

# Phoenix Homeowner Satisfaction Survey [2006]

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THIS SURVEY WAS PERFORMED BY ADVANCED ENERGY  
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COLLABORATIVE [STAC] PROGRAM AND FUNDED JOINTLY  
BY THE U.S. DEPARTMENT OF ENERGY AND  
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## **Phoenix Homeowner Satisfaction Survey [2006]**

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# Executive Summary

Residential heating and cooling systems that have been right-sized according to Manual J<sup>®</sup> are known to reduce energy consumption and provide better temperature and humidity control. However, there is a concern that some builders and mechanical contractors oversize heating, ventilation and air conditioning [HVAC] systems because they fear homeowner complaints<sup>1</sup>. There is anecdotal evidence to suggest that some homeowners with right-sized systems perceive them to be too small. Until now there has been no reliable data to determine whether homeowners are any less satisfied with the energy consumption, comfort or health of a home that has a right-sized HVAC system.

Right-sizing is typically done in conjunction with other high performance building improvements or building science techniques, such as low-E windows, higher SEER levels, tighter duct standards and proper installation<sup>2</sup>. Therefore, a homeowner's satisfaction depends on more than just the HVAC system. It will also depend on the contribution that these other building science techniques make to homeowner satisfaction.

In 2005, a survey was conducted of 708 homeowners in Phoenix. This survey, titled the *Phoenix Homeowner Satisfaction Survey*, compared the attitudes of homeowners of three categories of new home construction in Phoenix:

- 1) **Baseline homes** are built to local code and may or may not be right-sized.
- 2) **Energy Star<sup>®</sup> homes** are built to standards set by the U.S. Environmental Protection Agency [EPA]. Some Energy Star<sup>®</sup> [ES] homes may be right-sized, but right-sizing was not mandatory.
- 3) **Guaranteed Performance homes**, promoted by several private companies, are built to higher standards of building science, exceeding those of Energy Star<sup>3</sup>. According to Guaranteed Performance [GP] program standards, homes are to be right-sized according to Manual J.

The *Phoenix Homeowner Satisfaction Survey* confirms that owners of houses built according to strict standards of building science, including right-sizing, are more satisfied with the performance of their HVAC systems than owners of conventionally built houses. In fact, they are even more satisfied than owners of

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<sup>1</sup> In this report, the term builder refers to homebuilders and the term contractor refers to an HVAC or mechanical contractor.

<sup>2</sup> In this report, the terms Building Science and High Performance are used interchangeably, because they both refer to homes built to a higher standard.

<sup>3</sup> Guaranteed performance homes are built with features such as improved insulation systems, right-sized HVAC equipment, pressure balancing, interior moisture management, combustion safety, tight construction to reduce internal leaks and drafts, fresh air ventilation, and more.

houses built to Energy Star standards. They are more satisfied with energy costs, with comfort and with the perceived health of their families. **The survey confirms that right-sizing, in conjunction with other high performance building improvements or building science techniques, results in greater homeowner satisfaction.**

A parallel study conducted in Phoenix in 2005 concluded that Guaranteed Performance homes consume up to 33 percent less energy per square foot than baseline homes and up to 20 percent less than Energy Star homes. The *Phoenix Home Energy Efficiency Study [2005]* was performed by Advanced Energy and sponsored by the U.S. Environmental Protection Agency<sup>4</sup>. It compared the energy consumption of 7,141 homes in the Phoenix market, adjusting for such factors as square footage, whether the house had a swimming pool and whether it had gas or electric heat. [In order to evaluate conclusions from these two parallel studies, the 708 homeowners in the *Phoenix Homeowner Satisfaction Survey* were drawn from the 7,141 homes in the EPA study.]

**Results of these two surveys show evidence that homes incorporating building science techniques and features — often called high performance homes — consume less energy than comparable conventional homes and simultaneously make homeowners more satisfied.** This win-win situation can provide a foundation for future efforts to promote energy-efficient building principles.

However, homeowners do not understand the right-sizing concept. It is counter-intuitive to their notion of how a proper HVAC system should operate. For instance, they prefer a system that is responsive and can heat or cool their house quickly. They also associate continuous operation, typical in a right-sized installation, with wasted energy. One builder in Phoenix remarked, “Homeowners believe it costs money every time the unit is running.” Given a choice, most homeowners in the survey would choose a system that is oversized to one that is right-sized.

Another hurdle to overcome is a lack of awareness. Although the Phoenix market was an early adopter of the Energy Star and Guaranteed Performance programs, homeowners are generally unaware of these energy designations, especially Guaranteed Performance. Even people who bought a program home are often unaware of that fact.

In conclusion, right-sizing, together with other building science techniques, can reduce energy consumption at the same time it improves homeowner satisfaction. Right-sizing alone is a hard sell. Builders who want to include it in their product run the risk that homeowners will complain that their system is undersized. The challenge is to demonstrate cost savings, comfort and health benefits of right-sizing and building science in a way that stimulates the interest of homebuyers.

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<sup>4</sup> *The Phoenix Home Energy Efficiency Study*, 2005, has been presented to the U.S. Environmental Protection Agency and is currently under review.

# Introduction

This report documents the methodology and findings of the *Phoenix Homeowner Satisfaction Survey*. This work was performed under the State Technologies Advancement Collaborative [STAC] program and funded jointly by the U.S. Department of Energy [DOE] and participating state-based partners. The survey was managed by Advanced Energy and administered by The Hatteras Group. The purpose of the survey was to determine homeowner satisfaction with right-sized HVAC systems and attitudes toward the concept of right-sizing.

## Background

The United States – with 4.6 percent of the world’s population – accounts for 24.9 percent of the world’s primary energy consumption. Housing accounts for 36 percent of that consumption, or nine percent of the world’s primary energy consumption. In 2000, this consumption was projected to grow by 39 percent by the year 2010<sup>5</sup>.

In recent decades, rising energy prices, coupled with increased public awareness, has created a demand for more energy-efficient homes. Builders initially responded with simple energy-saving remedies, such as increased insulation, double-paned windows, tighter door seals and so on. Recent advances in building science, materials technology and building practices have introduced more effective and sophisticated methods of saving energy, such as combining high-efficiency HVAC equipment with improved duct sealing, infiltration barriers, low emissivity glass, compact fluorescent lighting, advanced framing, interior pressure relief, closed crawl spaces, etc.

The sizing of a home’s HVAC system plays a major role in the home’s energy consumption. Manual J<sup>®</sup> is the industry standard residential load calculation method, required by most building codes around the country. Systems that are sized according to Manual J protocols are considered right-sized. However, there is concern that many builders and mechanical contractors are over-sizing systems to avoid potential homeowner complaints.

For right-sizing to become common industry practice, builders must be convinced that homeowners prefer a right-sized system, and that homeowners are able to see clear benefits from right-sizing *in conjunction with* other high performance building improvements or building science techniques.

## Survey Objectives and Scope

The *Phoenix Homeowner Satisfaction Survey* [the Survey] was commissioned by the U.S. Department of Energy [DOE] to determine homeowner satisfaction with right-sized HVAC systems. The work is performed under the State Technologies Advancement Collaborative [STAC] program and funded jointly by the DOE and participating state-based partners. The Survey is part of a larger effort aimed at getting the highest

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<sup>5</sup> 2004 *Buildings Energy Databook*, U.S. Department of Energy

level of performance from residential air conditioning systems. This larger effort is focused on [a] metrics that better reflect field performance, [b] features that improve operating efficiency, [c] new climate sensitive air-conditioning designs and [d] field performance studies of existing systems. Although not part of this study, a parallel study conducted in 2005, *The Phoenix Home Energy Efficiency Study* addresses the issue of field performance studies of existing systems.

The *Phoenix Homeowner Satisfaction Survey* addresses several issues:

- Do homeowners understand the concept of right-sizing and its benefits?
- Are owners of homes with right-sized HVAC systems more satisfied than owners of homes with oversized systems?
- Are homeowners aware of the various energy programs?
- How do people manage their HVAC systems? For example, do owners of right-sized systems behave any differently than owners of oversized systems?

The survey was confined to Phoenix because of the city's high concentration of energy efficient homes, enabling researchers to study a sufficient sample of right-sized HVAC systems installed in homes. In addition, the major electrical utility in the market, Arizona Public Service [APS], added valuable cooperation by providing lists of homeowners. These lists did not compromise any confidential homeowner information, but enabled the researchers to efficiently reach survey respondents.

### **The Characteristics of the Phoenix Market**

In 2004, the Phoenix area became the largest market in the country for new residential construction, with more than 60,000 homes started. Production construction dominates the new home market in Phoenix, with many national homebuilders working in the area. Builders in Phoenix have supported the Energy Star and Guaranteed Performance programs by including these designations in their marketing materials and by consistent, rigorous testing of duct leakage and home infiltration. One important driver for their support is that a local utility partially subsidizes the cost of performance testing.

Home building contractors are more consolidated in Phoenix than most other cities. For example, one HVAC contractor installs the majority of all new home mechanical systems. Clearly, when the one such contractor changes business practices, it can have a powerful impact on the market as a whole.

According to the *Phoenix Home Energy Efficiency Study [2005]* the Phoenix market is one of the most energy-conscious markets in the country and an early adopter of both the Energy Star and Guaranteed Performance programs. Because these programs have been active in Phoenix since 1997 and 1998, Phoenix offers an excellent opportunity to study the attitudes of different types of homeowners.

## **Approach to the Survey**

Right-sizing is typically applied in conjunction with other energy-reducing materials and construction techniques, such as low-E windows, higher SEER levels, tighter duct standards and proper installation. As a result, overall homeowner satisfaction depends on more than just a right-sized HVAC system. The approach used for this survey was to compare attitudes of homeowners of three major categories of new homes in the Phoenix market: Baseline, Energy Star and Guaranteed Performance.

## **Baseline Homes**

Baseline homes are built to code and are not part of any energy efficiency program. According to the *Phoenix Home Energy Efficiency Study [2005]* typical Baseline homes built in Phoenix between 1998 and 2004, such as those represented in the survey, are anecdotally considered to be about up to 20 percent more energy efficient than homes built to the 1993 Model Energy Code [MEC] standard. Baseline homes may or may not be right-sized.

## **Energy Star Homes**

The Energy Star® homes program was established in 1995 by the EPA to create guidelines for reducing home energy use and promote partnerships with homebuilders to construct more energy efficient homes. To date, approximately 400,000 Energy Star homes have been constructed in the United States. Energy Star homes may or may not be right-sized. The homes are required to be independently verified to be at least 30 percent more energy efficient than the same house built to 1993 MEC, or 15 percent more efficient than state code, whichever is more rigorous. Energy savings are based on heating, cooling and hot water usage. To qualify for the Energy Star designation, design plans must first meet criteria for predicted energy use using computer simulation modeling. In addition, a random sampling of each builder's homes must pass a minimum of two field tests [duct and house leakage tests] to ensure that actual performance matches the computer modeling.

## **Guaranteed Performance Homes**

Several private companies, including Masco Corporation's Environments for Living®, Louisiana Pacific's now defunct Engineered for Life®, Arizona Public Service's Performance Built® and Tucson Electric, have promoted GP homes in Arizona. The majority of these homes are Masco Environments for Living® homes, which are designed to go a step beyond the Energy Star program by using advanced energy efficient materials and construction techniques to lower residential energy use even further. The standards and testing protocol for Environments for Living houses are more stringent than that of Energy Star®. Homeowners are guaranteed that energy consumption will not exceed a certain maximum average level or the difference will be refunded to them. In addition, the program offers homeowners a comfort guarantee, stipulating that temperatures in each room will not vary by more than  $\pm 3^{\circ}$  Fahrenheit from a previously

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<sup>6</sup> Specifications for an EFL program home may be viewed by going to the EFL website, <http://www.eflbuilder.com/>, and pressing on the Specifications page.

designated range of summer and winter thermostat settings. These guarantees are made by the program's sponsor and are marketed by those homebuilders that meet the program's requirements.

Guarantee Performance homes cost more to build because of materials costs, construction and the performance guarantee. Benefits to builders are supposedly in the form of lower warranty, or call back costs, and greater competitive differentiation in the new home marketplace. To date, approximately 90,000 houses nationwide have been built and certified to GP standards.<sup>7</sup>

This survey compared attitudes of GP homeowners with those of Energy Star and Baseline homeowners for several reasons. First, GP homes are required to be within one-half ton of the Manual J calculated tonnage. The GP homes in the survey were downsized by an average of 11.5 percent from Baseline and Energy Star HVAC systems on a square foot per ton basis.<sup>4</sup>

In addition, GP homes incorporate more stringent material, construction and testing standards than Baseline or Energy Star homes. In fact, they incorporate many principles that might become industry standards in the years to come. Therefore, understanding homeowner satisfaction with GP homes could provide support for developing future industry standards that go beyond, but also include right-sizing.

### **Anticipated Significance of Survey Findings**

If right-sizing is to become accepted industry practice and find a place in the market, builders must be convinced that homeowners prefer a right-sized system to an oversized system, and that homeowners are able to see clear benefits from right-sizing. The results of this survey should help each of the stakeholders in the new home construction market establish a stronger foundation for their decisions to support right-sizing in conjunction with improved building science.

- › Equipment manufacturers can benefit by meeting homeowner demands for new products that meet their needs more precisely.
- › Builders can benefit with a clearer understanding of what makes their homebuyers satisfied and how they can turn building science into competitive differentiation.
- › Utilities can benefit with better strategic directions and a stronger business case for local program support of energy efficiency and Demand Side Management programs.
- › Contractors can benefit by understanding their impact on homeowner satisfaction.
- › Government entities can benefit by creating standards and programs that truly meet the needs of the marketplace, while serving the public interest.

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<sup>7</sup> This number refers to homes in the nationwide Engineered For Life and Environments for Living programs.

# Survey

## Methodology

This survey was conducted in Phoenix during the spring and summer of 2005. It was conducted in two phases: [1] qualitative research among homeowners, builders and mechanical contractors and [2] a quantitative survey of 708 homeowners.

### Qualitative Research

The first steps began with qualitative research among homeowners, builders and contractors to understand what drives homeowner satisfaction and to ensure that the survey document was comprehensive and written in the homeowner's language. Two focus groups of homeowners were conducted in Phoenix on the evening of April 5, 2005. The first group comprised nine owners of Energy Star and Guaranteed Performance homes. The second comprised nine owners of Baseline homes. All panelists bought their new home within the past five years, and all were personally involved in the decision to buy their house. The groups were diverse in gender, age and income. In accordance with normal market research procedures, panelists were paid an incentive ranging from \$75 to \$100 to attend the focus groups.

In addition to the focus groups, selected builders and HVAC contractors serving the Phoenix market were interviewed in person to understand their attitudes about right-sizing and about the Guaranteed Performance and Energy Star programs. These interviews were conducted from April 4 to April 6 of 2005.

### Quantitative Research

A written, four page survey was mailed to 7,000 homeowners in Phoenix from lists provided by Arizona Public Service [APS] and by Masco Contractor Services, the sponsor of the Environments for Living® program, the largest GP program in Phoenix. A copy of this survey is presented in Appendix A. Homeowners were pre-recruited by telephone a few days before the survey was sent to them. The survey was held open during the months of July and August 2005. In all, 708 homeowners responded by returning completed surveys.

The Hatteras Group, a market research firm in Chapel Hill, North Carolina, designed the survey and tabulated the returned surveys. Overall, the survey had a sampling margin of error of 3.7 percentage points at a 95 percent confidence level. Appendix B shows the full results of the survey, including the margin of error for each question in the survey and for each segment of homeowner surveyed.

### Survey Limitations

The results in this survey apply only to the Phoenix market and should not be extended to other markets. Other markets may have different load patterns, concentrations of energy efficient housing, demographics, climates and utility rate structures. However, this survey can be repeated in other markets at any time.

Several factors could influence the statistical reliability of this survey:

- › **Over-Sampling.** The survey was not a random sampling of homeowners because the researchers wanted to achieve statistical reliability for each of the three categories of homeowner. Therefore, the researchers over-sampled Energy Star and Guaranteed Performance homeowners in order to gather a minimum number of responses for each category. However, within each category, homeowners were randomly sampled.
- › **Geographic Scope.** Baseline and Energy Star homeowners reside in all areas of Phoenix; however, most GP homeowners reside in a smaller geographic spread within Phoenix because this new program has not been adopted by as many builders. Therefore, the results may not represent as broad a cross-section of Phoenix.
- › **Construction Standards.** The *Phoenix Home Energy Efficiency Study [2005]* determined that some Baseline homes are actually built to Energy Star standards. While they are classified as Baseline homes in the survey, they are actually built to Energy Star standards. This may have the effect of bringing the responses of both categories closer together than normal. However, it would not affect the responses of GP homeowners.

### Who Responded

There were 708 responses to the survey, as shown in Table 1. Respondents were categorized into one of three groups based on the actual energy designation of their home as reported by the appropriate local utility and verified by Masco Contractor Services, the sponsor of the Environments for Living program. Thirteen respondents could not be categorized because they did not provide us their address and therefore the house in question could not be identified.

**Table 1: Composition of Survey Respondents**

CATEGORY	CODE	NUMBER OF SURVEYS	PERCENT OF TOTAL
Baseline Homeowners	B	205	29%
Energy Star Homeowners	ES	255	36%
Guaranteed Performance Homeowners	GP	235	33%
Unknown		13	2%
<b>Grand Total</b>		<b>708</b>	<b>100%</b>

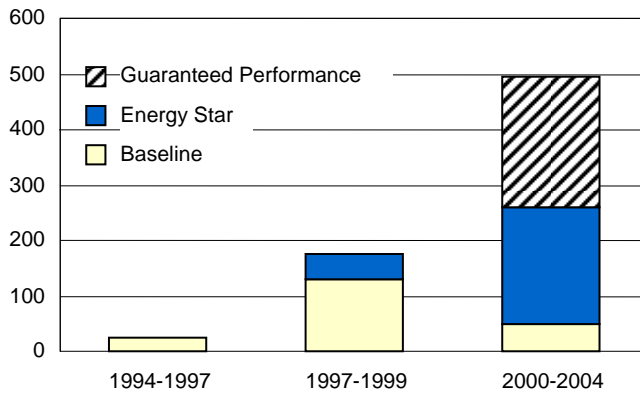
There are differences in the demographics of the three groups of homeowners as illustrated in Table 2. For example, ES homeowners have the biggest households with the most children. They are young and fairly affluent. GP homeowners are older, more affluent and live in smaller households. Their homes are large and presumably more expensive. Baseline homeowners are the least affluent and live in the smallest houses. Baseline homeowners are also between GP and ES homeowners in age and the presence of occupants under the age of 18.

**Table 2: Survey Demographics**

DEMOGRAPHIC	BASELINE HOMES	ES HOMES	GP HOMES	TOTAL SURVEY
Average household size	2.7	2.9	2.5	2.7
Percent of household occupants under the age of 18	28%	32%	20%	27%
Percent of homes with household incomes over \$50,000	60%	67%	77%	68%
Percent of respondents under the age of 45	47%	58%	33%	46%
Percent of homes over 1,600 square feet	53%	60%	86%	68%

All the homes in the survey were built between 1994 and 2004, with the majority built since 2000. Figure 1 shows the number of homes constructed by year and by category. Baseline homes were common in the 1990s. Energy Star homes entered the market in the late 1990s. Guaranteed Performance homes did not contribute to the market until 2000.

**Figure 1: Houses Built By Year and Category**



The characteristics of the houses in each of the three categories are depicted in Table 3. GP homes tend to be larger, one story dwellings. The presence of a swimming pool is not dependent on the category of house, nor is SEER rating.

**Table 3: Characteristics of Homes That Responded to the Survey**

CHARACTERISTIC	BASELINE	ES	GP
Average square feet	1,685 ft <sup>2</sup>	1,877 ft <sup>2</sup>	2,125 ft <sup>2</sup>
Percent of homes with gas heat	26%	47%	73%
Percent of homes with 2 or more floors	20%	23%	15%
Percent of homes with a swimming pool	19%	20%	18%
Average SEER rating	11.6	11.9	11.7
Average square feet per ton of cooling	423 ft <sup>2</sup> /ton	418 ft <sup>2</sup> /ton	474 ft <sup>2</sup> /ton

Another critical difference shown in Table 3 is high number of houses with gas heat, especially among the GP and ES categories. Since this survey is about right-sizing of electrical heating and cooling systems, the attitudes of homeowners with gas heat cannot be compared to those of homeowners with electric heat. Therefore, wherever appropriate, this report will present separate findings for homes with gas heat and homes that are all-electric. This difference will only be important when presenting findings about HVAC performance during the winter months, because in the summer cooling season all homes in the survey are electrically air-conditioned.

# Survey Results

The *Phoenix Homeowner Satisfaction Survey* has produced five important findings:

1. Owners of Guaranteed Performance homes are more satisfied with their comfort, energy cost and healthiness than owners of Energy Star or Baseline homes.
2. Homeowners do not understand the concept of right-sizing and would not choose it for their own home. This is true even for owners of GP homes.
3. Three chief complaints that homeowners have about the performance of their HVAC systems are the unevenness of temperature from room to room, the cost of air conditioning and noise.
4. Homeowners are generally unaware of the various energy programs in the Phoenix market [Energy Star, Environments for Living and Performance Built].
5. While some homeowners are conscientious and knowledgeable about managing their homes for energy efficiency, there are an equal number who are not.

## Drivers of Satisfaction

Homeowners that participated in the Phoenix focus groups said several factors are important when deciding whether to buy a particular new home. The principal factors are location, design and functionality. One homeowner said, “I bought a home for its location and size, the shape of the house and its light.” Energy isn’t a major consideration when buying a new house, as another homeowner said, “We didn’t pay attention to energy when we bought our house. We were just thinking about the size of the house, the number of bedrooms...”

However, once the decision is made and the homeowner has experienced living in the house, energy cost and performance of the HVAC system become very important. As one homeowner stated, “I didn’t realize how important it was when I bought my home. But if I were buying again, I’d pay more attention to [energy efficiency].”

Qualitative research among homeowners and builders in Phoenix identified a set of drivers that determine how satisfied a homeowner is with his or her house after they have had at least a year’s experience living in it. HVAC systems must satisfy four basic needs:

1. **Comfort.** Comfort is a basic need. Clearly, it’s hard to be satisfied in a house that does not deliver basic thermal comfort in all seasons of the year. To homeowners, comfort is a function of several things: air freshness, evenness of temperatures from room to room, the ability to regulate temperatures and responsiveness, or, the ability of the HVAC system to heat or cool the house quickly.
2. **Energy Efficiency.** Homeowners need a system that delivers comfort in all seasons at a reasonable cost.

3. **Reliable Performance.** Along with cost, homeowners also need a system that is easy to operate, reliable and does not require constant repair. Furthermore, they want a system that is not noisy.
4. **Healthiness.** There is emerging awareness of the link between the home and family health. Homeowners are beginning to see how their home can be a source of health threats from mold, mildew and airborne allergens. The link between health and home systems makes common sense to consumers. As one Phoenix homeowner said, “You have these dust mites and microbes in the air, getting pushed into your lungs from recirculated air, so naturally if you have fresh air and filter it properly, it should make you healthier.”

These four primary needs and specific drivers of satisfaction are shown in Table 4.

**Table 4: Drivers of Homeowner Satisfaction**

PRIMARY NEED	DRIVERS OF SATISFACTION
COMFORT	The ability of your home to keep you comfortable year round
	Evenness of temperatures from room to room in the summer and winter months
	The ability of your air conditioner to cool your home down quickly
	The ability of your heating system to warm your home up quickly
	The ability to regulate temperatures during all seasons
	The freshness of the air inside your home during those times you keep doors and windows shut
ENERGY EFFICIENCY	The cost of cooling your home
	The cost of heating your home in winter
RELIABLE PERFORMANCE	The reliability of your heating and cooling system [i.e., repair frequency]
	The noise of your heating and cooling system when running
HEALTHINESS	The ability of your heating and cooling systems to reduce allergies and other airborne ailments in your home

### **GP Homeowners Are More Satisfied**

**One of the key findings in this survey shows that Guaranteed Performance homeowners are more satisfied than Energy Star or Baseline homeowners on almost every one of the drivers of satisfaction. Guaranteed Performance homeowners in Phoenix are significantly more satisfied because of the comfort, energy efficiency, reliable performance and perceived healthiness.**

Using a scale of one to five, where one means “very dissatisfied” and five means “completely satisfied,” homeowners were asked to rate their satisfaction on each of the drivers of satisfaction listed in Table 4. Results were then analyzed two ways: by calculating the percent that were completely satisfied [those that gave a rating of five to the driver] and by calculating the average rating between one and five. These two methods are obviously highly correlated. The more people that give a five rating, the higher the average score. Appendix B presents the results of the full survey presented both ways; however, this report generally presents results as the percent of homeowners that are completely satisfied.

The table below summarizes the percent of homeowners that are completely satisfied with each driver of satisfaction<sup>8</sup>. In addition, it shows the statistical relevance of each measure. For example, on the first driver, “the ability of your home to keep you comfortable year round,” the difference between GP homeowners and all other homeowners is significant at the 99 percent confidence level. Thus, it can be said with statistical certainty that GP homeowners are more satisfied than ES or Baseline homeowners on that particular driver.

**Table 5: Satisfaction with Drivers of Satisfaction<sup>9</sup>**

CATEGORY OF HOME	NEED	DRIVER OF SATISFACTION	GP HOME-OWNERS	ES & BASELINE HOME-OWNERS	SIGNIFICANCE OF THE DIFFERENCE	
YEAR ROUND DRIVERS FOR ALL HOMEOWNERS	COMFORT	The ability of your home to keep you comfortable year round	49%	31%	99%	
		The freshness of the air inside your home during those times you keep doors and windows shut	40%	22%	99%	
	HEALTHINESS	Ability of heating and cooling systems to reduce allergies and other airborne ailments in your home	32%	17%	99%	
SUMMER PERFORMANCE DRIVERS FOR ALL HOMEOWNERS [Includes all homes in the survey]	COMFORT	Your ability to regulate temperatures during the summer	41%	25%	99%	
		The ability of your home to keep you comfortable during the summer	37%	21%	99%	
		The ability of your air conditioner to cool your home down quickly	36%	23%	99%	
	ENERGY EFFICIENCY	The evenness of temperatures from room to room during the summer	25%	13%	99%	
		The cost of cooling your home	22%	13%	99%	
		RELIABLE PERFORMANCE	The reliability of your cooling system [i.e., repair frequency]	53%	37%	99%
The noise of your cooling system when it's running	29%		17%	99%		
WINTER PERFORMANCE DRIVERS FOR ELECTRIC HEAT HOMES ONLY [Homes with gas heat are excluded]	COMFORT	Your ability to regulate temperatures during the winter?	42%	30%	95%	
		The ability of your heating system to warm your home up quickly	40%	27%	95%	
		The evenness of temperatures from room to room during the winter	29%	21%	ns	
	ENERGY EFFICIENCY	The cost of heating your home	27%	29%	ns	
		RELIABLE PERFORMANCE	The reliability of your heating system [i.e., repair frequency]	51%	38%	90%
			The noise of your heating system when it's running	32%	18%	95%

In the remainder of this section of the report, the data in Table 5 will be analyzed in fuller detail.

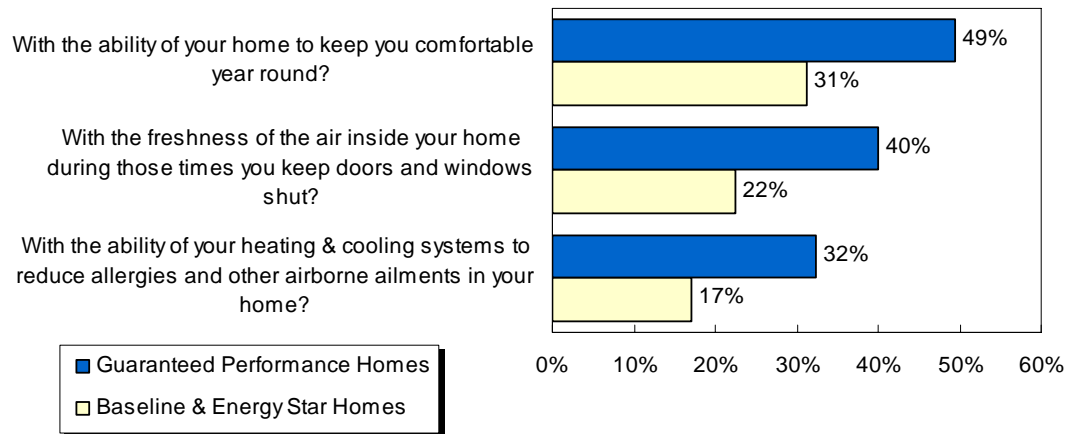
<sup>8</sup> Because the responses of ES and Baseline homeowners are similar for most questions in the survey, the two categories are combined in certain sections of this report so that they can be compared to GP homeowners. However, in Appendix B, the full results are shown for each of the three categories—GP, ES and Baseline.

<sup>9</sup> Statistical significance is calculated at either 90 percent, 95 percent or 99 percent confidence level. The term “ns” means there is no statistical difference between categories.

## Satisfaction with Overall Performance

There are three drivers of satisfaction that measure year round performance of the HVAC system: year round comfort, air freshness and perceived healthiness. On all three drivers, GP homeowners are significantly more satisfied than ES or Baseline homeowners. Figure 2 shows the percent of each category of homeowner that said they are completely satisfied with each driver of satisfaction.

**Figure 2: Percent Completely Satisfied With Overall Performance**



**Year Round Comfort.** One of the primary needs that an HVAC system must meet is comfort. As Figure 2 demonstrates, 49 percent of GP homeowners are completely satisfied with “the ability of their home to keep them comfortable year round” compared to 31 percent of Baseline and ES homeowners. This difference is significant at the 99 percent confidence level. Another way to look at these numbers is to say that GP homeowners are 58 percent more likely to be completely satisfied with their overall comfort [that is, 49 percent compared to 31 percent].

**Air Freshness.** Another way that homeowners define comfort is by perceived air freshness during those times when their windows and doors are shut. As Figure 2 demonstrates, GP homeowners are almost twice as satisfied with air freshness as ES and Baseline homeowners — 40 percent compared to 22 percent.

**Perceived Healthiness.** Almost one-third of GP homeowners report that they are completely satisfied with the ability of the heating and cooling systems to reduce allergies and airborne ailments in the home. This suggests that they recognize the connection between air quality and healthiness, and that they perceive their GP house to have a positive impact on their family’s health. GP homeowners are 88 percent more likely to be completely satisfied with healthiness than ES and Baseline homeowners.

Only a small fraction of homeowners in all three categories had ever experienced mold or mildew in their homes, less than four percent overall, which is not surprising for an arid climate. Therefore, perceived healthiness must derive from another source. There is some anecdotal evidence that the freshness of the

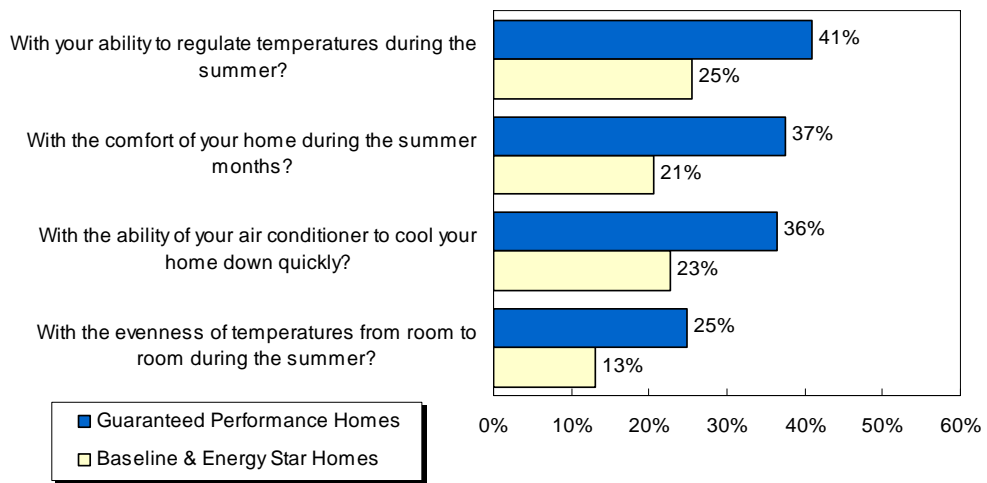
air in a GP home is one cause of this perceived healthiness. As one focus group homeowner said, “If there were fresh air rather than re-circulated air, that would, I hope, give you a feeling of health.”

This finding opens a potentially important avenue for further discovery. If there is a demonstrable connection between building science and healthiness, and if homeowners come to believe that connection, it opens a new dimension of building science. This survey deals only with perceptions and cannot test actual cause and effect relationships. Nonetheless, the fact that GP homeowners perceive themselves to be healthier should be important to builders, utilities and other entities.

### Comfort in the Summer

GP homeowners are more satisfied than other homeowners with their comfort during the summer months.

**Figure 3: Percent Completely Satisfied With Summer Comfort**



**Temperature Regulation.** One of the ways homeowners define comfort is by their ability to regulate temperatures during the hot summer months. Phoenix is notoriously hot during the summer, yet 41 percent of GP homeowners are completely satisfied with their ability to regulate temperatures in the summer, compared to only 25 percent of ES and Baseline homeowners. This difference is significant at the 99 percent confidence level.

**Responsiveness.** Another way homeowners define comfort is by the ability of their air conditioning to cool the house quickly. Here again, GP homeowners are 56 percent more likely to be completely satisfied than ES or Baseline homeowners.

This finding about responsiveness is significant because the perception among homeowners is that a right-sized system is not as responsive as an oversized system. Their perception is correct: oversized systems are more responsive. However, GP homeowners were more satisfied with the responsiveness of their systems, despite the fact that their systems were smaller than those of ES and Baseline homeowners.

The conclusion is that right-sized systems, when combined with other energy efficient materials and construction techniques, can meet response needs of homeowners.

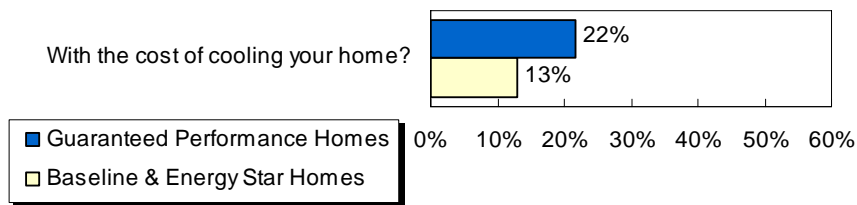
**Evenness of Temperatures from Room to Room.** The final way that homeowners define comfort is by the evenness of temperatures throughout the house. Homeowners are especially sensitive to hot spots in their house in the summer. As one homeowner said in the focus group, “Of all these things [related to comfort] I think room balance is the most important.” GP Homeowners are 92 percent more likely to be completely satisfied with evenness of temperatures than ES or Baseline homeowners.

Even though GP homeowners are more satisfied with temperature balance, this is still a problem area for a large number of homeowners. For example, only 25 percent of GP homeowners say they are completely satisfied. This is the lowest rating of all the comfort drivers, suggesting that temperature balance is an area for further development.

### Cooling Costs

Relatively few homeowners are perfectly happy with the cost of cooling their homes. For example, whereas 49 percent of GP homeowners are completely satisfied with their overall comfort [see Figure 2], only 22 percent are completely satisfied with their cooling costs [see Figure 4 below]. This finding is not unexpected, since consumers generally tend to complain about the price of most types of products. Even so, GP homeowners are almost twice as happy with the cost of air conditioning as ES and Baseline homeowners. This difference is significant at the 99 percent confidence level.

**Figure 4: Percent Completely Satisfied With Cooling Cost**



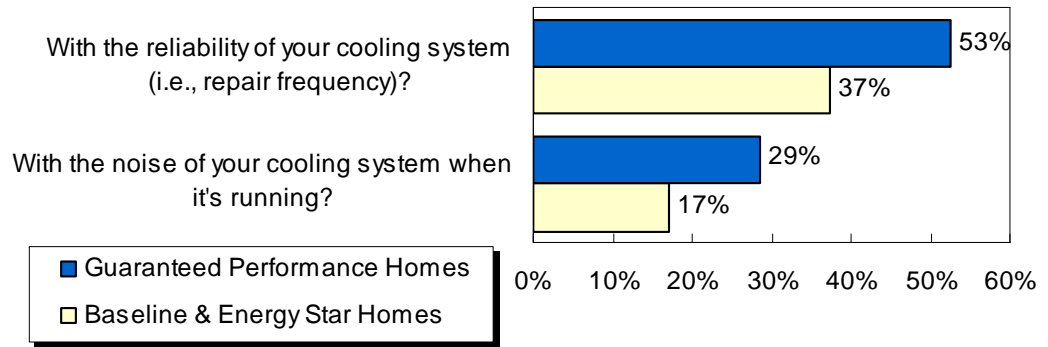
Guaranteed Performance homeowners have reason to be happier about their cooling bills. It has been demonstrated that GP homeowners have lower energy bills, on a comparable square foot basis, than either Energy Star or Baseline homeowners. The parallel study performed in 2005, the *Phoenix Home Energy Efficiency Study*, found that Guaranteed Performance homes consumed on average 2.80 kWh/ft<sup>2</sup> compared to 3.50 kWh/ft<sup>2</sup> for Energy Star homes and 4.16 kWh/ft<sup>2</sup> for Baseline homes. Thus, GP homes were up to 20 percent more energy efficient than ES homes, and up to 33 percent more efficient than Baseline homes. Since the average size of a GP house is larger than the other two categories, the GP homeowners in the study had higher total energy bills than either ES or Baseline homeowners. Baseline homes used 14,107 kWh per year on average, GP homes used 14,904 kWh and ES homes used an average of 15,831 kWh per year.

The *Phoenix Home Energy Efficiency Study* controlled for such factors as square footage, home exposure, the presence of a swimming pool, whether the house had gas or electric heat and other construction characteristics. However, the study did not control for lifestyle choices and demographics. The study was based on a total of 7,141 homes in the Phoenix area, including 3,336 Baseline homes, 2,979 Energy Star homes and 826 Guaranteed Performance homes. The 708 respondents for the *Phoenix Homeowner Satisfaction Survey* were drawn from this database of 7,141 homes.

**GP Homeowners Are Satisfied With Reliable Summer Performance**

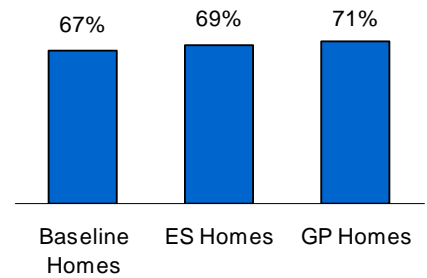
Reliable performance of their cooling system does not seem to be a concern to homeowners. Large numbers of homeowners in all categories say they are completely satisfied with system reliability. Even so, Figure 5 demonstrates that GP homeowners are more satisfied with reliable performance.

**Figure 5: Percent Completely Satisfied With Reliable Performance**



**Reliability.** Fifty-three percent of GP homeowners are completely satisfied with the reliability of their cooling systems, compared to 37 percent of ES and Baseline homeowners. This satisfaction is only partially explained by their repair records. As Figure 6 shows, only a few more ES and Baseline homeowners had repairs on their system in the past 12 months than GP homeowners. The reason for their satisfaction with reliability could derive from their overall satisfaction with the performance of their cooling systems.

**Figure 6 Percent That Had No Repairs To Their Cooling System In The Last 12 Months**

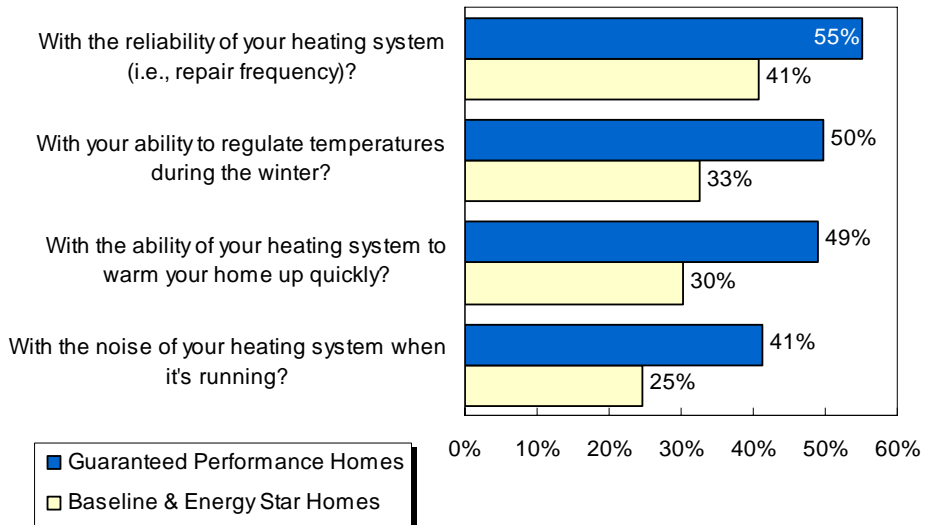


**Noise.** Noise is one aspect of cooling systems with which many homeowners are dissatisfied. As Figure 6 shows, only 17 percent — less than one in five — of Baseline and ES homeowners are completely satisfied with the noise of their cooling system. On the other hand, 29 percent of GP homeowners are completely satisfied.

### Satisfaction in the Winter

GP homeowners tend to be more satisfied with the performance of their systems in the winter as well as the summer. However, 73 percent of GP homes are heated with gas, 46 percent of ES homes and even 24 percent of Baseline homes. Therefore, the responses of those who heat their home with gas have been eliminated from the findings that are presented below in Figure 7. These findings relate only to those who heat their homes electrically.

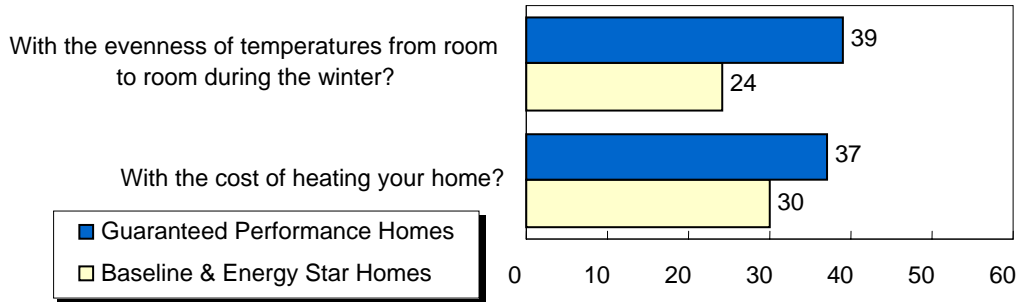
**Figure 7: Percent That Are Completely Satisfied in the Winter**



GP homeowners that heat with electricity are more satisfied with several aspects of their HVAC system than ES and Baseline homeowners. For example, 55 percent of GP homeowners with electric heat are completely satisfied with their system's reliability, 50 percent are completely satisfied with their ability to regulate temperatures and 49 percent are completely satisfied with responsiveness. However, whereas differences in the summer are significant at the 99 percent confidence level, differences are only significant at the 90 percent or 95 percent level in the winter. The contrast between right-sizing is more pronounced in summer climates such as in Phoenix.

When it comes to other measures of satisfaction during the winter months, there are no other differences among homeowners with electric heat. As Figure 8 demonstrates, there are modest differences between GP homeowners and ES and Baseline homeowners; however, these differences are not statistically significant at either the 95 percent or the 90 percent confidence level. Therefore, we cannot say that there is a preference for a right-sized system on these drivers of satisfaction during the winter.

**Figure 8: Percent That Are Completely Satisfied in Winter**



It is important to remember that right-sizing in Phoenix — a city with a summer load — applies to the load in the summer months and not the winter months. The conclusions of this survey as they apply to the winter months may not be applicable in a market with a winter load, such as Minneapolis or Chicago, or even a market with a more balanced load.

### Right-Sizing is a Tough Sell

Even though homeowners are more satisfied with houses that incorporate right-sizing along with other energy efficient features, right-sizing is not an easy concept for them to grasp. The concept of right-sizing is counter-intuitive to a homeowner’s notion of how a proper HVAC system operates. They assume that their system should be responsive; it should heat or cool their house quickly. They also associate continuous operation, typical in a right-sized installation, with wasted energy.

To test this hypothesis, homeowners were shown two concepts side by side and asked to choose which one is more economical, comfortable and responsive, as shown in Table 6. Option A represents a right-sized system and Option B represents a typical conventionally-sized system. Both concepts are written in the consumer’s language, because qualitative research demonstrated that homeowners have trouble grasping the concepts when they are written in technical language. Moreover, technical language could be misleading, in the sense that the term “right-sized” could lead one to think it is the right answer.

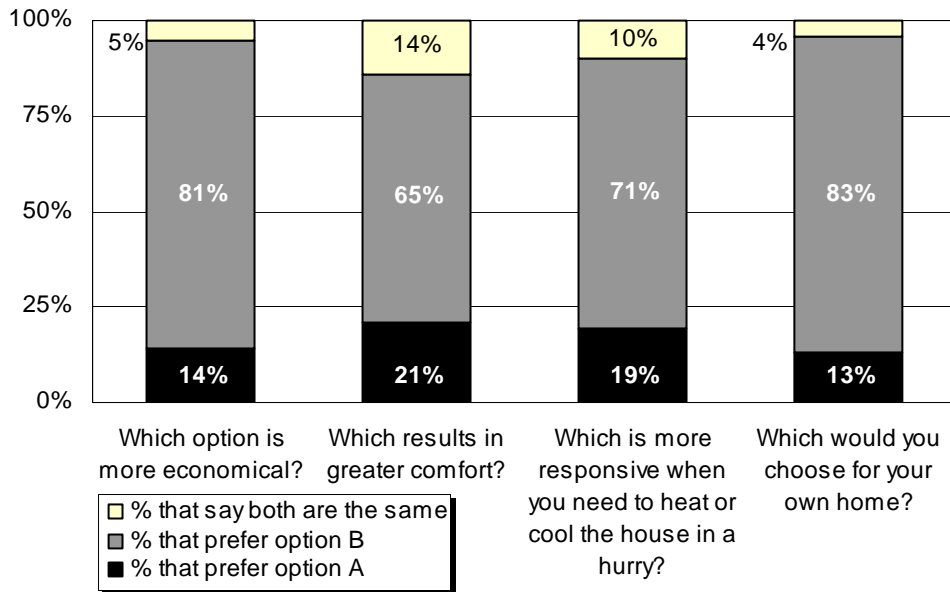
**Table 6: Right-sizing versus Conventional Sizing**

**OPTION A:** A heating and cooling system that is designed and sized to run continuously within a set temperature range. For example, this system might run for 45 minutes or more each hour during the hottest time of the year.

**OPTION B:** A heating and cooling system that is slightly larger than Option A and runs only when needed to maintain a comfortable temperature. For example, this system might run for less than 45 minutes each hour during the hottest time of the year.

Homeowners overwhelmingly chose the conventionally-sized system [Option B] over the right-sized system [Option A] on every measure, as shown in Figure 9. In fact, homeowners prefer the conventionally-sized system to the right-sized system by a factor of at least three to one on every measure.

**Figure 9: Preference for Right-Sizing versus Conventional Sizing**



**On Economy.** Homeowners were asked, “Which option is more economical?” They are six times more likely to believe that conventionally-sized systems are more economical. Eighty-one percent chose Option B for economy compared to 14 percent for Option A. This preference stems from a perception that systems that run continuously waste energy.

**On Comfort.** Homeowners were asked, “Which system results in greater comfort?” They are three times more likely to believe that conventional systems are more comfortable. Sixty-five percent chose Option B for comfort compared to 21 percent who chose Option A.

**On Responsiveness.** Homeowners were asked, “Which is more responsive when you need to cool or heat the house in a hurry?” They are almost four times more likely to believe that Option B, the larger system, is more responsive. Seventy-one percent chose Option B for responsiveness compared to 19 percent who chose Option A. The larger system gives homeowners the power to cool the house quickly.

**For Their Own Homes.** Homeowners were also asked, “Which system would you choose for your own home?” They are six times more likely to choose a conventional system for their own home. Eighty-three percent chose Option B compared to 13 percent who chose Option A.

### **Ingrained Beliefs About Sizing**

**Even though people who own right-sized homes are more satisfied, they do not believe a right-sized system is more economical, responsive or comfortable. This is a fundamental barrier to increasing the number of homes utilizing right-sized systems.**

Homeowners have two ingrained beliefs that block the idea of right-sizing. First, they believe that HVAC systems that run continuously waste money. Homeowners perceive a large unit that runs less often and cools the house more quickly as more efficient than a small unit. They are willing to believe a larger unit is more efficient and does not have to work as hard as a smaller one to handle the same load. In focus groups, one homeowner said, “Bigger is better if that means it runs less.”

Secondly, homeowners want their air conditioner and their heating system to respond rapidly. Responsiveness trumps efficiency, especially when the homeowner needs to heat or cool the house in a hurry. One homeowner said, “Comfort to me is feeling relief right away. I don’t want to wait an hour for my house to cool off.” Another homeowner said, “There are times when I override my electronic thermostat to cool it off right now.”

GP homeowners may not even realize that their own home has been right-sized. Therefore, they can only attribute their satisfaction to things other than right-sizing. Builders, uneducated HVAC contractors and inspectors can add to this dilemma. One builder in Phoenix said he was willing to oversize air conditioners to avoid homeowner complaints: “We oversize...up to the next logical break [in tonnage].”

Uneducated home inspectors and HVAC contractors sometimes tell homeowners with right-sized systems that their systems are undersized for the square footage in their houses. They may not understand the design of a high performance house. As another Phoenix builder said, “People call to complain their unit’s too small. Sometimes they’ve had a home inspector tell them the unit’s too small. The inspectors use rules of thumb and don’t recognize that it’s a high performance house.” Another builder complained that “One [homeowner] called to say the unit wasn’t big enough. He had called three contractors who all told him that for a house his size he needed four tons rather than three and a half.”

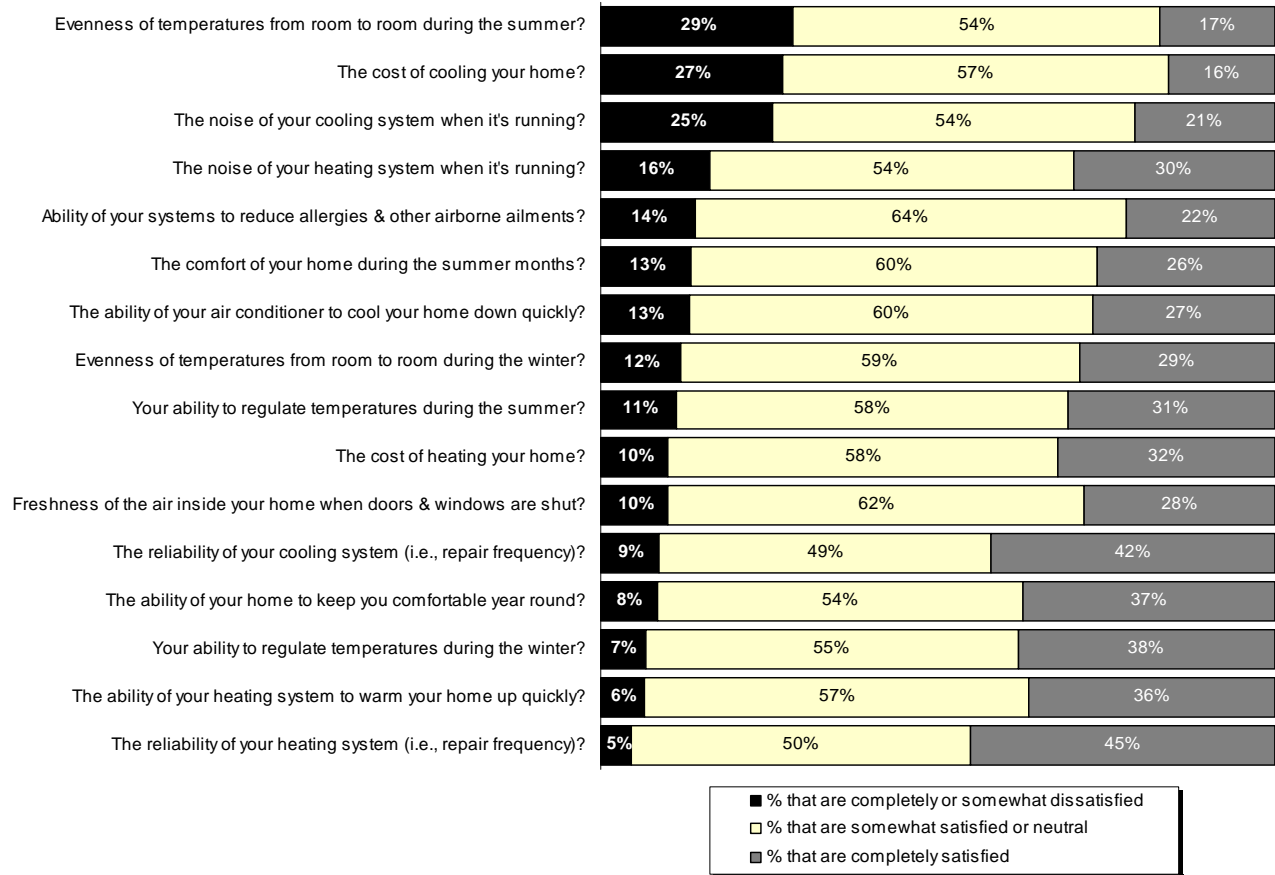
### **What Homeowners Complain About**

**Homeowners have three chief complaints about the performance of their HVAC systems: unevenness of temperature from room to room in the summer, the cost of air conditioning and noise.**

Figure 10 compares the percent of homeowners who are completely satisfied with a particular feature of their home [in gray] to the percent that are very or somewhat dissatisfied [in black.] The light space in the middle represents those who are neutral or only somewhat satisfied. Figure 10 lumps all categories together: GP, ES and Baseline. The comparison between those who are dissatisfied and those who are

completely satisfied is the most meaningful. For instance, 29 percent said they are very or somewhat dissatisfied with evenness of temperatures from room to room in the summer, compared to 17 percent that are completely satisfied. Obviously, more of the homeowners are dissatisfied than satisfied.

**Figure 10: Concerns about HVAC Systems**



The most prominent complaint is about evenness of temperatures from room to room in the summer. Obviously, temperatures are very high in Phoenix in the summer and the parts of the house that face the sun can be difficult to cool. One homeowner said, "Some rooms in my home do not cool or heat as well as the rest of the house."

Homeowners also expressed concern about the training of HVAC contractors and technicians. They were asked to agree or disagree with the statement, "Most heating and cooling contractors and technicians are properly trained and certified." As Table 7 demonstrates, only seven percent agreed completely. In the minds of homeowners, there is no clear consensus that HVAC contractors and technicians are properly trained.

**Table 7: Agreement with the statement, “Most HVAC contractors and technicians are properly trained and certified.”**

Completely Agree	7.0%
Agree Somewhat	28.9%
Are Not Sure	42.8%
Disagree Somewhat	16.6%
Completely Disagree	4.7%

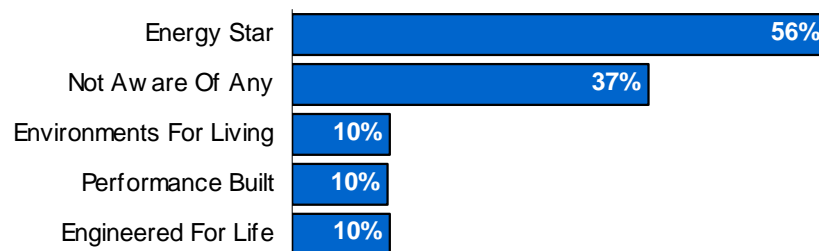
**Homeowners Are Unaware of Energy Programs**

Despite efforts to market specific energy programs in Phoenix, homeowners in the survey were not completely aware of these programs. There have been four such programs marketed in Phoenix over the past few years:

1. **Energy Star.** By far the most publicized program, Energy Star® homes meet or exceed the energy efficient standards set by the EPA’s Energy Star program. Many homeowners recognize the Energy Star logo on appliances.
2. **Performance Built.** Arizona Public Service [APS] sponsors a guarantee program called Performance Built.
3. **Environments For Living.** Masco Corporation sponsors the EFL program, which guarantees homeowners — with certain restrictions — that their energy consumption will not exceed a certain level and that room temperatures will be maintained within a certain range.
4. **Engineered For Life.** This brand was marketed until recently in Phoenix but has been discontinued. It was similar to the Environments for Living program.

Energy Star has the highest name recognition in Phoenix. Figure 11 illustrates that 56 percent of homeowners in the survey are aware of the Energy Star designation. But the remaining three designations have only minimal awareness, ten percent or less. Fully 37 percent of homeowners in the Phoenix market are not aware of any of the four designations.

**Figure 11: Awareness of Energy Programs**

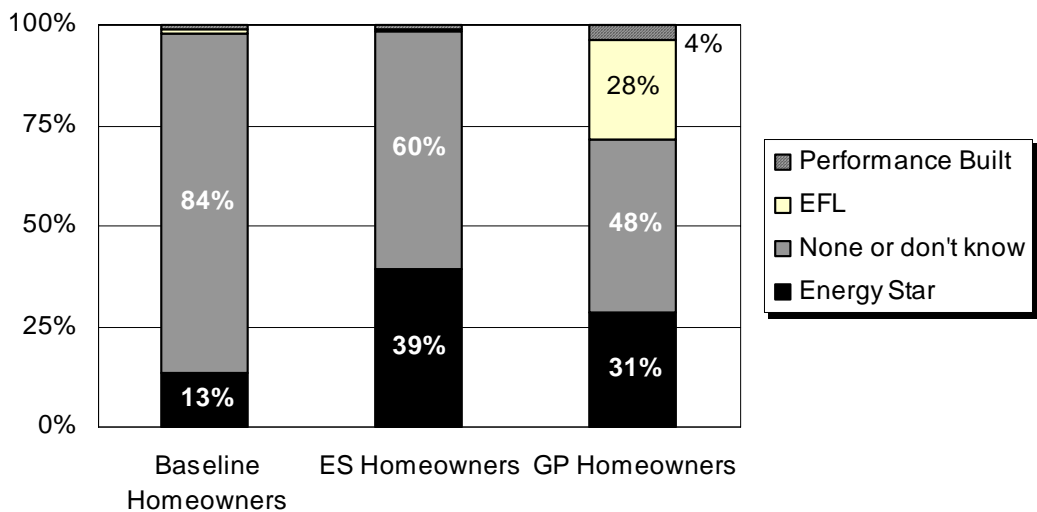


To compound the issue of little awareness, homeowners who have a program home are often unaware of it. In Figure 12, the first column represents conventional, or Baseline homeowners. Eighty-four percent of Baseline homeowners correctly perceive that their home does not belong to one of the four programs, but 13 percent mistakenly believe they own an ES home.

The second column in Figure 12 is for people who actually own an ES home. Only 39 percent recognize that fact. Sixty percent do not recognize that they own an ES home.

The third column represents GP homeowners, who own either an Engineered for Life, Environments for Living, or Performance Built home. Only 28 percent recognize that fact. Forty-eight percent do not recognize they own a GP home and 31 percent actually think they own an ES home. In fact, more GP homeowners believe they own an ES home than a GP home.

**Figure 12: Perceptions of the Category of Home Which One Owns**



### Managing Energy Consumption in the Home

One of the foundations of right-sizing is that a properly designed system running more or less continuously will consume less energy than a system that starts and stops frequently. The analogy is highway driving, which consumes less gasoline per mile than stop-and-start city driving. One issue is whether homeowners with right-sized systems adjust their behavior accordingly or if they manage their thermostats properly.

The survey found that GP homeowners report adjusting their thermostats less frequently than ES or Baseline homeowners. For example, 52 percent of GP homeowners say they do not adjust their thermostats when the house will be empty for the day compared to 33 percent of Baseline homeowners and 43 percent of ES homeowners.

**Table 8: Thermostat Behavior<sup>10</sup>**

Behavior	% of Baseline Home-owners	% of ES Home-owners	% of GP Home-owners	% of All Home-owners
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the day	33%	43%	52%	43%
I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.	62%	54%	46%	54%
I turn the thermostat off until I return later in the day	5%	3%	3%	3%

As previously mentioned, a majority of GP homeowners were unaware of that they live in a GP home. They thought they lived in an ES house, or that their house belonged to no program at all. Therefore, finding that they manage their thermostat more efficiently seems to confirm that a right-sized house has an impact on actual behavior, even if the inhabitants are unaware of whether their system is right-sized or not.

In the survey, those who live in a GP house and are aware that they do, are no more likely to manage their thermostats more efficiently than those who are unaware they live in a GP house [see Table 9]. So one cannot attribute their efficient thermostat management to the fact they understand the performance features of a right-sized house. One can only conclude that there is something about the house itself that leads them to set their thermostats more energy-efficiently.

**Table 9: Thermostat Behavior**

Behavior	GP Homeowners Aware They Live In A GP House	GP Homeowners Unaware They Live In A GP House
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the day	52%	52%
I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.	46%	45%
I turn the thermostat off until I return later in the day	2%	3%

When the homeowner's absence is longer, perhaps for a weekend, the majority of homeowners in every category [69 percent] adjust their thermostats up or down. Only eight percent leave the thermostats on a fixed setting. Over 20 percent go so far as to turn the thermostat off for the weekend. This behavior is the same for all categories of homeowner.

<sup>10</sup> Percentages that are circled are higher than average at the 95 percent confidence level. Percentages enclosed in a square are significantly less than the average.

**Table 10: Thermostat Behavior on the Weekend**

Behavior	% of Baseline Home-	% of ES Home-owners	% of GP Home-owners	% of All Home-owners
I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.	67%	72%	67%	69%
I turn the thermostat off until I return home	22%	20%	27%	23%
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the weekend	11%	8%	6%	8%

**Conscientious Homeowners**

Homeowners seem to have two philosophies about changing filters and frequent inspections. Some are conscientious about changing their filters and having their systems inspected, and those who wait for a problem to occur before taking action. For example, 46 percent have their system inspected at least once a year and 91 percent change air filters at least quarterly. Forty-four percent do both: they have their system inspected at least yearly and change their filters at least quarterly. They have been labeled as conscientious homeowners. The other 56 percent are less diligent, or they wait for a problem to occur.

**Table 11: Responses to the Question, “How often do you have your HVAC systems inspected?”**

CATEGORY	FREQUENCY	%
CONSCIENTIOUS HOMEOWNERS	Once a year	36%
	At least twice a year	10%
	<b>Subtotal</b>	<b>46%</b>
LESS DILIGENT HOMEOWNERS	Only when there’s a problem	37%
	Once every 2 years	13%
	Once every 3 or 4 years	5%
	<b>Subtotal</b>	<b>54%</b>

**Table 12: Responses to the Question, “How often do you change your air filter?”**

CATEGORY	FREQUENCY	%
CONSCIENTIOUS HOMEOWNERS	Monthly	51%
	Quarterly	40%
	<b>Subtotal</b>	<b>91%</b>
LESS DILIGENT HOMEOWNERS	Twice a year	6%
	Once a year or less	2%
	Never	1%
<b>Subtotal</b>	<b>9%</b>	

# Conclusions

The findings of this survey lead to several strategies for building greater awareness and preference for right-sized systems and energy efficient homes.

## **Develop New Technologies to Meet Homeowner Needs**

Homeowners are not completely satisfied with several aspects of their HVAC systems. Equipment manufacturers, contractors and builders should take these findings into account when designing the next generation of energy efficient HVAC systems. For example, reduce the noise of existing systems, create new approaches for balancing temperatures from room to room and use technology to give right-sized systems increased responsiveness. These actions can improve homeowner satisfaction.

## **Demand for Higher Performance**

The researchers believe that there is a latent demand for higher performance, or better building science, on the part of the homeowner. One survey respondent added the comment, “Energy efficient homes should be the standard in the construction industry.” Another said, “We would have loved the option to build an energy efficient home.” Unfortunately, this demand seems to be overshadowed by other factors at the time of purchase. Realtors and developers have learned what sells houses, and too often it is not energy-efficiency or applied building science.

Homeowners appreciate applied building science after buying the home, when they see the actual performance. Guaranteed Performance homeowners, for example, are more satisfied with all aspects of their home’s performance; so better building science does play a role in homeowner satisfaction. Yet only 37 percent of GP homebuyers said the program was “a main reason they bought their house.” Sixty-five percent said it was “a nice feature to have,” but not essential to their buying decision.

This suggests there is demand for better building science. The key is to discover how to make this demand more apparent to builders and developers before new homes are designed and constructed. Builders must see that the extra cost of energy efficiency pays off in long-term results like faster sales, higher revenues or lower warranty costs.

## **Right-Sizing Works, but it is a Tough Sell**

This survey demonstrates that right-sizing works. Along with other energy efficient features, it results in greater homeowner satisfaction. However, the concept of right-sizing is a tough sell. It seems to be counter-intuitive to the notion that many homeowners have about their HVAC systems. The fact that a unit runs continuously seems to indicate that the unit is undersized. Furthermore, responsiveness is important for the homeowner. One builder we interviewed said, “When you come back to your house on Sunday evening after being away all weekend, you don’t want to wait ‘til three a.m. for the house to cool down.”

These conclusions suggest that right-sizing must be combined with a total package of other building science features if it is to achieve market success. Such features include combining high-efficiency HVAC equipment with improved duct sealing, infiltration barriers, low emissivity glass, compact fluorescent lighting, advanced framing, interior pressure relief, closed crawl spaces and so on.

### **Emphasize the Benefits of Right-Sizing Rather Than its Technology**

Presentation of right-sizing and building science in a way that stimulates the interest of the potential homeowner, instead of attacking his or her preconceived notions about how an HVAC system ought to perform, is paramount. Changing long-held preconceptions could be a long, costly and difficult communications task. Based on the findings of this survey, researchers suspect one successful approach would be to communicate the benefits and not the technology of building science. Using less energy is important, but so are comfort, air quality, reliability and health. For example, as a result of this survey, it can be said that people who own homes built to principles of building science are more comfortable, feel healthier and are more satisfied with their energy bills. That positioning is a solid way to market applied building science to homeowners.

### **Low Awareness is a Hurdle to Overcome**

Awareness of the various energy programs in Phoenix is very low. For example, only 10 percent had heard of Environments for Living, Engineered for Life or Performance Built homes. Even those who own an ES or GP home are not always aware of that fact. Improving the awareness of such programs will be a key for building preference for right-sized systems. Post-purchase awareness and reinforcement for homeowners is also very important, as it reinforces their decision to buy an energy efficient home. That way, they might be more inclined to insist on an energy efficient house the next time they buy.

### **Results of the Survey are Statistically Significant**

The number of homeowners surveyed was large enough to give statistical reliability. It means that in the Phoenix market there is a statistically significant difference between the attitudes of GP homeowners and other categories of homeowners. However, these results are not extendable to other markets outside Phoenix.

## Recommendations for Further Study

This survey answers one of the key issues surrounding building science and demonstrates that people who live in those homes are more satisfied than other homeowners. However, other issues remain which could not be addressed by this survey.

**The impact of building science in winter load markets.** This survey studied homeowner satisfaction in a summer load climate. A parallel study in a winter load market would answer the issue of whether energy efficiency has as much impact on homeowner satisfaction.

**Long term impact of high performance homes.** This survey measured satisfaction at one point in time. It did not measure long term outcomes, such as actual number of service calls, resale value of the high performance home and actual utility bills adjusted for high-degree days. One way to track long term outcomes is through a longitudinal panel, or a panel of homeowners who agree to share their attitudes, costs, utility bills and other outcomes over a period of time, such as over a span of five years. This panel would compare owners of GP homes to owners of ES and Baseline homes.

**Valuation of various building science features.** Homebuilders today have an almost limitless array of features to add to their new homes. These include energy-efficient features, custom cabinetry, Internet wiring, bonus rooms and so forth. The list is quite long, but the value that homebuyers place on each possible feature is missing. For example, is energy-efficiency a more desired feature than custom cabinetry? If so, what are homeowners willing to pay for the feature? Such research could be very important in persuading builders, utilities and other entities that the value of promoting the performance of new homes is worth while.

A quantitative survey of homeowners could address this issue. There would be two end results to such research: [1] A ranking of the relative appeal of the options that homeowners have today when they buy a new house, and [2] The value, or utility, of each option, especially those that relate to building science, energy-efficiency or the performance of the home.

# THE PHOENIX HOMEOWNERS SATISFACTION SURVEY

## INSTRUCTIONS

This survey should take no more than 10 minutes. Just fill in the box with a pen or pencil  or place a check mark in the box  After you're done, drop it in the enclosed envelope and send it to us by September 30<sup>th</sup> to register for the \$1,000 sweepstakes.

**Thank you very much!**

## Please Tell Us About The House You Live In.

- When did you buy the home you live in now?  
Less than a year ago .....  1    1 to 5 years ago .....  2    More than 5 years ago.....  3
- Was your house new when you bought it?  
Yes.....  1    No .....  2
- How many square feet of air-conditioned space are in your house? Please give your best estimate.  
1,600 or fewer square feet .....  1    1,601 to 2,400 square feet.....  2  
Over 2,400 square feet .....  3    Don't know .....  4
- How many floors are in your home, including a finished basement?  
1 floor .....  1    2 floors.....  2    3 or more floors .....  3
- How many people of all ages live in your house year round? \_\_\_\_\_
- How many of these people are under the age of 18? \_\_\_\_\_
- Have any of the people who live in your house been to a doctor for allergies during the past two years?  
Yes.....  1    No .....  2    Don't know .....  3
- Which of the following best describes your heating system?  
Gas heat .....  1    Electric, including heat pump...  2    Other (e.g., solar) .....  3
- Which of the following best describes your air conditioning system?  
Gas air-conditioning .....  1    Electric, including heat pump...  2    None.....  3
- Have you heard of any of the following energy designations? **Check all that apply.**  
Energy Star Home .....  1    Environments for Living Home.  2    Performance Built Home .....  3  
Engineered for Life Home .....  4    None or don't know .....  5
- Does your home have any of these energy designations? **Check all that apply.**  
Energy Star Home .....  1    Environments for Living Home.  2    Performance Built Home .....  3  
Engineered for Life Home .....  4    None or don't know .....  5
- If your home has one of these designations, how important was it in your decision to buy the home?  
It was one of the main reasons I bought my home. ....  1  
It was a nice feature to have, but it wasn't the main reason I bought my home.  2  
It didn't enter into my decision at all. ....  3
- Do you participate in a time of use program with your electrical utility?  
Yes.....  1    No .....  2    Don't know .....  3

For internal use only:

**Are You Satisfied With Your Home?** Please circle your response

- |  | <u>Very<br/>Dissatisfied</u> |   |   |   | <u>Completely<br/>Satisfied</u> |
|--|------------------------------|---|---|---|---------------------------------|
| 14. On a scale from 1 to 5, where 5 means you are completely satisfied, how satisfied have you been with the <b>ability of your home to keep you comfortable year round?</b> ..... | 1                            | 2 | 3 | 4 | 5                               |
| 15. How satisfied have you been with the <b>freshness of the air inside your home</b> during those times when you keep doors and windows shut?.....                                | 1                            | 2 | 3 | 4 | 5                               |
| 16. How satisfied have you been with the ability of your heating & cooling systems to <b>reduce allergies and other airborne ailments in your home?</b> .....                      | 1                            | 2 | 3 | 4 | 5                               |

**Are You Satisfied With Your Heating & Cooling Systems?**

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 17. How satisfied have you been with the <b>cost of cooling your home?</b> .....          | 1 | 2 | 3 | 4 | 5 |
| 18. With the <b>comfort of your home</b> during the summer months? .....                  | 1 | 2 | 3 | 4 | 5 |
| 19. With the <b>evenness of temperatures</b> from room to room during the summer?.....    | 1 | 2 | 3 | 4 | 5 |
| 20. With the ability of your air conditioner to <b>cool your home down quickly?</b> ..... | 1 | 2 | 3 | 4 | 5 |
| 21. With the <b>reliability of your cooling system</b> (i.e., repair frequency?) .....    | 1 | 2 | 3 | 4 | 5 |
| 22. With your ability to <b>regulate temperatures during the summer?</b> .....            | 1 | 2 | 3 | 4 | 5 |
| 23. With the <b>noise of your cooling system</b> when it's running?.....                  | 1 | 2 | 3 | 4 | 5 |
| 24. How satisfied have you been with the <b>cost of heating your home?</b> .....          | 1 | 2 | 3 | 4 | 5 |
| 25. With the <b>evenness of temperatures</b> from room to room during the winter? .....   | 1 | 2 | 3 | 4 | 5 |
| 26. With the ability of your heating system to <b>warm your home up quickly?</b> .....    | 1 | 2 | 3 | 4 | 5 |
| 27. With the <b>reliability of your heating system</b> (i.e., repair frequency?) .....    | 1 | 2 | 3 | 4 | 5 |
| 28. With your ability to <b>regulate temperatures during the winter?</b> .....            | 1 | 2 | 3 | 4 | 5 |
| 29. With the <b>noise of your heating system</b> when it's running?.....                  | 1 | 2 | 3 | 4 | 5 |

**Do You Agree Or Disagree With The Following Statements?**

- |  | <u>Completely<br/>Disagree</u>        | <u>Disagree<br/>Somewhat</u>          | <u>Not<br/>Sure</u>                   | <u>Agree<br/>Somewhat</u>             | <u>Completely<br/>Agree</u>           |
|--|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| 30. My energy bills are reasonable for a house and family like mine .....  | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 31. My home's energy costs are lower than most other homes in the same price range in Phoenix .....  | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 32. My home is more comfortable than most other homes in the same price range in Phoenix.....  | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 33. My household suffers from fewer allergies & other airborne health risks than they would in most other homes in the same price range..    | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 34. The heating and cooling system in my home keeps the air fresher than in most other homes in the same price range in Phoenix.....         | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 35. My home has fewer problems with mold and mildew than in most other homes in the same price range in Phoenix .....                        | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 36. If I were looking for a new home today, I would look for a home with the Environments for Living or Engineered for Life designation..... | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 37. If I were looking for a new home today, I would look for a home with the Energy Star designation.....                                    | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 38. If I were looking for a new home today, I would look for a home with the Performance Built designation.....                              | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |
| 39. Most heating & cooling contractors & technicians are properly trained and certified .....  | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> | <input type="checkbox"/> <sub>4</sub> | <input type="checkbox"/> <sub>5</sub> |

# How Do You Manage Your Heating & Cooling Systems?

40. In the past 12 months, how many times have you had your heating or air-conditioning system repaired by a contractor?
- One time.....  1    Two or more times.....  2    Never had a repair.....  3
41. Have you ever had a problem with mold and mildew in your home?
- Yes.....  1    No.....  2    Don't know.....  3
42. How often do you have your heating and cooling systems inspected?
- At least twice a year.....  1    Once a year.....  2    Once every 2 years.....  3  
Once every 3 or 4 years.....  4    Only when there's a problem.....  5
43. How often do you change air filters in your home? Choose the answer that most nearly matches your practice.
- Monthly.....  1    Quarterly.....  2    Twice a year.....  3  
Once a year.....  4    Less than once a year.....  5    Never.....  6
44. What type of air filter do you use most frequently? Choose the one answer that best matches your practice.
- Flat filter (Usually a disposable filter with a flat filtering surface).....  1  
Pleated filter (Usually a disposable filter made with a pleated surface).....  2  
Reusable filter (A filter that can be rinsed with water or vacuumed clean).....  3  
High-efficiency particulate (HEPA) air filter.....  4  
Don't know.....  5
45. Do you have a programmable thermostat?
- Yes.....  1    No (Skip to Q47).....  2    Don't know (Skip to Q47).....  3
46. Do you use your programmable thermostat to vary your temperatures if you're away from home?
- Yes.....  1    No.....  2    Don't know.....  3
47. If the house will be empty **for the day**, how do you set your thermostat before you leave?
- I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.....  1  
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the day.....  2  
I turn the thermostat off until I return later in the day.....  3
48. If the house will be empty **for the weekend**, how do you set your thermostat before you leave?
- I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.....  1  
I don't adjust the thermostat; I leave it on a fixed temperature even if the house is empty for the weekend.....  2  
I turn the thermostat off until I return home.....  3
49. Which statement best describes your home?
- There are rooms in my house that are **always uncomfortable** and difficult to heat and cool.....  1  
There are rooms in my house that are **sometimes uncomfortable** and difficult to heat and cool.....  2  
All the rooms in my house are **comfortable** and easy to heat and cool.....  3
50. Which statement best describes how much your air conditioning unit is on and running?
- My air conditioner runs too much.....  1  
My air conditioner doesn't run enough.....  2  
My air conditioner runs just about the right amount of time.....  3



# Please Compare Two Heating & Cooling Systems.

**OPTION A**

A heating & cooling system that is designed & sized to run continuously within a set temperature range. For example, this system might run for 45 minutes or more each hour during the hottest time of the year.

**OPTION B**

A heating & cooling system that is slightly larger than Option A and runs only when needed to maintain a comfortable temperature. For example, this system might run for less than 45 minutes each hour during the hottest time of the year.

**Even if you are not sure, please check the ONE box that you think answers the question best.**

- |  | <u>Option A</u>                       | <u>Option B</u>                       | <u>Both Are The Same</u>              |
|--|---------------------------------------|---------------------------------------|---------------------------------------|
| 51. Which option is more economical? .....   | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> |
| 52. Which results in greater comfort? .....  | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> |
| 53. Which is more responsive when you need to heat or cool the house in a hurry? ..... | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> |
| 54. Which would you choose for your own home? .....                                    | <input type="checkbox"/> <sub>1</sub> | <input type="checkbox"/> <sub>2</sub> | <input type="checkbox"/> <sub>3</sub> |

## Do You Have Any Comments?

55. Do you have any comments for us about your home and its heating & cooling systems? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Please Tell Us About Yourself.

56. What is your age?
- |   |  |  |
|---|--|--|
| Under 21..... <input type="checkbox"/> <sub>1</sub> | 21 to 34 ..... <input type="checkbox"/> <sub>2</sub> | 35 to 44 ..... <input type="checkbox"/> <sub>3</sub>   |
| 45 to 59..... <input type="checkbox"/> <sub>4</sub> | 60 to 74 ..... <input type="checkbox"/> <sub>5</sub> | 75 or older..... <input type="checkbox"/> <sub>6</sub> |
57. What is your approximate household income?
- |   |  |  |
|---|--|--|
| Under \$25,000..... <input type="checkbox"/> <sub>1</sub>     | \$25,000 to \$49,999 ..... <input type="checkbox"/> <sub>2</sub> | \$50,000 to \$99,999 ..... <input type="checkbox"/> <sub>3</sub> |
| \$100,000 or more ..... <input type="checkbox"/> <sub>4</sub> |  |  |
58. Do you work for a public utility, homebuilder, realtor or anyone else in the home building trades?
- No..... <sub>1</sub>      Yes ..... <sub>2</sub>

**REGISTER FOR THE \$1,000 SWEEPSTAKES!**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone (Optional): \_\_\_\_\_

e-Mail Address (Optional): \_\_\_\_\_

Please submit this survey before September 30<sup>th</sup> to register for the \$1,000 sweepstakes. You need not complete the survey, but you must return this form to be entered. A random drawing to determine the winner will be held on October 14, 2005. The odds of winning are directly proportional to the number of surveys submitted, however we estimate that your chance of winning is approximately one in nine hundred. We assure you that your responses will remain confidential. Your personal information will not be sold or shared with any unauthorized third parties. This sweepstakes will officially close on October 14<sup>th</sup>, 2005

# APPENDIX B

This *Phoenix Homeowner Satisfaction Survey* was performed under the State Technologies Advancement Collaborative (STAC) program and funded jointly by the US DOE and participating state-based partners. The survey was managed by Advanced Energy and administered by The Hatteras Group. The purpose of the survey was to determine homeowner satisfaction with right-sized HVAC systems and attitudes toward the concept of right-sizing.

## Complete Results Of The Phoenix Homeowner Satisfaction Survey

During the summer of 2005, a direct mail survey was mailed to 7,000 homeowner in the Phoenix Metro area. There were 708 responses to the survey. Respondents were categorized into one of three groups based on the actual energy designation of their home as determined by the local electrical utility and the sponsor of the Environments for Living program in Phoenix. Thirteen respondents could not be categorized, because they did not give their address and therefore the house in question could not be identified. The 708 respondents comprised the following:

	CATEGORY	NUMBER	%
Baseline Homeowners	B	205	29.0%
Energy Star Homeowners	ES	255	36.0%
Guaranteed Performance Homeowners	GP	235	33.2%
Unknown		13	1.8%
<i>Grand Total</i>		708	100.0%

The full results of this survey are shown in the tables below. The titles and headings in the tables that follow are reprinted as they appear in the survey document itself, as presented in Appendix A. In each table, responses are shown for each category of homeowner. Expected errors are calculated at the 95% confidence interval. If a number is highlighted in blue, it means that number is significantly higher than the average for all categories. If it is highlighted in red, it is significantly less than the average for all categories. If the number is not highlighted in blue or red, it is not statistically different from the average for all categories.

## PART I—PLEASE TELL US ABOUT THE HOUSE YOU LIVE IN

First the survey asked homeowners to describe the house they live in. The average house in the survey is a one floor, 1,600 to 2,400 square foot house bought new within the last five years. On average 2.7 people live in this house.

### Q1. When did you buy the home you live in now?

Over 83% of respondents bought their home within the past five years.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Less than a year ago	24	11.7%	41	16.1%	35	14.9%	4	104	14.7%
1 to 5 years ago	99	48.3%	183	71.8%	195	83.0%	7	484	68.4%
More than 5 years ago	82	40.0%	31	12.2%	5	2.1%	2	120	16.9%
<i>Grand Total</i>	205		255		235		13	708	

### Q2. Was your house new when you bought it?

Most bought new homes, while 27% bought used homes.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	113	55.7%	177	69.7%	208	89.3%	11	509	72.4%
No	90	44.3%	77	30.3%	25	10.7%	2	194	27.6%
<i>Grand Total</i>	203		254		233		13	703	

**Q3. How many square feet of air-conditioned space are in your house? Give your best estimate.**

The most common home size was between 1,600 and 2,400 square feet. GP homeowners live in slightly larger homes.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1,600 or fewer square feet	92	45.5%	95	37.3%	30	12.8%	1	218	30.9%
1,601 to 2,400 square feet	87	43.1%	106	41.6%	124	52.8%	8	325	46.1%
Over 2,400 square feet	21	10.4%	48	18.8%	78	33.2%	4	151	21.4%
Don't know	2	1.0%	6	2.4%	3	1.3%		11	1.6%
<i>Grand Total</i>	202		255		235		13	705	

**Q4. How many floors are in your home, including a finished basement?**

Over 80% of the homes have only one floor.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 floor	165	80.5%	197	77.3%	199	84.7%	11	572	80.8%
2 floors	38	18.5%	56	22.0%	35	14.9%	2	131	18.5%
3 or more floors	2	1.0%	2	0.8%	1			5	0.7%
<i>Grand Total</i>	205		255		235		13	708	

**Q5. How many people of all ages live in your house year round?**

The average home has 2.73 occupants.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
None	2	1.0%	0	0.0%	0	0.0%	0	2	0.3%
One	38	18.5%	36	14.3%	27	11.5%	0	101	14.3%
Two	74	36.1%	86	34.1%	128	54.5%	8	296	42.0%
Three	35	17.1%	44	17.5%	38	16.2%	2	119	16.9%
Four	30	14.6%	47	18.7%	30	12.8%	2	109	15.5%
Five	17	8.3%	27	10.7%	10	4.3%	1	55	7.8%
Six	7	3.4%	8	3.2%	1	0.4%	0	16	2.3%
Seven	1	0.5%	2	0.8%	0	0.0%	0	3	0.4%
Eight	0	0.0%	2	0.8%	0	0.0%	0	2	0.3%
Ten or more	1	0.5%	0	0.0%	1	0.4%	0	2	0.3%
<i>Grand Total</i>	205		252		235		13	705	
<i>Average Number Of Occupants</i>	2.73		2.94		2.48		2.69	2.72	

**Q6. How many of these people are under the age of 18?**

Fewer than 40% of homes have a child under the age of 18 living in them.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Households with no child under 18	122	59.5%	126	49.4%	168	71.5%	9	425	60.0%
Households with one or more children under 18	83	40.5%	126	49.4%	66	28.1%	4	279	39.4%
No answer	0	0.0%	3	1.2%	1	0.4%		4	0.6%
<i>Grand Total</i>	205		255		235		13	708	

**Q7. Have any of the people who live in your house been to a doctor for allergies during the past two years?**

Allergies are evenly spread among different types of homes. 38% had a someone in their home visit a doctor for an allergy during the past two years.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	81	39.7%	100	39.4%	84	36.1%	4	269	38.2%
No	119	58.3%	151	59.4%	148	63.5%	9	427	60.7%
Don't know	4	2.0%	3	1.2%	1	0.4%		8	1.1%
<i>Grand Total</i>	204		254		233		13	704	

**Q8. Which of the following best describes your heating system?**

Electric heat is the predominant form of heating for B homes, but gas heat predominates in GP homes.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Gas heat	52	25.5%	119	46.7%	170	72.6%	9	350	49.6%
Electric, including heat pump	152	74.5%	136	53.3%	64	27.4%	3	355	50.4%
<i>Grand Total</i>	204		255		234		12	705	

**Q9. Which of the following best describes your air conditioning system?**

Electric air conditioning is the norm.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Gas air-conditioning	9	4.4%	10	3.9%	15	6.4%	2	36	5.1%
Electric, including heat pump	193	94.6%	244	96.1%	215	92.3%	10	662	94.0%
None	2	1.0%	0	0.0%	3	1.3%	1	6	0.9%
<i>Grand Total</i>	204		254		233		13	704	

**Q10. Have you heard of any of the following energy designations?**

There is little awareness of energy programs in Phoenix. ES has the most awareness at 56% of respondents. However, only 10% had heard of any other energy category. And 37% had never heard of any of the designations.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Energy Star Home	82	40.0%	168	65.9%	142	60.4%	7	399	56.4%
None or don't know	111	54.1%	81	31.8%	68	28.9%	5	265	37.4%
Environments for Living Home	5	2.4%	7	2.7%	59	25.1%	1	72	10.2%
Performance Built Home	20	9.8%	21	8.2%	29	12.3%	1	71	10.0%
Engineered for Life Home	10	4.9%	17	6.7%	45	19.1%	1	73	10.3%
<i>Total Respondents</i>	228		294		343		15	880	

**Note:** Numbers may not add because multiple answers were allowed. Percentages are of the actual number of respondents in each category. For example, there are 205 respondents in the baseline category, 82 of whom (or 40%) say they have an ES home.

**Q11. Does your home have any of these energy designations?**

People don't know the energy designation of their own home. For example, of 255 actual ES homeowners only 39% knew that fact.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Energy Star Home	27	13.2%	100	39.1%	74	28.4%	4	205	27.9%
None or don't know	173	84.8%	152	59.4%	112	42.9%	8	445	60.5%
Environments for Living Home	0	0.0%	0	0.0%	52	19.9%	1	53	7.2%
Performance Built Home	2	1.0%	3	1.2%	10	3.8%	1	16	2.2%
Engineered for Life Home	2	1.0%	1	0.4%	13	5.0%	1	17	2.3%
<i>Total Respondents</i>	204		256		261		15	736	

**Note:** Numbers may not add because multiple answers were allowed. Percentages are of the actual number of respondents in each category. For example, there are 205 respondents in the baseline category, 27 of whom (or 13%) say they have an ES home.

**Q12. If your home has one of these designations, how important was it in your decision to buy the home?**

Energy efficiency can be a reason for choosing a particular home. Of the respondents that actually live in an ES or GP house, 52.3% who answered the question said that the program was a main reason, or at least "a nice feature to have."

	ES		GP		Grand Total	
	#	%	#	%	#	%
It was one of the main reasons	21	10.3%	49	25.5%	75	14.5%
It was a nice feature to have, but it wasn't the main reason	83	40.9%	83	43.2%	200	38.8%
It didn't enter my decision at all	99	48.8%	60	31.3%	241	46.7%
<i>Grand Total</i>	203		192		516	

**Note:** The table is based on those respondents who actually live in an Energy Star, Guaranteed Performance or Performance Built house.

**Q13. Do you participate in a time of use program with your electrical utility?**

Over 65% participate in a TOU program with their utility.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	151	73.7%	181	71.0%	124	52.8%	7	463	65.4%
No	44	21.5%	62	24.3%	94	40.0%	6	206	29.1%
Don't know	10	4.9%	12	4.7%	17	7.2%		39	5.5%
<i>Grand Total</i>	205		255		235		13	708	

## PART II—ARE YOU SATISFIED WITH YOUR HOME?

Respondents were asked how satisfied they are with the comfort of their home. For example, they were asked to rate their satisfaction on a scale of 1 to 5, where 5 means “Completely Satisfied” and 1 means “Very Dissatisfied.” The weighted average of these responses and the expected error was then calculated at the 95% confidence interval.

### Q14. How satisfied are you with the ability of your home to keep you comfortable year round?

People in an GP home are more satisfied with their home’s ability to keep them comfortable year round. The average satisfaction rating for GP homeowners was 4.27 ± 2.7% out of a possible score of 5.0. This was significantly higher than either the B or ES ratings.<sup>1</sup>

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	5	2.4%	4	1.6%	3	1.3%		12	1.7%
2 = Somewhat Dissatisfied	17	8.3%	22	8.7%	8	3.4%	1	48	6.8%
3 = Neutral or Not Sure	41	20.0%	43	16.9%	28	11.9%	3	115	16.3%
4 = Somewhat Satisfied	87	42.4%	97	38.2%	80	34.0%	4	268	37.9%
5 = Very Satisfied	55	26.8%	88	34.6%	116	49.4%	5	264	37.3%
<i>Average &amp; Expected Error</i>	3.83 ±3.6%		3.96 ±3.1%		<b>4.27 ±2.7%</b>		4.00	4.02 ±1.8%	

### Q15. How satisfied have you been with the freshness of the air inside your home during those times you keep doors and windows shut?

GP homeowners are more satisfied with the freshness of the air within their homes than either ES or B homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	3	1.5%	9	3.5%	3	1.3%		15	2.1%
2 = Somewhat Dissatisfied	23	11.2%	18	7.1%	13	5.5%	1	55	7.8%
3 = Neutral or Not Sure	63	30.7%	69	27.1%	42	17.9%	3	177	25.0%
4 = Somewhat Satisfied	75	36.6%	97	38.0%	83	35.3%	6	261	36.9%
5 = Very Satisfied	41	20.0%	62	24.3%	94	40.0%	3	200	28.2%
<i>Average &amp; Expected Error</i>	3.62 ±3.7%		3.73 ±3.4%		<b>4.07 ±3.0%</b>		3.85	3.81 ±1.9%	

<sup>1</sup> In the remainder of this report, if a number is highlighted in bold, it means that it is significantly higher than the average for all categories. If it is not highlighted at all, it is not statistically different from the average for all categories. Thus in the table above for Q14, the Guaranteed Performance (GP) rating is significantly higher than the average. But neither Energy Star (ES) nor baseline (B) are higher than the average.

Significance was calculated by comparing the actual difference between ratings to the expected difference. For example, in Q14 the difference between GP and the average for all homeowners was 6.1% (4.27 minus 4.02 divided by 4.02 equals 6.1%.) Statistically, any difference less than 3.4% is not significant at the 95% confidence level. In other words, if the difference was less than 3.4% we would say the two ratings are statistically the same. Therefore, since the actual difference exceeds the expected difference we can say that GP homeowners are significantly more satisfied than the average for all homeowners.

However, if we compare ES responses to the average we see that the actual difference is less than the expected difference. Therefore, we can say that ES homeowners are not significantly more satisfied than the average.

**Q16. How satisfied have you been with the ability of your heating & cooling systems to reduce allergies and other airborne ailments in your home?**

GP homeowners are more satisfied with the ability of their HVAC system to reduce allergies and other airborne ailments in their home than either ES or B homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	7	3.4%	9	3.6%	4	1.7%		20	2.8%
2 = Somewhat Dissatisfied	33	16.2%	31	12.3%	13	5.6%	1	78	11.1%
3 = Neutral or Not Sure	79	38.7%	81	32.0%	59	25.4%	5	224	31.9%
4 = Somewhat Satisfied	55	27.0%	84	33.2%	81	34.9%	5	225	32.1%
5 = Very Satisfied	30	14.7%	48	19.0%	75	32.3%	2	155	22.1%
<i>Average &amp; Expected Error</i>	3.33 ±4.2%		3.52 ±3.7%		<b>3.91 ±3.2%</b>		3.62	3.59 ±2.1%	

**PART III—ARE YOU SATISFIED WITH YOUR HEATING & COOLING SYSTEMS?**

Next homeowners were asked how satisfied they are with the performance of their heating and cooling systems. For example, they were asked to rate their satisfaction on a scale of 1 to 5, where 5 means “Completely Satisfied” and 1 means “Very Dissatisfied.”

**Q17. How satisfied have you been with the cost of cooling your home?**

Focus groups in Phoenix in early 2005 found that homeowners are extremely concerned about energy costs during the hot summer months. On this critical measure, GP homeowners are more satisfied with the cost of cooling their homes than either ES or B homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	17	8.3%	30	11.8%	13	5.5%		60	8.5%
2 = Somewhat Dissatisfied	50	24.5%	43	16.9%	34	14.5%	4	131	18.6%
3 = Neutral or Not Sure	60	29.4%	88	34.6%	64	27.2%	3	215	30.5%
4 = Somewhat Satisfied	53	26.0%	58	22.8%	73	31.1%	5	189	26.8%
5 = Very Satisfied	24	11.8%	35	13.8%	51	21.7%	1	111	15.7%
<i>Average &amp; Expected Error</i>	3.08 ±5.1%		3.10 ±4.7%		<b>3.49 ±4.2%</b>		3.23	3.23 ±2.7%	

**Q18. With the comfort of your home during the summer months?**

GP homeowners are happier with the comfort of their homes during the summer.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	4	2.0%	8	3.1%	7	3.0%		19	2.7%
2 = Somewhat Dissatisfied	29	14.1%	32	12.5%	14	6.0%	1	76	10.7%
3 = Neutral or Not Sure	55	26.8%	73	28.6%	46	19.6%	3	177	25.0%
4 = Somewhat Satisfied	77	37.6%	87	34.1%	80	34.0%	5	249	35.2%
5 = Very Satisfied	40	19.5%	55	21.6%	88	37.4%	4	187	26.4%
<i>Average &amp; Expected Error</i>	3.59 ±3.9%		3.58 ±3.6%		<b>3.97 ±3.3%</b>		3.92	3.72 ±2.1%	

**Q19. With the evenness of temperatures from room to room during the summer?**

GP homeowners are happier with the evenness of temperatures in their home during the summer.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	28	13.7%	33	13.0%	14	6.0%		75	10.6%
2 = Somewhat Dissatisfied	42	20.5%	51	20.1%	32	13.7%	2	127	18.0%
3 = Neutral or Not Sure	71	34.6%	77	30.3%	48	20.5%	4	200	28.3%
4 = Somewhat Satisfied	39	19.0%	58	22.8%	82	35.0%	5	184	26.1%
5 = Very Satisfied	25	12.2%	35	13.8%	58	24.8%	2	120	17.0%
<i>Average &amp; Expected Error</i>	2.96 ±5.5%		3.04 ±5.0%		<b>3.59 ±4.2%</b>		3.54	3.21 ±2.8%	

**Q20. With the ability of your air conditioner to cool your home down quickly?**

In focus groups, one of the concerns with a “right-sized” HVAC system is the fear that the system won’t be responsive, that it won’t heat or cool the house in a hurry. Evidently GP homeowners don’t feel they give up much response with their HVAC system because they are happier with the ability of their air conditioner to cool their home down quickly than ES or B homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	6	3.0%	8	3.2%	4	1.7%		18	2.6%
2 = Somewhat Dissatisfied	25	12.3%	30	11.9%	19	8.2%	1	75	10.7%
3 = Neutral or Not Sure	61	30.0%	66	26.2%	43	18.5%	3	173	24.7%
4 = Somewhat Satisfied	72	35.5%	84	33.3%	82	35.2%	7	245	35.0%
5 = Very Satisfied	39	19.2%	64	25.4%	85	36.5%	2	190	27.1%
<i>Average &amp; Expected Error</i>	3.56 ±4.0%		3.66 ±3.6%		<b>3.97 ±3.3%</b>		3.77	3.73 ±2.1%	

**Q21. With the reliability of your cooling system (i.e., repair frequency)?**

GP homeowners are more satisfied with the reliability of their systems.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	6	3.0%	8	3.2%	8	3.4%		22	3.1%
2 = Somewhat Dissatisfied	9	4.4%	20	8.0%	9	3.9%	1	39	5.6%
3 = Neutral or Not Sure	43	21.2%	39	15.5%	24	10.3%	2	108	15.5%
4 = Somewhat Satisfied	80	39.4%	80	31.9%	69	29.7%	6	235	33.6%
5 = Very Satisfied	65	32.0%	104	41.4%	122	52.6%	4	295	42.2%
<i>Average &amp; Expected Error</i>	3.93 ±3.5%		4.00 ±3.4%		<b>4.24 ±3.1%</b>		4.00	4.06 ±1.9%	

**Q22. With your ability to regulate temperatures during the summer?**

GP homeowners are more satisfied with their ability to regulate temperatures during the summer.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	7	3.4%	8	3.1%	3	1.3%		18	2.5%
2 = Somewhat Dissatisfied	23	11.3%	28	11.0%	11	4.7%		62	8.8%
3 = Neutral or Not Sure	51	25.0%	61	23.9%	44	18.8%	3	159	22.5%
4 = Somewhat Satisfied	76	37.3%	88	34.5%	80	34.2%	7	251	35.6%
5 = Very Satisfied	47	23.0%	70	27.5%	96	41.0%	3	216	30.6%
<i>Average &amp; Expected Error</i>	3.65 ±4.0%		3.72 ±3.6%		<b>4.09 ±3.0%</b>		4.00	3.83 ±2.0%	

**Q23. With the noise of your cooling system when it's running?**

GP homeowners are more satisfied with the noise level of their cooling system when it's running.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Very Dissatisfied	21	10.4%	34	13.4%	14	6.0%		69	9.8%
2 = Somewhat Dissatisfied	39	19.3%	42	16.5%	27	11.5%	2	110	15.6%
3 = Neutral or Not Sure	56	27.7%	61	24.0%	48	20.4%	4	169	24.0%
4 = Somewhat Satisfied	56	27.7%	69	27.2%	79	33.6%	6	210	29.8%
5 = Very Satisfied	30	14.9%	48	18.9%	67	28.5%	1	146	20.7%
<b>Average &amp; Expected Error</b>	3.17 ±5.2%		3.22 ±5.0%		<b>3.67 ±4.1%</b>		3.46	3.36 ±2.7%	

**Q24. How satisfied have you been with the cost of heating your home?**

Homeowners were asked about the cost of their electrical heating system. There were no differences among the various types of homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	4	2.7%	7	5.3%				11	3.2%
2	14	9.5%	11	8.3%	5	8.1%	1	31	9.0%
3	43	29.1%	35	26.3%	17	27.4%		95	27.5%
4	51	34.5%	35	26.3%	23	37.1%	1	110	31.8%
Completely Satisfied = 5	36	24.3%	45	33.8%	17	27.4%	1	99	28.6%
<b>Average</b>	3.68 ±4.5%		3.75 ±5.3%		3.84 ±6.0%		3.67	3.74 ±3.0%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q25. With the evenness of temperatures from room to room during the winter?**

Those who heat with electric heat do not see a difference in the evenness of temperatures inside their home during the colder winter months.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	7	4.7%	7	5.2%	5	7.9%		19	5.5%
2	18	12.2%	11	8.2%		0.0%	1	30	8.6%
3	45	30.4%	40	29.9%	11	17.5%	1	97	27.9%
4	51	34.5%	43	32.1%	29	46.0%	1	124	35.6%
Completely Satisfied = 5	27	18.2%	33	24.6%	18	28.6%		78	22.4%
<b>Average</b>	3.49 ±4.9%		3.63 ±5.1%		3.87 ±6.9%		3.00	3.61 ±3.2%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q26. With the ability of your heating system to warm your home up quickly?**

GP homeowners are more satisfied with the ability of their heating system to heat their home quickly.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	1	0.7%	2	1.5%	1	1.6%		4	1.1%
2	9	6.0%	11	8.1%	2	3.2%		22	6.3%
3	43	28.9%	30	22.2%	7	11.3%	1	81	23.2%
4	65	43.6%	47	34.8%	27	43.5%	1	140	40.1%
Completely Satisfied = 5	31	20.8%	45	33.3%	25	40.3%	1	102	29.2%
<b>Average</b>	3.78 ±3.7%		3.90 ±4.3%		<b>4.18 ±5.2%</b>		4.00	3.90 ±2.5%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q27. With the reliability of your heating system (i.e., repair frequency)?**

All categories of homeowner are equally satisfied with reliability during the winter months.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	1	0.7%	5	3.8%	1	1.6%		7	2.0%
2	3	2.0%	6	4.5%	1	1.6%		10	2.9%
3	30	20.1%	23	17.3%	7	11.1%	1	61	17.5%
4	63	42.3%	44	33.1%	22	34.9%	1	130	37.4%
Completely Satisfied = 5	52	34.9%	55	41.4%	32	50.8%	1	140	40.2%
<i>Average</i>	4.09 ±3.3%		4.04 ±4.4%		4.32 ±4.9%		4.00	4.11 ±2.4%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q28. With your ability to regulate temperatures during the winter?**

GP homeowners are more satisfied with their ability to regulate temperatures during the winter months.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	3	2.0%	4	3.0%	1	1.6%		8	2.3%
2	8	5.4%	11	8.2%	1	1.6%		20	5.8%
3	36	24.5%	25	18.7%	7	11.3%	1	69	19.9%
4	61	41.5%	48	35.8%	27	43.5%	2	138	39.9%
Completely Satisfied = 5	39	26.5%	46	34.3%	26	41.9%		111	32.1%
<i>Average</i>	3.85 ±4.0%		3.90 ±4.6%		<b>4.23 ±4.9%</b>		3.67	3.94 ±2.6%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q29. With the noise of your heating system when it's running?**

GP homeowners are more satisfied with lack of noise of their electric heating system when it's running.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Very Dissatisfied = 1	12	8.1%	20	14.8%	3	4.8%		35	10.0%
2	26	17.6%	21	15.6%	2	3.2%	1	50	14.3%
3	42	28.4%	34	25.2%	10	15.9%		86	24.6%
4	42	28.4%	36	26.7%	28	44.4%	2	108	30.9%
Completely Satisfied = 5	26	17.6%	24	17.8%	20	31.7%		70	20.1%
<i>Average</i>	3.30 ±5.8%		3.17 ±7.0%		<b>3.95 ±6.4%</b>		3.33	3.37 ±3.8%	

Note: Responses are for those homeowners with electric heat. Answers for homes heated with gas are excluded.

**Q24-29. How satisfied have you been during the winter season?**

As Q8 demonstrated, almost half of all homes in the survey are heated with gas. The preceding six tables are for all-electric homes; they exclude homeowners that heat with gas. The following table compares the responses of homeowners that heat with gas to those with all-electric homes. Gas heat has a statistically higher rating on every question.

	AVERAGE RATING ON A SCALE OF 1 TO 5		
	GAS HEAT	ALL-ELECTRIC	TOTAL
Q24. The cost of heating your home?	<b>3.93 ±2.8%</b>	3.74 ±3.0%	3.83 ±2.0%
Q25. The evenness of temperatures from room to room?	<b>3.90 ±2.9%</b>	3.61 ±3.2%	3.76 ±2.1%
Q26. The ability of your system to warm your home up quickly?	<b>4.16 ±2.3%</b>	3.90 ±2.5%	4.03 ±1.7%
Q27. The reliability of your heating system?	<b>4.30 ±2.2%</b>	4.11 ±2.4%	4.20 ±1.6%
Q28. Your ability to regulate temperatures during the winter?	<b>4.14 ±2.4%</b>	3.94 ±2.6%	4.04 ±1.8%
Q29. The noise of your heating system when it's running?	<b>4.01 ±2.7%</b>	3.37 ±3.8%	3.69 ±2.4%

**PART IV—DO YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS?**

In the next series of questions homeowners were asked whether they agree or disagree with some statements about their home and their HVAC systems.

**Q30. My energy bills are reasonable for a house and family like mine.**

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	14	6.8%	15	5.9%	13	5.5%		42	5.9%
2 = Disagree Somewhat	35	17.1%	52	20.5%	28	11.9%	3	118	16.7%
3 = Not Sure	28	13.7%	25	9.8%	26	11.1%	1	80	11.3%
4 = Agree Somewhat	88	42.9%	109	42.9%	106	45.1%	7	310	43.8%
5 = Completely Agree	40	19.5%	53	20.9%	62	26.4%	2	157	22.2%
<i>Average &amp; Expected Error</i>	3.51 ±4.6%		3.52 ±4.2%		3.75 ±3.9%		3.62	3.60 ±2.4%	

**Q31. My home's energy costs are lower than most other homes in the same price range in Phoenix.**

Homeowners in GP homes think they are paying less than other homes in the same price range.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	12	5.9%	12	4.7%	12	5.2%		36	5.1%
2 = Disagree Somewhat	28	13.8%	33	12.9%	16	6.9%	2	79	11.2%
3 = Not Sure	114	56.2%	135	52.9%	113	48.5%	8	370	52.6%
4 = Agree Somewhat	30	14.8%	54	21.2%	45	19.3%	2	131	18.6%
5 = Completely Agree	19	9.4%	21	8.2%	47	20.2%	1	88	12.5%
<i>Average &amp; Expected Error</i>	3.08 ±4.2%		3.15 ±3.6%		<b>3.42 ±3.9%</b>		3.15	3.22 ±2.2%	

**Q32. My home is more comfortable than most other homes in the same price range in Phoenix.**

GP homeowners think their homes are more comfortable.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	8	3.9%	4	1.6%	2	0.9%		14	2.0%
2 = Disagree Somewhat	15	7.4%	29	11.4%	18	7.7%		62	8.8%
3 = Not Sure	126	61.8%	140	55.1%	119	51.1%	8	393	55.8%
4 = Agree Somewhat	40	19.6%	54	21.3%	53	22.7%	5	152	21.6%
5 = Completely Agree	15	7.4%	27	10.6%	41	17.6%		83	11.8%
<i>Average &amp; Expected Error</i>	3.19 ±3.6%		3.28 ±3.2%		<b>3.48 ±3.3%</b>		3.38	3.32 ±1.9%	

**Q33. My household suffers from fewer allergies & other airborne health risks than they would in most other homes in the same price range.**

GP homeowners perceive that their families suffer from fewer allergies and other airborne health risks.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	9	4.4%	10	3.9%	3	1.3%		22	3.1%
2 = Disagree Somewhat	17	8.4%	24	9.4%	13	5.6%		54	7.7%
3 = Not Sure	132	65.0%	173	67.8%	147	63.6%	9	461	65.7%
4 = Agree Somewhat	34	16.7%	35	13.7%	41	17.7%	2	112	16.0%
5 = Completely Agree	11	5.4%	13	5.1%	27	11.7%	2	53	7.5%
<i>Average &amp; Expected Error</i>	3.10 ±3.5%		3.07 ±3.1%		<b>3.33 ±3.1%</b>		3.46	3.17 ±1.9%	

**Q34. The heating and cooling system in my home keeps the air fresher than in most others homes in the same price range in Phoenix.**

GP homeowners think the air in their homes is fresher than other types of homes.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	7	3.4%	7	2.8%	2	0.9%		16	2.3%
2 = Disagree Somewhat	16	7.8%	25	9.8%	7	3.0%	1	49	7.0%
3 = Not Sure	149	73.0%	168	66.1%	143	61.6%	7	467	66.4%
4 = Agree Somewhat	24	11.8%	36	14.2%	52	22.4%	3	115	16.4%
5 = Completely Agree	8	3.9%	18	7.1%	28	12.1%	2	56	8.0%
<i>Average &amp; Expected Error</i>	3.05 ±3.2%		3.13 ±3.1%		<b>3.42 ±2.9%</b>		3.46	3.21 ±1.8%	

**Q35. My home has fewer problems with mold and mildew than in most other homes in the same price range in Phoenix.**

GP homeowners think they have fewer mold and mildew problems than in most other similar homes.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	5	2.5%	4	1.6%	1			10	1.4%
2 = Disagree Somewhat	7	3.4%	9	3.5%	3	1.3%	1	20	2.8%
3 = Not Sure	116	56.9%	157	61.6%	135	57.9%	7	415	58.9%
4 = Agree Somewhat	53	26.0%	52	20.4%	37	15.9%	3	145	20.6%
5 = Completely Agree	23	11.3%	33	12.9%	57	24.5%	2	115	16.3%
<i>Average &amp; Expected Error</i>	3.40 ±3.3%		3.40 ±2.9%		<b>3.63 ±3.1%</b>		3.46	3.48 ±1.8%	

**Q36. If I were looking for a new home today, I would look for a home with the Environments for Living or Engineered for Life designation.**

Even though awareness of GP homes is low, over 26% of all respondents “Completely Agreed” that they would look for an GP home the next time they buy a house. And GP homeowners are more likely to seek out the GP designation.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	1	0.5%	5	2.0%	5	2.1%		11	1.6%
2 = Disagree Somewhat	10	4.9%	9	3.6%	9	3.8%	1	29	4.1%
3 = Not Sure	95	46.6%	103	40.7%	62	26.4%	4	264	37.4%
4 = Agree Somewhat	58	28.4%	81	32.0%	72	30.6%	4	215	30.5%
5 = Completely Agree	40	19.6%	55	21.7%	87	37.0%	4	186	26.4%
<i>Average &amp; Expected Error</i>	3.62 ±3.3%		3.68 ±3.1%		<b>3.97 ±3.2%</b>		3.85	3.76 ±1.8%	

**Q37. If I were looking for a new home today, I would look for a home with the Energy Star designation.**

Thirty percent of all respondents “Completely Agreed” that they would look for an ES home the next time they buy a house.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	3	1.5%	4	1.6%	5	2.1%	1	13	1.8%
2 = Disagree Somewhat	7	3.4%	5	2.0%	6	2.6%		18	2.5%
3 = Not Sure	79	38.7%	70	27.5%	71	30.3%	2	222	31.4%
4 = Agree Somewhat	67	32.8%	98	38.4%	63	26.9%	8	236	33.4%
5 = Completely Agree	48	23.5%	78	30.6%	89	38.0%	2	217	30.7%
<i>Average &amp; Expected Error</i>	3.74 ±3.3%		3.95 ±2.8%		3.96 ±3.2%		3.77	3.89 ±1.8%	

**Q38. If I were looking for a new home today, I would look for a home with the Performance Built designation.**

The Performance Built designation is the least preferred. Only 22.2% “Completely Agreed” that they would seek it out in their next new house.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	3	1.5%	2	0.8%	4	1.7%		9	1.3%
2 = Disagree Somewhat	8	3.9%	4	1.6%	6	2.6%		18	2.6%
3 = Not Sure	98	48.0%	118	46.5%	99	42.3%	5	320	45.4%
4 = Agree Somewhat	59	28.9%	74	29.1%	59	25.2%	6	198	28.1%
5 = Completely Agree	36	17.6%	56	22.0%	66	28.2%	2	160	22.7%
<i>Average &amp; Expected Error</i>	3.57 ±3.4%		3.70 ±2.8%		3.76 ±3.2%		3.77	3.68 ±1.8%	

**Q39. Most heating & cooling contractors & technicians are properly trained and certified.**

Less than 7% of homeowners “Completely Agreed” that contractors and technicians are properly trained and certified.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
1 = Completely Disagree	9	4.4%	17	6.7%	7	3.0%		33	4.7%
2 = Disagree Somewhat	37	18.1%	43	16.9%	36	15.4%	1	117	16.6%
3 = Not Sure	89	43.6%	103	40.6%	102	43.6%	8	302	42.8%
4 = Agree Somewhat	60	29.4%	75	29.5%	65	27.8%	4	204	28.9%
5 = Completely Agree	9	4.4%	16	6.3%	24	10.3%		49	7.0%
<i>Average &amp; Expected Error</i>	3.11 ±4.0%		3.12 ±3.9%		3.27 ±3.7%		3.23	3.17 ±2.2%	

## PART V—HOW DO YOU MANAGE YOUR HEATING & COOLING SYSTEMS?

In the next few questions homeowners were asked how they manage their HVAC system.

### Q40. In the past 12 months, how many times have you had your heating or air-conditioning system repaired by a contractor?

Over 68% never had a repair on their HVAC system in the last year. And 24% had only one repair.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
One time	50	24.5%	65	25.6%	51	21.7%	3	169	23.9%
Two or more times	18	8.8%	13	5.1%	17	7.2%	1	49	6.9%
Never had a repair	136	66.7%	176	69.3%	167	71.1%	9	488	69.1%
<i>Grand Total</i>	204		254		235		13	706	

### Q41. Have you ever had a problem with mold and mildew in your home?

Mold and mildew are not problems in Phoenix. Only 3% reported a problem.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	7	3.4%	7	2.7%	10	4.3%		24	3.4%
No	168	82.4%	222	87.1%	204	86.8%	11	605	85.6%
Don't know	29	14.2%	26	10.2%	21	8.9%	2	78	11.0%
<i>Grand Total</i>	204		255		235		13	707	

### Q42. How often do you have your heating and cooling systems inspected?

There are apparently two models when it comes to inspecting an HVAC system either once a year or when there's a problem. Seventy two percent of all respondents fit into one of these two models.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Once a year	69	33.8%	93	36.6%	88	38.1%	2	252	35.9%
Only when there's a problem	79	38.7%	104	40.9%	69	29.9%	4	256	36.5%
Once every 2 years	27	13.2%	22	8.7%	36	15.6%	3	88	12.5%
At least twice a year	18	8.8%	21	8.3%	29	12.6%	2	70	10.0%
Once every 3 or 4 years	11	5.4%	14	5.5%	9	3.9%	2	36	5.1%
<i>Grand Total</i>	204		254		231		13	702	

### Q43. How often do you change air filters in your home? Choose the answer that most nearly matches your practice.

Over 91% of homeowners report that they change their air filters at least quarterly.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Monthly	97	47.5%	135	52.9%	122	51.9%	8	362	51.2%
Quarterly	85	41.7%	102	40.0%	93	39.6%	4	284	40.2%
Twice a year	8	3.9%	16	6.3%	13	5.5%	1	38	5.4%
Once a year	4	2.0%	1	0.4%	6	2.6%		11	1.6%
Never	3	1.5%			1	0.4%		4	0.6%
Less than once a year	7	3.4%	1	0.4%				8	1.1%
<i>Grand Total</i>	204		255		235		13	707	

### Q44. What type of air filter do you use most frequently?

Flat filters are the most popular.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Flat filter	70	34.3%	93	36.5%	107	45.5%	6	276	39.0%
Pleated filter	71	34.8%	85	33.3%	79	33.6%	5	240	33.9%
Reusable filter	31	15.2%	40	15.7%	16	6.8%		87	12.3%
HEPA air filter	25	12.3%	27	10.6%	24	10.2%	2	78	11.0%
Don't know	7	3.4%	10	3.9%	9	3.8%		26	3.7%
<i>Grand Total</i>	204		255		235		13	707	

**Q45. Do you have a programmable thermostat?**

Most GP homeowners have a programmable thermostat. However, the proportion is about the same for ES and B homeowners.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	98	48.5%	127	50.2%	204	87.6%	12	441	62.9%
No	98	48.5%	121	47.8%	27	11.6%	1	247	35.2%
Don't know	6	3.0%	5	2.0%	2	0.9%		13	1.9%
<i>Grand Total</i>	202		253		233		13	701	

**Q46. Do you use your programmable thermostat to vary your temperatures if you're away from home?**

Over two-thirds of all homeowners with a programmable thermostat vary temperatures when they're away from home.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Yes	71	65.7%	97	71.9%	142	68.6%	7	317	68.6%
No	32	29.6%	35	25.9%	64	30.9%	5	136	29.4%
Don't know	5	4.6%	3	2.2%	1	0.5%		9	1.9%
<i>Grand Total</i>	108		135		207		12	462	

**Q47. If the house will be empty for the day, how do you set your thermostat before you leave?**

Behavior varies among the three categories. Baseline and ES homeowners adjust their thermostat or turn it off if they're gone for the day. A greater proportion of GP homeowners leave it on a fixed setting.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.	125	62.5%	138	54.3%	105	45.5%	7	375	53.7%
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the day	66	33.0%	109	42.9%	120	51.9%	6	301	43.1%
I turn the thermostat off until I return later in the day	9	4.5%	7	2.8%	6	2.6%		22	3.2%
<i>Grand Total</i>	200		254		231		13	698	

**Q48. If the house will be empty for the weekend, how do you set your thermostat before you leave?**

If the family will be gone for the weekend, most homeowners in all three categories adjust their thermostat or shut it off.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
I adjust the thermostat by a few degrees, and then return it to the desired setting when I return home.	136	67.0%	183	72.0%	157	67.4%	9	485	69.0%
I turn the thermostat off until I return home	23	11.3%	19	7.5%	14	6.0%	1	57	8.1%
I don't adjust the thermostat; I leave it set on a fixed temperature even if the house is empty for the weekend	44	21.7%	52	20.5%	62	26.6%	3	161	22.9%
<i>Grand Total</i>	203		254		233		13	703	

**Q49. Which statement best describes your home?**

Almost 60% of all homeowners have rooms that are sometimes or always uncomfortable. However, 48% of GP homeowners report that all the rooms in their house are comfortable.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
There are rooms in my house that are <b>always uncomfortable</b> and difficult to heat and cool	36	17.6%	32	12.5%	22	9.4%	1	91	12.9%
There are rooms in my house that are <b>sometimes uncomfortable</b> and difficult to heat and cool	94	46.1%	130	51.0%	101	43.3%	5	330	46.8%
All the rooms in my house are <b>comfortable</b> and easy to heat and cool.	74	36.3%	93	36.5%	110	47.2%	7	284	40.3%
<i>Grand Total</i>	204		255		233		13	705	

**Q50. Which statement best describes how much your air conditioning unit is on and running?**

Over 24% say their air conditioner runs too much. A negligible few say it doesn't run enough.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
My air conditioner runs too much	54	26.7%	66	26.0%	46	19.8%	1	167	23.8%
My air conditioner doesn't run enough	3	1.5%	3	1.2%	3	1.3%		9	1.3%
My air conditioner runs just about the right amount of time	145	71.8%	185	72.8%	183	78.9%	12	525	74.9%
<i>Grand Total</i>	202		254		232		13	701	

## PART VI—PLEASE COMPARE TWO HEATING & COOLING SYSTEMS

In this section, respondents were asked to compare two hypothetical heating and cooling systems. Option A describes a right-sized system. Option B describes a typical oversized system.

<b>OPTION A</b>	<b>OPTION B</b>
A heating & cooling system that is designed & sized to run continuously within a set temperature range. For example, this system might run for 45 minutes or more each hour during the hottest time of the year.	A heating & cooling system that is slightly larger than Option A and runs only when needed to maintain a comfortable temperature. For example, this system might run for less than 45 minutes each hour during the hottest time of the year.

### Q51. Which option is more economical?

Over 80% think Option B is more economical.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Option A	21	10.3%	37	14.6%	37	15.9%	3	98	14.0%
Option B	167	82.3%	201	79.1%	191	82.0%	8	567	80.8%
Both are the same	15	7.4%	16	6.3%	5	2.1%	1	37	5.3%
<i>Grand Total</i>	203		254		233		12	702	

### Q52. Which results in greater comfort?

Over 65% think Option B is more comfortable.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Option A	42	20.8%	42	16.7%	58	25.0%	5	147	21.0%
Option B	131	64.9%	168	66.7%	149	64.2%	7	455	65.1%
Both are the same	29	14.4%	42	16.7%	25	10.8%	1	97	13.9%
<i>Grand Total</i>	202		252		232		13	699	

### Q53. Which is more responsive when you need to heat or cool the house in a hurry?

Over 70% think Option B is more responsive.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Option A	39	19.2%	46	18.1%	48	20.8%	2	135	19.3%
Option B	136	67.0%	188	74.0%	163	70.6%	11	498	71.0%
Both are the same	28	13.8%	20	7.9%	20	8.7%		68	9.7%
<i>Grand Total</i>	203		254		231		13	701	

### Q54. Which would you choose for your own home?

Over 82% would choose Option B for their own home.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Option A	24	11.9%	29	11.5%	35	15.0%	2	90	12.9%
Option B	168	83.6%	212	83.8%	192	82.4%	10	582	83.1%
Both are the same	9	4.5%	12	4.7%	6	2.6%	1	28	4.0%
<i>Grand Total</i>	201		253		233		13	700	

## PART VIII—PLEASE TELL US ABOUT YOURSELF

The final questions had to do with the demographics of the respondents.

### Q55. What is your age?

Ages were reasonably distributed, although ES homeowners were slightly younger.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
21 to 34	59	29.1%	71	28.3%	46	19.7%	1	177	25.3%
35-44	37	18.2%	74	29.5%	32	13.7%	3	146	20.9%
45-59	64	31.5%	70	27.9%	79	33.9%	3	216	30.9%
60-74	32	15.8%	35	13.9%	60	25.8%	3	130	18.6%
75 or older	11	5.4%	1	0.4%	16	6.9%	2	30	4.3%
<i>Grand Total</i>	203		251		233		12	699	

### Q56. What is your approximate household income?

More than 68% had incomes over \$50,000. GP homeowners were the most affluent. Baseline homeowners were the least affluent.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
Under \$25,000	11	5.9%	10	4.2%	8	3.9%		29	4.5%
\$25,000 to \$49,999	64	34.2%	69	28.9%	39	18.8%	3	175	27.1%
\$50,000 to \$99,999	90	48.1%	123	51.5%	102	49.3%	3	318	49.3%
\$100,000 or more	22	11.8%	37	15.5%	58	28.0%	6	123	19.1%
<i>Grand Total</i>	187		239		207		12	645	

### Q57. Do you work for a public utility, homebuilder, realtor or anyone else in the home building trades?

About 13% of all respondents worked in the home building industry. However, their responses did not differ significantly from the rest of the respondents.

	B		ES		GP		Un-known	Grand Total	
	#	%	#	%	#	%		#	%
No	176	88.4%	225	90.4%	192	82.8%	8	601	86.8%
Yes	23	11.6%	24	9.6%	40	17.2%	4	91	13.2%
<i>Grand Total</i>	199		249		232		12	692	