Work Paper SCE17HC005

**Revision 0**

**Southern California Edison**

**Whole House Fan**

**For Work Paper Reviewer Use Only**

**List all major comments that occurred during the review. This table may only be removed during management review.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Major Comment** | **Reviewer Name** | **Date** | **Outcome/Resolution** |
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# At-a-Glance Summary

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| --- | --- |
| **Measure Codes** | AC-19963, AC-19965, AC-19966, AC-19968, AC-19969, AC-19970, AC-19971, AC-19972 |
| **Measure Description** | Whole house fan can potentially eliminate the need to operate an air conditioner (not equipped with an economizer) when outside air temperatures are lower than space conditions |
| **Base Case Description** | Mechanical Central AC with Gas Furnace / Central HP equipment for space heating and cooling without night ventilation and/or air economizing |
| **Units** | Per Unit |
| **Energy Savings** | Refer to Excel Calculation Attachment 1 |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 2 |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 2 |
| **Effective Useful Life** | 20 years (HV-WHfan) |
| **Measure Installation Type** | Retrofit Add On (REA) |
| **Net-to-Gross Ratio** | 0.55 (Res-Default>2) |
| **Important Comments** | This work paper has a complementary Ex Ante Database data set that will be provided in a separate submission to the California Public Utilities Commission (CPUC). |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 10/30/2017 | Arvind Subramanya/TRC | - This work paper is an update of SCE13HC005.2.  - New calculation template update for 2017 program year.  - (8) New solution codes have been added in this update.  - Work paper is updated with 2016 Title-24 code requirement language.  - Measure impacts have been updated to reflect DEER 2017 values.  - Measure cost has been updated with costs from WO017 Cost Study Report.  - Only Residential Single Family Home (SFm) building type is used in this revision.  - Building Vintage of the year 1996 has been considered in this update.  - This update includes California Climate Zones CZ02 through CZ16.  - NTG IDs updated to include both default/downstream (Any) |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
|  |  |  |  |  |  |

Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This work paper details the values used to estimate the impacts of installing a whole house fan (WHF) to reduce residential cooling energy requirements. The existing base case for this measure assumes a (mechanically cooled) conditioned home with no night ventilation and no economizer. This revision of the work paper includes only Residential Single Family (SFm) building type.

A whole house fan can be used to transfer cool outside air to warm areas of a home through fenestration, similar to natural ventilation assisted by propeller fans in front of open windows. Using a whole house fan eliminates the need to operate an air conditioner (not equipped with an economizer) when outside air is already cooler than inside air. This can reduce electrical demand by powering only a fan motor, rather than both a fan motor and a compressor motor. In addition, cooling a space with nighttime and morning air will delay the need for an air conditioner until later in the day.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Whole House Fan |
| Existing Condition | Mechanical Central AC with Gas Furnace / Central HP (and absence of Whole House Fan) |
| Code/Standard | Refer to Section 1.4.2 – Codes and Standards |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
| N/A | N/A | AC-19963 | N/A | Whole House Fan with an air flow of 0.7 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM |
| N/A | N/A | AC-19965 | N/A | Whole House Fan with an air flow of 0.7 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM |
| N/A | N/A | AC-19966 | N/A | Whole House Fan with an air flow of 1.5 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM |
| N/A | N/A | AC-19968 | N/A | Whole House Fan with an air flow of 1.5 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM |
| N/A | N/A | AC-19969 | N/A | Whole House Fan with an air flow of 2.0 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM |
| N/A | N/A | AC-19970 | N/A | Whole House Fan with an air flow of 2.0 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM |
| N/A | N/A | AC-19971 | N/A | Whole House Fan with an air flow of 3.0 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM |
| N/A | N/A | AC-19972 | N/A | Whole House Fan with an air flow of 3.0 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM |

The measure requires that base case includes central HVAC system providing mechanical cooling. The base case HVAC system; however, does not include air-economizing and/or any type of central mechanical ventilation.

Eligible building type includes Residential – Single Family (SFm), for Climate Zones 2 through 16.

Additionally, the Energy Efficiency Rebate Program requirements dictate that the following conditions be met to be eligible for savings:

1. Whole house fan must be used with an existing central air conditioning unit or ducted evaporative cooler
2. Whole house fan must be permanently installed (connected to the framing)
3. Equipment selection and installation shall comply with all applicable regulations including but not limited to latest applicable NEC and/or Energy Standards T24.

## 1.2 Technical Description

This technology includes a ventilation fan (generally installed in the attic space) to introduce colder outdoor air into the space when outdoor temperature and humidity are adequate. The measure requires openings in the space including windows and attic vents for introducing and recirculating the cooler outdoor air into the space.

## 1.3 Installation Types and Delivery Mechanisms

The program/install type for the above measures is:

* Retrofit Add-On (REA)

The delivery methods that are available for the measure are:

* Financial Support – Down-stream - Deemed
* Partnership – Down-stream – Deemed
* Financial Support – Direct Install
* Partnership – Direct Install

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Retrofit Add-on (REA) | Above Customer Existing | N/A | EUL | N/A |

A delivery mechanism is a delivery method paired with an incentive method. Delivery mechanisms are used by programs to obtain program participation and energy savings.

**Delivery Method Descriptions**

|  |  |
| --- | --- |
| **Delivery Method** | **Description** |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |
| Down-Stream Incentive | The customer installs qualifying energy efficient equipment and submits an incentive application to the utility program. Upon application approval, the utility program pays an incentive to the customer. Such an incentive may be deemed or customized. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

This measure is included in the Database for Energy Efficient Resources (DEER) using the READi software version 2.4.7. Per DEER measure definition IDs, the following measures are being adopted from DEER:

WholeHouseFan-0.7CFM-ECM

WholeHouseFan-0.7CFM-PSC

WholeHouseFan-1.5CFM-ECM

WholeHouseFan-1.5CFM-PSC

WholeHouseFan-2.0CFM-ECM

WholeHouseFan-2.0CFM-PSC

WholeHouseFan-3.0CFM-ECM

WholeHouseFan-3.0CFM-PSC

In DEER 2017, this measure displays data in common units of “Each”, presented by climate zone and building vintage. Savings impacts were directly taken from DEER 2017 impacts for this work paper for Residential Single Family Home (SFm) building type. Per “DEER2008 Building Weights.xls” documentation suggesting highest population of SFM buildings for “before 1978”, measure adoption is primarily expected for older SFM vintages; hence, and conservatively, measure impacts are based on 1996 vintage.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | No |
| Scaled DEER measure | No |
| DEER Base Case | Yes |
| DEER Measure Case | Yes (Vintage 1996) |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | DEER 2017 per READI v2.4.7 |
| Reason for Deviation from DEER | N/A |
| DEER Measure IDs Used | WholeHouseFan-0.7CFM-ECM (Sample) |

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool. The relevant NTG values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Res-Default>2 | All other EEM with no evaluated NTGR; existing EEM with same delivery mechanism for more than 2 years | Res | Any | Any | 0.55 |

**Spillage Rate**

Spillage rates are not tracked in work papers; they are tracked in an external document which will be supplied to the Commission Staff.

**Installation Rate**

The IR values were obtained using the DEER READI tool v2.4.7. The relevant IR values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GSIA ID** | **Description** | **Sector** | **BldgType** | **ProgDelivID** | **GSIAValue** |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1 |

**Effective and Remaining Useful Life**

The EUL and RUL values were obtained using the DEER READI tool v2.4.7. DEER defines the RUL as 1/3 of the EUL value of host equipment. The relevant EUL and RUL values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| HV-WHfan | Whole House Fans | Res | HVAC | 20 | 6.7 |

### 1.4.2 Codes and Standards Analysis

**2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings [496]**

2016 Title-24 code is applicable for whole house fan systems under Climate zones 08 through 14 per table TABLE 150.1-A COMPONENT PACKAGE-A STANDARD BUILDING DESIGN.

The 2016 Title-24 code also applies for a NEW measure for the Climate Zones 08 through 14.

**SECTION 150.1 – PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR LOW-RISE RESIDENTIAL BUILDINGS**

**(C) Prescriptive Standards/Component Package**

12. Ventilation Cooling. Single family homes shall comply with the Whole House Fan (WHF) requirements shown in TABLE 150.1-A. When a WHF is required, comply with Subsections A. through C. below:

A. Have installed one or more WHFs whose total Air Flow CFM as listed in the CEC Directory is at least

1.5 CFM/ft2 of conditioned floor area; and

B. Have at least 1 square foot of attic vent free area for each 750 CFM of rated whole house fan Air Flow

CFM, or if the manufacturer has specified a greater free vent area, the manufacturers’ free vent area

specifications; and

C. Provide homeowners who have WHFs with a one page “How to operate your whole house fan”

informational sheet.

Per footnote requirements to TABLE 150.1-A:

When whole house fans are required (REQ), only those whole house fans that are listed in the Appliance Efficiency Directory may be installed. Compliance requires installation of one or more WHFs whose total airflow CFM is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12 [496].

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 24 (2016) | Title 24 Building Energy Efficiency Standards, Section 150.1, Table 150.1-A | January 01, 2017 |

## 1.5 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

1.5.1 - Program & Technology Review of Two Residential Product Programs:

Home Energy Efficiency Rebate (HEER) /Business & Consumer Electronics (BCE) - Study # SCE0306

1.5.2 - Codes and Standards Enhancement Initiative

For PY2004: Title 20 Standards Development Analysis of Standards Options for Whole House Fans

### 1.5.1 Non-DEER Study Review

N/A

# Section 2. Calculation Methodology

In this revision of the workpaper, measure impacts are adopted directly from DEER 2017 database from DEER READi v2.4.7 (Attachment #3) without deviations. Savings obtained are on a “per unit” basis, therefore no adjustments factors were used. In addition, impacts were obtained for various whole house fan system capacities with two type of motor technology - ECM and PSC as listed in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **ID** | **MeasureID** | **Description** | **Source** |
| 1 | WholeHouseFan-0.7CFM-ECM | Whole House Fan with an air flow of 0.7 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM | DEER2017 |
| 2 | WholeHouseFan-0.7CFM-PSC | Whole House Fan with an air flow of 0.7 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM | DEER2017 |
| 3 | WholeHouseFan-1.5CFM-ECM | Whole House Fan with an air flow of 1.5 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM | DEER2017 |
| 4 | WholeHouseFan-1.5CFM-PSC | Whole House Fan with an air flow of 1.5 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM | DEER2017 |
| 5 | WholeHouseFan-2.0CFM-ECM | Whole House Fan with an air flow of 2.0 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM | DEER2017 |
| 6 | WholeHouseFan-2.0CFM-PSC | Whole House Fan with an air flow of 2.0 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM | DEER2017 |
| 7 | WholeHouseFan-3.0CFM-ECM | Whole House Fan with an air flow of 3.0 CFM per square foot of conditioned area; ECM motor using 0.124 W/CFM | DEER2017 |
| 8 | WholeHouseFan-3.0CFM-PSC | Whole House Fan with an air flow of 3.0 CFM per square foot of conditioned area; PSC motor using 0.15 W/CFM | DEER2017 |

Therm savings for this measure in DEER2017 are documented as negative suggesting the measure (as evaluated in DEER) over-ventilates the space inducing slightly higher heating requirements compare to that from the base case.

In general, and given “DEER2008 Building Weights.xls” documenting highest population of SFM buildings for “before 1978”, measure adoption is primarily expected for older SFM vintages; hence, and conservatively, measure impacts are based on 1996 vintage.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Solution Codes** | **MeasureID** | **Climate Zones** | **Building Vintage** | **Building Type** |
| AC-19963 | WholeHouseFan-0.7CFM-ECM | CZ02 - CZ16 | 1996 | Residential Single Family Home (SFm) |
| AC-19965 | WholeHouseFan-0.7CFM-PSC |
| AC-19966 | WholeHouseFan-1.5CFM-ECM |
| AC-19968 | WholeHouseFan-1.5CFM-PSC |
| AC-19969 | WholeHouseFan-2.0CFM-ECM |
| AC-19970 | WholeHouseFan-2.0CFM-PSC |
| AC-19971 | WholeHouseFan-3.0CFM-ECM |
| AC-19972 | WholeHouseFan-3.0CFM-PSC |

The following table indicates measure impacts adopted from DEER/READI utilized.

READI Data Used

|  |  |  |
| --- | --- | --- |
| **Measure Code** | **Measure ID** | **READI Data** |
| AC-19963,  AC-19965,  AC-19966,  AC-19968,  AC-19969,  AC-19970,  AC-19971,  AC-19972 | WholeHouseFan-0.7CFM-ECM,  WholeHouseFan-0.7CFM-PSC,  WholeHouseFan-1.5CFM-ECM,  WholeHouseFan-1.5CFM-PSC,  WholeHouseFan-2.0CFM-ECM,  WholeHouseFan-2.0CFM-PSC,  WholeHouseFan-3.0CFM-ECM,  WholeHouseFan-3.0CFM-PSC |  |

# Section 3. Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case. The closest load shapes that are applicable to the measures in this work paper are listed in the table below.

Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Residential - Single-Family | SCE:Residential:AC\_Cooling-RC | Residential |

# Section 4. Costs

## 4.1 Base Case Cost

For a Retrofit Add-On (REA) measure, the base case cost is $0/home because the measure is not replacing and/or retrofitting an existing technology.

## 4.2 Measure Case Cost

In this revision of the work paper, both material and labor costs have been updated based on the combination of 2010-2012 Work Order 017 [475] and 2017 retail documentation. Refer to Attachment #2 for details. Cost calculation methodology is described below.

1. 2010-2012 Work Order Cost Study 017 [475] provides costs of implementing a (single fan) whole house fan measure for various whole house fan system capacities as shown in the below table. System capacities in WO017 are based on manufacturer cut sheets. Labor cost was estimated in referenced study based on 6.0 labor hours and a CA average labor rate of $67.02.

|  |  |  |  |
| --- | --- | --- | --- |
| **Whole House Fan System Capacity** | **Material Cost (WO017)** | **Material Cost Index** | **Labor Cost** |
| **CFM (single fan)** | **$** | **$/CFM** | **$** |
| 1600 | $535.10 | $0.334 | $402.09 |
| 2500 | $649.58 | $0.260 | $402.09 |
| 4500 | $903.98 | $0.201 | $402.09 |

1. From the above table, a polynomial curve fit was determined between System capacity (CFM) and measures’ cost index ($/CFM) establishing a relationship of $/CFM on CFM which was used for determining the material cost of measures currently supported in DEER2017.
2. From the DEER2017 measure impacts documentation, under vintage 1996, a whole house fan is expected to serve a conditioned space with an average area (including all territories) in the order of 2,123 SFT.
3. System airflow capacities (CFM) were then calculated by multiplying the proposed system sizing rates (CFM/SFT) and corresponding measure areas (SFT) for each proposed whole house fan capacity. Table below shows system sizing included in this work paper along with the calculated CFMs.

|  |  |  |  |
| --- | --- | --- | --- |
| **System Name** | **Average ConditionedArea** | **System Capacity Density** | **System Capacity** |
| **SFT** | **CFM/SFT** | **CFM** |
| WholeHouseFan-0.7CFM-ECM | 2123 | 0.7 | 1,486 |
| WholeHouseFan-0.7CFM-PSC | 2123 | 0.7 | 1,486 |
| WholeHouseFan-1.5CFM-ECM | 2123 | 1.5 | 3,184 |
| WholeHouseFan-1.5CFM-PSC | 2123 | 1.5 | 3,184 |
| WholeHouseFan-2.0CFM-ECM | 2123 | 2.0 | 4,245 |
| WholeHouseFan-2.0CFM-PSC | 2123 | 2.0 | 4,245 |
| WholeHouseFan-3.0CFM-ECM | 2123 | 3.0 | 6,368 |
| WholeHouseFan-3.0CFM-PSC | 2123 | 3.0 | 6,368 |

1. Airflow capacity (CFM) from Step 4 and the polynomial curve fit equation from Step 2 were used to calculate material costs for each proposed whole house fan. Although not indicated in WO017, cost calculated (estimated from WO017) in this step was assumed to be of a PSC motor since these are generally expected to be the defaulted motor supporting this technology.
2. In order to estimate the ECM motor material cost, a 27% increase factor was determined and applied to the PSC motor material cost. The 27% increase factor was estimated based on the difference in motor cost between PSC and ECM technology from online retailer - ecomfort.com [Attachment #2].
3. Airflow capacity (CFM) from Step 4 and labor cost per CFM from Step 1 were used to calculate the measures total cost. As the installation scope of work will remain the same irrespective of the motor type, labor costs for PSC motor is considered to be the same as ECM motor. Below table shows the measures total cost summary per solution code:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Solution Code** | **System Name** | **Average Area** | **System Sizing** | **System Capacity** | **Material Cost** | **Labor Cost** | **Total Cost** |
| **SFT** | **CFM/SFT** | **CFM** | **$ Per Unit** | **$ Per Unit** | **$ Per Unit (per System Capacity)** |
| AC-19963 | WholeHouseFan-0.7CFM-ECM | 2123 | 0.7 | 1,486 | $646.87 | $402.09 | $1,048.96 |
| AC-19965 | WholeHouseFan-0.7CFM-PSC | 2123 | 0.7 | 1,486 | $509.35 | $402.09 | $911.44 |
| AC-19966 | WholeHouseFan-1.5CFM-ECM | 2123 | 1.5 | 3,184 | $954.17 | $402.09 | $1,356.26 |
| AC-19968 | WholeHouseFan-1.5CFM-PSC | 2123 | 1.5 | 3,184 | $751.31 | $402.09 | $1,153.40 |
| AC-19969 | WholeHouseFan-2.0CFM-ECM | 2123 | 2.0 | 4,245 | $1,104.95 | $402.09 | $1,507.04 |
| AC-19970 | WholeHouseFan-2.0CFM-PSC | 2123 | 2.0 | 4,245 | $870.04 | $402.09 | $1,272.13 |
| AC-19971 | WholeHouseFan-3.0CFM-ECM | 2123 | 3.0 | 6,368 | $1,358.78 | $402.09 | $1,760.87 |
| AC-19972 | WholeHouseFan-3.0CFM-PSC | 2123 | 3.0 | 6,368 | $1,069.91 | $402.09 | $1,472.00 |

For Direct Install measures, SCE directly utilizes one or more contractors as part of the program. The actual cost can vary by contractor, the date in which the work occurred, and by the volume of business. Contractor costs are confidential information and are based upon contractually agreed upon pricing as established in their purchase order with SCE; therefore, the SCE program tracking system is the only source for this data.  SCE will utilize the actual program cost in evaluating the cost-effectiveness of the measure.

Please refer to Attachment #2 for cost calculation.

## 4.3 Full and Incremental Measure Cost

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| REA | MEC + MLC | MEC + MLC | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Full and Incremental Costs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure** | **Measure Name** | **Installation**  **Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| AC-19963 | WholeHouseFan-0.7CFM-ECM | REA | $1,048.96 | $1,048.96 | N/A |
| AC-19965 | WholeHouseFan-0.7CFM-PSC | REA | $911.44 | $911.44 | N/A |
| AC-19966 | WholeHouseFan-1.5CFM-ECM | REA | $1,356.26 | $1,356.26 | N/A |
| AC-19968 | WholeHouseFan-1.5CFM-PSC | REA | $1,153.40 | $1,153.40 | N/A |
| AC-19969 | WholeHouseFan-2.0CFM-ECM | REA | $1,507.04 | $1,507.04 | N/A |
| AC-19970 | WholeHouseFan-2.0CFM-PSC | REA | $1,272.13 | $1,272.13 | N/A |
| AC-19971 | WholeHouseFan-3.0CFM-ECM | REA | $1,760.87 | $1,760.87 | N/A |
| AC-19972 | WholeHouseFan-3.0CFM-PSC | REA | $1,472.00 | $1,472.00 | N/A |

# Attachments

1. SCE17HC005.0 - Calculation Template
2. SCE17HC005.0 - Cost Calculation
3. SCE17HC005.0 - DEER2017 Measure Definitions and Impacts
4. SCE17HC005.0 - Analysis of Standard Options for Whole House Fans

# References

# References in this version of the work paper is based on the references file *“[References\_08212017\_083127]”*.

# References used in this work paper are listed below:

# [475]

[496]

[504]