ENERGY EFFICIENCY MARKET ASSESSMENT OF NEW JERSEY CLEAN ENERGY PROGRAMS

BOOK II – RESIDENTIAL PROGRAMS

FINAL

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1. RESIDENTIAL GAS AND ELECTRIC HVAC PROGRAM MARKET ASSESSMENT

1.1 Program Introduction

This report presents the results of the Market Assessment for the New Jersey Residential Gas & Electric Heating Ventilating and Air Conditioning (HVAC) program (Residential HVAC Program). This analysis examines performance indicators, market share, changes from the baseline, incremental cost differences between ENERGY STAR and comparable non-ENERGY STAR products, the status of market barriers, codes and standards, rebates and incentives, and the program goals, and provides recommendations to improve the program.

The purpose of this evaluation is to provide data and insight that will assist with program-related decision-making. The New Jersey Residential HVAC Program constitutes an investment of System Benefits Charge (SBC) funds. The market assessment work is designed to help ascertain the return from these investments and how these returns can be enhanced.

1.1.1 Detailed Program Background

The Residential Gas and Electric HVAC Program promotes energy-efficient HVAC equipment and is designed to transform the market to one in which quality installations of high efficiency equipment are commonplace. The program promotes both the sale of high efficiency equipment and improvements in sizing and installation practices that affect operating efficiency. Rebates under this program are available to promote the installation of qualified HVAC equipment (ENERGY STAR® rated gas furnaces, boilers, and energy-efficient gas water heaters; energy-efficient central air conditioners; and heat pumps) in existing residential homes (retrofit) and newly constructed homes in New Jersey located in Smart Growth Areas, which are defined as Planning Areas 1 and 2, and Designated Centers, as described on the Policy Map of the New Jersey State Development and Redevelopment Plan. Builders or buyers of new homes in the above identified approved planning areas may participate in either the Residential HVAC Program or the New Jersey ENERGY STAR Homes Program, but not both.

The program employs several key strategies to address the market barriers and help transform the market:

- Financial incentives for the sale and purchase of ENERGY STAR rated gas heating equipment and energy-efficient water heaters, declining over time as the installations of energy-efficient equipment become commonplace.
- Financial incentives for the sale or purchase and installation of high efficiency electric HVAC heating and cooling equipment for which documentation of proper sizing and installation is provided, declining over time as the installations of energy-efficient equipment become commonplace.
- Communication with and education of HVAC manufacturers, distributors, and contractors.
- ENERGY STAR sales training for contractors (i.e., how to sell efficiency).
- Technical training for HVAC contractors on how to install energy-efficient natural gas equipment and key elements of quality electrical HVAC installations.
- Support efforts to promote HVAC technician certification through NATE certification testing.

The New Jersey Clean Energy Program has supported efforts to upgrade federal appliance efficiency standards and state building codes. The NJBPU and the participating utilities have submitted letters in support of certain upgrades to efficiency standards and building codes. In addition, utility activities have included technical support, dissemination of information, sponsorship of conferences on codes and standards, tracking of activities and monitoring developments, and review and modification of program designs to integrate changes to the standards and codes.

Customer Incentives

For cooling equipment installed under this program, documentation of proper sizing and installation of qualifying high efficiency equipment must be submitted. In the case of units installed in new homes, this will mean (a) submission of Manual J sizing calculations, (b) documentation of proper charging, and (c) documentation that airflow is within the range recommended by manufacturers (maximum acceptable variation of plus or minus 10%).

In the case of units installed in existing homes, documentation of proper sizing and installation will mean (a) submission of Manual J sizing calculations, (b) documentation of proper charging, and (c) documentation of proper airflow rates. For 2005, HVAC firms that have at least 75% of their technicians holding NATE certification were required to submit only the Manual J sizing calculation and signed certification of proper charge and airflow according to equipment manufacturers' specifications.

Statewide incentives for high efficiency central air conditioners and air source heat pumps in 2005 were as follows:

Minimum Efficiency Standards			2005 Incentives	
SEER	**EER**	**HSPF**	**Central A/C**	**Heat Pumps**
13.00	11.00	8.00	$200	$300
14.00	12.00	8.50	$400	$550

Statewide incentives for ground source heat pumps were as follows:

Qualifying Equipment	Minimum Efficiency Standards	2005 Incentives
Ground Source Heat Pump	13 EER	Up to $500/ton

Statewide incentives for high efficiency gas equipment in 2005 were as follows:

Qualifying Equipment	Minimum Efficiency Standards	2005 Incentives	Increased Rebates 11/1/05 – 4/30/06
Furnace	90% AFUE or greater, ENERGY STAR	$300	$500
Furnace with ECM[1]	92% AFUE or greater, ENERGY STAR	$400	$600
Boiler	85% AFUE or greater, ENERGY STAR	$300	$750
Water Heater	0.62 Energy Factor or greater	$50	$50

[1] Electronic Commutated Motor (ECM) or equivalent

1.1.2 Program-Specific Methodology

Surveys were implemented with the following populations:

1) Participating End Use Customers – Residential customers who purchased HVAC equipment through the program.

2) Nonparticipating End Use Customers – Residential customers who purchased HVAC equipment in the last fours years but not through the program.

3) Participating HVAC Contractors – Residential HVAC contractors who were identified as participating in the program.

4) Nonparticipating HVAC Contractors – Residential HVAC contractors who were identified as not participating in the program.

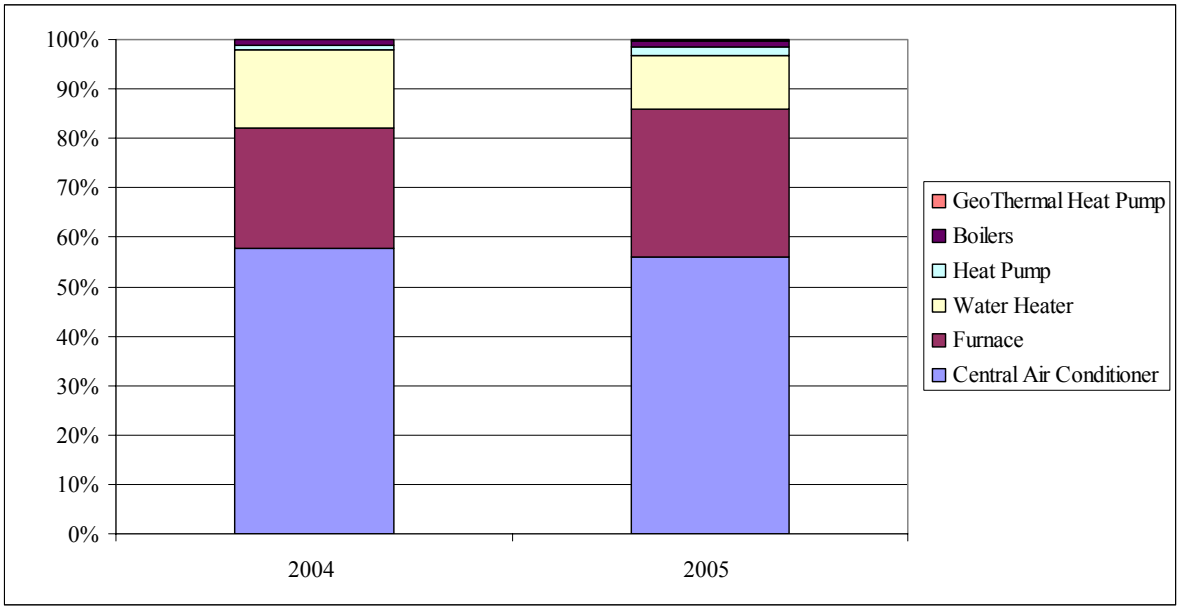
5) Distributors – Residential HVAC distributors who sell equipment in New Jersey.

6) Code and Standards Officials – Federal and state code and standards officials.

Participating End Users

Participating end use customers are defined as residential customers who received incentives through the program. The sample data came from spreadsheets each of the utilities provided in response to a request for data from the BPU. In 2004 there were a total of 25,587 rebates paid and more than half (58%) of these rebates were for central air conditioning equipment. Similarly, in 2005, 30,342 rebates were paid and more than 56% of these rebates were also for central air conditioning equipment. Figure 1-1 shows the distribution of rebates for 2004 and 2005.

Figure 1-1. Distribution of Residential HVAC Rebates



Source: Program data tracking workbooks provided by the participating New Jersey electric and gas utilities.

We combined the data from the seven utility databases and then selected as a sample all records where an incentive was paid in 2005, providing a sample of 30,342 records. For this population we had a target of 75 survey completions. We allocated the 75 surveys according to the number of rebates processed in 2005 by utility. For example 25% of the rebates in 2005 were central AC rebates from Public Service Electric & Gas, so 25% of the survey sample was targeted for this segment. For some of the segments a low participation rate resulted in no surveys being conducted for that segment. We have segmented these completions by rebate type (central AC, furnace, etc.) and utility (see Table 1-1).

Table 1-1. Program Rebates by Type, Utility, and Year

Rebate Type	Utility	2004	2005	*Survey Target*	*Surveys Completed*
Central Air Conditioner					
	Public Service Electric & Gas	7,343	7,067	*19*	*19*
	Jersey Central Power & Light	5,608	6,922	*19*	*19*
	Atlantic City Electric	1,732	2,800	*8*	*8*
	Rockland Electric Company	121	234	*1*	*1*
Central Air Conditioner Total		14,804	17,023	*47*	*47*
Furnace					
	Public Service Electric & Gas	3,650	4,035	*11*	*12*
	New Jersey Natural Gas		1,986	*5*	*6*
	South Jersey Gas	2,210	2,635*	*2*	*2*
	Elizabethtown Gas	378	391	*1*	*1*
Furnace Total		6,238	7,076	*19*	*21*
Water Heater					
	Public Service Electric & Gas	3,492	2,672	*7*	*8*
	E-town Gas	269	237	*1*	*1*
	Elizabethtown Gas		152	*0*	*0*
	South Jersey Gas	263	241*	*0*	*0*
Water Heater Total		4,024	3,061	*8*	*9*
Heat Pump					
	Public Service Electric & Gas	153	144	*0*	*0*
	Atlantic City Electric	64	138	*0*	*0*
	Jersey Central Power & Light	43	94	*0*	*0*
	Rockland Electric Company			*0*	*0*
Heat Pump Total		260	376	*0*	*0*
Boilers					
	Public Service Electric & Gas	159	200	*1*	*1*
	New Jersey Natural Gas		104	*0*	*0*
	Elizabethtown Gas	21	36	*0*	*0*
	South Jersey Gas	48	167*	*0*	*0*
Boilers Total		228	340	*1*	*1*
Geothermal Heat Pump					
	Atlantic City Electric	28	86	*0*	*0*
	Public Service Electric & Gas	5	1	*0*	*0*
	Rockland Electric Company			*0*	*0*
	Jersey Central Power & Light	0	0	*0*	*0*
Geothermal Heat Pump Total		33	87	*0*	*0*
Total Rebates		25,587	30,342	*75*	*78*

*Counts revised after surveys were completed

Nonparticipating End Use Customers

Nonparticipating end use customers are defined as residential customers that have purchased new HVAC equipment in the past 2 years, but have not received a rebate through the program. These surveys were a subset of the ENERGY STAR Products nonparticipant surveys. Nonparticipating end use customers were identified using a random digit dialing calling approach. Respondents to the survey call were screened to determine if they had installed any of 8 targeted residential appliance, including HVAC equipment in the past 2 years. Table 1-2 summarizes the targeted survey completions and the actual survey completions.

Table 1-2. Nonparticipant End Use Customer Survey Completions

Rebate Type	Target Survey Completes	Actual Survey Completes
Electric HVAC Measures (CAC, heat pumps)	75	81
Gas HVAC Measures (furnaces, boilers, water heaters)	75	80
Total	**150**	**157**

Participating HVAC Contractors

Participating HVAC contractors are defined as residential HVAC contractors who were identified as participating with the program. These are the contractors that are recorded in the program tracking databases. The contractor data from each of the utility tracking databases was combined and the duplicate contractors were identified by phone number and removed from the population. The result was a population of over 2700 participating HVAC contractors. Since many of these contractors operate in multiple utility service territories, it did not make sense to geographically segment the participating HVAC contractor population.

Nonparticipating HVAC Contractors

Nonparticipating HVAC contractors are defined as program-relevant trade companies who have not participated with the program. The initial population was identified using two sources: Eastern Heating and Cooling Council database and the Dun & Bradstreet database.

Per our request, Eastern Heating and Cooling Council (EHCC) provided their mailing list of HVAC contractors in the State of New Jersey. There were approximately 3,200 contractors in this mailing list. We cross referenced this list with the participating contractors. Approximately 33% of the contractors had recently participated in the program. In addition, during our survey work it was determined that a significant number of the contractors listed just did plumbing work and did not install HVAC units.

To supplement the Eastern Heating and Cooling Council data, we also used the Dun & Bradstreet database (D&B data) to identify other contractors. We identified 2,400 relevant New Jersey HVAC contractors, selecting them by standard industrial classification (SIC) codes for HVAC contractors. We then selected a random sample of this population. We cross-checked the final list with the list of participating contractors and the EHCC mailing list to eliminate duplicates.

Residential HVAC Distributors

To identify the residential HVAC distributors, we relied on the Dun & Bradstreet database (D&B data). We identified 32 relevant New Jersey HVAC distributors, selecting them by standard industrial classification (SIC) codes for HVAC distributors. We included the Philadelphia and New York City metropolitan areas to expand this list to 50 distributors. Distributors were screened, so that only those

distributors that sell residential HVAC equipment in New Jersey were surveyed. We then selected a random sample of this population.

On-Site Assessments Sample

The residential HVAC evaluation included 10 on-site assessments. During the participant surveys, respondents were asked if they would be willing to have an inspector come to their home to examine the HVAC equipment that was installed under the program. The sites were chosen based upon agreement by the respondent.

Sample Disposition

Most of the telephone surveys achieved an accuracy of 10% or better at a 90% confidence interval[2]. As discussed above the identified populations of HVAC distributions and contractors were exhausted before the targeted number of surveys could be completed. The completed surveys and the accuracies at a 90% confidence interval are shown in Table 1-3.

Table 1-3. Disposition of Residential HVAC Sample

Market Actor	Collection Mode	Targeted	Completes	%	Accuracy @ 90% Conf. Int.
Participating end use customers	Telephone Surveys	75	78	104%	9.0%
Participating end use customers	On-site Inspections	10	10	100%	n/a
Nonparticipating EUC	Telephone Surveys	150	157	105%	6.5%
Participating HVAC contractors	Telephone Surveys	70	70	100%	9.6%
Nonparticipating HVAC contractors	Telephone Surveys	50	33*	66%	13%
Distributors	Telephone Surveys	15[3]	7*	46%	31%
Federal standard and code officials	Telephone Interview	5	5	100%	n/a

*Population has been exhausted, survey efforts have been halted

1.1.3 Program Specific Previous Evaluations

We used a variety of secondary sources in this analysis. Some of the key reports are listed below.

Consortium for Energy Efficiency. ***Residential HVAC Programs National Summary***, September 2005

Rufo, M. ***National Energy Efficiency Best Practices Study***, December 2004.

[2] Assuming a large enough population size, a binomial answer category, and a more conservative variance based on a 50/50 split (a proportion of .5), a study with 68 completions will provide 90% confidence and 10% precision. It should be noted that each question in a survey will have a different confidence interval and precision depending upon the range of possible answers for multi-category questions or continuous variables and the dispersion of responses. While these confidence interval estimates for proportions are potentially misleading for questions that do not ask about a proportion, it has become relatively standard in evaluation and assessment research to report these levels since they allow for a comparison across survey efforts.

[3] HVAC Distributor target was calculated based upon 90% confidence interval and 20% accuracy.

York, D. and Kushler, M., ***America's Best: Profiles of America's Leading Energy Efficiency Programs.*** ACEEE Report Number U032. American Council for an Energy-efficient Economy, Washington, DC. 2003.

New York Energy $mart[SM] Program Evaluation and Status Report **Report to the System Benefits Charge Advisory Group Final Report - May 2005**

California Energy Commission, **2005 Building Energy Efficiency Standards for Residential and Nonresidential Buildings,** September 2004.

Highlights of Efficiency Vermont's Plans for 2006, December 16, 2005.

Xenergy Inc., ***New Jersey Residential HVAC Baseline Study***, November 16, 2001.

1.2 Assessment of Performance Indicators

This section presents a review of the appropriateness of the current program performance indicators, provides updated values for indicators that should be tracked by evaluation and market assessment efforts, and closes with a list of recommended indicators for the future.

1.2.1 Review of Current Indicators

Table 1-4 contains the "performance indicators that were proposed by the utilities in past filings with the BPU" according to the RFP for this evaluation. These indicators can also be found in "New Jersey Clean Energy Program, 2004-2005 Evaluation and Research Plan, Phase 1: Activities to be Initiated 2004" from August 5, 2004 by the CEEEP.

Table 1-4. Residential HVAC Program Performance Indicators

Indicator Area	Performance Indicator	Data Source
Electric Measures		
Rebate volumes and energy savings	Number of central A/C, heat pump, and thermostat rebates.	Program tracking data and protocols
HVAC training	Number of technicians participating in utility sponsored training on Manual J, charging/airflow, duct design, etc. Number of HVAC firms with at least one technician that has participated in utility sponsored training.	Program tracking.
Rebate inspections	"Passing" rate for inspections of rebate systems.	Program tracking.
Contractor certification	Number of HVAC technicians and/or contractors that have been certified.	Data from independent authority the Utilities should work with to promote certification.
Awareness/attitudes	% of customers aware of benefits of efficient equipment and quality installations. % of contractors using and/or aware of benefits and key elements of efficient equipment and quality installations.	Baseline Study/market assessment
Market share monitoring	Sales of high efficiency A/C and heat pumps as % of total NJ sales if possible.	Baseline Study/market assessment
Gas Measures		
Participation and energy impacts	Number of HVAC incentives paid for furnaces, boilers, water heaters, and thermostats.	Program tracking and protocols
Trade Ally Training	Number of HVAC technicians and/or contractors that have received sales training.	Program tracking
Customer awareness/attitudes	Percent of customers aware of benefits and key elements of high efficiency equipment.	Market assessment
Contractor awareness/attitudes	Percent of contractors aware of benefits and key elements of high efficiency equipment.	Market assessment
Market share monitoring	Sales and installation of high efficiency water heaters, furnaces, and boilers as % of total NJ sales of these products if possible.	Surveys and distributor sales data
Incremental cost (long term impact)	Incremental cost of high efficiency water heaters, furnaces, and boilers relative to standard equipment.	Market assessment

The evaluation team provided a review of these indicators in a memo on December 31, 2005. The purpose of that memo was to update and revise the indicators to serve as the "roadmap" for the market assessment report, guiding the data collection approach and analysis so that the research can effectively measure the efficacy of the programs in meeting the stated market transformation goals. For the Residential HVAC Program, the update is summarized in Table 1-5. This table defines which indicators should be kept, added, and dropped from the list of indicators of program performance. The primary change in this indicator list is the combination of the electric and gas indicators. It also lists the source of data for

tracking each indicator. This evaluation report will primarily address indicators that should be tracked by evaluation or market assessment efforts, not program tracking efforts.

Table 1-5. Assessment of Residential HVAC Indicators

Topic	Performance Indicator	New?	General Source	Detailed Source
Participation rate and energy savings	Number of Central A/C and heat pump rebates.	No	Program Tracking/ Savings Protocols	Utility and Honeywell DMC databases
Participation rate and energy savings	Number of HVAC incentives paid for furnaces, boilers, and water heaters.	No	Program Tracking/ Savings Protocols	Utility program tracking databases
HVAC training	Number of technicians participating in utility sponsored training on Manual J, charging/ airflow, duct design, etc.	No	Program Tracking	Utility program tracking databases/mailing lists/training attendee lists
HVAC training	Number of HVAC firms with at least one technician that has participated in utility sponsored training.	No	Program Tracking	Utility program tracking databases/mailing lists/training attendee lists
HVAC training	Number of HVAC technicians and/or contractors that have received sales training.	No	Program Tracking	Utility program tracking databases/mailing lists/training attendee lists
Rebate inspections	"Passing" rate for inspections of rebate systems (cooling only).	No	Program Tracking	Utility program tracking databases
Contractor certification	Number of HVAC technicians and/or contractors that have been certified.	No	Data from independent authority that provides certification	Training administrator tracking database
Awareness/attitudes	**% of customers aware of benefits of efficient equipment and quality installations.**	**No**	**Baseline Study/Market Assessment**	**Data will collected during participant surveys**
Awareness/attitudes	**% of contractors using and/or aware of benefits and key elements of efficient equipment and quality installations.**	**No**	**Baseline Study/Market Assessment**	**Data will collected during contractor surveys**
Participant satisfaction	**Satisfaction with program among participants.**	**Yes**	**Market Assessment**	**Participant surveys**
Contractor satisfaction	**Satisfaction with program among participating contractors.**	**Yes**	**Market Assessment**	**Contractor surveys**

Topic	Performance Indicator	New?	General Source	Detailed Source
Market share monitoring	**Sales of high efficiency A/C and heat pump as % of total NJ sales if possible.**	**No**	**Participant, Distributor surveys and Distributor Sales data**	**Honeywell/ Contractor/ Distributor/ Participant surveys/Regional Data**
Market share monitoring	**Sales and installation of high efficiency water heaters, furnaces, and boilers as % of total NJ sales of these products if possible.**	**No**	**Participant, Distributor surveys and Distributor Sales data**	**Honeywell/ Contractor/ Distributor/ Participant surveys/Regional Data**
Incremental cost (long term impact)	**Incremental costs of high efficiency water heaters, furnaces, and boilers relative to standard equipment.**	**No**	**Market Assessment**	**Participant, contractor, and distributor surveys supplemented by secondary data sources.**

The indicators highlighted in bold in the above table will be addressed in this assessment, the remaining indicators should be analyzed on an ongoing basis using program tracking data. As we address the indicators in the remainder of this section, we will repeat rows from Table 1-5 to signify the indicator we are currently addressing.

The program tracking data is currently maintained in separate systems by each utility. In the future under a Market Manager it should be much more centralized. The program tracking data provided to the evaluation team does not permit analyzing many of the indicators shown in the following table that depend on program tracking data. However, we present a summary of the data that we do have.

1.2.2 Update of Current Indicators

Customer Awareness/Attitudes

Topic	Performance Indicator	General Source	Data Presented Here?
Awareness/Attitudes	% of customers aware of benefits of efficient equipment and quality installations.	Participants survey	Y

Of those customers that participated in the NJ Clean Energy Programs, about 80% knew that high efficiency units were available prior to purchasing their new units. An even higher 87% said they had requested information on high efficiency equipment. For those who did not request it, the main reasons were:

- They had educated themselves already
- The contractor was already providing that information.

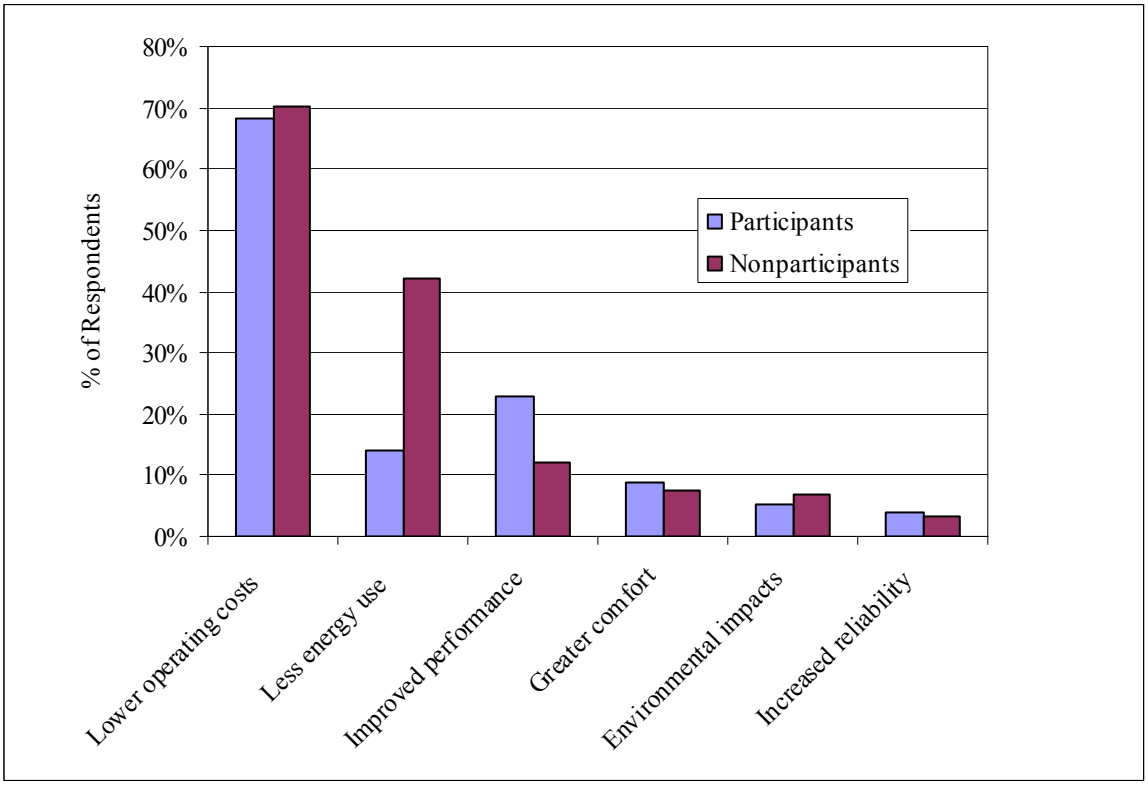
In contrast only two-thirds of nonparticipant respondents (65%) reported that prior to shopping for their new HVAC units they knew that high efficiency models of their specific unit types were available. In

addition, only half of respondents (49%) reported that they had requested information regarding high efficiency units from their installation contractor. The most common reasons provided by those who did not request information regarding high efficiency unit types included:

- Not convinced that operating costs would be lower (nine respondents)
- Perception that high efficiency units were unavailable (nine respondents)
- First/incremental cost concerns (four respondents)

The primary benefit that participants mentioned regarding high efficiency is lower operating costs (68% of the responses). Improved performance was mentioned close to 18% of the time, while comfort, reliability, and environmental benefits are seldom mentioned (Figure 1-2).

Figure 1-2. Benefits of High Efficiency Equipment

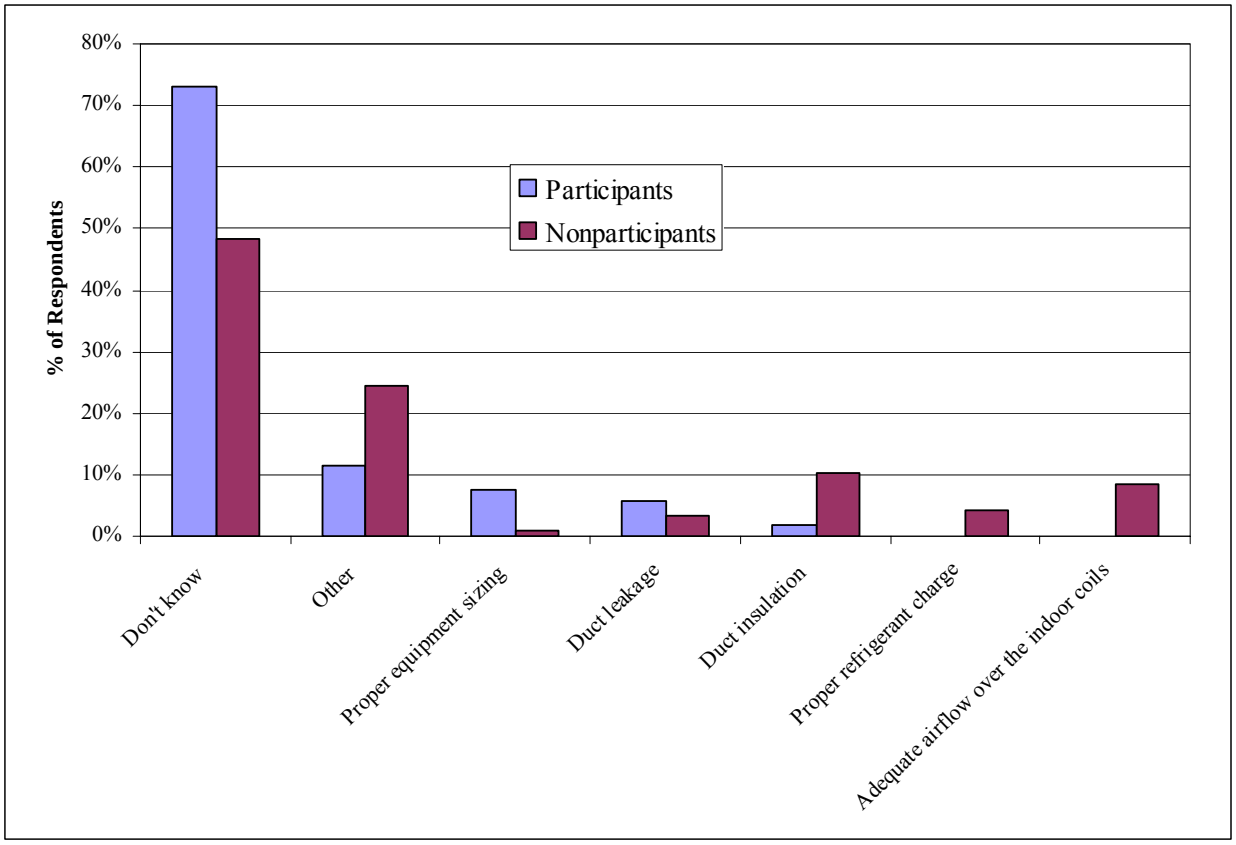


Source: HVAC Program Participant survey respondents; n = 78. HVAC Program Nonparticipant survey respondents; n = 157.

Although most participants knew about high efficiency equipment, most participants did not know how the efficiency of this equipment is measured. More than 50% of the participants were not aware of how efficiency of this equipment was measured. More than 25% of the participants were familiar with SEER and less were familiar with AFUE. Likewise, 89% of nonparticipant respondents reported that they did not know how HVAC equipment efficiency levels are measured.

Participants were asked what other factors affect the performance of their heating and cooling systems, in addition to installing high efficiency. Most (73%) do not know or were unsure. The 14 responses from those who had answers are provided in Figure 1-3 below.

Figure 1-3. Additional Factors Affecting Performance



Source: HVAC Program Participant survey respondents; n = 52. HVAC Program Nonparticipant survey respondents; n = 118.

Other responses include:

- The house's insulation, windows, doors.
- The thermostat setting. A variable speed motor.
- Size of house.

Nonparticipant respondents had limited knowledge of what other factors, in addition to efficiency level, could affect the performance of their HVAC systems. More than half of the respondents did not answer this question; however, of those who did, the most commonly cited other factors included:

- Duct insulation (10%)
- Adequate airflow over the indoor coils (8.5%)
- Proper refrigerant charge (4.2%)
- Duct leakage (3.4%)

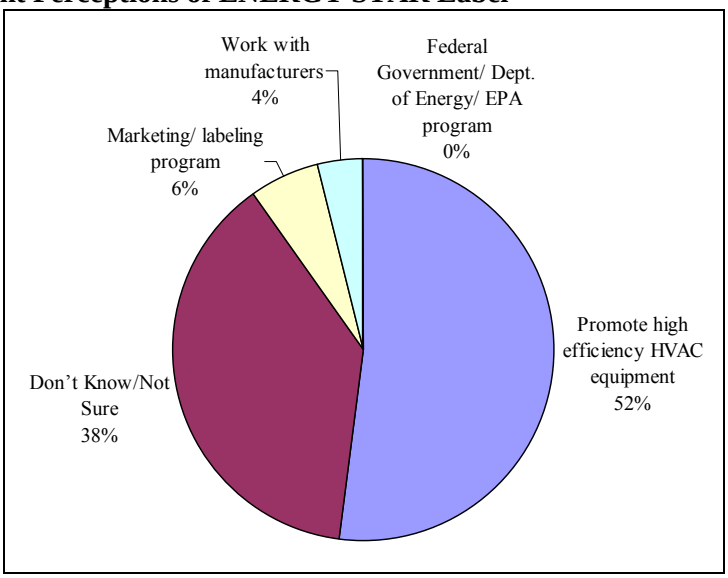
Energy Star Awareness

Most participants (62%) had heard of the ENERGY STAR Program (for air conditioners, gas furnaces, or gas boilers). That group was asked to put in their own words what the ENERGY STAR Program does.

The most common association with the ENERGY STAR Program is that it promotes high efficiency HVAC equipment (Figure 1-4).

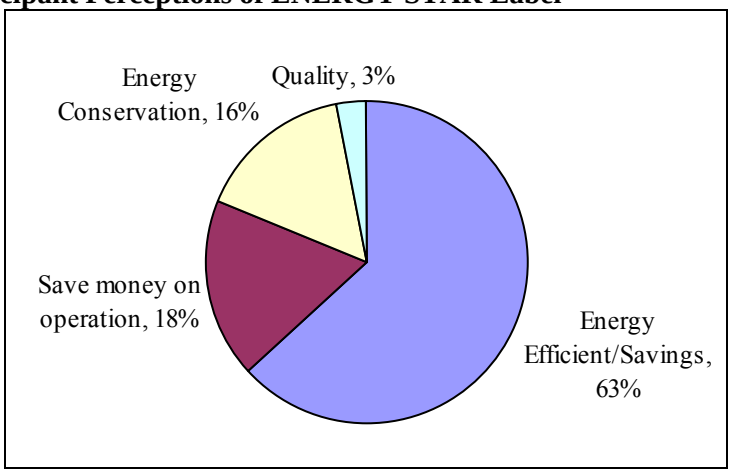
More than three-quarters of nonparticipants (78%) reported that they had seen or heard of the Energy Guide label. In addition, more than half of nonparticipants (60%) reported that they had seen or heard of the ENERGY STAR label. When asked what the ENERGY STAR label means to them, respondents most commonly selected "energy-efficient/savings" followed by "save money on operation" and "energy conservation" (Figure 1-5).

Figure 1-4. Participant Perceptions of ENERGY STAR Label



Source: HVAC Program Participant survey respondents; n = 52.

Figure 1-5. Nonparticipant Perceptions of ENERGY STAR Label



Source: HVAC Nonparticipant survey respondents; n = 123. Note other response categories were selected by less than 5% of respondents.

Twenty-three nonparticipant respondents (14%) reported that they were familiar with the New Jersey Clean Energy Programs with the Residential Electric and Gas HVAC Program being mentioned most often (22% of respondents) followed by Home Energy Analysis (9%) and the ENERGY STAR Products Program (4%). Four of the 23 respondents (17%) reported that they had participated in a New Jersey

Clean Energy Program; however, only two of these respondents provided the program name with both stating they had participated in the Residential Electric and Gas HVAC Program. None of the respondents reported that they were currently living in an ENERGY STAR-labeled home.

Contractor Awareness/Attitudes

Topic	Performance Indicator	General Source	Data Presented Here?
Awareness/Attitudes	% of contractors using and/or aware of benefits and key elements of efficient equipment and quality installations.	Contractor survey	Y

Almost all (91%) of the participating contractors surveyed were aware of the ENERGY STAR standards for residential HVAC equipment prior to the survey. Slightly less than half (46%) use the ENERGY STAR label as a selling point for high efficiency HVAC equipment. The contractors that don't use the ENERGY STAR label as a selling point commented that generally it has little meaning to customers and little meaning in the marketplace.

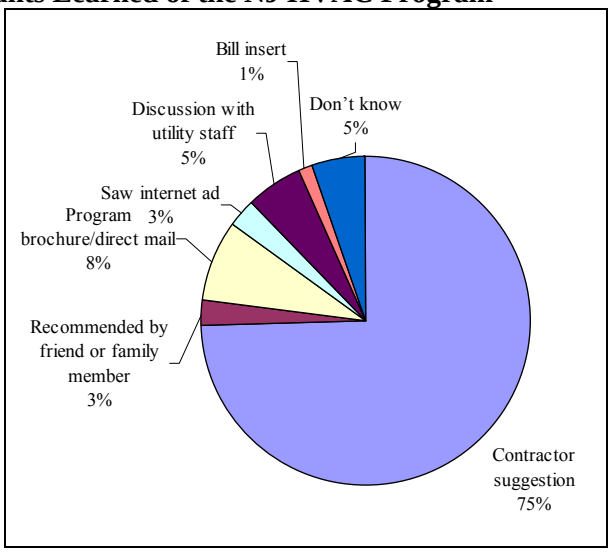
In contrast more than two-thirds (69%) of the nonparticipating contractors surveyed were aware of the ENERGY STAR standards for residential HVAC equipment prior to the survey. Of the nonparticipant contractors surveyed, more than half (57%) correctly identified ENERGY STAR as relating to equipment energy efficiency standards. Slightly less than one-third (30%) of nonparticipating contractors use the ENERGY STAR label as a selling point for high efficiency HVAC equipment. The nonparticipating contractors that don't use the ENERGY STAR label as a selling point agreed with the participating contractors that ENERGY STAR generally has little meaning to customers and little meaning in the marketplace.

Participant Satisfaction

Topic	Performance Indicator	General Source	Data Presented Here?
Participant satisfaction	Satisfaction with program among participants.	Participant surveys	Y

Most participants (73%) found out about the rebate program through their contractor (Figure 1-6). None of the customers learned about the rebate program through radio, TV, or newspaper ads.

Figure 1-6. How Participants Learned of the NJ HVAC Program



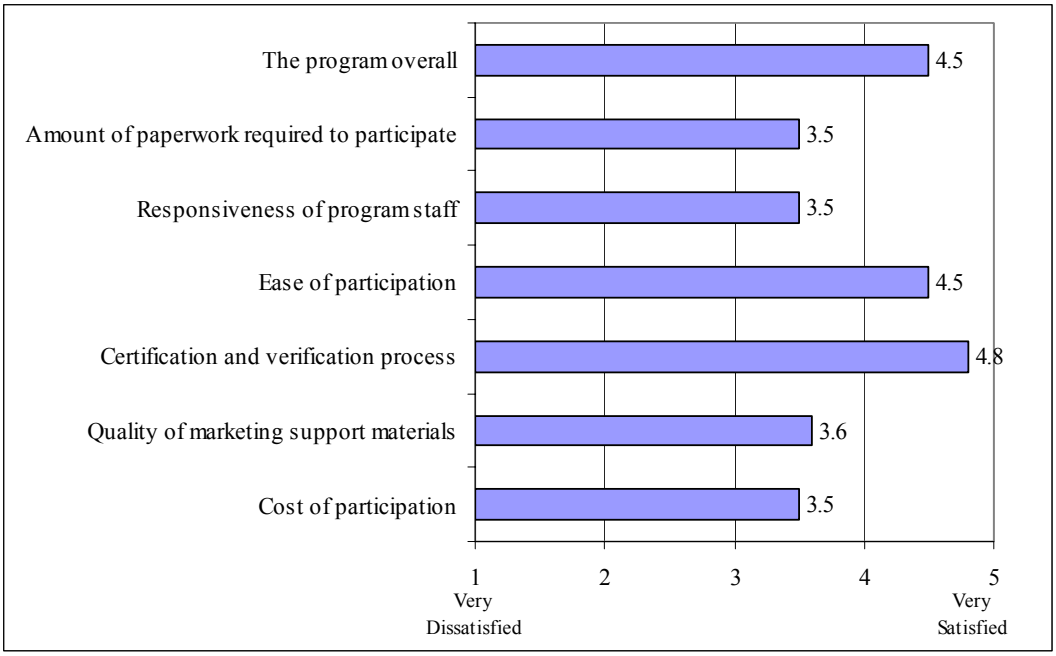
Source: HVAC Program Participant survey respondents; n = 76.

Overall participant satisfaction with the rebate program was quite high. On a 1-5 scale, where 1 means "very dissatisfied" and 5 means "very satisfied", the mean response was 4.5. While most (78%) said that there were no specific problems with the program, the 22% that felt there are specific problems mention some noteworthy issues. Their verbatim comments include the following:

- The contractor quoted one price and one rebate amount and at the end neither matched up.
- I want to know what happened with the rebate, because I never received it.
- It seemed to me that they rushed the job.
- The installation price was higher than the quote like the contractor was trying to take advantage of an older citizen.
- It seemed as if PSE&G weren't very communicative with the vendor since they had to discuss my rebate several times before I actually got it. For a while, it looked like I wasn't going to get one, but eventually, I did.
- The utility had lost my rebate application.
- There's no rebate given on windows.
- I had to send in the forms 3 times. Each time I sent in the exact same paper work. On the 3rd time, they accepted it.

Customers were asked to rate their level of satisfaction with each of the following aspects of the New Jersey Residential HVAC Program (Figure 1-7), also on 1-5 scale, where 1 means "very dissatisfied" and 5 means "very satisfied". There are no program elements that customers find particularly difficult.

Figure 1-7. Participant Program Satisfaction



Source: HVAC Program Participant survey respondents; n = 78.

The primary benefit that customers feel they received from participating in the program is that it helped in the purchase and installation of efficient equipment (Table 1-6).

Table 1-6. Benefits of Participating in the Rebate Program

Benefits	% of Respondents
Purchase/installation of efficient equipment	49%
Other	34%
Don't know	14%
Correct equipment sizing	3%
Proper airflow over the indoor coils	0%
Duct leakage measurement	0%
Proper refrigerant charge	0%

Source: HVAC Program Participant survey respondents; n = 77.

Most participants who responded as "Other" indicated that the rebate check was a major benefit of participating in the program.

Other responses:

- The rebate check. (Most common.)
- It helped me ask more questions of the contractor.

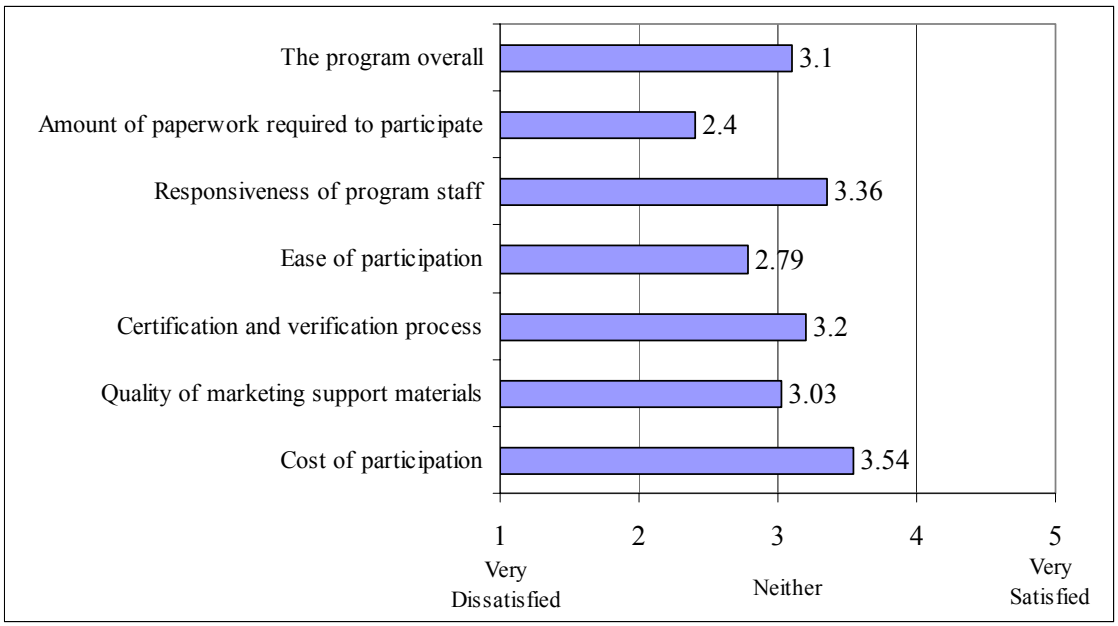
Almost 91% of the customers said that, if they hadn't participated in the program, they still would have installed a high efficiency unit. Only 3 customers were unsure about this. Among the few that said they wouldn't have installed a high efficiency unit anyway, four out of four said it was because of high costs.

Contractor Satisfaction

Topic	Performance Indicator	General Source	Data Presented Here?
Contractor satisfaction	Satisfaction with program among participating contractors.	Contractor surveys	Y

Participating contractors were asked to rate their satisfaction level, on a scale of 1-5 with 1 being very dissatisfied and 5 being very satisfied, with various aspects of the rebate programs, including cost of participation, quality of support, etc. The results (Figure 1-8) support some of earlier findings. The amount of paperwork required to participate and ease of participation get the lowest satisfaction ratings.

Figure 1-8. Contractor Satisfaction with the HVAC Program



Source: HVAC Program Participant Contractor respondents; n = 70.

The greatest satisfaction level was given to cost of participation. Many contractors are unaware of any costs associated with participating in the program.

Although the contractors are slightly satisfied with the program on average 80% of the contractors (55 out of 69 responses) indicated that there are specific problems related to the rebate program. They were then asked to give verbatim comments to explain the most prominent problems. The comments, which tell a lot about contractors' frustration with the Program, include the following verbatim quotes:

- The utilities often lose the applications.
- None of the rebate staff have any practical field experience or information. They are "by-the-book" only.
- The rebate forms are extremely complex and there are lots of hoops to participate.
- The staff people don't seem educated. They ask for information they already have, and ask for a ridiculous amount of information.

- 30% of time they lose paperwork.
- Takes forever to get check.
- None of my manufacturers are listed in ARI.
- The utility nit-picks the rebate applications, then rejects them.
- Most contractors want the rebates to go away. If the rebate is rejected by utility, it is very bad for the contractor. And there is no communication with the contractor.
- The SEER ratings don't match with the EER.
- I lose jobs because of Manual J. Customers like over-sized systems.
- The AC rebate is too complex, and we wait too long for the checks.
- They have cut out the kickback to the contractor.

Though these comments are varied, the most commonly mentioned points refer to the paperwork being too complicated, the checks taking too long to be delivered to the customers, and the confusion with the utility staff (lost paperwork was mentioned 5-6 times).

Moreover, the rebate program for heating equipment was seen in a much more favorable light. Contractors are much more content with the gas rebates offered by program.

Furthermore, contractor satisfaction seemed to vary by the utility in whose territory they work. Of all the New Jersey utilities, PSE&G received the most complaints from contractors, especially regarding the air conditioning program.

Contractors responded more positively when asked how effective they think the New Jersey Residential HVAC Program has been at stimulating the market for high efficiency equipment. Using a 1-5 scale, with 1 being very effective, and 5 being very ineffective, the mean response is 1.56, almost midway between somewhat and very effective. The verbatim comments provided shed light on why the contractors rated the program positively and negatively:

<u>Positive Comments</u>

- The rebate helps educate people.
- The money gets their attention.
- Increases my sales a lot.
- Money always entices.

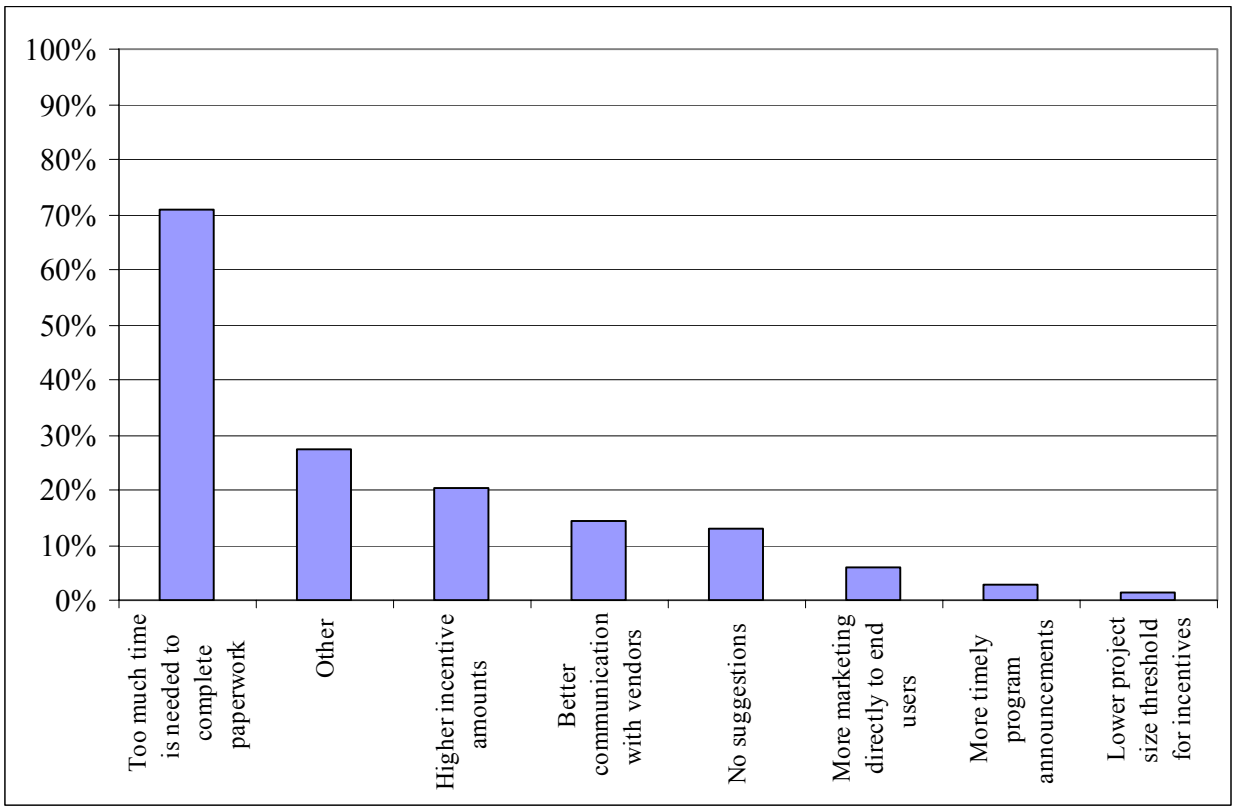
<u>Negative Comments</u>

- Rebates are not high enough.
- The rebate is not sufficient to inspire change.
- Most customers already want efficient equipment.
- Most contractors don't use rebate because of paperwork.
- Fuel savings is more valuable to customer than rebate.

- Rebate is not a factor. 99% already want 14 SEER.
- Money is good, but not if the checks never arrive.

Contractors were asked what aspects of the rebate programs, if any, should be changed. They were not prompted with a specific list of changes. Many suggested more than one change. The results are shown in Figure 1-9.

Figure 1-9. Contractors: Recommended Changes to the Program



Source: HVAC Program Participant Contractor respondents; n = 70.

Again, the amount of paperwork was far and away the most commonly cited aspect of the rebate program that should be changed. Increasing the incentive amounts was also cited somewhat frequently.

Contractors that had "other" comments made useful suggestions:

- Speed up check delivery time. (This was mentioned many times.)
- It would be good to be able to track rebates… put it online. (Putting the program online was mentioned several times.)
- Once a contractor qualifies with good track record, reduce requirements and paperwork.
- Drop the EER rating, and only use SEER.
- Insulation should be included (in the rebate program).
- Bring program back to new construction.

- Give contractors a cut.

The respondents were then asked if they have any additional comments, which drew out more useful suggestions and comments:

- I have to tell my customers there is no guarantee they'll get the rebate check and that it is their risk.
- If you reject a rebate, you should let the contractor know.
- The retrofit jobs are tough because the ductwork raises the cost a lot.
- Sometimes I have to pay a customer out of my pocket (when the check does not show up from the utility), and they end up doubting me, but I still like the program.
- Tell contractor about rejected rebate first (not at the same time as telling customer)! Also, utility says it'll be a couple weeks for check to arrive, but it is really a couple months.
- 95% of builders do not want high efficiency.
- There needs to be a focus on insulation.
- We need licensing in this industry. We can't let the few rotten apples spoil the industry.
- The coils mismatch on the AC rebate.
- The rebate with Carrier is much simpler.
- Market program much more, get the word out! Take the focus off servicing equipment and on to how they can buy down new equipment.
- Would be good to educate builders.
- Most competitors do not use the rebate because of extensive paperwork.
- AC is not used enough to recover savings, especially for 14-15 SEER.
- Utility staff is not up to date on equipment specs. I requested 50 forms, and only received 1, and must call numerous times to get more forms.
- The rebate program is a pain in the neck! The staff has weak understanding of the program and communicates poorly. Too long a wait for checks.

Market Share Monitoring

Topic	Performance Indicator	General Source	Data Presented Here?
Market share monitoring	Sales of high efficiency A/C and heat pump as % of total NJ sales if possible.	Honeywell/Contractor/Distributor/ Participant Surveys/Regional Data	Y
Market share monitoring	Sales and installation of high efficiency water heaters, furnaces, and boilers as % of total NJ sales of these products if possible.	Honeywell/Contractor/Distributor/ Participant Surveys/Regional Data	Y

Detailed results that address these two indicators are presented later in this report in Section 1.3.1 of the Market Share Assessment.

Incremental Equipment Costs

Topic	Performance Indicator	General Source	Data Presented Here?
Incremental cost (long term impact)	Incremental costs of high efficiency water heaters, furnaces, and boilers relative to standard equipment.	Participant, contractor, and distributor surveys supplemented by secondary data sources.	Y

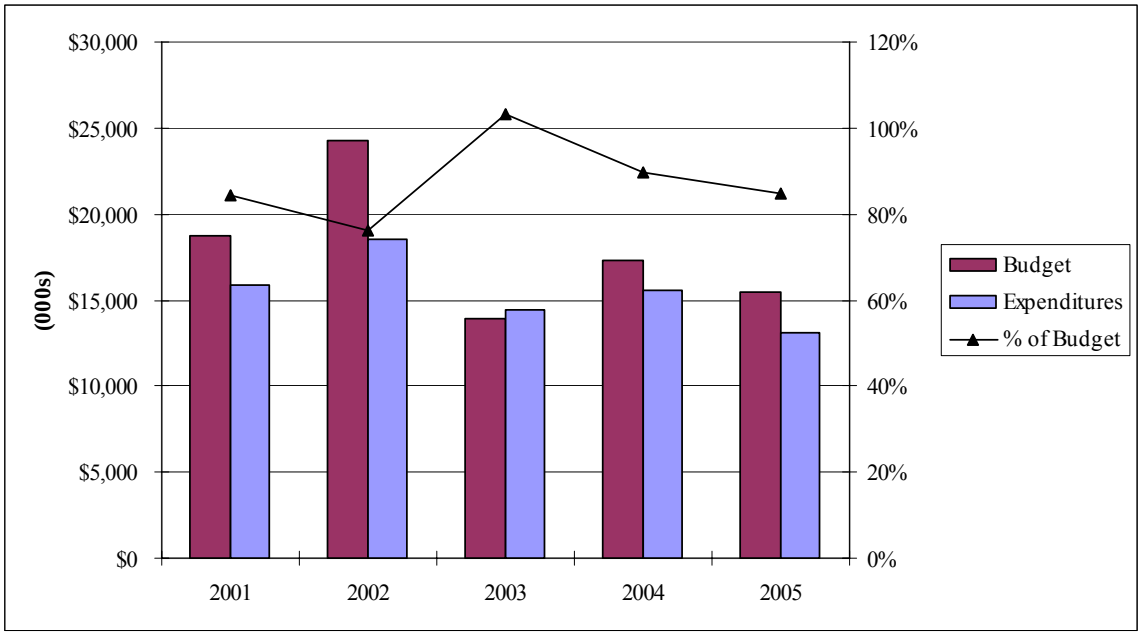
Detailed results that address this indicator are presented later in this report in Section 1.5: Incremental Cost Assessment.

Program Tracking Data

This section will present summary data based on the program tracking data provided to the evaluation or available in public reports.

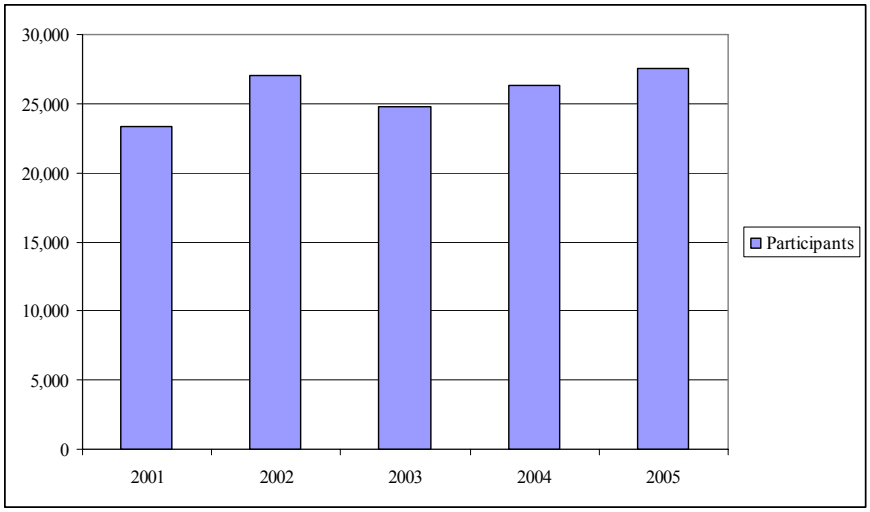
The program's ability to spend their allocated budget is a useful indicator of program management, staffing, and program targeting. Since 2001, the Residential HVAC Program has underspent its budget each year except 2003 (Figure 1-10). Underspending was modest in 2004. Although expenditures declined in 2005, the number of participants increased (Figure 1-11). In 2005 the marketing budget was reduced; the increase in participants is most likely due to market momentum.

Figure 1-10. Residential HVAC Program Budgeted and Actual Expenditures



Source: Program Quarterly Reports

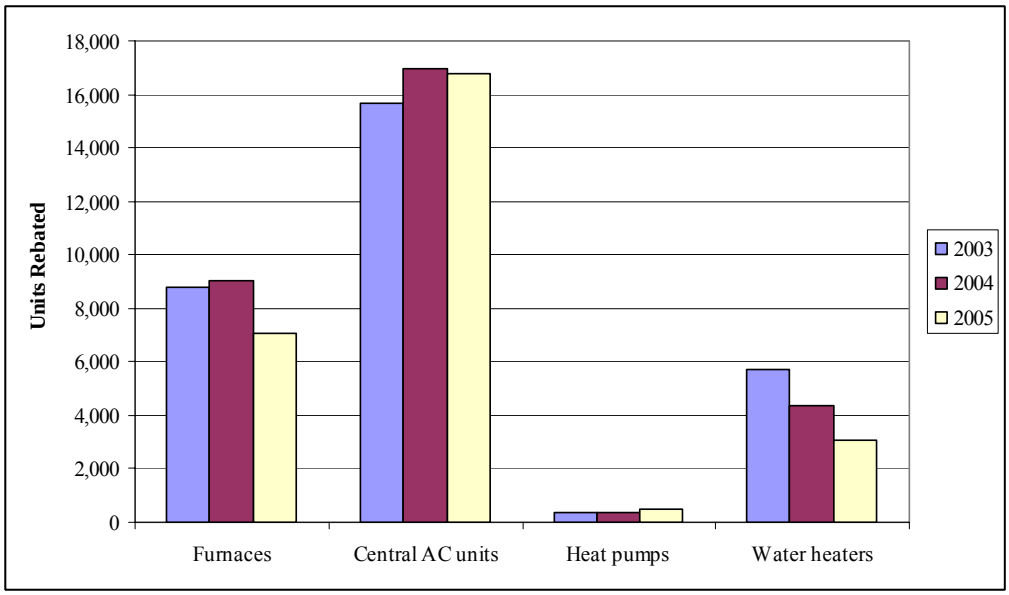
Figure 1-11. Residential HVAC Program Number of Participants



Source: Program Quarterly Reports

The distribution of program measures across measure types provides an indication of how dependent the program is on particular technologies. Central AC measures have been by far the most common measures (Figure 1-12).

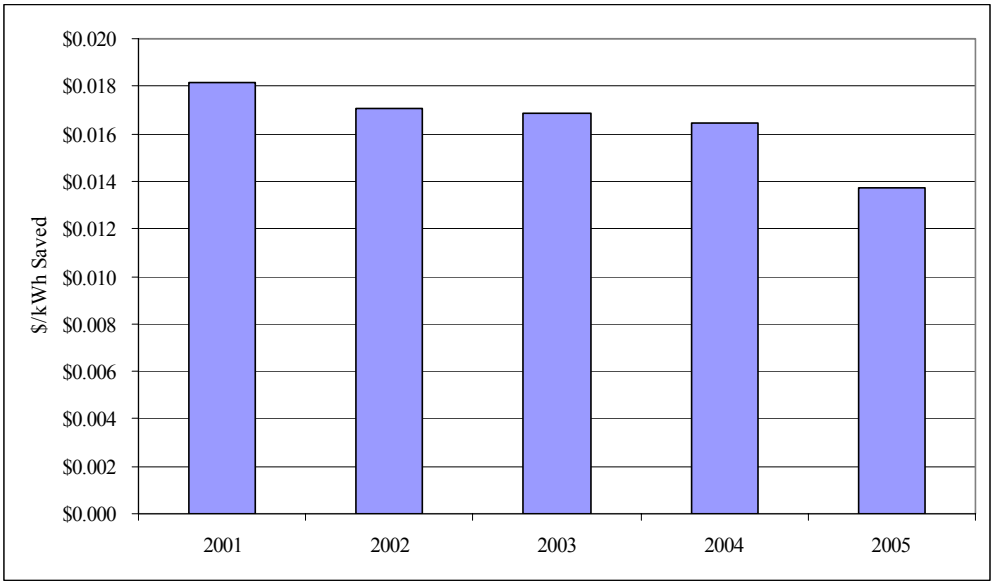
Figure 1-12. Total Measures Installed by Measure Type



Source: Clean Energy Program Annual Reports. The 2005 data is from utility databases.

Cost of conserved energy is often used as a metric for evaluating the success of a program. Using a simple formula of dividing annual program savings by total lifetime energy saved (including converting gas savings to kWh) indicates that the Residential HVAC Program's cost of conserved energy has been between 1.4 cents/kWh and 1.8 cents/kWh (Figure 1-13).

Figure 1-13. Residential HVAC Program Cost of Conserved Energy



Source: CEP Annual Report, actual program spending divided by lifetime energy saved (converting Dtherms to kWh).[4]

Estimated Program Energy Savings

For the program year ending December 31, 2005, the Residential HVAC Program reported total annual installed savings of 12,729 kW, 15,021 MWh, and 138,959 DTh. Actual expenditures represented 85% of budgeted expenditures. There were no official kWh and Therm goals; rather the energy savings goal was stated as "Following approval of the above goals, energy savings will be calculated consistent with the goals."[5]

Through the fourth quarter of 2005, the Residential HVAC Program[6]:

- Trained 620 contractors through Eastern Heating & Cooling Council who received instruction in courses covering air-conditioning, air flow/charging, NATE refresher, ACCA Manual J, and ACCA Manual D. Training results are lower than the corresponding period last year, but on track to meet goals.
- Added 118 contractors to the list of NATE certified technicians and 41 technicians to the list of NATE-certified gas technicians.

[4] Total Energy $Saved_{lifetime}$ = Lifetime MWh Saved + Lifetime Dtherms Saved x 1,000,000 Btu/Dtherm / (3.413 Btu/MWh)

[5] New Jersey's Clean Energy Program 2005 Program Descriptions and Budget Utility Managed Energy Efficiency Programs Updated June 8, 2005.

[6] New Jersey's Clean Energy Program Report submitted to the New Jersey Board of Public Utilities, March 28, 2006. Reporting Period: Year-to-Date through Fourth Quarter 2005 (January 1, 2005 through December 31, 2005).

- In response to increased winter fuel costs, increased the incentives payable on qualifying high efficiency heating equipment for installations during the six month period of November 1, 2005 through April 1, 2006. The gas utilities and Eastern Heating and Cooling Council announced the September 1 launch of the new incentive via mailings, as well as a website announcement.
- Announced the elimination of rebates for 13 SEER central air conditioners and heat pumps installed after December 31, 2005 due to the increase of the federal efficiency standard. A mailing was sent to the contractor database and information was posted to the website.
- Posted information on the website to explain the impact of the new federal energy efficiency standard to consumers.
- Continued with industry and contractor outreach.

Statewide participation for the Residential HVAC Program through the fourth quarter of 2005 was 27,510. This means that between January 1, 2005 and December 31, 2005, participating program managers paid rebates for the installation of 27,510 high efficiency central air conditioners, heat pumps, and ENERGY STAR qualifying furnaces and hot water boilers.

Table 1-7 compares the 2005 program goals to the actual program results. The program exceeded most of the quantitative goals, except for the NATE certification. The reduction in program marketing and outreach budgets may have caused the program to fall short of this goal. Table 1-8 shows the trends in the goals over the past 3 years. The effect of the reduction in marketing budget can be seen in the declining numbers for Manual J training, NATE certification, and sales training. The market share numbers will be discussed in Section 1.3.

Table 1-7. Residential HVAC Program 2005 Goals – Target vs. Actual

Goal	Target	Actual	% of Goal
Rebates Processed	25,500	27,510	108%
Train HVAC Technicians on Manual J	500	620	124%
NATE Certified	200	159	80%

Source: Program Annual and Quarterly Reports

Table 1-8. Residential HVAC Program Achievements 2003-2005

Goals	2003	2004	2005
Rebates Processed	24,786	26,345	27,510
Train HVAC Technicians on Manual J	1244	1103	620
NATE Certified	427	126	159
Fraction of CAC Buyers that Know High Efficiency Benefits	15%*	n/a	65%
HVAC Sales Training	172	21	0
Fraction of Furnace Buyers that Know High Efficiency Benefits	15%*	n/a	65%

Source: Program Annual and Quarterly Reports; * indicates program goal not actual results.

This evaluation included on-site assessments at 10 sites to review measure installations, look for missed opportunities, and examine the appropriateness of the protocols for calculating energy impacts. The calculation of energy savings is well documented in the protocols[7], which are fully reviewed in Section 1.4.3. During the on-site visits, the investigators looked for discrepancies between the protocol assumptions, program documentation, and what was actually found at the site. At 20% of the sites we found that the SEER ratings of the central AC were slightly lower than what was recorded in the program tracking database (13.5 SEER versus 14 SEER and 13 SEER versus 13.5 SEER). About 90% of the ducts were considered well sealed or average sealed. The ducts are run through unconditioned space about 90% of the time and 50% of these ducts are not insulated. The uninsulated ducts in unconditioned space may be impacting the energy savings from the central AC installations.

1.2.3 Recommendations for Appropriate Indicators

Based upon our review of the indicators and the achievements of the program, we recommended the performance indicators in Table 1-4 for tracking program performance. These indicators are listed beginning with indicators that should be tracked through the program tracking database and ending with indicators that should be tracked by evaluation efforts.

1.3 Market Share Assessment

This section addresses changes in the overall market for energy efficiency products and services in New Jersey and the market share of energy efficiency equipment. This section will begin with a discussion of the market penetration for energy-efficient equipment and the market for energy-efficient technologies in New Jersey. This section also includes how the New Jersey Residential HVAC Program compares to similar programs other states.

1.3.1 Where Do the Programs Stand?

Market share was estimated by surveying key market actors (participating contractors, nonparticipating contractors, and distributors). Each of these market actors was asked what percent of their sales by equipment type were high efficiency. For example, participating contractors were asked what percent of their sales of furnaces have an AFUE greater than 90%. The findings from these surveys are presented below.

The participating HVAC contractors were asked about new equipment types and the levels of efficiency typically installed in both existing homes and new construction sites. The results, shown in Table 1-9, below, show that the equipment used in retrofit projects does not significantly vary from equipment used in new construction.

[7] *New Jersey Clean Energy Collaborative: Protocols to Measure Resource Savings, September 2004 (NJCEP).*

Table 1-9. Participating Contractors: Market Share

Type of Equipment	Efficiency Level	(%) Retrofit Projects	(%) New Construction
Central Air	SEER 13	27%	25%
Central Air	SEER 14	44%	38%
Central Air	SEER 15	4%	7%
Air-Source Heat Pump	SEER 13	0%	30%*
Air-Source Heat Pump	SEER 14	60%*	70%
Air-Source Heat Pump	SEER 15	20%*	n/a
Gas Furnace	AFUE ≥90%	71%	77%
Gas Boilers	AFUE ≥85%	39%	29%
Gas Water Heaters	≥0.62 Energy Factor	n/a	n/a

* Denotes there is only one response.
n/a = no response.

The data shown above suggest that efficient gas furnaces are typically installed slightly more frequently in retrofit projects (75%) compared to new construction (70%). The same is true for SEER 14 central air-conditioners (44% compared to 38%). High efficiency gas boilers also follow this pattern; high efficiency gas boilers are installed more frequently in retrofit projects (39%) compared to new construction projects (29%). SEER 15 air-conditioners are seldom installed in either market. The data points for air-source heat pumps are too few to be significant (only one response per SEER level).

The nonparticipating HVAC contractors were also asked about new equipment types and the levels of efficiency typically installed in both existing homes and new construction sites. The results, shown in Table 1-10 below, show that the equipment used in retrofit projects does not significantly vary from equipment used in new construction.

Table 1-10. Nonparticipating Contractors: Market Share

Type of Equipment	Efficiency Level	(%) Retrofit Projects	(%) New Construction
Central Air	SEER 13	39%	36%
Central Air	SEER 14	21%	11%
Central Air	SEER 15	5%	4%
Air-Source Heat Pump	SEER 13	0%	50%*
Air-Source Heat Pump	SEER 14	100%*	50%*
Air-Source Heat Pump	SEER 15	0%	0%
Gas Furnace	AFUE ≥90%	41%	45%
Gas Boilers	AFUE ≥85%	33%	19%
Gas Water Heaters	≥0.62 Energy Factor	5%	35%

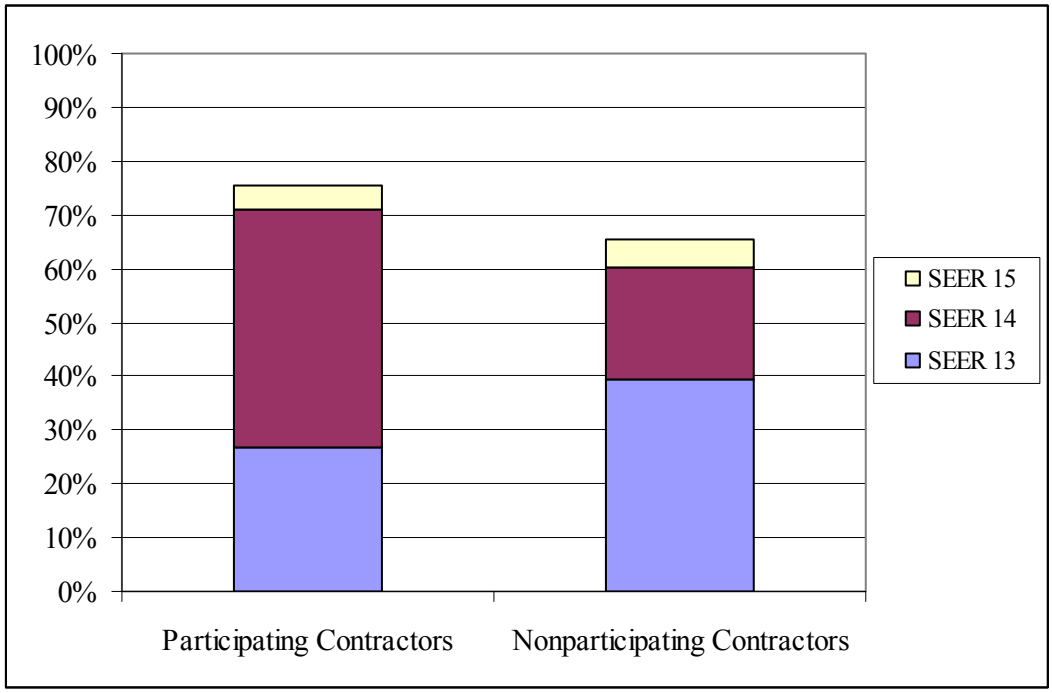
* Denotes there is only one response.

The data shown above shows that the market for SEER 13 central AC has become transformed. This is consistent with the recent change in Federal Minimum Appliance Standards with make 13 SEER the minimum efficiency level for central air conditioners. More than half of the units installed by nonparticipating contractors were SEER 13 units. The market for 90% AFUE gas furnaces is being transformed and the incentives should be shifted to the high AFUE units. There were not enough air-source heat pump installations reported by the nonparticipant to draw any conclusions about the transformation of that market.

Figure 1-14 and Figure 1-15 show how the market share of high efficiency central air conditioning installations compares for participating contractors versus nonparticipating contractors. Figure 1-14 shows this market share comparison for retrofit projects and Figure 1-15 shows this market share comparison for new construction projects. Participating contractors install high efficiency central air conditioning in retrofit projects at 75% of their installations, including projects not participating in the program. In contrast, nonparticipating contractors install high efficiency central air conditioning in retrofit projects at 65% of their installations. The results are similar for new construction. Participating contractors install high efficiency central air conditioning at 70% of all of their new construction projects and nonparticipating contractors only install high efficiency central air conditioning at 51% of all of their new construction projects. The market share data reported by the contractors in this study is also supported by the 73% market share for high efficiency CAC reported by the distributors who responded to the surveys.

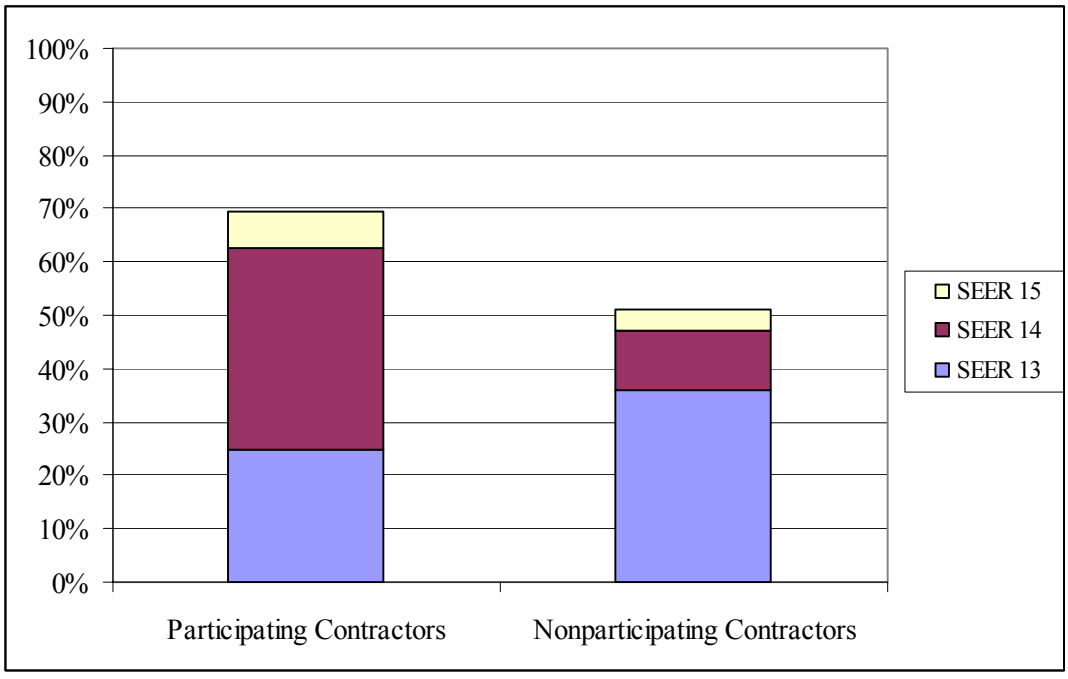
As stated above the market for 13 SEER units has been transformed and is now the minimum efficiency for central air conditioning. However, given the recent change in the federal standard the market share for high efficiency central air conditioning will drop as 13 SEER units no longer count. As Figure 1-14 and Figure 1-15 show the market share for units with efficiency greater than 13 SEER for participating contractors based on our research is about 50% for retrofit project and about 45% for new construction projects. Likewise the market share for units with efficiency greater than 13 SEER for nonparticipating contractors based on our research is about 25% for retrofit project and about 15% for new construction projects. The market will have to catch up to the change in federal minimum efficiency standard and the resulting higher efficiency tier levels.

Figure 1-14. Market Share Comparison – Retrofit Projects



Source: HVAC Program Participant Contractor respondents; n = 66. HVAC Program Nonparticipant Contractor respondents; n = 17.

Figure 1-15. Market Share Comparison – New Construction Projects



Source: HVAC Program Participant Contractor respondents; n = 37. HVAC Program Nonparticipant Contractor respondents; n = 10.

One of the most notable results of these surveys is the difference in market share by SEER level. It appears that the program is significantly influencing the efficiency of the central air conditioning units

that the participating contractors are purchasing. For both retrofit and new construction projects, nonparticipating contractors tend towards the lower end of the high efficiency market (13 SEER units), while participating contractors are purchasing the relatively higher efficiency (14 SEER units).

Table 1-11. Central Air Conditioning Market Share Comparison by SEER Level

	Retrofit		New Construction		Weighted Average[8]	
	Participating Contractors	Nonparticipating Contractors	Participating Contractors	Non participating Contractors	Participating Contractors	Non participating Contractors
SEER 13	27%	39%	25%	36%	26%	38%
SEER 14	44%	21%	38%	11%	42%	19%
SEER 15	4%	5%	7%	4%	5%	5%
Totals	**75%**	**65%**	**69%**	**51%**	**73%**	**62%**

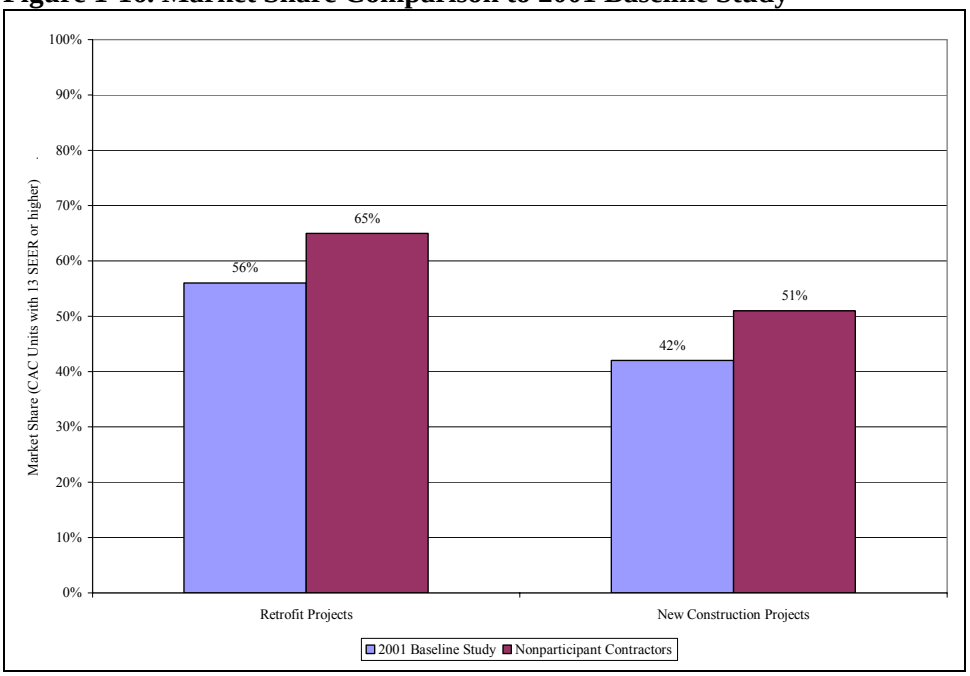
Source: HVAC Program Participant Contractor respondents; n = 66 Retrofit, 37 New Construction. HVAC Program Nonparticipant Contractor respondents; n = 17 Retrofit, 10 New Construction.

As expected, the market share for high efficiency CAC has increased since the 2001 Baseline Study. The 2001 Baseline Study found that the market share for central air conditioning units with SEER 13 or greater was 56% for retrofit projects and 42% for new construction projects.[9] At the time of the Baseline Study it appeared that the contactors had significantly over-reported their market share; however, the nonparticipating market share data corroborates those findings. We compare the 2001 Baseline Study results to the nonparticipants' results to provide the most conservative estimate of market share increases. This corresponds to an increase in market share of 9% since 2001 for retrofit projects and an increase in market share of 9% for new construction projects as reported by nonparticipating contractors. This represents an annualized increase in market share of 1.8% for retrofit projects and 1.8% for new construction projects. Figure 1-16 presents this comparison.

[8] Participating contractors perform 68% of their HVAC installations in existing homes and 32% of these installations in new homes. Nonparticipating contractors perform 79% of their HVAC installations in existing homes and 21% of these installation in new homes

[9] Xenergy, "New Jersey Residential HVAC Baseline Study", (Xenergy, Washington, D.C., November 16, 2001), p. 3-9.

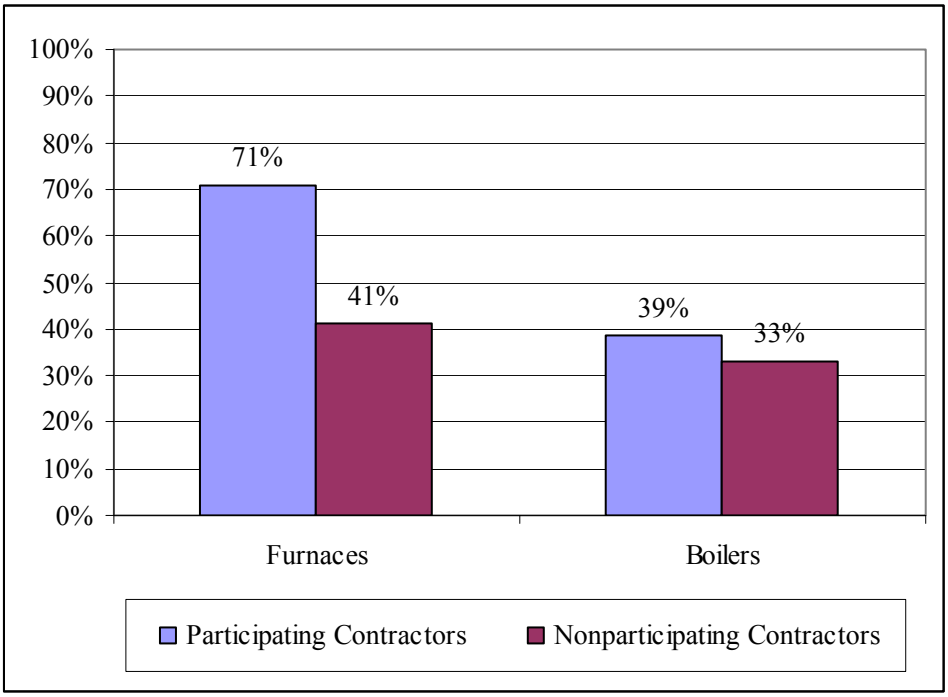
Figure 1-16. Market Share Comparison to 2001 Baseline Study



Source: 2001 Residential HVAC Baseline Study and HVAC Program Nonparticipant Contractor respondents.

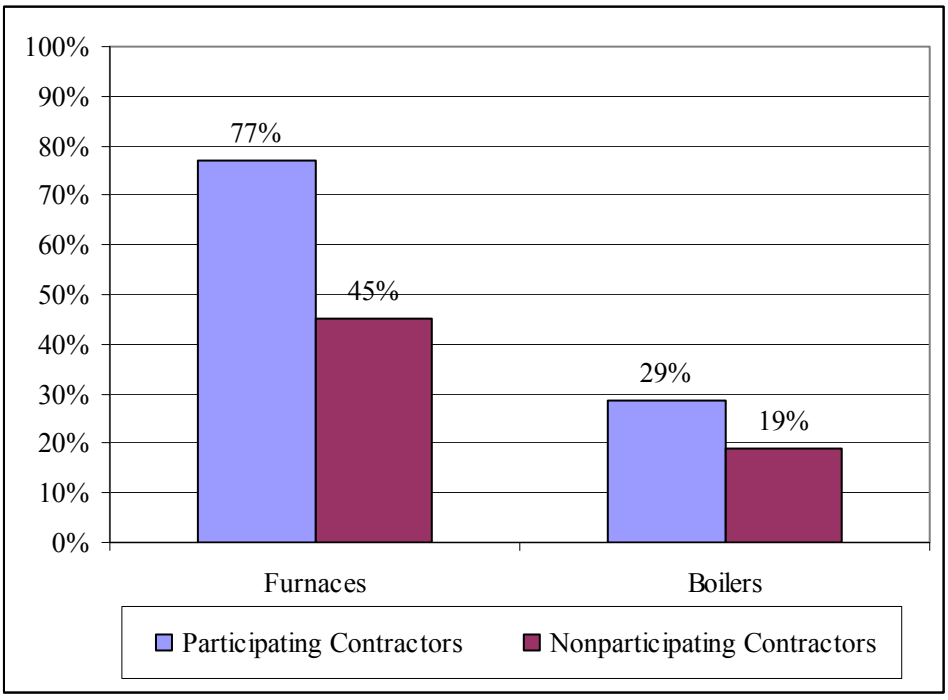
The program seems to be having more success getting contractors to install high efficiency furnaces (AFUE ≥ 90%) than high efficiency boilers (AFUE ≥ 85%). The market share for high efficiency furnaces according to participating contractors is 71% for retrofit projects and 77% for new construction projects. The surveyed participating contractors indicated that they did 68% of their HVAC installations in existing homes and 32% of their HVAC installations in new homes. Using these installation figures, the weighted average market share for high efficiency furnaces by participating contractors is 73%. The market share for high efficiency boilers according to participating contractors is 39% for retrofit projects and 29% for new construction projects. Using the same installation proportions as for furnaces, the weighted average market share for high efficiency boilers by participating contractors is 36%. Figure 1-17 and Figure 1-18 present these findings.

Figure 1-17. High Efficiency Furnace and Boiler Market Share Comparison – Retrofit



Source: HVAC Program Participant Contractor respondents; n = 66 Furnaces, n = 30 Boilers. HVAC Program Nonparticipant Contractor respondents; n = 17 Furnaces, n = 24 Boilers.

Figure 1-18. High Efficiency Furnace and Boiler Market Share Comparison – New Construction



Source: HVAC Program Participant Contractor respondents; n = 34 Furnaces, n = 25 Boilers. HVAC Program Nonparticipant Contractor respondents; n = 10 Furnaces, n = 14 Boilers.

The 2001 Baseline Study found the market share for high efficiency furnaces was 42% for existing homes and 27% for new homes.[10] In our study the nonparticipant responses provide the best comparison to the overall market. Considering the nonparticipant responses only, in new construction projects the market share for furnaces has significantly increased (27% to 45%); however, for retrofit projects the market share for high efficiency furnaces has remained the same (41%). The surveyed nonparticipant contractors indicated that they did 79% of their HVAC installations in existing homes and 21% of their HVAC installations in new homes. Using these installation figures, the weighted average market share for high efficiency furnaces by nonparticipating contractors is 42%. Again considering the nonparticipant responses only, the market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.

The results of the distributor surveys support the findings from the participating and nonparticipating contractors' surveys (Table 1-12). The distributors estimate that the market share for high efficiency central air conditioning equipment is about 73%, which is slightly higher than expected but still within the range (51% - 75%) provided by the contractors. For high efficiency furnaces (AFUE ≥ 90%), the distributors estimate the market share to be about 56%, which again is within the range (41% - 77%) provided by the surveyed contractors. Likewise for high efficiency boilers (AFUE ≥ 85%), the distributors estimate the market share to be about 29%, which again is within the range (19% - 39%) provided by the surveyed contractors.

Table 1-12. Distributors: Market Share

Type of Equipment	Efficiency Level	% of Sales
Central Air	SEER 13	66%
Central Air	SEER 14	6%
Central Air	SEER 15	1%
Air-Source Heat Pump	SEER 13	31%
Air-Source Heat Pump	SEER 14	8%
Air-Source Heat Pump	SEER 15	n/a
Gas Furnace	AFUE ≥90%	56%
Gas Boilers	AFUE ≥85%	29%

1.3.2 Benchmark Against Other States

A benchmarking study was conducted to compare selected key metrics of the New Jersey Residential HVAC Program against other residential HVAC programs across the U.S. We selected a total of four comparison programs that were similar to the New Jersey market, this included programs in Massachusetts, Connecticut, Long Island, and Iowa. Some of the key metrics for Program Year 2005,[11] summarized in Table 1-13, included:

- Annual budget
- Number of participants (incentives processed)
- Market share

[10] *Ibid.*, p. 3-9.

[11] Consortium for Energy Efficiency. ***2005Resindetial HVAC Programs National Summary***, September 2005

- Incentive types and levels
- M&V activities

Table 1-13. Comparison of NJ Residential HVAC Program to Other Residential HVAC Programs

Implementer	State	2005 Expenditures ($000s)	Participants	Expenditures Per Participant
New Jersey Utilities	NJ	$13,117	27,510	$480
MA Utilities	MA	$2,300	3,757	$610
CT Utilities	CT	$4,350	7,473	$580
LIPA	NY	$7,514	13,014	$580
MidAmerican	IA	$3,464	5,166[12]	$670

Each of these areas is discussed below in more detail.

Program size. For 2005, the NJ Residential HVAC Program had the largest budget (over $15 million) of the five programs examined.[13] The NJ program budget was almost twice the budget of the Long Island Power Authority's program, which was the next largest of this sample with a budget of about $7.5 million. New Jersey had the lowest expenditures per participant of this group at $480 spent per participant and MidAmerican spent the most per participant at $670.

Program participants. In terms of participants, the NJ program also had the largest number of this group with 27,510, which includes both air conditioning and heating equipment rebates. The Massachusetts program, Cool Smart with ENERGY STAR, had 3757 participants in 2005. For 2005, LIPA had a target of 13,000 participants, the Connecticut utilities had a target of about 7500 participants, and MidAmerican in Iowa had a target of about 5100 participants. As is shown in Table 1-13, NJ has the lowest expenditures per participant of this group. This is most likely due to the reduction in NJ's marketing and training budgets in 2005.

Market share. One of the important indicators of market transformation is the share of high efficiency HVAC sales versus the overall sale of HVAC equipment. Unfortunately the clearinghouse for HVAC sales data, Air-Conditioning and Refrigeration Institute, only provides this data to their members and restricts how the data can be used. As a result, utility programs throughout the country do not have the data to accurately determine the market share of high efficiency HVAC equipment. The best method for estimating the market share is by using the survey methods employed in this study. Market share studies of this nature were not available for the programs in this comparison group. However, based on anecdotal evidence the evaluation team would consider NJ to have one of the highest market shares for both high efficiency air conditioning and heating equipment. By any measure, however, the increase in market share for high efficiency HVAC equipment in NJ is an impressive accomplishment.

Verification Activities. Third-party verification of proper installation is required by two of the programs, Massachusetts and Long Island, and is recommended for the NJ Program. The Connecticut program

[12] The number of participants for MidAmerican was calculated based on the program savings goal of 9,566 MWh and an average savings per participant 540 kWh.

[13] Some differences in budgets, however, reflect differences in cost-accounting practices, and thus may not reflect efficiencies or inefficiencies of program implementation.

offers a contractor incentive for verification of proper installation using Digital Commissioning. The Massachusetts Quality Installation Verification (QIV) service checks for and reports on optimal refrigerant charge and system air flow, and involves testing installed systems by using specialized tools and reporting results to customers and to the program. The QIV service is one of the most advanced verifications of quality installation in the country. These verification activities are summarized in Table 1-14.

Table 1-14. Proper Sizing and Installation Verification

Implementer	State	M&V Protocols
New Jersey Utilities	NJ	Installation must be performed by a qualified contractor. Rebates will be processed only if your installing contractor submits documentation that the air conditioner or heat pump has been properly sized and installed. 10% of the applications are spot checked to verify compliance.
MA Utilities	MA	The program offers unit incentives for contractors who participate in QIV services. QIV service checks for and reports on optimal refrigerant charge and system air flow, and involves testing installed systems by using specialized tools and reporting results to customers and to COOL SMART. Tools available for this third-party verification process include the Honeywell Service Assistant and the CheckMe! phone-in service. Equivalent tools may also be used with prior program approval. After a residential customer central A/C installation, a QIV participating technician tests the system and takes a series of measurements. Cool Smart provides a QIV certificate that is mailed to the customer, providing third-party verification that the technician properly adjusted charge and airflow.
CT Utilities	CT	On new installations and retrofit installations, if the installing contractor commissions the new equipment with the Honeywell Digital Assistant or similar pre-approved tool, there will be an additional incentive to the contractor upon successful download of the data from the Honeywell tool. This additional incentive to the contractor will encourage those who already own the tool to use it correctly and those who do not have the tool to purchase one and get trained to use it.
LIPA	NY	Field inspections are conducted on 10% of installations through the 2005 program year.
MidAmerican	IA	The program does not have a verification component.

Incentive levels. Table 1-15 compares the rebates offered for 2006. The NJ rebates presented in this table are the current rebates. Although NJ was the first state to require proper sizing and proper installation, other states are also now requiring these practices also.

Table 1-15. 2006 Incentive Levels

	2006 NJ	MA[14]	CT[15]	LIPA[16]	MidAmerican[17]
CAC SEER 14 (≥ 11.5 EER)	-	$300	-		$200 + ($100 x (SEER-14))
CAC SEER 14 (≥ 12 EER)	$300		-	$300	$200 + ($100 x (SEER-14))
CAC SEER 15 (≥ 12.5 EER)	$400	-	$300	$400	$200 + ($100 x (SEER-14))
CAC SEER 16+	-	-	$550 (w ECM fan)	-	$200 + ($100 x (SEER-14))
Heat Pump SEER 14 (≥ 11.5 EER, 8.2 HSPF)	-	$300	-		$400 + ($100 x (SEER-14))
Heat Pump SEER 14 (≥ 12 EER, 8.5 HSPF)	$350	-	-	$300 (≥12 EER and HSPF ≥ 8.5)	$400 + ($100 x (SEER-14))
Heat Pump SEER 15 (≥ 12.5 EER, 8.5 HSPF)	$450	-	$300 (8.0 HSPF)	$400 (≥12.5 EER 8.5)	$400 + ($100 x (SEER-14))
HP SEER 16+	-	-	$550 (8.0 HSPF) (w ECM fan)	-	$400 + ($100 x (SEER-14))
Proper Installation	Required	$50 per ½ ton downsize	$100	Required	No
Proper Sizing	Required	Up to $150	No	Required	No
3rd Party Verification	-	$175 to contractor $125 to customer	No	Required	No
Ground Source Heat Pump	$500	-	$300 (13.4 EER) $550 (14.5 w ECM fan	-	$300/ton
Furnace (>90% AFUE)	$300	-	-	-	
Furnace (>92% AFUE and ECM)	$400	-	-	-	$250 + ($25 x (AFUE-92))
Boiler (> 85% AFUE)	$300	-	-	-	85 - 89.9% – $100 90% or greater: $200 + ($50 x (AFUE-90))
Water Heater (0.62+ EF)	$50	-	-	-	$50

[14] http://www.mycoolsmart.com/html/2006offerings.html

[15] http://www.cl-p.com/clpcommon/pdfs/companyinfo/publications/HVAC_Incentive_App.pdf

[16] http://www.lipower.org/cei/coolhomes.rebates.html

[17] http://www.midamericanenergy.com/pdf/ee_resident_rebates.pdf

1.3.3 Market Share Assessment Key Findings

Since the 2001 New Jersey Residential HVAC Baseline Study the market share for high efficiency HVAC products has increased. The market share for central air conditioning units with SEER 13 or greater increased from 56% to 65% for retrofit projects and from 42% to 51% for new construction projects. The market share for high efficiency furnaces stayed the same at 42% for existing homes and increased from 27% to 45% for new homes. The market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.

The NJ HVAC Program was one of the first residential HVAC programs in the country to require proper sizing and proper installation to receive an incentive for high efficiency HVAC equipment. Since then other programs have adopted these requirements. Some programs, Massachusetts for example, have gone a step further and have begun requiring third party verification of proper sizing and installation.

1.4 Baseline Savings Assessment

The objective of the Baseline Savings Assessment was to update the baseline against which the energy savings will be calculated and to measure the program success. In our surveys with participating and nonparticipating contractors and end users, we attempted to collect useful information to inform the baseline estimates on the efficiency of measures that would have been installed without the program as well as the current practices in the marketplace.

1.4.1 Common Practices

Energy-efficient Equipment

Participants reported that most of the time (71%), the contractor who installed the new unit recommended more than one unit for the customer to consider installing. Almost 100% of the time (56 of 57), the contractor explained that some units are more efficient than others.

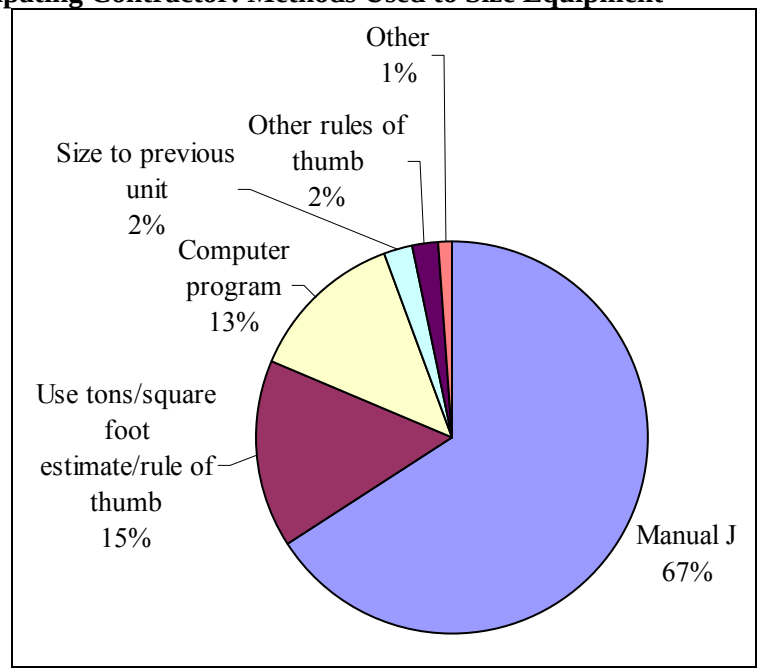
Similarly, nonparticipant contractors inform all or most of their customers about high efficiency units an average 85% of the time. In addition to the energy savings, the nonparticipating contractors also promote the following benefits of high efficiency HVAC equipment: quieter operation (21%), better warranty (18%), greater reliability (11%), and longer service life (13%).

Equipment Sizing

The participating contractors discussed the size of cooling (heating) capacity of the new unit 100% of the time with participants. The contractors provided the participants with documentation supporting the size of the unit installed 84% of the time (42 of 50).

Participating contractors were asked to identify the methods they use most often to size heating and cooling equipment, including those units installed outside the program. Their response is shown below, in Figure 1-19.

Figure 1-19. Participating Contractor: Methods Used to Size Equipment

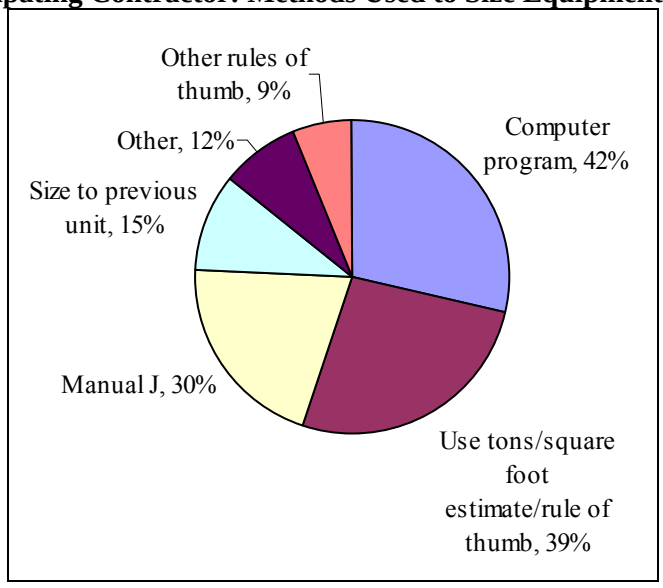


Source: HVAC Program Participant Contractor respondents; n = 70.

Manual J is the top method used by a great majority of the respondents, followed by tons per square foot estimates and computer programs. The computer programs used include Elite (most common), O'Brien, Quickload, Ritesoft, Slant Finn, and Wright J.

Nonparticipating contractors were also asked to identify the methods they use most often to size heating and cooling equipment. Their responses are shown below in Figure 1-20.

Figure 1-20. Nonparticipating Contractor: Methods Used to Size Equipment



Source: HVAC Program Nonparticipant Contractor respondents; n = 33.

For nonparticipant contractors the sizing methods used were more diverse than the participating contractors. This is expected since participating contractors are required to use Manual J to do the equipment sizing. Most nonparticipating contractors use computer programs, rules of thumb, or Manual J.

These other programs cited by the contractors may provide adequate sizing calculations; the Air Conditioning Contractors of America's (ACCA's) Manual J Residential Load Calculation Procedure is approved by American National Standards Institute (ANSI) and is the accepted industry standard for the proper sizing and selection of HVAC equipment in residential homes. The Residential HVAC Program should continue to support the use of the Manual J software.

Proper Refrigerant Charge

Participants also reported that the contractors discussed the need to ensure a proper refrigerant charge in the unit 62% of the time. They did not discuss this about 30% of the time. About 9% of the participants were not sure or could not remember. The contractors discussed the need to ensure proper airflow in the indoor part of the system 86% of the time.

Most (66%) participating contractors weigh refrigerant when checking the refrigerant charge in a newly installed heat pump or air conditioner. The superheat method is the second most common method used (20%), followed by sub-cooling (14%). Nonparticipating contractors are more evenly distributed among the three main methods for checking airflow. Nonparticipating contractors use the Superheat method 33% of the time, the subcooling method 29% of the time, and the weighing method 29% of the time (Table 1-16).

Table 1-16. Refrigerant Testing Methods

Method	Participating Contractors	Nonparticipating Contractors
Weigh the Refrigerant	66%	33%
Superheat Method	20%	29%
Subcool Method	14%	29%

Source: HVAC Program Participating Contractor: n= 58, Nonparticipant Contractor respondents; n = 13.

The Program currently requires the contractor to certify that the air conditioning units are properly charged to receive the rebate.

Indoor Coil Airflow

Contractors were asked if they routinely check the airflow over the indoor coils during an installation. Most (80%) said that they do. About 10% said no, and the other 10% did not know or were not sure.

Ductwork

The contractor checked to see that the participants' ductwork was adequately insulated about two-thirds (67%) of the time. The contractors recommended that insulation be added only 30% of the time. Participants said that their contractor discussed the impact of leakage in their ductwork (on the efficiency of the cooling and/or heating system) about 51% of the time.

Among those participants who had their ductwork checked, the contractor offered to measure the leakage about 52% of the time. Most participants (88%) accepted the contractor's offer to measure leakage in the

ductwork. Among those who did not accept the contractor's offer to measure leakage in their ductwork, the primary reason is that it is too expensive. Only 21% of the customers had additional ductwork added as part of their installation.

Participating contractors were asked what duct installation procedures they usually take to ensure efficient HVAC system operation. All of the respondents said they check insulation of all ducts in unconditioned spaces. However, none mentioned that they use special duct mastic to seal joints, seams, holes, or corners, or that they check installation of cold air returns (in all rooms except kitchen, bath, and laundry). In contrast only 25% of the nonparticipating contractors insulate ducts in unconditioned spaces (Table 1-17).

Table 1-17. Nonparticipating Contractors: Duct Insulation and Sealing

Procedure	%
Other	55%
Insulation of all ducts in unconditioned spaces	25%
Use of special duct mastic to seal joints, seams, holes, corners	15%
Installation of cold air returns in all rooms except kitchen, bath, and laundry	5%

Source: HVAC Program Nonparticipant Contractor respondents; n = 20.

Other duct sealing and insulation procedures mentioned:

- Use new bubble foil; 4.3 R-Value
- Transition plenums
- Wrap with double wrap and use metal duct wrap and seal all joints
- Size it properly using a duct calculator
- Manual D guidelines
- The company makes their own ducts; they do the sizing; try to tape all the joints and seal them
- Computer program does the duct sizing; uses the duct slide rule to make sure following standard
- Use ductulator
- Depends house by house; unconditioned and conditioned spaces; tight, sealed insulation across system
- CFM
- Duct calculator
- I use a "ductilator" -- a slide sheet
- Silicon every riser (glue tape); seal every joint possible
- Design for SMACNA standards and use Manual D

Furnace ECMs

Contractors were asked how often they promote furnaces with ECM (Electronic Commutated Motor) fans to their customers. Over 44% said that they do promote furnaces with ECM fans in *most* or *all* cases.

Almost 40% stated that they seldom or never promote furnaces with ECM fans. About 15% said they promote them in some cases.

A number of participating contractors were not so optimistic about ECM fans. Among those contractors who seldom or never promote furnaces with ECM fans, the most common reasons are that it is more complicated, needs more service, and has higher costs. On average, they stated that an ECM fans cost roughly 25% more, or $600-$700 more, than standard furnaces without these fans. When asked why customers choose to install furnaces without ECM fans instead of furnaces with ECM fans, almost all replied that it is due to higher costs.

1.4.2 What Impact Has the Program Had on the Baseline?

Two conditions must hold to substantiate a claim that the program has had an impact on the baseline. First, the baseline must have changed. Second, there must be evidence that the program caused the movement in the baseline. The previous subsections and the following one (review of the protocols) address whether the baseline has moved. This subsection addresses whether the program is likely to have caused any of this movement in the baseline.

If the program has caused movement in the baseline, it probably acted through one of two mechanisms (or both). First, by affecting purchase decisions on a large fraction of the sales for a given type of equipment and so moving the market through momentum (among other things). Second, by influencing the thinking of the key market actors. (Of course, these two mechanisms are not mutually exclusive.) The first mechanism is addressed in the Market Share discussion in Section 1.3. The second is discussed in the following.

Did the program affect the thinking of key market actors? If it did, it most likely could not have done so without their knowledge and awareness. Thus the first, and key, test is one of awareness.

The awareness of energy efficiency equipment was discussed in Section 1.2.2 above. Of those customers that participated in the NJ Clean Energy Programs, about 80% knew that high efficiency units were available prior to purchasing their new units. An even higher 87% said they had requested information on high efficiency equipment. For those who did not request it, the main reasons were:

- They had educated themselves already.
- The contractor was already providing that information.

In contrast two-thirds of nonparticipant respondents (65%) reported that prior to shopping for their new HVAC units they knew that high efficiency models of their specific unit types were available. In addition, only half of nonparticipant respondents (49%) reported that they had requested information regarding high efficiency units from their installation contractor.

The primary benefit that participants mentioned regarding high efficiency is lower operating costs (55% of the responses). Improved performance was mentioned close to 18% of the time, while comfort, reliability, and environmental benefits are seldom mentioned.

Most (62%) participating contractors surveyed claim that their practices in regard to sizing and installing residential HVAC equipment have not changed as a result of their experience with the Residential HVAC Program. About 25% said that their practices have changed, and roughly 13% were not sure. Of those contractors who claim to have made changes in their practices, the changes include the following:

- More frequent air-flow check.

- Use Manual J more frequently.
- More specific equipment sizing.
- More detailed calculations.

Conclusion: The participants are more aware of high efficiency HVAC equipment than nonparticipants and are more aware of the benefits of the equipment. Since the participants were asked about their awareness after participating in the program, their responses may be high. However, the number of nonparticipants that are shopping for high efficiency HVAC equipment is relatively high (65%) and indicates that the program is impacting the broad market. As discussed in Section 1.3, the program has increased the market share for high efficiency HVAC equipment and as evidenced by the relative high awareness high efficiency HVAC equipment by the nonparticipants the program has been successful in moving or transforming the market.

1.4.3 Adjustments to Savings Protocols

This section presents a detailed assessment of impact calculation methods and input assumptions for New Jersey's Residential HVAC Program. Methods and assumptions for the following HVAC measures covered by this program are discussed:

- Central air conditioners and air source heat pumps
- Ground source heat pumps and GS desuperheaters
- Gas furnaces and boilers
- Gas water heaters

The evaluation team's analysis included a review of the information provided in New Jersey's 2001 and 2004 Protocols to Measure Resource Savings, the 2001 New Jersey Residential HVAC Baseline Study, several papers that provided inputs to the Protocols, and information from the U.S. DOE's analysis materials for federal standards for air conditioners and heat pumps, gas furnaces and boilers, and gas water heaters. The rest of this section will examine the impact estimates for each residential HVAC measure in turn.

Central Air Conditioners and Air Source Heat Pumps

The current savings calculation algorithms in New Jersey are shown below. Estimates are done on a per-unit of equipment basis.

Cooling energy consumption and peak demand savings:

Energy Savings (kWh) = CAPY/1000 x [1/$SEER_{base}$ – (1/$SEER_{qual}$ x (1-ESF))] x EFLH

Peak Demand Savings (kW) = CAPY/1000 x [1/EER_{base} – (1/EER_{qual} x (1-DSF))] x CF

Heating energy savings for air source heat pumps:

Energy Savings (kWh) = CAPY/1000 x [1/$HSPF_{base}$ – (1/$HSPF_{qual}$ x (1-ESF))] x EFLH

Where:

CAPY — The capacity or output of the central air conditioner or heat pump being installed, and is expressed in BTUs/hour. This data is obtained from the Application Form, and is based on the model number.

$SEER_{base}$ — The seasonal energy efficiency rating [Btu/watt-hour] for the baseline (standard efficiency) equipment. The value used for this parameter is 10.0 SEER, and is based on the 1992 federal minimum efficiency standard that was in effect until January 2006.

EER_{base} — The energy efficiency rating [Btu/watt-hour] for the baseline (standard efficiency) equipment. The value used for this parameter is 9.2 EER, and is based on an analysis of ARI data by Chris Neme that was done in the mid to late 1990s. [18]

$SEER_{qual}$ — The energy efficiency rating [Btu/watt-hour] for the qualifying energy-efficient equipment being installed. This data is obtained from the application form, and is based on the model number.

EER_{qual} — The energy efficiency rating [Btu/watt-hour] for the qualifying energy-efficient equipment being installed. This data is obtained from the application form, and is based on the model number.

DSF — The demand sizing factor, or the assumed peak demand capacity saved due to proper sizing and proper installation. The value used for this parameter is 7%, and is based on a 1999 ACEEE paper by Neme, Proctor, and Nadel. [19]

ESF — The energy sizing factor, or the assumed energy saved due to proper sizing and proper installation. The value used for this parameter is 17%, and is based on a 1999 ACEEE paper by Neme, Proctor, and Nadel.

$HSPF_{base}$ — The heating seasonal performance factor for the baseline (standard efficiency) heat pumps. The value used for this parameter is 6.8 HSPF, and is based on the 1992 federal minimum efficiency standard that was in effect until January 2006.

$HSPF_{qual}$ — The heating seasonal performance factor for the efficient qualifying heat pumps. This data is obtained from the application form, and is based on the model number.

CF — The coincidence factor, which is the ratio between the unit's demand at time of system peak and the unit's connected demand. The value used for this parameter is 70%, and is based on an analysis of data presented in a 1998 ACEEE paper by Peterson and Proctor.

EFLH — The equivalent full load hours of operation for the average unit. The value used for the cooling EFLH is 660 hours, and the value used for heating EFLH is 2,250. These values are based on isometric lines that ARI and GAMA used to publish. The 660 hour cooling value used is lower than the 700 to 750 hour ARI values, and was adjusted based on Long Island load research data. [20]

[18] Personal correspondence with Chris Neme, February 28, 2006.

[19] C. Neme *et al*, "Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems", (American Council for an Energy-efficient Economy, Washington, D.C.), February 1999.

[20] Chris Neme, February 28, 2006, *op.cit.*

Discussion of Key Air Conditioner and Heat Pump Assumptions and Recommendations

U.S. Central Air Conditioner and Heat Pump Minimum Efficiency Standards Increased in January 2006

New Jersey's specifications for baseline (standard efficiency) air conditioners and heat pumps are based on the 1992 federal minimum efficiency standards for central air conditioners and heat pumps, which have since been superseded by federal standards for those products that were issued on January 22, 2001, and took effect on January 23, 2006. [21] The newer minimum efficiency standards for central air conditioners and heat pumps are an SEER rating of 13 and a HSPF of 7.7 (only for heat pumps). [22] These new values should replace the current assumptions used in the Protocols, as the latter are currently out of date.

Although not explicitly mandated by the 2006 DOE minimum efficiency standard, the EER of minimum efficiency central air conditioners and heat pumps also increased along with the required SEER ratings. The evaluation team examined the EER ratings for the 13 SEER central air conditioners that qualified for a central air conditioner rebate from New Jersey in 2005, and found that the average EER for these units was 11.3. This value should replace the old 9.2 EER estimate.

Other Parameters and Recommendations

The New Jersey Residential HVAC Baseline Study[23] examined the issue of HVAC system oversizing. The Baseline Study included site visits to 70 homes that had purchased a major HVAC system in the three years between July 1997 and July 2000. Detailed information was gathered for 71 cooling systems (two homes had two systems each). The study's authors concluded that 43% of the cooling equipment was oversized by 0.5 tons or more, and the average amount of oversizing was 0.37 tons. [24] The authors noted that this amount of oversizing was considerably less than a previous New Jersey study on this matter that concluded that the average amount of central air conditioner oversizing was 1.6 tons. [25] They suggested that the reason for the smaller amount of oversizing found in the Baseline Study may be due to the more recent vintage (1997-2000) of the air conditioning systems purchased that were inspected as part of the Baseline Study, and that New Jersey contractors appear to be more accurately sizing air conditioning systems than they had in the past. [26]

The Baseline Study authors conclude that the average savings achievable from proper sizing of air conditioning systems is about 2.9%.[27] This 2.9% savings estimate was extrapolated from other studies based on the amount of system oversizing found in New Jersey. It was not based entirely on New Jersey-specific measurements. This estimate is considerably smaller than the Protocols' assumed Energy Sizing Factor of 17% and Demand Sizing Factor of 7%. Since the Baseline Study results are more current than the values currently used in the Protocols, the evaluation team suggests using the 2.9% estimate from the Baseline Study for the ESF and DSF to estimate saving from proper sizing of air conditioners and heat pumps.

[21] Federal Register, Vol. 66, No. 14, Monday, January 22, 2001/Rules and Regulations, p. 7170-7200.

[22] Ibid, p. 7199.

[23] Xenergy, "New Jersey Residential HVAC Baseline Study", (Xenergy, Washington, D.C., November 16, 2001).

[24] *Ibid.*, p 6-11.

[25] *Ibid.,* p. E-6.

[26] *Ibid.*

[27] *Ibid.,* p. 6-14.

Ground Source Heat Pumps and Desuperheaters

The current savings calculation algorithms in New Jersey are shown below. Estimates are done on a per-unit of equipment basis.

Cooling energy consumption and peak demand savings:

Energy Savings (kWh) = CAPY/1000 x [1/$SEER_{base}$ – (1/EER_g x GSER)] x EFLH

Peak Demand Savings (kW) = CAPY/1000 x [1/EER_{base} – (1/EER_g x GSPK)] x CF

Heating energy savings:

Energy Savings (kWh) = CAPY/1000 x (1/$HSPF_{base}$ – [1/COPg x GSOP)] x EFLH

GSHP Desuperheater:

Energy Savings (kWh) = EDSH

Peak Demand Savings (kW) = PDSH

The following definitions are provided for terms that are used only for ground source heat pumps (GSHP) and desuperheaters. Other terms such as CAPY have the same definitions as previously provided for central air conditioners and air source heat pumps.

EER_g	The energy efficiency rating [Btu/watt-hour] for the GSHP being installed. The EERs of GSHPs are measured differently than the EERs of air source heat pumps, and focus on the entering water temperatures rather than ambient air temperatures. This data is obtained from the application form, and is based on the model number.
GSER	The factor to convert the EER_g for a GSHP into an equivalent SEER rating. The value used for this factor is 1.02, and comes from an analysis of GSHPs that Chris Neme conducted for PEPCO in 1996 or 1997. [28]
COP_g	The Coefficient of Performance for the GSHP being installed. This is a measure of the efficiency of the GSHPs. This data is obtained from the application form, and is based on the model number.
GSOP	The factor to convert the COP_g for a GSHP into a HSPF rating. The value used for this factor is 3.413, and is based on an engineering calculation.
GSPK	The factor to convert the EER_g for a GSHP into an equivalent EER for an air conditioner to allow the GSHP to be compared to a baseline air conditioner. The value used for this factor is 0.8416, and comes from an analysis of GSHPs that Chris Neme conducted for PEPCO in 1996 or 1997. [29]

[28] Chris Neme, February 28, 2006, *op.cit.*

[29] *Ibid.*

EDSH The assumed energy savings for a desuperheater. The value used for this factor is 1,842 kWh, and comes from an analysis of GSHPs that Chris Neme conducted for PEPCO in 1996 or 1997. [30]

PDSH The assumed peak demand savings for a desuperheater. The value used for this factor is 0.34 kW, and comes from an analysis of GSHPs that Chris Neme conducted for PEPCO in 1996 or 1997. [31]

The assumptions used in this calculations, although somewhat dated, based upon our review are reasonable, and are sufficiently accurate given the small volumes of GSHP products that receive rebates through the New Jersey Residential HVAC Program each year. The updated baseline air conditioner assumptions, $SEER_{base}$ and EER_{base}, discussed in the previous section should be used for GSHP products to calculate energy and demand savings.

Gas Space Heating Equipment

New Jersey's gas space heater energy savings algorithm is applicable to the purchase of an efficient gas space heater instead of a standard efficiency baseline unit. Efficient gas furnaces and boilers qualify for this part of the program. The gas energy savings are calculated on a per-unit of equipment basis:

Gas Savings (therms) = $(Capy_{qual} / Cap_{typ})$ x $[(AFUE_{qual} - AFUE_{base})/AFUE_{qual}]$ x Baseline Heating Usage.

Where:

Cap_{qual} The heating output capacity of the qualifying furnace/boiler in BTUs/hour. This information is obtained from the program application form, and confirmed with manufacturer data.

Cap_{typ} The heating output capacity of the typical or baseline furnace/boiler in BTUs/hour. The value used for this parameter is 80,000 BTUs/hour, and is based on a New Jersey utility analysis of heating customers' furnace or boiler typical output capacity.

$AFUE_{qual}$ The Annual Fuel Utilization Efficiency of the qualifying energy-efficient furnace or boiler. This information is obtained from the program application form, and confirmed with manufacturer data.

$AFUE_{base}$ The Annual Fuel Utilization Efficiency of the baseline standard efficiency furnace or boiler. The values used for this parameter are 80% for furnaces and 83% for boilers. These values are based on an analysis of the quantity of models available by efficiency rating as listed in the April 2003 GAMA Consumers Directory of Certified Efficiency Ratings.

Baseline Heating Usage The weighted average annual heating usage in therms of typical New Jersey gas heating customers. The value currently used for this parameter is 965 therms per year, and is based on a New Jersey utility analysis of gas heating

[30] *Ibid.*

[31] *Ibid.*

customers. This analysis was apparently conducted in the late 1990s, as the 965 therms figure was also used in the 2001 New Jersey protocols.

Discussion of the Gas Heating Savings Algorithm and Assumptions

The evaluation team has several suggestions regarding the assumptions and method used in estimating the savings for efficient gas space heating systems. Each of these recommendations is discussed below.

Baseline Heating Usage Assumption

The 965 therms per year estimated for space heating energy consumption appears to be overstated based on recent U.S. Energy Information Administration information on residential gas use in New Jersey. [32] The natural gas section of the EIA's web site shows that total residential New Jersey natural gas use in 2004 was 233.4 billion cu.ft., and there were 2.583 million residential natural gas customers in the state in 2004. So the average total residential natural gas use per customer in New Jersey in 2004 was 90,360 cu.ft., or about 904 therms. Further, the EIA information shows that New Jersey's average total residential gas use for the three summer months, which is unlikely to include any appreciable space heating usage, averages 5.438 billion cubic feet, so the residential non-heating gas use in New Jersey is about 28% of total residential gas usage. [5.438 billion cu.ft./month x 12 months/year / 233.4 billion total cu.ft./year = 28%.] So the total average space heating residential gas usage in New Jersey averages about 651 therms per year.

The 651 therms per year estimate for space heating in New Jersey is an overall average for both customers with standard and efficient space heating systems. For purposes of estimating savings from customers installing efficient space heating systems, one would prefer to use the average space heating gas usage for just customers with standard efficiency heating systems. However, such an estimate is not readily available to the evaluation team. Since the 965 therms per year currently used to estimate the savings for efficient gas space heating systems is larger than total average annual residential natural gas use in New Jersey, this estimate is almost certainly overstated. A revised method and assumptions for estimating energy savings from efficient space heaters is suggested at the end of this section

Standard Efficiency Heating Systems Size and Efficiency

The assumed typical space heating system capacity used in the Protocols, 80,000 BTUs/hour, is smaller than the average sized gas space heating system found in the New Jersey Residential HVAC Baseline Study. [33] The Baseline Study included site visits to 70 homes that had purchased a major HVAC system in the three years between July 1997 and July 2000. Detailed information was gathered for 63 heating systems. The average combined size of the gas furnaces and boilers was 91,000 BTUs/hour.[34]

The site visits included 33 gas furnaces, whose average AFUE was 81%.[35] In addition, 27% of the gas furnaces inspected met the New Jersey Residential HVAC Program requirements of a 90% AFUE or greater. [36] Also, 10 gas boilers were inventoried as part of the site visits, and the average efficiency of

[32] The Energy Information Administration's web site is www.eia.doe.gov.

[33] Xenergy, 2001, *op.cit*.

[34] *Ibid.,* p. 6-5.

[35] *Ibid.*

[36] *Ibid.*

these gas boilers was 75.8%.[37] No boilers inventoried met the program efficiency standard of 85% AFUE.[38] The average 75.8% AFUE for gas boilers is quite a bit lower than the 83% baseline efficiency assumed in the Protocols' space heating savings estimates. The 75.8% average boiler AFUE observed through the New Jersey Baseline Study is quite close to the current federal minimum efficiency standard for gas steam boilers of 75%.[39]

The average AFUE of 78% for standard efficiency gas furnaces observed through the New Jersey Baseline Study also matches the minimum federal efficiency standard for gas furnaces of 78%.[40] The above information can be used to calculate the average efficiency of the standard efficiency gas furnaces inventoried as part of the New Jersey baseline study: the overall average gas furnace efficiency = 81% = 90% efficient furnaces x 27% market share + X% standard efficiency furnaces x 73% market share. So X% efficient furnaces = (81% - 24.3%) / 73%, so X = 78%, which is the average efficiency of standard efficiency furnaces inventoried through the New Jersey Baseline Study. This 78% efficiency of the average standard efficiency gas furnace is lower than the assumed 80% AFUE used in the Protocols' space heating savings algorithm.

The average efficiencies for standard efficiency gas furnaces and boilers observed in the New Jersey Baseline Study suggests that the federal minimum efficiency standards for gas furnaces of 78% AFUE and 75% AFUE for gas boilers should be used to estimate the savings in the New Jersey gas space heating savings algorithm instead of the higher 80% value for gas furnaces and 83% value for gas boilers that are currently used.

In addition, the evaluation team analyzed the average sizes for the gas furnaces and boilers rebated through New Jersey's Residential HVAC Program in 2005. The overall average capacity for gas furnaces was about 80,000 BTUs/hour and was 117,000 BTUs/hour for gas boilers.

Suggested Revised Gas Space Heater Savings Algorithm and Assumptions

Since many of the current assumptions used to estimate the savings from efficient gas space heating systems in New Jersey appear to be out of date, the evaluation team suggests using a revised algorithm and assumptions for estimating gas space heater energy savings. The suggested new algorithm is shown below. It uses fewer market-based assumptions that can change over time, and although arithmetically equivalent to the previous algorithm, is simpler to calculate and easier to understand.

$$\text{Energy Savings (therms)} = (Cap_{base} \div AFUE_{base} - Cap_{qual} \div AFUE_{qual}) \times EFLH \div 100{,}000\ \text{BTUs/therm}.$$

The terms used above are the same as used in the current gas and electric space heating savings algorithms.

Unless better information is available, such as the capacity of the old furnace or boiler that was replaced, we suggest generally assuming that the capacity of the baseline unit is the same as the capacity of the new efficient unit. This is a reasonable assumption that simplifies the savings estimates.

The EFLH for gas heating systems can be approximately calculated by modifying the new energy savings formula to estimate overall average space heating energy use:

[37] *Ibid.*

[38] *Ibid*, p. E-5.

[39] Federal Register, Vol. 69, No. 145, Thursday, July 29, 2004/ Proposed Rules, p. 45423.

[40] *Ibid.*

Average Heating Use (therms) = (Cap_{avg} ÷ $AFUE_{avg}$) x EFLH ÷ 100,000 BTUs/therm.

Therefore, EFLH = Average Heating Use / (Cap_{avg} ÷ $AFUE_{avg}$) x 100,000 BTUs/therm.

In order for the average heating usage information to be compatible with other information from the Baseline Study, we need to calculate residential space heating gas use in New Jersey for 1999, about the midpoint of the Baseline Study participants' HVAC equipment purchases. In 1999, New Jersey residential gas users consumed an average of 932 therms of gas in total according to the EIA web site[41], doing similar calculations as were previously discussed for 2004. In 1999, average space heating residential gas use was about 676 therms of gas, from the calculation that 27.5% of gas use is for non-space heating gas use, as estimated from summer 1999 gas use, as was previously discussed for 2004.

The average size of New Jersey gas furnaces and boilers is about 91,000 BTUs/hour of output, from the Baseline Study. The average efficiency of these gas furnaces and boilers combined = (33 gas furnaces x 81% average AFUE + 10 gas boilers x 75.8% average AFUE) / 43 total gas space heaters = 80%.

So, from the above equation, the average EFLH = 676 therms / (91,000 BTUs/hour / 80% AFUE) x 100,000 BTUs/therm = 593 hours. This EFLH estimate is smaller than the corresponding estimate used in the Protocols to estimate space heating savings for heat pump systems. Several suggestions to further investigate this matter are provided in the Recommendations for Further Research section below.

Gas Water Heaters

New Jersey's gas water heater energy savings algorithm is applicable to the purchase of an efficient gas water heater instead of a standard efficiency unit. The savings are calculated on a per-unit basis:

Gas Savings (therms) = [(EF_{qual} –EF_{base})/EF_{qual}] x Baseline water heater usage

Where:

EF_{qual} = the energy factor of the qualifying energy-efficient water heater. These values are obtained from the program application forms and confirmed with manufacturer data.

EF_{base} = the energy factor of the baseline (standard efficiency) water heater. This value is fixed at 0.544, or 54.4%, the 1991 federal minimum efficiency standard for a 40 gallon water heater. This value is calculated from the formula EF = 0.62 - (0.0019 x gallons of capacity).

Baseline water heater usage = the annual usage of the baseline water heater, in therms. This value is fixed at 277 therms.

The "energy factor" for water heaters is a measure of a water heater's overall efficiency and is determined by U.S. DOE test procedures.

Discussion of Key Water Heater Assumptions and Recommendations

U.S. Water Heater Minimum Efficiency Standards Increased in 2004

[41] The EIA web site is www.eia.doe.gov.

New Jersey's specifications for baseline (standard efficiency) water heaters are based on the 1991 federal minimum efficiency standards for water heaters, which have since been superseded by federal water heater minimum efficiency standards that were issued on January 17, 2001, and took effect on January 20, 2004. [42] The newer minimum efficiency standard for gas water heaters is: EF = 0.67 - (0.0019 x gallons of capacity). [43] This newer minimum efficiency standard for gas water heaters should be used as the baseline value for water heaters sold in 2004 or later. For a 40 gallon water heater, the newer minimum EF = 0.67 – (0.0019 * 40) = 0.594, or 59.4%. This is about 9% higher that the 54.4% EF previously used in New Jersey.

Baseline Water Heater Energy Use from DOE Standards Analysis

DOE's water heater standards analysis also contains additional information that is relevant to New Jersey's baseline water heater use assumption of 277 therms per year. On the first page of DOE's most recent standards analysis, they provide the following statistics about typical water heaters before and after the standards took effect:

1. The typical gas water heater before the newer standards took effect used 234 therms of natural gas per year. [44]
2. The typical minimum efficiency gas water heater after the 2004 standards take effect will use 22 therms less than the previous typical water heaters, or about 212 therms of gas. [45]

We suggest using the U.S DOE's 212 therms of natural gas use for baseline water heaters for future gas water heater energy savings estimates. The estimates that DOE uses to develop minimum efficiency standards are very well reviewed, and represent very good information on this subject.

DOE also provides additional information in its standards analysis that could be useful for efficient water heater benefit-cost analysis. Specifically, DOE estimates that the average life expectancy for a gas water heater is 9 years. [46] The DOE estimate is based on considerable research used in setting appliance standards, and so is a good estimate for benefit-cost analysis purposes.

Recommendations for Future Research

As discussed in previous sections, several of the key assumptions used to estimate energy and peak demand savings for efficient HVAC systems are based on old data sources and it may be time to update these values. In addition some assumptions could be more accurate if they were based on New Jersey specific data. These include:

- The 70% coincidence factor estimate is based on a 1998 study.
- Although the sizing energy and demand savings factors, ESF and DSF, seem reasonable, they have not been empirically measured or verified in New Jersey.
- The EFLH for air conditioning systems are not based on New Jersey-specific measurements.

The above estimates ideally should be based on New Jersey-specific product monitoring and load research. The evaluation team suggests that New Jersey monitor a somewhat small (about 30-50

[42] Federal Register, Vol. 66, No. 11, Wednesday, January 17, 2001/Rules and Regulations, p. 4474-4497.

[43] *Ibid.* p. 4497.

[44] *Ibid.* p. 4474.

[45] *Ibid.*

[46] *Ibid*.

customers each) matched sample of qualifying and non-qualifying air conditioners and heat pumps in the summer of 2006 or 2007 to verify or adjust the estimates for the above parameters. The monitoring would use a combination of run-time meters and a smaller number of interval data recorders for the summer for air conditioners, and for a whole year for heat pumps and gas furnaces to measure:

- Cooling hours of use and EFLH.
- Heating hours of use and EFLH.
- Overall air conditioner and heat pump energy use, as well as connected demands, peak demands, coincidence factors, and how those actual values compare to the estimated values for those parameters. Where significant differences are found between the estimated and actual energy usage and demand for the equipment, additional investigation should be conducted to determine the reasons for the differences.
- Equipment sizing differences between qualifying units and non-qualifying units for similarly sized homes. This information should be used to verify or adjust the DSF and ESF parameters.

In addition, the evaluation team suggests that analysis of the above customers' electric and natural gas consumption should be conducted so that estimates for space heating and air conditioning energy use from the monitoring can be confirmed or modified based on the customers' actual billing histories.

1.5 Incremental Cost Assessment

A variety of secondary data sources were used to develop the incremental costs for the new efficiency tier levels. Additional data may be available after the completion of the customer and contractor surveys being conducted as part of the NJ HVAC Market Assessment. In past studies we have not found a wide variance in air conditioning equipment prices across the country. In addition a recently completed study by NEEP confirms these incremental cots.[47]

When the U.S. Department of Energy (DOE) updates a federal minimum appliance standard, a technical support document (TSD) is developed detailing the equipment specifications, estimating the energy savings potential, estimating the equipment costs, and conducting a life-cycle cost analysis of the proposed equipment. We reviewed the TSD for the upcoming air conditioning efficiency standard change and were able to pull from these documents an estimate of the incremental cost of going from the federal minimum efficiency to a higher efficiency air conditioning unit. Table 4.7 of the TSD provided estimates of the production costs for 13 SEER, 14 SEER, and 15 SEER units. These production costs were multiplied by the estimated retail markups from Table 4.14 of the TSD, to yield the retail price of these three units. From this data the incremental costs of installing a 14 SEER unit instead of a 13 SEER unit and the costs of installing a 15 SEER unit instead of a 13 SEER unit were calculated.

Recently, the evaluation team completed an update of the incremental costs of energy efficiency measures for the State of California. The updated incremental costs were captured in the 2004-05 Database for Energy-efficient Resources (DEER), Version 2.01, October 26, 2005. We pulled the incremental costs for the residential central air conditioning, heat pump, furnace and water heater measures. Boilers were not included in the DEER database. These incremental costs were uniform across the state. The costs were

[47] The Northeast Energy Efficiency Partnership is currently managing multi-year STAC-funded (State Technologies Advancement Collaborative (STAC)) research to address multi-fuel efficiency opportunities in all types of residential HVAC equipment (heating and cooling), including in-field research to assess the savings impacts of high efficiency equipment and best practices, development of duct-sealing protocols and marketing plans, market analysis, and development of a regional market transformation strategy.

given on a per ton basis for air conditioning and heat pump, on a per kBtu basis for furnaces and per tank size for water heaters. To match the DOE data, a 3-ton unit was assumed for air conditioners and heat pumps. The average size of the furnaces installed through the program was also used to convert the DEER data to an incremental cost per unit.

There was not sufficient data in these data sources to determine the difference in incremental costs between a 14 SEER unit with an EER of 11.5 and a 14 SEER unit with an EER of 12. These units were assumed to be comparable in price.

Table 1-18 summarizes the incremental costs from the DOE's Technical Support Documents and the California DEER database. The DOE data is based on a national sampling of the unit price.

Table 1-18. Incremental Cost Summary

Equipment Type	Efficiency	DOE	DEER
CAC (split system)	14 SEER	$347	$278
CAC (split system)	15 SEER	$459	$556
Heat Pump (split system)	14 SEER	$561	$294
Heat Pump (split system)	15 SEER	$673	$588
Furnace	≥ 90% AFUE	$684	$655
Furnace with ECM	≥ 90% AFUE	$945	$733
Boiler	≥ 85% AFUE	$109	n/a
Water Heater	≥ 0.62 Energy Factor	$220	$107

According to the surveys of participants, the contractors discussed the operating costs of different units 90% of the time. They provided a comparison of operating cost between units of different efficiencies 81% of the time. The contractors provided prices for both standard and high efficiency units again 81% of the time.

On average, participants reported the high efficiency unit was quoted to cost about $1,686 for the CAC equipment. The average *percent* estimate participants recalled being quoted for high efficiency units is 22% more than the standard efficiency CAC equipment.

Thirty-six percent of nonparticipants noted that their installation contractor provided prices for both standard and high efficiency units. The average price respondents reported for the high efficiency CAC units was $1,170 or 20% more than the standard efficiency CAC units depending on how respondents reported the differential (i.e., if the differential was reported as a dollar amount or percent difference).

Participating contractors were very reluctant to provide incremental cost data. Although confidentiality was ensured, only six contractors provided cost data. However, there was not enough data provided for the different SEER levels to be significant.

Nonparticipating contractors reported that the average incremental costs were about $370 for a 14 SEER central AC unit and about $770 for a 15 SEER unit (Table 1-19). This incremental cost data is line with the data from the DOE and DEER database.

Table 1-19. Average Cost of High Efficiency Central AC

Efficiency	Average Cost	Incremental Costs
13 SEER	$ 1,575	-
14 SEER	$ 1,947	$ 372
15 SEER	$ 2,346	$ 771

Source: HVAC Program Nonparticipant Contractor respondents; n = 18.

On average, participating contractors stated that a furnace with ECM fan costs roughly 25% more, or $600-$700 more, than standard furnaces. When asked why customers choose to install furnaces without ECM fans instead of furnaces with ECM fans, almost all replied that it is due to higher costs. Nonparticipating contractors responded that the ECM fan adds about $445 to the cost of the furnace.

1.6 Market Barriers Assessment

1.6.1 Has the Program Reduced the Market Barriers?

Participants were asked what they think the barriers are to purchasing high efficiency HVAC equipment for "customers like themselves". The top reasons cited are:

- Lack of money and not having enough information.
- Higher costs for that equipment.

Then customers were asked more generally about what they consider to be the major barriers to purchasing high efficiency HVAC equipment in New Jersey. Most could not identify any barriers (Table 1-20).

Table 1-20. Participants: Major Market Barrier in New Jersey

Major barriers	%
None	77%
Don't know	10%
First costs	6%
Lack of awareness of program	4%
Lack of awareness of the benefits	2%
Lack of contractors knowledge	0%
Can't differentiate between quality and poor installation	0%
Payback	0%
Lack of technical knowledge	0%
Other	0%

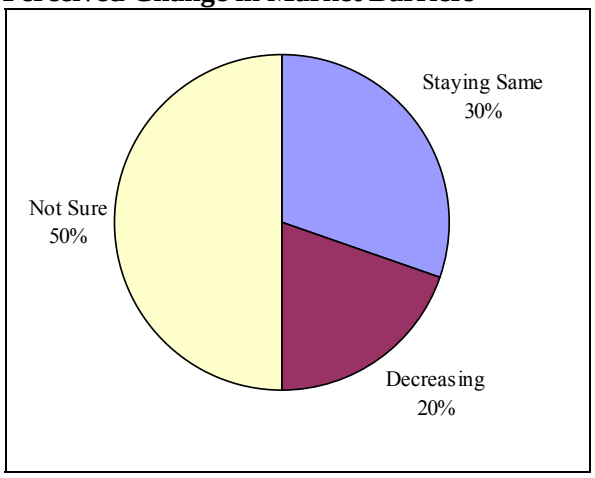
Source: HVAC Program Participant survey respondents; n = 63.

Customers were somewhat divided when asked how effective they think the New Jersey HVAC program is in reducing these barriers. A number of customers said they think it is not very effective at reducing these barriers, while others had more positive and useful comments:

- I think that over time, more people will become aware of these programs.
- It gives the public a greater awareness of these programs since most of the problems stem from the design side of this equation.
- It's a very effective program, but maybe they need to give forward looking projections of savings using models that demonstrate what is likely with the rising costs of energy.
- It helps by getting information to homeowners about energy conservation.
- It helps when you finally get the money back.

Customers were asked if they think these barriers are increasing, decreasing, or remaining the same. None said they think the barriers are increasing over time. About half were not sure whether barriers are increasing or decreasing. About 30% think they are staying at the same level (Figure 1-21).

Figure 1-21. Participants: Perceived Change in Market Barriers



Source: HVAC Program Participant survey respondents; n = 57.

Verbatim answers regarding market barriers to high efficiency include the following:

- Fuel costs are rising, so it (efficiency) looks more attractive.
- The rebate money helps, but it could be more.
- The equipment is getting more common.
- The more fuel price increases, the quicker will be the payback.

Contractors were asked to identify the biggest barriers they encounter when promoting high efficiency central air conditioners in existing homes. The results, shown in Table 1-21, suggest very different results for AC equipment and heating equipment.

Table 1-21. Participating Contractor: Market Barriers

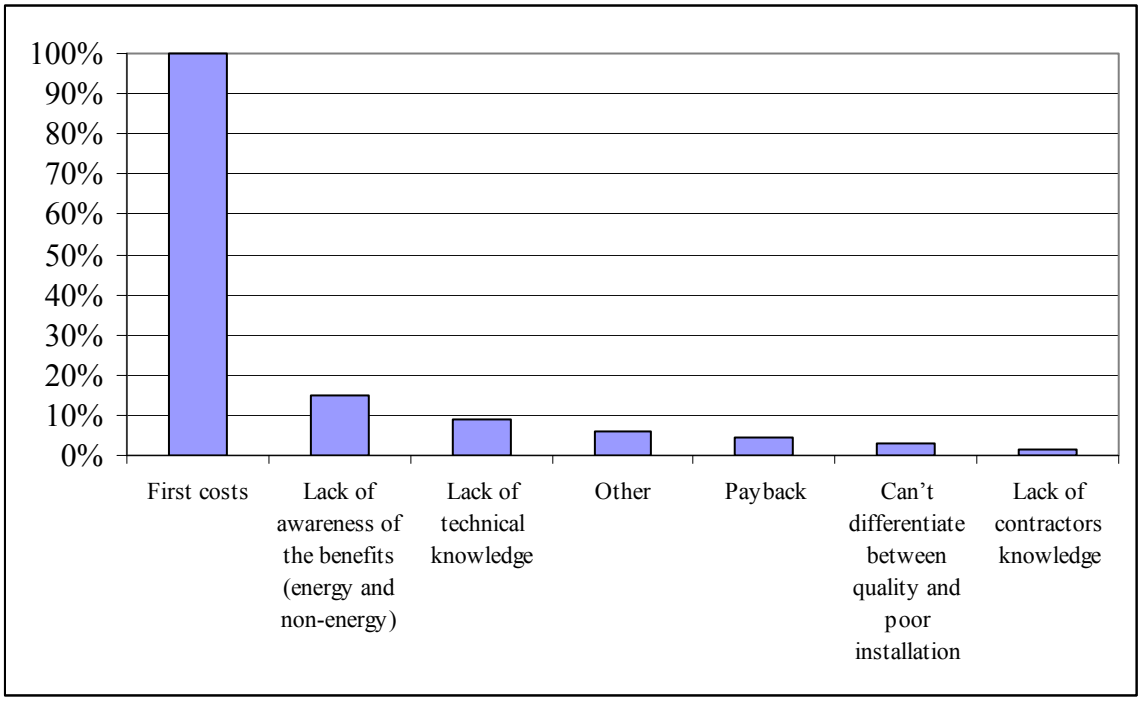
Contactors Barriers	Central Air	Heating Equipment
Utility rebate paperwork is a hassle	70%	14%
Savings to customers do not justify extra costs	4%	1%
Promotion of energy efficiency not important to business strategy	0	0
Perception that customers generally not interested in energy efficiency	0	0
Performance problems with high efficiency equipment	0	0
Reliability problems with high efficiency equipment	0	0
Availability problems	0	0
Do not believe it is profitable	0	0
Utility inspection process is a hassle	0	0
Not aware of high efficiency equipment	0	0
Don't know/not sure	1%	1%

Source: HVAC Participating Contractor survey respondents; n = 68.

Most contractors (70%) find the utility rebate paperwork to be the biggest barrier they encounter when promoting high efficiency central air conditioners in existing homes. For heating equipment (gas furnaces and boilers), that figure drops to 14%.

Contractors were asked to identify what they consider to be the major barriers to their customers' purchase of high efficiency HVAC equipment in New Jersey. The results (Figure 1-22) suggest that first cost is the primary barrier (selected by almost every contractor surveyed). This is a very different response than the participants.

Figure 1-22. Participating Contractors: Major Market Barriers for Participants

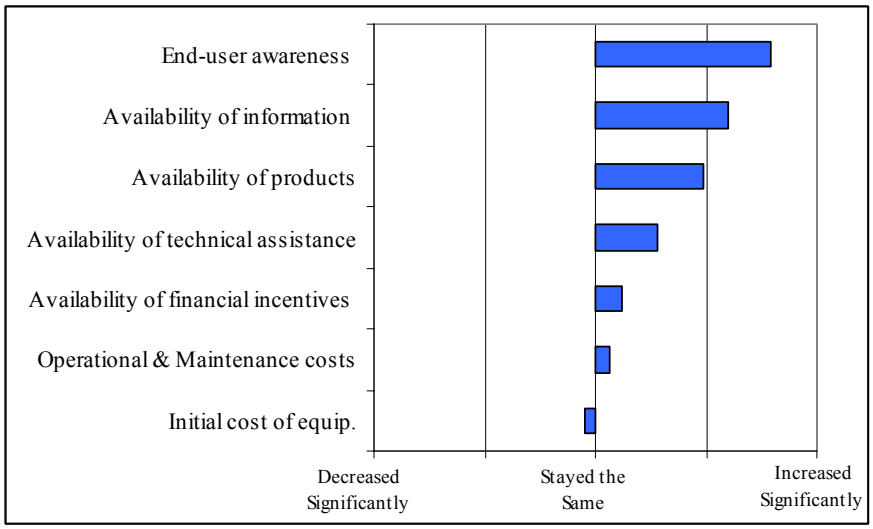


Source: HVAC Participating Contractor survey respondents; n = 68.

Lack of awareness of the benefits of energy efficiency is the second most commonly mentioned barrier, but it falls far behind first cost. Not even one contractor cited lack of awareness of the program as an important barrier.

Contractors were asked whether they think specific aspects of the high efficiency HVAC market have increased, stayed the same, or decreased over the previous two years. They were asked to choose from the following for each aspect: (1) increased significantly, (2) increased somewhat, (3) stayed the same, (4) decreased somewhat, or (5) decreased significantly. Any mean answer above 3.0 suggests that the individual item has decreased, in their view. Any mean answer below 3.0 suggests that they think the item has increased. The differences in the average responses from the status quo, an answer of 3, have been calculated and are shown on Figure 1-23.

Figure 1-23. Changes in the Market



Source: HVAC Participating Contractor survey respondents; n = 68.

Initial costs are thought to have decreased very slightly over the previous two years. Operating and maintenance costs and the availability of financial incentives are thought to have increased very slightly. Availability of equipment, information, and financial assistance are all seen to have increased "somewhat-significantly." Overall, the perception is that the market has shifted, but not dramatically, with the exceptions of customer awareness and availability of information. Based on these changes in market for high efficiency HVAC, it appears that some of markets barriers to high efficiency HVAC equipment are decreasing.

Overall, 100% of the responding participating contractors feel these barriers against high efficiency-HVAC equipment are generally decreasing. When asked why they think these barriers are decreasing, the most common responses include:

- Rising fuel costs (commonly cited).
- The whole industry is moving in that direction.
- Awareness is increasing.
- High efficiency makes sense.

1.6.2 Additional Potential Measures

In addition to the measures currently being incented under the Residential HVAC Program, two additional measures should be considered: 1) duct sealing and 2) mini-split ductless systems. Both of these measures were analyzed as part of the ongoing STAC study. The study found that due to changes in the marketplace, both of these measures now pass the societal benefit-cost screening test.

Ducts are an integral part of a forced-air heating or cooling system and their purpose is to circulate air to evenly heat and cool your home. Unfortunately, ducts are often leaky – wasting 7-12% of heating and cooling energy used by your home. By sealing the leaky ducts one can improve the efficiency of the heating and cooling system. In addition, sealing ducts has both health and safety benefits. Air leaks in the return duct may contain fumes from household and garden chemicals, insulation particles, and dust. These items can aggravate existing asthma and allergy problems. Duct leaks can also cause equipment to

backdraft (i.e., when combustion gases flow back into your home, instead of out the vents). If fireplaces, wood stoves, water heaters, furnaces, clothes dryers, or other combustion devices are in these depressurized areas, invisible gases, such as carbon monoxide (CO), can backdraft into your home instead of going up the chimney.

One method to eliminate losses associated with ductwork is to simply not use ducts. Mini-split system air conditioners have evaporator/air handler units within each conditioned room and are often referred to as ductless systems. Multi-evaporator systems run the refrigerant from one outdoor unit to several indoor units. These systems are most commonly used in multifamily housing applications or retrofit applications in which there is insufficient space to install ductwork.

According to the STAC Study[48], benefits of these systems include inherent zoning capability (cooling or heating only the area that needs to be conditioned), greatly reduced airside losses, and quiet operation.

The mini-split system equipment costs approximately $1,200 more than central systems. However, this does not take into account the cost of ductwork; therefore, in new construction, mini-splits will tend to be more cost-effective. Qualified installers and service technicians for mini-splits are more difficult to find than central AC installers. Many contractors earn a larger return on ductwork installation so they may be more reluctant to push sales of mini-splits except in cases where ducts are not feasible.

Duct losses, leakage, and convective losses can account for more than 30% of energy consumption for space conditioning, especially in cases where ductwork is located in an unconditioned space such as an attic. Mini-splits can achieve additional savings by providing cooling or heating only where it is needed. The savings from a mini-split are estimated to be 30% in heating and cooling.

The recommended incentive structure for these two new residential HVAC measures will be discussed in detail in Section 1.8.

1.7 Upgrade of Energy Efficiency Codes and Standards Assessment

Documented here is an assessment of the role that Residential HVAC Program had on changes in federal efficiency standards (e.g., the switch to the SEER 13 baseline beginning in 2006) and state energy codes. The team interviewed 5 of the key players, at both the federal and state levels, in the development of energy efficiency codes and standards.

The next section provides a brief summary of state and federal residential HVAC codes and standards. The following sections summarize the interviews with the code officials and present the recommendations for updates to the codes based upon the impact of the program.

1.7.1 Current Status of Residential Energy Codes and Standards

The State of New Jersey passed the New Jersey Uniform Construction Code Act on October 7, 1975. The Act became effective on February 3, 1976. All construction codes and their enforcement were controlled by the provisions stated in the act. Uniform Construction Code Regulations (NJAC 5:23-1 et seq.) went into effect on January 1, 1977. The New Jersey Uniform Construction Code is divided into subcodes (model codes and standards) that are adopted individually by the Commissioner of Community Affairs. The energy subcode contains the energy provisions.

[48] J. Proctor, "Emerging Technologies", Northeast Energy Efficiency Partnership, Lexington, MA, January 2006.

The New Jersey Uniform Construction Code Act stipulates that model codes and standards publications not be adopted more frequently than once every three years. The Commissioner of Community Affairs may make an amendment if it is found that an imminent peril exists to the public's health, safety, or welfare, or that the current code is contrary to the intent of the legislation mandating the code. The Department of Community Affairs (DCA) itself does not have the legislative authority to amend the code to include new material from codes not yet adopted.

At present, codes are frozen by law at the July 1, 1995 level, unless the DCA deems certain provisions of the new codes promulgated since then as essential to carrying out the intent of the law. This means that any efforts to upgrade or amend the codes must proceed through the codes office at the DCA, a codes advisory board, the DCA itself, and finally through the state legislature.

The Model Energy Code (MEC), now the International Energy Conservation Code (IECC), is the most commonly used residential energy code by states. As of January 2002, the 1995 MEC was mandatory statewide in New Jersey. Officials from the NJ Department of Community Affairs are reviewing the 2000, 2003, and 2006 IECC for possible adoption of one of these editions sometime in 2006.

The only differences from the 1995 MEC are adjustments for regional climate details, such as cooling degree days, which are slightly different for three different zones in New Jersey. Builders can comply with the codes by any one of four methods:

- Enrollment in the Energy Star program (30% more efficient than the uniform construction code).
- Compliance with prescriptive packages (these packages contain options with min/max efficiency levels for building envelope and HVAC).
- Use of the RESCheck Software (allows tradeoffs between HVAC equipment and building components such as insulation).
- Submittal of written application.

On January 23, 2006, the U.S. Department of Energy's (DOE) regulations under the National Appliance Energy Conservation Act (NAECA) established a new efficiency standard for certain heating and cooling systems. The greatest impact of the new requirements is on residential sized central air conditioners and heat pumps, whose minimum efficiency ratings are now SEER 13 for cooling and HSPF 7.7 for heat pump heating. NAECA is primarily understood as a manufacturing standard mandating that any new equipment produced in or imported to the United States beginning on the effective date be at least as efficient as the minimums. While NAECA does not prohibit the sale or installation of "old" equipment, it does contain lesser understood requirements governing state building codes with respect to the efficiency of equipment.

The US Department of Energy has the responsibility of implementing NAECA, including updating minimum required efficiency levels periodically. As new technologies and manufacturing techniques make higher levels of energy efficiency more affordable, DOE increases the NAECA minimums to reflect these improvements that are "technically feasible and economically justified." NAECA minimums generally preempt (nullify) state and local regulations, including building/energy code provisions that are inconsistent.

It is important for code officials, builders, and other stakeholders to understand the new limitations and to respond to the change. The US Department of Energy has developed its interpretation of the issue in two important ways. First, they have issued guidance to the states on relevant changes for them to consider to their codes. Second, DOE has issued a new version of REScheck software (v 3.7, release 1b) which

incorporates the new NAECA requirements. In addition, the Building Codes Assistance Project is available to assist states with understanding these important changes.

Most states and local jurisdictions have energy efficiency requirements in their building codes, and the change in NAECA does have an impact. Many energy codes allow for reductions in the efficiency of insulation or windows if high efficiency HVAC equipment is installed. As of January 23, 2006, air conditioners and heat pumps will need to exceed the new NAECA minimums for such trade-offs to be allowed. In other words, while "old" equipment can still be installed in new construction, no credit can be taken for trade-offs unless they reflect a baseline of SEER 13 for cooling and HSPF 7.7 for heat pump heating cycle.

Table 1-22 and Table 1-23 summarize the current residential heating and cooling equipment efficiency standards.

Table 1-22. New Residential Heat Pump and Air Conditioner Standards

Standard	Minimum Efficiency Stds.		
	SEER	EER	HSFP
1995 Model Energy Code (IECC)	10		6.8
Federal Appliance Standard (1/23/06)	13	10	7.7
ENERGY STAR	14	11.5	8.2

Table 1-23. Residential Furnace and Boiler Standards

Standard	Minimum AFUE	
	Furnace	Boiler
1995 Model Energy Code (IECC)	78%	80%
Federal Appliance Standard	78%	80%
ENERGY STAR	90%	85%

1.7.2 Interviews with Code Officials

The evaluation team investigated the impacts of the NJ Residential HVAC Program on the state and federal energy codes by interviewing players at different levels of code development. These interviews included representatives of the IECC, the Federal Minimum Appliance Standards, and the NJ Energy codes.

A member of the staff at the International Energy Code Council was interviewed. He described the process by which code updates were made at the International Code Council as using the governmental consensus process, which is an open, inclusive process that allows input from all individuals and groups. The committees hear all code change proposals. There is an appeals process to allow anyone to appeal an action or inaction of a code committee. Final decisions are made by International Code Council voting members.

Manufacturers, builders, and public interest groups are often part of the IECC process, including groups such as the American Gas Association, the Northeast Energy Efficiency Partnership, and the Midwest Energy Efficiency Alliance. All of these groups may attempt to influence the code adoption process according to their own interests. However, he said that he had not seen much direct activity from utilities in this process.

We spoke with a manager at the U.S. Department of Energy (DOE) and discussed the impact of the state-level energy efficiency programs on the Federal Minimum Appliance Standards. The manager said that codes are updated each year, through the International Code Council. When asked about the influence of energy efficiency programs, he said that the programs do impact code officials in that the higher efficiencies promoted in the programs become adopted into code earlier than they would have been otherwise. However, he was unable to determine the effect for specific programs.

To follow on the discussion with the IECC representative, the evaluation team contacted the Northeast Energy Efficiency Partnership (NEEP) and spoke with their manager for codes and standards. NEEP supplies technical assistance during the code development process. The manager said that in general most new buildings are built to a standard higher than the minimum code, because the market demands this higher level; thus, there is a disconnect between the codes and actual building standards. They are currently looking into ways to improve the code.

In regards to the impact of the state-level energy efficiency programs, the NEEP code manager thinks there have been some successes and some failures. He believes these programs do encourage more energy efficiency and do have significant market influence. He said that the programs help higher efficiency practices become more mainstream and become adopted as normal building practice. These programs are a precursor to the high efficiency technologies becoming adopted in the market and as code.

The code official from the NJ State Energy Office felt that the NJ Residential HVAC Program had not had a significant influence on the NJ codes and standards. He was aware of the program and understands how the program could influence the market, but could not assess the influence the program has had on the NJ Energy Codes

Finally we spoke with a manager at the NJ Division of Codes and Standards. He confirmed that the State is currently considering adopting the 2006 International Energy Code at the end of this year. He reported that improved energy codes can sometimes be detrimental to the building market and increase costs. However, he does not believe the federal increase in AC SEER level will affect the market too much, and that the cost of the 13 SEER HVAC will eventually decrease to around the current cost of 10 SEER units.

The Codes and Standards official did point out an area that the NJ CEP programs may be helping to save State funds. If a property is built to Energy Star standards, an inspector for the NJ ENERGY STAR Homes programs will inspect the job, and the code officials from his department will not do an inspection as the Energy Star standards are much higher than the state standards.

1.7.3 Impact of the Program on Codes and Standards

There is notable difference between the building energy codes (Model Energy Code 1995) and the standards which currently exiting in the residential HVAC market. The building codes follow from the IECC or Model Energy Codes. These codes are not strongly influenced by the activities of the state-level energy efficiency programs. The federal standards and ENERGY STAR standards while not directly influenced by the state-level energy efficiency programs, do respond to the market effects caused by these programs. For example, if the state-level programs did not exist than the market for high efficiency equipment would not grow as quickly. The federal standards officials do look at the changes in the market when deciding to increase the efficiency standards. According to the standards officials it would be difficult to determine the effects of a state-level program on the national market.

According to the results of the nonparticipating contractor surveys, the market for high efficiency air conditioning equipment is already well above the building code. Nonparticipating contractors report that they are installing equipment that meet or **exceed** the current NJ Energy Code, on 65% of retrofit projects

and on 51% of new construction project. The New Jersey Division of Codes should adopt the higher efficiency levels of the IECC 2006 code.

1.8 Rebate and Incentive Level Assessment

The Department of Energy has issued new energy efficiency standards for residential air conditioners and heat pumps that went into effect on January 23, 2006. Residential air conditioning and heat pumps manufactured as of January 23 must achieve a Seasonal Energy Efficiency Ratio (SEER) of 13 or higher; the current standard is 10. This assessment reviews the change in the residential air conditioning standards and provides recommendations for updating the NJ Residential HVAC Program rebates based upon these changes. The incentives for other residential HVAC equipment are also reviewed here.

In addition to the changes in the Federal Minimum Appliance Standards for central air conditioning and heat pumps, the Energy Policy Act of 2005 introduced a series of tax incentives that may also impact the incentives currently being offered by the Residential HVAC Program. Consumers take advantage of these tax incentives as a credit on their 2006 and 2007 federal income taxes.

1.8.1 Change in Federal Standards

As a result of the change in the federal appliance standard, both the ENERGY STAR and Consortium for Energy Efficiency (CEE) standards for high efficiency air conditioning equipment will change. The ENERGY STAR minimum efficiency requirements will increase from 13 SEER, a 30% savings over the previous federal minimum efficiency standard of 10 SEER, to 14 SEER, an 8% savings over the new federal minimum efficiency standard of 13 SEER.

CEE is currently waiting for final board approval of the proposed changes in efficiency level. The current proposal is for the CEE Tier 1 standards to be discontinued and the CEE Tier 2 standard to become the new CEE Tier 1 standard. In addition CEE will add a new Tier 2 standard at 15 SEER and 12.5 EER. Table 1-24 summarizes the current efficiency levels and Table 1-25 shows the new minimum standards for air conditioner efficiency.

Table 1-24. Previous Residential Air Conditioner Standards

Standard	Minimum Efficiency Stds		
	SEER*	EER*	HSFP
Federal Appliance Standard	10	9.2	6.8
ENERGY STAR/CEE Tier 1	13	11	8.0
NJ/CEE Tier 2	14	12	8.5

Table 1-25. New Residential Air Conditioner Standards

Standard	Minimum Efficiency Stds.		
	SEER	EER	HSFP
Federal Appliance Standard (1/23/06)	13	10	7.7
NJ ENERGY STAR	14	11.5	8.2
NJ Tier 1/CEE Tier 1	14	12.0	8.5
NJ Tier 2/CEE Tier 2	15	12.5	8.5

1.8.2 Available Tax Incentives

In August 2005, the Energy Policy Act of 2005 was signed into law. In addition to increasing the federal minimum energy efficiency standards on 16 products, the act includes manufacturer and consumer tax incentives for advanced energy saving technologies and practices. These tax incentive provisions provide for more than $2 billion for advanced energy saving technologies and practices beginning in 2006 and extending until 2007. Table 1-26 summarizes the available tax incentives.

Table 1-26. Available Tax Incentives

Advance Energy Savings Technology	Eligible Efficiency Level	Tax Credit	Years Covered
Central Air Conditioner & Heat Pump	15 SEER/12.5/ 9.0 HSPF	$300	2006 & 2007
Ground Source Heat Pumps (GSHP)			
GSHP Closed Loop	14.1 EER/3.3 COP	$300	2006 & 2007
GSHP Open Loop	16.2 EER/3.6 COP	$300	2006 & 2007
GSHP Direct Expansion (DX)	15 EER/3.5 COP	$300	2006 & 2007
Water Heaters (gas and oil)	0.8 Energy Factor	$300	2006 & 2007
Gas and Oil Furnaces and Boilers	≥ 95% AFUE	$150	2006 & 2007

1.8.3 2005 AC Rebate Levels

In 2005 the Residential HVAC Program provides customer rebates for the installation of cooling equipment under two efficiency tiers indicated above. Table 1-27 presents the 2005 rebate levels for each of these efficiency tiers.

Table 1-27. 2005 Central AC and Heat Pump Rebate Levels

	Minimum Efficiency Stds.			2005 NJ Incentives	
	SEER*	EER*	HSFP	CAC	Heat Pumps
ENERGY STAR/CEE Tier 1	13	11	8.0	$200	$300
NJ/CEE Tier 2	14	12	8.5	$400	$550

*Split systems

For cooling equipment under either tier, documentation of proper sizing and installation of qualifying high efficiency equipment must be submitted. In the case of units installed in new homes, this will mean (a) submission of Manual J sizing calculations, (b) documentation of proper charging, and (c) documentation that airflow is within the range recommended by manufacturers (maximum acceptable variation of plus or minus 10%).

In the case of units installed in existing homes, documentation of proper sizing and installation will mean (a) submission of Manual J sizing calculations, (b) documentation of proper charging, and (c) documentation of proper airflow rates. In 2005 the program was modified to such that HVAC firms that have at least 75% of their technicians holding NATE certification will be required to submit only the Manual J sizing calculation and signed certification of proper charge and airflow according to equipment manufacturers' specifications.

All applications are reviewed as they are processed for verification of the documentation of qualifying equipment efficiency rating, proper sizing, and proper installation. Each application and its information

are entered into a database which checks for duplicate applicants through an equipment serial number comparison.

On an ongoing basis, 10% of all rebate applications are selected for a quality assurance review and inspection by a third-party inspector contracted by each of the electric utilities. Assurance includes a paperwork review of the application and a field inspection to verify qualifying equipment installations and proper installation. Field measures of charge and airflow are not taken. A field inspection report is prepared and submitted to the utility.

1.8.4 Impact of New Standards on Energy Savings

As mentioned above, the change in the minimum federal standards and the ENERGY STAR and CEE efficiency levels will result in lower energy savings relative to the federal standard from the installation of high efficiency equipment. However, there will still be significant savings from continuing to promote proper sizing and installation.

Table 1-28 and Table 1-29 present the energy savings associated with the installation of a 2.7 ton air conditioning unit under the 2005 standards and the 2006 standards. Installing an air conditioning unit with proper sizing and installation practices that meets the 2006 ENERGY STAR standards will save 349 kWh/year and the installation of a 2005 ENERGY STAR qualified air conditioning unit with proper sizing and installation practices would have saved 716 kWh/year. This is a 51% reduction in energy savings and a 21% reduction in demand savings relative to the new standards.

As a result of the standards change, proper sizing and proper installation will become a larger portion of the energy savings. In 2005 the energy savings from proper sizing and proper installation was 36% of the total Tier 1 energy savings and 30% of the total Tier 2 energy savings. With the standard changes the energy savings from proper sizing and proper installation represents 69% of the energy savings for each of the first two tiers and 52% of the CEE Tier 2 energy savings. The actual energy savings from proper sizing and proper installation in both 2005 and 2006 is around 250 kWh. The decrease in the equipment savings has resulted in the energy savings from the proper sizing and installation making a greater contribution to the overall savings.

Table 1-28. 2005 Central AC and Heat Pump Savings Levels

	2005 Minimum Efficiency Stds.			Equipment Savings			Equip. Savings & Proper Size and Install		
	SEER*	EER*	HSFP*	kWh	kW	HP Heating kWh	kWh	kW	HP Heating kWh
Federal Minimum Std.	10	9.2	7.7	-	-	-	-	-	-
ENERGY STAR/CEE Tier 1	13	11	8	457	0.4	437	716	0.6	858
CEE Tier 2	14	12	8.5	566	0.6	582	806	0.7	978

*Split systems

Table 1-29. Estimate Energy Savings of New Efficiency Tiers

	2006 Minimum Efficiency Stds.			Equipment Savings			Equip. Savings & Proper Size and Install		
	SEER*	EER*	HSFP*	kWh	kW	HP Heating kWh	kWh	kW	HP Heating kWh
Federal Minimum Std.	13	10	7.7	-	-	-	-	-	-
NJ ENERGY STAR	14	11.5	8.2	109	0.3	157	349	0.4	567
NJ Tier 1/CEE Tier 1	14	12.0	8.5	109	0.4	157	349	0.5	567
NJ Tier 2/CEE Tier 2	15	12.5	8.5	203	0.5	987	427	0.6	1,256

*Split systems

The savings in these two tables was calculated in accordance with the NJ BPU Savings protocols. These protocols specify a proper sizing and installation energy efficiency improvement of 17% and a demand efficiency improvement of 7%.

1.8.5 Quality Installations

There is currently a study being conducted by NEEP, NYSERDA, and the NJ BPU under a STAC grant from the DOE to comprehensively assess the HVAC efficiency opportunities in the Northeast region and leverage research opportunities in New York and New Jersey that have high peak cooling loads. The study includes field measurements of HVAC equipment performance and installation quality.

Based on a sample of 70 AC units, preliminary findings from the study found that there was little difference between the quality of installation by NATE certified contractors and contractors that are not NATE certified. These preliminary results indicate that there is no statistically significant difference on refrigerant charge or air flow between contractors with 75% NATE certified technicians versus contractors that are unknown by or not responding to Eastern Heating and Cooling Council calls. The goal of NATE certification was to improve the quality of installation by contractors. If both the NATE and non-NATE certified contractors are installing units at the same high quality then this training is no longer necessary. If, however, both NATE and non-NATE contractors are installing units with poor quality; a more robust certification process may be needed. The results of this study are being finalized in the next couple of months.

Although there is significant potential savings from proper sizing and proper installation, it appears that the current NATE certification requirements may not be strong enough to capture these savings. This study suggests that an additional verification needs to be performed to ensure that the potential energy savings from proper sizing and installation are being achieved.

This study is also finding that the biggest impact on the energy consumption of air conditioning units is the leakiness of the home. A properly installed air conditioner on a home with a lot of infiltration will still cause the unit to run inefficiently.

1.8.6 Recommended Rebate Levels

NJ should continue to follow the ENERGY STAR and CEE efficiency levels. Supporting these efficiency levels will continue to send a strong market signal to the manufacturers and distributors to continue to build and stock high efficiency HVAC equipment. Although the ENERGY STAR efficiency level no

longer represents significant energy savings relative to the federal minimum efficiency standard (8% savings down from 30%), supporting this efficiency level will reinforce that the ENERGY STAR label is the symbol to look for high energy efficiency equipment. Supporting the ENERGY STAR level may depend on the results of the cost-effectiveness screening. This screening is outside the scope of this analysis.

However, since as a result of the standard changes, a greater percentage of the measure savings will be from the proper sizing and proper installation of the equipment, there should be more emphasis on this aspect of the program. We recommend having a two-tiered rebate approach. The first tier will be for the installation of the higher efficiency units, ENERGY STAR qualifying, CEE Tier 1, and CEE Tier 2. The second tier of rebates will be for the verification of the proper installation of the higher efficiency equipment.

Based on the preliminary findings of the NEEP study, verification of the proper installation of these units will have to be more extensive than the current procedures. We recommend offering an additional incentive for third-party in-field verification of the proper refrigerant charge and airflow using either the Honeywell Service Assistant tool or the Proctor Engineering CheckMe!^{tm} tool, or the equivalent. This tool should provide a report indicating whether the unit has been installed properly. The costs for the third-party verification contractor would have to be added to the program costs. The third-party verification will only be required for those customers that want to receive the additional rebate.

Although the change in the federal standards will result in less of a difference between the federal minimum efficiency standard for air conditioning units and the higher efficiency equipment, there will still be significant savings associated with the proper installation of high efficiency air conditioning units. Based upon our review of the expected savings and incremental costs for these measures, we recommend the rebate levels detailed in Table 1-30.

Table 1-30. Recommended Central AC (split systems) and Heat Pump Rebate Levels

	Minimum Efficiency Stds.			2006 NJ Incentives	
	SEER	EER	HSFP	CAC	Heat Pumps
NJ ENERGY STAR	14	11.5	8.2	$50	$100
NJ Tier 1/CEE Tier 1	14	12.0	8.5	$100	$150
NJ Tier 2/CEE Tier 2	15	12.5	8.5	$150	$200
Proper Size and Installation*				$250	$250

*Requires verification by certified 3rd party

A memo outlining the above discussion and rebate recommendations was presented to the BPU in early January. The BPU took these recommendations into consideration in determining the 2006 central air conditioning rebate levels. The BPU decided that although third party verification of sizing and installation may be worthwhile, the utilities currently don't have the resources to set up the necessary infrastructure. After the program has been transitioned over to the Residential Market Manager, the Clean Energy Council will review these recommendations again. Table 1-31 presents the incentive levels that were selected for 2006.

Table 1-31. Implemented 2006 Central AC (split systems) and Heat Pump Rebate Levels

	Minimum Efficiency Stds.			2006 NJ Incentives	
	SEER	EER	HSFP	CAC	Heat Pumps
NJ Tier 1/CEE Tier 1	14	12.0	8.5	$300	$350
NJ Tier 2/CEE Tier 2	15	12.5	8.5	$400	$450

There is a $300 tax incentive for ground source heat pumps that continues through 2007. We recommend leaving the incentive at $500 and using the tax incentive to help boost participation. This will allow the program to offer a higher incentive for ground source heat pumps without actually raising the incentive amount that the program pays.

Similarly, there is a $300 tax incentive for 15 SEER air conditioners and heat pumps that continues through 2007. We recommend leaving the incentive for 15 SEER at $400 and $450 for heat pumps and using the tax incentive to help boost participation. This will allow the program to offer a higher incentive for these units without actually raising the incentive amount that the program pays.

Based on the results of the market share assessment, the market for high efficiency furnaces is becoming transformed, but the market for high efficiency boilers is just beginning to be transformed. Participating contractors report that on average 73% of the furnaces and 35% of the boilers that they install are high efficiency. Nonparticipating contractors report that on average 42% of the furnaces and 30% of the boilers that they install are high efficiency. Therefore, the rebates for high efficiency furnaces should begin to be phased out due to the high market share. In addition as fuel prices rise the economics of high efficiency units will improve making these units more attractive to consumers. Due to the improved economics the rebates for both high efficiency furnaces and boilers should be gradually reduced over the next couple of years. Table 1-32 presents the recommended rebate levels for the natural gas measures.

The U.S. experienced a significant rise in the cost of natural gas and oil during the winter of 2005/2006. The BPU requested that incentive levels for high efficiency heating equipment be increased to help consumers manage their utility bills. While increasing the rebates may gain favor politically, this action actually sends a confusing signal to the market place. Rising fuel prices actually improve the cost-effectiveness of high efficiency equipment. The improved economics, resulting from the higher fuel costs, of purchasing the high efficiency equipment means that the incentives should actually be lowered. Purchasers will not need the rebates to “buy-down” the initial cost of the equipment to see an attractive payback on their investment in the high efficiency equipment. Also, if this response is used too often the market could be conditioned to only buy new units in the winter when the rebates are higher. This market reaction may lead to short-term bottlenecks for contractors and distributors.

Table 1-32. Recommended 2006 High Efficiency Natural Gas Equipment Incentives

Equipment Type	Minimum Efficiency Standards	Current Rebate Levels	Nov. 1, 2005 - April 30, 2006[49]	Recommended 2006 NJ Incentives
Furnace	≥ 90% AFUE (ENERGY STAR)	$300	$500	$200
Furnace with ECM or equiv.	≥ 92% AFUE (ENERGY STAR)	$400	$600	$300
Boiler	≥ 85% AFUE (ENERGY STAR)	$300	$750	$200
Water Heater	≥ 0.62 Energy Factor	$50	$50	$50

Rebates also should be created for two new measures: 1) duct sealing and 2) mini-splits ductless AC units. According to the STAC study, the incremental cost for sealing of ductwork is about $375 for labor and supplies. Based upon experience, it usually takes subsidizing between 40% and 50% of the cost of the measure for it to begin to penetrate the market, or about $150. Sealing leaky ducts will save both electricity and natural gas, therefore the $150 incentive should be divided between the electric and gas utilities.

Ductless, mini-split-system heat pumps (mini splits) make good retrofit add-ons to houses with "non-ducted" heating systems, such as hydronic (hot water heat), radiant panels, and space heaters (wood, kerosene, propane). They can also be a good choice for room additions, where extending or installing distribution ductwork is not feasible.

Like standard air-source heat pumps, mini splits have two main components: an outdoor compressor/condenser, and an indoor air-handling unit. A conduit, which houses the power cable, refrigerant tubing, suction tubing, and a condensate drain, links the outdoor and indoor units.

The STAC study found that the incremental cost of installing a standard efficiency mini-split system versus a SEER 13 central AC or heat pump is about $1,500 for a mini-split with 3 remote units in the home. The standard mini-split is estimated to save about 790 kWh annually compared to the SEER 13 CEC. The high efficiency mini-split with 3 remote units is estimated by the STAC study to cost about $3,500 more than the standard efficiency central AC unit and save about 990 kWh annually. In new construction projects there is additional cost savings due to the elimination of the duct work, approximately $200 to $1,000 in duct work savings depending upon the home. Table 1-33 presents the recommended incentive levels for the mini-split systems. Although incentives are typically set at 40%-50% of incremental costs, distribution of incentives across technologies is also important. The incentive levels have been chosen so that the incentives for mini-splits do not take significant funds away from technologies that are more cost-effective than these units.

[49] Increased incentives during the 2005/2006 winter were designed to help consumers manage the fuel costs during this period.

Table 1-33. Recommended Incentive Levels for Mini-Split Ductless Systems

Equipment Type	Minimum Efficiency Standards	Incremental Costs[50]	Incentive Existing Homes	Incentive New Construction
Standard mini-split system with 3 remote units	13 SEER and 11 EER	$1,500	$300	$200
High efficiency mini-split system with 3 remote units	15 SEER and 12.5 EER	$3,500	$450	$300

The rebates for the mini-split ductless systems and duct sealing should be added to the rebate Residential HVAC Program rebate process. The table of rebates should be added to the rebate form and the tracking system. The requirements for proper sizing and proper installation should be the same requirements as for the central air conditioning units. The program should inspect 50% of the duct sealing projects during the first year of the rebate and phase the quality assurance inspections down to 10% of duct sealing rebates by the 3 year that this measure is offered.

1.9 OCE Program Goals Assessment

This section will review the stated goals for the Residential HVAC Program, suggest alternative goals, and discuss target levels for the goals.

The 2005 Residential HVAC Program goals as expressed in the 2005 Utility Managed Program filing were:[51]

- Process 17,000 central air conditioner and heat pump rebates statewide.
- Process 8,500 ENERGY STAR qualified furnace and boilers rebates statewide.
- Train at least 500 HVAC technicians on either Manual J load calculations (including use of software applications), proper charging and airflow, technical material that must be understood to pass the North American Technician Excellence (NATE) certification test, duct sealing, duct design using ACCA Manual D, ENERGY STAR sales techniques, and/or any other substantial form of training that is directly related to program goals. Any training conducted using the same curricula provided by the program, including training provided by industry allies, shall count towards the goal.
- Add 200 New Jersey HVAC technicians to the list of those who are certified by NATE.
- Provide ENERGY STAR sales training to at least 50 sales representatives of HVAC contractors.
- Hold at least one individual outreach meeting to explain and promote program offerings (e.g., rebates, sales training, other training).
- Continue a NATE certification-training program for gas contractors.

We will address these goals and recommend other goals in the following paragraphs.

[50] Incremental cost is relative to a 13 SEER central AC not including the duct work.

[51] New Jersey's Clean Energy Program 2005 Program Descriptions and Budget, Utility Managed Energy Efficiency Programs, Updated June 8, 2005.

1.9.1 Number of Participants

Creating goals for the number of participants is common among energy efficiency programs. When the program focus changes little from year to year historical achievements can give reasonable bounds to targets. However, when programs change significantly, then historical patterns become much less useful and as a result, these goals become significantly more speculative. In some cases, focus on a goal of total savings or numbers of participants can work against other program goals. For example if the number of participants is the main focus then resources may get moved away from market transformation efforts, such as contractor education and training.

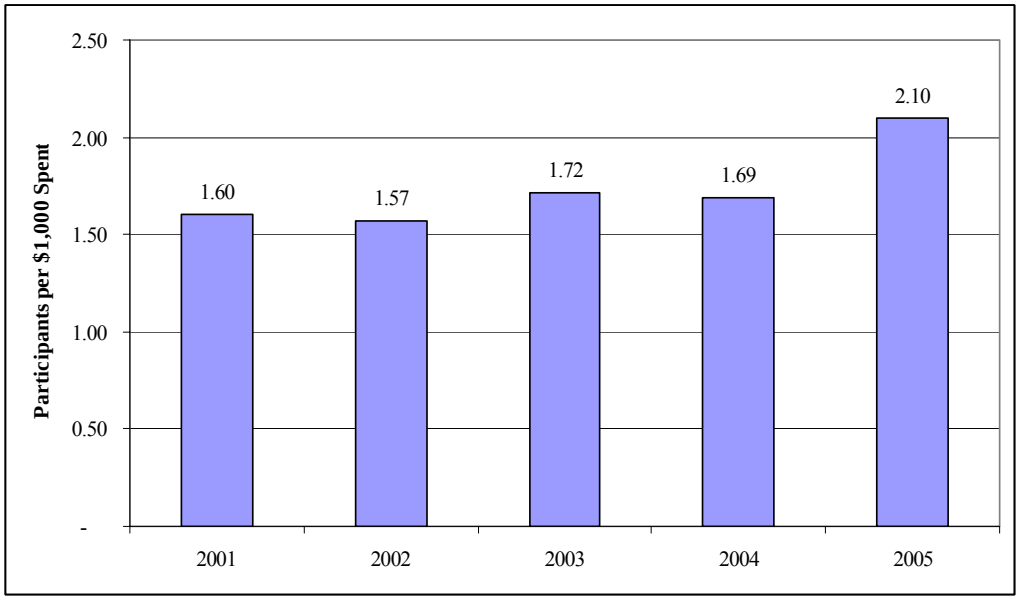
Is this the correct goal? Yes, maintain goals for number of participants but do not push the envelope too much in achieving these goals so that other goals are not met.

Program goal: Collectively process through completion at least 23,750 central air conditioner, heat pump, boiler, furnace, and hot water rebates. Last year about 28,000 rebates were processed, of which 17,000 were central AC rebates. Central AC units with efficiency less than 14 SEER accounted for 25% of the 17,000 central AC rebates, or 4,250 rebates. Adjusting last year's rebate total of the removal of less than 14 SEER units, the rebate goal should be 23,750

Discussion: Historically, the program has achieved between 1.46 and 2.21 participants for each $1,000 spent (Figure 1-24).

Recommendation: The participation goals must be set in relation to the budget and in relation to the size of the average project. Given historical patterns, a reasonable floor seems to be around 2.0 participants for every $1,000 spent with a stretch goal at 2.5 participants for every $1,000 spent by the program. Of course, historical patterns will not be relevant if the program changes its focus significantly.

Figure 1-24. Participants per $1,000 Expended



Source: CEP Annual Report. Number of participants divided by annual expenditures.

1.9.2 Contractor/Installer Training

One of the most cost-effective ways to transform a market is to work upstream with the key market actors to create more of a focus on energy efficiency. Currently the program sponsors the training of HVAC installers on Manual J load calculations (including use of software applications), proper charging and airflow, technical material that must be understood to pass the North American Technician Excellence (NATE) certification test, duct sealing, duct design using ACCA Manual D, and ENERGY STAR sales techniques.

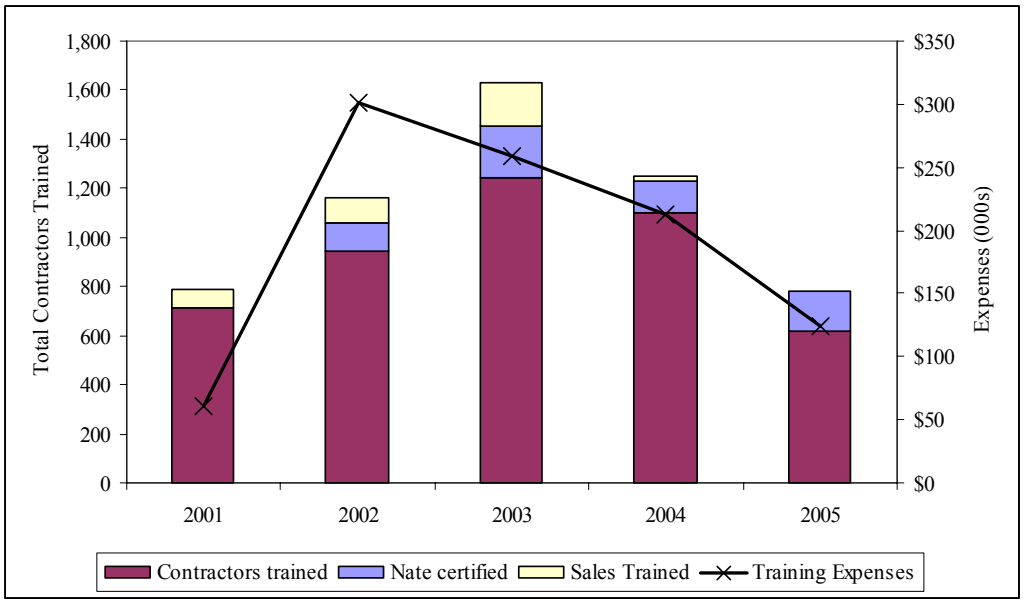
Is this the correct goal? Yes, the program should continue to offer training to the contractors. As evidenced by the survey data contractors, are very influential to the customers' decision to purchase high efficiency equipment.

Program goal: Train an additional 500 installers with the focus on proper installation and duct sealing.

Discussion: According to the participants and nonparticipant respondents, the contractors strongly influence their selection of HVAC equipment. The program should leverage the influence of the contractors by training them on the advantages of high efficiency equipment, sales techniques, and proper installation and duct sealing. Figure 1-25 show that the training expenses and the number of contractors trained has been declining since 2002. According to the 2001 Baseline Study there were approximately 2,500 residential HVAC contractors with an average of 30 employees per firm in New Jersey, or about 75,000 residential HVAC installers. The program has trained about 5,600 installers, about 7% of the installers in New Jersey, through 2005.

Recommendation: The training goals must be set in relation to the budget. Given historical patterns (Table 1-34), a reasonable floor seems to be around 6.0 contractors trained for every $1,000 with a stretch goal at 10 contractors trained for every $1,000 spent on training. Of course, historical patterns will not be relevant if the program changes its focus significantly. The training budget should be divided up between the general training (75%), NATE certification (10%), and ENERGY STAR sales training (15%). If the STAC study finds that NATE training does not improve the quality of installations than the portion of the training budget allotted to the NATE training should be reduced to 0% and the funds reallocated to the ENERGY STAR sales training.

Figure 1-25. Contractors Trained vs. Training Expenses



Source: CEP Fourth Quarter Reports 2001-2005.

Table 1-34. Contractors Train per Training Expenditures

	Training Expenditures ($000s)	Contractors Trained	Contractors Trained per $1,000
2001	$61	789	12.93
2002	$301	1,162	3.86
2003	$259	1,628	6.29
2004	$212	1,250	5.90
2005	$125	779	6.25

Source: CEP Fourth Quarter Reports 2001-2005.

1.10 Key Findings

The following are selected findings from the market assessment:

- Overall participant satisfaction with the rebate program was quite high. On a 1-5 scale, where 1 means "very dissatisfied" and 5 means "very satisfied", the mean response was 4.5. While most (78%) said that there were no specific problems with the program,
- Most participants (73%) found out about the rebate program through their contractor. None of the customers learned about the rebate program through radio, TV, or newspaper ads.
- The program has successfully increased the market share of high efficiency HVAC equipment in NJ. Since the 2001 New Jersey Residential HVAC Baseline Study, the market share for high efficiency HVAC products has increased. The market share for central air conditioning units with SEER 13 or greater increased from 56% to 65% for retrofit projects and from 42% to 51% for new construction projects. The market share for high efficiency furnaces stayed the same (42%) for existing homes and increased from 27% to 45% for new homes. The market share for high

efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.

- The 2001 Baseline Study found the market share for high efficiency furnaces was 42% for existing homes and 27% for new homes. Considering the nonparticipant responses only, in new construction projects the market share for furnaces has significantly increased (27% to 45%); however, for retrofit projects the market share for high efficiency furnaces has remained the same (41%). The surveyed nonparticipant contractors indicated that they did 79% of their HVAC installations in existing homes and 21% of their HVAC installations in new homes. Using these installation figures, the weighted average market share for high efficiency furnaces by nonparticipating contractors is 42%. Again considering the nonparticipant responses only, the market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.
- The NJ HVAC Program was one of the first residential HVAC programs in the country to require proper sizing and proper installation to receive an incentive for high efficiency HVAC equipment. Since then other programs have adopted these requirements. Some programs, Massachusetts for example, have gone a step further and have begun requiring third party verification of proper sizing and installation.
- Contractors report that first cost is still the biggest customer market barrier in purchasing high efficiency HVAC equipment.
- Market barriers continue to include lack of information and training of contractors and lack of information for consumers. The current program is designed to overcome these barriers and should continue.
- According to the results of the nonparticipating contractor surveys, the market for high efficiency air conditioning equipment is already well above the building code. Nonparticipating contractors report that they are installing equipment that meet or **exceed** the current NJ Energy Code, on 65% of retrofit projects and on 51% of new construction project.
- Based on the preliminary findings from the STAC study there was little difference between the quality of installation by NATE certified contractors and contractors that are not NATE certified. These preliminary results indicate that there is no statistically significant difference on refrigerant charge or air flow between contractors with 75% NATE certified technicians versus contractors that are unknown by or not responding to Eastern Heating and Cooling Council calls.

1.11 Program Recommendations

The recent change in the Federal Minimum Appliance Standard for central air conditioning units will have a major impact on the program over the coming year. Based upon our research with the market actors there appears to have been sufficient lead time for the change in the standards so that equipment availability and awareness of the change will not adversely impact the market. However, making future cooling related program changes during the fall and heating related program changes during the spring will insure that the market actors can respond effectively.

Market barriers continue to include lack of information and training of contractors and lack of information for consumers. The current program is designed to overcome these barriers and should continue. Recommendations for this program include:

- ***Continue with successful aspects of the existing program.*** The existing program appropriately promotes both the sale of qualifying energy-efficient HVAC equipment and proper system sizing

and installation "best practices" that affect operating efficiency. Since the incremental savings of the high efficiency CAC units is lower as a result of the change in federal standards, proper sizing and installation have become a larger portion of the savings and should continue to be emphasized. Through the use of incentives, and contractor training the program has successfully increased the market share of high efficiency HVAC equipment in NJ. Since the 2001 New Jersey Residential HVAC Baseline Study the market share for high efficiency HVAC products has increased. The market share for central air conditioning units with SEER 13 or greater increased from 56% to 65% for retrofit projects and from 42% to 51% for new construction projects. The market share for high efficiency furnaces stayed the same at 42% for existing homes and increased from 27% to 45% for new homes. The market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.

- ***Require third-party verification of proper installation.*** As a result of the increase in national standards the difference between standard efficiency and high efficienct cooling equipment has been decreased. For high efficiency cooling equipment installation the majority og the savings will come from proper sizing and installation rather than the improved equipment efficiency. Therefore, the program should require third-party in-field verification of the proper refrigerant charge and airflow using a qualified diagnostic tool, e.g., Honeywell Service Assistant tool or the Proctor Engineering CheckMe!^{tm} tool. The tool should be able to provide a report indicating whether the unit has been installed properly.

- ***Require proper sizing and installation of high efficiency furnaces and boilers.*** Similar to the cooling measures, the proper sizing and proper installation of furnaces and boiler can save 10%-15% of their energy use. Manual J should also be used to properly size furnaces and boilers. Conduct a duct lower test to ensure proper airflow across the blower.[52]

- ***Increase the outreach to contractors***. The program contractors are the channel through which most participants learn about the program. The program needs to continue to work closely with the contractors. The ENERGY STAR sales training should be continued. The program should work with contractors to develop sales materials that may help them with their promotion of high efficiency HVAC equipment. A return on investment matrix (or payback period) matrix could be developed that shows the return on their investment versus the cost of energy. The matrix or graph will help the contractors explain to the customers that investing in energy efficiency now will help them hedge against higher energy costs. The matrix will show that the more that fuel prices increase the better investment the high efficienct equipment becomes.

- ***Increase program marketing budget.*** Increase spending on marketing from 1.3% of expenditures in 2005 to 3% of expenditures in 2006. This will be mostly for materials to help contractors sell the program.

- ***Continue NATE training.*** Continue training efforts at current levels until results of the STAC study are finalized. If NATE certification of contractors is not producing higher quality installations than non-NATE contractors, then this training budget may not be cost-effective.

[52] For the details of properly sizing and testing proper installation heating equipment see "Specification of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems" by Rick Karg for Consortium for Energy Efficiency, July 2000.

- ***Explore the addition of a maintenance program for older CAC and heat pump units.*** Up to a 24.4% cooling energy savings and up to 12% heating savings can be accomplished by a program that diagnoses and repairs duct leakage, airflow, and overcharge on residential central air conditioners and furnaces.[53] The Cool Smart program in Massachusetts is a good example of this type of program. Cool Smart provides promotes the QIV Digital Checkup to measure for proper refrigerant charge and air flow of the central air conditioner or heat pump systems. A COOL SMART trained air-conditioning technician tests the system while it's running and takes a series of measurements which are analyzed via computer. Within a few minutes the technician and homeowner know how the system is performing. The Digital Checkup may be done as a special visit or during normally scheduled maintenance, tune up or repair work. The customer receives a $125 instant credit on the contractor invoice. To receive this incentive the customer must agree to pay the QIV contractor for repairs, if needed,; the unit must pass COOL SMART requirements at least for system charge with respect to air flow; and the unit must meet system requirements as defined above and the customer has not received an incentive for a Digital Checkup on the system within the past five years.

- ***Develop joint promotions with HVAC manufacturers, distributors, and/or contractors.*** The program should approach manufacturers and distributors about offering co-op advertising and joint promotions rather than current arrangement to simply communicate and educate these stakeholders.

- ***Include duct sealing in contractor training.*** Leaky air distribution ducts often wasting 7-12% of heating and cooling energy used by your home. By sealing the leaky ducts one can improve the efficiency of the heating and cooling system. In addition, sealing ducts has both health and safety benefits. Expand installation training to include how to properly size equipment and seal, balance, and test ducted distribution systems.

- ***Add an incentive for duct sealing to the program.*** Add a $150 incentive for duct sealing to the program. The contractors should be required to show documentation of their work. The program should inspect 50% of the duct sealing projects during the first year of the rebate and phase the quality assurance inspections down to 10% of duct sealing rebates by the 3 year that this measure is offered.

- ***Add incentives for mini-split ductless systems to the program.*** Incentives for ductless or "mini-split" systems should be added to the Residential HVAC Program. According to the analysis from the STAC study, these units pass the societal benefit-cost test. Ductless systems are made up of four components: the condensing unit, located outside the building; the indoor unit, or units, which can be wall or ceiling mounted; refrigerant lines, which connect the outdoor unit to the indoor unit; and a hand-held wireless remote or wall monitor which controls the entire system. The recommended incentive levels are presented in Table 1-35.

- ***Do not use short-term rebate increases to promote high efficiency equipment.*** Short term increases in high efficiency natural gas equipment incentives should not be used. An increase in energy costs improves the economics of purchasing high efficiency equipment and an additional incentive should not be necessary. Also if short term incentive increases are used the market

[53] Procter PE, John. "Appliance Doctor Pilot Project- Summer 1990 Activity". Pacific Gas and Electric Company. January 8, 1991.

could be conditioned to only buy new units in the winter when the rebates are higher. This market reaction may lead to short-term bottlenecks for contractors and distributors.

- ***Reduce Incentive for ground source heat pumps.*** Reduce the ground source heat pump rebate from $500 to $200, so that this equipment does not receive too high an incentive when combined with the federal tax credit.

- ***Reduce the incentives for central air conditioning and heat pumps.*** As a result of the change in federal minimum efficiency standards for residential central air conditioning and heat pumps the high efficiency tier levels for these types of equipment need to be update and the corresponding rebate levels need to be adjusted. Table 1-36 presents the recommended adjustments for these incentive levels.

- ***Reduce the incentives for furnaces and boilers.*** The market for high efficiency is gradually becoming transformed; as the market gets nearer to transformation, incremental costs will have decreased or first cost have become less of a barrier and the rebate levels should be decreased. In addition rising fuel prices have made high efficiency furnaces and boilers by economical. As a result of the improved economics the market should not need as high an incentive to purchase the high efficiency equipment. Table 1-37 presents the recommended adjustments for these incentive levels..

- ***Conduct a process evaluation to determine if the program procedures can be improved.*** During the next process evaluation investigate whether the amount of paperwork can be reduced or simplified. 70% of the contractors responded that paperwork is barrier to program participation. For tracking and verification purposes some amount of paperwork is necessary.

Table 1-35. Recommended Incentive Levels for Mini-Split Ductless Systems

Equipment Type	Minimum Efficiency Standards	Incremental Costs[54]	Incentive Existing Homes	Incentive New Construction
Standard mini-split system with 3 remote units	13 SEER and 11 EER	$2,000	$300	$200
High efficiency mini-split system with 3 remote units	15 SEER and 12.5 EER	$3,500	$450	$300

[54] Incremental cost is relative to a 13 SEER central AC not including the duct work.

Table 1-36. Recommended 2006 Central AC (split systems) and Heat Pump Rebate Levels

	Minimum Efficiency Stds.			2006 NJ Incentives	
	SEER	EER	HSFP	CAC	Heat Pumps
NJ ENERGY STAR	14	11.5	8.2	$50	$100
NJ Tier 1/CEE Tier 1	14	12.0	8.5	$100	$150
NJ Tier 2/CEE Tier 2	15	12.5	8.5	$200	$250
Proper Size and Installation*				$250	$250

*requires verification by certified 3rd party

Table 1-37. Recommended 2006 High efficiency Natural Gas Equipment Incentives

Equipment Type	Minimum Efficiency Stds.	Recommended 2006 NJ Incentives
Furnace	90% AFUE or greater (ENERGY STAR)	$200
Furnace with ECM or equiv.	92% AFUE or greater (ENERGY STAR)	$300
Boiler	85% AFUE or greater (ENERGY STAR)	$200
Water Heater	0.62 Energy Factor or greater	$50

2. NEW JERSEY ENERGY STAR HOMES PROGRAM MARKET ASSESSMENT

2.1 Program Introduction

The Residential New Construction Program (New Jersey ENERGY STAR Homes Program) is instrumental in promoting the construction of energy-efficient new homes in New Jersey. The program's long term goal is to transform the marketplace so that all new homes are built to EPA ENERGY STAR home standards.

ENERGY STAR homes include high-efficiency systems and upgrades not found in all standard new homes. Addressing the building shell, heating and ventilation equipment, water heating, and lighting and appliances reduces energy consumption and operating costs and increases comfort by reducing drafts and air leakage. Building practices can improve health and safety and possibly increase the resale value of the home. The ENERGY STAR home is about 30% more efficient than those built under the 1995 national Model Energy Code (MEC).

These technologies and practices are designed to save the owners of labeled homes money on their utility bills and improve the comfort of the home. The ENERGY STAR label is given only after the home's energy efficiency is verified. In New Jersey, a Home Energy Rating System (HERS) rating is performed by an accredited home energy rater through one of the two Program Implementers.

A HERS rating is an evaluation of the energy efficiency of a home, compared to a computer-simulated reference house (of identical size, climate zone, and shape as the rated home) that meets minimum requirements of the MEC. The ratings are performed by a home energy rater (Rater). Raters are trained to perform the function of both data collection and analysis. They review the home design plans, inspect a home to evaluate the minimum rated features and prepare an energy efficiency rating. The work of a Rater is typically overseen by a HERS Provider, a person or organization that develops, manages, and operates a home energy rating system, assuring that it complies with established national standards.

2.1.1 Detailed Program Background

Program Evolution

In 2001, the Residential New Construction (RNC) New Jersey ENERGY STAR Homes program was launched with seven regulated natural gas and electric utilities. In 2001, 4,553 homes were enrolled and committed to build to ENERGY STAR standards. In 2002, 1,881 homes were certified ENERGY STAR homes and 10,490 were enrolled. This enrollment was due in large part to the state's production builders who agreed to build their homes to ENERGY STAR standards. During the 2002 program year, the state building codes were upgraded from the 1993 BOCA National Energy Conservation Code to the 1995 CABO Model Energy Code. Raising the baseline against which the ENERGY STAR savings were measured reduced the energy savings per home. However, raising energy efficiency code standards is a long term goal of the RNC program.

The November 2002 filing of the utility collaborative proposed 2003 program goals and requirements. These goals included:

- Enroll 20% of New Jersey building permits in the RNC program

- Certify 3,000 homes
- Train at least 325 builders, subcontractors and architects

In 2003, the seven utilities continued to administer the program. The RNC program was modified in 2003 to incorporate Governor McGreevey's policy initiative to support development and redevelopment in the Smart Growth area. The Smart Growth area includes areas designated for growth in the State Development and Redevelopment Plan, including Planning Areas I and II and the Designated Centers using the Policy Map of the New Jersey State Development and Redevelopment Plan.[55] This modification meant that only RNC homes built within the Smart Growth area could qualify for incentives after March 5, 2003. Incentive commitments were honored for projects signed prior to March 5.[56] While homes built outside the Smart Growth area remained eligible for program certification services (beginning in 2005), no incentives would be paid for those homes. Utility program managers believe that the large number of enrollments in 2002 and 2003 were due in large part from commitments signed prior to an expiration date for grandfathering in projects that were located outside of the Smart Growth area.[57]

The BPU also considered changes to the administrative structure of the RNC in 2003. While these changes were considered, marketing activities were suspended. Because marketing was curtailed, the participating utilities had limited ability to generate additional demand for participation. Since it takes one to two years from the time the home is enrolled in the RNC program to completion of the home and receipt of the incentives, the reduction in marketing had little affect on the number of homes certified in 2003.

Also in 2003 the utilities proposed lowering incentive levels. However, incentive levels were not lowered for two reasons. First, production builders had already agreed to build their homes to ENERGY STAR standards, and second, incentives had already been limited to new construction within the Smart Growth areas.[58]

In November 2003, the New Jersey Board of Public Utilities (BPU) approved changes to the New Jersey Clean Energy Program for 2004 that affected all New Jersey ENERGY STAR Homes Program participants. First, new rebate levels and program requirements became effective as of January 1, 2004. Secondly, the New Jersey Board of Public Utilities approved the transition of program administration from the utilities to the BPU. The BPU's Office of Clean Energy approved several new program elements to be managed by the seven utilities. The program was also identified as one whose management could be transferred from the seven utilities to a third party Market Manager. Marketing to consumers continued to be curtailed as changes to the administrative structure were considered.

In 2004, program goals included:

- Enroll 20% of New Jersey building permits in the RNC program

[55] New Jersey Clean Energy Programs Report Submitted to the New Jersey Board of Public Utilities, May 6, 2005. A map of the Smart Growth areas can be found at http://nj.gov/dca/osg/docs/smartgrowthareasmap.pdf

[56] In 2005, House Bill 3959 and an identical Senate Bill S2252 were introduced to the NJ legislature. The bills requires NJ ENERGY STAR Homes Program incentives be available Statewide, without limitation to areas designated for growth in the State Development and Redevelopment Plan adopted pursuant to the "State Planning Act," P.L.1985, c.398 (C.52:18A-196 et al.) S2252 was referred to Senate Economic Growth Committee, where no vote was taken and it was rejected in committee. It has not been reintroduced. See http://www.njleg.state.nj.us/2004/Bills/A3500/3959_I1.HTM.

[57] 2003 final program evaluation, Residential New Construction Program.

[58] New Jersey Clean Energy Programs Report submitted to the New Jersey Board of Public Utilities. May 6, 2005.

- Certify 5,830 homes
- Train at least 150 builders, subcontractors and architects

In 2005, the New Jersey ENERGY STAR Homes Program continued under New Jersey's Clean Energy Program administered by the New Jersey Board of Public Utilities and managed by the seven utilities. Beginning June 1, 2005, new participation requirements and incentive levels went into effect.[59] Builders could submit homes for enrollment under the 2004 program requirements and incentives until May 31, 2005.

In 2005, an RFP was issued to transfer management of the energy efficiency initiatives from the utilities to an independent third party. The new administration would transition management including outreach, marketing and delivery, application processing, and reporting.

Program goals in 2005 were the same in 2004 and included:

- Enroll 20% of New Jersey building permits in the RNC program
- Certify 5830 homes
- Train at least 150 builders, subcontractors and architects

In addition to activities undertaken to meet overall program goals, the seven sponsoring utilities continued to implement several program activities. These included:[60]

- Continue to train builders, subcontractors and architects
- Support efforts to use a competitive market based HERS delivery infrastructure statewide, and maintain HERS standards, consistency, and quality assurance
- Adopt RESNET inspection protocols to reduce program costs
- Develop a procedure to deduct the cost of additional inspections from the value of the rebate for entities that require multiple re-inspections.

Management of the energy efficiency initiatives is slated to transfer to a third party in 2006.

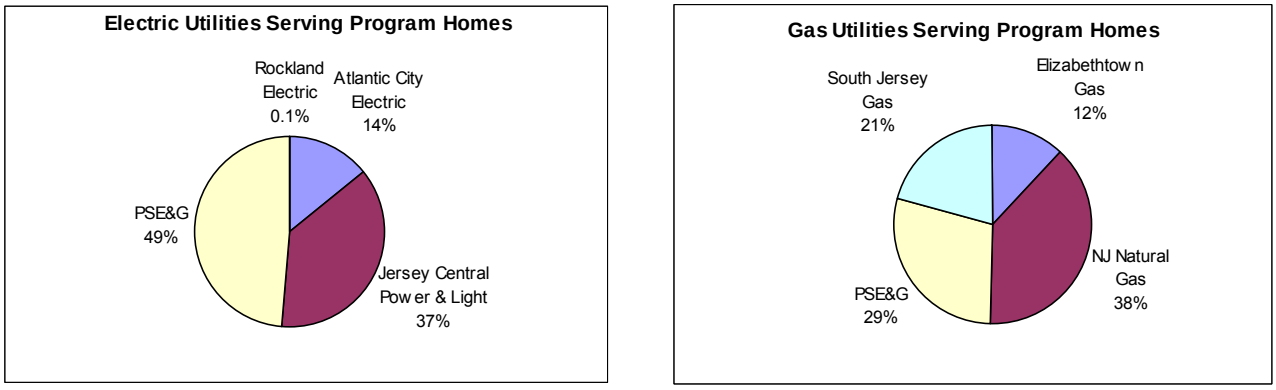
Program Implementation

The New Jersey ENERGY STAR Homes Program is currently implemented in seven utility service territories. These include PSE&G, Jersey Central Power and Light, Atlantic City Electric, Rockland Electric, South Jersey Gas, NJ Natural Gas, and Elizabethtown Gas. As shown in Figure 2-1, the majority of program ENERGY STAR homes (for 2005) were served by PSE&G (49%) or JCPL (37%) for their electric service and by NJNG (38%) or PSE&G (28%) for their natural gas.

[59] http://www.njenergystarhomes.com/html/builder/2005_program_changes.html

[60] New Jersey Clean Energy Program, 2005 Filing Revised June 8, 2005.

Figure 2-1. Program Homes by Utility Service Territory for 2005



Source: EAM Associates and MaGrann Associates Program Databases (n=8,009 Program Homes for 2005)

The New Jersey ENERGY STAR Homes Program is implemented by two companies that provide certification services for the state of New Jersey, EAM Associates, and MaGrann Associates. EAM serves the JCP&L service territory and MaGrann serves the other service territories, although there are a number of exceptions for certain large production builders.

Builders must use one of these two companies to apply for rebates from the utilities for homes they build within the Smart Growth areas. As noted above, while an independent rating firm could be used for the HERS rating, the independent firm cannot submit paperwork necessary to obtain the builder's rebate. Only three independent HERS rating companies could be identified who work in New Jersey.

Quality control for homes built to ENERGY STAR standards is assured by way of several avenues. The first avenue assures that ENERGY STAR homes are certified to meet all program guidelines by meeting the threshold HERS rating of 86. The second avenue employs an in-house technical plan review at both the beginning and the end of the process, pre-drywall on-site inspections, and a final on-site inspection with blower door and duct blaster testing. Builders may be required to provide correctional work. A follow-up inspection is conducted after corrective work is completed. Lastly, the program's database includes error checking for critical site and rebate information.

A number of market barriers to investments in energy efficiency upgrades in new construction were identified early in the program's development.[61] These are discussed fully in the *Market Barriers Assessment* section. Identified market barriers included:

- Builder design and construction decisions and technical skill levels
- Market actors' lack of information about energy-efficient homes

To address these barriers, the ENERGY STAR Homes Program included specific strategies. Again, these are discussed in the *Market Barriers Assessment* section. Key strategies include:

- Builder training, technical and marketing assistance, and incentives
- Home certification

[61] New Jersey Clean Energy Program, 2005 Filing Revised June 8, 2005.

2.1.2 Research Methodology

The assessment of the New Jersey ENERGY STAR Homes Program (the NJ ESH Program) relied on an extensive review of all program materials, primary data collection, and secondary data collection activities. The research approach is summarized and described in more detail below.

- Review of numerous secondary data sources including reports prepared for New Jersey and for other ENERGY STAR Homes programs
- Review of the NJ ESH Program tracking databases (EAM and MaGrann) and annual reports
- Department of Community Affairs building permit and occupancy permit data
- Telephone interviews with implementation staff at each of the utilities and the implementation contractors
- Telephone surveys with the following participating and nonparticipating market actor groups:
  - Participating and nonparticipating home builders
  - Participating and nonparticipating home purchasers
  - HERS raters
  - Code officials
- Telephone interviews with implementers of similar ENERGY STAR Homes programs throughout the country to establish benchmarking metrics

Primary Data Collection Activities

The primary data collection activities are summarized in Table 2-1, and discussed in more detail below.

Table 2-1. Summary of Primary Data Collection Activities

Market Actor	Data Collection Mode	Sample Source	Stratification	Targeted Completions	Final Completions	Accuracy (90% Conf. Int.*)
Utility and implementation staff	Telephone interviews	Program records	n/a	7-10	11	n/a
ES new home purchasers	Telephone Surveys	Program database	Random sample of participants from 2004-2005	70	76	9%
ES new home purchasers	On-site Inspections	Program database	Random	10	9	n/a
Nonparticipating new home purchasers	Telephone Surveys	Affordable Samples Inc. Random survey	Focus on "Smart Growth" areas	70	71	10%
Participating builders	Telephone Surveys	Program database	Prioritized more active participants	70	70	10%
Nonparticipating builders	Telephone Surveys	InfoUSA data, Random survey	30 True nonparticipants and 7 previous participants	70	37	15%
Home energy raters	Telephone Surveys	Program Implementer employees, internet search for independents	Mix of both independents and EAM/MaGrann rater employees	30	14	15%
Code officials	Telephone Interview	Program staff	Building and appliance	5	7	n/a

* The confidence and precision levels shown in the table are based on formulae for estimating proportions. The largest variance occurs when the proportion is 0.5; i.e., half of the respondents indicate they are in that group and half state that they are not in that group. The calculation assumes the variance with this 50/50 split. It should be noted that each question in a survey will have a different confidence interval and precision depending upon the range of possible answers for multi-category questions or continuous variables and the dispersion of responses.

Utility and Implementation Staff Interviews

Eleven program staff from the administrative utilities, EAM Associates, and MaGrann Associates were interviewed by telephone. The interviews were administered by Quantec staff and provided a context for the evaluation, including respondent perceptions about research issues, program impacts, and relevant market actors. Contact information for utility and staff interviews was supplied by the evaluation project manager for the BPU. All prime contacts were interviewed.

New Home Buyers

The study included 71 telephone interviews of buyers of new, non-ENERGY STAR single-family homes built since 2004, and 76 telephone interviews with purchasers of ENERGY STAR homes built since 2004.

Sample Frame: The sample frame for non-ENERGY STAR home buyers was a list of 2,538 new single-family homes supplied by Affordable Samples, Inc. ENERGY STAR home buyers were provided by the two program implementers, EAM and MaGrann. The data included participants in 2004 and 2005.

Sample Selection: The sample for the participating ENERGY STAR homebuyers was selected according to the following criteria: (1) single-family homes participating in 2004 or 2005; (2) proportionate sampling according to the distribution of utility service territories in which the new homes were built.

Affordable Samples drew a random sample of 3,000 single-family homes from a database of 5,651 according to the following criteria: (1) newly constructed single-family homes in New Jersey (2) homes purchased on or after January 1, 2004. The sample was selected within each of New Jersey's counties, prorated by the number of sales by county. The sample was then reduced to include only those counties and townships included in New Jersey's Smart Growth areas.[62] Townships and cities were identified using two methods. The first was through lists of Smart Growth areas on the New Jersey Smart Growth website.[63] The second method included using townships and cities of the participating home buyers. Quotas were established so that each utility service territory was included, proportionate to the distribution of service territories found in the participating home buyer sample.

Respondent Contact: The interviews were administered by Population Research Systems (PRS). The non-ENERGY STAR sample provided to PRS included 2,858 addresses from the ENERGY STAR databases. No names or zip codes were included in the data maintained in the databases, so a "reverse lookup" (based on address) for names and phone numbers was conducted. The ENERGY STAR sample provided to PRS included 841 names and phone numbers. To obtain 71 completed surveys, 636 nonparticipant respondents were attempted. The ENERGY STAR buyer sample attained a 25% response rate, while the non-ENERGY STAR survey attained a 22% response rate.

[62] Note that participating ENERGY STAR homes purchased in 2004 and 2005 could have been outside of the Smart Growth areas if they were entered into the program before March 2003. However, because the majority of the homes by 2005 would be in non-Smart Growth areas, the nonparticipant sample was limited to these same areas.

[63] http://www.nj.gov/smartgrowth/about_smartgrowth.html

Table 2-2. ENERGY STAR New Home Purchaser Disposition Sample

	Frequency (Percent)
Total ES New Home Purchasers Sample	**841**
Ineligible/Unused Sample	**533**
Not qualified	53
Wrong number/Non-working number	37
Language barrier	5
Unused / "live" sample	438
Eligible Sample	**636**
Completed Surveys	76 (25%)
Total Incompletes	**232**
Refused	117 (38%)
Call back	115 (37%)

Table 2-3. Non-ENERGY STAR New Home Purchaser Sample Disposition

	Frequency (Percent)
Total Non ES New Home Purchasers Sample	**2,538**
Ineligible/Unused Sample	**2,222**
Not qualified	35
Wrong number/Non-working number	70
Language barrier	6
Not attempted/ "live" sample	2,111
Eligible Sample	**316**
Completed Surveys	71 (22%)
Total Incompletes	**245**
Refused	63 (20%)
Call back	182 (58%)

On-Site Inspections

ENERGY STAR purchasers completing surveys were asked if they would agree to an on-site visit as part of the evaluation. A set of 13 randomly selected respondents agreed to the walk-through audit at their home. Nine on-site inspections were completed, with four canceling the appointment.

Builders

The study plan included a goal of 70 participating ENERGY STAR builders and 70 nonparticipating builders. The nonparticipant sample target was 35 true nonparticipants, those who had not previously participated in the program, and 35 previous program participants (those who had participated in the program in 2004 or earlier but had not received an incentive in the last 12 months). The original goal was designed based on experience with NYSERDA, where over 50% of the builders have dropped out of the ENERGY STAR Labeled Homes Program. According to New Jersey implementation staff, the attrition rate is far lower, and thus there are few previously participating builders to interview. In addition, there were a number of large one-time projects, such as senior homes, where the developer was the primary contact. The final sample for nonparticipant builders included 30 fully nonparticipating builders and seven previously participating builders. The small sample of seven previous participants still provides anecdotal analysis as to why some builders might have dropped from the program.

Sample Frame: Names of participating builders were obtained from the EAM and MaGrann Associates Program databases. Builders' names were not entered consistently in the databases. As a result, data cleaning was necessary to identify the contact list of unique builders. Further data cleaning was required because large production builders were entered multiple times, with projects spread across multiple locations. In many cases developers or development names were entered in the "builder name" field.

EAM and MaGrann provided names of previously participating builders (builder drop-outs). Drop-outs are often drop-outs only for one home or one project. EAM reported no drop-outs in 2004 and provided a list of four projects with dropped units in 2004. MaGrann listed seven dropped units in 2005. Builders who previously participated in the Program but then had no program activity in the last 12 months were determined through the screening questions at the beginning of the surveys.

The population of New Jersey builders was obtained from InfoUSA. The database, selected based on SIC code, included 725 names, phone numbers, addresses, and entries for number of employees and sales volume. This list included multiple entries for production builders, duplicate entries, and entries that were found not to be builders.

Sample Selection: The participating builder lists were cross referenced to the InfoUSA list to identify nonparticipating home builders. The activity of the participating building firm was determined using the number of program homes as determined from the program database. The activity of the nonparticipant building firm was determined using data provided with the sample. The numbers of surveys were apportioned according to their size. The largest production builders were sampled more heavily to focus on the more active builders. The final sample included interviews with many of the largest production builders in NJ, including K. Hovnanian, D.R. Horton, Ryan Homes, and Toll Brothers.

Respondent Contact: The interviews were administered by Quantec staff. The list of participants included 432 builders; the list of nonparticipants included 535 builders.

Table 2-4. Participating Builder Sample Disposition

	Frequency	Percent
Total ES New Home Builders Sample	432	
Ineligible/Unused Sample	315	
Duplicate, multiple offices	117	
Not qualified, not builder, sales office, not participant	38	
Wrong number/Non-working number	66	
Unused/ "live" sample	94	
Eligible Sample	117	100%
Completed Surveys	70	60%
Total Incompletes		
Refused	4	3%
Requested Fax/Mail Survey-not returned	1	1%
Call back, referred to someone else	25	21%
Maximum number of attempts reached	17	15%

Table 2-5. Nonparticipant Builder Sample Disposition

	Frequency	Percent
Total Non ES New Home Builders Sample	725	
Ineligible/Unused Sample	564	
Duplicate, multiple offices	190	
Not qualified, not builder	57	
Wrong number/Non-working number/disconnect/beeper	79	
Unused live sample	238	
Eligible Sample	161	100%
Completed Surveys	37	23%
Total Incompletes		
Refused	33	20%
Requested Fax/Mail survey-not returned	4	2%
Call back, referred to someone else	65	40%
Maximum number of attempts reached	22	14%

Home Energy Raters

Surveys with a sample of 30 independent home energy raters were planned. However, we learned that in New Jersey the home energy raters (HERS raters) who rate, inspect, and certify a home as ENERGY STAR qualified are employees of the two program implementers, EAM and MaGrann. Independent raters

are allowed to certify a home as ENERGY STAR compliant but only EAM and MaGrann can apply for the builder's rebate from the utilities. There are not 30 independent HERS raters in New Jersey, nor it appears, 30 certified HERS raters who are employees.

Sample Frame: Independent HERS raters were identified using a number of sources, including the EPA ENERGY STAR website, the National Energy Rater's Association, Home Energy Raters Alliance, Northeast Home Energy Rating System Alliance, Energy & Environmental Ratings Alliance, and RESNET. Referrals were also provided by EAM and MaGrann. HERS raters employed by both EAM and MaGrann were also available for interviews.

Sample Selection: Each of the seven EAM HERS raters was surveyed, and four MaGrann staff involved with various aspects of the rating and certification process were interviewed. Additional interviews including an independent New Jersey HERS rater and a firm that conducts ratings in surrounding states and who also bid on the third party Residential Market Manager RFP issued by the BPU. Another respondent was a provider of HERS training, but did not conduct ratings. Two firms were not reached after multiple messages were left on answering machines, and two who were reached did not conduct HERS ratings in New Jersey.

Respondent Contact: The interviews were administered by Quantec.

Code Officials

Five code officials were interviewed as part of the larger ENERGY STAR Program Assessment. Interviews are summarized in the *Codes and Standards Assessment* section. Two additional interviews were conducted: one with the Director of Codes and Technical Services of the New Jersey Builders Association and the second with the Director of the NJ CDA Codes and Standards Department.

Secondary Data Collection

Previous evaluations used as secondary data sources include the following reports:

- Quantec, LLC, Summit Blue Consulting, LLC, New York ENERGY STAR Labeled Homes Program Market Characterization, Market Assessment and Causality Evaluation, March 2006.
- ECONorthwest, ENERGY STAR Homes Northwest Market Progress Evaluation Report, Northwest Energy Efficiency Alliance, September 2005.
- Skumatz Economic Research, Inc., Summit Blue Consulting, LLC, Quantec, LLC, ENERGY STAR Homes and Home Performance with ENERGY STAR, Market Characterization, Market Assessment and Causality, NYSERDA. April 2005.
- Nexus Market Research Inc., GDS Associates, Inc., D. Conant, Shel Feldman Consulting, Megdahl & Associates, Incremental Cost of ENERGY STAR Homes in Massachusetts and New Hampshire, February 2003.
- Roper Starch Worldwide Inc., New Jersey Residential New Construction Attitude and Awareness Baseline Study Participating and Nonparticipating Homebuyer Surveys, April 2001.Assessment of Performance Indicators

- Vermont Energy Investment Corporation, EAM Associates, MaGrann Associates, New Jersey Energy Star Homes Program Incentives and Smart Growth Analysis, March 2003.

2.2 Assessment of Program Indicators

Updating and revising the indicators is a crucial step that precedes much of the program and market assessment activities. Progress indicators serve as a roadmap for the market assessment, guiding the data collection approach and analysis so that the research can effectively measure the efficacy of the programs in meeting the stated market transformation goals. This chapter presents an updated list of performance indicators and an assessment, based on all available primary and secondary data sources, of how these indicators have changed over time.

The updated list of performance indicators is presented in Table 2-6. Note the bold indicators highlighting those that were added by the evaluation team during our review of the existing indicators.[64] In addition, the indicators are now summarized by a general topic area that serves to guide the discussion below into the following areas: [65]

- Section 2.2.1discusses market actor awareness and knowledge
- Section 2.2.2 discusses the perceived value of energy efficiency measures and homes
- Section 2.2.3 discusses the recruiting and training activities
- Section 2.2.4 discusses the building practices
- Section 2.2.5 discusses satisfaction
- Section 2.2.6 discusses program savings

[64] A summary of the findings from the indicator review for all programs appears in the December 31, 2005 memorandum entitled "NJ Clean Energy Programs – Indicator Assessment," prepared by Summit Blue, LLC and Quantec, LLC.

[65] Indicators addressing market share and incremental cost are presented in other sections of this report and thus are not presented in this section.

Table 2-6. Residential New Construction Program Indicators

General Topic	Topic	Performance Indicator	New for 2005-2006?	Source	Detailed Source
Awareness and Knowledge	Awareness/Attitudes concerning ENERGY STAR Homes	Awareness of ENERGY STAR Homes	No	Evaluation	P/NP Builder and consumer surveys
Awareness and Knowledge	Awareness/Attitudes Concerning Home Energy Ratings and Mortgages	Market actors aware of ratings, energy-efficient mortgages	No	Evaluation	Market actor surveys
Awareness and Knowledge	Awareness/Attitudes Concerning Home Energy Ratings and Mortgages	Availability of ratings and mortgages increasing	No	Evaluation	P/NP Builder, HERS rater and consumer surveys
Perceived Value	Awareness/Attitudes Concerning ENERGY STAR Homes	Awareness of benefits of energy efficiency	No	Evaluation	P/NP Builder and consumer surveys
Perceived Value	**Awareness/Attitudes Concerning ENERGY STAR Homes**	**Increased consumer demand**	**Yes**	**Evaluation**	**P/NP Builder and consumer surveys**
Perceived Value	Awareness/Attitudes Concerning ENERGY STAR Homes	Increased perception of value and quality	Yes	Evaluation	P/NP Builder and consumer surveys
Recruiting and Training	Technical Assistance to Builders and Contractors	Number of builders and subcontractors trained	No	Program Tracking	Annual reports
Recruiting and Training	**Technical Assistance to Builders and Contractors**	**Number of HERS raters**	**Yes**	**Program Tracking**	**Program Implementers, internet research**
Building Practices	Builder Participation	Percent of builders building majority of homes to ENEGY STAR and number of participating builders	Modified	Program Tracking and builder surveys	Utility program tracking databases
Building Practices	Installation Rates for Efficient Equipment	Percent new homes with qualifying equipment	No	Program Tracking	Utility program tracking databases

General Topic	Topic	Performance Indicator	New for 2005-2006?	Source	Detailed Source
Building Practices	Supplemental Measures	P/NP builders reporting installation of efficient appliances and implementation of efficient building practices	No	Builder Surveys	Utility program tracking databases
Building Practices	**Building Performance**	**Current practice of non-ENERGY STAR building**	**Yes**	**M&V/Evaluation**	**M&V; NP builder surveys**
Market Share	Participation and Energy Savings	Number of homes certified (by type)	No	Program Tracking	Utility program tracking databases and reporting
Market Share	Market Share Monitoring	ENERGY STAR certified as percent of Occupant Certification	No	Program Tracking and DCA records	Utility program tracking databases
Satisfaction	Customer and Builder Satisfaction	Customer satisfaction with ENERGY STAR Homes	No	Evaluation	Customer surveys
Satisfaction	Customer and Builder Satisfaction	Builder satisfaction with the program	No	Evaluation	Builder surveys
Incremental Cost	**Building Performance**	**Incremental Cost**	**Yes**	**Evaluation**	**Builder Surveys**
Program Savings	Building Performance	kW, kWh, and MBTU savings	Yes	Program Reporting	Annual Reports

2.2.1 Awareness and Knowledge

One of the goals of the New Jersey RNC Program is to raise awareness and knowledge of ENERGY STAR homes and energy-efficient equipment among both participating and nonparticipating home purchasers and builders. The surveys explored awareness and knowledge on a number of levels for each market actor.

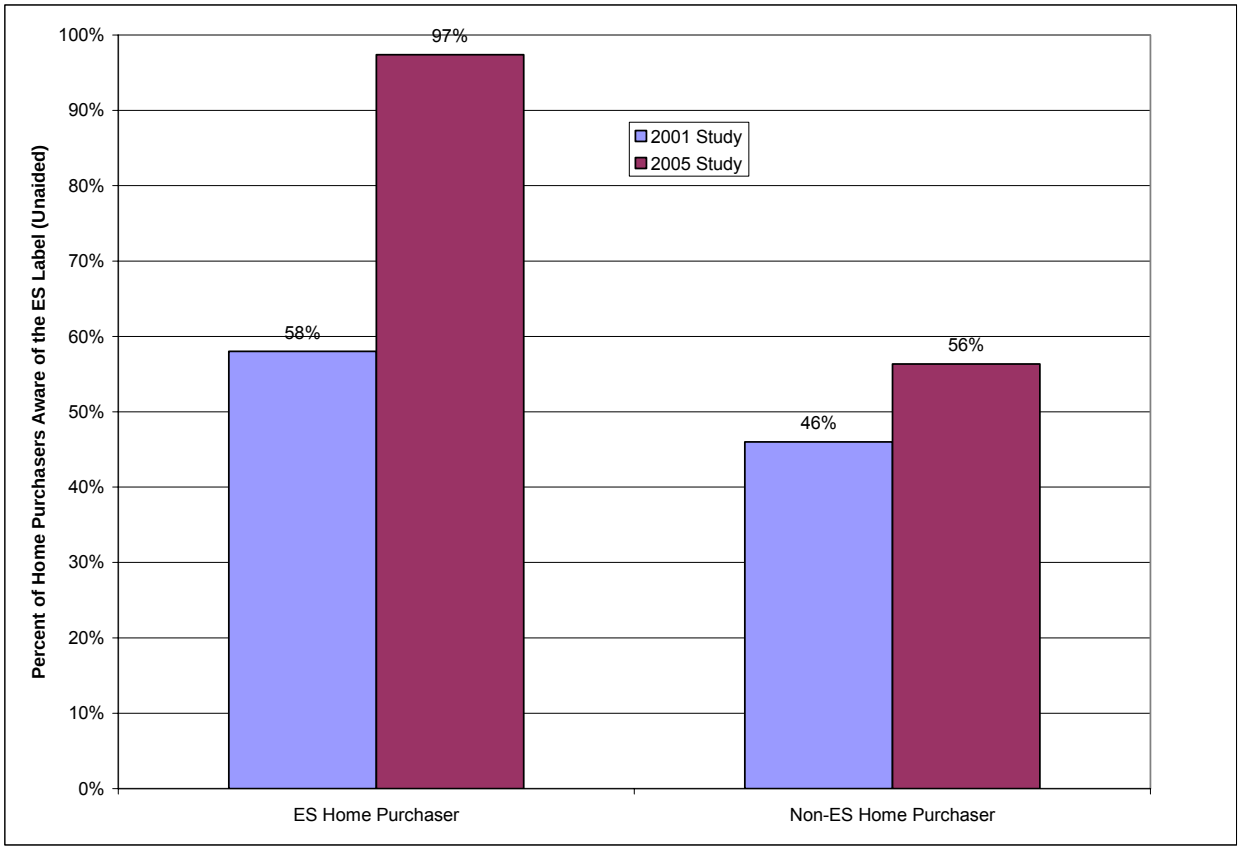
General Awareness of ENERGY STAR

For home purchasers, general awareness of the ENERGY STAR label was measured in two manners. First, without any description of the label or explanation of its application, each respondent was asked whether they had ever seen or heard of the ENERGY STAR label (an unaided query). Next, those who said they had not seen or heard of it were provided information regarding the label and asked again whether they had ever seen or heard of it (an aided query). This approach was employed for several reasons. First, a similar approach was utilized during the baseline study in 2001 and adoption of the methodology allows for longitudinal comparisons.

Second, many major appliances, regardless of their efficiency level, have a yellow FTC Energy Guide label and this approach helps clarify respondent confusion regarding the two labels. Lastly, since the interview was conducted by telephone, it is not possible to physically show respondents the ENERGY STAR label. It is possible that some respondents may have seen the label previously, but without physically seeing it or being provided a robust explanation, might report they had not.

Compared to the findings of the baseline study in 2001, more ENERGY STAR home purchasers and non-ENERGY STAR purchasers were aware of the ENERGY STAR label without being aided (Figure 2-2). While the increase was moderate for non-ES home buyers (46% to 56%), it was dramatic for ES home buyers (58% to 97%). In fact, all but two of the ES home buyers reported awareness of the ENERGY STAR label without any description or explanation.

Figure 2-2. Percent of Home Purchasers Aware of the ENERGY STAR Label (Unaided)



Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers, n=71 non-ES home purchasers) and the Residential New Construction Attitude and Awareness Baseline Study, Participating and Nonparticipating Home Buyer Survey, April 2001 (n=166 purchasers of ES homes, n=200 purchasers of non-ES homes)

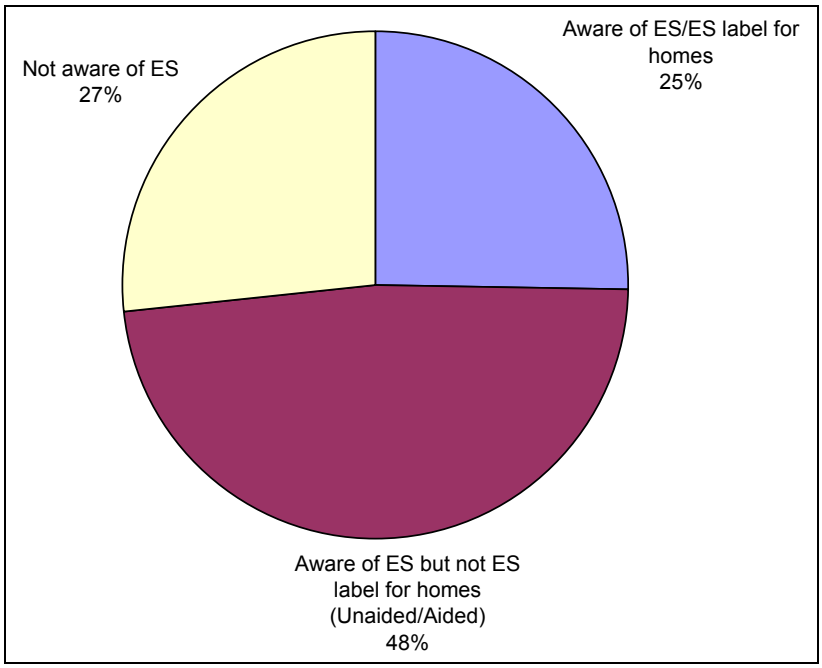
Awareness of the ENERGY STAR Label for Homes

In addition to being asked about general awareness of the ENERGY STAR label, each respondent was also asked whether they had seen or heard of the ENERY STAR label for homes, and whether or not their home was ENERGY STAR labeled. Not surprisingly, a significantly higher percentage of ES home purchasers (99%) expressed an awareness of the homes label compared to purchasers of non-ES homes (25%). Among the purchasers of non-ES homes, nearly half (48%) were aware of the ENERGY STAR label for products but not for homes (Figure 2-3). In other words, there is a substantial gap in terms of awareness of ENERGY STAR products versus ENERGY STAR labeled homes among purchasers of non-ES homes.

The purchasers of ES homes were nearly all aware (99%) that they were actually living in an ENERGY STAR home. The baseline study, however, found that awareness of ENERGY STAR label for respondents' own homes varied widely, and was as low as 60% among PSE&G customers (Figure 2-4).

The New Jersey ENERGY STAR Homes Program, therefore, has clearly helped ensure that purchasers of ES Homes are aware that their home is ES labeled.[66]

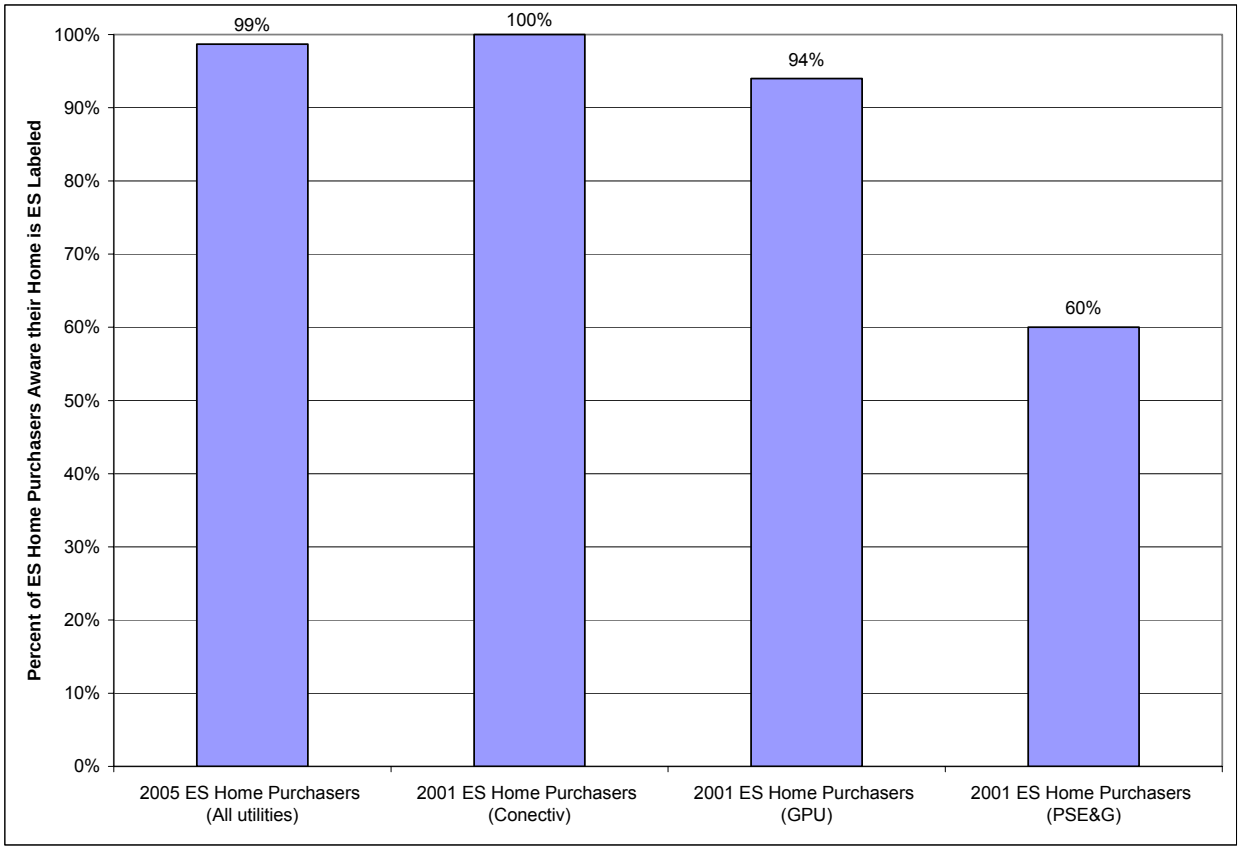
Figure 2-3. Awareness of the ENERGY STAR Label for Homes Among Purchasers of Non-ES Homes



Source: RNC Survey of New Home Purchasers (n=71 purchasers of non-ES homes)

[66] Similar results were found in New York, where a recent study of the New York ENERGY STAR Labeled Homes Program found that 92% of ES homes purchasers were aware their home was ES labeled, compared to a baseline from 2003 of only 59%. See "New York ENERGY STAR® Labeled Homes Program: Market Characterization, Market Assessment And Causality Evaluation," NYSERDA Final Report, April 2006.

Figure 2-4. Percent of ENERGY STAR Home Purchasers Aware Their Home is ES Labeled



Source: RCN Survey of New Home Purchasers (n=76 purchasers of ES homes) and the Residential New Construction Attitude and Awareness Baseline Study, Participating and Nonparticipating Home Buyer Survey, April 2001 (n=166 purchasers of ES homes).

ES home purchasers and non-ES home purchasers expressing familiarity with the ENERGY STAR Home label were then asked at what point in the home-buying process they became aware of the label. As evident in Table 2-7, the majority of the non-ES buyers (72%) were aware of ENERGY STAR-labeled homes prior to looking for their new home. While a significant percentage of participants were aware of the label before starting their search for a new home (43%), an equally large percentage were informed by their builder (44%). Among the "Other" responses provided by participants, three noted learning of the ENERGY STAR label during the signing period.

Table 2-7. Timing of ENERGY STAR Homes Label Awareness

	Purchasers of Non-ES Homes		Purchasers of ES Homes	
	N	%	N	%
Before starting the home search	13	72%	32	43%
Realtor brought it up	0	0%	6	8%
Builder brought it up	3	17%	33	44%
Other	1	6%	4	5%
Don't know	1	6%	1	0%
Total	**18**	**100%**	**75**	**100%**

Respondents were also asked if they knew how homes qualified for an ENERGY STAR designation. When asked about specifics of how home qualified, participants referred to various energy efficiency characteristics and ratings, but no nonparticipant could provide an answer. Again, this seems to bolster the finding that participants are much more aware of the efficiency characteristics of homes.

Role of Builders and Sales Agents

After learning when respondents became aware of the ENERGY STAR homes label, each respondent familiar with the label was asked how they first became aware. The largest percentage of non-ES home buyers and ES home buyers (28% and 41%, respectively) first learned of ENERGY STAR-labeled homes from their builders or sales agent (Table 2-8). In addition, those respondents that did mention the builder or sales agent as an initial source of awareness were asked, aided, if the builder or realtor brought up the ENERGY STAR label. In total, 83% of the respondents that purchased an ES Home indicated that the builder had brought up ENERGY STAR as a selling point, and nearly half (48%) reported that the realtor or sales agent brought up ENERGY STAR as a selling point. Note that the percentage of purchasers of non-ES labeled homes that reported the builder (17%) or realtor (11%) brought up ENERGY STAR was significantly smaller than the participants, further highlighting the information gap that remains among nonparticipants in the program.

Table 2-8. Source of ENERGY STAR Homes Label Awareness

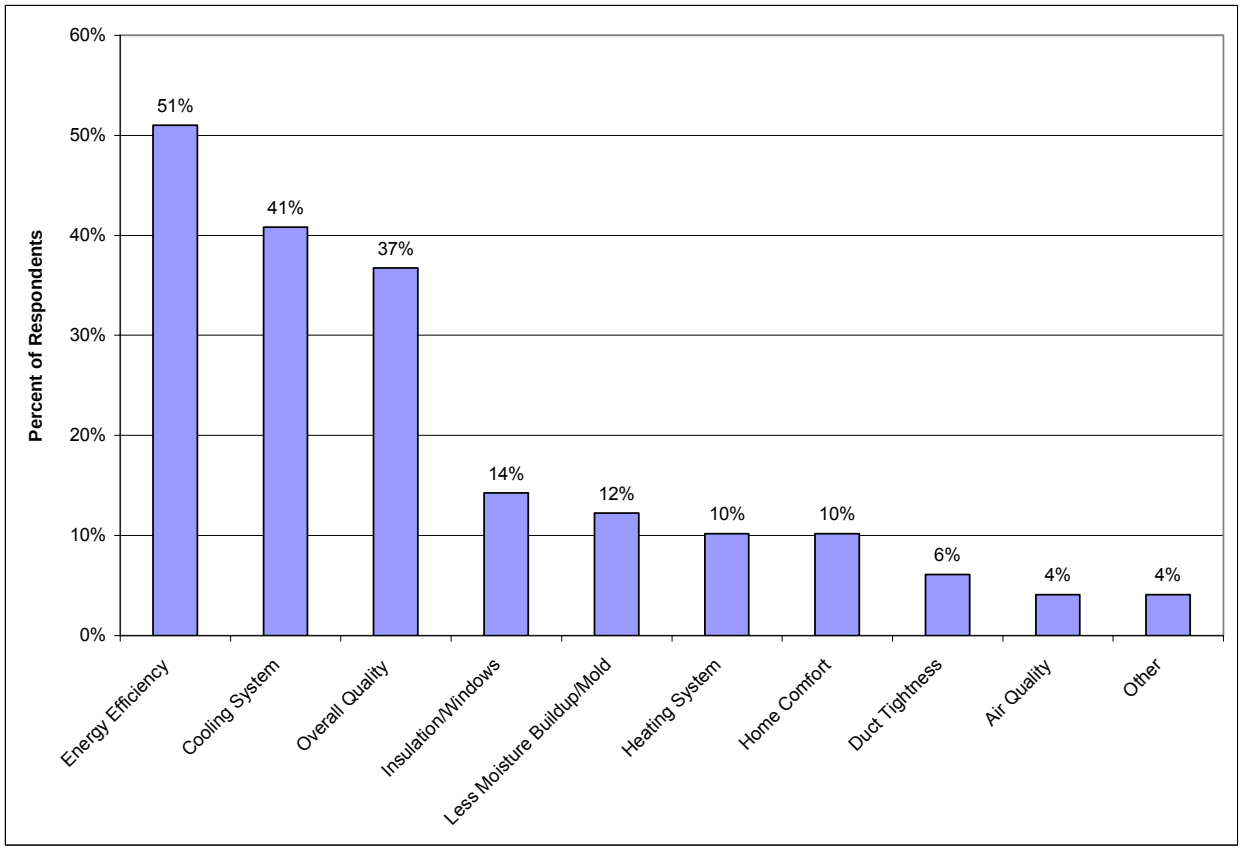
	Purchasers of Non-ES Homes		Purchasers of ES Homes	
	N	%	N	%
TV advertising	3	17%	3	4%
TV news feature story	2	11%	1	1%
Print ads or brochures	2	11%	8	11%
Newspaper/Magazine article	3	17%	9	12%
Website/Internet (unspecified)	2	11%	1	1%
Builder or sales agent	5	28%	31	41%
Word of mouth (friend, coworker, acquaintance)	0	0%	2	3%
Model home tour	0	0%	3	4%
Received a packet of information left at the house	0	0%	3	4%
Other	0	0%	7	9%
Don't know	1	6%	7	9%
Total	**18**	**100%**	**75**	**100%**

Table 2-9. Builder or Sales Agent Discussed ENERGY STAR as a Selling Point

	Purchasers of Non-ES Homes		Purchasers of ES Homes	
	N	%	N	%
Builder brought up	3	17%	62	83%
Realtor brought up	2	11%	36	48%
Total	**18**	**100%**	**75**	**100%**

Further, those home purchasers stating their builder, sales agent, or realtor had utilized the ENERGY STAR home label as a selling point were asked which specific ENERGY STAR features were promoted. Given that only two nonparticipants were eligible to respond to the question (i.e., stated that their builder, sales agent or realtor promoted the ENERGY STAR home label), Figure 2-5 displays the results of this inquiry for participants exclusively. Since participants were asked to mention all of the specific features promoted, the numbers in the table represent the number and percentage of total responding participants that noted each specific feature. Among the features mentioned by participants in the "Other" category were specific ENERGY STAR appliances, high efficiency windows and doors, and increased levels of insulation.

Figure 2-5. ENERGY STAR Features Promoted by Builder, Sales Agent and/or Realtor (Multiple Responses)

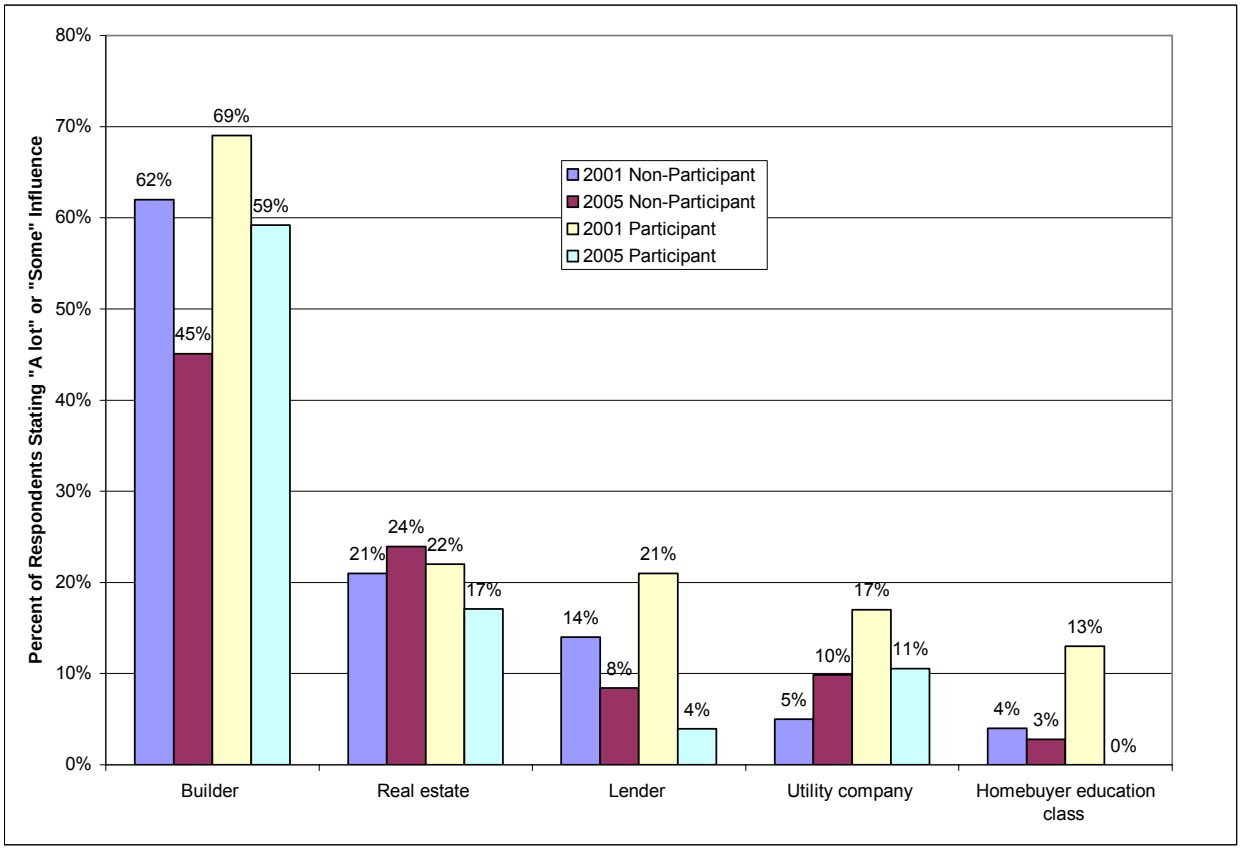


Source: RCN Survey of New Home Purchasers (n=76 purchasers of ES homes)

To further assess how much influence various upstream market actors have on the decision to purchase a home, respondents were asked to rate how influential their builder, real estate agent, lender, utility company, and homebuyer education class were during their decision-making process. The results from the 2001 baseline study and the current study are presented in Figure 2-6.

The results show that the influence of each type of market actor decreased from 2001 to 2005 for individuals who bought ENERGY STAR homes. The decrease in influence is consistent with decreases in funding for outreach by the program. Results for nonparticipants are more varied, increasing in some cases, but decreasing in others. Builders and real estate agents are still the most often mentioned category, and appear to remain critical conduits of information for both participants and nonparticipants.

Figure 2-6. Influence of Individuals (2001 and 2005)



Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers, n=71 non-ES home purchasers) and the Residential New Construction Attitude and Awareness Baseline Study, Participating and Nonparticipating Home Buyer Survey, April 2001 (n=166 purchasers of ES homes, n=200 purchasers of non-ES homes)

Builder Awareness

Another aspect of awareness and knowledge concerns not just consumers, but builders. In order to be successful the program must educate builders about the program itself. As shown in Figure 2-7, few of the true nonparticipating builders (17%) were aware of the program. For those that were fully aware – only five respondents – three of them said they chose not to participate in the program because they perceived it was a "hassle," one respondent wasn't sure of the commitment, and one was not as active as in the past in terms of construction activity.

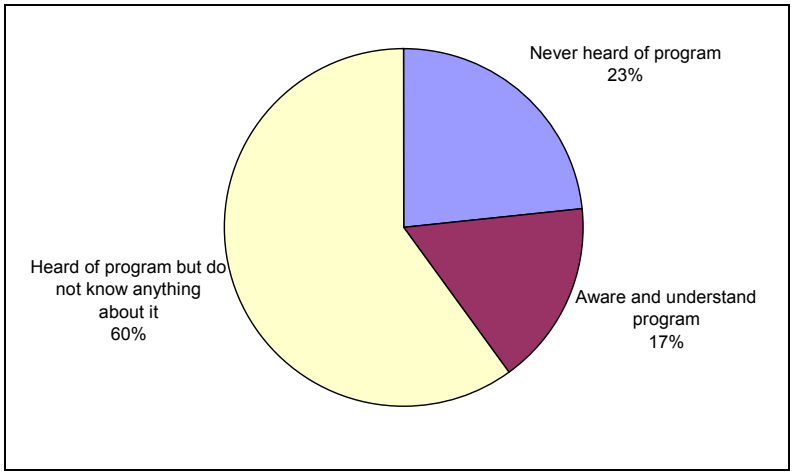
Similarly, the seven previously participating builders were asked why they were no longer participating in the program. The respondents cited the hassle (3), time consuming process (3), lack of customer demand (1), and higher incremental costs of home (1), among other reasons. Respondents reported:

> *"I failed to have a pre-inspection which made it impossible to meet program requirements. It was not a programmatic issue. I misunderstood the contract and we didn't budget for all of the necessary appliances."*

> *"I participated 3-4 years ago. It took too much time; the $2,500 incentive for a $300,000 house was not worth it. The agency was mistake prone, did not show up, it was too time consuming in general. I build to these standards anyway."*

"The inspectors were unreasonable, incentives have dwindled. We don't need ENERGY STAR to market the quality homes that we build as we have a longstanding history of building ENERGY STAR homes."

Figure 2-7. Awareness of the New Jersey ENERGY STAR Homes Program among Nonparticipating Builders



Source: RNC Nonparticipating builder survey (n = 30 builders that never participated in the program)

Role of the Builder

Participating builders were asked if, in their experience, home buyers looked to them as their primary source of information on home energy efficiency. Over half, 59%, said that they did. This reliance on the builder's expertise puts them in a unique position to promote ENERGY STAR homes and products. Since nearly 60% of builder's customers look to them for information on energy efficiency, and roughly half the builders stated their customers don't ask about ENERGY STAR appliances, there is a large opportunity for builders to promote efficient appliances.

2.2.2 Perceived Value

In addition to raising awareness, one of the goals of the New Jersey ENERGY STAR Homes Program is to ensure that consumers and builders perceive value in the ENERGY STAR label for homes. According to purchasers of ENERGY STAR homes, the primary motivations for purchasing an ENERGY STAR home were to lower energy/utility bills (42%) and to save energy (34%) (Figure 2-8). Interestingly, the third most frequent response (20% of respondents) had nothing to do with ENERGY STAR, but concerned other qualities of the house, such as location and layout:

"I liked the community and design, the house just happened to be [ENERGY STAR]."

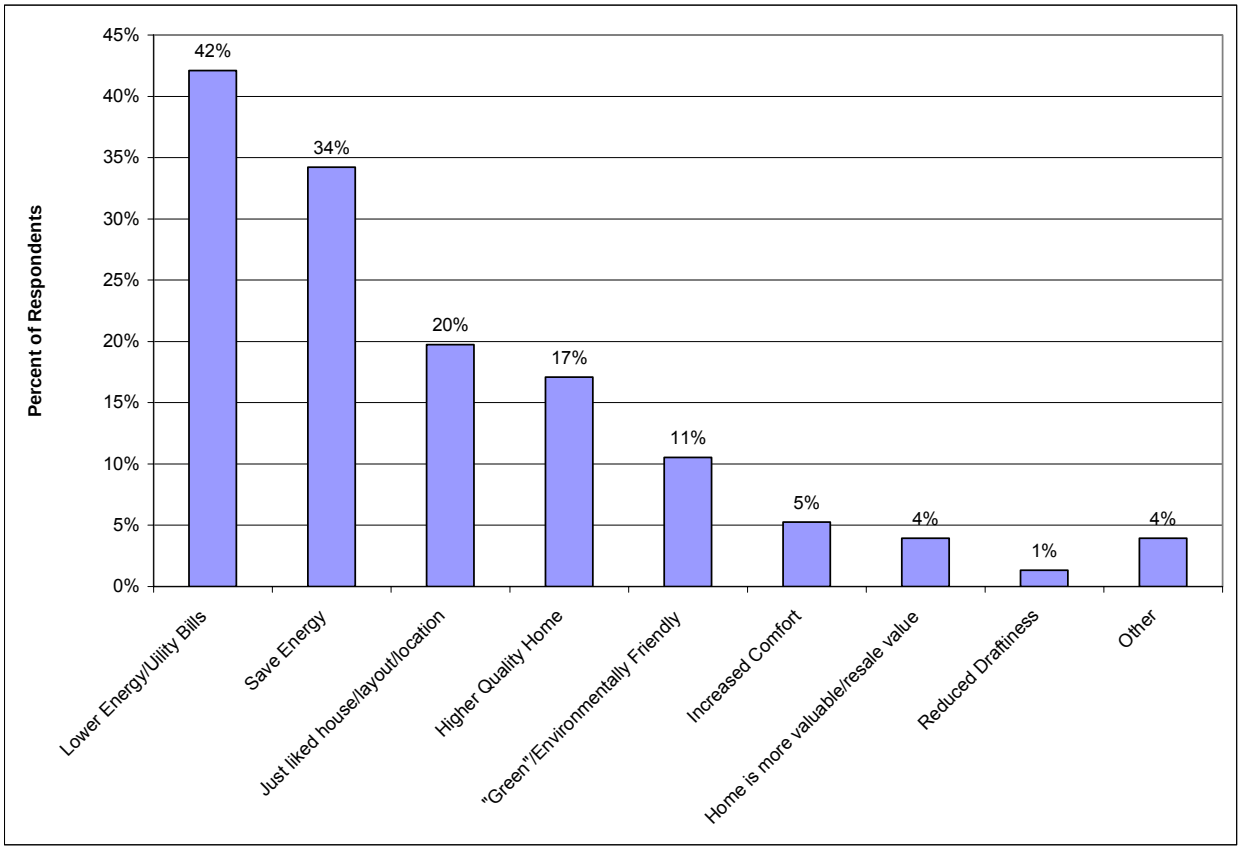
"Just liked the home, ENERGY STAR had no influence."

"We just liked the house, ENERGY STAR was a bonus."

"Had nothing to do with ENERGY STAR (just liked the home)."

In addition, 17% of the respondents purchased an ENERGY STAR home because they perceived the home was of higher quality compared to a standard home.

Figure 2-8. Reason for Buying an ENERGY STAR Home (Multiple Responses)

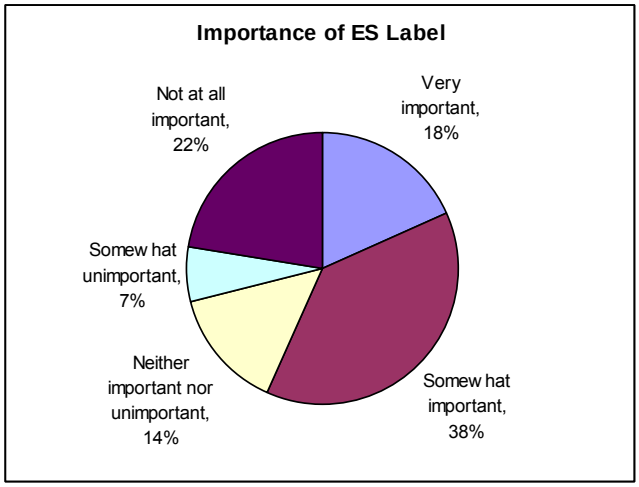


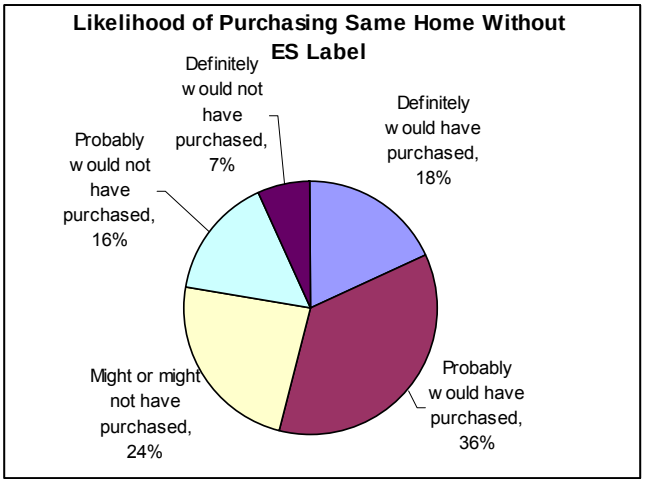
Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers)

Participants who had previously noted that they were aware of ENERGY STAR homes prior to searching for a new home were also asked whether they were specifically looking for an ENERGY STAR-labeled home when they began their search. Of the 32 ES home purchasers who were previously aware, only five (16%) stated they were specifically looking for an ENERGY STAR home.

A number of other questions also seemed to indicate that the influence of the ENERGY STAR label was mixed. For example, only just over half (56%) of participants stated that the ENERGY STAR label was a "Very" or "Somewhat Important" factor in the decision to buy the home, and 54% of respondents believed they would have definitely or probably purchased the same home even if it did not have the ENERGY STAR label (Figure 2-9).

Figure 2-9. Importance of ENERGY STAR Label and Likelihood of Purchasing Same Homes





Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers)

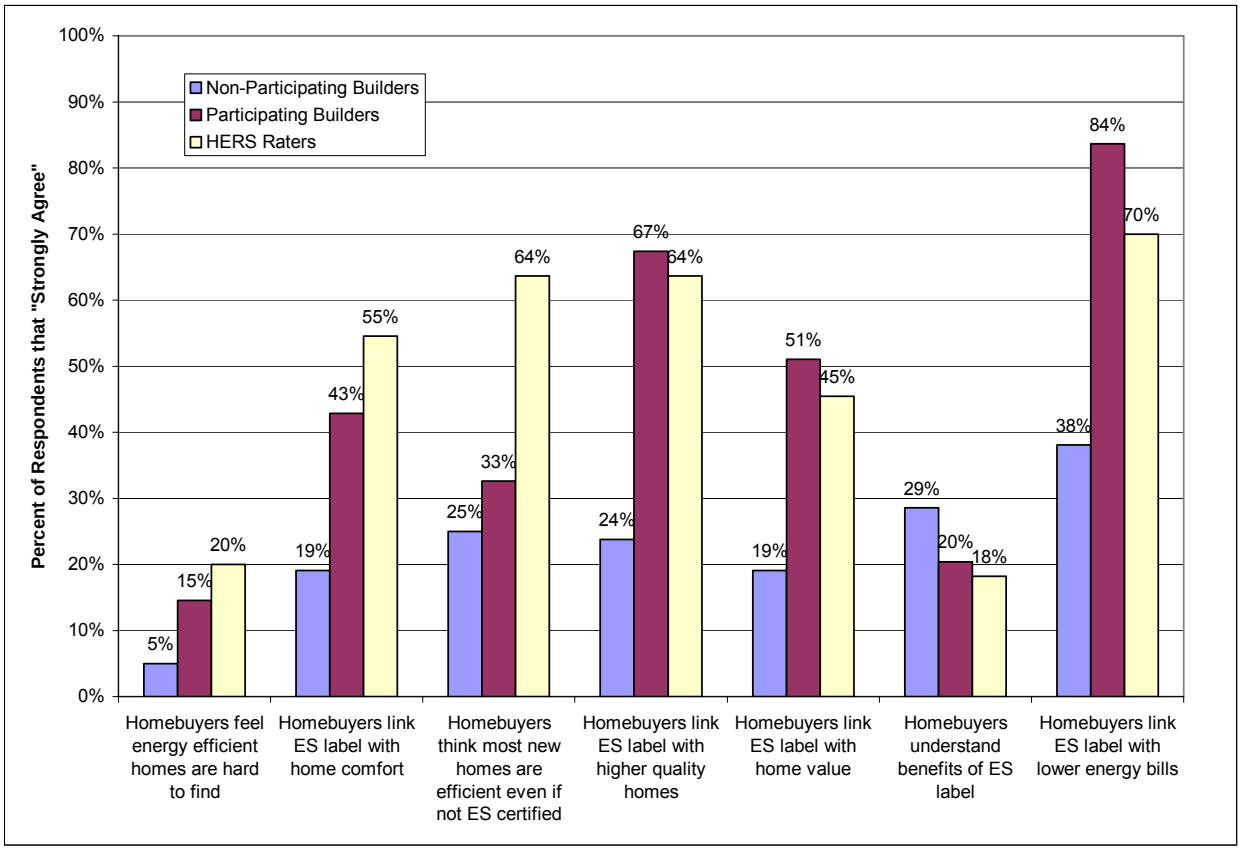
Another measure of perceived value is the importance of the energy efficiency of a house while shopping for a new home. To assess the importance of energy efficiency versus other factors, each respondent was asked to rate the importance of each factor included in Table 2-10. A similar assessment was conducted in 2001 and the table offers a comparison of nonparticipant and participant valuations of both evaluation efforts. While the questions were asked slightly differently in each study ("A lot of influence" in 2001 and "Very Important" in 2005), the findings are clearly comparable. Among the most interesting difference is the substantial increase in the percent of participants citing the importance of energy efficiency, which jumped from 39% to 64%. While it did not increase to the same extent, energy efficiency rose in importance for nonparticipants as well. Increasing energy costs likely played an important role in this change, as well as program marketing and education.

Table 2-10. Importance of Decision Making Factors (2001 and 2005)

	Factor Had "A Lot" of Influence on Home Purchase (2001)		Factor Was "Very Important" During Home Purchase (2005)	
	Non-ES Home Purchaser (n=200)	ES Home Purchaser (n=166)	Non-ES Home Purchaser (n=71)	ES Home Purchaser (n=76)
Location	83%	73%	69%	68%
Appearance	70%	75%	65%	74%
Price	70%	62%	70%	78%
Size	65%	69%	46%	57%
Quality of Construction	74%	78%	66%	83%
Comfort	52%	71%	69%	70%
Availability of Upgrades	40%	45%	15%	24%
Mortgage Financing	32%	36%	34%	22%
Energy Efficiency	28%	39%	34%	64%

Finally, if builders believe that customers perceive additional value in ENERGY STAR homes, they will construct more homes to ENERGY STAR specifications. As shown in Figure 2-10, the participating builders strongly agreed that home buyers not only link the ENERGY STAR label with lower energy bills (84%), but also associate ENERGY STAR homes with higher quality homes (67%) and increased home value (51%), important non-energy benefits of ES homes. The responding HERS raters also strongly agreed that home buyers perceive not only energy savings from ENERGY STAR homes (70%), but also increased quality (64%), comfort (55%), and home value (45%). Nonparticipating builders, however, were far less likely to associate consumer perceived value for ENERGY STAR homes for either energy savings or non-energy benefits. Their lack of perceived customer value, of course, is a strong deterrent for program participation.

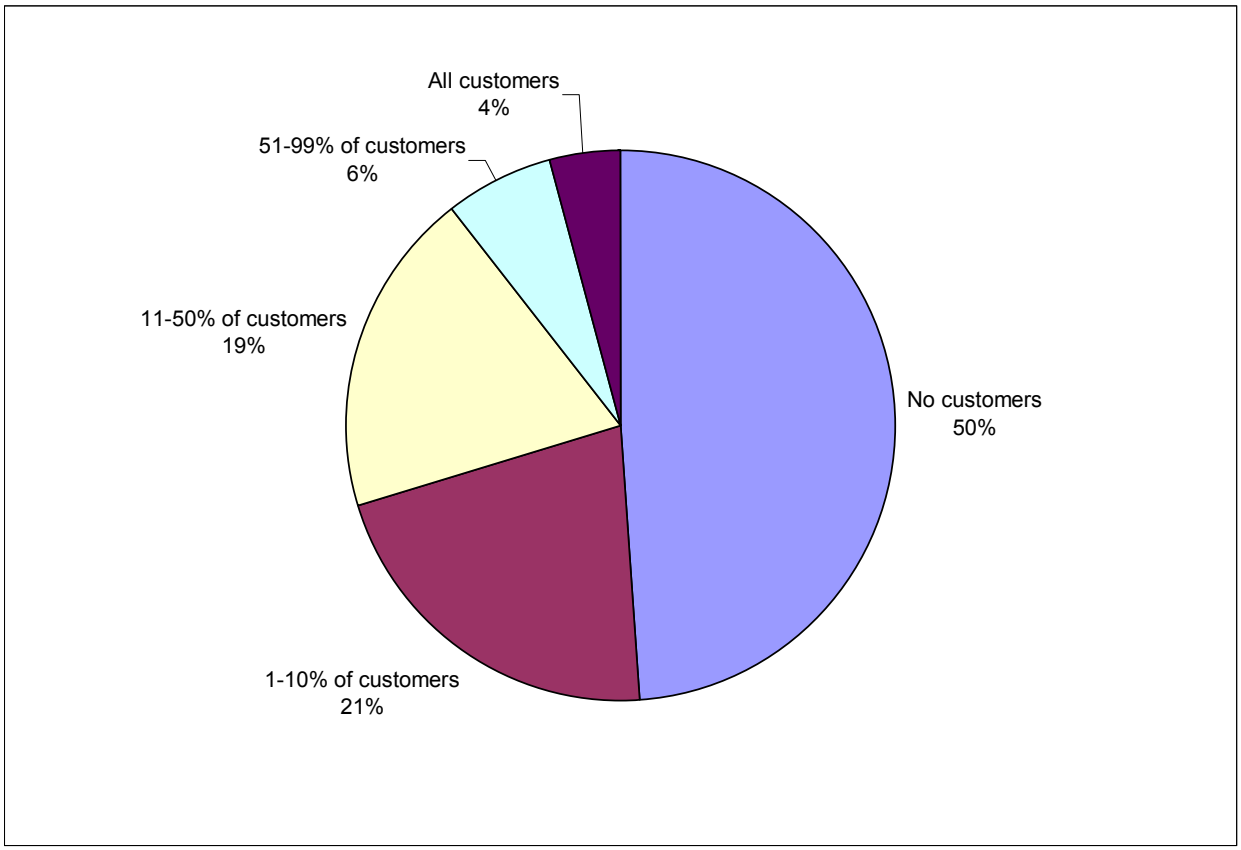
Figure 2-10. Builders and HERS Raters Perceptions of Consumer Beliefs



Source: RNC Builder Survey and HERS Survey (n=71 participating builders, n=37 nonparticipating builders, and n=14 HERS raters)

Another indicator for perceived value is increased consumer demand for ENERGY STAR labeled appliances and equipment. Interest in ENERGY STAR labeled equipment was relatively weak: half of the participating builders said that none of their customers request ENERGY STAR equipment (Figure 2-11). In fact, only 10% of the participating builders reported that more than half of their customers request ENERGY STAR.

Figure 2-11. Percent of Participating Builder Customers Requesting ENERGY STAR Labeled Equipment and Appliances

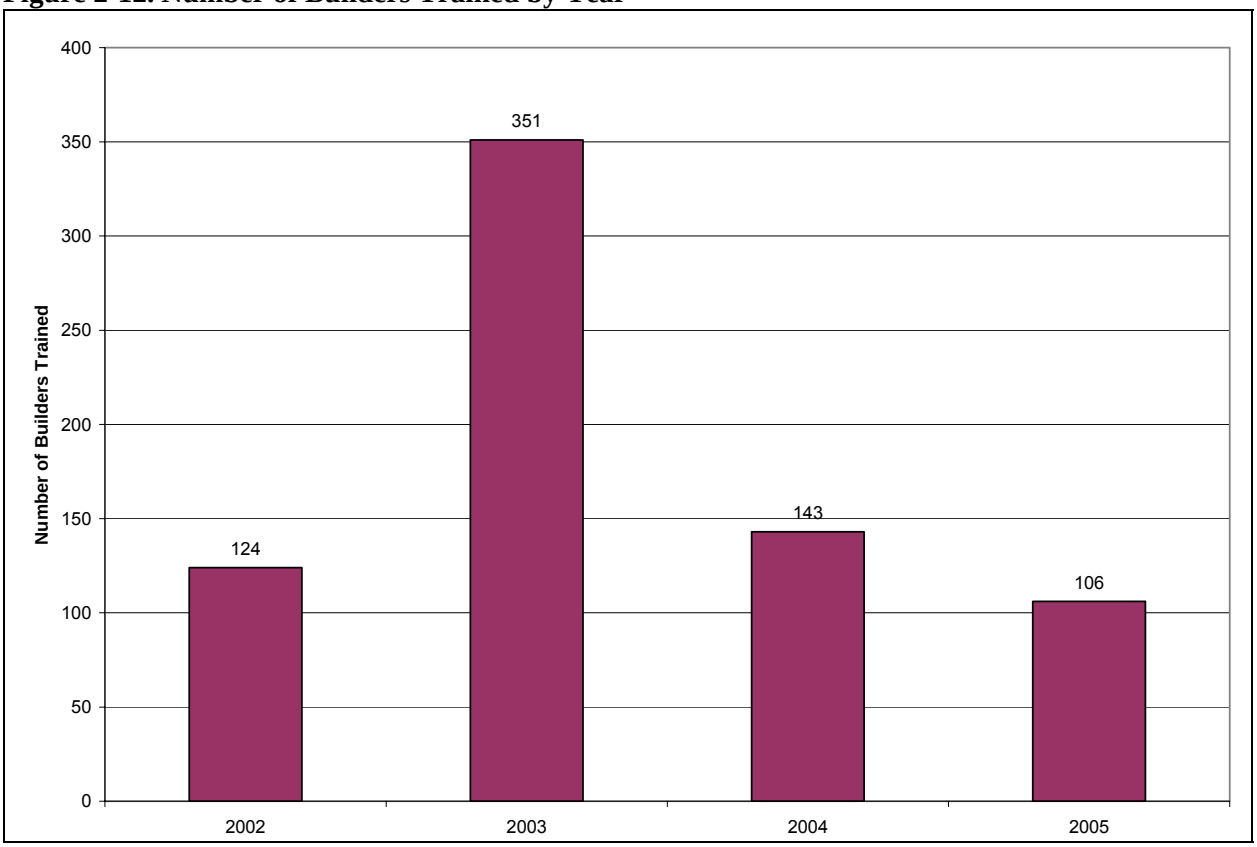


Source: RNC Builder Survey (n=71 participating builders)

2.2.3 Recruiting and Training Activities

Builder training can include classroom training, small group, one-on-one training, and other computer-based training. Training includes building science and energy efficiency, including for example, HVAC issues in sizing, charge, air flow, duct design and sealing, building envelope air sealing, insulation, lighting, appliances, and other topics. As shown in Figure 2-12 the program has had a total of 724 builder participants in the training sessions, with nearly half (351) participating in 2003. The initial project kick-off meetings with the builder and program implementer acting as the certification agency are not considered training sessions. In addition to ongoing training as home inspections are conducted, program implementers meet with builders, architects and others when program requirements change.

Figure 2-12. Number of Builders Trained by Year



Source: NJ ENERGY STAR Homes Program Annual Reports

The program has also targeted participation of the largest and most active production builders in New Jersey, and appears to be successful in this goal. For example, production builders such as K. Hovnanian, Ryan Homes, Toll Brothers, D.R. Horton, and others are the most active builders in the program.[67] In fact, the 70 participating builders that responded to the survey estimated that they build approximately 11,067 homes per year. As discussed in the *Market Share* section, in 2005 a total of 28,406 certificates of occupancy were issued in the State of New Jersey. The survey respondents, therefore, represent approximately 39% of all completed homes (multifamily and single-family) in New Jersey.[68]

2.2.4 Building Practices

In order to meet the stated goal of increasing the number of ENERGY STAR labeled homes in the State of New Jersey, the NJ ENERGY STAR Homes Program must influence the building practices of both the participating and nonparticipating builders. A number of metrics concerning building practices, including the number of ES Homes submitted to the Program, the baseline practices of nonparticipating builders, and the pre-Program building practices, are presented in the *Market Share* discussion (Section 2.3) or in

[67] A full list of New Jersey builders, and the number of homes they construct per year, was not available.

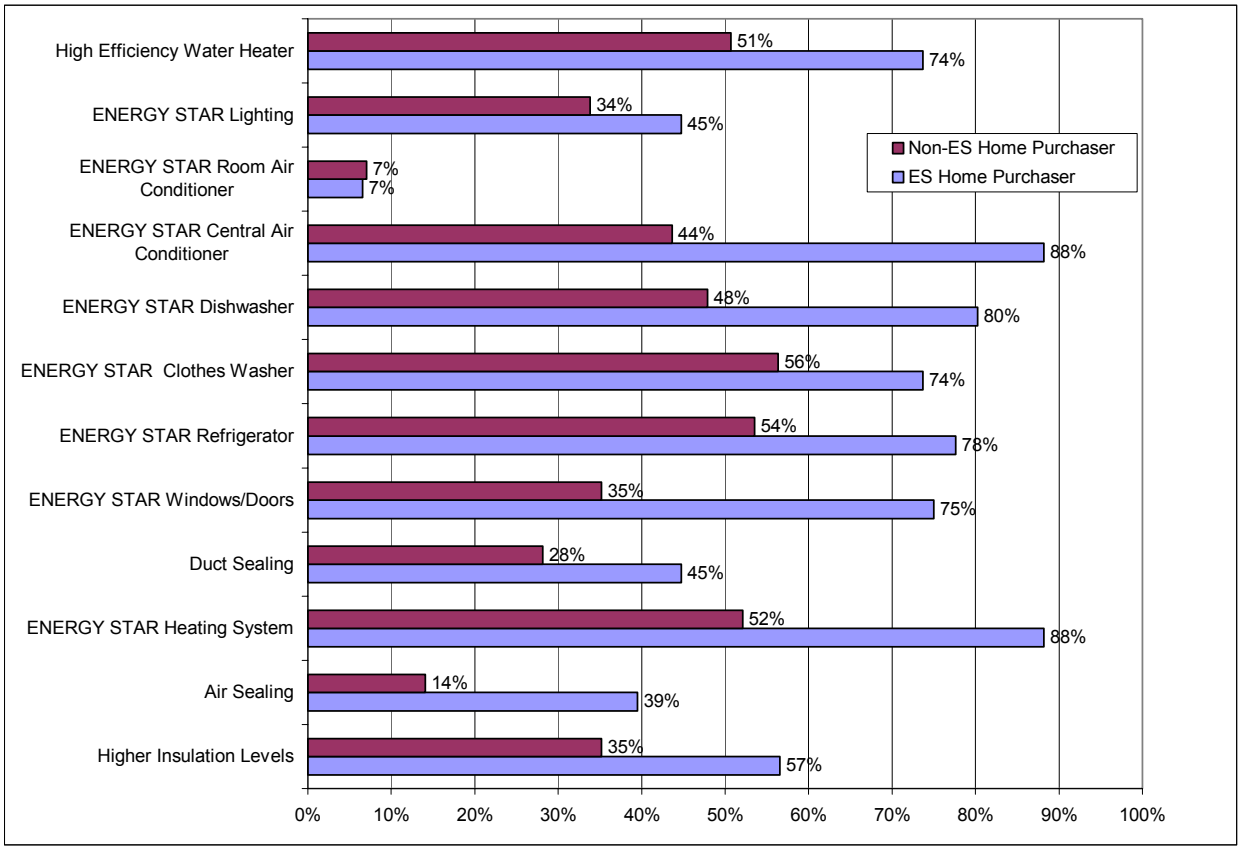
[68] This does not represent ENERGY STAR market share, but the percent of total completed homes that the Program participating builders have constructed (i.e., some of their homes are not built to ENERGY STAR standards). In addition, this only represents the survey respondents; including the total list of participating builders would represent well over 50% of all new construction activity in New Jersey.

the *Baseline Practices* discussion (Section 2.4). This section, therefore, examines a number of other indicators that assess building practices.

Reported Installations in ENERGY STAR vs. Standard Homes

In an effort to assess the differences in building practices between ENERGY STAR and non-ENERGY STAR homes, home purchasers were asked about the types of efficiency measures they had in their new homes.[69] As shown in Figure 2-13, the most dramatic differences were for efficient central air conditioners (88% in ES homes and only 44% in non-ES homes), efficient space heating systems (88% vs. 52%), and efficient windows/doors (75% vs. 35%). For every measure (with the exception of room air conditioners) the prevalence of efficient equipment was higher in the ENERGY STAR home vs. the non-ENERGY STAR homes.

Figure 2-13. Self-Reported Presence of Efficiency Measures from ENERGY STAR vs. Non-ENERGY STAR Home Purchasers



Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers, n=71 non-ES home purchasers)

Measure Installations

The New Jersey ENERGY STAR Home monthly reporting by implementers lists 21,603 CFL installed in 2005. Mechanical ventilation and ENERGY STAR washing machines were installed in 7,145 homes.

[69] As noted in the evaluation of the NJ ENERGY STAR Products Program the margin of error around consumer self-reported efficiency data are extremely high. However, the magnitude of the difference between purchasers of ES homes vs. Non-ES homes is informative.

Slightly less than the targeted number of three CFL per home was installed. More than the targeted amount of mechanical ventilation and washers were installed.

Table 2-11. Number of Program CFLs, Mechanical Ventilation, and ENERGY STAR Clothes Washers Installed in 2005

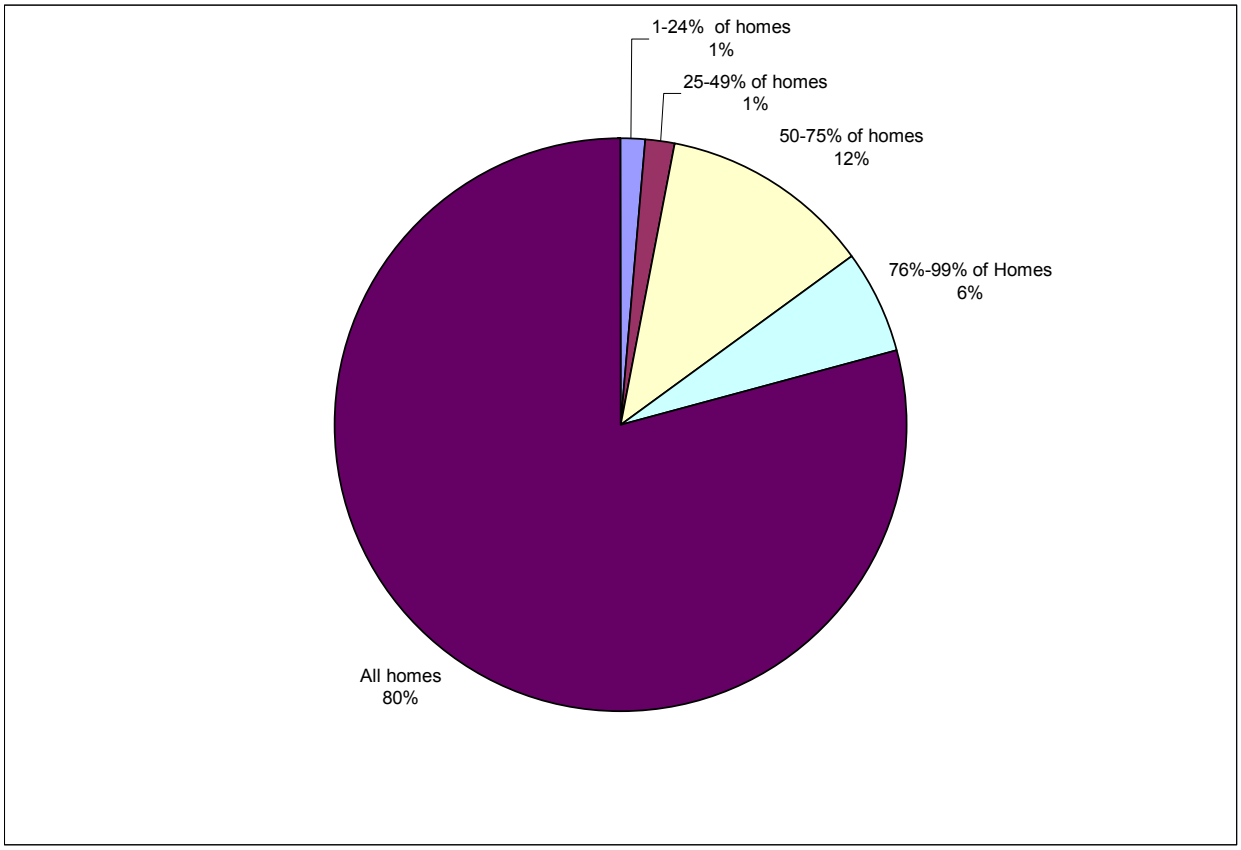
Measure	Target	Average	2005 Installations
CFL	3 per home	2.59 per home	21,603
Mechanical Ventilation & ENERGY STAR Clothes Washers	28% of homes	86% of homes	7,145

Source: NJ ESH monthly report 12-05.combined.xls provided by MaGrann Associates

ENERGY STAR Homes as a Percentage of All Homes

Another progress indicator for building practices is the number of ENERGY STAR homes constructed as a percentage of all homes constructed by participating builders: as this percentage goes up it indicates that the participating builders are making ENERGY STAR construction standard practice, an important goal of the Program. As shown in Figure 2-14, the participating builders were clearly committed to construct ENERGY STAR homes: 80% of the builders reported that all the homes they construct achieved HERS ratings of 86 or greater. In fact, 85% of all the homes built by the participating builders (weighted for the number of homes built) were ENERGY STAR qualified. Many of the largest production builders, including K. Hovnanian, Pulte Homes, Ryan Homes, Orleans Home Builders, Beazer Homes, and D.R.Horton, were not only all participating in the Program but all reported that 100% of their new homes are now all ENERGY STAR rated. This is a tremendous program achievement.

Figure 2-14. Percentage of Homes with HERS Ratings of 86 or Greater for Participating Builders



Source: RNC Builder Survey (n=71 participating builders)

2.2.5 Program Satisfaction

Another important progress indicator is satisfaction with both the program and program elements (i.e., energy savings), from both the builders and home buyers perspective.

Builder ENERGY STAR Homes Program Satisfaction

Participant builders were asked to rate their satisfaction with various components of the Program. As shown in Table 2-12, satisfaction was highest for the responsiveness of program staff (72% "Extremely or Somewhat Satisfied"), indicating general satisfaction with the program implementers (EAM Associates and MaGrann Associates). Satisfaction was also reasonably high for the certification/verification process (68%), also conducted by EAM and MaGrann.

Dissatisfaction, on the other hand, was highest for the incentive level (41% "Extremely or Somewhat Dissatisfied"), but generally moderate for the other items researched. Respondents reported:

> *"I don't understand why incentives are being stripped from NSG areas."*
>
> *"We don't have an issue with the ENERGY STAR program, but I do with the state legislated Smart Growth initiative."*

"The technical support offered was helpful. However, program needs more advertising and marketing. It should be advertised where people read: Better Homes & Garden, Real Estate section of the newspaper. It is not good that the program is only available in Smart Growth areas. They took the area where I build out of the incentives area. I am moving out of state because of this. I will use things I learned in the program but won't build in the Energy Star program."

"Basement insulation caused mold in our homes and this was quite costly for us to cover. There is less incentive to participate as incentives have dwindled, but we will continue to build at or near ENERGY STAR standard even if we drop the program."

"Increase rebates. Lower rebates deter participation. It becomes less of a marketing tool as incentives go down."

"We are phasing the program out now, due to increased homebuyer complaints. In our experience, the AC has had to run all day in many homes and was still unable to [get the home] below 80 degrees. Sizing requirements are too limiting. It is also difficult getting rebate dollars back as the process is not streamlined. We still have $600,000 in outstanding rebates today."

"We need more community specific advertising - cooperative advertising. A marketing representative for every community would be nice as we need more collaboration between program and builders to enhance public awareness."

"The program needs a facelift. The program needs to think bigger or more systematically about energy conservation if they really want to conserve energy."

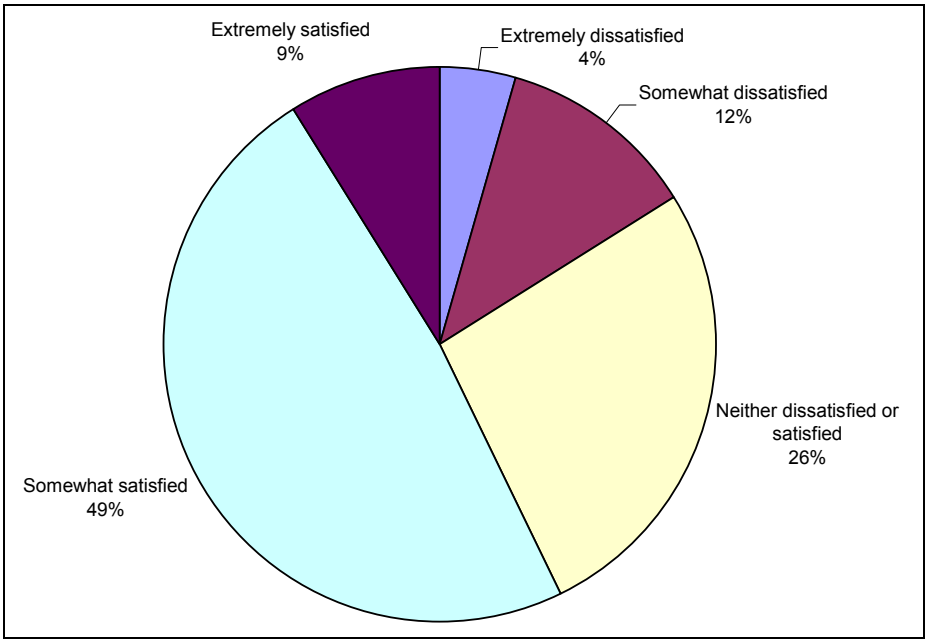
"Create a brochure documenting benefits with comparative analysis between conventional and ENERGY STAR homes."

Overall, 58% of participating builders stated they were "Extremely or Somewhat Satisfied" with the Program, and only 16% said they were "Extremely or Somewhat Dissatisfied" with the program (Figure 2-15).

Table 2-12. Participating Builder Satisfaction with Aspects of the New Jersey ENERGY STAR Homes Program[70]

	Participating Builders	
	Extremely or Somewhat Satisfied	**Extremely or Somewhat Dissatisfied**
Overall level of satisfaction	58%	16%
Cost of participation	29%	24%
Quality of Marketing Support Materials	38%	22%
Technical Training	49%	22%
Certification/verification process	68%	13%
Ease of participation	56%	15%
Level of incentive	25%	41%
Responsiveness of program staff	72%	9%
Amount of paperwork required	41%	28%
Market penetration	26%	22%

Figure 2-15. Participating Builder Overall Satisfaction with New Jersey ENERGY STAR Homes Program



Source: RNC Builder Survey (n=71 participating builders)

[70] The category "Neither Satisfied nor Dissatisfied" is excluded from this table.

Home Purchaser Satisfaction

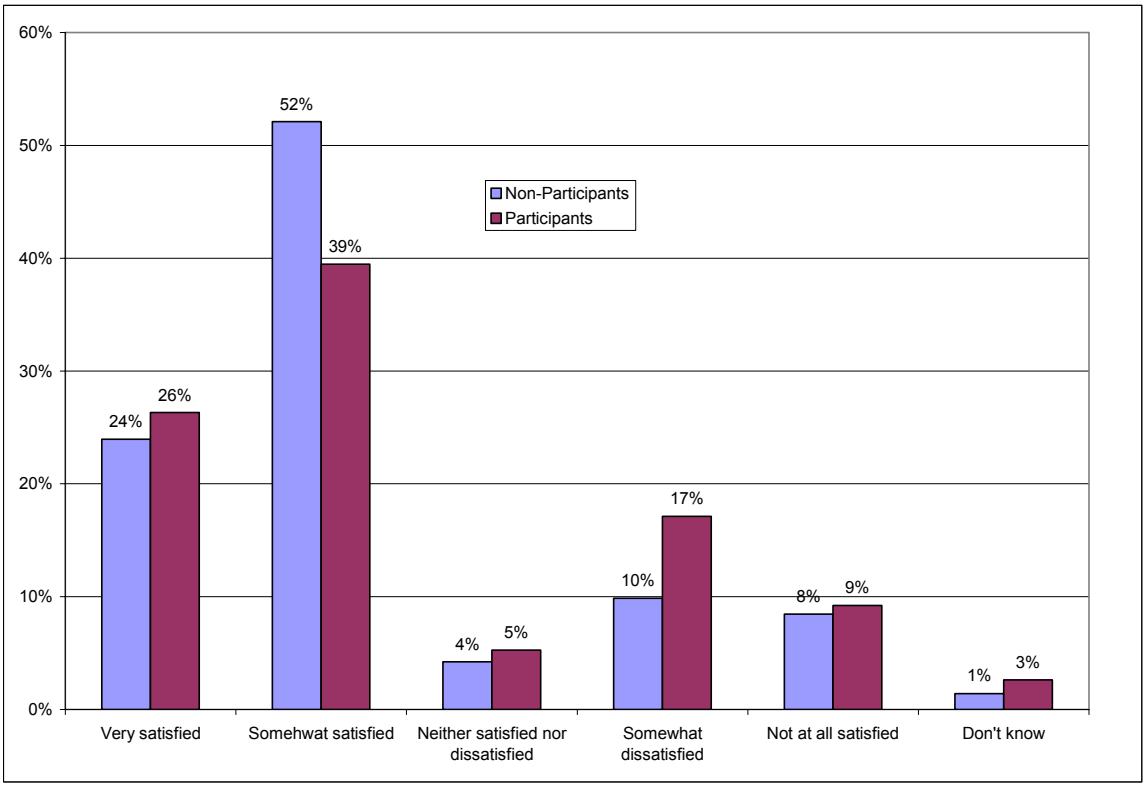
Purchasers of new ENERGY STAR homes do not receive the incentive check and have little or no interaction with program staff, and thus cannot comment on program satisfaction. However, respondents to the new home purchaser survey were asked about their satisfaction with the home's energy efficiency attributes and if they noticed any energy savings. Figure 2-16 demonstrates that while the majority of both non-ES (76%) and ES home buyers (65%) are either "Very or Somewhat Satisfied," a greater percentage of participants are dissatisfied than nonparticipants. This is likely due to the greater expectations for energy savings held by participants. For example, half of the purchasers of ENERGY STAR homes (50%) stated that their energy bills were higher than expected, compared to only 39% of non-ENERGY STAR homes (Table 2-13). The primary reasons for higher bills were increased utility costs and larger home size (compared to the respondent's previous home). The disappointment in energy savings, compared to expectations, was confirmed by comments made to the inspector during our on-site visits to homes of ENERGY STAR new home buyers. Comments from survey respondents who were ENERGY STAR new home buyers included:

> *"Moved from Michigan, compared to our bills there, these were cheaper [in NJ]."*
>
> *"Gas/electric bills have gone up."*
>
> *"Very large home. One room is much hotter or colder than the rest, I have to overcompensate to make it what I want."*
>
> *"We have a one floor house and it is more expensive to heat/cool this home that our previous home that was 3 levels."*
>
> *"The windows drafty, heating system is very poor and high ceilings."*
>
> *"We don't think the heating system is adequate for the size of our home."*
>
> *"Ceilings too high to properly cool/heat home. Poor insulation makes it drafty."*
>
> *"I don't think they did it properly. There's too much draft with the windows and doors"*

Non-Energy Star home purchaser comments included:

> *"I don't know [why my bills are high]. They're just high."*
>
> *"It's just the rates, nothing to do with home or construction."*
>
> *"Because of energy crisis."*
>
> *"Increased cost of gas/larger house."*
>
> *"I don't know, it's freezing. My bills are astronomical and it's still cold."*
>
> *"Drafty windows, insulation could be better."*
>
> *"The design is not energy-efficient."*

Figure 2-16. Home Purchaser Satisfaction with Home's Energy Efficiency Attributes



Source: RNC Survey of New Home Purchasers (n=76 ES home purchasers, n=71 non-ES home purchasers)

Table 2-13. Energy Bills Compared to Expectations

	Nonparticipants		Participants	
	N	%	N	%
Lower than expected	9	13%	12	16%
About as expected	32	45%	26	34%
Higher than expected	28	39%	38	50%
Don't know	2	3%	0	0%
Total	**71**	**100%**	**76**	**100%**

2.2.6 Program Savings

As shown in Table 2-14, energy and demand savings has generally been rising each year since program inception, up to an estimated 6,123 MWh, 18,897 kW, and 239,568 Decatherms in 2005. Note these estimates are based off of deemed savings values and are not adjusted for updates based on measurement and verification (M&V) engineering or billing analysis, nor any market effects (i.e., freeridership and spillover) net-to-gross analysis.

Table 2-14. Gross Energy and Demand Saving for the New Jersey ENERGY STAR Homes Program

	2001	2002	2003	2004	2005
Number of Program homes certified		1881	4,936	5,974	8,009
MWh annual energy savings	119	3,262	4,773	4,551	6,123
kW annual peak demand savings	11	3,415	11,201	14,869	18,897
Dtherms annual natural gas savings	356	83,638	136,914	183,693	239,568

Source: NJ ENERGY STAR Home Program Annual Reports

2.2.7 Recommendations for Appropriate Indicators

The indicator list that was updated for this evaluation generally contains a comprehensive set of progress indicators that should be considered when evaluating the NJ ESH Programs. The complete list of current and recommended indicators is shown in Table 2-6. Future evaluations might also want to consider examining marketing and promotion of ENERGY STAR homes (e.g., dollars spent by the program and builders, ad impressions, etc.) as a metric for builder commitment to ENERGY STAR homes.

2.2.8 Summary of Survey Findings

Awareness of ENERGY STAR homes is increasing among consumers. Compared to the findings of the baseline study in 2001, more ENERGY STAR home purchasers and non-ENERGY STAR purchasers were aware of the ENERGY STAR label. While the increase was moderate for non-ES home buyers (46% to 56%), it was dramatic for ES home buyers (58% to 97%). The purchasers of ES homes were nearly all aware (99%) that they were actually living in an ENERGY STAR home, compared to the baseline study that found as little as 60% of ENERGY STAR home purchasers actually knew they were living in an ENERGY STAR home.

Builders tend to have more influence than realtors, and tend to more actively use ENERGY STAR as a selling point. In terms of influence, 59% of purchasers of ES Homes said their builder had "a lot or some influence," compared to 17% that said realtors had "a lot" or "some" influence. Builders also more actively promote ENERGY STAR: 83% of the respondents that purchased an ES Home indicated that the builder had brought up ENERGY STAR as a selling point, while under half (48%) reported that the realtor or sales agent brought up ENERGY STAR as a selling point.

Awareness of the Program among non-participating builders is extremely low. In order to be successful the program must educate builders about the program itself. Only 17% of the non-participating builders, however, were aware of the program (beyond just hearing of it).

The perceived value of the ENERGY STAR label among home purchasers was moderate. Just over half (56%) of participants stated that the ENERGY STAR label was a "Very" or "Somewhat Important" factor in the decision to buy the home, and 54% of respondents believed they would have definitely or probably purchased the same home even if it did not have the ENERGY STAR label. In addition, although the primary motivations for purchasing an ENERGY STAR home were to lower energy/utility bills (42%) and to save energy (34%), the third most frequent response (20% of respondents) had nothing to do with ENERGY STAR, but concerned other qualities of the house, such as location and layout. Finally, of the

32 ES home purchasers who were previously aware of ENERGY STAR (before their home search), only five (16%) stated they were specifically looking for an ENERGY STAR home.

Increasing energy prices is causing energy efficiency to be a higher priority for home purchasers. Respondents in both the baseline study and the current study were asked to rate the importance of a number of factors in their home purchase, including location, price, appearance, size, and energy efficiency. There was a substantial increase in the percent of participants citing the importance of energy efficiency, which jumped from 39% in 2001 to 64% in the current study. Increasing energy costs likely played an important role in this change, as well as program marketing and education.

Builders believe that consumers associate ENERGY STAR homes with both energy savings and important non-energy benefits. The participating builders strongly agreed that home buyers not only link the ENERGY STAR label with lower energy bills (84%), but also associate ENERGY STAR homes with higher quality homes (67%) and increased home value (51%), important non-energy benefits of ES homes.

The Program appears to be impacting the adoption of efficient HVAC systems and shell measures. In an effort to assess the differences in building practices between ENERGY STAR and non-ENERGY STAR homes, home purchasers were asked about the types of efficiency measures they had in their new homes. The most dramatic differences were for efficient central air conditioners (88% in ES homes and only 44% in non-ES homes), efficient space heating systems (88% vs. 52%), and efficient windows/doors (75% vs. 35%).

The participating builders were clearly committed to construct ENERGY STAR homes. Eighty percent of the builders reported that all the homes they construct achieved HERS ratings of 86 or greater. In fact, 85% of all the homes built by the participating builders (weighted for the number of homes built) were ENERGY STAR qualified. Many of the largest production builders, including K. Hovnanian, Pulte Homes, Ryan Homes, Orleans Home Builders, Beazer Homes, and D.R.Horton, were not only all participating in the Program but all reported that 100% of their new homes are now all ENERGY STAR rated.

Participant builder satisfaction with the Program was generally good. Satisfaction was highest for the responsiveness of program staff (72% "Extremely or Somewhat Satisfied"), indicating general satisfaction with the program implementers (EAM Associates and MaGrann Associates). Satisfaction was also reasonably high for the certification/verification process (68%), also conducted by EAM and MaGrann. Overall, 58% of participating builders stated they were "Extremely or Somewhat Satisfied" with the Program, and only 16% said they were "Extremely or Somewhat Dissatisfied" with the program

Many purchasers of ENERGY STAR homes were disappointed in their perceived energy savings. While the majority of both non-ES (76%) and ES home buyers (65%) are either "Very or Somewhat Satisfied" with their new home, a greater percentage of participants are dissatisfied than nonparticipants. This is likely due to the greater expectations for energy savings held by participants. For example, half of the purchasers of ENERGY STAR homes (50%) stated that their energy bills were higher than expected, compared to only 39% of non-ENERGY STAR homes. The primary reasons for higher bills were increased utility costs and larger home size (compared to the respondent's previous home).

2.3 Market Share Assessment

One of the most critical indicators of Program success is the percentage of new homes constructed to ENERGY STAR standards. This section examines the market share for New Jersey ENERGY STAR certified homes, and also examines how the NJ ESH Program compares to a number of other similar

ENERGY STAR Homes programs across the country in terms of both market share and other benchmarking metrics.

2.3.1 Market Share of ENERGY STAR Homes

In 1999, 37,522 building permits were issued and 28,109 certificates of occupancy were issued. Of these newly occupied homes, 2.6% participated in a utility residential new construction program (the precursor of the NJ ESH Program) at one of three utilities offering the program. The market share of newly occupied homes was 3.9%.[71]

In 2001, the first year of the NJ ENERGY STAR Homes Program, 4,553 homes were enrolled and committed to build to ENERGY STAR standards (Table 2-15).[72] The committed homes spiked in 2002 and 2003 largely due to contractors enrolling homes to grandfather them in before they were no longer eligible under Smart Growth restrictions, and then dropped in 2004 and 2005. The number of ENERGY STAR certified program homes, however, has continued to rise steadily each year, from only 1,881 in 2002 to 8,009 program certified ENERGY STAR homes in 2005, for a total of 20,800 homes.[73] Market share, computed as the number of Program certified homes as a percentage of all certificates of occupancy issued, has also risen steadily each year, from only 6% in 2002 to 28% in 2005 (Figure 2-17).

Table 2-15. Market Share

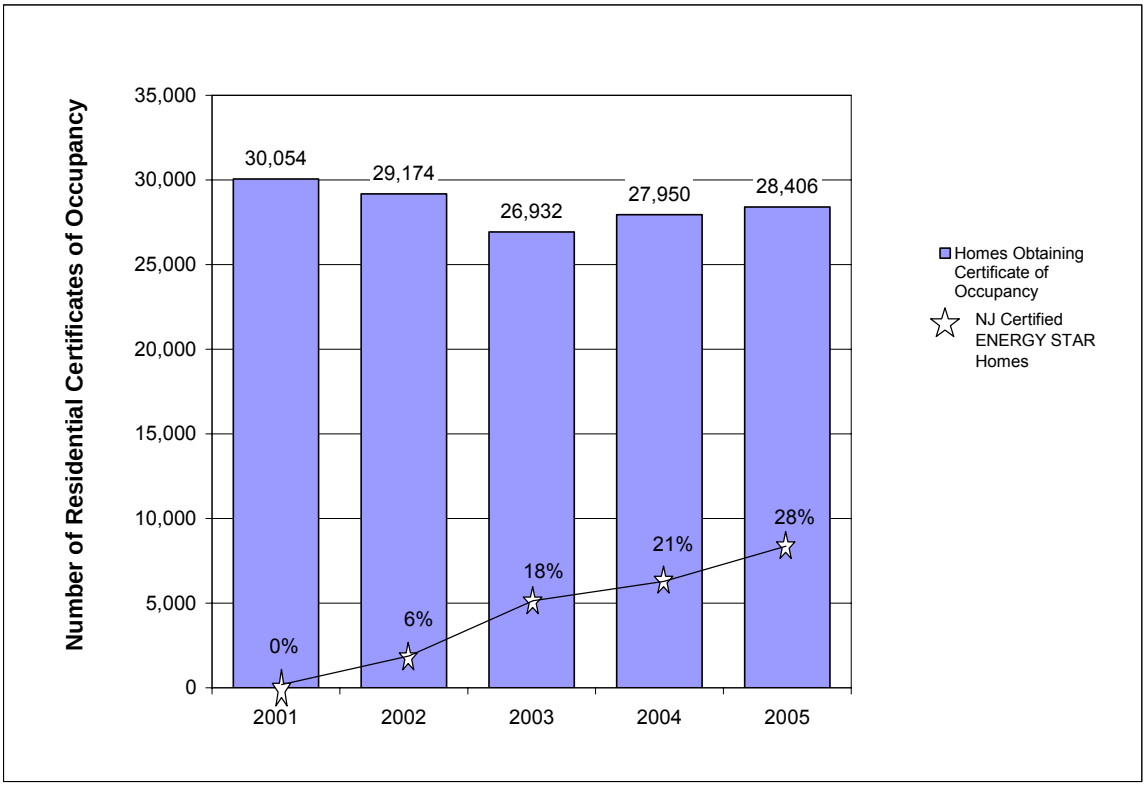
	2001	2002	2003	2004	2005
Market Share Based on Occupied Homes and ES Certified					
Certificate of Occupancy	30,054	29,174	26,932	27,950	28,406
Actual Participants (homes certified)		1,881	4,936	5,974	8,009
ENERGY STAR certified homes as % of certificates of occupancy	0.0%	6.4%	18.3%	21.4%	28.2%
Market Share Based on Permits vs. Committed Homes					
Housing units authorized (building permits)	35,680	34,589	35,171	39,254	38,025
Committed participants (signed on to build to ES standards)	4,553	10,490	12,168	6,526	8,337
Committed homes as % of building permits	12.8%	30.3%	34.6%	16.6%	21.9%

[71] Roper Starch Worldwide Inc. and Xenergy Inc., *Baseline Study of Attitudes and Awareness of Key Market Actors in the New Jersey Residential New Construction and Renewable Technology Market*. May 2001.

[72] It can typically take one or two years from issuance of the building permit to occupancy, so none were completed during the initial year of the program.

[73] This figure includes both single-family and multifamily (based on number of units).

Figure 2-17. Market Share for Single-family and Multifamily New Jersey ENERGY STAR Home Certified Homes



Source: NJ ENERGY STAR Homes Program Annual Reports and the Department of Community Affairs

There are currently 19,670 outstanding commitments for future certification. The number of commitments (enrollments) is important because of its impact on future year budgets and future year certification. Homes certified in 2004 and 2005 are, for the large part, homes enrolled in 2003. To sustain program growth and its ability to meet target market share goals, efforts to enroll homes must continue. In addition, retaining builders and bringing on new builders is important to sustained activity and growth.

2.3.2 Benchmarking Against Other ENERGY STAR Homes Programs

Quantec conducted a benchmarking study to compare selected key metrics of the New Jersey ENERGY STAR Homes Program against other ENERGY STAR Homes programs across the U.S. We selected a total of four comparison programs that had 2005 data available at the time of this study, and were located in New York, Texas (two programs), and Oregon. Some of the key metrics for Program Year 2005, summarized in Table 2-16, included:

- Annual budget
- Number of participating homes
- Number of homes built (market share)
- Estimated savings values
- Incentive types and levels
- M&V activities

- Requirements for participating homes
- Baseline assumptions

Each of these areas is discussed below in more detail.

Program size. For 2005, the NJ ESH Program had the largest budget (over $23 million) of all the five programs examined.[74] In terms of participating homes, however, the program trailed two ENERGY STAR homes in Texas: TXU had 13,014 participating homes in 2005, CenterPoint had 9,003 homes, while New Jersey had 8,009 homes.

Market share: The NJ ESH Program, with an estimated market share of 28% of all new homes constructed in 2005, was higher than any other program examined. The two Texas programs – TXU (24%) and CenterPoint (21%) – were the closest in terms of market share, followed by New York (13%) and Oregon (4%). The building markets and program lifecycle strongly influence market share. For example, in Texas there are a number of high volume production builders that participated in the program, and because of the large cooling load and baseline SEER level of 10 in 2005, qualifying for the program was attainable for relatively minor incremental cost and spec changes. In Oregon, the ENERGY STAR homes program was just launched in 2005, so is just getting established. By any measure, however, the NJ market share is an impressive accomplishment.

Estimated electric energy and demand savings. The average annual expected savings varied substantially between the five ENERGY STAR homes programs. The NJ ESH Program had the lowest expected electric savings, of only 765 kWh/home, well below the expected savings of New York (1,208 kWh/home) and Oregon (1,190 kWh/home), two states that would be expected to have lower average cooling loads.[75] The extremely high expected electric savings for TXU (1,976 kWh/home) and CenterPoint (2,837 kWh/home) are likely driven by the large cooling loads, but are somewhat surprising given the more stringent Texas building codes and assumption that the program homes are only 15% (rather than 30%) more efficient than the standard new home. Peak demand energy savings also varies substantially by utility, and is actually highest for New Jersey at 2.4 kW per program home. New York, with the lowest cooling load of those states that track demand savings, only averages peak demand savings of 0.2 kW/home.

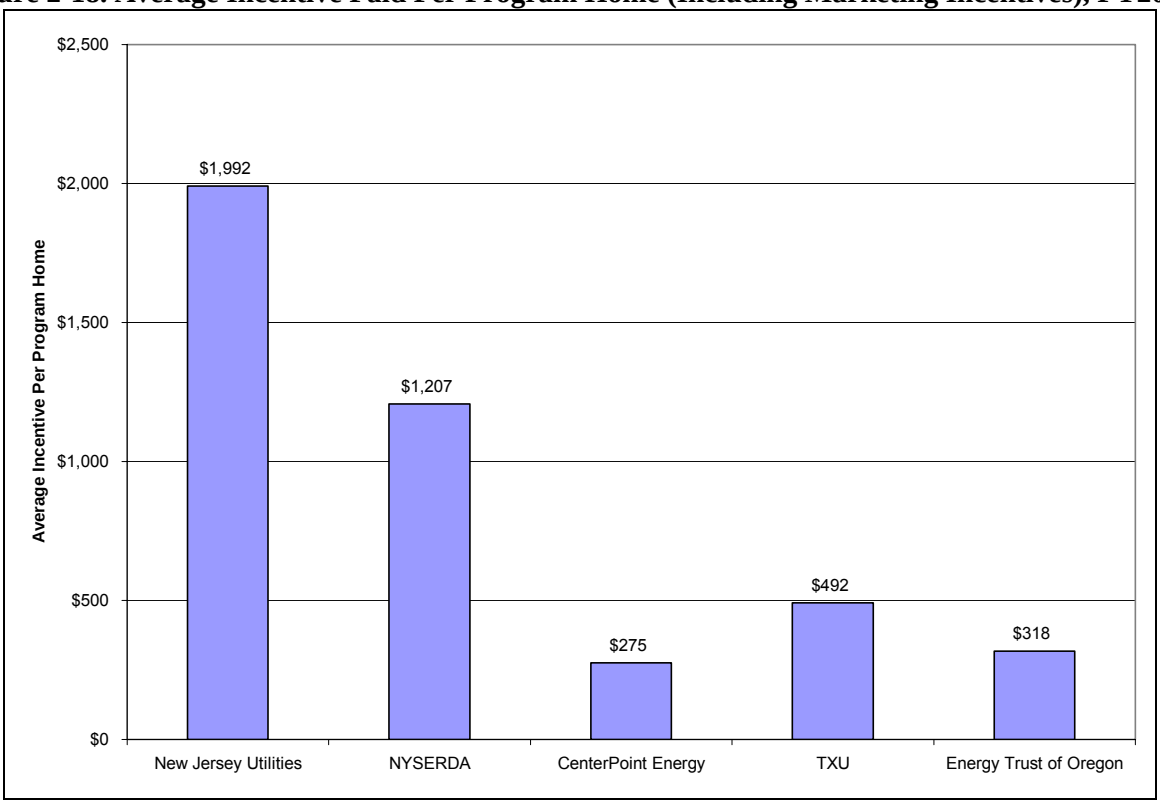
Gas savings. Gas savings are only tracked by the three regions with heating loads, and as expected are highest for New York (755 kWh/year), the state with the largest heating load (particularly since most of the program activity occurs in upstate New York). Average expected gas savings for New Jersey (299 therms/year) and Oregon (105 therms/year) substantially trail New York.

Incentive levels. The total amount of incentives (including marketing and PR incentives) were substantially higher for New Jersey ($15.9 million) than any other state we examined. As shown in Table 2-18, the average incentive per program home was also significantly greater in New Jersey than any other state: the average incentive per home ($1,992), is 65% greater than in New York ($1,207), the closest state both geographically and in terms of incentive levels. The other ENERGY STAR programs pay average incentives per home that are far lower than New Jersey or New York, all below $500.

[74] Some differences in budgets, however, reflect differences in cost-accounting practices, and thus may not reflect efficiencies or inefficiencies of program implementation.

[75] Note that differences can occur for a number of reasons including the average size of the home (NJ has a higher percentage of multifamily than New York), the assumed baseline home (NJ uses assumptions from a utility study), among other factors.

Figure 2-18. Average Incentive Paid Per Program Home (Including Marketing Incentives), PY2005



Source: Program reports and interviews with Program administrators.

Incentive structure. Three of the five ENERGY STAR homes programs offered simple incentive structures that were directly tied to the HERS rating and structure type. Oregon, however, offers a prescriptive approach ("builder option package") where incentives vary based on fuel types and the types of measures installed. These prescriptive approaches have the advantage of eliminating the plans analysis and HERS rating. The NJ ESH Program, by comparison, offers a somewhat hybrid approach: while still based on a HERS rating, incentives vary based on the conditioned space of the home, plus the program offers bonus incentives for certain measures (e.g., clothes washers and ENERGY STAR fixtures).

Marketing expenditures. The NJ ESH Program, despite having over four times the number of participating homes as the New York ENERGY STAR-Labeled Homes Program, only spent 24% of the marketing and advertising budget ($340,000) of the New York Program ($1.4 million). As presented elsewhere in this report, both builders and program implementers believed that the program needed more substantial marketing dollars to drive consumer awareness and demand for ENERGY STAR homes.

M&V and inspection activities. All but the Oregon ENERGY STAR Homes programs we examined required HERS ratings, although New York allows sampling for production builders using the same floor plan. Oregon requires inspections of homes to verify that program measures were installed, and also allows for a sampling of homes for production builders using the same floor plan. M&V activities varied widely by Program, with three of the five programs conducting periodic comprehensive evaluations that include extensive survey and interview efforts with market actors. The two programs in Texas, however, only conduct audits of program savings estimates and limited process evaluations.

Table 2-16. ENERGY STAR Homes Benchmarking Findings (for Program Year 2005) Summary

Implementer	State	Annual Budget (thou-sands)	Number of Certified ES Homes Built	State/ Region Market penetra-tion	Average Annual Electric (kWh) Savings/ home	Average Annual Peak Demand (kW) Savings/ home	Average Annual Gas (Therm) Savings/ home	Total Annual Incentives paid ($000)
New Jersey Utilities	NJ	$23,261	8,009	28%	765	2.4	299	$15,952
NYSERDA	NY	$2,965	1,719	13%	1,208	0.2	755	$2,074
CenterPoint Energy	TX	$2,777	9,003	21%	2,837	1.9	NA	$2,474
TXU	TX	$7,514	13,014	24%	1,976	2.2	NA	$6,398
Energy Trust of Oregon	OR	$2,570	888	4%	1,190	NA	105	$283

Implementer	Avg incentive per home	Incentives offered	Marketing expenditures (thousands)
New Jersey Utilities	$1,992	Core incentive of $500 + $0.6/sqft for SF, max core incentive $2,900; Additional incentives for efficient boilers, furnaces, AC, clothes washers, and light fixtures.	$340
NYSERDA	$1,207	$850/home direct to builders for SF ESLHs ($3500 for model homes)	$1,400
CenterPoint Energy	$275	$150/home (HERS 86-87.9), $200/home (HERS 88+).	NA
TXU	$492	$150/home (HERS 86-87.9), $200/home (HERS 88+).	NA
Energy Trust of Oregon	$318	Varies greatly by BOP and by upgrade options, ranges from $50/home to $700/home	$120

Implementer	M&V Activities	Inspections	Requirements	Assumed Baseline
New Jersey Utilities	Baseline study in 2002, comprehensive study with market actors in 2005-2006	100% HERS ratings	HERS 86+	30% more efficient than average home
NYSERDA	Every two years, extensive survey work with market actors	100% HERS ratings, exceptions for production builders with same floor plan	HERS 86+, ventilation system, electrical savings of at least 450 kWh/year	30% more efficient than average home
CenterPoint Energy	Audit evaluation and limited process evaluation in 2006	100% HERS ratings	HERS 86+	15% higher than home built to TX code
TXU	Audit evaluation and limited process evaluation in 2006	100% HERS ratings	HERS 86+	15% higher than home built to TX code
Energy Trust of Oregon	Initial comprehensive evaluations though NW Energy Efficiency Alliance	100% inspection, exceptions for production builders with same floor plan	Two builder option packages w/ additional technical compliance options (TCOs)	Code is close to ES, more stringent than ES

2.4 Baseline Savings Assessment

Understanding baseline practices in the residential new construction market is critical for future design of the New Jersey ENERGY STAR Homes Program. Furthermore, understanding the impact of the Program in shifting the baseline practices towards more energy-efficient measures is an important progress indicator. This section reviews the current building practices, the program influence in shifting the baseline, and the savings estimates that are reported by the Program.

2.4.1 Availability and Common Practice

Building Practices among Nonparticipant Builders

Nonparticipating builders were asked about the types of heating, cooling, lighting, and windows they install in the homes they build. The findings from these responses help provide insight into common practice among nonparticipating builders.[76]

In terms of heating systems, the majority of nonparticipating builders reported that they are installing high efficiency furnaces (83%), significantly greater than those that install standard efficiency furnaces (14%) (Figure 2-19). Similarly, the majority (68%) of builders also reported installing high efficiency (SEER 13+) central air-conditioning, far greater than standard efficiency air-conditioning equipment (25%) (Figure 2-20). These results indicate that efficient HVAC equipment is commonly installed by builders

[76] Because previously participating builders may continue to practice efficient building practices outside of the program, only the true nonparticipating builders are examined for this analysis. In addition, this is not an estimate of market share, but the percent of builders that use or do not use specific measures (i.e., the data are not weighted by the number of homes built). Market share estimates can be found in the residential HVAC and ENERGY STAR products reports.

that are *not* in the New Jersey ENERGY STAR Homes Program.[77] One reason for this may be the impact of the New Jersey Residential HVAC Program, which offers incentives for high efficiency HVAC equipment. In fact, a previously participating builder mentioned they found the incentive process far simpler for the HVAC program, and thus chose to install high efficiency HVAC equipment and receive the incentive through this other program.

Far fewer nonparticipating builders, however, reported using energy-efficient lighting. For example, as shown in Figure 2-21, only 21% of the builders reported installing CFLs, and none of the builders reported using ENERGY STAR lighting fixtures (or dedicated CFL fixtures). Interestingly, buyers were quite involved in the decision-making process, selecting the lighting (either independently or in consultation with the builder or architect) according to 62% of the builders (Figure 2-22). These results highlight the importance of targeting both "upstream" and "downstream" market actors in any market transformation program. In other words, buyers were neither selecting nor requesting ENERGY STAR lighting in the new homes, plus many builders were unaware of what qualified as ENERGY STAR lighting. For example, when asked why they don't install more efficient lighting, builders responded:

> *"I don't know which are ENERGY STAR, I was never told by the seller."*
>
> *"Home owners choose [the lighting]."*
>
> *"I never looked into it."*
>
> *"I'm not familiar with the quality and availability."*
>
> *"I order what the customer wants, I don't know if it is ENERGY STAR or not."*

Fifty-seven percent of the nonparticipating builders report installing high efficiency windows. Others thought they could be efficient windows but were not sure. Asked whether window suppliers recommended using energy-efficient windows, 16% said they always recommended high efficiency windows, 38% reported suppliers recommended high efficiency windows most of the time; however, 34% said suppliers never recommended efficient windows.

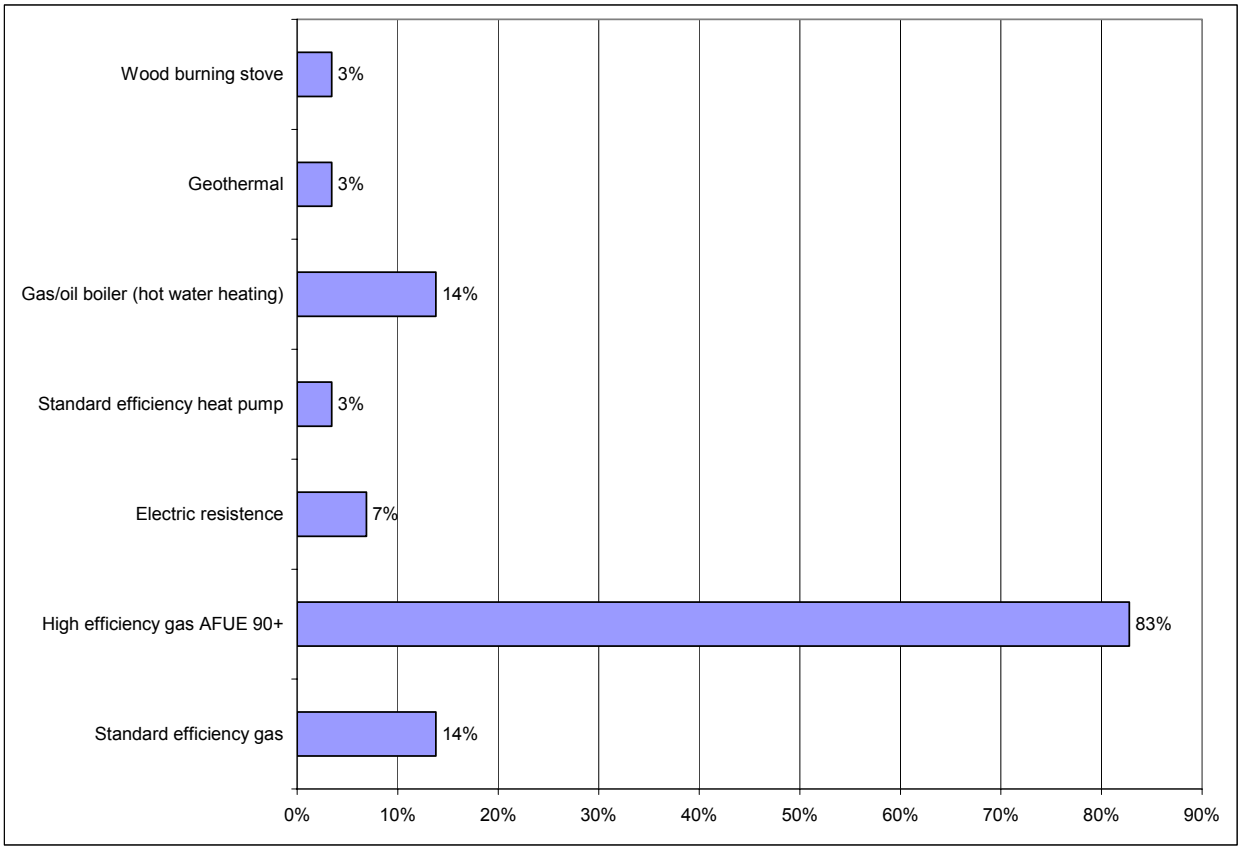
Builders were asked why they did not install high efficiency windows; 50% said the customer didn't request it, 20% said it added too much cost, and others said that "good double panes are as good as ENERGY STAR windows."

Builders were also asked if they were familiar with duct tightness testing and duct sealing for ducted heating systems. The majority (73%) said they were not familiar, and of those eight builders who were familiar with duct testing and duct sealing, none have duct tightness tests performed in the homes they build. Several builders were comfortable with their sealing work and did not see the need for duct testing. Other reasons given by builders included it was time consuming, not worth the hassle, and not required.

At the same time, builders did name some benefits of duct testing. These included verification that the HVAC was done correctly, the ducts didn't leak, and to catch problems before the customer moved in.

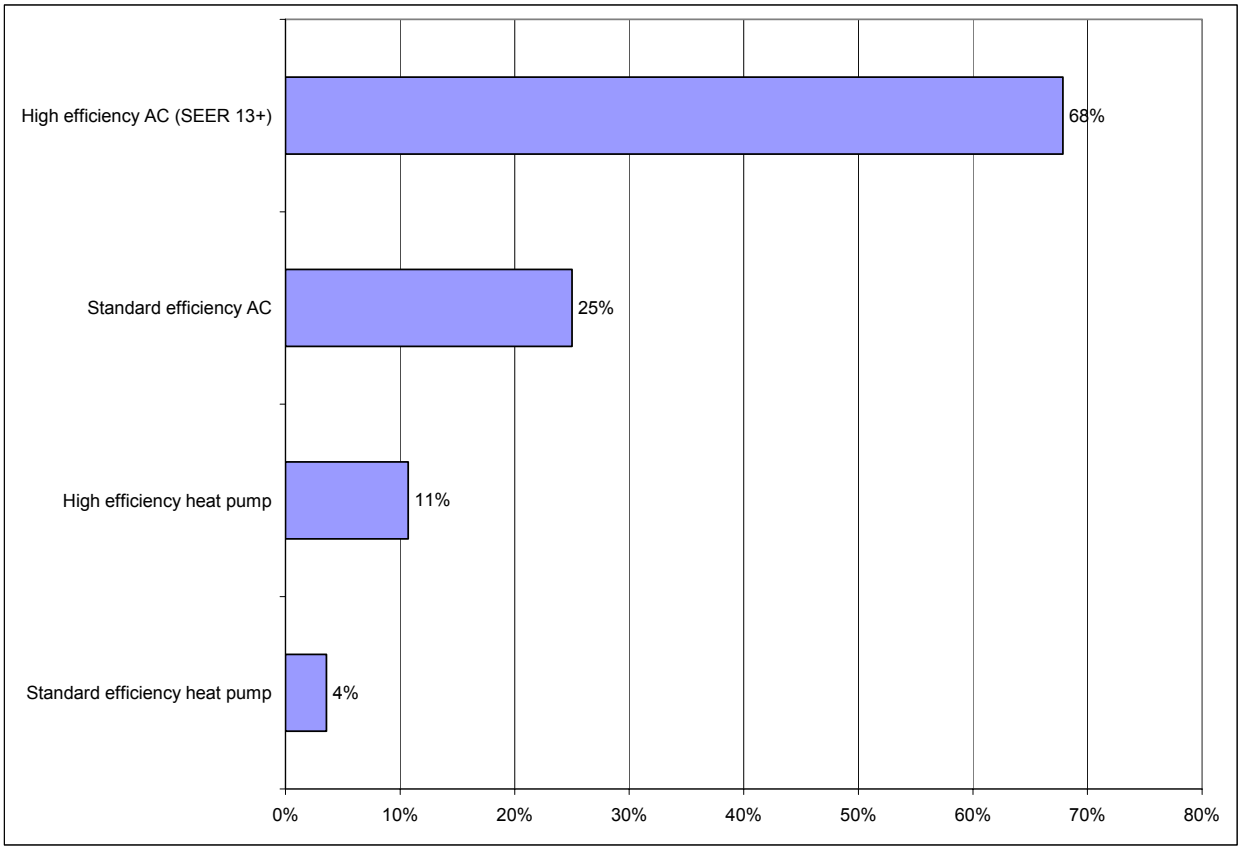
[77] These findings were confirmed by the companion study to this report of the Residential HVAC Program, which identified high estimated market share for energy efficiency HVAC equipment. For example, the participants in the HVAC program indicated that, for new construction projects, 70% of their central AC units exceed SEER 13 and 71% of their furnaces have an AFUE of 90% or greater.

Figure 2-19. Types of Heating Systems Installed by Nonparticipating Builders



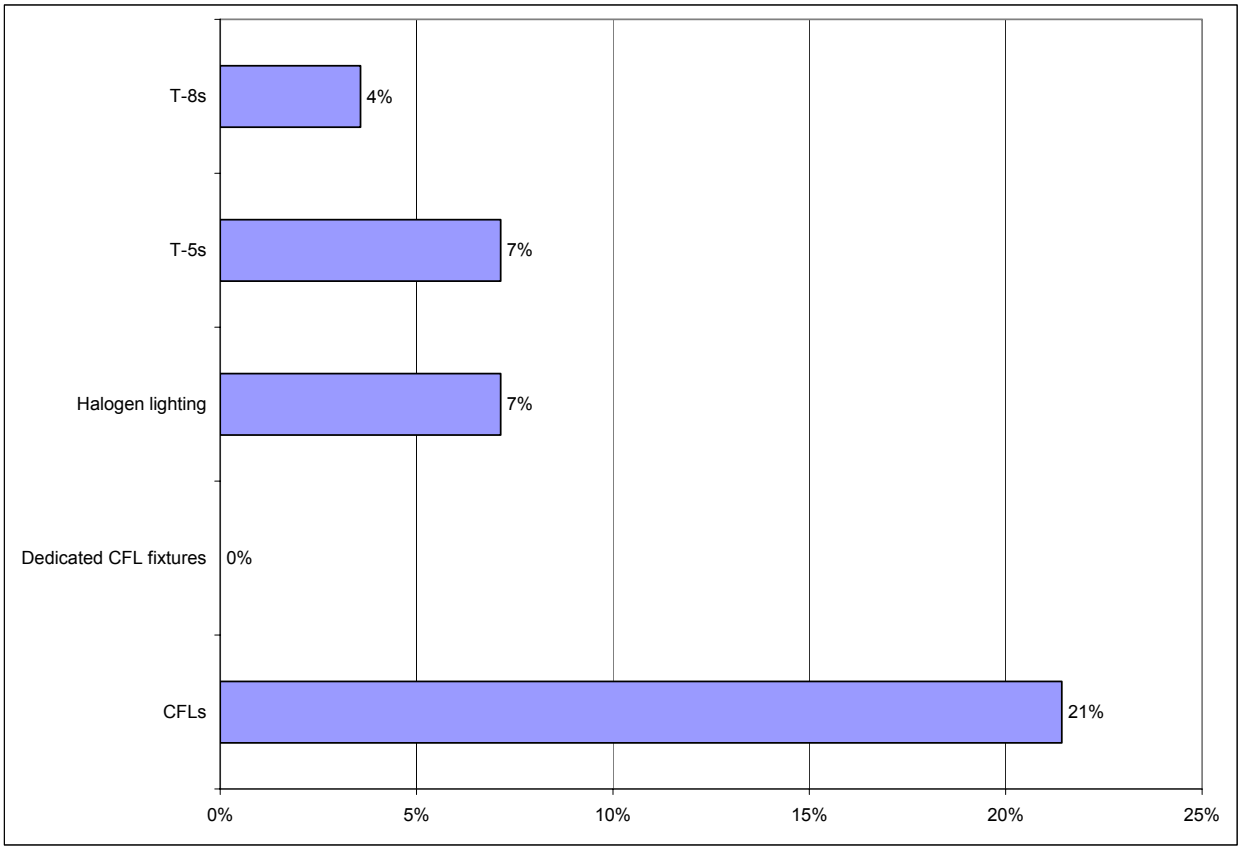
Source: RNC Builder Survey (n=30 true nonparticipating builders)

Figure 2-20. Types of Cooling Systems Installed by Nonparticipating Builders



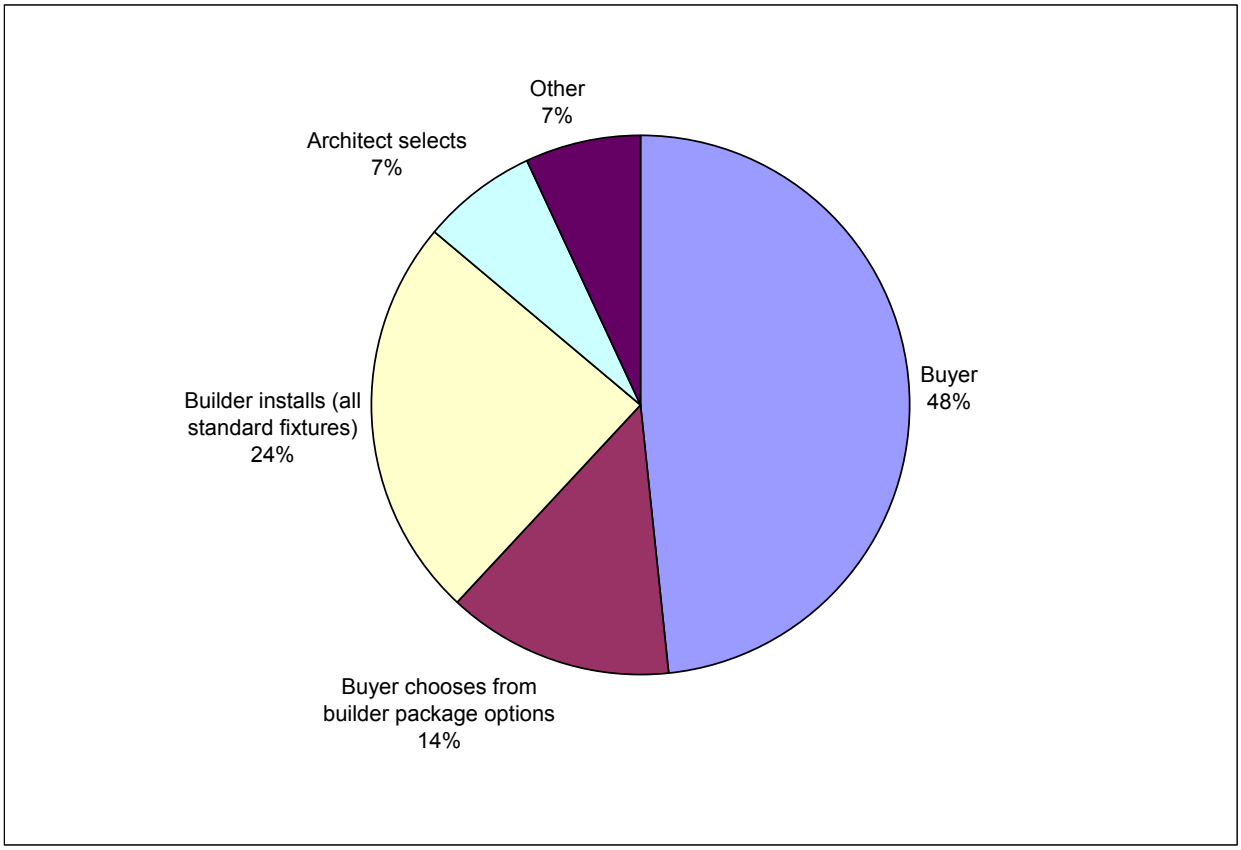
Source: RNC Builder Survey (n=30 true nonparticipating builders)

Figure 2-21. Types of Lighting Installed by Nonparticipating Builders



Source: RNC Builder Survey (n=30 true nonparticipating builders)

Figure 2-22. Decision-maker for Lighting

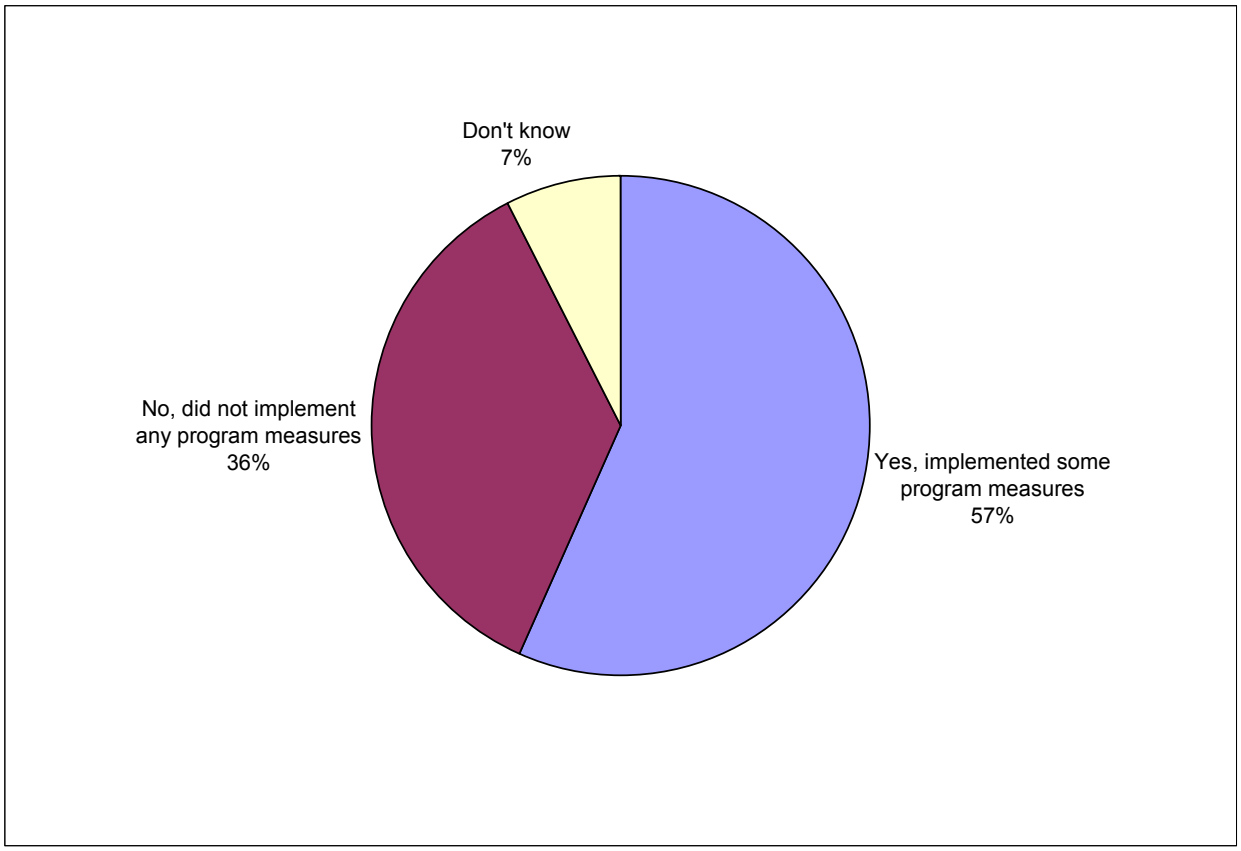


Source: RNC Builder Survey (n=30 true nonparticipating builders)

Baseline Building Practices of Participant Builders

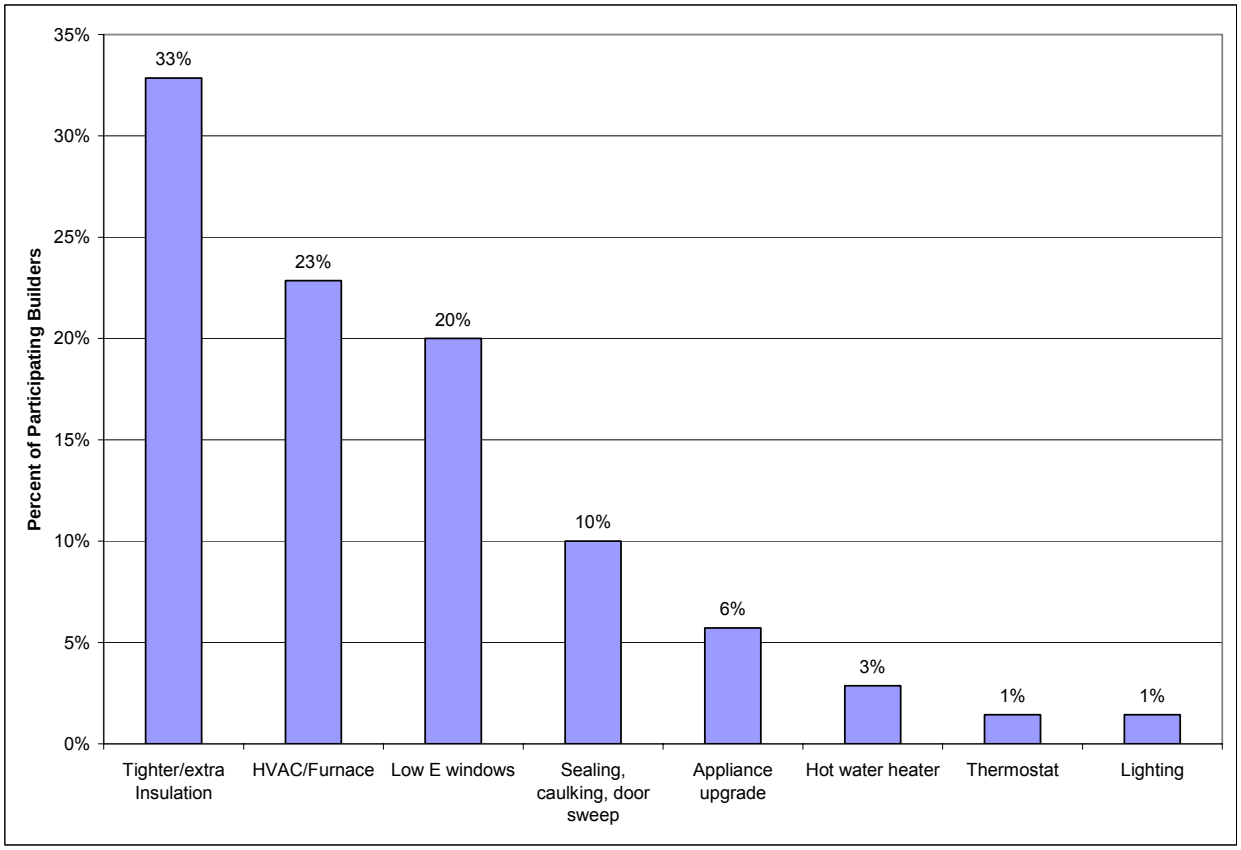
Participant builders were asked about their building practices *before* they became an ENERGY STAR partner. Over half the builders (57%) said they implemented some ENERGY STAR measures before they became aware of the Program (Figure 2-23). The most common measures included tighter/extra insulation (34%), efficient HVAC/furnace (23%), and efficient windows (20%) (Figure 2-24). One respondent reported that "All current measures were available as optional and would be offered if the buyer would pay extra."

Figure 2-23. Percent of Builders that Implemented Efficient Measures Before Participating in the New Jersey ENERGY STAR Homes Program



Source: RNC Builder Survey (n=70 participating builders)

Figure 2-24. Efficiency Measures Implemented Prior to Program Participation



Source: RNC Builder Survey (n=70 participating builders)

2.4.2 What Impact Has the Program Had on the Baseline?

The increase in market share of program incentivized ENERGY STAR homes – from only 6% in 2002 to 28% in 2005 – clearly indicates that the Program is having an impact on the residential new construction market. The nonparticipating builders, however, indicated that they are regularly implementing a number of program measures, particularly high efficiency HVAC equipment. Much of this impact, however, can likely be credited to the Residential HVAC Program.

The most substantial impact of the program might be in the number and type of measures installed by participating builders. The participating builders estimated that they would have only installed 34% of the energy efficiency measures were it not for the NJ ESH Program. In other words, while they might have installed a few measures (e.g., high efficiency HVAC equipment), it is highly unlikely they would have installed the collection of measures that are required to meet ENERGY STAR qualifications.

Duct sealing and testing and air sealing measures are perhaps most impacted by the Program. Participants did not report duct sealing, testing, or air sealing in the measures they previously implemented. Nonparticipant builders were either unfamiliar with duct sealing or felt it was too time consuming to implement. Few actually sealed ducts and none tested them for air leakage. The ENERGY STAR Program's new Thermal Bypass Inspection Checklist will further increase the energy savings with air sealing measures.

Finally, to meet current energy code standards, credit can be taken for installation of high-efficiency mechanical ventilation systems, but the mechanical ventilation systems are not required by code. Requiring higher efficiency mechanical ventilation systems through the ENERGY STAR Program ensures more find their way into the market place. HVAC equipment can be oversized when installed. Right-sizing this equipment using Manual J, as required by the Program, reduces consumption.

Summarizing, the sheer size of the Program is clearly having an impact on the residential new construction market, in terms of influencing some of the largest production builders in New Jersey to install the collection of measures that qualify homes for the ENERGY STAR rating. However, should the incentives be removed without replacing them with another marketing avenue, it is likely the market would regress, although the magnitude of such an impact is unknown. Replacing builder equipment incentive reductions with substantial marketing to increase awareness and drive consumer demand could reduce or prevent market regression.

On-Site Visits

Site visits were scheduled with purchasers of ENERGY STAR homes. A random stratified sample was generated so that site visits were scheduled in each utility territory. Of the 13 visits scheduled, nine were completed.

All homes had slab-on-grade foundations. Two of the nine owners said they saw rigid perimeter insulation. Furnace AFUE ranged from 90 to 92.6, with an average AFUE of 92. Of the five homes where the make, model, and efficiency level of the air conditioning units could be determined, all were ENERGY STAR qualified. Duct insulation and duct sealing was verified where ducts were accessible. There was a problem in one home where there was a hole at one boot allowing hot air to escape into the attic. The ceiling insulation was rated in good condition in all but one home; this installation was rated in fair condition. Air sealing was verified around plumbing, mechanical, and electrical penetrations in five homes. Only one was reported with “some” air sealing around penetrations.

2.4.3 Review and Update Protocol Assumptions

The energy savings from the New Jersey ENERGY STAR Homes Program is calculated based on the type of measures installed. For insulation upgrades, efficient windows, air sealing, efficient HVAC equipment, and duct sealing, the savings are generated directly from home energy rating software. The software compares the energy savings characteristics of the energy-efficient home to the baseline/reference home to calculate the savings. The peak demand savings is calculated as:

- Peak demand of baseline home = (PLb * OFb) / (SEERb * BLEER * 1,000)
- Peak demand of qualifying home = (PLq * OFq) / (EERq * 1,000)
- Coincident peak demand savings = (Peak demand baseline – Peak demand qualifying) * CF

Where:

- PL = Peak load of home in Btuh
- OF = Oversizing factor of HVAC unit in home
- SEER = Seasonal Energy Efficiency Ratio of unit

- BLEER = Factor to convert SEER to EER
- CF = Coincidence factor

In July 2002 the energy codes were changed to reflect the adoption of MEC 95. The Program then updated baselines in April 2003 (allowing a lag for the time from when the permits are issued until the home would be completed). The most recent assumptions are presented in Figure 2-25. Note that for 2006 the Program will have to change the assumptions for the baseline SEER level, as the new federal requirement is SEER 13.[78]

Figure 2-25. Savings Calculation Inputs for NJ ESH Program April 2003-Present

Component	Type	Value	Sources
PLb	Variable		Calculation of peak load of baseline from home energy rating tool
OFb	Fixed	1.6	PSE&G 1997 residential new Construction baseline study
SEER	Fixed	10	Federal minimum is SEER 10
BLEER	Fixed	0.92	Engineering Calculation
PLq	Variable		REM Output
OFq	Fixed	1.15	Program guideline for qualifying home
EERq	Variable		Program application
CF	Fixed	0.70	Based on analysis of six utilities by Proctor Engineering

The savings from the appliances and lighting measures are presented in separate protocols, and are discussed in the NJ ENERGY STAR Products evaluation, the companion study to this report.

Finally, ventilation equipment is also credited with additional savings of 175 kWh/year and peak demand savings of 60 watts. The values are based on a baseline fan of 80 Watts and an efficient fan of 20 Watts running for eight hours/day.

Note that the average annual kWh for 2005, as discussed in the *Benchmarking* section of this report, is 765 kWh/home. This is lower than any other programs examined, including the neighboring state of New York (and it would be expected that air conditioning saturation levels would be higher for New Jersey than New York). Given that New Jersey has a far higher percentage of multifamily and low-income (and thus smaller) households, it is expected that the savings per home would be lower.[79] However, the peak demand savings of an average of 2.4 kW per home is substantially higher than New York (0.2 kW/home), but this is likely due to the impact of the high saturation of central air conditioning units.

[78] Additional details on the protocols for calculating savings due to HVAC measures are described in Section 6, Residential Gas And Electric HVAC Program Market Assessment.

[79] Based on conversations with EAM and MaGrann.

2.5 Incremental Cost Assessment

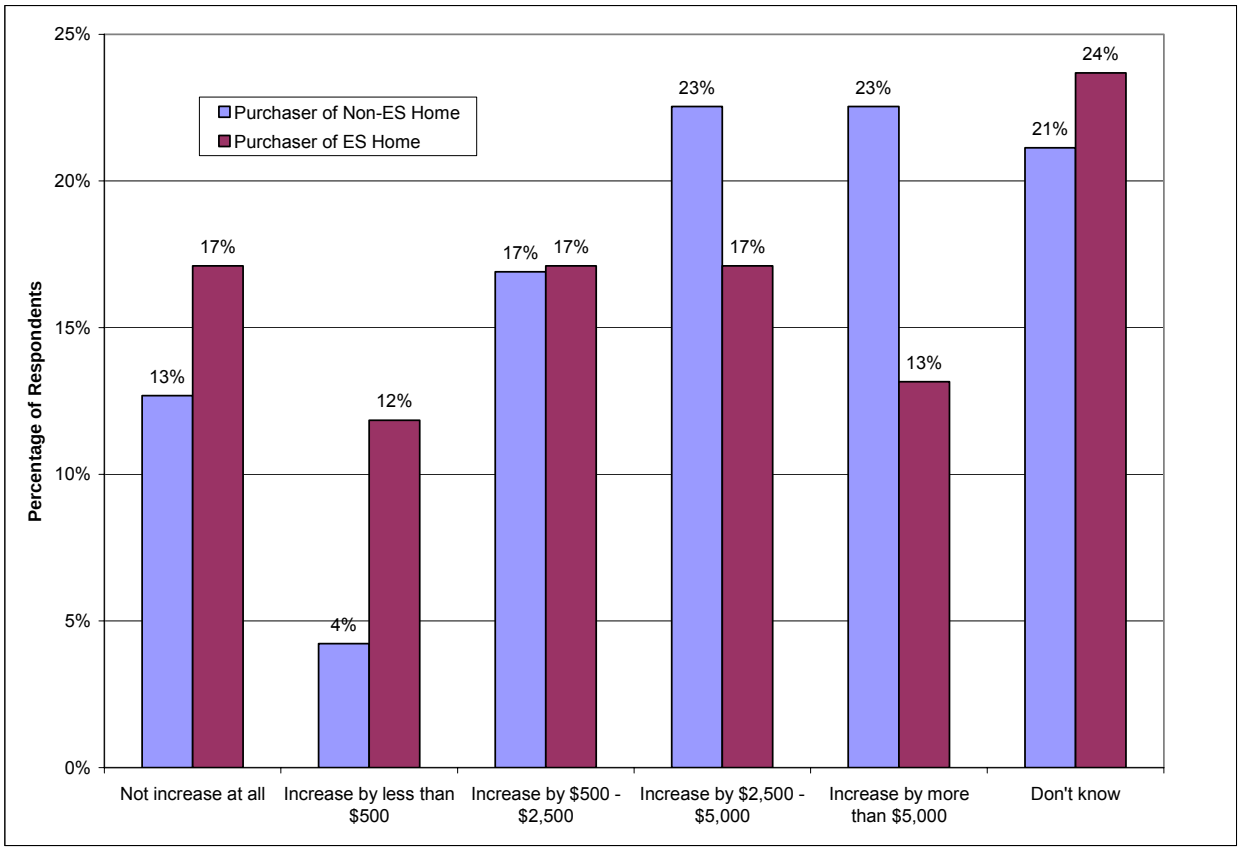
One of the underlying long-term goals of ENERGY STAR market transformation programs is to lower the incremental cost of efficient products. This outcome can be achieved as market share increases for efficient products, thus creating economies of scale in terms of manufacturing, distribution, and marketing expenses. However, as market share crosses a certain threshold and becomes common practice, the standards for efficient products are raised, the incremental cost goes up, and the cycle repeats itself.

One of the goals of this evaluation was to examine the incremental cost of ENERGY STAR homes. The results below present the perceived incremental cost from the buyer's perspective, the impact on profitability from the builder's perspective, and the measured incremental cost based on recent studies in other states.

Home Buyer Perceptions of Incremental Cost

Both purchasers of ENERGY STAR and non-ES homes were asked how much they believed a home's purchase price increased based solely on the additional energy efficiency features. Based on the responses, it appears that the perceived incremental cost was greater for purchasers of non-ES homes compared to purchasers of ES homes, indicating that perceived incremental cost among home purchasers still remains a market barrier (Figure 2-26). Interestingly, nearly a quarter (24%) of the participants could not even estimate the incremental cost of their home compared to a standard efficiency home.

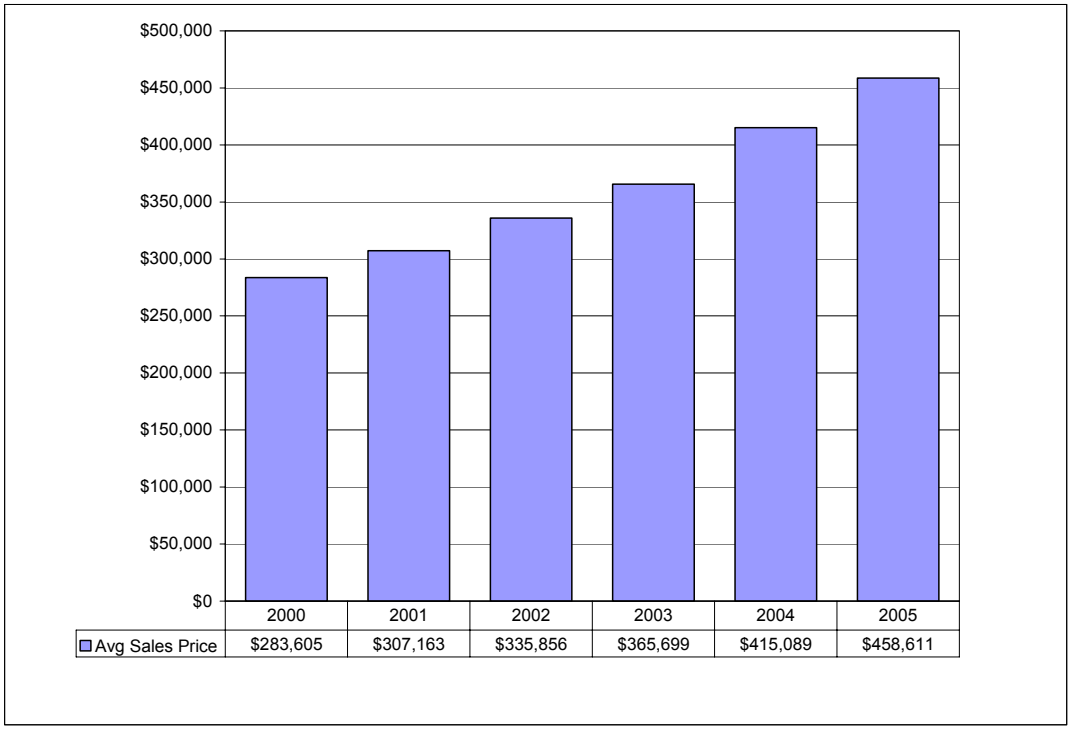
Figure 2-26. Home Purchaser Perceived Incremental Cost of Energy-Efficient Features



Source: RNC Home Purchaser Survey (n=76 ES home purchasers, n=71 non-ES home purchasers)

The average cost of new homes in New Jersey increased dramatically from 2000 to 2005, as shown below. In 2005, the average sales price of a new home was $458,611, compared to only $283,605 in 2000. Rising home prices may have the effect, in the long run, of decreasing both the actual and perceived incremental cost, as the percentage increase in the incremental cost is not likely to keep pace with the average homes price.

Figure 2-27. Average Sales Price for NJ New Homes, 2000-2005



Source: New Jersey Dept Community Affairs

Builder Perception of Profitability

Participant builders and knowledgeable nonparticipant builders, as well as the HERS raters, were asked if they thought ENERGY STAR homes were less profitable, about the same, or more profitable than conventional homes. The HERS raters all thought the homes could be more profitable, but noted that the consumer had to be aware of the energy benefits of the home in order for that to happen (Table 2-17). The participant and nonparticipant builders answered this question in nearly the same way. About 25% stated the ENERGY STAR home would be less profitable (many commented on the increased cost to build the home).[80] For 50% of the nonparticipants and 69% of the participants, the profit margins of ENERGY STAR homes were assessed to be about the same as a conventional home. Comments from all groups indicate that consumer awareness of the benefits of ENERGY STAR homes influences the profit potential of these homes.

[80] Note that although some participating builders believed ENERGY STAR homes are less profitable, they often indicated that they still provided an important perceived marketing differential.

Table 2-17. Profitability of ENERGY STAR Homes Compared to Conventional Homes

Perception of Profitability	Nonparticipant		Participant		HERS Rater	
	N	%	N	%	N	%
Less profit	3	25%	16	23%		
About the same	6	50%	47	67%		
More profit	1	8%	3	4%	11	100%
Didn't specify	2	17%	40	6%		
Total	**12**	**100%**	**70**	**100%**	**11**	**100%**

Additional Studies Examining the Incremental Cost of ENERGY STAR Homes

Three recent studies examined the incremental cost of ENERGY STAR homes in New York (Long Island and the rest of the State), New Hampshire, and Massachusetts. The Long Island study reported the costs for the most cost-effective upgrades were $1,084 for reaching 86 points, $2,605 for reaching 88 points, and $4,757 for reaching 90 points.[81] The study estimated that an 86 point home costs, approximately, an extra $6.50/month on a 30 year mortgage, but results in $30/month in savings.

Another recent study examined incremental costs of ENERGY STAR homes in Massachusetts and New Hampshire.[82] The average incremental cost per square foot for a medium (average 2,558 sq. ft.) home in Massachusetts was reported to be $1.24 and in New Hampshire $1.06. For this size home, the average incremental cost totaled $3,185 in Massachusetts and $2,716 in New Hampshire. Larger homes' (average 4324 sq. ft.) total incremental cost in Massachusetts was $5,802 for $1.34/sq. ft. and in New Hampshire the total incremental cost was $3,342 for $.77 per square foot.

In another study of ENERGY STAR homes in New York, the majority of purchasers reported the incremental cost of purchasing an ENERGY STAR home was much higher (15%) or somewhat higher (73%) than a similar home. An average incremental cost increase of 3.3% ($3.62/sq. ft.) was reported.[83]

These studies indicate that the incremental cost for ENERGY STAR homes can vary substantially based on the market actor interviewed, the location, and the size of the home. However, based on the above studies, the incremental cost for the average ENERGY STAR home probably falls between $2,000 and $3,000 for a 2,500 square foot home.

2.6 Market Barriers Assessment

2.6.1 Has the program reduced the market barriers

This section discusses the builders' perceptions about barriers and strategies to remove barriers. It also reviews the current barriers that remain to be addressed as this program evolves and matures. On the whole, market actors feel that the consumer marketing efforts used early in the Program need to be

81 Galvin, Faesy, Slote, and Harrison, Presentation entitled "Residential New Construction Baseline Study Best Practices: Results from Long Island, New York", American Council for an Energy-efficient Economy, August 27, 2004.

82 Nexus Market Research Inc., GDS Associates, Inc., D. Conant, Shel Feldman Consulting, Megdahl & Associates, Incremental Cost of ENERGY STAR Homes in Massachusetts and New Hampshire, Feb. 2003.

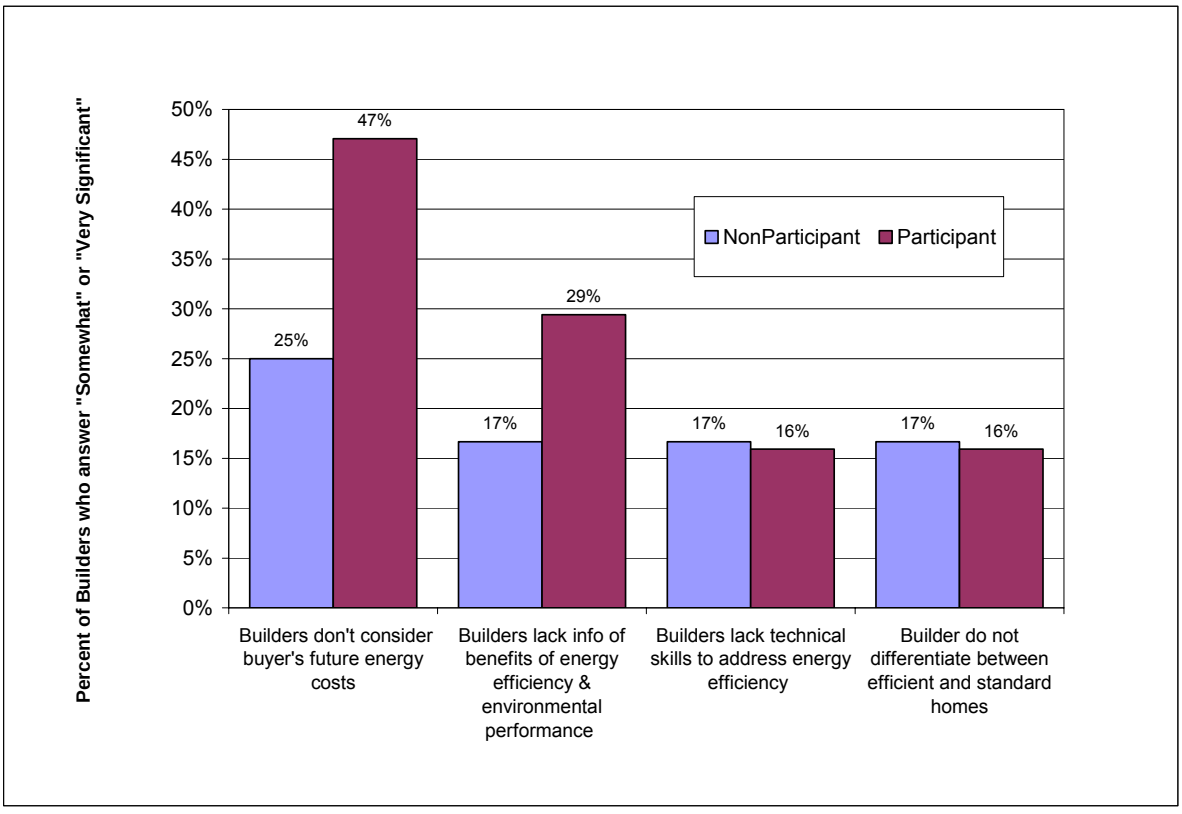
83 Quantec, LLC, Summit Blue Consulting, LLC, New York ENERGY STAR Labeled Homes Program Market Characterization, Market Assessment and Causality Evaluation, NYSERDA. March 2006.

reestablished and enhanced. Incentives were and continue to be instrumental in builder's decisions to participate in the Program. The early Program that was open to the entire State, without the Smart Growth limitations on incentives, is the preferred venue.

Summary of Market Barriers Identified in Builder Surveys

The Office of Clean Energy identified several barriers that might lead to construction or sale of fewer ENERGY STAR homes. In the builder surveys, participant builders and knowledgeable nonparticipant builders were asked to rate each item on a scale of 1 to 5, with 1 being "Not Very Significant" to 5 being "Very Significant." Figure 2-28 shows the percentage of respondents who answered "Somewhat" to "Very Significant." It clearly shows that participants feel builders don't consider a buyer's future energy costs when they make building decisions (47%). About half the non participants (25%) shared that opinion. The second statement "builders' lack of information about the benefits of energy efficiency and environmental performance" elicited "Somewhat" to "Very Significant" responses from 29% of participants and 17% nonparticipants.

Figure 2-28. Potential Barriers to Construction and Sale of ENERGY STAR Homes



Source: RNC Builder Survey (n=70 participating builders, n=37 nonparticipating builders)

Builders were also asked their perceptions of barriers that homebuyers are facing. Responses included

- Lack of education and awareness – 35% respondents
- First costs and payback – 17% respondents
- Homes are too air tight and not vented enough; mold issues – 4%

Other comments made by builders included:

"Uncertain of participating builders."

"First start of program's bad rap."

"Insulating basements; we have had several buyers inform us that they don't want to breathe fiberglass and are opposed to using so much insulation in the basement."

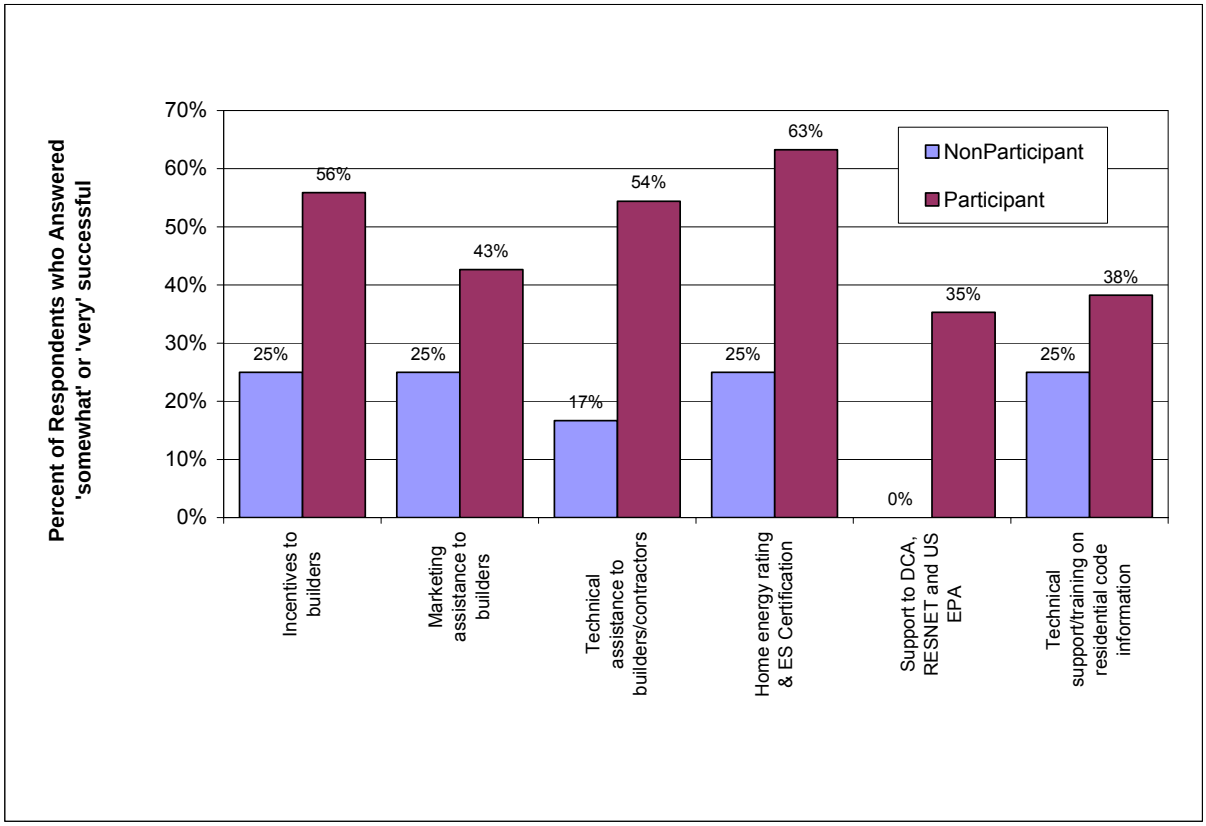
"Plumbers need to learn how to use hot water radiant heat."

"Sizing of HVAC equipment."

"Understanding geothermal and getting past believing in forced heat alternatives."

Respondents were then given a list of strategies being used to remove these barriers and were asked to rate how successful they felt these strategies were. The scale was a 1 to 5 scale with 1 being "Not at all Successful" to 5 being "Very Successful." Figure 2-29 shows those who answered "Very" or "Somewhat Successful." More participants felt these strategies were successful. Over half the participants felt that incentives to builders (56%), technical assistance to builders and contractors (54%), and the HERS rating and certification (63%), were successful strategies to promote the Program. Fewer respondents felt that state and federal support (35% participants), technical support and training on code updates and implementation (38% participants), and marketing assistance to builders (43% participants) were less successful efforts to promote the Program.

Figure 2-29. Success of Strategies to Promote Program

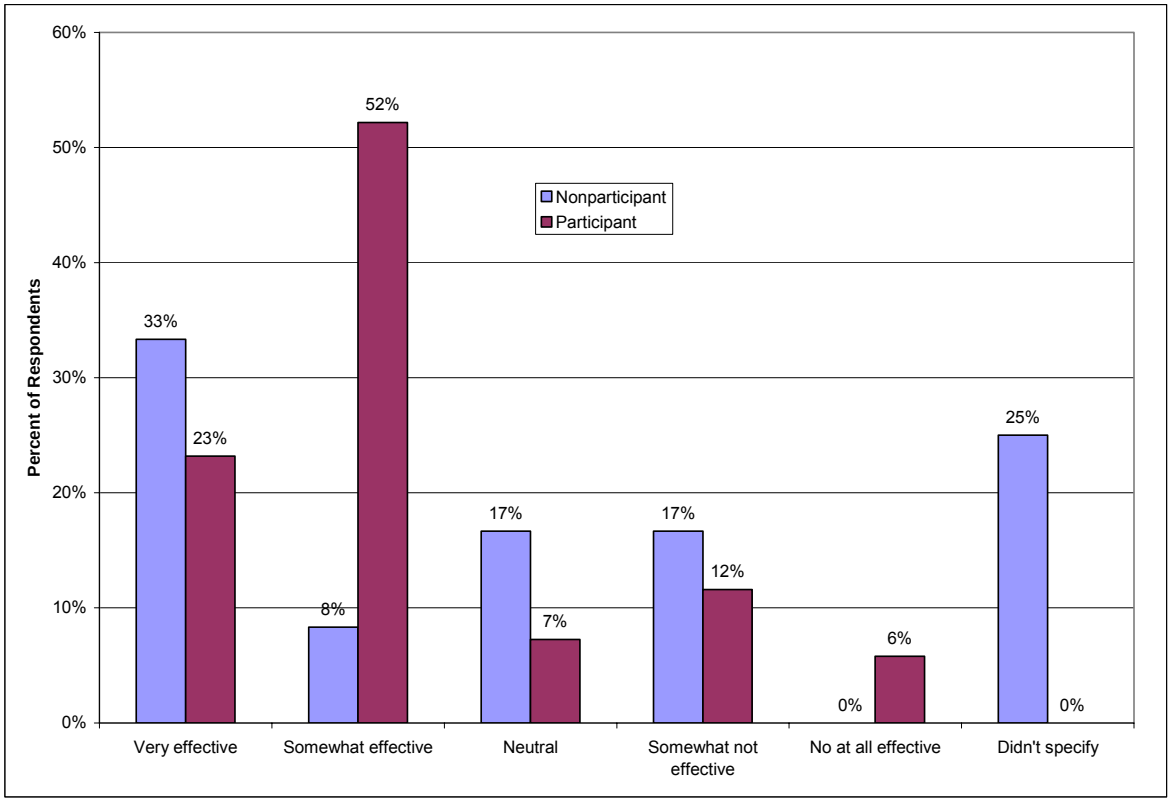


Source: RNC Builder Survey (n=70 participating builders, n=37 nonparticipating builders)

One issue that recurs in interviews with market actors is program marketing. Both participant and nonparticipant builders were asked how effectively the ENERGY STAR Homes Program promoted energy-efficient new construction. Figure 2-30 shows that 75% of the participants feel the program is

promoting energy efficient construction "Very or Somewhat Effectively," while 41% of the nonparticipants ranked effectiveness in these categories.

Figure 2-30. Effectiveness of the ENERGY STAR Homes Program in Promoting Energy-efficient New Construction



Source: RNC Builder Survey (n=70 participating builders, n=37 nonparticipating builders)

For participant and nonparticipant builders, word of mouth and referrals are the most effective methods used to market their homes. Newspaper ads were the second most effective method for both.

Table 2-18. Most Effective Methods to Promote Builder's Homes (ENERGY STAR or non-ENERGY STAR)

	Nonparticipant		Participant	
	N	%	N	%
Word of mouth/referrals	15	41%	26	37%
Brochures/sales materials	1	3%	12	17%
Newspaper ads	6	16%	12	17%
Internet	1	3%	6	9%
Model homes	1	3%	1	1%
Real estate ads	4	11%	1	1%
Realtor/Architect	5	14%	1	1%
MLS	2	5%	0	0%
Other	4	11%	5	7%
Don't market homes	11	30%	6	9%
Total	**37**	**100%**	**70**	**100%**

Source: RNC Builder Survey (n=70 participating builders, n=37 nonparticipating builders)

Nearly three quarters, 70%, of participant builders reported that they have not changed their marketing and promotion of ENERGY STAR homes over the last two years. Another 11% said they had increased their marketing somewhat and 6% said it had decreased somewhat.

Respondents were asked what should be changed to more effectively promote the Program. This was an open ended question and answers were categorized into one or more response options after listening to the answers. Combined, more consumer marketing and better coop advertising topped the list. Better communication within the program and with inspections followed. Together, increase the standards, increase the rebates, and don't restrict the program to the Smart Growth areas comprised 12% of the suggestions. These are the same issues and topics raised by the utility staff interviewed and the HERS raters and implementation staff.

Respondents were also asked if they needed anything as far as support, information, or tools to help them participate in and market the ENERGY STAR Program. They were also asked for any additional comments. Table 2-19 groups these comments, by topic, into one table.

Table 2-19. Promoting, Marketing, and Improving the Program

Builder's Suggestions to Improve the Program	N
More marketing to public	30
Better communication with program and inspectors. More cooperation with raters	12
Better coop advertising / help builders advertise / community specific marketing	12
Don't restrict incentives to Smart Growth	12
Increase rebate dollars	11
Brochures & display materials with good comparative information between standard and ENERGY STAR homes	11
Don't like insulation in basement. Significant moisture problems/mold hazard. Basement insulation caused mold; costly for us to cover	5
Increase the standards	4
Rebate checks arriving more timely; Program is backlogged	4
Reduce the amount of time needed. Takes too long for closing	3
Push for dedicated program builders	2
Better builder training	2
Better and more signs	2
Homeowner complaints about AC	2

These three questions clearly show that referrals are important to builders and that builders feel additional marketing is needed to increase consumer awareness and lead more consumers to purchase these homes. Satisfied buyers provide the referrals. Both are needed to maintain and grow the number of certified ES homes.

Other comments regarding support and program improvements included requests that consultants spend more time with builders, have two inspections and not three, expand services to solar energy, and "make it more builder friendly – there are too many programmatic changes to stay abreast of."

Three builders stated they were phasing out of the program and another was considering it. Reasons given included the removal of incentives outside the Smart Growth area, too many homeowner complaints related to mechanical equipment, and issues with the Program management.

Summary and Findings of Utility/Implementer Informant Interviews

Interviews were conducted with the New Jersey utilities and program implementers in November and December 2005. The purpose of the interviews was to gather background information on the program, to identify any programmatic issues for further examination, and to solicit recommendations for future program design.

Before discussing the specific findings, it should be noted that – primarily because of the planned transfer of program responsibilities to the Market Managers – there has been significant attrition in program staff at several the utilities. In addition to losing staff for circuit riding and attendance at meetings, the impact of that attrition is loss of institutional memory, especially regarding the development of the program and

the establishment of goals and objectives, and metrics. The results presented here, therefore are based on a subset of utility opinions and information.

We developed a structured discussion guide designed to elicit information on a variety of topics including implementation issues, marketing, barriers, indicators, and impacts.

Although there were many suggestions for program improvement and modification, in general, respondents felt that the program was very successful and was having a positive impact on the housing stock in New Jersey. In particular, the program market penetration goals were met or exceeded and the largest builders were signed up. In addition, respondents reported visible "spillover" from other parts of the Clean Energy Program, in particular, the HVAC training.

There was surprising consistency among the respondents regarding two issues. All of the respondents were critical of the lack of marketing to consumers regarding the benefits of ENERGY STAR homes. The feedback was that there was no direct demand for efficient homes, that few people were asking about them, and that the achieved market penetration was exclusively a function of market "push," rather than consumer "pull."

The second issue raised by most respondents was the perceived constraint on the diffusion of ENERGY STAR construction imposed by Smart Growth limits. Although new homes are eligible for ENERGY STAR certification in non-Smart Growth areas, they do not qualify for offset incentives. And while some builders are committed to ENERGY STAR regardless of where the homes are built, there are builder that have opted out of the program because of the building limitations. Some respondents even suggested that the limits on building would have a negative impact on advancing building codes. One respondent reported that they were aware that in one community there were over 250 residential demolitions scheduled but the community was not in a Smart Growth area, so replacement homes would not qualify for program incentives. This was characterized as a significant lost opportunity.

Utility respondents were concerned that their service territory or their fuel would not get adequate proportional representation under a new administrator, and some were particularly concerned that the inability to co-brand was hurting their customer relations.

There was some concern about the complexity of record keeping required as a result of program changes and construction lag times. Because of the time allowed between signing up and building completion, it was cumbersome to keep track of proper incentive levels and requirements. There was also the impression that not enough resources were allocated to record keeping and data systems, although general program reporting requirements were efficiently maintained.

Some concern was raised about the allocation of service territory to specific implementers. Builders voiced concerns to the utilities where they had evolved a relationship with one of the implementers over the years, but were required to work with another one because of the allocation.

There were no major concerns with either the program goals, or the performance indicators, with two exceptions. As mentioned above, the market barrier of customer information was not addressed due to the lack of resources for consumer outreach. There were also concerns about the validity of using the number of builders trained as an indicator of success. While training was felt to be important, the feedback we received indicated that the training of builders didn't necessarily translate into better results in the field. This is due primarily to the changing structure of the construction business. First, a great deal of construction is done by casual, or at least temporary, labor. Second, construction superintendents are increasingly coming from outside the industry, and do not have the required field experience. This results

in some problems in getting builders to meet the standards in the field, so a great deal of training comes from "hands-on" field work by the implementers. This activity does not show up in any indicator.

Finally, utilities were fairly consistent in their opinion that an independent rater/inspector industry should be encouraged, and that the cost of this service should be gradually shifted to the builders.

Summary and Findings of Program Implementer and HERS Raters Interviews

Interviews with fourteen Program Implementation staff and HERS raters identified a number of market barriers. As found in the builder surveys and other interviews, the majority of HERS raters and implementation staff felt the thrust of the program marketing has been toward the builders. Respondents indicated that there was a great need to educate consumers about ENERGY STAR homes and market the program to them. Raters and staff reiterated what the builders stated: builders deliver what buyers ask for, and unless buyers are aware of the program and ask for it, there will be little market demand as incentives are decreased and phased out.

The second most common issue raised was the restriction placed on rebates for homes built outside the Smart Growth area. Like the utility staff interview, the HERS raters and staff felt the Smart Growth limitation has been a hindrance to the program's market share. Raters reported, as found in some builder interviews, that some builders have stopped building to ENERGY STAR standards outside this area since they cannot receive the rebates. Most interviewed feel the rebates should not be restricted to homes built in the Smart Growth area.

Several interviewed noted that there is no movement to foster a competitive market for HERS raters. Like utility staff interviewed, support was voiced to open the market to HERS raters. As the market matures and incentives are phased out, the feeling is that a competitive market should be ready to provide the rating services that builders will want. Some suggested utilizing the New York model where builders choose any qualified agency to certify a home and apply for builder rebates. At the same time, it was suggested that a statewide program would require a primary rating agency. In this scenario, independent raters would work under the guidance of the primary provider, and could conduct the plans review, modeling, and field work.

Another issue raised by those interviewed was the requirement that builders working in specific territories use a specified Program implementer, that is, the HERS certification agency, to certify their homes as ENERGY STAR and apply for the rebate. Early in the 2001program, builders could choose which company to work with. This was changed so that each implementer provides services within a specific utility service territory. It was suggested that the restriction be lifted so that builders can choose the agency(s) they wish to work with. This would ease any difficulties that builders face who work in multiple utility territories and work with two certification agencies. As noted in the interviews with utility staff in the section above, utility staff recognized builder's concerns about service territory allocation to specific implementers.

Program implementation staff suggested that in 2001, incentives covered about 80% to 100% of the incremental cost of building to ENERGY STAR standards. They felt that, depending on how close the standard home is built to the ENERGY STAR standards, the current incentives cover about 50%-70% of the incremental cost of the upgrades. Respondents reported that some builders find the amount of the incentive is not enough to justify the steps needed to obtain it. They also felt some are building to or near the ENERGY STAR standard without incentives.

HERS raters and implementation staff reported that annual changes made to the ENERGY STAR requirements can be a barrier to builders. Respondents felt that builders want stable procedures and

requirements for program participation, and that annual changes may not provide enough lead time for the builder to smoothly incorporate changes into their procedures. It was suggested that a more formalized process such as that used by NYSERDA in New York would allow for more consistency in the manner in which changes are made.[84] It was also noted that procedural changes involving the equipment and building standards necessary to qualify as ENERGY STAR require many meetings to educate builders and architects around the territory.

HERS raters and staff reported that streamlining paperwork overall would help speed the entire inspection and certification process. Several interviewed indicated the Quality Installation Form (QIF) which states the Manual J duct sizing specifications have been followed, and is required of the builders to complete the certification process, was often difficult to obtain and were sometimes incorrect. It was suggested that data collected in the field could be entered electronically, on-site, eliminating data input at a later stage. It was suggested that alternatives to requiring the QIF form from the builders be developed.

It was stated that ENERGY STAR fixtures and appliances are not required to certify a home as ENERGY STAR compliant. Support was given for the advanced lighting package and appliance upgrades.

In New Jersey, 100% inspection of homes, i.e., 100% sampling, is required to apply for the rebates. Those interviewed expressed opinion both for and against the use of sampling in large developments. Some felt sampling would reduce overall costs and ease the workload. The cost of the entire process to certify one home was estimated to be around $1000 to $1200. On the other hand, it was expressed that allowing sampling would require additional tracking systems and resources as well as changes to protocol. In other states, if the sample home failed the inspection, inspection of the remaining homes in the development sample would be required, at builder's expense. If the builder fails to inspect the remaining homes then the associated incentives and savings can be reduced by an amount proportional to those that were tested and failed. A projection for the number of qualifying large developments should be conducted. Land availability, the size of developments, and other limitations will impact the number of actual developments where sampling could be instituted.

2.6.2 Are There New Products That May Help Improve Customer Acceptance?

Tankless water heaters qualify for Federal tax credits of up to $300 that can be applied toward the purchase price. Most readily available tankless water heater systems include those which are a minimum of 80% efficient (gas) and 99% efficient (electricity). Marketing advantages include on-demand hot water and significantly reduced unit sizes.

"Split air" systems, also commonly referred to as "ductless split systems" or "mini-splits" should also be considered and analyzed for cost-effectiveness. Mini-split system air conditioners have evaporator/air handler units within each conditioned room. These systems significantly reduce energy losses compared to conventional systems and are also eligible for federal tax credits of up to $300. The HVAC section of this market assessment (Section 6) suggests incentives for ductless or "mini-split" systems be added to the Residential HVAC Program. The same incentive should be added to the RNC program. Suggested incentives were $200 for standard mini-split system with 3 remote units (13 SEER and 11 EER) and $300 for high efficiency mini-split system with 3 remote units (15 SEER and 12.5 EER).

[84] NYSERDA issues periodic updates to builders, and issues annual Program Opportunity Notices, or PONs, that provide details about program practices and requirements.

2.7 Upgrade of Energy Efficiency Codes and Standards Assessment

This section summarizes NJ energy codes and standards as well as ENERGY STAR standards. This section also summarizes interviews with code officials, and makes recommendations for code updates.

2.7.1 Current Residential Energy Codes and Standards[85]

The State of New Jersey passed the New Jersey Uniform Construction Code Act in October, 1975, effective February 3, 1976. All construction codes and their enforcement were controlled by the provisions stated in the act. The New Jersey Uniform Construction Code is divided into subcodes (model codes and standards), and the energy subcode contains the energy provisions. Subcodes are adopted individually by the Commissioner of Community Affairs. As stipulated by the New Jersey Uniform Construction Code Act, however, subcodes cannot be adopted more frequently than once every three years. The Commissioner of Community Affairs may make an amendment if it is found that an imminent peril exists to the public's health, safety, or welfare, or that the current code is contrary to the intent of the legislation mandating the code. The Department of Community Affairs (DCA) itself does not have the legislative authority to amend the code to include new material from codes not yet adopted.

At present, codes are frozen by law at the July 1, 1995 level. Any efforts to upgrade or amend the codes must proceed through the codes office at the DCA, a codes advisory board, the DCA itself, and finally through the state legislature.

The 1995 Model Energy Code (MEC) was adopted as New Jersey's energy code in January 2002. The ENERGY STAR homes are 30% more efficient than the MEC.[86] Officials within the NJ Department of Community Affairs are currently reviewing the 2004 IECC for possible adoption sometime in the near future. The ENERGY STAR Website states that the IECC code is 15% more efficient than the current 1995 MEC currently in place. Figure 2-31 illustrates the relative efficiency of the MEC, IECC and ENERGY STAR homes.

Builders can comply with the MEC by any one of four methods:

- Enrolling the home in the ENERGY STAR program, which as noted, should result in a home 30% more efficient than the minimum uniform construction code.
- Compliance with prescriptive packages -- these Builder Option Packages packages contain options with min/max efficiency levels for building envelope and HVAC.
- Using the RESCheck Software -- the software identifies tradeoffs between HVAC equipment and building components such as insulation, keeping the home compliant with energy codes.
- Submitting a written application.

2.7.2 Impact of the Program on Codes and Standards

The evaluation team investigated the impacts of the NJ Residential New Construction Program on the state and federal energy codes through interviews with various players at different levels of code development. These interviews included representatives of the IECC, the codes divisions of the NJ DCA

[85] Additional discussion on residential codes and standards is discussed in Book 2, Section 1 of this report entitled "Residential Gas And Electric HVAC Program Market Assessment."

[86] <http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.homes_guidelns09>

and the NJ Builder's Association. Some of these interviews were conducted by the HVAC assessment team.

Overall, officials interviewed felt that the movement to a new state energy code (IECC) is being made independently from any results of the ENEGY STAR Residential New Construction program. Changes are largely driven by federal standards.

A member of the International Energy Code Council office described the governmental consensus process used to update codes. This open, inclusive process allows input from interested individuals and groups, typically including manufacturers, builders, the American Gas Association, the Northeast Energy Efficiency Partnership, and the Midwest Energy Efficiency Alliance. An appeals process allows appeal of the code committee's action. Final decisions are made by IECC voting members. The staff person interviewed noted that he had not seen much direct activity from utilities in this process.

A manager at the U.S. Department of Energy (DOE) discussed the impact of the state-level energy efficiency programs on the Federal Minimum Appliance Standards. The manager said that codes are updated each year, through the International Code Council. When asked about the influence of energy efficiency programs, he said that the programs do impact code officials in that the higher efficiencies promoted in the programs become adopted into code earlier than they would have been otherwise. However, he was unable to determine the effect for specific programs.

The Northeast Energy Efficiency Partnership (NEEP) supplies technical assistance during the code and standards development process. A NEEP respondent said that in general most new buildings are built to a standard higher than the minimum code because the market demands this higher level; he felt there is a disconnect between the codes and actual building standards. He believes the energy efficiency programs have significant market influence, encouraging increased efficiency and promoting mainstreaming and adoption of the building practices.

The NJ Division of Codes and Standards official confirmed the State was asked if the ENERGY STAR Program might influence adoption of higher efficiency energy codes in New Jersey. The DCA Department of Codes and Standards Director did not feel that ENERGY STAR standards were transforming the market. Rather, energy prices influenced code.

The NJ Builders Association Director of Codes and Standards felt there is no direct correlation between the ENERGY STAR Program standards and a move to the IECC; changes in code are influenced by National standards. He felt that code upgrades need a reasonable seven to ten year payback. Consumer rebates were discussed; he felt that negation of rebates outside Smart Growth areas was detrimental to the Program. He cited the reduction in consumer marketing and education and sees a need for more education and marketing to increase consumer product awareness.

2.7.3 Changes in Standards for 2006

For the 2006 program year, EPA proposed a new set of guidelines for ENERGY STAR for Homes in February 2005, in response to significant changes in residential energy codes and standards.[87] The 2006 guidelines apply to all homes permitted July 1, 2006 or later. In addition, all homes that are certified after January 1, 2007 must meet the 2006 guidelines.

Key changes in the revised EPA ENERGY STAR requirements for 2006 include:

[87] <http://www.energystar.gov/index.cfm?c=new_homes.hm_earn_star>

- The performance path is based on a fixed Expanded HERS score (83 in Climate Zones 1-5; 84 in Climate Zones 6-8)
- Limited mandatory requirements are added to the performance path
- Technical modifications are made to the prescriptive package
- The new Thermal Bypass Checklist provides additional guidance and detail for air sealing, and is required for all ENERGY STAR homes.

The EPA has asked that builders recognize the new Federal standards for central AC units during the first half of 2006, before the new ENERGY STAR Home standards take effect:

> "Note that the upcoming change in NAECA Standards (increasing the minimum SEER from 10 to 13) will have implications for HERS scores regardless of EPA's roll out of the new guidelines. This is because builders currently achieving energy savings from installing air conditioners that exceed 10 SEER will only be able to realize energy savings when exceeding 13 SEER. Builders should work with their HERS rater to identify energy efficiency improvements needed to achieve the HERS 86 and 15% savings above state energy code when qualifying homes as ENERGY STAR during the grandfathered period of switching to the new guidelines."

The EPA ENERGY STAR website also noted that in 2008 it intends to propose adding the Advanced Lighting Package as an additional requirement for 2009 ES homes. The lighting package requires 50% of the lighting in high use areas and outdoor lighting be ENERGY STAR labeled, and 25% in low-medium use areas.

2.7.4 Federal Tax Credits

The Energy Efficiency Tax Incentives in the Energy Policy Act of 2006 provide a $2,000 incentive to home builders of site-built and manufactured homes that provide 50% savings over the 2004 IECC code. At least one-fifth of the energy savings must come from building envelope improvements.[88] The building envelope component improvements must provide a level of heating and cooling consumption 10% below a comparable home.[89] The ENERGY STAR Website also notes an ES home is not guaranteed the tax credit:

> *Please note that, with the exception of the tax credit for an ENERGY STAR qualified manufactured home, these tax credits are not directly linked to ENERGY STAR.. Therefore, a builder of an ENERGY STAR qualified home may be eligible for a tax credit but it is not guaranteed.*[90]

ENERGY STAR homes, as noted above, are about 30% more efficient than the current code and 15% more efficient than the 2004 IECC code. An ENERGY STAR qualified home would need to be 35% more efficient than the current code to qualify for the tax credit.

[88] <http://www.energystar.gov/index.cfm?c=products.pr_tax_credits#6>

[89] <http://www.irs.gov/pub/irs-drop/n-06-27.pdf>

[90] <http://www.energystar.gov/index.cfm?c=products.pr_tax_credits#6>

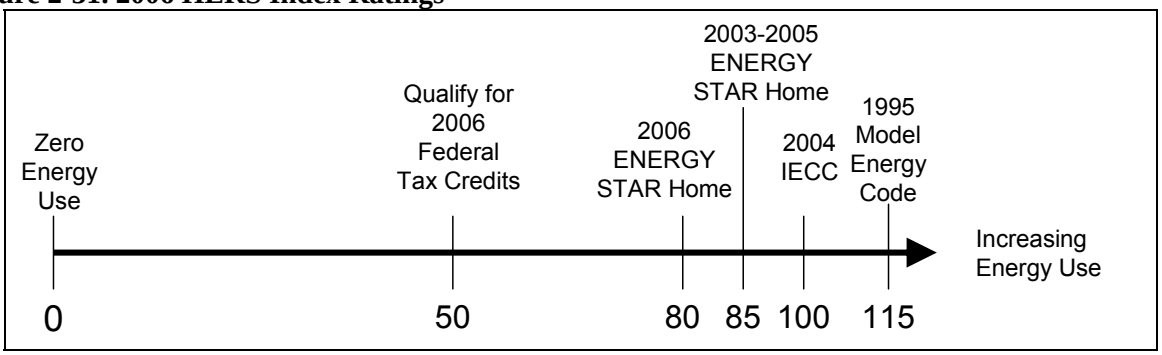
2.7.5 Changes in the HERS Ratings

EPA has additional comments on the 2006 program changes on their website. One comment reflects HERS ratings:

> "Note that homes built using the new guidelines are to utilize the new HERS rating system. The new system evaluates the energy efficiency of a home compared to a computer-simulated reference house of identical size and shape as the rated home that meets minimum requirements of the 2004 International Energy Conservation Code (IECC). The HERS rating results in a HERS Index score between 0 and 100, with the reference house assigned a score of 100 and a zero energy house assigned a score of 0. Each 1% reduction in energy usage (compared to the reference house) results in a one point decrease in the HERS score. Thus, an ENERGY STAR Qualified Home, required to be approximately 15% more energy-efficient than 2004 IECC in the south requires a HERS Index of 85; and an ENERGY STAR Qualified Home, required to be approximately 20% more energy-efficient than 2004 IECC in the north requires a HERS Index of 80."[91]

Figure 2-31 displays the relationships of the different codes and standards using the new HERS Index System.

Figure 2-31. 2006 HERS Index Ratings[92]



2.8 Rebate and Incentive Level Assessment

Program incentives are designed to reduce market barriers to efficiency improvements in new construction and cover incremental costs of the efficiency improvements. The electric utilities process electric rebates (incentives) and the gas utilities process gas rebates. The incentives are identical across utilities. Additional discussion about incentives is included in the *Benchmarking* section of this report.

2.8.1 Program Requirements and Incentive Levels: 2003 - 2006

Incentives reflect changing baselines such as the 2002 state building code upgrade, upcoming changes in the NAECA Standards, and a Model Energy Code move to the minimum requirements of the 2004 International Energy Conservation Code (IECC).

Three incentives are offered.

[91] <http://www.energystar.gov/index.cfm?c=new_homes.hm_earn_star>

[92] The 2006 HERS index scores correspond with percents (e.g., the 2003-2005 ENERGY STAR Home rating of 85 is 15% more efficient than the 2004 IECC rating of 100 and 30% more efficient than the 1995 MEC).

- First, core incentives are given for building shell and HVAC upgrades that achieve a HERS standard rating of 86 or better, out of a total of 100 points. The HERS 86 point performance standard can be met through any combination of insulation upgrades, duct sealing, and efficient HVAC equipment including furnaces, central air conditioners and heat pumps.

- Second, incentives are paid for supplemental HVAC equipment.

- Third, supplemental incentives are offered for high efficiency lighting fixtures and washing machines.

The 2003 program evaluation reported that reductions in the core incentives were considered for 2004 but not instituted because of concerns about how the builders would react to program changes made to implement the Smart Growth initiative. The report goes on to say that given the significant growth in the number of committed homes, a multi-year schedule to lower incentives should be considered.[93] In the 2004 Program year, however, other changes were made to program requirements and measure specific incentives, including:

- ***Homes were required to have automatically controlled mechanical ventilation, ducted to the outside***. These systems were optional in the 2003 program and eligible for a $100 incentive. Under the 2004 program the incentive was not available.

- ***Homes were required to have three ENERGY STAR hard-wired compact fluorescent fixtures***. These fixtures were optional in the 2003 program, and eligible for a $20 or $30 incentive (depending on fixture type). In the 2004 program, after the required three hard-wired light fixtures were installed, incentives were available for unlimited numbers of fixtures installed in high-use locations. Locations could not include closets, garages, unfinished basements, or other areas where lights would be on less than 2 hours per day.

- ***HVAC incentives were revised***. The central AC and heat pump rebates were reduced slightly.

In 2004, incentives were designed to cover 100% of the upgrade's incremental cost for electric and gas heated homes, and 50% of the upgrade's incremental cost for oil and propane heated homes or those with central air conditioning.[94]

In the 2005 program, changes were again made to program requirements and incentives, effective June 1, 2005. Homes submitted for enrollment by May 31, 2005 were eligible under the 2004 program requirements and incentives. Changes in the 2005 incentives included reductions in the overall core incentive levels and reductions in HVAC equipment incentives. All other 2005 requirements and incentives remained unchanged from 2004. In 2005, incentives were designed to cover about 100% of the incremental cost of efficiency upgrades for electric or gas heated homes and about 50% of incremental cost for homes with central air conditioning and oil or propane heat.[95]

For 2006, the Program is considering leaving the core incentive levels unchanged, but once again reducing the HVAC incentives. The 2003-2006 incentive levels, along with various Program requirements, are summarized in Table 2-20 through Table 2-22.

[93] 2003 NJ CEP Program Evaluation, July 30, 2004

[94] 2004 NJ CEP Filing. 5/6/05

[95] 2005 NJ CEP Filing. Rev 6/8/05

Table 2-20 Core Incentive Levels by Year

Core Incentive Levels Based On Residential Conditioned Floor Area By Program Year				
Dwelling Type	**2003 Incentive Level Maximums**	**2004 Incentive Level Maximums**	**2005 Incentive Level Maximums**	**2006 Incentive Level Maximums**
Single Family	$700 + $0.60/sq. ft.	$700 + $0.60/sq.ft.	$500 + $0.60/sq. ft.	$500 + $0.60/sq. ft.
Multiple Single Family ("Townhouse")	$200 + $0.60/sq. ft.	$200 + $0.60/sq. ft.	$150 + $0.60/sq. ft.	$150 + $0.60/sq. ft.
Multiple-Family Building ("Multi-Family")	$50 per dwelling unit + $0.60/sq. ft.	$50 + $0.60/sq.ft.	$0 + $0.60/sq. ft.	$0 + $0.60/sq. ft.
Maximum Core Incentive	$3,100	$3,100	$2,900	$2,900

Source: http://www.njenergystarhomes.com

Table 2-21. HVAC Incentive Levels by Year

HVAC Equipment Incentives By Program Year					
Equipment Type	**Minimum Efficiency Standards**	**2003 Incentive**	**2004 Incentive**	**2005 Incentive Maximum**	**2006 Incentive Maximum**
Gas Boiler	ENERGY STAR – 85% AFUE	$300	$300	$300	TBD
Gas Furnace	ENERGY STAR – 90% AFUE*	$300	$300	$300	TBD
Gas Furnace	ECM Fan Motor 92% AFUE+			$400	TBD
Central A/C	13 SEER, 11 EER	$370	$300**	$200**	$0**
Central A/C	14 SEER, 12 EER	$550	$500**	$400**	$300**
Central A/C	15 SEER, 12.5 EER			$400**	$400
Heat Pump	13 SEER, 11 EER, 8.0 HSPF	$460	$400**	$300**	$0**
Heat Pump	14 SEER, 12 EER, 8.5 HSPF	$710	$650**	$550**	$350**
Heat Pump	15 SEER, 12.5 EER, 8.5 HSPF			$550**	$450**
Ground Source Heat Pump	13 EER	$580 per ton	$500 per ton**	$500 per ton	$500 per ton

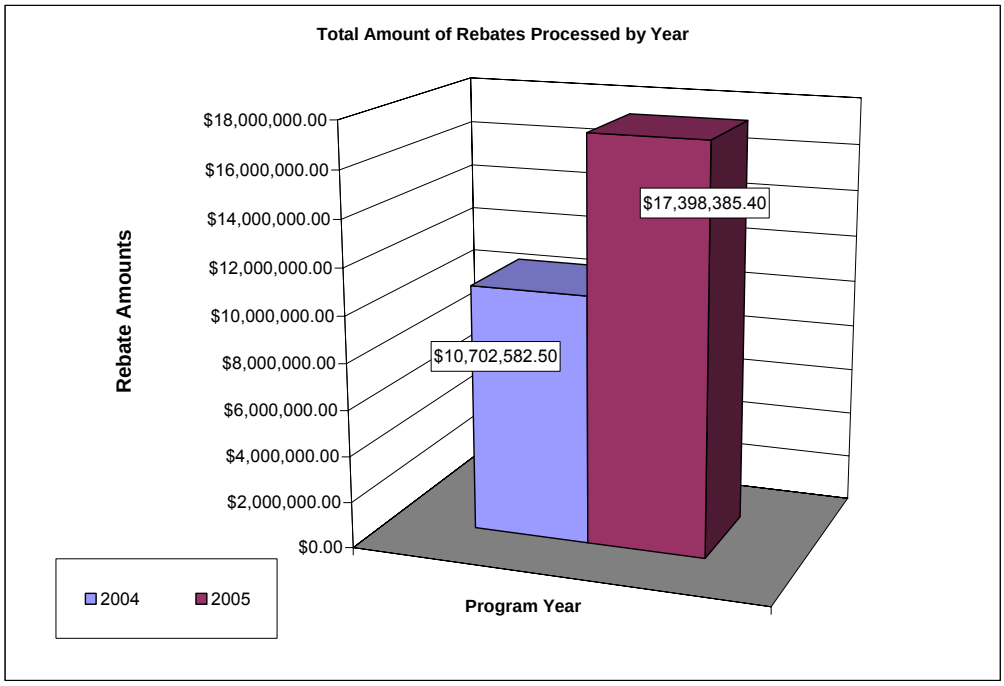
** Denotes Change
TBD = To be determined (Not yet determined for 2006)
Source: http://www.njenergystarhomes.com; http://www.njenergystarhomes.com/html/builder/2005_program_changes.html; http://www.njenergystarhomes.com/html/builder/2006change.html;

Table 2-22. Supplemental Requirements and Incentives by Year

Supplemental Requirements and Incentives By Program Year						
Equipment	2003		2004		2005 / 2006	
	Requirement	Incentive	Requirement	Incentive**	Requirement	Incentive
ENERGY STAR Labeled Lighting Fixtures (Hard Wired)	Optional	$30 each for recessed fixture $20 each for all others	At least 3 per home required	For more than 3 total fixtures per home: $30 each for recessed fixture $20 each for all others	At least 3 per home required	For more than 3 total fixtures per home: $30 each for recessed fixture $20 each for all others
Qualifying Mechanical Ventilation	Optional	$100	Required	N/A	Required	N/A
ENERGY STAR Labeled Washing Machines	N/A	N/A	Optional	Up to $175	Optional	Up to $175

Figure 2-32 shows the increase in the amount of rebates processed from 2004 to 2005.

Figure 2-32. Incentives Program Years 2004 and 2005



Source: Program Implementer tracking database

2.8.2 BOP Alternative to HERS

The 2006 National EPA ENERGY STAR label can be earned by one of two methods, a prescriptive approach described as Builder Options Packages (BOPs) or through HERS rating and certification (performance approach). BOPs offer a variety of packages featuring different combinations of window to floor area percentages, window glazings, insulation values, water heating, as well as different types of heating and cooling equipment. The packages are based on specific climate zones; the EPA specifies four climate zones in New Jersey.

The New Jersey ESH Program, as noted in the *Benchmarking* section, offers a somewhat hybrid approach to labeling homes as ENERGY STAR: while still based on a HERS rating, incentives vary based on the conditioned space of the home, plus the program offers bonus incentives for certain measures (e.g., clothes washers and ENERGY STAR fixtures). NJ ESH Program implementers stated that the builders currently customize plans regularly and the current energy efficiency upgrade packages may be nearly equivalent to a BOP already. One implementer estimated more than 50% of the ratings done by plans review would probably meet one of the BOPs options. One new facet of the 2006 program is prescriptive: the Thermal Bypass Checklist requires air sealing details and an inspection specifically for the Checklist.

Labeling a home ENERGY STAR using the prescriptive approach has the advantage of eliminating the plans analysis and final tests, thus saving the software analysis steps and some Program cost. Site visits and inspections are required with both approaches, as noted on the EPA Website:

> *Though constructing a home to BOP specifications negates the need for a full HERS rating, third-party verification that BOP requirements have been met is still necessary. Similar to HERS ratings, BOP ratings typically entail at least one on-site inspection of the home to test the leakiness of the envelope and ducts. However, unlike the HERS rating, the scores derived from these tests are compared with the pre-determined specification of the BOP to either pass or fail the house as an ENERGY STAR qualified new home.*

As discussed in the 2006 program changes above, the revamped 2006 HERS Index is modeled on a 2004 International Energy Conservation Code (IECC) reference home and BOPs to reach the increased standards. In the current (2005) system, the EPA started with the HERS score and created a comparable BOP. BOPs ENERGY STAR standards should not be more rigorous than a HERS Index home, and vice-versa. At the national level, EPA offers both options and recognizes both options are needed. In addition, the EPA believes that both options will result in a comparable ENERGY STAR home.[96]

2.8.3 Future Requirements and Incentives

We recommend that the New Jersey ENERGY STAR Homes Program adopt a number of changes to both the Program requirements and the incentive levels during the next several years.

Program Requirements

We recommend the prescriptive BOPs approach allowable under EPA ENERGY STAR guidelines also be allowed in New Jersey. Offering this approach provides a number of benefits, including:

- BOPs can reduce certification costs by eliminating the plans analysis and final tests required during HERS ratings;

[96] Jon Passe, EPA Partner and Support Coordinator, telephone conference call April 26, 2006.

- BOPs should provide homes of similar efficiency to homes receiving ENERGY STAR qualifying HERS ratings;

- Allowing BOPs in NJ ensures that all Nationally certified ENERGY STAR Homes will qualify for the NJ ENERGY STAR Home Program (i.e., if the Program requires HERS ratings nationally qualified ENERGY STAR Homes through the BOPs would not qualify for the NJ Program without a HERS rating);

- BOPs still require inspection by a certified professional, thus ensuring Program quality and compliance, plus providing employment opportunities for those qualified as HERS raters;

- BOPs could likely encourage increased participation, due to the potential popularity of the prescriptive approach.

Incentive Levels

The *Benchmarking* section points out that the NJ ESH Program, with an estimated market share of 28% of all new homes constructed in 2005, had a greater market share than any other program examined. The total amount of incentives (including marketing and PR incentives) were also substantially higher for New Jersey ($15.9 million) than any other State we examined. The average incentive per New Jersey home ($1,992) is 65% greater than in New York ($1,207), the closest State both geographically and in terms of incentive levels. In terms of program marketing however, the NJ ESH Program only spent 24% of the marketing and advertising budget ($340,000) of the New York Program ($1.4 million). As reported in other sections of this report, market actors felt substantial additions to marketing were needed to increase consumer awareness and demand for ENERGY STAR homes.

The NJ ESH Program has largely been driven by builder incentives. As reported elsewhere in this report, builders expressed dissatisfaction with the restriction of incentives outside Smart Growth areas. The restriction is impacting what and where they build, and some reported leaving the program because of the restrictions. Builders also voiced their concern about reduced incentives and their desire for increased incentives. At least one reported a desire to leave the program because of difficulties in obtaining incentives due, but none expressly said they would leave because incentives were reduced.

As the program matures and incentive levels decrease, consumer awareness and demand must increase to maintain and increase market share enough to replace the builder incentives. As the incentives are reduced, the reduction should be replaced by marketing efforts that increase consumer demand. Increased current and future consumer demand should offset builders' desire to drop out of the program (and discontinue the construction of ENERGY STAR homes) because of reduced incentive levels.

We therefore recommend shifting funds from builder equipment incentives to marketing by reducing the core rebates by 20% by the end of this year, for the 2007 program. In addition, we recommend additional reductions to specific equipment incentives. These reductions are summarized in Table 2-23 through Table 2-25.[97]

[97] Note that the new federal tax incentives may encourage some builders to construct homes that exceed the ENERGY STAR requirements. Given the recommended prioritization of shifting funds from measure incentives to marketing incentives, however, we do not recommend that N.J. implement a two-tiered incentive structure (i.e., one for ENERGY STAR and one to leverage the federal tax incentives) at this time.

Initially, the savings from rebate reductions should be wholly dedicated to marketing to drive the consumer market. We strongly encourage leveraging marketing funds with the use of cooperative (matching) advertising/marketing. This would mean that New Jersey would still maintain the highest average per home incentive level (including marketing funds) of any program we examined, plus, the builders would have control over some of the marketing funds through the cooperative advertising program.

This recommendation to shift funds to marketing, although arrived at independently, is consistent with the 2003 study of incentives by Vermont Energy Investment Corporation, EAM Associates, and MaGrann Associates.[98] In this study, the authors note, as we also stated, that the NJ ESH Program pays the builders the highest incentives, and that "builders are aware that incentives will be reduced at some point in the future, so they will not be surprised to learn that that time is here."[99] The following excerpt from the 2003 report supports an increase in marketing and reduction in incentives.

> *While reducing the incentive offerings appears to be justified, we want to be sure that participation is not too adversely impacted. It has been suggested that for each percentage drop in the incentive amount, there is an equal drop in the participation rate. In order to minimize this effect while also meeting the program's market transformation goals, we suggest an increase in consumer marketing. It is certainly going to be easier informing builders that the incentives are dropping if, on the other hand, the Working Group lays out a plan to ramp up marketing efforts and increase demand for ENERGY STAR homes.*

We also recommend continuing to phase out the equipment incentives as funds are shifted to marketing. Equipment incentives should therefore be reduced again for the 2008 program, although the magnitude of the reduction should be determined in fall 2007, when the impact of the 2007 reductions on Program participation can be evaluated. If funds are not simply eliminated but, instead, shifted to marketing, builder attrition would likely be minimal, and participation could even increase if consumer demand is perceived to increase.

We also recommend reducing program overhead by shifting a portion of the cost to verify and label a home (via either the HERS rating or BOPs) to the builder. In the current NJ ESH program, the HERS rating is financed by the implementers, and not by the builders. Builders currently only pay for inspections needed on callbacks after an initial failure. By contrast, the Energy Trust of Oregon is already beginning to phase out payment for the rating, shifting the cost to the builders, although their program is only two years old. Certified HERS raters are independent. At the onset of the program, the HERS rating was paid by the Trust. Beginning April 1, 2006, the builder was responsible for obtaining the rating and ETO paid the builder a $200 incentive to help defray the cost. Beginning Jan. 1, 2007, there will no longer be an incentive available, and the builders will pay for the rating out of pocket; the cost is expected to remain at about $400. Builders are allowed to hire from among any of the independent certified HERS raters. This procedure provided a transition period to develop an open market for certified raters.

[98] Vermont Energy Investment Corporation, EAM Associates, MaGrann Associates, New Jersey ENERGY STAR Homes Program Incentives and Smart Growth Analysis, March 2003.

[99] Ibid, page 15.

Table 2-23. Recommended 2006 and 2007 Core Incentive Levels

Dwelling Type	2005 Maximum Incentive Level	Recommended 2006 Incentive Level Maximum	Recommended 2007 Incentive Level Maximums
Single Family	$500 + $0.60/sq. ft.	$400 + $0.60/sq. ft.	$300 + $0.60/sq. ft.
Multiple Single Family ("Townhouse")	$150 + $0.60/sq. ft.	$120 + $0.60/sq. ft.	$100 + $0.60/sq. ft.
Multiple-Family Building ("Multi-Family")	$0 + $0.60/sq. ft.	$0 + $0.60/sq. ft.	$0 + $0.60/sq. ft.
Maximum Core Incentive	$2,900	$2,320	$1,900

Table 2-24. Recommended 2006 and 2007 HVAC Incentive Levels

Equipment Type	Minimum Efficiency Standards	2005 Maximum Incentive	2006 Recommended Incentive	2007 Recommended Incentive
Gas Boiler	ENERGY STAR – 85% AFUE	$300	$200	$150
Gas Furnace	ENERGY STAR – 90% AFUE*	$300	$200	$150
Gas Furnace	ECM Fan Motor 92% AFUE+	$400	$300	$200
Central A/C	14 SEER, 11.5 EER (NJ ENERGY STAR)	$200	$50	$0
Central A/C	14 SEER, 12 EER (NJ Tier 1/CEE Tier 1)	$400	$100	$50
Central A/C	15 SEER, 12.5 EER (NJ Tier 2/CEE Tier 2)	$400	$200	$150
Heat Pump	14 SEER, 11.5 EER, 8.2 HSPF	$300	$100	$50
Heat Pump	14 SEER, 12 EER, 8.5 HSPF	$550	$150	$100
Heat Pump	15 SEER, 12.5 EER, 8.5 HSPF	$550	$250	$200
Ground Source Heat Pump	13 EER	$500 per ton	$500 per ton	$400 per ton
Split system heat/cool	14 SEER	NA	$200	$200
Split system heat/cool	15 SEER and 12.5 EER	NA	$300	$300
Tankless water heater	EF .8	NA	$50	$50

Table 2-25. Recommended 2006 and 2007 Supplemental Requirements and Incentive Levels

	2005		Recommended 2006		Recommended 2007	
Equipment	**Requirement**	**Incentive**	**Requirement**	**Incentive**	**Requirement**	**Incentive**
ENERGY STAR Labeled Lighting Fixtures (Hard Wired)	At least 3 per home required	For more than 3 total fixtures per home: $30 each for recessed fixture $20 each for all others	At least 3 per home required	For more than 3 total fixtures per home: $30 each for recessed fixture $20 each for all others	At least 3 per home required	For more than 3 total fixtures per home: $30 each for recessed fixture $20 each for all others
Qualifying Mechanical Ventilation	Required	N/A	Required	N/A	Required	N/A
ENERGY STAR Labeled Washing Machines	Optional	Up to $175	Optional	Up to $175	Optional	Up to $175

2.8.4 Impact of 2004 IECC on Incentive Levels

The adoption of the 2004 IECC would reduce the current difference between state code and ENERGY STAR standards by 15%. Increasing energy efficiency of the state code would require further reductions in the ENERGY STAR core incentives since the difference between the two codes is reduced. Reductions in the core incentives which in turn would reduce the program cost. The core incentives should be cut in half the first year the IECC is adopted. The core incentives should be reduced further after the first year.

In Oregon, the ENERGY STAR Homes Northwest Certification Requirement (developed by EPA and the Northwest Energy Efficiency Alliance) establishes that ENERGY STAR homes must be 15% more efficient than the current state building code.[100] The Efficient New Homes Program provides up to $850 in incentives. Certification requirements and incentives are based on BOPS prescriptive methods. Reducing the NJ core incentives by half will result in core incentives higher than the maximum $850 found in Oregon.

Reducing the NJ core incentives again in the second year after IECC adoption would be reasonable. In particular, this could be coupled with allowing BOPS, and an incentive structure similar to Oregon's.

2.9 OCE Program Goals Assessment

2.9.1 Are These the Correct Goals?

The three goals for the ENERGY STAR Homes Program are:

- Percent of Market Share
- Number of Market Actors Trained

[100] <http://www.energytrust.org/Pages/about/library/news/040627_GreenBldgAward.pdf>; <http://www.energytrust.org/residential/enh/choose.html>

- Number of Homes Certified

These three goals are still relevant for the Program. Market share is the most meaningful goal and indicator of program success. As land is infilled and developed, regulations will likely require higher density housing. Additional efforts promoting ENERGY STAR to multi-family home builders will be important.

The number of homes certified is closely linked to market share and should also be retained as a goal.

For the program to sustain itself and grow however, builders need to be retained and new builders brought in. In addition, educating other market actors including real estate agents and developer's sales agents will be important. The number of market actors trained should be retained.

2.9.2 What Should the Target Goals Be Going Forward?

The current goals appear to still be relevant for the program. However, the program needs to address the training issue in the face of the changing nature of the building industry. Interviews with utility representatives and implementers suggested that building project managers are increasingly coming from outside the industry, and much of the training occurs on-site, because the labor pool is increasingly casual labor. Simply training more individuals or keeping the training at the same level, does not address this issue. Perhaps the training can be focused more specifically on those actors new to the building industry, rather than on the absolute number of individuals going through training.

The NJ ESH Program, despite having over four times the number of participating homes as the NYSERDA ENERGY STAR Labeled Homes Program, only spent 24% of the marketing and advertising budget ($340,000) of the New York Program ($1.4 million). As presented elsewhere in this report, both builders and program implementers believed that the program needed more substantial marketing dollars to drive consumer awareness and demand for ENERGY STAR homes. The potential increase in demand from this investment may allow a net savings in program expenses associated with incentives.

2.9.3 What Should the Stretch Goals Be?

In the last two years, the Program has exceeded its goals. The following are our recommended stretch goals:

- Increase the market share of ENERGY STAR certified homes, as a percent of Certificates of Occupancy, to 30%.
- Retain the market share of ENERGY STAR enrolled homes, as a percent of building permits issued, at 20%.
- Increase the number of homes certified to 8500.
- Increase the number of market actors trained to 250.
- Allocate funding to cooperative advertising.
- Move toward allowing incentives within replacement new construction outside the Smart Growth areas.
- Marketing expenditures (as either direct expenses or co-op advertising) make up 75% of all Program expenditures.
- Phase out program funding for HERS raters by 2007

2.10 Program Recommendations

The program has evolved around policy initiatives and movement toward administrative changes. Marketing efforts to the consumer were drastically curtailed in 2003 when the BPU considered changes to the administrative structure of the RNC. Another significant change occurred that year as the RNC was modified to incorporate Governor McGreevey's policy initiative to support development and redevelopment in the Smart Growth area. The Smart Growth area includes areas designated for growth in the State Development and Redevelopment Plan, including Planning Areas I and II and the Designated Centers using the "Policy Map of the New Jersey State Development and Redevelopment Plan." This modification meant that only RNC homes built within the Smart Growth area could qualify for incentives after March 5, 2003.

These two events – curtailing marketing to consumers and restricting the area eligible for incentives – have had an impact on the program.

At the onset of the RNC program in 2001, 4,553 homes were enrolled and committed to build to ENERGY STAR standards. By the end of 2005, 20,800 homes had been ENERGY STAR certified. In 2005, 8,337 homes enrolled in the ENERGY STAR program, and 38,025 obtained a building permit statewide. ENERGY STAR homes made up 21.9% of homes obtaining a building permit statewide in 2005. Certified ENERGY STAR homes made up 28.2% of new homes receiving a Certificate of Occupancy in 2005.

The program surpassed two of the three 2005 goals. While the number of certified homes far exceeded the 2005 target, it is important to remember that it takes one to two years for a home to move through the process from enrolling in the program (paralleling the housing permit stage) to the final Certified home (parallel to the Certificate of Occupancy). Some of these homes could be the last of those grandfathered in with the Governor's 2003 policy change.

Table 2-26. Program Goals for 2005

Target	Achievement
Enroll 20% of all new housing starts	21.9%
Train 150 builders	106
Certify 5,830 homes	8,009

2.10.1 Key Findings

This market assessment focused on market indicators that might be influenced by the New Jersey ENERGY STAR New Residential Construction program. The following are selected findings from the market assessment:

- The NJ ESH has made significant progress enrolling builders over the last three years. Many of the largest production builders, including for example, K. Hovnanian, Pulte Homes, Ryan Homes, Orleans Home Builders, Beazer Homes, and D.R.Horton, not only participate in the Program but all reported that 100% of their new homes are now all ENERGY STAR rated. This is a tremendous program achievement.
- New Jersey ES homes market share has steadily increased, and has the largest market share of ENERGY STAR homes of the programs we examined. In 2005, ENERGY STAR certified homes made up 28% of Certificates of Occupancy issued.

- New Jersey's builder incentives are extremely high, significantly higher than any other program we examined. This was also the case in a 2003 study conducted by VEIC, MaGrann and EAM.
- Changes and uncertainty in the program administration led to curtailing marketing to consumers around 2003. This shift away from marketing to consumers has had an impact on the program. Builders, implementers, and utility staff all call for renewed funding for consumer marketing.
- Restricting incentives only to areas designated Smart Growth has had an impact on the program. A large number of homes were enrolled in 2002 and 2003 to grandfather in the incentives. Some builders have now left the program because incentives are not available outside Smart Growth areas.
- HERS raters are employees of the Program implementers and are not independent contractors as they are in nearby states such as New York. There is some interest in moving to an independent rating system.
- New Jersey ENERGY STAR home buyers are aware of the ENERGY STAR home label. About 40% fewer purchasers of non-ENERGY STAR homes are aware of the ENERGY STAR home label.
- A recent study for Long Island reported the costs for the most cost-effective upgrades were $1,084 for reaching 86 points, $2,605 for reaching 88 points, and $4,757 for reaching 90 points. The study estimated that an 86 point home costs, approximately, an extra $6.50/month on a 30 year mortgage, but results in $30/month in savings.

2.10.2 Recommendations

A number of recommendations are offered here in response to feedback by builders, home buyers, utility staff and program administrators, as well as the professional judgment of the evaluators. Recommendations are suggested to improve the internal functioning of the program, its presence in the marketplace, and the program structure.

Program Structure

Reduce builder equipment incentive levels and shift funds to direct and cooperative marketing. This program has largely been driven by builder incentives, which, we found, are far higher than program incentives offered by other programs. Transforming the market for ENERGY STAR homes requires consumer demand for the product. The program cannot be driven by builder incentives alone. This assessment and an earlier VEIC study found incentive reductions were warranted. We recommend reducing the core rebates by 20% for the 2007 program, and reducing a number of rebates for HVAC equipment as well. Rebates for new technologies should be retained. Initially, the savings from incentive reductions should be wholly dedicated to marketing to drive the consumer market and offset reduced incentives . We strongly encourage leveraging marketing funds with the use of cooperative marketing and advertising. The impact of the 2007 changes should be evaluated to determine additional reductions in equipment incentives for 2008. Recommended incentives are summarized in Table 2-23 through Table 2-25.[101]

[101] Note that the new federal tax incentives may encourage some builders to construct homes that exceed the ENERGY STAR requirements. Given the recommended prioritization of shifting funds from measure incentives to marketing incentives, however, we do not recommend that N.J. implement a two-tiered incentive structure (i.e., one for ENERGY STAR and one to leverage the federal tax incentives) at this time.

Develop a high profile marketing plan for the ENERGY STAR homes program directed at consumers. Builders and other market actors all called for renewed consumer marketing to increase program visibility and consumer awareness. We recommend the program be marketed in a highly profiled manner, such as in the neighboring state of New York where, for example, prime time television ads and mass marketing are used. Greater consumer awareness and knowledge of the benefits of ENERGY STAR should increase demand, and raise the value of labeled homes, reducing the need for builder incentives. This will be especially important once incentives ramp down and phase out. For the market to fully transform, consumers must be asking for the product. The small potential increase in the homeowners monthly mortgage payments (as noted above) is one important message that can be incorporated into an advertising campaign.

Develop reasonable exceptions to restrictions in non-Smart Growth areas. Since the Smart Growth policies were enacted, there has been concern about builders' reactions to incentive restrictions. Builders did express dissatisfaction with the restrictions and some stated they were leaving the program because of the restrictions. We recommend the exceptions to the restrictions begin with allowing replacement new construction (demolitions) to qualify for Energy Star incentives and certification. This market niche represents a lost opportunity for energy efficiency unless it is included as a program opportunity.

Increase emphasis on the Builder Option Package (BOP, or prescriptive path) to ENERGY STAR certification as described within the EPA ENERGY STAR requirements The EPA ENERGY STAR Homes Program has recently adopted a prescriptive approach to ESH labeling, where a home would qualify for the ENERGY STAR label if specific criteria are met. The NJ ENERGY STAR Homes Program should also adopt this option, providing consistency with the EPA Program. In both the prescription and performance paths to certification, the home requires a pre-drywall, thermal inspection checklist, and final inspection with blower door and duct blaster. The prescriptive path eliminates the plans analysis and HERS rating, and could reduce program cost.

Allow inspection and verification sampling where applicable. EPA requires 100% inspection and verification of homes to meet Energy Star standards. However, in subdivisions with production builders, sampling is allowed when the same model or set of models is built within the subdivision. Sampling can be patterned after the guidelines employed by the Energy Trust of Oregon. Those guidelines stipulate that if the sample home fails the inspection, the builder must pay to have all homes in the subdivision certified. We recommend sampling where applicable to reduce program cost and ease the number of inspections in production developments.

Allow any RESNET-certified HERS rater to operate within New Jersey and provide full service to the builder. In the current Program HERS raters are employees of the Program implementation agencies. Very few independent raters could be identified. Independents are currently allowed to certify a home but cannot apply for the builder's rebates. Implementers and builders stated that the presence of knowledgeable independent HERS raters will be needed once the program incentives have been phased out. There was support for a transition to independent raters. When the program administration moves to third party provider, allow independent raters to complete all the steps necessary to apply for the incentive for the builder. Certified HERS raters will also be needed under the BOP option, which requires on-site inspections. Shifting to independent HERS raters has the added advantage of reducing the Program administrative fees.

Remove the requirement for the two existing program implementers to operate in only specified areas. Geographic boundaries based on utility service territory currently define the areas where each of the two Program implementers provide services. Builders who build across territories must use the designated service provider. Builders and implementers expressed the need to remove boundaries and allow other options. We recommend builders be allowed to select their implementer(s) regardless of the location of

the building. Geographic boundaries should be eliminated immediately or alternatively, eliminated once a single third-party administrator has been selected, to begin to allow builders these options. Builders may choose to work with one or more than one implementer depending on their needs. Several builders already work across boundaries and utilities have processes in place to accommodate builders who work with implementers without geographic boundaries.

Increase the visibility of the ENERGY STAR label within the homes. A number ENERGY STAR new homebuyers the responded to the survey expressed concern that their home may not be achieving the expected energy savings. In addition, consumers expect that an ENERGY STAR-labeled home contain ENERGY STAR-labeled equipment. The current Program pays supplemental incentives for ENERGY STAR lighting beyond the required 3 installations, and pays a supplemental incentive for mechanical ventilation and ENERGY STAR washers. We recommend the program incorporate additional requirements for lighting (e.g., the Advanced Lighting Package that will be reviewed by the EPA in 2008) and appliances, e.g., ENERGY STAR-labeled dishwashers, in the home package. Dishwashers, like clothes washers, are common appliances and should be ENERGY STAR. In addition, when consumers see the ENERGY STAR label on more equipment they are likely to have more confidence that the home is using more efficient equipment that will result in energy savings.

Consider additional incentivized equipment to improve home efficiencies particularly with respect to home and water heating products. We recommend tankless water heaters. Most readily available tankless water heater systems include those which are a minimum of 80% efficient (gas) and 99% efficient (electricity). Federal tax credits of up to $300 may be applied toward the purchase price. Marketing advantages include on-demand hot water and significantly reduced unit sizes. We also recommend, as also found in Section 6 HVAC assessment, "split air" systems, commonly referred to as "ductless split systems" or "mini-splits." These systems significantly reduce energy losses compared to conventional systems and are also eligible for federal tax credits of up to $300. The HVAC assessment suggests a $200 rebate for a standard mini-system and $300 rebate for a high efficiency system.

Internal Administration

Develop uniform forms and tracking database to consistently record data needed to evaluate the program. Data elements were not readily available in a common database or were inconsistent across utility and implementer databases. A uniform tracking database would include the full name, address, and zip code of each purchaser. Drop down menus with builders' business names, townships, cities, etc. would eliminate the multiple spellings that result in an inability to easily generate reports. Collection of consistent housing and rebate data, including house type, square footage, purchase price, gas rebate amount, electric rebate amount, qualifying measures installed, efficiency rating (SEER, EER, AFUE) would further assist in being able to describe program accomplishments. In addition, it would allow a cross check to determine whether builders have applied for both the HVAC incentives and the ENERGY STAR home incentives, which is not allowed under current guidelines. Common rebate application forms should be used by all utilities to eliminate completing different forms for different utilities.

Involve evaluators in the design of the database. Data that was not available in a common database included the full address with zip code, and the buyer's name and phone number. Other items not readily available in a common database or inconsistent are as noted in the preceding recommendation. Involving an evaluator in the design or development of a common database will ensure that data will be readily available to inform key metrics when program evaluations are conducted.

Enable the program administrator to process rebates 'in house' and eliminate the utility's role in receiving and processing paperwork. Builders stated there is too much time and trouble associated with receiving the rebate. Handling rebates through the utilities adds unnecessary time to the rebate process. At

least one utility has implemented a system where the program administrator issues the rebate check, eliminating the need to bundle paperwork and reducing the wait for the builder to receive the incentive.

3. ENERGY STAR PRODUCTS PROGRAM MARKET ASSESSMENT

3.1 Introduction

This report presents the results of the Market Assessment for the New Jersey ENERGY STAR® Products Program (NJESP Program).[102] This analysis examines performance indicators, market share, changes from the baseline, incremental cost differences between ENERGY STAR and comparable non-ENERGY STAR products, the status of market barriers, codes and standards, rebates and incentives, and program goals; it also gives recommendations to improve the program.

3.1.1 Detailed Program Background

Subsequent to the passage of the Electric Discount and Energy Competition Act of 1999, the Board of Public Utilities required the state's seven publicly owned electric and natural gas utilities to coordinate and offer similar energy efficiency programs. These programs all require approval by the New Jersey Board of Public Utilities (BPU) and have been designed to use the national ENERGY STAR effort as a platform.

The New Jersey ENERGY STAR Products Program was created to enhance the promotion of energy-efficient products to consumers throughout the state. Because the program did not have clearly defined expectations and aspects at its inception, it has been an evolving work-in-progress throughout the past five years. For example, the program began in 2001 as three separate efforts. During 2002, the lighting, appliances, and windows programs were all combined to form the ENERGY STAR Products Program. Retailer recruiting efforts took place during 2001 and 2002. During 2003, no additional retailer recruiting was done since the program was in "maintenance mode." In 2004, with authorization from the BPU, the program resumed establishment of relationships with new and existing retailers and manufacturers. The program also added a Home Energy Analysis, an online or mail audit option, for New Jersey consumers in 2004. This initiative allows consumers to understand how energy is used in their homes and to identify energy savings opportunities specific to them. Note that the Home Energy Analysis was not included as part of this evaluation.

In order to impact sales on a higher level, rebates for ENERGY STAR room air conditioner (RAC) were added in 2003, which were payable directly to the consumer and ranged from $20 to $25. Also during 2003, the program added the lighting incentive. The incentive was offered to manufacturers and retailers, allowing customers to purchase ENERGY STAR compact fluorescent light bulbs (CFLs) for approximately $1 during the two-month Change-a-Light campaign.[103] The RAC rebates and lighting incentives occurred again in 2004 and 2005.

In 2005 the program also incorporated a pilot Home Performance with ENERGY STAR (HPwES) initiative, and plans to launch the Program statewide in 2006. The HPwES Program will train and certify contractors that offer comprehensive energy improvement packages. Contractors certified to participate in the program will offer homeowners a customized energy efficiency package for their home that addresses

[102] The program is promoted publicly as "New Jersey for ENERGY STAR."

[103] The ENERGY STAR Change a Light, Change the World Campaign is a national challenge to encourage adoption of energy-efficient lighting in homes. The campaign includes local and national promotions that run from October 1 to November 30 annually.

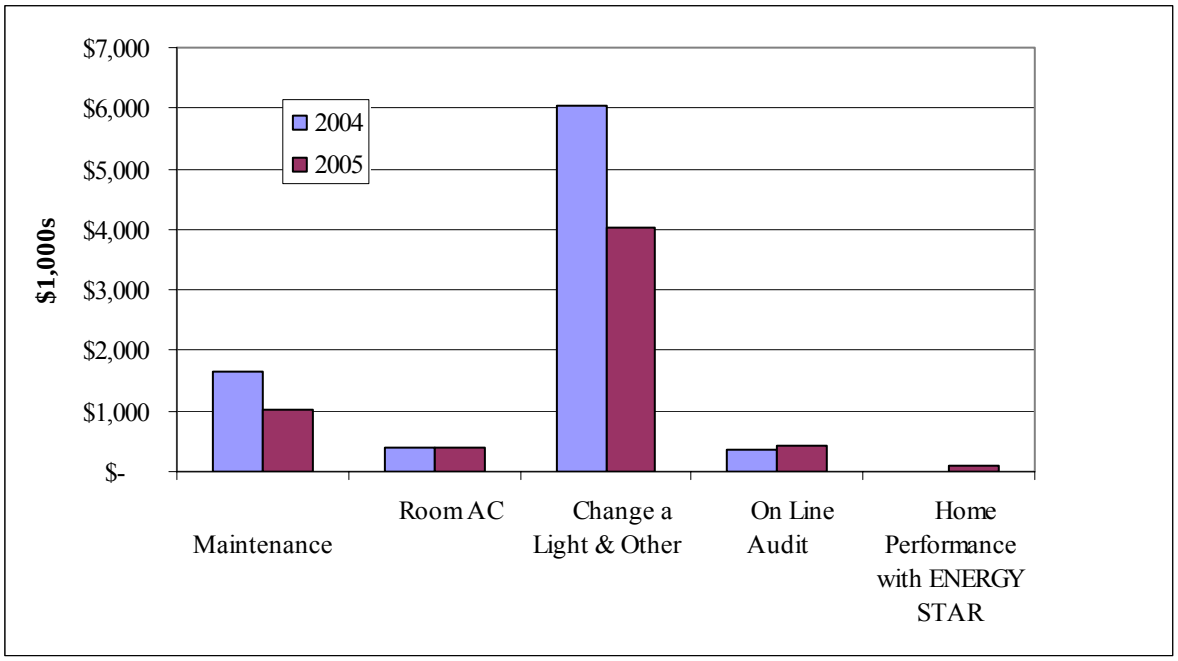
everything from heating and cooling systems to lighting retrofits. Note that the pilot program was not included as part of this evaluation.

The program's ultimate goal is to transform the New Jersey market into one where the offering and purchase of ENERGY STAR products are standard practice for retailers and consumers. The primary means of achieving this is to encourage the sales and purchase of ENERGY STAR-qualified residential appliances, lighting products, and windows via retailer partnerships. Various methods are employed to assist in this process. For instance, the program uses education of the public, marketing tools for participating retailers, proposed and supported separate state appliance standards (which were adopted and enacted), and rebates/incentives for consumers in order to shift the purchasing behavior of the public. The program has been recognized with ENERGY STAR Partner of the Year Awards in 2004 and 2005.

Currently, the program is implemented by New Jersey's investor-owned electric and natural gas utilities – Atlantic City Electric Company (ACE), Rockland Electric Company (RECo), Jersey Central Power & Light Co. (JCP&L), New Jersey Natural Gas Co. (NJNG), Elizabethtown Gas Co. (E-Town), Public Service Electric & Gas Co. (PSE&G), and South Jersey Gas Co. (SJG). Implementation support is provided by Honeywell International, Inc. (Honeywell).

Total program expenditures for 2004 and 2005 were $8,449,000 (84% of 2004 program budget) and $5,973,000 (88% of 2005 program budget). As demonstrated in **Error! Reference source not found.**, the vast majority of the budget is spent on the "Change a Light" initiatives.

Figure 3-1. Program Expenditures by Program Initiative[104]



Source: New Jersey 2004 and 2005 Clean Energy Program Reports, submitted to the New Jersey Board of Public Utilities

In addition to tracking expenditures by program, expenditures are tracked across various categories, including administration, marketing, incentives, etc. Program spending in 2005 across the various

[104] Maintenance is for overall program management and administration by Honeywell.

categories is shown in **Error! Reference source not found.**. The majority of the budget (65%) was spent on incentives for room air conditioners and lighting products. Implementation contractors account for 23% of program expenditures and provide support for the individual initiatives and the program overall. Marketing and administration each account for approximately 6% of the program budget. Administration includes both a portion of the maintenance services and utility administrative costs.

Table 3-1. 2005 Expenditures by Program Category

	Expenditure ($1000s)	Percent of Total
Administration	$349	5.9%
Sales	$14	0.2%
Marketing & Promotion	$354	5.9%
Training	$1	0.02%
Market Research, Evaluation & Program Development	$9	0.2%
Grants and Incentives	$3,896	65.2%
Implementation Contractor	$1,350	22.6%
Total	**$5,973**	**100%**

Program Participation to Date

Error! Reference source not found. illustrates the participating retailers (since program inception) by product type and shows the quantity of retailer entities and corresponding storefronts. The initial recruitment efforts were clearly successful: there is a good variety of retailers by product type and by the size of the retail entity. The program implementer was able to successfully recruit 496 retailers, from large chains to the individual "Mom & Pop" store, representing 1,722 storefronts.[105]

Table 3-2. Participating Retailers by Product Type

	Appliances	Lighting	Windows	Total
Retail Entities	119	146	257	496
Retail Storefronts	853	737	319	1,722

Source: Participating retailer database.

Participation in the program in 2005 included:

- A total of 14,708 room air conditioning rebates were paid.
- 1,160,029 CFLs were distributed.

[105] Note that some retail entities have been counted in multiple categories if they sell more than one product included in the program. Note also that the 2005 NJ Clean Energy Annual Report states that the Program has "over 1,500 retailers participating," referring to the number of retail storefronts, not retail entities. In addition, due to timing the annual report was an estimate based on the 2004 figure.

- 63,126 energy-efficient fixtures were distributed.
- 27,870 households completed a mail-in or on-line audit.

Additional program impacts, discussed throughout this report, include encouragement of increased adoption of a wide range of ENERGY STAR-labeled products in addition to room air conditioners and lighting including:

- Clothes washers
- Dishwashers
- Refrigerators
- Thermostats
- Windows

3.1.2 Research Methodology

The research approach used by the Assessment Team to conduct the evaluation of the ENERGY STAR Products Program consisted of the following activities:

- Primary data collection via surveys and interviews with the following market actor groups:
    - Utility program managers
    - Program implementation staff (Honeywell)
    - Participating and nonparticipating retailers
    - Manufacturers of appliances, lighting, and windows
    - Consumers – particularly those that purchased appliances, lighting fixtures or bulbs, or windows in the past 24 months
    - Codes and standards officials
- Review of numerous secondary data sources, including reports prepared for New Jersey and other programs similar to the New Jersey ENERGY STAR Products Program (see page 7 for a listing of sources).

Utility and Implementation Staff Interviews

Ten program staff from the utilities and the program implementer, Honeywell, were interviewed by telephone. The interviews were administered by evaluation staff and provided a context for the research, including respondent perceptions about research issues, program impacts, and relevant market actors. Contact information for utility and staff interviews was supplied by the evaluation project manager for the Board of Public Utilities. All prime contacts were interviewed.

Consumer Surveys

Consumer surveys were conducted with recent purchasers of various appliances, lighting, and window products, as well as a sample of non-purchasers.[106] More than 29,000 calls were made to New Jersey

[106] Survey purchaser respondents purchased one or more of targeted products in the previous 24 months.

residents to identify qualified respondents. A total of 990 interviews were completed to fill the modules listed in **Error! Reference source not found.**. Population Research Services (PRS) employed random digit dialing to conduct the surveys. Respondents were screened for purchase of the various products and completed up to two survey modules plus the light bulb module.

Table 3-3. NJ ENERGY STAR Products Consumer Survey Completes

Product	Target	Competed Survey Modules*	Percent of Target Completed	Accuracy at 90% Confidence Interval**
Refrigerators	200	212	106%	94%
Clothes washers	200	210	105%	94%
Room air conditioners	100	106	106%	92%
Lighting fixtures	100	101	101%	92%
Light bulbs	200	254	127%	95%
Thermostats	100	139	139%	93%
Windows	100	118	118%	92%
Non-Purchasers	100	100	100%	92%
Total	**1000**	**990**	**99%**	**97%**

* Respondents could complete more than one module, so the total of all the modules sums to more than the total number of survey completes.

** The confidence and precision levels shown in the table are based on formulae for estimating proportions. The largest variance occurs when the proportion is 0.5; i.e., half of the respondents indicate they are in that group and half state that they are not in that group. The calculation assumes the variance with this 50/50 split. It should be noted that each question in a survey will have a different confidence interval and precision depending upon the range of possible answers for multi-category questions or continuous variables and the dispersion of responses.

These surveys addressed several topics including:

- Awareness of ENERGY STAR
- Awareness of the New Jersey Clean Energy Programs
- Purchasing process, including identification of retailer at which products were purchased
- Criteria for selection of specific models
- Whether or not selected models were ENERGY STAR-labeled[107]

We also used data from the recently completed survey conducted by the Consortium for Energy Efficiency (CEE survey) to assess ENERGY STAR awareness nationally. A total of 1,225 survey were conducted via the Web with panel respondents. Over-sampling was conducted for New Jersey with a total of 216 respondents.

[107] Purchasers were asked if the specific model that they purchased had the ENERGY STAR label. In some cases (thermostats, room air conditioning, and lighting), we relied on the self-reporting of respondents. In other cases (top-load clothes washers and refrigerators), we asked for the make and model number purchased in order to verify ENERGY STAR status of specific products.

Retailer Surveys

Surveys were conducted with participating and nonparticipating retailers. Participating retailers were identified through Honeywell. The database of participating retailers identified both the participating sites and provided key contact information. To identify a sample of nonparticipating retailers where consumers commonly shopped, the most frequently mentioned retailers from the consumer survey were compared to the list of participating retailers, and an attempt was made to find those that were not participating in the program. However, because of the broad reach of the program, there were few nonparticipating retailers available to survey.[108]

Table 3-4. NJ ENERGY STAR Products Retailer Survey Completes

Product	Target	Participation Status			Percent Of Target Completed
		Participating	Nonparticipating	Total Completed Survey Modules*	
Clothes Washers	25	21	6	27	112%
Dishwashers	25	21	6	27	112%
Refrigerator	25	21	6	27	100%
Room AC	25	21	3	24	108%
Light Fixtures	15	13	7	20	100%
Light Bulbs	40	34	8	42	110%
Windows	15	13	3	16	100%
Total	100	71	17	88	88%

* Respondents could complete more than one module, so the total of all the modules sums to more than the total number of survey completes.

A total of 88 surveys were conducted to complete the various modules.[109] Participating retailers were identified through the program databases. The evaluation team sought to get a good representation across products as well as a mix of participants based on number of sites (i.e., large chains with more than ten participating sites, small chains with up to ten sites, and single-site participants).

The retailer surveys included the following areas of inquiry:

- Awareness of program
- Perceptions of consumers' knowledge and interest in the program
- Participation in program (i.e., training, cooperative advertising, etc.)
- Importance of various program elements

[108] As noted in later in the report, participating retailers represented 87% of all units sold for the products of interest.

[109] At the 90% confidence level this provides approximately 9% precision.

- Effectiveness of program elements and overall program
- Suggestions for program enhancement

Manufacturer Surveys

Error! Reference source not found. details the number of manufacturer surveys completed by product. Again, the sample was provided by the program implementation manager. At total of 37 contacts were made to complete surveys across 50 product modules.[110]

Table 3-5. NJ ENERGY STAR Products Manufacturer Survey Completes

Product	Target	Participation Status			Percent Of Target Completed
		Participating	Nonparticipating	Total Completed Survey Modules*	
Clothes Washers	5	2	5	7	140%
Dishwashers	5	2	3	5	100%
Refrigerator	5	1	3	4	80%
Room AC	5	1	4	5	100%
Light Fixtures	15	3	11	14	93%
Light Bulbs	5	3	3	6	120%
Windows	10	2	7	9	90%
Total	50	8	29	37	74%

* Respondents could complete more than one module, so the total of all the modules sums to more than the total number of survey completes.

Interviews with Codes and Standard Officials

The evaluation team investigated the impacts of the NJ ENERGY STAR Products program on the state and federal energy codes by interviewing players at different levels of code development. These interviews included representatives of the IECC, the Federal Minimum Appliance Standards, NJ Energy codes, and the Appliance Standards Awareness Project. These interviews informed the evaluations of several of the New Jersey Clean Energy programs.

Secondary Research Reports

We used a variety of secondary sources in this analysis. Some of the key reports are listed below.

KEMA, **National Awareness of ENERGY STAR for 2005.** Prepared for: Consortium for Energy Efficiency. May 2006.

Quantec, LLC. **New York ENERGY STAR® Products And Marketing Program: Market Characterization, Market Assessment And Causality Evaluation.** Prepared for NYSERDA. April 2006.

[110] At the 90% confidence level this provides approximately 12% precision (applying a finite population correction factor).

New Jersey Board of Public Utilities, Office of Clean Energy. **2005 Annual Report**.

Ingo Bensch and Sean Weitner. **Residential Programs: Market Assessment Appliance Sales** Itron, Inc. **California Residential Market Share Tracking – Appliances 2004**. Prepared for: Southern California Edison. December 6, 2005.

KEMA, Inc. **ENERGY STAR® Consumer Products Market Progress Evaluation Report.** Prepared for: Northwest Energy Efficiency Alliance. November 15, 2005.

New Jersey Clean Energy Programs Report. Prepared for: New Jersey Board of Public Utilities. May 6, 2005.

Nexus Market Research, Inc., RLW Analytics, Inc., Shel Feldman Management Consulting, Research Into Action, Inc. **Market Progress and Evaluation Report (MPER) For The 2004 Massachusetts ENERGY STAR Appliances Program**. Prepared for: Cape Light Compact, Massachusetts Electric, Nantucket Electric, NStar Electric, Western Massachusetts Electric Company and Fitchburg Gas and Electric Company. May 23, 2005.

Quantec, LLC. **Residential Market Assessment for ENERGY STAR Windows in the Northeast**. Prepared for: Northeast Energy Efficiency Partnerships. January 5, 2006.

New Jersey Board of Public Utilities, Office of Clean Energy. **2004 Annual Report**.

Vermont Energy Investment Corporation and Optimal Energy, Inc. **NEEP Strategic Initiative Review Quantitative Analysis Report**. Prepared for: Northeast Energy Efficiency Partnerships, Inc. Initiative Review Committee. September 29, 2004.

Tracking Study 2003. State of Wisconsin Department of Administration Division of Energy. July 2004.

RLW Analytics, Inc. **The New Jersey ENERGY STAR Products Working Group Appliance and Windows Baseline Studies, Final Report**, March 15, 2001. Prepared for: GPU Energy, Public Service Electric & Gas, Conectiv Power Delivery, New Jersey Natural Gas, Elizabethtown Gas, South Jersey Gas Co., and Rockland Electric.

Opinion Dynamics Corporation and Regional Economic Research. **Baseline Study of the New Jersey Residential Lighting Market.** Prepared for: Northeast Energy Efficiency Partnerships, Inc., Public Service Electric and Gas Company, GPU and Conectiv Power Delivery. November 1999.

XENERGY, Inc. **New Jersey Comprehensive Resources Analysis Market Assessment**. Prepared for: New Jersey Utilities Working Group. August 19, 1999.

3.2 Assessment of Program Indicators

Updating and revising the indicators is a crucial step that precedes much of the program and market assessment activities. Progress indicators serve as a roadmap for the market assessment, guiding the data collection approach and analysis so that the research can effectively measure the efficacy of the programs in meeting the stated market transformation goals. This chapter presents an updated list of performance indicators and an assessment, based on all available primary and secondary data sources, of how these indicators have changed over time.

The updated list of performance indicators is presented in **Error! Reference source not found.**. Note the bold indicators highlight those that were added by the evaluation team during our review of the existing

indicators.[111] In addition, the indicators are summarized by general topic areas that serve to guide the discussion below into the following areas: [112]

- Section 3.2.1 discusses recruiting and training.
- Section 3.2.2 discusses participant satisfaction.
- Section 3.2.3 discusses awareness and knowledge among trade allies and consumers.
- Section 3.2.4 discusses availability of energy-efficient products.

[111] A summary of the findings from the indicator review for all programs appears in the December 31, 2005 memorandum entitled "NJ Clean Energy Programs – Indicator Assessment," prepared by Summit Blue, LLC and Quantec, LLC.

[112] Indicators addressing market share and product pricing (incremental cost) are presented in other sections of this report and thus are not presented in this section.

Table 3-6. Performance Indicators

General Topic	Topic	Performance Indicator	New?	General Source	Detailed Source
Recruiting and training	Retailer participation	Number of trade allies promoting or co-sponsoring promotions of ENERGY STAR windows, lighting, and appliances.	No	Program Tracking/ Market Assessment	Honeywell / Retailer surveys
Recruiting and training	Manufacturer participation	Number of manufacturers promoting or co-sponsoring promotions of ENERGY STAR windows, lighting, and appliances.	No	Program Tracking/ Market Assessment	Honeywell / Manufacturer surveys
Recruiting and training	**Trade ally training**	**Number of allies trained**	**Yes**	**Program Tracking**	**Honeywell**
Satisfaction	**Trade ally satisfaction**	**Satisfaction with program among participating trade allies**	**Yes**	**Market Assessment**	**Retailer and manufacturer surveys**
Awareness and knowledge	Public awareness, consumer knowledge, and demand	% of customers aware of and requesting benefits and key elements of ENERGY STAR windows, lighting, and appliances	Modified	Market Assessment	Retailer, manufacturer, and end-use customer surveys; CEE survey
Awareness and knowledge	**Trade ally awareness and knowledge**	**% of retailers aware of benefits and key elements of ENERGY STAR windows, lighting, and appliances**	**Yes**	**Market Assessment**	**Retailer and manufacturer surveys**
Availability	Product availability	% of retail space devoted to ENERGY STAR windows, lighting, and appliances relative to space to devoted to non-qualified products	No	Market Assessment	Retailer surveys
Market Share	Market share monitoring	Sales of ENERGY STAR windows, lighting, and appliances as % of total NJ sales of these products (includes separate estimate for new construction/retrofit market).	No	Program Tracking/ Market Assessment	Honeywell DMC / Retailer, manufacturer, and end-use customer surveys/ Builder survey for RNC program

Incremental cost	Product pricing	Change, over time, of product prices	No	Program Tracking/ Market Assessment	Retailer and manufacturer surveys

3.2.1 Recruiting and Training

To be successful, the ENERGY STAR Products Program needs the commitment and participation of the retailers and manufacturers of ENERGY STAR products. There are a number of key performance indicators associated with recruiting and training, including the number of retailers and manufacturers in the program, the number that promote efficient products, and the number that have participated in trainings. These are presented below.

Retailer Participation

Retailers that enroll in the New Jersey ENERGY STAR Products Program agree to market the various ENERGY STAR products. They provide consumer education related to the benefits of ENERGY STAR using program educational and marketing materials. They may do cooperative advertising featuring ENERGY STAR-qualified products. The program also provides some training for retailer sales staff. Where applicable, retailers offer rebates and incentives for the purchase of qualified products or offer products at discounted prices.

To assess the level of retailer participation, the evaluation team looked at total participation in the program across product types and the percent of the total market those retailers represented based on responses from the consumer survey.[113] The program has achieved significant retailer participation, both in terms of the number of participating retailers and the percentage of the market represented, measured as the total percent of products purchased at retailers participating as program partners. As of 2005, a total of 496 retailers, representing 1,722 storefronts, were enrolled in the program (**Error! Reference source not found.**).

Table 3-7. Participating Retailers by Product Type

	Appliances	Lighting	Windows	Total*
Retail Entities	119	146	257	496
Retail Storefronts	853	737	319	1,722

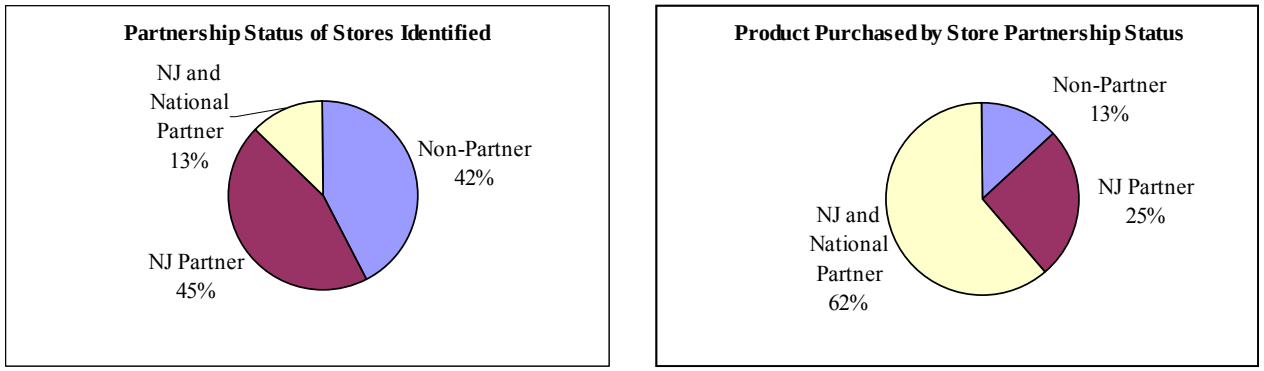
The retail entities enrolled in the program were compared to the stores identified in the consumer survey where various lighting, appliance, and windows (both ENERGY STAR and non-ENERGY STAR-qualified) were purchased. As shown in **Error! Reference source not found.**, 58% of the overall stores, representing 87% of the products purchased, were partners in the Clean Energy program. In general, over 85% of all product sales were through NJ retailer partners, reflecting the high rate of retailer participation the program has achieved (**Error! Reference source not found.**). The percent of sales among partner stores was highest for thermostats (95% in NJ only or NJ/national partners), refrigerators (93%), clothes washers (93%), and light bulbs (92%), yet lowest for windows (70% in NJ only or NJ/national partners).

[113] Consumers that purchased the various products were asked to identify the stores at which those products were purchased. New Jersey and National ENERGY STAR program partnership status was assessed for each of the stores identified.

These differences are largely caused by differences in distribution channels (store types) that are responsible for product sales. **Error! Reference source not found.** and **Error! Reference source not found.** provide two examples. Because 94% of programmable thermostats are sold in home improvement stores (e.g., Home Depot and Lowes), and because these national big box stores are NJ/national partners, the program has achieved high coverage. For windows, however, the distribution channels are less homogenous, with the bulk of the sales coming from home improvement stores (40%), lumber/builder supply stores (24%), and window/door specialty shops (15%). Program retailer partner coverage, therefore, requires more "mom and pop" specialty stores.

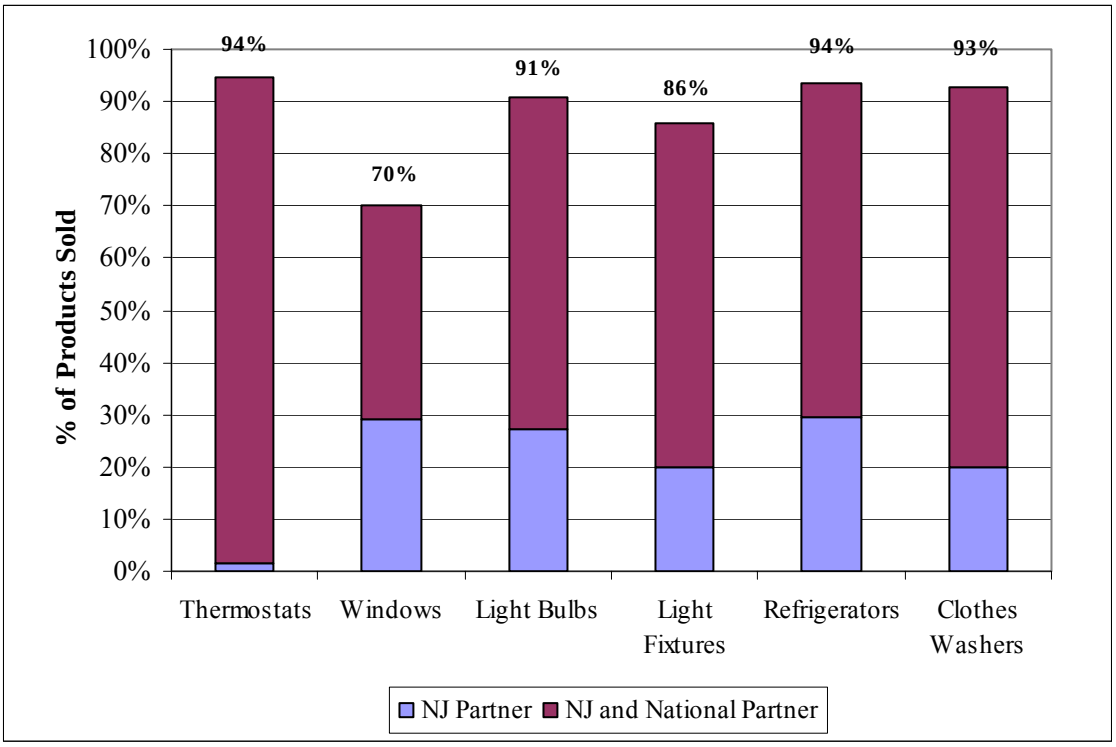
Appendix A presents detailed charts of the percent of product sales by both store type and partnership status for the remaining products, including light bulbs, light fixtures, refrigerators, and clothes washers.

Figure 3-2. NJ Clean Energy Program Partner Market Presence



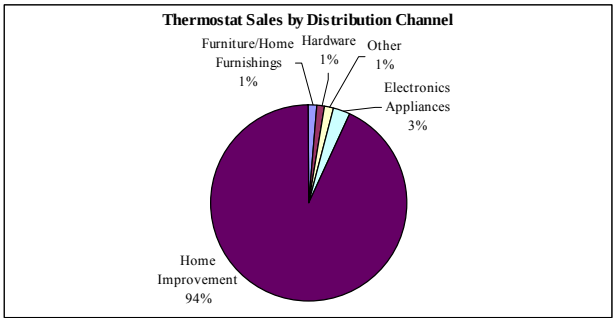
Source: NJ ENERGY STAR Products Consumer Survey

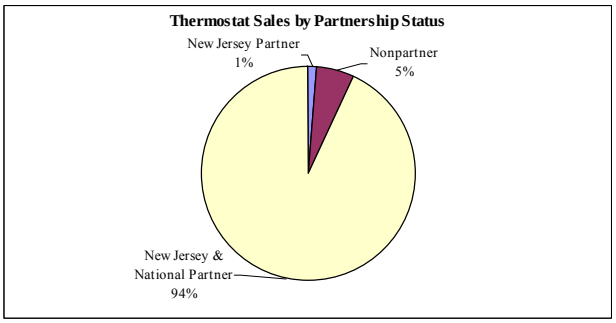
Figure 3-3. Summary of Partner Market Presence by Product



Source: NJESP Consumer Survey (n=990)

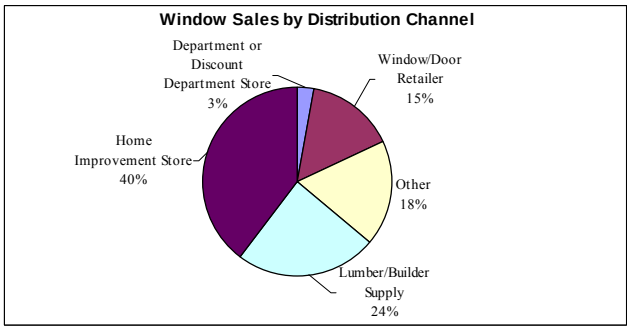
Figure 3-4. Distribution Channels and Partnership Status for Thermostat Retail Sales

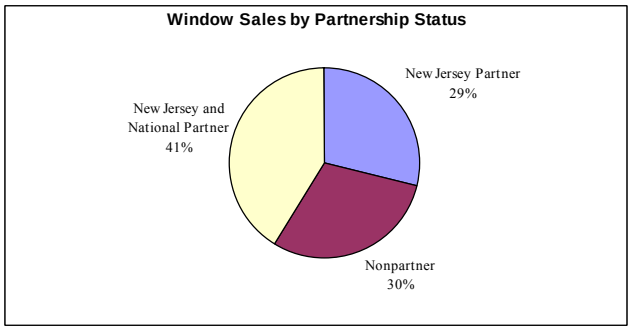




Source: NJESP Consumer Survey (n=73 thermostat purchasers with store name provided)

Figure 3-5. Distribution Channels and Partnership Status for Window Retail Sales

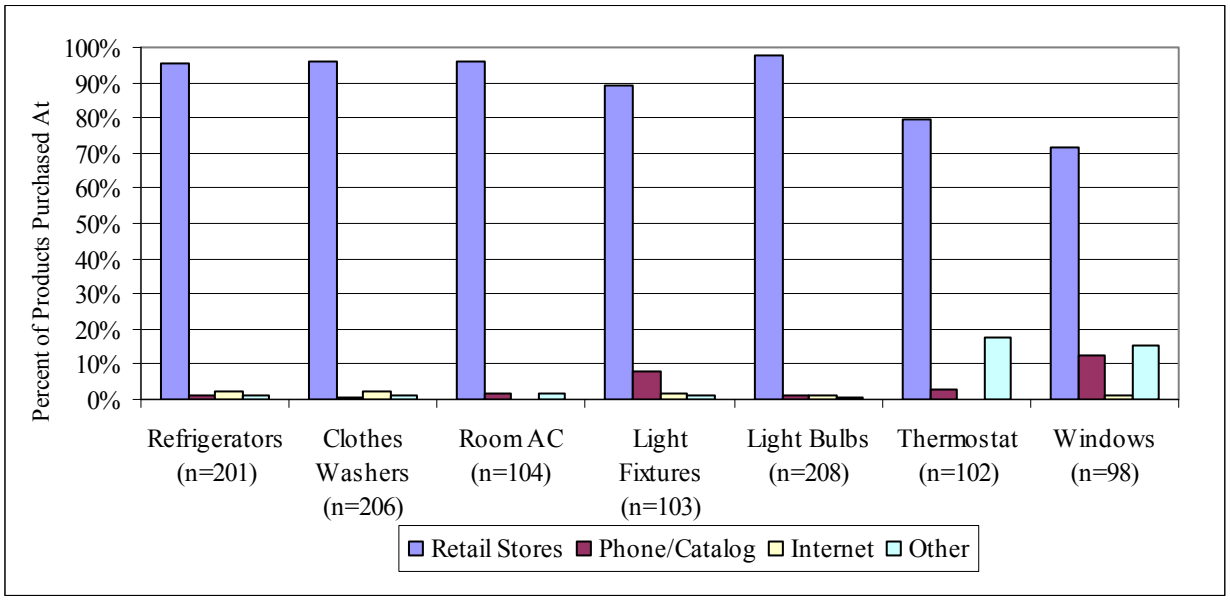




Source: NJESP Consumer Survey (n=55 window purchasers, representing 414 windows, with store name provided)

Retail stores continue to be the primary outlet in which each of the program products are purchased. Catalog/phone order purchases were a small but significant outlet for lighting fixtures and windows, while purchase through a contractor accounted for a portion of the window and thermostat sales as shown in **Error! Reference source not found.**.

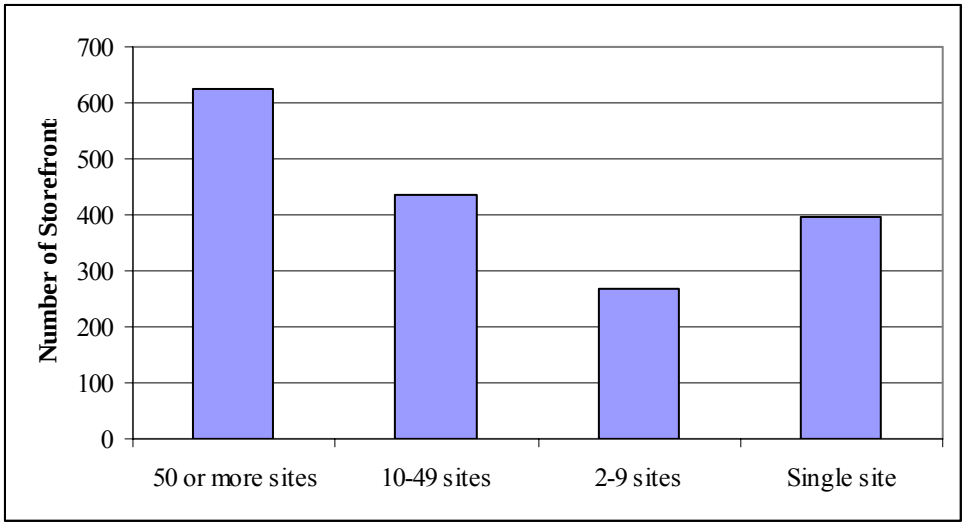
Figure 3-6. Where Products are Purchased



Source: NJESP Consumer Survey (n=990)

The program has a mix of large, big box retailers, small regional chains, and single-store sites. This mix provides broad coverage of the market as each of these store types is likely to serve different segments of the residential consumer market. **Error! Reference source not found.** shows the distribution of storefronts based on the number of sites associated with a specific retailer.

Figure 3-7. Distribution of Storefronts for Participating Retailers



Source: Participating Retailer Database

Though there is this wide distribution of retailer participation through the program, there is significant market concentration amongst the largest retailers. For example, the top five retailers sell 72% of all bulbs

sold, 64% of all lighting fixtures, and 61% of all clothes washers (**Error! Reference source not found.**). The results from this distribution channel analysis highlight the increasing importance – and dominance – of selected "big-box" retailers. Note that four of the top five retailers are partners of both the NJ and the National ENERGY STAR Programs, and one, Shoprite, is a NJ partner only.

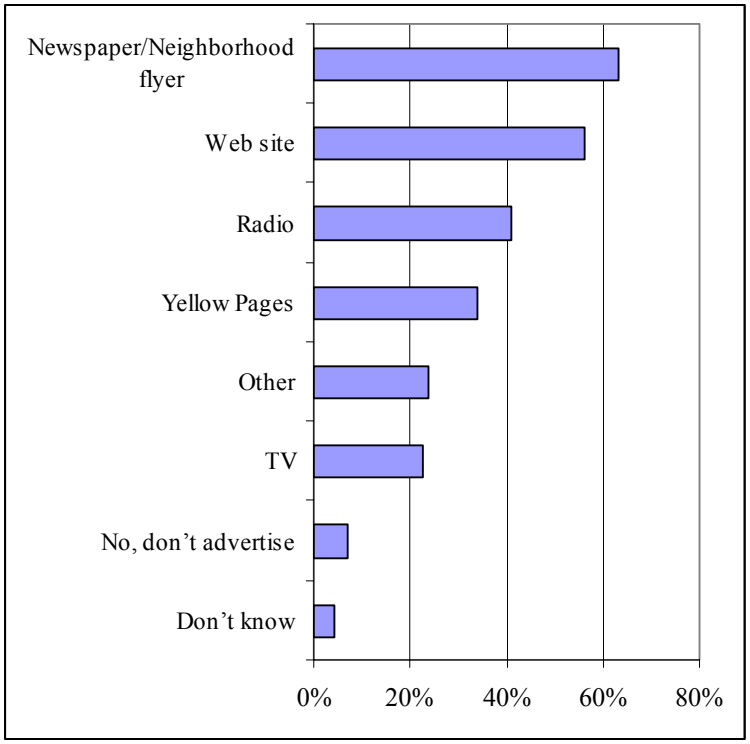
Table 3-8. Market Share for Top Five Retailers

Store	Refrigerators (n=212)	Clothes Washers (n=177)	Room ACs (n=174)	Lighting Fixtures (n=244)	Bulbs (n=689)
Sears	33%	42%	15%	0%	0%
Wal-Mart	0%	0%	10%	4%	7%
Home Depot	7%	5%	22%	45%	43%
Lowes	10%	14%	7%	15%	6%
ShopRite	0%	0%	1%	0%	16%
Total Top 5 Stores	**50%**	**61%**	**55%**	**64%**	**72%**

Source: NJ ENERGY STAR Consumer Survey

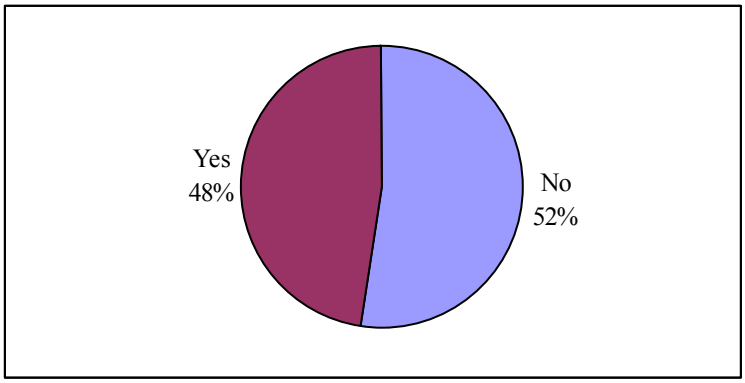
Retailers were asked about their efforts to promote ENERGY STAR products. Most retailers advertise their products using a variety of mediums as shown in **Error! Reference source not found.**. Almost half of the respondents that advertise indicated that they mention the ENERGY STAR label in their advertising as shown in **Error! Reference source not found.**. Of those including ENERGY STAR in their advertising, 12% indicated they had increased the use of ENERGY STAR significantly, 65% percent indicated that the had increased use somewhat, and only one respondent (3%) indicated decreasing use of the ENERGY STAR label.

Figure 3-8. Advertising Mediums Used by Retailers



Source: NJ ENERGY STAR Products Retailer Survey, n = 71

Figure 3-9. Retailer Use of ENERGY STAR in Advertising



Source: NJ ENERGY STAR Products Retailer Survey , n = 65

When considering the use of ENERGY STAR in advertising, retailers offered the following insights.

"More likely to use it for clothes washers - the efficiency is more easily seen!!!"

"Advertising depends on models available."

"Advertising decisions made by buying group." [114]

"Corporate office makes advertising decisions - what is advertised and how."

Manufacturer Participation

Many specifics of manufacturer participation were not clearly defined at program inception. This lack of structure has led to a detachment between the manufacturers of ENERGY STAR-qualified products and their role, if any, in the New Jersey ENERGY STAR Products Program. Through surveys with manufacturers on the list of participants, the team found several interesting trends. Eight of the 37 individual manufacturer respondents said that they were aware of the NJ ENERGY STAR Program.[115] One of the respondents stated, "*You need to market the program better to manufacturers as I was not aware that NJ had an ENERGY STAR fixture program*."

However, almost 90% of the respondents were aware of and participated in other ENERGY STAR programs and efforts, including the National ENERGY STAR Program sponsored by the EPA. These responses should be cause for concern as they indicate a lack of communication and connection to the program and its activities.

The team did not receive any information regarding participating programmable thermostat manufacturers. The national program has 42 partner manufacturers; of these, 30 currently have products listed as ENERGY STAR-qualified. The lack of a participating programmable thermostat manufacturer list reinforces the concept (received through the retail surveys) that the thermostat program is not well recognized through the NJ ENERGY STAR Products Program.

Over 90% of the manufacturer respondents said that they promote ENERGY STAR through their own marketing materials. Additionally, almost half of the respondents said that they have increased their use of the brand and label in their own marketing materials. It is interesting to note that this is mainly through printed advertising and packaging changes. The respondents were generally unable to give feedback about the cooperative advertising aspect of the NJ program. The team has noticed a general, nationwide trend where manufacturers generally coordinate with large retailers and not with individual programs.

Trade Ally Training

Trade ally training seems to be a challenging area for the New Jersey ENERGY STAR Products Program. Less than 15% of the participating retailers surveyed indicated that they had attended New Jersey's ENERGY STAR Products Program training. Along these lines, more than 90% of respondents stated that they had not attended regional or national energy efficiency training. Of those that had attended the training, universally they indicated that the training aided them in their:

- Promotion of ENERGY STAR products
- Awareness and knowledge of ENERGY STAR products
- Ability to educate consumers regarding ENERGY STAR products
- Ability to sell ENERGY STAR products

[114] Many of the smaller retailers (those with single or few sites) are members of buying groups that coordinate purchasing and advertising decisions on behalf of the individual entities.

[115] Twenty-three manufacturers indicated that they did not participate and six did not know their participation status.

Also, retailer feedback indicates that nearly half (33 of 75) receive some type of formal group training at least once a year. Of those that receive formal group training, all but one indicated that training addressed energy efficiency aspects. Small retailers were less likely to have group training because the staff is so small it's more efficient for them to train on an individual basis. Training was likely to occur just one time per year. More frequent training opportunities may keep retailers abreast of product changes and program developments. This is an area that should be reexamined in order to determine if more program-specific training needs to occur.

Of those that received in-store training (n=33), 49% indicate training was provided by manufacturer representatives, while approximately 45% indicated training was delivered by a program representative. Ten of 69 respondents indicated that they had attended off-site program-sponsored training. Since only a portion of the retailers are getting program training, expansion of this effort may be warranted as it would be less brand focused and able to provide unbiased information about general energy efficiency traits.

In particular with appliances and windows, retailers are receiving training about energy efficiency from manufacturer representatives. While this is an excellent sign that manufacturers are ensuring that retail staff are educated about certain high efficiency products, program-related training is still important.

A system that identifies available training (and allows for easy registration and scheduling) as well as tracks the completion of training by individuals and by company would provide greater certainty in assessing the overall training needs and accomplishments of the program.

Similarly, lack of awareness of the NJ ENERGY STAR Products Program meant that manufacturers were not well versed in the training provided through the program. Unfortunately, the lack of awareness amongst manufacturers was also seen when the team asked about the training they received. Of the eight manufacturers indicating that they participated in the program and were aware of the training offered, five indicated that the training was not effective. Again, these results are not surprising given that most of the respondents were unaware of the New Jersey program and the status of their participation in that program.

Clearly, this is an area where there is a great deal of potential to strengthen the relationships between manufacturer and the NJ program. A recent study conducted by Quantec for the Northeast Energy Efficiency Partnerships found that retailers and manufacturers participating in windows training in New Jersey were generally extremely satisfied with the training.[116] The primary recommendations were to:

- Provide technical training that complements the sales training, perhaps in coordination with DOE or another organization in order to provide the most up-to-date and sophisticated information.
- Encouraging manufacturers and retailers to attend market trainings together, in an effort to improve their ENERGY STAR windows dialogue.
- Leveraging training to market the program and engage nonparticipating retailers.
- Collect participant email addresses for use with sending follow-up announcements and providing information, as well as to offer refresher courses.

Manufacturers may not need training about high efficiency products, as they are often the source of that training, and have presumably have a high familiarity with the products they manufacturer. However, they clearly need training about what options there are in the NJ program and how they might be able to take advantage of opportunities.

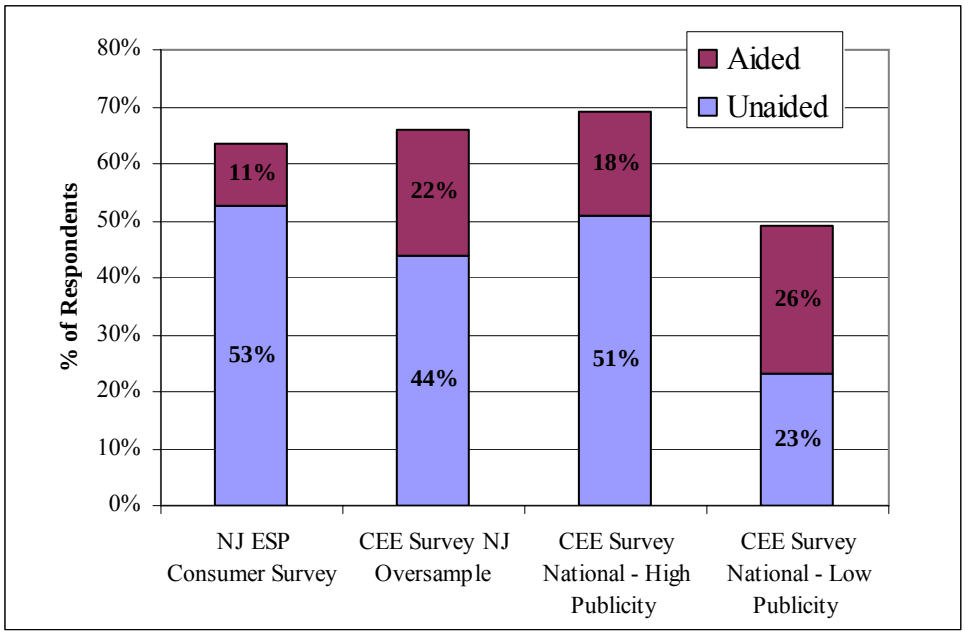
[116] Quantec, *Residential Market Assessment for ENERGY STAR Windows in the Northeast, Final Report.* January 2006.

3.2.2 Awareness and Knowledge

Public Awareness, Consumer Knowledge, and Demand

One of the critical indicators of program success is consumer awareness, knowledge, and demand for ENERGY STAR products. As shown in **Error! Reference source not found.**, approximately 64% to 66% of consumers in New Jersey are aware of the ENERGY STAR label.[117] Interestingly, although consumer awareness in New Jersey was higher than areas of the United States with low publicity (no local ES programs, 49% aware), it trailed other areas of the U.S. that were running ENERGY STAR programs and had high levels of exposure to related messaging (69% aware). The slightly lower percent of NJ consumers aware of ENERGY STAR vs. other high publicity areas of the U.S. might result from the reduced marketing budget faced by the program, compared to other programs that focus less on rebates and more heavily on cooperative advertising.

Figure 3-10. ENERGY STAR Awareness Levels

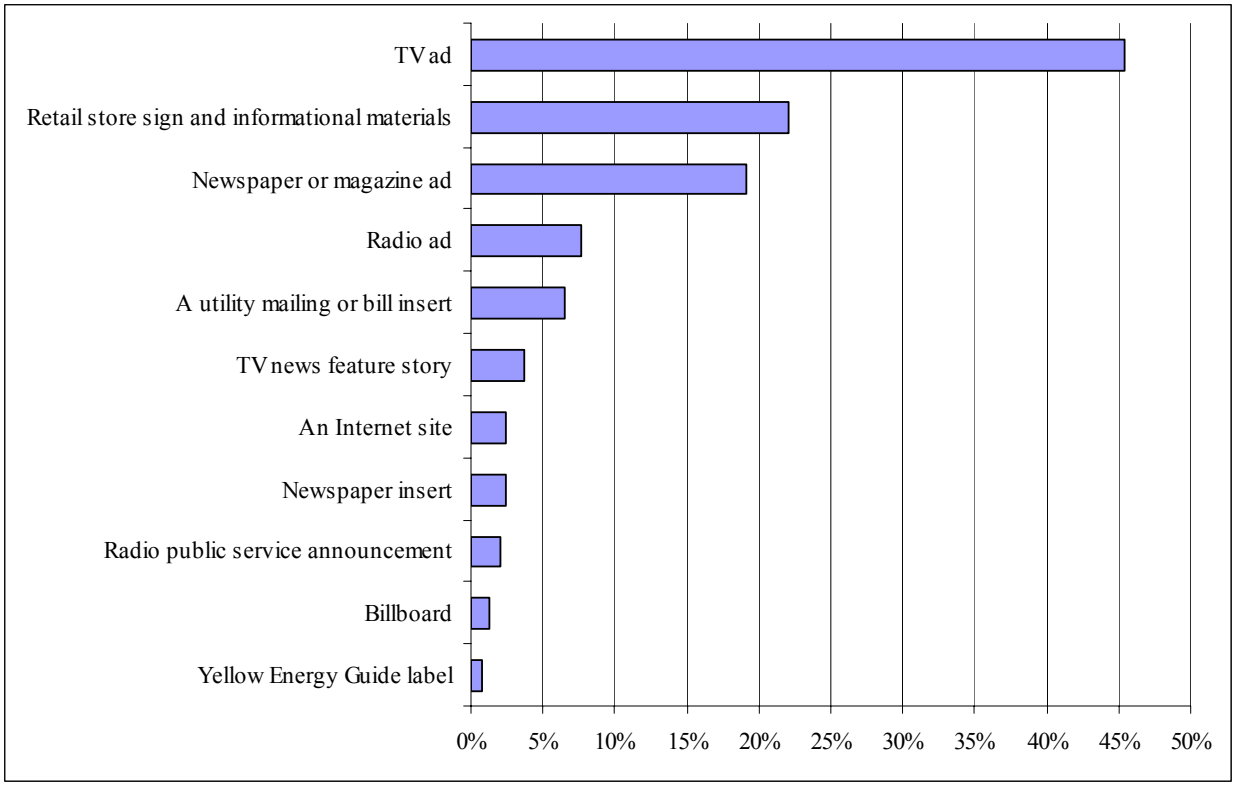


Source: NJESP Consumer Survey (n=990), 2005 CEE NJ Oversample for CEE Web Survey (n=216), 2005 CEE National Web survey (n=1,225)

Consumers heard or saw information about the ENERGY STAR label from a broad range of sources, as shown in **Error! Reference source not found.**. Primary sources of information regarding the ENERGY STAR label were TV advertising, retail store signage or materials, and print advertising.

[117] Differences in the aided/unaided responses between the consumer phone survey and CEE Web survey NJ oversample occur because of the different modes. Web surveys provide the best medium to assess actual unaided (simply asked awareness) vs. aided (shown a visual aid such as the ENERGY STAR logo).

Figure 3-11. How Consumers Learned of ENERGY STAR Label

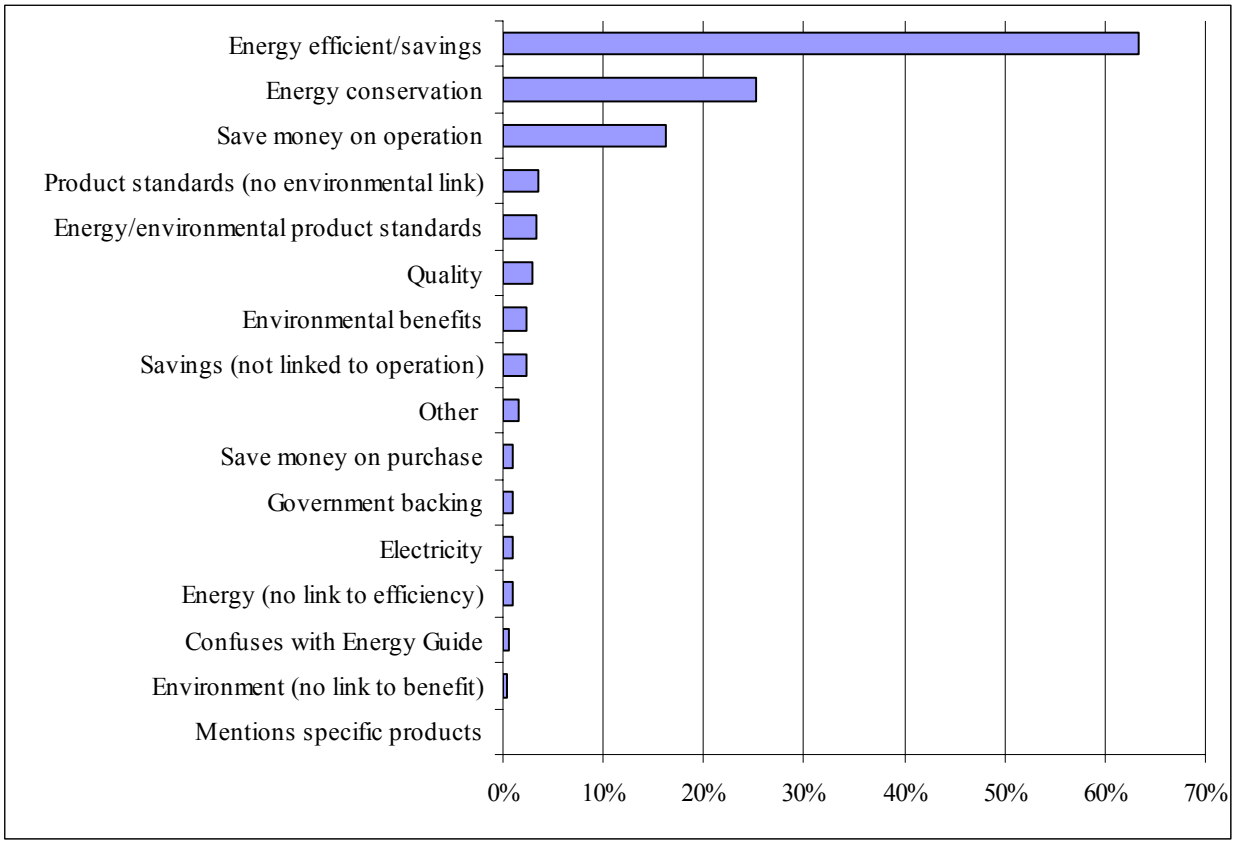


Source: NJ ENERGY STAR Products Consumer Retailer Survey, n = 382.

When asked about what ENERGY STAR means, respondents to the NJ Consumer Retailer Survey gave a wide range of answers (**Error! Reference source not found.**). More than 60% related ENERGY STAR directly to energy efficiency, and more than 20% referred to energy conservation[118]. When cost savings categories are combined they account for approximately 20% of responses, and 8% related ENERGY STAR to the environment (standards or benefits).

[118] Energy efficiency is commonly thought of getting the same level of service (be it lighting, heating, cooling) using less energy. Conservation would be reducing the amount of service used.

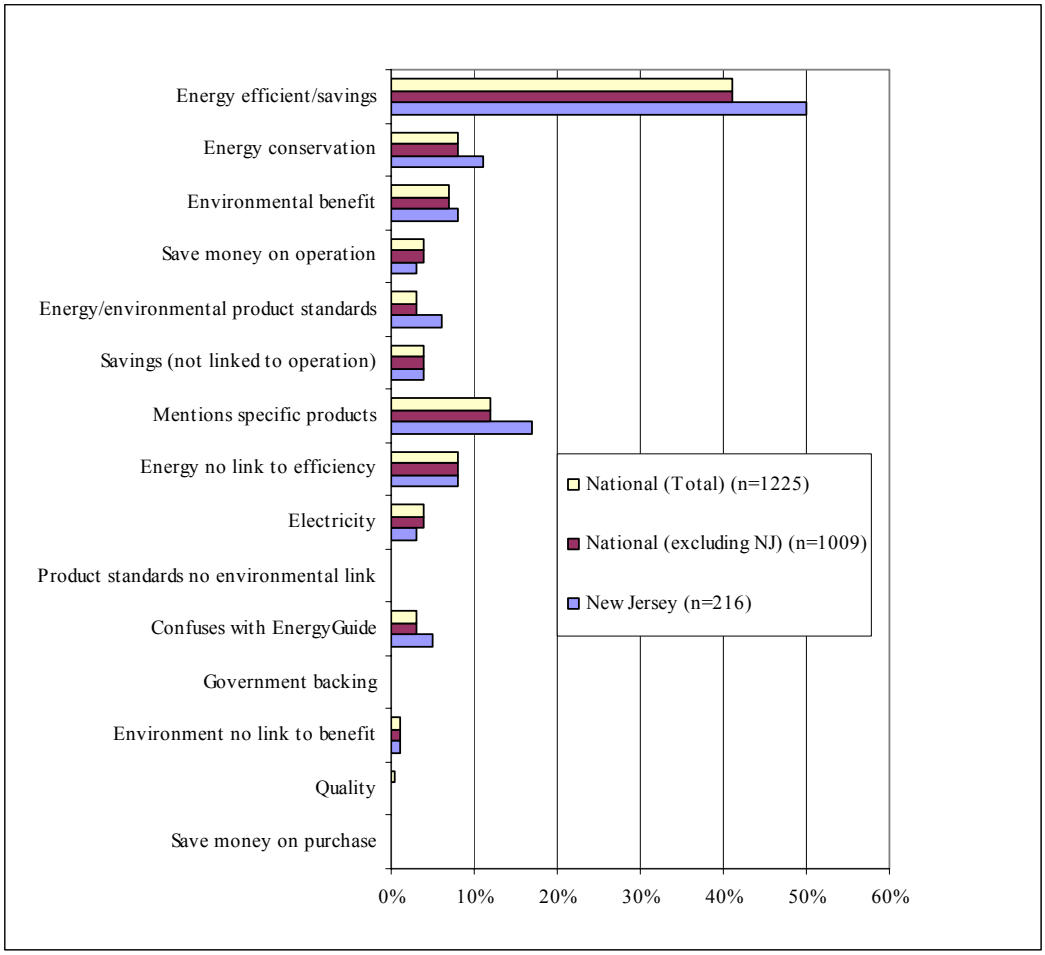
Figure 3-12. Meaning of ENERGY STAR Label to Consumers – NJ ENERGY STAR Products Consumer Survey



Source: NJ ENERGY STAR Products Consumer Retailer Survey (n = 636)

A similar question was asked of respondents to the CEE Survey. Responses to the CEE survey are shown in Error! Reference source not found.. In this survey, again the most common response was energy efficiency and savings, followed by specific mention of a product.

Figure 3-13. Meaning of ENERGY STAR Label to Consumers – CEE Survey



Source: CEE Survey

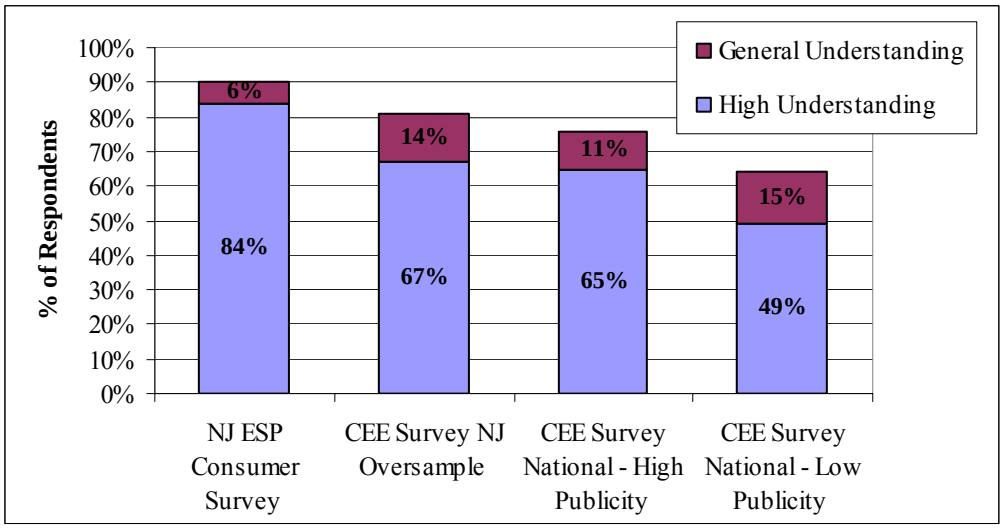
For each of the surveys, consumer responses can be categorized as indicative of either a high understanding of the ENERGY STAR label or a general understanding. **Error! Reference source not found.** shows the categorization of each potential response. Non-respondents or those responding "Don't know" were assumed to have no understanding.

Table 3-9. Categorization of ENERGY STAR Meaning Responses

High Understanding	General Understanding
• Energy-efficient/savings • Energy conservation • Environmental benefit • Save money on operation • Energy/environmental product standards • Savings (not linked to operation)	• Mentions specific product • Energy (no link to efficiency) • Electricity • Product standards (no environmental link) • Confuses with Energy Guide • Government backing • Environment (no link to benefit) • Quality • Save money on purchase

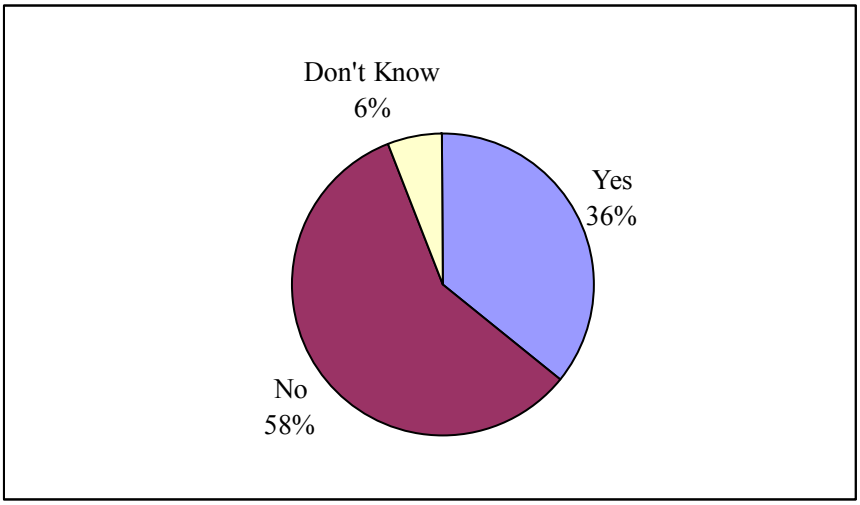
Based on these categorizations, the level of understanding of respondents to the NJ Energy Star Products Survey to the respondents to the CEE Survey are shown in **Error! Reference source not found.**. Note that the respondents to the NJ Energy Star Products survey had purchased a product at some point in the past year that could have influenced their understanding of the label meaning. **Error! Reference source not found.** shows that many of those respondents were not aware of ENERGY STAR prior to shopping for a particular product.

Figure 3-14. Level of Understanding of the ENERGY STAR Label



Source: NJESP Consumer Survey (n=557), 2005 CEE NJ Oversample for CEE Web Survey (n=216), 2005 CEE National Web survey (n=1225)

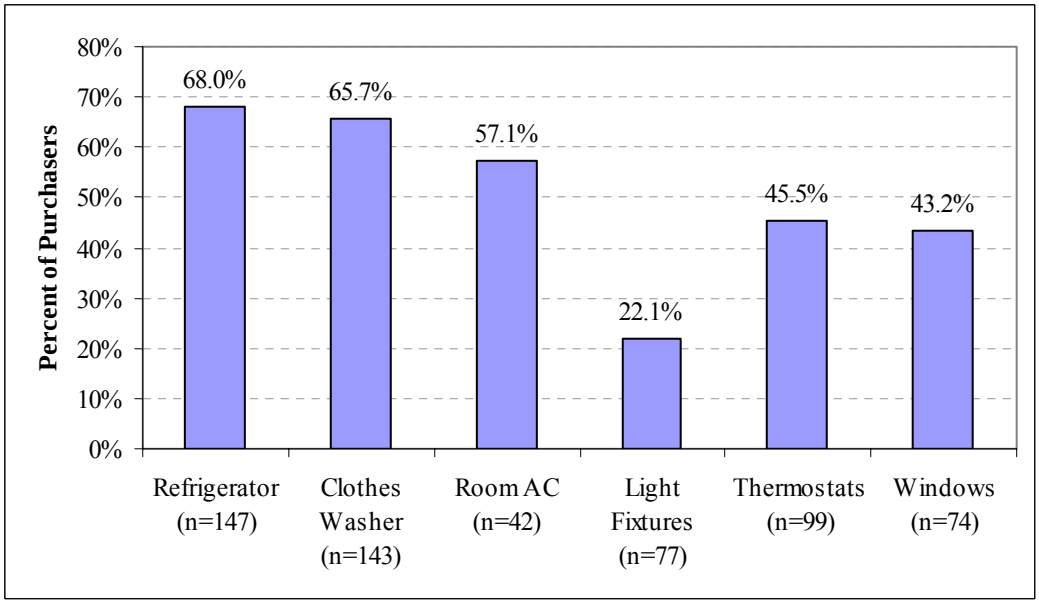
Figure 3-15. Awareness of ENERGY STAR Before Shopping for Products



Source: NJ ENERGY STAR Products, n=332

Of those respondents that were aware of ENERGY STAR, a high percentage reported purchasing at least one ENERGY STAR-labeled product. We note in our discussion of market share the challenges with using self-reported data, but present the feedback from consumers in **Error! Reference source not found.**.

Figure 3-16. Percent Purchasing an ENERGY STAR-Labeled Product (Based on Self-Reporting)

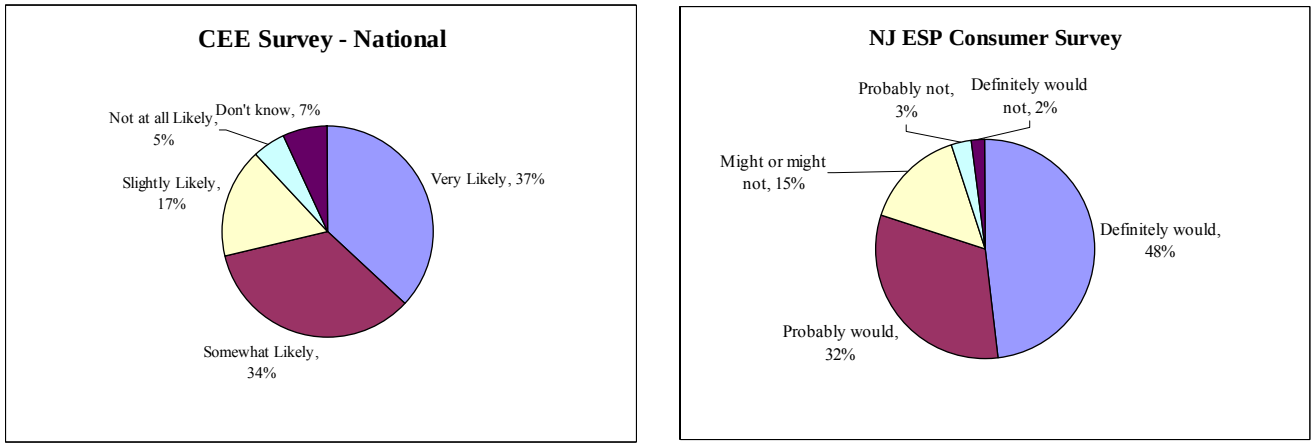


Source: NJ ENERGY STAR Products Consumer Survey

In both the NJ ENERGY STAR Products Consumer Survey and the CEE survey, those consumers that had purchased an ENERGY STAR product were asked about their likelihood to recommend ENERGY STAR to another person. In both cases, a majority indicated they would likely recommend ENERGY STAR. A somewhat higher percentage of the New Jersey respondents indicated they definitely would

recommend ENERGY STAR (48%) compared to those who indicated they were "Very Likely" to recommend in the national CEE survey (37%).

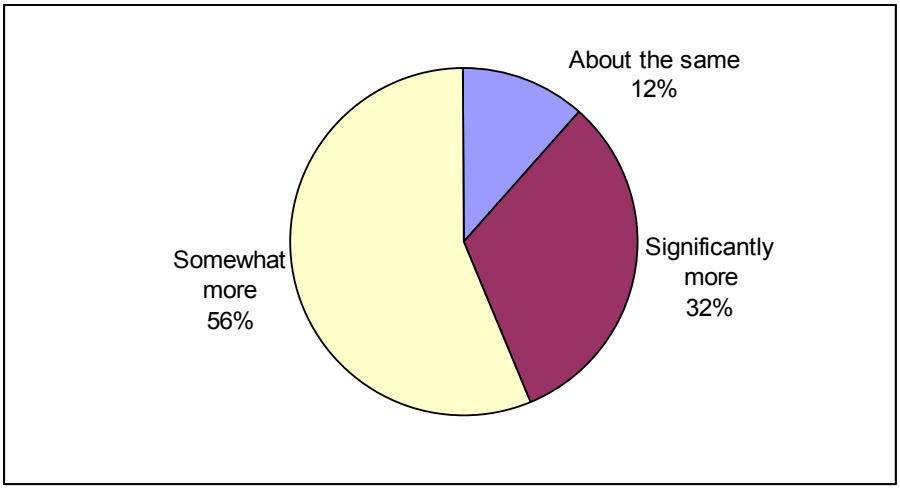
Figure 3-17. Likelihood of Recommending ENERGY STAR



Source: CEE Survey – National (n=202) NJ ENERGY STAR Products Consumer Survey (n=382)

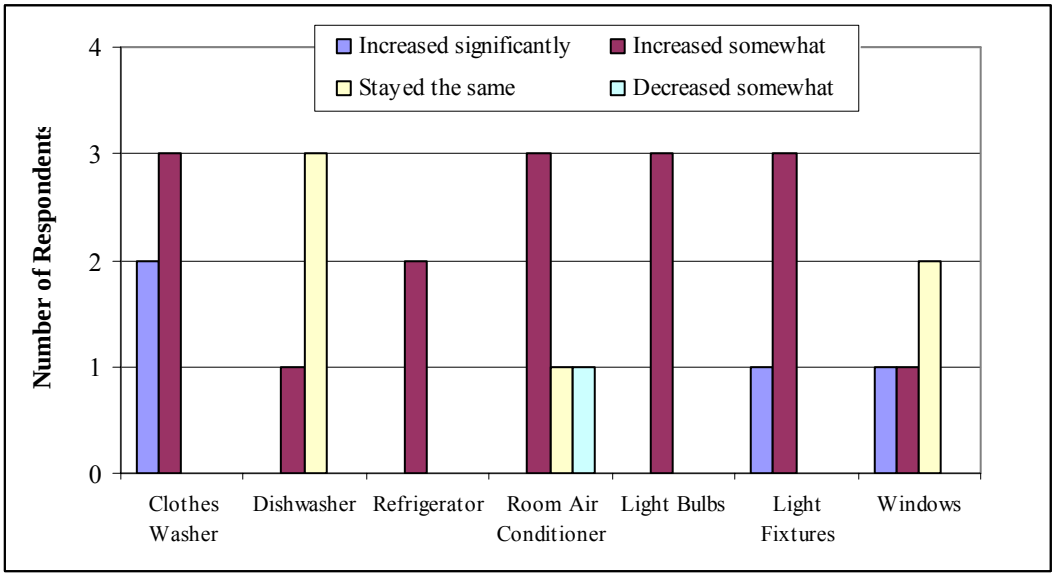
Retailers were asked about consumer inquiries related to ENERGY STAR products. Of the 59 retailers that responded to the question "*In what percentage of all your current sales transactions do customers ask for or about ENERGY STAR?*", they indicated 1 in 8 consumers (12.5%) coming in to their store asked about ENERGY STAR. When asked how consumer interest had changed over the past 3 years, 88% of retailers indicated increased consumer interest in the ENERGY STAR products as shown in **Error! Reference source not found.**. No retailers reported a decline in interest in ENERGY STAR-labeled products. Retailers attribute increases in consumer interest to mass media advertising, increased selection of ENERGY STAR products, concern about rising energy prices in the wake of Hurricane Katrina, and enhanced understanding of the energy and cost savings benefits of the label. Likewise, manufacturers attributed increased demand to program efforts, increasing energy costs, and greater consumer knowledge and awareness.

Figure 3-18. Retailers' Impressions of Changes in Consumer Interest in ENERGY STAR Products



Source: NJESP Retailer Survey (n=69)

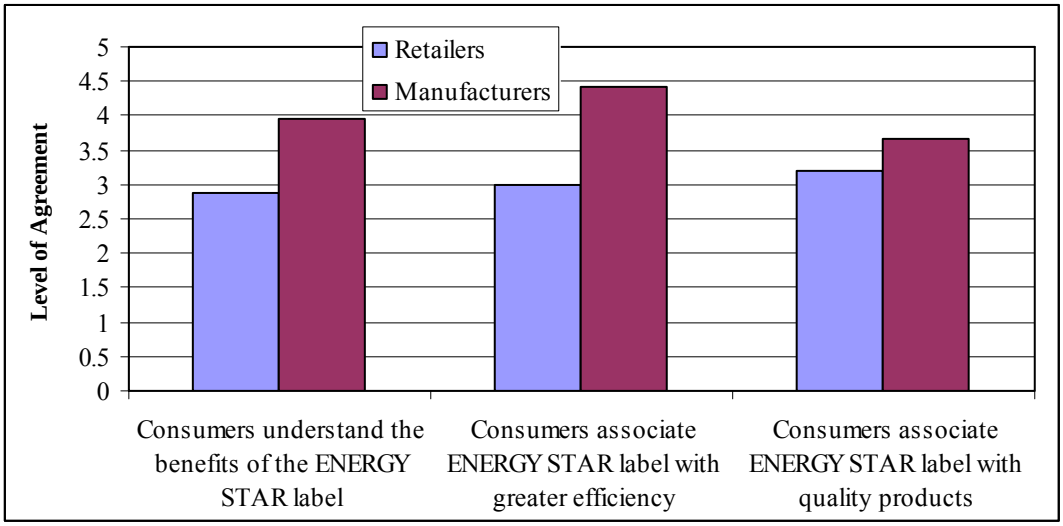
Figure 3-19. Manufacturers' Impressions of Changes in Consumer Interest in ENERGY STAR Products



Source: New Jersey ENERGY STAR Products Manufacturer Survey

Interestingly manufacturers felt that consumers had a better understanding of the meaning of the ENERGY STAR label than retailers did. Manufacturers also felt that there was a greater association with efficiency benefits and quality (**Error! Reference source not found.**).

Figure 3-20. Retailers' Perceptions of Consumer Understanding



Source: NJ ENERGY STAR Products Retailer Survey (n=62) NJ ENERGY STAR Products Manufacturer Survey (n =37)

Trade Ally Awareness and Knowledge

Retailers express greater awareness and knowledge about the availability and benefits of ENERGY STAR qualifying products. Retailers also note greater interest by consumers in ENERGY STAR and increased

sales of qualified products. Retailers attributed these increases in ENERGY STAR sales to many different things. Some of the common themes mentioned were:

- More customers desired ways to save due to rising energy costs.
- Greater variety of ENERGY STAR models available. Retailers said that all manufacturers are creating more ENERGY STAR-qualified models.
- Over time, the price (and incremental cost) of ENERGY STAR products has decreased.

Retailers and manufacturers that sold specific product categories were asked about their familiarity with the ENERGY STAR models of those products. Nearly all the retailers that sold appliances (clothes washers, dishwashers, and refrigerators) indicated that they were very familiar (62%) or somewhat familiar (33%) with the ENERGY STAR models.[119] **Error! Reference source not found.** clearly indicates the high level of retailer familiarity with these products. Only 5% of respondents indicated that they are not at all familiar with these items.

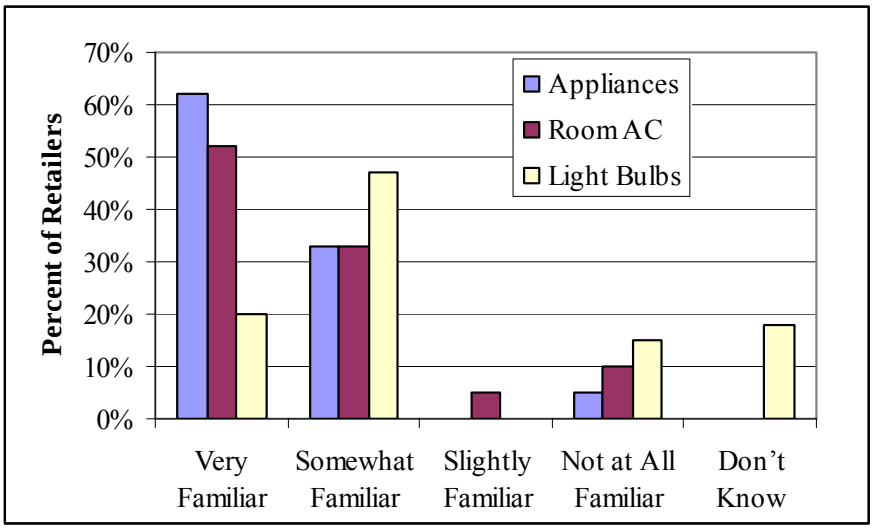
Nonparticipating retailers indicated a similarly high level of awareness related to ENERGY STAR products, but were less aware of the program. Nonparticipating retailers indicated the most effective mechanism to gain participation would be to provide more marketing to retailers – as one respondent said,*" They need to provide more information about what opportunities are available."*

Retailers selling room air conditioners, also reported high familiarity, although slightly lower than appliances, with the ENERGY STAR models. For example, 85% of room air conditioner retailers were either very familiar (52%) or somewhat familiar (33%) with the ENERGY STAR models. The slightly lower level of familiarity with ENERGY STAR-labeled room air conditioners may be due in large part to the tendency (in the past) of large home improvement stores to sell these products through their seasonal departments and not their appliance departments.

Familiarity with ENERGY STAR-qualified bulbs was the lowest of the three product categories. Only 20% of the lighting retailers said that they were very familiar with the product in comparison to over 60% for all the appliance types. Much of the lack of growth in familiarity for CFLs likely stems from the type of retailers that participate in the program for lighting. Employees of grocery stores, drug stores, and discount retailers tend to focus on other aspect of the business. In particular, the assessment team discovered that most of the grocery stores outsource their lighting inventory to a third-party vendor (i.e., a third-party, typically a lighting manufacturer representative, manages the product selection, stocking, and display). This lack of familiarity and knowledge is inherent to these retail outlets. Additionally, these retailers typically experience much higher rates of turnover, especially when compared to small appliance retailers. All these factors combine to make it more difficult to have well-informed salespeople for the bulb effort.

[119] The answers for all three appliances were identical so they are presented together.

Figure 3-21. Retailer Familiarity with ENERGY STAR Products



Source: NJ ENERGY STAR Products Retailer Survey (n=21 for clothes washers, dishwashers, refrigerators, and room air conditioning; n= 40 for light bulbs)

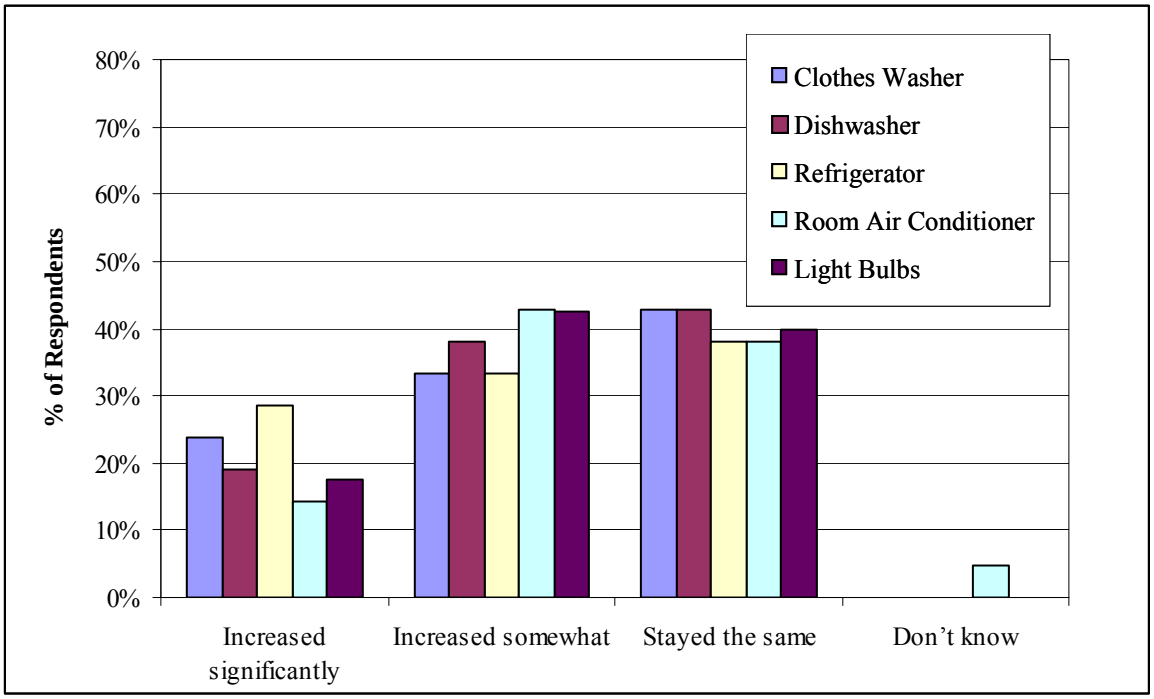
The New Jersey retail partners indicated that their awareness, knowledge, and familiarity with all program ENERGY STAR products has increased over the past year. In fact, for all ENERGY STAR-labeled products, even light bulbs, more than half of the participating retailers indicated that they had increased their familiarity with the ENERGY STAR product in the past year (**Error! Reference source not found.**). Retailers attribute changes in familiarity with various program aspects to:

- Training delivered through the program and other industry sources (vendors, manufacturers)
- Increased product availability – including a larger selection of models
- Increased consumer interest and demand
- Participation in the ENERGY STAR Products Program
- Training on increased options available through buyer groups
- Growing industry knowledge

In some cases the increase in familiarity was due to the tenure of the respondent. This was especially true for the larger retailers that have more staff turnover.

> *"I have learned a lot because I started about a year ago and had no prior knowledge. I received a great deal of training from manufacturer reps & corporate (sic) trainers."*

Figure 3-22. Changes in Retailer Familiarity with ENERGY STAR Products Over Past Year

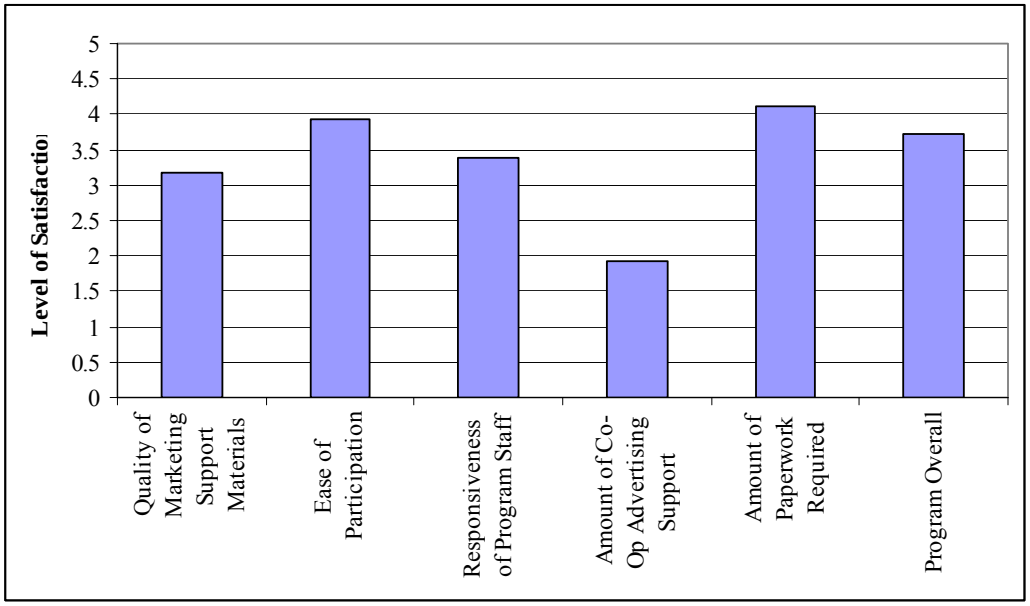


Source: NJ ENERGY STAR Products Retailer Survey (n=21 for clothes washers, dishwashers, refrigerators, and room air conditioning; n=40 for light bulbs)

3.2.3 Trade Ally Satisfaction

Retailers reported moderate satisfaction with the program. Retailers were asked about their satisfaction with various aspects of the program and the program overall. They were asked to give a rating on a scale of 1 to 5 where 1 was "Not at All Satisfied" and 5 was "Very Satisfied." The average rating given by the retailers is shown in **Error! Reference source not found.**. Ease of participation and the limited amount of paperwork required were definite strengths of the program. On the other hand, though, retailers were very interested in additional cooperative advertising opportunities.

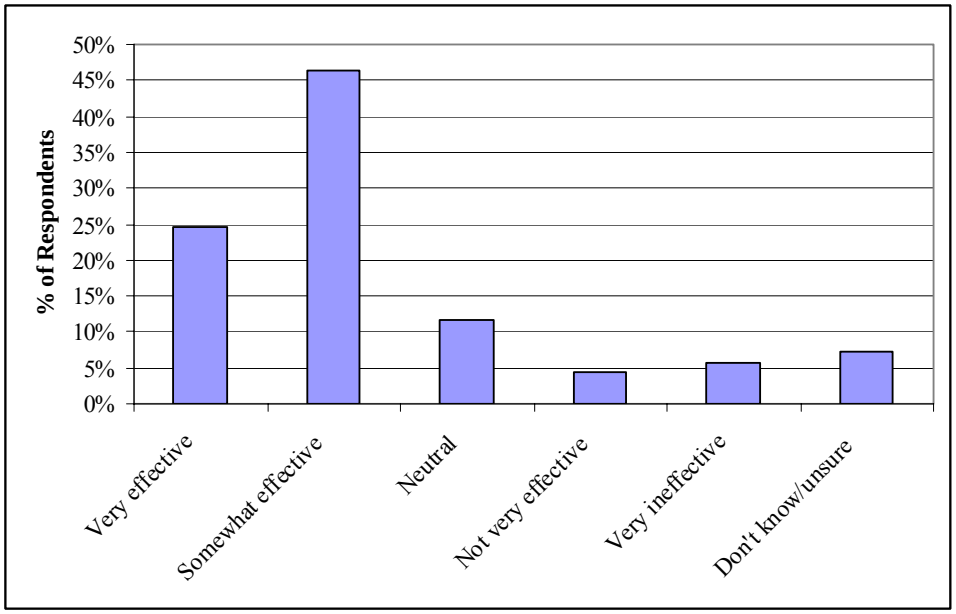
Figure 3-23. Retailer Satisfaction with the NJ ENERGY STAR Products Program



Source: NJ ENERGY STAR Products Retailer Survey (n=60)

It is important to note that many retailers credited the New Jersey ENERGY STAR Products Program directly with the increase in ENERGY STAR sales and share since consumers became aware of their options through program efforts. In particular, retailers did not carry ENERGY STAR lighting products prior to the program and some of them continue to stock CFLs regularly. Also, over 70% of retailers surveyed rated the program as effective and only 10% considered it not effective as shown in **Error! Reference source not found.**. This positive feedback indicates that the program has been successful in beginning the process of transforming the market for energy-efficient products in New Jersey.

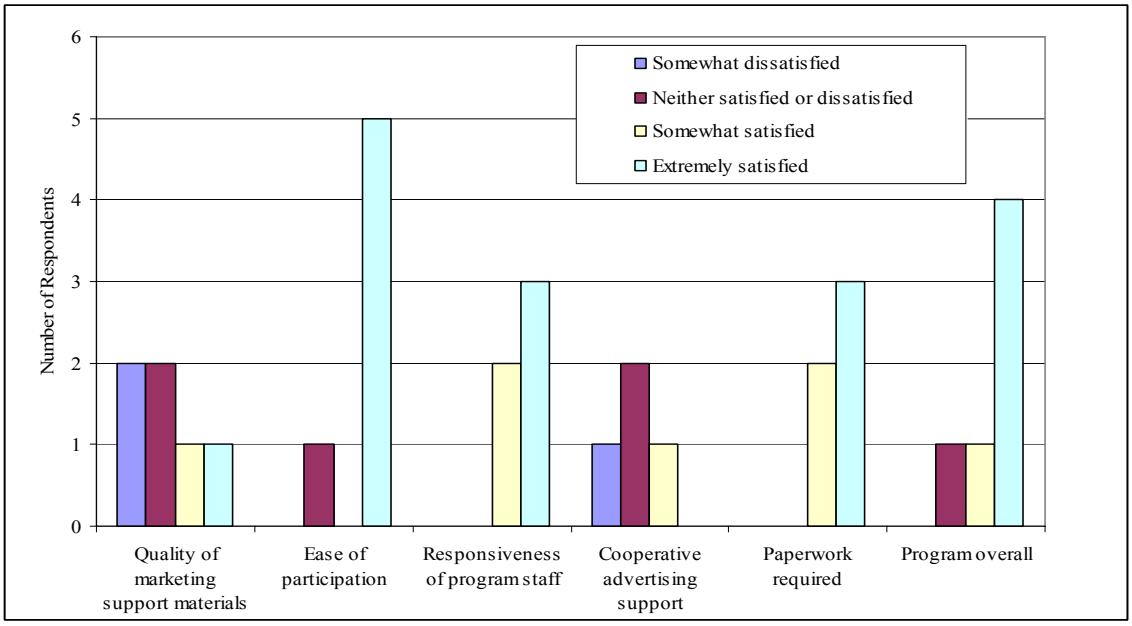
Figure 3-24. Retailer Assessment of Overall Program Effectiveness



Source: NJ ENERGY STAR Retailer Survey (n=69)

Assessing manufacturer satisfaction with the Program, however, is much more difficult. The list of contacts for the manufacturer survey came from Honeywell as a list of "participating" manufacturers. However, only 20% of manufacturer respondents indicated definitively that they participated in the program. At one time, a trade ally newsletter was provided for retailers and manufacturers. While some of the manufacturers received the newsletter and were made aware of program opportunities, they did not actively participate. Overall, the manufacturers that were aware of their participation seemed to be pleased with the program. Among the nine acknowledged participants, four believed the program was very effective and three believed the program was somewhat effective (two did not rate effectiveness). When asked about the effectiveness of various program aspects, the following responses were provided (**Error! Reference source not found.**).

Figure 3-25. Manufacturer Satisfaction with NJ ENERGY STAR Products Program



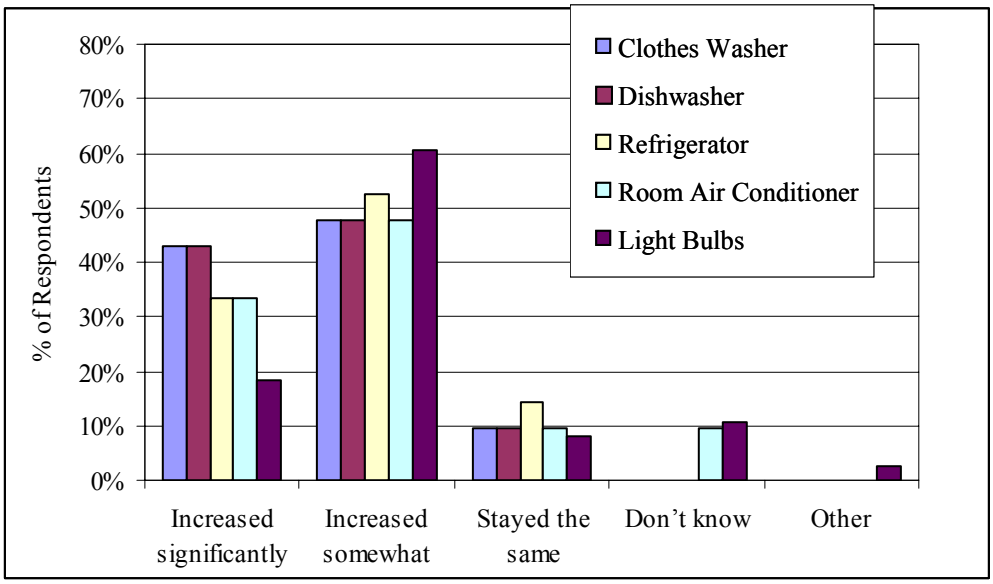
Source: NJ ENERGY STAR Products Manufacturer Survey

3.2.4 Product Availability

One of the best ways to measure the changes in product availability is to examine the amount of display space allocated to each item. Overall, 80% to 90% of retailers reported increased floor space dedicated to ENERGY STAR products over the past three years (**Error! Reference source not found.**). In particular, this growth is important and noticeable for bulbs. Some of the participating retailers indicated that they did not even stock CFLs prior to joining the program. Now, many of them carry this product year-round (instead of just during the two-month Change-A-Light campaign). The program was responsible for these changes that will continue to assist New Jersey residents with purchasing high-efficiency light bulb as indicated by the following retailer comments.

> *"Rite Aid did not carry CFLs prior to the program last year. Now, they regularly stock them."*
>
> *"They didn't carry them [CFLs] before, but brought in for program. Therefore, it increased."*
>
> *"Big Lots has only really carried the ENERGY STAR lighting for the past year or so. Customers have responded well to the rebates. Have seen good increases over the past year."*

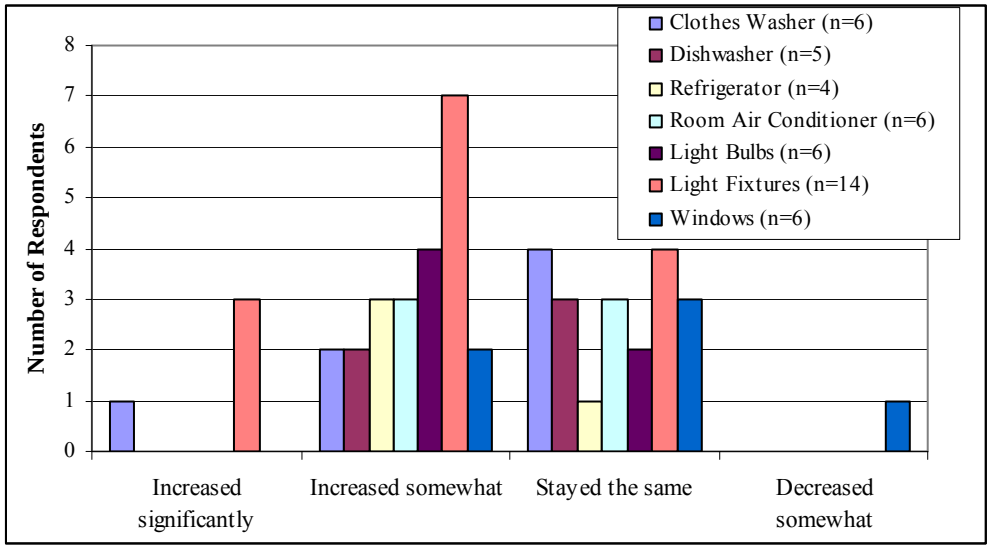
Figure 3-26. Change in Retail Floor Space for ENERGY STAR Products in Program – 2003 - 2005



Source: NJ ENERGY STAR Products Retailer Survey (n=21 for clothes washers, dishwashers, refrigerators, and room air conditioning; n= 38 for light bulbs)

When asked an analogous question about how the proportion of ENERGY STAR products has changed, manufacturers gave the responses as shown in **Error! Reference source not found.**. More than half of the clothes washer and dishwasher manufacturers stated that their ENERGY STAR product offerings have not changed in the past three years. However, 3 of 4 refrigerator manufacturers stated that their ENERGY STAR offerings have slightly increased during the same time period. For room air conditioners, the respondent split with half (n=3) saying that their line has not changed, but the other three saying that they have somewhat increased their ENERGY STAR product line. For light fixtures, three respondents indicated that they increased their offerings significantly and seven said that that their line has increased somewhat.

Figure 3-27. Change in Proportion of ENERGY STAR Products Manufactured – 2003- 2005



Source: NJ ENERGY STAR Products Manufacturer Survey

Two-thirds of bulb manufacturers have also increased their ENERGY STAR bulbs product line to some extent. Only one respondent, a window manufacturer, stated that they have decreased their ENERGY STAR-qualified product lines during the past three years. All others have either stayed the same or increased their ENERGY STAR offerings.

3.2.5 Estimated Program Energy Savings[120]

The impacts of the program are reported to the BPU on a quarterly basis. The energy and demand savings achieved in 2003 through 2005 are shown in the table below. Savings are attributed to two program components: room air conditioning and Lighting (including Change-a-Light). Savings are calculated using the per unit savings estimates specified in the New Jersey Clean Energy Program Protocols to Measure Resource Savings. [121] The number of units for room air conditioners is determined by the number of rebates processed and paid. For the Change-a-Light (CAL) initiative, the lighting quantities are determined based on the lighting products ordered and shipped to retailers. Per the CAL agreements, these numbers are verified through invoice documentation and site visits.[122] Program impacts have fluctuated with program budgets.

[120] Examples of savings calculations for ENERGY STAR clothes washers, dishwashers, and clothes washers are presented in Section **Error! Reference source not found.**.

[121] BPU Order in Docket No. EO04080894, December 22, 2004.

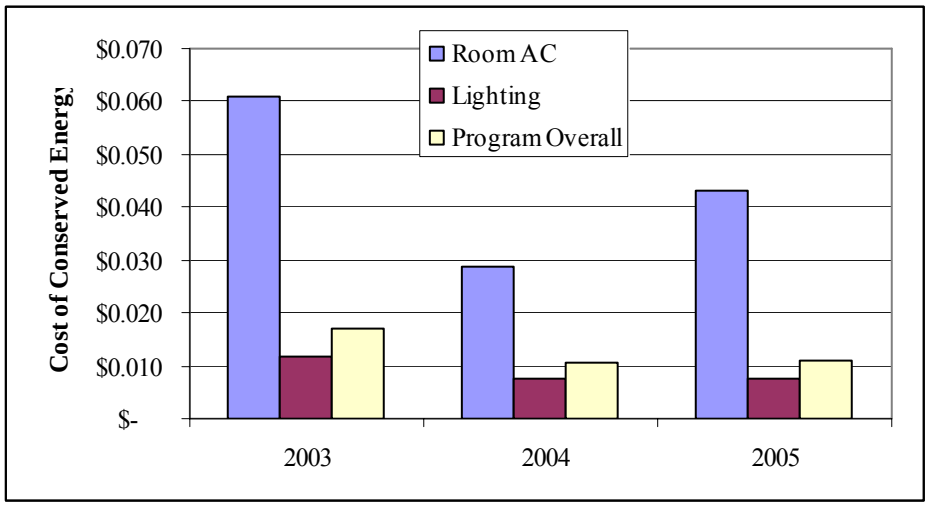
[122] E-mail correspondence with Maura Watkins, February 24, 2006.

Table 3-10. Program Savings

	2003		2004		2005	
	Annual Electric Savings (MWh)	Peak Demand Savings (kW)	Annual Electric Savings (MWh)	Peak Demand Savings (kW)	Annual Electric Savings (MWh)	Peak Demand Savings (kW)
Room Air Conditioning	1,432	1,499	1,377	1,441	921	1,662
Lighting	61,630	3,587	95,947	5,089	62,588	3,222

Cost of conserved energy (CCE) is often used as a metric for evaluating the success of a program. Using a simple formula of dividing annual expenditures by total lifetime energy saved, we calculate the CCE for the room air conditioning component of the program, the lighting component, and the ENERGY STAR Products Program overall. As expected, the CCE declines somewhat after the first year (CCE is higher in the first year because of program start-up costs). Overall, it appears that the ENERGY STAR product program provides cost-effective energy savings with a program level CCE of $0.011/kWh. (**Error! Reference source not found.**). Additional savings may be attributed to the program from increased market share of ENERGY STAR appliances. Inclusion of these savings reduce the CCE, as presented in Section **Error! Reference source not found.**.

Figure 3-28. ENERGY STAR Products - Cost of Conserved Energy



3.2.6 Recommendations for Appropriate Indicators

The evaluation team identified three additional indicators at the beginning of the assessment, those being: Trade Ally Training; Trade Ally Satisfaction; and Trade Ally Awareness and Knowledge. These indicators, along with the ones that had been tracked previously, demonstrate the success of the program well. However, retailer feedback indicated that the lack of program consistency is a significant challenge. Therefore, the addition of an indicator pertaining specifically to program consistency would be valuable. This may be measured in terms of continuity of funding or continuation of key program activities.

In the future, additional training criteria may be a valuable indicator of program progress – i.e., the type of training received by trade allies. Implementer specific documentation is recommended, including a tracking system for program training.

The data tracking associated with the program is limited. A more robust database to track participating trade ally relationships would assist in managing the program and would ensure that data required to inform key metrics to measure program success are available. The database should include, at a minimum:

- Participating retailer name and location
- Key contact information (updated regularly)
- Association with chain or buying group
- Training attendance
- Dates of in-store visits
- Cooperative advertising funding distributed and the contributions by participating retailers

Tracking of the cost of conserved energy would also give a sense of whether program accomplishments continue to align with resource commitments.

Each of the various indicators considered measure program progress. Following is a summary the indications of program progress in each area considered:

- ***Recruiting and training.*** The strong trade ally network is a strength of the New Jersey ENERGY STAR Products program, especially at the retail level. The participating retailers represent approximately 87% of the total targeted products sold in the state. Manufacturer participation was more nebulous, with several unaware of the program and their participation status.

- ***Satisfaction.*** Retailers and manufacturers are moderately satisfied with the Products program (3.7 on a scale of 1 to 5). They rated the process of participation (ease of participating, paperwork requirements) higher than the program features (marketing materials, cooperative advertising opportunities). Nearly half rated the program somewhat effective in addressing the key barriers, while one-quarter rated the program as very effective.

- ***Awareness and knowledge.*** Awareness levels of ENERGY STAR amongst consumers is comparable to awareness levels in other areas of the country with strong ENERGY STAR programs. In addition to awareness, New Jersey consumers had a high understanding of the ENERGY STAR label and its associated benefits. Likewise, retailers and manufacturers reported increased knowledge related to ENERGY STAR-labeled products.

- ***Product availability.*** Availability of ENERGY STAR-labeled products is robust, with both manufacturers and retailers reporting increases in the qualifying product models and more retail space dedicated to displaying qualified products.

- ***Energy savings.*** The program captures significant energy savings, particularly in the area of residential lighting. The annual savings in 2005 is enough to power approximately 7,500 typical New Jersey households[123].

[123] Based on average household consumption of 8,462 kWh based on sales and customer data from http://www.eia.doe.gov/cneaf/electricity/epa/.

3.3 Market Share Assessment

3.3.1 Current Estimates of Market Share

Tracking market share is an imperative step to assess the impact of an energy efficiency products program. There are a number of data sources that are typically used to estimate market share, including:

- ***EPA National Partner Sales Data, Collected by D&R International***. D&R collects sales data from the National ENERGY STAR® partners, combines all partner data (removing retailer names) and publishes them on the Internet in publicly available datasets. These data are extremely detailed, providing ENERGY STAR market share for four appliance types (refrigerators, clothes washers, dishwashers, and room ACs) by state, region, and quarter. The primary caveat to using these data, however, is that the compliance rate with providing sales data fluctuates, as the delivery of sales data is requested but not required to remain in the program. So the data provide useful comparisons for market share based on a sample of national partners within a given year, but multiyear comparisons can be misleading if the number and mix of retailers changes dramatically. Note also that 2005 data were not yet available at the time of this study.

- ***State or Regional Partner Sales Data***. Some states, such as New York, Wisconsin, and California, collect sales data from participating retailers. Similar to the national program, compliance levels may vary. At the time of this study, New Jersey did not have partner sales data that were available for analysis.

- ***Residential End-Use Customer Survey***. Residential end-use customer surveys have been used by a number of other research efforts to assess product market share. The advantages of these studies is that they provide extremely valuable insights into distribution channels, consumer awareness, and consumer perceptions. The disadvantage of these studies is that they typically rely entirely on self-reported customer estimates of efficiency levels, which can be highly inaccurate.

Due to the lack of retailer-reported sales data, the evaluation team chose to conduct a large-scale residential end-use customer survey approach to assess market share.[124] As discussed in the Methodology Section, the survey included a total of 990 respondents, with at least 100 recent purchasers for each of the following products: refrigerators, clothes washers, room air conditioners, lighting fixtures, light bulbs, thermostats, and windows.[125] In order to validate the self-reported ENERGY STAR purchases, respondents were also asked to provide the make and model number of refrigerators and top-loading clothes washers.[126]

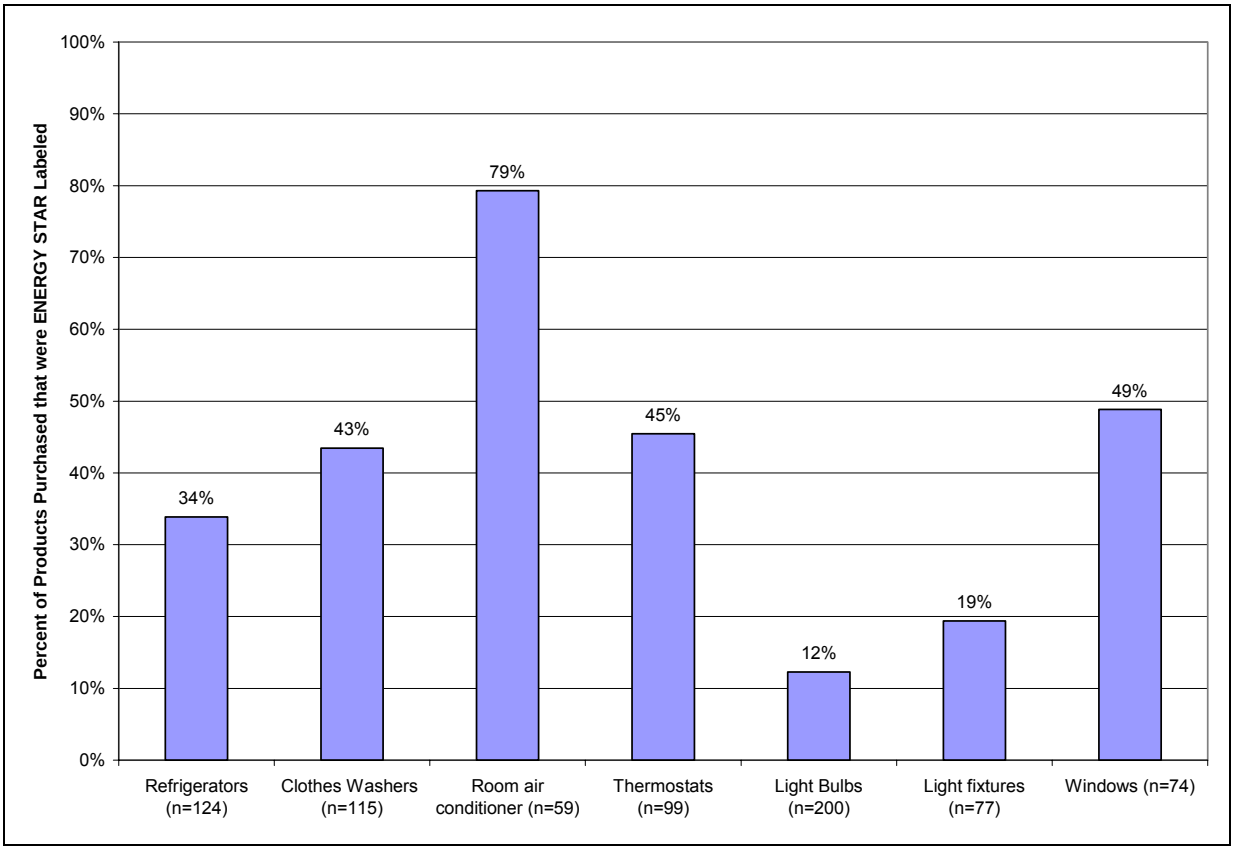
[124] If National retailer partner data become available, however, they may be integrated into the final draft of this report. This would be accomplished by replacing the survey estimated ENERGY STAR market share for the national partners with the D&R reported data, and similarly adjusting the self-reported estimates for the products purchased through other partner or non-partner channels. Note this would only impact the estimates for refrigerators, clothes washers, and room air-conditioners.

[125] According to DOE, ENERGY STAR-labeled dishwashers accounted for 92.5% of all available models with the specification in effect at the time of the survey. Due to the high market share and upcoming new specifications in 2007, dishwashers were not examined in the consumer survey. See "http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/clotheswash/ENERGY_STAR_ClothesWasher_Announcement.pdf"

[126] The make and model number were not collected for other products because it was believed they would not be available (e.g., for room ACs make/model often appears behind a nameplate that can be difficult to get to). In addition, front-loading washers were assumed to be ENERGY STAR-qualified.

A summary of the estimated New Jersey market share for ENERGY STAR-labeled products is presented in **Error! Reference source not found.**. A detailed discussion of the methodology used to generate the market share estimates is also provided below.

Figure 3-29. Percent of Products Purchased in NJ in 2004-2005 that were ENERGY STAR-Labeled[127]



Refrigerators and Clothes Washers

As noted earlier, to validate the self-reported purchases of ENERGY STAR refrigerators and top-loading clothes washers, the reported make and model numbers were compared against the EPA list of ENERGY STAR-qualified measures and were reviewed by a national expert at the EPA. The results identified a high margin for error with both false negatives and false positives. For example, although 68% of the respondents reported that their refrigerator was ENERGY STAR-qualified and a review of make/model numbers revealed that only 66% were actually ENERGY STAR-qualified, many of these (37 respondents, or 54%) incorrectly identified their refrigerator (**Error! Reference source not found.**). The discrepancy between self-reported and make/model verified was even more significant for top-loading clothes washers, where 16 of the 25 respondents (64%) had mistakenly reported that the model they had

[127] Note the "n" for each product refers to the number of usable survey responses that were used to generate the market share estimate (i.e., those that provided make and model, number of units purchased, or other product specific inputs that were used to generate the market share estimates.)

purchased was ENERGY STAR-qualified washer, yet make/model verifications revealed that it was not.[128]

Given the error rate, the evaluation team selected to rely only on the respondents that provided valid make/model numbers, and estimate market share based on verification on the EPA Web site whether the unit was or was not ENERGY STAR-labeled. Front-loading clothes washers were assumed to be ENERGY STAR-qualified, so the data were weighted to reflect the percent of top-loading vs. front-loading washing machines that were reportedly purchased (**Error! Reference source not found.**).[129]

Table 3-11. Self-Reported vs. Make/Model Verified ENERGY STAR Refrigerators and Top Loading Clothes Washers

Correctly Identified	Refrigerators		Top-Loading Clothes Washers	
	Frequency	Percent	Frequency	Percent
ENERGY STAR (ES)	25	37%	4	16%
Non-ES	6	9%	5	20%
Incorrectly Identified				
Reported ES, but not ES	36	53%	16	64%
Reported Non-ES, but ES	1	1%	0	0%
Total with Self-Reported with Valid Make/Model	68	100%	25	100%

Source: Residential End-User Telephone Survey.

Table 3-12. Adjustment for Front-Loading vs. Top-Loading Clothes Washers[130]

Style	Frequency	Percent of all Purchases	Percent ENERGY STAR
Top-Loading	138	66%	14%
Front-Loading	72	34%	100%
Total	210	100%	43%

Source: Residential End-User Telephone Survey.

[128] The implication of these data for future research is that self-reported incidence for the purchase of ENERGY STAR appliances has a high margin of error in both directions, and that a combination of false positives and false negatives may bias the results.

[129] Note that these figures were then used as inputs into the total market share estimates presented in **Error! Reference source not found.**.

[130] Percent of top loading clothes washers that are ENERGY STAR as validated by make/model lookups.

Room Air-Conditioners and Thermostats

For room ACs and thermostats there were no correction factors available based on a make/model verification, so the evaluation team needed to rely on the self-reported ENERGY STAR market share for survey respondents. A recent study for NYSERDA found that self-reported estimates for room ACs may be over-estimating the market share by a relative value of approximately 20%.[131] Should National retailer partner data become available before the final draft of this report, these adjustments can be incorporated.

The percentage of ENERGY STAR thermostats was determined in two ways: respondent visual confirmation of the ENERGY STAR symbol and whether or not it came "pre-programmed" to set back in the evening (a feature of ENERGY STAR thermostats).

CFLs and Light Fixtures

In terms of adjusting the number of self-reported CFLs based on consumer misunderstanding about what qualifies as a CFL, a number of studies have found that self-reported incidence of CFLs can differ substantially from what is found during an in-home inspection.[132] The evaluation team chose specific wording, however, to match a large-scale recruiting survey instrument that was used in a recent California metering study:[133]

> *"Did you purchase any compact fluorescent light bulbs? These are fluorescent bulbs that screw into regular light bulb sockets. They look different than standard incandescent bulbs in that they are often made out of thin tubes of glass bent into loops. They also typically cost a lot more than incandescent bulbs."*

Although the California study did not compute an adjustment factor, conversations with the study manager confirmed that this wording produced a high success rate, with few homes reporting to have CFLs and then actually proving not to have them upon inspection.[134] In addition, the metering study did not examine ENERGY STAR vs. non-ENERGY STAR CFLs. To account for these potential sources of error, the evaluation team reduced the estimated market share for CFLs by 30%: a portion of this accounts for the ENERGY STAR vs. non-ENERGY STAR (Aspen Systems found in New York State that approximately 23% of CFLs stocked were not ES qualified) and possible mis-reporting by the respondent.[135]

There were not sources of adjustments for the self-reported lighting fixture data, so the estimates rely entirely on the survey responses.

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[131] Quantec, LLC, and Summit Blue Consulting, "New York ENERGY STAR® Products And Marketing Program: Market Characterization, Market Assessment And Causality Evaluation," Prepared for NYSERDA, April 2006.

[132] One of the more recent studies, Kates, Brad, Jennifer Mitchell-Jackson, Lori Megdal, and Steve Bonanno, "Measuring the Success of CFL Energy Efficiency Programs," 2005 International Energy Program Evaluation Conference (IEPEC), found a high percentage of both false positives (reported CFLs but none installed) and false negatives (homes that reported no CFL but actually had them).

[133] KEMA, "CFL Metering Study, Final Report," Prepared for Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison, February 2005.

[134] E-mail from Tami Rasmussen of KEMA, Inc., February 2006.

[135] Note other studies have applied more dramatic discounting factors (see "ENERGY STAR Consumer Products, Market Progress Evaluation Report", Northwest Energy Efficiency Alliance, November 2005).

Windows

Estimating market share for windows has proven to be an extremely difficult task for a number of reasons. First, the ENERGY STAR specifications vary based on climate zone. Second, many market actors, including "upstream" market actors such as retailers – are often not familiar with the technical terms (e.g., U-Factor) that are used to determine the ENERGY STAR qualification. Labeling can also be confusing, as a number of manufacturers have chosen to show a map of the United States and shade qualifying ENERGY STAR areas, causing potential confusion on the part of respondents that do not carefully read the label. The findings from this study, therefore, are an estimate based on a single market actor, and it is assumed that there is a wide confidence interval around this estimate for the true market share. Note, however, that the ENERGY STAR market share estimate of 49% falls within range of market share for the entire region served by the Northeast Energy Efficiency Partnerships (46% to 65%), but does reflect a significant jump from a 2002 NEEP baseline study that estimated NJ market share of 25%. The jump may also reflect increased training and other NEEP activities, which were sponsored, in part, by the New Jersey Clean Energy Program. The increased market share in NJ may also be related to increasing market share of ENERGY STAR windows throughout the United States due to higher energy costs and other exogenous factors.

Market Share Based on Partnership Status

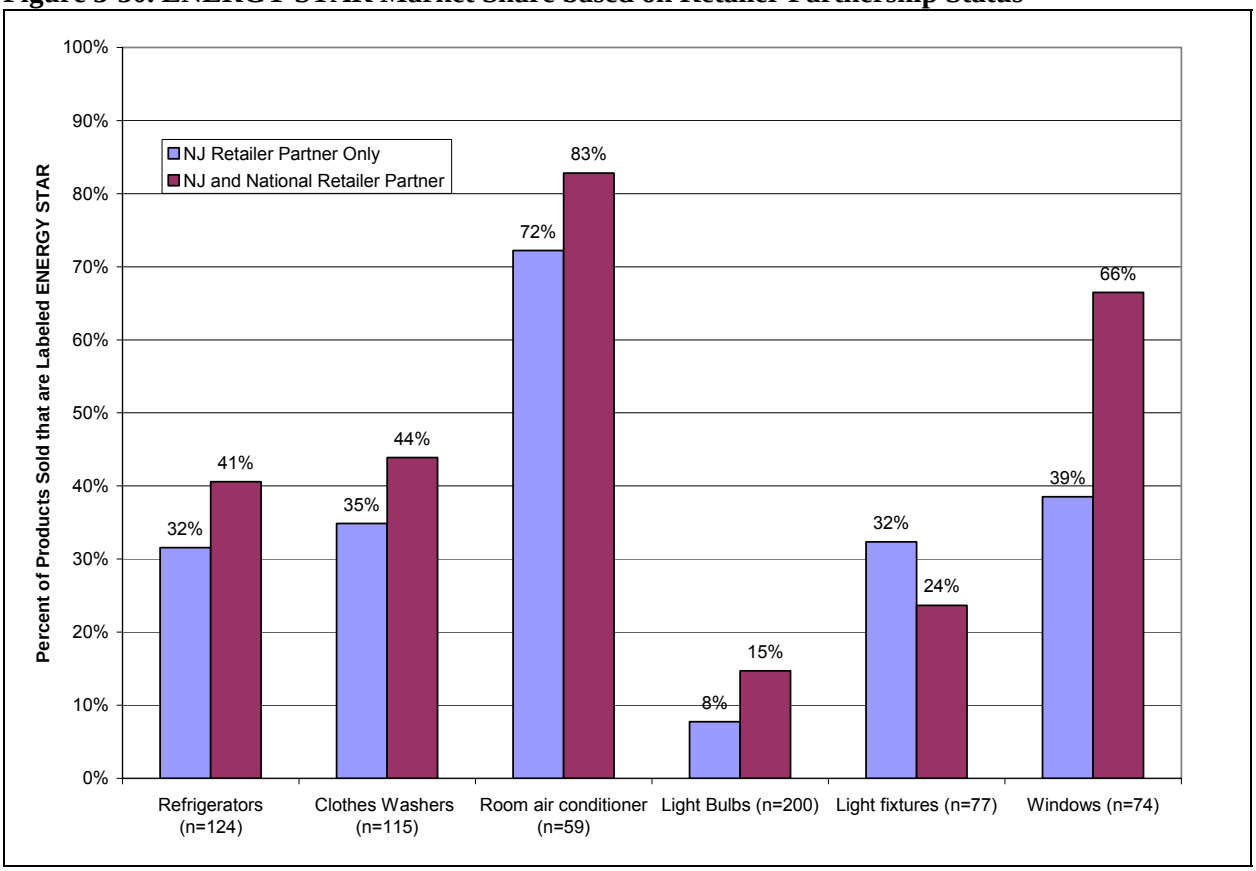
As discussed earlier, the majority of the products examined through this report are sold through retailers that are partners in the New Jersey ENERGY STAR Program. Some of these retailers – primarily the large, national, "big box" chains, are also National retailer partners. As shown in **Error! Reference source not found.**, the retailers that are partners in both NJ and Nationally have higher ENERGY STAR market share for all products examined except for lighting fixtures.[136] The increased market share for ENERGY STAR products among these retailers in both programs is not surprising given the apparent corporate commitment at both the state and national levels. Lighting fixtures, however, are unique in that more than half (51%) of all fixtures are sold through lighting specialty stores, the majority of whom are likely participating only in the New Jersey and not the national programs. These specialty stores most likely have less staff turnover, higher staff-to-customer ratios, higher average sales per customer, and other factors that contribute to higher ENERGY STAR sales.

Due to the high percentage of products sold through New Jersey or National partners, the sample of non-partners was too small to analyze separately. Results in other states have shown that the ENERGY STAR market share for non-partner retailers can vary based on the product and region, but are often higher than the regional or national partners. For example, in New York, non-partner retailers actually had higher ENERGY STAR market share for refrigerators and dishwashers than did the NY or National partners; in California, non-partners had higher ENERGY STAR market share for nearly all appliances. [137] One reason for this apparent paradox is that some of the non-partner stores may represent higher end "boutique" stores that have the ability to sell a higher percentage of 'high end" products, which also tend to be ENERGY STAR qualifying.

[136] Approximately 99% of the programmable thermostats were sold through retailers that were both NJ and National partners, so the results are not presented here.

[137] See Quantec, LLC, "New York ENERGY STAR® Products And Marketing Program: Market Characterization, Market Assessment And Causality Evaluation", Prepared for NYSERDA, April 2006, and Itron, California Residential Efficiency Market Share Tracking, Appliances 2002, January 2004.

Figure 3-30. ENERGY STAR Market Share based on Retailer Partnership Status[138]



Market Share Based on Distribution Channel

The limited sample sizes for most products do not allow the ability to "drill down" and estimate market share by distribution channel. For the refrigerators, clothes washers, and light bulbs, however, the larger sample sizes allow for this more detailed level of analysis among some of the more common distribution channels.[139]

As shown in **Error! Reference source not found.**, ENERGY STAR market share varied based on the distribution channel for refrigerators, with the highest market share occurring for department/discount stores (45%, vs. an overall average of 34%). This channel, representing 40% of all sales, was dominated by Sears, a New Jersey and National retailer partner. Clothes washers, on the other hand, showed little variation based on distribution channel, possibly due to the increasingly large market share of front-loading machines in all channels.

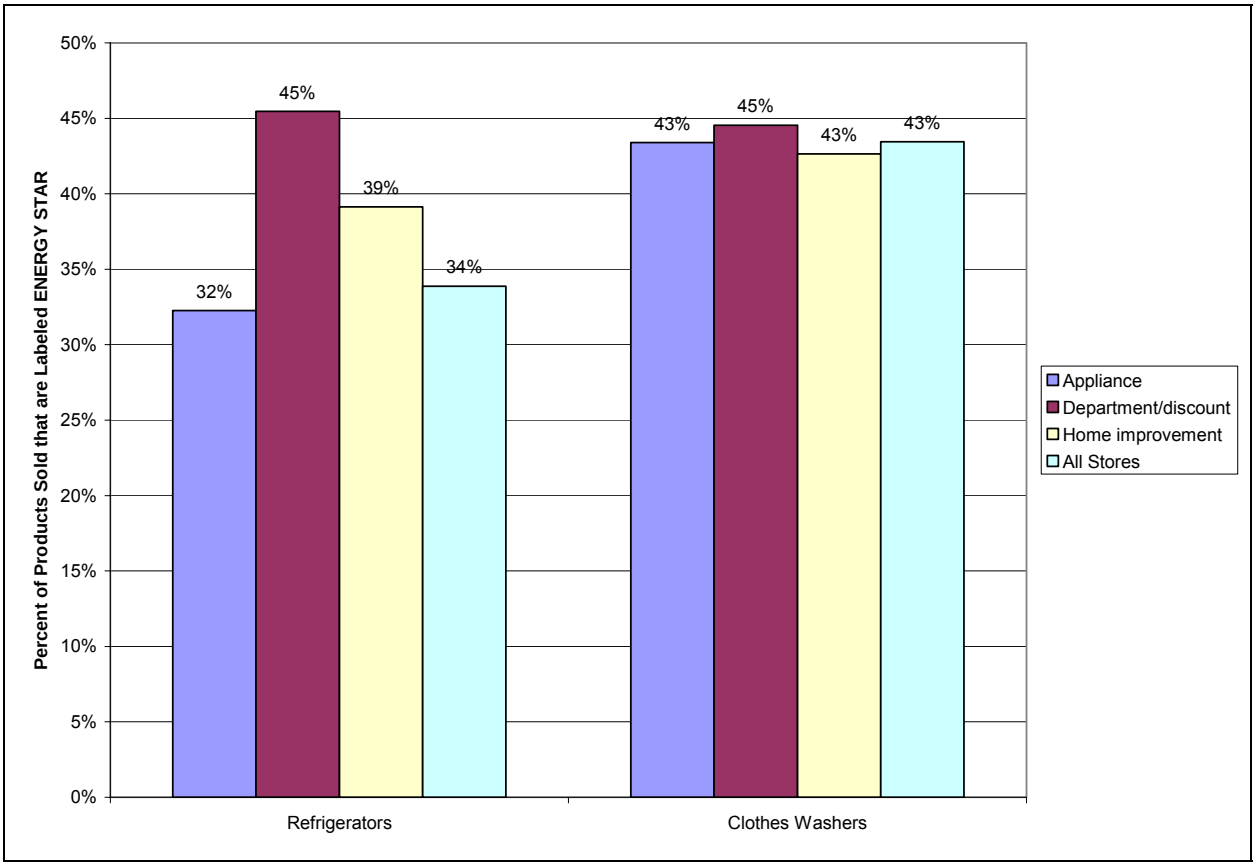
The market share for ENERGY STAR CFLs varied greatly based on distribution channel. For example, home improvement stores, dominated by New Jersey and National partners such as Home Depot and Lowes, had a 16% market share for ENERGY STAR CFLs; grocery stores, on the other hand, only had a 6% market share (**Error! Reference source not found.**). This disparity is quite important for program

[138] Note the weighted averages of the partnership status bars provides the best estimate for market share, presented in **Error! Reference source not found.**.

[139] Note that this analysis is presented independent of partnership status, an important predictor of ENERGY STAR market share.

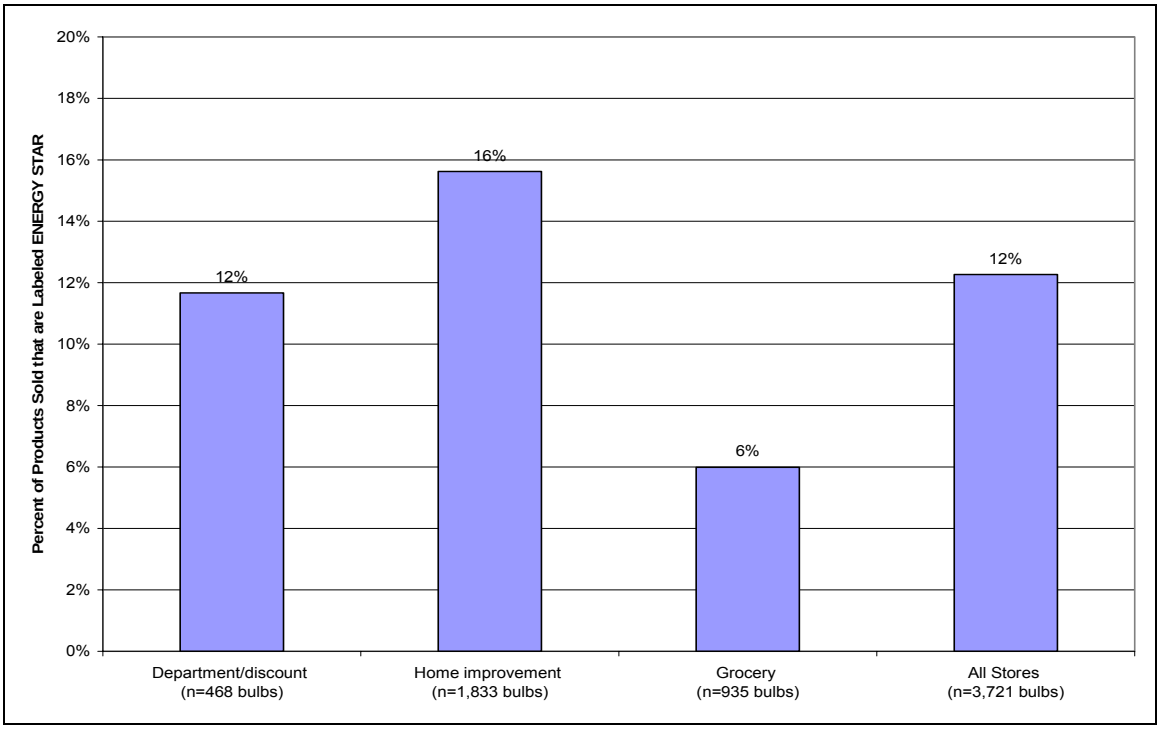
planning and resources: grocery stores make up an estimated 29% of all light bulbs sales yet significantly trail the other distribution channels in terms of the percent of bulbs sold that are ENERGY STAR qualifying.

Figure 3-31. ENERGY STAR Market Share Based on Distribution Channel for Refrigerators and Clothes Washers[140]



[140] Note the weighted averages of the distribution channel bars provides the best estimate for market share, presented in **Error! Reference source not found.**.

Figure 3-32. ENERGY STAR Market Share Based on Distribution Channel ENERGY STAR CFLs



3.3.2 Benchmarking against Other States

In order to assess the impact of the NJ ENERGY STAR Products Program, it can be helpful to compare it to other efforts across the country. **Error! Reference source not found.** illustrates the estimated market share for other areas promoting ENERGY STAR products. Please note that the data from which these estimates are developed vary by program: some simply rely on National Partner sales data, others on National and local Partner sales data, still others use telephone surveys, and some use combinations of all these methods. Additionally, since not all programs promote all four appliance types, some data were not available. Furthermore, not all programs estimate their share on an annual basis. Whenever possible, 2004 estimates have been used.

Table 3-13. Illustration of Estimated ENERGY STAR Appliance Market Share from Various Areas of the U.S. (2003-2005)

Area (Year for Estimate)	Clothes Washers	Dishwashers	Refrigerator	Room Air Conditioner
NJ (2004-2005)	43%	82%	34%	79%
NY (2005)	37%	86%	50%	56%
MA (2004)	34%	78%	45%	58%
WI (2003)	38%	n/a	29%	n/a
CA (2004)	56%	83%	45%	75%
NW Region (2004)	39%	85%	40%	n/a

Sources:

NJ ESP Consumer Telephone Survey

Quantec, LLC, with Summit Blue, New York Energy Star® Products And Marketing Program: Market Characterization, Market Assessment And Causality Evaluation, Prepared for NYSERDA, April 2006.
Nexus Market Research, RLW Analytics, Shel Feldman Management Consulting, and Research Into Action, "Market Progress and Evaluation Report (MPER) for the 2004 Massachusetts ENERGY STAR Appliances Program," May 2005

Energy Center of Wisconsin, Appliance Sales Tracking Study 2003, Prepared for State of Wisconsin Division of Energy, July 2004.

Itron, California Residential Efficiency Market Share Tracking, Appliances 2004, April 2005.

KEMA, ENERGY STAR Consumer Products, Market Progress Evaluation Report, Northwest Energy Efficiency Alliance, November 2005

CA results are from the 2004 RMST. WI results are from the 2003 ECW appliance tracing report. MA data are from the 2004 MPER which takes the data from D&R. NW results are from NEEA

Due to similarities in the New York and New Jersey markets, as well as program design, it is not unusual to see the similarities in market share for some appliances, including clothes washers and dishwashers. The larger share for room air conditioners in New Jersey may reflect the continued incentives that have been paid (New York discontinued the room air conditioner incentive in 2004). It is also interesting to note that New Jersey is within ten percentage points of New England's market share on all four appliance types studied, considering the long-term nature of the New England program. Overall, New Jersey is doing extremely well and has market shares that are very comparable to other states and regions with active programs promoting the purchase of ENERGY STAR-qualified appliances.

In addition to benchmarking against market share achieved in other areas, we reviewed the following programs for comparison to the New Jersey initiative in terms of program features, interaction with trade allies, and incentive strategies:

- Alliant Energy-Interstate Power & Light Co.[141]
- BC Hydro - Power Smart at Home[142]
- New York State Energy Research and Development Authority[143]

[141] www.alliantenergy.com

[142] http://www.bchydro.com/powersmart/

[143] http://www.getenergysmart.org/

- Pacific Gas & Electric[144]
- Sacramento Municipal Utility District (SMUD)[145]

Incentives

In terms of program features, the New Jersey program may be less well-defined than other efforts, and relies less on consumer incentives than some other programs. With the exception of the New York (NYSERDA) ENERGY STAR Products and Marketing Program, many of the programs tend to be targeted more toward consumers and lack the strong retailer network that New Jersey has established. **Error! Reference source not found.** shows the range of rebates offered for ENERGY STAR products.

Table 3-14. Examples of ENERGY STAR Product Rebates

Product	Incentive Ranges
Clothes Washers	$35 to $125
Dishwashers	$30 to $50
Light Bulbs	$1 to $10
Light Fixtures (including ceiling fans)	$15 to $20
Programmable Thermostats	$20 to $40
Refrigerator	$50
Room Air Conditioner	$50
Windows	$5/window to $1/square foot of glazing

While retailers were quite insistent that incentives are necessary for the successful promotion of ENERGY STAR products, they seem less sensitive to the level of the rebates. Further, as discussed in other sections of this report, consumers expressed lack of information and awareness as a greater barrier to adoption of ENERGY STAR-labeled products than price. The use of limited rebates, designed to generate interest in ENERGY STAR-labeled products, may serve as an effective promotional tool for retailers. Limited rebates to entice consumer interest, rather than those designed to cover a large percentage of incremental cost, may be useful to promote the program and increase market share.

Educational Program Features

The New Jersey ENERGY STAR Products Program relies primarily on its network of retailers to disseminate educational information to consumers about the benefits and availability of ENERGY STAR products. They maintain a Web site (www.njcleanenergy.org) that provides links to the Home Energy Analysis program, information about available incentives, and location of participating retailers. The Web site allows consumers to search by city, but not by product or store name.[146]

[144] http://www.pge.com/res/rebates/

[145] http://www.smud.org/residential/saving/rebate_pdfs/CFL_availabilitylist.pdf

[146] This may be an enhancement to the Web site to consider.

The Web site provides a substantial amount of information for program stakeholders and consumers. However, awareness of the Website is low, even among participating retailers. The Web site focuses on those products and services that are actively promoted and provides limited information on other ENERGY STAR products (such as home electronics and office equipment).

NYSERDA maintains an exceptional Website that provides a broad range of information including:

- Information about a broad range of ENERGY STAR-labeled products
- Qualifying makes and models
- Links to participating manufacturers and retailers
- An energy calculator so customers can determine the potential savings to specific customers of the adoption of ENERGY STAR-labeled products.

The ENERGY STAR Products program has achieved remarkable impacts in terms of increased market share. The market share for the various products is, in many cases, equal to or greater than other states that would be considered leaders in the promotion of ENERGY STAR products (e.g., New York, California, and the Pacific Northwest). In comparing the New Jersey program to other programs, we found a stronger emphasis on developing the trade ally infrastructure than some of the other programs, but less emphasis on direct consumer communications and incentives. Combining the program features that ensure substantial supply of ENERGY STAR products with program elements that drive consumer demand could drive further increases in market share, making New Jersey a clear standout in the nation.

3.3.3 Summary of Market Share and Benchmarking

Market share was determined based on a combination of sales data collected from National EPA ENERGY STAR retailer partners and the residential end-use customer telephone survey. The results indicate that ENERGY STAR market share was highest for room air-conditioners (79%), windows (49%), thermostats (45%), and clothes washers (43%).

The retailers that are partners in both NJ and Nationally have higher ENERGY STAR market share for all products examined except for lighting fixtures. The increased market share for ENERGY STAR products among these retailers in both programs reflects corporate commitment at both the state and national levels. Lighting fixtures, however, are unique in that more than half (51%) of all fixtures are sold through lighting specialty stores, the majority of whom are likely participating only in the New Jersey and not the national programs.

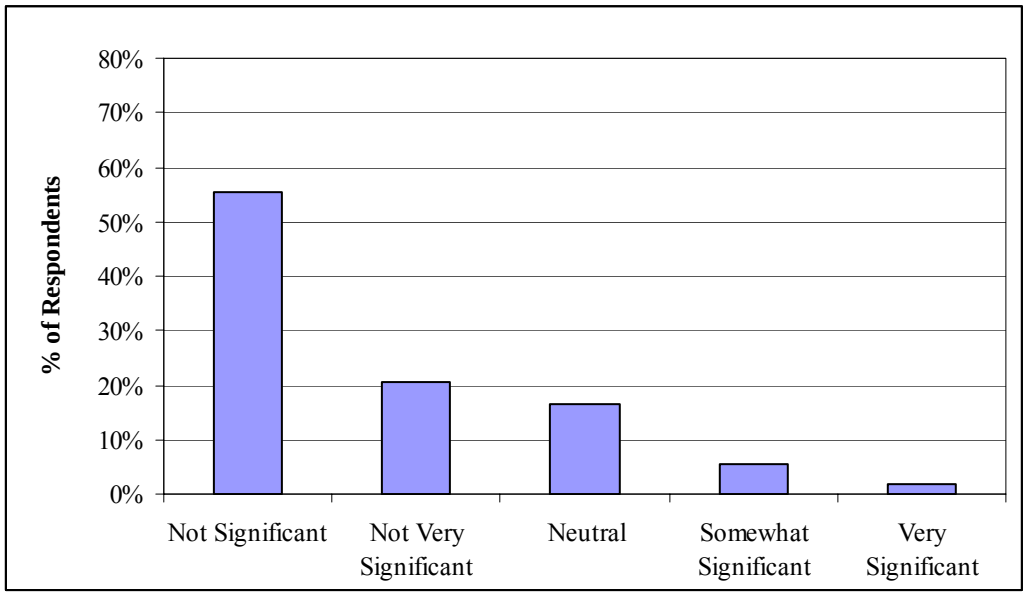
Market share also varied sharply by distribution channel, particularly for CFLs. For example, although grocery stores make up an estimated 29% of all light bulbs sales, only 6% of bulbs sold in groceries are ENERGY STAR qualifying (6%), significantly trailing the other distribution channels such as home improvement stores (16%).

3.4 Baseline Savings Assessment

3.4.1 Availability and Common Practice

As noted in the Assessment of Performance Indicators Section, ENERGY STAR product availability was generally not seen as an issue by retailers or manufacturers. The only ENERGY STAR products that retailers mentioned difficulty in obtaining were lighting fixtures, both interior and exterior. This may be because of the strong emphasis that consumers place on style and appearance in selecting light fixtures.

Figure 3-33. Retailer Feedback Regarding The Lack of Available ENERGY STAR Product



Source: NJ ENERGY STAR Products Retailer Survey (n=54)

3.4.2 What Impact Has the Program Had on the Baseline?

While the market share estimates presented earlier provide a useful benchmark for future research, they do not provide insight into what the market share would have been in absence of the NJ ENERGY STAR Products Program. To answer this question, the research team assembled the EPA National Partner Sales data (collected by D&R International), by State, for 2000 through 2004 (the most recent year available).[147] As noted above, the National Partner Sales data includes ENERGY STAR market share for refrigerators, clothes washers, dishwashers, and room air conditioners.

A total of 27 states were selected as candidate comparison States because they did not run ENERGY STAR Products Programs. These States were then ranked by median income and education levels (percent of population with a bachelors degree) in comparison to New Jersey.[148] A total of four States

[147] This approach is a variation of the approach initially conducted in Wisconsin. See Glacier Consulting, "FY04 Net-to-Gross Savings Adjustments for ENERGY STAR-qualified Clothes Washers," Submitted to Wisconsin DOA and Wisconsin WECC, June 2005.

[148] Note that this approach does not account for other factors that may influence market share, including energy prices, climate zone, population center distribution (urban/suburban/rural), precipitation/drought, etc. A recent study found that many of these can be significant predictors of ENERGY STAR market share (see Nexus Market Research, RLW Analytics, Shel Feldman

were then selected as comparison States because they ranked within the top ten in comparison to New Jersey.[149] The weighted average (based on number of units shipped to each State) National Partner market share was then calculated for each of the four appliances where data were available: refrigerators, clothes washers, dishwashers, and room air-conditioners.[150] The ENERGY STAR market share from these comparison States, therefore, serves as an estimated baseline as to what might have occurred in New Jersey in absence of the NJ ENERGY STAR Products Program.[151]

The results from the analysis are presented in **Error! Reference source not found.** and **Error! Reference source not found.**.[152] The data reveal that there are modest impacts in terms of sales of ENERGY STAR refrigerators, clothes washers, and dishwashers (i.e., New Jersey ENERGY STAR market share rises slightly greater than the comparison states). For room air conditioners the impact of the New Jersey program appears more pronounced, with ENERGY STAR market share increasing at a greater rate, on average, than the comparison states.

The detailed data from the figures, along with ENERGY STAR market shares for the National Retailer Partners for the entire United States plus the magnitude of the differences, is presented in **Error! Reference source not found.** and **Error! Reference source not found.**. The higher growth in market share achieved in New Jersey for refrigerators, clothes washers, dishwashers, and room air conditioners may be attributable to the ENERGY STAR Products Program, which works to ensure greater availability of qualified products and increase the awareness of consumers as to the benefits of selecting labeled technologies. At the same time, however, this method recognizes that factors exogenous to the New Jersey ENERGY STAR Products Program, including higher energy prices, the National ENERGY STAR Program, and the impact of ENERGY STAR programs from other regional states, have an impact on ENERGY STAR market share in New Jersey, and should be taken into consideration when looking at further program impacts.

Management Consulting, and Research Into Action, "Market Progress and Evaluation Report (MPER) for the 2004 Massachusetts ENERGY STAR Appliances Program," May 2005).

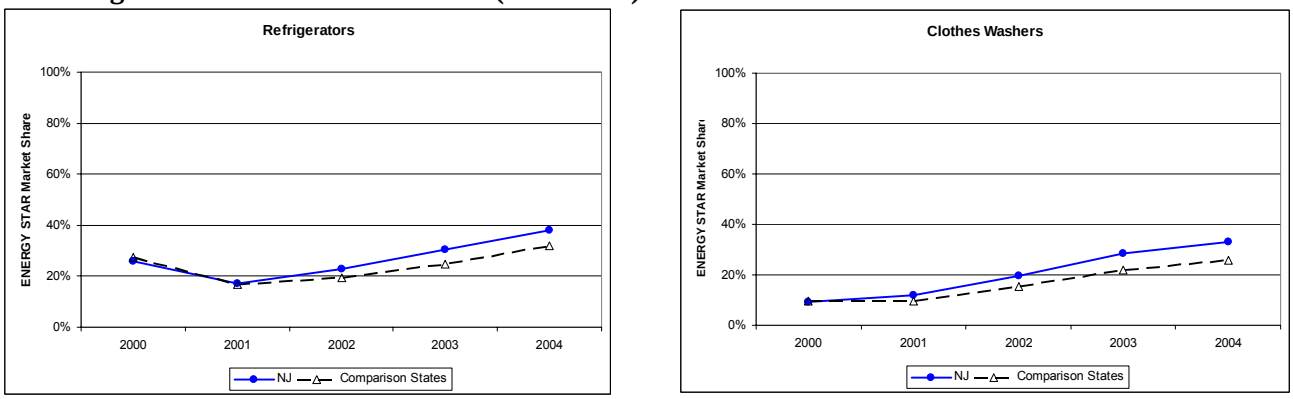
[149] Comparison states included states without ENERGY STAR Products programs with similar income and education levels. These states included Alaska, Delaware, Hawaii, and Virginia.

[150] Shipment data were collected by the Association of Home Appliance Manufacturers, and are generally used as a proxy for sales.

[151] Note this approach does not attempt to assess the reciprocal nature and infrastructure impacts of market transformation programs. For example, the NJ Program may have led to greater availability, increased marketing, reduced incremental cost, and higher ENERGY STAR sales in additional states. Similarly, other programs, such as the New York State ENERGY STAR Products and Marketing Program, may have influenced sales and NJ and additional states. However, this approach does help account for differences in retailer reporting by year.

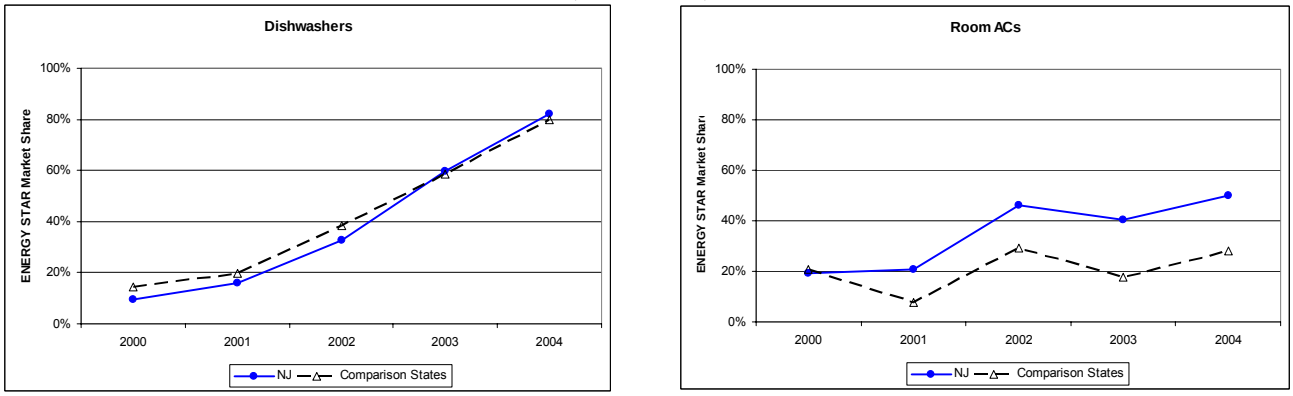
[152] Note that 2005 data were unavailable, and the market share is only based on national partners that report sales data, so will differ from the earlier market share figures. In addition, the data have not been adjusted for changes in federal standards or "noise" caused by different retailers reporting their sales data; both of these factors can cause decreases in market share from one year to the next.

Figure 3-34. ENERGY STAR Market Share, as Reported by National ENERGY STAR Partners, for Refrigerators and Clothes Washers (2000-2004)



Source: EPA National Partner Sales Data, Collected by D&R International

Figure 3-35. ENERGY STAR Market Share, as Reported by National ENERGY STAR Partners, for Dishwashers and Room Air Conditioners (2000-2004)



Source: EPA National Partner Sales Data, Collected by D&R International

Table 3-15. Comparison of Appliance Baseline Results to National ENERGY STAR Market Share Program Estimates for New Jersey, Comparison States, and U.S.

Area	Baseline [1]	2000[2]	2001[2]	2002[2]	2003[2]	2004[2]
NJ						
Clothes Washers	8%	9%	12%	20%	28%	33%
Dishwasher	10%	9%	16%	33%	60%	82%
Refrigerator	15%	26%	17%	23%	30%	38%
Room Air Conditioners	12%	19%	21%	46%	40%	50%
Comparison States						
Clothes Washers	n/a	10%	10%	16%	22%	26%
Dishwasher	n/a	14%	20%	38%	59%	80%
Refrigerator	n/a	27%	17%	19%	25%	32%
Room Air Conditioners	n/a	21%	8%	29%	18%	28%
National						
Clothes Washers	n/a	9%	10%	16%	23%	27%
Dishwasher	n/a	11%	20%	36%	57%	78%
Refrigerator	n/a	27%	17%	20%	26%	33%
Room Air Conditioners	n/a	19%	12%	36%	29%	35%

1 Baseline figures from The New Jersey ENERGY STAR Products Working Group Appliance and Windows Baseline Studies.

2 2000-2004 ENERGY STAR percentages from D&R International. Please keep in mind that the data sources are not identical between years.

Table 3-16. Comparison of Growth in Estimated Market Share by Appliances From 2000-2004 – New Jersey and Comparison States

Appliance	New Jersey	Nationwide	Difference (Absolute %)
Clothes Washers	24%	16%	8%
Dishwasher	73%	66%	7%
Refrigerator	12%	5%	7%
Room Air Conditioners	31%	7%	24%

3.4.3 ENERGY STAR Products Program Saving Protocol Review

The ENERGY STAR Products Program attributes savings only to two products:

- Lighting – including bulbs and fixtures

- Room air conditioners

While savings estimates for other products (appliances and windows) are included in the protocol, they have not been used to assess program impacts historically since the market assessments required to estimate impacts have not been performed. The following Section 3.4.4 assesses the program impacts for these other products.

This section presents a detailed assessment of impact calculation methods and input assumptions for New Jersey's ENERGY STAR Products Program. Methods and assumptions for the following measures are discussed in some detail:

- Compact fluorescent light bulbs (CFLs)
- Compact fluorescent fixtures
- Room air conditioners

We also comment on the savings protocol values used for appliances and measures and compare them with other estimates for energy savings estimates for these measures.

Lighting

Compact Fluorescent Light Bulbs

The current savings calculation algorithms in New Jersey are shown below. Estimates are done on a per-bulb basis.

- Electricity Impact (kWh) = ((CFL_{watts}) x (CFL_{hours} x 365))/1000
- Peak Demand Impact (kW) = (CFL_{watts}) x Light CF/1000

Where:

- CFL_{Watts}= Average Watts replaced (incandescent – CFL)
- CFL_{hours} = Average daily burn time for replacement bulbs
- Light CF (coincident factor) = Summer coincident factor for all lighting measures

New Jersey used the inputs to the savings algorithm to calculate per unit savings from CFLs as shown in **Error! Reference source not found.**.

Table 3-17. CFL Savings Calculations

Variable	Value
CFL_{watts}	42 Watts
CFL_{hours}	2.5 hours
Light CF	5%
Measure Life	6.4 years
Annual Electricity Impact (kWh)	38.3
Peak Demand Impact (kW)	.002

Discussion of Assumptions. The values used for CFL_{Watts} and CFL_{hours} are both quite conservative, but comparable to values used in other jurisdictions with mature energy efficiency programs and relatively high saturations of CFLs. The savings per CFL declines as more bulbs are installed per customer (assuming the customer uses an economic dispatch approach to installing the bulbs, i.e., installing them in those fixtures or lamps most frequently used). Of those respondents to the consumer survey reporting purchasing CFLs, on average, they purchased nine bulbs, so the lower average use is reasonable.

For example, the Northwest Power Planning Council Regional Technical Forum (RTF) assumes impacts for interior CFLs ranging from 32 kWh to 53 kWh annually depending on bulb size (15-watt to 26-watt) and an average of 39 kWh.[153] However, the Northeast Energy Efficiency Partnerships (NEEP) uses 50.8 kWh per year in its assessment of efficiency potential.[154] A recent California metering study found the average CFL is used for 2.3 hours/day, is 13-17 watts, and replaces a 60 watt bulb, suggesting an average annual savings of about 37.8 kWh/bulb (although deemed values for 2004-2005 assume 48.9 kWh/year for CFLs less than 20 watts and 67.5 kWh/year for bulbs 20-24 watts).[155] New York, which assumes lower saturation of CFLs, assumes that the bulbs are used for about 4.7 hours a day, with energy savings of 94 kWh/year and peak demand savings of .0056 kW.[156]

The measure life, given the number of hours the bulb is used per day, would equate to a 5,840-hour bulb life. This is shorter than the 10,000-hour rated life of most bulbs that is used by most other programs, and is extremely conservative. Assuming 10,000 hours for the bulb, at an average use of 2.5 hours/day, would provide an estimated life of 10.9 years.

The coincident factor, or the percentage of bulbs that would be on at the time of the system peak, of 5% is reasonable as residential lighting is not a highly coincidental load. Note that other programs assume higher coincident diversity factors (e.g., NYSERDA assumes a coincidence diversity factor of 10.3%).

In addition, the savings calculation assume 100% installation rates for all bulbs shipped as part of the program. There is evidence from many other studies that some CFLs are not immediately installed or have early failures.[157] Installation rates tend to be lowest for "give-away" type programs and highest for programs where consumers actually purchase the bulb, and typically range between 75% and 90%. Given that the NJ Program is a buy-down type program installation rates are most likely closer to 90%. A conservative approach would adjust the number of bulbs downward, therefore, by 10% to 15% to account for lack of installation or early failure. However, the Change-a-Light campaign likely has spillover effects that extend beyond the number of units attributed to the program (i.e., demand for CFLs extends beyond the seasonal campaign). Thus adjustments for installation rates and failures are not recommended unless other market effects factors that may offset any savings reductions – including spillover – are examined.

Compact Fluorescent Fixtures (Hard-Wired)

Electricity Impact (kWh) = $((Fixt_{watts}) \times (Fixt_{hours} \times 365))/1000$

Peak Demand Impact (kW) = $(Fixt_{watts}) \times$ Light CF/1000

[153] www.nwcouncil.org – Conservation Resource Database

[154] NEEP Strategic Initiative Review Quantitative Analysis Report, p. 29. NMR (Nexus Market Research)

[155] KEMA, Inc., "CFL Metering Study Final Report," Prepared for PG&E, SDG&E, and SCE, February 25, 2005.

[156] NYSERDA deemed savings database.

[157] See "CFL Programs that Work", *Home Energy*, May-June 2003. Also summarized at http://www.eere.energy.gov/state_energy_program/case_study_detail_info.cfm/cs_id=8

Where:

- $Fixt_{Watts}$= Average Watts replaced for an efficient fixture installation
- $Fixt_{hours}$ = Average daily burn time for an efficient fixture installation
- Light CF (coincident factor) = Summer coincident factor for all lighting measures – currently fixed at 5%.

Key inputs and savings calculations for compact fluorescent fixtures is shown in **Error! Reference source not found.**.

Table 3-18. Compact Fluorescent Fixture Savings Calculations

Variable	Value
$Fixt_{watts}$	90 Watts
$Fixt_{hours}$	3.5 hours
Light CF	5%
Measure Life	20 years
Electricity Impact (kWh)	115.0
Peak Demand Impact (kW)	0.0045

Discussion of Assumptions. The value for $Fixt_{Watts}$ would be consistent two-lamp fixture which is typical. Hours of use ($Fixt_{hours}$ = 3.5/day) are slightly higher than that used for CFLs which is appropriate given that consumers would be encouraged to replace fixtures that are used most frequently with the energy-efficient models. The RTF estimates average savings of 122 kWh for interior CFL fixtures and 120 kWh for ENERGY STAR-labeled fixtures overall and a measure life of 15 years. NEEP uses an estimate of 53.8 and a 20-year measure life.[158] NYSERDA assumes average use of ENERGY STAR fixtures of 4.2 hours/day, estimated annual energy savings of 115 kWh, and estimated peak demand savings of 0.0077 kW. In general, the algorithm and assumptions used by the New Jersey Clean Energy program are appropriate and reasonable.

Compact Fluorescent Fixtures (Portable)

Electricity Impact (kWh) = (($Torch_{watts}$) x ($Torch_{hours}$ x 365))/1000

Peak Demand Impact (kW) = ($Torch_{watts}$) x Light CF/1000

Where:

- $Torch_{Watts}$= Average Watts replaced for a torchiere installation
- $Torch_{hours}$ = Average daily burn time for a torchiere installation

[158] Does not specify any fixture characteristics such as number of bulbs, wattage differential or hours of use.

- Light CF = Summer coincident factor for all lighting measures – currently fixed at 5%.

Table 3-19. Compact Fluorescent Fixture (Portable) Savings Calculations

Variable	Value
$Torch_{watts}$	245 watts
CFL_{hours}	3.5 hours
Light CF	5%
Measure Lifetime	10 years
Electricity Impact (kWh)	313.0
Peak Demand Impact (kW)	0.01225

These values are extremely close to the values assumed by NYSERDA, which assume daily use of 3.6 hours, annual energy savings of 325 kWh, and annual peak demand savings of 0.025 kWh. However, the new State Appliance Efficiency Standards of New Jersey, which went into effect in March of 2005, now require that torchieres consume no more than a total of 190 watts.[159] Given the new standards the deemed savings values for portable fixtures (torchieres) based on a 245 watt reduction appear to be too high, and should be reduced downward or eliminated from the program. Since the 190-watt maximum would still allow for incandescent lamps to be purchased, continuing to include them in the program with a reduced impact ($Torch_{watts}$) of 100 to 120 watts is suggested.

Room Air Conditioners

The protocol for Room Air Conditioners is simply:

- Electricity Impact (kWh) = ESavRAC
- Demand Impact (kW) = DSavRAC x CFRAC

Where:

- $ESav_{RAC}$ = Electricity savings per purchased ENERGY STAR room AC
- $DSav_{RAC}$ = Summer demand savings per purchased ENERGY STAR room AC
- CF_{RAC} = Summer demand coincidence factor for room AC

Key inputs and savings calculations for room air conditioners are shown in **Error! Reference source not found.**.

[159] Pew Center on Climate Change. More details are presented in the Upgrade of Energy-Efficiency Codes and Standards Assessment Section.

Table 3-20. Room Air Conditioner Savings Calculations

Variable	Value
$ESav_{RAC}$	56.4 kWh
$DSav_{RAC}$	0.1018 kW
CF_{RAC}	58%
Measure Life	10 years
Peak Demand Impact (kW)	0.059 kW

Discussion of Assumptions. CF_{RAC} is developed based on data from Potomac Electric Power Company (PEPCo) and is assumed to be correct. The protocols say very little about how the $ESav_{RAC}$ is developed (i.e., average unit size or hours of use). This estimate compares favorably to the estimates prepared by D&R based on national shipment data and estimates developed by NEEP in their assessment of the energy efficiency potential for the Northeast, but assumes higher annual savings compared to a NEEP strategic initiative review and estimates prepared by NYSERDA since NJ has a warmer climate (a higher number of cooling degree days) than these other regions, thus justifying the slightly higher savings estimate.

Table 3-21. Comparison of Room Air Conditioner Annual Energy Savings Estimates

Product	NJ Protocol	D&R[160]	NEEP Strategic Initiative Review[161]	NYSERDA*
Room Air Conditioner	56.4 kWh	76 kWh	27-37 kWh based on size.	39.6 kWh

* NYSERDA deemed savings database.

Other Appliances

New Jersey uses deemed savings values to assess savings for each appliance in the ENERGY STAR Products Program. Per unit savings estimates used to determine program impacts are based on a 2000 Market Update Report prepared by RLW Analytics.[162] Again, we compare those estimates to those derived by D&R, NEEP, and NYSERDA. These comparisons reveal that there is a wide range of savings estimates for these appliances. The estimates for clothes washers and dishwashers, of course, will vary sharply based on the water heating fuel type. Note, however, that the New Jersey estimates do not account for electric savings for homes with non-electric water heat, and thus are conservative in their estimates for electric savings (i.e., efficient clothes washers and dishwashers have associated electric savings even for homes with gas, oil, or other hot water heating fuels). The New Jersey estimate for refrigerators is actually quite conservative, substantially lower than any other source examined for this report.

We recommend the following modifications to estimation of savings from adoption of ENERGY STAR-labeled appliance:

[160] Correspondence with Bill McNary of D&R International.

[161] NEEP Strategic Initiative Review. September 29, 2004. p. 23.

[162] 2002 Market Update Report for National Grid's Appliance Program.

- Adoption of D&R's savings estimate for refrigerators which is based on a comparison of national shipment data of qualifying and non-qualifying equipment – this would increase the per unit savings from 48 kWh to 68 kWh.

- ENERGY STAR-labeled clothes washers are available in a wide range of efficiency levels – with Modified Energy Factors (MEF)[163] ranging from 1.4 to 2.8, with a median MEF of 1.8. Tiered savings estimates for clothes washers with MEF up to 1.8, and those with MEF of 1.8 or higher may be appropriate. In addition, new federal standards come into effect in 2007, along with new requirements for the ENERGY STAR-label. Savings should be reassessed based on the new standard and new ENERGY STAR requirements.

Table 3-22. Comparison of Appliance Energy Savings Estimates

Product	NJ Protocol	D&R	NEEP Strategic Initiative Review	NYSERDA*
Clothes Washers	201 kWh (Electric Water Heat) 10.6 therms (Gas Water Heat) 1.06 MMBtu (Oil Water Heat)	297 kWh	192 kWh	127 kWh 0.76 MMBtu
Dishwashers[164]	82 kWh (Electric Water Heat) 3.95 therms (Gas Water Heat) 0.395 MMBtu (Oil Water Heat)	107 kWh	152 kWh	50 kWh 0.32 MMBtu
Refrigerator	48 kWh	68 kWh	86 kWh	79 kWh

* Based on the NYSERDA deemed savings database. Note that savings are NY State averages (excluding Long Island), with fuel specific savings based on saturation levels of water heating fuel types. The actual electric and gas savings per home depends on the water heater fuel type. For example, dishwashers are assumed to result in 42.5 kWh/year for gas water heated homes and 97 kWh/year for electric water heated homes.

Windows

The protocol for calculating window savings entails multiplying the square footage of windows replaced by a savings per square foot. The savings per square foot is developed based on modeling a 2,500 square foot home using REM Rate, a building energy simulation tool used primarily for home energy ratings. Separate savings estimates are available for various heating and cooling equipment combinations, including:

- Heat Pumps

[163] The higher the Modified Energy Factor, the more efficient the clothes washer is. MEF takes into account the amount of dryer energy used to remove the remaining moisture content in washed items.

[164] Dishwasher savings includes both savings from water heating and from direct electric use of the dishwasher. Gas and oil savings appear to be misstated in the protocol (e.g., $GSav_{DW}$ is shown as 0.0754 kW). The gas and oil savings are taken directly from the RLW Analytics ENERGY STAR 2000 Market Update for National Grid referenced in the protocols.

- Gas Heat with Central Air Conditioning
- Gas Heat without Central Air Conditioning
- Oil Heat with Central Air Conditioning
- Oil Heat without Central Air Conditioning
- Electric Heat with Central Air Conditioning
- Electric Heat without Central Air Conditioning

While this provides the most accurate approach to estimating energy savings using pre-determined values, it would require the collection of a significant amount of information from window retailers/buyers (e.g., type of heating and cooling system, square footage of home) if they were to begin to track impact for windows attributable to the ENERGY STAR Products Program. As an alternative, program level estimates could be based on average fuel shares and typical equipment configurations.

3.4.4 Additional Program Savings

As noted above, the NJ ENERGY STAR Program has historically only claimed energy savings for the lighting and room air conditioner portions of the Program, but the intent has been to report additional savings based on increased market share of other ENERGY STAR products as measured in this study. The promotion of the ENERGY STAR label, however, would be expected to lead to additional sales of other ENERGY STAR qualifying products. The baseline section above identifies the incremental market share for a number of products that could be attributed to the program. Combining incremental market share with total unit shipments allows for the calculation of total units attributable to the program. Total expected energy savings can then be computed by multiplying by the average expected savings per unit.

Examples of these calculations are shown in **Error! Reference source not found.**, **Error! Reference source not found.**, and **Error! Reference source not found.**.[165] Note these estimates use the New Jersey protocols for savings per unit, which are not adjusted per year and do not account for electric savings even for homes with non-electric DHW. Saturation levels are based on JCP&L estimates and are assumed to be the same for the entire state. Note that the incremental savings from these additional appliances is relatively small when compared to the current savings being claimed for lighting measures. For example, for 2004 the total additional electric savings for clothes washers, dishwashers, and refrigerators is estimated to be 1,364 MWh, compared to total claimed lighting savings of 95,947 MWh.

[165] EPA partner sales data for 2005 were not available at the time of this report so net units for 2005 could not be estimated.

Table 3-23. Example of Calculation of Additional kWh Program Savings from Appliances

	A	B	C	D	E	F	G
Product	**Net Increase in Market Share**	**# Units Shipped**	**Net Units**	**Net Units with Electric DHW**	**Savings/ Unit (kWh)**	**Total Annual Savings (kWh)**	**Total Lifetime Savings (kWh)**
2001							
Clothes Washers	2.7%	200,700	5,352	1,392	201	279,710	3,636,235
Dishwashers	1.1%	151,600	1,738	452	82	37,059	741,174
Refrigerator	1.87%	260,700	4,862	4,862	48	233,388	3,967,588
Total 2001						550,157	8,344,997
2002							
Clothes Washers	3.2%	210,500	6,757	1,757	201	353,121	4,590,579
Dishwashers	-1.1%	166,400	-	-	82	-	-
Refrigerator	3.6%	283,000	10,098	10,098	48	484,691	8,239,745
Total 2002						837,812	12,830,324
2003							
Clothes Washers	4.5%	231,600	10,311	2,681	201	538,849	7,005,034
Dishwashers	5.7%	180,500	10,372	2,697	82	221,130	4,422,597
Refrigerator	4.91%	313,800	15,417	15,417	48	740,026	12,580,449
Total 2003						1,500,005	24,008,080
2004							
Clothes Washers	4.0%	246,400	9,969	2,592	201	520,986	6,772,824
Dishwashers	5.6%	188,800	10,582	2,751	82	225,619	4,512,371
Refrigerator	3.9%	327,400	12,876	12,876	48	618,043	10,506,738
Total 2004						1,364,648	21,791,933

Sources:
A (Net increase in market share): Comparison of EPA National Partner Sales Data for NJ vs. comparison states (See Section 8.4.2)
B (Number of units shipped): Association of Home Appliance Manufacturers (AHAM)
C (Net Units): A * B
D (Net Units with Electric Domestic Hot Water heat): Assumes 26% saturation based on JCP&L estimate.
E (Savings per unit): NJ Protocols.
F (Total annual savings): D * E

G (Total lifetime savings): F * Measure Lifetimes (from NJ Protocol: Clothes washers – 13 years; Dishwashers – 20 years; Refrigerators – 17 years)

Table 3-24. Example of Calculation of Additional Gas Program Savings from Appliances

	A	B	C	D	E	F	G
Product	**Net Increase in Market Share**	**# Units Shipped**	**Net Units**	**Net Units with Gas DHW**	**Savings/ Unit (Therms)**	**Total Annual Savings (Therms)**	**Total Lifetime Savings (Therms)**
2001							
Clothes Washers	2.7%	200,700	5,352	3,158	10.6	33,473	435,151
Dishwashers	1.1%	151,600	1,738	1,026	3.95	4,051	81,018
Total 2001						37,524	516,170
2002							
Clothes Washers	3.2%	210,500	6,757	3,987	10.6	42,258	549,359
Dishwashers	-1.1%	166,400	-	-	3.95	-	-
Total 2002						42,258	549,359
2003							
Clothes Washers	4.5%	231,600	10,311	6,083	10.6	64,485	838,299
Dishwashers	5.7%	180,500	10,372	6,119	3.95	24,172	483,436
Total 2003						88,656	1,321,735
2004							
Clothes Washers	4.0%	246,400	9,969	5,882	10.6	62,347	810,510
Dishwashers	5.6%	188,800	10,582	6,244	10.6	24,662	493,250
Total 2004						87,009	1,303,759

Sources:
A (Net increase in market share): Comparison of EPA National Partner Sales Data for NJ vs. comparison states (See Section 8.4.2)
B (Number of units shipped): Association of Home Appliance Manufacturers (AHAM)
C (Net Units): A * B
D (Net Units with Gas Domestic Hot Water heat): Assumes 59% saturation based on JCP&L estimate.
E (Savings per unit): NJ Protocols.
F (Total savings): D * E
G (Total lifetime savings): F * Measure Lifetimes (from NJ Protocol: Clothes washers – 13 years; Dishwashers – 20 years; Refrigerators – 17 years)

Table 3-25. Example of Calculation of Additional Oil Program Savings from Appliances

	A	B	C	D	E	F	G
Product	**Net Increase in Market Share**	**# Units Shipped**	**Net Units**	**Net Units with Oil DHW**	**Savings/ Unit (MMBtu)**	**Total Annual Savings (MMBtu)**	**Total Lifetime Savings (MMBtu)**
2001							
Clothes Washers	2.7%	200,700	535	3,158	1.06	567	7,375
Dishwashers	1.1%	151,600	174	1,026	1.06	69	1,373
Total 2001						636	8,749
2002							
Clothes Washers	3.2%	210,500	676	3,987	1.06	716	9,311
Dishwashers	-1.1%	166,400	-	-	1.06	-	-
Total 2002						716	9,311
2003							
Clothes Washers	4.5%	231,600	1,031	6,083	1.06	1,093	14,208
Dishwashers	5.7%	180,500	1,037	6,119	1.06	410	8,194
Total 2003						1,503	22,402
2004							
Clothes Washers	4.0%	246,400	997	5,882	1.06	1,057	13,737
Dishwashers	5.6%	188,800	1,058	6,244	1.06	418	8,360
Total 2004						1,475	22,098

Sources:
A (Net increase in market share): Comparison of EPA National Partner Sales Data for NJ vs. comparison states (See Section 8.4.2)
B (Number of units shipped): Association of Home Appliance Manufacturers (AHAM)
C (Net Units): A * B
D (Net Units with Gas Domestic Hot Water heat): Assumes 10% saturation based on JCP&L estimate.
E (Savings per unit): NJ Protocols.
F (Total savings): D * E
G (Total lifetime savings): F * Measure Lifetimes (from NJ Protocol: Clothes washers – 13 years; Dishwashers – 20 years; Refrigerators – 17 years)

In 2004, these additional savings impacts from increased market share of appliances increased program savings by 8% and reduced the overall program cost of conserved energy from $0.011/kWh to $0.010/kWh.[166]

3.4.5 Summary of Baseline Saving Assessment

- The baseline market share for ENERGY STAR Products has shifted significantly. Market share measurements calculated for the 2004 program year in this analysis provide the best benchmark against which to measure changes in market share in subsequent years.

- The protocols used for determining per unit energy savings are appropriately conservative in most cases. Savings for specific products should reassessed periodically, particularly when minimum efficiency standards or ENERGY STAR requirements change.

- Additional savings, beyond those currently tracked, are achieved through the program as a result of increases in market share for ENERGY STAR-labeled refrigerators, clothes washers and dishwashers. In 2004, these additional savings increased program impacts by 8%.

3.5 Incremental Cost Assessment

3.5.1 Average Retail Price Compared to the Baseline Price

The evaluation team used a number of sources to estimate the incremental cost associated with ENERGY STAR products, each of which is discussed below.

Incremental Cost Estimates Based on Survey Data

When dealing with survey respondents, it can be difficult to obtain accurate information about the incremental cost differences between ENERGY STAR and comparable non-ENERGY STAR products. In particular, there were some specific difficulties during the survey process with regard to the incremental price difference between ENERGY STAR and comparable non-ENERGY STAR appliances. Many of the respondents' answers seemed significantly different than expected based on the experience of the assessment team and other secondary research. Some of the difficulty may be due to the fact that product features can sometimes differ substantially between ENERGY STAR and non-ENERGY STAR models. For example, most ENERGY STAR clothes washers are front-loaders and non-ENERGY STAR are top-loaders. Due to these challenges, the incremental price data gathered via the retailer and manufacturer surveys may not accurately reflect the market.

Incremental Cost Estimates Based on Web Research

In order to estimate the average incremental cost for ENERGY STAR products compared to standard products, the assessment team conducted independent pricing research. This entailed searching for New Jersey retailers with websites where product prices were posted. Additionally, the team also used "big box" retailer sites where pricing information specific to New Jersey was available. (Retailers were excluded from the analysis when the information available was not specific to New Jersey.) Whenever possible, pricing information on ENERGY STAR-qualified and non-qualified products was obtained for clothes washers, dishwashers, refrigerators, and light bulbs.[167] Additionally, the team also looked at other

[166] Total energy savings for cost of conserved energy calculation determined by converting Therms and MMBtu to kWh.

[167] At the time these data were being gathered, the team was unable to find New Jersey specific pricing for room air conditioners.

factors depending on product type. For instance, wattage and single versus multi-pack data was also gathered for light bulbs. Volume data was obtained for refrigerators and clothes washers. The team assembled all the available information found on these websites in order to conduct some basic examination as well as comparison to the baseline pricing information.

The lighting baseline study indicated that price was an important factor in whether people decided to purchase CFLs. In terms of lighting, the price of CFLs has decreased considerably across the country over the past few years. New Jersey has followed that trend. In 1998, the baseline evaluation found, "… the average retail price of a CFL bulb is about $15." From the current pricing research for NJ, the current average price of a singly packaged ENERGY STAR bulb is approximately $6 per bulb. However, the prevalence of CFL multi-packs in the market has altered the overall average price. Currently, the average per unit price of CFLs purchased in a multi-pack is less than $4.

The independent pricing research detailed above is illustrated in **Error! Reference source not found.**, which summarizes the pricing differences (through averages) detected by assessment team.

Table 3-26. Comparison of Product Prices

Product/Sub-Product Category	ENERGY STAR Price	Non-ENERGY STAR Price
Refrigerators Overall	$1569	$703
Refrigerators 17-22 cu ft.	$1282	$784
Clothes Washers	$852	$394
Front-Loading Clothes Washers	$649	NA
Dishwashers	$675	$416
Light Bulbs*	$5.34	$0.90

* Includes incandescent bulbs and CFLs sold singly and in multi-packs.

It is important to note that many of these product prices are size sensitive. In the pricing research done, no ENERGY STAR-qualified refrigerators (other than some compacts) were found less than 17 cubic feet in volume. On the other hand, the non-qualified refrigerators ranged between 9 and 22 cubic feet. Therefore, consumers needing small refrigerators due to space constraints most likely do not have the same variety of ENERGY STAR choices as without those constraints. Also, the comparison of average prices where the size ranges overlap is interesting as it shows an approximate $500 average increase for an ENERGY STAR refrigerator between 17 and 22 cubic feet in volume. This compares with an incremental cost of $60 estimated by DOE[168] and $33 in the NEEP Strategic Initiative Review.[169]

With appliances, it is often seen that higher efficiency levels are often packaged with other performance features. The pricing research does not contain data allowing a comparison of average cost within size ranges that includes differences in other features (e.g., refrigerators with through the door water and ice or washers with multiple cycle options). However, it is important to note that through-the-door dispensers typically negatively impact a refrigerator's efficiency.

[168] "Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards."

[169] NEEP Strategic Initiative Review. September 29, 2004. p. 22. Calculated from synopsis of COE technical support document: Cost-Efficiency Analysis in Support of the Energy Conservation Standards for Refrigerators/Freezers.

Although the models of top-loading ENERGY STAR-qualified clothes washers have increased in the past few years, the price difference between ENERGY STAR and non-ENERGY STAR is significant. At present, the team found no ENERGY STAR clothes washers under $400 in New Jersey. In comparison, most non-ENERGY STAR clothes washers start in the $250-$300 range.

ENERGY STAR dishwashers are available at all price points. The pricing research found no real price gap between qualified and non-qualified dishwashers. Additionally, the variety of available models that are ENERGY STAR-qualified is significantly better than that of non-qualified models. As noted early, over 92% of the current models available are now ENERGY STAR-qualified.

Incandescent bulbs continue to be priced as low as $0.25 each in New Jersey (through a multi-pack purchase). An average standard incandescent bulb costs approximately $0.90. Please note that for the purposes of this report, a standard incandescent bulb is not 3-way, dimmable, daylight/full spectrum, or colored. For the most comparable incandescent and ENERGY STAR CFL bulbs, the incremental cost difference is $4.44. However, the incentive offered by the program which allowed ENERGY STAR CFL purchases for $0.99 virtually eliminated the incremental average cost different between the bulbs.

Estimates of Incremental Cost in New York

A recent study conducted by Quantec for NYSERDA used an extensive product and price database collected by Aspen, Inc. to estimate the incremental cost of ENERGY STAR products.[170] The evaluation team developed regression models to control for different product features, including size, style/layout, manufacturing location, etc. The results of the analysis show that the incremental cost attributable to ENERGY STAR can vary widely, from as low as 15% for room air conditioners to as high as 83% for clothes washers (**Error! Reference source not found.** and **Error! Reference source not found.**).

[170] Quantec, LLC, and Summit Blue Consulting, "New York ENERGY STAR® Products And Marketing Program: Market Characterization, Market Assessment And Causality Evaluation," prepared for NYSERDA, April 2006.

Table 3-27. Detailed Pricing Results for ENERGY STAR Appliances for NYSERDA

	Refrigerators	Dishwashers	Clothes Washers	Air Conditioners
# of observations	511	433	204	143
ES Price ($)	$1,349.81	$602.51	$927.50	$295.71
NES Price ($)	$945.40	$434.40	$456.34	$248.59
Mean $ Difference (ES-NES)	$404.41	$168.11	$471.16	$47.12
Mean % Difference ((ES-NES)/NES)	43%	39%	103%	19%
Difference Due to ES ($)	$243.29	-$1.14	$379.69	$36.56
Difference Due to ES (%)	26%	0%	83%	15%
Factors most influential on price	ES, changeable color panel, stainless steel finish, size (depth, height, width), side by side	Stainless steel finish, delayed start, energy saver setting, electronic tap buttons, grinder, push buttons, towerless	ES, sale value, special finish, capacity, cycles, warranty, size (depth, height, width)	ES, movable louvers, manufacturing location, capacity, ac type
Insignificant (or collinear) factors	Water filter, access type, ice maker, adjustable shelves, manufacturing location, warranty, bottom freezer	Racks, changeable color panel, es, hot start, quiet mode, annual energy use, arms, size, options, build in, dial, made in sweden, wash level	Manufacturing location, depth, temperature setting, top load, annual energy use	Delay start, electric t-stat, quick mount, hepa filters, heats and cools, remote control, timer, variable t-stat settings, cooling settings, size, warranty, fan speed, thermos settings, slide-out chassis, special finish, sale value, volts

Table 3-28. Detailed Pricing Results for ENERGY STAR Lighting Fixtures for NYSERDA[171]

	Ceiling Mounted Fixtures	Suspended Fixtures
# of observations	304	195
ES Price ($)	$53.49	$239.82
NES Price ($)	$43.10	$165.90
Mean $ Difference (ES-NES)	$10.39	$73.92
Mean % Difference ((ES-NES)/NES)	24%	45%
Difference Due to ES ($)	$24.24	$62.40
Difference Due to ES (%)	56%	38%
Factors most influential on price	ES, Brand, Country of origin, Size (width*depth), Number of bulbs	ES, Brand, Country of origin, Size (width*depth), Number of bulbs
Insignificant factors	Number of shades, Special shades	Special shades

3.5.2 Changes in Incremental Cost

Retailers were asked to assess the change in the incremental cost of ENERGY STAR vs. standard products. As shown in **Error! Reference source not found.**, there was no clear consensus that the incremental cost had gone up (18%) or down (23%). In fact, over a third of the responses (35%) were "don't know," indicating that retailers had a difficult time answering this question. Uncertainty regarding the incremental cost was highest among the lighting (bulb and fixture) retailers, possibly for a number of reasons, including:

- Change in prices due to Change-a-Light campaign – prices drop during the campaign, and then increase after the campaign.
- The nature of the retailers that sell light bulbs – drug stores and grocers that may outsource light bulb stocking and display.
- Retailers that have recently joined the program – just started stocking CFLs and ENERGY STAR fixtures, and lack historical price knowledge.

Among those respondents that said the incremental cost was decreasing, many credited increased consumer demand driving increased production/sales and the resulting economies of scale for the production of efficient models. Generally, however, it is not clear that incremental cost has changed at all during the last few years.

[171] The data also included CFLs, but these were based off of the incremental cost of going from a non-ENERGY STAR CFL to an ENERGY STAR CFL and provided counterintuitive results (negative incremental cost), possibly due to the types of stores that carry them (e.g., those stores that carry ENERGY STAR CFLs sell higher quantities and can discount). Similarly, other measures (e.g., outdoor fixtures) provided counterintuitive results and are not included here.

Federal tax credits are available to manufacturers of energy-efficient appliances in 2006-2007 that should have some impact on incremental cost of those items. Tax credits of $75 to $175 are available for the manufacture of refrigerators that exceed the current efficiency standards by 15 to 25% or more. A credit of $100 per unit are available for clothes washer that meet the 2007 ENERGY STAR standard. Credits for dishwashers meeting the 2007 ENERGY STAR standard are to be determined. These tax incentives are offered to the manufacturer of the appliances. In working with manufacturers, the program will want to encourage manufacturers to pass at least part of the tax savings on to consumers as lower incremental cost. Additional cooperative advertising opportunities could be offered to these manufacturers.

Figure 3-36. Retailer Perception of Incremental Cost Changes Over the Last Three Years, All Products Combined

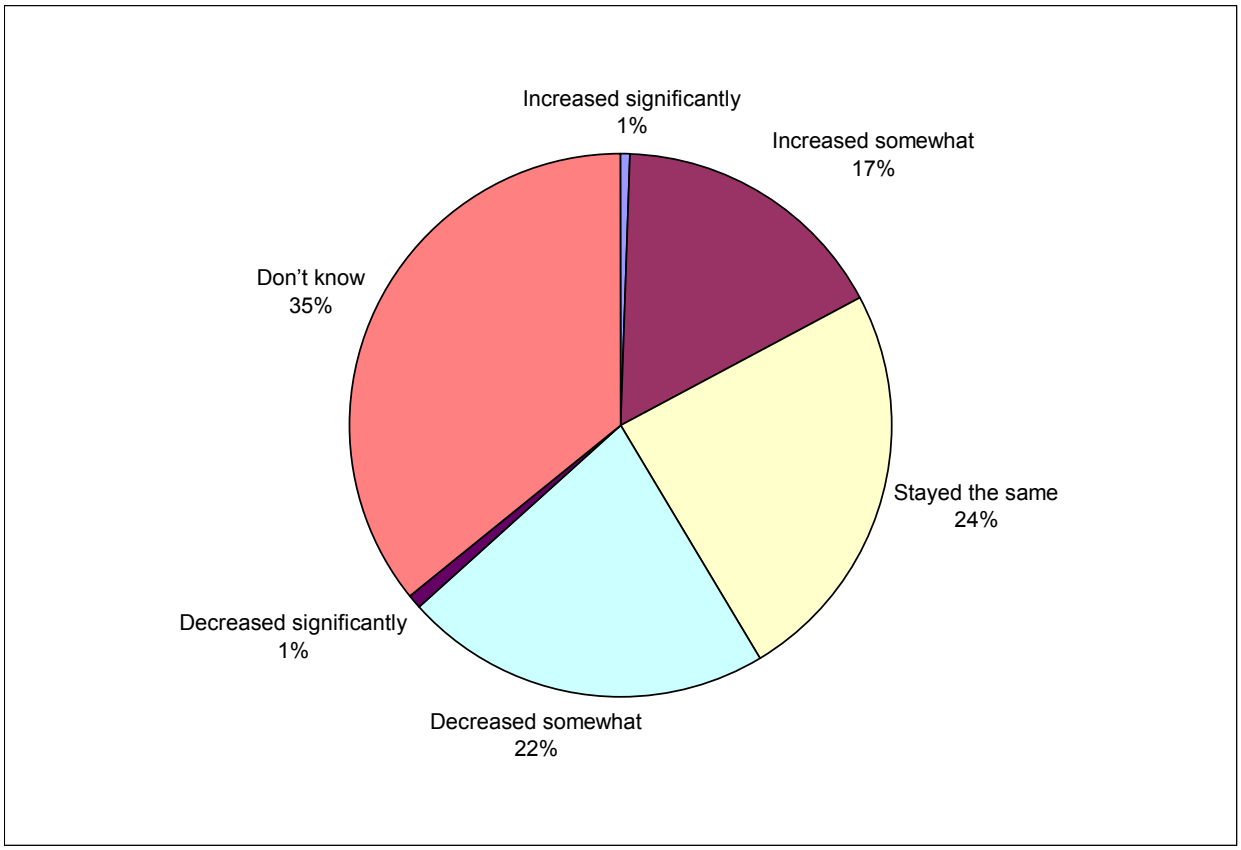


Table 3-29. Retailer Perception of Incremental Cost Changes the Last Three Years, by Product

	Clothes Washer		Dishwasher		Refrigerator		Room Air Conditioner		Light Bulbs		Light Fixtures		Windows	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Increased significantly	1	5%	-	0%	-	0%	-	0%	-	0%	-	0%	-	0%
Increased somewhat	4	19%	4	19%	4	19%	4	19%	6	15%			2	15%
Stayed the same	7	33%	6	29%	8	38%	5	24%	4	10%	2	22%	3	23%
Decreased somewhat	6	29%	8	38%	6	29%	7	33%	2	5%	2	22%	1	8%
Decreased significantly	-	0%	-	0%	-	0%	-	0%	-	0%	1	11%	-	0%
Don't know	3	14%	3	14%	3	14%	5	24%	27	69%	4	44%	7	54%
Total	**21**	**100%**	**21**	**100%**	**21**	**100%**	**21**	**100%**	**39**	**100%**	**9**	**100%**	**13**	**100%**

3.5.3 Summary of Incremental Cost Assessment

Changes in incremental cost of ENERGY STAR-labeled products varies across product types. Products for which the functionality is similar between labeled and non-labeled products (e.g., lighting and dishwashers) tend to have lower incremental costs. For ENERGY STAR products that often have increased performance features packaged with the improved efficiency (clothes washers and to a lesser degree, refrigerators), incremental costs tend to be higher, or have not decreased as much.

3.6 Market Barriers Assessment

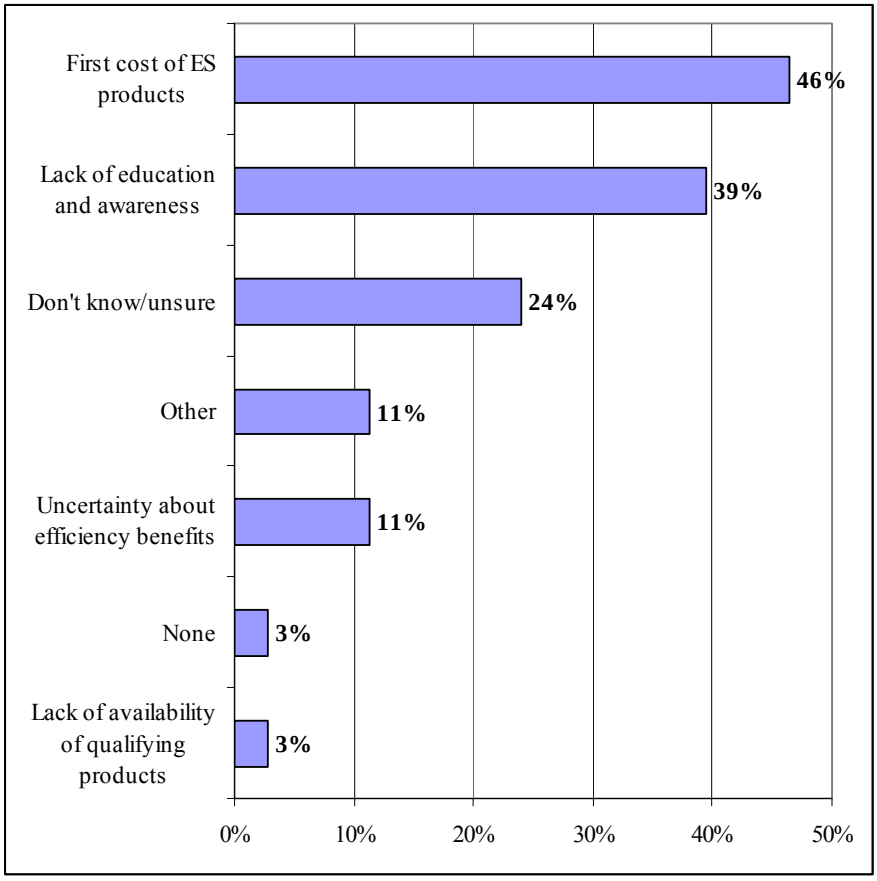
The different product types have different challenges with regard to market barriers. However, the participating retailer respondents provided significant feedback in terms of what were the market barriers to achieving higher market share, and the effectiveness of the program in addressing them.

The primary market barriers identified by retailers and manufacturers included:

- First cost of ENERGY STAR products
- Lack of education and awareness
- Uncertainty about benefits

As shown in **Error! Reference source not found.**, nearly half of the retailers identified the higher cost of the ENERGY STAR-labeled products as a major barrier to adoption of energy-efficient technologies. The second most often identified barrier was the lack of education and awareness amongst consumers.

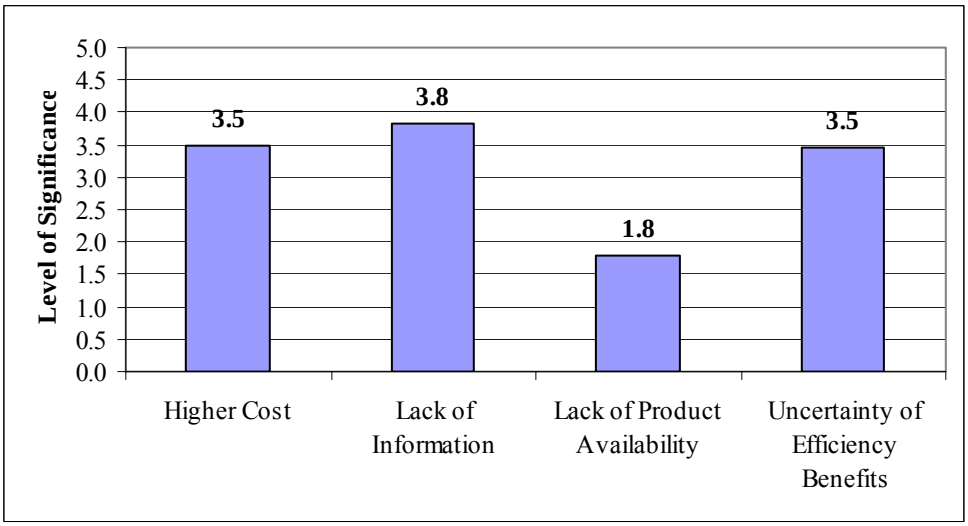
Figure 3-37. Retailers' Perceptions of Barriers to Adoption of ENERGY STAR-labeled Products



Source: NJ ENERGY STAR Products Retailer Survey, n=71

We then asked retailers to rate the significance of those barriers on a scale of 1 to 5 where 5 was "very significant" and 1 was "not at all significant".

Figure 3-38. Significance of Barriers to Adoption



Source: NJ ENERGY STAR Products Retailer Survey, n=54.

Though more retailers identified higher first cost of products as a barrier, the lack of information was regarded as the most significant barrier to adoption of ENERGY STAR-labeled products. Uncertainty regarding efficiency benefits and higher first cost were regarded as equally significant. Product availability was not considered a significant barrier.

The barriers already known by the program are accurate for appliances and light bulbs. However, windows retailers have many issues specific to them.

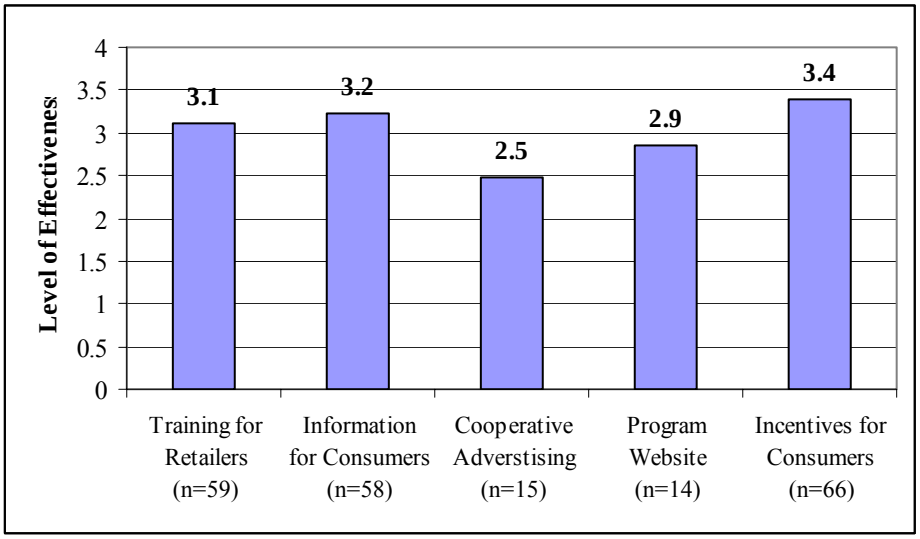
The comments below illustrate their struggles well.

> "A major barrier to people purchasing ENERGY STAR windows is when customers are buying new windows for their house because they are fixing it up to sell it. Since they will not be paying the heating bill, they won't pay for the increased expense of ENERGY STAR windows."
>
> "My experience is that generally homeowners are willing to pay for the ENERGY STAR windows while landlords and renters are not. Also, when it's a single window replacement issue (necessary due to breakage), it's harder to upsell to ENERGY STAR."
>
> "They only sell ENERGY STAR windows. 97% of our company's business is from contractors, although our showrooms are open to the public. We do not stock many windows, but instead, special order direct from the manufacturers. I haven't seen the program rep in quite awhile and actually was not aware that the program was still going on."
>
> "We sell 99% ENERGY STAR windows. As far as I know, our program person only visited us once. I believe that people only understand ENERGY STAR after they have spoken with a salesperson at our store, but not before that point."

Most of the small chain program participants for the window portion sell virtually all ENERGY STAR windows. Therefore, the non-ENERGY STAR windows are mostly sold through the large chain home improvement and builder supply stores.

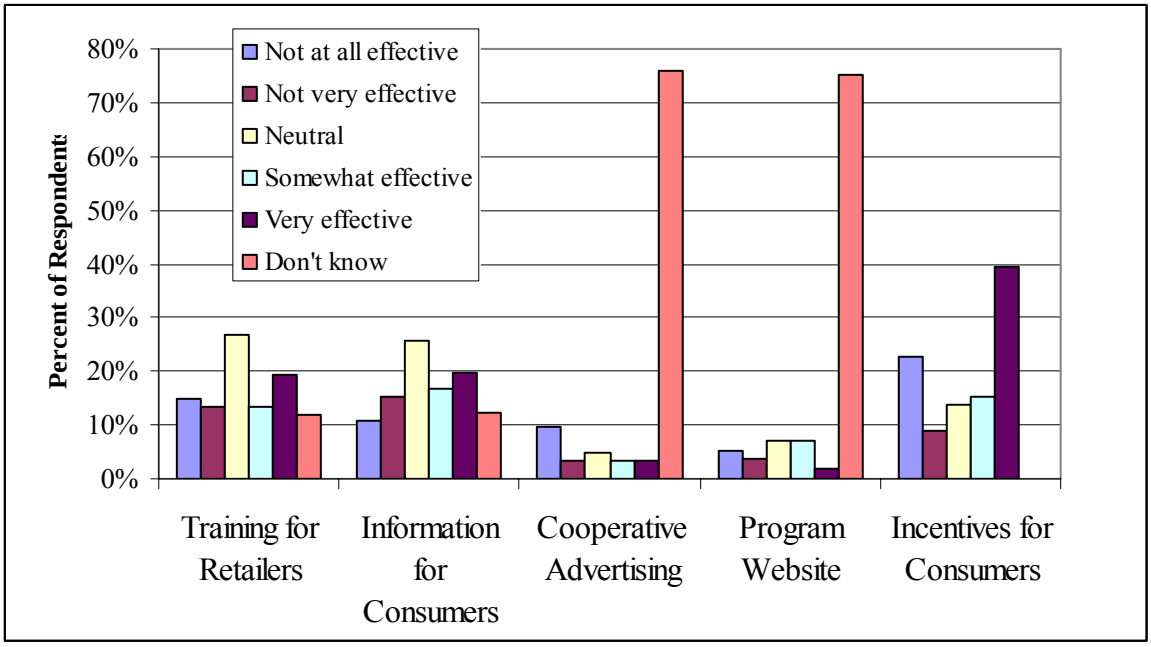
Retailer's perceptions about the program's effectiveness in reducing the barriers are shown in **Error! Reference source not found.** and **Error! Reference source not found.**. **Error! Reference source not found.** shows the average rating of the effectiveness of the various program elements, while **Error! Reference source not found.** shows the distribution of ratings. Interestingly, there was little awareness amongst retailers about the program website and the cooperative advertising opportunities, with over 70% of respondents unable to comment. This is key, because the lack of information, which can be addressed via cooperative advertising and website content, appears to be the biggest barrier for both retailers and consumers (as discussed below).

Figure 3-39. Effectiveness of Program Elements in Reducing Market Barriers



Source: NJ ENERGY STAR Products Retailer Survey

Figure 3-40. Effectiveness of Program Elements in Reducing Market Barriers



Source: NJ ENERGY STAR Products Retailer Survey (n=66)

We also asked consumers about barriers to adoption of ENERGY STAR-labeled products. When asked about what prevented them from purchasing an ENERGY STAR product, consumers gave the following responses as shown in **Error! Reference source not found.**.

Table 3-30. Consumer Reasons for Not Purchasing ENERGY STAR-Qualified Products

Product	n	Too expen-sive	Couldn't find one with the features/ style/ quality I wanted	Wasn't sure what the label meant	Just wasn't a consid-eration	Not too sure if it is Energy Star or not	Wanted to stay with brand/ didn't recognize new brand	Contractor/ company recomm-ended	Other/ Don't Know
Refrigerators	47	10.6%	8.5%	2.1%	66.0%	10.6%	0.0%	0.0%	2.1%
Clothes Washers	49	8.2%	6.1%	4.1%	75.5%	2.0%	0.0%	0.0%	4.1%
Room AC	24	15.4%	19.2%	15.4%	42.3%	0.0%	3.8%	0.0%	3.8%
Light Fixtures	60	0.0%	31.7%	0.0%	65.0%	0.0%	0.0%	0.0%	3.3%
Light Bulbs	149	7.8%	4.6%	0.0%	75.2%	0.7%	4.6%	0.0%	7.2%
Thermostat	43	0.0%	2.3%	0.0%	83.7%	2.3%	0.0%	7.0%	4.7%
Windows	42	4.8%	7.1%	0.0%	76.2%	0.0%	0.0%	2.4%	9.5%

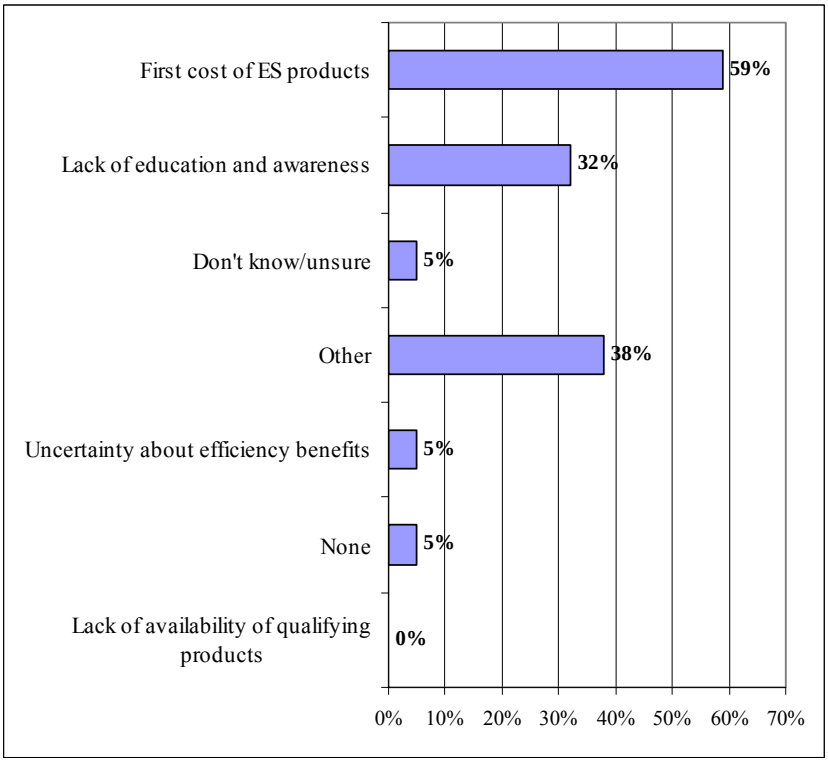
Source: NJ ENERGY STAR Products Consumer Survey. Respondents that did not purchase an ENERGY STAR-qualified product.

While the responses vary by product, consumers report price as a much lower concern than retailers did. The most frequent response was that the purchase of the ENERGY STAR product was not a consideration for the consumer. This would align with the retailers' concerns about lack of information. Price seemed to be a factor mostly with the room air conditioners. This may be because consumers are hesitant to pay a premium for an energy-efficient model that they perceive may be used infrequently. As would be expected, the ability to identify qualifying ENERGY STAR models with desired features or style was most significant with light fixtures.

Manufacturers were also asked about the barriers to adoption of energy-efficient technologies. Their responses are shown in **Error! Reference source not found.**. Again, first cost was the most frequently cited barrier (59% of respondents). Lack of education and awareness was named by 32% of respondents.

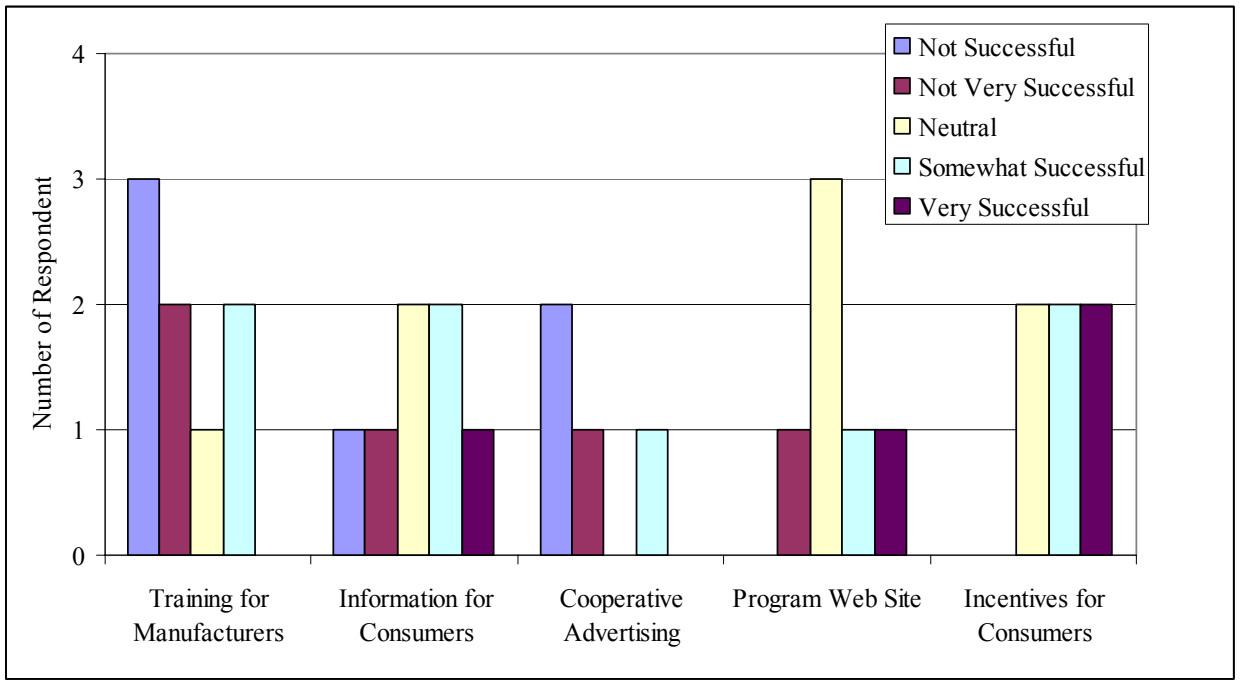
Manufacturer perceptions of the success of the program elements in reducing these barriers are shown in **Error! Reference source not found.**. Clearly, manufacturers see room for improvement, especially in the areas of training and cooperative advertising.

Figure 3-41. Manufacturers' Perceptions of Barriers to Adoption of ENERGY STAR-labeled Products



Source: NJ ENERGY STAR Products Manufacturer Survey (n=37)

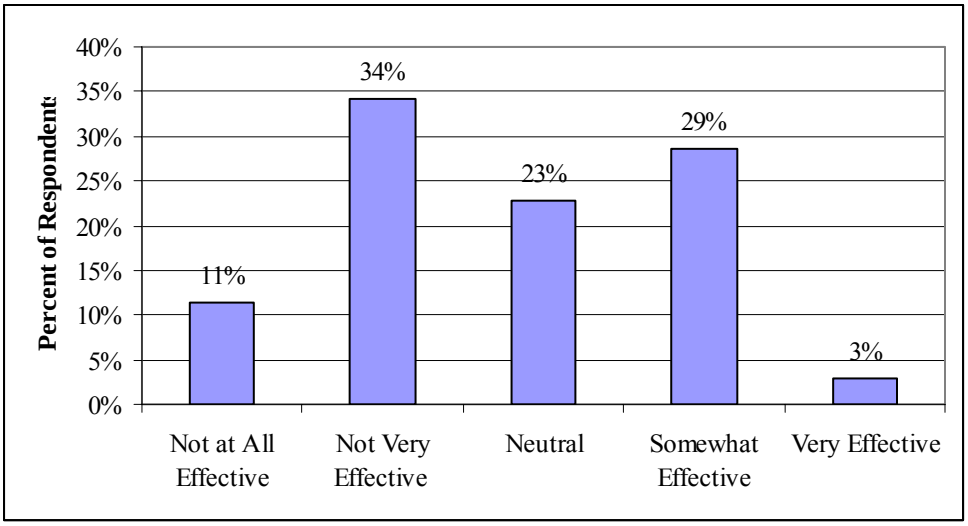
Figure 3-42. Effectiveness of Program Elements in Reducing Market Barriers



3.6.1 Summary of Program Effect on Market Barriers

The ENERGY STAR Products Program has achieved some success in reducing market barriers. However, there is still a great deal of room to make improvements. **Error! Reference source not found.** depicts the feedback received from retailer survey respondents about the program's effectiveness in reducing the market barriers affecting the penetration of all products. Only 3% of respondents indicated that the program is very effective with regard to lessening the impact of market barriers. More retailers said that the program was not effective at reducing the barriers (45%) compared to those who said that the program was effective (32%). Over one-fifth of all respondents said they were neutral, meaning that the program was neither effective nor ineffective. These responses clearly demonstrate that there is additional potential for the program.

Table 3-31. Retailer Perception of Program Effectiveness in Reducing Market Barriers



Source: NJESP Retailer Survey (n=71 participating retailers)

The high number of consumers indicating that the purchase of ENERGY STAR-labeled products was just not a consideration for them (**Error! Reference source not found.**) indicates further room for improvement of the program.

When asked what they would change to make the program more effective, retailers' responses were in three primary areas:

- Provide additional rebates:

  "The program is a great opportunity to introduce people to the ENERGY STAR bulbs. Incentives create a win-win situation for the utility, the retailers and the public."

  "Need incentives for appliances."

  "Need better rebates for consumers. Anything to help reduce the price gap."

- Provide more marketing and educational support:

  "Education - lots of TV advertising (needs to be catchy & funny- memorable though)."

"Incorporate a strong consumer education component into the program."

"More marketing materials needed for retailers."

- Provide more consistency in program approach:

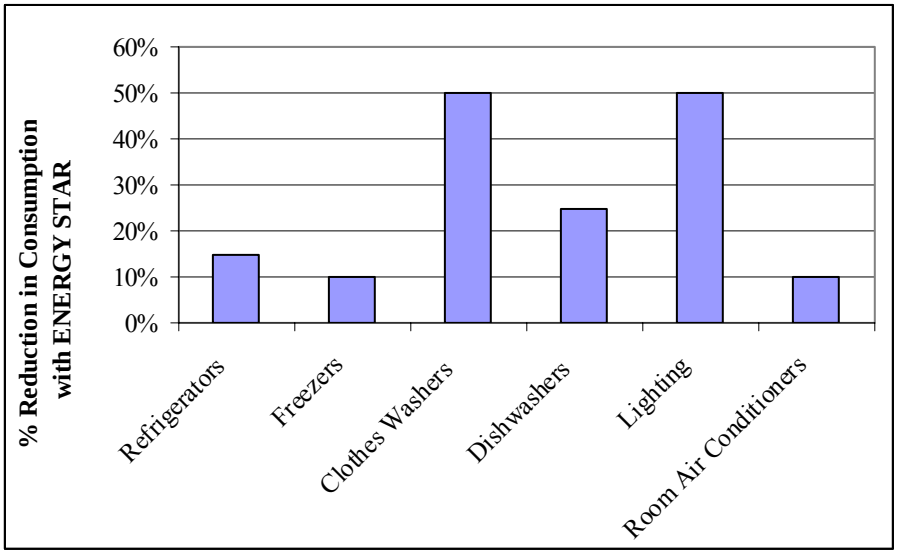
  "We are not sure that rebates will be available, but need to order stock for the upcoming season. It will affect our decision."

The most significant market barriers, as seen by consumers and retailers, are the lack of awareness and understanding and the additional cost of high-efficiency technologies. Feedback on the relative importance of these two barriers is mixed, but awareness and knowledge appears to a slightly more significant barrier. In theory, the program addresses both of these barriers directly, with consumer education and advertising and incentives (or buy-downs). One of the most telling statistics is the high number of consumers that did not purchase ENERGY STAR qualified products that reported they hadn't considered an ENERGY STAR option (**Error! Reference source not found.**). There were few suggestions for new program elements, but significant feedback that there needed to be more of and consistent availability of existing program elements, i.e., marketing and communication materials, consumer advertising, and incentives.

3.7 Upgrade of Energy Efficiency Codes and Standards Assessment

Federal standards related to appliance efficiency have closed the gap between the minimum efficiency levels and the best available technologies; however, even with the narrow gap, significant savings are available. For example, it is estimated that ENERGY STAR clothes washers and lighting reduce energy consumption by 50% when compared to the current federal standards (**Error! Reference source not found.**). This highlights the importance that changes in codes and standards, in conjunction with programs like ENERGY STAR Products, can have on energy consumption.

Figure 3-43. Savings from ENERGY STAR over Federal Standards



Source: www.energystar.gov

New Jersey is one of eight states that have established state appliance efficiency standards.[172] In 2005, the state passed legislation for the following items:

- Commercial clothes washers
- Commercial refrigerators and freezers
- Illuminated exit signs
- Air-cooled very large commercial package air conditioning and heating equipment
- Low-voltage dry-type distribution transformers
- Torchiere lighting fixtures
- Traffic signal modules
- Unit heaters

Most germane to the Products program are the torchiere lighting fixtures and unit heaters. Within two years of the legislation going into effect (by March 2007), no products can be offered for sale in New Jersey unless they meet or exceed the specified standard.

Torchiere lighting fixtures, referred to as portable lighting fixtures in the ENERGY STAR Products Program, can consume a maximum of 190 Watts, and not be retrofitted to use more than that. Interestingly, there are incandescent torchiere lamps that meet the new efficiency standard. While the new standard may not drive significant increases in penetration of the energy-efficient torchiere lamps, it will prevent the adoption of high-wattage halogen torchieres. Unit heaters[173] must be equipped with an intermittent ignition device (i.e., no pilot light) and must have either power venting or an automatic flue damper.

To help facilitate implementation of these standards, incentives for energy efficiency torchiere lamps that exceed the new standard may be offered. Incentives, offered at the consumer level, will create awareness both of the availability of the efficient technologies and New Jersey's efforts to promote efficient use of energy within the state. Incentives will also encourage participating retailers to stock equipment that meets or exceeds the new standard prior to March 2007.

Ultimately the efficiency standards for these products were addressed by federal legislation. NJ will be able to implement its standards until the federal standards for the same products go into effect (i.e., the federal standards will supersede the state standards). The ability of states to establish upgraded codes and standards is felt to support the establishment of new and higher standards at the federal level. As one person interviewed stated, "*The state efforts have pushed federal efforts*."

Beyond the current federal and state standards, the Appliance Standards Awareness Project (ASAP) recommends that states adopt new codes and standards for a wide range of products including compact

[172] Pew Center on Climate Change.

[173] "Unit heater" means a self-contained fan-type heater that uses natural gas, propane, or fuel oil and is designed to be installed within a heated space. Unit heaters include an apparatus or appliance to supply heat, and a fan for circulating air over a heat exchange surface, all enclosed in a common casing. Unit heaters do not include "warm air furnaces" as specifically defined under the federal Energy Policy Act of 1992

audio products (shelf stereos) and DVD players and recorders[174]. By doing so, they estimate the following potential savings in one year and by the year 2020 shown in **Error! Reference source not found.**.

Table 3-32. Potential Savings from Adoption of Standards for Home Electronics

	Energy Savings in One Year (GWh)	Energy Savings by 2020 (GWh)	Summer Peak Capacity Reduction in 2020 (MW)
Compact Audio Products (e.g., Shelf stereo)	10.1	50.5	7.0
DVD Players and Recorders	1.5	7.3	1.0
Total	**11.6**	**57.8**	**8.0**

Source: ASAP Summary of Benefits by Product for New Jersey

It is a common perception that many of the home electronics currently available are energy-efficient, however, according to ASAP, only 28% of the compact audio products manufactured in 2004 met the ENERGY STAR specifications. It is estimated that 64% of DVD players met the ENERGY STAR standards in 2005. For either of these products, the incremental cost of meeting the standard is estimated to be very low, about $1 to modify power supply design to substantially reduce standby power use (53 kWh per year for audio products and 11 kWh per year for DVD products).

While the adoption of new appliance and equipment standards helped to pave the way for similar legislation at the federal level and will result in accelerated savings for the state, they will have little, if any impact on the ENERGY STAR Products program. There may be some short term opportunities to offer additional incentives for torchiere lamps to increase supply and demand of products that meet or exceed the new standard that comes into effect.

New Jersey may also consider adoption of efficiency standards for certain home electronics equipment. Adoption of additional standards could save 57.8 GWh by 2020, or enough electricity to power 6,800 New Jersey homes.

3.8 Rebate and Incentive Level Assessment

To date, the New Jersey ENERGY STAR Products Program has implemented incentives targeted at two product types:

- CFLs and lighting fixtures
- Room air conditioners

The program utilized a manufacturing buy-down program for ENERGY STAR bulbs. This effort allowed CFLs to be available to the public at $0.99. In 2005, a total of $3,597,000 was spent on lighting incentives (buy-down) to promote the sale of 1,223,155 lighting products. The average incentive per product is

[174] We discuss these two equipment categories because of their potential fit with the ENERGY STAR Products program.

calculated at $2.90. It is important to note that 5% of the lighting products were fixtures for which a larger incentive was likely paid.

The retailer feedback with regard to this lighting incentive was generally positive:

> *"*Overall, I like the program and think it does a good job of getting people to try the CFLs. I've had repeat customers from satisfaction with the long life of these bulbs."
>
> "My experience was that the rebates encouraged people who were skeptical to try the bulbs."
>
> "I think that people did not realize that the ENERGY STAR bulbs were going to save electricity. I believe that they were simply responding to the incentive."
>
> "We have the ENERGY STAR bulbs on a high visibility end cap in the store and they continue to sell well. The customers have given positive feedback to store employees about the long life of the bulbs."
>
> "During beginning of program, the bulbs sold very well but now sales have slowed significantly. I would really like to see a rebate on CFL multi-packs!"

The New Jersey ENERGY STAR products contracts with manufacturers and retailers so that specific lighting products are offered to consumers at a discounted prices. It is important to note that several retailers stated that they would prefer a lighting incentive program where they would be able to sell the ENERGY STAR bulbs that they normally carry rather than be required to sell bulbs specific to the program. Although this change would require a different approach to the incentives from the sponsor, it is a possible way to encourage greater CFL purchases, and increase both the depth and the breadth of program participation.

A number of retailers also voiced concern that the intense, but short-lived annual span of the program can confuse and frustrate consumers as they may shop following the promotion and not find the products or the anticipated reduced prices they were looking for. The utilities and program implementers echoed this concern. They reported that the targeted Change-A-Light promotion has proved effective, but forces the implementers to spend a tremendous amount of money ($3 million to $6 million) in only a two month time frame. This leads to a "quick hit" approach and does not give the retailers the "ammunition" they need to effectively promote ENERGY STAR products throughout the year. A year round approach, with a more aggressive marketing campaign during the fall months, would allow retailers to stock qualifying products throughout the year, eliminate consumer confusion, lead to higher retailer satisfaction, and facilitate program implementation.

For room air conditioners the program offered limited rebates ($20-$25) directly to the end-user. The retailer feedback for this rebate was more varied. Many retailers gave feedback that the roll out of the rebate program took place too late and they would really appreciate having all the training and materials prior to the rebate period. Also, since some of the utilities subsidized room air conditioners under previous programs, a few respondents voiced that they would like to see some of the higher rebates levels from the past again. Most of the retailers, regardless of size, agreed that whether consumers purchased ENERGY STAR room air conditioners was impacted by the weather much more than anything else. The general consensus was that during hot summers (and particularly hot days) consumers buy the room air conditioners that are available. Consumers will purchase the ENERGY STAR units regardless of cost, because all the less expensive and less efficiency units have already been sold. During mild summers, it is difficult to sell the ENERGY STAR units even with the rebate. However, there was a clear indication that

the rebates affected the stocking practices of retailers, with several of them indicating that they needed to know about the rebates to make their purchasing decisions.

While retailers were quite insistent that incentives are necessary for the successful promotion of ENERGY STAR products, they seem less sensitive to the level of the rebates. The use of limited rebates, designed to generate interest in ENERGY STAR-labeled products, may serve as an effective promotional tool for retailers. Limited rebates to entice consumer interest, rather than those designed to cover a large percentage of incremental cost, may be useful to promote the program and increase market share.

Historically, the program has not offered incentives for appliances such as clothes washers, refrigerators or dishwashers though they promote them through participating retailers.

Finally, discussions with the utilities and program implementer revealed that a relatively small percentage (5%) of the budget is spent for cooperative advertising. Cooperative advertising can greatly leverage funds, reinforce the commitment on the part of participating retailers and manufacturers, and overcome barriers such as awareness and perceived value.

Available Tax Incentives

In August 2005, the Energy Policy Act of 2005 was signed into law. In addition to increasing the federal minimum energy efficiency standards on 16 products, the act includes manufacturer and consumer tax incentives for advanced energy saving technologies and practices. These tax incentive provisions provide for more than $2 billion for advanced energy saving technologies and practices beginning in 2006 and extending until 2007.

With regard to the ENERGY STAR Program, the Energy Policy Act offers homeowners incentives of 10% of the cost, up to $200, for the installation of ENERGY STAR qualified windows, skylights, and storm windows.[175] These federal incentives are likely to increase interest in ENERGY STAR windows and provide an opportunity for the Program to ramp up marketing efforts to promote these incentives.

Summary of Incentive Recommendations

The New Jersey ENERGY STAR Products Program should consider the following criteria for strategically determining rebate strategies. The primary factors that should be considered include:

- The efficiency improvement to be gained by moving from a technology that meets a standard to one that meets or exceeds the ENERGY STAR-label criteria
- Incremental cost – how much of a price premium exists for a qualifying model of a particular product
- Existing market share – an indication of the extent to which selection of high-efficiency models have become standard practice
- The particular factors that customers and retailers reported as barriers to adoption of energy efficient technologies

[175] Incentives are also offered for a number of other ENERGY STAR qualified products, including exterior doors, storm doors, metal roofs. Note that there is a $500 maximum amount per homeowner for all improvements combined.

Based on those criteria, we make the following incentive recommendations:

- ***Offering year-round lighting promotion activities***. While the program may continue to leverage the national Change-A-Light campaign, year-round marketing and incentives should be adopted. There is substantial remaining savings potential and market share, from a total bulb perspective, is lower than any other product.

- ***Shifting funds from incentives to co-op advertising***. The cooperative advertising budget should be at least 50% of the program budget. Retailer and manufacturer contributions will at least double, if not triple, the amount of advertising and marketing spending. Co-op advertising may also allow for better collaborations with smaller retailers. For example, rebates for programmable thermostats require careful tracking of SKU numbers and sales figures; smaller retailers often do not have the sophisticated systems to conduct this type of tracking, thus putting them at a disadvantage compared to the major "big box" chains.

- ***Utilizing incentives as a marketing tool to drive consumer interest***. Retailers reported that the primary role of incentives was to raise awareness on the part of the consumer, not necessarily fully eliminate the incremental cost of the product. As an example, incentives can be reduced by 50% for room air conditioners, where ENERGY STAR market share is now extremely high, and the experience in New York is that once the market gains a certain amount of momentum incentives can be reduced or eliminated with only minimal loss in market share. One of the goals should be to utilize incentives to interest new (first-time) purchasers of ENERGY STAR products, not reduce the cost for repeat purchasers of ENERGY STAR products that will purchase the product regardless of the incentive.

- ***Offer lighting incentives at the retail level***. Offering coupons redeemable at local retailers or point-of-purchase rebates reinforces with consumers the higher value of ENERGY STAR-labeled products and creates higher recognition for the program.

- ***Allocating more program resources for lighting fixtures***. Lighting fixtures lagged other products in market share, yet had extremely high potential energy savings. The program should consider offering incentives and cooperative advertising as a means of raising consumer and retailer awareness and interest. Light fixtures have the added advantage of "locking in" the savings once the fixture is installed; CFLs, on the other hand, may be removed and replaced with incandescents because dissatisfaction over the light quality, performance (e.g., flicker or delay), or early failure. Incentives for torchiere lamps, particularly until new standards come into effect, will help prepare the market for standard change (i.e., encourage stocking of lamps that meet the new standard, increase customer familiarity with more efficient models).

- ***Consider incentives for ENERGY STAR-labeled clothes washers***. ENERGY STAR clothes washers can save half the energy used by a standard efficiency model, still face a significant incremental cost gap, and lag behind other products in market share. A tiered incentive may be considered that encourages consumers to move to units with higher MEF.

3.9 OCE Program Goals Assessment

The New Jersey ENERGY STAR Products Program has two stated goals:

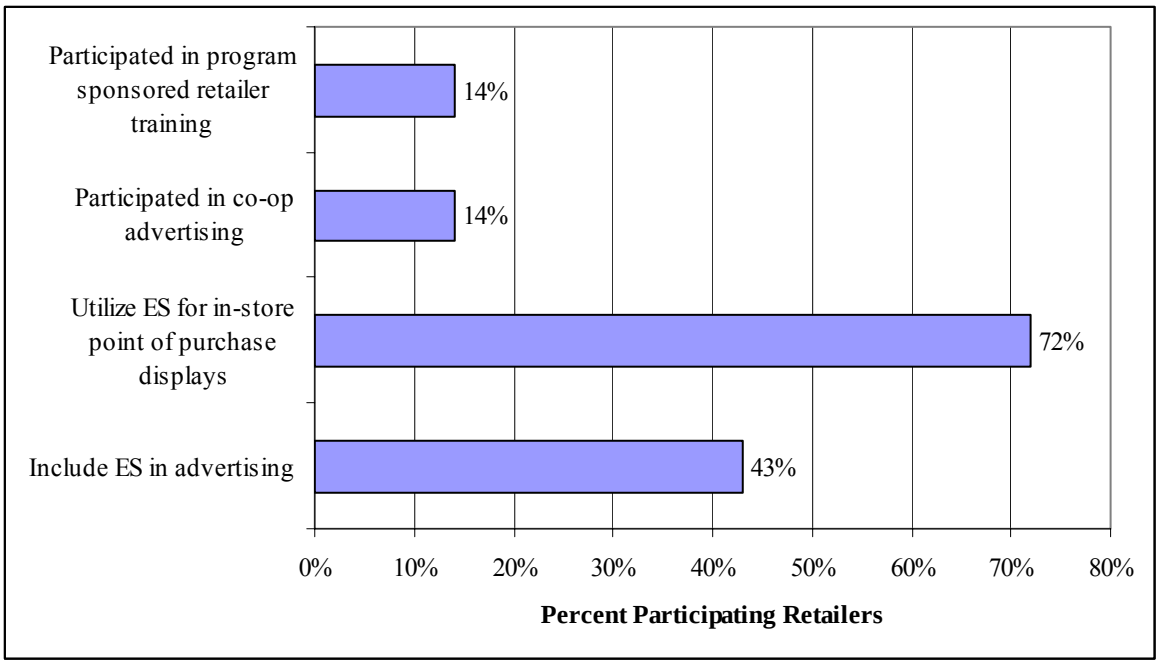
Maintain retailer ENERGY STAR partner commitments. This includes placing marketing materials in the stores that promote ENERGY STAR products, training sales associates in the benefits of and

how to sell ENERGY STAR products, and continuing to sponsor co-op advertising and product promotions that at least 15% of enlisted program retailers participate in by year-end.

Develop a broad based consumer promotion designed to have the most benefit to NJ consumers with input from the BPU, and industry. The ENERGY STAR products to be promoted (e.g. CFLs, clothes washers) will be selected in consultation with the BPU and industry experts.

The first goal has generally been met, although the level of success has varied by the different components of the goal. For example, although the program staff regularly visits participants to distribute materials and verify they are displayed, retailer training is being conducted on an ad-hoc basis so the actual level and extent of the training is not explicitly being recorded and is unknown (although 14% of retailers that responded to the survey reported that they participated in program sponsored training). In addition, 43% of the participating retailers that responded to the survey reported that they include ENERGY STAR in their advertising, and 72% reported that they utilize ENERGY STAR for their in-store point of purchase displays, well above the goal of 15%. However, few of the responding retailers (14%) reported using the co-op advertising through the program.

Figure 3-44. Retailer Participation in the New Jersey ENERGY STAR Products Program



Source: NJESP Retailer Survey (n=71 participating retailers)

The second goal does not present a quantitative goal, but a general description of program design and focus. Based on discussions with the utilities and implementation staff it appears that the program design has included a number of stakeholders, including the BPU, OCE, utilities, and manufacturers. However, the uncertainty regarding program budgets and delays with program planning have impeded program progress. For example, extensive negotiations with two major windows manufacturers to promote ENERGY STAR windows broke down after the planned (and later rejected) suspension of the ESP Program was announced. Joint promotions with manufactures need to be planned months in advance of their busy season (e.g., summer promotions of room air conditioners), and uncertainty and delays about program funding severely inhibits any joint promotion efforts. Utility respondents reported:

"The biggest challenge is the status of market managers and a need for a greater sense of certainty. People have been focused in past, now staff is dwindling: creativity takes confidence."

"We have not had a consistent program …everybody thinks the program is going away."

"We were proud of market presence two years ago, we have been in maintenance mode since"

3.9.1 Are these the correct goals?

Utility and stakeholder respondents reported that the current goals were originally developed with NEEP, and then revised slightly for New Jersey, with little market data to support their decisions. According to one respondent, "You cannot set up quantitative goals without the means of knowing where you are in beginning and end." When the transition of the programs was announced the utilities deliberately adjusted the goals to account for the future uncertainty, scaling them back or making them more "open ended" as appropriate.

Quantitative goals related to program participation levels (in terms of number of retailers, number of consumers, or percent market share achieved) and energy and demand savings achieved should be determined. The current vagueness of the program goals will unlikely move the program forward, however, they provide a basis for a larger more detailed structure with appropriate and realistic goals for the separate aspects of the ENERGY STAR Products Program.

3.9.2 What should the target goals be going forward?

Goals need to establish thresholds or targets to be able to assess not only if the program is successful, but how successful it is. Because the majority of products that are sold are sold through retailers that have already signed a participation agreement, these goals are generally set with the idea of not necessarily expanding up-stream market actor participation, so much as further engaging the current group of retailer participants.

Based on the historical performance of the program and the findings from this evaluation, the following targets may be considered:

Table 3-33. Suggested Program Goals

Program Goal	Quantitative Target	Basis for Quantitative Target
Co-op advertising	25% of participating retailers utilize co-op advertising	Projected to be attainable, but provides a significant increase (78%) over current levels.
Co-op advertising	20% of the program expenditures are allocated to co-op advertising	Represents a significant increase over the current 6% spent on marketing and promotions.
Co-op advertising	Retailer expenditures on co-op advertising match program advertising expenditures	Investment by retailers in advertising of ENERGY STAR qualified products is a meausure of their engagement in the program and leveraging of program dollars.
Training	20% of participating retailers participate in a formal training session	Projected to be attainable, but provides a significan increase (~40%) over current levels.
Market Share	Market share for targeted products should increase by 2% a year above the figures in this report	Market share increases for various products have ranged from -1.1% to 5.6%. This goal provides for steady and sustainable increases in market share.

3.9.3 What should the stretch goals be?

The following are suggested "stretch" (more aggressive) goals that should be considered:

Table 3-34. Suggested Program Stretch Goals

Program Goal	Quantitative Target
Co-op advertising	35% of participating retailers utilize co-op advertising
Co-op advertising	50% of the program expenditures are allocated to co-op advertising
Co-op advertising	Retailer expenditures on co-op advertising are double program advertising expenditures
Training	30% of participating retailers participate in a formal training session
Market Share	Market share for targeted products should increase by 4% a year above the figures in this report

3.10 Program Recommendations

At the present time, the New Jersey ENERGY STAR Products Program is in – according to a number of stakeholders – a "holding pattern." There is no strong recruitment of additional retailer or manufacturer partners and little marketing outside the Change-A-Light effort. Uncertainty exists on whether rebates for

room air conditioning will continue to be offered, making retailers wary about stocking a high percentage of ENERGY STAR models for the 2006 season.

Participating retailers continue to promote ENERGY STAR-labeled appliances (clothes washers, dishwashers and refrigerators), but some feel the marketing materials are dated and less effective than they could be. There was considerable confusion amongst the window retailers about current program status, some wondering if the program was still active.

While the awareness and market share achievements of the program are significant, the sense of the market assessment team is that the program could be modified or enhanced to increase the market share of ENERGY STAR-labeled products even further, and this section summarizes our key findings and recommendations. Recommendations are offered for the Products program as a whole and for specific technologies included under the Products umbrella.

3.10.1 Key Findings

Market assessment tracks changes in markets over time with a specific focus on market indicators that might be influenced by the ENERGY STAR Products program. The following are selected findings from the market assessment:

- The threat of program suspension, the uncertainty regarding program budgets, and the delays with program planning have impeded program progress. These factors have limited the ability of the program to work with a number of manufacturers. The program can only rely on previous "momentum" and established relationships with loyal partners for so long before these get "stale" and require a new infusion of marketing and incentive initiatives.
- The program has established a strong infrastructure with retailer participants that represent more than half of the store fronts in the state and account for more than three-quarters of the product sales.
- The retailers had widely disparate experiences with regard to their program representatives, some reporting frequent interaction and others reporting little or no interaction since program sign-up. This compares to feedback from the program implementer indicating monthly retailer visits. Possible reasons for these contradictory responses may be based on the quantity of retailers that the implementer needs to visit, or the fact that the implementer cannot reach all sales staff on each visit (especially at the larger, "big box" stores).
- The program training is currently conducted primarily on an ad-hoc, informal basis, with only 14% of the responding retailer reporting that they had participated in program sponsored training. Instead, most retailers currently obtain their product information from the manufacturers.
- Incremental cost of some ENERGY STAR products, light bulbs in particular, have been reduced significantly. For example, the 1998 baseline evaluation found the average retail price of a CFL bulb about $15; currently, the average per unit price of CFLs purchased in a multi-pack is less than $4.
- Participating retailers have increased their efforts to promote ENERGY STAR-labeled products, providing additional product options and dedicating additional floor space.
- New Jersey consumers are aware of the ENERGY STAR label and recognize the efficiency benefits of products bearing the label.
- New Jersey's ENERGY STAR Appliance Market Shares have, at least, doubled for most products over the past five years.

- The Program has achieved significant energy savings at an attractive cost of conserved energy.
- The Program is somewhat effective in addressing the primary barriers to adoption of energy efficient technologies (those being lack of awareness and understand and the first cost) with program marketing materials and available incentives.
- Some opportunities for program improvements exist to ensure that the program is effective at reducing market barriers to selection of ENERGY STAR products.

3.10.2 Recommendations

Program Umbrella

Structure the program in a clear, consistent way for retailers and consumers. The assessment team received a great deal of feedback that retailers and the public were confused about the timeframe for the rebates and incentives offered. Future designs should be structured around a consistent year-round promotion effort, with targeted periods of more intense efforts that coincide with purchasing patterns (e.g., targeting room air-conditioners during summer months). Mid-course changes to the program should made with great caution to ensure that market momentum is not diminished.

Formalize the market manager selection and transition. The survey respondents reported that the on-going uncertainty about the future of the program has severely impeded program progress. Joint promotions with manufacturers and retailers need to be planned months in advance of their busy season (e.g., summer promotions of room air conditioners), and uncertainty and delays about program funding severely inhibits any joint promotion efforts.

Develop more systematic communication between retailers and program implementers. Although the program implementer indicated they conduct monthly visits to participating retailers, the retailers reported widely disparate experiences with regard to their program representatives, some reporting frequent interaction and others reporting little or no interaction. A formal schedule for retailer visits would provide clearer expectations for retail participants and allow better tracking of interactions by the implementer.

Integrate a program training effort that is conducted with all participating retailers on a regular basis. The NJ ENERGY STAR Program can offer more objective (not brand-specific) information and training about what high-efficiency products are, the advantages to retailers offering them, and benefits to consumers purchasing them. Retailers historically have high turnover rates, so training sessions should be scheduled on a regular basis to educate new sales staff, plus regular classes can provide more detailed product information to more experienced sales staff. Furthermore, the program should carefully track the number of training sessions, the number of attendees, and the usefulness of the classes (through brief follow-up surveys).

Develop a low-income program targeted toward the education of non-native English speakers and target rebates on ENERGY STAR clothes washers, refrigerators and room air conditioners to these consumers. Retailer feedback indicated that low-income, non-native English speakers were the least likely to purchase ENERGY STAR products due to their price sensitivity. Supplemental rebates for these customers may be able to funnel through utility assistance programs. This action will most likely result in market penetration gains, as well as reduce the potential for freeridership.

Significantly expand the cooperative advertising program. Cooperative advertising can greatly leverage funds, reinforce the commitment on the part of participating retailers and manufacturers, and overcome barriers such as awareness and perceived value. This directly addresses a major concern of the retailers, who overwhelming said that they would like to see more marketing/education of the public about what

ENERGY STAR is and the clear benefits of the program. It also allows some of the smaller retailers who would like to have more opportunities through the program take advantage of cooperative advertising funds.

Conduct formal mystery shopping activities. The NJ ENERGY STAR Products Program should participate in the EPA mystery shopping multi-State study. Currently, the program will occasionally dispatch field staff to check on stocking, POS displays, and retailer awareness of ENERGY STAR. This is an informal process and used primarily for quality assurance, not as a formal assessment of program efficacy. The EPA study, referred to as the Retail Store Level (RSL) assessment, contains three components: a Sales staff evaluation (SSE) to evaluate the use of ENERGY STAR in sales pitch, a display check inventory (DCI) to check the presence of marketing materials, and the product shelf inventory (PSI) to check on stocking practices.

Regularly track program progress and evaluate performance. Once specific metrics are established, and a more robust database to track program activity, regular review of program progress toward meeting established goals should be conducted. Automated reporting, on a quarterly basis, of key metrics could facilitate regular tracking of the program. Comprehensive evaluations, conducted bi-annually, can assess the overall program performance, effect on market barriers, and changes in the baseline from which to measure market effects. Interim assessments, triggered by market activity such as changes in standards or ENERGY STAR requirements, should also be done to ensure the program pushes the envelope in terms of the adoption of more efficient technologies by New Jersey residents that otherwise would not have purchased them.

Windows

Responding utilities and stakeholders indicated that little effort has been made to integrate windows into the program. This was echoed by retailers currently "participating" in the program that were unaware the program was still in existence. There have been some training sessions for retailers, but little else. In fact, extensive negotiations with two major windows manufacturers to promote ENERGY STAR windows broke down after threaten suspension of the ESP Program was announced. Gas utilities, in particular, have large potential savings to be gained from an efficient windows program.

A clear, structured program to promote ENERGY STAR windows should be created. The program should include the development of explicit goals and tangible program elements for how to achieve them. For example, the training sessions for retailers should be ramped back up and co-op advertising should be offered for window manufacturers and dealers. The timing for promoting energy efficiency windows is particularly good with the Energy Policy Act of 2005 offering federal tax incentives for the installation ENERGY STAR qualifying windows. Participation in the NEEP ENERGY STAR Windows initiative should be continued.

Programmable Thermostats

Eliminate or reassign the thermostat program. Due to the nature of this product, it may achieve more if it were to be included in another portion of the State's energy efficiency program portfolio. Though these are offered by the larger retail outlets, they are not typically offered by the majority of participating retailers. In addition to being an important delivery agent for programmable thermostats, HVAC contractors can provide the necessary training to ensure that thermostats can be used effectively to achieve the desired savings.

Lighting

While market penetration in terms of number of customers purchasing at least one ENERGY STAR labeled fixture or compact fluorescent light bulb is high compared with other regions, when measured as a percent of total fixtures or bulbs purchased, there is clearly additional opportunities for cost-effective lighting applications. Tiered rebates, that increase in absolute dollars as well as percent of incremental cost, the more fixtures or bulbs that are purchased, may increase the depth as well as the breadth of participation. In addition, many bulb purchasers do not recognize that the compact fluorescent bulbs purchased may have the ENERGY STAR-label. With the purchase of multiple bulbs, the significance of the ENERGY STAR-label may increase because the consumer is making a larger investment.

The targeted Change-A-Light promotion has proved effective, but forces the implementers to spend a tremendous amount of money ($3million to $6million) in only a two month time frame. This leads to a "quick hit" approach and does not give the retailers the "ammunition" they need to effectively promote ENERGY STAR products throughout the year. It also leads to consumer confusion and frustration, as they may shop following the promotion and not find the products or they anticipated reduced prices they are looking for. A year round approach, with a more aggressive marketing campaign during the fall months, would allow retailers to stock qualifying products throughout the year, eliminate consumer confusion, lead to higher retailer satisfaction, and facilitate program implementation.

Appliances

Based on feedback from the participant surveys, increasingly high levels of market penetration have been achieved with refrigerators, clothes washers and room air conditioners. As the incremental cost of ENERGY STAR labeled refrigerators comes down, and more qualifying models are available, it may be that the market is nearly transformed. Threshold or target levels for the various performance indicators (e.g., market share greater than 70%) should be established to allow program administrators to recognize when these markets are substantially transformed. Future efforts should also consider branding a "best of the best" or "ENERGY STAR Plus" effort that identifies models that exceed the ENERGY STAR requirement. This effort is currently being conducted in other areas of the country for products with high ENERGY STAR market share (e.g., dishwashers, where over 92% of units now qualify for ENERGY STAR).

Incentives

Based on the recommended criteria for use in establishing incentives for various ENERGY STAR products, we recommend the following incentive ranges for specific technologies.

Table 3-35. Recommended Incentive Levels

ENERGY STAR Technology	Proposed Incentive Range	Basis for Recommended Incentive Level
Compact Fluorescent Light Bulbs	- $1.00 - $2.00 for standard CFLs - $2.00 - $3.00 for specialty CFLs (dimmable or three-way) - $5.00 - $7.00 for CFL multi-packs (3 or more bulbs)	Prices of CFLs have come down significantly, so the incentive for a single bulb should be reduced. Increased incentives for specialty bulbs will increase their adoption, while increased incentives for multi-packs will increase the depth of participation for this measure. Lower incentives (from the current buy-down level) are necessary to
ENERGY STAR-labeled Fixtures	$25 rebate for 2006-2007, $20 rebate for 2008, $15 rebate for 2009	Relatively robust incentives are needed to jump start adoption of this technology, but the rebates may decrease over time as it becomes more accepted.
Room Air Conditioners	Continue with $20 rebate for 2006, reduce incentive to $15 for 2007, $10 for 2008 and eliminate thereafter.	Availability of consumer incentives, even small incentives, encourage stocking of high-efficiency units. Incentives should decrease as the efficient units become more available and accepted by consumers.
Clothes Washers	- $50 rebate for ENERGY STAR-labeled washers with MEF up to 1.80 - $75 to $100 for washers with a MEF of 1.80 or higher	Significant energy savings are available through adoption of qualifying clothes washers, especially those with highest MEFs. The tiered rebate encourages adoption of the highest effciency units.

Market Share Tracking

One key measurement of the efficacy of the New Jersey ENERGY STAR program efforts is the market share of ENERGY STAR products. In order to track program impacts and estimate savings, it is important that market share be tracked on a regular basis. Market transformation programs across the country have applied a myriad of approaches to estimating market share. Some approaches are extremely rigorous, using multiple data sources to triangulate estimates and conduct comprehensive "gap analyses," while others rely solely on secondary data that are readily available (e.g., National ENERGY STAR partner sales data) as a proxy for total market penetration.[176]

[176] Dimetrosky, Scott, David Mattingly and Susan Pascoe, "A Comparison of the Practices Used to Track ENERGY STAR® Market Share," 2006 ACEEE Summer Study (Forthcoming).

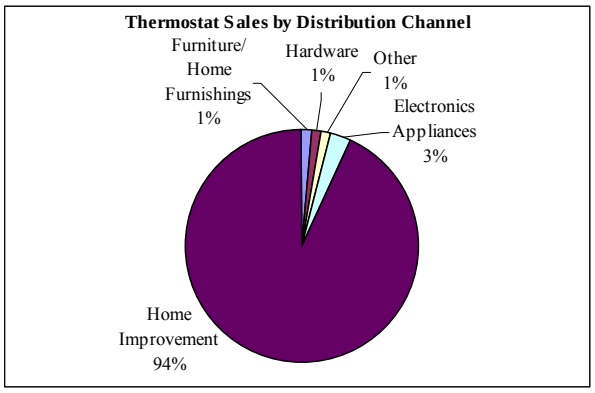
The New Jersey ENERGY STAR Program should conduct basic market share tracking every year by relying on the EPA National Partner data collected by D&R International. These data are free of charge, and readily available from the ENERGYSTAR.GOV Website. At a minimum the program should replicate the analysis conducted for this study by selecting a comparison group of states based on income and education levels and examining trends in market share for ENERGY STAR products as reported by the National Retailer partners. If budget allows, a regression model should be run to include additional explanatory variables.

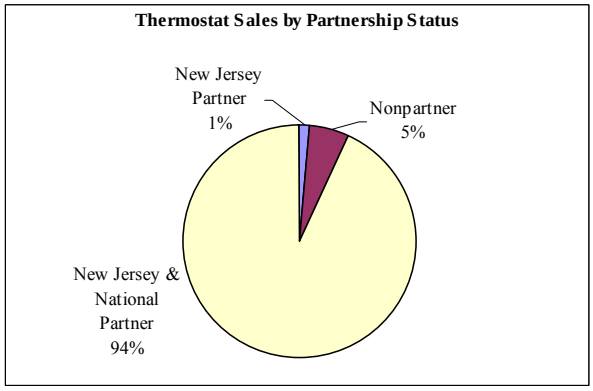
The Program should also attempt to enforce sales data reporting by State retailer partners. The ability of New York to collect sales data from regional partners shows that high levels of compliance can be achieved without severe retailer attrition. For New York, these data typically represent an equal, of not greater, number of total units as the National Retailer Partner data. Other states have achieved high compliance rates by allowing retailers to submit data via email, web, fax or telephone. The national and retailer sets of sales data can be combined for a relatively low-cost method to assess ongoing, annual market share levels. In fact, as shown in Appendix A, for many products the two sets of data will represent over 90% of all sales, thus providing a fairly precise examination of market share. In addition, getting partner retailers to provide sales for lighting products will help fill a missing gap that is not covered through other sources, including the EPA Partner data.

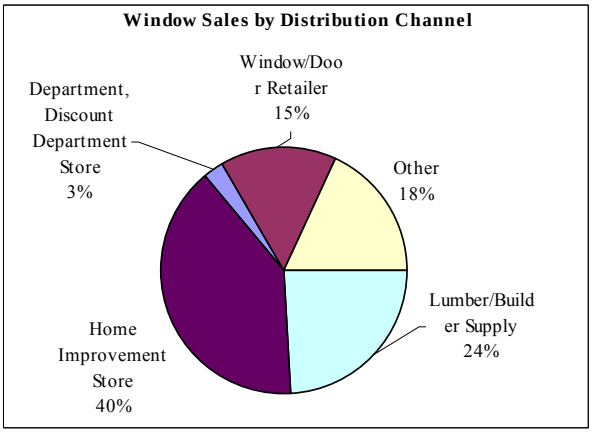
Finally, if sales data are not able to be collected from the NJ Partner retailers, then NJ should conduct a study similar to this one approximately every three years. The use of telephone surveys provide important insight into distribution channels, and when combined with the request for make and model numbers can provide more precise estimates of market share for some products.[177]

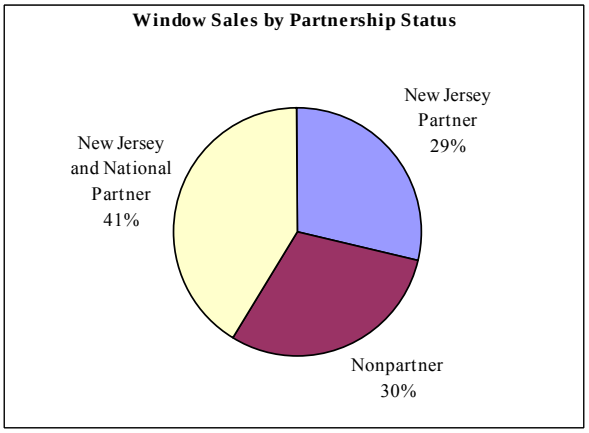
[177] Additionally, the program should participate annually in the CEE ENERGY STAR Web TV survey, plus conduct an oversample for NJ residents every three years (because the Web TV survey replenishes it's sample every three years). The CEE study provides an extremely cost-effective approach to collecting cross-sectional time-series data.

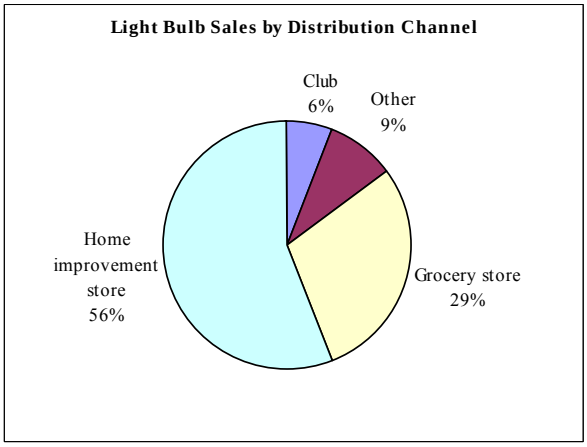
Appendix A: Sales by Distribution Channel and Partnership Status

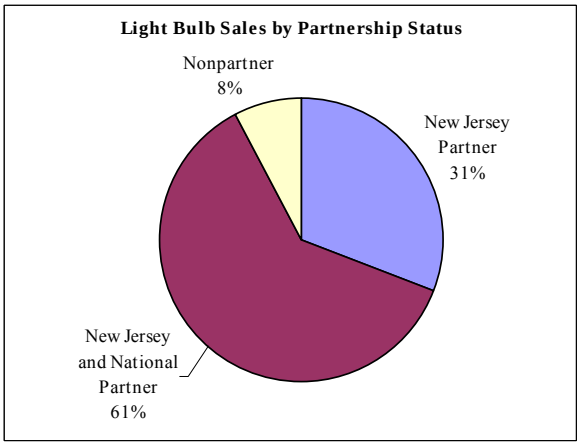


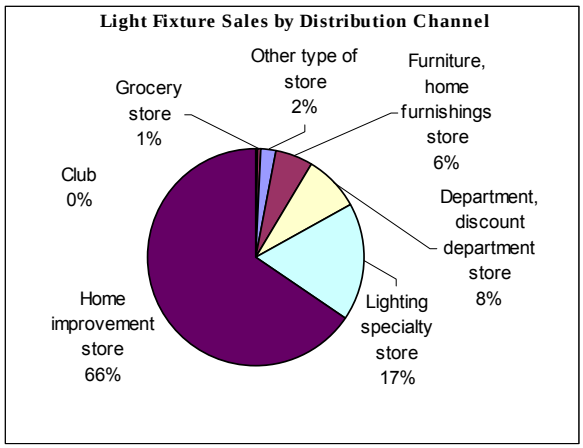


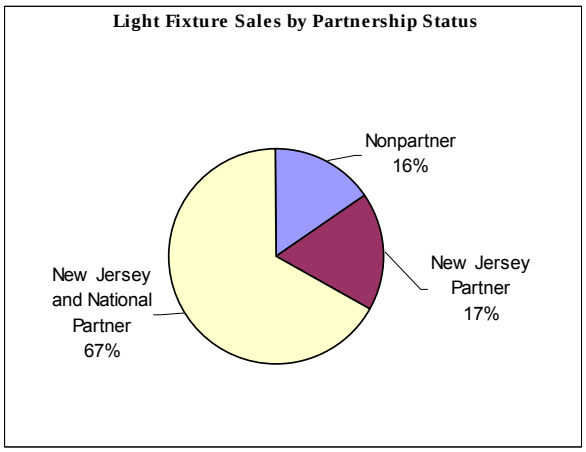


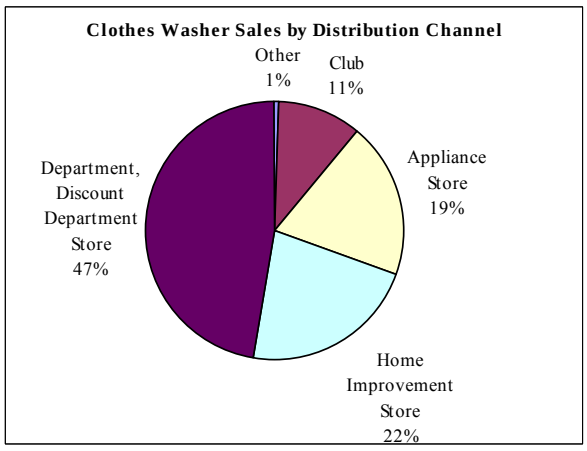


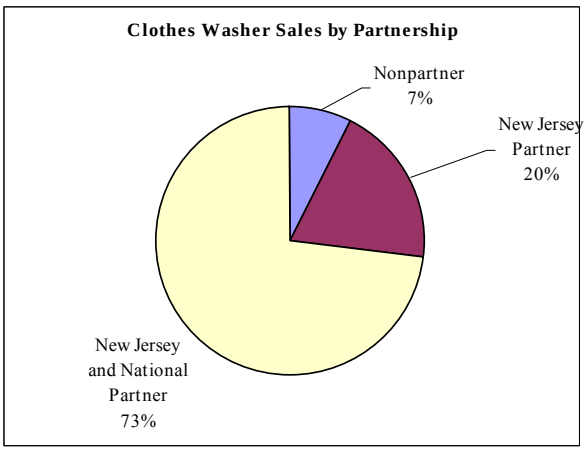


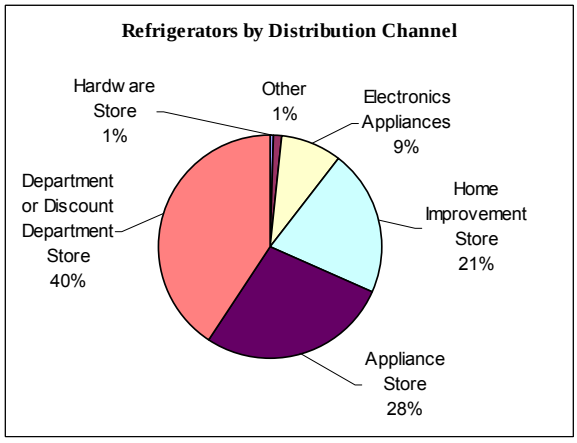


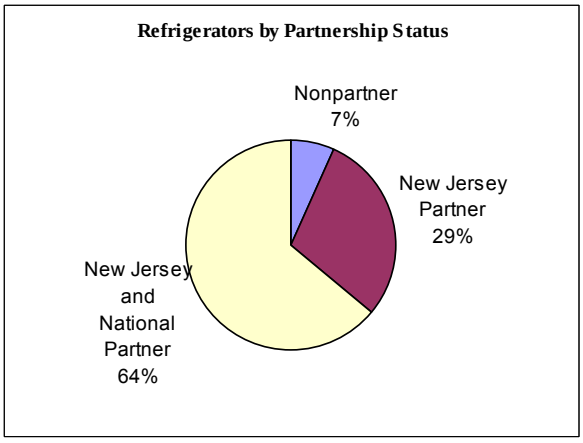

Light Fixture Sales by Distribution Channel
Other type of store 2%
Furniture, home furnishings store 6%
Grocery store 1%
Club 0%
Department, discount department store 8%
Home improvement store 66%
Lighting specialty store 17%

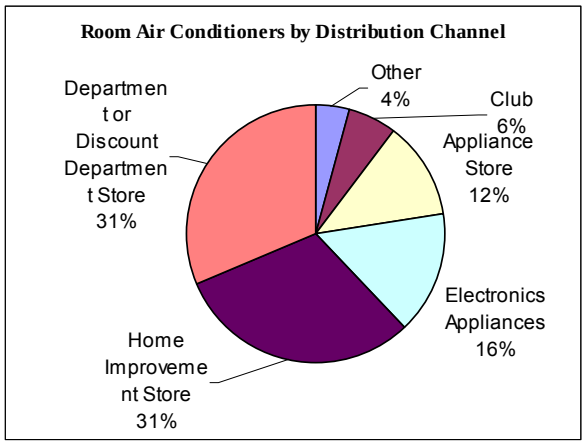

Light Fixture Sales by Partnership Status
Nonpartner 16%
New Jersey Partner 17%
New Jersey and National Partner 67%

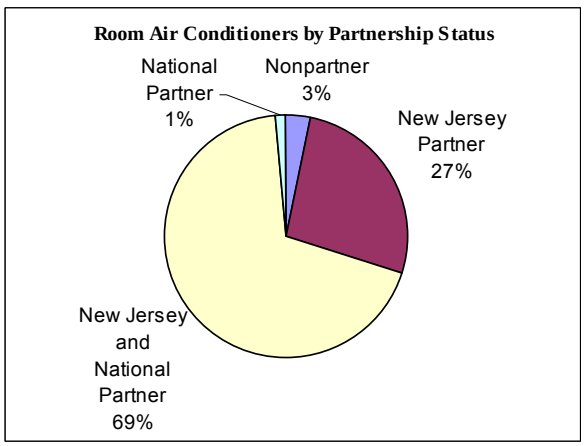

Clothes Washer Sales by Distribution Channel
Other 1%
Club 11%
Appliance Store 19%
Department, Discount Department Store 47%
Home Improvement Store 22%


Clothes Washer Sales by Partnership
Nonpartner 7%
New Jersey Partner 20%
New Jersey and National Partner 73%


Refrigerators by Distribution Channel
Hardware Store 1%
Other 1%
Electronics Appliances 9%
Department or Discount Department Store 40%
Home Improvement Store 21%
Appliance Store 28%


Refrigerators by Partnership Status
Nonpartner 7%
New Jersey Partner 29%
New Jersey and National Partner 64%


Room Air Conditioners by Distribution Channel
Other 4%
Club 6%
Appliance Store 12%
Electronics Appliances 16%
Home Improvement Store 31%
Department or Discount Department Store 31%


Room Air Conditioners by Partnership Status
National Partner 1%
Nonpartner 3%
New Jersey Partner 27%
New Jersey and National Partner 69%