**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Program:** Home Performance with ENERGY STAR

**Description:**
Home Performance with Energy Star program, residential natural gas and electric customers receive a cash rebate for implementing multiple energy efficiency improvements.

The Home Performance with ENERGY STAR product provides a comprehensive, holistic product for residential natural gas and electric customers who are implementing multiple energy efficiency improvements. Public Service uses this approach by requiring a comprehensive audit followed by meetings with an Energy Advisor to assist the customer with prioritizing the needed improvements in the home. The Energy Advisor can assist in getting and evaluating contractor quotes to perform the work as well as follow up with the contractor to ensure quality of services provided.

The Home Performance with ENERGY STAR Product provides a “systems approach” to comprehensive energy improvements. Public Service uses this approach by requiring an upgraded home “shell,” including code level attic insulation and a reduction in air infiltration coupled with a combustion safety check if naturally-vented combustion appliances (furnace/boiler or water heater) remain in the home after product participation.

Low-income customers may participate in this product, but also have dedicated product offerings.

**Program References:**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures &quot;Attic Insulation&quot;, &quot;Wall Insulation&quot;, and &quot;Air Sealing&quot;</td>
<td>Refer to Program &quot;Insulation and Air Sealing - CO&quot; to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for all &quot;Attic Insulation&quot;, &quot;Wall Insulation&quot;, and &quot;Air Sealing&quot; measures.</td>
</tr>
<tr>
<td>Measures &quot;Heating Efficiency&quot;, &quot;High Efficiency Furnace&quot;</td>
<td>Refer to Program &quot;Residential Heating - CO&quot; to find formulas and variables for (Customer Dth, Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for all &quot;Heating Efficiency&quot; measures.</td>
</tr>
<tr>
<td>Measures for &quot;Energy Star Clothes Washer&quot;</td>
<td>Refer to Program &quot;Energy Star New Homes - CO&quot; to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for all &quot;Energy Star Clothes Washer&quot; measures.</td>
</tr>
<tr>
<td>Measures for &quot;Water Heating Efficiency&quot;</td>
<td>Refer to Program &quot;Water Heating - CO&quot; to find formulas and variables for (Customer Dth, Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for all &quot;Water Heating Efficiency&quot; measures including condensing water heaters, instantaneous water heaters, and heat pump water heaters.</td>
</tr>
<tr>
<td>Measures for &quot;Refrigerator Replacement&quot;, &quot;Removal of Primary Refrigerator&quot;</td>
<td>Refer to Program &quot;Refrigerator and Freezer Recycling - CO&quot; to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for &quot;Refrigerator Replacement&quot;, and &quot;Removal of Primary Refrigerator&quot; measures.</td>
</tr>
<tr>
<td>Measures for &quot;Air Conditioning&quot; and &quot;Ground Source Heat Pumps&quot;</td>
<td>Refer to Program &quot;High Efficiency Air Conditioning - CO&quot; to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PckW, etc.) for all &quot;Air Conditioning&quot;, &quot;Ground Source Heat Pump&quot; and &quot;Quality Install&quot; measures.</td>
</tr>
</tbody>
</table>
DEEMED SAVINGS TECHNICAL ASSUMPTIONS

| Measures for "Air Conditioning Quality Install" | Refer to Programs "Air Conditioning - CO" and "Residential Heating - CO" to find formulas and variables for Therms Saved at Customer for the heating portion of "Air Conditioning Quality Install" measures. |
| Measures for "Evaporative Cooling" | Refer to Program "Evaporative Cooling - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCkW, etc.) for all “Evaporative Cooling” measures. |
| Measures for "Programmable T-Stat Setback" | Refer to Program "Home Energy Squad - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCkW, etc.) for all "Programmable T-Stat" measures. |
| Measures for "Energy Star Smart Thermostat" | Refer to Program "Smart Thermostat and Optimization" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCkW, etc.) for all "Energy Star Smart Thermostat" measures. |

**Algorithms:**

- **Setback_Thermostat_PClW (Coincident kW Saved at Customer):**
  \[
  \text{Setback}_\text{Thermostat}_\text{PClW} = \text{Setback}_\text{Thermostat}_\text{kW} \times \text{CF}
  \]

- **Gross kW Saved at Customer:**
  \[
  \text{Gross kW Saved at Customer} = \text{Gross Annual kWh / Hours}
  \]

- **Gross Peak Coincident kW Saved at Customer (PC_kW_Saved):**
  \[
  \text{Gross Peak Coincident kW Saved at Customer (PC_kW_Saved)} = \text{Gross kW Saved at Customer} \times \text{CF}
  \]

**Variables:**

- **Effn:**
  \[
  \text{Effn} = \text{Efficiency of the newly installed natural gas heating unit. We will use the nameplate value provided by the customer.}
  \]

- **BTUH:**
  \[
  \text{BTUH} = \text{Size of the newly installed natural gas heating unit. We will use the nameplate value provided by the customer.}
  \]

- **Setback_Thermostat_Dtherm (Customer Dtherm Savings per year):**
  \[
  \text{Setback}_\text{Thermostat}_\text{Dtherm} = 4.19
  \]

  Annual energy savings for heating due to an average temperature setback of 2.4 degree F for Heating Season and baseline home heating is 61.6 DTherms / year. Savings is = 4.19 DTherms / year.

- **Setback_Thermostat_kWh (Customer kWh Savings per year):**
  \[
  \text{Setback}_\text{Thermostat}_\text{kWh} = 118
  \]

  Annual energy savings for cooling energy due to average temperature setback of 1.33 Degree F for Cooling Season. Baseline cooling energy per year is 1,901 kWh and the annual savings is 118 kWh / year.
## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF (Setback Thermostat Coincidence Factor)</td>
<td>76%</td>
<td>CF for cooling only per T-Stat Setback Bin Calcs in the &quot;Home Energy Squad - CO&quot; program.</td>
</tr>
<tr>
<td>Setback Thermostat Measure Life</td>
<td>10</td>
<td>Reference 2</td>
</tr>
<tr>
<td>Setback Thermostat Incremental Cost</td>
<td>$50.00</td>
<td>Reference 3</td>
</tr>
<tr>
<td>Setback_Thermostat_kW (Customer kW Savings)</td>
<td>0.140</td>
<td>Customer kW savings for cooling energy due to average temperature setback of 1.33 Degree F and Home Energy Squad's model savings of 0.1056 kW / degree of setback.</td>
</tr>
<tr>
<td>Clothes washer electric energy savings (Gross Annual kWh)</td>
<td>See Table 1</td>
<td>Energy savings for the clothes washer are based on the ENERGY STAR Clothes Washer Savings Calculator: Reference 4. This will vary based on source for domestic hot water heat: gas or electric.</td>
</tr>
<tr>
<td>Clothes washer Hours</td>
<td>295</td>
<td>Assumed Annual Hours of operation for a clothes washer, based on number of duty cycles and a duty cycle of 1 hour.</td>
</tr>
<tr>
<td>Clothes Dryer Hours</td>
<td>283</td>
<td>Assumed Annual Hours of operation for a clothes dryer, based on number of duty cycles and a duty cycle of 1 hour.</td>
</tr>
<tr>
<td>Clothes washer natural gas savings (Gross Dth/Yr)</td>
<td>See Table 1</td>
<td>Energy savings for the clothes washer are based on the ENERGY STAR Clothes Washer Savings Calculator: Reference 4. For homes with gas domestic hot water heat.</td>
</tr>
<tr>
<td>Non-energy O&amp;M savings</td>
<td>See Table 1</td>
<td>Water Savings per year for an Energy Star Clothes Washers</td>
</tr>
<tr>
<td>CF Clothes Washer &amp; Clothes Dryer</td>
<td>See Table 1</td>
<td>Coincidence Factor of Energy Star Clothes Washers and Clothes Dryers</td>
</tr>
<tr>
<td>Incremental Cost Clothes Washer</td>
<td>See Table 1</td>
<td>Incremental Cost of an energy star Clothes Washer (Reference 5)</td>
</tr>
<tr>
<td>Incremental Cost Clothes Dryer</td>
<td>See Table 1</td>
<td>Incremental Cost of an energy star Clothes Dryer (Reference 5)</td>
</tr>
<tr>
<td>Measure Life Clothes Washer</td>
<td>11</td>
<td>Life of an energy star Clothes Washer (Reference 6)</td>
</tr>
<tr>
<td>Measure Life Clothes Dryer</td>
<td>12</td>
<td>Life of an energy star Clothes Dryer (Reference 6)</td>
</tr>
<tr>
<td>BTU to kWh</td>
<td>3412</td>
<td>Conversion from BTU to kWh, 1kWh = 3412 BTU</td>
</tr>
<tr>
<td>NTG</td>
<td>116.00%</td>
<td>Net-to-Gross Factor = We will use 116% based on Reference 1.</td>
</tr>
</tbody>
</table>

---

References:
- Reference 1
- Reference 2
- Reference 3
- Reference 4
- Reference 5
- Reference 6
DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Tables:

<table>
<thead>
<tr>
<th>Table 1 (Reference 4)</th>
<th>Front Loading Clothes Washer</th>
<th>Top Loading Clothes Washer</th>
<th>Energy Star Dryer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Water Savings/Year - Gallons</td>
<td>1,180</td>
<td>5,443</td>
<td>N/A</td>
</tr>
<tr>
<td>kWh Savings in home with electric water heater</td>
<td>151</td>
<td>397</td>
<td>98</td>
</tr>
<tr>
<td>kWh Savings in home with gas water heater</td>
<td>125</td>
<td>306</td>
<td>98</td>
</tr>
<tr>
<td>DTherm Savings in home with gas water heater</td>
<td>0.12</td>
<td>0.41</td>
<td>N/A</td>
</tr>
<tr>
<td>Coincidence Factor (CF)</td>
<td>3.37%</td>
<td>3.37%</td>
<td>3.23%</td>
</tr>
<tr>
<td>Non-Energy O&amp;M Savings</td>
<td>$8.30</td>
<td>$38.26</td>
<td>$-</td>
</tr>
<tr>
<td>Incremental Cost</td>
<td>$50.00</td>
<td>$190.00</td>
<td>$75.00</td>
</tr>
</tbody>
</table>

Inputs:
- Reference Stand-alone programs for a complete list of required customer inputs
- Identify all implemented measures
- Quantity Refrigerators Removed

Example Inputs from Standalone Programs:
- Actual cost of Attic Insulation
- Attic Square Footage Insulated
- Attic Insulation R-Value Pre Project
- Attic Insulation R-Value Post-Project
- Actual Cost of Air Sealing
- BTUH size of new fuel fired heating equipment
- EFFn of new heating equipment
- EFFn of new domestic water heating equipment
- Blower Door Test-in CFM50
- Blower Door Test-out CFM50
- Climate Zone (Front Range, Western Slope, or Mountains)
- Number of Stories above grade in Home
- Conditioned Square Footage
DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Assumptions:
Any home with an existing ACH natural of 0.45 ACH will not be eligible for the air sealing measure.
A Blower Door Test will be required for all participating homes.
The Attic Bypass Air Sealing energy savings will be captured with Air Sealing and Weather Stripping measure.
TMY3 Climate Data used for the following areas: Front Range = Denver; Western Slope = Grand Junction; Mountains = Alamosa

The NTG for the Tier 1 evaporative coolers is 59.7%. This was determined in the 2006 Summit Blue Consulting report. The NTG for the Tier 2 evaporative coolers is assumed to be 116% to match the rest of the Home Performance Program. 100% due to the low market participation. The average of these two numbers (presumably the arithmetic mean) is used for the Tier 1 evaporative coolers.
Qualifying Evaporative Cooling Equipment must be new and be a permanently installed direct Tier 1 or 2, indirect or two stage evaporative cooling unit. Portable coolers or systems with vapor compression equipment are not eligible, nor is used or reconditioned equipment.
Quality install procedures require duct sealing which also benefits and existing associated gas furnace as well.

References:
1. COLORADO HOME PERFORMANCE WITH ENERGY STAR® PROGRAM EVALUATION Printed May 2014
3. Xcel Energy estimate
5. ENERGY STAR Appliance Calculator Incremental Costs - Cadmus research on available models, July 2016

Changes from 2017 / 2018 Plan
Added evaporative cooling
Revised Deemed sheet to fit new standard format
removed refrigerator replacement measure
Added QI Heating savings to existing Res AC Quality Install measures.
Removed Tank Type gas water heaters.
Modified ENERGY STAR Clothes Washer to separate Top Loading and Front Loading as well as incorporate dry savings due to water removal.
Added ENERGY STAR Clothes Dryer to capture additional savings due to Energy Star Features and Sensors.