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HVAC
CONDENSER COIL CLEANING, COMMERCIAL
SWSV004-01

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MEASURE NAME

Condenser Coil Cleaning, Commercial

STATEWIDE MEASURE ID

SWSV004-01

TECHNOLOGY SUMMARY

Dirty or fouled condenser coils restrict air flow, reduce heat transfer efficiency and compressor efficiency, and can increase compressor run time. Coil cleaning eliminates air blockages between fins and can remove leaves, dust, grime, and other contaminants from the fin and tube heat transfer surfaces thus improving heat transfer efficiency, decreasing compressor run time, and increasing efficiency.

MEASURE CASE DESCRIPTION

The measure case is defined as a cleaned condenser coil on a qualifying air conditioning unit with or without thermal expansion valves.

Measure Case Specification

| Statewide Measure Offering ID | Measure Offering Description |
|-------------------------------|--|
| SWSV004A | Condenser Coil Cleaning on Small Pkg AC system with No TXV |
| SWSV004B | Condenser Coil Cleaning on Small Pkg AC system with TXV |

BASE CASE DESCRIPTION

The base case is defined as an uncleaned, functional condenser coil on qualifying air conditioning unit, with or without thermal expansion valves.

CODE REQUIREMENTS

This measure is not governed by either state or federal codes and standards.

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 | None. | n/a |
| Federal Standards | None. | n/a |

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 |
|--------------------------|---------------|--------|
| BRO-RCx | DnDeemDI | Com |
| BRO-RCx | DnDeem | Com |
| BRO-RCx | DnDeemDI | Ind |
| BRO-RCx | DnDeem | Ind |

Eligible Building Types and Vintages

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

Eligible Climate Zones

This measure is applicable in all California climate zones.

PROGRAM EXCLUSIONS

None.

DATA COLLECTION REQUIREMENTS

Data collection requirements are to be determined.

USE CATEGORY

HVAC

ELECTRIC SAVINGS (kWh)

The electric unit energy savings (UES) of condenser coil cleaning of nonresidential air conditioning (AC) units were derived from impacts in the Database of Energy Efficient Resources (DEER). The DEER version used to calculate savings for these measures is DEER 2020.

Statewide Measure Offering IDs and DEER Energy Impact IDs

| Statewide Measure Offering ID | DEER Measure ID |
|-------------------------------|-----------------------------|
| SWSV004-01A | NE-HVAC-RefChg-Inc-Typ-ntxv |
| SWSV004-01B | NE-HVAC-RefChg-Inc-Typ-txv |

The UES of this coil cleaning measure were derived as a function of the nonresidential refrigerant charge adjustment (RCA) measure (SWSV002), in accordance to the “Workpaper Disposition for Non-Residential HVAC Rooftop Quality Maintenance” issued by the Energy Division of the California Public Utilities Commission (CPUC) in 2013 (May 2013 NRQM Disposition).¹

In particular, the UES values for this measure were calculated by applying a multiplier stipulated in the May 2013 NRQM Disposition to the RCA vintage-weighted electric energy UES value, as shown:

$$UES_{cond\ coil\ cleaning} = UES_{RCA-wtd} \times AdjFactor$$

The adjustment factor was determined by the Energy Division as follows:

1. Quality maintenance (QM) treatments include an RCA as well as “non-charge” related measures, including condenser coil cleaning, evaporator coil cleaning, and air-flow adjustment.
2. The savings associated with *all* non-charge measures, collectively, is equal to 25% of the RCA UES value.
3. Because of the lack of quantified evidence of the impacts of the non-charge measures, the Energy Division stipulated the distribution of the total non-charge measure savings across the three non-charge measures as follows:

| Non-charge Measure | Percent of Total Non-charge Impacts (%) | Source |
|--------------------------|---|---|
| Condenser Coil Cleaning | 50% | California Public Utilities Commission (CPUC), Energy Division, Ex Ante Review Team. 2013. “Workpaper Disposition for Non-Residential HVAC Quality Maintenance.” May 2. Page 7. |
| Evaporator Coil Cleaning | 25% | |
| Air Flow Adjustment | 25% | |

¹ California Public Utilities Commission (CPUC), Energy Division. 2013. “Workpaper Disposition for Non-Residential HVAC Rooftop Quality Maintenance.”

California Public Utilities Commission (CPUC), Energy Division. 2013. “20132014-CommercialHVACMaintenance-SavingsValues-April2013-v1-2.xlsx”

4. The UES of the condenser coil cleaning measure is therefore calculated as 50% of the total non-charge impacts (50% of 25% = 12.5%) of the RCA impacts.

Note that the measure impacts are based on recent DEER2020 updates as of 6/6/19 that affect “APreWBkWh” for energy, “APreWBkW” for peak demand and “APreWBtherm”. As we move forward to true statewide offerings, the “PA” would be “Any”, however there were issues when revising the impacts from MASControl3 and could only produce PA-specific impacts. The IOUs were provided guidance from the EAR Team to help consolidate the PA-specific records to create “Any” for this statewide workpaper submission for all nonresidential building types with the exception to “Com” and removed “IOU” for building location to only include all 16 California climate zones.

| BldgLoc | Convert from PA to Any, as shown | Comment |
|---------|----------------------------------|--|
| CZ01 | PGE | |
| CZ02 | PGE | |
| CZ03 | PGE | |
| CZ04 | PGE | |
| CZ05 | PGE | |
| CZ06 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ07 | SDG | |
| CZ08 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ09 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ10 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ11 | PGE | |
| CZ12 | PGE | |

| | | |
|------|---------|---|
| CZ13 | PGE | |
| CZ14 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ15 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |
| CZ16 | SCE/SCG | For predominantly electric measure records, delete SCG record; for predominantly gas measure records, delete SCE record. |

A sample calculation using a small office with package AC and no TXV located in climate zone 16 is provided below.

$$6.56 \left(\frac{kWh}{ton \times year} \right) \times 0.125 = 0.82 \left(\frac{kWh}{ton \times year} \right)$$

PEAKELECTRIC DEMAND REDUCTION (kW)

The peak demand reduction values were calculated following the same approach as the electric savings. See Electric Savings.

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 methodology to calculate the RUL conforms with Version 5 of the Energy Efficiency Policy Manual, which recommends “one-third of the effective useful life in DEER as the remaining useful life until further study results are available to establish more accurate values.”² This approach provides a reasonable RUL estimate without the requiring any a priori knowledge about the age of the equipment being

² California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32.

replaced.³ Further, as per Resolution E-4807, the California Public Utilities Commission (CPUC) revised add-on measures so that the EUL of the measure is equal to the lower of the RUL of the modified system or equipment or the EUL of the add-on component.”⁴

Resolution E-4818⁵ defined behavior, retrocommissioning, and operational (BRO) measures and the EUL was subsequently stipulated in Resolution E-4952.⁶

Effective Useful Life and Remaining Useful Life

| Parameter | Value | Source |
|-----------|-------|--|
| EUL (yrs) | 3.0 | California Public Utilities Commission (CPUC). 2018. <i>Resolution E-4952</i> . October 11. Page A-36. |
| RUL | n/a | |

BASE CASE MATERIAL COST (\$/UNIT)

The base case is the existing equipment; therefore, the base case cost is \$0.

MEASURE CASE MATERIAL COST (\$/UNIT)

The material cost per ton was derived from the average cost per ton from a cost survey conducted of eight active, program-participating contractors and technicians.

BASE CASE LABOR COST (\$/UNIT)

The base case is the existing equipment; therefore, the base case labor cost is \$0.

MEASURE CASE LABOR COST (\$/UNIT)

The labor cost per ton was derived from the average cost per ton from a cost survey conducted of eight active, program-participating contractors and technicians.

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 NTG value, stipulated in Resolution E-4952,⁷ is based

³ KEMA, Inc. 2008. "Summary of EUL-RUL Analysis for the April 2008 Update to DEER." Memorandum submitted to Itron, Inc.

⁴ California Public Utilities Commission (CPUC). 2016. Resolution E-4807. December 16. Page 13.

⁵ California Public Utilities Commission (CPUC). 2017. *Resolution E-4818*. February 9. Page 9.

⁶ California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. Page A-36.

⁷ California Public Utilities Commission (CPUC). 2018. *Resolution E-4952*. October 11. Page A-35.

upon results of an impact evaluation study of commercial sector HVAC quality maintenance programs implemented in California.⁸

Net-to-Gross Ratios

| Parameter | Value | Source |
|--|-------|--|
| NTG – Commercial Condenser Coil Cleaning | 0.45 | DNV GL. 2017. <i>Impact Evaluation of 2015 Commercial Quality Maintenance Programs (HVAC3)</i> . Prepared for the California Public Utilities Commission. April 7. Table 5. Page 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. This GSIA rate is based on the weighted average of the commercial and industrial refrigerant charge adjustment measure installation rates reported in an impact evaluation study of 2006-2008 HVAC “high impact” measures.⁹

Gross Savings Installation Adjustment

| Parameter | GSIA | Source |
|---|-------|--|
| GSIA - Commercial Refrigerant Charge & Airflow Adjustment | 0.638 | Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, prepared by KEMA, February 10, 2010. |

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 based upon 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 | Yes |

⁸ DNV GL. 2017. *Impact Evaluation of 2015 Commercial Quality Maintenance Programs (HVAC3)*. Prepared for the California Public Utilities Commission. April 7. Table 5. Page 7.

⁹ KEMA, Inc., The Cadmus Group, Inc., and Summit Blue Consulting, LLC. 2010. *Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs. 2006 – 2008 Program Year. Final Consultant Report. Volume 1*. Prepared for the California Public Utilities Commission. February 10. Table 3-1. Page 13.

| DEER Item | Comment |
|--------------------------------|---|
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2020, READI v2.5.1 |
| Reason for Deviation from DEER | DEER does not contain this type of measure. |
| DEER Measure IDs Used | N/A |
| NTG | Source: HVAC3. The NTG of 0.45 is associated with NTG ID: NonRes-HVAC-maint |
| GSIA | Source: Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs The GSIA of 0.638 is associated with GSIA ID: Com-RCA-All |
| EUL/RUL | Source: E-4818. The value of 3 years is associated with EUL ID: NonRes-RCx-Operational |

REVISION HISTORY

Measure Characterization Revision History

| Revision Number | Revision Complete Date | Primary Author, Title, Organization | Revision Summary and Rationale for Revision |
|-----------------|------------------------|---|--|
| 01 | 06/07/2019 | Keith Valenzuela, Engineering Manager, AESC | Draft of consolidated text for this statewide measure is based upon: WPSDGENRHC1020_R4_Commercial Cond Coil Cleaning PGE3PHVC156_R4_Condenser Coil Cleaning Consensus reached among Cal TF members. |
| | 06/09/2019 | Jennifer Holmes, Cal TF Staff | Revisions for submittal of version 01. |
| | 06/27/2019 | Kelvin Valenzuela, SDG&E | Accepted Track Changes |