High Efficiency Direct Vent Gas Fireplaces for the Existing Homes Program
Proposed Measure Revision for 2015

Conservation Advisory Council
July 23, 2014

Measure Description

Direct vent gas fireplaces, including zero clearance and freestanding units and inserts. The measure is currently offered in the Existing Homes and Home Performance with ENERGY STAR programs. Additional research is needed to expand the measure to the Existing Buildings Multifamily and Efficient New Homes programs.

Need for Review

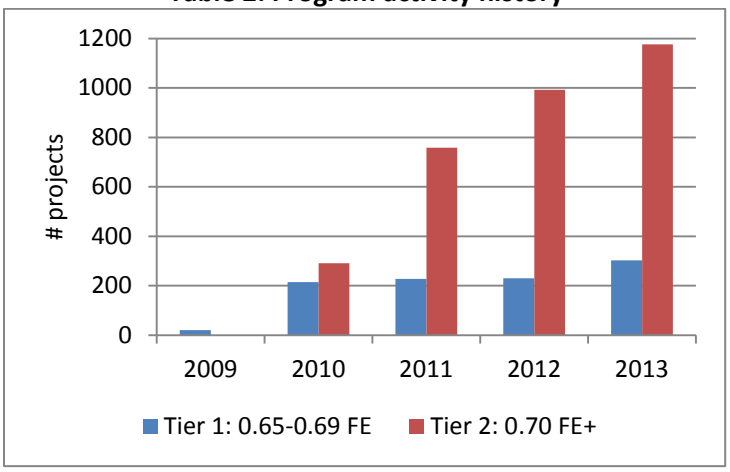
Energy Trust first provided incentives for efficient gas fireplaces in 2009 as a pilot offering to test the savings performance and market potential for upgrading participants to the more efficient option than the market baseline. No other regional utility had offered incentives prior to that time, and we were not familiar with the market and typical usage. NW Natural provided support in market understanding as did a survey of vendors completed by a third party contractor. The market survey results guided our determination of the market baseline efficiency, prevalence of standing pilot lights, and the size of the market in Oregon. The study also helped us design the savings estimate based on the assumption that the majority of the units would be the primary heat source, operating 20 hours per week during the heating season. With this information we designed a two tier offer, shown in the table below:

Table 1: Initial measure offer

Tier	FE (%)	Incentive
Tier 1	65-69.9%	$200
Tier 2	70+%	$250

For the past 5 years, program activity has increased significantly. In 2013, hearths provided 13% of Existing Homes total gas savings. Since 2010, the majority of installed equipment has been the higher efficiency tier, including all of the project growth. The number of installed hearths from 65 to 69 FE has remained stable. By 2013, 80% of qualifying equipment was in Tier 2, 20% Tier 1.

Table 2: Program activity history



After 5 years of increasing participation, each of the key assumptions needs to be updated to better reflect the changing market and typical use of hearths. By summer 2013 we began to look for ways to evaluate our key assumptions. Billing analysis turned out to be inconclusive. Since we are incenting participants to purchase the more efficient unit over the market baseline, billing analysis was not a good fit since the pre-conditions varied significantly. To better inform our market understanding, three studies were commissioned over the course of 9 months;

- Updated market data vendor survey to determine current market efficiency baseline and use of standing pilot lights
- A metering study to determine the hours of use compared to our 20 hours/week assumption
- Survey of distributors to determine if the Oregon market was more efficient than other states/regions and if Energy Trust's program influenced upstream decisions regarding efficiency

Proposed changes

The updated vendor survey showed a shift in the market baseline to 67 FE. As a result, two new efficiency tiers are proposed: a lower efficient tier from 70 to 74 FE and a more efficient tier at 75 FE and above. With the minimum requirement of 70 FE very close to the 67 FE baseline, there appears to be no incremental cost. We are offering an incentive at this efficiency level based upon a market design need to retain widely available equipment while the market can adapt to respond to the higher efficiency tier. When calculating savings, the average efficiency in the range will be used, not the minimum, so energy savings potential remains in the lower tier. The higher efficiency tier is cost effective but equipment availability may be limited. This shift will support the market advancing toward the new level while retaining the current, most popular efficiency level.

Energy savings based on thermal efficiency

The efficiency rating is the Fireplace Efficiency score from the Canadian P4 test. Savings are calculated according to the following formula:

$$\Delta therm = hr\ x\ \frac{kBtu}{hr}\ x\ (\frac{1}{baseline} - \frac{1}{FE})$$

The efficiency is based on the average in each bin, as shown in the table below. The heat capacity for each efficiency tier was averaged from program data from 2013. Fireplaces with an efficiency rating

between 70 and 74 FE averaged 33 kBtu/h, and fireplaces with ratings of 75 FE or higher had an average heat capacity of 26 kBtu/h. Hours of use averaged 15 per week in the metering study.

Table 3: baseline efficiency

	overall market	total program (includes free-riders)	free-riders (subset of total program)	non program	non program or free rider	average FE in each bin
below 65	1971	0	0	1971	1971	61.0
65 to 69	2806	260	117	2546	2663	67.0
70 to 74	2806	1074	483	1732	2215	71.6
75 +		20	9		9	77.2
total	**7583**	**1354**	**609**	**6249**	**6858**	**66.8**

The overall market size was an outcome of the market survey. 23 out of the 48 members of the Oregon Hearth, Patio, and Barbecue Association were interviewed and their responses assumed to be representative of the members the survey contractor was unable to interview. The extrapolated responses were compared to program activity. The market baseline of top selling brands was calculated by averaging the efficiency of non-program equipment, including free-riders. Free-ridership is 45%, according to rolling average quarterly Fast Feedback results. However, this reflects the impressions of participants, and may be somewhat distorted in two ways. First, the program appears to have influenced the efficiency of available equipment, based on at least one distributor's perspective. Second, as is the case for all replacement equipment measures, customers may have difficulty distinguishing between the efficiency of the model chosen and the efficiency they would have otherwise chosen. They may or may not have been presented with a choice by the dealer, who may or may not have proposed the same equipment without incentives. Free-riders surveys are particularly difficult to interpret during periods of significant market transition. The baseline survey indicates that we have been experiencing such a period. Thus, we may incorporate the free-riders calculations into our savings forecasts, but also look for ways to claim some market transformation savings over time.

For the new lower efficient tier (Tier 1, 70-74 FE), the savings are 19.9 annual therms (15 hours per week x 40 weeks x 33 kBtu/h x (1 / 66.8 FE – 1 / 71.6 FE). For the higher efficient tier (Tier 2, 75+FE), the savings are 31.5 annual therms (15 hours per week x 40 weeks x 26 kBtu/h x (1 / 66.8 FE – 1 / 77.2 FE).

A sensitivity analysis was done to determine the effect of free-ridership on the energy savings. Although we know that some degree of free-ridership is present, the sensitivity of the savings to changes in free-ridership can be determined by removing the free-riders from the baseline. The resulting average baseline efficiency is 66.4 FE. If an alternative approach to free-ridership were selected, the maximum energy savings from thermal efficiency would be 21.7 annual therms for equipment from 70 to 74 FE and 32.9 annual therms for equipment at or above 75 FE, a change of 9.0% and 4.5% respectively.

Energy savings based on intermittent pilot ignition

Intermittent ignition savings are calculated by multiplying the heat input by the number of hours the pilot would otherwise be on and the Net to Gross ratio (NTG). The heat input is 600 Btu/h, the hours

8760 minus the hours the fireplace is in operation, and NTG is 0.81 based on the percentage of standing pilot lights in the baseline when the measure was implemented in 2009. Savings from the intermittent ignition system are 39.7 therms ((8760 hours – 40 weeks x 15 hours per week) x 0.006 therms / h x 0.81).

A third party contractor interviewed representatives of three manufactures whom they assert cover the majority of the Portland market and approximately 30% of the state market. We learned that standing pilot lights have nearly vanished and at least one distributor credits our program with that change. One expert noted that they sell standing pilot lights in other states but only about 1% of Oregon sales have standing pilot lights. To recognize this influence, although standing pilots are no longer in the market baseline, savings for intermittent ignition systems will be claimed for each unit in the program in 2015. These savings recognize that we helped move the market away from standing pilot lights earlier than they otherwise would have. Continuation of this practice beyond 2015 will depend upon additional market data we are able to collect and if we can determine from that data a reason to continue to claim ignition system transformation savings.

In addition, one interviewee from the distributor survey claimed that due to Energy Trust influence, they changed their product line and only sell high efficiency units now. To account for this influence, we propose estimating the balance of this distributor's sales in Oregon that did not receive an Energy Trust incentive and booking those savings for 2014.

Measure Cost

Table: 2013 program data

Tier	Average cost
67 to 69	$4,553
70 to 74	$4,067
75 and up	$4,241

Cost Effectiveness

	Measure	Measure Lifetime (Maximum 70 yrs)	Annual Gas Savings, therm	Total Cost	MAX ETO Incentives	Utility System PV of Benefits	Societal PV of Benefits	Combined Utility System BCR	Combined Societal BCR
1	67 FE baseline vs 70	20	59.5	$1	$357	$357	$357	1.0	357
2	67 FE baseline vs 75	20	71.1	$173	$426	$426	$426	1.0	2.5

Effects of proposed changes

New tiers will push the market towards higher efficiency units. With the market baseline shift and fewer load hours, there are less per unit savings, especially for tier 1. Impacts to the market if there were no incentive for units below 75 FE are unknown, but may include a disengagement from the efficiency

market, considering the small market share of units with efficiencies above this level. It is unlikely that the market will continue to move as fast as it has for the last few years but with continued engagement with supply chain actors, it seems plausible that the program can continue to drive the higher efficiency levels. Because manufacturers have improved their products over the years, there's little risk of "backsliding" to 61 FE. Continuing to take credit for promoting intermittent pilot lights over standing pilot lights for a year helps to continue to support the market.

The change to baseline has a significant effect on the aggregate savings. Savings would decrease by approximately 35%, if the project volume were to remain steady at the level achieved in 2013, with nearly all equipment in the 70 to 74 FE tier. In addition, increasing the efficiency required for the two tiers would decrease aggregate savings by about 15%.

Next steps

A market transformation plan will be developed, to set a baseline for future efficiency development against which we can measure our actual impact. For example, in 2015, we estimate that 95% of incentives will support 70-74 FE units and 5% will go to 75 FE and greater. If we did not change our structure in 2015, the market would most likely still move towards higher efficiency levels but at a slower pace. The difference between actual sales and our natural baseline shift could be claimed as market transformation savings.