



July 13, 2006
REPORT #E06-158

Residential Water Heater Market

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ASSESSMENT OF THE RESIDENTIAL WATER HEATER MARKET IN THE NORTHWEST

FINAL

Prepared for
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Portland, Oregon

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July 13, 2006

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1 Introduction

The Northwest Energy Efficiency Alliance (Alliance) embarked upon this study of the water heater market with a desire to capture information from two different perspectives. The first is to provide a supply-side market characterization of the Northwest region's residential water heater market with insights into how the market differs from the national market. The second is to survey residential consumers to understand behaviors and attitudes related to the purchase and replacement of water heaters.

The Alliance's position going into the study is that the electric water heating market continues to be a major efficiency resource opportunity (335 aMW). Most of the available resource is projected to come from heat pump water heaters even though the technology has been slow to emerge as a viable consumer produce. The Northwest Power and Conservation Council (NWPC) projects that sixty four percent of all housing units in the Northwest currently use electric resistance water heaters. They estimate that over 3 million existing electric water heaters will be replaced in the region between now and 2025. Even with increasing gas penetration in the new construction market, the NWPC estimates that new water heater installations will push the total in the region to over 4 million new units in the next 20 to 25 years. The goal of this study is to help the Alliance better understand the market as it determines how best to move forward to help stimulate the heat pump water heater market.

KEMA conducted the study using supply-side interviews of various water heater market actors including manufacturers, distributors, wholesalers, retailers, and installers. We also interviewed a limited number of industry experts and reviewed existing literature. The supply-side research focused on understanding the market structure and characterizing the market shares and trends.

For the consumer perspective, KEMA surveyed 286 recent water heater purchasers to gather product and purchasing preference information. Consumers answered a series of question about their old and new water heater characteristics, reasons for replacement, shopping behaviors, relative importance of decision factors, and demographics. Both the supply and consumer elements of the study focused on the four states that comprise the NW market (Washington, Oregon, Idaho, and Montana)

The remainder of the document is organized as follows:

Section 2: Project Methodology

Section 3: Market Share Estimates

Section 4: Market Structure and Relationship Between Market Actors

Section 5: Technology Trends

Section 6: Promotional Barriers and Opportunities

Section 7: Utility Experience with Heat Pump Water Heater Initiatives

Section 8: Consumer Research

Section 9: Conclusions



Appendix A: Supply Side Survey Instruments
Appendix B: Consumer Telephone Survey Instrument

2 Project Methodology

KEMA performed numerous interviews to identify the structure, players, size, and characteristics of the water heater market. This study consists of a supply-side literature review and series of interviews targeted towards water heater industry experts, manufacturers, distributors, retailers, and installers. The study also includes a consumer survey targeted to recent water heater purchasers.

2.1 Supply-side Research

The supply-side research consisted of a literature review, a limited number of interviews with experts in the field, and a series of supply-side market actors including manufacturers, distributors, wholesalers, retailers, and installers.

2.1.1 Literature Review

The literature review was helpful in developing a list of key market actors, better understanding the technology challenges, and understanding the barriers and drivers within the water heater market. There were several key documents that provided information to support the project:

- Emerging Technologies & Practices: 2004, ACEEE
- Transferring Residential Heat Pump Water Heater Technology to the Market, Presentation by John Tomlinson of ORNL, January, 2002
- Washington State University Energy Program – Cooperative Extension (internet document)
- U.S. DOE – Energy Efficiency and Renewable Energy – Internet Consumer Info Fact Sheet, last update June 2004
- ORNL – Emerging Energy-Efficient Technologies in Buildings: Technology Characterizations for Energy Modeling, May, 2004 (SWS, Integrated Energy Equipment, etc.)

2.1.2 Expert Interviews

KEMA's expert interviews focused on the expert's perspectives of the market actors, product flow and general water heater market knowledge. Expert interviews included:

- Jim Lutz, Lawrence Berkeley National Labs (LBL)
- Russ Johnson, Johnson Research - Mr. Johnson is the consultant supporting John Tomlinson, Oak Ridge National Laboratory for all their Heat Pump Water Heater reports.
- Dave Sutula, Gas Appliance Manufacturers Association.

2.1.3 Supply-side Market Actor Interviews

KEMA directly surveyed supply-side actors. The first step was to create a pool of water heater manufacturers, distributors, retailers, and installers and use that list to conduct supply-side interviews. There were three versions of the survey to allow interviewers to focus questioning on pertinent issues with each of the various types of market player. Surveys are available as Appendix A of this report. The supply-side surveys focused on the following key areas:

- Assessment of market share (manufacturers) and company sales figures
- Breakdown of sales figures by water heater characteristics
- Assessment of the water heater market structure and firms' competitors
- Marketing activities and trends.

KEMA conducted interviews during July and August 2005. The study yielded 26 completed surveys with 8 manufacturers, 3 retailers, 7 wholesaler/distributors, and 8 installers. We also conducted research interviews with the Energy Trust of Oregon and the Oregon Department of Energy who both provided supporting supply-side information about their understanding of and involvement in the market as well as their understanding of consumers' motivations and barriers.

As anticipated, many of supply side market actors contacted by KEMA were unwilling to complete a survey.¹ The interviews posed different challenges depending on the market actor:

- One major **manufacturer** refused to participate in the survey except for a few simple questions. Other manufacturers provided some information but would not fully participate and hesitated to provide market share and competitive information because they felt that the information was confidential and sensitive. While manufacturer response was guarded, this group did provide the most informative and comprehensive source of information.
- **Distributors and installers** who declined to participate in the survey were often very busy with ongoing projects or out in the field. They seemed more time constrained than manufacturers. Despite challenges, distributors and installers provided details on the types of units they sell and the range of consumers they serve.
- **Retailers**, especially national home improvement chains (Home Depot, Lowe's) and chain stores (Sears), were difficult to contact because of their corporate structure and difficulty locating the appropriate staff member. We attempted to make contact with retailers both using corporate contacts as well as store level contacts and also requested leads from other market actors who deal with the big box stores. Large retailers were

¹ Overall incidence among supply-side interviews was approximately 25 percent.

reluctant to discuss market shares, but did provide important insight into the ways they bundle water heaters with installation services.

While the supply-side interviews provide a solid basis for understanding the various players and how they operate within the market, sales figures and share breakdowns by group are less available from the survey because of the limited sample size and reluctance of some market actors to provide detailed market information. Market share values throughout the report are triangulated using available data with notations on their derivation.

2.2 Consumer Interviews

KEMA worked with RDD, a telephone survey firm located in the Northwest, to implement the consumer interviews. We purchased a list that included recent water heater purchasers. The list was developed using a proprietary, consumer household segmentation model that was designed to behaviorally model water heater purchasers using data from Simmons Market Research Bureau, the U.S. Census, household demographics, and other data sources.² Despite initial testing that indicated a 18 percent incidence of recent water heater purchasers, the actual incidence of recent water heater purchasers included in the list was only 3.6 percent. Based on the fact that the sample statistics compared rationally to the population based data, we believe that the list yielded a sample that was representative of recent water heater purchasers in the northwest.³

The consumer sample frame was segmented by state in proportion to the state's population with quotas set by state. The survey firm conducted interviews between late August and early October of 2005. At the outset of the survey, interviewers screened consumers to determine if they had in fact purchased a water heater within the last year and to insure the surveyor was speaking with the person who decided which

² The list was a "RUF HIGH PERFORMANCE" list we acquired through J. Edwin Brown. The lists are created using Ruf's proprietary consumer household-level segmentation system to create behavioral models, analyzing data from Simmons Market Research Bureau, the U.S. Census, household demographics and other data sources on people who have engaged in the specific behavior (water heater purchase) in the past year, and projecting that behavior to identify highly similar households based upon the RUF models.

³ The study results differ from the population in ways that are logical for the market. For example, the study had 85 percent single family housing, which is higher than the population rate of 77 percent from the census. This is reasonable since single family occupants are more likely to purchase water heaters. Also, 93 percent of the sample owned their own homes. This is again an expected deviation from the population since renters are typically not responsible for water heater purchases. The mean income level from this survey was higher (\$67,800) than the income found using the same scale in the consumer lighting survey from MPER1(\$54,900) which is taken as a baseline for a random dialed survey of the region. Again, because of the other differences, this is expected.

water heater to purchase. Table 2-1 shows the consumer surveys by state level targets and actual completes.⁴

**Table 2-1
Target and Actual Consumer Survey Completes**

	Washington	Oregon	Idaho	Montana	TOTAL
Target Percent of Population	51%	30%	11%	8%	100%
Target Completes	154	89	34	23	300
Actual Percent of Population	54%	27%	12%	8%	100%
Actual Completes	154	76	33	23	286

The telephone survey is available as Appendix B. It ran an average of 11.5 minutes overall and included details in the following areas to support the research objective of assessing consumer product and purchasing preferences:

- Existing water heater details
- Reasons for replacement
- Consumer shopping process
- Purchase details
- Installation details
- Tax credit or rebate awareness
- Relative importance of decision factors
- Concept questions about alternative water heater options
- General consumer shopping patterns
- Demographics.

KEMA worked closely with the Alliance to design the survey. We thoroughly pre-tested the CATI system and listened into several surveys at the outset of the project. As a result of the pre-test process, we added a few coding choices for consumers and added interviewer clarification notes on a couple of questions.

⁴ The number of Oregon completes is shy of the quota because the OR incidence was the lowest (3.3 percent) and as a result, RDD ran out of sample in Oregon just prior to completing the phone surveys.

3 Market Share Estimates

In order to determine the market share of water heaters by manufacturer as well as the share of retrofit and new construction units, the study team collected as much first order data from individual market actors as possible. Since several key players were not willing to participate in the survey, we used secondary interviews with competitors and other market actors to fill in any blanks. Supply-side market share information is thus compiled from a variety of sources and provides the best estimate based on all data points.

3.1 National and Regional Sales Figures

The national appliance factory shipment data presented in Table 3-1 come from Appliance Magazine’s web site.⁵ While the Alliance attempted repeatedly to obtain additional detail from the Gas Appliance Manufacturer’s Association (GAMA), GAMA would not provide additional data.⁶ The Appliance Magazine numbers do reference GAMA as a data source.

As shown, nationally there were approximately 9.35 million new water heaters shipped from August 1, 2004 through July 31, 2005. Shipments declined from the 9.55 million in 2003 and 9.63 million in 2004. Note that the total water heater market size is developed with input from major manufacturers and includes standard tank water heaters. It does not include tankless or heat pump models so some of the decline in units should be attributed to increasing interest in these alternative technologies.

**Table 3-1
National Water Heater Factory Shipments**

National Residential Water Heater Shipments	2003	2004	Aug 1, 04 - July 31, 05	National Fuel Shares
Electric Water Heaters	4,429,880	4,572,932	4,463,562	48%
Gas Water Heaters	5,124,265	5,053,775	4,885,957	52%
Total Water Heaters	9,554,145	9,626,707	9,349,519	

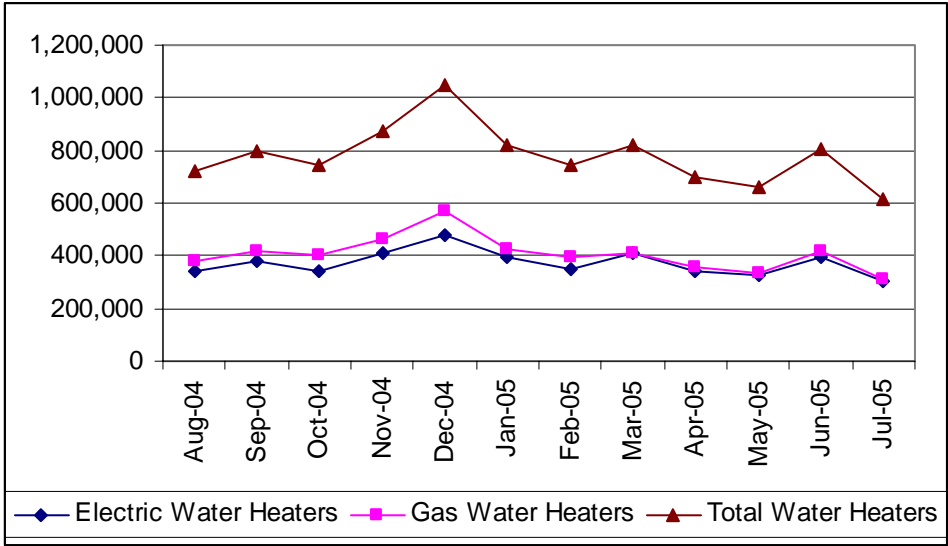
⁵Appliance Magazine’s website (<http://www.appliancemagazine.com/>). Appliance Magazine is a 60-year old trade publication targeted to manufacturers, purchasers, and marketing executives in the Appliance field. They produce monthly national factory shipment tables that include all household appliances and are derived from data Appliance Magazine gathers from the following Sources: Air-Conditioning and Refrigeration Institute, APPLIANCE magazine estimates, Association of Home Appliance Manufacturers, Consumer Electronics Association, and Gas Appliance Manufacturers Association.

⁶ GAMA is currently increasing the definition of the data they collect and has two projects that are of interest to this research. GAMA now collects specific factory shipment data by state as well as some data by specific retailer. While the Alliance tried numerous times to obtain data from GAMA, we were told that the manufacturers are unwilling to share it.

The share of water heaters by fuel type varies by region based on the overall fuel and building stock. While the most recent national fuel shares show electric water heaters at 48 percent, the consumer survey component of this study indicated an electric water heater share in the Northwest retrofit market of 57 percent.⁷ The higher share of electric units in the Northwest is primarily due to the low relative cost of electricity.

Figure 3-2 demonstrates how the monthly national water heater shipments vary throughout the year with a shipment peak at the end of the calendar year.

Figure 3-2
National Water Heater Factory Shipments by Month and Fuel



Using census-based housing data,⁸ the total number of housing units in the Northwest is 5.0 million compared to 119.3 million homes throughout the United States. The Northwest thus represents 4.2

⁷ A proprietary study KEMA performed for a portion of Oregon corroborates the higher regional electric water heating share. Average electric water heating shares in that study were slightly higher than the 57 percent from this consumer survey (+/- 2% at a 90% confidence interval). It is important to note, however, that the same proprietary study demonstrates that electric shares declined in newer homes to a point where new homes shares of electric units are closer to the national average.

⁸ <http://quickfacts.census.gov/qfd/index.html> for 2002 housing statistics on the number of households and the number of new building permits. For this paper we assume that the growth rate in the Northwest is consistent with the nation such that the percentage of housing units from the 2002 census data can be applied to 2004-2005 appliance shipment figures.

percent of the national housing stock.⁹ We have applied the 4.2 percent Northwest housing stock to the national water heater factory shipments to develop a base number of water heater shipments to the Northwest. For the August 1, 2004 to July 31, 2005 time period, this yields 392,700 water heaters.

Using census data again, we assume that all new building permits in the year require a new water heater. The census data for new housing starts for the Northwest is 79,500 units.¹⁰ We assume each new housing unit needs a new water heater. This leaves 313,300 water heaters that are part of the retrofit market. The new construction market thus makes up 20 percent of the total water heaters being installed in the region and the retrofit market makes up the remaining 80 percent (see Table 3-3).¹¹

**Table 3-3
Northwest Water Heater Projections**

Projected Northwest Water Heater Totals	Approximate 7/04-6/05 Total	Share
Percent of Housing Stock	4.2%	
Total Water Heaters	392,700	
Estimated Electric Units	223,800	57%
Estimated Gas Units	168,900	43%
Estimated New Construction	79,400	20%
Estimated Retrofit Units	313,300	80%

We also applied the consumer collected electric and gas shares to the regional water heaters to establish the approximate number of gas and electric units in the region.

Using the number of retrofit units in the region divided by the housing stock, we identify that 6.3 percent of existing homes replace their water heater each year. This yields an average water heater life of approximately 15.9 years. This calculated life is longer than other study results and the consumer survey reported average age at replacement.¹² These facts lead us to believe that the actual number of units sold is likely higher than the numbers derived in this section. We report the lower values to provide a conservative estimate.

⁹ For comparison purposes, the population of the Northwest is equal to 4.1 percent of the U.S. population.

¹⁰ Census data: Housing units authorized by building permits, 2002.

¹¹ Manufacturer and Distributor interviews corroborated the 80-20 split.

¹² The California Database for Energy Efficiency Results (DEER) indicated an average water heater life of 15 years for electric standard tanks, 13 years for gas standard tanks, and 20 years for gas tankless units. GAMA cited a national water heater life of 8 to 12 years nationally with big variations by region based on water quality, which has a big impact on tank life. The consumer survey performed for this study yielded an average unit life of 12.9 years, which in turn yields a slightly higher 7.8 percent of all existing household replacing their water heater annually. As noted in the text, we use the lower 6.3 percent replacement rate as a conservative estimate.

3.2 Market Shares by Manufacturer

In 2002, Appliance Magazine published a table of water heater manufacturer market shares for the 2001 U.S. market. Table 3-4 includes these figures alongside the manufacturer market share values we developed as part of the study’s supply-side market actor interviews. The biggest shift in shares since the 2001 study is a result of the merger between AO Smith and State Industries. In 2001, AO Smith had 13 percent market share and State Industries had 18 percent for a combined market share of 31 percent. As a combined company, AO Smith-State Industries now manufactures about one quarter of all water heaters. The table is based on the standard tank market as the Appliance Magazine data does not include alternative technology. The share values were confirmed through manufacturers with some direct responses, some triangulation based on other manufacturer information, and then our own adjustments based on the results as a whole and feedback from other market actors.

While the large manufacturers likely overstated market shares and left too small of a place holder for other players and other technology, there is no definitive market share assessment of alternative water heater technologies. The consumer survey included self reported data stating that 4.5 percent of new water heaters were tankless units, 2.1 percent were heat pumps and 3.5 percent were other types, Our experience with self-reported surveys is that consumers tend to over-report alternative technologies, especially among those who answer “Other”. Interviews with several tankless manufacturers indicated that together they may have over 27,000 units in the Northwest. We have established an estimate that the market for alternative technology water heaters is in the range of 5 to 9 percent or 20,000 to 35,000 units.

**Table 3-4
Manufacturer Market Share and Estimated Units Sold**

Manufacturer	2001 Market Share¹³	2005 Estimated Market Share	Estimated 2004 Northwest Units*	Self Reported 2004 Northwest Units
Rheem-Ruud	41%	40% ¹⁴	157,100	
AO Smith-State Ind.	31%	25%	98,200	
Bradford White	14%	17%	66,800	72,684
American Water Heater	14%	17%	66,800	
Other Manufacturers		1%	3,900	
Total Standard Tank Market		100%	392,800	

* Estimated units are triangulated using the assumed number of water heaters in the Northwest multiplied by the reported market share for each manufacturer.

¹³ Source: Appliance Magazine – A Portrait of the U.S. Appliance Industry, Sept. 2002

¹⁴ Rheem-Ruud declined to respond to our market share query, but several other manufacturers stated that Rheem-Ruud has roughly 40% market share.

4 Market Structure and Relationship Between Market Actors

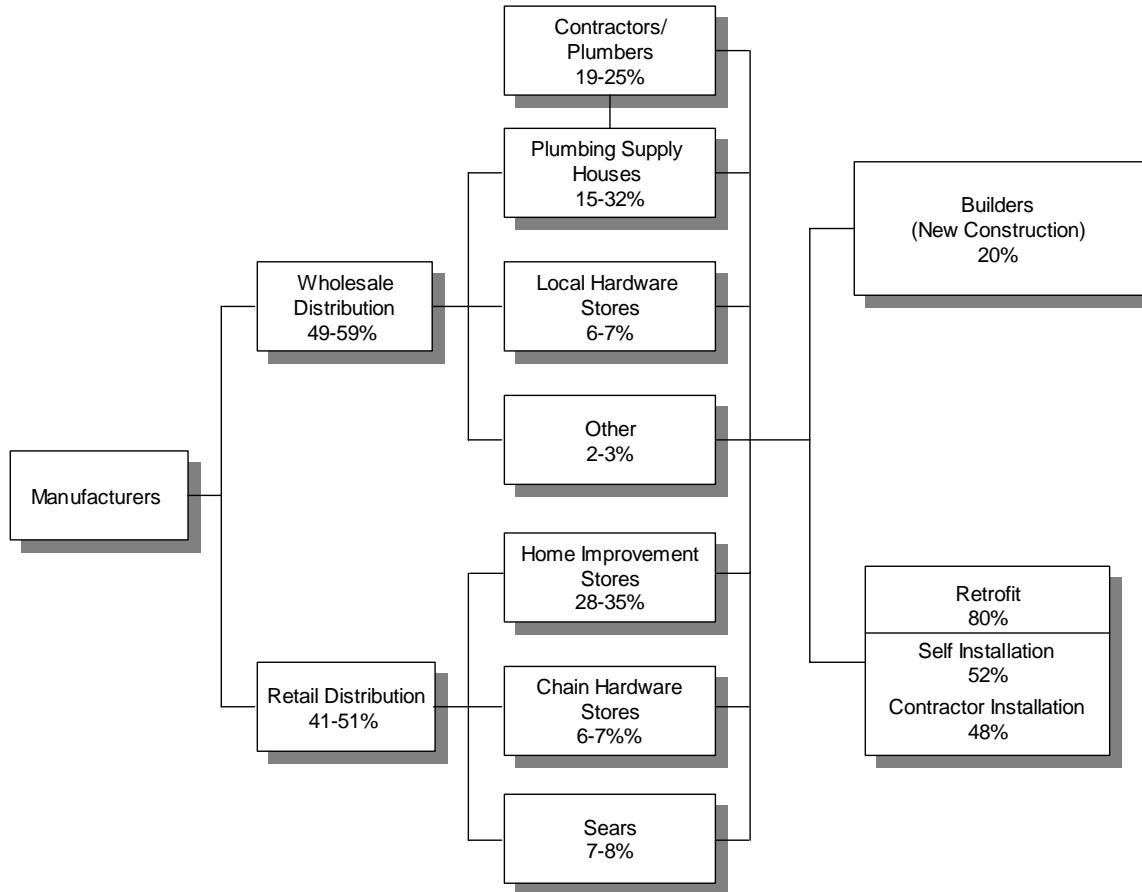
The water heater market consists of two primary distribution channels as shown in Figure 4-1. The upper path is the wholesale distribution channel. Manufacturers distribute their products to wholesalers and distributors who are also referred to as plumbing supply houses. These distributors then supply the market at those plumbing supply houses with sales to contractors or homeowners or through local hardware stores or other smaller retail outlets.

The second distribution channel is from the manufacturers directly to the retail market. Many of the manufacturers have branded water heater lines that they supply directly to large retailers. These include home improvement stores such as Home Depot or Lowe's as well as chain stores such as Sears and True Value Hardware.

In both the wholesale and retail markets, builders, contractors, and self-installers can generally purchase their water heaters from any of the retail sources. The new construction market makes up about 20 percent of the overall market. We have assumed conservatively that the majority of new construction water heaters flow through the wholesale distribution chain. Table 8-4 in Section 8.2 provides a more detailed description of the issues around the percentages that are applied to this overall market distribution table.

Because distributors often act as plumbing supply stores, the distribution path is fairly direct from the manufacturer to the retailer even in the wholesale channel. In many cases, manufacturers supply specific brands for a given retailer. The detailed descriptions of manufactures and distributors in the remainder of the section provide specific examples.

**Figure 4-1
Residential Water Heater Distribution Channels**



The remainder of this section in the full report includes detailed findings from confidential interviews. The information is available in the Alliance’s internal version, but is excluded from this version for confidentiality reasons.

4.1 Manufacturers

While the top four manufacturers are responsible for almost 100 percent of the standard water heater tank market, numerous smaller firms are working to create new water heater technology or other market niche products.

(Section details removed for confidentiality reasons)

4.2 Distributors – Wholesalers

The distributor network supplies approximately 50 percent of the water heaters in the Northwest. While we do not have firm distribution numbers, several manufacturers, retailers, and industry experts provided wholesale/retail splits of roughly 50 percent. The range of industry responses to the distribution split question went from a low retail rate of 45 percent to a high of 55 percent. This ratio has anecdotally shifted from 40 percent direct retail and 60 percent wholesale ten years ago. All indications are that this national percentage is the same as in the Northwest.

Water heater distributors across the Northwest typically provide service in one or two states, with a few large distributors providing services across the whole region. Distributors in many cases only provide services to installers in a wholesale market arrangement. However, several large distributors reported that they do supply a relatively small percentage of their water heaters directly to consumers.

The list of distributors and wholesalers in Table 4-3 provides a summary of those we identified in the course of performing this study and the states where we understand they operate. The list identifies the fact that there are numerous players in the distribution market with no clear leader. Many installers or manufacturers pointed us towards the distributors we contacted and no one player appears to make up more than 5 percent of the overall water heater market. Because approximately 50 percent of all water heaters flow through the distribution market, this translated into no single distributor making up more than 10 percent of the distribution sales. While the number of distributors that have reported their total water heater sales numbers to us is very small, our understanding from other market actor input is that there are numerous distributors who are considered players in the market.

(Section details removed for confidentiality reasons)

4.3 Retailers

Retailers provide consumers with direct access to water heater equipment and in many cases also directly offer installation services or provide referrals to installation partners. Retailers sell not only to consumers directly, but also to the trade on behalf of consumers.

4.3.1 National Home Improvement Chains and Large Retail Stores

National home improvement chain retailers have become an increasingly large player in the water heater market in the past ten to fifteen years. Although we were unable to get any firm market share numbers directly from these large retailers, the manufacturers and industry experts agree that on a national level, retail versus wholesale water heater distribution is split nearly in half. This ratio has shifted from about 40

percent big box and 60 percent wholesale channels 10 years ago. All indications are that this national percentage is the same in the Northwest.

(Section details removed for confidentiality reasons)

4.4 Installers

KEMA surveyed nine installers in the region. These were randomly picked from a list initially provided by ECOS consulting. Once we had attempted to contact all of the installers on the ECOS list, we also searched for other Installers on the Internet and did random calls from the new list. We specifically sought out franchise plumbers to help better understand how that market operates. Installers fall into three categories:

(Some section details removed for confidentiality reasons)

- Independent plumbing contractors who happen to install water heaters as one of their many services – six surveyed
- Franchise plumbers (Mr. Rooter) or water heater installation specialists (Fast Water Heaters) – two surveyed
- Plumbing contractors that also acts as a distributor (George Morlan Plumbing) – one surveyed.

Installation volumes ranging from lows of 50 or 100 units annually to a few in the 800 to 1000 range and one (Fast Water Heater) that indicated that region-wide, including Northern California, they install 12,000 water heaters per year. Over half (56 percent) of the water heater installers indicated that they were installing more water heaters this year than the year before. Another 22 percent said they were selling the same number of water heaters this year and the remaining 22 percent declined to respond. Only one of the installers who had seen growth in the last year predicted steady water heater volume for the coming year. The rest predicted continued market growth.

All of the installers indicated that they receive their water heaters through one of the distributors. More than half of the installers (63 percent) indicate that they contact their sales representatives frequently (daily or weekly).

Sixty-three percent of installers reported that they actively market their installation services. The most common marketing venue is the phone book with other venues including television, radio, Internet, neighborhood newspapers, and direct mail. When asked how they get most of their business, 63 percent indicated word of mouth or repeat business as the most effective lead generation tool and 50 percent indicated the yellow pages.

Installers typically provide a full range of plumbing and related services. Firms generally stated that water heaters made up 5 to 15 percent of their business.

Installers install equipment from the primary manufacturers.

Over half (55 percent) of the installers indicated that they install more gas units than electric.

Fuel switching is not a major portion of anyone’s water heater business. Most installers indicated that they do a small percentage of their work as fuel switches (from less than 1 to 10 percent of all installations). Only three installers (33 percent) indicated that they do any tankless installations and all of those were very low volumes (3 percent or less). None of the installers indicated that they install heat pump water heaters.

Installers reported a wide range of stated emergency versus planned replacements indicating that some firms specialize more heavily in the emergency repair business. This includes having features like 24 hour service or expedited turn around which draw consumers who need service at non-business hours. Five of the nine surveys (56 percent) had high emergency replacement numbers (72 percent or higher). One (11 percent) was evenly split between emergency and planned replacements. The final three (33 percent) had higher rates of planned replacement (70 percent or higher). The franchises both reported high rates of emergency replacement (72 and 95 percent).

Installation costs ranged depending on the installer. Six of the respondents provided costs and their results are summarized in Table 4-9.

Table 4-9 <table numbering from full report>

Installer Reported Equipment and Installation Costs by Fuel

	Average Cost	Minimum Cost	Maximum Cost
Gas Equipment Cost	\$279	\$200	\$385
Electric Equipment Cost	\$228	\$175	\$250
Gas Total Installed Cost	\$637	\$350	\$1,100
Electric Total Installed Cost	\$475	\$250	\$900

n=6

All of the installers who provided cost information indicated that they do offer warranties on their installation. They also all offer equipment warranties, often directly through the manufacturer.

When asked how frequently installers discuss energy efficiency with their consumers, the franchises both reported that they always discuss efficiency. Other plumbing contractors had mixed responses with some indication that they are discussing it more frequently now than in the past. Over half (55 percent) indicated that they never discuss energy efficiency or that they do so infrequently. In one case, a firm

indicated that the only time they discuss efficiency is as part of fuel switching projects because the fuel switch is typically driven by cost-effectiveness concerns. The most common barrier to convincing consumers to buy efficient units is cost (89 percent). Only one firm indicated that consumers did not care at all about energy efficiency.

5 Technology Trends

5.1 Technology Expert Perspective

KEMA interviewed contacts at Lawrence Berkeley Labs (LBL), Oakridge National Laboratories (ORNL), and Gas Appliance Manufacturers Association (GAMA) and reviewed studies and reports from the American Council for Energy Efficiency Economy (ACEEE). While this section briefly discusses the technical issues, the Alliance has other efforts underway to provide more technical detail on the water heater market. In general, there are some higher efficiency options, and experts perceive that several manufacturers are close to developing even better technology, but they need more concerted sales, support, and intelligent feedback to bring their products to maturity. Many of the products that are being presented as options are still not fully tested in the market. The LBL contact noted that the California Energy Commission is pushing for manufacturer or other industry incentives for natural gas water heaters to increase the energy factor (EF) up to the high 70s or low 80s, which would be an improvement over the current top end gas water heater energy factor of 61 to 62.

In general, experts agreed with the 80 to 85 percent of the market providing water heaters for retrofit projects. KEMA learned that the national average water heater life is between 8 and 12 years with distinct differences by region based primarily on local water quality.

Manufacturers of gas water heaters have been spending the last several years working on meeting new safety guidelines that were placed into effect on a voluntary basis in July 2003. These standards become official in 2005 (staged by type). The standards address efficiency, flammable vapor issues, and emissions. Because of the challenges of meeting these standards, manufacturers have been working on creating new improved models. Research and development costs coupled with increasing materials costs and transportation costs have increased the price of residential water heater tanks. This has made gas tankless water heaters an even more attractive option with 2- to 3-year paybacks.

On the electric front, several contacts indicated that for standard tank units, there is not much room for efficiency gains in standby losses since those have been tackled extensively. Other efficiency options may be possible, but heat pump or tankless units provide the most likely room for efficiency gains in the electric market. Tankless electric units are not heavily recommended because of household capacity and voltage issues.

5.1.1 Heat Pump Water Heater Considerations

Several sources agreed that the best opportunity for improving energy efficiency in the electric water heater replacement market is with heat pump water heaters, if installed properly. The efficiency is doubled over standard resistance water heaters, producing an energy savings of 50 percent. The major market challenges for the heat pump water heaters are that the market is small, and, in the past, they have had some reliability problems. Because of low production volumes as well as more complicated systems, heat pump water heaters currently have higher retail costs than their standard tank alternatives. For example, in the new construction market, the current costs for heat pump water heaters are roughly three times greater than standard tanks, which create up-front cost issues and stretch simple payback periods to four years.

The market has come up with some improved prototype designs for add-on heat pump water heaters for the replacement market as well as integrated space heating, cooling, and water heating systems for the new construction market.

There presently are four manufacturers of heat pump water heaters in the U.S. There are others in Australia, Japan, China and Europe, though none have been imported to the U.S. These manufacturers include:

- **Applied Energy Recovery Systems (AERS)** <http://www.aers.com/> Model R-106 has been on the market for many years, but could use more product testing. Model WH-6BX-1 is supposedly undergoing an "intensive engineering review". That model was used in a Northeast Utilities program, and would have benefited by incorporating improvements identified in the program.
- **ECR International (E-Tech)** http://www.ecrinternational.com/prod_wattersaver.asp ECR's WatterSaver is a "drop-in" heat pump water heater, whose development was supported by Oak Ridge and TIAX (a collaborative Research and Development company working with ECR on the product development), among others. We understand that ECR is pausing production while they review their marketing approach.
- **Trevor-Martin** <http://www.trevormartincorp.com/wcc12.asp> They primarily manufacture desuperheaters and heat pump swimming pool heaters. They have been quietly developing an "add-on" heat pump water heater, the model WCC-12, but have not marketed it widely.
- **Nyle Special Products** <http://www.nyletherm.com/waterheating.htm> They have been inactive but are coming back from a lawsuit. Model Nyletherm-1 (Northeast Utilities) had some problems initially, but seemed to have been largely corrected. They are working on another model as well (Nyletherm-110)

5.1.2 Tankless Water Heater Considerations

Tankless water heaters pose other opportunities, particularly in smaller applications or where residents are not around full time. Because of the consumer desire for unlimited hot water, many people are drawn to these systems. In some large applications, contractors have been known to combine tankless and standard tank systems to handle bigger water heater demands while gaining some efficiency from the tankless option for most water use. Tankless systems are available in both gas and electric versions. Tankless manufacturers include Bosch-CEC, Rinnai, Takagi, Noritz, and Paloma.

5.1.3 Other Water Heater Options

Another hot water heater that offers more efficiency is the Grey Water Heat Exchanger or Gravity Film Exchanger (GFX) <http://gfxtechnology.com/>. It's a good device when used appropriately, but there are concerns that the developer has made excessive claims for his product that have counteracted his credibility. The GFX deserves consideration in new residential construction because it is so simple to implement. Its only real impediment is that in some homes the plumbing drain orientation does not provide sufficient space.

Another new technological approach for residential water heating is to improve the hot water distribution system, which would save on four types of energy loss.¹⁵ The focus is to reduce/eliminate hot water pipe energy loss. Single and dual-lever sinks pull hot water into the pipes that is never used and then cools in the pipes; this is water that has already been heated once. Dishwashers typically draw from the water heater (on average) six times per load, water cools each time, then has to be re-heated by the dishwasher's booster heater. And finally for larger homes with long water distribution systems, the losses are greater and therefore cause the occupants to keep the tank set temperature higher, creating a greater temperature differential and greater water heat loss. Reducing the amount of water loss is another benefit when incorporating water re-circulation pumps within the distribution system.

5.2 Manufacturer Perspective on Technology

Manufacturers agree that natural gas tankless water heaters have made significant headway into the residential market over the past few years. Tankless units are particularly popular in the new construction sector, and that trend will likely continue. The manufacturers cited the following technology trends as popular:

- Emergence of tankless units, which are lightweight, easy to handle and install, and can achieve 28 percent savings

¹⁵ Current California Energy Commission studies performed by Gary Klein

- Higher efficiency is currently in vogue due to:
 - Increased costs of both gas and electricity and
 - The higher market price of standard water heater tanks
- Gas unit manufacturers have made safety and “combustible-chambers” improvements to comply with flammable vapor tests mandates
- Builders and home owners are tending to install either power venting or combined venting for their heating and water heating systems; power venting units have more installation flexibility which is something plumbers appreciate
- Lightweight plastic tanks with more insulation are easy to handle and install.
- Federal tax credits (\$300 currently) have increased the interest in higher efficiency and gas tankless units
- Rebates of up to \$2000 in some areas for solar hot water systems may help push solar water heating systems further along
- Lower emissions requirements on gas units are a result of new mandates – while these are good in some ways, they have created challenges for manufacturers as they have made efficiency improvements more challenging, while once again increasing the base cost of gas water heaters
- Smart Water Heaters are a recent line of electric tank products designed by American Water Heater. These units use computers to monitor use and develop an efficient profile. Smart Water Heaters were not well accepted by the plumbing community because of the computer element. Plumbers felt that the computer components created a repair challenge outside of their standard scope of services. Smart Water Heaters seem to sell reasonably well at Lowe’s.

Manufacturers believe that consumers are interested in tankless units because of a market desire to have “unlimited” hot water in a short amount of time. They also want improved energy efficiency, longer water heater life and corresponding increases to the warranty of the unit. Consumers are interested in safety features and seem to go for the best priced water heater with little, if any, brand name recognition as compared to other residential appliances. Manufacturers believe that replacement consumers want a similar unit to the one they are replacing and don’t do much research to compare technologies.

6 Promotional Barriers and Opportunities

While the various market players are continually working on new products, there are several market barriers in the water heater sales process. This section outlines barriers in various elements of the market. Barrier information is not only from the groups indicated, but also from expert technical interviews.

6.1 Barriers to Increasing Heat Pump Water Heater Market

Manufacturers have not opted to build heat pump water heaters in significant volume for several reasons. The greatest concern is equipment cost as the production and consumer cost of heat pump water heaters is higher than the market is currently willing to pay. Other market barriers include:

- Installation issues – since heat pumps involve both plumbing and HVAC issues, the product crosses two trades and thus complicates installation, repair, and responsibility lines that are more cleanly established with standard tank systems.
- Awareness – there is a general lack of awareness of what heat pumps are and what they do. This awareness issue impacts many elements of the sales chain. Consumers don't know who to ask about units. Installers who do not install heat pump water heaters now think they are too complicated for a basic plumber to install. Distributors are not aware of the features and if they have a unit in stock, the counter person is likely unaware of it or does not know enough to promote the technology.
- Marketing issues – because consumer awareness of the technology is low, manufacturers have difficulty marketing the products.
- Payback – heat pump water heaters not only pose a challenge with high first costs, but some argue that the energy efficiency is not enough to provide a viable (short) consumer payback.
- Size – one manufacturer indicated that the size of the units is a constraint especially as consumers are demanding more water and have options like tankless units that offer unlimited hot water.
- Reliability – although actual product reliability has improved, it is still not up to the level of other home appliances and there are ongoing issues with perceived reliability resulting from early product reliability problems.

The contact at LBL provided insight shared by others as to the needs of the marketplace. “I do not believe that the market will grow just from retail sales. I believe that there have to be organized programs by electric utilities or similar entities, to move large numbers of heat pump water heaters. This is necessary to bring manufacturing costs down. I firmly believe that this market has to grow from local successes — the local ‘sponsor’ has to find one plumber who is ‘sold’ on the product and support him

intensely until he saturates his market. The program should learn from his feedback and then do the same in an adjacent market. A plumber in Connecticut installed several thousand heat pump water heaters in the Northwest Utilities program, and now he wants desperately to do more installations on his own.”

As with manufacturers, the biggest barrier from the distributor, wholesaler, and retailer perspective is the initial cost of the heat pump water heater. Equipment costs are generally at least \$700 over the cost of a standard electric tank and labor costs are also significantly higher for the heat pump system. The heat pump systems that are integrated, and used most in the new construction market, have even higher costs and are complicated to install. Very few installers know how to install them so they are treated as a specialty item. Due to some early equipment issues, the installer and builder market has some continued negative perceptions of the equipment and installation practices. It appears that the actual issues have been resolved, but the perception that heat pump water heaters are problematic and complicated to work with persists.

In addition to the price and installation issues, contractors and installers report that a key barrier for them is the lack of information about the equipment. The lack of information pertains to both contractors and their consumers. When heat pump water heaters are in place, contractors find that repairs and replacement parts are very expensive. According to the Fast Water Heater representative if a heat pump water heater is being repaired, the time it takes is “brutally” long which in turn frustrates consumers and makes the job harder on both the consumer and the contractor.

6.2 Barriers to Converting to Hot Water from Electric to Gas

While fuel conversions are minimal in the region, they do occur. The biggest barrier to making the conversion is the venting issues. Gas systems currently offer newer venting solutions, but added piping costs and other installation issues still create a natural barrier. Also, the starting cost for a gas tank is typically higher than an electric tank.

6.3 Barriers to Higher Efficient Water Heater Purchases

Equipment costs continue to be the primary market barrier to achieving higher efficiency. With gas units, the 90 percent AFUE or higher provides a higher efficient option but substantially increases the cost. In the case that there are additional venting requirements, this option is even less of a viable solution. Unit size can also be a problem with higher efficiency units.

6.4 Barriers to Tankless Units

Barriers to gas tankless units in the replacement market are primarily construction costs associated with altered venting requirements. Rerunning the gas lines can also pose barriers. It appears that for smaller

homes with up to three people, the tankless systems work well. However, when there is much greater hot water demand from more people or other issues, other water heater products, like standard tanks or heat pump water heaters, are better able to deliver an adequate quantity of hot water. Since water quantity is a common concern of consumers, the tankless units require a comprehensive awareness campaign so consumers do not purchase a system that is not appropriate for their needs.

7 Utility Experience with Heat Pump Water Heater Initiatives

In 2002, Northeast Utilities (NU) in Connecticut offered a heat pump water heater program. The program was initially designed to install 5,000 heat pump water heaters, but the program was cut due to federal budget cutting. The final program fell short of goal, but did ship about 3,000 to 4,000 units into the area. Under the NU program, the utility purchased add-on heat pump water heater units, solicited and selected appropriate homes for its installation, conducted specialized training and qualification criteria for installation contractors and worked to ensure that the program was successful in meeting its energy saving goals. The add-on water heaters are add-on components to a standard water heater tank. They are used to feed hot water into the existing storage tank. The program used Nyle Special Products to manufacture the units.

In 2003, The New York State Energy Research and Development Authority (NYSERDA) offered \$300 incentives for ECR International's Watersaver "drop-in" heat pump water heater units. This unit was certified with a 2.4 Energy Factor¹⁶.

¹⁶ GAMA 2003; ACEEE, Emerging Technologies & Practices, 2004

8 Consumer Research

KEMA worked with RDD, a telephone survey firm located in the Northwest, to implement the consumer interviews. The objective of the consumer survey was to contact recent water heater purchasers and assess their product preferences and selection criteria as well as their purchasing and water heater installation behaviors. The consumer survey consisted of 286 completed surveys. The surveys were fielded by phone and a copy of the survey instrument is available in Appendix B.

The consumer sample frame was segmented by state in proportion to the state’s population with quotas set by state. The survey firm conducted interviews between late August and early October of 2005. At the outset of the survey, interviewers screened consumers to determine if they had in fact purchased a water heater within the last year and to insure the surveyor was speaking with the person who decided which water heater to purchase. There are 286 completed consumer surveys with state-level targets and completes provided in Table 8-1.¹⁷

**Table 8-1
Target and Actual Consumer Survey Completes**

	Washington	Oregon	Idaho	Montana	TOTAL
Target Percent of Population	51%	30%	11%	8%	100%
Target Completes	154	89	34	23	300
Actual Percent of Population	54%	27%	12%	8%	100%
Actual Completes	154	76	33	23	286

8.1 Water Heater Characteristics

All consumer survey participants had water heaters that were newly installed within the last year. Over half (46 percent) of them were installed less than 6 months ago, with the remainder installed up to or about 1 year ago. The average age of the replaced water heaters is 12.9 years. The average age showed significant differences by grouped states, with water heaters in Washington and Oregon averaging 13.5 years at the time of replacement and those in Montana and Idaho at 10.3 years.¹⁸ This difference was also significant between metropolitan areas (average age of 13.8 years) and outlying areas (11.8 years).

¹⁷ The number of Oregon completes is shy of the quota because the OR incidence was the lowest (3.3 percent) and as a result, RDD ran out of sample frame in Oregon just prior to completing the phone surveys.

¹⁸ GAMA provided national average water heater life at 8-12 years. They did note that the life varies significantly based on water quality and areas with harder water tend to have much shorter equipment lives.

Consumers reported that one third (32 percent) of existing water heaters are replaced before they fail. Of the water heaters that do fail prior to replacement (68 percent), 60 percent have a sudden failure and the remaining 40 percent do not fail suddenly.

Consumers whose water heaters fail showed a range of time it took them to replace the water heater. Many said that the unit was not working well prior to replacing which allowed them to stretch out their purchase decision. The average consumer with a failed water heater replaced it in 6.9 days.

Of those who knew their water heater type, the majority reported installing standard tanks (89 percent). Five percent reported installing tankless units and two percent, heat pump water heaters. The mean water heater size reported was 51.6 gallons with the difference between electric units (53.2 gallons) and gas units (49.1 gallons) apparently small, but significant. Although there were only a small number of customers who had alternative technology water heaters, the consumer survey results indicated that 70 percent of the alternative units are tankless and the remaining 30 percent are heat pumps. These results likely underestimate the relative size of the tankless market. The manufacturer results indicate a much higher rate of tankless units relative to heat pump units with approximately 20,000 to 32,000 tankless units and only 500 to 2,000 heat pump units. This yields an alternative technology ratio of between 15 and 25 tankless units sold for each heat pump unit.

A range of manufacturers makes water heaters. Just over half of the consumers we surveyed were aware of their water heater manufacturer. We have grouped the model names into the primary brands to collapse the results into the key manufacturer categories. Comparing the consumer and supply side share values, both Rheem and American Water Heater shares were similar. The fact that the Bradford White consumer values are lower than the national values correlates to Bradford White's comment that their strongest regional markets are in the Northeast and the Southwest. The fact that AO Smith-State Industries consumer-reported numbers are higher than the industry values may stem from a combination of the familiarity of the AO Smith brand names (Maytag, Kenmore) coupled with the fact that prior to the company merger in 2002, AO Smith and State had a higher combined market share of 31 percent.

**Table 8-2
Market Share by Manufacture from Consumer Survey Results**

Manufacturer	Consumer Reported Units	Consumer Reported Share	Manufacturer Share (Table 3-4)
Rheem or Ruud (including GE, Hotpoint, Richmond, Everclean)	48	32%	37%
AO Smith/State Industries (including Kenmore, Craftsman, Maytag, ProMax, State Select)	53	36%	23%
American Water Heater (including Whirlpool, Proline, US Craftmaster)	27	18%	16%
Bradford White	12	8%	16%
Rinnai Tankless	3	2%	5%
Bosch	3	2%	2%
Tagaki	2	1%	na
TOTAL	148	52% of consumers	

Only a small percentage of consumers (13 percent) reported that their new water heater was the same brand as their previous unit. Two thirds (67 percent) said they had a different brand and the remaining consumers were not sure.

In the Northwest, water heaters are more often electric (57 percent) than gas (37 percent). In metropolitan areas, electric units make up half of the units (50 percent) while in outlying areas (where gas is less available) electric water heaters make up a significantly higher (65 percent) portion of the total units. Consumers who self install their water heaters are much more likely to have electric units (72 percent) than those who use an installer (43 percent).

There is a slight shift in market share from electric towards gas units. Old water heaters were 64 percent electric compared with the 57 percent of new retrofit units. Consumers who switched fuels reported that they did so to save money, they were more comfortable with gas, or they wanted their heating and water heating to use the same fuel. Only one-third (35 percent) of all consumers use electricity to heat their homes (42 percent have gas heat and the remaining 21 percent have oil, propane, solar, or wood heat). Among those who have different heating and water heating fuels, they cite high initial cost (35 percent), difficulty installing gas lines in the water heater location (30 percent), ventilation challenges (26 percent), and lack of awareness (9 percent) as the primary reasons to not convert their water heater to match their heating fuel.

Mean water heater costs (including installation) were estimated at \$440. The average cost for self installed units was \$332 while the contractor installed cost was \$578. There is an average difference of

\$246. The reported costs varied significantly by installation method and within that by location, store type, and fuel (see Table 8-3).

**Table 8-3
Consumer-Reported Water Heater Cost by Installation Method**

Water Heater Group	Self Installation	Contracted Installation	Difference (Presumed Installation Cost)
Metropolitan areas	\$329	\$630	\$301
Outlying areas	\$335	\$480	\$145
Purchased through Contractor/Plumber	\$325	\$848	\$523
Purchased at Plumbing Supply Store	\$378	\$698	\$320
Purchased at Hardware Store (including Sears)	\$260	\$458	\$198
Purchased at National Home Improvement Store	\$331	\$351	\$20
Electric Water Heaters	\$295	\$470	\$175
Natural Gas Water Heaters	\$409	\$684	\$275
Overall	\$332	\$578	\$246

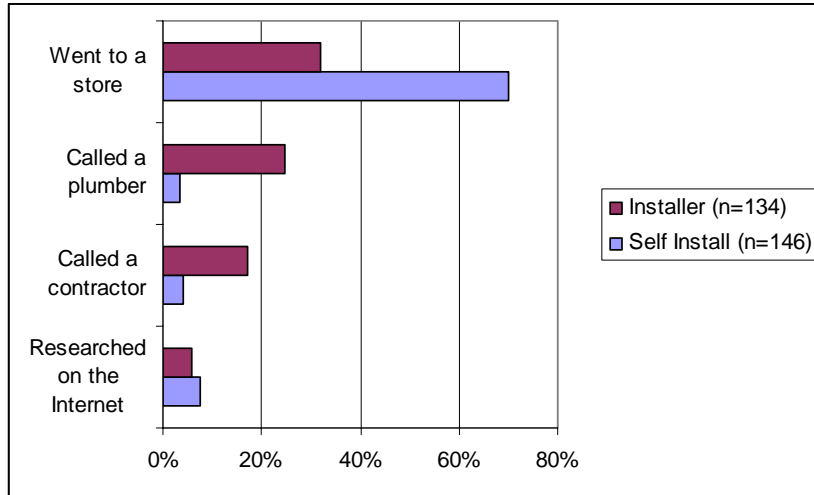
8.2 Consumer Shopping Process

For consumers who had a working water heater, the primary reasons for replacement include:

- It was getting old and it was time to replace it before it broke (43 percent)
- We wanted a more efficient unit (25 percent)
- We were doing a remodel, which included a new water heater (9 percent)
- We wanted a different type of water heater (6 percent).

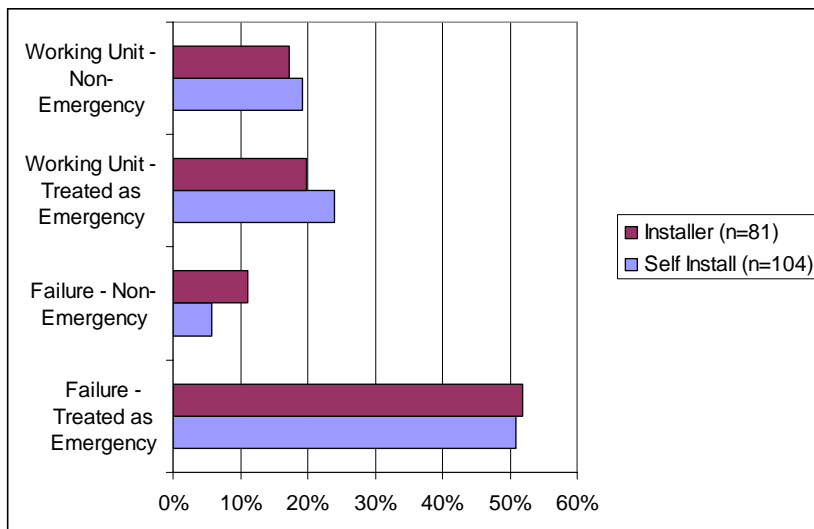
Consumers initiate their water heater purchase by going to a store (51 percent), calling a plumber (14 percent), calling a contractor (11 percent), or doing Internet research (7 percent). Other responses included contacting friends or relatives and starting the work themselves. Figure 8-1 shows that consumers who self installed their new units were much more likely to go to a store right away than those who had an installer. Self installers make up 52 percent of the replacement market.

Figure 8-1
Initial Step in Researching Water Heater Purchase by Installation Type



The fact that customers required an emergency replacement did not appear to significantly alter the way they installed their water heater.

Figure 8-2
Installation Method Based on Water Heater Status at Time of Replacement



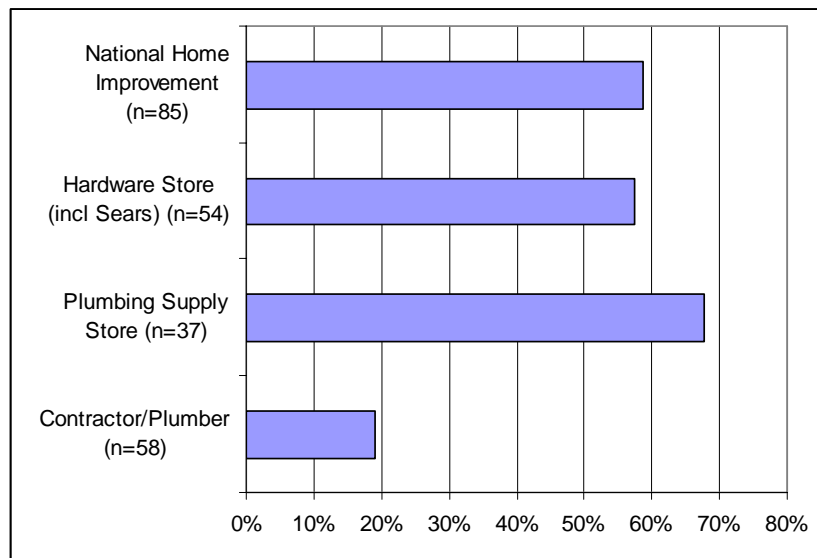
Of the consumers who went directly to a store, half of them started at a national home improvement store (49 percent). Others started with a plumbing supply store (14 percent), a local hardware store (12 percent), a chain hardware store (10 percent) or a chain store (9 percent). As consumers needed more

information, they used sales people (26 percent), the yellow Energuide label (20 percent), the Internet (14 percent), and the utility help desk (6 percent). Just over one-third of consumers who visited stores (37 percent) indicated that they saw retail store display information about water heaters.

About half of all consumers considered only one water heater during their purchase process. The other half looked at several options. On average, consumers considered 1.9 different water heaters in their purchase decision. A few variations from this average include the fact that consumers with a sudden failure researched their new purchase slightly less with 1.7 water heaters considered. Consumers who made their final purchase at a big box store researched the most water heaters (2.2), while those who worked with a contractor researched the least (1.5).

About half of the consumers requested prices from more than one source (46 percent). Figure 8-3 shows shopping behaviors by store type. Most notable is the fact that consumers who worked with a contractor or plumber, tended to rely on that source much more than someone who was shopping through one of the various stores.

Figure 8-3
Frequency with which Consumers Requested Prices from Numerous Sources



The top reasons people cited for not shopping around were:

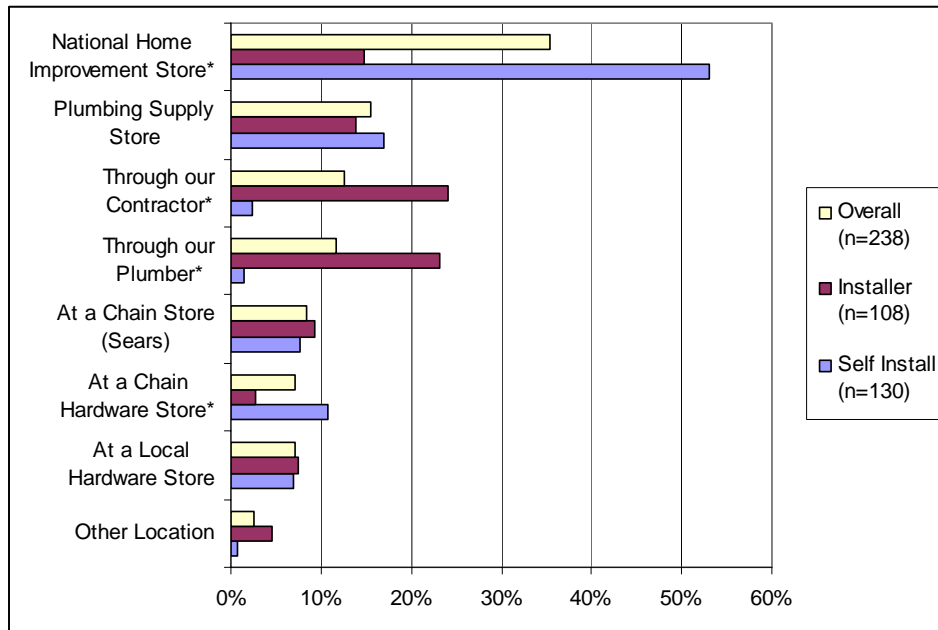
- No time to research (21 percent)
- I trust my contractor to make the right decision (19 percent)
- I did not care enough to shop (18 percent)

- I used the same brand or supplier I have used in the past (12 percent)
- My contractor got the best price for me (9 percent).

Among the consumers who were shoppers, most (80 percent) purchased their water heater themselves while a small percentage (16 percent) had their contractor purchase the water heater on their behalf. Among consumers who used a contractor or plumber for the work, only one-quarter (27 percent) purchased their water heaters themselves. Of the 50 shoppers who ended up purchasing their water heater at a national home improvement chain, 4 percent had the contractor purchase their unit for them while the remainder purchased the water heater themselves.

Consumers purchased their water heaters at a variety of locations as shown in Figure 8-4. Home improvement chains are the most common locations for a water heater purchase (35 percent) with the majority of those who purchased there self-installing their own systems. Plumbing supply stores and chain hardware stores are the next most common sources of water heaters for the self-installation market. Those who used an installer were most likely to purchase their equipment through their contractor, plumber, home improvement store or at a plumbing supply store.

Figure 8-4
Water Heater Purchase Location by Installation Method



The water heaters that customers purchase come through either the wholesale or retail distribution channel. Table 8-4 separates each purchase location into its appropriate distribution channel from the information available. The 50-percent split between the markets that manufacturers, retailers, and industry experts cited is mirrored in the consumer results. While most of the report is focused on the retrofit market, Table 8-4 also adds in the new construction market and assumes that the new construction water heaters all go through a wholesale channel. By adding in the new construction market, the total split between the retail and wholesale market shifts such that retail now represents only 41 percent of the total. Although we do not have more detailed market data, we expect that the new construction market does not actually all flow through the wholesale market; instead numerous contractors use retail chains to acquire their water heaters. Thus, the values represent the likely outer bounds and the actual retail market channel share likely falls in between 41 and 51 percent. Because the 50-percent wholesale/retail split is a commonly cited value by market actors including manufacturers, retailers, and industry experts as well as being supported by our consumer information, we have relied on that split in the characterization of the overall market.

**Table 8-4
Consumer Reported Purchase Location by Distribution Channel**

	Consumer Reported Direct Retail Chain (n=122)	Consumer Reported Wholesale Chain (n=116)	Adjusted Retail Chain	Adjusted Wholesale Chain
National Home Improvement Store	35%		28%	
Plumbing Supply Store		15%		32%
Through our Contractor		13%		10%
Through our Plumber		12%		9%
At a Chain Store (Sears)	8%		7%	
At a Chain Hardware Store	7%		6%	
At a Local Hardware Store		7%		6%
Other Location		3%		2%
TOTAL	51%	49%	41%	59%

Over one-half of the time, consumers installed their water heaters by themselves (52 percent). Of those who had someone install their unit, about half of those (46 percent) indicated that the person who did the installation was affiliated with the store where the consumer purchased their water heater.

Table 8-5 provides detailed consumer survey results for the replaced water heaters and where consumers went for their final unit. Using the 313,000 replacement water heaters projected in the Northwest market

from the Appliance Magazine and U.S. Census data, this table includes extrapolations of the regional number of units sold in each store. The condition of existing water heater and final purchase location percentages in the table are drawn directly from the consumer survey results. These consumer percentages are thus applied to the supply side totals to create estimated Northwest market totals by store and water heater condition. The only store that provided an estimate of their actual sales volume was Sears, which estimated 10,000 units per year. The Sears projection is significantly lower than the 26,500 estimated in this table.¹⁹

**Table 8-5
Percent of Water Heaters Sold by Store Type and Existing Unit Status**

	Working Units n=73 32%		Non-Working with Sudden Failure n=95 41%		Non-Working with No Sudden Failure n=68 28%		Total Replacement Units n=236 100%	
	Store Percents	Extrapolated Units by Store	Store Percents	Extrapolated Units by Store	Store Percents	Extrapolated Units by Store	Store Percents	Extrapolated Units by Store
National Home Improvement (Home Depot, Lowes)	30%	29,800	41%	52,300	32%	28,100	35%	110,200
Contractor or Plumber	26%	25,800	25%	32,200	22%	19,100	25%	77,100
Plumbing Supply Store	18%	17,600	13%	16,100	16%	14,000	15%	47,700
Hardware (Chain and Independent)	14%	13,600	12%	14,800	18%	15,300	14%	43,700
Chain (Sears)	8%	8,100	8%	10,700	9%	7,700	8%	26,500
Other	4%	4,100	1%	1,300	3%	2,600	3%	8,000
TOTALS	100%	99,000	100%	127,400	100%	86,800	100%	313,200

Sources: Appliance Magazine, 2000 Census Data, and Consumer Survey

8.3 Consumer Perceptions Regarding Willingness-to-Pay

About one third of all consumers indicated that they were aware of some water heater rebate or tax incentive. These included funds available through:

- Local utility rebate (14 percent, 20 percent among those with a working unit that is significantly different from those who had a non-working unit with a sudden failure and only 9.7 percent rebate awareness)
- State income tax credit (6 percent overall, 15 percent in Oregon)

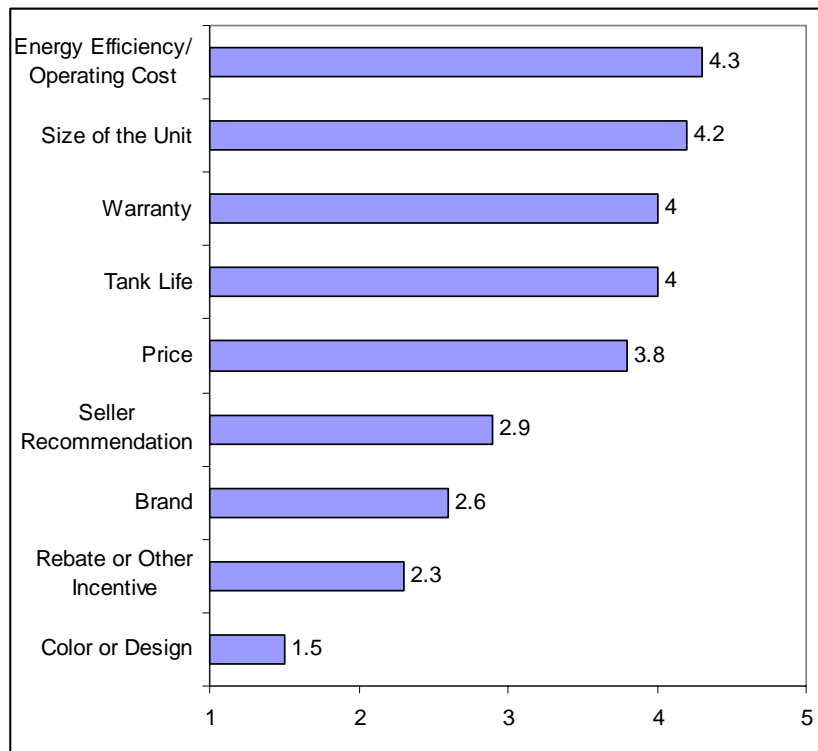
¹⁹ Several market actors did mention that Sears’ share of water heater sales was declining as national home improvement stores continue to expand their water heater market share. In addition, the consumer survey question was labeled “Chains (Sears, Orchard Supply)” so consumers who bought from other chains were grouped into this category. With a number of chain stores that operate in a small region and have only three or four stores, it is likely that several consumers classified their purchase location as a chain other than Sears.

- Manufacturer rebate (5 percent)
- Retailer rebate (4 percent)
- Other rebate (4 percent).

About two-thirds (65 percent) of the consumers who were aware of a rebate indicated that they intended to apply for those rebates. A slightly higher percentage (72 percent) of those who were aware of tax credits indicated that they intend to apply for the credit.

Consumers were asked to rate a number of specific factors that may have affected their water heater decision. The top two factors were operating cost/energy efficiency (4.3) and size of the unit (4.2). Warranty and tank life followed closely behind, with equal rankings of 4. The ratings were on a scale of 1 (not at all important) to 5 (very important). Figure 8-6 provides a comparison of the mean rating for the various water heater factors.

Figure 8-6
Relative Importance of Water Heater Decision Making Factors



Most of the ratings were consistent across groups. One significant difference was that recommendations from a salesperson, contractor or plumber (mean = 2.9) are more important to consumers who buy from a contractor/plumber (3.9) or from a plumbing supply store (3.2) than to those who buy at a national home improvement stores (2.1) or hardware store (2.5).

Consumers spend an average of \$440 to replace their water heater. Electric units average \$352 whereas gas units are more at \$581. Table 8-3 in section 8.1 above provides more detail on the average cost breakdowns.

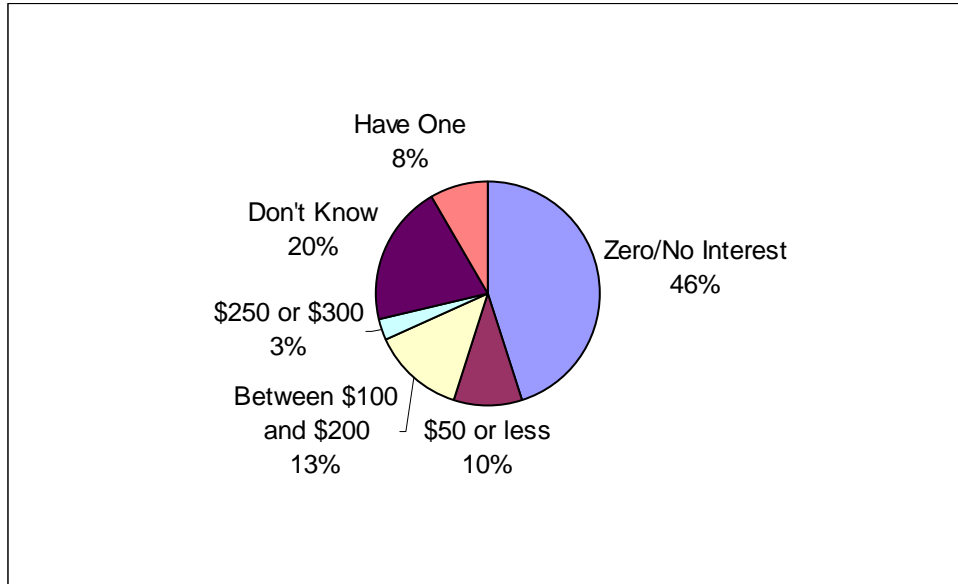
Consumers were asked about their willingness to pay for a hypothetical ENERGY STAR water heater. For electric consumers, the proposed efficient water heater was described as follows:

“The new ENERGY STAR water heater saves you \$125 every year on your annual electric bill by heating your water more efficiently. It is manufactured by a leading water heater manufacturer, and has the same tank life and warranties as your current water heater.”

Consumers report that the most important factors that affect their purchase are energy efficiency or lower operating cost, size of the unit, warranty, and tank life. While energy efficiency/lower operating cost ranked as the most important decision factor along with tank size, only 26 percent of respondents said that they would be willing to pay more (\$119 on average) for this more efficient electric water heater (heat pump) that would save them \$125 per year.

Almost half of all consumers expressed no interest in the water heater. The 8 percent of consumers who report that they “have one” are consumers who believe that they have already purchased the most efficient water heater.

Figure 8-7
Willingness to Pay for an Electric ENERGY STAR Water Heater

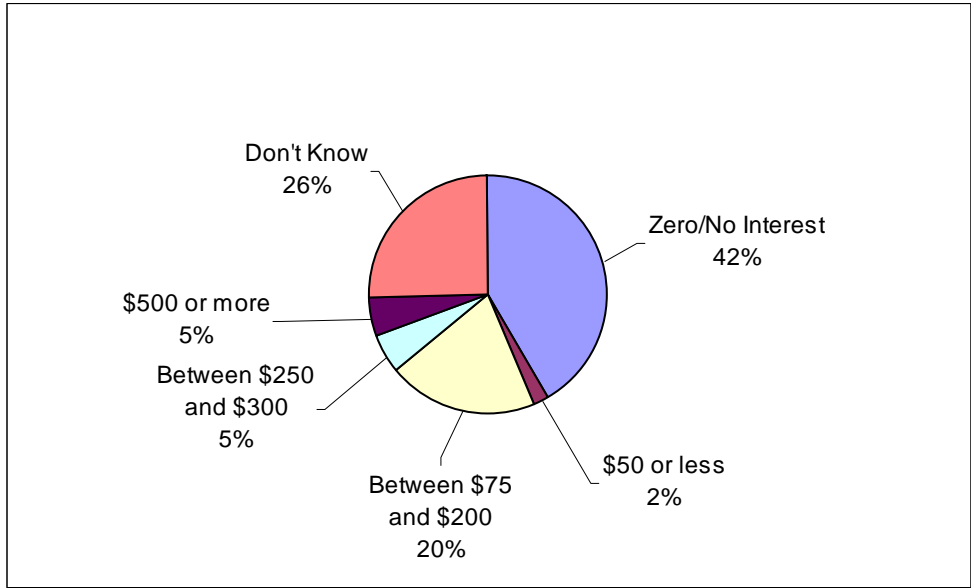


Natural gas consumers were provided with the following description of a hypothetical tankless water heater:

“The new high-efficiency tankless gas water heater allows you to have unlimited hot water. This system would save you \$75 each year on your gas bill. It is manufactured by leading water heater manufacturers and has the same tank life and warranties as your current water heater.”

Gas consumers have a slightly higher reported willingness to pay, with 32 percent saying they would be willing to pay more (an average of \$247) for a tankless unit with \$75 annual savings.

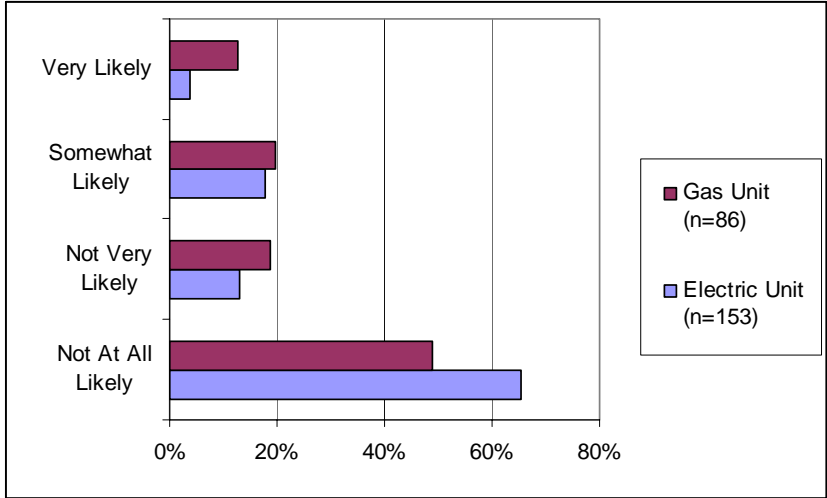
Figure 8-8
Willingness to Pay for a Natural Gas ENERGY STAR Water Heater



In both the electric and natural gas options, the survey went on to describe the additional cost of the more efficient water heater as \$500 more than the consumer’s current water heater (including tax credits and rebates). Consumers were asked how likely they would pay this additional amount considering the \$125 per year energy savings for electricity or \$75 savings for gas.

Consumers were not generally interested in purchasing either of the new technology-based units once we specified that the water heater would cost an additional \$500. Figure 8-9 shows customer willingness to pay the additional cost. A small percentage of consumers (4 percent for electric and 12 percent for gas) said they would be “very likely” to purchase the more efficient systems at the \$500 price point.

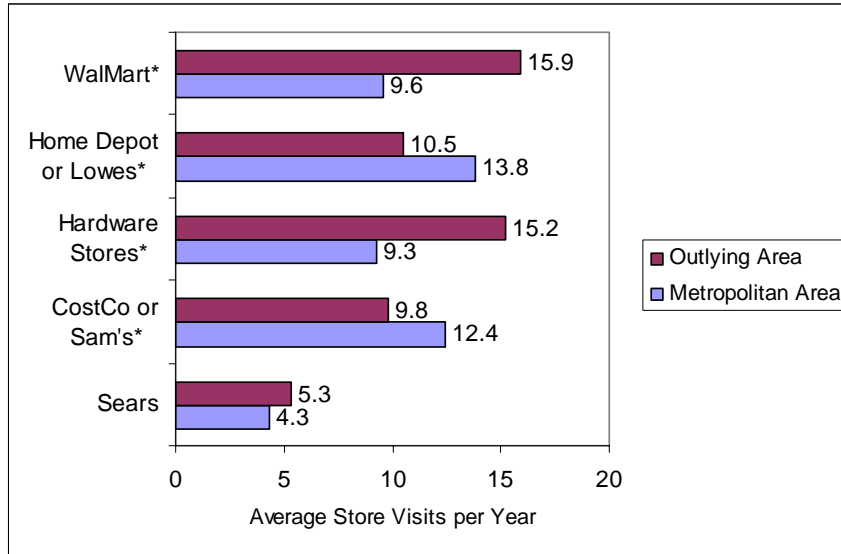
Figure 8-9
Consumer Willingness to Pay an Additional \$500 for a More Efficient Water Heater



Gas customers were more likely to indicate an interest in purchasing than electric customers despite the fact that the annual gas savings of \$75 were less than the \$125 annual electric savings. The gas model did have the added feature description of providing unlimited hot water while the electric unit focused on the unit being more efficient.

In order to understand purchase frequencies, we included questions about how often consumers shop at a variety of stores. Figure 8-10 reports on the mean frequency by store type and location. Consumers in metropolitan areas were most likely to shop more frequently at home improvement stores and buying clubs while those in outlying areas were more likely to shop at WalMart and hardware stores. Overall, consumers shop most frequently at WalMart followed by national home improvement chains. The shopping differences did not vary significantly by the water heater installation method.

Figure 8-10
Mean Shopping Frequency: Visits Per Year by Store Type and Location



* Stores with an asterisk show a statistically significant difference in the average number of visits per year.

9 Conclusions

This section outlines the major conclusions from the study with specific mention where appropriate of how the findings may relate to the heat pump water heater market. The sections are introduced by a summary conclusion followed by key facts from the study.

9.1 Water Heater Sales

The market sales data support the NWPCC market share estimates with study projections of over 3.5 million retrofit and a total of 4.4 million retrofit and new construction units needed in the region in the next 20 years. To date, the water heater market is almost completely a standard tank market with overall market share of standard tanks between 91 and 95 percent. Tankless units have made more sales progress than heat pump units, and there are over 15 tankless units sold for each heat pump unit. Heat pump manufacturers are still quite small and many are still working to get their products into the marketplace. A large utility program in the Northeast in 2002 created a short-term market for heat pumps, but also created setbacks for one of the key manufacturers.

- Just over 9 million water heaters are sold annually nationwide (not including alternative technology water heater models, such as heat pump water heaters and “tankless” models).
- In the Pacific Northwest, approximately 390,000 standard model water heaters are sold each year.
- We estimate that alternative water heaters make up another 20,000 – 35,000 units each year in the Pacific Northwest.
- There are at least 15 and likely upwards of 25 tankless units manufactured for each heat pump water heater.

9.2 Fuel Shares and New versus Replacement Market

The retrofit market is a significant portion (80 percent) of the water heater market since water heaters last an average of 12.9 years so consumers must regularly replace their units. Since there is currently no ENERGY STAR water heater, there is an opportunity to use the large replacement market as a target for additional information campaigns. Northwest electric shares of 57 percent electric units are higher than other regions. The new construction market tends to use gas water heaters at a higher rate than in the retrofit market so as the share of electric units declines so too will the retrofit opportunities.

- Approximately 80 percent of all water heaters are sold for retrofit applications, and 20 percent for new construction.
- For retrofit applications, the electric-gas split is approximately 57–43 percent.

- For new construction, there are fewer electric models with the electric-gas split is closer to 48–52 percent.

9.3 Water Heater Manufacturers

The four primary water heater manufacturers make up 99 percent of the standard tank market. Smaller manufacturers typically make alternative technology water heaters and specialize in one of the two primary types and typically only one fuel. Both standard tank and tankless manufacturers have retail partnerships, which creates a natural supply and sales chain. Heat pump manufacturers do not as yet have well-established partnerships.

- Four primary manufacturers serve the water heater market: Rheem-Ruud, A.O. Smith/State Industries, Bradford White, and American Water Heater Company. These manufacturers sell over 90 percent of all water heaters and 99 percent of all standard tank units.
- The largest alternative technology manufacturers are Bosch and Rinnai Corporation for tankless units and Nyle for heat pump water heaters. Nyle reports an 80 percent share of the heat pump market.
- There are currently four U.S. based heat pump manufacturers. Several other companies make heat pumps in other regions of the world.
- While manufacturers of standard tank units tend to make both electric and gas versions, alternative technology water heater manufacturers tend to focus on electricity or gas rather than both fuels. Alternative technology manufacturers also focus on only one of the technologies (tankless or heat pump water heaters).

9.4 Distribution / Retail Market

The distribution market is evenly split between wholesale and retail channels. Manufacturers have made efforts to establish partnerships with the retail market particularly the big box home improvement stores. This creates natural distribution channels for their products. These partnerships coupled with a large self-install retrofit market have increased the share of units that are sold through home improvement chains and other big box markets. The biggest wholesale and retail distributors have installers on staff or have established relationships with installers to simplify the purchase options for the consumer. This creates a one-stop experience for consumers. Heat pump water heaters do not currently have established retail relationships so the technology is not as readily available to consumers who buy directly at a big box type store. Any future campaign would need to make early efforts to provide the product through the home improvement and other large market channels.

- About 50 percent of water heaters are sold through wholesale market channels, and 50 percent are sold through retail channels.
- Distributors range from tiny businesses that supply 30 to 50 units per year to large suppliers selling 10,000 to 20,000 units per year. No distributor appears to have more than 10 percent market share of the wholesale market.
- With the exception of several large distributors, most distribution companies only provide products and services to installers in a wholesale market arrangement.
- Only a few distributors have direct partnership agreements with specific manufacturers. Most typically stock numerous models from one or two manufacturers.
- Heat pump manufacturers do not have retail partnerships or dealer incentives in place.
- In the retrofit market, 40 percent of water heaters are purchased through distributor or installation contractors/plumbers, 35 percent are purchased through home improvement centers, and 22 percent are purchased through hardware or department store chains.
- National home improvement chains typically sell private label water heaters that manufacturers make specifically for that retailer. Each large chain retailer has a relationship with a specific manufacturer.
- Home improvement stores and chains often have a network of installers with whom they partner.
- Retailers like to partner and appear to minimize the number of manufacturers they stock. Heat pump manufacturers should align with retailers as much as possible.

9.5 Installation

Installers tend to work with the same product and/or manufacturer for their projects. Installation of heat pumps can be a specialty service, which many installers do not currently perform. With almost half of all retrofit units self installed and almost three quarters of the self-installed units being electric, heat pump water heaters would need to be easy for consumers to install themselves in order to be a viable product.

- Installers typically work with a single distributor for all their water heaters.
- Most installers report water heaters make up between 5 and 10 percent of their overall businesses.
- Installers reported average electric water heater costs (installed) of \$475 and gas costs of \$637.
- Heat pump units need to be easy to install since they will make up only a small portion of an installer's workload.
- In the retrofit market, about half of the water heaters sold are self-installed (52 percent self-install and 48 percent installed by plumber or contractor).
- Consumers who self install their water heaters are much more likely to have electric units (72 percent) than those who use an installer (43 percent).

9.6 Consumer Purchase Behavior

Only half of retrofit consumers shopped around when they made their purchase and those who did shop looked at only a few different water heaters. Just over 40 percent of all replacements are considered emergencies, which adds a time sensitivity to the decision-making process. Gas water heaters (\$581) are overall more expensive than electric units (\$353), and consumers who self install their units spend an average of \$246 less than those who have their unit installed.

Although consumers rank energy efficiency/operating costs as the most important feature that influenced their water heater purchase (along with tank size, warranty, and tank life), most consumers indicated that they would not be willing to pay a higher price for an energy efficient water heater. These results imply that heat pump water heaters would need to be priced very competitively or be offered with incentives that would make their first cost to consumers similar to standard tanks. Consumers with gas fuel did indicate a greater willingness to pay a premium for tankless water heaters that offer “unlimited hot water” in addition to lower operating costs, suggesting that “unlimited hot water” is a value-added benefit for which consumers are willing to pay.

- In the retrofit market about 41 percent are emergency replacements, 32 percent are working replacements, and 28 percent are non-emergency, non-working replacements.
- Half of all customers considered only one water heater during their purchase process. The other half considered an average of 1.9 different water heaters.
- Consumers spend an average of \$440 to replace their water heater with electric units averaging \$353 and gas units \$581.
- Customer who self installed their units reported costs of \$332 on average, with contractor installed units at \$578.
- The most important purchase factors are energy efficiency or lower operating cost, size of the unit, warranty, and tank life.
- Only 26 percent of respondents said that they would be willing to pay more (\$119 on average) for a more efficient water heater (heat pump) that would save them \$125 per year.
- Gas consumers have a slightly higher reported willingness to pay, with 32 percent saying they would be willing to pay more (an average of \$247) for a tankless unit with \$75 annual savings.
- Consumers who saw a feature benefit with the gas tankless unit (unlimited hot water) showed a higher interest in paying more for that unit than the proposed heat pump option.
- Only 4 percent of electric and 12 percent of gas customers said they would be “very likely” to purchase a more efficient water heater if it cost an additional \$500.

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- Heat pump water heaters will have to be priced very competitively to succeed in the market.