|  |
| --- |
| HVAC  Air cooled chiller, Path B  SWHC052-01 |

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Measure Name

Air-Cooled Chiller, Path B

Statewide Measure ID

SWHC052-01

Technology Summary

Chilled water systems use a central plant chiller(s) to cool and distribute water that is used to cool air to meet building cooling demand. An air-cooled chiller rejects heat from the refrigeration cycle to the ambient air using fans (forced convection). Even though an air-cooled chiller is less efficient than a water-cooled chiller, it provides other advantages: lower first cost, lower maintenance and operational costs, less complex technology, requires less space, and less water usage. Air-cooled chillers are common in commercial and industrial applications and are available in a wide range of capacities, from less than 50 tons to several hundred tons. The 2019 California Building Energy Efficiency Standards (Title 24 Part 6)[[1]](#footnote-2) contains a prescriptive requirement in Section 140.4(j) limiting the capacity of air-cooled chillers to 300 tons with a few exceptions.

The efficiency rating of an air-cooled chiller is based on the unit operation under standard test conditions, typically determined by AHRI Standard 550/590 – 2020.[[2]](#footnote-3) Air-cooled chillers have two different measures of energy efficiency: 1) full load efficiency, represented by the energy efficiency ratio (EER); and 2) part load efficiency, represented by the integrated part load value (IPLV). The units of both EER and IPLV are expressed in British thermal units per watt-hour (Btu/Wh) for air-cooled chillers.

Air-cooled chillers with variable speed compressors offer efficiency benefits over fixed-speed compressors when operated in part load because the chiller avoids cycling losses. Because buildings spend the majority (~90%) of their operating hours in part-load conditions (as evidenced by the AHRI IPLV rating which weights the test point representing full-load conditions at 1%), the use of variable speed chillers can result in substantial energy savings.

Measure Case Description

The measure case is defined as a variable speed air-cooled (screw) chiller for use in a nonresidential building that exceeds the minimum efficiency requirements set forth by Title 24 Part 6 in both full load and integrated part load conditions under Path B. In conformance to Resolution E-5082,[[3]](#footnote-4) measure offerings are defined as follows:

* Tier 1, the full load efficiency of the air-cooled chiller should exceed Title 24 Path B minimum requirement by 7% and the integrated part load efficiency of the air-cooled chiller should exceed Title 24 Path B minimum requirement by 12%.
* Tier 2, the full load efficiency of the air-cooled chiller should exceed Title 24 Path B minimum requirement by 7% and the integrated part load efficiency of the air-cooled chiller should exceed Title 24 Path B minimum requirement by 20%.

Measure offerings are required to meet both full load AND integrated part load efficiency requirements specified below.

Measure Case Specification

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure Offering ID** | **Measure Offering** | **Capacity  (tons)** | **Tier** | **Full Load EER (minimum)** | **IPLV (minimum)** |
| SWHC052A | Air-cooled Screw Chiller, Path B | < 150 | Tier 1 | 10.4 | 17.7 |
| SWHC052B | Air-cooled Screw Chiller, Path B | < 150 | Tier 2 | 10.4 | 19.0 |
| SWHC052C | Air-cooled Screw Chiller, Path B | ≥ 150 | Tier 1 | 10.4 | 18.0 |
| SWHC052D | Air-cooled Screw Chiller, Path B | ≥ 150 | Tier 2 | 10.4 | 19.3 |

Base Case Description

The base case is defined as a variable speed (i.e., Path B) air-cooled (screw) chiller for use in nonresidential buildings that meets the minimum efficiency requirements set forth by the 2019 California Building Energy Efficiency Standards (Title 24) in both full load and integrated part load conditions. (See Code Requirements.)

Base Case Specification

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment Type** | **Capacity  (tons)** | **Tier** | **Full Load EER** | **IPLV** |
| Air-cooled Screw Chiller, Path B | < 150 | Base Case | 9.7 | 15.8 |
| Air-cooled Screw Chiller, Path B | ≥ 150 | Base Case | 9.7 | 16.1 |

Code Requirements

Applicable state and federal codes and standards for air-cooled chillers are specified below.

Applicable State and Federal Codes and Standards

|  |  |  |
| --- | --- | --- |
| **Code** | **Applicable Code Reference** | **Effective Date** |
| CA Appliance Efficiency Regulations – Title 20 | n/a | n/a |
| CA 2019 Building Energy Efficiency Standards – Title 24 | Section 110.2 (a), Table 110.2-D;  Section 140.4 (j) | January 1, 2020 |
| Federal Standards | None | n/a |

The 2019 California Building Energy Efficiency Standards (Title 24 Part 6)[[4]](#footnote-5) requires air cooled chillers to meet minimum full-load efficiency (EER) and integrated part-load efficiency (IPLV) ratings. The Title 24 base case for this above-code measure is listed in section 110.2 (a) Table 110.2-D.

Table 110.2-D Air Chilling Packages – Minimum Efficiency Requirements (2019 Title 24)[[5]](#footnote-6)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equipment Types** | **Size Category (tons)** | **Path A Efficiency** | **Path B Efficiency** | **Test Procedure** |
| Air-cooled, with condenser, electrically operated | < 150 | ≥ 10.1 EER  ≥ 13.7 IPLV | ≥ 9.7 EER  ≥ 15.8 IPLV | AHRI 550/590 |
| ≥ 150 | ≥ 10.1 EER  ≥ 14.0 IPLV | ≥ 9.7 EER  ≥ 16.1 IPLV |
| Air-cooled, without condenser, electrically operated | All capacities | Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements. | |

Title 24 also specifies alternate efficiency compliance paths for chiller types. Path A requires a high full-load efficiency; Path B sets a lower minimum full-load efficiency than Path A but requires a higher minimum integrated part-load efficiency. DEER Resolution E-5082 stated “For 2022, this resolution modifies the DEER requirement for air-cooled Path B chillers by allowing a lower full-load efficiency improvement of seven percent above code for both tiers, but requires a higher part-load efficiency improvement of 12 percent for tier 1 and 20 percent for tier 2 chillers (the exact EER and IPLV requirements can be found in the table titled “Measure Case Specification”). This change will not affect the existing DEER2020 air-cooled chiller measures because their energy savings were determined assuming fixed-speed operation (Path A). Instead, this change will apply to non-DEER deemed measures supported by workpapers for chillers that comply via the Path B option.”[[6]](#footnote-7) It is this policy change that has enabled this Non-DEER Path B air-cooled chiller measure to move forward.

For a given chiller, there will always be both a rated full-load efficiency (EER in Btu/Wh for air cooled units) and a rated IPLV. The selection of an efficiency tier level must be based on both parameters. If the rated full-load efficiency and the rated IPLV are both greater than or equal to the tier level values, then that tier is valid.

Air-cooled chillers with a leaving evaporator fluid temperature higher than 32 °F must comply with Title 24 Table 110.2-D when tested or certified with water at standard rating conditions.

Normalizing Unit

Tons of cooling capacity (Cap-tons).

Program Requirements

Measure Implementation Eligibility

All combinations of measure application type, delivery type, and sector that are established for this measure are specified below. Measure application type is a categorization based on the circumstances and timing of the measure installation. Each measure application type is distinguished by its baseline determination, cost basis, eligibility, and documentation requirements.  Delivery type is the broad categorization of the delivery channel through which the market intervention strategy (financial incentives or other services) is targeted. This table also designates the broad market sector(s) that are applicable for this measure.

*Note that some of the implementation combinations below may not be allowed for some measure offerings by all program administrators.*

Implementation Eligibility for Investor-Owned Utilities

| **Measure Application Type** | **Delivery Type** | **Sector** |
| --- | --- | --- |
| Normal replacement (NR) | UpDeemed | Com |
| Normal replacement (NR) | DnDeemed | Com |
| Normal replacement (NR) | DnDeemDI | Com |
| New Construction (NC) | UpDeemed | Com |
| New Construction (NC) | DnDeemed | Com |
| New Construction (NC) | DnDeemDI | Com |
| Normal replacement (NR) | UpDeemed | Ind |
| Normal replacement (NR) | DnDeemed | Ind |
| Normal replacement (NR) | DnDeemDI | Ind |
| New Construction (NC) | UpDeemed | Ind |
| New Construction (NC) | DnDeemed | Ind |
| New Construction (NC) | DnDeemDI | Ind |

For midstream and upstream delivery types, when possible, the program administrator (PA) shall claim the “specific building type savings” in which the equipment will be installed and submit that information at claims level on CEDARS website. In cases where there is no “building type” information available for a given project, program administrator shall claim the weighted savings of “Com” building type.

Eligible Products

Products are required to meet both full load and integrated part load efficiency requirements specified in the Measure Offering Description.

The energy and demand impacts of this measure are applicable only to commercial building applications with chiller equipment serving space conditioning. Other chiller measures serving non-space comfort and/or processes and/or industrial applications shall be evaluated and incentivized under custom programs.

Eligible Building Types and Vintages

This measure is applicable for new construction and existing nonresidential buildings of any vintage.

Eligible Climate Zones

This measure is applicable in any California climate zone.

Program Exclusions

Per Section 140.4 (j) of the 2019 California Building Energy Efficiency Standards (Title 24 Part 6),[[7]](#footnote-8) chilled water plants shall not have more than 300 tons provided by air-cooled chillers, except where the water quality at the building site fails to meet the manufacturer specifications for the use of water-cooled chillers, chillers that are used to charge a thermal energy storage system with a design temperature of less than 40 °F, or systems serving healthcare facilities.

Data Collection Requirements

Data collection requirements are to be determined.

Use Category

HVAC

Electric Savings (kWh)

The electric unit energy savings (UES) of a Path B air-cooled chiller were calculated based on performance data collected from the market. Southern California Edison (SCE) collected performance data from 18 chillers from three major chiller manufacturers at a range of full load and part load efficiency levels, with an emphasis on Path B improvements over code minimum requirements, and provided this data to the CPUC’s Energy Division (ED).

The process by which the representative chillers were chosen was referred to as the “median performance curve” selection in which modeled savings were chosen from three chillers closest to the Tier 1 efficiency requirements and another three chillers closest to the Tier 2 efficiency requirements. SCE then modeled these six chillers, along with four chillers at Title 24 efficiency levels, across three building types, two climate zones, and one vintage. Past Upstream HVAC incentive program data was analyzed to determine which three building types would be used. This data indicated that secondary education (ESe), manufacturing – biotech (MBT), and large office (OfL) are most representative for air-cooled chillers. SCE elected to use climate zones 9 and 13 to capture representative California weather. The 2007 building vintage was used as it falls in the middle of the rolled-up existing (“Ex”) vintage. This exercise was not separately conducted for each of the two air-cooled chiller size categories. All modeling was conducted within the MASControl3 environment.

The median performance curve exercise yielded a representative chiller at code-minimum, Tier 1, and Tier 2 efficiency levels. Once the representative chillers were chosen, the full parametric modeling exercise across all appropriate building types, climate zones, and vintages was conducted. The tables below outline the specific building types, vintages, and climate zones modeled for this effort. The 2020 vintage is used as “New” for this measure.

**Building Type Description**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Building Type** | **Building Type Code** | **Modeled** | | Assembly | Asm | No | | Community College | ECC | Yes | | Primary School | EPr | No | | Relocatable Classroom | ERC | No | | Secondary School | Ese | Yes | | University | EUn | Yes | | Grocery | Gro | No | | Hospital | Hsp | Yes | | Nursing Home | Nrs | Yes | | Hotel | Htl | Yes | | Motel | Mtl | No | | Manufacturing Biotech | MBT | Yes | | |  |  |  | | --- | --- | --- | | **Building Type** | **Building Type Code** | **Modeled** | | Manufacturing Light Industrial | MLI | No | | Office – Large | OfL | Yes | | Office – Small | OfS | Yes | | Restaurant – Fast-Food | RFF | No | | Restaurant – Sit-Down | RSD | No | | Retail – Multistory Large | Rt3 | Yes | | Retail – Single-Story Large | RtL | No | | Retail – Small | RtS | No | | Storage – Conditioned | SCn | No | | Storage – Unconditioned | Sun | No | | Warehouse – Refrigerated | WRf | No | | Greenhouse | GHs | No | |

**Vintage**

|  |  |  |  |
| --- | --- | --- | --- |
| **Vintage Era** | **Vintage** | **Vintage Code** | **Modeled** |
| Old (Old) | 1975 | Before 1978 | No |
| 1985 | 1987-1992 | No |
| 1996 | 1993-2001 | No |
| Median (Ex) | 2003 | 2002-2005 | Yes |
| 2007 | 2006-2009 | Yes |
| 2011 | 2010-2013 | Yes |
| 2015 | 2014-2016 | Yes |
| Recent (Rec) | 2017 | 2017-2019 | No |
| 2020 | After 2019 | Yes |
| New (New) | New | New Construction | No |

**Climate Zone**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Climate Zone** | **Climate Zone Description** | **Modeled** | | 1 | Arcata Area (CZ01) | Yes | | 2 | Santa Rosa Area (CZ02) | Yes | | 3 | Oakland Area (CZ03) | Yes | | 4 | Sunnyvale Area (CZ04) | Yes | | 5 | Santa Maria Area (CZ05) | Yes | | 6 | Los Angeles Area (CZ06) | Yes | | 7 | San Diego Area (CZ07) | Yes | | 8 | El Toro Area (CZ08) | Yes | | |  |  |  | | --- | --- | --- | | **Climate Zone** | **Climate Zone Description** | **Modeled** | | 9 | Pasadena Area (CZ09) | Yes | | 10 | San Bernardino Area (CZ10) | Yes | | 11 | Red Bluff Area (CZ11) | Yes | | 12 | Sacramento Area (CZ12) | Yes | | 13 | Fresno Area (CZ13) | Yes | | 14 | China Lake Area (CZ14) | Yes | | 15 | Blythe Area (CZ15) | Yes | | 16 | Mount Shasta Area (CZ16) | Yes | |

The electric unit energy savings (UES) were calculated as the difference in annual energy consumption of the baseline models and the measure case models for each building type, climate zone, and vintage.

The Statewide Measure Offering IDs and description are provided below.

Measure Offering IDs and Measure Description

| **Statewide Measure Offering ID** | **Minimum EER** | **Minimum IPLV** | **MASControl3 Measure IDa** | **Measure Offering Description** |
| --- | --- | --- | --- | --- |
| SWHC052A | 10.4 | 17.7 | NE-HVAC-Chlr-AirCldScrewChlr-1Cmp-AllSizes-0.95kwpton | Air Cooled Variable Speed Screw Chiller (< 150 tons, 10.4 Min EER, 17.7 Min IPLV) |
| SWHC052B | 10.4 | 19.0 | NE-HVAC-Chlr-AirCldScrewChlr-1Cmp-AllSizes-0.95kwpton | Air Cooled Variable Speed Screw Chiller (< 150 tons, 10.4 Min EER, 19.0 Min IPLV) |
| SWHC052C | 10.4 | 18.0 | NE-HVAC-Chlr-AirCldScrewChlr-1Cmp-AllSizes-0.95kwpton | Air Cooled Variable Speed Screw Chiller  (>= 150 tons, 10.4 Min EER, 18.0 Min IPLV) |
| SWHC052D | 10.4 | 19.3 | NE-HVAC-Chlr-AirCldScrewChlr-1Cmp-AllSizes-0.95kwpton | Air Cooled Variable Speed Screw Chiller  (>= 150 tons, 10.4 Min EER, 19.3 Min IPLV) |

a Although all offerings were based on the same initial MASControl3 Measure ID, the performance curves and full-load EIR value were modified for all offerings. More details can be found in the supporting workbook titled “SWHC052-01 ACC Path B Modeling Plan.xlsx”

UES were estimated for both building-specific and commercial aggregated “Com.” DEER2020 building weights[[8]](#footnote-9) were used to calculate the weighted average UES values for the commercial sector (designated by building type “Com”). DEER2020 building weights are available as a function of program administrator (PA), building type, building location (CZ), and building vintage (by model year). Measure Year-style vintages are mapped to DEER2020 style vintages, also known as eras (Old, “Ex” representing median existing, “Rec” representing recent, and ”New” representing new construction), according to the DEER2020 update.[[9]](#footnote-10) Consolidation of building weights and UES was required as follows to match with the measure offerings.

Since the measure offerings distinguish building age at the era level (“Ex” or “New”), the weights table as indexed by year-style vintage needed to be transformed to align with the indexing of the DEER measure UES and measure offerings. Weights for model year vintages 2003 to 2015 (representing buildings with actual vintages from 2002 to 2016) were summed to determine the weights of the “ex” era for each combination of PA, building type, and building location. For “New” era, there is only one corresponding model year and weight and hence no consolidation was required.

The outcome of the building and vintage weighting process is a set of savings values for the Com building type for two vintages (“Ex” and “New”) and 16 climate zones. The supporting documentation also provides the results for each of the 10 building types in addition to Com.

Peak Electric Demand Reduction (kW)

The DEER peak demand period as defined in DEER2020 was used to calculate peak demand for each model and subsequently used to calculate peak demand reduction for each measure case.[[10]](#footnote-11) The DEER2020 Peak Period Update changed the hours of the day, from 2 to 5 p.m. to 4 to 9 p.m., but not the summer days by climate zone. However, when using the CZ2022 weather data, the actual calendar dates needed to be recalculated from what was determined using the CZ2010 data. This was accomplished by using the DEER method of calculating the three-day window by climate zone but with applying the new CZ2022 8760 ambient temperatures to the “CZ2010 Peak Period Determination – v3.xlsm” workbook.[[11]](#footnote-12) The peak kW savings calculations were done following DEER procedures. The peak period is a three-day summer heat wave specific to each of the 16 climate zones. The three-day period for each climate zone is shown in the table below (assumes a 2009 simulation calendar year, with January 1 occurring on a Thursday).

DEER Peak Period Days by Climate Zone for CZ2022 Weather Data

|  |  |
| --- | --- |
| **Climate Zone** | **Peak Period Days** |
| CZ01, CZ02, CZ03, CZ04 | August 26-28 |
| CZ05 | September 16-18 |
| CZ06, CZ10, CZ12, CZ13, CZ14, CZ15 | June 29-July 1 |
| CZ07, CZ08, CZ09 | September 2-4 |
| CZ11, CZ16 | August 12-14 |

SCE used the combination of the peak period days between the hours of 4-9 p.m. to extract the average electricity usage from each simulation for both the base case and measure cases. The peak savings were calculated as the difference between the electricity consumption between the two cases over the specified time periods by climate zone. These calculations were done using MASControl3 post-processing scripts.

Gas Savings (Therms)

Not applicable.

Life Cycle

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention did not cause the replacement or alteration.

The EUL and RUL specified for the air-cooled chiller measure are presented below. The estimated lifetime of an air-cooled chiller was derived as the median of estimates reported in various retention studies conducted in California. (A New England study reported an estimated life of 23 years[[12]](#footnote-13) that was not accounted for in the EUL adopted for this measure, due to the 20 year cap imposed by the California Public Utilities Commission.[[13]](#footnote-14) Note that RUL is only applicable for add-on equipment, and thus not applicable for this measure.

**Effective Useful Life and Remaining Useful Life**

| **Parameter** | **Value** | **Source** |
| --- | --- | --- |
| EUL (yrs) – measure | 20.0 | San Diego Gas & Electric (SDG&E), Marketing Programs & Planning. 2004. 1994 & 1995 Commercial Energy Efficiency Incentives Ninth Year Retention Evaluation. Study ID Nos. 925 & 961.  Southern California Edison Company. 2006. Southern California Edison Commercial/ Industrial/ Agricultural Energy Efficiency Incentives Program Ninth Year Retention Study. CEC Study ID #558 Calmac Study ID: SCE 0243.01.  ADM Associates, Inc. 2003. Southern California Edison Commercial/Industrial/Agricultural Energy Efficiency Incentives Program Retention Study. Prepared for Southern California Edison Company.  San Diego Gas & Electric. 2006. 1996 & 1997 Nonresidential New Construction Program Ninth Year Retention Evaluation. Study ID No. 1006. |
| RUL (yrs) | n/a | - |

Base Case Material Cost ($/unit)

The base case material cost is representative of minimally efficient Title 24 equipment and was derived from costs provided by distributors of four different equipment manufacturers in 2020. The average cost per ton was calculated for Tier 1 and Tier 2 equipment (both relative to the same base case) for units less than 150 tons and greater than or equal to 150 tons.[[14]](#footnote-15)

Measure Case Material Cost ($/unit)

The measure case material cost was derived from costs provided by distributors of four different equipment manufacturers in 2020. The average cost per ton was calculated for Tier 1 and Tier 2 equipment for units less than 150 tons and greater than or equal to 150 tons.[[15]](#footnote-16)

Base Case Labor Cost ($/unit)

The labor cost is expected to be the same for the installations of base case and measure case equipment. Because the labor cost cancels out in the incremental measure cost calculation, the labor cost was not determined.

Measure Case Labor Cost ($/unit)

The labor cost is expected to be the same for the installations of base case and measure case equipment. Because the labor cost cancels out in the incremental measure cost calculation, the labor cost was not determined.

Net-to-Gross (NTG)

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. These NTG values are based upon the average of all NTG ratios for all evaluated 2006 – 2008 commercial and industrial programs, as documented in the 2011 DEER Update Study conducted by Itron, Inc. This sector average NTG (“default NTG”) is applicable to all energy efficiency measures that have been offered through commercial and industrial sector programs for more than two years and for which impact evaluation results are not available.

Net-to-Gross Ratios

| **Parameter** | **Value** | **Source** |
| --- | --- | --- |
| NTG – Commercial & Industrial | 0.60 | Itron, Inc. 2011. *DEER Database 2011 Update Documentation.* Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.  DEER2019 READI v2.5.1 (NTG ID: “Com-Default>2yrs” & “Ind-Default>2yrs”) |

Gross Savings Installation Adjustment (GSIA)

The gross savings installation adjustment (GSIA) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor varies by end use, sector, technology, application, and delivery method. This GSIA rate is the current “default” rate specified for measures for which an alternative GSIA has not been estimated and approved.

Gross Savings Installation Adjustment Rate

| **Parameter** | **Value** | **Source** |
| --- | --- | --- |
| GSIA | 1.0 | California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 31. |

Non-Energy Impacts

Non-energy impacts for this measure have not been quantified.

DEER Differences Analysis

This section provides a summary of inputs and methods from the Database of Energy Efficient Resources (DEER), and the rationale for inputs and methods that are not DEER-based.

DEER Difference Summary

| **DEER Item** | **Comment / Used for Workpaper** |
| --- | --- |
| Modified DEER methodology | DEER methods used but with different input/performance curve values to capture Path B Air-cooled chiller equipment characteristics currently not supported by DEER |
| Scaled DEER measure | No |
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | DEER2020, READI v2.5.1 |
| Reason for Deviation from DEER | Path B air-cooled chiller measures do not exist in DEER, this Non-DEER workpaper was authorized by CPUC Resolution E-5082. |
| DEER Measure IDs Used | n/a |
| NTG | Source: DEER2019. The NTG of 0.60 is associated with NTG IDs: *Com-Default>2yrs & Ind-Default>2yrs.* |
| GSIA | Source: DEER. The GSIA of 1.0 is associated with GSIA ID: *Def-GSIA* |
| EUL/RUL | Source: DEER2014. The value of 20 years is associated with EUL ID: *HVAC-Chlr*. |

Revision History

Measure Characterization Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision Number** | **Date** | **Primary Author, Title, Organization** | **Revision Summary and Rationale for Revision**  **Effective Date and Approved By** |
| 01 | 2021-02-01 | Andres Fergadiotti, SCE;  Bryan Boyce, Energy Solutions | Initial draft |

1. California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings.* CEC-400-2018-020-CMF. [↑](#footnote-ref-2)
2. Air-Conditioning, Heating, and Refrigeration Institute (AHRI). 2020. AHRI Standard 550/590 (I-P): *Standard for Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle.* Arlington (VA): AHRI. Re-published with Errata Sheet. [↑](#footnote-ref-3)
3. California Public Utilities Commission (CPUC). 2020. *Resolution E-5082*. Aug 27. Page A-42. [↑](#footnote-ref-4)
4. California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings.* CEC-400-2018-020-CMF. [↑](#footnote-ref-5)
5. California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings.* CEC-400-2018-020-CMF. Table 110.2-D. [↑](#footnote-ref-6)
6. California Public Utilities Commission (CPUC). 2020. Resolution E-5082. Aug 27. Page A-42. [↑](#footnote-ref-7)
7. California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings.* CEC-400-2018-020-CMF. [↑](#footnote-ref-8)
8. California Public Utilities Commission (CPUC), Energy Division. (n.d.) “DEER2020-Building-Weights.xlsx.” [↑](#footnote-ref-9)
9. California Public Utilities Commission (CPUC). 2018. Resolution E-4952. Oct 11. Page A-22. Table 4 [↑](#footnote-ref-10)
10. DEER2020 – Peak Period Update <http://deeresources.com/index.php#PkPeriod>; <http://deeresources.com/files/DEER2020/download/CZ2010%20Peak%20Period%20Determination%20-%20v3.xlsm>. [↑](#footnote-ref-11)
11. Ibid. [↑](#footnote-ref-12)
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