

Counting the Stars in America's Eyes: The ENERGY STAR® Household Survey

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ABSTRACT

ENERGY STAR® is a government/industry partnership whose goal is to make it easy for businesses and consumers to save money, increase energy efficiency, and protect the environment. The program is promoted by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), in partnership with organizations including state governments and utility companies.

The Consortium for Energy Efficiency (CEE) sponsored a national household survey to obtain information on consumer awareness and understanding of the ENERGY STAR label and its influence on energy-related purchase decisions. The sample was designed to support comparison between areas with high and low levels of local program activity. In addition, CEE members were invited to field the survey locally to facilitate direct comparison between the effects of the program in their areas with those in the country at large. The national and partner samples were pooled to provide a richer database for examining the national program.

Findings from this study indicate that the EPA and DOE strategy of partnering with third-party organizations to build momentum for ENERGY STAR is an effective strategy for building awareness, understanding, and influence of the ENERGY STAR label. Substantial portions of U.S. consumers are aware of and understand the label. The label influences purchase decisions, and partner publicity efforts improve awareness and understanding.

Future survey efforts using a similar questionnaire will provide a rich time series on the program's effects. The results are useful also in identifying the qualitative factors that affect label understanding, awareness, and influence.

Introduction

ENERGY STAR® is a government/industry partnership whose goal is to make it easy for businesses and consumers to save money, increase energy efficiency, and protect the environment. The program is promoted by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) in partnership with other public and private organizations, including state governments and electric and gas utility companies. Currently, the label appears on 31 product categories, as well as on homes, office buildings, and schools.

To qualify for the label, products and buildings must meet specific ENERGY STAR criteria. These criteria vary by category, but generally mean that the product or building ranks in the top 20 to 30 percent for energy performance. Regional energy efficiency program administrators have become increasingly valuable partners in educating their constituents about the financial and environmental benefits of ENERGY STAR, particularly qualifying residential lighting and appliances.

In the summer of 2000, the Consortium for Energy Efficiency (CEE) sponsored the development and fielding of a household survey to obtain information at a national level on consumer awareness and understanding of the ENERGY STAR label and of its influence on energy-related purchase decisions. CEE

partners, who include utility and non-utility administrators of local ENERGY STAR initiatives, had a strong interest in this information.

The sample was designed to support comparison between areas with high and low levels of local program activity. In addition, CEE members, ENERGY STAR partners, were invited to field the survey locally to facilitate direct comparison between the effects of the program in their area with those in the country at large. CEE and sponsoring members made the survey data publicly available. The EPA sponsored some analyses of the data (U.S. Environmental Protection Agency 2001). The national sample and partner samples were pooled to provide a richer database for examining the national program.

Methods

Questionnaire Design

The survey was designed to provide information on respondents' awareness of the ENERGY STAR label, their purchases of ENERGY STAR products, and the influence of the label on those purchase decisions. The questionnaire also collected data on demographics and sources of information used when considering energy-related purchases for the home.

An important question in assessing awareness and influence of the label was how the message of the label was understood, both by those who had been aware of it previously and those who had not. To gauge understanding, without the filter of previous questions, the questionnaire began with open-ended questions asking the respondent to look at the label and write down what message(s) they thought it gave. The remaining questions were closed-ended, requiring simple yes/no answers, multiple-choice responses, or a selection of all applicable items from a list.

The questionnaire was kept to a moderate length and designed with an informal, easy-to-read look in a self-mailing format. The survey began with an introductory script from CEE and referred to the EPA and DOE as sponsors of the ENERGY STAR programs being assessed by the survey. Many CEE members who fielded the survey locally included a cover letter in the survey package, providing the respondent with a familiar sponsoring organization, such as their utility or a state energy agency.

Sampling

National Sample. The national sample was a two-stage sample. In the first stage, Designated Marketing Areas (DMAs) were randomly selected. A DMA consists of all counties in which the largest television-viewing share is assigned to stations in that same area. These non-overlapping DMAs cover the entire continental United States, Hawaii, and parts of Alaska. There are currently 210 DMAs throughout the U.S. Only the largest 57 DMAs in the country, accounting for approximately 70 percent of U.S. households, were included in the first-stage sampling frame for this survey. In the second stage, a random selection was made from household data for each selected DMA.

The national sample was designed to facilitate comparisons between areas with high levels of publicity and areas with low levels of publicity. For this purpose, the largest 57 DMAs were classified into one of three publicity levels in the first stage as follows:

- **High message saturation:** An area that has received targeted federal efforts (PSA and media outreach) resulting in over 500 Gross Rating Points¹ (GRPs); the area has been exposed to an active third-party (e.g., utility, state, or regional energy-efficiency systems benefit charge administrator) promotion of ENERGY STAR for more than one year. Active promotion was defined as including at least three of the following activities in a given year: bill stuffers, paid ads, retailer promotion/programs, rebates, special events, media promotions.
- **Low message saturation:** An area that has not received targeted federal efforts or been exposed to local ENERGY STAR promotions via an active third party (e.g., utility, state, or regional energy-efficiency systems benefit charge administrator); areas that have received only national spillover from ENERGY STAR promotions resulting in under 500 GRPS from federal efforts.
- **Other:** An area not satisfying either the High or Low definition.

Within each of these publicity strata, a simple random sample of four DMAs was initially selected. After the initial sample yielded low response rates, an additional sample of four more DMAs was drawn from the Low and Other publicity strata. Additional DMAs were not selected in the High publicity stratum because all the DMAs in this stratum were already included in either the national sample or the partner samples.

Partner Samples. Samples sponsored by CEE members in their own regions were fielded for the following areas:

- California, excluding the City of Los Angeles
- Connecticut, excluding Hartford
- Massachusetts
- Vermont
- Wisconsin

In each of these five areas, a simple random sample was drawn from the full set of households. Unlike the national sample, these surveys included a cover letter. They were mailed simultaneously with the first national sample.

Combined Sample. Ideally, the CEE partner frame would have been identified in advance and the national frame restricted to areas outside the partner frame. However, some of the partner surveys were not planned until after the national effort was underway, and the combination of the national and partner samples was not agreed to until after the first wave of data collection was complete. Thus, adjustment for overlap between the two frames was made after the fact. The adjustment procedures developed appropriate weights to provide unbiased estimates from the combined sample, with corresponding variance calculation formulas.

¹ A gross rating point is an industry standard unit of measurement of advertising audience size, and is equal to one percent of the total potential audience universe. It is used to measure the exposure of one or more programs or commercials without regard to multiple exposure of the same advertising to individuals.

The overlap was handled by dividing the total represented area into two distinct pieces. The first was the partner frame in its entirety. The second was that portion of the national frame not included in the partner frame — the national frame minus the partner frame. We refer to this second portion as the “restricted national frame.”

The Venn Diagram in Figure 1 illustrates the combined sample classification approach. The weighting and variance calculation procedures treated the restricted national sample and the partner sample as two independent samples representing their respective areas.

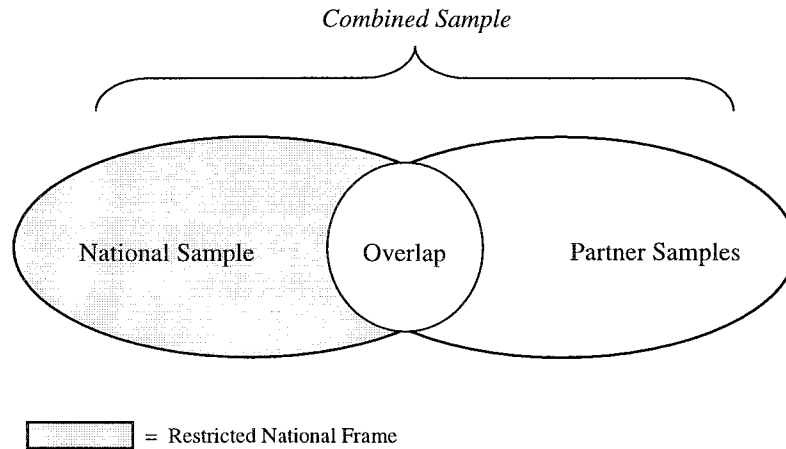


Figure 1. Venn Diagram of Combined Sample

The restricted national frame excludes any zip code area that was part of the CEE partner frame. That is, instead of an entire DMA, we consider only the “restricted DMA,” excluding any zip codes that were designated for the partner sample. If an entire DMA selected for the national sample was also part of the CEE partner frame, the DMA would be considered only as a part of the partner sample and would be excluded from the restricted national sample. The frames and samples are summarized in Table 1.

Table 1. Distribution of Frames and Samples

	National Alone	Partner Alone	Combined
# of DMAs	57	27	74
# of households (millions)	69.9	13.5	72.8
% U.S. households	69.2%	13.4%	72%
% of combined frame	96%	18.5%	100%
Sample			
# of households	780	2,176	3,496
% of sample	22.3%	77.7%	100%

Note: National Alone and Partner Alone do not add due to overlap.

Response Rates

Survey response rates for the initial and additional samples are summarized in Table 2.

Table 2. Survey Response Rates

	National Alone		Partner Alone	Combined
	Initial	Additional		
Sent	7,500	6,400	20,350	34,250
Returned	491	289	2,716	3,496
Response Rate	6.5%	4.5%	13.3%	10.2%

Possible reasons for the low response rates may include:

- Declining nationwide response rate to surveys in general;
- A survey sponsor (CEE) unfamiliar to most respondents;
- The open-ended questions in the beginning require some thought, which could discourage interest in, and the timely completion of, the survey; and
- Response rates are calculated as the ratio of surveys returned to survey addresses mailed, not as the ratio of returns to valid or eligible addresses in the sample. The purchased lists of households used as the sample frame in each DMA or partner-sponsored area may have included a large proportion of ineligible or invalid listings.

Analysis

The primary analysis consists of calculating means and proportions for various subgroups of interest and determining the standard errors of these estimates. Means and proportions are calculated using the expansion weights, which reflect the sampling rates for each portion of the sample. Standard errors reflect the two-stage structure for the national sample and the stratification of the CEE partners' sample into partner areas. The standard errors were calculated using SUDAAN[®], special-purpose software designed for the analysis of complex survey data (Shah, Barnwell & Bieler 1997).

Findings

Assessment of Nonresponse Bias

To assess the potential for nonresponse bias, the distribution of key demographic characteristics of the responding sample, weighted in the same manner as for the rest of the analysis, were compared with national census data. Age and income distributions are shown in Tables 3 and 4.

Table 3. Age Distribution for Weighted Sample and National Census Data

Householder / Respondent Age	Percent of Households		% Smpl-% Pop
	Population	Weighted Combined Sample	
Pop, 15-24; Smpl, 18-24	5.6%	0.7%	-4.9%
25-34	18.1%	10.0%	-8.2%
35-44	23.1%	18.2%	-4.9%
45-54	19.4%	25.5%	6.1%
55-64	13.1%	16.6%	3.5%
65-74	10.9%	16.4%	5.4%
75 or older	9.8%	12.7%	2.9%
Total (%)	100.0%	100.0%	
Total (1,000s)	103,875	63,883	

Source: Current Population Statistics for 1998, U.S. Census Bureau

Table 4. Income Distribution for Weighted Sample and National Census Data

Total Household Annual Income (before taxes)	Percent of Households		% Smpl-% Pop
	Population	Weighted Combined Sample	
Less than \$5,000	3.2%	1.4%	-1.8%
\$5,000-\$9,999	7.1%	3.0%	-4.1%
\$10,000-\$14,999	7.8%	3.8%	-4.0%
\$15,000-\$24,999	14.0%	13.8%	-0.2%
\$25,000-\$49,999	29.2%	28.9%	-0.3%
\$50,000-\$74,999	18.6%	24.3%	5.7%
\$75,000 and over	20.1%	24.8%	4.7%
Total (%)	100.0%	100.0%	
Total (1,000s)	103,875	56,861	

Source: Current Population Statistics for 1998, U.S. Census Bureau

Comparisons of demographics for the (weighted) responding sample with national Census data show broadly similar demographic profiles, with certain systematic differences. The differences are similar to those that are common for mail residential household surveys in general. Younger and lower income households are less likely to respond to the survey than are older and higher income households. These broad characteristics should be considered when interpreting the survey results.

A general concern regarding nonresponse is whether survey respondents are more likely than nonrespondents to be aware of, understand, or be influenced by the ENERGY STAR label. This possibility cannot be assessed from the demographic information. Individuals with a greater interest in energy efficiency might have been more inclined to complete the survey for the following reasons:

- The survey was sponsored by an entity identified as the "Consortium for Energy Efficiency."

- The introduction to the survey identified EPA and DOE as promoting the program being assessed by the CEE survey.
- The first question referred to a picture of the ENERGY STAR label on which “EPA” and “DOE” appear.

For these reasons, the survey results may overstate the levels of awareness, understanding, and influence nationwide. Nevertheless, the survey provides useful comparisons across publicity levels, giving information on the relative importance of different factors. The results also are useful as a baseline for future tracking efforts, which are likely to have similar nonresponse effects.

Understanding of the ENERGY STAR Label

The first two survey questions were used to assess whether the respondent understood the message of the ENERGY STAR label. A respondent might understand the message even if previously unfamiliar with the label. The questions asked the respondent to describe in his/her own words the first, and then any other, message(s) that came to mind when looking at the label.

The open-ended responses were coded into 28 detailed response categories. For purposes of this analysis, these detailed response categories were initially combined into five levels of understanding as follows.

High understanding (H): The respondent mentioned one or more of the following:

- Savings
- Energy efficiency
- Environmental benefit
- Product standards.

General understanding (G): The respondent mentioned one or more of the following:

- Energy
- Environment
- Quality
- Government backing.

However, the respondent did not specifically mention savings, efficiency, benefits, or standards.

No understanding (N): No answer, or a response not included in the High or General understanding level.

Mixed G–N: The detailed response category includes some General understanding responses and some No understanding responses.

Mixed H–G: The detailed response category includes some High understanding responses and some General understanding responses.

Nationwide, 37 percent of households had a high level of understanding of the ENERGY STAR label. Significant differences in the level of understanding were found among subgroups of consumers defined by demographic and housing characteristics, as well as by previous experience related to ENERGY STAR. Results are summarized in Table 5.

Table 5. Factors Related to Higher Understanding of the Label

Factor	Groups		Percent with High Understanding			
	A	B	A	B	Difference	p-value
Publicity Level	High	Low	41	34	7	0.0200
Previously Aware of Label	Yes	No	64	19	45	< 0.0005
Housing Tenure	Own	Rent	39	27	12	0.0050
Housing Type	Single Family	Multifamily	40	30	10	0.0200
Pay Own Energy Bills	Yes	No	38	38	0	1.0000
Respondent Age	35-44	> 75	51	14	37	< 0.0005
Household Income	> \$75,000	< \$25,000	51	25	26	< 0.0005

- Understanding was higher in areas with higher levels of publicity, indicating that the publicity does improve label understanding (p-value < 0.01).
- Respondents who were previously aware of the label had higher understanding than those who did not recall seeing it before the survey. This finding suggests that customers who have seen the label in its intended contexts (on products or in publicity materials) are more likely to have a good understanding of what it means than those encountering it for the first time. At the same time, high understanding among a portion of those not previously aware suggests that the label itself can communicate its intended message to a small but significant portion of the population.
- Homeowners and those in single-family homes had higher proportions with a High level of understanding than did renters or those in multi-family homes. However, there was no significant difference in understanding between consumers who paid their own energy bills and those who did not. This pattern of findings suggests that understanding of ENERGY STAR is more strongly related to customer characteristics, such as age and income, which are associated with single-family home ownership than to the consumers' *perceived* opportunity for financial benefit associated with responsibility for energy bills.
- The percentage of consumers with a High level of understanding clustered in the range of 44 to 51 percent for consumers in the age ranges between 18 and 54, then dropped off with increasing age to a low of 14 percent for those over 75.
- High understanding increased steadily with income level, with the highest income group having over twice as high a proportion as the lowest group.

Awareness

Nationwide, 41 percent of households have seen the ENERGY STAR label. Label awareness is much higher in the high-publicity areas than in the low-publicity areas — 52 percent versus 37 percent (p-value < 0.0005).

Store displays and direct mail were the most common sources where respondents recalled seeing the label, at 58 and 41 percent, respectively. Print media and television each scored around 33 percent.

Among those who were aware of the label, the most common product on which they'd seen it was computers and monitors. Over half the aware respondents in all publicity categories had seen the label on these products. Next most common were refrigerators, with the label seen by 43 percent of aware respondents, followed by dishwashers, washing machines, televisions, room air conditioners, and central air conditioners. For each of the latter group of products, 21 to 25 percent of aware respondents reported having seen the label on that product.

Influence

Among respondents who were aware of the ENERGY STAR label and had purchased one of the eligible products within the past 12 months, 74 percent reported having bought an ENERGY STAR product. This proportion did not vary significantly across publicity levels. One reason for this lack of difference is that ENERGY STAR awareness is, in part, the result of making an ENERGY STAR purchase. The proportion of all households making ENERGY STAR purchases may be higher in high-publicity areas. However, in this survey, only respondents who were previously aware of the label could meaningfully be asked about prior ENERGY STAR purchases.

Nationwide, about 50 percent of those who reported that they bought an ENERGY STAR-labeled product also reported that they were influenced by the label to buy that product. The proportion influenced was significantly higher in the high-publicity areas compared with the low-publicity areas, 58 percent versus 35 percent (p -value = 0.02). Thus, where publicity is low, the effect of the label on purchase decisions is significantly reduced. However, the purchase of an ENERGY STAR product may itself lead to greater label awareness and understanding, which in turn may influence future purchases.

Comparison with Other Studies

Study results were compared with several other studies. Of particular interest is comparison with results from the Energy Information Administration's 1997 Residential Energy Consumption Survey (RECS; Energy Information Administration 1997). The RECS is a national household survey with a response rate of over 80 percent. Only a limited number of questions about the ENERGY STAR label were asked on the survey. These questions included whether the respondent had previously seen the label, and whether it had influenced any purchases.

The RECS found that 27 percent of households were previously aware of the ENERGY STAR label, as compared with 41 percent in the CEE survey. The difference may reflect the passage of time, or nonresponse bias in the CEE survey.

With respect to the influence of the label, the RECS and CEE results are more consistent. Among all RECS respondents who were previously aware of the label, 32 percent reported that the label had influenced a purchase decision. For the CEE survey, the influence question was asked only for those who had purchased eligible equipment within the past 12 months. Among these respondents, 37 percent reported that the label had influenced a purchase decision.

Conclusions

The findings in this study confirm that substantial portions of U.S. consumers are aware of and understand the ENERGY STAR label. Moreover, the label influences purchase decisions, and publicity efforts improve awareness, understanding, and influence of the label.

This questionnaire provides useful data for comparing publicity levels and information on the relative importance of different purchasing factors. The results are useful as a baseline for future tracking efforts. Future survey efforts using a similar questionnaire will provide a rich base of time-series data and an important and useful information source for parties supporting the ENERGY STAR program and related programs promoting energy efficient household products.

The results are useful also in identifying the qualitative factors that affect label understanding, awareness, and influence. Overall, the findings from this study indicate that the EPA and DOE strategy of partnering with third-party organizations to build momentum for ENERGY STAR is an effective strategy for building awareness, understanding, and influence of the ENERGY STAR label.

Acknowledgments

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