**Workpaper WPSCGREHC130115A**

**Revision 04**

**Southern California Gas Company**

**Customer Programs Department**

**High Efficiency Furnaces 92 AFUE (1.08 HIR), 95 AFUE (1.05 HIR), 96 AFUE (1.04 HIR), and 97 AFUE (1.03 HIR)**

**- Residential**

Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Revision No. | Date | **Description** | **Author** |
| 0 | January 25, 2013 | Original release | Kyle Dunn (MWE2) |
| 01 | June 23, 2013 | Revised to include 92 and 97 AFUE furnaces, to use 80% AFUE for baseline furnaces, to use NTG of 0.7 for 95 and 97 AFUE furnaces, to include savings for all climate zones, and to use weighted average for SCG climate zones | Kyle Dunn (MWE2) and Phillip Hasley (Hasley Consulting) |
| 02 | December 6, 2013 | -Updated per DEER 2014 database  -Removed weighted average for SCG climate zones to use DEER values instead. | Miguel Urrea (SCG) |
| 03 | April 24, 2014 | Added 96 AFUE Residential Gas Furnace measure and cost data | Joseph Pan (SCG) |
| 04 | December 28, 2016 | * Updated Gas Savings values from DEER 2017 * Adjusted NTG Ratios due to lifetime of measures | Matthew  Mendoza (SCG) |

# 

Measure Summary Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Measure Name | IOU | CZ | Building Type | EUL or RUL | NTG | Unit  Definition | Program Type (NEW, ROB, RET) | Incremental Measure Cost ($/unit) | Gas  Savings (Therms/  unit) | Gross Unit Annual Electricity Savings (kWh/unit) | User Entered kW Savings per unit (kW/unit) | % Eligible for TOU AC  Adjustment | Gross  Realization Rate (GRR) |
| Efficient Central Furnace, 92% AFUE,  (Res-GasFurnace-AFUE92,SFm,Existing,IOU) | SCG | IOU | SFm | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $131.63 | 21.8 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 92% AFUE,  (Res-GasFurnace-AFUE92,MFm,Existing,IOU) | SCG | IOU | MFm | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $66.13 | 9.2 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 92% AFUE,  (Res-GasFurnace-AFUE92,DMo,Existing,IOU) | SCG | IOU | DMo | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $113.30 | 12.2 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 95% AFUE,  (Res-GasFurnace-AFUE95,SFm,Existing,IOU) | SCG | IOU | SFm | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $441.55 | 27.2 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 95% AFUE,  (Res-GasFurnace-AFUE95,MFm,Existing,IOU) | SCG | IOU | MFm | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $221.81 | 11.5 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 95% AFUE,  (Res-GasFurnace-AFUE95,DMo,Existing,IOU) | SCG | IOU | DMo | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $380.05 | 15.2 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 96% AFUE, (Res-GasFurnace-AFUE96,SFm,Existing,SCG-IOU) | SCG | IOU | SFm | 20 (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $759.13 | 28.9 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 96% AFUE, (Res-GasFurnace-AFUE96,MFm,Existing,SCG-IOU) | SCG | IOU | MFm | 20 (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $381.35 | 12.3 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 97% AFUE,  (Res-GasFurnace-AFUE97,SFm,Existing,IOU) | SCG | IOU | SFm | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $1,182.79 | 30.5 | N/A | N/A | N/A | 1.0 |
| Efficient Central Furnace, 97% AFUE,  (Res-GasFurnace-AFUE97,DMo,Existing,IOU) | SCG | IOU | DMo | 20  (HV-EffFurn) | 0.55 (Res-Default>2) | Residential  Furnace | RobNc | $1,018.05 | 17.1 | N/A | N/A | N/A | 1.0 |

Note: For the complete list of Measures, refer to Appendix A for the accompanying calculation spreadsheet

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1. General Measure & Baseline Data

Measure & Delivery Description

Measure Description

* + - 1. Natural gas burning furnaces provide heat to a conditioned space by passing combustion products past a heat exchanger. The forced air heating system uses natural gas, mixing it with air inside a burner where it ignites inside the combustion chamber. A blower fan pulls cool air in and from the rooms through the return air ducts into the furnace heat exchanger. The cool air is then heated by passing over the heat exchanger connected to the combustion chamber. Warm air then flows back into the rooms through the ductwork. The exhaust gases from the burner are vented outside through the flue passage connected to the heat exchanger. Furnaces usually have high utilization hours through the year. A gain in efficiency can therefore result in significant energy savings.
    1. Qualifying Efficiency
       1. A central gas furnace with an AFUE equal to or greater than 92% and less than 95% for residential single family, multifamily and mobile homes is part of Southern California Gas Company’s (SCG) deemed rebate program delivered under the downstream, midstream, and upstream catalog rebate programs.
       2. A central gas furnace with an AFUE equal to or greater than 95% and less than 96% for residential single family, multifamily and mobile homes is part of Southern California Gas Company’s (SCG) deemed rebate program delivered under the downstream, midstream, and upstream catalog rebate programs.
       3. A central gas furnace with an AFUE equal to or greater than 96% and less than 97% for residential single family, multifamily and mobile homes is part of Southern California Gas Company’s (SCG) deemed rebate program delivered under the downstream, midstream, and upstream catalog rebate programs.
       4. A central gas furnace with an AFUE equal to or greater than 97% for residential single family, multifamily and mobile homes is part of Southern California Gas Company’s (SCG) deemed rebate program delivered under downstream, midstream, and upstream catalog rebate programs.
    2. Program Restrictions and Guidelines
       1. This measure is applied to a residential single family, multifamily and mobile homes located in SCG’s service territory. To qualify the applicant must have natural gas distributed to the installation address for the gas furnace rebate. The central natural gas furnace must have an Annual Fuel Utilization Efficiency (AFUE) rating of ≥ 92% and < 95%, ≥ 95% and < 96%, ≥ 96% and < 97%, and ≥ 97% for incentives.
    3. Measure Application Type
       1. The DEER Measure Cost Data Users Guide found on [www.deeresources.com](http://www.deeresources.com) under DEER2011 for 13-14 Database Format hyperlink. DEER2011 Database format, spreadsheet “SPTdata\_format-V0.97.xls” [1] defines the terms as follows:

Table 1: Measure Application Type

|  |  |  |
| --- | --- | --- |
| Code | Description | Comment |
| ROB | Replace on Burnout | Measure applied when existing equipment fails or maintenance requires replacement |
| NC | New Construction | Measure applied during construction design phase as an alternative to a code-compliant standard design |

* + - 1. The application type for this measure is replace on burnout (ROB) and new construction (NC). Both ROB and NC use the effective useful life (EUL) as the basis for measure life. The base case for both ROB and NC is a central natural gas furnace meeting the minimum efficiency standard for the time of installation. Prior to May 1, 2013, Title 20 and 24 required furnaces with a rated input of less than 225,000 Btu to have a minimum Annual Fuel Utilization Efficiency (AFUE) of 78%. Furnaces installed in mobile homes with a rated input of less than 225,000 Btu required a minimum AFUE of 75% and furnaces with a rated input greater than or equal to 225,000 Btu required a minimum AFUE of 80%. After May 1, 2013, the US Department of Energy (DOE) Energy Regulations superseded California’s Title 20 and 24 standards, and an AFUE of 80% is now required for all furnaces.
      2. A 2007 lawsuit brought by several states and environmental groups against the DOE challenged the residential gas furnace minimum efficiency levels as being too low. At the time, the DOE acknowledged that 99 percent of all furnaces sold already met the new minimum efficiency level of 80% AFUE. [2] A survey of furnace retailers conducted by SCG in early 2013 found no residential furnaces offered for sale with an efficiency of less than 80% AFUE. This indicates the residential new furnace market is saturated with 80% AFUE furnaces.
    1. Market Applicability

This measure applies to all types of residential buildings, including mobile homes, single family, and multi-family buildings.

Delivery Method

The delivery method is SCG’s deemed rebate program delivered under the downstream, midstream, and upstream catalog rebate programs.

* + 1. Terms and Conditions
       1. The measure (or measures) described herein is only available to California Investor-Owned Utility (IOU) Customers whom are paying the Public Goods Charge, and are Customers of the IOU for which the particular measure (or measures) described herein are being offered through the IOU’s Energy Efficiency program.
       2. Customer must have natural gas distributed by SCG to the installation address.
       3. All installations must replace the previously installed product.
       4. The central natural gas forced air furnace must have an Annual Fuel Utilization Efficiency (AFUE) rating of 92% to 94.9%, 95% to 95.9%, 96% to 96.9%, or 97% to qualify for incentives.
       5. Go to www.ahridirectory.org to search for qualifying products that meet or exceed the requirements in the Furnace Rebate Table.

DEER Differences Analysis

Baseline Efficiency

The 2017 Database for Energy Efficient Resources (DEER2017) v2.4.7 [3] data include: gas energy savings, equipment useful life, and net-to-gross for this measure (Res-GasFurnace-AFUE92, Res-GasFurnace-AFUE95, Res-GasFurnace-AFUE96 and Res-GasFurnace-AFUE97). The DEER2017 database adopted the US Department of Energy (DOE) (10 CFR Part 430)[3] Energy Regulations that take effect May 1, 2013 as the baseline standard for all installations. The DEER2017 database uses a baseline standard efficiency of 80% AFUE.

* + 1. Purpose for Revision and Calculation of Savings
       1. The purpose for a newly revised workpaper, Revision 04, is due to the changes in DEER savings. Since the previous revision, the minimum AFUE for all residential furnaces has been defined at 80%, due to the revision of Title 20.
       2. Annual gas savings for this measure has been provided within DEER 2017 in the units of therms per kBTUh. The gas savings within this measure has been converted to therms per unit, this calculation can be seen in Attachment A, *Measure Summary Table and Savings Calculations*. This change in gas savings measurements allows for an incentive based on the entire unit installed based on AFUE, as opposed to an incentive based on manufacturer rated gas input.

Incremental Measure Cost

* + - 1. The 2017 Database for Energy Efficient Resources (DEER2017) v2.4.7 [3] data include: gas energy savings, equipment useful life, and net-to-gross of this measure (Res-GasFurnace-AFUE92, Res-GasFurnace-AFUE95, Res-GasFurnace-AFUE96 and Res-GasFurnace-AFUE97). However, it does not contain information on equipment unit costs, installation and incremental costs.
      2. Data was collected through a survey of vendors that sell residential gas furnaces. The incremental measure costs used in this workpaper are the arithmetic average of the survey cost data for the gas furnaces covered by this workpaper.
      3. Data from DEER2008 v2.05 [4] database was used to estimate the installation costs.

Table 2: DEER Use and Technology Table

|  |  |  |  |
| --- | --- | --- | --- |
| *DEER USE and TECHNOLOGY TABLE* | | | |
| Use Category Description | Use Category | Use Sub Category Description | Use Sub Category |
| HVAC | HVAC | Space Heating | HVAC-SpHt |
|  |  |  |  |
| Technology Groups Description | Technology Groups | Technology Types Descriptions | Technology Types |
| Space Heating Equipment | SpaceHtg\_eq | Gas Furnace | GasFurnace |

Code Analysis

* + 1. ***Title 20:*** This measure falls under the current Title 20 of the California Energy Regulations, section 1605.1 e, Gas and Oil Space Heaters and Electric Residential Boilers. As of November 19th, 2015, the minimum AFUE for Mobile Home gas furnaces is 80% for all furnaces of any input rating, according to Table E-6, *Standards for Commercial Gas/Oil-Fired Central Furnaces*. This table also shows for all other building types, the minimum AFUE is 80% for non-weatherized gas furnaces and 81% for weatherized gas furnaces. It also states on table E-5, furnaces with a rated input of more than 225,000 BTU/hr shall have an AFUE of 80%.
    2. ***Title 24:*** Title 24 of the California Energy Regulations references California’s Title 20 Appliance Efficiency Standards for the minimum efficiency of furnaces installed in California.
    3. ***Federal Standards:*** This measure falls under Federal DOE (10 CFR Part 430) [5] Energy Regulations. Under this regulation, compliance with the standards in the direct final rule will be required on May 1, 2013 for non-weatherized furnaces and on January 1, 2015 for weatherized furnaces and central air conditioners and heat pumps. Because most residential type furnaces are installed inside the house, it’s considered as non-weatherized for which the minimum AFUE is 80%.
       1. On January 14, 2013, the US DOE proposed to settle a lawsuit brought by the American Public Gas Association that seeks to roll back gas furnace efficiency standards. If accepted by the court, the Federal minimum efficiency standards will revert to a minimum AFUE of 75 for mobile homes and a minimum AFUE of 78 for all other residential furnaces. [6]
    4. **California Energy Commission Appliance Efficiency Database:** Market distribution and availability are provided in Attachment C. For more details, please refer to California Energy Commission Appliance Efficiency Database.

Measure Effective Useful Life

* + 1. The Effective Useful Life (EUL) estimates were downloaded directly from DEER2017; an EUL value of 20 years was obtained from the “EUL\_Summary\_10-1-08.xls [7] spreadsheet, under the “DEER EUL Summary” tab and located on cell number D118.
    2. Remaining Useful Life does not apply to this measure as the measure application type is ROB and NC, no early retirement in the program.

Table 3: Effective Useful Life

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Building type | Bldg Vintage | Climate Zone | EUL (yrs) | RUL (yrs) | DEER Version |
| ALL | AV | ALL | 20 | 0 | DEER2017 |

* + 1. In-service rate/first year installation rate: DEER does not have an in-service rate (ISR) for this measure. An assumption has been taken to assume the ISR will be 1 since the majority of the customers will replace their furnace after the existing furnace burns out.

Table 4: In Service Rate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Building type | Bldg Vintage | Climate Zone | In-service rate | DEER Version |
| ALL | AV | ALL | 1 | DEER2017 |

Net-to-Gross Ratios for Different Program Strategies

* + 1. The NTG ratio was based on support tables supplied within DEER READI v.2.4.7.
    2. The NTG ratio for all furnaces having an AFUE ≥92% fall under the program approach “all other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years with a NTG ratio of 0.55."

Gross Realization Rate

Gross realization rate of 1.00 is applied to the measures in this document.

* 1. EM&V, mARKET POTENTIAL, AND OTHER STUDIES
     1. There are no EM&V studies identified that address residential furnaces. However, there is a report entitled “California Residential Efficiency Market Share Tracking, HVAC 2005”, prepared by Itron and completed on December 2005, that addresses the average annual AFUE ratings of central gas furnaces, which ranges from 81.0 to 82.6, during the study period. This study also tracks the market share of Energy Star qualified units sold in California

1. Energy Savings & Demand Reduction Calculations

Load Shapes

N/A

Energy Savings

Annual Gas Energy Savings

* + - 1. This measure is located in the DEER 2017 database; gas impact savings were extracted from the READI tool and are used for these measures.
      2. The 2017 Database for Energy Efficient Resources (DEER2017) v2.4.7 [3] data include: gas energy savings for these measures (Res-GasFurnace-AFUE92, Res-GasFurnace-AFUE95, Res-GasFurnace-AFUE96, and Res-GasFurnace-AFUE97). Gas impact savings for these measures were pulled directly from the DEER READI tool for each climate zone and IOU that serves gas customers within California. The breakout by IOU was made because DEER shows different savings values by IOU in the same climate zone; see “Measure Summary table and Savings Calculations” spreadsheet for the range of savings.
      3. Annual therm savings for this measure has been calculated in therms per unit (furnace), rather than therms per kBTUh. This change in gas savings measurements allows for an incentive based on the entire unit installed per AFUE%, as opposed to an incentive based on manufacturer rated gas input.

1. Base Case & Measure Costs

Base Case Cost

* + 1. When the customer is replacing equipment on burnout (ROB) or buying new equipment (NC), the customer must buy a new furnace to continue operating, so the base case cost is that of a baseline (standard) furnace (not the existing furnace). The baseline furnace is an 80% AFUE furnace due to the market saturation of these furnaces.
    2. The base case cost is shown in Table 7 below.

The table lists the results of a survey of equipment vendors that sell residential gas furnaces. The table provides the average base case cost per kBtuh for each furnace efficiency.

The burner input capacity of these units ranged from 38 to 140 kBtuh.

* + - 1. The base measure costs shown in Table 6 represent an arithmetic average of the corresponding equipment cost. The cost data and calculations are included in an Excel file embedded as Attachment B, “WPSCGREHC130115A\_rev3\_cost\_data.xlsx.” The equipment costs do not vary by climate zone because they were taken from a survey of national furnace vendors.
      2. Data from DEER 2008 v2.05 [4] was used to estimate the installation labor costs. The installation cost per kBtuh in the DEER 2008 2.05 database is the same regardless of the measure case efficiency. Cost case IDs EffFurn-78AFUE, EffFurn-cond-94AFUE, EffFurn-cond-96AFUE all show an installation labor cost of $5.84/kBtuh.
      3. The measure costs are converted to $/furnace according to the typical furnace size for different building types: 63.9 kBtuh for single family, 32.1 kBtuh for multi-family, and 55 kBtuh for mobiles homes.
      4. Although DEER includes installation cost multipliers by climate zone, these were not applied to the installation cost because the installation cost multipliers are irrelevant when determining the incremental measure cost. The installation cost is the same for a base case or measure case furnace.

Table 6: Base case and Measure case cost analysis, per kBtuh

|  |  |
| --- | --- |
| Base case cost ($/kBtuh) | |
| 80% | $12.00 |
| 92% | $14.06 |
| 95% | $18.91 |
| 96% | $23.88 |
| 97% | $30.51 |
| Labor Cost ($/kBtuh) | |
|  | $5.84 |

The following Measure Application Types are appropriate to these measures. The Base Case Costs were calculated using the values from Table 6 as well as the typical furnace sizes mentioned in B.5 within this section. These base cases are shown below in Table 7:

Table 7: Base Case Costs (per furnace)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Building Type | Measure Application Type | Baseline | Equipment Cost | Labor / Installation Cost | Maintenance / Other Cost | Total Measure Case Cost |
| SFm | ROB, NC | Code | $766.80 | $373.18 | $0 | $1,139.97 |
| MFm | ROB, NC | Code | $385.20 | $187.46 | $0 | $572.66 |
| DMo | ROB, NC | Code | $660.00 | $321.2 | $0 | $981.20 |

*All costs are noted as $ per measure unit*

Gross Measure Cost

* + 1. Gross Measure Cost is the cost to install an energy efficient measure per the CPUC calculators. This definition implies a different meaning depending on the Measure Application type.

This Measure Application Types are: NC or ROB, so the Gross Measure Cost (GMC) is represented by the equation below (choose):

GMC = Measure Equipment Cost + Labor Cost

\*Note: Various complicated price fluctuations are not addressed in these equations, such as future costs due to inflation in labor, future costs due to deflation in material cost, and other variables that cannot be accurately described at this time. We assume that, unless stated otherwise, the measure case labor and base case labor are assumed to be the same value.

* + 1. Tables 8 through 11 list the results of a survey of equipment vendors that sell gas furnaces. The burner capacity of these units ranged from 38 to 135 kBtuh. The gross measure costs shown in Tables 8 through 11 represent an arithmetic average of the equipment cost. The cost data and calculations are included in an Excel, Attachment B, “WPSCGREHC130115A\_rev3\_cost\_data.xlsx.”
       1. Data from DEER2008 v2.05 [4] was used to estimate the installation labor costs. The installation cost per kBtuh in the DEER2008 2.05 database is the same regardless of the measure case efficiency. Cost case IDs EffFurn-78AFUE, EffFurn-cond-94AFUE, EffFurn-cond-96AFUE all show an installation labor cost of $5.84/kBtuh.
       2. Although DEER includes installation cost multipliers by climate zone, these were not applied to the installation cost because the installation cost multipliers are irrelevant when determining the incremental measure cost. The installation cost is the same for a base case or measure case furnace.
       3. High efficiency furnaces are typically equipped with higher cost options than baseline furnaces that result in substantially higher equipment costs. These options include modulating gas valves and variable speed blower motors. The cost for these (mandatory) options result in higher measure case equipment costs than a furnace without these options. This workpaper does not seek to compare base case and measure case furnaces with identical options, but to compare furnaces available in the marketplace for each thermal efficiency case.

Table 8: Measure Case Costs for ≥ 92% & < 95% AFUE (per furnace)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Building Type | Measure Application Type | Equipment Cost | Labor / Installation Cost | Maintenance / Other Cost | Total Measure Case Cost |
| SFM | ROB, NC | $898.43 | $373.18 | $0 | $1,271.61 |
| MFm | ROB, NC | $451.33 | $187.46 | $0 | $638.79 |
| DMO | ROB, NC | $773.30 | $321.20 | $0 | $1,094.50 |

All costs are noted as $ per measure unit

Table 9: Measure Case Costs for ≥ 95% & < 96% AFUE (per furnace)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Building Type | Measure Application Type | Equipment Cost | Labor / Installation Cost | Maintenance / Other Cost | Total Measure Case Cost |
| SFM | ROB, NC | $1,208.349 | $373.18 | $0 | $1,581.53 |
| MFm | ROB, NC | $607.01 | $187.46 | $0 | $794.48 |
| DMO | ROB, NC | $1,040.05 | $321.20 | $0 | $1,361.25 |

All costs are noted as $ per measure unit

Table 10: Measure Case Costs for ≥ 96% & < 97% AFUE (per furnace)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Building Type | Measure Application Type | Equipment Cost | Labor / Installation Cost | Maintenance / Other Cost | Total Measure Case Cost |
| SFM | ROB, NC | $1,525.93 | $373.18 | $0 | $1,899.108 |
| MFm | ROB, NC | $766.55 | $187.46 | $0 | $954.012 |
| DMO | ROB, NC | $1,313.40 | $321.20 | $0 | $1,634.60 |

All costs are noted as $ per measure unit

Table 11: Measure Case Costs for ≥ 97% AFUE (per furnace)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Building Type | Measure Application Type | Equipment Cost | Labor / Installation Cost | Maintenance / Other Cost | Total Measure Case Cost |
| SFM | ROB, NC | $1,949.59 | $373.18 | $0 | $2,322.77 |
| MFm | ROB, NC | $979.37 | $187.46 | $0 | $1,166.84 |
| DMO | ROB, NC | $1,678.05 | $321.20 | $0 | $1,999.25 |

All costs are noted as $ per measure unit

Incremental Measure Cost

* + 1. Incremental Measure Cost is the premium cost to install an energy efficient measure over a standard efficiency measure or code baseline measure. While IMC has a straightforward definition depending on the Measure Application type, the equation does vary.

This Measure Application Types are: NC or ROB so the Incremental Measure Cost (IMC) is represented by the appropriate equation below:

IMC = Measure Equipment Cost – Base Case Equipment Cost

\*Note: Various complicated price fluctuations are not addressed in these equations, such as future costs due to inflation in labor, future costs due to deflation in material cost, and other variables that cannot be accurately described at this time. We assume that, unless stated otherwise, the measure case labor and base case labor are assumed to be the same value.

Table 12: Summary of ICM Costs (per furnace)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AFUE | Building Type | Measure Application Type | Baseline | Incremental Measure Cost |
| ≥ 92% & < 95% | SFM | ROB, NC | Code | $131.63 |
| ≥ 92% & < 95% | MFm | ROB, NC | Code | $66.13 |
| ≥ 92% & < 95% | DMO | ROB, NC | Code | $113.30 |
| ≥ 95% & < 96% | SFM | ROB, NC | Code | $441.55 |
| ≥ 95% & < 96% | MFm | ROB, NC | Code | $221.81 |
| ≥ 95% & < 96% | DMO | ROB, NC | Code | $380.05 |
| ≥ 96% & < 97% | SFM | ROB, NC | Code | $759.13 |
| ≥ 96% & < 97% | MFm | ROB, NC | Code | $381.35 |
| ≥ 96% & < 97% | DMO | ROB, NC | Code | $653.40 |
| ≥ 97% | SFM | ROB, NC | Code | $1,182.79 |
| ≥ 97% | MFm | ROB, NC | Code | $594.17 |
| ≥ 97% | DMO | ROB, NC | Code | $1,018.05 |

Attachments

1. Measure Summary Table and Savings Calculations
   1. WPSCGREHC130115A-Rev04\_Res\_HE Furnaces\_Measure Summary Table and Savings Calculations.xlsx
2. Cost Data
   1. WPSCGREHC130115A-Rev04\_Res\_HE Furnaces\_Cost Data.xlsx
3. Furnace Market and Distribution
   1. WPSCGREHC130115A-Rev04\_Res\_HE Furnaces\_Furnace Market and Distribution.xlsx

References

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