AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
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August 6, 2015

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program, Mailstop EE-5B
1000 Independence Avenue SW
Washington, DC 20585-0121

**Re**: Energy Conservation Standards for Residential Boilers; Proposed Rule
Docket Number EERE-2012-BT-STD-0047

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Dear Ms. Edwards:

On July 1, 2015 the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) submitted comments in response to the Department of Energy's (DOE) notice of proposed rulemaking (NOPR) regarding amended efficiency standards for residential boilers issued in the March 31, 2015 *Federal Register*. In those comments we noted that the NOPR analysis has not accurately accounted for the increased costs of installing boilers at the proposed revised efficiency levels and we informed DOE that AHRI was conducting a survey of contractors who install residential boilers to obtain information from the field on actual installation costs. The survey, conducted in conjunction with ACCA and the Plumbing, Heating and Cooling Contractors Association (PHCC), has been completed and the survey report is attached. The separate survey forms used for gas and oil boiler installations also are attached. These supplemental comments submit the survey results to DOE and address the information provided therein.

The survey received:

- 154 total responses
- 133 with some usable data on installation costs
- 107 responses on gas boilers and 47 on oil boilers
- 32 contractors responded to both the gas and oil boiler surveys
- Approximately one-third of the responses are from the Northeast, one-third from the Midwest and the rest from other parts of the U.S.

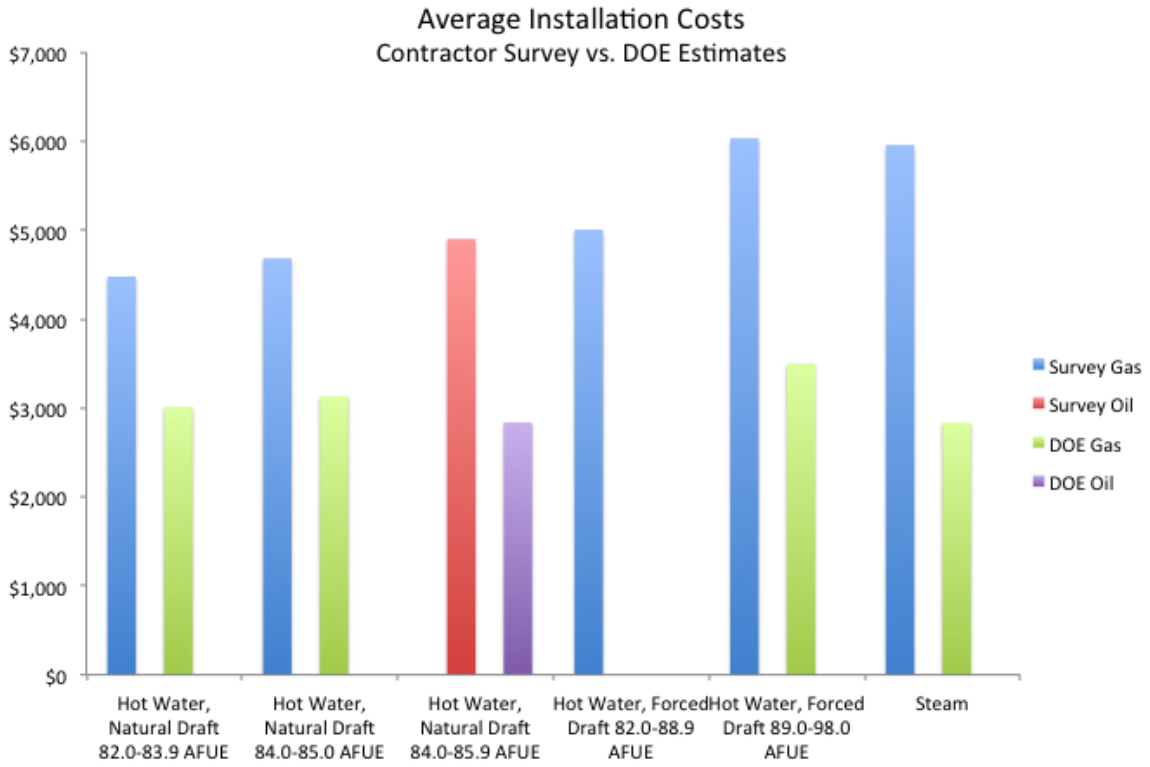
This is approximately a 1% response rate of usable data from the total membership of ACCA and PHCC and nearly a 2% total response rate.

The NOPR analysis of energy efficiency standards for gas and oil boilers developed cost estimates for boiler installation that range from median values of $2800 for oil hot water and all steam boilers to $3500 for condensing gas hot water boilers.[1] These estimates are significantly below those of installing contractors as determined in the survey, which range from $4500 for non-condensing oil and gas hot water boilers to $6000 for condensing gas hot water and for steam boilers (Figure 1). Note because of small sample sizes, the only information for oil boilers in Figure 1 is for the category "Natural Draft 84.0 to 85.9 AFUE." The NOPR analysis estimates that the incremental cost for installing a condensing boiler

[1] DOE Lifecycle cost model, sheet "Forecast Cells", cells Y2326-AG2343, note Median value used for DOE because Mean values can be distorted by extreme outlying amounts.

is approximately $500, while the survey shows the contractors' estimated incremental cost is approximately $1500.

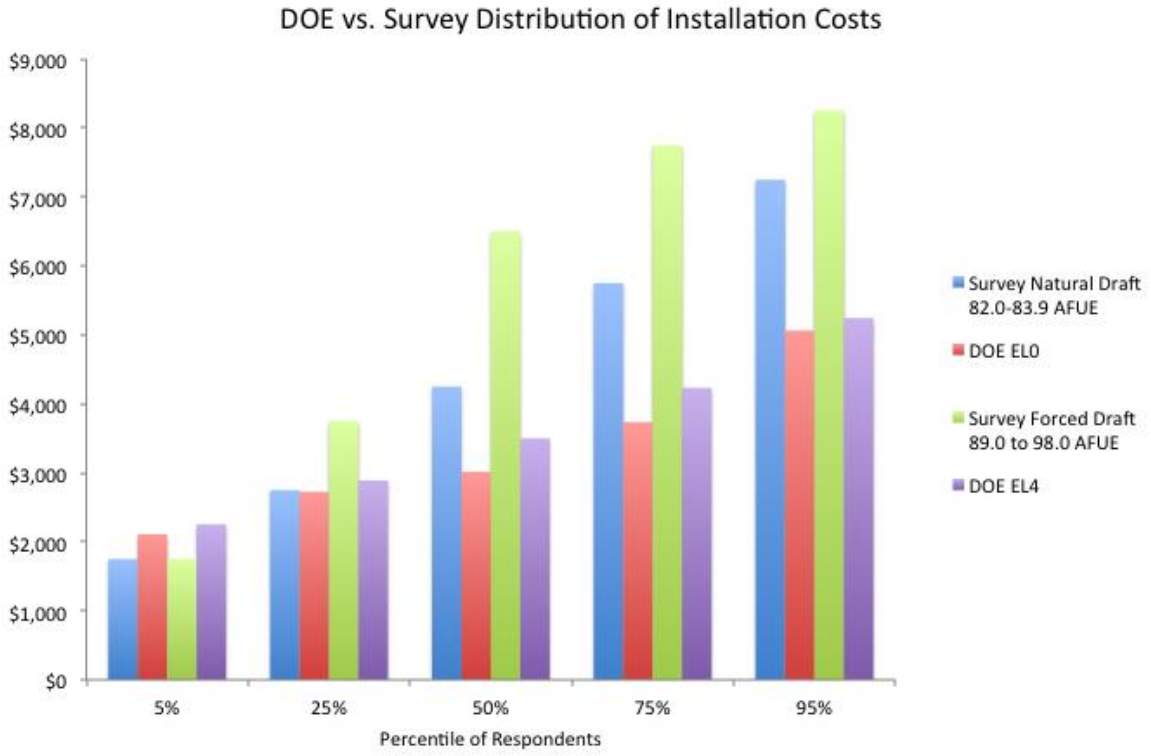
Figure 1: Comparison of DOE and Contractor Survey Installation Costs




The major source of the differences is in the estimates of "above Median" costs, where the DOE amounts are substantially less than the estimates by contractors (Figure 2). There is something systematically wrong with the DOE estimation process in which DOE uses a cost build up from component elements. While this can be an acceptable methodological approach, as this data shows, it needs to be calibrated with actual marketplace data in order to be reliable.

It is important to note that the cost estimates by contractors are only for installations that they perform, that is ones that they and customers believe are economically and practically beneficial. The DOE estimates are for installations in all circumstances, including complex venting options where sidewall venting is either not possible or would require internal reconstruction. Therefore, the DOE and the contractor estimates are not directly comparable. The contractor estimates represent a more conservative set of circumstances. Recognizing this, the NOPR analysis, which considers the full range of installation situations, is clearly underestimating the cost of installation.

Figure 2: Range of Estimated Installation Costs




On July 10, 2015 AHRI submitted comments responding to the DOE's NOPR regarding amended efficiency standards for residential non-weatherized and mobile home gas furnaces. In those comments we addressed the process used by DOE to calculate the cost to end customers of higher efficiency equipment. Specifically we commented on the use of an "incremental" markup to estimate the additional cost of more efficient equipment. Those July 10, 2015 comments provided information on a survey of contractors we conducted to get information on installation costs and markup practices for residential gas furnaces. That survey established that contractors do not use different markups pre and post standards. There is no reason to expect that contractors installing boilers have a different markup practice than those contractors installing furnaces. The comments and criticisms of the incremental markup concept presented in our July 10, 2015 comments on the residential furnace NOPR, including the document prepared by Everett Shorey and cited in footnote 48 on page 36 of those comments, are equally applicable to this rulemaking.

The following table compares the estimated total installed costs for various boiler types shown in Table 8.2.5 from the NOPR's Technical Support Document (TSD) to two revised estimates of the total installed costs. The "AHRI Survey" estimate adds the median installed costs from the AHRI survey to the NOPR's estimated "Consumer Price" shown in Table 8.2.4. The "AHRI Survey + Constant Markup" recalculates the markup of the higher efficiency models using the baseline markup, rather than the lower

incremental markup assumed in the analysis, and adds that increase in estimated "Consumer Price" to the estimate in the "AHRI Survey" column.

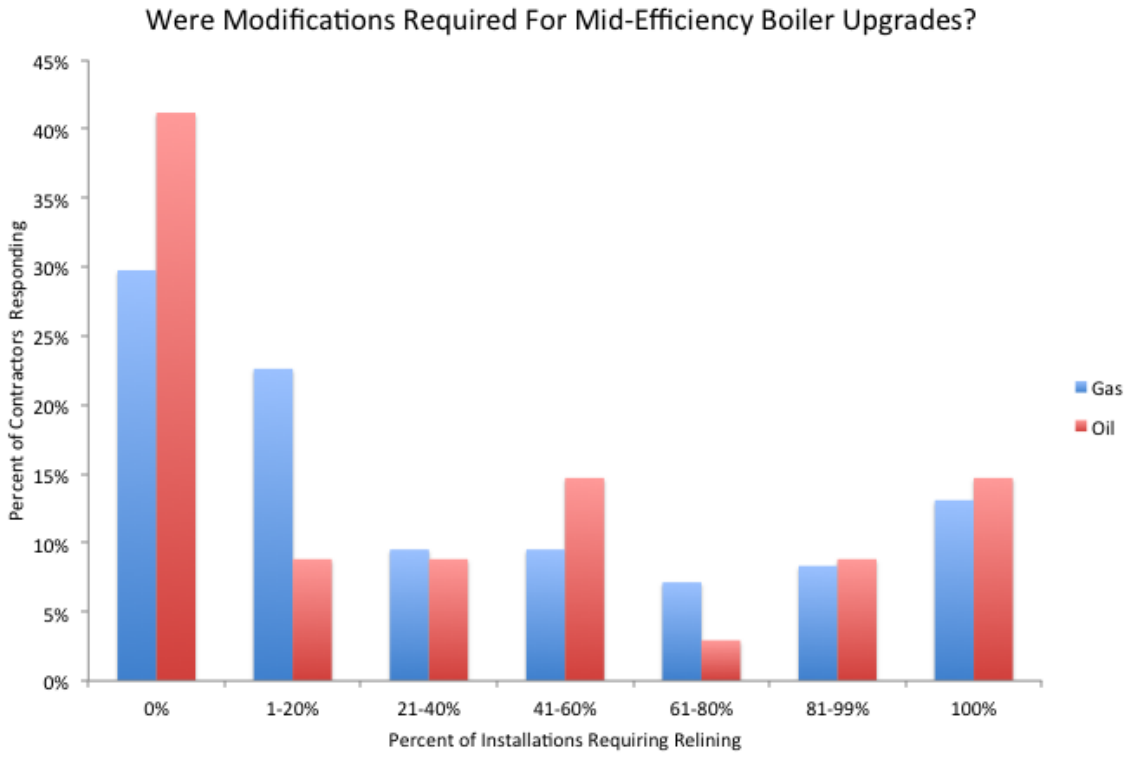
| Boiler Product Class | Efficiency Level (AFUE) | Total Installed Cost ($) | | |
|---|---|---|---|---|
| | | NOPR TSD (Table 8.2.5) | AHRI Survey | AHRI Survey + Constant Markup |
| Gas, Hot Water | 82 | 5405 | 6603 | |
| | 83 | 5447 | 6645 | 6710 |
| | 84 | 5461 | 7159 | 7246 |
| | 85 | 5585 | 7289 | 7583 |
| Gas, Steam | 80 | 5569 | 8532 | |
| | 82 | 5621 | 8571 | 8631 |
| | 83 | 5928 | 8867 | 9386 |
| Oil, Hot Water | 84 | 7089 | 9020 | |
| | 85 | 7332 | 9211 | 9511 |
| | 86 | 7527 | 9380 | 9945 |
| Oil, Steam | 82 | 7128 | 10054 | |
| | 84 | 7422 | 10348 | 10806 |
| | 85 | 7579 | 10499 | 11193 |
| | 86 | 7873 | 10792 | 11943 |

The survey on boiler installation costs clearly indicates that the NOPR analysis has underestimated that aspect of the total installed cost of a residential boiler. The survey also indicates a wide range of installed costs that has not been considered by the analysis. The unsupported assumption that the markup for models with incremental increases in efficiency is less than the standard markup employed by contractors also underestimates the price that consumers pay for higher efficiency residential boilers. The last column of this table, which combines the effects of those two inaccuracies, shows that the analysis has significantly underestimated the actual total installed cost that consumers will be paying for boilers at the efficiency levels considered in the NOPR analysis. Accordingly the life cycle cost (LCC) analysis and associated payback periods are not correct. The LCC values are much higher for each efficiency level and the payback periods are significantly longer.

Further compounding this underestimation of costs is the mischaracterization of the installations that will need added work on the venting system. The contractors' estimates of the cost of "above Median" installations start to climb rapidly. The survey results reflect only current "average" installations. The real amounts for higher cost installations are likely to be significantly higher than these contractor estimates, especially for condensing and near-condensing situations where venting system changes and rework are likely to be more complex. For example, contractors currently estimate that only a small percentage of mid-efficiency boilers currently require chimney relining or other venting modifications (Figure 3). As installations become more complex, the need for venting modifications will surely

increase, raising the costs above those already estimated by the contractors and likely bringing the expected cost for mid-efficiency boilers more closely in line with those of condensing ones.

Figure 3: Need to Modify Venting




The survey also asked contractors to provide their estimate of the typical life of the various types of residential boilers based on their own experience. The responses summarized in Figure 12 of the survey report show a distinct difference in the estimated lifetimes of non-condensing and condensing gas boilers. The average estimated life of a condensing gas boiler provided by the survey results is about 15 years. This is significantly less than the average 25 year lifetime assumed in the NOPR analysis.

The survey results provide information addressing specific inputs used in the NOPR analysis and raise issues concerning the results generated from those inputs. There is a more fundamental concern regarding the modeling processes used by DOE for this analysis. AHRI's concerns with Monte Carlo simulations and the use of the Crystal Ball randomizer are fully discussed in our July 10, 2015 comments responding to DOE's residential furnace NOPR. In particular the Life Cycle Costing (LCC) model does not accurately measure either the economic effects on consumers or the amount of energy saved.

The problems with the DOE methodology are:

1. Random selection of structures and fuel costs does not give an ordered ranking.
2. Weighted random assignment of base case and standards case costs and savings can defy economic rationality: a consumer can be assigned an illogical base and standards case situation.
3. Consumers can be assigned illogical combinations, such as computing the costs and benefits of the highest efficiency heating equipment in Miami or the costs and benefits of lowest efficiency heating equipment in Alaska.

Basically, the analysis assumes that all consumer decisions are random so it produces and uses a random number generator. What is needed is a methodology that assumes the marketplace is rational but calculating incorrectly (that the market functions but incorrectly) and measures the degree of market failure. The LCC does not do that. The flaws of the LCC tool being used for the residential furnace NOPR analysis are not unique and specific to that rulemaking. These issues concern the fundamental basis of the LCC analysis process. Accordingly those comments and concerns also apply to the analysis for this residential boiler NOPR.

Respectfully Submitted,

Frank A. Stanonik
Chief Technical Advisor

Attachments: Survey of Boiler Installation Contractors, July 2015
Survey Questionnaires

# Survey of Boiler Installation Contractors
July 2015

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Shorey Consulting, Inc.

# Boiler Installation Survey of Residential Contractors

## Overview of Survey

The Air-Conditioning, Heating and Refrigeration Institute (AHRI), in conjunction with ACCA Association and the Plumbing-Heating-Cooling Contractors Association (PHCC) conducted a survey of residential heating contractors during June and July 2015 to understand the differences in installation costs between various types and efficiencies of residential gas and oil fired boilers. The survey was conducted to provide empirical data to inform the standard setting process undertaken by DOE for residential boilers.

The survey received:

- 154 total responses
- 133 with some usable data on installation costs
- 107 responses on gas boilers and 47 on oil
- 32 contractors responded to both the gas and the oil surveys
- Approximately one-third of the responses are from the Northeast, one-third from the Midwest and the rest from around the country.

This is approximately a 1% response rate of usable data from the total membership of ACCA and PHCC and nearly a 2% total response rate. The text of the surveys is contained in Appendices A&B.

## Characterization of Respondents and Installations

Of the total actually installing boilers, they averaged 30-35 boilers installed per year (Figure **1**). This corresponds to approximately 4500 annual boiler installations per year, or 1-2% of total annual boiler shipments.

The vast majority of reported boiler shipments are for replacements. New construction represented less than 10% of installations and 67% of contractors reported no new construction installations and 91% of oil boiler contractors reported no installations in new construction (Figure 2).

Figure 1: Annual Gas Boiler Installations

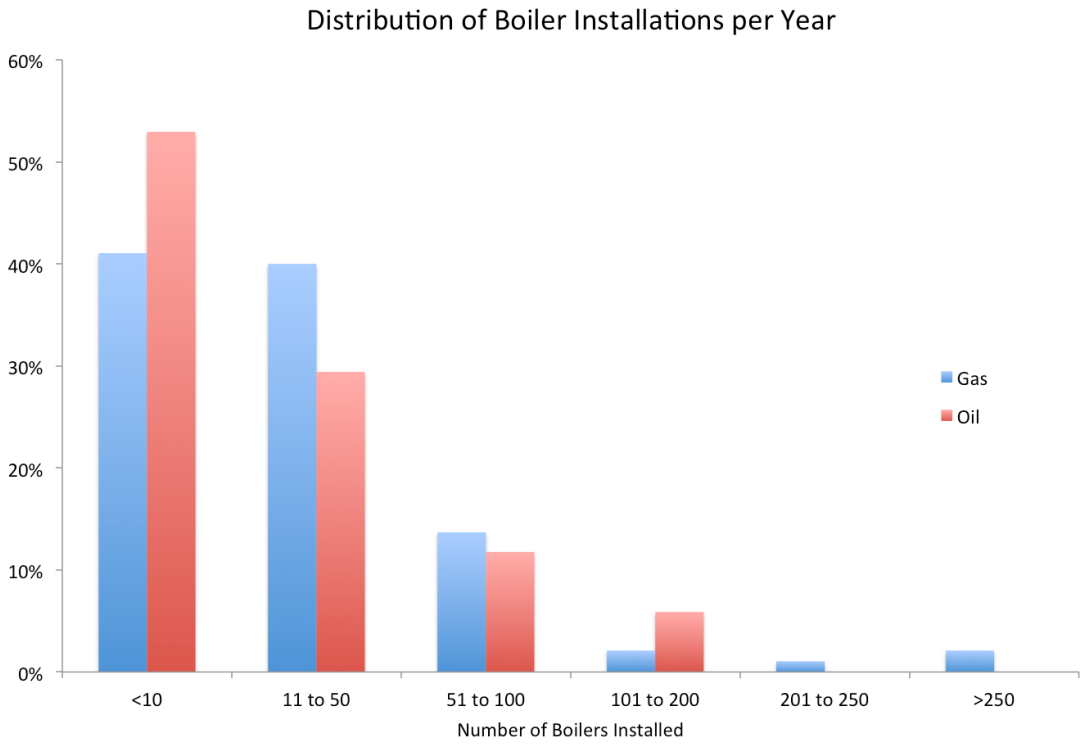
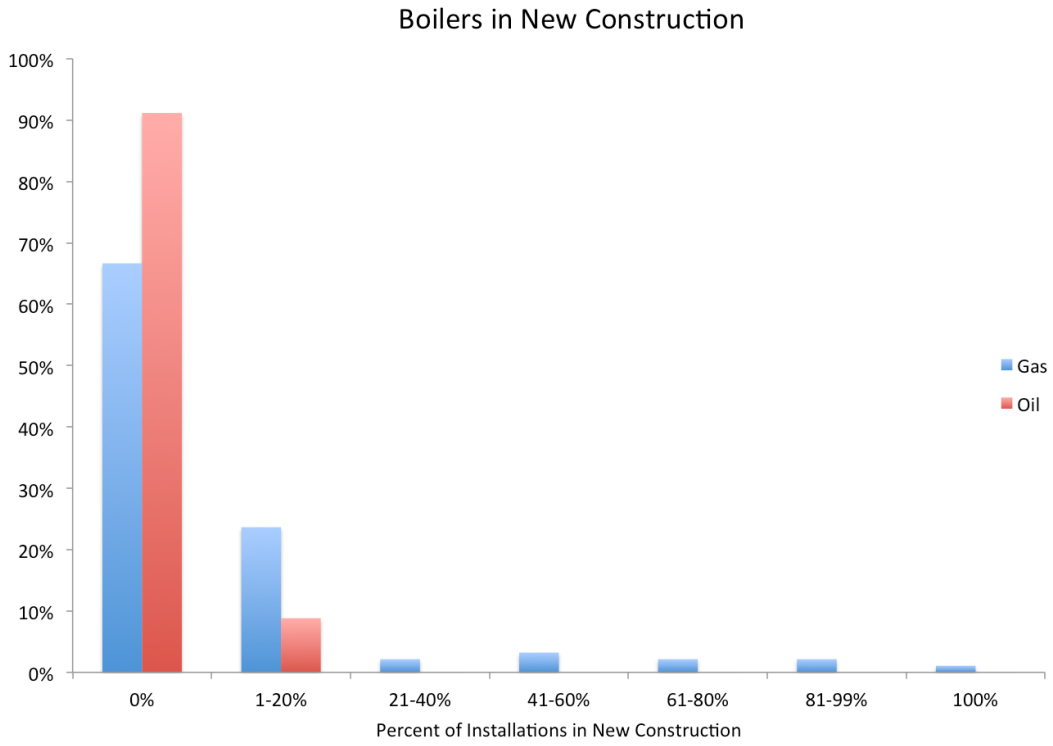
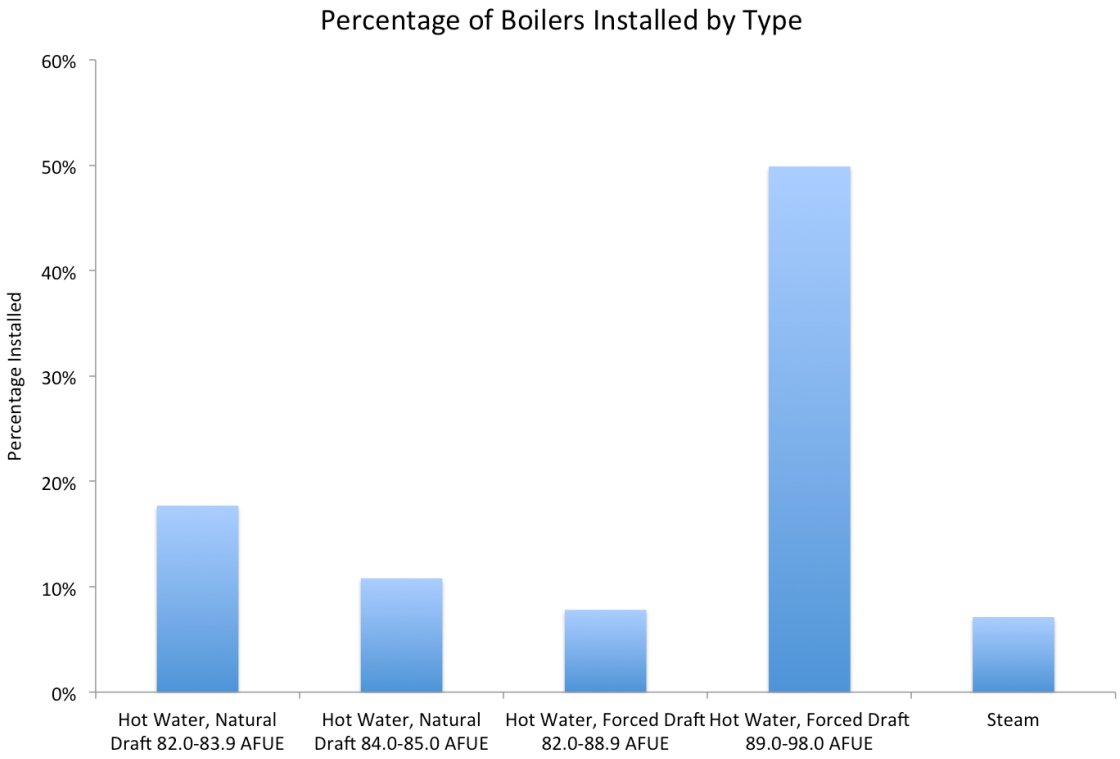



Figure 2: New Construction Percent



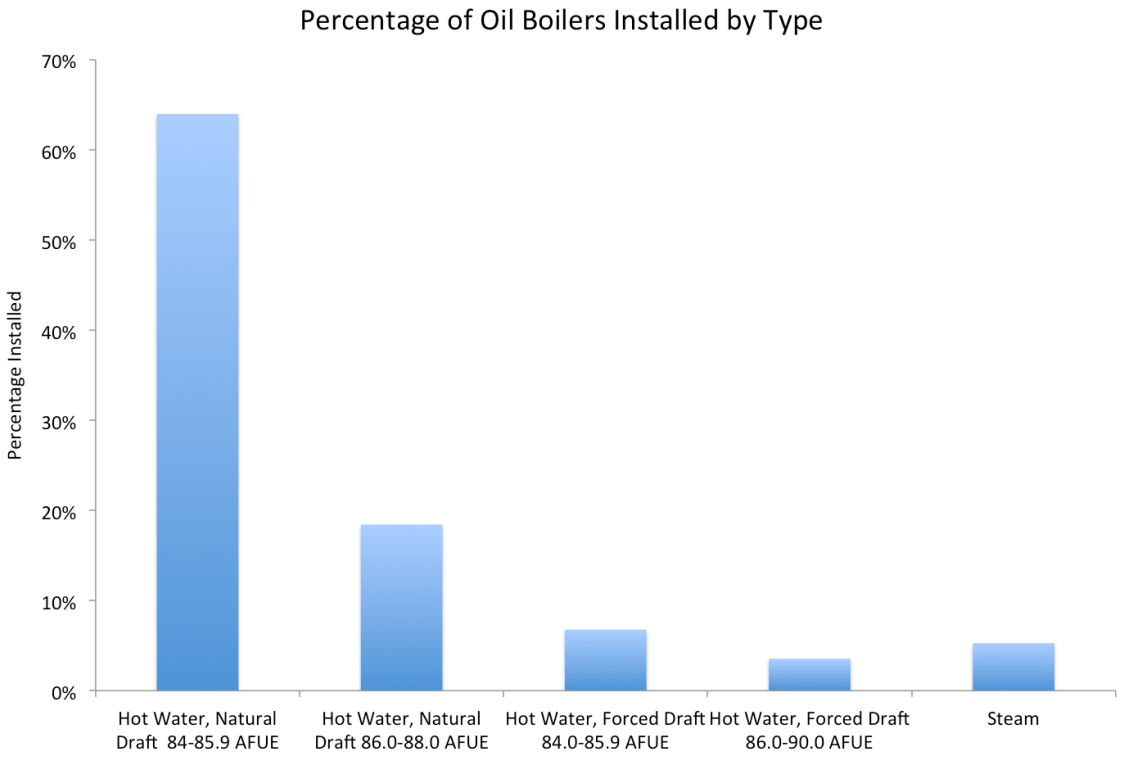
The efficiency of boilers installed varies by fuel. Approximately 50% of the gas boilers installed were condensing boilers with AFUEs of 89 or higher (Figure **3**).

Figure 3: Gas Boilers by Efficiency




Oil boiler installations were highly concentrated in lower tier of natural draft products (Figure **4**).

Figure 4: Oil Boilers by Efficiency




## Installation Costs

The survey asked respondents to estimate the cost for installing a boiler in a "typical" installation in both the gas and oil surveys:

> "What was the total cost to the homeowner for an "average" boiler installation for everything other than the boiler itself (including labor/mark-ups for the entire job, any normal vent or chimney modifications, plumbing/vent/electrical components, condensate pumps, secondary pumps, etc.)? We realize there is no "average" project but we would like your best estimate of what the typical cost might be."

Respondents were offered cost options in bands of $500 from "Less than $500" to "Over $8000". Response rates varied considerably between the various efficiency categories reflecting both the total responses to the survey and to the frequency of installation for that type of boiler project.

Table 1: Installation Cost Responses - Gas Survey

| Gas | Hot Water, Natural Draft 82.0-83.9 AFUE | Hot Water, Natural Draft 84.0-85.0 AFUE | Hot Water, Forced Draft 82.0-88.9 AFUE | Hot Water, Forced Draft 89.0-98.0 AFUE | Steam |
|---|---|---|---|---|---|
| Number of Responses | 51 | 43 | 36 | 70 | 31 |

Table 2: Installation Cost Responses - Oil Survey

| Oil | Hot Water, Natural Draft 84.0-85.9 AFUE | Hot Water, Natural Draft 86.0-88.0 AFUE | Hot Water, Forced Draft 84.0-85.9 AFUE | Hot Water, Forced Draft 86.0-90.0 AFUE | Steam |
|---|---|---|---|---|---|
| Number of Responses | 31 | 17 | 14 | 14 | 16 |

The average installation cost[1] varied from $4500 for Hot Water, Natural Draft 82.0-83.9 – Gas installation to $6000 for Hot Water, Forced Draft 89.0-98.0 AFUE – Gas (Figure **5**).[2] There is considerable variation in installation costs between respondents (Figure 6 and Figure **7**) and the survey seems to have underestimated the maximum cost for Forced Draft 86.0-90.0 AFUE gas boilers so that there is a clustering in the highest band. This clustering effect at the top cost band is less pronounced in oil boilers, but again there is a very small sample size for all but the 84-86 AFUE natural draft oil boilers.

[1] Installation costs are computed by taking the midpoint of the cost bands and $1750 for the lowest band and $8250 for the highest.

[2] Oil boilers other than Natural Draft 84.0 to 85.9 AFUE excluded for reasons of small sample sizes.

Figure 5: Average Installation Cost

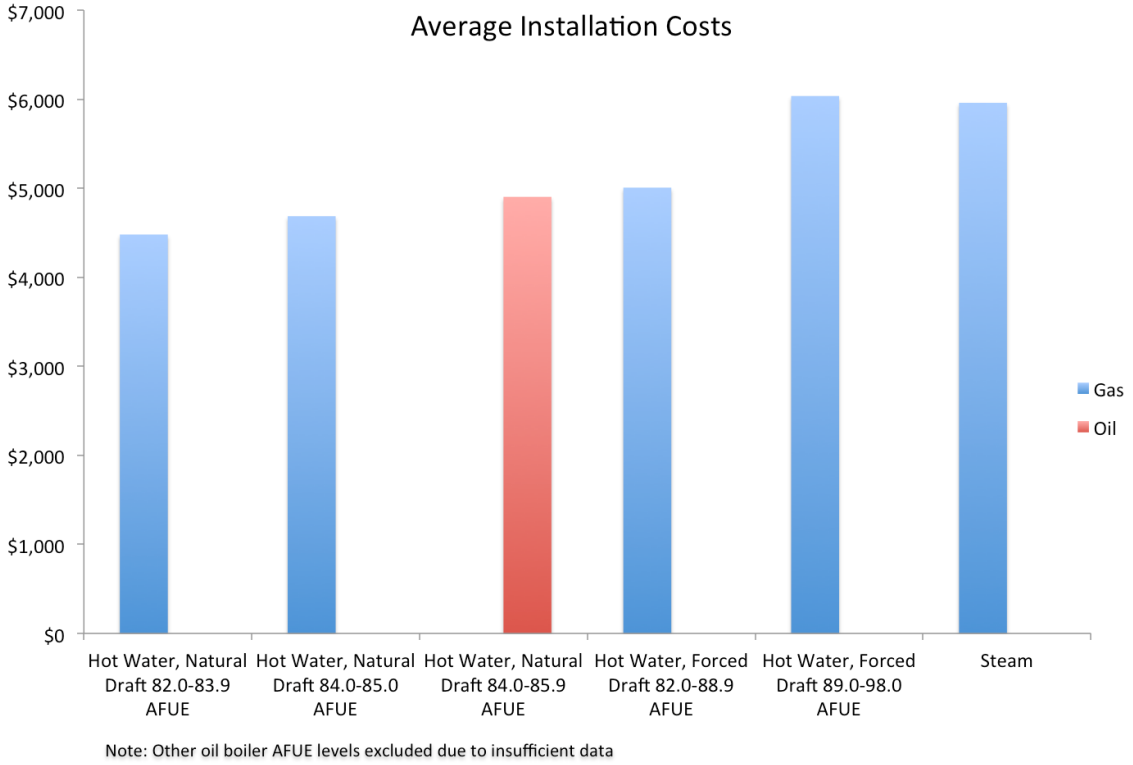



Figure 6: Gas Boiler Installation Cost Range

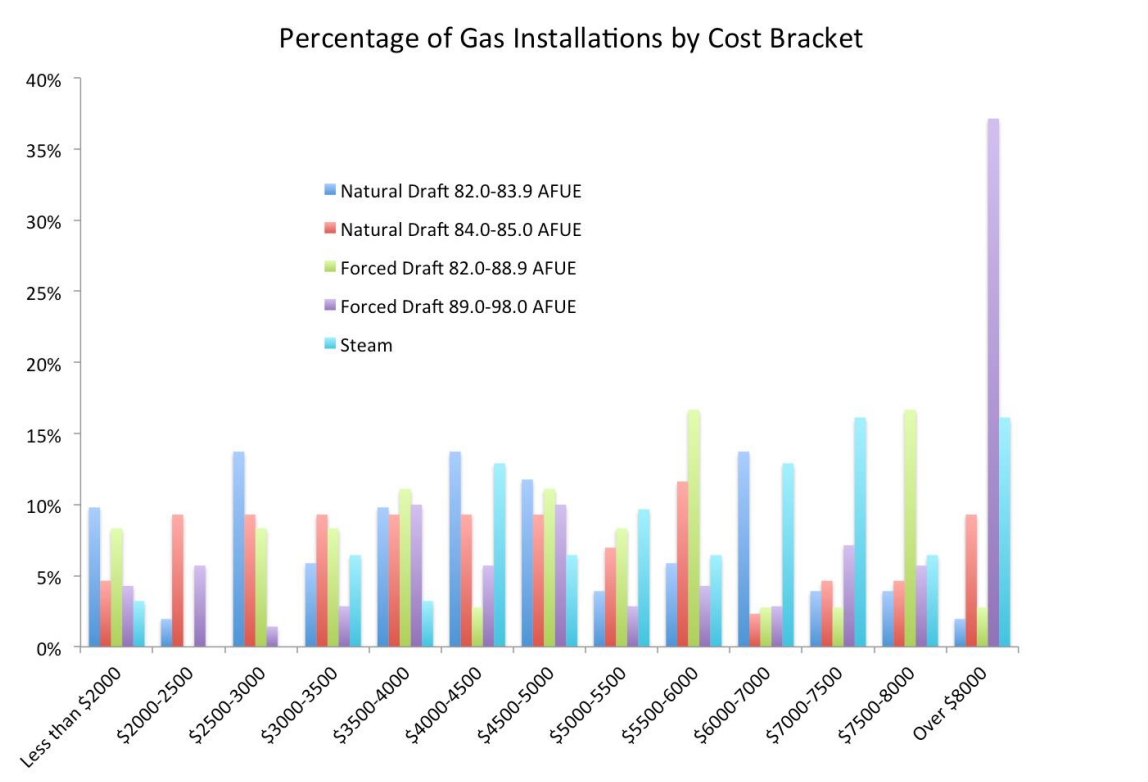
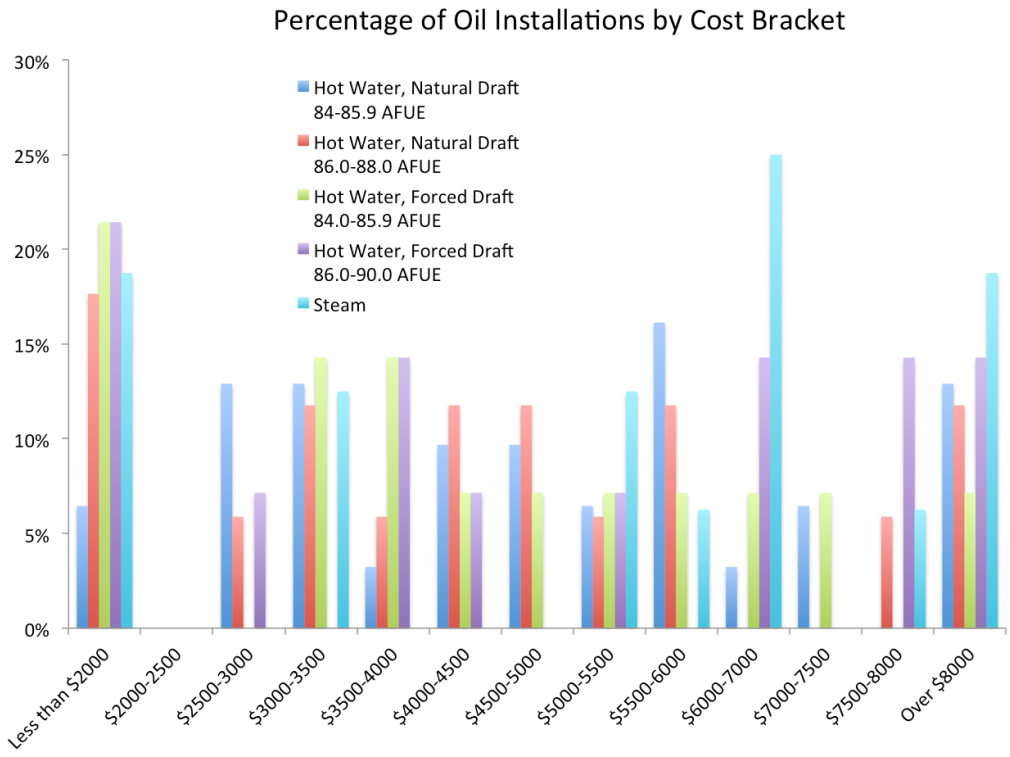


Figure 7: Oil Boiler Installation Cost Range




The limitations of sample size restrict the level of conclusion that can be drawn from the surveys. It is clear that non-condensing boilers have significantly lower installation costs than do condensing ones. The installation cost for Forced Draft 89-98 AFUE boilers is on the order of $1000 to $1500 higher than for Natural Draft boilers. It could be expected for the installation costs of the lower AFUE oil and gas Forced Draft boilers to be higher than the costs for the Natural Draft ones. This result does not appear in the survey data. It is not clear whether this is a real result or a reflection of small sample sizes and the averaging across cost ranges.

## Venting

The survey covered several venting issues in addition to gross installation costs. The first question was whether chimneys needed to be relined for “mid-efficiency” (gas: 82-83 AFUE, oil: 86 AFUE) and the second had to do with the cost of upgrading a venting system. On average 35% of chimneys need to be relined, with significant variation; 50% of the systems do not require much if any relining (Figure **8**). The costs to reline a chimney seem largely unrelated to the efficiency of the new boiler (Figure **9**). However, the sample sizes are small and could be disguising real information on relining frequency and cost.

Figure 8: Need to Reline or Upgrade Chimney

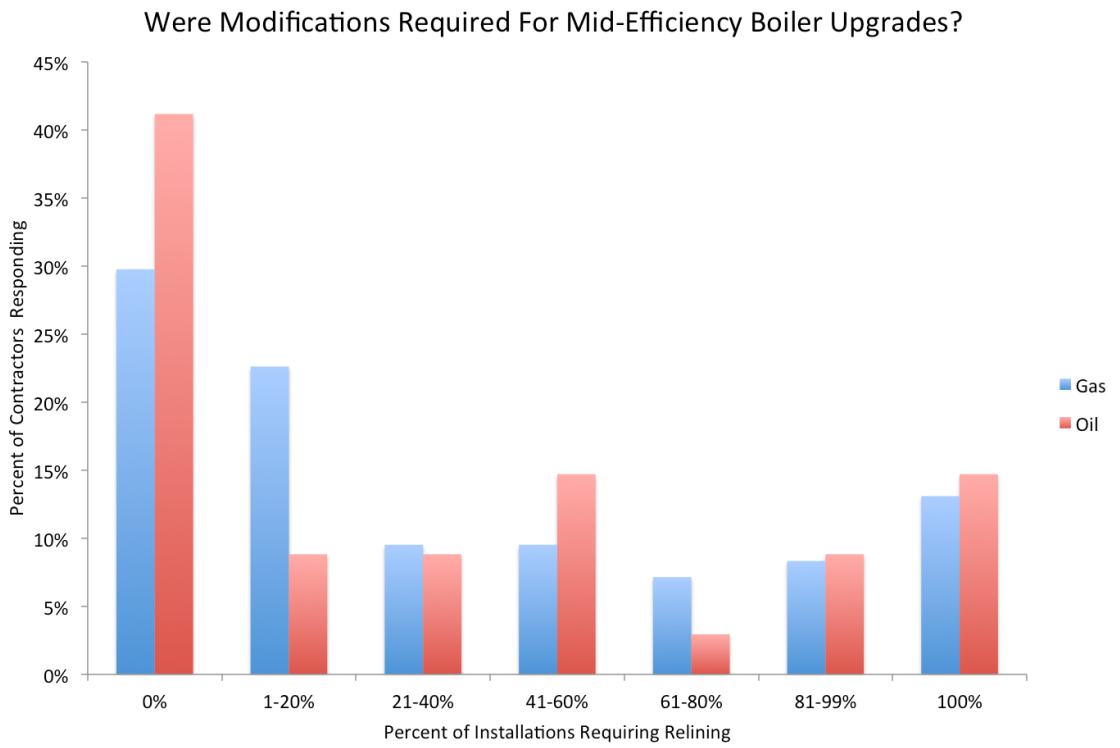
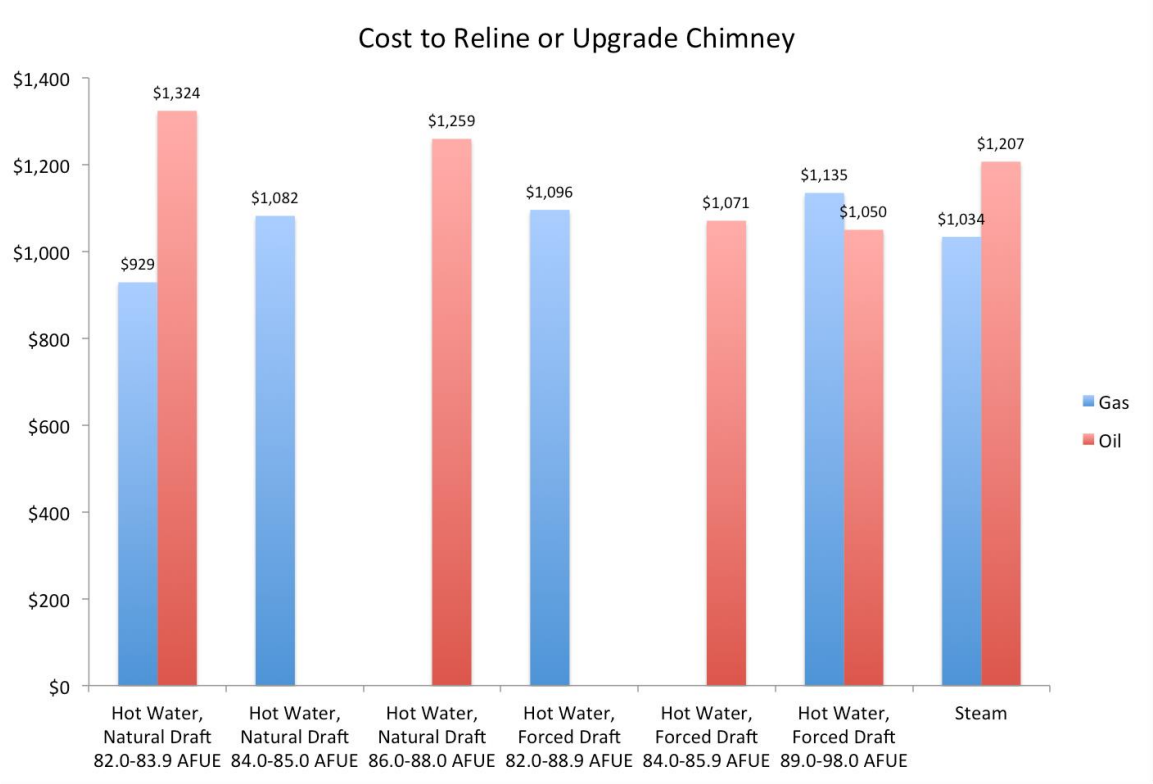



Figure 9: Cost to Reline or Upgrade Chimney



## Usage of Boilers for Both Heat and Hot Water

Contractors report that 35-40% of hot water boilers are used for both domestic hot water and space heat. Steam boilers are rarely used (5-10%) on a combined basis. While combined usage on average is low for hot water boilers, there is considerable variation across contractors on the frequency of combined usage (Figure **10** and Figure **11**).

Figure 10: Combined Heat and Hot Water – Gas

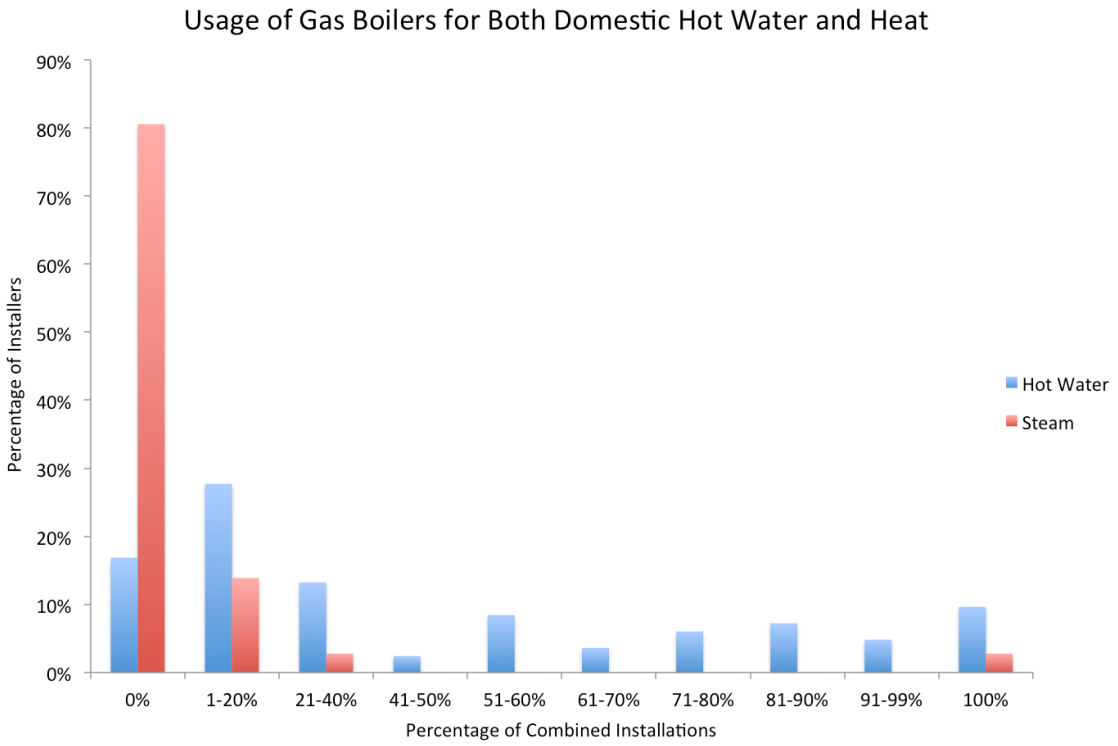
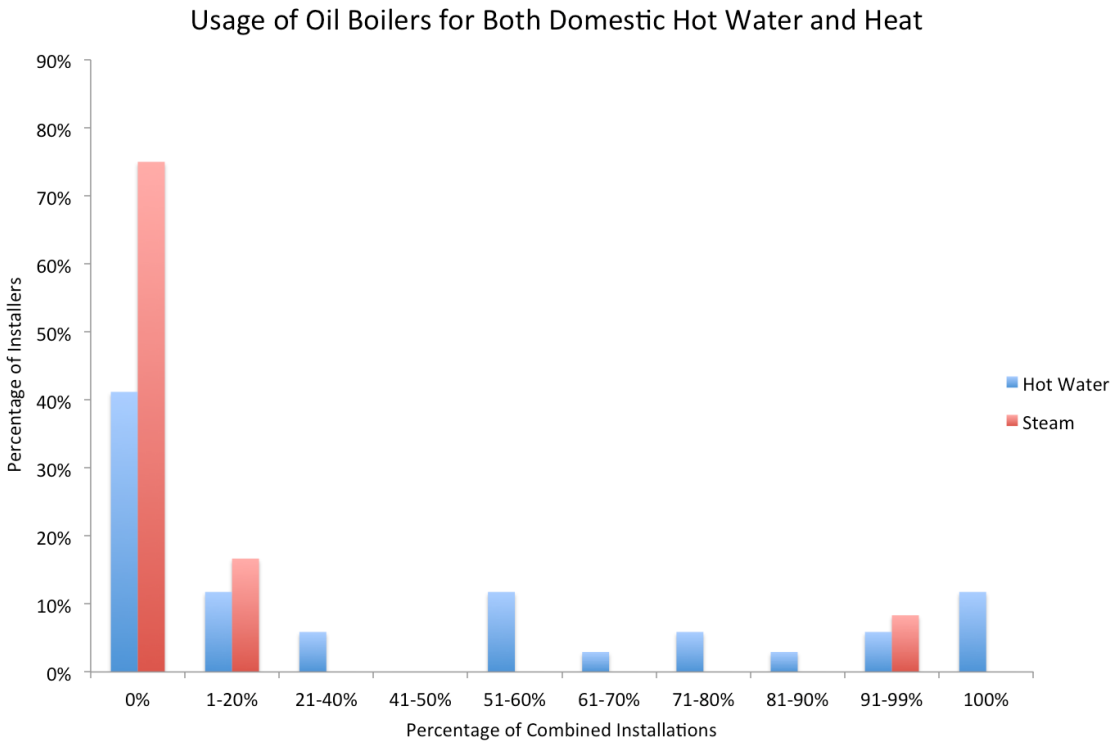


Figure 11: Combined Heat and Hot Water – Oil




## Boiler Life

Contractors report that the typical lifetime of traditional gas and oil hot water boiler is approximately 25 years. Steam boilers are estimated to have a slightly shorter average lifetime closer to 20 years. Condensing gas boilers are estimated to have a noticeably shorter expected life of approximately 15 years. There is significant range in estimated lifetimes (Figure **12** and Figure **13**).

Figure 12: Estimated Lifetime – Gas

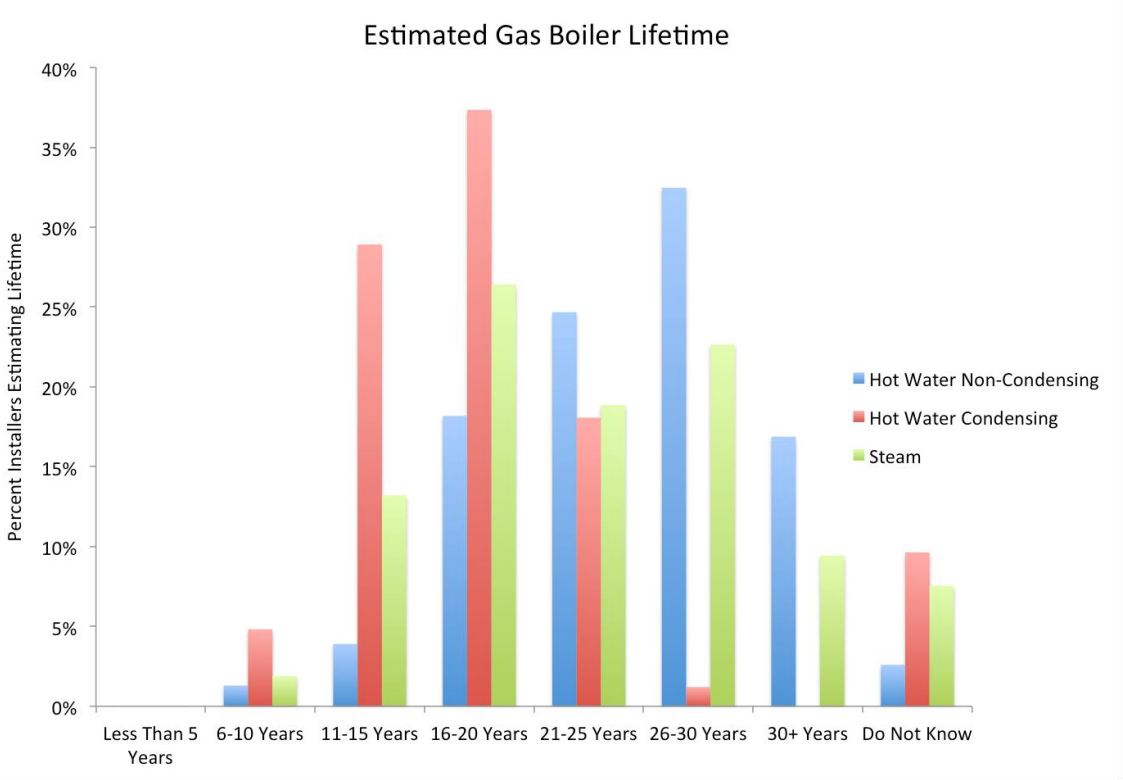
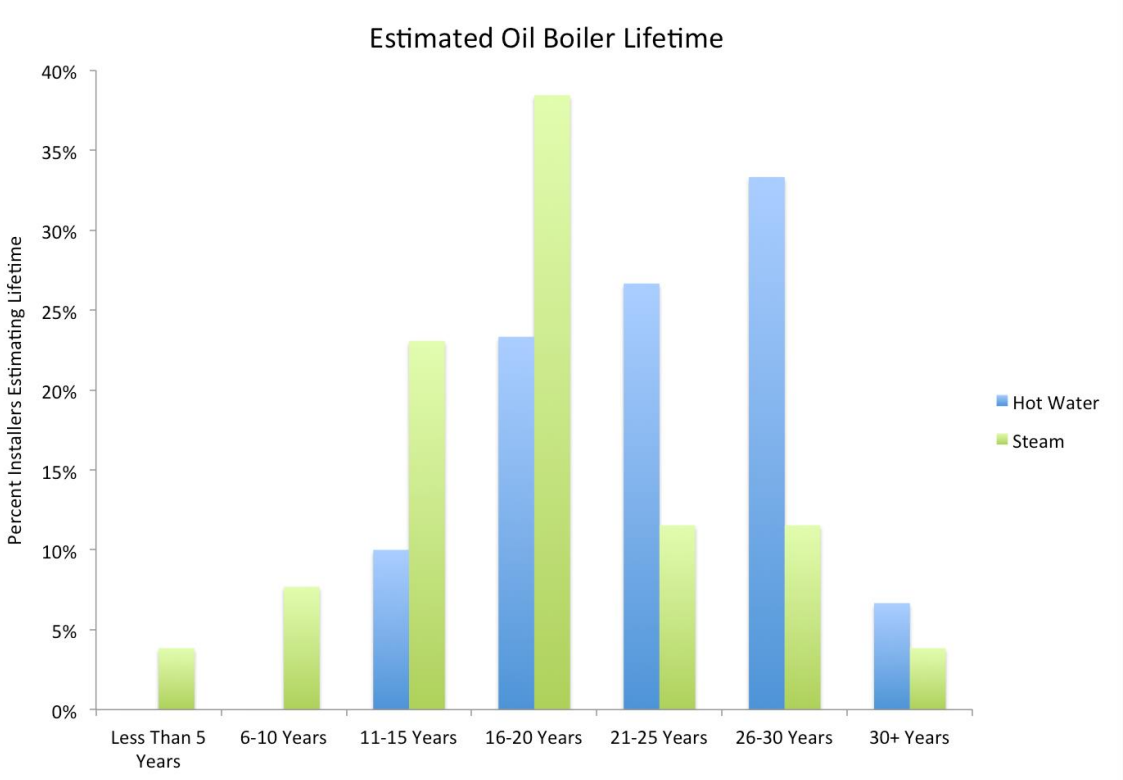



Figure 13: Estimated Lifetime – Oil



## Limitations of the Data and Analysis

As with all analyses, there are limitations on the scope and accuracy of the data and conclusions. All surveys have sample error based on the size of the sample, where this form of error is generally well understood. In addition, all surveys have data accuracy and coverage errors that are generally hard to define statistically. Based on the sample of 107 contractors to the gas survey, the sample error is 9.4%. The sample error for the oil survey is 16.8% because of the small number of responses.

All cost values are computed based on mid-point ranges of the data bands. This brings in some level of estimation error. These errors have some tendency to cancel each other out. While this is a source of potential error, this is a standard approach for dealing with data bands.

Contractors were surveyed on their perception of installation costs for an "average" project. This could have widely different meanings for the responding contractors and there are almost certainly wide variations in the costs for individual projects. With that caveat, this data provides a "top-down" marketplace anchor for any other form of estimation.

Contractors' perceptions are based on projects they actually install. Therefore, their estimates of installation costs are limited to those applications with significant market presence. The validity of responses for low volume boiler efficiency/fuel combinations should be treated with caution.

## Written Comments

Contractors were given the opportunity to provide additional comments and approximately 11 did so.

Gas Survey

> All installations have reported higher than estimated energy use benefits. We are conservative in our savings estimates but still get the sale for higher performing systems.
> Boilers are not furnaces, regulators need to understand the increased complexity of hydronic systems as compared to hot air systems.
> Consumers will save a tremendous amount of money on properly sized equipment, demand on infrastructure is significantly reduced by efficient use of fuels. Consumers quickly lose sight of the fuel savings when the demands of service fall on them.
> I would not like to see the energy efficiency increased. Most people are already installing High Efficiency Boilers where possible. There are some installations where the higher efficiencies boilers are not practical.

I'm seeing overall reliability of condensing equipment to be increasing over the last four years. Weak link in the systems to be combustion fans and control boards. Just hard to find a manufacture that is willing to stand behind their product.
Present condensing boilers require service which can be expensive- is this cost figured into the calculations for payback for higher efficiency boilers?
Venting is going to be a big issue if minimum standards are mandated by DOE

Oil Survey

How much demand will there be for oil on 2021? Might as well start a survey for coal fired boilers too
I want to tell my customers 30 years and have a younger generation replace it again but it just isn't that way anymore.
Stainless steel venting is expensive
We do not install oil fired equipment

# Contractor Questionnaire – Cost of Installation and Markup Practices
# Residential Gas Boilers

Introduction

The US Department of Energy sets minimum efficiency standards for heating and cooling equipment, including gas-fired boilers. In order to help gauge the effect that various minimum efficiency standards would have on consumers and contractors, ACCA, PHCC and the boiler manufacturers' association, AHRI, are conducting a survey of installation costs. In addition we are seeking some information on markup practices. This survey should take less than 15 minutes to complete. Of course, all responses will be kept anonymous unless you want a call back. Thank you for your cooperation.

Question 1: What state are you located in?

Question 2: Do you serve multiple states?

If yes, which ones?

Question 3: How many residential gas boiler installations did your company perform in the past year?

1. Fewer than 10
2. 10-50
3. 50-100
4. 100-150
5. More than 150

Question 4: What percentage of those total gas boiler installations were in new homes?

1. 0%
2. 1-20%
3. 21-40%
4. 41-60%
5. 61-80%
6. 81-99%
7. 100%

Question 5: What percentage of your total gas boiler installations fell into the categories below? Check one box in each column.

| | **HOT WATER** | | | | **STEAM** |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or B Vent; i.e. a Category I Appliance | | Forced Draft Vented with Stainless Steel, CPVC, PVC , PP system or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 82.0-83.9 | AFUE: 84.0-85.0 | AFUE: 82.0-88.9 | AFUE: 89.0-98.0 | Any AFUE |
| 0% | | | | | |
| 1-20% | | | | | |
| 21-40% | | | | | |
| 41-60% | | | | | |
| 61-80% | | | | | |
| 81-99% | | | | | |
| 100% | | | | | |

Question 6: What was the total cost to the homeowner for an "average" boiler for everything <u>other than the boiler itself</u> (including labor/mark-ups for the entire job, any normal vent or chimney modifications, plumbing/vent/electrical components, condensate pumps, secondary pumps, etc) We realize there is no "average" project but we would like your best estimate of what the typical cost might be. Check one box in each column.

| | **HOT WATER** | | | | **STEAM** |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or B Vent; i.e. a Category I Appliance | | Forced Draft Vented with Stainless Steel, CPVC, PVC , PP system or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 82.0-83.9 | AFUE: 84.0-85.0 | AFUE: 82.0-88.9 | AFUE: 89.0-98.0 | Any AFUE |
| Less than $2000 | | | | | |
| $2000-2500 | | | | | |
| $2500-3000 | | | | | |
| $3000-3500 | | | | | |
| $3500-4000 | | | | | |
| $4000-4500 | | | | | |
| $4500-5000 | | | | | |
| $5000-5500 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| $5500-6000 | | | | | |
| $6000-7000 | | | | | |
| $7000-8000 | | | | | |
| Over $8000 | | | | | |

Question 7. What percentage of your replacement installation where the unit has an AFUE of 82% to 83% required rework or relining of the masonry chimney used as part of the venting system?

1. 0%
2. 1-20%
3. 21-40%
4. 41-60%
5. 61-80%
6. 81-99%
7. 100%

Question 8: In a replacement installation that requires rework or replacement of the vent system what was the cost to the homeowner of <u>just the work to the vent system</u> associated with an "average" installation (i.e. modifications to the existing system or the new vent system)? Check one box in each column.

| | **HOT WATER** | | | | **STEAM** |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or B Vent; i.e. a Category I Appliance | | Forced Draft Vented with Stainless Steel, CPVC, PVC , PP system or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 82.0-83.9 | AFUE: 84.0-85.0 | AFUE: 82.0-88.9 | AFUE: 89.0-98.0 | Any AFUE |
| Less than $100 | | | | | |
| $101-250 | | | | | |
| $251-500 | | | | | |
| $501-750 | | | | | |
| $751-1000 | | | | | |
| $1001-1500 | | | | | |
| $1501-2000 | | | | | |
| $2001-3000 | | | | | |
| Over $3000 | | | | | |

Question 9: What percentage of those residential gas boilers which you install also provides domestic hot water (either directly or using an indirect water heater)?

| | Hot Water | Steam |
|---|---|---|
| 0% | | |
| 1-20% | | |
| 21-40% | | |
| 41-50% | | |
| 51-60% | | |
| 61-70% | | |
| 71-80% | | |
| 81-90% | | |
| 91-99% | | |
| 100% | | |

Question 10: What percentage of your condensing gas boiler installations are provided with a "two pipe" system for venting and the supply of combustion air?

1. 0%
2. 1-20%
3. 21-40%
4. 41-60%
5. 61-80%
6. 81-99%
7. 100%

Question 11: Based on your own experience, what do you think a typical life is for the following types of residential gas boilers? Check one box in each column.

| Estimated Life Expectancy (years) | Hot Water | | Steam |
|---|---|---|---|
| | Non-Condensing | Condensing | Any Efficiency |
| Less than 5 | | | |
| 5-10 | | | |
| 10-15 | | | |
| 15-20 | | | |
| 20-25 | | | |
| 35-30 | | | |
| More than 30 | | | |
| Don't Know | | | |

Question 12: Are there any other comments you would like to make about installation, service, or markups or boilers in general?

Thank you for your participation.

# Contractor Questionnaire – Cost of Installation and Markup Practices
# Residential Oil Boilers

Introduction

The US Department of Energy sets minimum efficiency standards for heating and cooling equipment, including oil-fired boilers furnaces. In order to set efficiency levels that most accurately capture the effects on consumers and contractors, ACCA, PHCC and the boiler manufacturers' association, AHRI, is conducting a survey of installation costs. In addition we are seeking some information on markup practices. This survey should take less than 15 minutes to complete. Of course, all responses will be kept anonymous unless you want a call back. Thank you for your cooperation.

Question 1: What state are you located in?

Question 2: Do you serve multiple states?

If yes, which ones?

Question 3: How many residential oil boiler installations did your company perform in the past year?

1. Fewer than 10
2. 10-50
3. 50-100
4. 100-150
5. More than 150

Question 4: What percentage of those <u>total</u> oil boiler installations were in new homes?

1. 0%
2. 1-20%
3. 21-40%
4. 41-60%
5. 61-80%
6. 81-99%
7. 100%

Question 5: What percentage of your total oil boiler installations fell into the categories below?

| | HOT WATER | | | | STEAM |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or L Vent | | Forced Draft Vented or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 84.0-85.9 | AFUE: 86.0-88.0 | AFUE: 84.0-85.9 | AFUE: 86.0-90.0 | Any AFUE |
| 0% | | | | | |
| 1-20% | | | | | |
| 21-40% | | | | | |
| 41-60% | | | | | |
| 61-80% | | | | | |
| 81-99% | | | | | |
| 100% | | | | | |

Question 6: What was the total cost to the homeowner for an "average" boiler for everything <u>other than the boiler itself</u> (including labor/mark-ups for the entire job, any normal vent or chimney modifications, plumbing/vent/electrical components, condensate pumps, secondary pumps, etc) We realize there is no "average" project but we would like your best estimate of what the typical cost might be. Check one box in each column.

| | HOT WATER | | | | STEAM |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or B Vent; i.e. a Category I Appliance | | Forced Draft Vented with Stainless Steel, CPVC, PVC , PP system or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 84.0-85.9 | AFUE: 86.0-88.0 | AFUE: 84.0-85.9 | AFUE: 86.0-90.0 | Any AFUE |
| Less than $2000 | | | | | |
| $2000-2500 | | | | | |
| $2500-3000 | | | | | |
| $3000-3500 | | | | | |
| $3500-4000 | | | | | |
| $4000-4500 | | | | | |
| $4500-5000 | | | | | |
| $5000-5500 | | | | | |
| $5500-6000 | | | | | |
| $6000-7000 | | | | | |
| $7000-8000 | | | | | |
| Over $8000 | | | | | |

Question 7: What percentage of your replacement installations where you installed a mid-efficiency (86% AFUE) boiler required rework or relining of the masonry chimney used as part of the venting system?

1. 0%
2. 1-20%
3. 21-40%
4. 41-60%
5. 61-80%
6. 81-99%
7. 100%

Question 8: In a replacement installation that requires rework or replacement of the vent system what was the cost to the homeowner of <u>just the work to the vent system</u> associated with an "average" installation (i.e. modifications to the existing system or the new vent system)? Check one box in each column for each type of oil boiler that you install.

| | **HOT WATER** | | | | **STEAM** |
|---|---|---|---|---|---|
| | Natural Draft Vented into a Masonry Chimney (unlined or lined) or B Vent; i.e. a Category I Appliance | | Forced Draft Vented with Stainless Steel, CPVC, PVC , PP system or a field supplied power venter | | Venting Systems All Types |
| | AFUE: 84.0-85.9 | AFUE: 86.0-88.0 | AFUE: 84.0-85.9 | AFUE: 86.0-90.0 | Any AFUE |
| Less than $100 | | | | | |
| $101-250 | | | | | |
| $251-500 | | | | | |
| $501-750 | | | | | |
| $751-1000 | | | | | |
| $1001-1500 | | | | | |
| $1501-2000 | | | | | |
| $2001-3000 | | | | | |
| Over $3000 | | | | | |

Question 9: What percentage of those residential oil boilers which you install also provides domestic hot water (either directly or using an indirect water heater)?

| | Hot Water | Steam |
|---|---|---|
| 0% | | |
| 1-20% | | |
| 21-40% | | |
| 41-50% | | |
| 51-60% | | |
| 61-70% | | |
| 71-80% | | |
| 81-90% | | |
| 91-99% | | |
| 100% | | |

Question 10: Based on your own experience, what do you think a typical life is for the following types of residential oil boilers? Check one box in each column.

| Estimated Life Expectancy (years) | Hot Water, Non-Condensing | | Steam |
|---|---|---|---|
| Less than 5 | | | |
| 5-10 | | | |
| 10-15 | | | |
| 15-20 | | | |
| 20-25 | | | |
| 35-30 | | | |
| More than 30 | | | |
| Don't Know | | | |

Question 11: Are there any other comments you would like to make about installation, markups or furnaces in general?

Thank you for your participation.