**Work Paper SCE13HC027**

**Revision 1**

**Southern California Edison Company**

**Portable Room Air Conditioners**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | AC-70890 |
| **Measure Description:** | Installation/replacement of standard efficiency portable room air conditioner with a more efficient unit. The measure is a 12,000 BTU/h portable room AC with a minimum EER of 11.9 |
| **Base Case Description:** | The base case is a 12,000 BTU/h room air conditioner (room AC) with an average EER of 11.0 |
| **Energy Impact Common Units:** | Unit |
| **Energy Savings :** | Refer to Excel Calculation Attachment |
| **Gross Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Measure Incremental Cost ($/unit):** | Refer to Excel Calculation Attachment |
| **Effective Useful Life (years):** | 9.0 |
| **Measure Application Type:** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratios:** | 0.55 |
| **Important Comments:** | * This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately. * Work paper documentation and energy and demand savings are based on previous version of the work paper - SCE13HC027. Methodology for estimating energy and demand savings exclude 2014 MASControl and READi tool applications. |

# Document Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Workpaper and Revision # | Tech. Revision | MM/DD/YY | Author/Affiliation | Summary of Changes |
| SCE13HC027.0 | No | 03/29/2012 | James Gowen/Matrix | Updated work paper to new template |
| SCE13HC027.1 | No | 04/11/2014 | Andres Fergadiotti/SCE | -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14. |

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the E3 Calculator inputs for the purchase and installation of portable room air conditioners (portable room ACs). The base case for this measure is a 12,000 BTU/h room air conditioner (room AC) with an average EER of 11.0. The measure is a 12,000 BTU/h portable room AC with an average EER of at least 11.9. General manufacturer information and model description on Portable room AC for estimating measure impacts and cost can be found in Attachment 2.

Table 1 Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| AC-70890 | 12 kBtu/hr Portable Room Air Conditioner DX Equipment |

Eligibility requires replacement based on burnout (ROB) of an existing portable room air conditioner of 12,000 Btu/h with matching capacity but higher efficiency unit.

## 1.2 Technical Description

The measure consists of the installation of high efficient portable air conditioner delivering a cooling output of 12,000 Btu/h. Depending upon usage and heat gain characteristics in the space (room), generally a 12,000 Btu/h unit can provide sufficient air-conditioned for a 500 to 800 square foot space. Advance Portable Room AC technology may include multi-cooling speeds, humidification control, automatic restart, and/or self-evaporating technology.

## 1.3 Measure Application Type

The delivery method is Financial Support – Downstream Incentive – Deemed.

The program type is ROB.

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

This specific measure is not included in the Database for Energy Efficient Resources (DEER) Version 2014 [386]. Therefore, the DEER will not be used to determine energy savings and demand reduction estimates.

Table 2 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | No |
| Deviation from DEER | DEER does not contain this type of measure. |
| DEER Version | N/A |
| DEER Run ID and Measure Name (Sample) | N/A |

**Net to Gross**

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 5 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [351]. The relevant NTGR for this measure is shown in Table 3 below.

Table 3 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| Res-Default>2 | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Res | Any | All | 0.55 |

\*Denotes that the column is taken from the DEER NTG Table.

**Installation Rate**

The installation rate (IR) is identified in the calculation attachment. This value is obtained from the support table available in READi. Currently there is no versioning on the installation rate table. To address appropriate selection of the installation rate the date of the workpaper will serve as the last date checked for updated IR values. The installation rate varies by end use, sector, technology, application, and delivery method. The relevant IR values for this measure are shown in Table 4 below.

Table 4 Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GSIA\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | GSIAValue\* |
| Res-RAC-SCE | Residential Room AC; Annual Installation Rate | Res | Any | NonUpStrm | 0.96 |

**Spillage Rate**

Spillage rate will also be applied to measures however the values will not be tracked in the workpapers. The spillage rate will be tracked in an external table to be supplied to the Energy Division.

**READi Technology Fields**

To support the development of the ED ex ante tables, select fields from the ex ante database will be identified in the workpaper. For a full set of values associated with the measures in the workpaper refer the Excel calculation template.

Table 5 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this workpaper |
| Measue Case UseCategory | HVAC |
| Measure Case UseSubCats | Space Cooling |
| Measure Case TechGroups | dx AC Equipment |
| Measure Case TechTypes | Room AC |
| Base Case TechGroups | dx AC Equipment |
| Base Case TechTypes | Room AC |

### 1.4.2 Codes and Standards Analysis

There are no requirements defined in Title 20 – 2014 Appliance Efficiency Regulations [422] for portable room ACs, so there is no code impact. The baseline is assumed to be code compliant room ACs.

Table 6 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 20 (2014) | California’s Title 20 Appliance Efficiency Program Codes | May 2014 |

### 1.4.3 Non-DEER Study Review

N/A

### 1.4.4 Measure and Base Case Effective Useful Life

DEER14 update documentation provides EUL and RUL information to be used for the 2015 program cycle extension on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “Summary of EUL-RUL Analysis for the April 2008 Update to DEER” provides the RUL value as a flat 1/3 of the EUL value. The RUL value will only be applied to the first baseline period for retrofit measures that have applicable code that will affect the energy savings. In all other installation types and retrofit with no applicable code that affects the energy savings, the RUL is not applicable to either the first or second baseline period.

To obtain the EUL value the DEER14 update documentation, EUL\_Summary\_10-1-08.xls [213], was consulted. Table 5 below identifies the value/methodology used for the measures in this work paper.

Table 7 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| HV-RAC-ES | Residential | HVAC | Room AC - Energy Star | 9 | N/A |

# Section 2. Energy Savings & Demand Reduction Calculations

**Determination of operating hours**

The 2006-2008 impact study report for room ACs was used to obtain typical room AC operating hours in climate zones 6, 8, 9, and 10 [329]. Using annual cooling degree days, climate zone 10’s operating hours were scaled to determine operating hours for climate zones 13 through 15, and climate zone 6’s hours were scaled to find climate zone 16’s hours.

Example: Determining operation hours for climate zone 14

Annual cooling degree days for zone 14 = 1557

Annual cooling degree days for zone 10 = 1154

Total cooling hours for zone 10 = 631 hours

Normalized cooling hours for zone 10 = 631 hrs / 1154 CDD = 0.5468 hrs / CDD

Annual cooling hours for zone 14 = 0.5468 hrs / CDD x 1557 CDD = 851.4 hrs

**Energy Savings**

Equation 1 shows how the measure case demand (kW) was determined. Based on an average efficiency (EER) of six different portable room AC units of 11.0, the average measure case demand (kW) was estimated as 1.01 kW as shown in Attachment 2 - Savings Calculations Tab.

Similarly, the base case demand (kW) was estimated as 1.09 kW based on equipment efficiency (EER) in the order of 11.9 as shown in Attachment 2 - Savings Calculations Tab.

**Estimated kW demand of a 12,000btu/h portable AC:**

Equation 1

****

*KWdemandofAC = [(12000 / 11.9) / 1000] = 1.01 kW*

Equation 2 shows how the measure case kWh usage was determined, for climate zone 6. The kW demand was multiplied by the operational hours defined in the impact report.

Estimated energy usage of a 12,000btu/h portable AC in climate zone 6:

Equation 2

*EnergyUsageofAC = [1.01 x 225hrs] = 227.54 kWh*

Equation 3 shows how the kWh energy savings was determined, for climate zone 6. The measure case (portable room AC) kWh was subtracted from the base case (room AC) kWh.

**Estimated energy savings of a 12,000 btu/h portable AC in climate zone 6:**

Equation 3



*EnergySavings = 244.86 – 227.54*

*EnergySavings = 17.31 kWh*

**Demand Reduction**

Equation 4 shows how the peak demand reduction was determined, for climate zone 6. The measure case kW was subtracted from the base case kW.

**Estimated Demand Reduction of a 12,000 btu/h portable AC in CZ 6:**

Equation 4







Table 7 shows the annual energy savings (kWh) and peak demand reduction (kW) for a 12,000 BTU/h portable room AC vs. a room AC in climate zones 6, 8,9,10,13,14,15, and 16. Detailed energy savings and demand reductions can be seen in Attachment 2.

Table 7 Portable air conditioner estimated annual Energy Savings (kWh) and estimated Peak Demand Savings (Climate Zone 6, 8, 9, 10, 13, 14, 15, and 16)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Climate Zone | Average Base case KW | Average Measure case KW | Average Base case kWh | Average Measure case kWh | Demand Reduction KW | Energy Savings kWh |
| 6 | 1.09 | 1.01 | 244.86 | 227.54 | 0.08 | 17.31 |
| 8 | 1.09 | 1.01 | 402.65 | 374.18 | 0.08 | 28.47 |
| 9 | 1.09 | 1.01 | 568.07 | 527.90 | 0.08 | 40.17 |
| 10 | 1.09 | 1.01 | 686.69 | 638.13 | 0.08 | 48.55 |
| 13 | 1.09 | 1.01 | 686.69 | 638.13 | 0.08 | 48.55 |
| 14 | 1.09 | 1.01 | 926.10 | 860.62 | 0.08 | 65.48 |
| 15 | 1.09 | 1.01 | 896.72 | 833.31 | 0.08 | 63.40 |
| 16 | 1.09 | 1.01 | 487.54 | 453.06 | 0.08 | 32.45 |

# Section 3. Load Shapes

The difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for this measure is the New AC-Ret load shape. See Table 9 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.

Table 9 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Residential – Single Family | Misc\_Commercial | New AC-Ret |
| Residential Mobile Home - Double-Wide | Misc\_Commercial | New AC-Ret |

# Section 4. Base Case & Measure Costs

Base Case and Measure Costs on the measure were estimated by using DEER 2008 and AC equipment manufacturer documentation. Since the measures are assumed to be installed as ROB, the installation cost differential between the base case and measure case is zero for the customer.

## 4.1 Base Case Cost

Base case costs are estimated by averaging retail market prices for several different models of 12,000 BTU/h room ACs. The base case cost is $513.67. Individual costs for each model can be found in Attachment 2.

## 4.2 Measure Case Cost

Measure case cost was estimated by analyzing cost documentation in DEER2008 for residential air-conditioning equipment (e.g., D08-RE-ResAC) as a function of SEER/EER. Based on this information, an incremental cost factor of 1.147 was estimated between base case and measure case approximating an estimated measure case cost of $588.70. Refer to Attachment 2 for details and supporting documentation.

## 4.3 Gross and Incremental Measure Cost

### 4.3.1 Gross Measure Cost

For **ROB**, GMC is represented by the equation below:

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

(Base Case Equipment Cost + Base Case Labor Cost)

\*Note: Unless stated otherwise the measure case labor and base case labor are assumed to be the same value reducing the equation to the following:

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

*GMC = $588.70 - $513.67 = $75.03*

Individual costs for each model can be found in the Calculations spreadsheet Attachment 2.

### 4.3.2 Incremental Measure Cost

In the case of ROB, the IMC and GMC end up having the same equation and hence the same value. Therefore, incremental costs are calculated by subtracting the base case cost from the measure cost as documented in Section 4.3.1

# Attachments

1.  2. 

# References



[351]

[277]

[213]

[329]

[31]

[49]

# Appendix A – SCE/ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCE Program Type | ED Application Type | 1st Baseline Savings | 2nd Baseline Savings | 1st Baseline Cost | 2nd Baseline Cost | 1st Baseline Life | 2nd Baseline Life |
| New | New Construction (Nc) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Replace on Burnout (ROB) | Replace on Burnout (Rob)/Normal Replacement (NR) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Retrofit (RET) | Early Replacement (ER) | Above Cust. Existing | Above Code/Standard | Full Cost | Incremental Cost | RUL | EUL-RUL |
| Retrofit – First Baseline Only (REF) | Early Replacement RUL (ErRul) | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |
| Retrofit Add-on (REA) | N/A | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |