

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Heating System Rebates

Residential natural gas customers receive a cash rebate for purchasing high-efficiency heating equipment.

#### Algorithms:

New Furnace & Boiler Savings (Dth)	= ((BTUH x EFFh/EFFb) - BTUH) x (1 - oversize factor) x Hrs / 1,000,000
Furnace from AFUE 78% to 92% (Tier 1): Natural gas savings (Gross Dth)	Energy savings for the gas furnace were calculated in EnergyGauge using a baseline home model calibrated to typical home size and characteristics for the Denver area (see below for characteristics) = 9.8 Dth
Furnace from AFUE 78% to 94% (Tier 2): Natural gas savings (Gross Dth)	Energy savings for the gas furnace were calculated in EnergyGauge using a baseline home model calibrated to typical home size and characteristics for the Denver area (see below for characteristics) = 11 Dth
85% boiler natural gas savings (Gross Dth)	Energy savings for the gas boiler were calculated in EnergyGauge using a baseline home model calibrated to typical home size and characteristics for the Denver area (see below for characteristics) = 3.7 Dth
Net Dth	= Gross Dth x NTG

#### Variables:

NTG	Net-to-Gross Factor = We will use 77% (Reference 6)
BTUH	= Rated new furnace or boiler Input BTUH nameplate data provided by customer on rebate form.
EFFb	EFFb = 78% for furnaces before new DOE install standards and 90% after New DOE Install Standards; EFFb = 80% for boilers.
EFFh	= Efficiency for higher efficiency furnace will be provided by the customer on the rebate form.
Hrs	Equivalent Full Load Heating Hours for Furnace and Boiler equipment will be assumed as follows: 94% AFUE Furnace = 958 Hours 92% AFUE Furnace = 978 Hours 85% AFUE Boiler = 698 Hours
oversize factor	= Oversizing factor on new furnace or boiler Input BTUH nameplate. Colorado oversize factor is assumed to be zero
Measure life	Furnace Life = 18 years (Reference 5) Boiler Life = 20 years (Reference 8)

#### Incremental cost:

High-efficiency furnace rated at an AFUE of 92 is \$450. (Reference 1)
High-efficiency furnace rated at an AFUE of 94 is \$505. (Reference 1)
High-efficiency boiler rated at an AFUE of 85 is \$440. (Reference 1)

#### Provided by Customer:

Efficiency of new unit (Furnace 92%, 94% - Boiler 85%)  
Furnace or Boiler Nameplate Capacity of new unit at sea level (BTUH, Input)

#### Verified during M&V:

Yes

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Changes From 2011:

Change Program Savings Calculation Method to match the Minnesota program.

#### Building Characteristics for Prototype Home Used for Modeling:

Single Family

Two story (Reference 3)

3 bedroom 2 bathroom (Reference 3)

2000 square feet (Reference 3)

Basement foundation (Reference 3)

HVAC:

heating - gas furnace 78 AFUE (55.9 kBtu unit required) - 85% of homes have gas heating, and 78% of which are forced air furnaces (Reference 2)

cooling - 59% have Central Air Conditioning model required a 2.5 ton unit to meet the cooling load (Reference 2)

air handler is in the basement and supply ducts and return ducts are assumed to be in majority interior space

Windows:

61% of homes have double pane windows (Reference 2)

double pane low-E are standard (Reference 4)

Model assumes 15% of wall area glazing

applied a u-factor of 0.53 (average between clear glass double pane and low-E )

#### Insulation Levels:

Existing Ceiling Insulation: R-19 (Reference 4)

Existing Wall Insulation: R-11 (Reference 4)

#### Basement Assumptions

Assumed basement walls to have R-11 insulation

Basement is considered finished space but not conditioned

The air handler is located in the basement

Some homes will have smaller sections of the basement conditioned – maybe a bonus room etc, however this cannot be easily modeled in EnergyGauge

#### Appliances (Reference 2)

85% have dishwashers

74% electric ranges

88% and 89% have clothes washer and dryer (electric)

85% water heating is gas - model used a 40 gallon storage tank

68% of homes have ceiling fans

#### Average Customer Energy Consumption: (Reference 2)

kWh annually: 9,000 roughly for a 2,000 square foot home

Therms annually: 835

#### Assumptions

For the Heating System Rebate product, the incremental costs are limited to the cost of new equipment (not installation costs). Since the furnace or boiler will be replaced regardless of the efficiency rating of the unit, and assuming no additional required ductwork, installation and equipment rental costs do not apply.

Furnace and Boiler equipment oversize factor is zero.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. California Energy Commission's Database for Energy Efficient Resources (DEER) <http://www.energy.ca.gov/deer>  
(Does not include labor of equipment rental fees as this measure is considered a replace on burnout)
2. 2006 Residential Energy Use Colorado Service Area - Xcel: Bruce Neilson
3. American Housing Survey for Denver - US Census Bureau
4. Xcel Energy CO DSM Potential 2006 - prepared by Kema
5. Draft Technical Support Document: Energy Conservation Standards for Residential Furnaces and Boilers, Efficiency Standards for Consumer Products: Residential Central Air Conditioners And Heat Pumps, Prepared for US DOE, September 2006
6. Summit Blue 2006 Midwest Residential Market Assessment and DSM Potential Study.
7. Baseline costs from RS MEANS Repair and Remodeling Cost Data 2007
8. 2007 ASHRAE HVAC Applications Handbook Chapter 36, page 36.3, Table 4 (Boiler life time was reduced to 20 years from 24 years in the ASHRAE Handbook)