Work Paper SCE17HC061

**Revision 1**

**Short Form**

**Southern California Edison**

**Demand Controlled Ventilation for Single Zone Packaged HVAC**

**Introduction**

This short form workpaper documents (WP) the values adopted from PGE’s WP entitled “Demand Controlled Ventilation for Single Zone Packaged HVAC” (PGECOHVC168\_R2). SCE adopts all the values in PGECOHVC168\_R2 - Demand Controlled Ventilation, with the following exceptions.

* Changed applicable climate zones to only SCE climate zones.
* Added Up-Stream Programs: Up-Stream delivery mechanism & Mid-Stream Programs: Mid-Stream delivery mechanism.
* Added Agric-Default>2yrs and Ind-Default>2yrs NTG IDs for manufacturing building types.
* Added clarification on SCE’s incentive method description and applicability.
* For 2019 program year, the install type has been updated to Retrocommissioning, “BRO-RCx”.
* Workpaper Revision 1 is applicable for the 2019 program cycle

# Document Revision History

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| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 1 | 12/27/2018 | Stephen Brett Reno, TRC | * Transferred savings to calculation templates for the 2018 program year. * Changed applicable climate zones to only SCE climate zones. * Added Up-Stream Programs: Up-Stream delivery mechanism. * Added Mid-Stream Programs: Mid-Stream delivery mechanism. * Added Agric-Default>2yrs and Ind-Default>2yrs NTG IDs.   General Policy Requirements:   * 2018 Workpaper Updates are primarily in response to D.16-08-019 which created the Behavioral, Operational, and Retrocommissioning (BRO) measure classification with EUL values of one to three years with retrocommissioning assigned a three-year EUL. Resolution E-4818 directed that all measures which utilize a degraded performance baseline and/or are restorative of performance in nature be classified as retrocommissioning. |
| 2 | 12/27/2018 | Stephen Brett Reno, TRC | * Transferred savings to calculation templates for the 2019 program year. * For 2019 program year, the install type has been updated to Retrocommissioning, “BRO-RCx”.   General Policy Requirements:   * 2019 Workpaper updates are primarily in response to Resolution E-4818 which added new measure application types including but not limited to Add-On Equipment (AOE) and BRO-Retrocommissioning (BRO-RCx). |

**Measure Summary**

Table 1: Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form work paper details adding Demand Controlled Ventilation (DCV) to an existing packaged single zone direct expansion (DX) HVAC unit with an economizer. The savings values are based on PGE’s workpaper PGECOHVC168\_R2 – “Demand Controlled Ventilation” document.  The target market for DCV is spaces in commercial buildings served by packaged single zone DX HVAC units, sometimes referred to as rooftop units (RTU) and split systems.  The measures described in this workpaper are available for 12 DEER building types: Asm (Assembly), EPr (Education – Primary School), ERC(Education - Relocatable Classroom), ESe(Education – Secondary School), EUn (Education – University), MBT (Manufacturing Biotech), OfS (Office - Small), RFF (Restaurant – Fast Food), RSD (Restaurant – Sit-Down), Rt3 (Retail – Multistory Large ), RtL(Retail – Single-Story Large), RtS (Retail – Small). These measures are defined for all SCE California climate zones. |
| **1.1 Measure & Baseline** | Baseline  The base case for this measure is a single zone packaged HVAC system with an economizer that provides a fixed amount of outside air ventilation to a space when not economizing. Fixed position ventilation corresponding to Title 24 2016 requirement or 20% of supply air, whichever is greater.  Measure  Add Demand Controlled Ventilation (DCV) to an existing packaged single zone direct expansion (DX) HVAC unit with an economizer. This measure operates an existing economizer outside air damper based on measured CO2 concentration in the space or return duct. |
| **1.2 Technical Description** |  |
| **Measures** | AC-22633 (HV026): Add ADEC and CO2 Sensor to AC unit with Gas Heat  AC-86020 (HV027): Add CO2 Sensor to AC unit with Gas Heat with ADEC  AC-61708 (HV028): Add ADEC and CO2 Sensor to AC only unit  AC-28289 (HV029): Add CO2 Sensor to AC only unit with ADEC  AC-26856 (HV030): Add ADEC and CO2 Sensor to HP  AC-59214 (HV031) Add CO2 Sensor to HP with ADEC  When not economizing, most systems that do have economizers provide a fixed minimum amount of outside air, depending on the greater of two Title 24 2016 requirements- a floor area-based ventilation rate and an occupant-based ventilation rate. This may result in over-ventilation during times when their spaces have few occupants. When the occupant-dependent rate is greater than the floor-area dependent rate, DCV may be used to reduce the minimum amount of ventilation that must be supplied to the space. DCV allows the system to provide additional ventilation up to the occupant-dependent rate only when necessary for periods of high occupancy.  Refer to PGECOHVC168\_R2 Section 1.2 for detailed savings description. |
| **Code for All Measures** | This measure is a retrofit to an existing system and is not governed by either state or federal codes/standards as long as the project does not include other code-triggering activities such as replacement of HVAC systems. However Title 24 2016 provides economizer control, general ventilation, and DCV requirements that are considered to be best practice.  Refer to Section 1.4.2 of PGECOHVC168\_R2 for additional details. |
| **Requirements** | Equipment used for the measure must meet the following qualifications for rebate eligibility. The requirements below draw on Title 24 2016 §120.1(a)4 requirements for DCV, although they deviate slightly in some respects since the application of retrofit controls on a packaged unit is not considered a code-triggering event. One primary deviation from Title 24 2016 requirements is that a return air duct-mounted CO2 sensor is allowed whereas Title 24 2016 specifies that the sensor must be mounted in the zone and include a display.   * To be eligible for CO2 sensor-only rebate, existing economizer control must be a digital type control and must have the capability to control the damper in response to a CO2 sensor signal. * To be eligible for ADEC with CO2 sensor rebate, a program-qualifying ADEC or Enhanced Ventilation controller must be installed in addition to the CO2 sensor. See bullet above for qualifying ADEC specification. * For each system with demand one sensor per 10,000 ft² of floor space. When a zone or a control ventilation, CO2 sensors shall be installed in each room with no less than space is served by more than one sensor, signal from any sensor indicating that CO2 is near or at the setpoint within a space, shall trigger an increase in ventilation to the space. * Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to the level required if DCV were not installed. * CO2 sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1,000 ppm concentration when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 5 years.   The following eligibility requirements must be satisfied prior to application of the measure:   * Existing system must be packaged single zone DX cooling unit with gas heat [HV026, HV027], cooling only unit [HV028, HV029], or heat pump [HV030, HV031] * Existing system must have an operable airside economizer installed, and economizer high limit must be optimized for the climate per Title 24 2016 Table 140.4-B, adapted as shown in Table 1 of PGECOHVC168\_R2 for reference. * Existing system must ventilate continuously during occupied hours and may not have any other device previously installed that is intended to perform DCV such as an occupancy sensor that controls ventilation rate. * The measure shall only be applied where it will result in a reduction to the overall ventilation that is supplied for the space.   Refer to Section 1.1 of PGECOHVC168\_R2 for additional details. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| **Installation Type** | Deviation. Install type changed from Retrofit Add-On (REA) to 2019 Install type: **Add On Equipment (AOE)** |
| **Delivery Mechanisms** | Financial Support: Direct Install,  Financial Support: Down-Stream Incentive – Deemed,  Deviation, adding:   * **Mid-Stream Programs: Mid-Stream Incentive** * **Up-Stream Programs: Up-Stream Incentive**   For SCE, incentive methods include On-bill Finance/Loan - The program offers financing for the cost an efficient measure as part of the utility bill. This can be an add-on option to an existing program or can serve as an organizing principle for its own program. |
| **1.4.1 DEER Data** |  |
| **Net-Gross-Ratio** | NTG ID: Com-Default>2yrs, Agric-Default>2yrs, Ind-Default>2yrs  NTGR: 0.60 |
| **Effective and Remaining Useful Life** | EUL ID: HVAC-VSD-DCV (EUL: 15.0 / RUL: 3.0)  The first baseline life is the RUL of the host equipment life. 1st Baseline life = 5 years. |
| **Section 2. Calculation Methodology** |  |
| **Energy savings/Peak Demand Reduction – All Measures** | Savings were estimated using eQUEST. The DEER prototypes for the customer average case of the Tech IDs were used with some modification. All savings are normalized by cooling tons.  DEER prototypes were generated using MASControl v3. Except educational classroom building type with heat pumps, DEER prototypes for AC and Heat Pump measures were created using the “110to134kBtuh” cooling capacity range.  To create the base case prototypes, the DEER prototypes were modified with the following characteristics:  Min Outside Air: 0% changed to 20%  Max Outside Air: 100% changed to 0%  Hourly Occupancy: 100% of peak changed to 90% of peak  Economizer Changeover Temperatures: Varies changed to Title 24 2016 compliant  To create the measure case prototypes, the base case prototypes were modified with one of two different Outside Air Flow cases, depending on which produced the greater amount of airflow:  a. 20% of supply airflow  b. Title 24 Table 120.1-A Minimum Ventilation Rate  The peak period is defined as 2:00 PM to 5:00 PM on three specific weekdays defined by DEER2014 and varies by climate zone.  Refer to PGECOHVC168\_R2 Section 2 for detailed savings description. |
| **Section 3. Load Shapes** | DEER:HVAC\_Split-Package\_AC,  DEER:HVAC\_Split-Package\_HP |
| **Section 4. Costs** |  |
| **Section 4.1 Base and Measure Costs** | Refer to full workpaper PGECOHVC168\_R2 Section 4 for detailed costing methodology. |
| **Base Cost** | Add ADEC and CO2 sensor to existing system:  The base case is the customer’s existing equipment; therefore, the base case cost is $0.00.  Add CO2 sensor to existing system with ADEC:  The base case is the customer’s existing equipment; therefore, the base case cost is $0.00. |
| **Measure Cost** | Add ADEC and CO2 sensor to existing system:  Material: $79.34  Labor: $65.64  Total: $144.98  Add CO2 sensor to existing system with ADEC:  Material: $32.48  Labor: $32.21  Total: $64.69 |

**Savings and Calculation Methodology**

This short form made no changes to the adopted PGE savings.

**Costs**

This short form made no changes to the adopted PGE costs.

**Attachments:**

SCE17HC061.1\_A1 - Calc Templates\_2019