**Work Paper PGE3PPRO109**

**Outdoor Commercial Pool Covers**

**Revision # 1**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Outdoor Commercial Pool Covers, Revision 1**

**Measure Codes I3, I4**

**Resource Solutions Group**

# At-a-Glance Summary

|  |  |  |
| --- | --- | --- |
| **Applicable Measure Codes:** | **I3** | **I4** |
| **Measure Description:** | This measure is for the installation of a new pool cover on an un-covered commercial outdoor pool | |
| **Energy Impact Common Units:** | Area-ft2 | |
| **Base Case Description:** | Source: The base case for this measure is an un-covered outdoor pool | |
| **Base Case Energy Consumption:**  **The Values Are Updated Per ED Disposition in Excel File** | Source: Natural Gas consumption varies by site and climate zone | |
| **Measure Energy Consumption:** | Source: Therms vary by site and climate zone. | |
| **Energy Savings**  **(Base Case – Measure):** | Source: Therm savings vary by site and climate zone where the pool cover is installed | |
| **Costs Common Units:** | Dollars $ per Square Foot | |
| **Base Case Equipment Cost ($/unit):** | Source: The base case cost for this measure assumes that there would be no pool cover installed. The base case cost is $0.00 | |
| **Measure Equipment Cost ($/unit):** | Source: Actual Projects.  I3: $2.60 | Source: Actual Projects.  I4: $1.95 |
| **Gross Measure Cost ($/unit)** | Source: Actual Projects.  I3: $2.60 | Source: Actual Projects.  I4: $1.95 |
| **Measure Incremental Cost ($/unit):** | Source: Actual projects  I3: $2.60  I4: $1.95  ER = measure equipment plus labor including overhead and profit. | |
| **Effective Useful Life (years):** | Source: Actual Projects (product warranty). The Effective Useful Life is 6 years | |
| **Measure Application Type:** | Early Retirement (ER) | |
| **Net-to-Gross Ratios:** | Source: NonRes-Default. The NTG for this measure is 0.70 | |
| **Important Comments:** |  | |

At-A-Glance Measure ListMeasure Units: [Square Foot of Pool Cover Installed]

| **Measure Code** | **DEER RunID** | **Measure Description** | **Building Type** | **Building Vintage** | **Climate Zone** | **Peak Electric Demand Reduction (kW/unit)** | **Electric Savings (kWh/unit)** | **Gas Savings (Therms/unit)** | **Base Case Cost ($/unit)** | **Measure Cost ($/unit)** | **Measure Incremental Cost ($/unit)** | **Effective Useful Life (years)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z01 | 0 | 0 | 4.52 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z02 | 0 | 0 | 4.17 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z03 | 0 | 0 | 4.52 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z04 | 0 | 0 | 4.17 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z05 | 0 | 0 | 4.52 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z11 | 0 | 0 | 3.82 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft.  **The Values Are Updated Per ED Disposition in Excel File** | ANY | ANY | Z12 | 0 | 0 | 3.82 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z13 | 0 | 0 | 3.82 | $0.00 | $2.60 | $2.60 | 6 |
| I3 | Engineering Calculations | Commercial Outdoor Pool Cover- Large ≥11,000 Sq.Ft. | ANY | ANY | Z16 | 0 | 0 | 4.17 | $0.00 | $2.60 | $2.60 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z01 | 0 | 0 | 4.52 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z02 | 0 | 0 | 4.17 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z03 | 0 | 0 | 4.52 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z04 | 0 | 0 | 4.17 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z05 | 0 | 0 | 4.52 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z11 | 0 | 0 | 3.82 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z12 | 0 | 0 | 3.82 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z13 | 0 | 0 | 3.82 | $0.00 | $1.95 | $1.95 | 6 |
| I4 | Engineering Calculations | Commercial Outdoor Pool Cover- Small ≤ 10,999 Sq.Ft. | ANY | ANY | Z16 | 0 | 0 | 4.17 | $0.00 | $1.95 | $1.95 | 6 |

# Work Paper Approvals

|  |  |
| --- | --- |
|  |  |
| **Grant Brohard**  Manager, Technical Product Support | Date |
| **Jeff Gleeson**  Manager, Process Products. | Date |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **Date** | **Section-by-Section Description of Revisions** | **Author (Company)** |
| **Revision 0** | **06/24/2012** | **Outdoor Commercial Pool Covers**  **Changed BCR to ANY; AV to ANY; SQFT to Area-ft2** | **Danny Ng, Michael Corbett (Resource Solutions Group)**  **Ed Elliott** |
| **Revision 1** | **1/1/2013 (effective date)** | **ISR and NTG updated per Energy Division Disposition** | **Mark Tiemens (PG&E)** |

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# Section 1. General Measure & Baseline Data

## 1.1 Product Measure Description & Background

***Catalog Description –*** This measure is for installing a new pool cover on outdoor commercial pools for a process heating end-use. This measure requires that there be no existing pool cover installed on a commercial outdoor pool or if there is an existing pool cover, it has reached the end of its useful life and is no longer effective as defined below in Section 1.4.2.

***Program Restrictions and Guidelines***

*This measure is only applicable to the commercial market sector for process heating end-use applications. Application of this measure is for the addition of a pool cover on existing commercial outdoor pools in schools. This equipment is considered an ER measure, Add-on, type as defined in Section 10 of the Clarification on Early Retirement (ER), Dual Baselines, Industry Standard Practice (ISP) & Project Costs. The existing commercial outdoor pool must not be covered or the current cover has reached the end of its useful life and is no longer effective, as defined in Section 1.4.2 below.*

***Terms and Conditions:***

* *This measure is for commercial outdoor pools that currently do not have a cover or the pool cover has reached the end of its useful life.*
* *Pool covers must have a manufacturer’s warranty of 5 years of greater to qualify for a rebate.*
* *All pool covers installed greater than or equal to 11,000 square feet MUST be accompanied by the installation of a power winder and reel to put on and take off the pool cover.*
* *Rebate is based on the square footage of the pool.*
* *These measures are only applicable to commercial pool applications in the School Energy Efficiency (SEE) Program.*
* *Customer must provide documentation that the pool cover is being installed on an existing commercial pool cover.*
* *Customer must provide appropriate cut sheets and proof of payment that the product meets the specified warranty of 5 years or greater.*

***Market Applicability:***

*This measure is to serve PG&E’s Third Party School Energy Efficiency (SEE) Program customers who have natural gas distributed to the installation site by PG&E. These customers are associated with the school industry such as owners and operators of schools within the PG&E service territories. The intent of offering Commercial Outdoor Pool Covers within the SEE program is to help these PG&E customers reduce energy usage through a streamlined, cost-effective delivery. School customers and the vendors that serve them are able to access rebates for this energy efficiency measure without the complication and delay associated with a custom incentive process.*

*The installation of new pool covers on existing outdoor commercial pools is intended to capture energy savings from process load water heating. School customers serviced by PG&E in climate zones 1, 2, 3, 4, 5, 11, 12, 13, and 16 can apply for the rebate. Qualifying rebates will be paid downstream based the installation of new pool covers installed on existing outdoor commercial pools with a customer provided proof of payment from a manufacturer or vendor.*

***1.2 Product Technical Description***

By installing pool covers, the heating load on the pool boiler will be reduced by reducing the 1) heat loss from the water to the environment and 2) the amount of actual water lost due to evaporation (which then requires additional heated water to make up for it).

The main source of energy loss in pools is through evaporation. This is particularly true of outdoor pools where wind plays a larger role. The point of installing pool covers is threefold. First, it will reduce convective losses due to the wind by shielding the water surface. Second, it will insulate the water from the colder surrounding air. And third, it will reduce radiative losses to the night sky. In doing so, evaporative losses will also be minimized and the boiler will not need to work as hard in replenishing the pool with hot water to keep the desired temperature.

The calculations based on these types are savings are done using the RSPEC! Energy Smart Pools Software that was created by the U.S. Department of Energy.[[1]](#endnote-1)

## 1.3 Measure Application Type

*This section discusses the effective useful life of both the base equipment and the measure.*

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 : Measure Application Type

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

|  |  |  |
| --- | --- | --- |
| **Code** | **Description** | **Comment** |
| ER | Early retirement | *measure applied while existing equipment still viable, or retrofit of existing equipment* |

*Since the base case assumes that the existing commercial outdoor pool operates without a pool cover, the Outdoor Pool Cover is considered an Add-On measure and therefore qualifies under the Early Retirement (ER) application type. Referenced from Section 10 of Clarification on Early Retirement (ER), Dual Baselines, and Industry Standard Practice (ISP) and Project Cost guidelines.*

## 1.4 Product Base Case and Measure Case Data

## 1.4.1 DEER Base Case and Measure Case Information

The DEER data do not contain the appropriate information for this measure.

## 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.

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

Section 114(b)2 of Title 24 states that for newly installed pools, the following should also be installed:

“Covers. A cover for outdoor pools or spas that have a heat pump or gas heater.”

The reason that this measure does not fall into this Title 24 category is because this measure is not directed towards or applicable towards new construction projects. This measure instead falls under the Early Retirement category. Installation on an existing pool will not trigger a code requirement.

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

**Hours of Operation:** The hours of operation vary by site.

**Effective Useful Life:** The effective useful life of a pool cover is typically one year longer than it’s warranty period. Pool covers are typically offered with 3 and 5 with some companies offering a 6 year prorated warranty. Historically, sites purchase less expensive covers with shorter warranties, but to qualify for this program, facilities most often purchase 5 year warranty covers. Using 5 year warranty covers as the baseline, the EUL of pool covers are typically 6 years.

**Net to Gross Value:** Table 2 below summarizes all applicable Codes and Standards-based Net-to-Gross ratios for programs that may be used by this measure.

Table 2: Codes and Standards Net-to-Gross Ratios

|  |  |  |  |
| --- | --- | --- | --- |
|  | | **Code or Standard** | |
| Program Approach | NTG | Code or Std | Reference |
| Third Party Program | 0.70 | N/A | NonRes-Default |

The NTG Ratios in Table 2 are appropriate for the measure(s) because:

* There are no applicable codes or standards which define the NTG of this measure, therefore we are using the NonRes-Default rate of 0.70.[[2]](#endnote-2)

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

There are no M&V or other studies which apply to these measures. 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

There are no further data or calculations provided for the support of the measures in this workpaper.

***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.

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

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

Table 3: Calculation Inputs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Input Variable** | **Variations** | **Base Case 1 Average Value** | **Base Case 2 Average Value** | **Measure Case Average Value** | **Reference Section** |
| **Electric Savings** | CZ, BT, BV | 8.07 | *N/A* | *3.91* | *Section 2* |
| **Gas Savings** | CZ, BT, BV, IE | 0 | N/A | 0 | Section 2 |
| **Hours of operation** | CZ, BT, BV | 8030 | N/A | 8030 | Section 2 |
| **Full Cost** | ER, ROB, NC | $2.12 | N/A | $2.12 | Section 4 |
| **Incremental Cost** | ER, ROB, NC | $2.12 | N/A | $2.12 | Section 4 |
| **EUL /RUL** | ER, ROB, NC | N/A | N/A | 6 | Section 1.4.2 |
| **NTG** | One / many | 0.70 | N/A | 0.70 |  |
| **TOU Factor** | *A/C projects only* | *N/A* | *N/A* | *N/A* | *Section 1.4.5* |

# Note: Operating hours are based on the schedule set forth in Section 2.3. The pool is in operation for 11 out of 12 months of the year (11/12 x 8760 hours per year). This includes hours for when the pool is occupied (pool covers off) and when the pool is unoccupied (pool covers on) only for the months in which the pool is in “operational” state (i.e. the pool is being heated).

The pool is “occupied” or “in-use” for 64 hours a week. However, the pool is in “operation” for 24 hours a day for 11 months out of the year. That calculates out to 8,030 hours per year as stated in Table 3. In both the pre-case and the post-case, the pool is in “operation” for 8,030 hours per year. The main thing to see here is that “operating hours” does NOT equal “occupied/in-use” hours.

# Section 2. Calculation Methods

Table 4: 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 |

Notes:

*Since the base case assumes that the existing outdoor commercial pool operates without a pool cover, the Commercial Outdoor Pool Cover is considered an Add-On measure and therefore qualifies under the Early Retirement (ER) application type. Referenced from Section 10 of Clarification on Early Retirement (ER), Dual Baselines, and Industry Standard Practice (ISP) and Project Cost guidelines.*

## 2.1 Electric Energy Savings Estimation Methodologies

There is 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 U.S. Department of Energy (DOE) produced a software tool for estimating pool energy consumption as part of their Reduce Swimming Pool Energy Costs! Program (RSPEC!). This RSPEC! software tool (Energy Smart Pools Version 2.0a) was used to evaluate the typical energy savings for this measure.1

This is the same tool used in PG&E’s Commercial Pool Heater[[3]](#endnote-3) (PGECOPRO105, Rev 2) work paper. In addition, this program was evaluated by an independent party (Sandia National Laboratories2) which concluded that:

“Sizing the solar collector requires knowledge of how much heat is required to maintain a pool at the desired temperature. We used the **RSPEC!** Software as our load estimating tool; we also compared RSPEC to these other tools and found considerable variation in the predicted load. We evaluated the various load predictions and came to the conclusion that the best load predictions are obtained using either the RSPEC! Software tool or the RetScreen tool.”

Because the RSPEC! Software only has two applicable weather sites to choose from (San Francisco and Sacramento), simulation runs were performed using both weather sites individually and both weather sites averaged together. The methodology chosen for this is taken from the PG&E pool heater workpaper to be consistent in the models.

Runs were performed with a weather site set to San Francisco (to represent Climate Zones 1, 3 and 5) and another site set to Sacramento (to represent Climate Zones 11, 12, and 13). A third category to represent Climate Zones 2, 4, and 16 is included, which is taken as the average between the San Francisco and Sacramento runs. This methodology is consistent with the PG&E pool heater workpaper (with the exception of climate zone 16; see below).2

As can be seen from the table below, Climate Zone’s 1, 3, and 5 have relatively close average temperatures and standard deviations from the average. Climate Zone 1 does have slightly lower values than Climate Zone 3 (represented by San Francisco), but their similar standard deviations put them within each other’s range.

Climate Zones 11, 12, and 13 are all central (inland) locations. They have similar maximum temperatures and minimum temperatures, and their standard deviations from the average are relatively high. As a result, these climate zones can be reasonably grouped together in one category.

Climate Zones 2 and 4 are taken as the average of the coastal (Climate zone 1, 3, and 5 represented by the San Francisco weather site) and the central (Climate zone 11, 12, and 13 represented by the Sacramento weather site) climate zones. For Climate Zones 2 and 4, the minimum and maximum temperatures are represented best by averaging the coastal and central climate zones, and the standard deviation from the average is also between the two.

Climate Zone 16 is also taken as an average of the Coastal and Central climate zones because this method seems to best represent the temperatures for Climate zone 16. As can be seen from the table below, the coldest temperatures in Climate zone 16 are lower than both the central and coastal climate zones but closer to the colder extreme of the central climate zones. The maximum temperature lies between the coastal and central climate zones’ averages, and the average temperature overall throughout the year lies closer to the coastal climate zone. With the limited availability of California cities available in RSPEC, the best approximation for Climate zone 16 was an average of the coastal and central climate zones.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Climate Zone | 1 | 2 | 3 | 4 | 5 | 11 | 12 | 13 | 16 |
| Min Temp | 32 | 28 | 34 | 28 | 31 | 27 | 27 | 28 | 11 |
| Max Temp | 80 | 99 | 91 | 97 | 93 | 105 | 103 | 106 | 96 |
| Average Temp | 54 | 57 | 57 | 59 | 58 | 61 | 59 | 64 | 50 |
| Standard Deviation | 7 | 13 | 8 | 11 | 10 | 16 | 14 | 16 | 16 |

\* Weather data from DOE[[4]](#endnote-4)

The RSPEC! program has 15 primary user inputs to perform savings calculations for pool covers. Below is a list of the 15 different inputs including explanations of how the variables were modified. A thorough sensitivity analysis of these parameters has been completed as part of the PG&E’s Commercial Pool Heater[[5]](#endnote-5) (PGECOPRO105, Rev 2) work paper.

Type Pool: Outdoor

Pool Size: 6,400 sqft *(gas savings varies linearly with square footage, so the baseline square footage does not affect the therms/sq.ft. savings)*

Monthly Schedule: January 15 through December 15 *(based on actual customer surveyed data; differs from PG&E pool heater workpaper since this is schools sector specific)**[[6]](#endnote-6)*

Daily Schedule: Sunday: Closed

Monday: 7am to 7pm (12 hours)

Tuesday: 7am to 7pm (12 hours)

Wednesday: 7am to 7pm (12 hours)

Thursday: 7am to 7pm (12 hours)

Friday: 7am to 7pm (12 hours)

Saturday: 10am to 2pm (4 hours)

*(Derived from actual customer surveyed data; differs from PG&E pool heater workpaper since this is schools sector specific)*3

Weather Site: (1) Sacramento (Climate Zones 11, 12, and 13)

(2) San Francisco (Climate Zones 1, 3, and 5)

(3) Average of Sacramento and San Francisco (Climate Zones 2, 4, and 16)

*(This methodology is consistent with PG&E’s pool heater workpaper, except for Climate Zone 16)*2

Windspeed: (1) 10% *(value equivalent to site with “good windbreak” based on aerial shots of pools*4*; see RSPEC! wind speed input description below; value is also more conservative than the suggested default value of RSPEC! and lower than the value used in the PG&E pool heater workpaper*2 *since this is applicable strictly to schools.)*

(2) 1% *(most conservative value that represents a pool that sees little wind passing over it due to screens and buildings)*

Shading: (1) 23% *(based on survey done for 15 school sites to estimate shading; more conservative estimate that is more school specific than the PG&E pool heater workpaper, which estimates a 30% shading factor for outdoor pools; see RSPEC! shading factor input description below)**[[7]](#endnote-7)*

(2) 5% *(conservative value that represents the lower end of the shading % based on one standard deviation from the average; standard deviation = 18%)*

Pool Temp: 80ºF *(typical pool temperature; consistent with PG&E pool heater workpaper)*2

Activity Level: High *(see RSPEC! activity level input description below)*

Pool Heater Fuel: Natural Gas

Pool Heater Efficiency: 83% *(Typical range of pool heaters seen in the field are standard efficiency 80% pool heaters and higher efficiency 85% pool heaters; an average of the two is used for this model)*

**Pool Cover Data:**

Cover Type: Insulated

System: Manual

Cover R-Value: 0.5[[8]](#endnote-8)

Pool Coverage %: 100

RSPEC! input descriptions:

**Wind Speed %:** Monthly weather station Wind Speeds are stored in each weather file. The Wind Speed at the weather station is usually measured several feet off the ground. Wind Speed at the pool surface is usually below the weather station speed. This input allows you to adjust the weather station wind speed to be used in the calculations for a more accurate representation of the wind speed at the pool surface. Use the following as a guideline for inputting wind speed percent:

No windbreak: 30%

Moderate windbreak: 20%

Good windbreak: 10%

If in doubt, a figure of 15% can be used.

**Shading %:** Some pools are located in shady areas or are screened in. The Shading factor allows you to input a percentage that will allow the analysis to take these factors into consideration. Typically the pool acts as a giant solar collector. Locating it in a shaded area or putting screen over it will substantially lower the solar energy collected by the pool and require more energy input to maintain the desired temperature. In hot climates like Arizona, this may keep your pool from overheating however. The Energy Smart Pools calculation assumes that the pool is completely un-shaded during the peak solar hours of 8 am and 4 pm. If the pool is shaded some during this time, enter a percentage based on percent of the pool that is shaded and the percent of the time between 8 am and 4 pm that it is shaded. Pools that are screened-in should use a shading percentage between 50-75%.

**Activity Level:** Select either high or low for normal activity level during open hours. Low indicates an average of up to 2 swimmers in a 1000 square foot pool over all hours of operation. High is any number over that.

For a discussion of the tool’s sensitivity to the above parameters, please reference PG&E’s pool heater workpaper which provides an analysis on the listed parameters.2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RSPEC! Savings Summary[[9]](#endnote-9),[[10]](#endnote-10)** |  |  |  |  |  |  |  |

Scenario #1:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | Climate Zones | % Wind | % Shade | Sq. Ft | Base case Therms | Proposed Therms | Therms Saved | Therms Saved/sq.ft. |
| Sacramento | 11,12,13 | 10% | 23% | 6,400 | 54,534 | 25,229 | 29,305 | 4.58 |
| San Francisco | 1,3,5 | 10% | 23% | 6,400 | 69,208 | 35,443 | 33,765 | 5.28 |
| Both (averaged) | 2,4,16 | 10% | 23% | 6,400 | 61,871 | 30,336 | 31,535 | 4.93 |

Scenario #2:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | Climate Zones | % Wind | % Shade | Sq. Ft. | Base case Therms | Proposed Therms | Therms Saved | Therms Saved/sq.ft. |
| Sacramento | 11,12,13 | 1% | 5% | 6,400 | 37,014 | 17,464 | 19,550 | 3.05 |
| San Francisco | 1,3,5 | 1% | 5% | 6,400 | 45,924 | 21,842 | 24,082 | 3.76 |
| Both (averaged) | 2,4,16 | 1% | 5% | 6,400 | 41,469 | 19,653 | 21,816 | 3.41 |

Final Savings (Average of Scenario’s #1 and #2):

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | Climate Zones | % Wind | % Shade | Sq. Ft. | Base case Therms | Proposed Therms | Therms Saved | Therms Saved/sq.ft. |
| Sacramento | 11,12,13 | Avg. (10%,1%) | Avg. (23%,5%) | 6,400 | 45,774 | 21,347 | 24,428 | **3.82** |
| San Francisco | 1,3,5 | Avg. (10%,1%) | Avg. (23%,5%) | 6,400 | 57,566 | 28,643 | 28,924 | **4.52** |
| Both (averaged) | 2,4,16 | Avg. (10%,1%) | Avg. (23%,5%) | 6,400 | 51,670 | 24,995 | 26,676 | **4.17** |

|  |  |
| --- | --- |
| **Savings by Climate Zone** | |
| Climate Zone | Therms Saved/sqft |
| 1 | 4.52 |
| 2 | 4.17 |
| 3 | 4.52 |
| 4 | 4.17 |
| 5 | 4.52 |
| 11 | 3.82 |
| 12 | 3.82 |
| 13 | 3.82 |
| 16 | 4.17 |

# *Section 3. Load Shapes*

For purposes of the net benefits estimates in the E3 calculator, what is required is the demand load shape that ideally represents the *difference* between the base equipment and the installed energy efficiency measure. This *difference* load profile is called the Measure Load Shape and is the preferred load shape for use in the net benefits calculations. The measure equipment and controls may alter the typical end use profile, making it difficult to select a single demand profile to represent the measure category. The measure demand profile is expected to follow the same typical end use profile as the base case equipment, although slightly lower in overall demand.

The E3 Calculator contains a fixed set of load shapes selections that are the combination of the hourly avoided costs and whatever load shape data were available at the time of the tool’s creation. In this case the measure load shape “Commercial Process” is most appropriate to show the possibility that the equipment could be run at any time during the year.

## 3.1 Base Case Load Shapes

The closest load shape chosen for this measure is the 7 = Commercial Process load shape. See Table 8 for a list of all Building Types and Load Shapes.

Table 5: Base Case Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **E3 Alt. Building Type** | **Load Shape** |
| BCR- Both Residential and Commercial | Commercial | 7 = Commercial Process |

## 3.2 Measure Load Shapes

There are no measure case load shapes applicable to this measure in the DEER 2011 database. The base case shapes shown below are to be used in the cost avoidance calculation.

Table 6: Measure Case Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **E3 Alt. Building Type** | **Load Shape** |
| BCR- Both Residential and Commercial | Commercial | 7 = Commercial Process |

# Section 4. Base Case & Measure Costs

Table 7: Base Case EUL/RUL

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Measure Life Basis** | **First Baseline Period Gross Measure Cost (RUL)** | **Second Baseline Period Gross Measure Cost (EUL – RUL)** |
| ***ER (early retirement)*** | RUL/  EUL-RUL | Calculated as Full Gross Measure Cost | Calculated as Negative Full Gross Base Case Cost |

## 4.1 Base Case(s) Costs

There is no base case cost as the commercial outdoor pool has no covers currently in operation.

## 4.2 Measure Case Costs

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

Table 8: Equipment and Labor Costs

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Measure Code*** | **Measure Application Type** | **Baseline** | **Equipment Cost** | **Labor / Installation Cost** | **Maintenance / Other Cost** | **Total Measure Case Cost** |
| I3 | ER | No Pool Cover | $2.60 | $0 | $0 | $2.60 |
| I4 | ER | No Pool Cover | $1.95 | $0 | $0 | $1.95 |

*All costs are noted as $ per square foot*

The measure costs above are based on taking the average of pool cover costs from past projects done through the School Energy Efficiency (SEE) Program for PG&E. Averages come from a sample size of (77) pool cover projects.[[11]](#endnote-11)

Note that the increased cost for the large pool cover application results from the requirement that a powered winder must be purchased to ensure that installation and removal of the cover is possible and safe for one person.

## 4.3 Incremental & Full Measure Cost

Table 9: Incremental Costs

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure Application Type** | **Gross Measure Cost**  **(RUL Period/First Baseline)** | **Gross 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 |

# *4.3.1 Gross Measure Cost*

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: **ER**, so the Gross Measure Cost (GMC) is represented by the equation below:

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

(Base Case Equipment Cost + Base Case Labor Cost)

GMC = $2.60 For Large Pool Covers

GMC = $1.95 For Small Pool Covers

# *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.

This Measure Application Types is: **ER** 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 = $2.60 For Large Pool Covers

IMC = $1.95 For Small Pool Covers

Table 10: Summary Table for Section 4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure ID** | **Measure Application Types** | **Base Case Total Cost** | **Measure Case Total Cost** | **Gross Measure Case Cost** | **Incremental Measure Cost** |
| I3 | ER | $0.00 | $2.60 | $2.60 | $2.60 |
| I4 | ER | $0.00 | $1.95 | $1.95 | $1.95 |

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# Input Appendices

1. Energy Smart Pools Software (RSPEC!)

   <http://www.rlmartin.com/rspec/software.htm> [↑](#endnote-ref-1)
2. SPTdata\_FDormat-V0.97.xls [↑](#endnote-ref-2)
3. PG&E Pool Heater Workpaper [↑](#endnote-ref-3)
4. Weather data:

   <http://apps1.eere.energy.gov/buildings/energyplus/cfm/weather_data3.cfm/region=4_north_and_central_america_wmo_region_4/country=2_california_climate_zones/cname=California%20Climate%20Zones> [↑](#endnote-ref-4)
5. PG&E Pool Heater Workpaper [↑](#endnote-ref-5)
6. Survey of past participants for pool schedules

   [↑](#endnote-ref-6)
7. Aerial shots of pools with shading % estimates

   [↑](#endnote-ref-7)
8. T-Star Pool Covers cutsheet (R-value of approximately 0.5)

   [↑](#endnote-ref-8)
9. Sacramento RSPEC! Runs

   [↑](#endnote-ref-9)
10. San Francisco RSPEC! Runs

    [↑](#endnote-ref-10)
11. Pool cover costs from past projects

    Workpaper planning Template

    [↑](#endnote-ref-11)