

Data – Kindling for Fire(places): Using Data to Inform Program Design for High Efficiency Gas Fireplaces

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ABSTRACT

What are the expected energy savings? Are the energy savings real? What does the market look like? Where is the market going? Did the program influence the market? These are key questions for program design and planning, and evaluators are often in the best position to supply the answers and work with program designers and planners to translate findings into action. Getting answers to these questions was a top priority for Energy Trust of Oregon, an independent nonprofit that offers incentives for high-efficiency gas fireplaces.

To answer these questions, the authors undertook three studies. The first study involved interviews with fireplace vendors to gather information about the market baseline efficiency, determine the prevalence of fireplaces with intermittent pilot ignition systems, and how often customers use their fireplace, which are critical pieces of information for cost-effectiveness and estimated savings.

The second study involved the installation of metering equipment on 49 gas fireplaces to gather a more accurate estimate of customer fireplace use, pre-existing heat sources, and how customers are using fireplaces in conjunction with other heating systems.

The final study involved interviews with market actors to assess Energy Trust's influence on the gas fireplace market, specifically, the availability of high efficiency hearths with intermittent pilot ignition systems.

In the paper, we will describe the information gaps these three studies aimed to fill. Then, we will summarize each study's methods, results, and impact on the gas fireplace offering, ending with a summary of program changes made in response to the studies, as well as a description of next steps.

Introduction

Energy Trust's Existing Homes program has offered incentives for qualifying high-efficiency, direct-vent gas fireplaces since 2009. The gas fireplace offering began as a pilot and had relatively low volume before growing rapidly in 2010 (primarily due to increased incentives). As of 2014, savings from gas fireplaces represent 13% of the Existing Homes program's gas savings, and fireplaces are considered a key offering for gas customers.

A study of Oregon fireplace vendors was commissioned in 2009 to understand three key drivers of savings: market baseline efficiency, ignition system type, and hours of use. The study was performed again in 2013 to assess changes in the gas fireplace market. The 2013 vendor study revealed a large increase in the average market baseline efficiency and marked increase in the number of units sold with intermittent pilot ignition (IPI). Additionally, a billing analysis undertaken in late 2013 suggested that gas savings were not present for customers that installed gas fireplaces in 2010. These results led to a number of program changes and spawned additional questions. One of the questions was about the assumed hours of use, a key driver of savings. A metering study was completed to get a more accurate estimate of hours of use, and gather additional information about what gas fireplaces are replacing and how customers are using fireplaces in conjunction with other heating systems. The significant changes in the gas fireplace market led Energy Trust to assess its influence on those changes by conducting interviews with several market actors.

In the next section, we discuss each study’s methods, results, and impact on the gas fireplace offering, ending with a summary of program changes made in response to the studies, as well as a description of next steps.

Study Methods, Results, and Impact

2009 Vendor Study – Methods and Results. Energy Trust launched its gas fireplace measure as a pilot in 2009. A study of Oregon gas fireplace vendors was commissioned that same year¹ to understand market baseline fireplace efficiency, ignition system type, and hours of use, which was used to refine savings estimates for the then relatively new gas fireplace measure. Twenty-three hearth vendors were surveyed by Dethman & Associates about high-efficiency, direct-vent gas fireplaces, including the average efficiency, prevalence of IPI, and customer use of fireplaces for heating.

As shown in Figure 1 below, vendors estimated that about 39% of their top-selling fireplaces had IPI, rather than a standing pilot light, and the average fireplace efficiency (FE) was 61%. Vendors were also queried about customers’ use of fireplaces for heating. As shown in Table 1, the majority (74%) of vendors reported that at least half of customers planned to use the fireplace for heating. This information was used to determine that on average, customers use their fireplace an average of 20 hours per week during the heating season (May – September).

Figure 1. Average fireplace efficiency and IPI prevalence

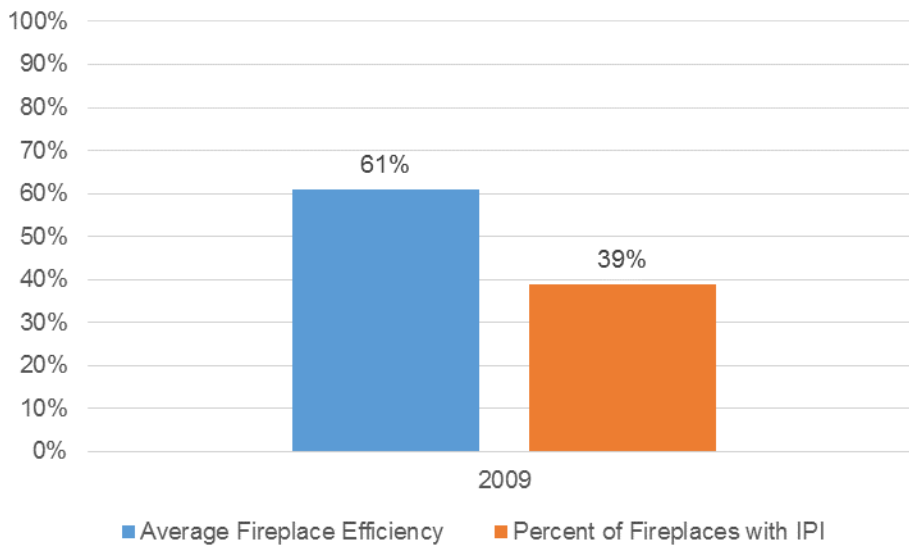


Table 1. Proportion of buyers planning to use fireplace as major heat source

	Number of Vendors	Percent of Vendors
25% or less	2	9%
25%-50%	4	17%
50%-75%	7	30%
More than 75%	10	44%
Total	23	-

¹ A more complete summary of the 2009 vendor study can be found here: http://assets.energytrust.org/api/assets/reports/Gas_Fireplace_Studies.pdf.

2009 Vendor Study – Impact. Based on the results of this study, Energy Trust revamped the high-efficiency gas fireplace measure. During the measure’s pilot phase, the Existing Homes program provided a \$70 incentive for efficient fireplaces and assumed nominal savings (8 therms). In 2010, the program transitioned the measure out of pilot phase and developed savings estimates using the information about average FE, IPI prevalence and hours of use (Table 2). The program also developed a two-tiered incentive structure, which is shown in Table 2 below. The tiers were intended to encourage sales of higher efficiency fireplaces. Additionally, starting in 2010, an additional incentive was provided for units with IPI.

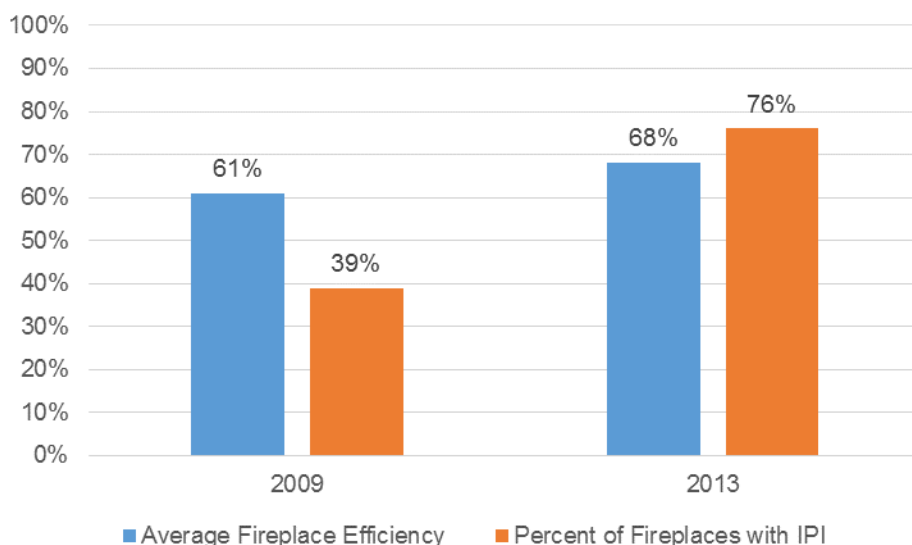
Table 2. Incentives and savings for gas fireplaces, 2009-2012

Program Year	Measure	Incentive	Savings ²
2009	Gas Fireplace	\$70	5.76-8.0
2010-2012	Gas Fireplace 65%-69% FE	\$100	35.39
2010-2012	Gas Fireplace 70%+ FE	\$150	51.89
2010-2012	Intermittent Pilot Ignition (IPI)	\$100	39.66

2013 Vendor Study – Methods and Results. As noted above, the gas fireplace measure began as a pilot, but grew quickly to comprise about 13% of the Existing Homes program’s gas savings in 2014. Due to this large increase, and in response to anecdotal evidence that the gas fireplace market had experienced rapid change, Energy Trust worked with Cadmus to undertake a second round of surveys with 23 vendors in 2013³, as an update to the prior 2009 study.

The study revealed marked changes relative to 2009. As shown in Figure 2, the average fireplace efficiency rose from 61% in 2009 to 68% in 2013 and the percent of fireplaces with IPI went from 39% in 2009 to 76%. 74% of top-selling units had an FE that was above the program’s lowest tier (65% FE).

Figure 2. 2009 and 2013 vendor study results



² These are first year savings.

³ A more complete summary of the 2013 vendor study can be found here: http://assets.energytrust.org/api/assets/reports/Gas_Fireplace_Studies.pdf.

2013 Vendor Study – Impact. Given these changes in the market, it became necessary to revise the program requirements and incentive levels for fireplaces, since the program was incentivizing units that appeared to be common in the market. Table 3 below shows the revised program requirements and incentive levels for 2013-2015. First, starting at the beginning of 2013, all fireplaces receiving an incentive were required to have an IPI or on-demand⁴ pilot light. Second, the program revised the required fireplace efficiency levels for 2015 to 70-74.9 FE and above 75 FE, and increased the incentives for these tiers to \$250 and \$350, respectively. Estimated savings were also revised.

Table 3. Incentives and savings for gas fireplaces, 2013-2015

Program Year	Measure	Incentive	Savings
2013-2014	Gas Fireplace 65%-69% FE with IPI	\$200	85.37
2013-2014	Gas Fireplace 65%-69% FE with On-Demand Pilot	\$200	62.07
2013-2014	Gas Fireplace 70%+ FE with IPI	\$250	106.97
2013-2014	Gas Fireplace 70%+ FE with On-Demand Pilot	\$250	83.67
2015	Gas Fireplace 70%-74% FE with IPI	\$250	79.4
2015	Gas Fireplace 70%-74% FE with On-Demand Pilot	\$250	42.8
2015	Gas Fireplace 75%+ with IPI	\$350	90.9

Finally, the results of the 2013 vendor study spurred the program to understand what was driving the observed changes in the market – Energy Trust’s program, or something else? Energy Trust designed a study to investigate these changes in the market, which is described in the next section.

Market Actor Interviews – Methods and Results. The shifts in the market observed through the 2009 and 2013 vendor studies prompted the program to ask what was driving the market – Energy Trust incentives, or something else? To investigate this, Energy Trust worked with Cadmus to interview three gas fireplace manufacturers and distributors about the impact of Energy Trust’s program on the Oregon gas fireplace market, any differences between the market in Oregon and other states, how the Oregon market has changed over time, and the reasons for these changes.

Interviewees were asked about the impact of Energy Trust’s program on the Oregon market in two ways: what the Oregon fireplace market was like before Energy Trust’s fireplace offering, and what they think the Oregon market would look like currently if there were no rebates. One respondent said there was a low proportion of high-efficiency units in the market prior to Energy Trust’s program, and this is much higher now. Another respondent said that in 2009, consumers were looking for high efficiency, but in the wake of the recession, they are not aware of differences in efficiency and not willing to pay for efficiency. From this respondent’s perspective, efficiency isn’t a driver for consumers and neither are rebates. The third respondent said that Energy Trust doesn’t drive people into stores to purchase fireplaces, but Energy Trust’s program has had a major impact on the high-efficiency gas fireplace market because it helps to sell high-efficiency products to customers looking to buy fireplaces.

If Energy Trust did not offer rebates, one respondent said there would be fewer high-efficiency fireplaces in the Oregon market. The other two respondents said that there would not be a large impact on the Oregon market, but one of these two noted that rebates helped maintain the market during the recession.

When asked about how Oregon’s high-efficiency fireplace market is different from other regions, one respondent said rebates are pushing the market to high-efficiency units, and noted that other regions outside of Oregon still had a large prevalence of standing pilot lights. The other two respondents said

⁴ On-demand is similar to IPI, with some differences.

Oregon’s high-efficiency gas fireplace market is the same as what they see in other regions they serve.

Regarding changes in the Oregon market over time and the reasons for those changes, two respondents said the sale of high-efficiency products has gone up, and credited Energy Trust with that change. The third respondent said they have not seen any changes in sales of high-efficiency units in the Oregon market.

Market Actor Interviews – Impact. The market actor interviews provided a mixed picture of Energy Trust’s influence on the gas fireplace market. Two of three respondents thought that Energy Trust’s fireplace offering had an impact on the high-efficiency gas fireplace market in Oregon. However, only one of the three respondents thought the Oregon market was different from other areas they serve. The inconclusive findings and very small sample size (n = 3) signaled the need for a more comprehensive and structured examination of the gas fireplace market, which led Energy Trust to commission a market transformation study, which is discussed more in the Next Steps section.

Metering Study – Methods and Results. The growth of the gas fireplace measure between 2010 and 2013 necessitated a hard look at whether the estimated savings for the fireplace measure were actually realized. In late 2013, Energy Trust staff performed a billing analysis of just over 100 sites that installed high efficiency gas fireplaces in 2010. This analysis showed that participants slightly increased their consumption between 2009 and 2011 (by about 6 therms) while non-participants and future participants decreased their consumption by between 47 and 58 therms. This result led to four potential explanations for why savings do not appear to be present, which are summarized in Table 4.

Table 4. Hypotheses for billing analysis results

#	Hypothesis	Description
1	Fuel-switching	Customers are moving from using electricity to heat their home to using their gas fireplace, which could lead to increases in gas consumption.
2	Replacement	Gas fireplaces may not be replacing old gas fireplaces; if this is the case, it would result in load building.
3	Displacement	After installing a fireplace, customers may be switching from primarily heating their home with a highly efficient gas furnace (furnaces commonly have high annual fuel use efficiencies) to a relatively less efficient gas fireplace, which could result in load building.
4	Hours of use	Before the metering study, Energy Trust assumed that customers use fireplaces about 20 hours per week during the heating season, which was based on the 2009 vendor study discussed previously. If use of gas fireplaces is lower than expected, it could reduce savings.

To investigate hypotheses #2-4, Energy Trust undertook a metering study to learn: 1) what gas fireplaces are replacing, 2) how customers are using fireplaces in conjunction with other heating systems, and 3) how often customers are using their fireplace.

Energy Trust contracted with Ecotope to perform this metering study⁵, which involved a customer survey and site visits to install metering equipment in 35 homes with efficient fireplaces (that received incentives through Energy Trust) and 14 homes with baseline fireplaces (less efficient fireplaces⁶ that did

⁵ A more complete summary of the metering study can be found here:

http://assets.energytrust.org/api/assets/reports/Gas_Fireplace_Studies.pdf.

⁶ The FE ratings for fireplaces in the baseline group ranged from “Unrated” (meaning there was not an FE rating on NRCan’s website) to 64.4%.

not receive incentives through Energy Trust).

Tables 5-7 below show results to three of the survey questions that provide insight into what gas fireplaces are replacing and how customers are using fireplaces. Table 5 shows that about half of new gas fireplaces are replacing wood-burning fireplaces or stoves and just under half are replacing an old gas fireplace. About 10% are not replacing anything (a new fireplace). This sheds light on the billing analysis results; if fireplaces are not replacing an old gas fireplace (which the survey results suggest is happening about half of the time), we would expect that savings would be more difficult to detect through billing analysis.

Table 5. Did the gas fireplace you purchased replace ...

	All	Baseline	Efficient
A wood burning fireplace or stove	20 (41%)	3 (21%)	17 (49%)
An old gas fireplace	24 (49%)	7 (50%)	17 (49%)
Nothing (new fireplace)	5 (10%)	4 (29%)	1 (3%)
Total	49	14	35

As shown in Table 6, only 16% of respondents said they were using the fireplace as the main heating source for their home. Most respondents (84%) said that they did not use their fireplace as the main heating source for their home. However, when these respondents were asked how they use the gas fireplace, over 90% said they used it for heating in conjunction with other systems.

Table 6. Are you using the gas fireplace as the main heating source for your home?

	All	Baseline	Efficient
No	41 (84%)	10 (71%)	31 (89%)
Yes	8 (16%)	4 (29%)	4 (11%)
Total	49	14	35

To determine exactly how many hours customers used the fireplace, customers were surveyed about their use of their fireplace and metering equipment was installed between February 9 and April 30, 2014 (81 days). Due to data logger issues at six sites, these sites were dropped from the same, for a total of 43 sites that were metered. Table 7 below shows the reported and metered fireplace use per week, along with the standard deviation. On average, customers reported using their fireplace 26 hours per week, and the metering results showed about 17 hours of use per week, suggesting that customers tended to over-report use by about 53%. Only nine of the 42⁷ sites that estimated their weekly use under-reported hours of use.

Table 7. Reported and metered fireplace use per week, by group

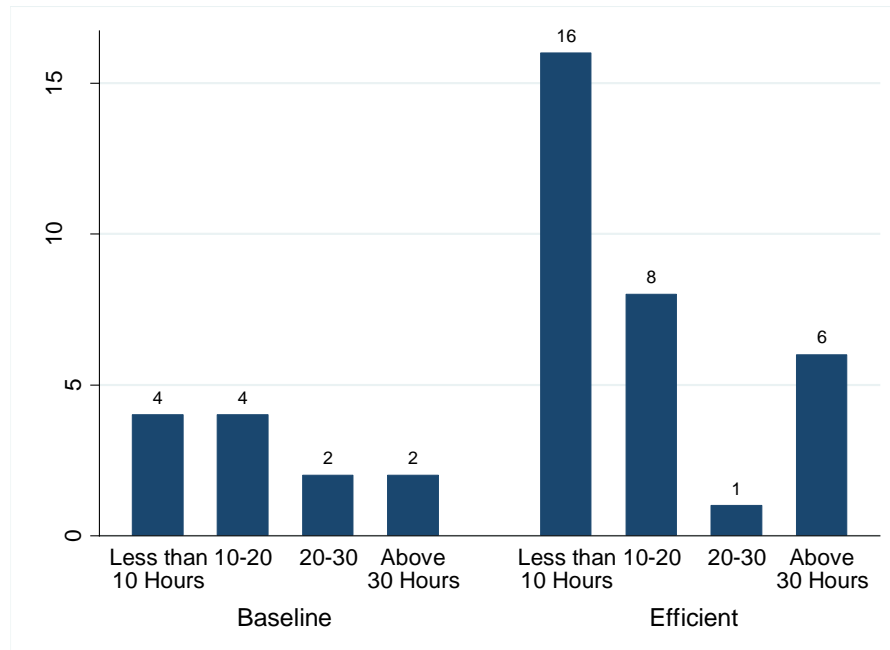
	All	Baseline	Efficient
Average reported use per week (hours)	26 (s.d. = 25)	31 (s.d. = 36)	24 (s.d. = 19)
Average metered use per week (hours)	17 (s.d. = 17)	21 (s.d. = 20)	15 (s.d. = 16)

Figure 3 below shows the distribution of average metered weekly hours of use for the Efficient and Baseline groups. What is striking is that a large number of sites use the fireplace less than 10 hours (a

⁷ A customer at one of the 43 sites that was metered did not provide an estimate of use.

third of the Baseline group and just over half of the Efficient group) and a small number of sites that use the fireplace extensively.

Figure 3. Distribution of average weekly hours of use (metered)



Metering Study – Impact. The metering study results led Energy Trust to update the assumed hours of use (which were originally based on responses from the 2009 vendor study); this resulted in revised savings estimates for 2015 (see Table 3). Additionally, the information obtained about what fireplaces are replacing confirms that billing analysis is not an appropriate method for evaluating savings, which will influence the way the offering is evaluated in the future.

Summary: Using Results to Inform Program Design

In summary, data from these three gas fireplace studies influenced and informed Energy Trust’s high-efficiency gas fireplace offering. The 2009 vendor study provided information used to develop the estimated gas fireplace measure savings, as well as set the incentive levels and efficiency tiers. The 2013 vendor study revealed large shifts in the Oregon gas fireplace market over a short period of time, and resulted in the program moving to a higher FE requirement, adopting an IPI requirement, and revising incentive levels and savings estimates. Interviews with market actors provided a mixed picture of Energy Trust’s influence on the Oregon gas fireplace market, and some limited information about how the Oregon market compares to other areas served by manufacturers and distributors. Finally, the metering study provided a more accurate estimate of how often customers are using fireplaces and information about what fireplaces are replacing, which resulted in changes to savings estimates and will influence the way the gas fireplace offering is evaluated in the future.

Next Steps

In response to the three studies described above and the resulting program changes, Energy Trust has commissioned a gas fireplace market transformation study that has several goals: understand relationships among market actors, understand Energy Trust’s influence on the market from a broader range and larger number of market actors, and collect information about where the market is going so

Energy Trust can track changes in the market moving forward and potentially claim savings. The study will be complete in June 2015.

Additionally, Energy Trust is considering incentivizing the installation of efficient gas fireplaces in new homes. To investigate this as a potential measure, the program collected data on fireplaces installed in just under 200 new homes, which revealed that units with relatively low FE (average of 56%) were being installed and a number of builders were installing units with standing pilot lights. Interviews were conducted in early 2015 to learn about how builders make decisions around installing fireplaces and where they are sourcing products, and a survey of new homeowners will be completed in May 2015 to learn how much these fireplaces are being used by residents of newly constructed homes.

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