|  |
| --- |
| HVAC  Unitary Air-Cooled AC or Heat Pump,  < 65 kBtuh, Commercial  SWHC014-01 |

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Measure Name

Unitary Air-Cooled Air Conditioner or Heat Pump, < 65 kBtuh, Commercial

Statewide Measure ID

SWHC014-01

Technology Summary

A unitary system is an air conditioning system that cools one or a few spaces, in contrast to a centralized system where a chiller serves most or all of the building. A unitary system uses direct expansion (DX), is typically factory designed, and is available as a packaged or split system for commercial use. A split system consists of an indoor unit (fan, cooling coil, heating elements, filter) connected by refrigerant piping to an outdoor unit (fan, compressor, condenser, expansion valve). A packaged system incorporates all the components into a single unit that is typically mounted on a roof. Heat pumps allow the refrigeration cycle to run in reverse and can therefore provide both heating or cooling for a conditioned space.

Measure Case Description

The measure case is defined as an air-cooled air conditioner or heat pump with a cooling capacity < 65 kBtuh, installed in a nonresidential building. The minimum efficiency requirements of measure offerings are specified below.

Measure Case Specification

| **Unit Type** | **Cooling Capacity Range (kBtuh)** | **Seasonal Energy Efficiency Rating (SEER)** | **Pre-economizer?** |
| --- | --- | --- | --- |
| Packaged AC | < 55 | 15 | No |
| Packaged AC | < 55 | 16 | No |
| Packaged AC | < 55 | 17 | No |
| Packaged AC | < 55 | 18 | No |
| Packaged AC | 55 - 65 | 15 | No |
| Packaged AC | 55 - 65 | 16 | No |
| Packaged AC | 55 - 65 | 17 | No |
| Packaged AC | 55 - 65 | 18 | No |
| Split AC | < 45 | 15 | No |
| Split AC | < 45 | 16 | No |
| Split AC | < 45 | 17 | No |
| Split AC | < 45 | 18 | No |
| Split AC | 45 - 55 | 15 | No |
| Split AC | 45 - 55 | 16 | No |
| Split AC | 45 - 55 | 17 | No |
| Split AC | 45 - 55 | 18 | No |
| Split AC | 55 - 65 | 15 | No |
| Split AC | 55 - 65 | 16 | No |
| Split AC | 55 - 65 | 17 | No |
| Split AC | 55 - 65 | 18 | No |
| Packaged HP | < 55 | 15 | No |
| Packaged HP | < 55 | 16 | No |
| Packaged HP | < 55 | 17 | No |
| Packaged HP | 55 - 65 | 15 | No |
| Packaged HP | 55 - 65 | 16 | No |
| Packaged HP | 55 - 65 | 17 | No |
| Split HP | < 55 | 15 | No |
| Split HP | < 55 | 16 | No |
| Split HP | < 55 | 17 | No |
| Split HP | < 55 | 18 | No |
| Split HP | 55 - 65 | 15 | No |
| Split HP | 55 - 65 | 16 | No |
| Split HP | 55 - 65 | 17 | No |
| Split HP | 55 - 65 | 18 | No |

Base Case Description

The base case is defined as an existing air-cooled air conditioner or heat pump with cooling capacity < 65 kBtuh in a nonresidential building that meets the federal minimum efficiency standard of 14 SEER. (See Code Requirements).

Code Requirements

Both state and federal standards govern the energy performance of packaged and split system AC and heat pumps. The standards referenced below establish the minimum SEER of 14.0 for three-phase package AC units, both split and package heat pumps, and the minimum SEER of 13.0 for three-phase split systems < 65 kBtu/h.[[1]](#footnote-1) The California Building Energy Efficiency Standards (Title 24) is not applicable because it applies only to unitary air conditioning and heat pump units > 65 kBtuh.

Applicable State and Federal Codes and Standards

|  |  |  |
| --- | --- | --- |
| **Code** | **Applicable Code Reference** | **Effective Date** |
| CA Appliance Efficiency Regulations – Title 20 (2019) | Section 1605.1, Table C-4 | January 1, 2015 |
| CA Building Energy Efficiency Standards – Title 24 | None | n/a |
| Federal Standards | 10 CFR 430.32(c)  10 CFR 431.97, Table 1. | January 1, 2015 |

Normalizing Unit

Per cooling ton

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 |

Eligible Products

Eligible products must meet the specification presented in the Measure Case Description; minimum efficiency requirements by tier are listed in the table below. Tier 1 specifications are derived from the Tier 2 CEE Commercial Unitary Air Conditioner Specifications. Tiers 2, 3 and 4 promote higher efficiency units offered by the HVAC industry. Note that a unit must meet either the SEER or EER requirement, it is not required to meet both.

Minimum Efficiency Requirements

| **Unit Type** | **Tier** | **Minimum SEER** | **Minimum EER** |
| --- | --- | --- | --- |
| Packaged AC | Code | 14 | 11.6 |
| Tier 1 | 15 | 12.0 |
| Tier 2 | 16 | 12.4 |
| Tier 3 | 17 | 13.0 |
| Tier 4 | 18 | 14.0 |
| Split System AC | Code | 14 | 12.0 |
| Tier 1 | 15 | 12.5 |
| Tier 2 | 16 | 13.0 |
| Tier 3 | 17 | 13.5 |
| Tier 4 | 18 | 14.0 |
| Packaged Air-cooled Heat Pump | Code | 14 | 11.6 |
| Tier 1 | 15 | 12.0 |
| Tier 2 | 16 | 12.4 |
| Tier 3 | 17 | 13.0 |
| Tier 4 | 18 | 14.0 |
| Split System Air-cooled Heat Pump | Code | 14 | 12.0 |
| Tier 1 | 15 | 12.5 |
| Tier 2 | 16 | 13.0 |
| Tier 3 | 17 | 13.5 |
| Tier 4 | 18 | 14.0 |

Additional eligibility requirements include:

* All unitary AC equipment is eligible.
* The replacement must be “like for like” (i.e., a heat pump for a heat pump)
* Retrofitted equipment must have cooling capacity (e.g., Btu/h) within +/- 5% of existing equipment OR the contractor must provide a load calculation verifying that the new unit is sized correctly for the load.

Eligible Building Types and Vintages

This measure is applicable for all nonresidential building types and vintages.

Eligible Climate Zones

This measure is applicable in any California climate zones.

Program Exclusions

Central systems and domestic hot water systems are not eligible.

Data Collection Requirements

Data collection requirements are to be determined.

Use Category

HVAC

Electric Savings (kWh)

The electric energy savings of a unitary air-cooled air conditioners and heat pumps < 65 kBtuh were drawn directly from the Database of Energy Efficient Resources (DEER). The version used to calculate savings for these measures is DEER2020. The results were reported in the Remote Ex-Ante Database Interface (READI) tool; the results have not been modified.

Since DEER does not have measures for 18 SEER packaged heat pumps, those savings were taken directly from DEER using the lower savings values for 17 SEER equipment.

Electric savings values vary by building type, building vintage, and climate zone. All DEER “Com” building types as well as the “existing” vintage (“Ex”, weighted DEER vintages) and all climate zones were used.

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

Measure Offering IDs and DEER Measure IDs

| **Statewide Measure Offering ID** | **DEER Energy Impact ID** | **Measure Offering Description** |
| --- | --- | --- |
| SWHC014A | NE-HVAC-airAC-Pkg-lt55kBtuh-15p0seer | Unitary Air-Cooled, Commercial, Packaged AC, < 55 kBTU/h, 15 SEER, with No Economizer |
| SWHC014B | NE-HVAC-airAC-Pkg-lt55kBtuh-16p0seer | Unitary Air-Cooled, Commercial, Packaged AC, < 55 kBTU/h, 16 SEER, with No Economizer |
| SWHC014C | NE-HVAC-airAC-Pkg-lt55kBtuh-17p0seer | Unitary Air-Cooled, Commercial, Packaged AC, < 55 kBTU/h, 17 SEER, with No Economizer |
| SWHC014D | NE-HVAC-airAC-Pkg-lt55kBtuh-18p0seer | Unitary Air-Cooled, Commercial, Packaged AC, < 55 kBTU/h, 18 SEER, with No Economizer |
| SWHC014E | NE-HVAC-airAC-Pkg-55to65kBtuh-15p0seer | Unitary Air-Cooled, Commercial, Packaged AC, 55 - 65 kBTU/h, 15 SEER, with No Economizer |
| SWHC014F | NE-HVAC-airAC-Pkg-55to65kBtuh-16p0seer | Unitary Air-Cooled, Commercial, Packaged AC, 55 - 65 kBTU/h, 16 SEER, with No Economizer |
| SWHC014G | NE-HVAC-airAC-Pkg-55to65kBtuh-17p0seer | Unitary Air-Cooled, Commercial, Packaged AC, 55 - 65 kBTU/h, 17 SEER, with No Economizer |
| SWHC014H | NE-HVAC-airAC-Pkg-55to65kBtuh-18p0seer | Unitary Air-Cooled, Commercial, Packaged AC, 55 - 65 kBTU/h, 18 SEER, with No Economizer |
| SWHC014I | NE-HVAC-airAC-Split-lt45kBtuh-15p0seer | Unitary Air-Cooled, Commercial, Split AC, < 45 kBTU/h, 15 SEER, with No Economizer |
| SWHC014J | NE-HVAC-airAC-Split-lt45kBtuh-16p0seer | Unitary Air-Cooled, Commercial, Split AC, < 45 kBTU/h, 16 SEER, with No Economizer |
| SWHC014K | NE-HVAC-airAC-Split-lt45kBtuh-17p0seer | Unitary Air-Cooled, Commercial, Split AC, < 45 kBTU/h, 17 SEER, with No Economizer |
| SWHC014L | NE-HVAC-airAC-Split-lt45kBtuh-18p0seer | Unitary Air-Cooled, Commercial, Split AC, < 45 kBTU/h, 18 SEER, with No Economizer |
| SWHC014M | NE-HVAC-airAC-Split-45to55kBtuh-15p0seer | Unitary Air-Cooled, Commercial, Split AC, 45 - 55 kBTU/h, 15 SEER, with No Economizer |
| SWHC014N | NE-HVAC-airAC-Split-45to55kBtuh-16p0seer | Unitary Air-Cooled, Commercial, Split AC, 45 - 55 kBTU/h, 16 SEER, with No Economizer |
| SWHC014O | NE-HVAC-airAC-Split-45to55kBtuh-17p0seer | Unitary Air-Cooled, Commercial, Split AC, 45 - 55 kBTU/h, 17 SEER, with No Economizer |
| SWHC014P | NE-HVAC-airAC-Split-45to55kBtuh-18p0seer | Unitary Air-Cooled, Commercial, Split AC, 45 - 55 kBTU/h, 18 SEER, with No Economizer |
| SWHC014Q | NE-HVAC-airAC-Split-55to65kBtuh-15p0seer | Unitary Air-Cooled, Commercial, Split AC, 55 - 65 kBTU/h, 15 SEER, with No Economizer |
| SWHC014R | NE-HVAC-airAC-Split-55to65kBtuh-16p0seer | Unitary Air-Cooled, Commercial, Split AC, 55 - 65 kBTU/h, 16 SEER, with No Economizer |
| SWHC014S | NE-HVAC-airAC-Split-55to65kBtuh-17p0seer | Unitary Air-Cooled, Commercial, Split AC, 55 - 65 kBTU/h, 17 SEER, with No Economizer |
| SWHC014T | NE-HVAC-airAC-Split-55to65kBtuh-18p0seer | Unitary Air-Cooled, Commercial, Split AC, 55 - 65 kBTU/h, 18 SEER, with No Economizer |
| SWHC014U | NE-HVAC-airHP-Pkg-lt55kBtuh-15p0seer-8p2hspf | Unitary Air-Cooled, Commercial, Packaged HP, < 55 kBTU/h, 15 SEER, with No Economizer |
| SWHC014V | NE-HVAC-airHP-Pkg-lt55kBtuh-16p0seer-8p5hspf | Unitary Air-Cooled, Commercial, Packaged HP, < 55 kBTU/h, 16 SEER, with No Economizer |
| SWHC014W | NE-HVAC-airHP-Pkg-lt55kBtuh-17p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Packaged HP, < 55 kBTU/h, 17 SEER, with No Economizer |
| SWHC014X | NE-HVAC-airHP-Pkg-lt55kBtuh-17p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Packaged HP, < 55 kBTU/h, 18 SEER, with No Economizer |
| SWHC014Y | NE-HVAC-airHP-Pkg-55to65kBtuh-15p0seer-8p2hspf | Unitary Air-Cooled, Commercial, Packaged HP, 55 - 65 kBTU/h, 15 SEER, with No Economizer |
| SWHC014Z | NE-HVAC-airHP-Pkg-55to65kBtuh-16p0seer-8p5hspf | Unitary Air-Cooled, Commercial, Packaged HP, 55 - 65 kBTU/h, 16 SEER, with No Economizer |
| SWHC014AA | NE-HVAC-airHP-Pkg-55to65kBtuh-17p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Packaged HP, 55 - 65 kBTU/h, 17 SEER, with No Economizer |
| SWHC014AB | NE-HVAC-airHP-Pkg-55to65kBtuh-17p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Packaged HP, 55 - 65 kBTU/h, 18 SEER, with No Economizer |
| SWHC014AC | NE-HVAC-airHP-Split-lt55kBtuh-15p0seer-8p7hspf | Unitary Air-Cooled, Commercial, Split HP, < 55 kBTU/h, 15 SEER, with No Economizer |
| SWHC014AD | NE-HVAC-airHP-Split-lt55kBtuh-16p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Split HP, < 55 kBTU/h, 16 SEER, with No Economizer |
| SWHC014AE | NE-HVAC-airHP-Split-lt55kBtuh-17p0seer-9p4hspf | Unitary Air-Cooled, Commercial, Split HP, < 55 kBTU/h, 17 SEER, with No Economizer |
| SWHC014AF | NE-HVAC-airHP-Split-lt55kBtuh-18p0seer-9p7hspf | Unitary Air-Cooled, Commercial, Split HP, < 55 kBTU/h, 18 SEER, with No Economizer |
| SWHC014AG | NE-HVAC-airHP-Split-55to65kBtuh-15p0seer-8p7hspf | Unitary Air-Cooled, Commercial, Split HP, 55 - 65 kBTU/h, 15 SEER, with No Economizer |
| SWHC014AH | NE-HVAC-airHP-Split-55to65kBtuh-16p0seer-9p0hspf | Unitary Air-Cooled, Commercial, Split HP, 55 - 65 kBTU/h, 16 SEER, with No Economizer |
| SWHC014AI | NE-HVAC-airHP-Split-55to65kBtuh-17p0seer-9p4hspf | Unitary Air-Cooled, Commercial, Split HP, 55 - 65 kBTU/h, 17 SEER, with No Economizer |
| SWHC014AJ | NE-HVAC-airHP-Split-55to65kBtuh-18p0seer-9p7hspf | Unitary Air-Cooled, Commercial, Split HP, 55 - 65 kBTU/h, 18 SEER, with No Economizer |

Peak Electric Demand Reduction (kW)

The peak demand reduction of a unitary air-cooled air conditioners and heat pumps < 65 kBtuh were drawn directly from the Database of Energy Efficient Resources (DEER). The version used to calculate savings for these measures is DEER2020. The results were reported in the Remote Ex-Ante Database Interface (READI) tool; the results have not been modified.

Since DEER does not have measures for 18 SEER packaged heat pumps, those savings were taken directly out from DEER using the lower savings values of 17 SEER.

See Electric Savings for additional details.

Gas Savings (Therms)

The gas unit energy savings of a unitary air-cooled air conditioners and heat pumps < 65 kBtuh were drawn directly from the Database of Energy Efficient Resources (DEER). The version used to calculate savings for these measures is DEER2020. The results were reported in the Remote Ex-Ante Database Interface (READI) tool; the results have not been modified.

Since DEER does not have measures for 18 SEER packaged heat pumps, those savings were taken directly out from DEER using the lower savings values of 17 SEER.

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 unitary air-cooled air conditioner and heat pump units are presented Below. The estimated lifetime of this measure was retrieved from the Energy Efficiency Policy Manual, v. 2.0 (2003). Note that RUL is only applicable for add-on equipment and accelerated replacement installations and is not applicable for this measure.

Table : Effective Useful Life and Remaining Useful Life

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Source** |
| EUL – Rated years | 15.0 | California Public Utilities Commission (CPUC), Energy Division.  2003. Energy Efficiency Policy Manual v 2.0. Page 17. |
| RUL - Rated years | n/a | n/a |

Base Case Material Cost ($/unit)

Base case equipment costs for split and packaged AC units (13 and 14 SEER only) and HP units (13, 14, and 15 SEER only) were obtained from the *2010–2012 WO017 Ex Ante Measure Cost Study* conducted by Itron, Inc.[[2]](#footnote-2) All measure offerings except the to-code units use the 14 SEER costs as base case costs. The to-code measure offerings are assigned the 13 SEER costs as base case costs.[[3]](#footnote-3)

Measure Case Material Cost ($/unit)

Measure case equipment costs for split and packaged AC units (13 and 14 SEER only) and HP units (13, 14, and 15 SEER only) were obtained from the *2010–2012 WO017 Ex Ante Measure Cost Study* conducted by Itron, Inc.[[4]](#footnote-4) These costs were first converted to per-ton costs and then linearly extrapolated to determine costs for up all units up to 18 SEER.[[5]](#footnote-5)

The cost for the single phase 15 SEER air conditioners and heat pumps are the same as the three-phase 15 SEER AC and HP costs.

Base Case Labor Cost ($/unit)

The base case installation labor costs were derived using the same approach as the base case material costs. See Base Case Material Cost.

Measure Case Labor Cost ($/unit)

The measure case installation labor costs were derived using the same approach as the measure case material costs. See Base Case Material Cost.

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. The relevant NTG values for all packaged and split system air conditioner and heat pump replacements are specified below. The NTG for this measure was stipulated by the California Public Utilities Commission (CPUC) Energy Division in Resolution E-4952, which approved the Database for Energy Efficient Resources (DEER) for 2020. This NTG value is based upon results presented in the 2015 Upstream HVAC Programs.[[6]](#footnote-6)

**Net-to-Gross Ratios**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Source** |
| NTG - All package HVAC AC and HP replacements with upstream incentives | 0.65 | California Public Utilities Commission (CPUC). 2018. Resolution E-4952. October 12. Page 36, Table 7. |

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. The assigned GSIA value for this measure is specified below. 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. *Energy Efficiency Policy Manual Version 5*. 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** |
| --- | --- |
| 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 | No |
| DEER Version | DEER2020 |
| Reason for Deviation from DEER | Most of the measures are drawn directly from DEER. DEER2020 contains measures for up to 18 SEER packaged ACs, split system ACs, and split system HPs, and up to 17 SEER packaged HPs. The savings for 17 SEER units were taken for 18 SEER packaged HPs |
| DEER Measure IDs Used |  |
| NTG | Source: DEER2020. The NTG of 0.65 is associated with NTG ID: *NonRes-sAll-mHVAC-DX-up* |
| GSIA | Source: DEER. The GSIA of 1.0 is associated with GSIA ID: *Def-GSIA* |
| EUL/RUL | Source: DEER. The value of 15 years is associated with EUL ID: *HVAC-airAC, HVAC-airHP* |

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 | 06/30/2018 | Jennifer Holmes  Cal TF Staff | Draft of consolidated text for this statewide measure is based upon:  PGECOHVC126, Revision 7 (July 1, 2017)  WPSDGENRHC0023, Revision 2 (January 2, 2018) – short form  SCE17HC012, Revision 1 (February 2, 2018) – short form  Consensus reached among Cal TF members. |
| 01 | 10/04/2019 | Henry Liu  PG&E,  Bryan Boyce and Garrett Hedberg  Energy Solutions | Updated energy impacts with DEER2020 values.  Updated NTG.  Finalized workpaper document in statewide format and created MeasureDataSpec and EAD Tables. |
| 01 | 11/15/2019 | Henry Liu  PG&E,  Bryan Boyce and Garrett Hedberg  Energy Solutions | Corrected typo in the Measure Case Description, removed to-code language from workpaper, in response to CPUC feedback.  Additional QC on MeasureDataSpec and EAD Tables, minor editorial/references adjusted. Corrected CZ16 savings in EAD table from PG&E to SCE DEER values. |

1. California Energy Commission (CEC). 2019. California Code of Regulations Title 20. CEC-140-2019-002. January. Section 1605.1, Table C-4.

   Code of Federal Regulations at 10 CFR 431.97.

   Code of Federal Regulations at 10 CFR 430.32. [↑](#footnote-ref-1)
2. Itron, Inc. 2014. 2010-2012 WO017 Ex Ante Measure Cost Study Final Report. Prepared for the California Public Utilities Commission.  [↑](#footnote-ref-2)
3. Pacific Gas and Electric (PG&E). 2017. “SWHC014-01 Cost Calculations.xlsx.” [↑](#footnote-ref-3)
4. Itron, Inc. 2014. 2010-2012 WO017 Ex Ante Measure Cost Study Final Report. Prepared for the California Public Utilities Commission.  [↑](#footnote-ref-4)
5. Pacific Gas and Electric (PG&E). 2017. “SWHC014-01 Cost Calculations.xlsx.” [↑](#footnote-ref-5)
6. DNV GL. 2017. *Impact Evaluation of 2015 Upstream HVAC Programs (HVAC1).* Prepared for the California Public Utilities Commission (CPUC). April 7. [↑](#footnote-ref-6)