

# **When the Lights Went Out: Achieving Residential Program Savings in a New Era**

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## **ABSTRACT**

The prospect of a future where the lighting market has been transformed has many Program Administrators asking the question, “What’s Next?” Tasked with answering this question, the authors set out to document current standards, identify gaps in program offerings, and review potential study results. Armed with a highlighter, a rolodex of industry experts, and a never-quit attitude, the authors did a deep dive on the future of products programs. The purpose of our research was to aid in the development and design of a products program given the loss of savings from lighting and increasing federal standards, which leave little room for successful program intervention from other energy-efficiency measures that have been mainstays of past efforts.

For this study, we conducted a thorough review of current standards, interfaced these results with potential studies, and gathered market intelligence from experts and thought leaders who have examined residential energy and demand savings measures. These measures included gas and electric appliances and products, residential energy storage and backup systems, connected home products, demand response solutions, and innovative program designs and strategies. Across 24 interviews, we explored the following:

- Products that have shown substantial savings
- Products that have demonstrated success in or hold promise for demand response solutions
- Products that interviewees intend to focus on or emphasize in future planning
- How programs can best influence consumer choice and purchasing behavior
- How products programs can best succeed and achieve cost-effectiveness moving forward

This paper discusses the results of these interviews and identifies products and program designs that are particularly viable in the changing residential landscape.

## **Introduction and Objectives**

Residential products programs are the focus of much interest because of the prospect of a future where the lighting market has been transformed. Tasked with answering the question, “What’s next for products?” we set out to document current standards, identify gaps in program offerings, and review potential studies to help characterize the next generation of residential products program offerings.

We developed the present research as an iterative process, with initial tasks laying the groundwork for follow-up research. Documenting codes and standards served as stage 1 of this process, followed by a market scan in which we conducted interviews with industry experts. The

results presented here are supplemented at points by a review of the literature and sources recommended by the interview participants.

While the codes and standards documentation is focused on technical potential, the market scan was meant to address products and methods that have proven successful, according to interview participants who cited their potential now and in the future. The research also sought to address emerging technologies that may offer substantial, low-cost savings, and how to improve delivery methods and affect behavioral changes to achieve future savings. While we asked interviewees to consider cost-effectiveness and economic potential during the interviews, it is important to note that this was a qualitative review and some of the measures identified as having potential may not align with the results of region-specific cost-effectiveness screenings.

The goal of the market scan was to gather and report market intelligence from experts and thought leaders who have examined, or are in the process of examining, new residential energy and demand savings measures. Topics covered included gas and electric appliances and products, residential energy storage and backup systems, connected home products, innovative demand response solutions, and innovative program designs and strategies. Interviewees included Program Administrators (PAs) from across the nation, ENERGY STAR consultants, members of regional and national energy-efficiency organizations, evaluators, and smart strip manufacturers. We also conducted follow-up research based on the key takeaways of our interviews, identifying and reviewing reports, products and technologies, and other information of value. This also included drawing on our insights from market intelligence gathered at the 2016 and 2017 ENERGY STAR Partners meeting, and a literature review focused on the ENERGY STAR Retail Products Platform (ESRPP) and its early evaluation reports.

Although sections of the market scan interviews focused on particular products or technologies, interview participants were often hesitant to address the specific savings of a particular measure. These participants cited uncertainty about the exact efficiency or savings of a particular technology, and/or a belief that traditional downstream approaches have a relatively bleak outlook for some products and appliances. As such, a large focus of our reporting is centered around program designs and the best ways to overcome barriers facing products-programs moving forward. Ultimately, the following topics were discussed in the interviews and pursued in our research:

- Products that have shown substantial savings in their own programs
- Products that have shown or have promise in demand response solutions
- Products interviewees intend to continue to focus on or place greater emphasis on in future planning
- How interviewees think programs can best influence consumer choice and purchasing behavior
- How products programs can best succeed and reduce program and administrative costs moving forward

We specifically asked respondents about measures or strategies that were currently achieving savings while reducing program and administrative costs in their regions. Accordingly, the findings reported throughout this research typically focus on opportunities, though many barriers undoubtedly exist and several challenges have been noted.

The findings in this paper are laid out as follows:

- **Traditional Products and Emerging Technologies** extends the research on the documentation of codes and standards by drawing on discussions surrounding specific products and technologies in the market scan interviews.
- **Effectively Leveraging Efficient Products** provides the best methods identified by respondents for successfully operating programs and delivering efficient products to consumers.
- **Claiming Savings/Reducing Program Costs** discusses the barriers identified that can prevent programs from succeeding (e.g., free-ridership) and the program designs that can help to overcome these barriers.
- **Retail Product Platform (RPP)** gives an overview of the ENERGY STAR RPP program and provides insight from PAs who are currently administering the program.

## Methodology

Our study included the following research tasks:

- Documenting codes and standards of residential energy and demand savings measures
- Interviewing industry experts and thought leaders (detailed below)
- Gathering market intelligence at the 2016 and 2017 ENERGY STAR Partners meeting
- Conducting a literature review focused on the ENERGY STAR Retail Products Platform (ESRPP)

We completed 17 interviews with 24 participants throughout August and September of 2017. Table 1 shows the sectors in which the interview participants primarily work.

Table 1. Interview participants

Contact sector	Organizations	Participants
<i>Total</i>	<i>17</i>	<i>24</i>
Program administrators	5	7
Regional or national energy-efficiency organizations	5	9
Power strip manufacturers	2	3
Efficient technology designers	2	2
Consultants/evaluators	3	3

We identified our interviewees by drawing on the insights gained through the documentation of codes and standards; the Massachusetts PAs and the Energy Efficiency Advisory Council (EEAC) consultants provided guidance. Respondents included PAs running successful products programs, PAs with innovative approaches or program designs, and industry

experts and evaluators who had substantial knowledge of efficient products and emerging technologies. In many cases, the respondents had authored materials on current codes and standards and we sought to gain further insight into a specific idea, technology, or approach. Interviews covered a wide range of topics, including savings potential of efficient products, demand-response opportunities, the role of emerging technologies, behavioral approaches, innovative program designs, achieving cost-effectiveness, evaluating programs and claiming savings, and the state of downstream rebates and the potential to move upstream.

## **Traditional Products and Emerging Technologies**

This section focuses on interviewees' insights into specific products and appliances, and presents strategies identified by interviewees (e.g., behavioral changes) that are utilized by existing programs to target efficiency or demand response solutions. While we attempt to integrate discussions surrounding delivery methods, this section is primarily focused on reporting the current state, potential, and opportunities of existing technologies and strategies.

By documenting technical potential through a codes and standards review, we initially identified clothes washers and dryers, refrigerators, room air conditioners, and pool pumps as the measures with the greatest technical savings potential, mostly due to the existence of Consortium for Energy Efficiency (CEE) tiers above ENERGY STAR, and/or room to increase market penetration of ENERGY STAR models. All of these measures were corroborated to show potential by one or more interviewees. Several of these products are also included in the ESRPP portfolio.

Additionally, we include smart thermostats, dehumidifiers, TVs, air purifiers, Electric Vehicle (EV) chargers, advanced power strips, connected home technologies, and residential batteries in this section as respondents frequently identified these products as having potential.<sup>1</sup> In many cases, these products are emerging technologies (e.g., smart thermostats, EV chargers, batteries, and other connected products) that are rapidly improving with low program activity given high consumer interest, or with program activity that is difficult to define. These factors create greater savings opportunities. In other cases, these were more traditional products that are increasingly viable due to new advancements (e.g., dehumidifiers and TVs).

As noted above, there were relatively few discussions on the incremental costs associated with these products. Most measures discussed achieve roughly the same level of savings as – or a lower level of savings than – 10 LED light bulbs would, despite substantially higher costs for many of these products. This further highlights the challenges of replacing savings produced from lighting.

### **CEE Tiers**

Many interviewees first identified products with CEE tiers above ENERGY STAR as those with the greatest potential, *if* those higher tiered products can be properly leveraged. “Any

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<sup>1</sup> Most of these measures present immediate opportunities; however, the greatest savings potential for EV chargers and connected home technologies may still be a few years away. EV charger savings opportunities will grow with increased market share of EVs and more prevalence of fast-charging, both of which will increase their energy consumption and associated opportunities for savings. Connected home device use is also rapidly growing, but in this case, savings are limited mainly by a lack of information on how they can best be used to achieve savings and what level of savings can be expected. Future studies by PAs and other organizations into their effectiveness as energy-efficiency and demand-response solutions will make their inclusion in program activity more viable.

*product with higher CEE tiers is worth looking into [for program inclusion],”* said one respondent. *“I think we often leave savings on the table when we just do ENERGY STAR,”* added another, claiming that programs often create more savings than they take credit for because the sales of the most efficient products are not separately accounted for within the program. Several participants also noted the challenges of promoting higher CEE tiers that stemmed from the need to educate consumers and retailers, or from a lack of availability of the highest tier of products. This led some participants to suggest putting a greater focus on promoting the ENERGY STAR Most Efficient specification for qualified products, which would allow a tier above the traditional ENERGY STAR certification while still utilizing consumer and implementer familiarity with the ENERGY STAR label.

### **Clothes Washers**

Clothes washers were frequently mentioned as a measure with good savings potential due to the existence of CEE tier 2 and 3 standards and an ENERGY STAR Most Efficient label. Interviewees’ data also showed that a large portion of the market continues to purchase inefficient top loading washers. Respondents identified manufacturing constraints as barriers that have slowed the adoption of highly efficient models. One evaluator indicated that top loading washers *“still aren’t being designed to the way that we want them to be designed. There are still markets of people that are buying washers that aren’t efficient because they still aren’t being made.”* This respondent went on to add that she believes washers are still a product where a downstream rebate can move the price to a point where consumers would be interested in purchasing a specific model. Another PA told us that although their program promotes higher tier washers, not many models above tier 1 (i.e., the ENERGY STAR standard) exist. Therefore, consumers are often unaware of these models or struggle to find them, limiting the program’s success. This may present an opportunity to work directly with retailers and manufacturers. She added that this is a challenge for the program as the higher tiered models are necessary to achieve substantial savings in their portfolio. The new ENERGY STAR Most Efficient label may help to incentivize manufacturers to produce more efficient products.

### **Clothes Dryers**

Several respondents identified dryers as a measure that shows savings potential. Although there are no CEE tiers above ENERGY STAR, there is an ENERGY STAR Most Efficient designation that can be used in dryer incentives. Interviewees identified the potential for heat pump dryers, although they also noted that an educational process would be required to make this technology more mainstream. Another respondent said that the Super-Efficient Dryer Initiative (SEDI) provides some opportunities to identify highly efficient dryers and potentially create a multi-tiered specification. Inefficient testing methods mean that dryers likely have more opportunities than previously identified. Although these outdated test methods were not specifically mentioned by any participants, it is a focus of the SEDI report (NEEA 2016).

### **Refrigerators and Freezers**

Some respondents also identified refrigerators as having potential due to the existence of tier 2 and 3 specifications. Although, one PA called the tier 3 specification *“pretty much non-existent in the market.”* Several respondents discussed influencing consumer’s purchases of

efficient refrigerators. One PA advocated for switching to a midstream model because “*there’s not a lot of effect for giving a \$50 rebate for a \$1000 refrigerator.*” While that argument was not disputed, others pointed to refrigerators as a product where strategies to increase efficiency have been successful, identifying the high ENERGY STAR saturation of refrigerators as a blueprint for a successful model in increased appliance efficiency. “*I think the reason ENERGY STAR is so successful with fridges is because those are the nice fridges. They have all the nice features and those are the features people want. That’s where I think having the manufacturer strategies comes in. We’re successful with refrigerators because it’s bundled with a lot of other features,*” said one PA. This suggests that a similar model, where manufacturers add new features and efficiency simultaneously, may make tier 2 and 3 refrigerators more prominent in the market without the need for much program intervention. Since this implies that customers are frequently purchasing ENERGY STAR models due to the available features and not necessarily rebates, there may be some free-ridership with base ENERGY STAR models that could be eliminated with a midstream model targeting higher-tiered units. ENERGY STAR is also focusing on future refrigeration technology and has chosen solid-state refrigerators as the 2017 ENERGY STAR Emerging Technology Award Category. These refrigerators must save at least 15% over the existing ENERGY STAR specification and have potential to achieve more savings and reduce harmful refrigerants (ENERGY STAR 2017).

Although no respondents specifically dismissed refrigerators, two did share some concern that with the cost of a refrigerator (and the suggested rebate amount that it may take to influence a customer), it is important to be sure a program including refrigerators is making an impact with its achieved savings. “*We get the same amount of savings from a refrigerator as we get from about three LEDs,*” said one respondent.

One PA also identified the potential for stand-alone freezers. She stated that her utility was bringing this product back in 2018, after previously removing the measure, as the most efficient models now pass their screening.

## **Room Air Conditioners**

Two respondents stated that high EER room air conditioners are continuing to show good savings. Two others identified their increasing potential as a demand-response option since connected home devices allow greater controllability. Room ACs are included in the ESRPP portfolio, and several discussed their potential in that capacity. There is also the potential that the growth of inverter technology in room air conditioners will lead to more efficiency in the near future.

## **Pool Pumps**

Several respondents identified pool pumps as a measure that shows significant opportunities that may have been underappreciated in the past. “*One thing we’ve been asked when looking at pool pumps is, are they a national thing, or are they an Arizona thing? The answer seems to be that it’s national, savings are available in most places. There’s a shortage of efficient products to make it worth our while,*” said one national efficiency organization director. Respondents specifically identified the substantial increases in per-unit efficiency of variable-speed pumps, bearing in mind the added costs of such measures.

Some respondents advocated moving pool pumps upstream, identifying them as an easier product to work with retailers or manufacturers than some others, due to the relatively small

number of stakeholders in the space. One PA told us that her utility had been running a successful program working with just two large retailers that accounted for most of the local pool-related equipment sales. Although respondents liked the short-term opportunities available in pool-pumps, two raised concerns that the opportunities may cease to exist over time. One PA told us that their state commission is planning to raise the baseline against which pool pumps are measured (from single-speed to multi-speed) due to market transformation, which will significantly limit the savings opportunities of even the most efficient variable speed models. For this reason, her utility is planning to sunset the measure soon. Another told us that the finite number of pools, especially in cold-weather states, severely limits long-term opportunities in this space. A third concern is that the upcoming DOE standard (if enacted) will limit the ability to obtain additional pool-pump savings. However, variable-speed pumps will still offer some savings, and many pool pump motors are replaced before the entire pump. The DOE standard will not apply to replacement motors and there might be opportunities to influence the replacement motor market through mid or upstream intervention or by setting a state standard.

### **Other Measures Identified**

Respondents identified the savings potential from some measures that we initially deemed to have moderate to low savings potential based on a codes and standards review. These included dehumidifiers and TVs. They also identified some measures that did not have specific savings potential attached. These included smart thermostats, advanced power strips, and emerging technologies, such as connected home devices.

### **Leveraging Efficient Products**

As increasing baselines and saturation of efficient products make it more difficult to run a successful products program, good program design and effective delivery take on increasing significance. *“It’s going to be a hard go for a while, or maybe forever, because cheap energy savings are gone. The key now is trying to be comprehensive,”* explained one respondent. This section outlines the strategies that market scan interviewees suggested to more effectively leverage efficient products and to help programs achieve successful savings or demand-reduction in a low-cost manner. It is worth noting that the Retail Products Platform (RPP) was a frequently discussed topic in program-design strategies. The key findings related to effectively leveraging efficient products are discussed below.

**Many consumers do not consider efficiency when deciding what product to buy or think of it only as an afterthought.** To combat this, the utility or the program needs to insert themselves into the decision process at an early stage, while research is being conducted and the decision of what to purchase is being made. This can be achieved by presenting consumers with more materials and resources on efficiency during their research or by presenting them with a more efficient array of choices to promote an efficient decision even if the consumer does not know that they are making one.

**In many cases, efficient products exist that meet customer’s criteria in terms of price and features; however, due to a greater number of inefficient products meeting the same criteria, there are often cases where the consumer is unaware that an efficient product that suits their needs and budget exists.** Working with online retailers to rearrange the order in which search results appear to include efficiency, or making efficient product placement more prominent in-store, could help solve this problem.

**Online tools, social media messaging, and similar strategies can help integrate the utility and energy-efficiency into the consumers' thought process.** Purchase decisions are often made before the consumer reaches the store, so finding ways to reach them sooner is essential.

**There is still a role for downstream rebates, but there needs to be a deep understanding of the most effective timing and placement.** Incremental costs have to be considered in downstream programs to ensure that rebates are influencing decisions and achieving savings. Choosing between downstream, midstream, or upstream options should not be viewed as black or white, but rather there should be some interaction across methods to best target opportunities. For example, offering downstream incentives for a product until its ENERGY STAR market saturation reaches a certain point and switching to midstream at that point.

**Customer targeting and Pay-for-Performance models are on the rise, but as with downstream rebates, these are not “catch all” solutions.** Customers are becoming more comfortable with their data being shared. This creates opportunities in big data solutions, such as targeting high-use customers or allowing a third party to use these approaches and paying them for results.

**Interviewees agree that more can be done in the multifamily market, although most were unsure of the best ways to target this group.** Many suggested broad market transformations to be the best solution here so that the array of products everyone is selecting from is more efficient, whether they are shopping for a single or multifamily home. Behavioral approaches were also cited.

## **Claiming Savings and Reducing Program Costs**

Given the challenges facing PAs and implementers in running successful and cost-effective products programs, we also asked respondents to share their insights on how these programs can best succeed and reduce administrative and program costs, and what the greatest barriers are to do so. The most commonly identified barriers included (1) increasing baselines, (2) the rapidly changing market and greater saturation of ENERGY STAR models, (3) the inability of programs to fully claim their impacts because of spillover and non-tier-based savings, and (4) free-ridership. The key findings that emerged from this line of questioning are below.

**Innovative program design can help tackle program cost concerns by preempting barriers.** Many advocated for switching to a mid-stream model, but other strategies were mentioned. These included increasing marketing, educational, and social media efforts; and finding ways to make efficient products more accessible by increasing their visibility in online or in-store assortments or providing point of sale rebates.

**Program Administrators need to take advantage of any savings that they can claim to achieve program success.** This may involve breaking program sales down into more categories to claim credit for the most efficient tiers or models being sold or attempting to expand the non-energy impacts (NEIs) that can be claimed through a program, with a focus on grid/transmission flexibility.

**Being able to claim credit for standards changes is a valuable asset.** There may be greater opportunities to get involved in standards advocacy or to track how a program has influenced a national codes or standards change, allowing for the program to claim savings.

**Free-ridership is a major hindrance to achieving success, especially as the market penetration of ENERGY STAR products increases.** Using targeting to reduce free-ridership



or using a market baseline approach to measure changes (as is being used by many to evaluate midstream models like the ENERGY STAR Retail Products Platform), where appropriate, were among the solutions suggested by respondents to target free-ridership.

## **ENERGY STAR Retail Products Platform**

This section provides an overview of the strengths and weakness of the Retail Products Platform (RPP) model, focusing on both regional RPP efforts and the national ENERGY STAR Retail Products Platform (ESRPP). This was the most frequently suggested structure for maintaining a robust products program for years to come. Many identified the opportunities that it creates to stay involved in products that would otherwise not be viable. These opportunities are due to the national-approach of the method, which would, in-theory, substantially reduce single utility, state, or regional costs, although it remains to be seen if this method will work as planned. The key findings from our review of the model and interviewees' insights related to RPP are below.

**RPP offers opportunities to stay involved in products that likely would not be viable otherwise due to higher program costs.** Per-unit incentives in RPP are typically lower than those in downstream programs. Sharing planning and administrative costs through national collaboration allows PAs to continue running programs for many products that would otherwise not have been viable.

**The large scale of ESRPP programs increases chances of real market transformation and allows reduced costs/streamlining, but also means loss of local utility “touch” and some ability to dictate what goes into portfolios.** The large scale of the program creates greater influence on the retailers and reduces costs by streamlining program design and evaluation efforts. The availability of data provided by retailers, and the ability to quickly adapt based on that information, makes it easier to measure and optimize program impacts and other opportunities, although early PA participants have reported some difficulty with the data portal.

**Determining how to evaluate/claim savings is critical to its success and survival.** Traditional EM&V approaches do not necessarily apply, and free-ridership is inherently high. New approaches are needed to fully understand the platform's success. Some interviewees advocated for switching to market-baseline measurements for evaluating the program; however, in many cases, the market has already become more efficient because of previous program intervention, which may diminish measurable effects of new or increased program activity.

**The ESRPP design means the utility will become less visible in products programs.** The loss of the customer-utility relationship, with the decreased focus on downstream rebates and a decreased consumer awareness of the utility's role in efficiency, means that PAs will have to stay on top of other efforts to raise awareness.

**Potential exists for very high long-term rewards if full potential or market transformation is modeled. Even greater claimed savings are available if RPP drives standards changes that can be claimed by PAs.** The long-term potential of market transformation will offer significant savings in years to come if the model works as planned. There also may be opportunities to coordinate RPP and standards advocacy efforts, as market transformation should lead to faster adoption of tighter federal and ENERGY STAR standards.

**RPP is unproven and still faces many challenges.** The need to pay incentives on all qualified units may mean that the decreased costs will be minimal or non-existent compared to downstream programs, despite RPP's lower per-unit incentives and decreased administrative

costs. However, if these challenges can be overcome, this model offers a potential way to run a successful program for products that are no longer viable downstream.

## Key Takeaways and Conclusions

While respondents agree that savings from products are unlikely to reach the level of savings from lighting programs, there are still opportunities to achieve savings by leveraging the most efficient products on the market through well-structured programs. As there is no single silver bullet product to replace these savings, successful programs need to find the right design and assortment of products. Increasing consumer awareness of efficiency and ensuring the utility is *present* when consumers are researching or purchasing a new product was deemed critical in these efforts. Many respondents also advocated for switching some products to a midstream approach (specifically the ENERGY STAR Retail Products Platform [ESRPP] approach) as a way to increase market influence at lower per-unit costs (RIA, Apex Analytics, and Illume 2017). Finally, respondents thought that embracing new program designs and/or technologies would provide a substantial opportunity for energy efficiency and demand-response. Table 2 summarizes the key strategies identified through the interviews for creating successful products programs.

Table 2: Strategies Identified in Successful Products Programs

Strategy	Approach
Identifying the proper assortment of products	<ul style="list-style-type: none"> <li>• Emerging smart/connected technologies offer savings and demand-response potential, and there are opportunities to influence consumers early in these new markets (e.g., smart thermostats, connected homes, advanced power strips, residential batteries, home energy reports).</li> <li>• New technologies in traditional goods can create savings in products where opportunities have become limited (e.g., heat pump dryers, inverter room air-conditioners).</li> <li>• Higher CEE Tiers and ENERGY STAR Most Efficient Products also offer opportunities to increase savings in products traditionally included in downstream portfolios (e.g., CEE tier 3 refrigerators and clothes washers).</li> </ul>
Changing the market	<ul style="list-style-type: none"> <li>• Midstream and upstream efforts may help to increase the market share of ENERGY STAR and higher tiered products.</li> <li>• National collaboration through ESRPP or other codes and standards initiatives could have significant impact on all consumers.</li> </ul>
Engaging the consumer and influencing their decision-making	<ul style="list-style-type: none"> <li>• Identify where consumers make their purchasing decisions and surround them with efficiency at that point.</li> <li>• Work to influence efficiency in the online marketplace, where consumers often research products. Use marketing and targeting to influence traditionally hard to reach customers.</li> </ul>
Claiming savings	<ul style="list-style-type: none"> <li>• Establishing strong baselines and using a market-transformation framework, where appropriate, will allow savings to be identified and will help overcome traditional challenges in dealing with free-ridership.</li> </ul>

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|  | <ul style="list-style-type: none"><li>• Claiming savings from products sold at tiers above ENERGY STAR, and identifying additional grid benefits and NEIs created by newer technologies, can increase program viability.</li></ul> |
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