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| High Efficiency Furnace Installation Cost |
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High Efficiency Furnace Installation Cost

# Introduction

Re: D.12-08-044, Sec. 3.6.5.3.1. High Efficiency Forced Air Unit (FAU), and Ordering Paragraph 61.

In the August 23, 2012, Decision (D.12-08-044) for the 2012-2014 Energy Savings Assistance (ESA) Application, the CPUC directed the IOUs to file an estimate for High Efficiency Forced Air Unit (HE-FAU) costs by housing type and climate zone. This request was made to inform cost effectiveness evaluation of this measure.

To determine the installed cost of HE-FAUs, contractors provided pricing for a list of common tasks associated with upgrading from a conventional (65% or 80% AFUE) furnace to a High Efficiency Forced Air Unit (HE-FAU) (95% AFUE). To account for the variation encountered in the field (not every upgrade requires all tasks) the cost of the individual tasks were normalized based on projected frequency to determine average installed measure cost. These results, presented to the CPUC, are shown in Appendix C with a summary Shown in Table 1. Also shown in Table 1 is an estimate of current cost to replace Standard Efficiency Forced Air Units (SE-FAU) in the ESA Furnace Repair and Replacement Program (R&R program).

**Table 1: Initial Cost Estimates**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| System Type | HE-FAU - Heat Only | | HE-FAU - Split System with Cooling | | Current ESA SE-FAU Replacement Cost (80% FAU) |
| Climate Zone | 1 & 3-8 | 2 & 9-16 | 1 & 3-8 | 2 & 9-16 | All |
| Average Installed Cost | $4027 | $4502 | $7406 | $7656 | $2600 |

After receipt of the initial cost estimates, DRA asked for more supporting information to understand the reasoning behind the cost estimates. This document provides detail around the pricing assumptions supporting the original numbers provided above, and includes equipment cost from HVAC wholesale distributors who provide equipment to the HVAC retrofit market and home builders.

# Scope

This document is intended to summarize all of the relevant and available detail surrounding the furnace cost estimates. Specifically, this document addresses the following:

1. HE-FAU replacement cost estimate using estimates directly from ESA contractors
2. SE-FAU replacement cost using available information from ESA R&R Programs
3. Comparison of HE-FAU replacement cost and SE-FAU furnace replacement cost
4. Wholesale distributers HE-FAU equipment cost for a range of equipment characteristics and brands.

## Methodology

### HE-FAU Cost from ESA Contractors

The average cost estimates for HE-FAU’s were determined using the following steps.

1. HVAC contractors were contacted to provide pricing for various components, using the HVAC “Average Cost Information Survey”. A copy of this survey form is included in Appendix A[[1]](#footnote-2). Contractors reported an inclusive base cost including Equipment, Labor, and Permits with add-ons for variability in installations.
2. Data received was compiled to document ranges of pricing received and reasonable cost estimates were determined for the basic components (those needed at every installation) and incidental components.
3. Frequency of each incidental component was estimated. For example, Title 24 Duct Testing is required 100% of the time in CZ 2 & 9-16 but condensate pumps are only required in 10% of HE-FAU installations. This information was based on input from ESA weatherization contractors and private HVAC contractors.
4. For each line item, weighted average costs were calculated. For example, a filter base is estimated cost $120 but is only installed in 10% of homes. Therefore, the filter base contributes an average of $12/home.
5. The average base cost and incidental components were totaled for various Climate Zones and heating types.

### Results

Of the approximately 50 contractors polled for this survey, 4 responded. Raw data is shown in Appendix B and summarized in Table 2.

**Table 2: Price Reported from ESA Contractors**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System Type | High Efficiency - Heat Only | | High Efficiency - Split System with Cooling | |
| Climate Zone | 1 & 3-8 | 2 & 9-16 | 1 & 3-8 | 2 & 9-16 |
| Average Estimated Base Price | $3900 | | 7300 | |
| Average Estimated Installed Cost | $4250 | | $7550 | |

# SE-FAU replacement cost using available information from ESA Furnace R&R PRogram

To inform the installed cost estimate of HE-FAU’s, the cost of SE-FAU’s installed in the R&R program was examined.

## Methodology

An estimate SE-FAU replacement cost under the ESA program was determined using the following steps.

1. Utility R&R program pricing was obtained from R&R program staff.
2. Furnace costs were analyzed in an attempt to identify the costs associated with each component. Based on this data, estimates of each component were generated.
3. Total SE-FAU installation cost was calculated as the sum of the line item estimates.

## Findings

Analysis of ESA R&R program costs showed that although FAU’s are replaced in the R&R program, the program costs do not accurately characterize the true installation cost of FAUs do to the following:

1. R&R program cost data includes wall furnaces, which are the majority of the R&R program installations. Since these units are less expensive to install and do not require duct work or HERS verifications, average program measure cost is not reflective of the true cost to install a SE-FAU
2. SE-FAU units typically exceed the measure cost maximum and are often abandoned to install a wall furnace in the R&R program. This allows the R&R program to provide heat to clients in need without exceeding the prescribed measure maximum.
3. There are many fees that may be added above and beyond the base furnace replacement charge billed by an ESA R&R contractor. Examples of these fees are as follows:
   1. Duct Sealing
   2. Duct Testing
   3. HERS duct test (paid to HERS Rater)
   4. HERS admin fee (paid to R&R contractor)
   5. HERS RCA verification (paid to HERS Rater)
   6. NGAT testing
   7. Permit fee (paid to authority having jurisdiction)
   8. Permit fee (paid to R&R contractor)

## Results

Estimated installed cost for FAU replacements in the Furnace R&R program is shown in Table 3. This data represents average costs and actual cost may vary by program and climate zone.

**Table 3: Itemized SE-FAU Costs from ESA R&R Program**

|  |  |
| --- | --- |
| Item | Cost |
| FAU Replacement | $ 1,900 |
| Duct Sealing | $ 180.00 |
| Duct Testing | $ 90.00 |
| HERS Fee (Contractor) | $ 70.00 |
| HERS Duct Test Fee ( Rater) | $ 170.00 |
| NGAT | $ 35.00 |
| Permit Admin Fee (Contractor) | $ 70.00 |
| Permit Fee (AHJ) | $ 180.00 |
| Total | $ 2,600.00 |

# Direct Comparison of HE-FAU replacement cost AND SE-FAU replacement cost

The estimated cost to install a HE-FAU is approximately double the current ESA program cost. A breakdown and comparison of these cost estimates is shown in Table 4.

**Table 4: Comparison of Itemized Costs for HE-FAUs and SE-FAUs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Base Price Components** | **Current ESA SE-FAU Cost Estimate CZ 1&3-8** | **Current ESA SE-FAU Cost Estimate CZ 2 & 9-16** | **HE-FAU Cost Estimate CZ 1&3-8** | **HE-FAU Cost Estimate CZ 2&9-16** |
| **Furnace** | $1,900 | $1,900 | $1,000 | $1,000 |
| **Labor/Overhead/Profit** | $1,450 | $1,450 |
| **Transition to existing Duct work** | $315 | $315 |
| **Piping and Connections** | $50 | $50 |
| **Vent system ($150-450)** | $0 | $0 | $300 | $300 |
| **Condensate line and drain pan** | $0 | $0 | $300 | $300 |
| **Permits ($175-650)** | $250 | $250 | $250 | $250 |
| **Programmable T-stat** | $50 | $50 | $50 | $50 |
| **CO & Smoke alarms** | $150 | $150 | $150 | $150 |
| **NGAT** | $35 | $35 | $35 | $35 |
| **Estimated Base Cost:** | $2,385 | $2,385 | $3,900 | $3,900 |
| **Individual Items/Components** | | | | |
| **AC Condenser** |  |  |  |  |
| **AC Evaporator Coil** |  |  |  |  |
| **Filter base** |  |  | $12 | $12 |
| **Concrete pad** |  |  |  |  |
| **Line set flush** |  |  |  |  |
| **Line set replacement** |  |  |  |  |
| **Condensate pump** |  |  | $13 | $13 |
| **Refrigeration charge & airflow adjust** |  |  |  |  |
| **Duct testing & sealing  (T-24)** | $25 | $250 | $25 | $250 |
| **Duct system replacement** | $70 |  | $70 | $70 |
| **HERS Verification - Ducts** |  | $250 |  | $250 |
| **HERS Verification - Refrigerant Charge and Airflow** |  |  |  |  |
| **Electrical** |  |  | $5 | $5 |
| **Carpentry/remodeling/misc** |  |  | $2 | $2 |
| **Estimated Total Per Unit Cost:** | $2,480 | $2,885 | $4,027 | $4,502 |

## Furnace Cost:

Three wholesale HVAC distributors were interviewed (Slakey Brothers, Ferguson. and AirCold) to determine HE-FAU equipment pricing. Reported equipment costs range from $715 to $1350 including sales tax of 7.25%. This price will vary based on the following factors:

1. Furnace characteristics
2. Contactor volume
3. Regional pricing burden
4. Furnace manufacturer
5. Furnace capacity (BTU output)

## Labor:

HE-FAUs are constructed differently from SE-FAU’s, have more complicated control systems and stricter requirements than standard 80% furnaces. These factors require more labor to install an HE furnace than a standard furnace and include but are not limited to the factors explained below. The labor estimates ranged from $600 to $2000 and a cost of $1450 per unit was used.

### Furnace Construction

HE-FAUs use a larger heat exchanger than standard furnaces because the heat exchanger must transfer more heat from the combustion gasses to the conditioned air. As a result, the furnace itself is typically larger than the furnace it is replacing; often requiring more time to modify mounting systems, and move existing supply and return plenums.

### Furnace Controls

HE-FAUs are higher performance but also require more time to commission during installation. Failure to practice proper commissioning procedures can lead to furnace faults due to undersized ductwork, improper venting, etc.

## Transition to Existing Duct Work:

Due to the larger size of HE-FAUs, sheet metal or duct board transitions to existing duct supply and return plenums must be created. In some cases, completely new plenums will have to be fabricated, even if the balance of the existing distribution system is used. An average cost of $315 was used in the cost estimate.

## Vent System

HE-FAUs pull more heat out of the combustion gasses causing moisture in the gasses to condense. This condensate is acidic and cannot be vented through the existing galvanized B-Vent, so new PVC venting must be installed in every system.

In the simplest cases, the PVC venting can be run inside of the existing B-vent and does not required significant work. However, in cases where the replaced furnace shared a vent with a water heater, or in cases where direct venting is required, the old vent must be abandoned. In these cases, the venting is more complicated, and may require specialized vent kits and/or new penetrations be cut into roof. This cost can range from $150 - $450, and a cost of $300 was used.

## Condensate Line and Drain Pan

In all cases, a condensing furnace needs a condensate line to collect and dispose of the moisture from the heat exchanger and the vent pipe. In systems with an A/C system, there is likely an existing condensate drain. However, for furnace only systems a drain line must be installed. In attic mounted systems, a drain pan must be installed.

# Conclusion

HE-FAU installation costs have been defined to inform cost effectiveness calculations for HE-FAU replacement. These prices represent estimated average installed costs, including equipment, installation labor, permits, and other fees. Conclusions resulting from this study are as follows:

1. ESA R&R Program costs do not directly reflect FAU costs for the following reasons
   1. The R&R costs include a majority of wall furnaces which are fundamentally different than FAUs.
   2. R&R program costs do not include necessary components required for HE-FAU installations, such as high efficiency venting system, condensate line, and transitions to existing duct work.
   3. Utilities do not track all individual component costs, since jobs are billed as complete installations, which make it difficult to discern individual component cost from the total cost.
2. HE-FAU equipment cost ranges from $715 to $1,350.
3. The estimated HE-FAU installed cost is approximately double the estimated SE-FAU cost ($2,600 vs. $4,250).

The estimated cost of a HE-FAU for use in cost effectiveness calculations is shown in Table 5.

**Table 5: HE-FAU Installed Cost Estimates**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System Type | HE-FAU - Heat Only | | HE-FAU - Split System with Cooling | |
| Climate Zone | 1 & 3-8 | 2 & 9-16 | 1 & 3-8 | 2 & 9-16 |
| Average Installed Cost | $4027 | $4502 | $7406 | $7656 |

# Appendix A: HVAC “AVERAGE COST” Information survey

**HVAC “Average Cost” Information Survey**

This research is for utility-sponsored low income energy efficiency programs overseen by the CA Public Utilities Commission (CPUC).

* Needed are *ballpark average* *price ranges* for of a High Efficiency Furnace replacement.
* These are *approximate prices* for the areas you serve. If prices vary widely by area, please complete a survey for each separate area.
* If you do not install something, put “X” the N/A box. If you are not in a CZ with Title 24 (T-24) requirements, write “n/a” in the $ box.
* *This is not a bid and is not binding, and all information will be kept confidential.* Thank you!

Please estimate installed pricing for housing types shown below, assuming installation of the following equipment:

* Furnace only: 95 AFUE, 60,000 Btu (90,000 Btu in colder climates)
* Split System: Furnace = 95 AFUE, 60,000 Btu (90,000 Btu in colder climates), AC = 3-ton, minimum 13 SEER
* Package Unit Furnace = 78 AFUE, 60,000 Btu (90,000 Btu in colder climates), AC = 3-ton, minimum 13 SEER

|  |
| --- |
| **Pricing is for (counties/cities): CEC Climate Zone(s):** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Additional Items Needed on Some Jobs** | **Approximate Price Range** | **Housing Type** | **Average Installed Price\*** | | |
| **Heat Only** | **Split System** | **Package Unit** |
| * Crane | $ | **Single Family** |  |  |  |
| * Curb | $ | **$** | **$** | **$** |
| * Filter base | $ | [ ] N/A | [ ] N/A | [ ] N/A |
| * Concrete pad | $ | **Multi-Family (Average apt.)** |  |  |  |
| * Line set flush | $ | **$** | **$** | **$** |
| * Line set replacement | $ | [ ] N/A | [ ] N/A | [ ] N/A |
| * Condensate line | $ | **Mobile Home (60-ft. double-wide)** |  |  |  |
| * Condensate pump | $ | **$** | **$** | **$** |
| * Refrig. charge & airflow adjust (T-24, split) | $ | [ ] N/A | [ ] N/A | [ ] N/A |
| * Duct Testing & Sealing (T-24) | $ | **\*Items presumed to be included in all system prices:**   * **Furnace and Labor** * **Permits** * **Programmable Thermostat** * **CO and Smoke Alarms** | | | |
| * Duct replacement (crossover for MH) | $ |
| * Electrical (typical average | $ |
| * HERS Rater fee (T-24) | $ |
| * Other: | $ |
| * Other | $ |

# Appendix B: HE-FAU Installation cost received from Esa Contractors

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Contractor #1** | | | **Contractor #2** | | | **Contractor #3** | | | **Contractor #4** | | |
| **Base Price Components** (Furnace, Labor, Permits,  T-stat, Smoke/CO alarms) | **Heat Only** | **Split System** | **Package Unit** | **Heat Only** | **Split System** | **Package Unit** | **Heat Only** | **Split System** | **Package Unit** | **Heat Only** | **Split System** | **Package Unit** |
| Single Family (1200 sq. ft. average) | $ 4,000 | $ 6,000 | $ 5,000 | $ 3,400 | $ 3,750 | N/A | $4500-$5000 | $8600-$9000 | $5500-$6000 |  |  |  |
| Multi-Family | $ 3,500 | $ 5,000 | $ 3,800 | N/A | | | N/A | | | N/A | | |
| Mobile Home | $ 3,800 | $ 5,000 | N/A | N/A | | | $3500-$4000 | $7600-$8100 | $5500-$6000 |  |  |  |
| Crane | $ 200 |  |  |  |  |  |  |  |  | $ 300 |  |  |
| Curb | $ 400 |  |  |  |  |  |  |  |  | $ 500 |  |  |
| Filter Base | $ 150 |  |  |  |  |  |  |  |  | $ 120 |  |  |
| Concrete Pad | $ 250 |  |  |  |  |  |  |  |  | $ 50 |  |  |
| Line Set Flush | $ 250 |  |  |  |  |  | $ 750 |  |  | $ 50 |  |  |
| Line Set Replacement | $ 450 |  |  |  |  |  | $ 750 |  |  | $ 150 |  |  |
| Condensate Line | $ 150 |  |  |  |  |  | $ 91 |  |  | $ 150 |  |  |
| Condensate Pump | $ 250 |  |  |  |  |  | $ 130 |  |  | $ 400 |  |  |
| Refrigerant Charge and Airflow | $ 450 |  |  |  |  |  |  |  |  | $ 300 |  |  |
| Duct Test and seal | $ 750 |  |  | $ 359 |  |  | $350-$1000 |  |  | $ 500 |  |  |
| Duct Replacement | $ 750 |  |  |  |  |  | $1400-$1700 |  |  |  |  |  |
| Electrical | $ 850 |  |  |  |  |  | $ 72 |  |  | $ 200 |  |  |
| HERS Fee |  |  |  |  |  |  | $495-$695 |  |  | $ 300 |  |  |
| Title 24 |  |  |  | $ 120 |  |  |  |  |  |  |  |  |
| Refrigerant Charge |  |  |  | $ 50 |  |  |  |  |  |  |  |  |
| Programmable T-Stat |  |  |  |  |  |  | $ 150 |  |  |  |  |  |
| Smoke/CO Alarms |  |  |  |  |  |  | $ 59 |  |  |  |  |  |
| Permits |  |  |  |  |  |  | $215-650 |  |  |  |  |  |
| Vent System |  |  |  |  |  |  |  |  |  | $ 250 |  |  |

# Appendix C: Previously provided HVAC Information survey Results and Column Definitions





1. Contractors consider pricing to be confidential, and were not willing to provide itemized costs for every component of the installation. Furthermore, all costs were provided on the condition of anonymity. [↑](#footnote-ref-2)