**Work Paper PGECOAPP123**

**Ozone Laundry Nonresidential**

**Revision # 6**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Ozone Laundry Nonresidential**

**Measure Codes B85**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Applicable Measure Codes:** | **B85** |
| **Measure Description:** | Installation of an ozone generator on an existing or new commercial laundry facility |
| **Energy Impact Common Units:** | Total on-site washer capacity [pounds] |
| **Base Case Description:** | The base case is a conventional washing machine without an ozone generator with a hot water boiler meeting minimum regulated thermal efficiency standards.  i.e. 80% thermal efficiency as required by Title 20. |
| **Base Case Energy Consumption:** | Source: Engineering calculations |
| **Measure Energy Consumption:** | Source: Engineering calculations |
| **Energy Savings**  **(Base Case – Measure):** | 39.3 therms per lb of laundry capacity  Source: Engineering calculations |
| **Costs Common Units:** | Total on-site washer capacity [pounds] |
| **Base Case Equipment Cost ($/unit):** | $0 |
| **Measure Equipment Cost ($/unit):** | Source: Engineering calculations  $138.41 |
| **Gross Measure Cost ($/unit)** | Source: Engineering calculations  $138.41 |
| **Measure Incremental Cost ($/unit):** | Source: Engineering calculations  $138.41 |
| **Effective Useful Life (years):** | 10 Years |
| **Measure Application Type:** | Retrofit add-on (REA) |
| **Net-to-Gross Ratios:** | Source: DEER 2014, READI version 1.0.4  NTG = 0.60[[1]](#endnote-1) Com-Default>2yrs |
| **Important Comments:** |  |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **Revision Date** | **Section-by-Section Description of Revisions** | **Author (Company)** |
| **Revision 1** | **9/3/09** | **Original work paper**  **Ozone Laundry Nonresidential**  **PGECOAPP123 R0** | **Tim Minezaki (kW Engineering)** |
| **Revision 2** | **3/8/10** | **Updated NTG** | **Andrew Wieszczyk (PG&E)** |
| **Revision 3** | **5/21/12** | **Ozone Laundry PGECOAPP123 R3.doc**  **NTG updated and DEER tech type table added** | **Jenny Roecks (PG&E)** |
| **Revision 3** | **8/24/12** | **Ozone Laundry PGECOAPP123 R3.doc**  **Adjustments made for ED directives** | **Steve Blanc(PG&E)** |
| **Revision 4** | **5/2/2014** | **Ozone Laundry PGECOAPP123 R4.doc**  **Updated with new template.** | **Jia Huang (PG&E)** |
| **Revision 5** | **1/1/2016** | **Ex ante format change** | **Jia Huang (PG&E)** |
| **Revision 6** | **8/9/2017** | **Updated cost calculations with SCG data. Revised measure eligibility requirements. Expanded applicability to nursing homes, correctional facilities, and large hotels/motels (>250 rooms) based on SCG project data. Changed measure application type from ROB to REA. Add direct install channel.** | **Jia Huang (PG&E)** |
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# Section 1. General Measure & Baseline Data

## 1.1 Product Measure Description & Background

***Catalog Description –***

The ozone laundry system(s) is a piece of equipment that is added-on to new or existing commercial washing machine(s). The system generates ozone (O3), a naturally occurring molecule, which helps clean fabrics by chemically reacting with soils in cold water. Adding an ozone laundry system(s) will reduce the amount of chemicals, detergents, and hot water needed to wash linens. Using ozone also reduces the total amount of water consumed, saving even more in energy.

***Requirements:***

* Customer must have a natural gas-fired boiler or natural gas water heater that supplies hot water to the on-premise laundry equipment.
* Laundry systems equipped with tunnel washers are not eligible.
* The washing capacity of each washing machine must be rated at 200 pounds or less.
* The ozone laundry system(s) must be a new purchased product and installed with a new or existing commercial washing machine(s).
* The ozone laundry system(s) must transfer ozone into the water through:
  + Venturi Injection

or

* + Bubble Diffusion
* This incentive only applies to the following facilities with on-premise laundry operations:
  + Hotels/motels
  + Fitness and recreational sports centers.
  + Nursing homes
  + Correctional facilities

***Application Process:***

* Must include a manufacturer’s specification sheet documenting manufacturer name, equipment model, and ozone laundry system’s serial number(s).
* Must include total washer capacity in pounds for operating washer units with ozone laundry system(s) connected.

***Program Restrictions and Guidelines***

***Terms and Conditions:***

The rebate is downstream provided to the customer at the time of sale upon receipt of application and invoice.

This measure may also be used in a Direct Install program.

***Market Applicability:***

This measure is applicable for hotels, health centers, nursing homes, and correctional facilities. Data for health centers from three NRR applications show gas savings consistent with that of hotels. However, it will currently be assumed that health centers will use the same measure energy savings that are calculated for hotels. This measure is not applicable to residential or multi-family facilities.

Table 1 below shows the market potential savings from ozone across a variety of market sectors. Detailed calculations regarding the market potential calculations can be found in the appendix.

Table 1 Market Potential

|  |  |  |  |
| --- | --- | --- | --- |
| **Market Sector** | # of Facilities in California | Water Savings [Gal/year] | Gas Savings [Therms/year] |
| Hospitality [hotels/motels] [[2]](#endnote-2) | 5,480 | 774,138,346 | 10,904,499 |
| Nursing Homes [[3]](#endnote-3) | 1,274 | 170,266,358 | 2,398,369 |
| State Prisons [[4]](#endnote-4) | 33 | 251,445,378 | 3,541,855 |
| County Jails [[5]](#endnote-5) | 58 | 130,146,869 | 1,833,247 |
| Gymnasiums [[6]](#endnote-6) | 3,337 | n/a | n/a |
| Total Market Potential: | | 1,325,996,950 | 18,677,970 |

## 1.2 Product Technical Description

This work paper provides an estimate of energy savings associated with retrofitting a conventional commercial laundry system with an ozone generator. Ozone is a powerful oxidant and disinfectant which can reduce odors and remove organic contaminants. Ozone cleans fabrics by chemically reacting with soils. Ozone removes electrons from the soils, causing the soils to break down into smaller molecules that become water soluble and are released from the linen by ordinary agitation. Because of its properties, it is a good alternative to conventional detergents and bleach. The use of ozone allows laundry machines to operate effectively in cold water. Natural gas energy savings will be achieved at the hot water heater/boiler as they will be required to produce less hot water to wash each load of laundry. The decrease in hot water usage will increase cold water usage, but overall water usage at the facility will decrease.

The most common method of producing ozone for laundry applications is via corona discharge. Simply put, dry air is passed through an electrical field. The electric field causes some of the oxygen molecules to split into separate oxygen atoms. Individual oxygen atoms are unstable and attach to other oxygen molecules, forming ozone molecules. Ozone is rarely generated and then stored, but instead is generated and/or while the washer-extractor is in operation. Different manufacturers of ozone equipment for laundry operations use a variety of techniques to apply or introduce the ozone gas into the washer-extractor. The four most common methods are:

1. Recirculation injection – Wash water is continuously circulated between the washer and ozone system. As a result, the wash water is continuously re-oxidized and ozone-enriched.
2. Diffusion – Ozone is continuously injected directly into the sump of the washer throughout each step of the wash cycle.
3. Direct water injection – A venturi injects ozone into the cold-water supply line leading to the washer.
4. Charge system – Ozone is mixed with cold water and then continually recycled between a contact vessel and the ozone system to maintain a predetermined ozone level in the water. The water containing ozone is delivered to the washer on demand and the ozone-enriched water is not recharged once it enters the washer.

## 1.3 Measure Application Type

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*, defines the terms as follows:

Table 2 Measure Application Type[[7]](#endnote-7)

*Identifies the measure application type in the Measure Implemenation table in DEER2011.*

|  |  |  |
| --- | --- | --- |
| **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* |

This measure is identified as Retrofit add-on (REA).

## 1.4 Product Base Case and Measure Case Data

## 1.4.1 DEER Base Case and Measure Case Information

This measure is not included in the Database for Energy Efficient Resources (DEER).

**Net-to-Gross Assumption:**

Table 3 below summarizes all applicable DEER based Net-to-Gross ratios for programs that may be used by this measure.

Table 3 DEER Net-to-Gross Ratios

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **DEER Spreadsheet** | |
| Program Approach | NTG | File name | Cell Number |
| Com-Default>2yrs:  All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | 0.6 | SupportTable\_NTGR.csv1 | D52 |

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

***Title 20:*** This measure does not fall under Title 20 of the California Energy Regulations. However, water heating equipment is regulated under the Title 20 Appliance Standard of the California Energy Regulations (October 2012). Section 1605.1.f.1 (Table F-3) requires that gas hot water supply boilers have a minimum thermal efficiency of 80%.[[8]](#endnote-8)

***Title 24:*** This measure does not fall under Title 24 of the California Energy Regulations.

***Federal Standards:*** This measure does not fall under Federal DOE or EPA Energy Regulations.

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

***1.4.3.1 The Benefits of Ozone in Hospitality On-Premise Laundry Operations[[9]](#endnote-9)***

PG&E’s Emerging Technologies Program developed a paper highlighting the potential therm savings of ozone washers at a hospitality site in Emeryville, California. The value of the natural gas saved due to the replacement of hot water with cold was the leading component of total savings. The value of the electricity savings was minor, but the value of the water and sewer savings was larger than expected. Total savings resulted in a simple payback of 7.5 months.

***1.4.3.2 Santa Barbara County Jail Ozone Laundry Detergent[[10]](#endnote-10)***

SCG’s Emerging Technologies Program conducted a study to evaluate the benefits of installing an ozone injection system at the laundry processing facility at the Santa Barbara County Jail. The objective was to determine the gas and water savings when using an ozone laundry injection system versus the convention laundry system. The facility operates 7 days a week from 6:30a.m. to 4:30p.m. Approximately 2,000 pounds of laundry was washed daily for 1,200 inmates from the jail, Santa Maria, and Lompoc correctional facilities. The existing equipment used hot water provided by a 500,000 Btu/hr natural gas boiler reheated by a 76,000 Btu/hr water heater. Wash equipment consists of three 90 pound Continental commercial washer-extractors and two 75 pound washer-extractors. The project resulted in an 88.1% reduction in natural gas usage and 18.6% in water usage.

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

**Energy Savings Assumption (ΔW, ΔTherms):** A number of ozone washing machine projects have received incentives under PG&E’s Non-Residential Retrofit-Demand Response (NRR-DR) incentive program. The data gathered from those incentive reviews has been utilized to calculate run-time factors, measure cost data, and base case efficiency factors. Ozone technology was also installed in hotels and nursing facilities have received incentives under SCG’s customized retrofit program as well. Data from these projects were used to supplement existing data and support the application to larger hotels and nursing facilities.

**Base Case Costs and Measure Case Costs:** An average measure cost per unit capacity was generated using data collected from ozone laundry projects that received incentives SCG’s customized retrofit program.

**Effective Useful Life:** The measure equipment effective useful life (EUL) is estimated at 10 years based on the typical life of the ozone generator’s corona discharge unit.

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

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.

The specific values and results are summarized in Table 4

Table 4 TOU Adjustment Factors

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure** | ***kWAC*** | ***kWTotal*** | **%** |
| Ozone Generator | 0 | 0 | 0 |

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

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Input Variable** | **Variations** | **Base Case 1 Average Value** | **Base Case 2 Average Value** | **Measure Case Average Value** | **Reference Section** |
| **Electric Savings** | Any | -- | *--* | *--* |  |
| **Gas Savings** | Any | -- | -- | Varies | *Section 2* |
| **Hours of operation** | Any | -- | -- | -- |  |
| **Full Cost** | REA | -- | -- | $138.41 | *Section 4.3.1* |
| **Incremental Cost** | REA | -- | -- | $138.41 | *Section 4.3.2* |
| **EUL /RUL** | REA | -- | -- | 10 years | *Section 1.4.4* |
| **NTG** | One | -- | -- | 0.6 | *Section 1.4.1* |
| **ISR** | No | -- | -- | -- |  |
| **TOU Factor** | *A/C projects only* | *--* | *--* | *--* |  |

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# Section 2. Calculation Methods

Table 5 Baseline by Measure Application Type

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Measure Life Basis** | **First Baseline Period: Energy Savings Baseline** | **Second Baseline Period: Energy Savings Baseline** |
| ***REA (retrofit add on)*** | **EUL** | Code Baseline | N/A |

Notes:

* For REA measures, First Baseline is the baseline for the full EUL. There is no second baseline.

## 2.1 Electric Energy Savings Estimation Methodologies

Based on data and analysis provided by the Emerging Technologies Report6 and several ozone generator manufacturers, we recognize that in addition to the natural gas savings from ozone generation, there are potential impacts to site electrical energy use. The potential impacts are discussed below; however, there is currently insufficient data to accurately quantify the net magnitude of the impacts for this analysis.

* **Hot Water Pump(s)** [kWh]: reduced hot water consumption may result in additional electrical savings by reducing the pumping load.
* **Clothes Washer** [kWh]: retrofitting existing washer to utilize ozone can reduce the total washer cycle length saving electrical energy for each cycle.
* **Clothes Dryer** [kWh and therms]: the reduced washer cycle length may decrease the dampness of the clothes when they move to the dryer. This can result in shorter runtimes which result in gas and electrical savings.
* **Ozone Generator** [kWh]: the ozone generator uses electricity to generate ozone and thus will add to the site energy use.

As this technology matures and becomes more widely adopted, further data may be available to quantify the net electrical energy impacts.

## 2.2. Demand Reduction Estimation Methodologies

There is no anticipated demand reduction associated with this measure.

## 2.3. Gas Energy Savings Estimation Methodologies

Gas savings calculations for this measure were based solely on the reduction in hot water use. In calculating therm savings based on hot water use, four main components are needed:

1. Gas Energy Intensity for Hot Water (a measure of boiler efficiency)
2. Washer Utilization Factor (a measure of washer use rate)
3. Hot Water Usage Factor (a measure of how efficient a baseline machine is)

Hot Water Reduction Factor (a measure of how well the ozone system reduced hot water from the base case).

### *Calculating Gas Energy Intensity for Hot Water (therms / gallon of hot water)*

In order to estimate savings normalized per unit of washer capacity [lbs of laundry], average gas energy intensity is needed [therms/gallon]. This factor is a measure of the typical boiler efficiency and is translated into a quantity of hot water used.

Engineering calculations were developed based on assumptions about the boiler, incoming municipal water temperature, and hot water temperature for the boilers. The base case boiler efficiency is the regulated minimum efficiency (80%), per Title 20 Appliance Standard of the California Energy Regulations (October 2012). Section 1605.1.f.1 (Table F-3) requires that gas hot water supply boilers have a minimum thermal efficiency of 80%.6 The incoming municipal water temperature is assumed to be 60 °F with the hot water supply temperature assumed to be 135 °F. These temperatures were based on default test procedures on clothes washers set by the Department of Energy’s Office of Energy Efficiency and Renewable Energy[[11]](#endnote-11). Enthalpies for these temperatures were obtained from ASHRAE Fundamentals[[12]](#endnote-12).

The gas energy intensity is based on the difference in enthalpy between the incoming municipal water and the boiler supply temperature multiplied by the density of water and divided by the boiler efficiency:







This value represents the amount of thermal energy required to raise one gallon of water from 60 ºF to 135 ºF.

### *Determining Washer Utilization Factor (annual laundry / lbs laundry capacity)*

In order to estimate savings normalized per unit of washer capacity [lbs of laundry], an average washer utilization factor is needed. That is, the average annual quantity of clothes washed [lbs of laundry] per unit of washer capacity [lbs of laundry] is needed. This factor is a measure of the runtime of a typical laundry facility in terms of the common unit [lbs of laundry capacity].

Average utilization factors were generated using data collected from existing ozone laundry projects that received incentives under the NRR-DR program. The median value was used to prevent limited data points from skewing the washer utilization factor. Table 6 summarizes data gathered from several NRR-DR projects:

Table 6 Washer Utilization Rate



Note:

- 4,380 lbs/lb-capacity approximates to an average washer use rate of 12 cycles/day.

- The shaded rows in Table 6 represent projects that did not have washer utilization data. This is due to differing calculation methods.

### *Determining Hot Water Usage Factor (gallons of hot water / lb of clothes)*

In order to estimate savings, a typical hot water use per unit of laundry is needed. This factor represents how efficiently a typical conventional washing machine utilized hot water normalized per unit of clothes washed.

Average hot water usage factors were generated using data collected from existing ozone laundry projects that received incentives under the NRR-DR program. Table 7 summarizes data gathered from several NRR-DR projects:

Table 7 Hot Water Use Factor



Note:

- The shaded rows in Table 7 represent projects that did not have hot water data available. This is due to differing calculation methods.

### *Determining Hot Water Reduction Factor (% reduction in hot water)*

In order to calculate the savings resulting from installation of an ozone generator, an average hot water reduction factor is needed. This factor represents how much more efficient an ozone injection washing machine is compared to a typical conventional washing machine as a rate of hot water reduction.

Average hot water reduction factors were generated using data collected from existing ozone laundry projects that received incentives under the Non-Residential Retrofit Demand Reduction program (NRR-DR). Table 8 summarizes data gathered from several NRR-DR projects:

Table 8 Hot Water Reduction Factor



Note:

- The shaded rows in Table 8 represent projects that did not have total water data available. This is due to differing calculation methods.

***Annual Gas Savings:***

Finally, the average annual gas savings for the measure is calculated below:

Annual Gas Savings [therms/Unit] = Annual Base Gas Usage – Annual Measure Gas Usage

  








# *2.4 Water Savings Estimation Methodologies*

Water savings are presented here for information only and not as a basis of energy impacts. The savings calculations listed here account for the combination of hot and cold water used. Savings calculations for this measure were based on the reduction in total water use from implementing an ozone washing system to the base case. There are three main components in obtaining this value:

1. Water Usage Factor (a measure of how water efficient a base case machine is)
2. Water Reduction Factor (a measure of how well the ozone system reduced water from the base case)
3. Washer Utilization Factor (a measure of washer use rate)

Average water usage and water reduction factors were generated using data collected from existing ozone laundry projects that received incentives under the Non-Residential Retrofit Demand Reduction program (NRR-DR). Table 9 summarizes data gathered from several NRR-DR projects:

Table 9 Water Usage and Reduction Factors



Note:

- The shaded rows in Table 9 represent projects that did not have total water data available or did not have washer utilization data available. This is due to differing calculation methods.

The Washer Utilization Factor is also based on data collected from the NRR-DR program and is calculated above in the Gas Savings Calculations.

Finally, the average annual water savings for the measure is calculated below:





# *2.5 SoCalGas Energy Savings Estimation Methodology*

As a reference to estimation methodology in the previous section (2.4), SoCalGas utilized manufacturer rated information to analyze and calculate an estimate of the amount of therm savings that a customer will experience when implementing an ozone injection system onto their washers. Washer manufacturers provide washing cycle information and include details such as steps (Rinse, Extract, Drain, Etc.) and will also detail how much water is used and the temperature of the water the washer will be pulling from the boiler during that step (Hot, Warm, Cold). SCG was able to use this information in combination with site specific data such as water temperature (°F) and loads of laundry processed per day.

The following equation to calculate heat capacity can be used to calculate the amount of energy needed to provide the required water temperature to the washer traditionally, without the implementation of ozone.

Where *m* is equal to the mass of the water (lbs) and *Cp* is equal to the specific heat capacity of water (BTU/lb°F). *T2* refers to the temperature that the water must be raised to for the needs of washing, *T1* refers to the temperature of the water supplied to the boiler from the city, and *η* represents the efficiency of the boiler. The term *Q* signifies the amount of energy needed to raise a specific mass of water from T1 to T2. This was calculated for each step in the washing cycle to sum up the total amount of energy the unit would use for one washing cycle. This can then be multiplied by loads/day and operational days per week to find the total amount of gas needed to operate the washer annually.

To reiterate what’s stated in section 1.1, the injection of ozone allows clothes and linens to be cleaned in cold water. This allows for the new calculation of energy usage with the implementation to ozone to cause the value of T2 to be lessened and or in most all cases equal to the value of T1, causing the energy needed to be put into the system to become zero. This is where the savings for the technology originates and the use of the above calculation serves as a basis for showing where the savings is coming from. A short example of this calculation can be seen in “SCG Ozone Example Calculation.xls”.

Estimated gas savings in this attachment were developed from a sample of customized projects from Southern California Gas Company’s customized energy efficiency program. These projects include:

- 10 projects installed in hotel rooms with <250 guest rooms

- 5 projects installed in hotel rooms with >250 guest rooms and

- 7 projects installed in nursing facilities

See file “SCG Ozone Laundry Project Data.xlsx” for details on these projects. An average of each set of projects is provided below:

|  |  |
| --- | --- |
|  | Average therm savings (per lb laundry capacity) |
| Hotels <250 rooms (10 projects) | 41.2 |
| Hotels >250 rooms (5 projects) | 35.77 |
| Nursing Facilities (7 projects) | 47.5 |
| Hotels (all, 15 projects) | 39.4 |

The gas savings for nursing facilities were estimated to be 47.5 therms per pound of laundry capacity. The remaining 15 projects installed in hotels are averaged at 39.4 therms per pound of laundry capacity.

# *Section 3. Load Shapes*

Load Shapes are an important part of the life-cycle cost analysis of any energy efficiency program portfolio. The net benefits associated with a measure are based on the amount of energy saved and the avoided cost per unit of energy saved. For electricity, the avoided cost varies hourly over an entire year. Thus, the net benefits calculation for a measure requires both the total annual energy savings (kWh) of the measure and the distribution of that savings over the year. The distribution of savings over the year is represented by the measure’s load shape. The measure’s load shape indicates what fraction of annual energy savings occurs in each time period of the year. An hourly load shape indicates what fraction of annual savings occurs for each hour of the year. A Time-of-Use (TOU) load shape indicates what fraction occurs within five or six broad time-of-use periods, typically defined by a specific utility rate tariff. Formally, a load shape is a set of fractions summing to unity, one fraction for each hour or for each TOU period. Multiplying the measure load shape with the hourly avoided cost stream determines the average avoided cost per kWh for use in the life cycle cost analysis that determines a measure’s Total Resource Cost (TRC) benefit.

## 3.1 Base Case Load Shapes

Load shapes are not applicable to gas measures because the price of gas is not dependent on time-of-use.

## 3.2 Measure Load Shapes

Load shapes are not applicable to gas measures because the price of gas is not dependent on time-of-use.

# Section 4. Base Case & Measure Costs

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Measure Life Basis** | **First Baseline Period Full Measure Cost (RUL)** | **Second Baseline Period Full Measure Cost (EUL – RUL)** |
| ***REA (retrofit add on)*** | EUL | Calculated as Full Gross Measure Cost | N/A |

## 4.1 Base Case(s) Costs

Since this is an REA measure, the base case cost is zero.

## 4.2 Measure Case Costs

The measure case cost is derived by taking an average of project costs from 22 customized projects conducted in SCG’s territory. The costs were averaged for both the material and labor costs, as they are provided. These costs can be seen within “SCG Ozone Laundry Project Data.xlsx”.

## 4.3 Incremental & Full Measure Costs

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Full Measure Cost**  **(RUL Period/First Baseline)** | **Full Measure Cost**  **(EUL-RUL Period/ Second Baseline)** | **Incremental Measure 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 Application Types are: **REA**, so the Full Measure Cost (FMC) is represented by the equation below:

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

(Base Case Equipment Cost + Base Case Labor Cost)

*FMC = ($129.35 per (unit) + $9.06 per (unit)) - $0 per (unit) = $138.41 per unit*

\* The unit is pound of washing capacity of washers.

## 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.

The Measure Application Type is **REA** so the Incremental Measure Cost (IMC) is represented by the appropriate equation below:

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

(Base Case Equipment Cost + Base Case Labor Cost)

*IMC = ($129.35 per (unit) + $9.06 per (unit)) - $0 per (unit) = $138.41 per unit*

**Summary Table for Section 4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure ID** | **Measure Application Types** | **Base Case Total Cost** | **Measure Case Total Cost[[13]](#endnote-13)** | **Full Measure Case Cost** | **Incremental Measure Cost** |
| B85 | REA | $0 | $138.41 | $138.41 | $138.41 |

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     [↑](#endnote-ref-13)