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Analysis of Comparative Energy Use of Residential Furnaces and Heat Pumps

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An ACEEE White Paper

High level observations:

* ACEEE analysis is of interest to PG&E but not directly applicable.
  + DOE Full Fuel Cycle (FFC) values for Therms and kWh used which is equivalent to the source energy multiplier of 3, while CEC uses Time Dependent Value (TDV) which results in a 3.8 multiplier.
  + Analysis uses 4 power plant heat rates (HR - Btu/kWh): 6161, 6503, 7667, and 10354. CEC finds CA that electricity production heat rate is 7260.
  + Renewable procurement at 33% creates a net heat rate of 4792.
  + HSPF over estimates heating efficiency nationally but probably appropriate for California’s mild climates.
  + Low net heat rate (NG plant HR \* renewable percentage) offsets difference between FFC and TDV making ACEEE analysis germane to California.
  + Analysis shows Heat Pumps in California are more energy efficient than furnaces.
* Heat Pumps have no efficiency credit in CEC Title 24 because the DOE minimum efficiency of each (Furnaces at 80 AFUE and Heat Pumps at 8.2 HSPF) is used to set the heating budget.
* Heat Pumps are 1.8 times more expensive to operate with electricity at $0.27/kWh and gas at $1.83/Therm.

Conclusions

* Current CEC Title 24 makes HP and Furnace heating separate but equal.
* Current CPUC approved rates make natural gas heating much less expensive.
* Future electricity rates at $0.19/kWh could make operating cost equal for furnaces and heat pumps.
* CEC definition of Zero Net Energy as being TDV = 0 allows gas usage to be offset by on site PV kWh.
* No action needed other than sending ACEEE my “track changes” edits of the draft.

Figure 1 for ACEEE Draft

Comparison of current DOE minimum efficiency 80%AFUE furnace with an 8.2 HSPF electric heat pump based on DOE FFC multiplier.

