**Work Paper PGECOFST109**

**Commercial Rack Oven - Gas**

**Revision # 5**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Commercial Rack Oven - Gas**

**Measure Codes F142**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Applicable Measure Codes:** | **F142** |
| **Measure Description:** | Commercial Rack Oven - Gas |
| **Energy Impact Common Units:** | Each |
| **Base Case Description:** | Source: PG&E Calculations, Existing Rack Oven |
| **Base Case Energy Consumption:** | Source: PG&E Calculations 5,405 Therms per year |
| **Measure Energy Consumption:** | Source: PG&E Calculations 3,301 Therms per year |
| **Energy Savings**  **(Base Case – Measure):** | Source: PG&E Calculations 2,104 Therms per year |
| **Costs Common Units:** | Source: PG&E Calculations per Rack Oven |
| **Base Case Equipment Cost ($/unit):** | Source: PG&E Calculations $12,513 |
| **Measure Equipment Cost ($/unit):** | Source: PG&E Calculations $16,641 |
| **Gross Measure Cost ($/unit)** | Source: PG&E Calculations $16,641 |
| **Measure Incremental Cost ($/unit):** | Source: PG&E Calculations $4,128  ROB, NC = measure equipment cost – base case equipment cost |
| **Effective Useful Life (years):** | Source: DEER 2014 12 years [www.deeresources.com](http://www.deeresources.com) |
| **Measure Application Type:** | Replace on Burnout (ROB), or New Construction (NC). |
| **Net-to-Gross Ratios:** | Source: DEER 2014 Com Default > 2yrs |
| **Important Comments:** |  |

# Work Paper Approvals

The following Manager(s) approved this workpaper through the PG&E Electronic Data Routing System under Routing Requisition # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |
| --- |
|  |
| **Grant Brohard**  Manager, Technical Product Support |
| **Carolyn Weiner**  Manager, Appliance Products |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **Revision Date** | **Section-by-Section Description of Revisions** | **Author (Company)** |
| **Superseded** | **8/22/2006** | **Food Service Gas ALL Measure Workpapers 8-22-06 Final (2).doc** | **PG&E** |
| **Revision 0** | **12/11/2007** | **Commercial Rack Ovens PGECOFST109 R0.doc** | **David Zabrowski (Fisher-Nickel, Inc.)** |
| **Revision 1** | **6/1/09** | **Changes to EUL, NTG from 2008 DEER V2.05, language and references, costs updated** | **David Zabrowski, Lauren Mills (Fisher-Nickel, inc.), Steve Blanc PG&E** |
| **Revision 2** | **2/10/2010** | **Update to DEER 2009-11 NTG file** | **David Zabrowski (Fisher-Nickel, inc.), Steve Blanc PG&E** |
| **Revision 3** | **6/8/2012** | **Updated NTG and cost data Remove measure F141 due to lack of available product**  **Updated BLD, CZ and VIN to** | **Kong Sham (Fisher-Nickel, inc.),**  **Charlene Spoor, PG&E** |
| **Revision 4** | **8/22/12** | **ANY per READI requirements** | **Charlene Spoor (PG&E)** |
| **Revision 5** | **5/14/2014** | **Updated to new template, DEER2014 references** | **Charlene Spoor (PG&E)** |

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# Section 1. General Measure & Baseline Data

## 1.1 Product Measure Description & Background

***Catalog Description –*** This work paper documents the rationale for the Energy Efficient Commercial Rack Oven (Gas) measures as listed in the Commercial Food Service Catalog. The Commercial Food Service Catalog is part of Pacific Gas and Electric Company’s Customer Energy Efficiency Program. PG&E offers incentives to non-residential customers for installing qualifying lighting, refrigeration, air-conditioning, food service, and agricultural equipment.

**F142:** The tested commercial rack oven must meet or exceed baking energy efficiency of ≥ 50% utilizing ASTM Standard F2093[[1]](#endnote-1).

***Program Restrictions and Guidelines***

This measure includes new commercial gas rack ovens that meet the qualifications listed in Table 1. Used or rebuilt equipment is not eligible. Customers must provide proof that the appliance has a cooking-energy efficiency that meets the requirements in Table 1.

***Terms and Conditions:*** The rebate for measure code F142 is down-stream, provided to the customer at the time of installation upon receipt of application and invoice. This is not a Direct install program.

**Table 1 Energy Efficiency Requirements for Commercial Rack Ovens.**

|  |  |  |
| --- | --- | --- |
| **Measure Code** | **Rack oven Type** | **Cooking-Energy Efficiency\*** |
| F142 | Rack Ovens (Gas) | ≥ 50% |
|  |  |  |

\*Based on the heavy-load test in ASTM F2093

***Market Applicability:*** This measure is applicable to any commercial cooking application, including (but not limited to) casual dining and quick service restaurants, hotels, motels, schools, colleges and recreational facilities. The rebate for measure code F142 is down-stream, provided to the customer at the time of installation upon receipt of application and invoice. This is not a Direct install program.

## 1.2 Product Technical Description

## Commercial ovens are the most widely used appliances in the food service industry. Many food service operations rely heavily on the versatility of ovens. Operators can cook varieties of foods in large quantities with a single appliance. An oven can be simply described as a fully enclosed, insulated chamber used to heat food. With competition rising among equipment manufacturers, new designs that incorporate timesaving features via sophisticated control packages are being introduced.

## Rack ovens offer high volume production and even baking in a relatively compact footprint. A single rack oven typically accommodates 15 pans of product at a time, effectively replacing three standard full-size convection ovens. These large capacity ovens fill the requirements of high-volume retail and baking operations. They are also ideal for reheating (“rethermalizing”) many products prepared in cook/chill systems as well as baking and roasting. The rack oven is capable of producing thousands of identical products or many diverse menu items within the same cooking cavity.

## Rack oven performance is determined by applying the ASTM Standard Test Method for the Performance of Rack Ovens (F2093). The ASTM standard test method is considered to be the industry standard for quantifying the efficiency and performance of rack ovens.

## 1.3 Measure Application Type

The DEER 2014 Ex Ante Database Format defines the terms as follows:

Table 2 Measure Application Type[[2]](#endnote-2)

*Identifies the measure application type in the Measure Implementation table in DEER2014.*

|  |  |  |
| --- | --- | --- |
| **Code** | **Description** | **Comment** |
| ER | Early retirement | *Measure is more efficient than code/std; Dual baseline, full measure costs required* |
| ROB | Replace on Burnout | *Single baseline (above code), incremental or full costs* |
| NC | New Construction | *Single baseline (above code), incremental or full costs* |
| REA | Retrofit Add On | *Single baseline (above pre-existing), full measure costs required* |

Since there are no EM&V studies on the useful life of rack ovens and it is regular practice in the commercial foodservice industry to purchase equipment only when it is needed (e.g., replacement or additional capacity), Therefore his measure is focused on ROB and NC applications only.

## 1.4 Product Base Case and Measure Case Data

This Work Paper uses ASTM Standard Test Method for the Performance of Commercial Rack Ovens (F2093) for calculation of energy use and demand, based on testing in an approved and qualified laboratory. In the absence of mandatory regulations for testing commercial rack ovens, there is little incentive on the part of equipment manufacturers to have their baseline equipment tested. Therefore, the ASTM performance parameters for baseline equipment were drawn from a sample of economy grade equipment tested by the Food Service Technology Center and is summarized in Table 3.

**Table 3 Baseline ASTM test results for Commercial Rack Ovens.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Cooking-Energy Efficiency\*** | **Production Capacity (lb/h)** | **Idle Energy Rate (Btu/h)** |
| Rack Ovens (Gas) | 30% | 250 | 65,000 |

\*Based on the heavy-load test in ASTM F2093.

The measure case data was drawn from the list of commercial rack ovens that have been tested by IOU testing laboratories as of April 20, 2012. Subsequent tests have been completed and the values have not changed. The complete list is in Appendix A and the averages are summarized in Table 4.

**Table 4 Baseline ASTM test results for Energy Efficient Commercial Rack Ovens.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Cooking-Energy Efficiency\*** | **Production Capacity (lb/h)** | **Idle Energy Rate (Btu/h)** |
| Rack Ovens (Gas) | 50% | 280 | 35,000 |

\*Based on the heavy-load test in ASTM 2093.

## 1.4.1 DEER Base Case and Measure Case Information

The DEER 2014 database does not contain information on energy use or savings for an energy-efficient gas rack oven measure. The only reference in DEER 2014 for Commercial cooking equipment is for Estimated Useful Life and Net To Gross values.

**Table 5 DEER Use and Technology Table**



**EUL Gas Savings** **(ΔTh): DEER Version and Impact IDs**

* The EUL Gas savings were downloaded from DEER directly, they match the intended measures.

**Table 6 DEER 2014 Effective Useful Life**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Building type** | **Bldg Vintage** | **Climate Zone** | **Effective Useful Life** | **Deer units** | **DEER Version** | **Impact IDs** |
| **ANY** | **ANY** | **ANY** | **12** | **Each** | **DEER 2014** | **DEER 2014 v1.05** |

**Net-to-Gross Assumption:** The 2014 DEER NTGR Values file does not specifically list commercial food service appliances. The default used for non-residential measures is 0.6.[[3]](#endnote-3) However, we are convinced that this default value underestimates the actual importance of the rebate programs in motivating FS operators to purchase EE equipment.

The rebate for measure code F142 is down-stream, provided to the customer at the time of installation upon receipt of application and invoice. This is not a Direct install program.

Table 7 below summarizes all applicable DEER 2014 based Net-to-Gross ratios for programs that may be used by this measure.

Table 7 DEER 2014 Net-to-Gross Ratios

|  |  |
| --- | --- |
|  |  |
| Program Approach | NTG |
| Com Default > 2 yrs | 0.60 |

The NTG Ratios in Table 1 are appropriate for the measure(s) because:

* They are downloaded from DEER2014 directly.

**In-service rate/first year installation rate**: *DEER 2014 lists an ISR of 1*

The rebate for measure code F142 is down-stream, provided to the customer at the time of installation upon receipt of application and invoice. This is not a Direct install program.

**In-service rate: DEER Version and Impact IDs**

* The in service rates were downloaded from DEER directly, they match the intended measures for climate zones and building types and vintages.

**Table 8 DEER 2014 In Service Rate**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Building type** | **Bldg Vintage** | **Climate Zone** | **In-service rate** | **DEER Version** | **Impact IDs** |
| **Any** | **Any** | **Any** | **1** | **DEER2014** | **DEER 2014 v 1.05** |

## 1.4.2 Codes & Standards Requirements Base Case and Measure Information

This measure is not governed by either state or federal codes and standards.

ASTM Standard Test Method for thePerformance of Rack Ovens (F2093) is applicable for estimating energy use and cooking performance. It was used to estimate the energy consumption of the base case and measure equipment.

## 1.4.3 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

There were no specific EM&V studies identified that addressed cooking measures in the commercial sector. Information on the base and measure case are found in the other sub-sections of 1.4.

## 1.4.4 Assumptions and Calculations from other sources—Base and Measure Cases

**Energy Savings Assumption (ΔW, ΔTherms):** The Food Service Technology Center conducted an assessment of major commercial cooking appliance technologies in 2002, which included a chapter on ovens[[4]](#endnote-4).The study showed that gas oven efficiencies vary from 10 to 50%. Further testing at the Food Service Technology Center indicated a baseline efficiency of 30% for gas rack ovens**Error! Reference source not found.**.

Since the current Title 20 regulations do not include a minimum performance requirement for rack ovens, the base case for existing models of gas rack ovens was determined from the Food Service Technology Center database of appliance performance.

**Base Case Costs and Measure Case Costs:** The Base Case costs include only the equipment. Since this measure is applicable for ROB and NC installations, the installation and maintenance costs are expected to be the same for the customer. The estimated equipment cost is based on recent list cost data for gas rack ovens and applying an industry-standard 50% discount to the manufacturer published list prices.

Equipment prices for these work papers were compiled from a number of sources including, Autoquotes, equipment sales reps and manufacturer sources[[5]](#endnote-5). Since equipment pricing in food service is closely held information and prices vary widely according to buying volume and other factors, we cannot list the sources for prices specifically.

The Measure costs include only the equipment, as explained above. The estimated equipment cost is based on recent list cost data and applying an industry-standard 50% discount to the manufacturer published list prices (see Appendix A).

**Table 9 Base Case and Measure Case Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Costs ($)** | | |  |
| **Building type** | **Bldg Vintage** | **Climate Zone** | **Base Case** | **Measure Case** | **IMC** | **Reference** |
| **Any** | **Any** | **Any** | **$12,513** | **$16,641** | **$4,128** | **FSTC Study** |

***1.4.5 Time-of-Use Adjustment Factor***

This section of the work paper explains the time-of-use adjustment factors applied to hard-wired air conditioning installations. These factors are applied to the total avoided cost valuation.

We are required by CPUC decision 06-06-063 dated June 29, 2006 to apply time-of-use (TOU) adjustment factors on residential A/C and commercial A/C (packaged and split-system direct-expansion cooling) measures only. Since this is not an A/C measure, the TOU adjustment factor is 0.

***1.5 Summary of Inputs for Savings Calculations***

The following table provides references to sections that document the inputs for calculation:

**Table 10 Summary of Inputs for Savings Calculations**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Input Variable** | **Variations** | **Base Case 1 Average Value** | **Base Case 2 Average Value** | **Measure Case Average Value** | **Reference Section** |
| **Electric Savings** | N/A | N/A | N/A | N/A | Section 1.4.1 |
| **Gas Savings** | None | 5,405 | N/A | 3,301 | Section 2.3 |
| **Hours of operation** | None | 4380 | N/A | 4380 | Section 2.3 |
| **Full Cost** | None | $12,514 |  | $16,641 | Section 1.4.4 |
| **Incremental Cost** | None | N/A | N/A | $4,128 | Section 1.4.4 |
| **EUL /RUL** | None | 12 | N/A | 12 | Section 1.4.1 |
| **NTG** | One | 0.6 | N/A | 0.6 | Section 1.4.1 |
| **ISR** | No |  |  |  |  |
| **TOU Factor** | A/C projects only | N/A | N/A | N/A | Section 1.4.5 |

# Section 2. Calculation Methods

Table11 Baseline by Measure Application Type

|  |  |  |  |
| --- | --- | --- | --- |
| ****Measure Application Type**** | ****Measure Life Basis**** | ****First Baseline Period: Energy Savings Baseline**** | ****Second Baseline Period: Energy Savings Baseline**** |
| ***ER* (early retirement)** | **EUL** | Customer Average Baseline | Code Baseline |
| ***ROB* (replace-on-burnout)** | **EUL** | Code Baseline | N/A |
| ***NC* (new construction)** | **RUL/EUL-RUL** | Code Baseline | N/A |
| ***REA (retrofit add on)*** | **EUL** | Code Baseline | N/A |

Notes:

* For ROB and REA measures, First Baseline is the baseline for the full EUL. There is no second baseline.
* For ER measures, First Baseline Period is the period for the RUL(remaining useful life),defined by the CPUC as RUL=1/3 EUL. Second baseline period for ER is Code baseline for the period EUL-RUL.

## 2.1 Electric Energy Savings Estimation Methodologies

* There were no electric energy savings associated with this measure.

## 2.2. Demand Reduction Estimation Methodologies

* There is no anticipated demand reduction associated with this measure

## 2.3. Gas Energy Savings Estimation Methodologies

The industry standard for energy use and cooking performance of rack ovens is ASTM Standard Test Method for thePerformance of Rack Ovens (F2093). The results of this testing procedure form the basis for the energy savings calculation of these measures. Table 12 shows an example of the calculation results under ASTM F2093 for a baseline vs. an energy-efficient rack oven.

**Table 12 Commercial Gas Rack Oven Cost Effectiveness Example.**

|  |  |  |
| --- | --- | --- |
| **Performance** | **Baseline Model** | **Energy Efficient Model** |
| Preheat Time (min) | 20 | 20 |
| Preheat Energy (Btu) | 100,000 | 85,000 |
| Idle Energy Rate (Btu/h) | 65,000 | 35,000 |
| Heavy Load Cooking Energy Efficiency (%) | 30% | 50% |
| Production Capacity (lbs/hr) | 250 | 280 |
| Operating Hours/Day a | 12 | 12 |
| Operating Days/Year | 365 | 365 |
| Number of Preheats per Day | 1 | 1 |
| Pounds of Food Cooked per Day a | 1,200 | 1,200 |
| Gas Cost ($/therm) | $1.00 | $1.00 |
| ASTM Energy to Food (Btu/lb) | 235 | 235 |
| Daily Energy Consumption (Btu) | 1,480,800 | 904,400 |
| Annual Energy Consumption (therms) b | 5,405 | 3,301 |
| Estimated Energy Savings (therms/yr) | - | 2,104 |
| Annual Energy Cost ($) | $5,405 | $3,301 |
| Estimated Cost Savings ($/yr) | - | $2,104 |
| Incremental Measure Cost c | - | SEE APPENDIX A |
| Estimated Useful Life (EUL) d | 12 years | 12 years |

a Operating estimates based on the procedure for calculating daily energy consumption of a rack oven based on reported test results, Appendix X3 in ASTM 2093.

b 1 therm = 100,000 Btu.

c Incremental measure cost was determined through comparison of an average of published pricing listed in APPENDIX A.

d The estimated useful life is on 2014 DEER EUL estimates.

Daily Energy Consumption Calculation and Definitions

EDAY = (LBFOOD x EFOOD) ÷ EFFICIENCY + [IDLERATE x (TON - LBFOOD/PC – nP x TP/60)]   
+ nP x EP

Where:

|  |  |
| --- | --- |
| EDAY = | Calculated Daily Energy Consumption (Btu/day) |
| LBFOOD = | Estimated Pounds of Food Cooked per Day |
| EFOOD = | ASTM Energy to Food (Btu/lb) = Btu/pound of energy absorbed by food product during cooking |
| EFFICIENCY = | Measured Heavy Load Cooking Energy Efficiency % |
| IDLE RATE = | Measured Idle Energy Rate (Btu/h) |
| TON = | Estimated Operating Hours/Day |
| PC = | Measured Production Capacity (lbs/hr) |
| TP = | Estimated Preheat Time (min) |
| nP = | Estimated Number of preheats/Day |
| EP = | Measured Preheat Energy (Btu) |

# *Section 3. Load Shapes*

Commercial rack oven load shapesdiffer among food service facilities (quick service, casual dining, hotels, college, schools, hospitals etc) depending on daily menu variations, hours of operation, serving periods, day-of-week, and facility location (city downtown, suburban mall, access to interstate highways, etc.). Consequently, applicable average TOU and hourly load shapes for rack ovens are unavailable. The ASTM Standard Test Method used to generate energy use data is based on hours of use and operating state (preheat, idle, and heavy-load cooking). Generally, rack ovens are used to prepare food within a few days to a few hours before it is served, so loads tend to not necessarily be coincident with regular meal periods (breakfast, lunch, and dinner). Between meal periods rack ovens may be used to prepare ingredients for either the next meal period or for menu items to be served the next several days (in which case the ingredients are refrigerated immediately after cooking).

## 3.1 Base Case Load Shapes

The closest load shape chosen for this measure is the DEER Gas Annual load shape. See **Error! Reference source not found.** for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table13 Base Case Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **E3 Alt. Building Type** | **Load Shape** |
| Restaurant – Fast Food | NON\_RES | DEER:Gas Annual |

## 3.2 Measure Load Shapes

The gas load profile for the high efficiency gas rack oven is expected to be the same as the Base Case. The profile will vary as explained in Section 3.1. The Measure Load Shape for the high efficiency rack oven will use less energy.

# Section 4. Base Case & Measure Costs

High efficiency gas rack ovens typically list for more than standard-efficiency gas rack ovens. However, high-efficiency designs are often bundled with other features such as all-stainless steel construction and high-quality components and controls. In addition to lower operating costs, high-efficiency rack ovens frequently exhibit better baking uniformity and higher production capacities.

**Table 14 DEER 2014 Base Case and Measure Case Cost Definitions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Measure Life Basis** | **First Baseline Period Full Measure Cost (RUL)** | **Second Baseline Period Full Measure Cost (EUL – RUL)** |
| ***NC (new construction)*** | EUL | Calculated as Incremental Measure Cost | N/A |
| ***ROB(replace on burnout)*** | EUL | Calculated as Incremental Measure Cost | N/A |
| ***ER (early retirement)*** | RUL/  EUL-RUL | Calculated as Full Gross Measure Cost | Calculated as Negative Full Gross Base Case Cost |
| ***REA (retrofit add on)*** | EUL | Calculated as Full Gross Measure Cost | N/A |

## 4.1 Base Case(s) Costs

The Base Case costs include only the equipment. Since this measure is applicable for ROB and NC installations, the installation and maintenance costs are expected to be the same for the customer. The estimated equipment cost is based on recent list cost data for gas rack ovens and applying an industry-standard 50% discount to the manufacturer published list prices.

Equipment prices for these work papers were compiled from a number of sources including, Autoquotes, equipment sales reps and manufacturer sources[[6]](#endnote-6). Since equipment pricing in food service is closely held information and prices vary widely according to buying volume and other factors, we cannot list the sources for prices specifically.

The following Measure Application Types are appropriate to this measure. The Base Case Costs are:

**Table 15 Calculated Base Case Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Measure Code*** | **Measure Application Type** | **Baseline** | **Equipment Cost** | **Labor / Installation Cost** | **Maintenance / Other Cost** | **Total Base Case Cost** |
| F142 | NC | Industry Practice | $12,513 | $N/A | $N/A | $12,513 |
| *F142* | ROB | *Industry Practice* | *$12,513* | *$N/A* | *$N/A* | *$12,513* |

*All costs are noted as $ per measure unit*

## 4.2 Measure Case Costs

The Measure costs include only the equipment, as explained in Section 4.1. The estimated equipment cost is based on recent list cost data and applying an industry-standard 50% discount to the manufacturer published list prices (see Appendix A).

The following Measure Application Types are appropriate to this measure. The Measure Case Costs are:

**Table 16 Calculated Measure Case Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Measure Code*** | **Measure Application Type** | **Baseline** | **Equipment Cost** | **Labor / Installation Cost** | **Maintenance / Other Cost** | **Total Measure Case Cost** |
| F142 | NC | Industry Practice | $16,641 | $N/A | $N/A | $16,641 |
| F142 | ROB | Industry Practice | $16,641 | $N/A | $N/A | $16,641 |

*All costs are noted as $ per measure unit*

## 4.3 Incremental & Full Measure Costs

Incremental costs are used in the analysis. High efficiency rack ovens require no additional labor or maintenance compared to base case rack ovens. Since this measure is applicable for ROB and NC installations, the installation and maintenance costs are expected to be the same for the customer.

**Table 17 Calculated Incremental and Full Measure Costs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Full Measure Cost**  **(RUL Period/First Baseline)** | **Full Measure Cost**  **(EUL-RUL Period/ Second Baseline)** | **Incremental Measure Cost** |
| ER | Measure Equipment Cost  +Measure Labor Cost | (-1)x(Base Equipment Cost  + Base Labor Cost) | Measure Equipment Cost  – Base Case Equipment Cost |
| ROB | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |
| NC | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |
| REA | Measure Equipment Cost  – Base Case Equipment Cost | N/A | Measure Equipment Cost  – Base Case Equipment Cost |

# *4.3.1 Full Measure Cost*

Full 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.

The Measure costs include only the equipment, as explained in Section 4.1. The estimated equipment cost is based on recent list cost data and applying an industry-standard 50% discount to the manufacturer published list prices (see Appendix A).

This Measure Application Type(s) is (are): **NC** or **ROB**, so the Full Measure Cost (FMC) is represented by the equation below (choose):

FMC = Measure Equipment Cost – Base Case Equipment *Cost*

*FMC = $ 16,641 per (unit) - $ 12,513 per (unit) = $ 4,128 per unit*

\*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.

# *4.3.2 Incremental Measure Costs*

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.

Incremental costs are used in the analysis. High efficiency rack ovens require no additional labor or maintenance compared to base case rack ovens. Since this measure is applicable for ROB and NC installations, the installation and maintenance costs are expected to be the same for the customer.

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

IMC = (Measure Equipment Cost + Measure Labor Cost) –

(Base Case Equipment Cost + Base Case Labor Cost)

IMC = Measure Equipment Cost – Base Case Equipment Cost

*IMC = $ 16,641per (unit) -- $ 12,513per (unit) = $ 4,128 per (unit)*

**Table 18Summary Table for Section 4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure ID** | **Measure Application Types** | **Base Case Total Cost** | **Measure Case Total Cost[[7]](#endnote-7)** | **Full Measure Case Cost** | **Incremental Measure Cost** |
| **F142** | NC | **$12,513** | **$16,641** | **$16,641** | **$4,128** |
| **F152** | ROB | **$12,513** | **$16,641** | **$16,641** | **$4,128** |

# 

# Input Appendices

## Appendix A: Equipment Cost Data for Gas Rack Ovens

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | Model | Fuel Source | List Price($) | Cost\* ($) |
| Baseline | Rack Oven #1 | Gas | $30,974 | $15,487 |
| Baseline | Rack Oven #2 | Gas | $25,168 | $12,584 |
| Baseline | Rack Oven #3 | Gas | $23,436 | $11,718 |
| Baseline | Rack Oven #4 | Gas | $18,792 | $9,396 |
| Baseline | Rack Oven #5 | Gas | $22,846 | $11,423 |
| Baseline | Rack Oven #6 | Gas | $28,940 | $14,470 |
| Energy Efficient | Rack Oven #7 | Gas | $39,212 | $19,606 |
| Energy Efficient | Rack Oven #8 | Gas | $31,861 | $15,931 |
| Energy Efficient | Rack Oven #9 | Gas | $31,861 | $15,931 |
| Energy Efficient | Rack Oven #10 | Gas | $31,200 | $15,600 |
| Energy Efficient | Rack Oven #11 | Gas | $30,387 | $15,194 |
| Energy Efficient | Rack Oven #12 | Gas | $37,650 | $18,825 |
| Energy Efficient | Rack Oven #13 | Gas | $30,800 | $15,400 |

## \*Estimated purchase price and Incremental Measure Cost (IMC) were based on an industry-standard 50% discount off the manufacturer’s list price.

## Equipment Incremental Cost Data for Energy Efficient Rack Ovens\*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Category | Baseline Unit Price | Energy Efficient Unit Price | Incremental Price Difference | Baseline Unit Cost | Energy Efficient Unit Cost | Incremental Measure Cost (IMC) |
| Rack Oven | $25,026 | $33,282 | $8,669 | $12,513 | $16,641 | $4,128 |

## \*Estimated purchase price and Incremental Measure Cost (IMC) were based on an industry-standard 50% discount off the manufacturer’s list price.

## References

1. 1American Society for Testing and Materials. *Standard Test Method for the Performance of Rack Ovens*. ASTM Designation F2093, in Annual Book of ASTM Standards, West Conshohocken, PA.

   2*SPTdata\_format-v0.97.xls* from DEER Database for Energy-Efficient Resources; Version 2011 4.01 found at: [http://www.deeresources.com/2011](http://www.deeresources.com/index.php?option=com_content&view=article&id=68&Itemid=60) Under: DEER2011 Update Documentation linked at: [DEER2011 Database Format](http://www.deeresources.com/DEER2011/download/SPTdbFormat_Documentation.zip) Tab: (Implementation) Cells: (C225-C229)

   3Fisher-Nickel, inc., D. Fisher, et al., 2002. Commercial Cooking Appliance Technology Assessment. Food Service Technology Center Report 5011.02.26, pp. 7-1 to 7-31.

   4*EUL\_Summary\_10-1-08.xls* from DEER Database for Energy-Efficient Resources; Version 2011 4.01 found at: [http://www.deeresources.com/2011](http://www.deeresources.com/index.php?option=com_content&view=article&id=68&Itemid=60) Under: DEER2011 Update Documentation linked at: [EUL/RUL Values](http://www.deeresources.com/deer0911planning/downloads/DEER_EULS_4-14-08.doc) Cells: (D82)

   5 *DEER2011\_NTGR\_2012-05-16.xls* from DEER Database for Energy-Efficient Resources; Version 2011 4.01 found at: [http://www.deeresources.com/2011](http://www.deeresources.com/index.php?option=com_content&view=article&id=68&Itemid=60) Under: DEER2011 Update Documentation linked at: [DEER2011 Update Net-To-Gross table](http://www.deeresources.com/DEER2011/download/DEER2011_NTGR_2012-05-16.xls) Cells: (T56,U56)

   6 AutoQuotes electronic catalog for foodservice equipment and supplies <http://www.aqnet.com/> . American Society for Testing and Materials. *Standard Test Method for the Performance* ***of*** *Rack Ovens*. ASTM Designation F2093, in Annual Book of ASTM Standards, West Conshohocken, PA. [↑](#endnote-ref-1)
2. The DEER Measure Cost Data Users Guide found on [www.deeresources.com](http://www.deeresources.com) under *DEER2011 Database Format* hyperlink, DEER2011 for 13-14, spreadsheet *SPTdata\_format-V0.97.xls.* [↑](#endnote-ref-2)
3. [↑](#endnote-ref-3)
4. [↑](#endnote-ref-4)
5. [↑](#endnote-ref-5)
6. [↑](#endnote-ref-6)
7. 7SCE, Measure Cost Revision 5 revised for PG&E by S.L. Blanc 2012

    [↑](#endnote-ref-7)