Work Paper SCE17HC068

**Revision 0**

**Short Form**

**Southern California Edison**

**Single Package Vertical Heat Pump**

**Introduction**

This short form workpaper (WP) documents the values adopted from PGE’s WP entitled “Single Package Vertical Heat Pump” (PGECOHVC172 R0). SCE adopts all the values in PGECOHVC172 R0 – “Single Package Vertical Heat Pump”, with the following adjustment and exceptions

1. SCE is only supporting PGE measure HV372 with indicated adjustments to the measure: Install 11.00 EER, 3.25 COP SPVHP (≤54,000 Btu/h) with economizer only (but excluding DCV). This will be adopted as SCE solution code AC-20018
2. Measure requirements are updated to include:
   1. Only 3.5 and 4 ton systems. Measure implementation is only limited to these system (nominal capacity) sizes, excluding 3.0 ton systems (non cost effective) and 5.0 ton (already requiring air-economizing)
   2. Only measures with Economizer (with controls) but without Demand controlled ventilation (DCV).
3. Only SCE climate zones (territories) are included
4. Only the ROB program type is being adopted.
5. Measure and base case material costs are revised to use an average of 3.5 and 4 ton systems. Measure case costs have been updated to include air-economizer with controls but excluding that for DCV controls.
6. PGE EUL and Load Shape revised and aligned to use values specific to Heat Pumps.
7. Measure impacts for adopted measure have been revised to exclude DCV benefits. In average (and as determined by re-evaluation of the building energy models), measure impacts have been reduced by 3%.

**Please note that there are still undergoing efforts and/collaboration with PGE (and statewide team) to further align measure offerings and cost documentation which will likely be reflected in next workpaper update.**

# Document Revision History

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| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 2/26/2018 | Lake Casco/TRC | * Savings for PGE workpaper based on PGECOHVC172 R0 – “Single Package Vertical Heat Pump” were adjusted to exclude DCV. * Transferred savings values to SCE Calculation template for the 2017 program year. * Adopted only PGE’s measure HV372 (AC-20018) * Only adopted ROB program type * Updated measure requirements for systems to only include systems of 3.5 and 4 tons without DCV * Updated costs to use an average of 3.5 and 4 ton systems * PGE EUL and Load Shape were revised to use values specific to Heat Pumps * Only SCE Climate zones are adopted |

**Measure Summary**

Table : Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form work paper documents the inputs for measures that reduce the energy associated with providing conditioned air to a building via single package vertical heat pumps (SPVHP). The savings values are based on PGE’s workpaper PGECOHVC172 R0 – “Single Package Vertical Heat Pump” document.  This type of HVAC system is typically found serving portable school classrooms, offices, and/or administrative spaces, and the measures contained herein are tailored for the education sector. The measures constitute replacement of a standard SPVHP with a high efficiency SPVHP with air-side economizer and controls. |
| **1.1 Measure & Baseline** | **AC-20018**, ROB (PGE ID – HV372)  Measure: Install 11.00 EER, 3.25 COP SPVHP (≤54,000 Btu/h) with economizer and controls.  Baseline: 2016 Title 24 Minimally code compliant SPVHP without economizer and DCV (10.0 EER, 3.00 COP, no economizer or DCV)  Please refer to Attachment #1 Calculation Templates for additional information on codes and baseline condition. |
| **1.2 Technical Description** |  |
| **Measures** | AC-20018: Install 11.00 EER, 3.25 COP SPVHP (≤54,000 Btu/h) with economizer |
| **Code for All Measures** | The code baseline of a SPVHP with 10.0-EER cooling mode efficiency, 3.0-COP heating mode efficiency, and no air-side economizer or DCV controls comes from the 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24 2016).  The minimum cooling and heating efficiencies are given in Table 110.2-E Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps – Minimum Efficiency Requirements. Per Section 140.4(e)1, air economizers are not required on a cooling air handler with a cooling capacity 54,000 Btu/hr or less. Per EXCEPTION 1 to Section 120.1(c)3, classrooms are not required to have demand control ventilation.  See Section 1.4.2 of PGECOHVC172 R0 for more details. |
| **Requirements** | Eligibility Requirements:   * Measure case must match solution code requirements (11.00 EER, 3.25 COP SPVHP (≤54,000 Btu/h) with economizer and controls) * Only measure cases with 3.5 and 4 tons systems are eligible * Measure cannot include DCV controls   Implementation and installation requirements: Measures presented in this Workpaper apply SCE climate zones and the following building types:  Education – Relocatable Classroom (ERC) |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| **Installation Type** | Replace on Burnout (ROB)  Note: Based on terminology from CPUC Resolution E-4818, this measure is Normal Replacement (NR). |
| **Delivery Mechanisms** | Financial Support: Down-Stream Incentive - Deemed |
| **1.4.1 DEER Data** |  |
| **Net-Gross-Ratio** | NTG ID: K-12School-ComCollege  NTGR = 0.85 |
| **Effective and Remaining Useful Life** | HVAC-airHP, EUL = 15 years, RUL = 5 years |
| **Section 2. Calculation Methodology** |  |
| **Energy savings/Peak Demand Reduction – All Measures** | Energy savings and demand reduction for the measures contained in this workpaper were estimated using latest eQUEST/DOE2.2 energy modeling software. DEER prototypes were generated using MASControl v3.00.28 for the 2008 Title-24 (C08) case of the Tech ID D08-NE-HVAC-airHP-Pkg-55to64kBtuh-15p0seer-8p2hspf with a 2007 vintage.  These baseline prototypes were modified slightly to better fit the base case for this workpaper. Details on the modifications to the baseline and measure case models are provided in Section 2 of PGECOHVC172 R0.  Peak demand calculations were calculated taking the average values of the hourly energy profiles from the models during the applicable DEER peak demand periods for each climate zone.  See Section 2 of PGECOHVC172 R0 for more details.  As part of this adoption (and per further evaluation of the building energy simulation models), the PGE savings have been reduced on average by approximately 3% to account for the exclusion of DCV in the measure case. The details of the change are described below in the Savings and Calculation Methodology section.  Adjusted calculations are found in Attachment 2. |
| **Section 3. Load Shapes** | DEER:HVAC\_Eff\_HP |
| **Section 4. Costs** |  |
| **Section 4.1 Base and Measure Costs** | Please refer to Attachment #1 Calculation Templates for detailed baseline and measure costs. Details of the changes are described below in the Costs section. |

**Savings and Calculation Methodology**The following changes have been applied to the adopted PGE Savings. (Attachment 2)

1. SCE is removing the requirement for demand controlled ventilation (DCV) from the measure. Based on evaluations of the eQuest model, the PGE approved savings are on average reduced by approximately 3% to account for the absence of DCV. The savings reduction of 3% has been applied to both the energy savings and demand reduction values.

**Costs**The following changes have been applied to the adopted PGE Costs (Attachment 3).

1. Equipment costs for the base case and measure case systems were sampled from various models for the average of 3.5 and 4 tons systems.
2. For the measure case material costs, the economizer is equipped with an economizer controller.
3. As documented in PGE’s workpaper PGECOHVC172 R0, the assumed labor cost for the base case and measure case is $875.15. Using the average capacity of 3.5 tons, the assumed labor cost per ton is $250.04. This is assumed for both the base case and measure case. No added installation costs are assumed for the factory installed economizer on the measure case.

**Savings Calculation Workbook**

1. SCE17HC068.0 A1 - Calculation Template
2. SCE17HC068.0 A2 - SCE Cost Update