Workpaper Plan

PGECOHVC143 - VFD and Enhanced Ventilation for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps

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1. Approach

Following narrative describes methodology adopted by PG&E for revisions to existing work paper PGECOHVC143 - VFD and Enhanced Ventilation for Packaged HVAC Units with Gas Heating and Packaged Heat Pumps.

There have been DEER changes to the prototype models that served as the base case for this work paper. The latest revision of PGECOHVC143 (rev2) uses modified DEER 2014 prototypes (from MASControl v3.00.19) to serve as the base case. The DEER 2015 prototypes (MASControl v3.00.27) have been updated with regard to HVAC unit performance curves. This memo presents a work paper plan to update PGECOHVC143 using the DEER 2015 prototypes to serve as the base case with modifications similar to those outlined in the latest revision of the work paper. Other sections of the work paper will be reviewed and updated as needed, in particular the codes & standards section and the measure cost section; measure costs may have changed since the latest revision of the work paper.

1. Methodology for Evaluating Measure

The latest work paper revision describes that energy savings and demand reduction were estimated using eQUEST 3.64 energy modeling software, with DEER 2014 prototypes for the customer average case (CAv) of the D08-NE-HVAC-airAC-SpltPkg-110to134kBtuh-11p5eer and D08-NE-HVAC-airHP-SpltPkg-110to134kBtuh-11p5eer-3p4cop Tech IDs from MASControl v3.00.19 served as the base case with CZ2010 weather files and the following modifications:

1. A minimum outside air fraction (OAF) of 20% was used instead of 0% that indicates closed damper leakage for packaged HVAC systems are higher than previously thought.
2. A maximum outside air fraction of 70% was used instead of 100% that indicates return air damper leakage and exhaust air re-entrainment for packaged HVAC systems are higher than previously thought, leading to inability of most systems to provide 100% outside air.
3. Economizer dry-bulb changeover temperatures were set in accordance with Title 24.

For this work paper update, eQUEST 3.64 energy modeling software will again be used to estimate savings, but instead with DEER 2015 prototypes for the customer average case of the D08-NE-HVAC-airAC-SpltPkg-110to134kBtuh-11p5eer and D08-NE-HVAC-airHP-SpltPkg-110to134kBtuh-11p5eer-3p4cop Tech IDs from MASControl v3.00.27 serving as the base case with the same CZ2010 weather files and the same modifications as listed above. This is summarized below in Table 1 (with differences highlighted).

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| **Item** | **PGECOHVC143rev2**  **(latest revision)** | **PGECOHVC143rev3**  **(proposed update)** |
| DEER prototypes | 2014 | 2015 |
| eQUEST version | 3.64 | 3.64 |
| DEER weather files | CZ2010 | CZ2010 |
| MASControl version | 3.00.19 | 3.00.27 |
| CAv Tech IDs | D08-NE-HVAC-airAC-SpltPkg-110to134kBtuh-11p5eer  D08-NE-HVAC-airHP-SpltPkg-110to134kBtuh-11p5eer-3p4cop | D08-NE-HVAC-airAC-SpltPkg-110to134kBtuh-11p5eer  D08-NE-HVAC-airHP-SpltPkg-110to134kBtuh-11p5eer-3p4cop |
| Prototype modifications | Minimum OAF = 20%  Maximum OAF = 70%  Economizer changeovers in accordance with Title 24 2013 | Minimum OAF = 20%  Maximum OAF = 70%  Economizer changeovers in accordance with Title 24 2016 |
| Measure Descriptions | • Retrofit a variable speed motor with controls to an existing motor on a packaged single zone direct expansion (DX) HVAC unit with an economizer with or without an advanced digital economizer controller (ADEC).  • Retrofit the existing motor with a NEMA Premium Efficiency motor and variable frequency drive with or without an ADEC.  • Retrofit the existing motor with a permanent magnet motor (PMM) and variable frequency drive with or without an ADEC. | • Retrofit a variable speed motor with controls to an existing motor on a packaged single zone direct expansion (DX) HVAC unit with an economizer with or without an advanced digital economizer controller (ADEC).  • Retrofit the existing motor with a NEMA Premium Efficiency motor and variable frequency drive with or without an ADEC.  • Retrofit the existing motor with a permanent magnet motor (PMM) and variable frequency drive with or without an ADEC. |

Table 1

The same building types, climate zones, and vintages will be modeled, with the exception that one additional building vintage will be included (v14 representing 2012-2014).

A summary of the changes from DEER2014 to DEER2015 is provided in the attachment 2015DEER-PackagedAndSplitDXUpdate-24Nov2014.xlsx. A summary of the model input changes to Tech ID NE-HVAC-airAC-SpltPkg from DEER2014 (MASControl v3.00.19) to DEER2015 (MASControl v3.00.27) is provided in the attachment NE-HVAC-airAC-SpltPkg summary of differences.docx

The latest work paper revision states that this measure is a retrofit to an existing system, and is not governed by either state or federal codes and standards as long as the project does not include other code-triggering activities such as replacement of HVAC systems. We expect this not to change. However, the latest work paper revision references Title 24 2013 for economizer high limit control, and we will update this as needed to refer to Title 24 2016.

1. Measure Cost Analysis

The latest work paper revision uses measure cost information developed at that time (2014). The measure cost analysis will be reviewed and updated as needed to the most current available cost data, including survey data from a recent update to the statewide HVAC QM non-DEER workpapers sponsored by PG&E. This survey data may be supplemented with information from additional data sources that may include, but are not limited to:

* RSMeans
* 2010-2012 WO017 Ex Ante Measure Cost Study and/or latest CPUC supported cost study

1. Timeline and Budget

Workpaper updates are expected to be completed within five weeks.

1. Attachments



