Over the Hill? A Look at a Mature Mid-Stream Residential Appliance Program[1]

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ABSTRACT

The New York Products Program (NYPP) is a long-standing program focusing on residential appliances and lighting, and has been a major contributor to portfolio benefits. However, as the residential products market has shifted, the ability of the program to continue to claim ENERGY STAR market share and associated benefits has become increasingly challenging. A recent evaluation of the program utilized interviews with program staff and implementation contractor staff, surveys with end-use residential customers in New York and selected comparison areas, and surveys and interviews with participating and non-participating retailers and manufacturers to assess both program processes and impact (including attribution analysis). The results reflect increasing awareness and sales of ENERGY STAR appliances throughout the U.S., at least partially driven by the availability of Federal ARRA funding to promote ENERGY STAR products. The overall maturity of the ENERGY STAR market, reflected in the increasing awareness and sales throughout the U.S., has led to a considerable decline in impacts attributable to the program. To be successful and really demonstrate market lift, residential appliance programs require a focus on developing robust baseline market estimates, capturing reliable and comprehensive data, and focusing future program efforts towards efficiencies greater than ENERGY STAR, including the Most Efficient specification.

Background

The New York Products Program (NYPP; previously called the New York Energy $mart^{SM} Products Initiative), established in 1999, seeks to increase sales of residential energy-efficient appliances, lighting, and home electronics products. NYPP works on the supply side with retailers and manufacturers and on the demand side by marketing to consumers. NYPP's overall goal is market transformation: to increase awareness of and demand for energy-efficient products, including ENERGY STAR® certified appliances, lighting, and home electronics. Program activities include incentives for cooperative advertising and special promotions, as well as marketing campaigns on both the supply and demand sides of the appliance and lighting markets. Other activities include the development and distribution of: special point-of-purchase (POP) materials; educational materials, inclusion of program information on the www.nyserda.ny.gov website, coordination with retailers to obtain donations of ENERGY STAR appliances and lighting in support of the Program's outreach at trade shows, home shows, and county and state fairs, as well as training sessions for retail sales staff and managers.

At the end of 2012, the NYPP had 823 participating partners, representing 99 appliance-only retail storefronts, 177 appliance and consumer electronics retail storefronts, and 547 active lighting storefront partners. The majority of the storefronts (81%) were part of a chain, while 19% were independent retailers. The Program also offered 743 full retailer training sessions, with a total of 3,185 participants. During the 2010-2012 period, the NYPP paid $13,711,560 to participating retailers and manufacturers.

[1] Any opinions expressed, explicitly or implicitly, are those of the authors and do not necessarily represent those of the New York State Energy Research and Development Authority.

A Market Characterization, Market Assessment, Process, and Market-Based Impact Evaluation (MCAP) was conducted in 2014, with the primary goals being to understand the effectiveness of program design, implementation, and program processes and explore opportunities for improvement (process evaluation); to describe energy markets and provide background information to help define programs, delivery concepts, target markets, and potential for different types of programs (market characterization); track changes in markets with a specific focus on market indicators that might be affected by the Program in question (market assessment); and to estimate net impacts attributable to the Program (impact evaluation).

This paper focuses on the market assessment and impact portions of the evaluation, providing information on the methodology, findings, conclusions, and recommendations for program years 2010-2012.[2]

Methodology

The evaluation utilized a comprehensive approach, examining a variety of primary and secondary data sources to generate information on a number of topics, including:

- The size of the residential market for qualifying appliances;
- The type and quantity of efficiency measures installed as a result of the Program;
- Changes in awareness and understanding of energy efficiency; and
- The estimated attribution of energy savings to the NYPP.

Table 1 summarizes the evaluation data collection activities, methodology and key research topic objectives. The evaluation team relied primarily on three data sources to estimate market penetration for ENERGY STAR products in the NYSERDA region:

- **National Partner Sales Data Collected by D&R International.** D&R collects sales data from national ENERGY STAR partners, combining and anonymizing all partner data. These data are extremely valuable in detail, providing ENERGY STAR market share for four appliance types (refrigerators, clothes washers, dishwashers, and room ACs) by state, region, and year.
- **NYSERDA Partner Sales Data Collected by Lockheed Martin.** The reporting of sales data, including the number of ENERGY STAR and non-ENERGY STAR units sold, by month, is a requirement for partners in the Program, and compliance is typically above 90% for active retailers. In order to allow the analysis of NYSERDA-only partners and NYSERDA partners that are also national partners (also called NYSERDA & national partners, or dual partners), the evaluation team split the retailers by partnership status.
- **Residential End-Use Customer Telephone Survey.** As part of the residential end-use customer random digit dial survey, the evaluation team targeted 200 respondents per product who had purchased a new refrigerator, clothes washer, dishwasher, or room ACs between 2010 and 2012. Respondents were asked to provide detailed information about where purchases were made, as well as about the energy efficiency of the product. In order to validate the self-reported purchases of ENERGY STAR products, the evaluation team asked respondents to provide the make and model number of the appliance. Final sample sizes, along with the number that were able to provide make/model lookups, is summarized in Table 2.

In terms of program attribution, estimating the impacts due to market transformation programs is an inherently difficult task, particularly for the NYPP, which does not offer direct incentives to end-use customers. In fact, as an upstream program, the program may be invisible to end-use customers, in that many customers may not even be aware that the program exists. In order to estimate impacts from the

[2] Note the report also provided updates on key metrics from evaluations conducted over the prior ten years.

NYPP, the Evaluation Team attempted to use a market-based approach to estimating program sales, and by extension, energy and demand savings. The evaluation of the program sought to estimate the overall penetration of sales of ENERGY STAR appliances in the NYSERDA region and compare the sales with a group of regions serving as the control group.

The comparison areas were selected based on their similarity in terms of household and demographic characteristics to New York, and included Washington, D.C. and Houston, TX (to represent downstate NY) and the state of Virginia (to represent upstate NY, with a mix of urban areas as well).[3] The Team verified that there were no direct DSM program activity in these areas and no suspected impact of nearby DSM activity.

There are two common limitations to this comparison area approach. First, the approach does not account completely for other factors that may influence market share, including energy prices, climate zone, population center distribution (urban/suburban/rural), precipitation/drought, etc., all of which may be predictors of ENERGY STAR market share. Second, the baseline comparison approach assumes a non-program area that is the theoretical equivalent to New York in the absence of program activity, and does not account for the possibility that the efforts in New York and other states with ENERGY STAR programs have collectively influenced the sales in the comparison states.

While this impact cannot be accurately quantified (there is no way to "undo" the significant program activity that has occurred in New York and elsewhere), it means estimated baseline sales for all states – including the comparison states – may be overstated. In other words, sales outside New York – and estimated baseline sales – may have been lower in absence of the NYPP and national programs (i.e., estimates of program impacts inside New York may be conservative).

To assess the issue regarding the potential influence of the NYPP in the comparison states, the Evaluation Team conducted interviews with national retailers, members of the Department of Energy (DOE), Environmental Protection Agency (EPA ENERGY STAR staff), and the Appliance Standards Awareness Project (ASAP).

While the Evaluation Team acknowledges that this finding would lead to conservative estimates of savings using the comparison area approach, there is also no known alternative method – other than self-reported counterfactual estimates of Program influence by the upstream participants – to estimate the true market level impacts of the NYPP.

Another confounding factor during this time period was the availability of ARRA rebates. Most State Energy Efficient Appliance Rebate Program (SEEARP) rebates occurred in 2010, and thus influenced the total sales in New York and any other regions that offered them (including all of the three regions comprising the comparison area). The Evaluation Team reviewed these effects by examining ARRA rebates within the NYSERDA and comparison areas. The Evaluation Team, in collaboration with D&R, was able to access all SEEARP rebate data from 2009-2011. All appliance sales were normalized to the region's household populations (excluding Nassau and Suffolk counties for NY and including only metro area counties for Houston).

[3] Comparison areas were selected (and ultimately weighted to represent NY) based on demographic and household characteristics, including home ownership, type of residence (e.g., single family, multifamily), head of household age, and head of household education. Note the Team was unable to do cross-sectional, time-series analysis (i.e., using the exact same regions as in prior studies and tracking differences in sales over time) due to the introduction of new appliance programs in previous comparison regions (though two of the three regions – Washington, DC and Houston, TX - did remain the same for this analysis).

Table 1. Data Collection Activities for NYPP Evaluation

Evaluation Activity	Methodology	Research Topic
Tracking Database Review	Summarize program data	▪ Establish high impact measures to focus evaluation efforts
NYSERDA and Lockheed Martin Staff Interviews	Telephone In-Depth Interview	▪ Understand the experiences and lessons learned in working with retailers and manufacturers ▪ Document planned program revisions
End-Use Customer Surveys New York State (200 per product)	Telephone Survey	▪ Equipment saturations ▪ Purchase patterns by distribution channel ▪ Awareness/influence of ARRA rebates ▪ Efficient product market share
End-Use Customer Surveys Comparison Area (200 per product, total across all states)	Telephone Survey	▪ Equipment saturations ▪ Purchase patterns by distribution channel ▪ Awareness/influence of ARRA rebates ▪ Efficient product market share ▪ Establish baseline sales for attribution analysis
Participating Appliance Retailer Surveys (70 Storefront Surveys)	Telephone Survey	▪ Influence of NYPP ▪ Trends in consumer purchasing behavior ▪ Storefront stocking behavior ▪ NYPP satisfaction ▪ Impacts of ARRA
Participating Appliance Manufacturer Interviews (2 Interviews)	Telephone Interview	▪ Influence of the program on business practices ▪ Changes in the market ▪ Perceived sustainability of program impacts ▪ NYPP Satisfaction
Participating and Non-Participating Appliance Retailer Interviews (5 Corporate Interviews)	Telephone Interview	▪ Influence of NYSERDA program efforts on sales of ENERGY STAR and other high-efficiency products in NY and other areas of the United States ▪ Changes in awareness, availability, pricing, and marketing efforts that may have resulted from the NYPP ▪ Perceived sustainability of program impacts ▪ NYPP Satisfaction ▪ Perceived market effects due to the program
DOE/EPA/ASAP Interviews (4 interviews)	Telephone Interview	▪ Influence of NYSERDA program efforts on sales of ENERGY STAR and other high-efficiency products in NY and other areas of the United States (focus on comparison areas)

Table 2. Final Sample Sizes for Customer Surveys

Respondents	Refrigerators		Clothes Washer		Dishwasher		Room AC	
	NY	Comp.	NY	Comp.	NY	Comp.	NY	Comp.
Total Number Respondents	145	294	170	247	141	203	184	135
Respondents Providing Model Number	96	207	84	115	84	127	55	36
Percent Providing Model Number	66%	70%	49%	47%	60%	63%	30%	27%

Key Findings

The Team examined market penetration for ENERGY STAR products in NY, then estimated the baseline sales that would have occurred in absence of program intervention, and finally combined the two to estimate the program attributable sales.

ENERGY STAR Market Penetration

The analysis determined that the ENERGY STAR market penetration trend has varied significantly by appliance over the 12-year period that was examined. For example, as shown below in Figure 1, ENERGY STAR market penetration for refrigerators climbed steadily in the early 2000s, stayed steady in the mid 2000s, and then rose significantly again from 2009 to 2012 to over 70%. Market penetration for ENERGY STAR clothes washers rose nearly steadily from approximately 15% in 2001 to over 70% in 2012 (Figure 2). Dishwashers exhibited a steep rise in ENERGY STAR market penetration from approximately 15% in 2001 to over 80% in 2006, and then has stayed at over 80% despite numerous ENERGY STAR specification changes since then (Figure 3). Finally, the ENERGY STAR market penetration for room air conditioners has been volatile over the period that was examined, varying substantially by year (Figure 4), possibly reflecting differences in buying trends that might be depending on the weather.

Perhaps most notable is that by 2012, the ENERGY STAR market penetration in the NYSERDA region is relatively high (over 70%) for all four appliances examined through the study.

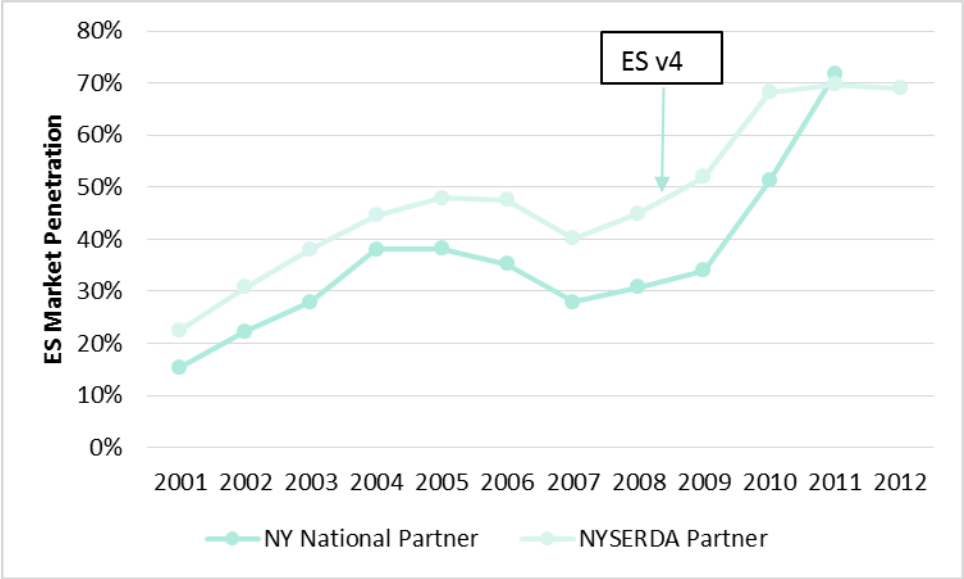

Figure 1. NYSERDA Region Market Penetration of ENERGY STAR Refrigerators by Year and Partnership Status

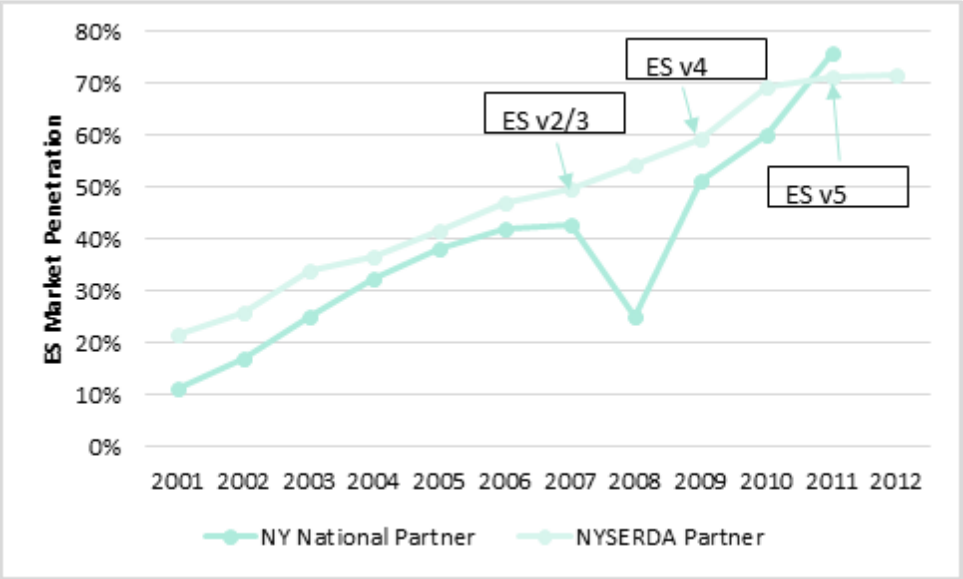

Figure 2. NYSERDA Region Market Penetration of ENERGY STAR Clothes Washers by Year and Partnership Status

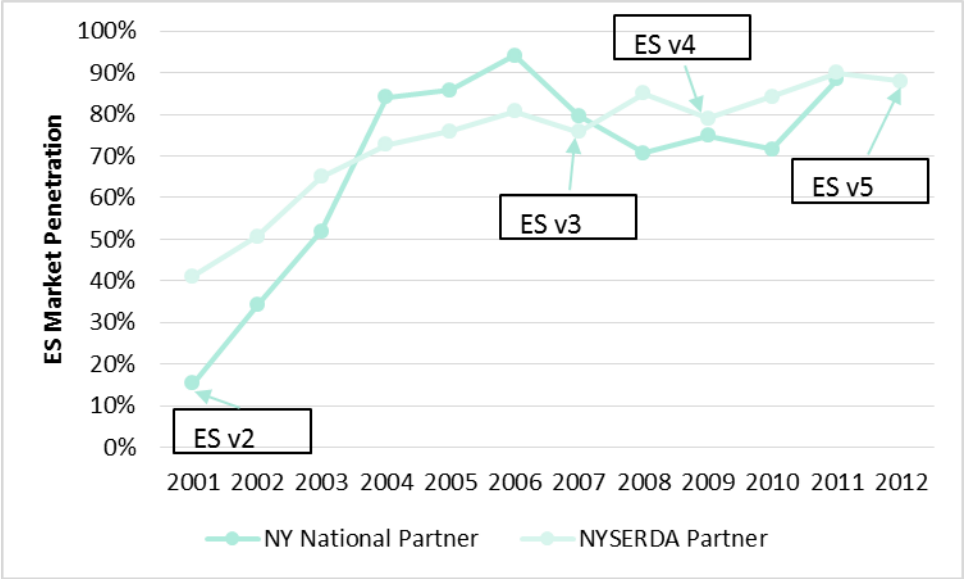

Figure 3. NYSERDA Region Market Penetration of ENERGY STAR Dishwashers by Year and Partnership Status

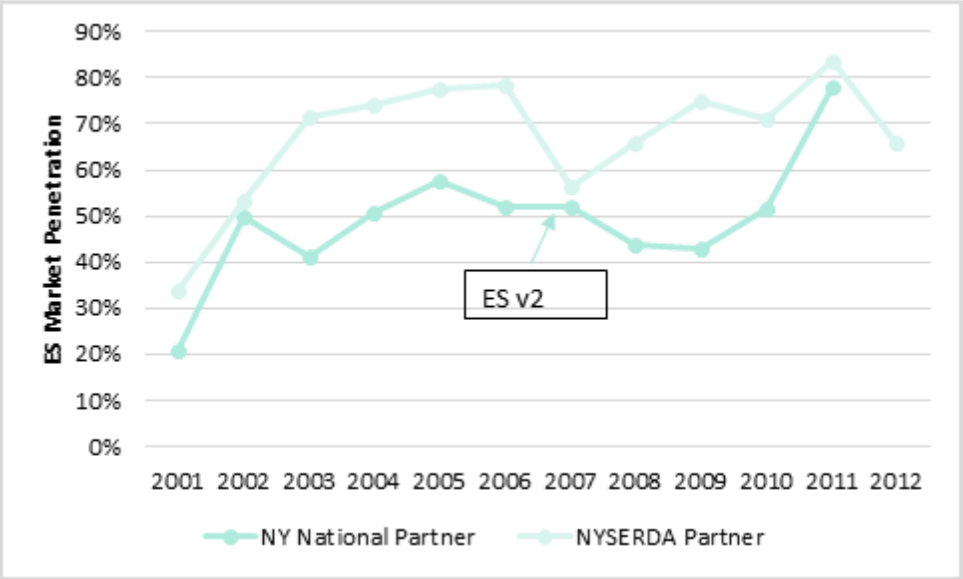

Figure 4. NYSERDA Region Market Penetration of ENERGY STAR Room ACs by Year and Partnership Status

Baseline Sales of ENERGY STAR Units Based on Comparison Area Data

To estimate baseline ENERGY STAR sales, the Evaluation Team relied on the consumer surveys and D&R sales data in the comparison areas. The weighted average ENERGY STAR market share for the comparison areas is then assumed to be the baseline market share of ENERGY STAR products that would have occurred in New York in absence of the NYPP.

The Evaluation Team analyzed the results of the comparison area consumer survey coupled with the comparison area National partner ENERGY STAR sales (from D&R International) and ran the same market share analysis used for the NYSERDA region to serve as the baseline sales.

An overview of the ENERGY STAR market penetration for the analyzed appliances is shown below in Figure 5.[4] As can be seen in this figure, all appliances showed equal or even greater ENERGY STAR market penetration in the comparison area than in New York.

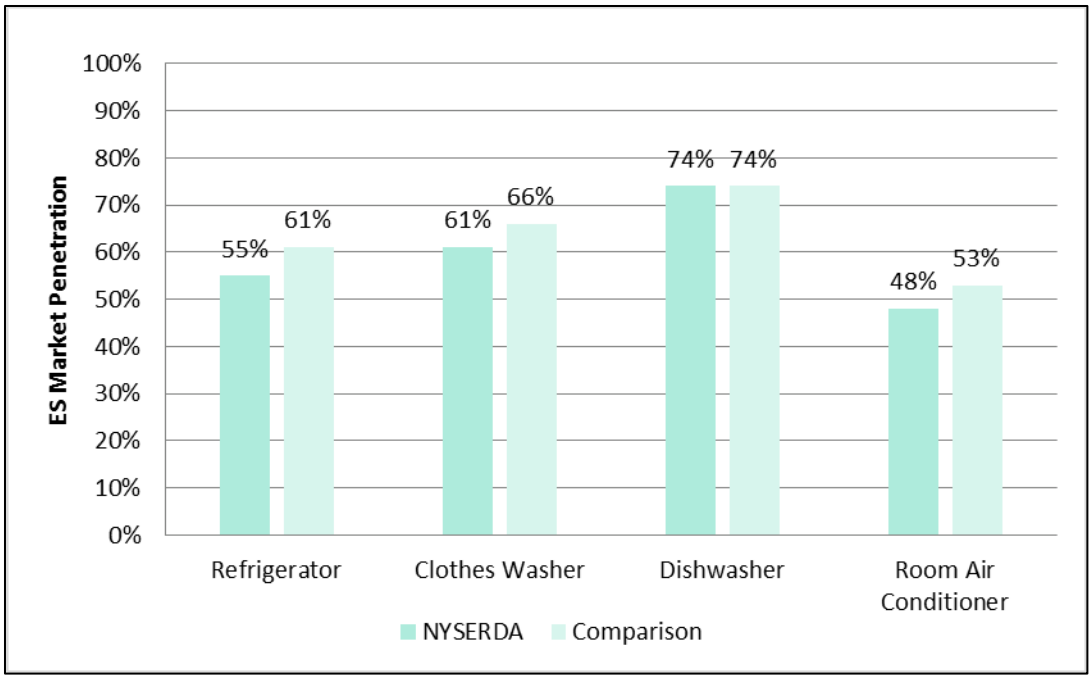

Figure 5. ENERGY STAR Market Penetration of High Impact Measure Appliances in NYSERDA vs. Comparison Area, 2010-2012

Market Lift Using Alternative Analyses

The Evaluation Team explored additional perspectives and data sources – as supplemental analysis to the research described above – to examine any potential market lift in the NYSERDA region, using a number of additional approaches. As discussed below, however, none of these methods identified any lift in ENERGY STAR market penetration for NYSERDA vs. the comparison area.

Logit Model

The Evaluation Team developed a logit model based on consumer survey data, estimating the probability of choosing ENERGY STAR models in NY versus comparison areas. The model offers the advantage of controlling for additional exogenous variables, including home ownership, head of household age, and head of household education. The model, however, found no results with statistical significance, and no greater likelihood of ENERGY STAR appliance purchase in NYSERDA Area versus Comparison Area.

[4] Note, as a compilation of various data inputs (e.g., consumer surveys and participant sales data reporting), statistical significance testing could not be conducted on the summary penetration estimates. The Team, however, did also attempt to develop statistical models through logit modeling. Note also these figures are based on the combined market penetration for three years (2010-2012) using all data sources (sales and survey data), so may differ from the long-term longitudinal analysis presented in prior figures.

Review of National Partner Data Only

The Team reviewed national partner sales data compiled by D&R for the NYSERDA and comparison areas. The Team analyzed sales across all retailers and then again for retailers that were common across the regions. As shown in Figure 6, other than a slight lift for Room ACs, not one appliance shows higher ENERGY STAR penetration in NYSERDA areas relative to the weighted composite value across the comparison areas for all retailers. When comparing the same exact group of retailers in the two regions there was slightly higher ENERGY STAR penetration of dishwashers and Room ACs in NYSERDA regions.

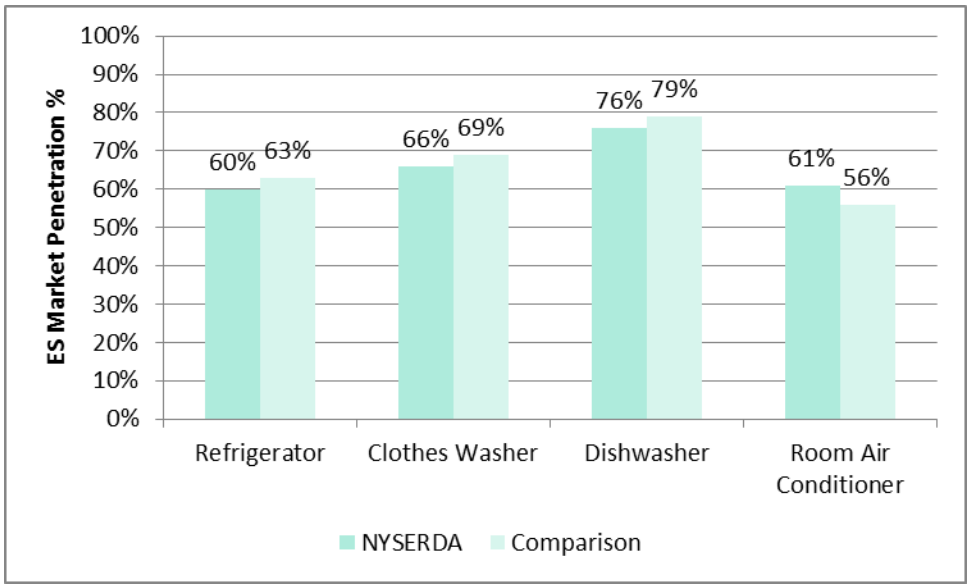

Figure 6. ENERGY STAR Market Penetration of Appliances in NYSERDA vs. Comparison Area based on D&R Retailer Sales, 2010-2012

Review of NYSERDA and comparison area consumer survey results alone

As a final option to investigate sales data for market lift in the NYSERDA region, the Team reviewed the ENERGY STAR penetration based solely on the results of the NYSERDA and comparison area consumer surveys (administered for both NYSERDA and comparison areas).[5] The consumer surveys did not show results consistent with those of the other data sources. Figure 7 shows the ENERGY STAR penetration between NYSERDA and the comparison region based on the consumer survey. Once again, however, a clear picture of market lift does not appear, with clothes washers showing slight lift and Room ACs showing significant lift, but refrigerators actually showing a negative lift (i.e., greater reports of ENERGY STAR sales in the comparison area than NY). Note, however, caution should be made with these results especially since Room ACs had the lowest survey success rate and in particular had very low successful make and model procurement from participants (sample sizes are provided in Table 2).

[5] Note that the consumer survey results show a substantially lower ENERGY STAR penetration relative to the D&R and NYSERDA tracking data. The underlying reasons for this lower penetration are most likely due to incorrect model numbers (participants mistaking other product information like serial number for model number), and a large share of the participants not being able to provide a model number, which lowered the overall count of available models with which to lookup the Energy Star status.

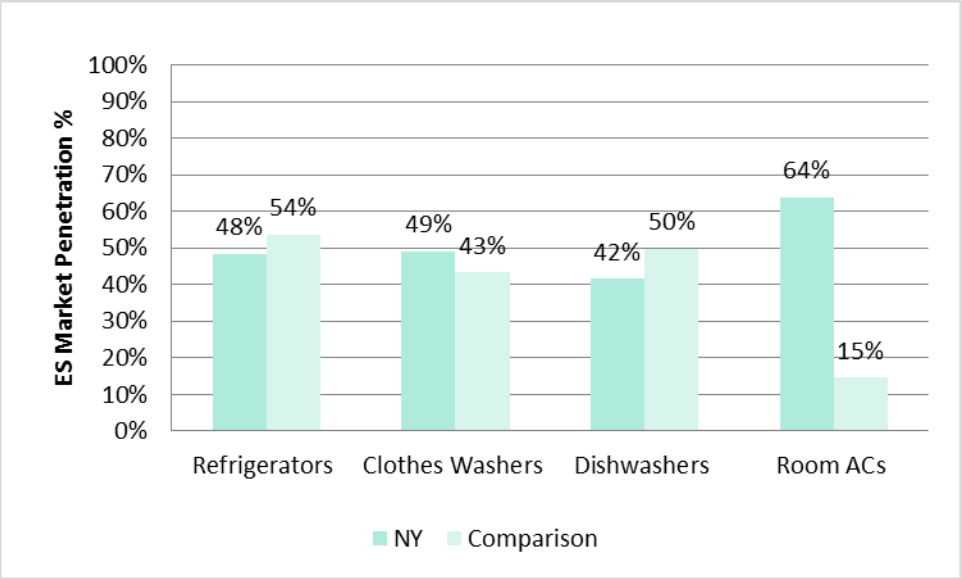

Figure 7. ENERGY STAR Market Penetration of Appliances in NYSERDA versus Comparison Area based on Consumer Survey

Attribution Using Participating Retailer Self-Report

In addition to the comparison area data analysis, the study examined a counterfactual, self-report baseline approach based on interviews with both participating corporate retailers and storefront managers. Use of this self-reported, counterfactual, is a bottom up rather than top down approach to estimating market lift. The self-report approach is based on the partner storefront survey (N=71) and a single corporate survey. Retailers were asked:

> *"By what percentage do you estimate your store's sales of ENERGY STAR [Corresponding Product] would be lower if the NYPP ENERGY STAR promotional incentives for [Corresponding Product] were not available?"*

A review of the single corporate interview showed an overall market lift attributed to the NYPP of approximately 5% for all products, while the storefront surveys revealed a self-reported market lift of 20% for refrigerators, clothes washers, and dishwashers, and 26% for room ACs.

Final Attribution Estimation

Summarizing the various sales lift analysis shows the following results:

- Baseline sales analysis using comparison region data – no lift
- D&R data – no/minimal sales lift
- Consumer survey logit model - no/minimal sales lift
- Corporate retailers (representing National and NYSERDA partners) – minimal (5%) sales lift
- Participating Retailer Self Report (representing NYSERDA partners only) – approximately 20% sales lift

While these last findings appear contrasting, it is likely that the first three approaches are not able to pick up the market lift from program participants, since they represent approximately half (and less than half for some products) of the total market sales. In other words, if there is only modest market

lift among a smaller percentage of the total market, examining a total sales based market lift approach may not able to detect the small shift in sales among specific retailer groups. Ultimately, the Evaluation Team, therefore, applied the storefront self-reported sales lift (20%) to NYSERDA-only retailers and the corporate self-reported sales lift (5%) to National and NYSERDA-partner retailers.

Conclusions and Recommendations

The following conclusions and recommendations are based on the Evaluation Team's review of the extensive evaluation data and results for the market and impact analysis. Note, while the data and analysis were based on NYSERDA, the conclusions and recommendations should be relevant for other program administrators considering support of ENERGY STAR appliances.

Conclusion: The NYSERDA partner ENERGY STAR market share is very high (in 2012 market share was 75% for clothes washer, 88% for dishwasher, 72% for refrigerators, and 67% for Room AC). When comparing results to the prior NYSERDA studies, ENERGY STAR awareness has not changed significantly since 2010, likely because the ENERGY STAR market has matured and awareness has remained high.

Recommendation: Considering the current program design (shifting focus from all ENERGY STAR products to Most Efficient products) and the findings contained in this report, NYSERDA should carefully consider the viability and continued support of consumer appliances. It is critical to track market share very closely and monitor potential program impacts. There are significant risks and constraints associated with the future cost effectiveness and evaluability of the program, including: the uncertainty surrounding baseline sales, the availability and sharing of partner sales data, potentially higher incremental costs for "Most Efficient" appliances, lower savings due to ever improving new standards, and a limited variety of Most Efficient models. If early indicators show lackluster market lift, NYSERDA should seriously reconsider continuation of this program.

Conclusion: Sales lift of ENERGY STAR products for NYSERDA-only partners was moderate, for retailers that team with both NYSERDA and also work with national ENERGY STAR program (big box) the reported sales lift was limited, and lift was not evident at all for retailers outside of the program but within the NYSERDA market area.

Recommendation: Focus recruitment efforts on retailers that are not receiving support through the national ENERGY STAR program to help them sell more efficient products, as this represents the best opportunity for program attribution.

References

Apex Analytics and RIA. 2013. "New York Products Program: Market Characterization, Assessment, Process, and Market-Based Impact." NYSERDA.

Cadmus Group, Abt SRBI, Beacon Consultants, ERS, Navigant, and NMR. 2012. "NYSERDA American Reinvestment and Recovery Act 2012 Impact Evaluation Report: State Energy Programs. NYSERDA.

Cadmus Group and Navigant Consulting. 2012. "New York Energy $mart Products Program Market Characterization And Assessment Evaluation Final Report." NYSERDA.

Quantec, LLC and Summit Blue Consulting. 2006. New York Energy Star® Products and Marketing Program Market Characterization, Market Assessment and Causality Evaluation." NYSERDA.