



HVAC

WATER-COOLED CHILLER

SWHC005-01

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MEASURE NAME

Water-cooled Chiller

STATEWIDE MEASURE ID

SWHC005-01

TECHNOLOGY SUMMARY

Chilled water systems use a central plant chiller(s) to cool and distribute water that is in turn used to cool air to meet building cooling demand. Water-cooled chillers use a condenser water loop and cooling towers to reject heat from the refrigeration cycle, generally achieving higher efficiencies relative to air-cooled systems. Water-cooled chillers are common in commercial and industrial applications and are available in a wide range of capacities, generally from 100 tons to several thousand tons.

Electrically operated water-cooled chillers are categorized by compressor type and tonnage capacity in efficiency standards such as ASHRAE 90.1 2016¹ and the California 2019 Building Energy Efficiency Standards (Title 24 2019).² Compressor technologies include positive displacement (reciprocating and rotary screw or scroll) and centrifugal.

The efficiency ratings for a water-cooled chiller are based on the unit operating under standard test conditions, normally determined by AHRI Standard 550/590 – 2016³. Chillers have two different energy efficiency rated conditions: 1) Full load efficiency (EER, kWh/Ton) and 2) Part load efficiency (Integrated Part Load Value (IPLV)).

MEASURE CASE DESCRIPTION

The measure case is defined as a variable speed water-cooled chiller for use in nonresidential buildings that exceeds the minimum efficiency requirements set forth by the California 2019 Building Energy Efficiency Standards (Title 24) in both full load and integrated part load conditions. In conformance to Resolution E-4952⁴ two tiers of measure offerings are defined as follows:

- Tier 1, both the full load efficiency (kW/Ton) AND integrated part load efficiency (IPLV) of the chiller technology should exceed Title 24 minimum requirement by 10%.

¹ American Society of Refrigeration and Air-conditioning Engineers (ASHRAE), 2016. *ANSI/ASHRAE/IES Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings*.

² California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings*. CEC-400-2018-020-CMF.

³ Air-Conditioning, Heating, and Refrigeration Institute (AHRI). 2016. *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. February.

⁴ California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11.

- Tier 2, both the full load efficiency (kW/Ton) AND integrated part load efficiency (IPLV) of the chiller technology should exceed Title 24 minimum requirement by 15%.

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

Measure Case Specification

Statewide Measure Offering ID	Measure Offering	Nominal capacity (tons)	% Exceeds Title 24	Full load (kW/Ton)	IPLV (kW/Ton)
SWHC005I	Centrifugal w/ Conventional VSD	< 150	15%	0.591	0.374
SWHC005J			10%	0.626	0.396
SWHC005A	Centrifugal w/ Conventional VSD	150 - 299	15%	0.540	0.340
SWHC005B			10%	0.572	0.360
SWHC005C	Centrifugal w/ Conventional VSD	300 - 399	15%	0.506	0.332
SWHC005D			10%	0.536	0.351
SWHC005E	Centrifugal w/ Conventional VSD	400 - 599	15%	0.497	0.323
SWHC005F			10%	0.527	0.342
SWHC005G	Centrifugal w/ Conventional VSD	≥ 600	15%	0.497	0.323
SWHC005H			10%	0.527	0.342
SWHC005S	Variable Speed Screw	< 75	15%	0.663	0.425
SWHC005T			10%	0.702	0.450
SWHC005O	Variable Speed Screw	75 - 149	15%	0.638	0.417
SWHC005P			10%	0.675	0.441
SWHC005K	Variable Speed Screw	150 - 299	15%	0.578	0.374
SWHC005L			10%	0.612	0.396
SWHC005M	Variable Speed Screw	300 - 599	15%	0.531	0.349
SWHC005N			10%	0.563	0.369
SWHC005Q	Variable Speed Screw	≥ 600	15%	0.497	0.323
SWHC005R			10%	0.527	0.342

BASE CASE DESCRIPTION

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

CODE REQUIREMENTS

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

Applicable State and Federal Codes and Standards

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

The California 2019 Building Energy Efficiency Standards (Title 24)⁵ requires water chillers to meet minimum full-load efficiency (kW/ton) and minimum integrated part-load efficiency (IPLV) values. The Title 24 2019 base case for this above-code measure is listed in section 110.2 (a) Table 110.2-D.

Title 24 also specifies alternate efficiency compliance paths for chiller technology. Path A requires a high full-load efficiency while Path B sets a lower minimum full-load efficiency than Path A but requires a higher minimum integrated part-load efficiency. The measure offerings specified for this measure are variable speed chillers that fall under Path B compliance.

For a given chiller, there will always be both a rated full-load (kW/Ton) and part-load (IPLV) efficiency. The selection of an efficiency tier level must be based on both of these parameters. If the rated full-load efficiency and the rated IPLV are both greater than or equal to the DEER established tier levels, then that tier is valid.

Water-cooled chillers with a leaving evaporator fluid temperature higher than 32°F shall show compliance with Table 110.2-D of Title 24 when tested or certified with water at standard rating conditions. The table below shows the requirements for Path B compliance.

Water Chilling Packages - Minimum Efficiency Requirements: Path B⁶

Equipment Type	Size Category (tons)	Maximum Allowable Full-load (kW/ton)	Maximum Allowable IPLV (kW/ton)
Centrifugal w/ Conventional VSD	< 150	0.695	0.440
Centrifugal w/ Conventional VSD	150 - 299	0.635	0.400
Centrifugal w/ Conventional VSD	300 - 399	0.595	0.390
Centrifugal w/ Conventional VSD	400 - 599	0.585	0.380
Centrifugal w/ Conventional VSD	≥ 600	0.585	0.380
Variable Speed Screw	< 75	0.780	0.500
Variable Speed Screw	75 - 149	0.750	0.490
Variable Speed Screw	150 - 299	0.680	0.440
Variable Speed Screw	300 - 599	0.625	0.410
Variable Speed Screw	≥ 600	0.585	0.380

⁵ California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)*. CEC-400-2018-020-CMF.

⁶ California Energy Commission (CEC). 2018. *2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24)*. CEC-400-2018-020-CMF. Table 110.2-D.

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

Measure Application Type	Delivery Type	Sector
Normal replacement (NR)	UpDeemed	Com
New construction (NC)	UpDeemed	Com
Normal replacement (NR)	DnDeemed	Com
New construction (NC)	DnDeemed	Com
Normal replacement (NR)	DnDeemDI	Com
New construction (NC)	DnDeemDI	Com

Eligible Products

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

Eligible Building Types and Vintages

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

Eligible Climate Zones

This measure is applicable in all California climate zones.

PROGRAM EXCLUSIONS

All measures related to constant speed screw, constant speed centrifugal, and frictionless chillers are excluded due to the stringency of the tiers specified for the 2020 update of the Database of Energy Efficient Resources (DEER) and equipment availability in the market.

DATA COLLECTION REQUIREMENTS

Data requirements include a market assessment of latest chiller technology including performance characterization to support the update/expansion of measure offerings and to evaluate efficiency tiers to better align with market. .

Further, Path B chillers focus primarily on integrated part load value (IPLV) and less on full-load efficiency. Hence, specifying the same efficiency tiers for full-load efficiency and IPLV will not allow Path B chillers to meet the measure requirements. Resolution E-4952⁷ recognizes that establishing a threshold for efficiency based solely on the IPLV would require a considerable primary research effort.

USE CATEGORY

HVAC

ELECTRIC SAVINGS (kWh)

High efficiency chillers range widely in rated kW/ton performance at both full load and part load conditions; 20 combinations of high-performance chiller technologies were used to document savings of these measure offerings. Centrifugal chillers are often designed to operate at conditions other than those specified by AHRI 550/590.⁸ The 2019 California Building Energy Efficiency Standards (Title 24) provides tables with the different full and part load minimum operating efficiencies required for non-standard operating conditions. (See Code Requirements.)

The electric unit energy savings (UES) of a water-cooled chiller were retrieved directly from the Database of Energy Efficient Resources (DEER). UES values were provided for each climate zone, for each of 10 nonresidential building types,⁹ for existing and new vintages, and for variable speed (Path B) chillers. The version used to support savings for these measures is DEER 2020 (version D20 v0). The results were reported in the Remote Ex-Ante Database Interface (READI) tool v2.5.1.

⁷ California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. Page A-64.

⁸ Air-Conditioning, Heating, and Refrigeration Institute (AHRI). 2016. 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. February.

⁹ Values were available for the following building types: education - community college (ECC), education - secondary school (Ese), education - university (EUn), health/medical – hospital (Hsp), lodging – hotel (Htl), manufacturing – biotech (MBT), health/medical – nursing home (Nrs), office – large (OfL), office – small (OfS), retail – multi-story large (Rt3).

The DEER Energy Impact IDs and the associated Measure Offering IDs and description are provided below.

Measure Offering IDs and DEER Measure IDs

Statewide Measure Offering ID	DEER Energy Impact ID	Measure Offering Description
SWHC005A	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-150to299tons-0.54kwpton-0.34IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (150 to 299 tons, 0.54 Max kW/ton, 0.34 Max IPLV)
SWHC005B	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-150to299tons-0.572kwpton-0.36IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (150 to 299 tons, 0.572 Max kW/ton, 0.36 Max IPLV)
SWHC005C	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-300to399tons-0.506kwpton-0.332IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (300 to 399 tons, 0.506 Max kW/ton, 0.332 Max IPLV)
SWHC005D	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-300to399tons-0.536kwpton-0.351IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (300 to 399 tons, 0.536 Max kW/ton, 0.351 Max IPLV)
SWHC005E	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-400to599tons-0.497kwpton-0.323IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (400 to 599 tons, 0.497 Max kW/ton, 0.323 Max IPLV)
SWHC005F	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-400to599tons-0.527kwpton-0.342IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (400 to 599 tons, 0.527 Max kW/ton, 0.342 Max IPLV)
SWHC005G	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-gte600tons-0.497kwpton-0.323IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (>= 600 tons, 0.497 Max kW/ton, 0.323 Max IPLV)
SWHC005H	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-gte600tons-0.527kwpton-0.342IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (>= 600 tons, 0.527 Max kW/ton, 0.342 Max IPLV)
SWHC005I	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-lt150tons-0.591kwpton-0.374IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (< 150 tons, 0.591 Max kW/ton, 0.374 Max IPLV)
SWHC005J	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-lt150tons-0.626kwpton-0.396IPLV-VarSpd-CndRlf	Water Cooled Centrifugal Chiller w/1 conventional VSD compressor and condenser relief (< 150 tons, 0.626 Max kW/ton, 0.396 Max IPLV)
SWHC005K	NE-HVAC-Chlr-WtrCldScrewChlr-150to299tons-0.578kwpton-0.374IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (150 to 299 tons, 0.578 Max kW/ton, 0.374 Max IPLV)
SWHC005L	NE-HVAC-Chlr-WtrCldScrewChlr-150to299tons-0.612kwpton-0.396IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (150 to 299 tons, 0.612 Max kW/ton, 0.396 Max IPLV)
SWHC005M	NE-HVAC-Chlr-WtrCldScrewChlr-300to599tons-0.531kwpton-0.349IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (300 to 599 tons, 0.531 Max kW/ton, 0.349 Max IPLV)
SWHC005N	NE-HVAC-Chlr-WtrCldScrewChlr-300to599tons-0.563kwpton-0.369IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (300 to 599 tons, 0.563 Max kW/ton, 0.369 Max IPLV)

Statewide Measure Offering ID	DEER Energy Impact ID	Measure Offering Description
SWHC005Q	NE-HVAC-ChlR-WtrCldScrewChlR-75to149tons-0.638kwpton-0.417IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (75 to 149 tons, 0.638 Max kW/ton, 0.417 Max IPLV)
SWHC005R	NE-HVAC-ChlR-WtrCldScrewChlR-75to149tons-0.675kwpton-0.441IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (75 to 149 tons, 0.675 Max kW/ton, 0.441 Max IPLV)
SWHC005Q	NE-HVAC-ChlR-WtrCldScrewChlR-gte600tons-0.497kwpton-0.323IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (>= 600 tons, 0.497 Max kW/ton, 0.323 Max IPLV)
SWHC005R	NE-HVAC-ChlR-WtrCldScrewChlR-gte600tons-0.527kwpton-0.342IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (>= 600 tons, 0.527 Max kW/ton, 0.342 Max IPLV)
SWHC005S	NE-HVAC-ChlR-WtrCldScrewChlR-lt75tons-0.663kwpton-0.425IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (< 75 tons, 0.663 Max kW/ton, 0.425 Max IPLV)
SWHC005T	NE-HVAC-ChlR-WtrCldScrewChlR-lt75tons-0.702kwpton-0.45IPLV-VarSpd	Water Cooled Variable Speed Screw Chiller (< 75 tons, 0.702 Max kW/ton, 0.45 Max IPLV)

Since chiller upstream programs do not track the specific building type of the chiller installation, DEER2020 building weights¹⁰ were used to calculate the weighted 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 (climate zone, CZ), and building vintage (by model year). Year-style vintages are mapped to DEER2020 style vintages (old, “ex” representing median existing, recent, and new). Consolidation of building weights and UES was required as follows to match with the measure offerings.

1. Since the measure offerings distinguish building age at the era-style vintages, 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. Example, 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.
2. The DEER2020 UES values for “new” are provided for “Any” PA; however, the weights table is indexed by specific PAs. Hence, for “new”, the weights of all the PAs were combined in each climate zone that intersects the service areas of more than one PA.
3. The DEER2020 UES values for “old, ex, recent” are provided for each specific PA (SCE, PGE, SDG), so there are multiple UES entries in each climate zone that intersects more than one PA service area. For example, “ex” vintage UES for CZ15 are provided for SCE, PGE, and SDG. In such cases the corresponding PA specific weights from Step 1 were applied.
4. For ease of implementation the UES values for “old” and “ex” were consolidated using weighted average into “ex”, and “rec” has been removed.

¹⁰ California Public Utilities Commission (CPUC), Energy Division. (n.d.) “DEER2020-Building-Weights.xlsx.”

5. Finally, using the above steps, weighted average energy and demand UES are calculated and presented as combinations for any PA; commercial (com) building type; ex and new vintages and all 16 CZs. Please refer to the calculation file¹¹ for details.

Note that the DEER measure impacts are based on the DEER2020 impact IDs “AStdWBkWh” for energy and “AStdWBkW” for demand, per building type “COM”, and for all 16 California climate zones.

PEAK ELECTRIC DEMAND REDUCTION (kW)

The peak demand reduction values for a water-cooled chiller were retrieved directly from the Database of Energy Efficient Resources (DEER). See Electric Savings for an explanation of the approach.

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 not caused the replacement or alteration.

The EUL and RUL specified for the water-cooled chiller measure are presented below. The estimated lifetime of a water-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 years¹² 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) Note that RUL is only applicable for add-on equipment and is not applicable for this measure.

¹¹ Southern California Edison (SCE). 2019. “SHWC005-01 Water-cooled chiller analysis.xlsx.”

¹² GDS Associates, Inc. 2007. *Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures. Prepared for the New England State Program Working Group (SPWG).*

¹³ California Public Utilities Commission (CPUC), Energy Division. 2003. *Energy Efficiency Policy Manual v 2.0.* Page 16.

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. <i>1994 & 1995 Commercial Energy Efficiency Incentives Ninth Year Retention Evaluation</i> . Study ID Nos. 925 & 961. Southern California Edison Company. 2006. <i>Southern California Edison Commercial/ Industrial/ Agricultural Energy Efficiency Incentives Program Ninth Year Retention Study</i> . CEC Study ID #558 Calmac Study ID: SCE 0243.01. ADM Associates, Inc. 2003. <i>Southern California Edison Commercial/Industrial/Agricultural Energy Efficiency Incentives Program Retention Study</i> . Prepared for Southern California Edison Company. San Diego Gas & Electric. 2006. <i>1996 & 1997 Nonresidential New Construction Program Ninth Year Retention Evaluation</i> . Study ID No. 1006.
RUL (yrs)	n/a	-

BASE CASE MATERIAL COST (\$/UNIT)

The base case material cost was derived from cost data collected in 2017 from a single manufacturer of water-cooled variable speed centrifugal chiller of varying capacity ranges¹⁴ that meet the minimum requirements of the California 2016 Building Energy Efficiency Standards (Title 24). Note that the minimum water-cooled chiller efficiency requirements did not change from 2016 to 2019 (see Code Requirements).

A regression equation was developed by plotting a trend line for centrifugal chiller using capacity categories and costs. The baseline costs for screw-type chillers were then calculated using the regression equation. For each size category, the trend line for the centrifugal units was used to estimate missing base case costs for screw chiller technology. For this analysis, it was assumed that the cost by size category for positive displacement chillers approximates that of centrifugal chillers.

MEASURE CASE MATERIAL COST (\$/UNIT)

The measure material case cost was derived from 2017 equipment cost data provided by a single manufacturer given current market availability. A portion of cost data was verified against program participation data from prior years. (For instance, and when available, the magnitude of the cost value and deviation between the new material cost and historical cost were compared.)

The chiller technology represented in the cost data were classified into tiers, according to the measure case definition and based on the requirements of the 2017 Database for Energy Efficient Resources (DEER): Tier 1 (10% above Title 24) and Tier 2 (15% percent above Title 24). An average incremental cost for each capacity range was calculated for each tier using the manufacturer cost data.

A regression equation was developed from trend line of centrifugal chillers using size categories and incremental costs. The incremental measure costs (IMC) for screw type chillers were then calculated using the regression equation.

¹⁴ Southern California Edison (SCE). 2019. "SHWC005-01-Cost Analysis .xlsx."

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. This NTG value is based on DEER NTG ID: Com-Default>2yrs, DEER2019 version. This is further based upon the average of all NTG ratios for all evaluated 2006 – 2008 commercial 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 sector programs for more than two years and for which impact evaluation results are not available. The NTG for chiller is further authenticated in Resolution E-4952 (Page A-52).

Net-to-Gross Ratios

Parameter	Value	Source
NTG - commercial	0.60	Itron, Inc. 2011. <i>DEER Database 2011 Update Documentation</i> . Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.

GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)

The gross savings installation adjustment (GSIA) 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 Rates

Parameter	Value	Source
GSIA	1.0	California Public Utilities Commission (CPUC), Energy Division. 2013. <i>Energy Efficiency Policy Manual Version 5</i> . Page 31.

NON-ENERGY IMPACTS

Non-energy benefits 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	No
Scaled DEER measure	No
DEER Base Case	Yes
DEER Measure Case	Yes
DEER Building Types	Yes
DEER Operating Hours	Yes
DEER eQUEST Prototypes	Yes
DEER Version	DEER 2020, READI v2.5.1
Reason for Deviation from DEER	n/a
DEER Measure IDs Used	NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-lt150tons-0.591kwpton-0.374IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-lt150tons-0.626kwpton-0.396IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-150to299tons-0.54kwpton-0.34IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-150to299tons-0.572kwpton-0.36IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-300to399tons-0.506kwpton-0.332IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-300to399tons-0.536kwpton-0.351IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-400to599tons-0.497kwpton-0.323IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-400to599tons-0.527kwpton-0.342IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-gte600tons-0.497kwpton-0.323IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldCentChlr-Conv-1Cmp-gte600tons-0.527kwpton-0.342IPLV-VarSpd-CndRlf NE-HVAC-Chlr-WtrCldScrewChlr-lt75tons-0.663kwpton-0.425IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-lt75tons-0.702kwpton-0.45IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-150to299tons-0.578kwpton-0.374IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-150to299tons-0.612kwpton-0.396IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-300to599tons-0.531kwpton-0.349IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-300to599tons-0.563kwpton-0.369IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-75to149tons-0.638kwpton-0.417IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-75to149tons-0.675kwpton-0.441IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-gte600tons-0.497kwpton-0.323IPLV-VarSpd NE-HVAC-Chlr-WtrCldScrewChlr-gte600tons-0.527kwpton-0.342IPLV-VarSpd
NTG	Source: DEER2019. The NTG of 0.60 is associated with NTG ID: <i>Com-Default>2yrs</i>

DEER Item	Comment / Used for Workpaper
GSIA	Source: DEER2011. The GSIA of 1.0 is associated with GSIA ID: <i>Def-GSIA</i>
EUL/RUL	Source: DEER2014. The value of 20 years is associated with EUL ID: <i>HVAC-Chlr.</i>

REVISION HISTORY

Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision
01	06/30/2018	Jennifer Holmes Cal TF Staff	Draft of consolidated text for this statewide measure is based upon: SCE17HCO43, Revision 0 (November 14, 2017) SCE13HC043, Revision 2 (January 15, 2016) SCE13HC043, Revision 1 (May 14, 2014) Consensus reached among Cal TF members.
	05/06/2019	Akhilesh Endurthy Solaris Technical	Updated based on DEER2020/ E-4952 New Statewide workpaper template Add New Construction (NC) MAT
	05/31/2019	Jennifer Holmes Cal TF Staff	Revisions for submittal of version 01.