM Fan	571	2,046	7.00	$100	$0	$212	0.10289

Measure Description	Stipulated Output								Economic Assumptions		Technical Assumption
Electric Measure Description	Rebate as a % of Incremental Cost (%)	Incremt'l Cost Payback Period w/o Rebate (yrs)	Incremt'l Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved ($/kWh)	Rebated Lifetime cost /Cust KWh Saved ($/kWh)	Customer kW Savings (kW)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings ($)	Energy O&M Savings ($)	Coincidence Factor (%)
EC Fan Motor on new Residential Furnace with AC	47%	2.89	1.53	812	$0.123	$0.007	0.19	0.17	-$10.15	$0.00	79%
EC Fan Motor on new Residential Furnace no AC	47%	3.48	1.84	691	$0.145	$0.008	0.21	0.07	-$10.15	$0.00	30%
EC Fan Motor on existing Residential Furnace with AC	47%	3.94	2.08	582	$0.172	$0.025	0.25	0.17	-$6.06	$0.00	61%
EC Fan Motor on existing Residential Furnace no AC	47%	4.84	2.55	485	$0.206	$0.029	0.24	0.07	-$6.06	$0.00	26%

Measure Description	Program Forecast Inputs: 2017		Program Forecast Inputs: 2018		Stipulated Forecast Inputs			2017		
Electric Measure Description	2017 Participants (-)	2017 Units (-)	2018 Participants (-)	2018 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)	2017 NET Gen kW (kW)	2017 NET Gen kWh (kWh)	2017 Rebate Budget ($)
	6.013	6.072	6.616	6.616				861	4.883.086	$607.200
EC Fan Motor on new Residential Furnace with AC	5,007	5,057	5,508	5,508	94%	100%	100%	789	4,181,461	$505,700
EC Fan Motor on new Residential Furnace no AC	906	915	997	997	94%	100%	100%	58	643,840	$91,500
EC Fan Motor on existing Residential Furnace with AC	85	85	94	94	94%	100%	100%	13	50,376	$8,500
EC Fan Motor on existing Residential Furnace no AC	15	15	17	17	94%	100%	100%	1	7,408	$1,500

Gas Product Detailed Technical Assumptions																		Program Forecast Inputs				Stipulated Forecast Inputs			Program Forecast Outputs			Program Forecast Outputs		
Measure Description	High Efficiency Product Assumptions		Baseline Product Assumptions		Economic Assumptions					Stipulated Output						Economic Assumptions		2017		2018		Valid Throughout Filing Period			2017			2018		
Natural Gas Measure Description	High Efficiency Product Description / Rating	High Efficiency Product Consumption (Dth/yr)	Baseline Product Description / Rating	Baseline Product Consumption (Dth/yr)	Life of Product (years)	Average Rebate Amount	Average Baseline Product Cost	Average Incremental Cost of Efficient Product	Assumed Energy Cost ($/Dth)	Rebate as a % of Incremental Cost	Increm'l Cost Payback Period w/o Rebate	Increm'l Cost Payback Period with Rebate	Average Annual Customer Dth Savings	Average rebated cost per Dth Saved	Average rebated Lifetime cost per Dth Saved	Non-Energy O&M Savings	Energy O&M Savings	2017 Participants (-)	2017 Units (-)	2018 Participants (-)	2018 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)	2017 NET Dth (Dth)	2017 Rebate Budget ($)	2017 Incremental Cost ($)	2018 NET Dth (Dth)	2018 Rebate Budget ($)	2018 Incremental Cost ($)
																		3,127	3,158	3,127	3,158				53,589	$378,960	$2,912,865	53,589	$378,960	$2,912,865
95% Efficient Furnace	96.4% AFUE Furnace without ECM	96	80% AFUE Federal Standard Efficiency Furnace	116	18	$120	$740	$922	$5.24	13%	8.92	7.76	19.73	$6.08	$0.34	$0	$0	3,127	3,158	3,127	3,158	89%	100%	100%	53,589	$378,960	$2,912,865	53,589	$378,960	$2,912,865