

Can Short Term ARRA Stimulus Funding Achieve Long Term Market Transformation?¹

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ABSTRACT

The New York Energy SmartSM Products (NYESP) program, implemented by the New York State Energy Research Development Authority (NYSERDA), offers promotional incentives to consumer appliances manufacturers and retailers to increase awareness, understanding, product availability, and sales of residential ENERGY STAR[®] and other energy efficient products. Over the past 10 years, NYESP has successfully achieved a gradual increase in ENERGY STAR home appliance market shares. In early 2010, NYSERDA supplemented this largely promotional program, using a \$16 million grant from America Recovery and Reinvestment Act (ARRA) funding, to pay nearly 170,000 consumer rebates for ENERGY STAR appliance purchases.

This paper presents research supporting an evaluation of NYSERDA's ARRA-funded appliance rebate program, but it is not representative of the final results from this yet-to-be completed study. Trend analyses using sales data reported by program retail partners over the years and through the duration of the ARRA rebate program illustrate the effects of supplementary ARRA stimulus funds on the ENERGY STAR appliances market share level at NYSERDA's retail partner stores. ENERGY STAR market share changes for rebated appliances are compared to non-rebated appliances promoted through the NYESP program and the ENERGY STAR share predicted by extrapolating the historical trend. The results show an apparent large jump in the percentage of ENERGY STAR sales of most rebated appliances compared to non-rebated appliances. The paper discusses why some appliances seemed to increase more than others and concludes that the ARRA program did significantly impact ENERGY STAR sales of refrigerators, freezers and clothes washers.

Introduction

Background

In 1999, NYSERDA established a program for promoting energy-efficiency products to consumers. Incentives are provided to retailers and manufacturers (Partners) who participate in advertising, special promotions, employee training, and who work to increase market share of ENERGY STAR products. Since inception, the program implementer has collected Partner sales data for a variety of appliances that are available in ENERGY STAR and non-ENERGY STAR models.

A variety of stores in NYSERDA's service territory² are retailers for the NYESP program. At the end of 2010, roughly 300 retail store owners were participating, representing over 1,200 storefronts. Approximately 75 percent of those storefronts are chain stores, while 25 percent are independent retailers. In 2010, the program paid nearly 1,500 cooperative advertising incentives worth roughly \$600

¹ The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority (NYSERDA).

² For most of its major programs, NYSERDA's territory covers the state of New York with the exception of Long Island. While the rebate program was offered to all New Yorkers, this paper analyzes data from the NYSERDA territory only.

thousand to participating retailers. In order to be eligible for the incentives, retailers provide their monthly appliance sales data as described below.

In 2010, ARRA funding became available to the state of New York for rebating certain consumer appliance purchases. Individual rebates were offered for the purchase³ of ENERGY STAR refrigerators (\$75), freezers (\$50) or clothes washers (\$75); or for an ENERGY STAR three-appliance bundle consisting of a CEE Tier 2 or 3 refrigerator and clothes washer and CEE Tier 1 or 2 level dishwasher (\$500).⁴

The appliances tracked in this analysis include ARRA rebated appliances: clothes washers, dishwashers, refrigerators, and freezers; as well as non-ARRA rebated appliances: through-the-wall air conditioners, room air conditioners and lighting fixtures. Sales data are aggregated into ENERGY STAR and non-ENERGY STAR unit sales quantity for each appliance.

Scope

This paper discusses an analysis of sales data from the NYESP program tracking from January 2001 to the most current available data, March 2011. Sales data comes from program partners and are aggregated by the program implementer. Since the number, size, and type of participating retailers has changed throughout the years, the quantities reported fluctuate (i.e., more stores participating usually causes higher total quantities reported). To account for this, total unit sales quantities between years are not presented for stringent historical comparison; instead, the average percent of ENERGY STAR units out of the total sales (market share) is used for time series comparisons. Table 1 summarizes the reporting compliance from NYSERDA Partners in the years 2007 through 2010.

Table 1. NYSERDA Partner Reporting Compliance in Annual Averages

Year	Number of Retail Partner Storefronts	Percent of Retail Partners Reporting Sales	Percent of Reporting Partners Consistently Reporting for the Past 6 Months
2007	770	62%	90%
2008	841	87%	98%
2009	977	83%	99%
2010	1,274*	83%	97%

* This number includes HVAC retailers, which were not included in previous years.

ARRA rebates were available to consumers in the territory starting February 12, 2010 until funding ran out on March 4, 2011. The program was put on hold twice during this period when NYSERDA received enough applications to potentially use all of the funds available. Consumers were allowed to submit applications online and then follow up with actual receipts, which were needed to collect the rebate. Since some applications were eventually not fulfilled because they did not meet program requirements, NYSERDA allowed additional consumers to submit applications to a waiting list. Those on the waiting list had no guarantee they would receive a rebate. These applications were processed on a first-come, first-served basis as additional funds became available. Because of the timing of this paper, sales effects during 2011 are limited to preliminary data through the end of the first quarter, which a significant portion of Partner stores have not reported.

³ Additional incentives were offered for recycling the old appliance.

⁴ CEE Tier refers to specific ENERGY STAR standards from the Consortium for Energy Efficiency, an organization funded by DOE and EPA. These efficiency levels are all above the minimum required level to achieve an ENERGY STAR rating.

As part of a recent evaluation, a market actor survey was used to generate information regarding a number of topics related to the NYESP program, including consumer and retailer awareness, knowledge, accessibility, market share, incremental cost, and perceived value of ENERGY STAR. While most of the survey information applied to analysis outside of this paper's scope, some pertained directly to the effect of ARRA rebates on appliance sales; These supplemental ARRA questions were intended to collect additional data to support that program's evaluation. For example, retailers who participated in the NYESP program were specifically asked their perceived change in ENERGY STAR appliance sales and drivers during 2010.

Methodology

Surveys

The research team surveyed 72 retail and wholesale store managers from a population of approximately 1,000 participating stores, providing an overall estimated confidence interval of 90 percent with precision of +/- 10 percent. However, not all participants answered all questions, so precision dropped for some results. Specific to the ARRA rebate program, 60 retailers responded on reasons for the sales change in the 2010 period. Due to multiple appliance questions, a total of 83 responses among all appliances were received. The individual responses were aggregated to calculate the average percent of each response across appliances. Results from the survey and response levels can be found in Table 2 in the Results section of this paper.

Estimating the Baseline

The first step in assessing the ARRA impacts was to estimate the natural ENERGY STAR market share growth without rebates. Program education and marketing from the state's NYESP program and the ENERGY STAR DOE/EPA promotional programs are assumed to be the main drivers in this growth through 2009. This growth was linearly extrapolated to 2010 to predict what the natural market growth have been from these existing programs alone, providing the baseline for ENERGY STAR market share in 2010. Any additional market share gained is assumed to be driven by the ARRA rebate program, as seemingly no other significant external programs overlap directly with these products during the short term ARRA rebate offering. The other factor possibly affecting sales is the economy, which by itself has an unknown effect on the ENERGY STAR market share of appliances sold; however, the economy may be responsible for lower total sales in 2008 and 2009. This difference between the extrapolated 2010 market share and the actual reported market share is shown in Figure 1 as Δ . Clothes washers are used here as an example.

A Fisher F-statistic was used to determine the goodness of fit for the linear model. Clothes washers, dishwashers and refrigerators were all good fits, while freezers were a poor fit.⁵ Standard errors were also calculated and used to create error bands for each appliance's baseline. Results from these data processing steps can be found in the Results section of this report. There are some limitations to this model, especially in regards to removing external influences such as past rebate programs by NYSERDA or local utilities.

⁵ The ENERGY STAR market share for freezers appears to be the most erratic and only shows sharp and short-lived increases during times of rebate program activity. Freezers were also the most recent of the appliances to become part of the NYESP program and have the least amount of available sales data, starting in 2004.

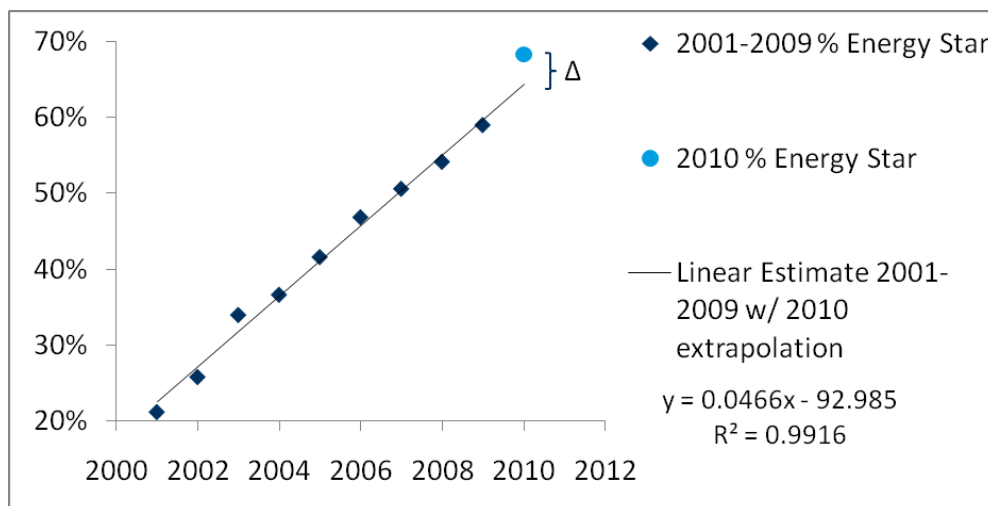


Figure 1. Extrapolation of Market Share for Clothes Washers

Results

Surveys

Two questions pertaining to 2010 sales were asked of partner retailers during the phone survey. In the first, they were asked if they thought sales had increased, decreased, or stayed the same between January 1, 2010 and the time of the survey (summer 2010). As a follow up, if they reported a change, they were asked why the change occurred. The majority (93 percent) of respondents reported an increase in sales for their products. For products with ARRA rebates, the retailers cited government incentives, such as rebates, as the number one reason for the increase⁶. Other reasons for sales increases included: a growing customer awareness and demand for environmentally friendly products, increased promotions and changes in the economy. The biggest reason reported for the change in room air conditioner sales was a change in the weather.

Interestingly, two respondents reported a sales decrease because of government incentives. One was discussing dishwashers, which were only available in the bundled option and at the CEE Tier 2 level. The other was referring to room air conditioners that were not part of the ARRA rebate program. More often, reasons cited for a decrease in sales was lowering promotions for those products and decreasing that area of business.

Statistical analysis showed that, at a 10 percent level of significance, ARRA rebated products were reported significantly more often to have sales increases due to government incentives over products without the ARRA rebates. A summary of the survey results can be seen in Table 2.

⁶ The question asked was open-ended, however responses were coded into pre-identified categories. The category where most responses best fit was “customer demand has increased from government incentives such as ARRA or tax incentives”.

Table 2. Percent of Survey Responses on How and Why Sales Changed During First Half of 2010

Survey Responses	ARRA Rebate			No ARRA Rebate	
	Clothes Washer n=24	Dishwasher n=13	Refrigerator n=22	Lighting Fixtures n=9	Room AC n=15
Sales increased because of government rebates	71%*^	77%*^	73%*^	22%	13%
Sales increased for another reason	29%	15%	27%	56%	67%
Sales decreased	0%	8%	0%	22%	20%

* Significantly greater than Lighting Fixtures.

^ Significantly greater than Room AC.

Sales Data

Consistent with what retailers reported, a sales increase in 2010 is also reflected by an analysis of annual trends of total appliance sales reported by the Association of Home Appliance Manufacturers (AHAM). These include both ENERGY STAR and non-ENERGY STAR appliance shipments to the state of New York. As shown in Figure 2, sales of the four ARRA appliance types distributed to New York decreased from 2007 through 2009 and then increased, at least slightly, in 2010.

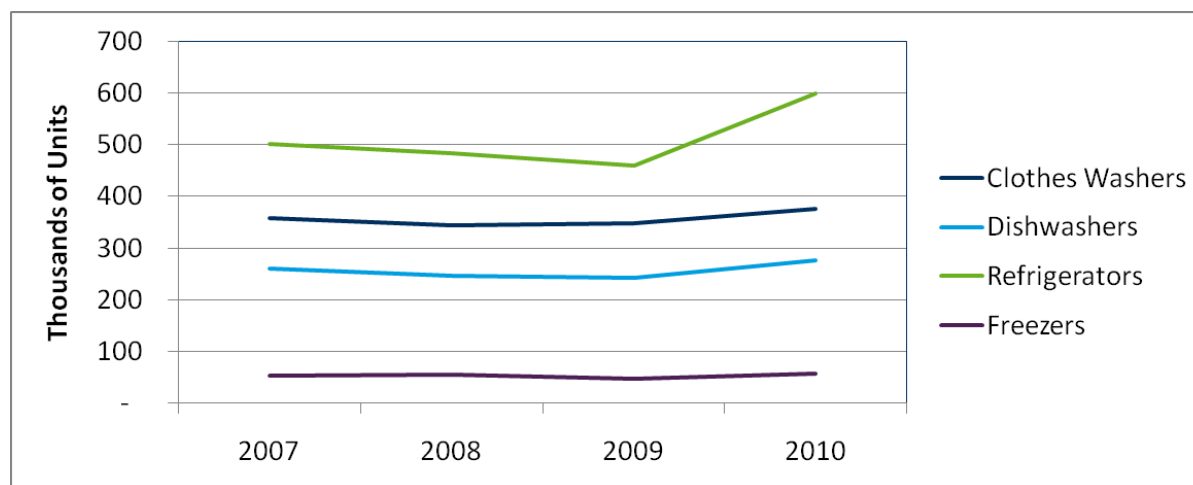


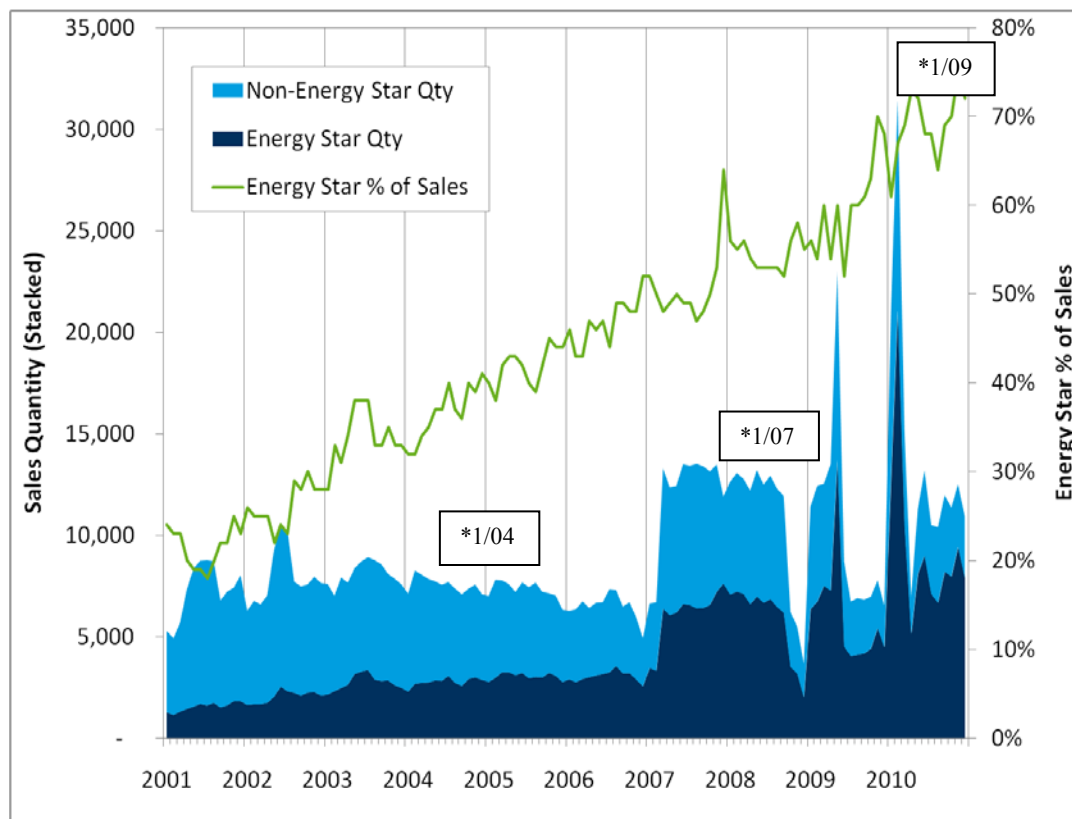
Figure 2. Annual Trends of Distributor Appliance Sales in New York (AHAM 2007, 2008, 2009, 2010)

By analyzing partner sales data, it can be postulated that ARRA funds considerably increased sales of the products they promoted. Figures 3 through 5 show a large spike in product sales at the beginning of 2010 when the rebates first became available.⁷ After around two months, sales drop off significantly for a month. After the drop, sales increase back to normal or slightly elevated levels over pre-ARRA rebate, but never as high as the initial spike. While the long-term trend may be affected by the general increase in the number of NYSERDA Partners, the number of Partners during the period of

⁷ A spike during the second quarter of 2009 is also illustrated in the figures. This is due to other types of program activity prior to the NYSERDA ARRA rebates.

ARRA rebates was relatively stable. These fluctuations may be explained by the program timetable. NYSERDA anticipated the program running for a relatively short period of time and advertised it accordingly. Once the initial program applications were received, any new purchasers were placed on a waiting list and rebates were not assured. When NYSERDA discovered that a large number of applications were for unqualified purchases, it advertised the rebate again (as subject to budget limitations) and sales began to increase again. Each ARRA rebated appliance is discussed in more detail below.

Figure 3 shows clothes washer sales trends at Partner stores for the entirety of the NYESP program tracking. At the beginning of 2010 when the ARRA rebates started, a significant three month sales spike occurred in both ENERGY STAR and non-ENERGY STAR clothes washers. After an April drop, sales regained ground and increased through the year. ENERGY STAR market share continued to fluctuate above and below its previous peaks. This general trend of increasing ENERGY STAR sales over the years has been attributed to NYSERDA's ongoing NYESP program (Colby, 2011).⁸ In general, the percentage increase of 2010 ENERGY STAR sales is higher than any of the previous years' increases. Later, this paper discusses whether this increase is greater than the average annual market share trend associated with the NYESP program. Preliminary 2011 data show a sustained market share of 69 to 71 percent through March 2011.



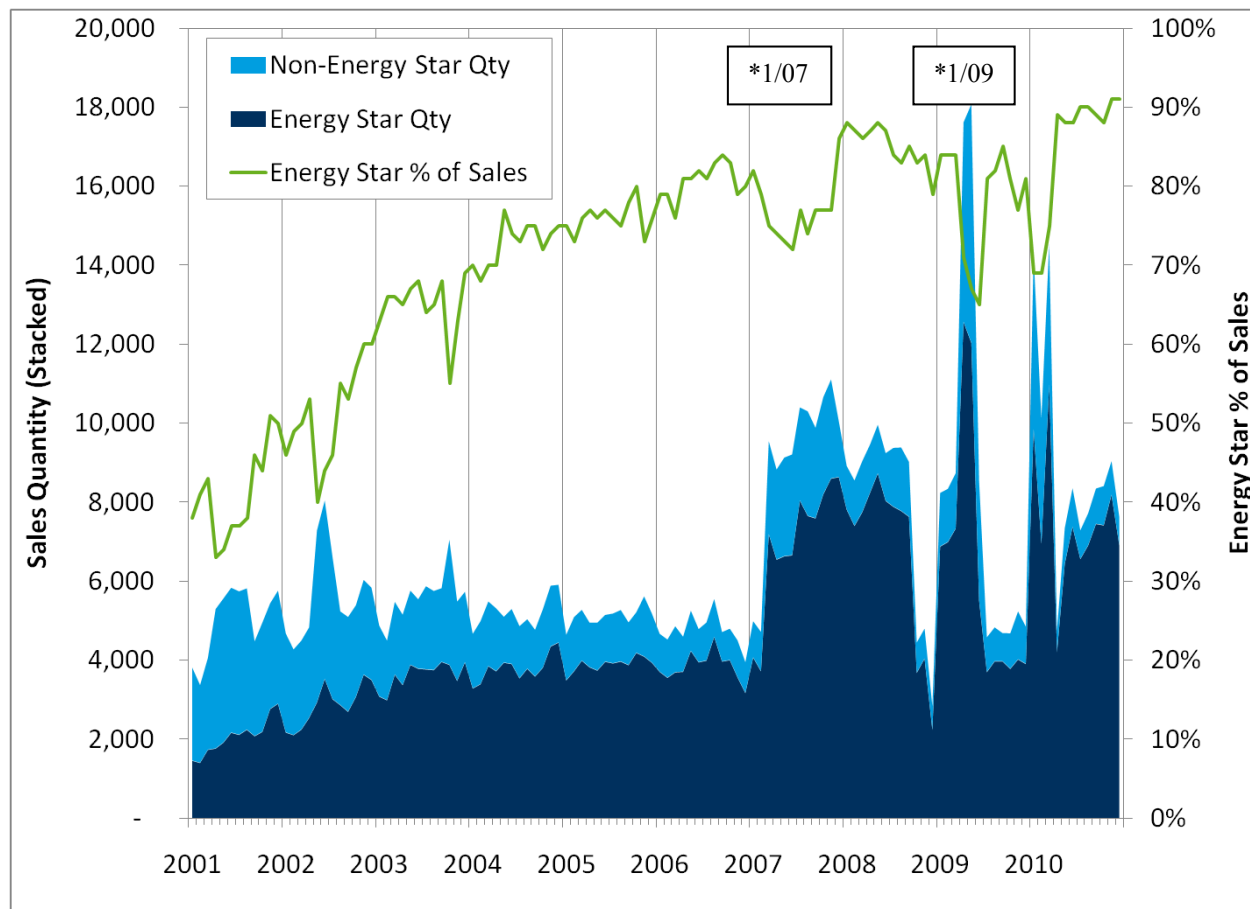
* ENERGY STAR compliance standards changed for clothes washers.

Figure 3. Clothes Washer Partner Sales

⁸ Also see Dimetrosky, Bicknell & Titus 2007 for discussions on data available for attribution analysis.

Dishwashers are the only appliance in the ARRA rebate program that did not see an overall annual increase in ENERGY STAR market share for 2010 (Figure 4). This is largely impacted by a drop in ENERGY STAR market share during the first few months of 2010. While dishwasher sales certainly increased during the initial program months, ENERGY STAR sales did not increase as much as non-ENERGY STAR sales. After the initial rebate months, market share returned to an elevated level for the remainder of the year. Reasons for this effect potentially include the already high saturation of ENERGY STAR dishwashers in the market; that dishwashers are the only appliance in the rebate program that must be purchased in a multi-appliance bundle; and dishwashers required a higher efficiency rating above standard ENERGY STAR to qualify for the ARRA rebate.

Preliminary data for 2011 show a sustained market share of 88 percent through March, but only final program data, anticipated for later in 2011, will show if the rebate had an overall positive effect for ENERGY STAR dishwasher sales during the ARRA program period.



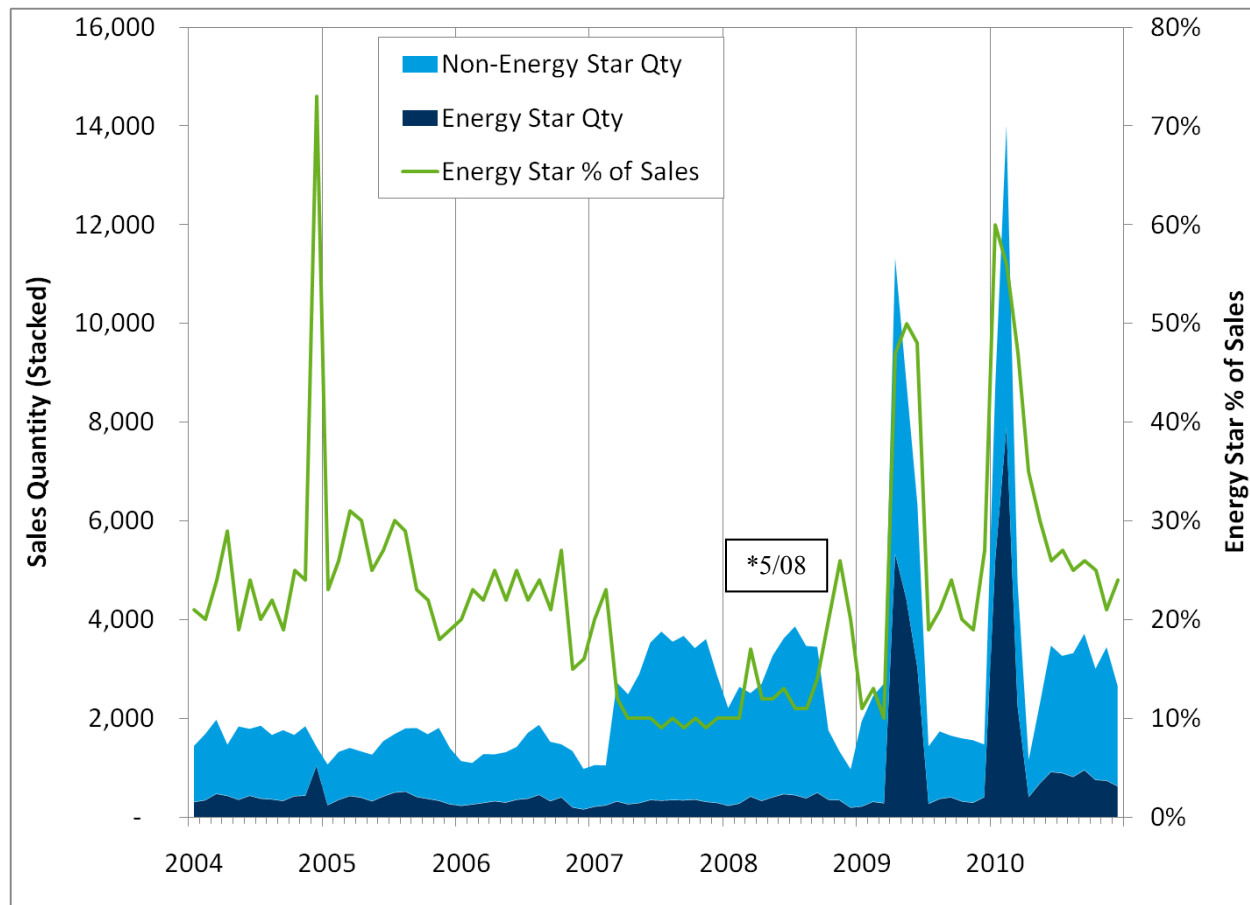
* ENERGY STAR compliance standards changed for dishwashers.

Figure 4. Dishwasher Partner Sales

As shown in Figure 5, ENERGY STAR shares of freezer sales also spiked in the first few months of the ARRA rebate offering and then generally trended higher for a few months before tapering off at the end of the year. Interestingly, ENERGY STAR freezer sales share dropped off more than other appliances over the course of 2010. One reason may be the relatively lower penetration of freezers in

homes compared to other appliances. Freezers were also the only appliance not part of the bundled option, and they are not common in most New York households.⁹

Preliminary 2011 data show an elevated market share of 32 percent through February, that subsequently dropped back to a more typical share of 22 percent in March. At the time of this analysis, approximately three-quarters of expected retailers had reported sales data for January/February and only one-third had reported for March, so these preliminary results are subject to change.



* ENERGY STAR compliance standards changed for freezers.

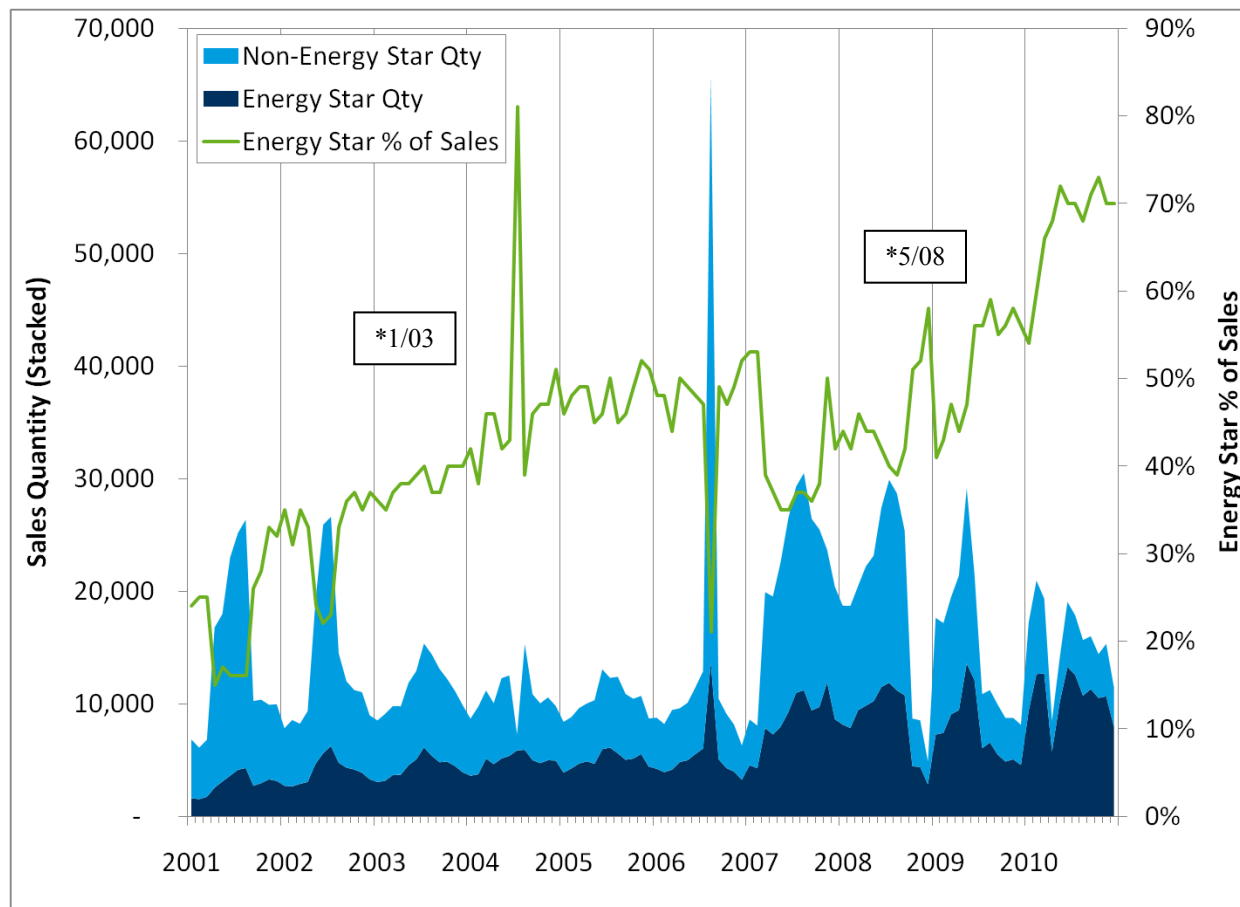
Figure 5. Freezer Partner Sales

Refrigerators showed the highest sustained ENERGY STAR sales share of all ARRA rebated appliances (Figure 6). The ENERGY STAR market share jumped in early 2010 and stayed higher than normal for the remainder of the year. The last change to ENERGY STAR standards for refrigerators was in early 2008 in which efficiency standards were increased; thus, it is unlikely that this type of change would be correlated to the market share increase in 2010. In addition, no other new refrigerator rebate programs were being conducted at the time of the increase.¹⁰ Preliminary 2011 data show an elevated

⁹ Freezer sales for New York in 2010 were seven units per 1,000 households; compared to the national average of 15 units and the Wyoming average of 88 units sold per 1,000 households in 2010.

¹⁰ There was a refrigerator recycling incentive program conducted in the region for homes with second refrigerators that warrants further investigation in terms of its potential impact on increased ENERGY STAR sales and market share. Customers were not allowed to receive incentives from both programs, however the NYSEDA ARRA program was slightly more financially attractive.

market share for ENERGY STAR refrigerators of 69 percent through March. As more sales data is reported, it will be determined if this trend is sustained.



* ENERGY STAR compliance standards changed for refrigerators.

Figure 6. Refrigerator Partner Sales

Table 3 shows the annual percent of total Partner store appliance sales that were ENERGY STAR. For all appliances with ARRA rebates, the ENERGY STAR sales percent increased from 2009 to 2010 (by a sales-weighted average of 11 percent). All appliances without ARRA rebates decreased in the ENERGY STAR percent of sales in 2010 (by a sales-weighted average of three percent). Preliminary numbers for 2011 show that ARRA rebated appliances continue to increase in the final months of the program. Non-ARRA rebated appliances continue to decrease in ENERGY STAR market share for the same period. The stagnant economy negatively affected ENERGY STAR appliance sales in general, as evidence by the appliance sales drop from 2008 through 2009 as well as a drop in the ENERGY STAR market share. Fortunately, in 2010 the ARRA stimulus rebates and the improving economy, were effective in increasing both total appliance sales and the ENERGY STAR market share. As Table 4 indicates, however, other factors may also be involved. Some increases are steady, some are large and some are small. Some are very sporadic with increases and decreases year-to-year.

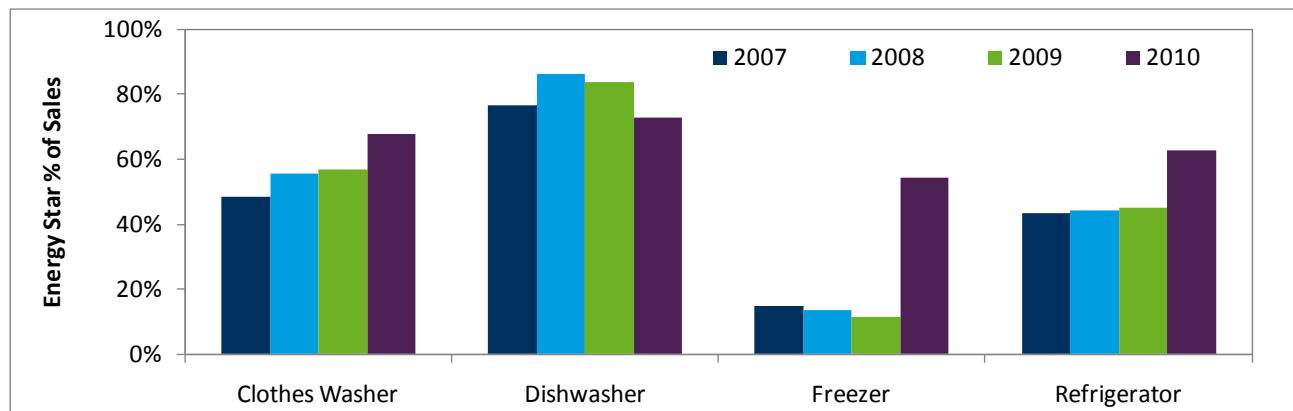
Table 3. Annual ENERGY STAR Market Share at Partner Stores

Year	ARRA Rebate in 2010				No ARRA Rebate in 2010		
	Clothes Washer	Dishwasher	Freezer	Refrigerator	Lighting Fixtures	Thru-the-Wall AC	Room AC
2001	21%	41%	NA	20%	5%	NA	24%
2002	26%	51%	NA	30%	21%	NA	43%
2003	34%	65%	NA	38%	27%	NA	72%
2004	37%	73%	26%	46%	24%	64%	76%
2005	42%	76%	25%	48%	14%	78%	76%
2006	47%	81%	22%	38%	11%	77%	79%
2007	51%	77%	10%	39%	12%	84%	48%
2008	54%	85%	14%	43%	20%	73%	58%
2009	59%	76%	36%	50%	22%	84%	72%
2010	68%	83%	41%	67%	17%	79%	71%

Table 4. Percent Change in ENERGY STAR Market Share at Partner Stores Over the Previous Year

Year	ARRA Rebate in 2010				No ARRA Rebate in 2010		
	Clothes Washer	Dishwasher	Freezer	Refrigerator	Lighting Fixtures	Thru-the-Wall AC	Room AC
2007	8%	-5%	-53%	5%	11%	-39%	9%
2008	7%	11%	30%	10%	63%	20%	-13%
2009	9%	-11%	168%	15%	12%	24%	14%
2010	16%	9%	13%	35%	-23%	-2%	-6%

To focus in on a narrower snap shot of time, the months in which 2010 sales spiked and when the ARRA rebate program began were compared to the same months in previous years. The percent of ENERGY STAR sales for the months with highest total sales, February and March, are compared from 2007 to 2010 in Figure 7. Freezers had the greatest ENERGY STAR market share increase for the two month period; the 2010 market share increased over the same period in previous years by an average of 41 percent. The ENERGY STAR refrigerator market share increased by 19 percent and the ENERGY STAR clothes washer market share increased by 14 percent over those same prior years (2007-2009). As discussed further below and shown in Table 6, dishwashers were a small portion of the ARRA stimulus program.

**Figure 7.** February and March ENERGY STAR Percent of Partner Sales by Year

As discussed in the Methodology section above, a predicted ENERGY STAR market share was calculated based on growth from existing programs before the ARRA rebates. The difference between this expected market share and the actual market share is attributed to the ARRA program (Table 5). For example, clothes washers show a four-percent increase attributed to the ARRA program with a standard error range of a three to five percent increase (standard error of $\pm 1\%$). Clothes washers, freezers, and refrigerators all show a significant increase in ENERGY STAR market share over previous years. Dishwashers showed a significant decrease.

Table 5. Market Share Growth Attributed to ARRA Rebates

ENERGY STAR as % of Total Sales	Clothes Washer	Dishwasher	Freezer	Refrigerator
Predicted Natural 2010	64%	92%	23%	52%
Actual 2010	68%	83%	41%	67%
Increase from ARRA Rebates	4%	-9%	18%	15%
Standard Error \pm	1%	8%	10%	7%

When reviewing this data, it is helpful to understand the number of each appliance type rebated in comparison to the total appliance sales during 2010. Using final NYSERDA rebate application counts, Table 6 shows the paid rebate numbers by appliance and computes the estimated proportion of ENERGY STAR distributor sales in New York of those rebated appliances.

Table 6. Percentage of Appliance Sales Rebates in New York 2010

Appliance	ES and Non-ES Total Sales (AHAM 2010)	ENERGY STAR Market Share (NYSERDA Partners)	ES Sales (AHAM \times ES Market Share)	ARRA Rebates Paid (NYSERDA)	Percent Rebated of Total ES Sales (ARRA Rebates \div ES Sales)
Clothes Washer	375,600	68%	255,400	81,917	32%
Dishwashers	276,200	83%	229,200	2,370	1%
Freezer	57,400	41%	23,500	4,242	18%
Refrigerator	598,400	67%	400,900	80,654	20%

It is also important to note the existing ENERGY STAR market share when investigating this data. Dishwashers received the lowest share of rebates, had the highest existing market share, and the lowest calculated net impact from the rebates. While this analysis compares only ENERGY STAR sales in general, dishwasher rebate recipients were required to purchase a CEE Tier 2 dishwasher, which is a higher standard than ENERGY STAR. For these reasons, there is no positive net impact from the ARRA program for dishwashers.

Freezers have the lowest natural predicted 2010 ENERGY STAR market share and received 10 percent of the number of ARRA rebates provided. According to our preliminary analysis, the net ARRA impact on the program was largest for freezers, at 18 percent. Clothes washers received the highest share of rebates but have the highest existing ENERGY STAR market share outside of dishwashers. Thus, the preliminary net ARRA impact was small but positive.

Refrigerators, with a predicted 2010 natural market share of 59 percent and the highest number of rebates, but the second highest percentage of rebates, also showed a significant net ARRA impact of 15 percent based on this initial analysis.

Conclusions

Both retailer surveys and the trend analysis indicate a significant effect of the ARRA program in increasing the ENERGY STAR market share of promoted appliances. While month-to-month and year-to-year data can show significant variation, a strong case can be made that clothes washer, refrigerator, and freezer appliance sales and ENERGY STAR market shares were significantly impacted by the ARRA rebates. Since dishwashers have a high ENERGY STAR market share to begin with, combined with the higher efficiency requirements to participate in ARRA rebates and the lower percentage of actual rebates paid through ARRA, the ARRA impacts on the ENERGY STAR dishwasher market share may not be significant. While results during the “wait-list” period and preliminary post-ARRA rebate program sales data indicate that the higher ENERGY STAR market shares are sustainable, more time is needed to conclude whether a short-term stimulus can achieve long-term transformation.

Another conclusion pertains to the value of the data informing this analysis. For the past ten years, NYSERDA required participating NYESP retailers to provide monthly ENERGY STAR and total sales data by appliance, creating a valuable data history for informing program intervention analyses over time. This level of data is unusual in evaluations. Continuing to work through retailers globally to obtain data on all types of energy efficiency product sales should be an ongoing effort for the evaluation industry.

Acknowledgments

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