Scotty, We Need More Power! A Complete Examination of Advanced Power Strips

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ABSTRACT

In recent years, Advanced Power Strips (APS) have become an increasingly common part of residential portfolios. Early studies have shown that in aggregate, APS could achieve substantial energy savings, specifically in the growing and hard to address area of residential plug-load consumption. This makes APS especially appealing to program administrators; some even view them as an opportunity to help offset residential lighting savings as that market nears transformation. However, recent field studies have suggested lower baseline energy usage than expected, meaning that possible savings in real world applications fall short of initial lab-reported values. Furthermore, customers' lack of awareness and understanding of APS have proven to be substantial barriers as market penetration remains low and in-service rates for APS have often been found to be lower than for other products.

To understand savings opportunities, barriers to adoption, and customer awareness and acceptance of APS, the authors primarily drew from five recent studies completed in the northeast: two residential appliance saturation survey (RASS) studies, one from Connecticut and one from Rhode Island; a market scan of new and emerging products; an APS field study from Massachusetts; and an appliance survey from Massachusetts. Through this broad approach, we found that large opportunities exist and, at least in the short-term, net-to-gross values for APS are very high. However, savings are largely dependent on overcoming the many barriers that exist. APS can be a successful measure in residential products programs, but to understand their true impacts, they must be subjected to more rigorous considerations of how customer behavior affects and limits the real-world savings opportunities.

Introduction

With residential lighting programs on the decline, many utilities are looking for the next big thing to save energy in single- and multifamily homes. Many program administrators (PAs) have identified plug-load consumption as an opportunity for new savings. Plug load is already responsible for a large share of residential energy use and is likely to grow as the number of connected and charging devices increases. According to a recent study conducted by the California Energy Commission, plug loads accounted for "virtually all of the 2013-2016 residential energy consumption growth" (Fable 2016). Unlike lighting, plug loads come from all types of devices. Many of these have low market penetration or low energy draws, making them unsuitable for support by programs at the individual product level. But one device, advanced power strips (APS), could serve as a one-size-fits-all solution to curb many plug loads. APS have become increasingly common in residential portfolios in recent years, but will they offer enough savings to replace lighting? In this paper, the authors explore APS and help answer questions surrounding energy and demand savings potential, customer attitudes, and potential barriers and opportunities for program success.

Methodology

This paper draws from findings of residential appliance saturation survey (RASS) studies completed in Connecticut (NMR 2019), Massachusetts (Navigant 2018), and Rhode Island (NMR 2018). This paper also draws from an APS metering study completed in Massachusetts (NMR 2019) and a consumer products survey, also focused on Massachusetts (NMR 2018). We used data from these studies and a literature review to estimate controllable device usage, APS generated savings, and customer interaction/acceptance. Through looking at all these factors, we present a holistic view of what opportunities and barriers exist for APS inclusion in residential products programs.

The RASS studies relied on web-based surveys and on-site verification visits to inform the saturation of existing APS. As APS saturation is typically low, the RASS studies also helped identify opportunities for APS by cataloging the presence of device hubs (i.e., home entertainment centers [HEC] and personal computers [PC] with peripheral devices) that can be controlled by APS. Using Massachusetts APS metering data and a literature review of other APS studies, we determined the annual savings of an APS unit. To calculate the kWh savings from an active APS, we relied on the metering study and used a difference-in-differences regression analysis that used field data from a six-month metering period of treatment and control sites.[1] A sample of treatment sites was then randomly selected to have an APS installed after a three-month pre-period. Finally, since any savings opportunities are limited by real-world behavioral challenges, we drew upon a literature review of in-service rates (ISRs), self-reported configurations from the Massachusetts consumer survey, and technician-observed configurations of pre-existing APS during the Massachusetts metering study to determine how many customers had an incorrect configuration or had removed their APS over the six-month metering period.

APS Background

There are currently two tiers of APS technology in the market: Tier 1 (basic) and Tier 2 (advanced), which advertises greater savings than Tier 1. Tier 1 APS are most common and can be used with HEC or PC end uses. These strips have three types of outlets: *always-on*, *control*, and *switched*. When properly configured, the devices in the *switched* outlets are used only in conjunction with the device in the *control* outlet. When the *control* device is turned on, the *switched* outlets are provided with energy and the devices can be used. When the *control* device is not on, there is no electricity flowing to the *switched* outlets, meaning that they are not drawing any standby power. For example, you might have a television plugged into the *control* outlet, with a DVD player, streaming device, gaming console, and soundbar plugged into the *switched* outlets. These devices would always be used alongside the television and thus do not need to be provided with power when the TV is turned off. A device that is used regardless of whether the TV is on, such as a modem or a router, would be plugged into an *always on* outlet. A similar configuration could be used for PCs, with devices such as a printer or monitor being *switched* and not drawing energy when the PC is not active.

Tier 2 devices work similarly, but do not have a *control* outlet. These devices only have *always on* and *switched* outlets. The *switched* outlets are set on a timer and/or are activated by movement. They shut off and stop the flow of power after a set (user-adjustable) amount of time passes without the strip receiving a signal (infrared, Bluetooth, etc.) or without picking up movement through an occupancy sensor. Tier 2 APS are designed differently for HEC and PC end uses, and are typically only offered in HEC configurations through residential program activity.[2] In addition to increasing energy savings by reducing vampire draws (i.e., energy consumption when a device is not active) like Tier 1 APS, the automatic shutdown capabilities of Tier 2 APS can curb energy use by shutting off the television if a viewer is no longer actively watching (e.g., if they fall asleep or leave the room). While there are strengths and weaknesses to the practicality and user friendliness of each APS tier and type, incorrect configuration is probably the biggest threat to savings opportunities.

[1] A difference-in-differences regression measures a treatment effect by observing treatment and control groups in a pre- and post-event period (in this case, the installation of APS units) and determining the effect based on differences in the post-treatment period relative to behavior for each group in the pre-treatment period.

[2] Tier 2 PC devices are also offered through some C&I programs.

Existing Residential Plug-loads

A recent ACEEE study identified plug load management as the top measure for energy savings through 2030, citing an Energy Information Administration (EIA) report that found miscellaneous energy loads consume more than one-third of electricity used in residential applications. While these plug-loads can come from thousands of products, many are associated with HECs and PCs, including desktop computers and laptops, and their peripherals. The EIA predicts that television and set top boxes will account for roughly one-third of plug-load consumption through 2040.

The recent Connecticut, Massachusetts, and Rhode Island RASS studies confirmed the presence of multiple HECs and PCs in nearly all homes (Table 1), with an average of more than two televisions and roughly two PCs (desktop or laptop combined) per home. The RASS studies also found a substantial number of peripheral devices that were either on the same power strip as televisions or PCs or could be added to the same power strip. Gaming consoles, surround sound systems, and monitors were common throughout these three states and all represent devices that could be controlled by APS. During the APS metering study conducted in Massachusetts in 2017, several other peripherals were frequently found alongside televisions and PCs. These devices included DVD/Blu-Ray players (present at 56% of Massachusetts sites), streaming devices (36%), phones (34%), and table or floor lamps (23%). There was an average of 3.1 peripherals found alongside each television, while 3.2 devices were found on the same strip as or adjacent strips to the PC. Connecticut RASS results were slightly lower, with 2.3 peripherals alongside televisions in HEC environments and 2.7 peripherals alongside PCs.

Table 1. Penetration and average number of consumer electronics in Connecticut and Rhode Island

	Penetration			Avg. Number of Units		
Device	CT (n=2,394)	RI (n=896)	MA (n=6,673)	CT (n=2,394)	RI (n=896)	MA (n=6,673)
Television	98%	96%	93%	2.39	2.29	2.10
Desktop Computers	75%	44%	42%	0.75	0.52	0.53
Laptop Computers	85%	81%	61%	1.45	1.31	0.96
Game Console	46%	47%	36%	0.74	0.85	0.56
Television Sound System	43%	45%	48%[1]	0.51	0.45	0.59[1]
Monitor	59%	46%	46%	N/A	0.68	0.70
Router	77%	93%	89%[2]	N/A	0.97	0.96[2]
Modem	80%	88%	92%[2]	N/A	0.91	0.96[2]
Stand-alone sound equipment	24%	35%	N/A	N/A	0.52	N/A

[1]The Massachusetts RASS study did not separate television sound systems from stand-alone audio equipment.
[2]Includes combined modems and routers.

These studies also found APS penetration to be low in Connecticut and Massachusetts. Rhode Island had substantially higher penetration, likely due to aggressive program support for APS through a National Grid direct install program. Table *2* shows that just over one quarter of Rhode Island homes (27%) had an APS installed, which is higher than APS penetration in both Massachusetts (16%)[3] and Connecticut (4%). The Connecticut study found that there is significant opportunity for increased APS adoption, with an average of 2.0 opportunities per home to attach an APS to an HEC and 1.3 opportunities per home to connect to a PC. It is important to note that these APS penetration values were based on APS observed by trained technicians who visited homes—they were not self-reported by customers. Self-reported APS

[3] Like Rhode Island, the Massachusetts PAs provide APS as a leave-behind measure as part of direct install programs.

penetration in both Connecticut and Rhode Island was shown to be extremely unreliable as customers often confused standard surge protectors and power strips. This is discussed in more detail in the Threats to Savings Opportunities section and as part of a companion poster being presented at IEPEC 2019 (*Do You Know What's in Your Basement? Comparing Knowledge with Reality*).

Table 2. Percentage of APS owners in select studies

Study	Percentage of APS Owners	N
Connecticut RASS	4%[1]	227
Rhode Island RASS	27%[1]	700
Massachusetts APS Metering	16%[2]	168

[1]Weighted penetration from statewide sample.
[2]Percent of pre-existing APS found at sites in metering sample.

To help establish baseline energy usage for HECs and PCs, the Massachusetts APS metering study metered HECs and PCs that were not connected to APS devices. The study found that the average HEC (including peripherals) consumed 471 kWh/year, while PCs (including peripherals) drew an average of 399 kWh annually; although, consumption for both varied widely from household to household.

Energy consumption is driven by both the number of peripherals on a strip and television and PC hours of use (HOU). HEC systems were active (i.e., turned on) for an average of four hours and 45 minutes per day in the Massachusetts study. This result was nearly identical to the television viewing values reported in the fourth quarter 2017 Nielsen Report, which stated that the average adult in Boston consumed four hours and 46 minutes of TV daily across all media (i.e., Live TV, time-shifted TV, DVD/Blue-Ray, gaming, and streaming).

While the greatest users in terms of time and energy have the greatest opportunities for large savings, customers who use these devices less may still have substantial opportunities to experience the benefits of the energy saving technology. When devices are active for shorter periods, the APS can spend more time in standby mode without providing energy to its peripheral ports. This means that the energy reduction potential (ERP) (i.e., the percent of energy that can be reduced by an APS) during standby hours could still be significant, and possibly more impactful, by reducing vampire draws from customers who often have their PCs or HECs turned off.

APS Savings Opportunity/Solution

Recognizing the opportunity to curb plug-loads and reduce vampire loads, many PAs have begun offering Tier 1 and Tier 2 APS as part of their residential products programs. They are often offered through a kit or direct install program, or through online utility marketplaces. Some traditional rebates are offered through retail channels, but these are less common. Based on research conducted for Massachusetts, the authors found it was uncommon for APS to be found available for sale outside of a utility program.

The level of savings from APS has been the subject of debate and, as Table 3 shows, there are conflicting results from various studies. APS savings are dictated by user behavior, both in configuration and in adjusting or reacting to Tier 2 automatic shutdowns. In controlled lab environments, the strips are capable of achieving maximum savings with optimal configuration and assumptions that customers will not override automatic shut-down capabilities. While this information is useful to show the devices' full potential, lab testing can create unrealistic expectations about savings levels. Early results driven by lab testing outputs caused many technical resource manuals (TRMs) to assign savings values to APS that were artificially high. This may have helped advance the technology by increasing their inclusion in many product portfolios, but it likely hurt long-term understanding and adoption of APS when it became clear that the strips could not always reach the maximum level of savings.

Field studies have attempted to provide more accurate depictions of the savings that APS achieve, but have been somewhat limited by small sample sizes. Field results are typically lower than what is found in a lab, but, with greater consumer awareness and education, real world savings could more closely approach lab-tested results. Table 3 compares the ERP, energy savings, and baseline energy usage from several recent studies using field results and laboratory and/or simulated savings methodologies. The higher ranges of ERPs in field studies do approach those modeled in laboratory environments, but the kWh savings are typically far lower, mainly due to lower observed baseline energy consumption. These field studies are also not fully subjected to real world issues of persistence and attrition and were often set-up by technicians; thus, eliminating possible configuration error by the customer. When these additional behavioral elements are introduced to a field study, the ERP and energy savings deviate further from those measured in a fully controlled environment.

Table 3. ERP, kWh savings, and annual kWh usage from select Tier 2 APS studies

Study	Methodology	% ERP	Savings (kWh)	Baseline Usage (Annual kWh)
UL Environment	Laboratory Testing	22%-47%	79-333	397-702
Calplug	Simulated Savings/Laboratory Testing	48-53%	306-386	602.85
PG&E	Simulated Savings	27%-50%	118-214	432
PG&E	Pre/Post Testing with Field Data	25%-29%	110-125	432
Silicon Valley Power	Pre/Post Testing with Field Data	49.5%	164	331
Massachusetts PAs	Regression Analysis with Field Data	37%-50%	174-236	471

There have been fewer recent studies to characterize the savings opportunities for Tier 1 strips. Typically, the energy savings have been found to fall in the 70-100 kWh range annually per strip. The 2017 Massachusetts APS metering study found slightly higher savings based on data collected from participating customers. This study estimated savings to be 127 kWh for HEC end-uses and 84 kWh in PC environments; however, these savings decreased to 89 kWh and 66 kWh, respectively, when factoring in realization (i.e., proper setup) and ISRs.

Despite the variability in the findings, these results suggest that APS *could* represent a substantial level of savings. To provide context, we compare APS savings to a familiar measure (residential LEDs). As Figure 1 shows, the average and higher estimates of Tier 2 APS savings are similar to that of replacing between six and twelve general service LEDs in a home.[4] Although there are far fewer power strips to replace in a home than light bulbs, energy savings in a home may not be limited to a single APS. Customers may have multiple HEC or PC setups in their homes with peripherals that could be controlled by an APS. Customers may also benefit from attaching strips to rarely used, secondary devices to reduce standby draws.

Despite their potential, this figure also shows that APS cannot serve as a full replacement for lighting savings. It takes the highest estimates of APS potential to begin to approach lighting savings. While savings for LEDs are fairly stable, the need to educate customers on proper set-up and use of an APS means that APS will either not achieve the savings laid out below, or will require additional costs to educate customers in order to achieve the savings.

[4] Tier 1 Strip cost from Tricklestar: . https://www.tricklestar.com/ Tier 2 average cost for Tricklestar and Embertec: https://www.embertec.com/ and LED general service price from NEEA Residential Lighting Market Characterization Study: https://neea.org/img/documents/Results-of-2017-2018-Northwest-Residential-Lighting-LTM-and-Tracking-Study.pdf

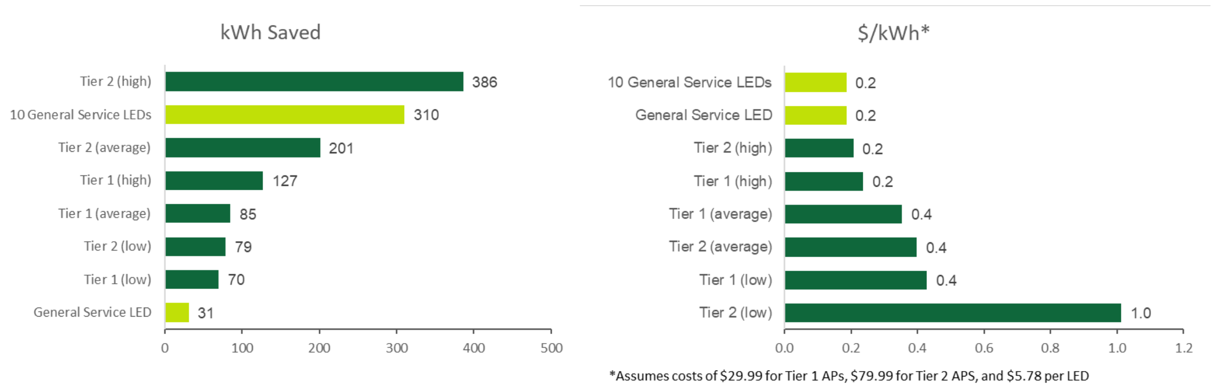

Figure 1: Energy and dollars per kWh savings of APS and LEDs

While the savings opportunities for APS certainly vary based on technology, end-use, and measurement methodology, every study completed on their savings potential has found that APS do yield statistically significant savings. By understanding the barriers and identifying the best paths to delivery and customer education, PAs can help APS approach their substantial maximum level of savings, and can successfully include APS in their residential portfolio offerings.

Threats to Savings Opportunities

To maximize the energy and demand savings potential of APS, the threats to savings opportunities must be understood and planned for. These threats include limited familiarity with APS and understanding of how to use them, lack of appeal to customers, difficulty in setting up devices, difficulty in removing devices, and declining baseline usage in HEC and PC environments. We discuss these in greater detail below.

Limited knowledge and familiarity

Lack of customer awareness is a major barrier for any new technology, including APS. Self-reported penetration numbers from the Connecticut and Rhode Island RASS studies highlight the lack of customer understanding of the product. Among survey respondents whose homes were visited for verification visits in Connecticut, 60% reported owning an APS in a pre-visit web-survey that included pictures and descriptions of APS – but technicians only observed APS in 4% of homes. In Rhode Island, 71% of online survey respondents self-reported that they had at least one APS in their home, but only 27% were confirmed owners during site-visits. In these cases, customers were confusing traditional surge protectors and power strips with APS. This lack of awareness is problematic because it means there is a limited customer base seeking APS and, even if customers do own APS, they are likely unprepared to configure the devices properly without additional assistance. If customers are unable to tell the difference between APS and traditional power strips, it is likely that they will set up the APS in a way that does not maximize savings or may cause them to incorrectly conclude that a strip has malfunctioned or failed, leading them to uninstall the APS altogether. For example, if a lamp is plugged into a *switched* outlet and the customer tries to use it without the control device turned on, they may believe that their power strip is defective because the power could not flow to the outlet. We discuss these configuration challenges further in the *Difficulty in setting up devices* section below.

Lack of widespread availability and persistence

Part of the low APS penetration may be due to a lack of availability. To date, APS have not become a common retail item. According to interviews with leading APS manufacturers, only a small share (1-2%) of APS are sold outside of energy-efficiency programs. Most APS are sold through utility marketplaces or installed or distributed through direct-install programs. Per the literature review completed for the Massachusetts consumer product survey, the uptake in APS usage after being distributed through a utility program can vary widely (NMR 2018). Studies on ISRs have found that there are many cases of customers not using the devices after receiving them as part of a program. Table 4 shows that just over three-quarters of customers install the APS; however, some leave-behind programs yielded far lower ISRs.

Table 4. In-service rates of APS in Massachusetts and other recently completed studies

Product Name (Sample Size)	MA Primary Research ISR (CI)[1]	Literature Review			
		ISR Range	Median	Study Count	Sources
Leave Behind Tier 1 APS (250)	81% (77%, 85%)	42% - 86%	78%	5 studies; 6 values	OK 2016; NM 2016; MO Ameren 2014; PA ADM 2013-14; LA 2012-13
Online/Downstream Tier 1 APS (359)	89% (87%, 92%)	80%	80%	1 study	Ontario 2015
Online Tier 2 APS (340)	81% (78%, 85%)	80% - 87%	83%	2 studies with 3 values	CA SDG&E 2014-15; CA PG&E & SDG&E 2014-15

While there is some variability in ISR based on delivery method, the median findings were all similar (78% for leave-behind Tier 1 APS, 80% for Online/Downstream Tier 1 APS, and 83% for Online Tier 2 APS). There was a far greater range of findings in studies assessing ISR of leave-behind Tier 1 APS programs than in the studies assessing other delivery methods. This is unsurprising, as customers who received the strips as a leave-behind measure did not actively seek out the product, unlike customers who actively purchased through downstream retail channels or online marketplaces. The low end of the range of ISRs from leave-behind programs (42%) suggests that there may be a substantial customer base who would not use the APS they received even if they were properly educated on the benefits. Figure 2 and Figure 3 show Tier 1 APS customer survey responses in Massachusetts based on delivery method (leave behind versus online). Seventy-nine percent of online purchasers had the APS installed at the time of the survey, which is 10% higher than leave-behind customers with APS installed. Six percent of leave-behind customers had removed the APS, compared to just 1% of online customers. These results suggest that customers who seek out the strips are more likely to leave them installed, further highlighting the need to educate unaware customers how to install and configure an APS, thereby increasing the likelihood of its retention.

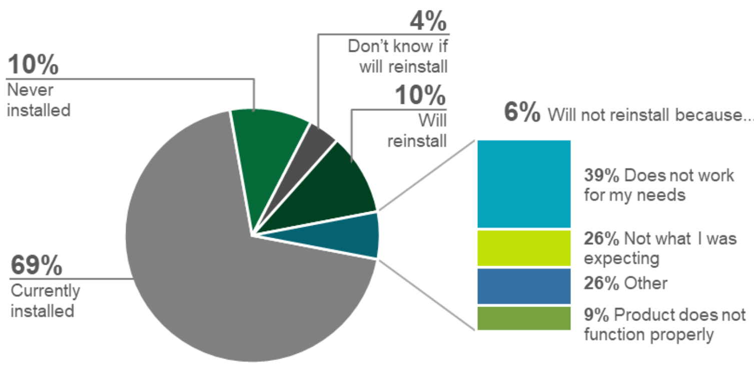

Figure 2: Leave Behind Tier 1 APS Installation (n=250)

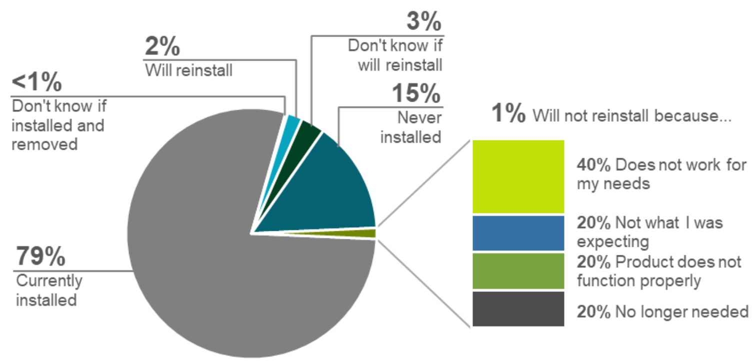

Figure 3: Online Tier 1 APS Installation (n=357)

Finally, the Massachusetts products survey study asked customers about their satisfaction with APS. Eighty-one percent of online Tier 1 customers reported being satisfied with their product, compared to 70% of online Tier 2 APS purchasers. Customers who had bought their APS online were significantly more satisfied with their strips than those who had received them as a leave-behind measure (74% satisfied). Leave-behind Tier 1 APS respondents were also substantially less likely (75%) than online Tier 1 APS (81%) respondents to say they would recommend the product. Again, these numbers suggest that customer satisfaction with APS is greater when customers are aware and actively seeking the product. The 70% satisfaction rating for Tier 2 devices, despite all the purchases being through online channels (i.e., from customers actively deciding to buy a Tier 2), shows that there are barriers preventing customers from successfully adopting the technology, even when they understand the benefits.

Difficulty in setting up devices and removal

Lower customer satisfaction is likely driven largely by incorrect setups or a lack of customer awareness that Tier 2 timer settings can be adjusted if they are experiencing an unwanted number of involuntary shut-offs. Both the Massachusetts metering and product survey studies derived realization rates based on the proportion of customers who had properly configured devices. This was taken from self-reported customer behavior in the survey study and technician observed set-ups in the metering study. APS units were divided into the following three categories:

- *No savings:* Strips with no peripherals in the *switched* outlets and/or no device in the *control* outlet.

- *Reduced savings:* Strips with at least one peripheral plugged into the *switched* outlets and a device in the *control* outlet, but with the primary end-use (i.e., the TV or PC) plugged into an *always-on* outlet.
- *Full savings:* Strips with at least one controlled peripheral and the primary end-use device (i.e., the TV or PC) plugged into the *control* outlet.

With these designations, the studies calculated realization rates using the following formula, which assumed that no-savings sites accounted for no savings, reduced-savings sites achieved 50% savings, and full-savings sites needed no adjustment:

*Realization_Rate = 1-(%No Savings + (50% * %Reduced Savings))*

Table 5 shows the realization rates from each study. Technicians found that 4% of sites were set up to achieve no savings and 8% were set up to achieve partial savings. Customers self-reported far less efficient setups, with 38% achieving no savings and 13% having reduced savings. These configurations resulted in realization rates of 92% at technician observed sites and 56% in self-reported scenarios.

Table 5. Realization rates from Massachusetts APS studies

Study	Methodology and Technology	N	% Sites with No Savings (a)	% Sites with Reduced Savings (b)	Suggested Realization Rate [1-(a+(50%*b)]
MA APS Metering	Observed by Technicians; Pre-existing Tier 1 APS	26	4%	8%	92%
MA APS & Products Survey	Survey of program participants; Tier 1 APS Owners	611	38%	13%	56%

While subject to self-reported error, the authors believe that the survey of Massachusetts APS owners provides a reliable source for ISR and retention rate estimates as customers were only asked to report if their strips were installed and, if so, remained in use. The study defined ISR as the percentage of products obtained that were ever installed, regardless of whether they were still installed at the time of the survey. In addition, the study defined short-term retention as the proportion of products ever installed that remained installed at the time of the survey. The study found an overall combined ISR and short-term retention rate of 78% for all strips: 81% for Tier 1 APS and 74% for Tier 2. Within Tier 1 users, PC customers were less likely to remove the strips. PC customers had a combined ISR and retention rate of 86%, compared to 76% for Tier 1 HEC customers.

Table 6. In-service and retention rates from Massachusetts APS/Products survey

APS Category	Sample (n)	ISR	RET	ISR + RET
All APS	951	84%	94%	78%
Tier 1 – All	611	85%	96%	81%
Tier 2 – All	340	82%	91%	74%
Tier 1 – Additional Breakdowns				
Tier 1 – HEC	252	81%	94%	76%
Tier 1 – PC	359	89%	97%	86%

Adjusting savings for in-service, retention, and realization rates reduces the energy savings achieved by APS. Figure 4 shows the effects on savings after accounting for ISR, short-term retention rates, and realization rates. All told, these adjustments reduce energy savings by 26% for Tier 1 devices (from 105 kWh unadjusted to 78 kWh) and by 32% for Tier 2 devices (207 kWh to 141 kWh). This loss of savings due to real world behavior is a major threat to the viability of successful implementation of APS as a measure in products programs. Still, this also represents a real opportunity for PAs who, through education and training, may be able to increase ISR, retention, and realization to capture increased savings.

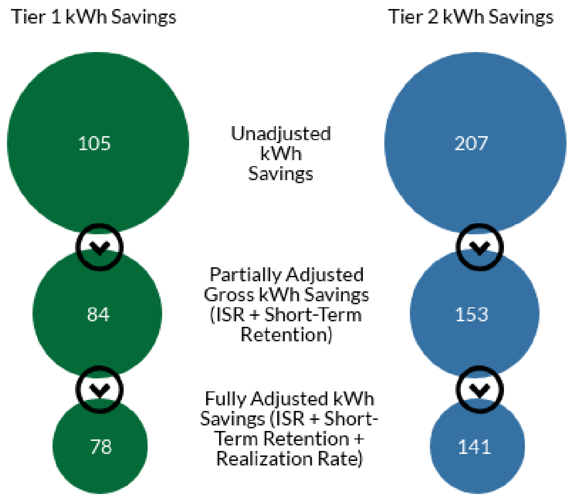

Figure 4. Full and Adjusted Savings for Tier 1 and Tier 2 APS in Massachusetts Metering Study

Declining baseline usage

Finally, the potential savings could diminish with decreased baseline energy usage. According to Nielsen, the "total media use among U.S. adults remains unchanged year-over-year at 10-and-a-half hours per day…[but] there are shifts in where that time being spent is dedicated to, as…increases in Internet connected devices and app/web smartphone usage [are] gradually replacing time spent on other sources" (Nielsen 2019). While streaming may replace traditional television viewing, and thus not decrease the usage time to a great extent, smart TVs with built in streaming options and the disappearance of DVD players from the market will likely reduce the number of peripherals that APS can potentially control. Gaming consoles have also made up a large share of HEC energy consumption, with standby draws contributing substantially to the loads that APS can control and reduce, but newer generation consoles (set to release in the next few years) may have lower standby consumption; thus, limiting these opportunities (NRDC 2014). Furthermore, if end-use televisions and other peripherals, such as sound bars, continue to grow in efficiency, this will further diminish baseline usage. On the PC side, the increasing trend of laptops over desktops may also threaten APS savings. As shown above, laptops were roughly twice as prevalent as desktops in both the Connecticut and Rhode Island RASS studies, and as the Massachusetts metering study showed, consumed far less energy. This likely decreasing baseline should be taken into account when considering long-term savings viability from APS.

Conclusions and Takeaways

As the recent studies we referenced show, APS are proven to generate statistically significant savings. The higher and even moderate estimates of these savings are substantial, especially for a measure that can so easily be installed and can replace an existing surge protector or non-smart power strip.

However, customer awareness, understanding, and acceptance remain a significant barrier for PAs looking to include APS in their residential products programs. The actual savings can quickly diminish if customers do not correctly configure the devices or if they remove them altogether due to a lack of understanding. To help boost savings potential, programs should consider going beyond leaving APS behind or selling them through online market places with no further guidance. Instead, they should offer some basic level of training to educate customers on their use and best practices. Multiple barriers and threats to savings exist, and the lower overall potential savings and replacement opportunities mean that it is very unlikely that APS will replace LEDs as a dominant centerpiece in residential portfolios. However, with the right design and awareness of their limitations, APS have the potential to create significant savings in the hard-to-control field of growing residential plug-load consumption.

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