Business & Consumer Electronics: A Strategy for the Northeast

Northeast Energy Efficiency Partnerships
August 2013

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About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency in the building sector through public policy, program strategies and education. Our vision is that the region will fully embrace energy efficiency as a cornerstone of sustainable energy policy to help achieve a cleaner environment and a more reliable and affordable energy system.

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GLOSSARY

Active mode/ On mode	Power state in which the product is connected to a main power source, has been activated, and is capable of providing one or more primary functions.
Active Energy Consumption	The sum of energy consumed from products in the active and idle power modes when a product has full functionality.
APS	Advanced Power Strip
BCE	Business and Consumer Electronics
CFL	Compact Fluorescent Lamp
Cloud Computing	Internet-based computing in which large groups of remote servers are networked so as to allow sharing of data-processing tasks, centralized data storage, and online access to computer services or resources.
Connected Home	Similar to home automation, but includes opportunity for the end user to receive additional analytics, optimization, and remote control.
CRT	Cathode Ray Tube, typically the screen image system from early computer monitors and televisions.
Deep Sleep	A power mode for STBs popularized by ENERGY STAR that allows a two-way network connection to drop into a low power state (or shut off completely) until the user activates the device or the device needs to activate itself to receive data.
Digital Media Receiver (DMR)	A home entertainment device that can connect to a home network to retrieve digital media files (such as music, pictures, or video) from a personal computer or other networked media server and play them back on a home theater system or TV.
DOE	Department of Energy
DTA	Digital Transport Adapter
DVR	Digital Video Recorder
EISA	Energy Independence And Security Act Of 2007
EM&V	Evaluation, Measurement and Verification
EPA	Environmental Protection Agency
ES	ENERGY STAR
Gateway	A set top box that accesses content from the service provider on behalf of a thin client.
HD	High-definition
Home Automation	Refers to the automation of the home and may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security.
HVAC	Heating, Ventilation, and Air Conditioning
Idle mode	Power state within “active” mode in which a product is not performing a primary function and no content is actively being delivered to the end-user.
IECC	International Energy Conservation Code®

IP	Internet Protocol
kWh	Kilowatt Hour
LED	Light-Emitting Diode
LEED	Leadership in Energy & Environmental Design
MEPS	Minimum Energy Performance Standards
Moore's Law	An observed progression in semiconductor development in which the physical die size of semiconductors with equivalent capabilities (e.g., transistor count) is halved every 18 months to two years
Multifunction Devices (MFD)	An office machine which incorporates the functionality of multiple devices, such as scanning, copying, printing, or faxing, into one device.
NEEP	Northeast Energy Efficiency Partnerships
Network Router	A device that forwards data packets, such as web pages, email, IM, and videos between computers and the Internet.
Off Mode	Power state in which the product is connected to a main power source, is not providing any "active" or "sleep" mode functions, and cannot be switched into any other mode except by user actuation activation of a manual power switch.
OLED	Organic Light-Emitting Diode
Over the Top (OTT) Content	Refers to content that arrives from a third party, such as Netflix, and is delivered to an end user device, leaving the internet provider responsible only for transporting IP packets.
Program Administrator (PA)	Designation for a person who administers (plans and executes) an energy efficiency program.
Passive Energy Consumption	The sum of energy consumed from products in the sleep and off power modes when a product has limited functionality.
Path to Purchase	The route that shoppers take from discovery of a product/need to actual purchase of a product.
Phablet	Combination of a smartphone and tablet.
Plug Load	The sum of miscellaneous energy use from products when they are in idle, sleep, and off power modes, and thereby not being used actively.
POP	Point-of-Purchase
R&D	Research and Development
SD	Standard Definition
SEAD	Super-Efficient Equipment and Appliance Deployment Initiative
Second-screen Phenomenon	The use of an additional electronic device (e.g. tablet, smartphone) that allows a consumer to interact with the content they are consuming, such as TV shows, movies, music, or video games.
Set Top Box (STB)	A device that generally contains a tuner and connects to a television set and an external source of signal, turning the source signal into content in a form that can then be displayed on the television screen or other display device.
Service Providers	Company that offers subscription-based service to access content through either cable, IP, or satellite technology

Showrooming	Practice of using smartphones within retail stores to compare product pricing with e-tailers.
Sleep mode/ Standby mode	A state in which the product is connected to a mains power source, is incapable of providing a primary function, and offers user-oriented or protective functions which may persist for an indefinite time (e.g., remote control, clock, occupancy sensing).
Smart	Products that use information and analytics to reduce energy use, while optimizing comfort and convenience.
Smartphones	A mobile phone built on a mobile operating system, with more advanced computing capability and connectivity than a feature phone.
Sound Bars	A home theater speaker system in a single cabinet that simulates surround sound.
SSD	Solid State Drives; a data storage device that uses solid-state memory to store persistent data.
Streaming	Multimedia that is constantly received by and presented to an end-user while being delivered by a provider.
Thin Client	A more efficient STB that has less functionality and features.
TRM	Technical Reference Manual
TV	Television
TWh	Terawatt-hours

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EXECUTIVE SUMMARY

The Northeast Mid-Atlantic region is a leader in energy efficiency and has achieved very substantial energy savings over the last several decades; Business and Consumer Electronics (BCE), however, represents a plug load category that continues to grow, both in energy consumption and in the number of devices drawing power. The total energy used by BCE products in the United States makes up 13.2 percent of annual residential electric energy consumption. Individually, however, BCE devices use a relatively small amount of energy, making efficiencies hard to capture. With all of these challenges, the BCE product category becomes one of the highest hanging fruits for efficiency programs, policies, and advocacy. This report seeks to represent a unified regional strategy to provide clear direction about how to rise up to pick this fruit, transform the BCE market, and keep the Northeast and Mid-Atlantic region a leader in BCE efficiency.

BCE Market Assessment

BCE products are a part of a fast-moving, highly profitable, unpredictable, and very competitive global industry. Innovation occurs quickly and causes short product life cycles with a few major manufacturers leading this charge for most BCE products. The top ten retailers, nine of which are Fortune 500 companies, account for nearly 80 percent of total sales of BCE products in the United States. Brick-and-mortar stores are still the preference of most consumers purchasing BCE products; however, online retail is growing in sales for BCE products.

Business and Consumer Electronics Market Snapshot

Top 5 Global Manufacturers	Top 5 U.S. Retailers	Top 5 Internet Retailers
Apple Dell Hewlett Packard Samsung Sony	Best Buy Walmart Amazon.com Apple Retail Stores Target	Apple Dell Hewlett Packard Samsung Sony

Top 5 U.S. Service Providers	Top 3 Regional Retailers
Comcast DIRECTV Dish Network Time Warner Verizon	PC Richards & Son J&R Music and Computer World Abe's of Maine

In addition to retailers and manufacturers, service providers such as cable companies also play a large role in the BCE market. The Northeast and Mid-Atlantic region[1] is covered by 11 service providers, with 4-9 service providers operating in each state. Service providers are different than traditional retailers or manufactures; they sell content instead of products, rent products (set top boxes), and establish long term contracts with consumers.

The BCE industry moves so quickly that major trends emerge readily. Some of the most significant BCE trends are increased streaming and connectivity (including the growing popularity of mobile devices), product convergence, cloud computing, and the connected home. Each emerging trend has an opportunity to serve as disruptive technology for the current generation of BCE products. While all of these trends are significant, the connected home trend could have the greatest potential for energy savings by enabling consumers to control products in their home while also providing them with data to make adjustments to their energy-consuming behavior.

BCE Product Efficiency

There are a variety of factors that influence the energy consumption and potential savings of BCEs. Energy efficiency certifications and labels, such as ENERGY STAR®, have helped raise the bar for efficiency in BCE products by providing a differentiator for manufacturers and retailers. While ENERGY STAR has been an invaluable tool to set the baseline for BCE product efficiency, other labels such as ENERGY STAR Most Efficient, TopTen USA, EPEAT, and the Super-efficient Equipment and Appliance Deployment (SEAD) Global Efficiency Medal have emerged and are also recognizing efficient BCE products. The rapid pace of innovation makes it challenging for energy efficiency certifications and labels to continuously identify the most efficient products, and deeper awareness and understanding of the labeling options is necessary to successfully impact the market.

Within any BCE product, energy is consumed in two ways: when it is operating and when it is off. Approximately 24 percent of energy is consumed by BCE products in idle (active waste), sleep, and off modes. In the Northeast and Mid-Atlantic region, an estimated 4.2 Terawatt-Hours (TWh) of energy are consumed by BCE products when they are not being actively used. BCE products such as advanced power strips (APS) can eliminate some of this consumption, and new technologies can address idle or wasted power mode and can offer further savings.

Large energy savings potential exists for game consoles and STBs, but these products also have unique challenges. Desktop computers and televisions offer marginal energy savings for models that meet high efficiency certifications and labels, however these savings are much smaller than they had been before significant advances occurred in display technology. STBs may have the greatest efficiency opportunity, as there are multiple avenues to

1 Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New York, New Jersey, Pennsylvania, Rhode Island and Vermont.

pursue improvements, including product level, changing the configuration of a home, or a consumer switching altogether to a more efficient option to instantly access content. Through trial and error, pilots, and innovative collaboration, increased efficiency can be attained within this BCE product segment. Game consoles present another BCE product category that can provide large energy savings. The industry is overwhelmingly dominated by just three manufacturers with similar market share, and user experience and functionality are the primary motivators of design. ENERGY STAR has developed a recognition criteria for game consoles, though to-date none of the major devices are recognized (though Nintendo's new game console, Wii U, could meet the criteria). While significant energy savings exist for game consoles, PAs are challenged to providing incentives that would not cause freeridership issues.

BCE products offer a wide range of possible energy savings for consumers considering the purchase of an efficient model or mitigating plug load consumption. An analysis of opportunities on a per-product-segment basis is provided below.

BCE Product	Efficiency Market Channel Target	Potential for Incremental Savings from Efficient Purchases	Potential for Plug Load Savings (through controls)*
Content (STBs and Network-Enabled Streaming Devices)	Service Provider and Retailer	High	High
Gaming	Manufacturer	Moderate	Moderate
Television	Retailer and Manufacturer	Low	Moderate
Computing	Retailer and Manufacturer	Moderate	Low to Moderate
Components	Retailer and Manufacturer	Low	--
Audio Visual (A/V) Devices	Retailer	Low	Moderate
Office Imaging	Retailer and Manufacturer	Low	Low
Mobile	Manufacturer	--	--

***Controls refers to APS or Home Automation – BCE products that are capable of controlling others.**

Current BCE Programs

Many energy efficiency programs have covered BCE products and most often have taken a midstream program model approach to incentive products such as televisions, computers,

and monitors. Some PAs have implemented advanced power strip programs, a step toward addressing the energy load associated with in-home BCE products. Some PAs have also experimented with Set Top Box programs. While some programs in the Northeast Mid-Atlantic are achieving significant savings from BCE programs, the per-unit savings achieved are not as large as those seen in other product programs such as lighting or appliances. Additionally, there are several states that do not run or have minimal BCE programs. The evaluation methodology and deemed savings for programs to claiming BCE energy savings vary widely across North America for both TV and APS programs. As such, there are opportunities to better align savings claims, expand covered products, and for more PAs to offer BCE programs.

Consumer Attitudes

Though recognition for efficiency indicators such as ENERGY STAR and the FTC Energy Guide is very high, in general, consumers are not considering efficiency as a primary purchase consideration. Efficiency ranks within the top five features behind price, features, warranty, and size. Consumers are no longer exhibiting brand loyalty—a development that makes influencing their "path to purchase," or the way they arrive at their purchasing decision, no longer a linear path as it was before the internet. Consumers gather product information through blogs, online reviews, social media, and other online sources and use it to inform decision making. Consumers spend extensive time researching BCE products, using an average of more than 14 sources of information prior to going to the store to make a purchase. There is no longer a single proven method of reaching consumers, so influencers must tap into several methods, especially online, to achieve the desired outcome.

Policy Movements

In many cases, the primary mechanism for policy to achieve energy efficiency is by setting an efficiency floor or minimum efficiency performance standard to ensure that inefficient units cannot be brought to market. The mechanism also has the effect of creating a fair competitive environment for producers. The BCE products most often included in state, federal, or international policy include TVs, STBs, and external power supplies. Building codes and standards also present an opportunity to influence BCEs. The incorporation of plug load into commercial building code through ASHRAE 90.1-2010 supports the evidence of a growing focus on curtailing plug loads.

Barriers to Increasing BCE Product Efficiency

Our analysis focused on four primary types of barriers for energy efficient BCE products:

- **Product and industry barriers** exist due to the nature of the industry. They include rapid technological advancement, focus on functionality over efficiency, a limited number of players involved, converging products, and lack of uniformity.
- **Program administrator barriers** reflect the confines and effect of evaluation that PAs need to account for in the design of programs. These barriers include diminish-

ing energy savings, uncertainty with behavior-based savings, inability to attribute energy savings to programs, and challenge in differentiating the efficient products from the inefficient utilizing multiple certifications and specifications.

- **Consumer barriers** reflect a lack of awareness and low priority of energy efficiency for BCE products, the complexity in the purchase process for BCE products, the relatively small annual financial savings per efficient product as compared to the purchase price, and limited retirement opportunities.
- **Policy barriers** include the impact that a short product life cycle has on motivating prolonged rulemaking procedures, industry resistance to change, and federal preemption of state rulemakings.

Overall, these barriers can be met with a variety of near-, medium-, and long-term opportunities.

Opportunities and Strategies for Advancing BCE Product Efficiency

Action is needed to address the growing energy consumption of BCE. Many opportunities exist for advancing energy efficient BCE products and we have developed strategies that will help surmount the challenges discussed and have the highest likelihood of successful implementation. These recommended strategies vary in degree of implementation complexity, level of collaboration necessary, and estimated timeline.

Focus	Strategy	Collaboration	Complexity	Timeline
Advance Product Efficiency	PAs partner with service providers to increase the penetration of multi-room and thin client configurations	High	High	Medium
	PAs offer incentives for consumers to trade out multi-room STB configurations for thin clients	Low	Low	Medium
	Efficiency advocates encourage consumers to move to Digital Media Receivers (DMRs)	Low	Moderate	Medium
	Efficiency advocates impact game console efficiency	Moderate	Moderate	Medium
	PAs increase the installation of APS through a direct install program	Low	Low	Short
	PAs support APS products that can reduce energy consumption in idle or active waste mode (Tier 2 products)	Low	Low	Short
	Coordinated efforts to educate consumers about proper use of APS and product settings	Low	Low	Short
	PAs ensure that all cost-effective savings have been achieved from TVs	Moderate	Low	Short
	PAs limit TV support to certain screen sizes	Moderate	Low	Short
	PAs support smart TVs and OLEDs	Moderate	Low	Short
Expand PA Efforts	PAs implement short-term incentive programs	Low	Moderate	Short
	PAs create an electronics recycling program	Low	Moderate	Medium
	C&I PAs pursue computer monitor and desktop programs for commercial customers	Low	Moderate	Medium
	PAs utilize load disaggregation to implement behavior-based programs	Low	High	Medium
	PAs explore new incentive models based directly on energy reductions	Moderate	High	Long
	PAs pursue incentive programs that encourage service providers to increase home energy management services	Low	Moderate	Long
	PAs provide incentives for individual home energy management products	Low	Moderate	Long
	PAs pursue incentives for demand-response-enabled products	Low	Moderate	Long
	Regional coordination to conduct studies on smart device energy consumption impacts and coordinate with ENERGY STAR	Moderate	Low	Medium

Focus	Strategy	Collaboration	Complexity	Timeline
Innovate through Marketing and Outreach	PAs improve efficiency education and marketing to consumers	Low	Low	Short
	PAs help retailers train sales associates by providing targeted training materials or trainings	Low	Low	Short
Drive change through Policy and Collaboration	Monitor and support a STB voluntary agreement that establishes strong energy savings measures	Moderate	Moderate	Short
	Building Efficiency Advocates extend plug load management into residential and commercial building codes and standards	Moderate	Moderate	Medium to Long
	Northeast Mid-Atlantic States work collaboratively to pursue state level minimum efficiency standards	Moderate	Moderate	Medium
	Efficiency advocates collaborate to assist ENERGY STAR in creating new specifications for existing products	Moderate	Moderate	Medium
	Labeling organizations collaborate to streamline the most efficient labeling options	High	Moderate to High	Medium
	PAs establish strong relationships with retailers	High	Low	Medium
	PAs discuss new BCE program approaches with regulators, and evaluators	High	High	Medium
	PAs establish strong relationships with manufacturers	High	High	Long
	Efficiency industry collaborates with R&D departments	High	High	Long

We have prioritized the strategies that present the largest savings opportunity as well as are feasible to implement. Implementing these recommended strategies will take planning and cooperation with multiple stakeholders. Further research for BCE products, emerging trends, and other related topics covered within this report is vital to expand understanding of opportunities for impact in a quick-moving market and to influence regulatory and policy decisions for the betterment of BCE efficiency.

Conclusion

The BCE product category offers a wide range of energy efficiency opportunities and we have outlined many recommendations and next steps towards capturing BCE energy savings. With partnerships and collaboration between NEEP, program administrators, national retailers and manufacturers, policy makers, regulators, efficiency advocates and thought leaders in this space, the Northeast Mid-Atlantic region has the tools to push forward as an efficiency leader in BCE.

NEEP is committed to fostering collaboration and continuing work to improve BCE efficiency with interested stakeholders through working groups or collaborative initiatives that implement the outlined recommendations. Together as a region, we can overcome these barriers and pick the high hanging fruit of achieving energy efficiency in Business and Consumer Electronics.

Through successful implementation of this strategy report, the region can achieve a goal of ***20% total*** (TWh) BCE category energy reduction by ***2020***.

Industry Coordination
Energy Efficiency Programs
Consumer Education & Marketing
Policy

+

Product level efficiency gains
Moving away from inefficient products
Deeper mitigation of idle, sleep, and off mode energy waste
Fulfillment of strategies and recommendations including those for game consoles and STBs.

INTRODUCTION

Northeast Energy Efficiency Partnerships, Inc., (NEEP) is developing this report to provide the Northeast Mid-Atlantic region with actionable strategies that can be used to advance the efficiency of business and consumer electronics products (herein referred to as BCEs) and reduce the overall energy use associated with BCE. The Northeast Mid-Atlantic region is a leader in energy efficiency and has achieved very substantial energy savings over the last several decades. Significant standards have been set for appliances and programs have surpassed savings goals through lighting initiatives, but BCEs represent a plug load category that continues to grow, both in energy consumption and in the number of devices drawing power. Additionally, each BCE device only uses a relatively small amount of energy, so while collectively this is a great savings opportunity, on the per-product basis it is difficult to see the savings. With all of these challenges, the BCE product category becomes one of the highest hanging fruits for efficiency programs, policies, and advocacy. This report seeks to represent a unified regional strategy to provide clear direction about how to rise up to pick this fruit, transform the BCE market, and keep the Northeast and Mid-Atlantic region a leader in BCE efficiency.

NEEP's Market Strategies team has produced several technology-specific strategy reports[2]; however, a report covering this scope of products and breadth of opportunities is a first for NEEP to-date. Instead of just analyzing the savings potential of one BCE technology, such as televisions or computers, we decided to take a more holistic view of the BCE product category as it evolves and grows. Addressing the BCE industry at this time is extremely important. The amount of energy BCE products currently consume and demand for existing and yet-to-be-released technologies will only continue to grow as costs reduce and these technologies become more widely accessible. Given this challenge, we established three primary ways to approach impacting BCE efficiency. First, we can ensure that the products available at retail or through service provides are as efficient as possible. Next, we can limit the energy consumed by the installed base at a home or business through behavioral changes and capturing wasted energy via plug load management. Finally, we can embrace and encourage existing trends that are substituting existing product categories with new technologies with comparable functionality, such as a consumer watching programs on their tablet instead of on a television.

NEEP has completed this report to help the Northeast and Mid-Atlantic region identify opportunities to reduce energy consumption related to BCE products. This report aims to help regional stakeholders pursue energy savings through tactics and programs as well as recommends partnerships and opportunities to build on for future savings. Whether acting independently or as a collaborative, the Northeast Mid-Atlantic region can achieve energy savings in the very near future through strategies outlined within this report.

2 Available from: http://neep.org/efficient-products/index

The BCE market is unique and does not have the level of regional variation of other efficiency product categories, such as HVAC. Therefore, in many cases this report takes a national or even international approach to appropriately reflect the market. A regional perspective is provided where appropriate and feasible. Additionally, given the size of the BCE industry, we were careful to clearly outline our research topics and themes prior to conducting research. The objectives of this research effort include:

- Providing a market assessment of the current state of the BCE industry, including identifying major BCE industry market actors;
- Establishing a profile of BCE product energy consumption;
- Analyzing existing BCE programs and products;
- Reviewing the consumers' path to purchase;
- Understanding BCE energy efficiency policy trends;
- Identifying barriers (i.e., market, institutional, policy, etc.) to achieving energy savings; and
- Recommending product and market transformation strategies to generate future energy savings and to spur innovation.

There has been support from interested stakeholders for increased efficiency of BCE products and great strides have been made in efficiency for certain BCE product categories (e.g., televisions and computers). However, because the efficiency of these popular products has increased substantially in recent years, energy savings have and are continuing to diminish. This has complicated program design for program administrators who are responsible for driving energy savings by increasing the market adoption of efficient products. Continued successful support of BCE products through energy efficiency programs hinges on finding new opportunities for energy savings beyond what has been generated through traditional product categories and existing program delivery models.

Given the rapidity with which the market evolves, identifying new opportunities and scenarios for BCE products to save energy now means identifying opportunities that may have a greater level of risk, or are contingent on many parties working together to foster change. Energy savings can still be generated in the BCE product category, but new and innovative approaches that require regional or national coordination must be established. While there is no one solution that will capture the energy savings of BCEs, this report will present strategies that, if implemented, are likely to lead to immediate energy savings as well as longer-term recommendations and opportunities that can reduce energy use associated with BCE into the future.

BCE SITUATIONAL ANALYSIS

BCE is a fast-moving, highly profitable, unpredictable, and very competitive global industry. Sales for BCE products are estimated to grow 4.5 percent in 2013, reaching $215.8 billion, a forecasted all-time high for the industry.[3] An industry this large has many components that must be understood to consider strategies that can be enacted to increase efficiency. Within this section, we assess the market for BCE products as well as examine product efficiency, energy efficiency program design, consumer behavior, and policy. This situational analysis will highlight several of the barriers and opportunities for BCE products that will be discussed further in later sections.

Market Assessment

BCE products are products that have a circuit board, are intended for use by consumers, and are available for purchase or rent through a retailer or reseller. BCE products facilitate communication, entertainment, and productivity. The BCE products addressed in this report are included and defined in Table 1. This table also provides an overview of BCE product segments and individual technologies within each segment.

Table 1. BCE Product Segments

Product Segments	Technology
Audio Visual (A/V) Devices	Home theater in a box, sound bars, amplifiers, receivers, shelf systems, docking stations, DVD and Blu-Ray players
Components	Battery charging systems, external power adapters
Computing	Desktop PCs, laptops, thin clients
Content	Set-top boxes (STBs), Digital media receiver (DMRs)
Controls	Advanced power strips (APS), home automation
Gaming	Game consoles
Mobile Devices	Smart phones, tablets
Office Imaging	Copiers, multifunction devices, printers, scanners
Televisions (TVs)	LCD, LED, plasma, OLED

Market Size and Pace

The BCE industry is rapidly growing and evolving. BCE product sales are estimated to grow 4.5 percent in 2013, reaching $215.8 billion: a forecasted all-time high for the industry.[4] Rapid technological advancement forces older BCE products to become obsolete very quickly. In 2013, specific BCE products—including laptops, smartphones, tablets, and network-enabled TVs—will be the core BCE products responsible for driving sales. In 2012, these four

3 Consumer Electronics Association. (2012). CE Industry Yearly Revenues Expected to Surpass $200B for First Time. Retrieved May 31, 2013, from http://www.ce.org/News/News-Releases/Press-Releases/2012-Press-Releases/CE-Industry-Yearly-Revenues-Expected-to-Surpass-$2.aspx

4 Consumer Electronics Association. (2012). CE Industry Yearly Revenues Expected to Surpass $200B for First Time. Retrieved May 31, 2013, from http://www.ce.org/News/News-Releases/Press-Releases/2012-Press-Releases/CE-Industry-Yearly-Revenues-Expected-to-Surpass-$2.aspx

technologies accounted for nearly 47 percent of BCE industry revenue in the United States. In 2007, of those four products, only laptops were firmly established in the market from a customer demand and sales perspective.

Moore's Law helps to explain the incredible pace and penetration of these relatively new BCE products. Moore's Law illustrates an observed progression in semiconductor development in which the physical die size of semiconductors with equivalent capabilities (e.g., transistor count) is halved every 18 months to two years.[5] This productivity gain allows new and "better" products to be introduced very quickly.

To keep pace and stay profitable, manufacturers strive for innovation. They have sophisticated supply chains and business models designed to maximize profits while minimizing risks. For example:

- Apple, as a manufacturer, sells through its entire product inventory to distributors, retailers, or other consumers in five days.[6] .
- Samsung sells through its entire product inventory in 12 days.[7]
- Dell built its reputation on "just-in-time" manufacturing processes, in which it develops products on demand from customer orders.

A Global Supply Chain: Key Market Players

BCE products are on the global stage with minimal variation in design between regions, nations, or even continents. Supply chains differ by product category and are optimized to gain an advantage over the competition. The supply chain typically consists of a mix of suppliers, manufacturers, distributors, and retailers.

1. Suppliers develop components, such as batteries or circuit boards, which are purchased by manufacturers along with other components to make a product.
2. The product is sold from a manufacturer to a distributor.
3. Manufacturers and distributors sell the product to a retailer or directly to the customer.
    a. This direct interaction limits the number of organizations in the supply chain and lowers the price for the end-user. It therefore could increase the profit margin each organization receives as the product moves through the supply chain.
    b. Manufacturers and retailers make the decisions that impact product design and inventory availability for the consumer.
4. Consumer demand impacts inventory turnover for almost all BCE product categories, therefore determining which products and associated components continue to be manufactured, upgraded, and invested in.

5 Can we Talk? Utilities to Cable, Satellite and IP Service Providers: is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes? Bolioli, Beavers, Michalski.
6 Campbell, M. (2012). Apple turns over entire inventory every five days. Apple Insider. Retrieved from http://appleinsider.com/articles/12/05/31/apple_turns_over_entire_inventory_every_five_days.
7 Samsung C&T. Financial Ratio. Retrieved June 2013, from http://www.samsungcnt.com/en/ir/activity.asp.

Service providers, another major player in the supply chain, are essential for products that allow consumers to access content (e.g., cable, streaming video, etc.). They operate in a different manner than retailers and manufacturers. Their operations will be covered in later section of the report.

Manufacturers

Several key manufacturers produce the majority of BCE products. They are characterized as being profit-driven, innovative, and nimble. How an actual BCE product is produced varies from manufacturer to manufacturer.

While there are several major manufacturers, recognized as household names, less-well-known suppliers and contract manufacturers play an important role within the supply chain. Suppliers produce specific components, such as LEDs for backlighting of televisions, and sell them to contract manufacturers or manufacturers to assemble the complete product. Contract manufacturers may or may not complete the assembly of a product based on the agreement they have with the company to which they are contracted. Contract manufacturing maximizes profits because it allows manufacturers to concentrate on design and sales rather than non-core functions, maximizing profit.[8] Another common BCE practice is to have companies license their brand for products. For example, Funai Corporation produces all Philips televisions through a licensing agreement.

The majority of BCE products are manufactured on the Pacific Rim, where suppliers are abundant; contract manufacturers are prevalent (Foxconn in Taiwan); and major manufacturers are located (Sony in Japan, LG in South Korea, Samsung in South Korea, Panasonic in Japan, and Lenovo in China).

Available reports on BCE manufacturers and NPD data from 2011 U.S. sales[9] were used to identify the top five manufacturers, which are ranked based on U.S. revenue and future growth potential. Table 2 lists and describes these manufacturers.

8 Dhekne, R., Sadanand Chittal, S. (2011, May). Supply Chain Strategy for the Consumer Electronics Industry. Retrieved from http://www.wipro.com/documents/insights/The%20Future%20of%20Supply%20Chain%20Strategy%20for%20Consumer%20Electronics.pdf.

9 NPD Group. (2012, February 13). Apple tops 2011 as the #1 Brand and Best Buy is the #1 Retailer. Retrieved from https://www.npd.com/wps/portal/npd/us/news/press-releases/pr_120213/

Table 2. Top Five U.S. BCE Manufacturers

Rank	Manufacturer	Fortune Global 500 Rank[9]	BCE Products Segments Produced
1	Apple	56	Computing, content, mobile
2	HP	31	Computing, mobile
3	Samsung	20	Audio visual, computing, content, gaming, mobile, television
4	Dell	147	Computing, mobile
5	Sony	87	Audio visual, computing, content, game consoles, television

The products manufactured by these top five encompass multiple BCE product segments. However, these top five manufacturers do not dominate in all BCE product categories. Typically, a few manufacturers dominate BCE product categories, such as gaming consoles, mobile phones, and tablets. For instance, in game consoles, Nintendo, Microsoft, and Sony are the top—and only[11]—three manufacturers competing in the category. Variability exists for "older" categories such as TVs and audio visual devices.

Retailers

Similar to what is seen with manufacturers, a small group of retailers are responsible for the majority of BCE product sales. Data from a report issued by This Week in Consumer Electronics (TWICE), was used to identify the top U.S. retailers, top online-only retailers, and top retailers located in the Northeast and Mid-Atlantic, which are presented in Table 3 and Table 4.

10 CNNMoney. (2012, July 23). Global 500. Retrieved from http://money.cnn.com/magazines/fortune/global500/2012/full_list/101_200.html

11 New game console system Ouya was released on June 25, 2013. Reuters. (2013, June 25). Ouya's $99 videogame console challenges pricier Xbox, PlayStation. Retrieved fromhttp://www.reuters.com/article/2013/06/21/us-ouya-videogames-idUSBRE95K18920130621

Table 3. Top BCE Retailers (Both U.S. and Regional)

Retailer	2011 Sales (in $ Millions)[12]	Sales Growth from 2010 (%)[13]	2013 Fortune 500 Rank[14]	TWICE 100 Retailer Rank[15]
Abe's of Maine^	$113	-8.00%	--	57
Amazon.com*	$12,017	51.50%	49	3
Apple Retail Stores*	$11,173	29.10%	6	--
Best Buy*	$32,470	0.20%	61	--
Buy.com	$264	-5.20%	--	37
Costco Wholesale*	$5,051	1.50%	22	--
Dell*	$3,451	-19.00%	51	8
Gamestop*	$4,816	-2.50%	298	--
Hewlett Packard	$844	-2.30%	--	22
J &R Music and Comp World^	$400	-5.90%	--	31
Newegg.com	$2,452	6.90%	--	11
PC Richards^	$688	-3.20%	--	24
RadioShack*	$3,389	-3.50%	--	--
Sam's Club*	$2,624	-4.40%	1	--
Target*	$6,486	-0.10%	36	--
Walmart*	$20,532	4.90%	1	--

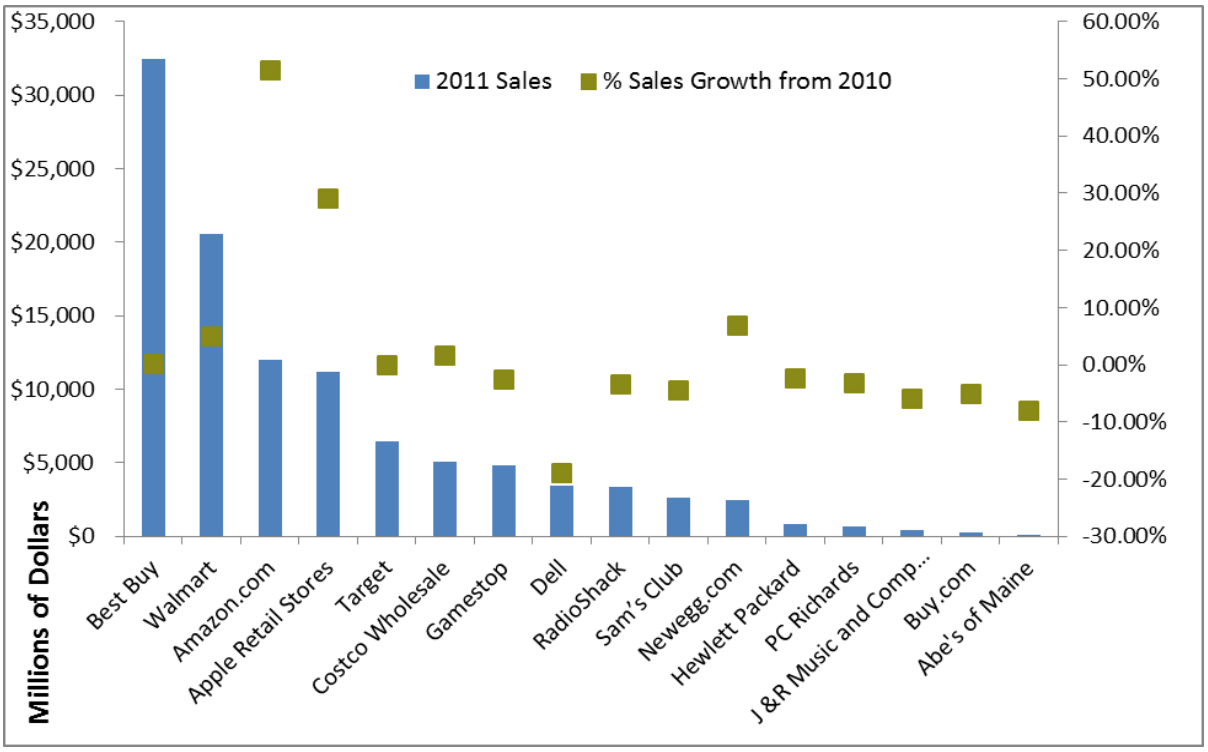
***Denotes the top ten retailers.**

^Denotes the top retailers that only have a regional presence.

Ten of these retailers (denoted above with an *) comprise 76 percent of annual BCE sales, according to data provided by the TWICE report.[16] Local retailers who do not compete on a national scale still have an important regional impact. In the Northeast and Mid-Atlantic regions, three retailers that sold a selection of BCE products exclusively made the TWICE report list.[17] If sales of the top ten retailers are weighted by population and compared to the Northeast and Mid-Atlantic retailers, PC Richards would be ranked 8th in the region. The data are also included in Figure 1.

12 This Week in Consumer Electronics (2012, May 21).Top 100 Consumer Electronics Retailers.
13 Ibid
14 CNN Money. (2012). Fortune 500. Retrieved from http://money.cnn.com/magazines/fortune/fortune500/.
15 Ibid
16 It is worth noting that BrandSource's members, a national buying group whose members are small appliance and electronics retailers, would be in the top ten list. We chose not to include them because their total revenue is aggregate of individual members.
17 Several other regional retailers were included in the TWICE report that sold only cameras or other electronics products that are not being analyzed in this report.

Figure 1. U.S. BCE Retailer Sales and Projected Growth



Online

The top five online-only retailers show the growth and potential of online retail. EMarketer projects online sales of BCE products will climb from $48.6 billion in 2012 to $80.2 billion in 2016.[18] Two manufacturers are included in the top five because they sell directly to consumers through the online channel.[19]

Table 4. Top 5 E-Commerce Only BCE Retailers

Retailer	2011 Sales (in $ Millions)[18]	Sales Growth from 2010 (%)[19]	TWICE 100 Retailer Rank[20]
Amazon.com	$12,017	51.50%	3
Dell	$3,451	-19.00%	8
Newegg.com	$2,452	6.90%	11
Hewlett Packard	$844	-2.30%	22
Buy.com	$264	-5.20%	37

18 eMarketer. Consumer Electronics Purchase Path Upended, (2012, October 5). Retrieved from http://www.emarketer.com/Article/Consumer-Electronics-Purchase-Path-Upended/1009395.

19 Emerging online retailers, such as TigerDirect, account for a large portion of BCE sales, however, TigerDirect's 2011 sales figures was combined with parent company Systemax and we could not extrapolate the difference in sales between the two entities. Systemax is currently listed as number 11 in the TWICE report.

20 This Week in Consumer Electronics (2012, May 21).Top 100 Consumer Electronics Retailers.

21 Ibid

22 Ibid

As the sales analyses in the previous tables show, many BCE retailers and manufacturers are experiencing negative sales growth. The trend is most likely tied to difficulties created by the changing retail landscape related to convenience and prevalence of consumers shopping around for the best price. While BCE-specific retailers still remain the dominant choice for purchasing new devices, other channels (namely online and in other big box retail stores such as Walmart) have made significant inroads in the past five years. Consumer BCE purchases from 2011 are summarized in Table 5.

Table 5. Consumer Purchases of BCE Products In-Store and Online[23]

Purchase Made at a Physical Store		Purchase Made Online	
Consumer electronics retailer (e.g., Best Buy)	51%	eCommerce website (e.g., Amazon.com, ebay.com)	18%
Manufacturer branded store (e.g., Apple Store)	23%	Consumer electronics retailer website (e.g., bestbuy.com)	14%
Communications service provider (e.g., AT&T)	18%	Manufacturer's website (e.g., apple.com)	9%
Other (e.g., Walmart, Costco)	24%	Communication service provider website (e.g., Verizon.com)	6%
		Other website (e.g., walmart.com)	8%

Service Providers

Service providers play an important role with certain BCE products such as set-top-boxes (STBs) and have a very different business model from that of the retailers and manufacturers previously discussed. The typical process flow for service providers is as follows:

1. Consumers select a service provider: a cable, satellite, or IPTV company.
    a. Generally, the consumer is able to provide little to no input at the time of enrollment (aside from whether they would like premium services, such as DVR and premium channels, added to their account).
2. The service provider offers consumers media and communication services ("content").
    a. The three types of service providers use cable, IP (telecommunications), or satellite technology to transmit programming through an STB. Each service provider offers different services to consumers beyond basic programming. Examples of different services include:
        i. Premium channels such as HBO
        ii. High-definition (HD) programming
        iii. Digital video recorders (DVRs) that can record programs for playback at consumers' convenience

23 Accenture. (2012). Always On, Always Connected: Finding Growth Opportunities in an Era of Hypermobile Consumers. Retrieved June 2013, from http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_EHT_Research_2012_Consumer_Technology_Report.pdf

iv. Content streaming services that allow consumers to access programming content remotely from their phone or tablet

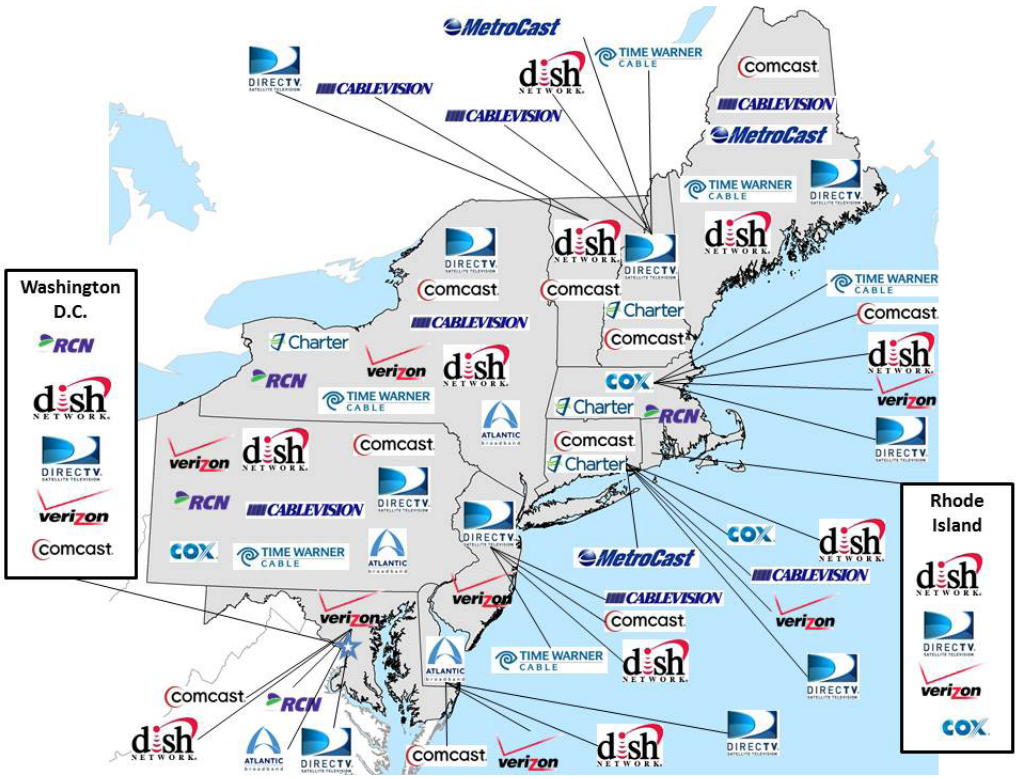
v. Multi-room DVRs that allow consumers to limit the number of STBs in their home while they receive the same service from thin clients that access the headend of a single DVR.

3. If necessary, the STBs are leased to the consumer for the term of the service agreement.

4. A contractor installs STBs.

If the consumer has a choice of service providers, the primary drivers are hardware features and programming options.[24] An overview of the service providers and their availability in the Northeast and Mid-Atlantic is illustrated in Figure 2.

Figure 2. Northeast and Mid-Atlantic Service Providers[25]



24 Can we Talk? Utilities to Cable, Satellite and IP Service Providers: is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes? Bolioli, Beavers, Michalski.

25 The Cable Study. Cable providers by state. Retrieved June 2013, from http://www.thecablestudy.com/findlocalcableproviders/findlocalcableproviderbystate.aspx.

Table 6 details the various services offered by service providers in the Northeast and Mid-Atlantic.

Table 6. Different Services Offered by Northeast and Mid-Atlantic Service Providers[26]

Service Provider	Type	Brand	HD STB	DVR	Streaming	Multi-Room DVR
Atlantic Broadband	Cable	-	✓	✓	-	✓
Cablevision	Cable	Optimum	✓	✓	Optimum App	-
Charter	Cable	-	✓	✓	Charter On-The-Go	-
Comcast	Cable	XFINITY	✓	✓	XFINITY mobile	✓
Cox	Cable	-	✓	✓	Cox TV Connect	✓
DIRECTV	Satellite	DIRECTV	✓	✓	Genie	✓
Dish Network	Satellite	Dish	✓	✓	Dish Anywhere	✓
Metrocast	Cable	-	✓	✓	-	✓
RCN	Cable	-	✓	✓	-	✓
Time Warner	Cable	-	✓	✓	TWC TV	✓
Verizon	IP	FiOS	✓	✓	FiOS On Demand	✓

The majority of service providers in the Northeast and Mid-Atlantic offer enhanced services and products to consumers. While services such as streaming continue to increase in popularity, traditional content consumption through broadcast or network programming remains virtually unchanged from 2012 to 2013.[27]

Global revenue from "over the top" devices (DMRs that deliver content via the Internet to home entertainment systems) exceeded $8 billion in 2012, and is projected to reach $20 billion in 2015. Fifty-seven percent of the revenue from "over the top" services was generated in North America alone.[28] Many consumers now use "over the top" devices, in addition to receiving traditional content from service providers. This growing trend is worth noting when considering how consumers will access their content in the future.

Emerging BCE Trends

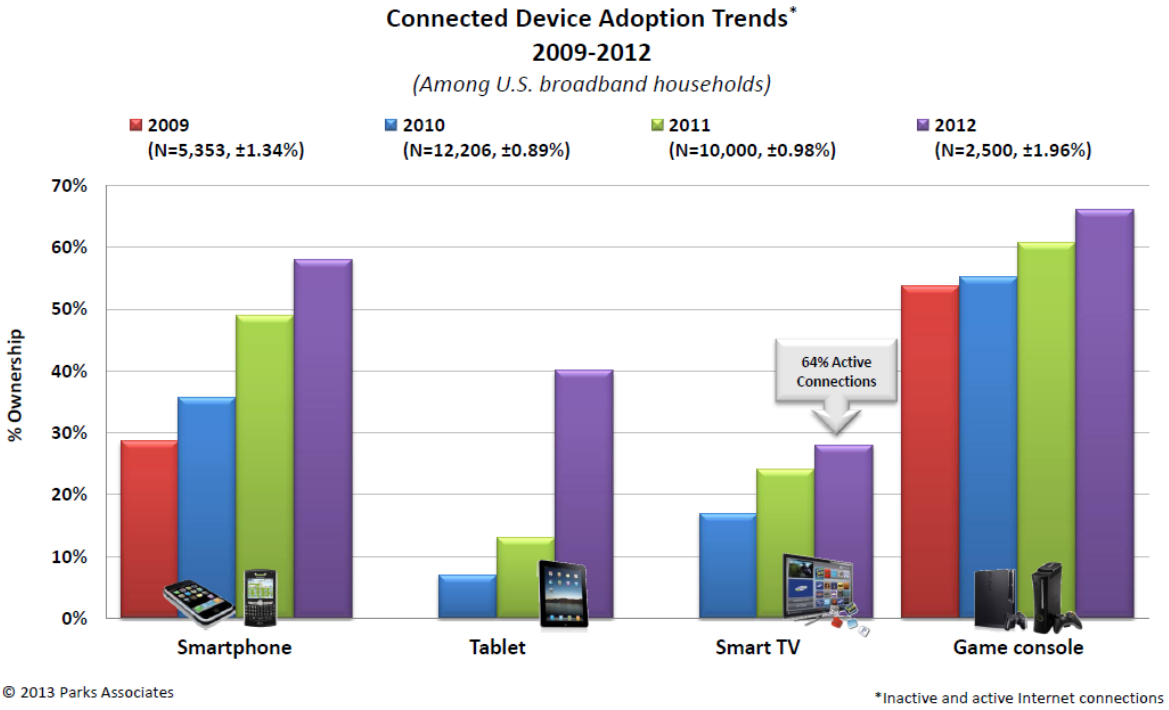
Over the past few years, several trends across all electronics product categories have emerged that are driving new consumer purchasing habits and the development of new ways of interacting with content. These trends include the increased streaming and connectivity of devices, convergence of existing and emerging products, effect of cloud computing, and concept of "Smart."

26 Analysis was completed using service provider websites to determine available options service providers offer in the Northeast and Mid-Atlantic.
27 Lafayette, J. (2013, June 10). New Cross Platform Report says fewer people have multichannel subscriptions. Retrieved from http://www.broadcastingcable.com/article/493938-Nielsen_Time_Spent_Watching_Traditional_TV_Up.php.
28 Kritsonis, T. (2013, May 22). How set-top boxes like Roku and Apple TV have changed TV forever. Retrieved from http://www.digitaltrends.com/home-theater/over-the-top-how-set-top-boxes-like-roku-and-apple-tv-have-changed-tv-forever/#ixzz2XGeAG0XW.

Increasing Connectivity and Streaming

Internet connectivity has influenced how consumers access media and has led to expanded BCE product capabilities. Several trends indicate the prevalence of connectivity, which has jumped over the past three years. Seventy-eight percent of U.S. households now own a home network router, up from 58 percent in 2009. The adoption of a router is forecasted to reach 95 percent by 2016.[29] The average U.S. household has just over 3.5 connected devices and, by 2016, it will have approximately 4.5 devices.[30] Between the first quarter of 2012 and the first quarter of 2013, the presence of smartphones in U.S. households increased from 57 percent to 66 percent. The presence of tablets also increased from 31 percent to 48 percent of U.S. households.[31] Figure 3 shows the connected device adoption trends.

Figure 3. Connected Device Adoption Trends[32]

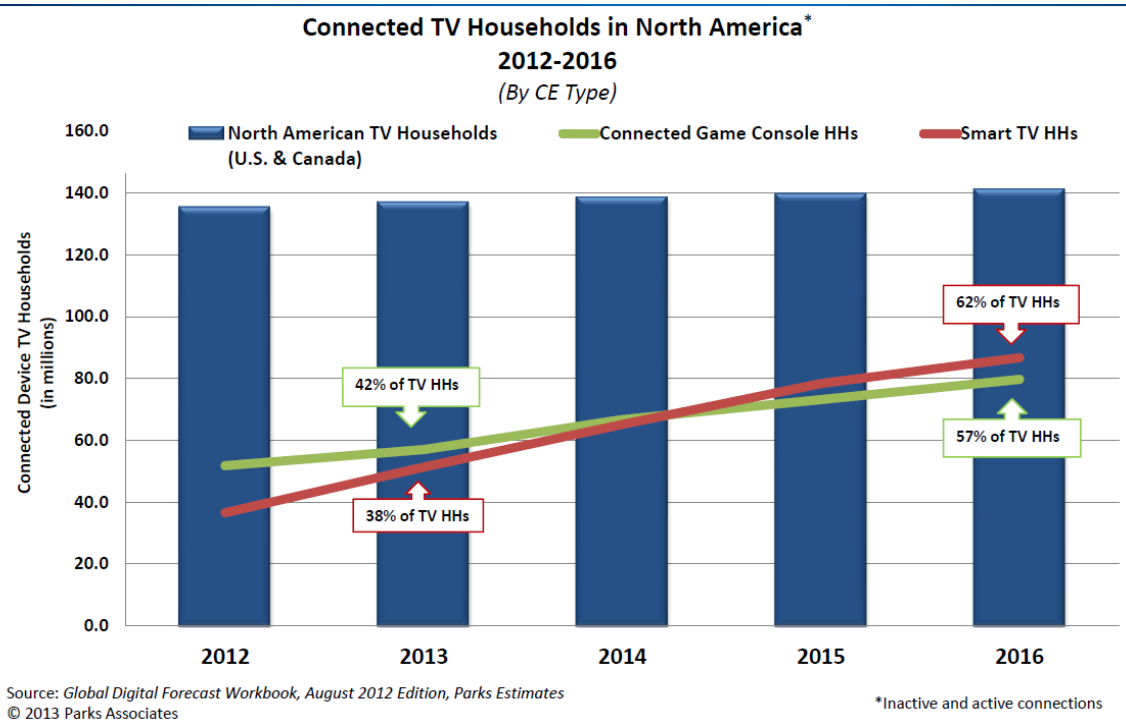


One notable trend, increased connectivity, has enabled is streaming media content. Streaming content is media that viewers access through the Internet and can watch without downloading files or the content to a local drive. Streaming requires consistent and reliable internet connectivity, but, with the increased connectivity of U.S. homes, streaming has become ever more popular with households. Not only is streaming available on smartphones

29 Parks Associates. (2012). Expanding to the Home Network: The Evolution of Premium Support. Retrieved June 2013, from http://www.parksassociates.com/support-whitepaper-2013.
30 Ibid
31 Parks Associates, (2013). Enabling Connected Media Experiences: Mastering Video Delivery, User Engagement, and Monetization Strategies. Retrieved June 2013, from http://www.parksassociates.com/whitepapers/mportal-media.
32 Parks Associates. (2013). New Paths to the Connected Consumer: Multiscreen Experiences and User Interaction. Retrieved June 2013, from http://createasphere.com/presentations/DAM-LA-2013/NewPathstotheConnectedConsumer.pdf.

and tablets, but it has also become available on non-mobile devices such as TVs. A Smart TV is a television that connects to the Internet and allows users to access internet-driven media and applications. Smart TV ownership grew from 17 percent to 26 percent from 2010 to 2013.[33] Figure 4 shows the increased number of connected TV households in North America.

Figure 4. Connected TV Households in North America (2012-2016)[34]



Increased consumer connectivity likely means increased hours of use and number of devices used at any given time, leading to increased energy consumption. Already 47 percent of tablet owners, or 15 percent of U.S. households, engage in at least one second-screen activity on their tablets monthly. The most popular activity is searching or requesting information for products or services, followed by checking TV listings.[35] Additionally, video viewing on tablets doubled to 0.6 hours per week between 2010 and 2012.[36]

While the amount of time Americans spend watching television remains steady, time spent on live television is decreasing in favor of time-shifted content. In Q4 2011, Americans turned on their TVs for an average of five hours and 21 minutes each day, an increase of half an hour per month over Q1 2009. Over the same period, the average amount of time spent on time-shifted television (e.g., video on demand or programming recorded on a DVR)

33 Parks Associates, (2013). Enabling Connected Media Experiences: Mastering Video Delivery, User Engagement, and Monetization Strategies. Retrieved June 2013, from http://www.parksassociates.com/whitepapers/mportal-media.
34 Parks Associates. (2013). New Paths to the Connected Consumer: Multiscreen Experiences and User Interaction. Retrieved June 2013, from http://createasphere.com/presentations/DAM-LA-2013/NewPathstotheConnectedConsumer.pdf.
35 Parks Associates, (2012). Trends, Technologies, and Ecosystems: Evolution of the Digital Home. Retrieved June 2013, from http://www.ospmag.com/files/pdf/whitepaper/Parks_Assoc_Evolution_of_the_Digital_Home_White_Paper.pdf
36 Ibid

increased an hour per month[37].

It is anticipated that technological advances will continue with more and more products relying on and improving connectivity capabilities. Currently, not all connected devices are compatible. Unless there is full interoperability among connected devices, advances may be tempered slightly.

Product Convergence

A major trend that is impacting BCE products is product convergence. This occurs when a new generation of products incorporates new features and functionality that was available only through separate, stand-alone products during the previous generation. An example for a home office is that in the past a consumer had to purchase a printer, a scanner, and a fax machine separately. Now they can purchase a multifunction device that combines the same abilities as those three devices. Another example is gaming consoles that are no longer a product that enables just video game playing. They now play DVDs and Blu-Rays, can be used to browse the Internet, and can stream TV shows and movies. This "convergence" trend can be seen across all product categories.

As the functionality of individual products has expanded, it has increased the competition within the consumer electronics industry. DVD player manufacturers no longer compete only with other DVD manufacturers, but also with computer STB manufacturers, game console manufacturers, service providers, and others, since consumers view content in many different ways. Product convergence leads to rapid product development and the subsequent introduction of new technologies that diminish sales for other product categories.

This dynamic environment will continue to make it challenging for industry analysts to isolate products and understand how they might affect markets and be received by consumers. PAs will also face challenges, because they typically require energy savings to be benchmarked against certain industry or baseline standards. It will become more difficult to identify the correct baseline or standard to use when products cross multiple categories and serve multiple functions. That being said, this convergence can mean a greater number of efficient options and opportunities exist.

The Advent of Cloud Computing

As defined by the National Institute of Standards and Technology, cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Essentially, cloud computing has significantly increased the accessibility and speed of internet media and activity.

37 The Nielsen Company 2010

Advances in cloud computing are shifting the location at which energy is consumed from the individual home or business to data centers. Cloud computing has significantly expanded the flexibility available to consumers. For instance, devices such as computers and TVs are taking the place of STBs, as consumers can access media through pre-existing devices. Hypothetically, this takes the plug load and processing power away from the home and places it into a larger, more efficient data center. Data centers, however, are rapidly growing into a major commercial and industrial level energy user, with the growth rate of data centers estimated at 9.6 percent per year through 2020[38], and representing 1.1-1.5 percent of all global electricity use[39].

Concept of "Smart"

Many of the emerging BCE trends apply generally to the industry and will impact efficiency tangentially through increased hours of use or through changes in energy consumption. "Smart" products, on the other hand, have specific and unique energy implications. For purposes of this report, "smart" products use information and analytics to reduce energy use, while optimizing comfort and convenience. The consumer electronics industry uses the term more broadly to mean a product that is "connected" and capable of receiving and/or providing feedback. However, with the more specific definition focused on energy consumption, smart products may have one or more of the following features:

- **Information.** Energy information allows consumers to understand how they are using energy within their home. They can then make behavioral changes based on the additional information (e.g., in-home displays that provide near-real-time energy consumption information)
- **Optimization.** Energy optimization means that these products automatically put the level of energy consumption at an ideal level based on any number of factors, such as weather or consumer habits. (For example, Nest Thermostat creates predictive algorithms that optimize energy use based on user thermostat setting behavior and weather fluctuations.)
- **Control/Automation.** Save energy through mandating energy efficiency or conservation steps that restrict or eliminate consumer choice (e.g., Smart Plugs, which can remotely turn things off or on). This category includes security and home automation systems that would allow a consumer to put the whole house in certain modes; e.g., when the house is in "away" mode, lights stay off. Products that can automatically respond to a pricing signal from a utility would also fall into this category.
- **Diagnostics.** This area allows for consumers to understand trends and receive feedback from products that might indicate an increase in energy consumption (e.g., appliances that inform consumers when they're starting to use more energy, possibly indicating that a repair is needed).

38 McKinsey. (2009, July). Unlocking energy efficiency in the US economy. Retrieved from http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/~/media/204463A4D27A419BA8D05A6C280A97DC.ashx

39 Koomey, Jonathan. (2011). Growth in Data center electricity use 2005 to 2010. Oakland, CA: Analytics Press. Retrieved from http://www.analyticspress.com/datacenters.html

These features are not mutually exclusive. For example, Ecofactor, an SaaS thermostat platform, optimizes heating and cooling based on weather changes, provides information to users on how they are using their HVAC system, can be remotely controlled via a smart phone or web platform, and provides diagnostic information on home insulation effectiveness, leaky ducts, HVAC efficiency, and the value of upgrades/repair.

Home Automation and the Connected Home

Individual connected products, whether "smart" in terms of energy consumption or not, are enabling home automation (the remote control of home systems, including HVAC, lighting, appliances and security) and the advent of the connected home. The connected home is similar to home automation, but may include additional analytics, optimization, and remote control. Data may be used to optimize comfort and convenience by adjusting lighting scenarios, unlocking doors, or reporting irregular activities. While the cost is still too high for mass adoption, the connected home will become more and more accessible for consumers over the next several years, increasing consumers' understanding about energy usage within the home.

The "connected home" concept, specifically, can have a tremendous impact on the energy and utility market because energy-consuming products and technologies communicate with one another, the homeowner, and the utility. These systems can analyze data to reduce electricity usage in times of peak demand. The additional information consumers receive may also lead to changes in their energy consumption patterns. The benefits of this connectivity to the customer are convenience and control, as well as verification and measurement of any control action in near-real time. As such, it will become an important consideration for energy efficiency programs.

Customers can purchase or acquire smart products at retail stores such as Best Buy and Lowe's, through service providers (that bundle home security or home energy management services as a value-add to providing content), and direct manufacturer sales. As the product category matures, direct-to-consumer sales are likely to decrease. As consumers become increasingly connected through multiple smart products and devices, multiple platforms will be bundled together (i.e., energy management, cable, security, or health services). Telecommunications organizations, mobile platforms, and service providers have started to look toward energy management as a value-add to other services they already provide. As an example, Verizon and Comcast both offer a home security, automation, and energy management system. In the future, additional functions may be added on to the integrated platforms.[40]

Information will be delivered through pre-existing networks in the home (e.g., security, home automation), TVs, tablets, computers, smartphones, and independent energy management devices (e.g., in-home displays, thermostats). As with all converging products in the BCE space, these devices will compete for market dominance. Convergence and disrup-

40 Weissberger, Alan. "New Telco Services Enable the Connected Home – Part 1." 2011. http://viodi.com/2011/07/25/new-telco-services-part-1/comment-page-1/.

tions in the electronics industry will likely continue to impact the development of remote energy management.

The challenges within the connected home and home automation are security and interoperability of devices on different platforms. Consumers will be more apt to embrace the connected home when these two challenges are met.

BCE Product Energy Efficiency

The market overview showed that BCE products continue to be a successful and expanding industry. This increased adoption also has meant an increased growth in the total energy used by these products. In 2010, consumer electronics products were estimated to consume 193 TWh of electricity, accounting for 13.2 percent of total U.S. residential electric energy consumption.[41]

BCE product consumption is derivative of a few factors:

- An increase of the penetration of BCE products found in homes and subsequent connected load
- Necessary expansion of product functionality in reaction to consumer demand
- Increased hours of operation from consumer adoption and behavior

Decreasing the energy consumption and increasing the energy efficiency of BCE products is possible based on:

1. How products are used in homes
2. How products are purchased in stores
3. How product options are understood and acted upon in unique situations

Therefore, understanding the energy efficiency for BCE products and how they are supported is imperative. We will discuss the labeling and certifications available for efficient BCE products, the energy savings potentials from BCEs, and provide a profile of the energy consumed by BCE products.

41 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

Labels and Certifications

Several energy efficiency labels and certifications exist that are dedicated to identifying energy efficient BCE products.

ENERGY STAR® is the most widely known label, with 87 percent of consumers reporting that they recognize the brand in 2012 (an all-time high).[42] The ENERGY STAR program aims to identify the top 25 percent of the most energy efficient products available in a product class. ENERGY STAR is administered through the Environmental Protection Agency (EPA). In addition to efficiency, ENERGY STAR screens products based on quality measures to ensure that consumers not only have an efficient product, but a high-quality product as well. ENERGY STAR has been the basis of program design for PAs to increase the penetration of energy efficient lighting and consumer products within their designated territory.

The energy savings available within that top 25 percent designation can vary greatly within product and model categories. Additionally, the design and life cycle of BCE products can move at a faster pace than the ENERGY STAR program is able to. To capture more energy savings, toward the end of the previous decade PAs began to support products that were more energy efficient than the ENERGY STAR designations, and began to develop new mechanisms for identifying eligible products.[43]

As a result, other labels and certifications work with the ENERGY STAR product list to identify BCE products that are even more efficient than ENERGY STAR-certified BCE products. These other labels and certifications tend to lack the recognition power of ENERGY STAR, but can also take into consideration elements beyond efficiency and in some cases identify products that are more environmentally sustainable. In this way, ENERGY STAR becomes the baseline for efficiency, with other labels and certifications building upon it to achieve different end goals.

42 U.S. EPA. (2013). National Awareness of ENERGY STAR® for 2012: Analysis of 2012 CEE Household Survey. Retrieved from http://www.energystar.gov/ia/partners/publications/pubdocs/National%20Awareness%20of%20ENERGY%20STAR%202012%20508%20compliant.pdf?b1ef-17eb

43 For example, television programs that were implemented at the midstream level in coordination with retailers might have supported ENERGY STAR version 4.1 TVs plus 20% increased efficiency.

Table 7 provides an overview of the all of the various energy efficiency labels and certifications that support BEC products.

Table 7. Overview of Energy Efficiency Labels and Certifications[44]

Label	Purpose	BCE Products
	ENERGY STAR®: Voluntary program that identifies the top 25% of energy efficient models within a specific product class by setting performance specifications and facilitating third party quality assurance testing.	Televisions, computer monitors, desktop computers, imaging equipment, enterprise servers, power supplies, audio/video, STBs, game consoles
	ENERGY STAR® Most Efficient: Extension of the ENERGY STAR Program that identifies the top 10% of energy efficient models within a specific product class.	Televisions, computer monitors
	EPEAT®: Comprehensive environmental rating system that identifies environmentally conscious computers and other electronic equipment.	Televisions, computer monitors, desktop computers, imaging equipment
	Super-efficient Equipment and Appliance Deployment (SEAD) Global Efficiency Medal: Global competition to identify the most energy efficient model in a product class in four markets (North America, Europe, Australia, and India).	Televisions, computer monitors
	TopTen USA™: Identifies the top 10 energy efficient models of a product class available in the U.S. market.	Televisions, computer monitors, desktop computers, laptop computers

ENERGY STAR plays a very important role because it propels the industry forward with each new specification it sets. As new specifications are developed, efficiency levels continue to increase, further pushing the BCE industry toward increased efficiency.

As BCE products increase in efficiency, they have the opportunity to receive other certifications and labels such as ENERGY STAR Most Efficient, TopTen USA, and SEAD's Global Efficiency Medal. TopTen USA and ENERGY STAR Most Efficient identify a subset of BCE products within ENERGY STAR's database that are the most energy efficient and pose the greatest opportunity for increased adoption by PAs, manufacturers, retailers, and consumers.

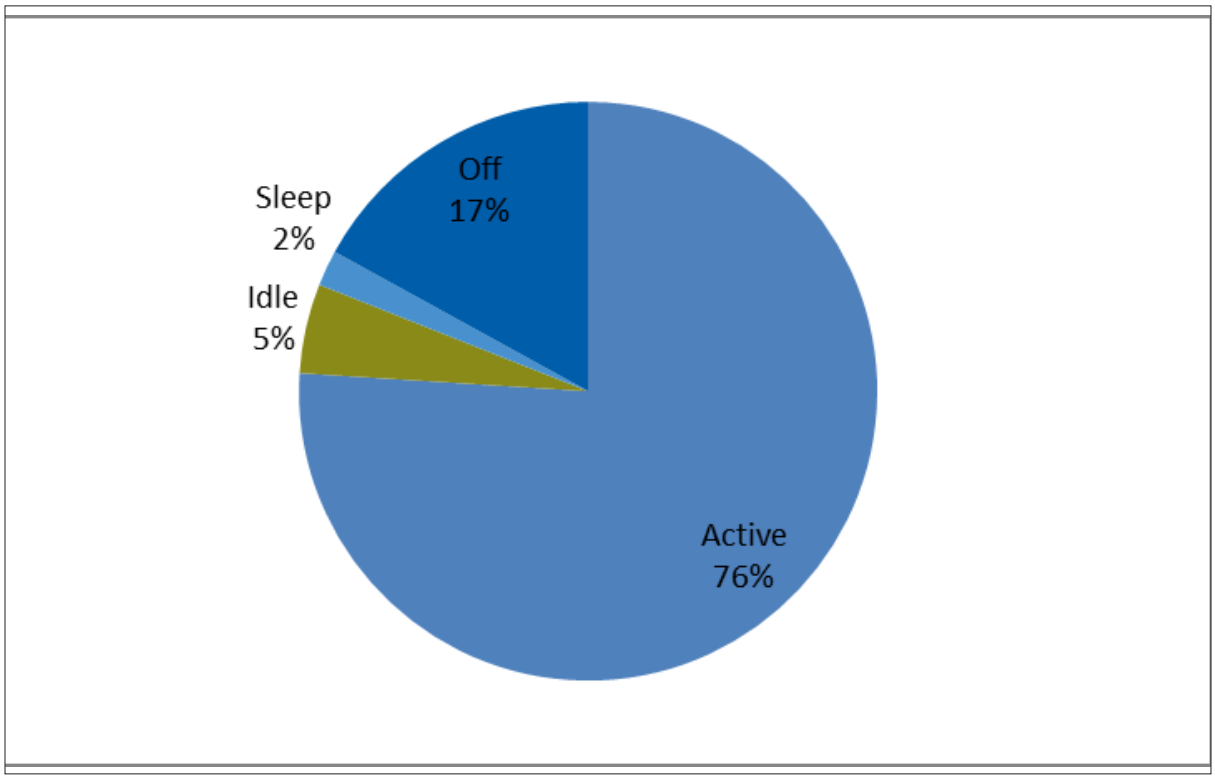
44 Websites (in order presented): www.energystar.gov, www.energystar.gov/mostefficient, www.epeat.net, www.super-efficient.org, www.toptenUSA.org

Some of the energy efficiency labels and certifications do not cover all BCE product segments, but generally the product segments not currently covered are either already very efficient or could be covered within the next few years, such as tablets and mobile phones.

Energy Savings Potential from Installed BCE Products

BCE products consume energy in two ways. The first is when they are being used, or in "active" mode. The second is when they are waiting to be used, or in the "idle," "sleep," or "off" modes. In their 2010 study on U.S. household consumer electronics energy consumption, Fraunhofer USA concluded that 76 percent of total annual energy consumption of 17 selected BCE products came from active mode, as shown in Figure 5.[45]

Figure 5. Total Annual Energy Consumption of 17 BCE Products



It is also important to understand that 19 percent of the annual energy consumed by BCE products is consumed while products are turned off or in sleep mode. Additionally, although American households continue to purchase additional BCE products (the average U.S. home has 24 BCE products[46]), older BCE products tend to remain in homes until the end of their useful life. These BCE products are typically much less efficient in all four modes in comparison to more modern BCE products available for purchase today.

45 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

46 Consumer Electronics Association. (2011, May). Powering Intelligent Electricity Use. Retrieved from http://store.ce.org/Powering-Intelligent-Electricity-Use_p_318.html.

Data from a recent report on miscellaneous energy loads issued by the American Council for an Energy Efficient Economy (ACEEE) states that BCE product categories consume 172.9 TWhs of energy annually.[47] Three of the top five residential miscellaneous energy loads are TVs (70.1 TWhs), STBs (28.0 TWhs), and personal computers (27.1 TWhs).[48] This data supports the fact that addressing miscellaneous energy loads, or plug loads, is an opportunity.

Potential Product Energy Savings

PAs and consumers are beginning to recognize the opportunity to save energy from BCE products when they are in idle, sleep, and off modes. However, it is difficult to calculate energy savings from plug loads because an accurate representation of what is in consumers' homes, the time of use for all of the BCE products in different power modes, and the power draw for each one of those modes for each BCE product has not been well established.

The Fraunhofer report was used to estimate what potential energy savings could be derived from products in each of the four modes of power consumption, with the assumption that all products consume energy equally in the same power mode. Table 8 provides a speculative overview of the potential energy savings that could be achieved by addressing BCE products installed in homes in Northeast and the Mid-Atlantic.

47 Kwatra, S., Amann, J., Sachs, H. Miscellaneous Energy Loads in Buildings, ACEEE Research Report A133, Retrieved from http://www.aceee.org/research-report/a133.
48 Ibid

Table 8. Northeast and Mid-Atlantic Energy Consumption from Installed BCE Products

BCE Product Segment	BCE Product Category	Unit Energy Consumption (kWh)[47]	Installed Base (in millions)[48]	Annual Energy Consumption (TWh)[49]	Active Mode (TWh)[50]	Other Modes (TWh)[51]
Audio Visual	Receivers	65	19.93	1.30	0.97	0.32
	Blu-Ray players	14	2.42	0.03	0.02	0.01
	Computer speakers	37	14.90	0.55	0.15	0.40
	DVD players	28	44.89	1.26	0.14	1.12
	Multifunction devices	12	22.75	0.27	0.01	0.26
Computing	Desktop computers	220	20.33	4.47	4.09	0.38
	Laptops	63	26.57	1.67	1.49	0.18
	Computer monitors	97	26.37	2.56	2.35	0.20
Content and Gaming	Game consoles	18	21.94	0.39	0.19	0.20
Televisions	Televisions	183	71.06	13.00	11.25	1.76
	Total	737	271.16	25.5	20.66	4.83

The dataset used for this analysis included only BCE products whose functionality could be altered by a consumer to reduce or eliminate energy consumption in idle, sleep, and off modes—often by automatically shutting down the product into a full off mode. STBs were removed from the analysis because STBs lack settings that the consumer can select to limit energy consumption in these modes. The remaining products consume an estimated total of 4.84 TWhs of energy annually in the Northeast and Mid-Atlantic regions of the U.S. Addressing idle, sleep, and off modes in the Audio Visual product segment provides the greatest percentage of energy savings (44 percent) followed by TVs (36 percent), computing (16 percent), and content and gaming (4 percent). These figures represent only an estimation of what can be obtained by mitigating these power draws and conveys potential opportunities for energy savings that we recommend be explored further.

49 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

50 Applied multiplier of 20.1313% to reflect Northeast and Mid-Atlantic Population from U.S. Census projections to Table 3.1 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

51 Adjusted to reflect Northeast and Mid-Atlantic Population using Table 3.1 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

52 Applied time in active mode per BCE product using Table 4.5 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

53 Applied time in idle, sleep, and off modes per BCE product using Table 4.5 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

Technology that has the capability to impact three modes—idle, sleep, and off—can eliminate passive energy and active waste. Products may have technology built in to automatically shut down after a period of inactivity. Alternatively, an external product such as an advanced power strip may be used to achieve similar results for products without built-in shutdown capabilities. Active waste occurs when a product is in idle mode or is being used in an idle manner (e.g. a person leaving a television on while they sleep). A few reports have been released that quantify potential energy savings from technologies that eliminate passive energy and active waste. Two available reports provided a range of savings of 236 – 381 kWh, or roughly 49 percent of the connected load from a home entertainment system.[54],[55]

Advanced Power Strips (APS)

The energy consumption of plug loads can be impacted by using technologies such as advanced power strips. The most popular APS technology supported by efficiency programs exhibits "control" functionality, in which a master outlet is capable of controlling the power to other outlets. These are referred to as Tier 1 APS and they generally target passive waste, impacting only two modes—sleep and off. PAs who support this technology claim between 75 and 80 kWh annual savings. Energy consumed in sleep and off mode is defined as passive energy (sometimes referred to as passive standby energy) because it is consumed when a product is turned off and not being used. There are also Tier 2 APS that target more active waste for larger energy savings.

NEEP convened a working group to address issues related to APS product development, such as product testing, quality assurance, marketing, outreach, and potential per-unit energy savings. The working group helped to elevate the potential of APS through various findings and the creation of reports on potential deemed savings and testing protocols.[56] In addition to these findings, the working group identified Tier 2 products that could potentially save more energy than an APS given their ability to address idle mode power. Additional field studies are required to fully understand the savings potential of Tier 2 products.

Two of the major reasons APS have not been adopted quickly is the lack of consumer awareness on their existence and lack of consumer understanding on installation. APS requires an assisted sales approach in order for the consumer to understand why they need it and how to use it appropriately to receive its full benefit. These barriers need to be overcome in order for APS to be sold in higher volume and provide maximum energy savings.

54 Energy Consult and EPRI, (2012, October 16). Advanced Power Strip (APS) Audio Visual (AV) Field Trial: California.
55 Karebo Systems, (2013, March 6). Audiovisual standby power controller: Energy savings field trial, South Africa June – August 2012.
56 Reports available from http://neep.org/efficient-products/business-consumer-electronics/plug-loadadvanced-powers-strips/index

Energy Consumption of Purchased BCE Products

BCE products and potential energy savings can be derived using sales forecasts through 2016 of the BCE segments identified at the beginning of the report using findings from Consumer Electronics Association (CEA).[57] The analysis focuses on BCE products that have forecasted sales of over one million units and a forecasted sales growth of 20 percent or greater from 2013 through 2016. Table 9 provides an overview of forecasted BCE product sales in the U.S. and Northeast and Mid-Atlantic regions.

Table 9. Forecasted BCE Product Sales in the Northeast and Mid-Atlantic through 2016 [58][59][60]

BCE Product Segment	BCE Product Category	Sales Growth[56]	U.S. Sales (in thousands)[57]	N.E. and M.A. Sales (in thousands)[58]
Audio Visual	Sound bar	22%	2,492	501.72
	Docking stations (MP3 compatible radios and speakers)	16%	15,047	3,029.09
	Blu-Ray players	3%	11,624	2,340.02
Computing	Desktop computer	-3%	5,398	1,086.59
	Laptops	12%	27,979	5,632.54
Content	Set-top boxes	15%	42,750	8,606.14
	DMRs (Roku, Apple TV)	44%	9,988	2,010.62
Gaming	Gaming consoles (home consoles)	39%	18,511	3,726.51
Mobile	Tablets	27%	142,626	28,712.51
	Smart phones	25%	152,082	30,616.07
Office Imaging	Multifunction printers	9%	12,873	2,591.57
Televisions	Televisions	-10%	32,281	6,498.58

While growth is projected for sound bars, DMRs, game consoles, tablets, and smart phones, decline is projected for desktop computers and TVs.[61]

57 BCE products that have a declining market share, such as DVD players, were left out of the analysis.
58 Sales growth is the increase/decrease in projected sales in 2016 using 2013 as a baseline. The analysis uses data from CEA Consumer Electronics Detailed Forecast Module, CEA
59 Average of forecasted sales from 2013 – 2016 taken from CEA Consumer Electronics Detailed Forecast Module, CEA
60 Applied multiplier of 20.1313% to reflect population of Northeast and Mid-Atlantic states in comparison to U.S. total population. Population figures taken from U.S. Census Table 1. Annual Estimates of the Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2012
61 Computer monitor sales were unable to be forecasted due to the way the dataset was delivered.

Televisions

The most visible BCE product is the television. While forecasts predict television sales will decline over the next three years, the TVs that will be sold will have increased functionality including:

- Ultra-high definition (98 percent)
- Network-enabled (47 percent)
- Three-dimensional (49 percent)
- Internet application capabilities (48 percent)

OLED TVs will represent a small fraction of the market (3 percent of sales) with LED back-lighting dominating (74 percent). Forty-four percent of TVs sold will be smaller than 40 inches, and 49 percent will have screen sizes of 40 inches or greater.[62] Connectivity, more-efficient back lighting, and large screens—trends that we see currently—are forecasted to continue to grow.

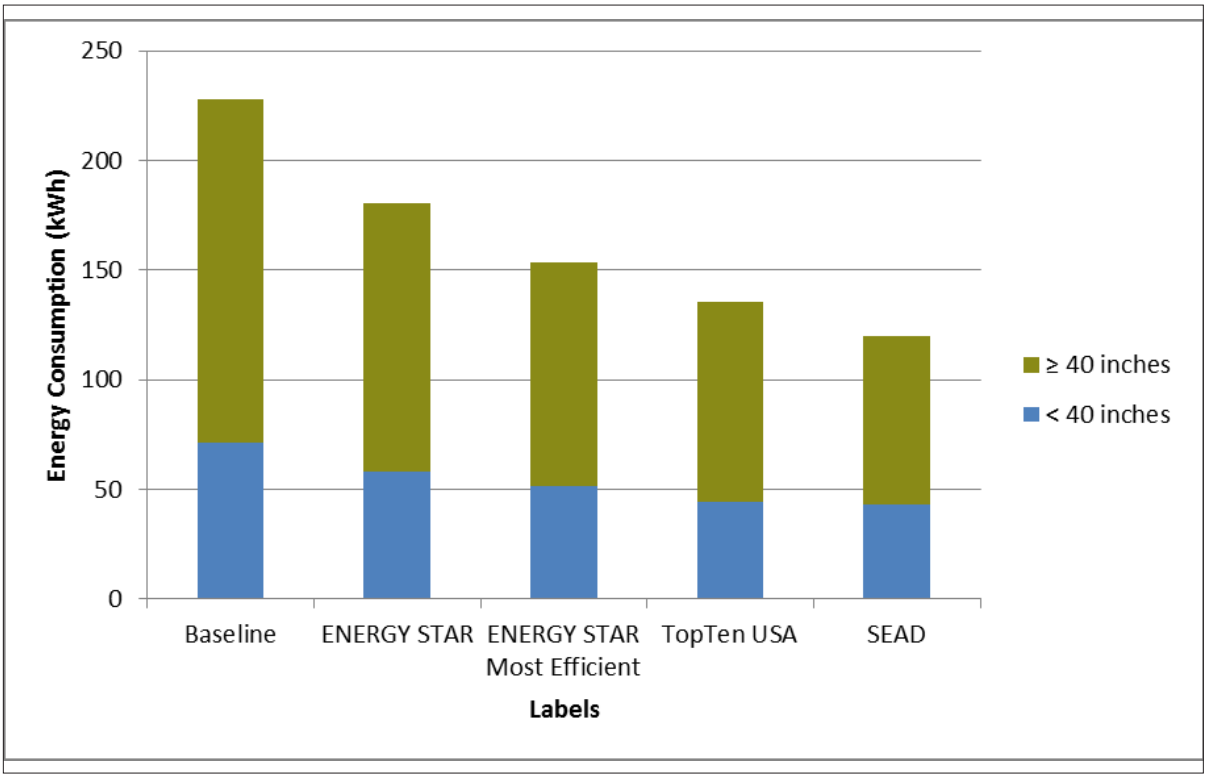
This market has been transformed in recent years. For example, the annual energy consumption of ENERGY STAR-compliant 42-inch TVs decreased from 208 watts to 66 watts over the last three specification cycles.

The ENERGY STAR market penetration for TVs is currently 96 percent.[63] Energy savings for TVs can be derived from the high efficiency models (which are covered by other labels). An analysis of the various energy efficiency certifications and labels is provided in Figure 6 to convey potential energy savings.

62 Analysis on digital displays table FC-108 from CEA Consumer Electronics Detailed Forecast Module, CEA

63 U.S. EPA. (2011). ENERGY STAR Unit Shipment and Market Penetration Report. Retrieved from http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2011_USD_Summary_Report.pdf.

Figure 6. Television Energy Use (±40 Inch)



We used a random sample of TVs available for purchase through retailers to determine the baseline. The remaining numbers from Table 11 are derived from qualified product lists and other lists that denote efficiency.[64] Minimal energy savings exist in the small television category; in the large television category, however, savings exist if high efficiency certifications and labels are considered.

Using that same data collection methodology, we produced another scenario in which only 42-inch TVs were counted for determining energy savings, as shown in Table 10. SEAD and TopTen USA were excluded because no 42-inch TVs meet their certifications currently.

Table 10. Energy Use for 42-Inch Televisions (kWh)

Designation	42-Inch TV
Baseline	116.0
ENERGY STAR	94.9
ENERGY STAR Most Efficient	77.7

Energy savings potential varies (approximately by 10 kwh) when comparing ENERGY STAR-certified TVs greater than or equal to 40 inches and ENERGY STAR Most Efficient TVs greater than 40 inches. When compared with the baseline model, ENERGY STAR Most Efficient TVs

64 The numbers used to generate the SEAD figures represent only three products: one less than 40 inches TV, and two TVs greater than or equal to 40 inches.

would generate 38.3 kWh in energy savings. We used the same analysis to determine if greater energy savings persists in much larger screens when comparing ENERGY STAR and ENERGY STAR Most Efficient 60-inch TVs, as seen in Table 11.[65]

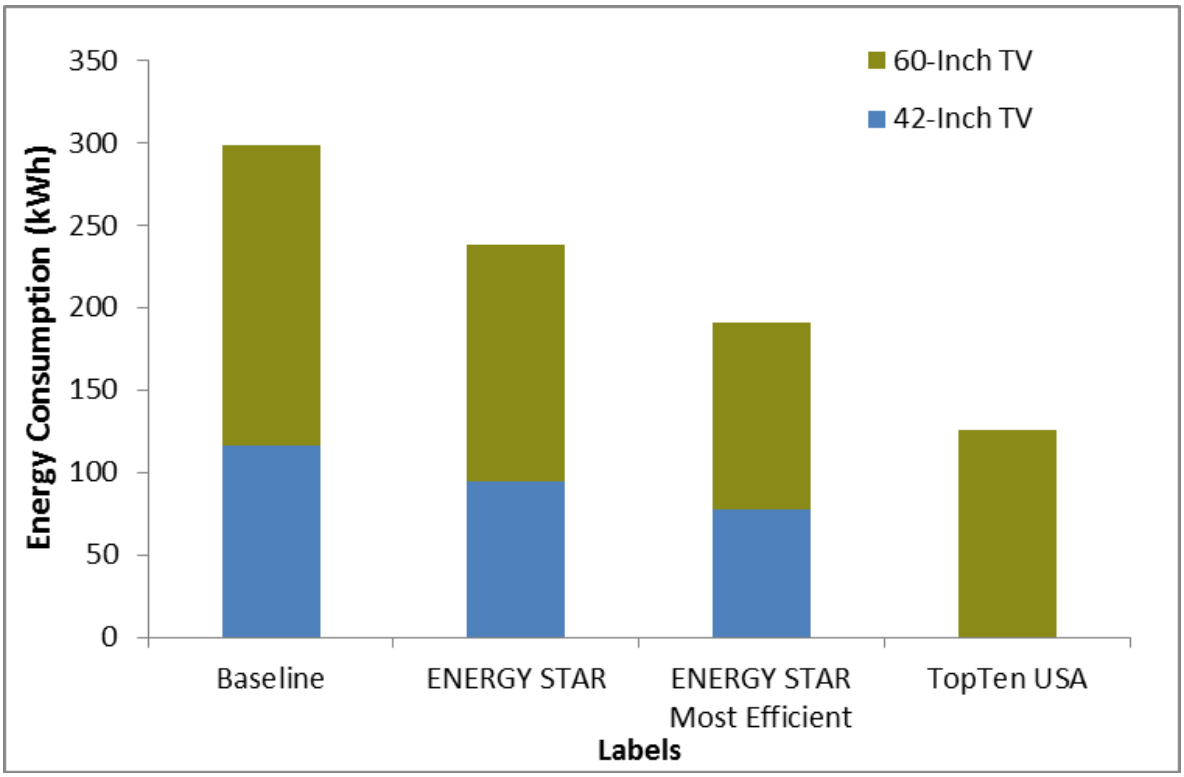
Table 11. Energy Use for a 60-Inch Television (kWh)

Designation	60-Inch TV
Baseline	182.7
ENERGY STAR	142.7
ENERGY STAR Most Efficient	113.0
TopTen USA	126.0

In the larger TV category, energy savings potential increased by 30 and 40 kWh, respectively, when compared with savings available from TVs larger than 40 inches. TopTen USA energy savings remains consistent with about 60 kWh annual energy savings.

This is also represented visually in Figure 7.

Figure 7. Television Energy Use (42- and 60-Inch)



65 SEAD was not included because they did not award a Global Efficiency Medal to a television that was 60 inches.

The marginal energy savings available for TVs is based on several variable factors including the high efficiency certification and label used, the current consumption of the products on those lists, the impact of outliers on potential savings, and the baseline that is being used.

Computing

Computing products provide energy savings as expressed in Table 12.

Table 12. Energy Consumption from Computing Products Based on Certification (in kWh)

Computing Products	Baseline[64]	ENERGY STAR[65]	ENERGY STAR M.E.[66]	TopTen USA[67]
Desktop Computer	239.00	162.00	NA	48.94
Laptop	75.00	52.00	NA	19.90
Computer Monitor	66.00	52.00	24.81	29.57

Desktops

Energy savings opportunities exist with desktop computers if baseline energy consumption is compared with ENERGY STAR and TopTen USA certifications and lists. According to an ENERGY STAR Unit Shipment report from 2011, ENERGY STAR-certified desktop computers have a market penetration of 17 percent, which means there is opportunity to increase adoption.[70] While there are persistent savings available and low penetration of baseline efficient desktop computers, sales are decreasing as the penetration of other BCE products, such as laptops and tablets, increases.[71] Working through contract sales, procurement, and institutional purchasing channels may be the best approach to impact desktop computers, as 68 percent are sold to commercial consumers.[72]

Laptops and Monitors

The energy savings potential for laptops and computer monitors are marginal when comparing the baseline ENERGY STAR specification and non-ENERGY STAR products. Solid-state drives (SSD), drives that have no moving parts compared to traditional hard drives, are becoming more prevalent in laptops.[73] The laptop and monitor models that meet ENERGY STAR Most Efficient and TopTen USA criteria offer more savings, as the difference between the baseline and highest tier of efficiency is 41 - 55 kWh for both product categories.

66 ENERGY STAR Office calculators
67 Ibid
68 Analysis of ENERGY STAR Most Efficient Qualified Product List
69 Analysis of TopTen USA computing products: www.TopTenUSA.org
70 U.S. EPA. (2011). ENERGY STAR Unit Shipment and Market Penetration Report. Retrieved from http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2011_USD_Summary_Report.pdf.
71 NMR Group, Inc. (2012, October 23). Massachusetts Consumer Electronics Potential Qualitative Research Study. Retrieved from http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2012/2012%20Residential%20Studies/ MA%20Consumer%20Electronics%20Potential%20Qualitative%20Research%20Study%20FINAL%202012-10-23.pdf.
72 Independent research
73 Schmid, P., Roos, A. (2008, June 26). The SSD Power Consumption Hoax: How can Battery Runtime be Shorter? Retrieved from http://www.tomshardware.com/reviews/ssd-hdd-battery,1955-2.html.

ENERGY STAR-certified laptops and computer monitors have a market penetration of 75 percent and 85 percent,[74] respectively, but penetration of ENERGY STAR Most Efficient and Top-Ten USA laptops and computer monitors is currently unknown. Due to the high penetration of ENERGY STAR certified laptops and computer monitors, using it as a baseline instead of non-ENERGY STAR certified products provides a more accurate depiction of potential energy savings opportunities. When the potential energy savings are adjusted from ENERGY STAR to the highest efficiency tiers, potential energy savings changes to 27 – 32 kWh.

Content

Access to content is changing the way consumers interact with content. Product convergence, new technologies, and the advent of cloud computing have leveled the playing field where content is no longer associated with a device. An example is the idea that a consumer can access HBO programming only with a set top box (STB). The availability of content has allowed for new technologies to enter the market. In this section, traditional STBs are covered in addition to Digital Media Receivers (DMRs).

Set-Top Boxes

STBs represent a growing market in BCE. Energy efficiency advocates have continuously supported measures to increase the efficiency of various STB devices. The average annual U.S. energy consumption of STBs is 23-27 TWhs.[75],[76] Table 13 provides an overview of STB energy consumption segmented by cable, satellite, and IP, as well as standard definition (SD), high definition (HD), and DVR STBs.

Table 13. Energy Consumption of STBs[77]

Transmission	STB Functionality	Active (W)	Off (W)	Unit Energy Consumption (kWh)
Cable	Non-DVR (SD)	16.50	15.90	142.00
	Non-DVR (HD)	14.90	13.50	125.00
	DVR (SD or HD)	29.60	27.30	249.00
Satellite	Non-DVR (SD)	8.50	7.60	70.00
	Non-DVR (HD)	20.70	18.20	169.00
	DVR (SD or HD)	24.00	21.80	199.00
IP	Non-DVR (SD)	10.70	10.50	93.00
	Non-DVR (HD)	13.50	11.80	112.00
	DVR (SD or HD)	19.30	14.90	152.00

74 Ibid

75 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

76 Horowitz, N. (2011, June 1). Are Today's Video Game Consoles Playing Games with the Environment? Retrieved from http://switchboard.nrdc.org/blogs/nhorowitz/are_todays_video_games_playing.html.

77 Neugebauer, R., Frazer, B., May-Ostendorp, P., Calwell, C., Ecos Consulting. (2008, November). Lowering the Cost of Play: Improving the Energy Efficiency of Video Game Consoles. Natural Resources Defense Council Issue Paper. Retrieved from http://www.nrdc.org/energy/consoles/files/consoles.pdf.

While DVR boxes consume the most energy in comparison to all available STBs, they account for only 24 percent of STBs installed in the U.S. The non-DVR SD is the most prevalent, with a penetration of 50 percent.[78] When comparing sales projections from present day through 2016, cable STBs are forecasted to decrease by 28 percent, satellite STBs are forecasted to remain flat, and IP STBs are forecasted to increase by 42 percent.[79] As penetration shifts from cable to other transmissions such as IP, an efficiency gain exists.

78 Ibid
79 CEA Consumer Electronics Detailed Forecast Module, CEA

SPOTLIGHT ON STB ENERGY SAVINGS

STB energy consumption has been widely publicized for almost a decade, yet minimal strides have been made in the deployed efficiency of STBs. Three potential solutions exist that, if enacted, could greatly reduce STB energy consumption.

- ***Deep Sleep:*** Over time, STBs are becoming more efficient due to the ENERGY STAR Program's work on standards, most notably version 3.0 and version 4.0. These specifications require STB manufacturers to produce STBs that are capable of "deep sleep," which drastically reduces energy consumption. According to figures from an NRDC report, this new mode could reduce annual energy consumption for a cable HD DVR by 58 percent.[80]
- ***Limit the Number of STBs:*** There is an opportunity to limit the number of STBs in a home. In Table 8, which includes an overview of service providers, nine of 11 service providers have multi-room configurations. A multi-room approach can replace the comparatively high function and high power STBs (e.g., HD DVR) with a lower-function STB (e.g., HD non-DVR) while providing the same or better user experience. This is accomplished by enabling a home's multiple non-DVR STBs to access content stored on a single DVR, as opposed to operating multiple DVRs.[81]
- ***Gateway or Thin Client:*** Using a gateway and thin client configuration to replace the stand-alone STBs or multi-room approach offers even more energy savings. Thin clients use less than half the energy of a stand-alone box because they have no conditional access system, and therefore have no direct connection to the service network. When they implement a sleep state, they consume approximately 25 percent of the energy of a typical stand-alone.[82] According to figures from NRDC, approximately 278 kWh annually could be saved by moving from multi-room to gateway-thin client configuration for three TVs.[83]

80 Analysis conducted using information from page 4 in the following report: http://www.nrdc.org/energy/files/settop-boxes.pdf
81 Ibid
82 Ibid
83 NRDC. (2011, June). Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Set-Top Boxes. Retrieved from http://www.nrdc.org/energy/files/settopboxes.pdf.

Digital Media Receiver

Additional energy savings of 18 to 54 kWh could be achieved by eliminating the gateway altogether, using special TVs that are designed to receive service directly.[84] The RVU Alliance and other similar organizations are currently working to create protocols to enable devices to receive content independent of STBs by interacting directly with TVs, or other media devices.[85] Samsung, DIRECTV, and other prominent BCE industry players belong to the RVU Alliance. The work of the RVU Alliance could play a major role in decreasing the overall number of STBs within the home over the coming years.

Table 14 outlines potential energy savings using the most efficient STB scenario of a gateway-thin client configuration.

Table 14. Potential Energy Savings from Using a DMR

Configuration	Annual Energy Consumption (kWh)
Total Gateway-Thin Client Configuration[86]	179
Room 1: HD DVR	115
Room 2: HD Thin Client	32
Room 3: HD Thin Client	32
Total DMR Configuration	99
Room 1: Cable DTA[87]	39
Room 1: DMR	20
Room 2: DMR	20
Room 3: DMR	20

While gateway-thin client configuration currently offers the best savings for STBs, using a configuration that uses DMRs can extract even more energy savings. Our calculation factors in the use of a cable DTA for use on the main television in the home so the consumer can receive basic programming upon turning on their television.

This approach comes with a trade-off: consumers may not be able to access all the content they desire unless they purchase services from content providers such as Netflix, Amazon Prime, Hulu, and others. Consumers may revert to standard STBs if this technology is not supported properly (similar to the phenomenon that occurred with early compact fluores-

84 Ibid

85 Can we Talk? Utilities to Cable, Satellite and IP Service Providers: is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes? Bolioli, Beavers, Michalski.

86 Analysis conducted using information from page 4 in the following report: NRDC. (2011, June). Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Set-Top Boxes. Retrieved from http://www.nrdc.org/energy/files/settopboxes.pdf.

87 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

cent lights when consumers replaced installed CFL bulbs with incandescent light bulbs when dissatisfied with the performance of the CFL).

Gaming

Game consoles offer considerable opportunities for energy savings, given the current inefficiency and penetration of existing units. More than 40 percent of homes own at least one game console.[88] Three manufacturers, Nintendo (Wii), Microsoft (Xbox), and Sony (PlayStation), make up the market for game consoles. New game consoles, such as Ouya, are on the horizon, but no projections are available as to how they will impact sales and disrupt market penetration from Nintendo, Microsoft, or Sony. Figure 8 provides an overview of the penetration of each console, its efficiency, and the last two generations of consoles in the market.

Figure 8. Overview of the Three Game Console Manufacturers[89]

Current Generation Console	Wii U	XBOX ONE	PS4
Efficient?	✓	X	X
Last Generation Console	Wii	XBOX 360	PS3 PlayStation 3
Sales split of three major last generation game consoles	40%	31%	28%

The efficiency designation in Figure 4 corresponds to which game consoles would be able to meet the guidelines ENERGY STAR has developed for its recognition program[90]. According to these guidelines, only the Wii U, the latest generation of Nintendo's Wii, could qualify for the voluntary program. Though the Wii U's energy performance qualifies it to be recognized by ENERGY STAR, it is not currently being recognized. It is anticipated that the next generation Xbox One and PS4 will be released in November 2013; it is unclear if those devices will seek ENERGY STAR recognition. The recognition criteria does not set energy consumption limits on active game-play, but rather aims to reduce energy waste from standby mode, the active navigation menu, and from active streaming media. This criterion is designed to

88 Neugebauer, R., Frazer, B., May-Ostendorp, P., Calwell, C., Ecos Consulting. (2008, November). Lowering the Cost of Play: Improving the Energy Efficiency of Video Game Consoles. Natural Resources Defense Council Issue Paper. Retrieved from http://www.nrdc.org/energy/consoles/files/consoles.pdf.

89 Sales information was taken from multiple sources including Wikipedia

90 Details on ENERGY STAR Recognition Program at: https://www.energystar.gov/products/specs/game_console_version_1_0_recognition_program_pd

maximize the primary function of the console, active game play, while keeping the other console functions efficient.

The Natural Resources Defense Council (NRDC) has conducted multiple studies on gaming consoles. An overview of game console energy consumption from the last generation consoles that entered market in 2005-2006 is provided in Table 15. Further research is needed to assess how long game consoles are in each mode to determine energy savings potential.

Table 15. Legacy Game Console Energy Consumption[91]

Console and Year Released	Active (W)	Idle (W)	Off (W)
Microsoft Xbox 360 (2007)	118.80	117.50	3.10
Microsoft Xbox 360 (Launch 2005)	172.00	162.00	2.20
Microsoft Xbox (2001)	64.00	59.90	1.70
Sony PlayStation 3 (2007)	150.10	152.90	1.10
Sony PlayStation 3 (Launch 2006)	181.00	181.00	1.10
Sony PlayStation 2 (2000)	24.20	24.20	1.70
Sony PlayStation (1994)	8.00	6.50	1.40
Nintendo Wii (2006)	16.40	10.50	1.90
Nintendo GameCube (2000)	23.00	22.70	0.70
Nintendo 64 (1996)	7.30	7.80	1.10
Nintendo Super Nintendo (1991)	7.30	5.40	1.50

Microsoft and Sony were able to reduce energy consumption in their 2005-2006 game console devices by switching to more efficient components.[92] They may be able to make upgrades with their new generation of game consoles that would qualify them for ENERGY STAR's voluntary program. Energy savings for these older gaming consoles reside in limiting idle-mode consumption.

Audio Visual

Sound bars' sales are surging because they improve the sound from TVs and simulate surround sound.[93] The increase in forecasted sales of sound bars and docking stations is significant. However, the amount of energy savings that can be derived from upgrading from an inefficient model to an ENERGY STAR-certified model is minimal. An independent analysis completed on sound bars and docking stations shows potential annual energy savings of 6.5 kWh and 1.2 kWh, respectively.[94] These two products achieve energy savings when they are

91 Neugebauer, R., Frazer, B., May-Ostendorp, P., Calwell, C., Ecos Consulting. (2008, November). Lowering the Cost of Play: Improving the Energy Efficiency

92 Horowitz, N. (2011, June 1). Are Today's Video Game Consoles Playing Games with the Environment? Retrieved from http://switchboard.nrdc.org/blogs/nhorowitz/are_todays_video_games_playing.html.

93 CEA. (2012, July). Digital America 2012. Retrieved from http://content.ce.org/PDF/DigitalAmerica2012_abridged.pdf.

94 Independent analysis completed on sound bars and docking stations comparing models that are non-ENERGY STAR and ENERGY STAR certified.

in the idle mode. Auto power-down can reduce consumption by five to 10 watts by switching from idle to sleep modes. Additional energy savings could be claimed by supporting higher efficiency sound bars and docking stations, but the potential savings gains may not be enough to substantiate quantifying potential savings.

Blu-Ray players, or HDDVD players, also provide minimal opportunities for energy savings. They consume similar amounts of energy in comparison to their predecessors, DVD players: a difference of a few watts in active mode and idle.[95]

Office Imaging

Multifunction devices are a product category that will continue to grow in sales over the next three years. Multifunction devices combine the functionality from other office devices such as scanning, copying, printing, and faxing. The convergence of technology into one integrated solution should impact sales and penetration of other single-function devices. While sales are poised to increase and obvious consumer benefits exist, market penetration of ENERGY STAR-certified multifunction devices is 100 percent.[96] Other office imaging devices, such as copiers (80 percent) and stand-alone printers (100 percent) have high penetration as well. The ENERGY STAR Program is currently working on version 2.0 for Imaging Equipment with an anticipated release date of January 1, 2014.

When analyzing the ENERGY STAR-certified product list for multifunction devices, there was variability in annual energy consumption ranging from 0.40kWh to 108.59 kWh. The average consumption of the 1,699 multifunction devices on the qualified product list is 5.92 kWh, with only 67 products consuming more than 20 kWh annually.[97] The disparity in energy consumption of certified products and 100 percent market penetration highlights a need to reassess energy savings opportunities for multifunction devices after the new specification is released.

Mobile

The mobile category is the fastest growing BCE product segment. Tablets and smartphones are inherently energy efficient because they are designed to have long battery lives and use power through battery chargers that consume only a few watts when charging. Modern battery chargers do not contribute significantly to a home's plug load. We included tablets and smartphones in our analysis because they can enable energy savings in the future with increased connectivity and interoperability of devices.

As discussed in the Emerging Trends section, tablets and smartphones will help consumers save energy by allowing users to access controls for HVAC, lighting, and plug load devices remotely from their home. These devices allow consumers to have remote access to data and home controls.

95 Energy Resource Solutions (ERS). "Electronics Equipment Power Draw." Prepared NYSERDA. August 24, 2010
96 U.S. EPA. (2011). ENERGY STAR Unit Shipment and Market Penetration Report. Retrieved from http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2011_USD_Summary_Report.pdf.
97 Independent analysis of the ENERGY STAR qualified product list for Imaging Equipment

Tablets and smartphones are also offsetting traditional BCE product use. It is challenging to quantify energy savings associated with these products, but consumers are increasingly using tablets and smartphones, as opposed to the more energy intensive TV and computer, to access streaming content. This trend could lead to a decrease in television consumption within homes. While further research is needed to fully understand how this trend will impact energy consumption, studies show that consumers are beginning to shift content consumption to other connected devices.[98]

BCE Energy Efficiency Program Design

Many programs have historically supported BCE programs, but have had varied success and used an assortment of models. Because the savings potential varies considerably by product, and even within a product category, these programs have been challenging. We reviewed deemed annual savings estimates from some of the larger programs in the nation to determine if consistent savings estimates are available for BCEs across different programs. Overall we determined that deemed savings vary greatly for certain products, but can be relatively stable for others. We examined two of the BCE products for which incentives are offered most often: TVs and advanced power strips.

Existing BCE Energy Efficiency Programs

Currently, there are 21 PAs in North America that are implementing programs that have some focus on BCE products. This represents a 34 percent decrease in PA support for BCE programs when compared with the number of programs that were in place in 2011.[99] Existing BCE programs provide incentives for TVs, desktop computers, computer monitors, APS, and STBs.

Table 16 provides an overview of these programs.

Table 16. Overview of Existing BCE Programs

BCE Product Category	PAs with Program (#)	Program Structure
Televisions	13	Mid-stream incentive to retailers based on varying levels of energy efficiency.
Computer Monitors	8	Mid-stream incentive to retailers and customer rebate.
Desktop Computers	8	Mid-stream incentive to retailers and customer rebate.
APS	14	Multiple channels including upstream buy-down, mid-stream mark-down, and downstream rebates; direct install through implementers are an option as well.
STBs	2	Mid-stream incentive to the service provider.

98 Deloitte. 2012. Devices, Consumption, and the Digital Landscape 2012. Retrieved from http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_tmt_Executive_Summary_Devices_Study_052112.pdf.
99 Consortium for Energy Efficiency. (2011, July). CEE Consumer Electronics Program Summary - July 2011. Retrieved from http://library.cee1.org/content/cee-consumer-electronics-program-summary-july-2011.

In the appendix, we provide a full overview of all PAs in the U.S. and Canada that implement BCE programs including the products that are a part of the program, the associated incentive, the participating retailers, and the marketing efforts included.

The Shift Away From Midstream Model

Over the past several years, many BCE programs have been implemented via a midstream strategy, delivering incentives to the retailer, instead of downstream to the customer or upstream to the manufacturer or distributer.

With the midstream model, the participating retailer receives an incentive for each efficient television sold within a PA's territory, and the PA will claim a specific level of energy savings for each unit sold. Televisions have a very small per-product energy savings margin and, as a result, the individual incentive that is justified ($10) would not be large enough to influence a customer that is purchasing an expensive TV ($400). The midstream model was initiated to leverage the effect that that dollar amount can have on a retailer, which traditionally has small profit margins. The idea behind the midstream model is that the retailer is the target audience, instead of the end-user. The awarded incentive will motivate retailers to stock and sell more-efficient TVs, thereby transforming what customers purchase and, potentially, influencing the products that are produced by manufacturers.

In addition, with these programs, the retailers are traditionally responsible for marketing the energy efficiency program and informing the customer that the product is efficient. In many instances, it is mandatory for retailers to include the necessary point-of-purchase (POP) material on the eligible products.

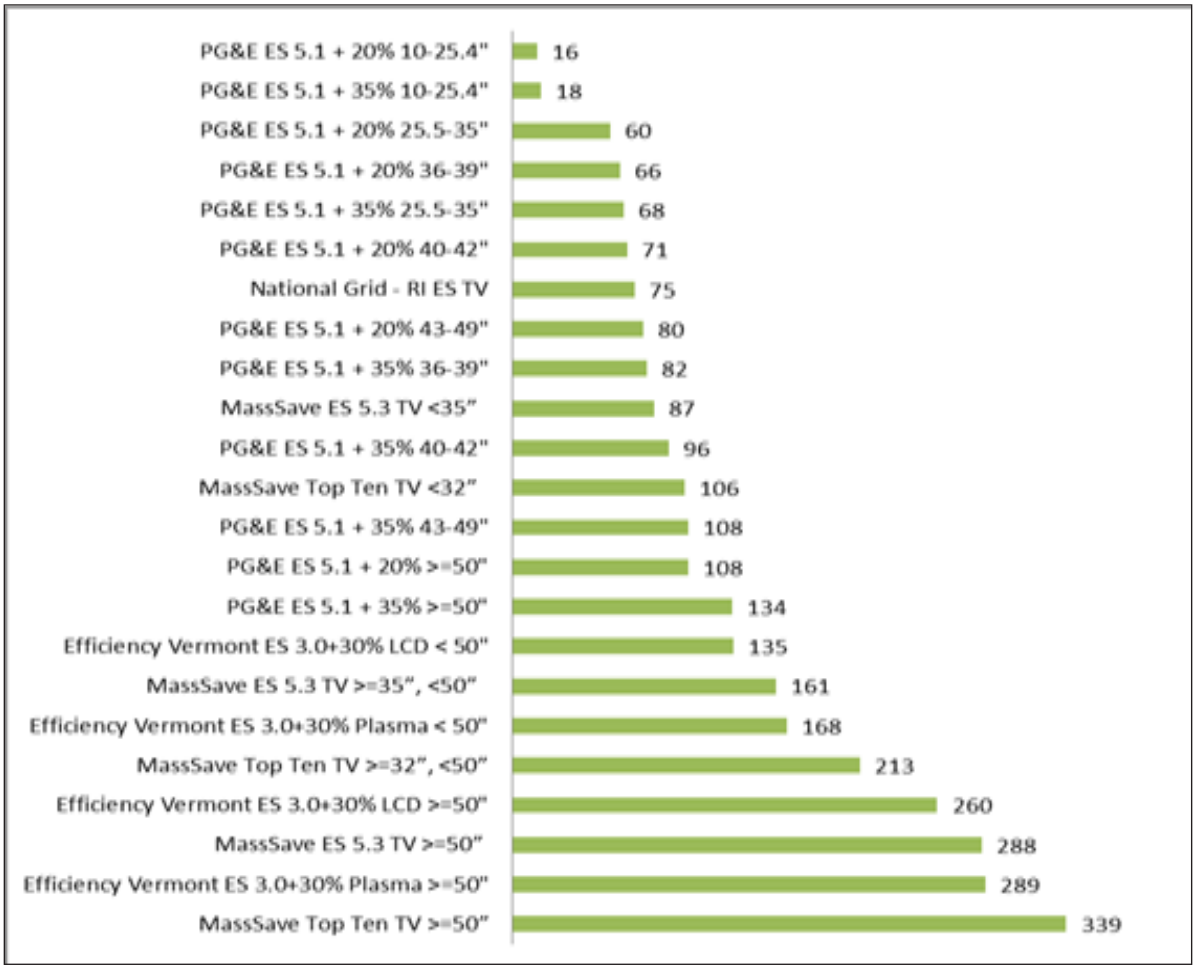
While this existing midstream program model has proven effective and generated substantial amounts of energy savings, there are limited opportunities to generate additional attributed savings through the existing model. The barriers to the existing midstream model are described in detail in a later section.

Televisions (TVs)

TV programs appear to be on the decline due to diminishing energy savings from a market that has been predominantly transformed. PAs continue to support high efficiency labels and certifications in order to be allowed to implement programs.

Figure 9 examines energy efficient television savings estimates from the National Grid, Rhode Island, Massachusetts, and Vermont Technical Reference Manuals (TRMs) and PG&E Working Papers. The annual energy savings range from 16 to 339 kWh/year when broken out by television diagonal screen size and the particular standard (ENERGY STAR and TopTen USA). The variability of these savings estimates reflects the unique energy efficiency challenges that the BCE industry presents to energy efficiency programs.

Figure 9. Annual TRM Savings (kWh/yr) for TV Programs[100]



When setting qualification levels, programs are targeting products that have higher efficiency than is designated by the ENERGY STAR program.

- California offers incentives for TVs with efficiency levels 20 percent and 35 percent more stringent than ENERGY STAR version 5.1. Version 5.1 (which has the same efficiency requirement as ENERGY STAR 5.3) was not deemed stringent enough to realize savings.
- Mass Save also examined a level beyond the ENERGY STAR 5.3 level and partnered with TopTen USA to determine the Top 10 most efficient television models available in Massachusetts. These more aggressive standards are necessary within this product category because, with short production cycles, BCE manufacturers can meet new ENERGY STAR standards months before their effective date (generally nine months after the official final version is issued).
- Mass Save also examined TopTen USA for their computer specification. A standard ENERGY STAR computer saved 70 kWh annually, while a TopTen computer saved 80 kWh annually.

100 Multiple Technical Resource Manuals used for analysis of TV characterization.

- Efficiency Vermont was also compelled to go 30 percent beyond ENERGY STAR 3.0 level.

In addition, there is inconsistency in the baseline data used to develop the TRM and associated energy savings:

- The savings estimates vary a great deal between the high estimate of Mass Save and Efficiency Vermont and the lower savings of National Grid Rhode Island and PG&E. The short production cycles not only influence which standard is relevant, but also lead to uncertainty regarding what constitutes a baseline TV.
- PG&E and National Grid Rhode Island recognized that a baseline was best represented as the average energy consumption of all available TVs sold.

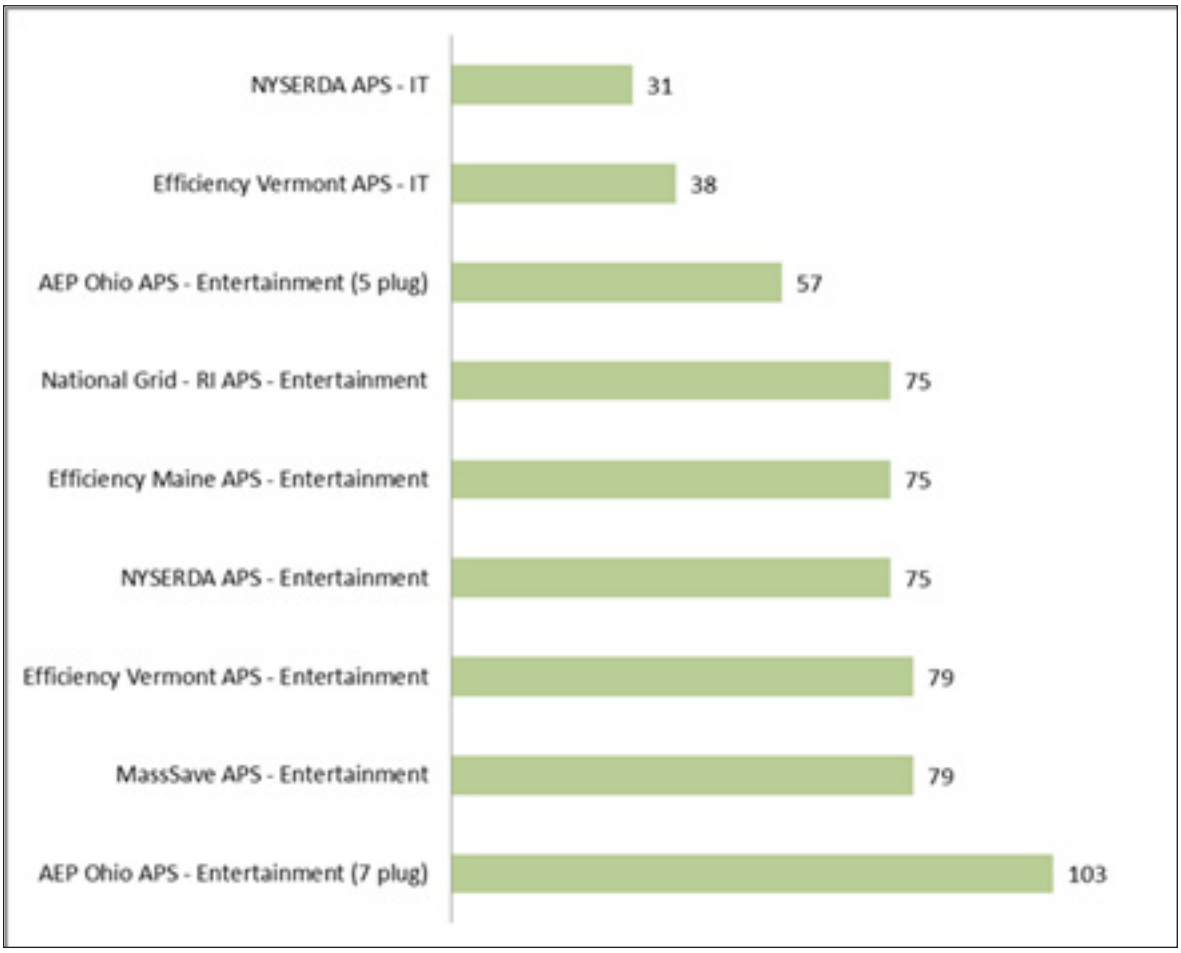
Baseline data skews energy savings potential and accounts for the large variance of savings projected in Figure 12.

Advanced Power Strips (APS)

Once APS programs were launched in the Northeast, the number of APS programs surpassed the number of TV programs for the first time. This may show that a growing number of PAs are considering new methods outside the traditional midstream model to capture energy savings, such as direct install programs. These new methods could provide PAs with an understanding of the BCE products in a consumer's home and how often they are used. This information would allow the PA to develop profiles if combined with other demographic information that can be used to develop a more accurate depiction of potential energy savings for their service territory. In addition, a direct install program also verifies installation and that energy savings can be achieved. The major barrier for this approach is the cost of having APS installed in a home.

Figure 10 shows the deemed savings for APS across a number of program implementers. In this case, the saving estimates are very similar. The APS "entertainment center" savings for the four Northeast programs—Mass Save, Efficiency Maine, Efficiency Vermont, and National Grid—are very close because they all reference the same APS study performed by Ecos Consulting. Efficiency Vermont adds a savings estimate for an APS powering a home office or "IT" set-up as well, at a much lower annual savings. (Similarly, computer savings were based on the same EPA study, resulting in basically the same estimate of computer savings across two different utilities.)

Figure 10. Analysis of Available APS TRMs[101]



AEP Ohio's APS entertainment center savings, based on a NYSERDA study, offered a more refined breakdown of savings between five-plug and seven-plug APS units. However these savings, when averaged, fall in line with those from the Northeast programs' estimates. Their estimates of savings are also very close to those of the four Northeast programs for both the APS powering a home office or entertainment system.

Tighter estimates of savings can be expected for APS because the savings are generated based upon typical usage patterns for home entertainment, the number and type of devices that make up a home entertainment package, and their power usage when not in use. These elements of the savings calculation will not vary as much as the active energy use of consumer electronic products.

Set Top Box (STB)

While STB programs still have lower implementation levels than the popular midstream TV programs, there are a few active STB programs. The New Jersey Clean Energy Program (NJCEP) works with local service providers to usher in change. NJCEP issued a request for

101 Multiple Technical Resource Manuals use for analysis of APS characterization.

proposals to service providers to respond for funding to purchase new energy efficient STBs on a per-unit basis. No evaluation has been conducted yet for this approach, though if successful, this program approach could serve as a model for other program implementers. BC Hydro has also implemented STB programs, but has the luxury of influencing consumers directly, as STBs are purchased by the customer in Canada instead of being rented.

BCE from the Consumer's Perspective

While retailers, manufacturers, and service providers are integral parts of the BCE Industry, the consumer ultimately has the most influence. Consumers have considerable power in an industry in which products have become a commodity, such as BCEs. From our research, we found that consumer demand for better and cheaper devices is shortening product life cycles and leading to rapid obsolescence.[102] Consumers convey to manufacturers and retailers what they are interested in through new channels such as blogs and social media, and if manufacturers are unable to adjust their product offerings accordingly, consumers will switch to another brand or model that will meet their wants and needs.

Changing patterns in consumer brand loyalty, purchasing habits, and decision making are compounding the challenges faced by BCE marketers. According to a recent study, only 3 percent of consumers say they are loyal to a brand and never buy other brands within specific product categories.[103] Additionally, the customary consumer purchase funnel has significantly changed with the explosion of product choices and digital channels, coupled with the emergence of an increasingly discerning, educated consumer. Traditionally, consumers started with certain brands in mind (the wide end of the funnel). Marketing messages guided them as they methodically reduced the number of product candidates and moved through the funnel. At the end of the process, they emerged with the brand they chose to purchase. Today, the path to purchase is less linear and more complex. Marketers are required to use increasingly sophisticated strategies to influence consumers toward preferred brands and products.[104]

Pre-Purchase Research

Consumer pre-purchase research for consumer electronics happens through many different channels. However, one of the most influential channels, according to consumer research, is the internet. According to one study, 91 percent of internet users had researched electronics products online before making a purchase in-store.[105] We are nearly 20 years out from the establishment of a commercialized internet, and consumers now understand that the

102 Dhekne, R., Sadanand Chittal, S. (2011, May). Supply Chain Strategy for the Consumer Electronics Industry. Retrieved from http://www.wipro.com/documents/insights/The%20Future%20of%20Supply%20Chain%20Strategy%20for%20Consumer%20Electronics.pdf

103 AMP Agency. (2011). Inside the Buy. Retrieved from http://www.ampagency.com/wp-content/uploads/pdfs/InsideTheBuy.pdf.

104 McKinsey Quarterly. Court, D., Elzinga, D., Mulder, S., Jørgen Vetvik, O. (2009, June). The Consumer Decision Journey. Retrieved from http://www.mckinsey.com/insights/marketing_sales/the_consumer_decision_journey

105 eMarketer. Consumer Electronics Purchase Path Upended, (2012, October 5). Retrieved from http://www.emarketer.com/Article/Consumer-Electronics-Purchase-Path-Upended/1009395.

online environment provides endless amounts of information, commerce, entertainment, and social networking, and expect all of it to be at their disposal when making purchasing decisions. For consumer electronics, consumer interest in pre-purchase research is largely driven by cost comparisons and details on product performance.[106]

Further, there appears to be a relationship between pre-purchase research and the likelihood of a customer completing the purchase of a BCE product. In a study by Retrevo, more than half the respondents (53 percent) said they had the experience of going to the store to buy an electronics product, but could not decide what to buy. The most common reason cited (30 percent) for a non-purchase was the consumer's feeling that he or she did not have the information needed (online prices, reviews, and specifications, etc.) to make an informed purchasing decision, followed by a feeling of being overwhelmed by the number of choices available.[107] This dynamic may be a driver in the important role retail sales associates can play in assisting with consumer purchases of BCE products, and importantly, which products and models they ultimately choose to buy. For example, one study cites that, when at a "brick and mortar" retailer, 86 percent of consumers take advantage of the in-person assistance, including 77 percent who consult with associates in the store before buying a product and 71 percent who seek their advice after making the purchase.[108]

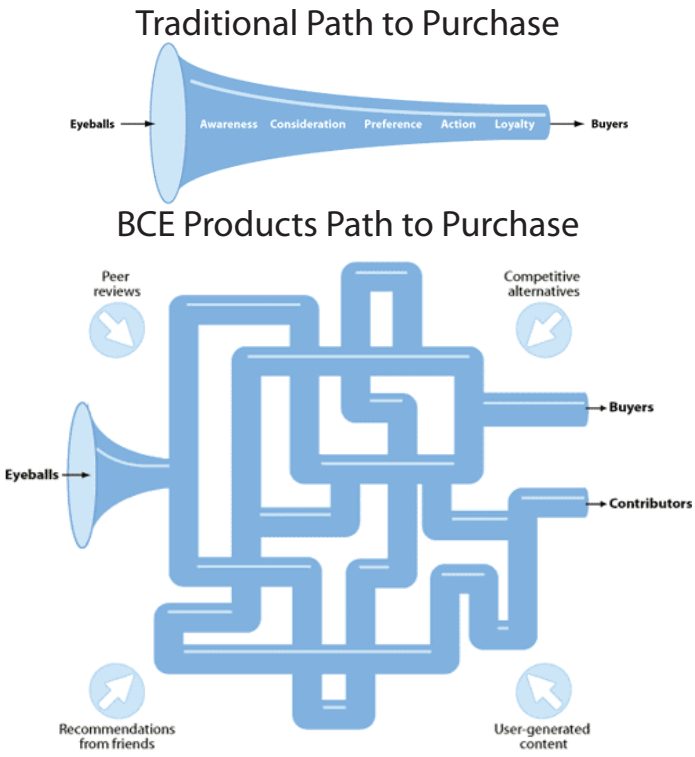
"Showrooming" is another challenging marketing dynamic stemming from trends in digital mobility and altering consumer shopping habits. This practice is characterized by consumers using their smart phones within brick and mortar retail stores to enter product SKUs, scan merchandise codes, and compare pricing with e-tailers. This practice essentially relegates the brick and mortar retailer to the role of an unpaid showroom that consumers use to physically evaluate the prospective product (i.e., touch, feel, wear) and then order elsewhere, online. The issue is the same for garments, durables, or any other item on the retail floor. Without marketing strategies to combat showrooming, brick and mortar retailers could see revenue decline in nearly equal proportion to the increase in showrooming.[109] Approximately 43 percent of U.S. adults have participated in showrooming. Best Buy is ranked as the top store at which consumers showroomed, followed by Walmart and Target.[110] Showrooming can have a large impact as Best Buy, Walmart, and Target are within the top five in U.S. sales of BCE products. A recent report issues by the CEA reports that the percentage of consumers using showrooms to browse and research their purchases has risen to 72 percent.[111] While this specific trend may not directly influence sales of efficient BCE products, it a key aspect

106 AMP Agency. (2011). Inside the Buy. Retrieved from http://www.ampagency.com/wp-content/uploads/pdfs/InsideTheBuy.pdf.
107 Marketing Charts staff. (2011, October, 21). Electronics Sales Most Often Lost to Web. Retrieved from http://www.marketingcharts.com/wp/direct/electronics-sales-most-often-lost-to-web-19751/.
108 Wolf, A. (2013, June 25). Retail Stores Remain Dominant CE Channel: CEA. Retrieved from http://www.twice.com/articletype/news/retail-stores-remain-dominant-ce-channel-cea/107485.
109 Shaeffer, C. How to Solve the Retail Problem of Showrooming. Retrieved from http://www.crmsearch.com/showrooming.php
110 Deatsch, K. (2012, December 10). 43% of U.S. adults participate in showrooming. Retrieved from http://www.internetretailer.com/2012/12/10/43-us-adults-participate-showrooming.
111 Wolf, A. (2013, June 25). Retail Stores Remain Dominant CE Channel: CEA. Retrieved from http://www.twice.com/articletype/news/retail-stores-remain-dominant-ce-channel-cea/107485.

of the consumer decision journey of which BCE marketers should be cognizant when designing consumer education and marketing initiatives around energy efficient BCEs.

Consumer Path to Purchase

As discussed above, the consumer decision journey has evolved into a complicated, less linear path to purchase. The path can have the effect of lengthening the pre-purchase phase of a consumer's purchasing journey. In a study by Google/Shopper Sciences, a significant portion (73 percent) of consumers surveyed said their path to purchase is more complex and less direct than it used to be. More than half of shoppers in the market for BCE products are taking a month or more to make their purchase decision, and 20 percent are deciding within one to three weeks. This timeline does not change when considering low-cost or high-cost tech products. The average tech shopper uses more than 14 sources of information to arrive at a decision. Younger shoppers use more than 21 sources. [112]



A variety of behaviors and factors come into play that can influence what the consumer identifies as a need; what options they prefer; and how, when, and what they purchase.[113] To expand further, the Google study outlined a new decision-making model for BCE products that consists of three levels, or "moments of truth":

- *Zero Moment of Truth*: pre-shopping activities, typically, conducting research via Internet search.

112 Google/Shopper Sciences, U.S. (2011, April). Zero Moment of Truth Study – Consumer Electronics. Retrieved from www.thinkwithgoogle.com/insights/uploads/466368.pdf/download/ ▫
113 Ibid

- *First Moment of Truth*: interacting with a sales person or point-of-purchase materials in store.
- *Second Moment of Truth*: after purchase experience, e.g., blogging about new purchase and using social media.

Prior to mass adoption and use of the Internet, consumers would arrive at the awareness stage largely through paid advertising that relied on some form of mass media as its delivery channel. Consumers now rely on these types of "Zero Moment of Truth" and "Second Moment of Truth" activities to aide them in their decision-making processes. The vast majority of shoppers—nearly 9 out of 10—engage in Zero Moment of Truth activities such as online search, comparison website, brand, and retailer website research.[114]

Consumer Segments to Watch

Two consumer demographic segments that BCE marketers could consider for targeted marketing strategies over the next 10 years are Millenials and Baby Boomers. Millenials, those consumers born between the early 1980s and 2000s, will hold the largest consumer buying power by 2017. Millenials are leading the adoption of new technologies, such as smartphones and tablets. Those surveyed from this segment about their BCE purchasing behavior have indicated they will not buy these products without first consulting user-generated content (44 percent), and believe reviews on a company's website have a greater impact on purchase decisions than recommendations from family and friends (51 percent). Furthermore, younger consumers are more ambitious in their purchase intentions: a greater percentage of younger than older consumers intend to purchase products in each of the 19 BCE categories in the next 12 months.[115]

The Baby Boomer demographic (born between 1946 and 1964) is another important demographic for BCE products. Twenty-five percent of consumers aged 50 and up are interested in purchasing an HDTV in the next year. More broadly, 43 percent of consumers surveyed over age 50 were planning to spend over $500 on consumer electronics in the next 12 months. These purchases are most likely to occur in stores and not online. Thirty percent of consumers over age 60 still exhibit discomfort in providing credit card information online.[116]

Consumer Attitudes toward Energy Efficiency

The consumer is the focal point of the BCE industry. According to various reports from Northwest Energy Efficiency Alliance (NEEA), Opinion Dynamics Corporation, and the Consortium for Energy Efficiency (CEE), efficiency is low in priority of the features and benefits

114 Ibid
115 Accenture. (2012). Always On, Always Connected: Finding Growth Opportunities in an Era of Hypermobile Consumers. Retrieved June 2013, from http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_EHT_Research_2012_Consumer_Technology_Report.pdf.
116 Ingraham, N. (2009, January 28). Security Fears, Not Confusion, Keep Older Consumers from Buying CE Online. Retrieved from https://blog.compete.com/2009/01/28/security-fears-not-confusion-keep-older-consumers-from-buying-ce-online/.

consumers are looking for in BCE products. Customers value the energy efficiency of TVs less than they do other product attributes such as size, resolution, and price.[117] As a result, sales associates often will show customers ENERGY STAR TVs, but will considerably less frequently discuss energy efficiency as an important attribute or even mention ENERGY STAR. Two studies cite that retailers do not think that efficiency is worthwhile to emphasize in sales pitches.[118]

Beyond TVs, other BCE products elicit negative reactions from customers in regard to energy efficiency. The aforementioned study finds that consumers believe that efficiency may limit PCs' quality and usability. In some cases, consumers see turning off one device as unattractive, because other devices depend on its being left on. One retailer interviewee added that, given that customers are usually focused on the processing power of a desktop PC, an efficiency message can actually deter the customer from purchasing an energy efficient model.[119]

Consumers respond in the same manner when surveyed about taking energy saving measures such as using power management settings on their computers and using devices to mitigate plug load into consideration. In a consumer survey, power management settings for displays were reported to be enabled in 68 percent of PC stations. As for plug load, 36 percent of telephone survey respondents were aware of advanced power strips, but only 11 percent could describe with accuracy the purpose of its functionality (to eliminate standby power loss).[120] Findings from several reports have concluded that consumers tend not to understand plug load management products and thus are hesitant to purchase them.[121]

While energy efficiency is not a primary purchase motivator for BCE products, consumers still consider it during their path to purchase. According to a study completed by the CEA, environmentally friendly attributes ranks 5th in importance at 57 percent behind price (87 percent), variety of features (76 percent), warranty (73 percent), and size (58 percent).[122]

BCE Product Policy

Public policy can also be an effective channel to drive energy efficiency in the BCE market. The areas of policy that can impact BCE efficiency include upcoming energy efficiency label and certification specifications, building energy codes and appliance standards, ratepayer energy efficiency programs, and international policy.

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117 Opinion Dynamics Corporation. (2010, November 1). The Market for Energy Efficient Electronics: Pre-Program findings on consumer perceptions and retail shelf stocking practices. Retrieved from http://neea.org/docs/reports/themarketforenergyefficientelectronics1cba99cd20561.pdf.

118 NMR Group, Inc. (2012, October 23). Massachusetts Consumer Electronics Potential Qualitative Research Study. Retrieved from http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2012/2012%20Residential%20Studies/MA%20Consumer%20Electronics%20Potential%20Qualitative%20Research%20Study%20FINAL%202012-10-23.pdf.

119 Ibid

120 Ibid

121 Ibid

122 Consumer Electronics Association. (2008, December 4). Going Green: An Examination of the Trend and What it Means to Consumers and the CE Industry. Retrieved from http://store.ce.org/Going-Green--An-Examination-of-the-Trend-and-What-it-Means-to-Consumers-and-the-CE-Industry_p_102.html

Updates to Energy Efficiency Label and Certification Specifications

ENERGY STAR has several new specification releases and updates scheduled that will impact the efficiency of a wide range of BCE products. Continual specification updates and revisions by ENERGY STAR decrease the number of certified products on the qualified product list. In the spring of 2013, specification updates for audio visual devices and televisions occurred within months of one and other. This is important to maintain the high levels of efficiency and performance that have come to be associated with the brand. Table 17 provides an overview of the specifications that are being revised or developed for BCE products under ENERGY STAR.

Table 17. Upcoming ENERGY STAR BCE Product Specifications[123],[124]

Product	Date of Revision or Update	Summary
AV	5/1/2013 Version 3.0	On mode requirements for Blu-Ray, and allowance for multiple networking and controls protocols.
Displays (Computing)	6/1/2013 Version 6.0 TBD Version 6.1	Switchable graphics, adders, power supply efficiency, workstation requirements, and thin clients and small-scale servers. Includes tablets in 6.1
Game Consoles	3/5/2013 Version 1.0	Establishes a baseline specification for game consoles that use less than 0.5 W when in standby, 40.0 W when in active navigation, and 50.0 W when in active streaming mode.
Imaging Equipment	1/1/2014 Version 2.0	Meet updated requirements for external power supplies, and digital front end or operation mode specifications.
STBs	TBD Version 4.1	Allowances for multi-room STBs and expands the menu of home networking capabilities.

All specifications are revisions except for game consoles. The game console program is a voluntary program that recognizes manufacturers who comply with the performance specification levels.

Updates to Codes and Standards

Building codes, product standards, and high performance building standards are another set of policy tools that impact BCE. Based on the research gathered, TVs, external power supplies, and battery chargers are the BCE products most commonly impacted by standards. These products are typically addressed through setting standards that enforce minimum energy performance. Plug load is most often impacted by building codes and standards. This

123 http://www.energystar.gov/products/specs/
124 http://www.energystar.gov/products/specs/

section outlines some of the recent policy updates in respect to energy codes, appliance standards, and regional energy planning.

Energy Codes

Building energy codes are designed to set minimum requirements for efficient design and construction in new and renovated commercial and residential buildings. Buildings are built to last, so a building built today will have an impact on energy use for the next 50 to 100 years or beyond. Once the building energy code has been set, there is an opportunity to advance these codes over time to make them more energy efficient and include additional provisions as technology advances.

Policies focused on building energy codes and high performance building standards complement, enhance, and ensure a better return on investment for energy efficiency programs.[125] While in the past, energy codes focused only on construction practices, the current and future codes may require that building inhabitants become active participants in reducing the energy consumption of their buildings by being cognizant of their surroundings.[126] This includes potential provisions for plug load from BCEs.

ASHRAE is a building technology society which sets the international model commercial energy code that is broadly adopted in states throughout the United States. ASHRAE 90.1-2010[127], their most recent commercial building standard, aims to reduce plug loads in commercial spaces for outlets supplying 125 volts by specifying that at least fifty percent of these outlets that serve private offices, open offices, and computer classrooms must be provided with automatic shutoff control. Buildings are encouraged to put parasitic loads (i.e., printers, chargers, heaters, etc.) on half of the outlets so they can be switched off with occupancy, as plug-in loads can account for 15 percent to 50 percent of a commercial building's electricity.[128] In order to continue eligibility for federal funding, the US Department of Energy (DOE) has requested that states file a certification that shows they will operate to ASHRAE 90.1 2010 standards in 2013, though they have two years before they need to enact those changes.[129]

On the residential front, plug load management is not currently included in existing codes or standards. The current residential code, 2012 IECC (International Energy Conservation Code), does not include a plug load provision. A draft version of a residential ASHRAE 90.2 is currently in development, with a target publication date of mid-2015. There is potential to include plug load as a provision in the next versions of these codes and standards. To reach the next level of performance, efficiency requirements must trickle down to building inhabitants and their behaviors. How people interact with the building and how process

125 More information at http://neep.org/Assets/uploads/files/public-policy/building-energy-codes/MPBEC_12-6-12_FINAL.pdf
126 Callan, D. (2013, January 23). The widely used energy standard reaches an inflection point that demands both efficient design and accountability from building inhabitants. Retrieved from http://www.csemag.com/single-article/ashrae-901-2010-sets-the-energy-standard/e9b5f53395ccb6bdceff841f79bfd407.html
127 Available from: https://www.ashrae.org/resources--publications/bookstore/standard-90-1
128 Ibid
129 Retrieved from: http://www.energycodes.gov/regulations/determinations

loads are handled in the building will all be crucial to the success of and compliance with ASHRAE 90.1-2010, and beyond.[130]

Appliance Standards

Policy efforts for BCE products at the state, federal, and international level all have the same common goal: to establish minimum efficiency standards for the most commonly used products. These minimum efficiency standards set a baseline level of efficiency that must be reached in order for a BCE product to be sold on the open market. Standards can have significant savings impacts as they often remove the least efficient products from the marketplace. In California, the leader in state appliance standards, the California Energy Commission (CEC)'s energy efficiency standards have, since 1975, saved consumers over $74 billion on their electricity bills.[131] An overview of enacted appliance standards, the rulemaking procedure that typically encompasses BCE products and standards in development is provided in Table 17.

130 Ibid
131 From CEC: http://www.energy.ca.gov/efficiency/savings.html

Table 17. Established and Upcoming State, Federal, and International Standards

BCE Product	State[132, 133]	Federal[134,135,136]	International[137,138,139,140]
AV Products	CA, CT^, OR	NA	NA
Battery Chargers/External Power Supplies	CA	Request for information^	Australia, Canada, China, European Commission^, Jordan^, Korea, New Zealand, Switzerland, Turkey
Computers	CA	NA	China, European Commission, Japan
STBs	CA^	Test Procedure*	Australia, China, European Commission, Israel, Jordan^, New Zealand, Switzerland, Turkey, Vietnam^
Televisions	CA, OR, CT^	Test Procedure*	Australia, Bangladesh^, Canada^, China, European Commission, Japan, Jordan^, Korea, New Zealand, Switzerland, Turkey, Vietnam^

^Potential rulemaking

***Upcoming action**

Voluntary Agreements

In addition to government-enacted codes and standards, there are also voluntary agreements into which industry can negotiate and elect to enter. These agreements can act as a substitute for codes and standards where industry and stakeholders agree on performance standards that can be obtained. This tool can be more cost-effective from a time-and-resources standpoint than regulation, especially when the product category is complex.

Set top boxes (STBs) are a good example of a product that could benefit from a voluntary agreement, as the role of the consumer, service provider, and manufacturer is different than for any other BCE product. Groups such as the National Cable and Telecommunications Association, CEA, service providers, and efficiency advocates have been interested in establishing a STB voluntary agreement. In 2012, industry members entered into an industry-only voluntary

132 Appliance Standards Awareness Project. (2012, March). Energy and Water Efficiency Standards Adopted and Pending by State. Retrieved from http://www.appliance-standards.org/sites/default/files/State_status_grid_MAR_2012_1.pdf.
133 Smart Electronics Initiative. (2013, March 26). California starts efficiency standards for computers and other electronics. Retrieved from http://smart-electronics.org/california-energy-commission-efficiency-standards.
134 Energy Conservation Program: Energy Conservation Standards for Battery Chargers and External Power Supplies; Proposed Rule. 77 FR 18478 (March 27, 2012).
135 Department of Energy. Appliance and Equipment Standards. Retrieved June 2013 from http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/34.
136 Energy Conservation Program: Test Procedures for Set-top Boxes. 78 FR 5075 (January 23, 2013).
137 If a different citation is not provided, all international regulations and standards were identified through: CLASP. Global Standards and Label Information. 2013. http://www.clasponline.org/Tools/Tools/SL_Search/SL_SearchResults/SL%20Detail%20Page?m=9fe973b0-ae91-43a6-ab97-80de23b9e3f2
138 http://oee.nrcan.gc.ca/regulations/17311
139 European Commission. (2012, July 12). Commission Staff Working Document: Establishment of the Working Plan 2012-2014 under the Ecodesign Directive. Retrieved from http://ec.europa.eu/enterprise/policies/sustainable-business/documents/eco-design/working-plan/files/comm-swd-2012-434-ecodesign_en.pdf.
140 Bangladesh Ministry of Power, Enegy and Mineral Resources. (2012, October 22). Energy Efficiency and Conservation Rules, Initial Draft. Retrieved from http://www.powerdivision.gov.bd/powerdivision/uploads/21.pdf.

agreement requiring 90 percent of STBs purchased and deployed after 2013 to meet ENERGY STAR version 3.0. Currently industry members and efficiency advocates are in the process of negotiating an agreement requiring efficiency commitments beyond ENERGY STAR version 3.0 to take effect at a later date. If a STB voluntary agreement is successful, such agreements could be a tool to influence other BCE products such as game consoles. NEEP would support a potential voluntary agreement between industry and efficiency advocates that establishes strong energy savings measures.

Northeast and Mid-Atlantic Energy Efficiency Program Planning and Policy

Table 18 is a review of the policy aspirations and challenges for Northeast and Mid-Atlantic states.[141] With the exception of Delaware, New Hampshire, and Pennsylvania, all states in NEEP's region mentioned efforts to influence consumer electronics policy (with varying degrees of commitment).

141 Table 18 includes consumer electronics-specific data from NEEP member states from their program plans.

Table 18. Regional BCE Program Planning

State	Policy or Program Activity
Connecticut	• Leverage TopTen USA to encourage consumers to purchase high efficiency consumer electronics and appliances.[142] • Work closely with NEEP to promote higher efficiency standards.[143]
Maine	• Raise awareness among end-users about the benefits and availability of energy efficient products, such as efficient power strips. • Provide financial incentives, likely aimed at upstream market actors, to encourage a market 'push' of energy efficient devices. • Look into adopting new energy efficiency standards; including those for television sets.[144]
Maryland[145]	• Review efforts and incentives to increase the energy efficiency of cable and satellite TV boxes.[146] • Look into providing higher incentives to higher efficiency offerings.
Massachusetts[147]	• Increase awareness of the benefits of buying or recycling ENERGY STAR products and to expand the availability and use of energy efficient electronics using incentives to increase sales and lower costs for consumers. • Promote more efficient products using CEE Tiers, ENERGY STAR Most Efficient and Top Ten.
New Jersey	• Consumer electronics are a part in leading overall demand growth and of interest to the state.[148]
New York	• Efficiency of BCE products remains a focus.[149]
Rhode Island	• Plan to continue to test new products and technologies as they enter the market (including entertainment system controls, smart TVs, and gaming systems). • Promote efficient cable boxes via RI cable provider.[150]
Vermont	• Promote and encourage the purchase of electronics through marketing, consumer rebates, and upstream support.[151] • Focus on BCEs because of their significant and growing impact on electricity use. • Will continue to engage retailers to increase sales of efficient electronics.

The majority of the Northeast and Mid-Atlantic states seem adamant about continuing to explore opportunities for BCE products through their efficiency programs by addressing plug load, marketing and education, and appliance standards through collaborative efforts.

142 CT 2013-2015 Electric and Natural Gas Conservation and Load Management Plan. (2012, November 1). Retrieved from http://www.ctenergyinfo.com/2013_2015_CLM%20PLAN_11_01_2012_FINAL.pdf.

143 Connecticut Department of Energy and Environmental Protection. (2013, February 19). CT 2013 Comprehensive Energy Strategy. Retrieved from http://www.ct.gov/deep/lib/deep/energy/cep/2013_ces_final.pdf.

144 Efficiency Maine Trust. (2010, April). Triennial Plan of the Efficiency Maine Trust, 2011-2013. http://www.efficiencymaine.com/docs/other/EMT_Final_Tri_Plan.pdf

145 Maryland did not approve the downstream consumer electronics incentives proposed for the purchase of high definition TVs, computer monitors, laptops and other electronic devices—incentives in the range of $5 to $30 were too low to influence consumer behavior in the purchase of high-priced electronic equipment.

146 Maryland Energy Administration. (2011, September 1). Recommendations for Enhancing Utility Energy Efficiency Program Performance: EmPOWER Maryland Plans for 2012 to 2014. Retrieved from http://webapp.psc.state.md.us/intranet/Reports/2012%20EmPower%20Maryland%20Report.pdf.

147 Three Year Energy Efficiency Program Plans, 2013-2015, p. 134-137.

148 State of New Jersey. (2011, December 6). 2011 New Jersey Energy Master Plan. Retrieved from http://nj.gov/emp/docs/pdf/2011_Final_Energy_Master_Plan.pdf.

149 NYSERDA. (2013, February 14). NYSERDA Energy Efficiency Portfolio Standard Program. Retrieved from www.nyserda.ny.gov/Energy-Data.../2012q4-nyserda-eepsii.pdf

150 Rhode Island Least Cost Procurement Plan, 2012-2014, p. 24.

151 Efficiency Vermont 2013 Annual Plan. (2012, November 1). Retrieved from http://www.efficiencyvermont.org/docs/about_efficiency_vermont/annual_plans/EVT-AnnualPlan2013.pdf.

BARRIERS TO ADVANCING BCE ENERGY EFFICIENCY

The previous sections of the report have outlined the current state of the BCE industry. This section will discuss the barriers to increasing energy efficiency adoption and decreasing energy consumption that exist within this product category. The identified barriers fall into four categories, each of which will be covered in depth within the following subsections. These categories include product and industry, program administration and evaluation, consumer, and policy barriers.

Product and Industry Barriers

A number of industry barriers present challenges towards achieving energy savings.

Rapid Technological Advancement

The BCE market moves very rapidly. Products have short lifecycles and new products and technologies can be released within just months of a previous edition. With this rapidly changing product mix and functionality mix, retailer and consumer demand also shifts constantly.

Utility programs often cannot move at the pace required to keep up with the BCE market and are not nimble enough to react to market changes and advancements. This makes it difficult to understand which efficient products will result in lasting savings and for which products programs should offer incentives.

In addition, the pace of the market makes it difficult for programs to influence product design, release, and distribution. Often, efficiency incentives are not finalized when manufacturers and retailers are making product decisions so, even if influence is possible, the incentive amounts are not taken into account. Existing BCE program evaluations found that, even though the necessary industry stakeholders were involved in energy efficiency qualification criteria, these communications often occurred after products had already been designed for the coming year.[152] There was not a direct or easily identifiable program influence or impact. This can make it difficult for programs to readily influence retailer and manufacturer buying decisions, thus complicating program attribution.

Focus on Functionality

The industry is focused on improving the functionality and operability of BCE products; energy efficiency is generally not a significant part of the development process. Though some inherently efficient considerations are made, such as longer battery life, those decisions are framed with more focus on improving the consumer experience and less focus on reducing product plug loads.

152 Opinion Dynamics Corporation. (2010, November 1). The Market for Energy Efficient Electronics: Pre-Program findings on consumer perceptions and retail shelf stocking practices. Retrieved from http://neea.org/docs/reports/themarketforenergyefficientelectronics1cba99cd20561.pdf.

Limited Number of Players

A limited number of key players manufactur and sell in many product categories (e.g., game consoles, set-top boxes). With products like these, manufacturers have found their niche and have released a product that meets a certain market demand, or has a foothold in the market due to certain qualities or characteristics. For example, Xbox and Wii are inherently different by offering different games and play experience and relying on different operating systems. Wii users will not easily switch to Xbox and vice versa. Even though Wii is more efficient than Xbox, PAs are limited in the type of energy efficiency program intervention that they can pursue because, if they were to promote an efficient game console, they would be promoting only one product released by one manufacturer to a consumer that was not likely to purchase the other inefficient product (in this case, the Xbox) anyway. That would lead to freeridership concerns. It also would violate PAs' ability to "fairly" distribute ratepayer funds.

Converging Products

The Emerging Trends section discussed the rapid and continued expansion of the functionality of BCE products. There are now many devices that can complete multiple activities while previously most devices had been able to complete only one function. For example, a game console plays DVDs, streams TV shows, and plays the radio. Just a few years ago, a consumer would have needed a cable box, a DVD player, and a radio to perform these activities. This convergence makes it challenging to document, benchmark, and understand product energy usage and performance trends, since the baseline for products that are converging is unclear.

In addition to complicating program design and development, product overlap and convergence complicates standard, specification, and labeling development. A phablet[153], a product that has recently evolved, is the convergence of a tablet and a phone. Currently, it is unclear whether phablets are taking market share from phones or tablets or neither. As a result, a proper baseline cannot be established. Tablets will be covered under the ENERGY STAR 6.1 specification for computing devices, but smartphones are not currently specified. Determining what products converging technologies should be compared to will be an ongoing and shifting challenge.

Lack of Uniformity

While many PAs in the Northeast and Mid-Atlantic communicate regularly regarding their BCE programs, the programs are typically implemented individually or by state with the exception of a few "consortia" that work with a region to implement programs. This is challenging and time consuming for retailers and manufacturers who must coordinate with many individual utilities and has resulted in lower participation in energy efficiency programs. PG&E, SCE, SDG&E, NEEA, SMUD, and Nevada Power do collaborate on a BCE initiative, an approach that has enabled them to effectively work with many national retailers and

153 A small tablet that also functions as a phone.

manufacturers and represent a sizeable portion of the U.S. population. However, consortia are the minority and, in order to increase the influence of energy efficiency, it is important to collaborate across the industry and combine efforts to affect change. The Retail Action Council, which is a recently established group consisting of retail partners, ENERGY STAR, and efficiency program implementers that work closely to align efficiency efforts, is a good example of collaboration.

Program Administrator Barriers

In addition to inherent industry and consumer behavior barriers, additional barriers that complicate the delivery of energy efficiency programs for PAs are as follows:

Diminishing Per-Unit Energy Savings

For a time, there was a notable difference in energy consumption between the available efficient television models and the available inefficient television models. This discrepancy presented a large energy savings opportunity for many programs throughout the country because consumers would save measureable amounts of energy by purchasing the efficient TV. Today, the most energy efficient BCE products available at retail are only slightly more efficient than competing products. The minimal energy consumption difference between the energy efficient product and the baseline product leads to smaller energy savings available for energy efficiency PAs and less opportunity for cost-effective program design.

Historically, TVs have generated the majority of energy savings for BCE programs. The decreased energy savings margins have reduced the energy savings opportunity traditionally present with TVs, leading to the need to shift BCE program focus to other products and strategies. Meanwhile, there is no "next TV" (a widget to replace the energy savings generating capability of the TV) because the many of the efficient and inefficient BCE products on the market consume similar amounts of energy, or the products are too nuanced for a straightforward program. This makes BCE products less well-suited for energy efficiency rebate programs from a cost-effectiveness standpoint, therefore complicating PAs' ability to pursue energy efficiency programs within this product category, or requiring innovative implementation strategies.

Uncertainty with Behavior-Related Energy Savings

Behavior-related energy programs (power management, APS, or connected home/home energy management) are a potential energy efficiency opportunity since many of the devices that are now available within the connected home can help consumers manage their energy consumption. With these behavior-based programs, claimed energy savings result from changes in consumer behavior.

Multiple complications arise with this model. Behavior-based savings are not as concrete as specific product savings and are the result of consumers' decreasing energy consumption by

using less of a product or using a product differently. PAs encounter challenges when quantifying savings from and assigning attribution for behavior-based programs. A consistent evaluation, measurement, and verification (EM&V) model has also not yet been developed for these types of programs where behavior savings can be applied to specific actions or product categories.

Inability to Attribute Energy Savings to Programs

BCE programs encounter a number of EM&V challenges. It has been difficult to characterize program influence in order to properly assign attribution. As these programs intend to change retailers' stocking, buying, and selling patterns—not to directly target the end consumer—the traditional EM&V model cannot be used with these programs.[154] As a result, the industry is developing new models to evaluate program energy savings, but consensus about a fair and defensible approach has not been reached.

While programs may have influenced retailer decisions and purchasing patterns, EM&V assessments have proven that it is not possible to definitively say there is a solid link between BCE programs and the increase in energy efficiency products on the market. Anecdotal evidence confirms that programs did influence retailers to consider energy efficiency criteria during assortment decision-making. However, EM&V reports have also stated that retailer decisions were influenced by many other factors, including the complexity of the assortment decision-making process and the importance of product assortment and sales to retailers' financial success, which have complicated assigning (and quantifying) program attribution.[155]

Challenge of Promoting Multiple Certifications and Specifications

When choosing energy efficient equipment, consumers may be confused because the information they receive is conflicting or too complex to understand. When attempting to understand product capabilities, consumers often state that sales associates are unhelpful. Though training of sales associates is in place or has been attempted, it is not easy for retailers or PAs to train associates about the nuances of the programs and create lasting impressions due to high retail sales associate turnover rates. Also, efficiency is often not a focus for sales associates when making a BCE sale. As a result, consumers often have to rely on in-store signage for information about each BCE product. Unfortunately, because of the myriad signs, stickers, and general point-of-purchase (POP) information, consumers are bombarded with unfamiliar messaging from many different entities (e.g., manufacturer sales, retailer information, and PA POP).

Consumer Barriers

When consumers are thinking about purchasing BCE products, they generally do not consider energy efficiency. Overall, consumers are less inclined to purchase energy efficient

154 Traditional EM&V approaches are described here: http://www.nrel.gov/docs/fy02osti/31505.pdf
155 KEMA, (2013, April 15). Impact Evaluation Report: Business and Consumer Electronics Program.

products if they cost more than standard efficiency products in the same category.[156] Lack of awareness and understanding, and the importance placed on product functionality, are barriers for BCE programs.

Lack of Awareness

Consumers do not always understand what benefits energy efficient products provide or, sometimes, even that there is an energy efficient option when considering BCE product purchases. Since efficiency benefits are not understood, the opportunity to entice consumers with energy efficiency benefits is not maximized. Even if consumers become aware of efficiency during their buying process, they are still confused about the performance of efficient products; there is often a pre-existing notion that performance will be sacrificed if an efficient device is chosen. Studies have shown that energy efficiency elicits negative reactions from customers, as some consumers believe that efficiency may limit quality and usability.

Efficiency is Not a Priority

Consumer research has shown that consumers value efficiency less than they value other aspects of their consumer electronics products such as functionality, price, and resolution (for products with a display).[157] While many consumers today consider the energy consumption of major appliances during the purchase cycle, this consideration has not spread to BCE products. Hypotheses for this lack of consideration include the lower per-unit energy consumption of electronics compared to appliances, or consumers' attitudes that their electronics are for entertainment purposes so they think more frivolously about the purchase.

BCE Product Purchase Complexity

The consumer path to purchase is highly varied because consumers use many different information sources to research BCE products. Many consumers complete research on the internet prior to purchasing a product in the store, while others visit the store via "showrooming" before making a purchasing decision in another location (either in another retail store or online). As a result, influencing a customer's purchasing decision has become much more challenging and complex. As such, the marketing approach required is more complex for this product category, with limited understanding of the benefits that emerge.

Limited Retirement

Even though products are coming onto the market rapidly, there is evidence that products do not leave the market as quickly. One market research firm found that, on average, U.S. consumers planning to purchase a television in 2012 planned to replace a television that was

156 NMR Group, Inc. (2012, October 23). Massachusetts Consumer Electronics Potential Qualitative Research Study. Retrieved from http://www.ma-eeac.org/Docs/8.1_EMV%20Page/2012/2012%20Residential%20Studies/MA%20Consumer%20Electronics%20Potential%20Qualitative%20Research%20Study%20FINAL%202012-10-23.pdf.

157 Opinion Dynamics Corporation. (2010, November 1). The Market for Energy Efficient Electronics: Pre-Program findings on consumer perceptions and retail shelf stocking practices. Retrieved from http://neea.org/docs/reports/themarketforenergyefficientelectronics1cba99cd20561.pdf.

6.1 years old, down from an average age of 7.2 in 2011.[158] The older unit typically ends up in a spare room or with a relative in their home so although these products are being replaced, they are not being retired and removed from the electric grid.

Policy Barriers

Innovation is a key driver of BCE product development and consumption. Policy is powerful, and while sometimes acting to spur innovation, at other times there are significant barriers that inhibit the effectiveness of policy tools in furthering energy efficiency enhancements for BCE products.

Short Product Lifecycle Makes Policy Actions Challenging[159]

Short product lifecycle limits the effectiveness of the energy efficiency certifications and labels. By the time new specifications have been released and qualified-BCE product lists are updated, the market has already released the next wave of efficient products. Organizations that oversee energy efficiency certifications and labels make every effort to stay ahead of the curve, but the pace of innovation makes it extremely difficult for them to identify and label the most current, energy efficient BCE products in the market.

The high market penetration of ENERGY STAR-certified devices is an example of this barrier. Although specifications seem to go through constant updates, penetration remains extremely high given how fast manufacturers can make adjustments to their production practices to meet specifications.

Industry Resistance

The BCE industry does collaborate with energy efficiency advocates on voluntary programs to make sustainable change, but has historically been opposed to energy efficiency regulation. Industry believes regulation sets restrictions on what they can produce and sell, stifling innovation. This perspective is counter to energy efficiency advocates and policy experts, who believe regulation drives innovation by weeding the most inefficient products from the marketplace and allowing the market to continually evolve. Common understanding of goals among energy efficiency advocates and the BCE industry could help overcome these issues.

Federal Preemption

Federal rulemakings preempt state-level standards—a situation that could potentially deter states from developing BCE product standards. Federal rulemaking procedures typically take up to five years to complete, given the structure of the federal process. States would perceive limited benefit in developing a state standard in the event that it was preempted by a federal standard, because of the cost and time that would have been invested.

158 http://www.displaysearch.com/cps/rde/xchg/displaysearch/hs.xsl/index.asp
159 The product lifecycle challenge was addressed in the Product Barriers section.

OPPORTUNITIES TO REDUCE ENERGY USE

Based on the research and analysis performed in the market assessment and the identified barriers, we have identified several strategies to help the Northeast Mid-Atlantic region stay a leader in BCE energy efficiency. As previously noted, BCE products have a very fast life cycle. Product development and distribution does not factor in energy efficiency unless it is inherent in technological improvements (e.g., reduced production costs using a cheaper component that happens to have a higher efficiency level), mandated by policy, or enticed through financial incentives. Holistically, BCE product efficiency has increased for the majority of product segments, but further action is needed to maintain efficiency gains, influence efficiency of existing yet inefficient segments, and maximize the efficiency of BCE products that have yet to be developed. While barriers are inherent to this product category, many opportunities still exist for advancing energy efficient BCE products. We have developed strategies that will help surmount the challenges discussed and have the highest likelihood of successful implementation.

These strategies are outlined in the following four sections:

1. Advance Product Efficiency
2. Expand Program Administration Efforts
3. Innovate through Marketing and Outreach
4. Drive Change through Policy and Collaboration

Each section includes a table of opportunities, which includes recommended tactics categorized based on the need for collaboration, ease of implementation, and length of time to achieve the tactic. Tactics with a short timeframe could be implemented within nine months. Those with a medium timeframe could be implemented in nine months to two years; those with a long timeframe in more than two years.

Opportunities and Strategies: Advance Product Efficiency

This section addresses the importance of shifting use from inefficient or less-efficient products to the more-efficient options. Widget-based energy efficiency opportunities for BCE products available through the market are provided in Table 19. The potential for incremental savings from efficient purchases is based on savings estimates provided in previous sections. The table also highlights whether energy savings can be achieved from each product by connecting it to controls such as an APS. The potential for energy savings drove the product market transformation strategies in Table 20.

Table 19. Market Transformation Opportunity for BCE Products

BCE Product	Efficiency Market Channel Target	Potential for Incremental Savings from Efficient Purchases	Potential for Plug Load Savings (through controls)*
Content (STBs and Network-Enabled Streaming Devices)	Service Provider and Retailer	High	High
Gaming	Manufacturer	Moderate	Moderate
Television	Retailer and Manufacturer	Low	Moderate
Computing	Retailer and Manufacturer	Moderate	Low to Moderate
Components	Retailer and Manufacturer	Low	--
Audio Visual (A/V) Devices	Retailer	Low	Moderate
Office Imaging	Retailer and Manufacturer	Low	Low
Mobile	Manufacturer	--	--

***Controls refers to APS or Home Automation – BCE products that are capable of controlling others.**

We feel that content (STB/DMRs), game consoles, use of advanced power strips, and TVs currently offer the greatest opportunity for product energy efficiency improvements. AV devices, office imaging, components, and mobile devices do not present as much opportunity for product-level savings and are not be the focus of these recommendations. Potential savings from computing are available through program approaches and are covered in the Expand Program Administration section.

Table 20. Energy Savings Strategy Potential – Product Approaches

Strategy	Collaboration Needs	Complexity of Implementation	Timeline Required
PAs partner with service providers to increase the penetration of multi-room and thin client configurations	High	High	Medium
PAs offer incentives for consumers to trade out multi-room STB configurations for thin clients	Low	Low	Medium
Efficiency advocates encourage consumers to move to Digital Media Receivers (DMRs)	Low	Moderate	Medium
Efficiency advocates impact game console efficiency	Moderate	Moderate	Medium
PAs increase the installation of APS through a direct install program	Low	Low	Short
PAs support APS products that can reduce energy consumption in idle or active waste mode (Tier 2 products)	Low	Low	Short
Coordinated efforts to educate consumers about proper use of APS and product settings	Low	Low	Short
PAs ensure that all cost-effective savings have been achieved from TVs	Moderate	Low	Short
PAs limit TV support to certain screen sizes	Moderate	Low	Short
PAs support smart TVs and OLEDs	Moderate	Low	Short

Extract the STB Savings

Since we feel that STBs offer the greatest potential for product-level energy savings potential, we have presented a range of opportunities and recommendations to help achieve those savings.

Target the Service Provider

Recommendation: PAs partner with service providers to increase the penetration of multi-room and thin client configurations.

Service providers control the development, purchase, and distribution of the STB market and are therefore the entities that must be influenced in order to drive energy savings in this product category. Energy savings could be achieved by increasing the penetration of multi-room and gateway-thin client configurations, which would remove existing STBs from homes and limit future STB penetration. Nine out of 11 service providers have the capability of providing multi-room and gateway devices to consumers. PAs must work together to create a sizeable enough market that would gain the attention of service providers. To start, PAs can engage with smaller, regional service providers who may be more susceptible to localized efforts, or may be more nimble in their product deployment. There are several opportunities and angles to working with service providers, and multiple options are outlined below.

One strategy would be for the service provider to offer a solution for the consumer that would allow them to bypass the need to use additional STBs in other rooms. As was discussed in previous sections, the energy savings potential is dependent upon how many HD or SD STBs are being replaced, but it could be as high as 440 kWh with the replacement of three existing STBs. It could be piloted as a full-scale program with financial incentives that subsidize the incremental cost the service provider is paying for the multi-room, gateway, or thin client STBs.

Another strategy could take advantage of the fact that service providers regularly update their hardware as new products and configurations become available to consumers. Efficiency programs could offer incentives for the installation of new, advanced STB hardware (which includes multi-room and gateway-thin client configurations) when an upgrade option is available.

Another option could be to leverage marketing opportunities to increase awareness of the energy consumption, ultimately leading to increased demand from consumers for more-efficient products. This strategy will work only if PAs are able to work collaboratively with service providers; otherwise, the relationship may be strained and future opportunities for collaboration could be minimized. Regional Energy Efficiency Organizations such as NEEP can help coordinate these types of efforts.

Finally, a long-term opportunity could exist to engage the regulators of the cable industry to promote efficiency and thin client availability as a priority. For these strategies, evaluators could use traditional methods of evaluating the difference in energy use of the new devices and basic STBs (that would have been installed without PA intervention).
While consumers have more options because of product convergence (the support of streaming technology by cable, satellite, and Internet service providers) and a slight expansion of the players in the market, consumers still do not widely understand their options or the energy costs and costs of ownership associated with receiving content from service providers.

Target the Consumer

Recommendation: PAs offer incentives for consumers to trade out second- and third-room STB configurations for thin client and multi-room configurations.

Market research has shown that second and third TVs are used in ancillary rooms in homes. Generally, these rooms also have an STB (which is drawing power continuously) that, like the TV, may be used infrequently. Multi-room configuration can be used to reduce household STB energy consumption. Encouraging consumers to trade out second- and third-room STBs for thin clients could lead to claimable energy savings.

To have a defensible program, data that supports that consumers are moving to a more efficient configuration would be necessary to ensure that additional load is not being added to the home's profile. This could include a copy of a turn-in receipt showing the consumer returning the old STB. With this approach, the PAs could develop tiered incentives based on what the consumer turns in (e.g., $20 for an HD non-DVR STB, or $50 for an HD DVR STB). Given the need for documentation, there may be a need for PAs to coordinate with the service provider to obtain information confirming a retrofit.[160] This might lead to a program directed at the service provider, rather than the end customer, and PAs should be open to discussing program design with service providers.

Product performance and functionality would not be compromised by this change. It would be important to impart to consumers that the quality of their service would not decrease. The messaging could include energy saving benefits, but could also include the technological benefits that would be seen from converting from a traditional STB to a multi-room or thin client device.

The annual savings potential on a per-unit basis is between 70 and 230 kWh.

Recommendation: Efficiency advocates encourage consumers to move to Digital Media Receivers (DMRs).

The BCE product with the largest forecasted growth (44 percent) over the next three years is the DMR. These "over the top" devices have the ability to stream media directly from the internet to a television. ENERGY STAR-certified DMRs consume just 20 kWh annually.[161]

The energy savings for this BCE product category exist not by promoting the use of a more energy efficient DMR over an inefficient one, but by convincing the consumer to "cut the cord" and cancel cable subscriptions, thereby removing the traditional STB from the grid. The trend of DMRs being selected over STBs is well established, and as more mainstream and additional content is available on DMRs, the number of pay-TV subscribers using a tra-

160 Further research is needed to assess what the consumer would receive from the service provider if they opted for a more efficient configuration.

161 Independent analysis using the ENERGY STAR STB Qualified Product List

ditional set-top box will decline.[162] Educating consumers and intervening at the consumer preference level to push forward this efficient trend would be a potential role for efficiency advocates. If DMR adoption becomes more widespread, it may eventually become possible for PAs to incentivize such efficient products (with the approval of regulatory agencies).

Impact Gaming Console Efficiency

Recommendation: Efficiency advocates collaborate with game console manufacturers to encourage improved console efficiency and adoption of the ENERGY STAR recognition for Game Consoles.

Game consoles present a great opportunity to impact energy efficiency and the existing ENERGY STAR recognition criteria is a powerful tool. It is likely that technological improvements will be made during the product development phase, so it is important to try to engage manufacturers and bring efficiency, such as using solid state drives rather than electro-mechanical hard drives, into the conversation.

The first step would be to meet with industry experts to understand the potential and any barriers to adopting the ENERGY STAR recognition. This effort could also involve conducting collaborative research about how game console efficiency can be profitably improved to present manufacturers with an enticing case. Groups such as NEEP and NRDC can work through these potential barriers in collaboration with ENERGY STAR.

Beyond policy advocacy, NEEP can play a role in educating consumers on the amount of energy their game consoles use when idle. While awareness of the energy consumption has increased following the NRDC report described in the market assessment, a creative social media marketing campaign could increase awareness for the mass market. Demonstrating consumer support for game console efficiency could be used to leverage conversations with manufacturers.

These strategies can begin immediately with industry-level conversations. Since game consoles usually have multiple iterations, if ENERGY STAR recognition is not feasible for the upcoming product releases (e.g., the upcoming launch of Xbox One and PlayStation 4)[163], there may be opportunity to influence the second or third iteration of game consoles. For example, both Sony and Microsoft made several updates to the last generation game console prior to launching the most recent generation. Ultimately, if the ENERGY STAR recognition is adopted by manufacturers, it may be possible for PAs to claim savings on game consoles (with the approval of regulatory agencies).

162 Keough, B. (2013, May 28). As many drop their cable provider in favor of streaming, is cutting the cord worth it? Retrieved from http://www.usatoday.com/story/tech/2013/05/28/reviewed-cut-the-cord-tv/2156677/.
163 Microsoft's and Sony's next generation of game consoles is estimated to enter the market November 2013.

Aggressively Focus on Savings from Advanced Power Strips

Recommendation: PAs increase the installation of APS through a direct install program.

Research from a recent study indicates that less than 5 percent of consumers have APSs and use them correctly.[164] While some Northeast Mid-Atlantic PAs currently implement APS programs, program penetration is relatively low. Since there are energy savings to be achieved within this category, it is important for PAs to continue implementing existing APS programs and for PAs without existing programs to considering the potential available with APS. NEEP has convened an APS Working Group to help new and existing APS programs operate successfully. The Working Group has several products, including a forthcoming APS Testing Protocol document to help programs decide which products to promote.

Programs should be structured to allow PAs to confidently claim energy savings from technologies in idle, sleep, and off modes by maximizing the installation rate of these products. This could be facilitated through a direct install or home audit program. West coast utilities have begun to experiment with this model by using the retailer's home installation teams (such as those at Sears Blue Crew and Best Buy Geek Squad) to conduct the home audit during an already-scheduled site visit. This model is still in an experimental phase where utilities are trying to understand how to best structure incentives to retailers and consumers and what type of in-home quick efficiency upgrades can be completed (computer power management settings, installation of APS, etc.).

This program implementation strategy would document product installation and could allow PAs to collect information about connected BCE products. Collecting this information would help to build a load profile to estimate savings. To obtain primary data to help determine energy savings, PAs could install meters on installed devices to track realized savings as well as work to collect pre-APS data or using a control group. Ultimately, we think the Northeast Mid-Atlantic region could achieve a 20 percent penetration rate of APS by 2020.

Recommendation: PAs support APS products that can reduce energy consumption in idle or active waste mode (Tier 2 products).

PAs have been mostly concerned with addressing power consumption for BCE products when they are off, and now should begin to address active power waste to achieve greater energy savings. Tier 1 APS technology can impact only two of the four power modes BCE products use (sleep and off mode). Tier 2 technology exists that is capable of impacting idle or active waste mode, which accounts for nearly 17 percent of total annual BCE product energy consumption.

164 NMR Group, Inc. (2012, October 23). Massachusetts Consumer Electronics Potential Qualitative Research Study. Retrieved from http://www.maeeac.org/Docs/8.1_EMV%20Page/2012/2012%20Residential%20Studies/MA%20Consumer%20Electronics%20Potential%20Qualitative%20Research%20Study%20FINAL%202012-10-23.pdf.

Adding technology that can mitigate idle mode power to qualified product lists is necessary to achieve greater savings. PAs should regard the Tier 1 APS as a first-generation plug load technology. PAs may need to pilot this technology to determine a range of savings that can be claimed in the service territory; however, the range of savings should be significantly higher than a standard APS given the different product functionalities. Additional studies may be necessary to understand the full savings potential of Tier 2 products and the EM&V Forum at NEEP may be an appropriate place for regional research. NEEP's APS Working Group has a forthcoming APS Testing Protocol that can help programs assess which products (Tier 1 or Tier 2) should be included in programs.

Recommendation: Coordinated efforts to educate consumers about proper use of APS and product settings that can save energy.

Many BCE technologies present an educational opportunity that could be addressed by adding an educational component to an APS program. PAs can work with consumers to help them mitigate idle-, sleep-, and off-mode power draws by enabling certain settings on their devices and encouraging the use of an APS. If PAs were to pursue a direct install program, this education could occur while PAs are installing APS in consumers' homes. There are also opportunities to increase training of retailers and floor staff on how to educate consumers on APS and proper installation. There could exist a potential role for ENERGY STAR to help develop consistent educational materials regarding APS, and perhaps roles for efficiency advocates to promote these materials through a social media campaign.

Continue TV Promotions with New Technological Advances

Recommendation: PAs ensure that all cost-effective savings have been achieved from TVs.

Television efficiency has increased over the past five years with support from the ENERGY STAR program, PAs, energy efficiency advocates, retailers, and manufacturers. Even though many of the TVs manufactured today comply with high efficiency certifications and labels, it does not necessarily mean that the consumer only has access to the highly efficient product when making a purchase. It is important to understand the market saturation of efficient TVs, not just the efficiency level of TVs in production.

In general, there may be an opportunity to sell energy efficient TVs in a number of states in which the market penetration may be lower. For instance, in Vermont, more than 50 percent of homes still have CRT TVs. It is likely that these consumers will consider purchasing a new TV and PAs can help consumers prioritize efficiency when shopping for new TVs by continuing to promote and rebate this efficient product.[165] Therefore, until deeper efficient TV saturation has been reached, PAs should continue to run TV incentive programs. Greater energy savings can be claimed by using stricter efficiency criteria such as TopTen USA or ENERGY STAR Most Efficient.

165 Panel discussion with Lara Bonn, Efficiency Vermont, NEEP Regional Summit.

Recommendation: PAs limit TV support to certain screen sizes.

If PAs continue to support television programs, it is recommended that they limit their support to specific screen sizes in an upstream or midstream program approach. As shown in analysis earlier in this report, larger TV screen sizes offer a greater energy savings opportunity than smaller screen sizes and larger TVs are preferred by consumers. While small TVs use less energy than larger TVs, it is unlikely that PAs will be able to play a role in encouraging consumers to adopt a smaller TV. As discussed in previous sections, energy consumption ranks low in terms of priorities for purchasing a new electronic product. It is important to understand that the remaining savings that can be generated from TVs will not approach what has been customary with the midstream TV program that many PAs are considering eliminating. Freeridership should always be considered for programs targeted toward TVs.

Recommendation: PAs support smart TVs and OLEDs.

There may be opportunities for programs to increase support of smart TVs and OLEDs. At of the end of 2012, 26 percent of TVs purchased were internet-enabled.[166] Access to streaming content could limit the use of STBs for consumers, especially with the advent of the RVU Alliance and other groups that are popularizing technology that does not include the STB as the receiving service. If the increased use of smart TVs limits the use of STBs, this could reduce the total BCE load from the home.

OLEDs are the most efficient television product in market, at the time of this report. These products are very expensive right now, but once prices drop, there may be an opportunity to create incentive programs around this product. OLEDs have similar functionality to the inefficient plasma TVs, so programs focusing on replacing plasma with OLED TVs may have a more receptive audience motivated by the additional features both technologies offer. As OLEDs become more cost-effective for programs, PAs should actively support OLED TVs.

Opportunities and Strategies: Expand Program Administration Efforts

A number of program design opportunities may generate energy savings for existing PA programs. While the existing midstream model has limited remaining energy savings potential, it is important to exhaust that potential and work to pursue savings from alternate approaches.

166 Ibid

Table 21. Energy Savings Strategy Potential – Program Administration Approach

Strategy	Collaboration Needs	Complexity of Implementation	Timeline Required
PAs implement short-term incentive programs	Low	Moderate	Short
PAs create an electronics recycling program	Low	Moderate	Medium
C&I PAs pursue computer monitor and desktop programs for commercial customers.	Low	Moderate	Medium
PAs utilize load disaggregation to implement behavior-based programs	Low	High	Medium
PAs explore new incentive models based directly on energy reductions	Moderate	High	Long
PAs pursue incentive programs that encourage service providers to increase home energy management services	Low	Moderate	Long
PAs provide incentives for individual home energy management products	Low	Moderate	Long
PAs pursue incentives for demand-response-enabled products	Low	Moderate	Long
Regional coordination to conduct studies on smart device energy consumption impacts and coordinate with ENERGY STAR	Moderate	Low	Medium

Consider Short-Term Incentive Programs

Recommendation: PAs implement incentive programs that target the sale of efficient products for a brief period of time.

During large sales periods, such as Black Friday and tax holidays, price is one of the main purchase motivators of customers. These periods result in inefficient BCE products entering the market at the expense of more energy efficient products. PAs could consider a short-term incentive program to offset inefficient BCE products from entering retail.

Short-term incentive programs could further enforce the presence of energy efficient BCE products during these days when purchases are highest and product assortment is likely to be less efficient. The short-term programs could potentially have a greater impact than year-long programs if implemented during peak sales periods. A BCE product that could be considered for these short bursts is the highly efficient large screen TV.

If this strategy is pursued, it is important to remember that Black Friday is a very critical sales day for retailers and PAs should expect to have limited cooperation from retailers (including limited POP and marketing opportunities through traditional retailer channels). Cyber Monday is also a critical time for retailers. Conversations about the possibility of short-term programs during peak sale periods should begin well in advance of those days.

Recycle Old BCEs

Recommendation: PAs create an electronics recycling program.

As new BCE products are purchased, the old BCE products often are placed in another room of the house, are given away second-hand to family members or friends, or are sold on the resale market. Pursuing recycling and bounty programs to remove old, inefficient BCE products from circulation is a potential strategy that Northeast Mid-Atlantic PAs can pursue. Infrastructure and program design models for BCE recycling or bounty programs exist. Programs can be modeled after refrigerator replacement programs and potentially leverage and expand existing infrastructure, such as the Second Refrigerator Replacement program in Vermont. NEEP could help develop BCE product guidelines (e.g., age, size).

With this program model, PAs facilitate the removal of old, inefficient BCE products from circulation and the secondary market. CRT TVs, old stereo receivers, and other products with higher power draw, or older products that do not have four power consumption modes could be removed from the market. The savings are smaller with electronics recycling than with refrigerators, because BCE products are not running constantly, but savings do still exist. Further research is necessary to determine which BCE product categories and sizes could be cost-effective from a programming perspective.

PAs could also subsidize electronics recycling events or collection points as a limited way to claim further savings. Potential partnerships with groups such as the Electronics Take Back Coalition exist.

Engage Decision Makers in Commercial Buildings

Recommendation: C&I PAs pursue computer monitor and desktop programs for commercial customers.

Our analysis showed that 68 percent of desktop computers are sold to commercial consumers. This market should be engaged separately through commercial programs to ensure computer desktops and computer monitors that have high efficiency certification and labels are being purchased and optimized once installed, through training programs on power management, brightness, and other energy efficiency settings that can be enacted.

Per-unit financial incentives could be provided to entice large purchases. Large private institutions (not public due to the prevalence of pre-existing procurement support for energy efficient computers) should be targeted to make the greatest gains in efficiency.

Pilot Behavior-Based Programs

Recommendation: PAs utilize load disaggregation to implement behavior-based programs.

Load disaggregation has become a hot topic for many energy efficiency programs, although implementation of programs is still relatively small.[167] Plotwatt and Bidgely are two start-up companies who are creating load disaggregation software. While not its initial focus, OPower's capabilities have also grown in this category as their energy consumption dataset has grown. Belkin is also developing product capabilities in this area.

These software-based technologies review customer energy consumption and are able to provide substantial insight into customer behavior and the way energy is consumed on an individual basis. Load disaggregation can increase the understanding of what end-uses are actually in the home and how much they are consuming. This type of technology can provide perspective about consumer behavior and if the data is broken out further, it can be used to track nuances and changes.

Northeast Mid-Atlantic PAs with existing BCE programs are encouraged to pilot load disaggregation programs. If these technologies are deployed, they may be able to more accurately assess the load impact of a BCE program. In some instances, savings can be claimed through behavior changes due to access to the information that this technology provides. A recommended first step is to reach out to software companies and manufacturers to learn more about the technology and jointly discuss how it can be used.

Recommendation: PAs explore new incentive models based directly on energy reductions.

Providing pay-for-performance rebates are viable options within this product category. Providing monthly, quarterly, or annual incentives based on energy consumption reduction over time, which can be verified through connected home or connected device platforms, can generate energy savings. This type of rebate program directed at the residential customer would be new, but the concept is based on commercial efficiency programs, many of which provide a calculated incentive based on actual energy savings, rather than a deemed incentive based on assumptions. This model could be applied to residential customers, as more readily accessible data will make it easier to verify energy reductions.

While C&I programs have already used a calculated incentive model, new opportunities exist due to increased information and analytics. The latest ASHRAE 90.1-2010 standards require that 50 percent of outlets must be automatic power receptacles, which enable remote control of products. This will allow facilities managers to remotely program devices to go off when people are not in an office. PAs with existing C&I programs should explore appropriate opportunities to collaborate and trial new technologies with commercial building owners.

167 OPower is now in over 80+ utilities, but their primary product is the neighbor comparison report. They continue to grow their product suite new features and functionality providing deeper insight into end uses.

Increase Adoption of Home Energy Management Services and Devices

Recommendation: PAs pursue incentive programs that encourage service providers to include home energy management services at a discounted price in their home automation packages.

Northeast and Mid-Atlantic efficiency programs could coordinate with service providers, such as cable companies, to provide incentives to increase adoption rate of home energy management services. While most major players are now providing some home energy management services, adoption rates remain low. Within the home automation and connected home concepts is the potential to unearth a whole new category of energy efficiency-savings opportunities. As the connected home could become a large part of consumers' lives, it is important that PAs collaborate with the industry to help to fully understand these trends and integrate them into program design. Smart products can also provide verification of energy savings, which will help to mitigate EM&V challenges.

Given the uncertainty around energy savings from home energy management, it is recommended to pursue pilots with the service providers that can continue forward into a full program if predetermined energy savings goals are met. Service providers should be open to designing a pilot, because they will benefit from being able to include verified cost savings in their advertisements.

Recommendation: PAs provide incentives for individual home energy management products.

PAs can motivate consumers to adopt single smart product devices that provide energy savings. Certain opportunities exist to provide rebates and incentives for single devices within the smart products market (e.g., rebates/incentives for: Nest, Iris, Ecofactor, Honeywell and OPower devices; smart plugs; in home displays). These devices are available in retail stores (and also through service provider bundled packages) and PAs can leverage existing retailer relationships to place POP or provide training for sales associates on rebate information. Similar to programs that provide home energy management service providers with incentives, additional research is needed to confirm whether these programs can generate quantifiable energy savings and whether there is an appropriate EM&V model that can be developed to properly evaluate program savings and attribution. Studies report 10 percent-20 percent energy savings from smart products, but few statistically significant studies have been conducted.[168] If the energy savings are truly 10 percent-20 percent of end use of whatever the device is controlling (e.g., reducing HVAC usage by 20 percent), then the incentive could be large enough to be provided directly to the consumer. If the energy savings turns out to be smaller, alternative program designs directed at retailers or manufacturers may be more appropriate.

168 "Destined to Disappoint: Programmable Thermostat Savings are Only as Good as the Assumptions about Their Operating Characteristics." 2012 ACEEE Summer Study. Malnic, Wilairat, Holmes, Perry, and Ware.

Another challenge that faces home energy management systems is clearly defining the product categories that qualify for an incentive. This will remain a challenge, and place additional burden on PAs in program design, until ENERGY STAR has clear specifications for this new category.

Recommendation: PAs pursue incentives for demand-response-enabled products.

Exploring demand response and pricing program opportunities for enabled devices could prove fruitful for PAs. Demand response opportunities exist within the connected home platform. This could include incentives for connected products that allow for utility control during peak periods. PAs should understand what their demand response program requirements are and then discuss with manufacturers whether their products could meet the program requirements.

Recommendation: Regional coordination to conduct studies on smart device energy consumption impacts and coordinate closely with EPA ENERGY STAR on new product specifications.

Home automation and home energy management has potential within the BCE product category. New products that enable customers to control and optimize their energy consumption through connected devices (home automation) are achieving greater market share. However, lack of interoperability and slower market adoption (when compared with other BCE product categories) limits the ability for PAs to immediately implement programs around this technology. Because of this lag, an opportunity exists to fully understand the influence of smart devices on BCE product energy consumption and educate consumers about efficiency opportunities and how to mitigate energy load. PAs are primed to increase the penetration and uptake of home automation controls and build programs that catch the manufacturer and consumer in the development and initial purchase phases, respectively. Coordinated research could be facilitated by groups such as the Regional EM&V Forum.

Most recently, ENERGY STAR began a specification process for a Residential Climate Control specification. The Residential Climate Control specification is a revised version of the programmable thermostat specification, which was suspended in 2009.[169] While not finalized, this new specification may include a requirement for the thermostat to be able to connect with utilities AMI networks for participation in demand response programs. Moving forward, ENERGY STAR will continue to consider how to incorporate connectivity and home energy management into product specifications. Active involvement of PAs with ENERGY STAR's specification process will help ENERGY STAR understand how efficiency programs view this new product category and how to best design voluntary specifications.

169 ENERGY STAR. (n.d.). Climate Control Specifications Version 1.0. Retrieved from: https://energystar.gov/products/specs/node/161

Opportunities and Strategies: Innovate through Marketing and Outreach

We have reviewed the current marketing and outreach best practices used by retailers, manufacturers, and program administrators to promote BCE programs and products. With the complex path to purchase, marketing becomes a critical aspect of many midstream BCE programs. These recommendations are divided into two categories; recommendations that educate the consumer and those that impact retailers.

Table 22. Energy Savings Strategy Potential: Consumer Approaches

Strategy	Collaboration Needs	Complexity of Implementation	Timeline Required
PAs improve efficiency education and marketing to consumers	Moderate	Low	Short
PAs help retailers train sales associates by providing targeted training materials or trainings	Moderate	Low	Short

Consumer Education

Recommendation: PAs improve efficiency education and marketing to consumers.

Many consumers rely on in-store signage, online information, and retail associates for information about differences between products. As mentioned previously, 53 percent of study respondents experienced indecision (from not having the required information such as comparable prices, reviews, or specifications, to feeling overwhelmed by the number of choices) because there was not a clear product "winner" and the salesperson was of little help.[170]

BCE-specific brick-and-mortar stores still represent the majority of BCE sales and are a good target for program administrators when marketing efficient electronics programs. However, online sales are increasing in popularity, so it is important that PAs also market online, as many consumers complete research about certain products prior to visiting the brick-and-mortar store to aid in their decision-making process.

A number of marketing best practices have been showcased by PAs with existing programs. For example:

- PG&E program created a short video that plays two times per hour on the TVs on display at key participating retailers.
- NYSERDA's website contains a database including retailers by region and by product that offer the respective ENERGY STAR product.
- BC Hydro encourages retailers participating in their program to market program-

170 Marketing Charts staff. (2011, October, 21). Electronics Sales Most Often Lost to Web. Retrieved from http://www.marketingcharts.com/wp/direct/electronics-sales-most-often-lost-to-web-19751/.

discounted models by offering performance bonuses based on specific marketing metrics. It collects those metrics by monitoring the amount of advertising the retailers conduct.[171]

- Efficiency Vermont administers its consumer electronics program online through manufacturer or retailer websites. Online incentive mechanisms encourage a whole subset of people who may never visit a brick-and-mortar store to purchase efficient BCE. Even if consumers who are conducting pre-purchase research online for TVs and PCs do not actually purchase online, their awareness of energy efficiency and the availability of incentives can be increased this way.[172]

We recommend using digital and social media as the primary mechanism to convey information the benefits and options with efficient BCEs, given how central it is to a consumer's path to purchase for BCE products. There is also an opportunity for additional consumer education through in-store point of purchase (POP) material. Groups such as ENERGY STAR or the Retail Action Council could work with Regional Energy Efficiency Organizations such as NEEP to coordinate regional or even national POP material to create consistency in partnerships with national retailers.

Retailer Education and Sales Associate Training

Recommendation: PAs help retailers train sales associates by providing targeted training materials or trainings.

The retail channel should also continue to be targeted as messengers to convey energy efficiency information. PAs are encouraged to develop trainings for retail sales associates that will allow them to engage with consumers on energy efficiency, which may lead to the sale of a more energy efficient BCE products or consumers taking energy savings actions to offset consumption.

Without PA assistances, retail sales associates may not understand all of the efficient products or have the knowledge to fully help the customer select and efficient option. Retailer trainings and materials can assist sales associates in becoming efficiency "advocates" when attempting to communicate the benefits of an efficient product. A marketing piece (e.g., a sell sheet, a pamphlet to hand to consumers, a "cheat" sheet) that is concise and self-explanatory will assist retailers in program engagement, especially in view of the high turnover rate of sales associates. PAs could also develop trainings for sales associates to help them explain the Energy Guide certification label to consumers, which many consumers already understand and trust for appliances, but don't know to look for it for electronics. Several retailers have incentive compensation programs for sales associates when they sell products that are a qualified BCE energy efficient product.

171 NMR Group, Inc. (2012, October 23). Massachusetts Consumer Electronics Potential Qualitative Research Study. Retrieved from http://www.maeeac.org/Docs/8.1_EMV%20Page/2012/2012%20Residential%20Studies/MA%20Consumer%20Electronics%20Potential%20Qualitative%20Research%20Study%20FINAL%202012-10-23.pdf.
172 Ibid

It can be most effective to focus on a key message that quickly helps to brand the product as energy efficient. In addition, a significant aspect to marketing BCE at retail is allowing the consumer to interact with the product and/or marketing message.[173] For marketing material consistency, ENERGY STAR can be a resource to review and provide recommendations to PAs.[174] As has been shown through existing programs and based on research gathered, program marketing should occur simultaneously through multiple channels in order to be effective and reach the majority of prospective consumers, creating multiple impressions.

Opportunities and Strategies: Drive Change through Policy and Collaboration

Policy and collaboration create unique opportunities for a variety of stakeholders to act and improve or promote BCE efficiency. Policymakers, PAs, efficiency advocates, and government at all levels have a role to play to push BCE efficiency forward.

Table 23. Energy Savings Strategy Potential: Policy Approaches

Strategy	Collaboration Needs	Complexity of Implementation	Timeline Required
Monitor and support a STB voluntary agreement that establishes strong energy savings measures	Moderate	Moderate	Short
Building Efficiency Advocates extend plug load management into residential and commercial building codes and standards	Moderate	Moderate	Medium to Long
Northeast Mid-Atlantic States work collaboratively to pursue state level minimum efficiency standards	Moderate	Moderate	Medium
Efficiency advocates collaborate to assist ENERGY STAR in creating new specifications for existing products	Moderate	Moderate	Medium
Labeling organizations collaborate to streamline the most efficient labeling options	High	Moderate to High	Medium
PAs establish strong relationships with retailers	High	Low	Medium
PAs discuss new BCE program approaches with regulators, and evaluators	High	High	Medium
PAs establish strong relationships with manufacturers	High	High	Long
Efficiency industry collaborates with R&D departments	High	High	Long

173 Ibid

174 For Northeast ENERGY STAR Marketing Material Review, please reach out to Marianne Graham, ICF International working in support of EPA/ENERGY STAR, Marianne.Graham@icfi.com, 603-291-0071.

National Policy Plays

Several opportunities exist to influence national policy, especially regarding potential STB voluntary agreement and influencing building codes and standards. In addition to engaging with states, NEEP's Appliance Standards project will engage with federal rulemaking when appropriate.

STB Efficiency

Recommendation: Monitor and support a STB voluntary agreement that establishes strong energy savings measures.

As discussions regarding a potential STB voluntary agreement continue, it is important for NEEP and efficiency advocates to stay involved to ensure that if an agreement is reached, it has the potential to significantly reduce the energy used by STBs. Depending on the outcomes, NEEP and other Regional Energy Efficiency Organizations may want to take an active role in pushing forward STB efficiency and working with PAs to help claim energy savings from this work.

Building Energy Codes and Standards

Recommendation: Building Efficiency Advocates extend plug load management into residential and commercial building codes and standards.

While ASHRAE 90.1-2010 for commercial buildings includes a plug load provision, plug load is not currently included in residential building codes or standards. The NEEP Building Codes Team monitors building code updates and works with the Regional Codes Leadership Group to keep them informed of developments. The Building Codes Team can provide recommendations to the future iterations of the residential ASHRAE 90.2 and future versions of IECC codes to encourage the inclusion of a plug load provision.

Additionally there is an opportunity for stretch codes, which go above and beyond the current code provisions and can be adopted by state and local governments, to gain deeper plug load savings. NEEP has developed a commercial model stretch code that goes beyond the current ASHRAE 90.1-2010 provision. As such, for those areas that adopt this stretch code, their plug load energy savings could be greater than what they would get from ASHRAE 90.1-2010. NEEP also has recommendations for elements to include into a residential stretch code that may include a plug load component.[175]

Long-term potential to influence high performing building standards may exist for both residential and commercial buildings. Programs such as ENERGY STAR for Homes, LEED for Homes, and Home Performance with ENERGY STAR could include incorporation of efficient BCE products and plug load management in their future iterations. Some commercial standards, such as the CHPS (Collaborative for High Performance Schools) standard already include elements of plug load management, and that could be expanded to other commercial standards.[176]

175 For states that are interested in this model stretch code, contact Carolyn Sarno, Senior Project Manager, High Performing Buildings at NEEP, csarno@neep.org.

176 More information: http://neep.org/public-policy/energy-efficient-buildings/high-performance-public-buildings/index

State Policy

Recommendation: Northeast Mid-Atlantic States work collaboratively to pursue state level minimum efficiency standards.

There are potential opportunities to integrate BCE products into state policies in the Northeast and Mid-Atlantic states—specifically policies around minimum efficiency standards. The Northeast and Mid-Atlantic regions have a long history of leveraging the technical requirements developed by California's standard-setting process, mostly through the enactment of legislation. Most states in the region (with Maine, Pennsylvania, and Delaware being the exceptions) have adopted at least a portion of state standards originally developed in California. The majority of state appliance standards adopted by California, and, subsequently, many of the states in NEEP's region, have since become federal standards.

It is expected that by mid-2014, the California Energy Commission will adopt minimum efficiency standards for several CE product categories, including computers, displays, game consoles, network equipment, and set-top boxes, in the timeline shown in Table 24.[177]

Table 24. Proposed Appliance Phasing - California

Phase	Phase 1: Short Term (Q2 2012 - Q2 2013)	Phase 2: Mid-Term (Q2 2013 - Q2 2014)	Phase 3: Long Term (Q2 2014 - Q2 2015)
Consumer Electronics	Displays, Game consoles, Computers, Set-top boxes	Servers, Imaging equipment	Low power modes, Power factor

California has a rare situation in that its Energy Commission has the authority to develop and adopt appliance standards unilaterally. Connecticut is the only other state in the country with a similar regulatory authority to adopt state efficiency standards; however, the state has not to-date used this authority. NYSERDA in New York was given a limited authority to establish standards for consumer audio/video products (including Televisions, DVD players/recorders, digital television adapters and compact audio products), although they have not to-date executed this directive.

NEEP's Appliance Standards Project, a regional effort to drive state and federal appliance standards, has been tracking the ongoing process in California and tentatively plans to help states evaluate the energy savings potential that the California standards may have in the Northeast and the Mid-Atlantic. If significant savings are available, the Project will help states through the process of developing their own bills and working to have them passed. This may take the form of working with state energy offices, energy efficiency program

177 STATE OF CALIFORNIA ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION
2012 Rulemaking on Appliance Efficiency Regulations; Docket No. 12-AAER-2, Order 12-0314-16. http://www.energy.ca.gov/appliances/2012rulemaking/notices/prerulemaking/2012-03-14_Appliance_Efficiency_OIR.pdf

administrators, or legislators to work collaboratively to try to adopt and emulate the California standards.

Program administrators in Rhode Island, Massachusetts, and New York (NYSERDA) have recently been given the flexibility to spend program resources toward the development, advocacy, and adoption of appliance standards and receive claimable savings. Historically, program administrators have not been able to claim savings associated with this regulatory work, but these potential state standards may open an opportunity for PAs to pursue this activity. NEEP's regional project will continue to engage PAs and regulators in all states to consider a similar model. All states that have a level of regulatory authority or flexibility to invest program resources to setting standards are encouraged to work with NEEP's Appliance Standards Project to achieve these energy savings through BCEs.

Maximize ENERGY STAR and Streamline Labeling Efforts

Recommendation: Efficiency advocates collaborate to assist ENERGY STAR in creating new specifications for existing products.

The ENERGY STAR Program plays a key role in setting and maintaining product specifications. It implements a third-party performance testing program and the label is an identifiable symbol to consumers regarding energy efficiency. Energy Advocates continuing to advocate for the ENERGY STAR portfolio's adoption of new technologies and product categories would maximize the brand recognition that exists and give relevant energy efficiency specification levels to other BCE products. This allows the ENERGY STAR Program to continue to serve as a pipeline for identifying efficient BCE products and expanding the products covered by the BCE label. Energy Advocates should lead this effort but should be informed by PA guidance and experience.

Recommendation: Labeling organizations collaborate to streamline the most efficient labeling options to keep pace with the most efficient product offerings.

The BCE industry moves with incredible speed, making it very challenging if not impossible for the specifications set by ENERGY STAR to keep up with the product efficiency levels released by the industry. There are additional labeling organizations, such as ENERGY STAR Most Efficient and TopTen USA that focus on only a subset of the industry and are able to update more frequently to continue to set high performance specifications for BCE products. It is important that these specifications and labels always reflect what is in market (or about to come out), and this will require further collaboration between all labeling entities, which would also streamline the labeling and certification process. While largely the case, all labels for BCE products could be based on existing ENERGY STAR specifications. This would decrease customer and stakeholder confusion without compromising labeling integrity, as well as help to drive more efficient product production.

With multiple energy efficiency labels and certifications in market, it is crucial that advocacy groups coordinate with one another to avoid consumer, retailer, and manufacturer confusion. ENERGY STAR Most Efficient and TopTen are most closely aligned. ENERGY STAR Most Efficient has an advantage over TopTen USA because ENERGY STAR brand recognition exists. However, confusion with the ENERGY STAR logo could exist with the Most Efficient label. The concept of TopTen USA is very marketable because consumers can identify with top ten lists and offers an additional consumer benefit as TopTen verifies product availability before adding any product to the list. However, without strong support from industry and efficiency programs, TopTen USA will have a challenging time gaining adoption due to lack of awareness.

Also, the Federal Trade Commission (FTC)'s Energy Guide label is a widely recognized and accepted energy consumption benchmark. The Energy Guide is easy to understand and does an excellent job conveying energy consumption for TVs to consumers. The Energy Guide could be applied to other well-known BCE products such as computer monitors and desktop computers. This will increase awareness of energy efficiency in regard to BCE products for consumers and commercial decision makers. Currently, energy efficiency is not a major part of purchasing decisions, but this small change may help to elevate it in the minds of consumers.

Regional Energy Efficiency Organizations such as NEEP can help coordinate communications between PAs the labeling organizations to provide regular and informed feedback.

Program Collaboration

PAs and organizations across the country (with conflicting or divergent agendas) can work regionally and nationally to achieve consensus about the BCE product and program approach. This can help to establish streamlined program offerings or consistent program strategy and approach on a national level.

Working with Retailers

Recommendation: PAs establish strong relationships with retailers.

This can include strategies mentioned in previous sections, such as engaging industry stakeholders to attempt to influence BCE product efficiency or the sale of efficient BCEs. Retailers have indicated time and again in this space that it is much easier to engage with a larger entity, rather than multiple parties. This helps the retailer by decreasing the administrative effort needed to work with PAs and implement local efficiency programs. If multiple PAs create a unified program, retailers can implement that program in multiple stores, multiple states, multiple regions and, ideally, nationally. The Retail Action Council is a good resource to assist PAs when working with retailers.

Creating Dialogue among PAs, Regulators, and Evaluators

Recommendation: PAs discuss new BCE program approaches with regulators, and evaluators.

For many of the recommended program strategies in this report, Northeast Mid-Atlantic PAs have not yet claimed savings. Depending on the state, the regulators and evaluators may or may not be in a position to attribute savings from a new program model. As such, as PAs are developing plans for new program approaches, conversations with regulators and evaluators are necessary to ensure programmatic success and fair attribution of savings.

Working with Manufacturers and Service Providers

Recommendation: PAs establish strong relationships with manufacturers.

Manufacturers and service providers will not be influenced by an organization that works with only a minority of its customers. As mentioned earlier in the report, three manufacturers, Nintendo (Wii), Microsoft (Xbox), and Sony (Playstation), produce almost all game consoles. Currently, Xbox and Playstation are not currently able to pass ENERGY STAR recognition. While these different manufactured products serve very different purposes, there may be an ability to influence Microsoft and Sony to produce a more-efficient product through conversations and discussions. It would be difficult to implement an efficiency program targeted at Wii users because freeridership would be high; however, there are other ways to drive the efficient design of the Microsoft and Sony system. Between the issuing of this report and the launch of the new game consoles, an opportunity exists to collaborate and advocate for participation by Microsoft and Sony in ENERGY STAR's voluntary game console program.

In addition, there may be an opportunity to leverage work completed by retailers' technology services (e.g., Best Buy's Geek Squad). Technology service entities are often in consumers' homes and could use that time to help consumers better understand how to monitor and control their energy consumption. For example, all Best Buy technicians could provide customers with an advanced power strip during each home visit and instruct the customer about its benefits, even setting it up for them to control some energy consuming products. This program would require collaboration between PAs and retailers.

This approach could have some immediate implications. NEEP can help facilitate conversations, align with ongoing efforts in California, or initiate discussions with the Retail Action Council to expand the national energy conversation.

Partner with Research and Development (R&D) Departments

Recommendation: Efficiency industry collaborates with R&D departments.

Partnering closely with R&D departments of leading electronics manufacturers or other industry organizations would enable NEEP and its strategic partners to understand what new innovations are occurring in the BCE space, and either design programs that will address the increased load when these innovations come to market, or work with the manufacturer to

encourage changes to the energy components.

However, this approach involves developing sophisticated relationships with the manufacturers, which may prove to be challenging because these companies must be willing to partner and share their research. An approach like this would also likely need to be a national strategy because, at the manufacturing level, it is nearly impossible to trace a product to the end-user so it would be harder to track energy savings based on building energy use reduction. There may be a possibility to seek assistance from the Retail Action Council. NEEP and other Regional Energy Efficiency Organizations (REEOs) and ENERGY STAR can assist with this effort.

CONCLUSION

The BCE product category offers a wide range of energy efficiency opportunities, from widgets to standards, from changing home configurations to recycling inefficient products. While there are barriers and challenges, we have outlined many recommendations and next steps towards overcoming these issues and making great strides towards capturing this energy savings. With partnerships and collaboration between NEEP, program administrators, national retailers and manufacturers, policy makers, regulators, efficiency advocates and thought leaders in this space, the Northeast Mid-Atlantic region has the tools to push forward as an efficiency leader in BCE.

NEEP is committed to fostering collaboration and continuing work to improve BCE efficiency and related issues, such as plug load, with interested stakeholders. This may take shape as the creation of new working groups or collaborative initiatives that could implement the outlined recommendations and ultimately produce energy savings results.

We feel that through successful implementation of this strategy report, the region can achieve a goal of 20 percent total (TWh) BCE category energy reduction by 2020. This will be possible from product level efficiency gains, trends moving away from inefficient products, deeper mitigation of idle, sleep, and off mode energy waste, and the fulfillment of strategies and recommendations including those for game consoles and STBs. These will be driven by industry coordination, energy efficiency programs, consumer education and marketing, and policy.

In table 26, we show the energy consumption levels for the Northeast Mid-Atlantic area in the major product categories that we envision achieving savings. As such, we hope to decrease the regional BCE energy consumption of 30.21 TWh to 24.17 TWh. While it is unlikely that the installed base for these products will decrease (and in fact trends demonstrate that most of these categories will increase in installed base), and even with potential increases in population in this region, we still feel that this is an achievable goal if the region coordinates and collaborates.

Together as a region, we can overcome these barriers and pick the high hanging fruit of achieving energy efficiency in Business and Consumer Electronics.

Table 25. Northeast and Mid-Atlantic Energy Consumption and Potential 2020 Savings

BCE Product Segment	BCE Product Category	Unit Energy Consumption (kWh)[178]	Installed Base (in millions)[179]	Annual Energy Consumption (TWh)[180,181,182]
Audio Visual	Receivers	65	19.93	1.3
	Blu-Ray players	14	2.42	0.03
	Computer speakers	37	14.9	0.55
	DVD players	28	44.89	1.26
	Multifunction devices	12	22.75	0.27
Computing	Desktop computers	220	20.33	4.47
	Laptops	63	26.57	1.67
	Computer monitors	97	26.37	2.56
Content and Gaming	Game consoles	18	21.94	0.39
	Cable STB	150	17.51	2.63
	Satellite STB	112	15.3	1.71
	IP STB	115	3.22	0.37
Televisions	Televisions	183	71.06	13
Total	**All Products**	**1114**	**307.19**	**30.21**
Regional Goal: Annual Consumption by 2020 (20 percent reduction)				**24.168**

178 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

179 Applied multiplier of 20.1313% to reflect Northeast and Mid-Atlantic Population from U.S. Census projections to Table 3.1 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

180 Adjusted to reflect Northeast and Mid-Atlantic Population using Table 3.1 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

181 Applied time in active mode per BCE product using Table 4.5 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

182 Applied time in idle, sleep, and off modes per BCE product using Table 4.5 - Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA

Additional Research Needed

Additional research will help characterize the energy savings potential that remains within the BCE industry. The data in this report outlines potential opportunities for energy savings. However, further data is necessary in order to develop effective programs, marketing and outreach campaigns, and policy approaches. We recommend further research for the following topics:

- **An industry study about energy usage patterns in homes:** Understanding energy usage patterns can lead to a better construction of energy savings potential, which can lead to additional programs, marketing, and policy opportunities. A statistically significant quantitative analysis, not a qualitative analysis where existing research is used to populate findings, is necessary in many cases.
- **Further quantitative and qualitative research to increase the understanding of how much passive energy could be saved.** We recommend support for technologies that can impact idle, sleep, and off modes, since the majority of energy consumed by BCE products not in active mode is in the idle mode (17 percent)[183] and advanced power strips cannot control this energy flow currently.
- **Quantitative study on installed BCE products:** Data necessary to determining potential energy savings from existing BCE products includes the products installed in consumers' homes, the time of use for all of the BCE products in different power modes, the power draw for each mode and for each BCE product, and the age of each product.
- **Quantitative study on integrated savings from smart-home controls:** Data necessary to determine the potential energy savings from smart-home products includes interactive effects of different products, how customers actually use smart-home controls, and average energy savings for different product configurations.
- **Whether content consumption is shifting from STBs to connected devices.** While further research is needed to fully understand how this trend will impact energy consumption, studies show that consumers are beginning to shift content to consumption other connected devices.[184] If opportunities with DMRs are pursued, it is important to determine if these devices are offsetting load or adding to the connected load in a home. Future research may be needed to identify whether consumers (or a targeted set of consumers) would embrace using network-enabled streaming devices given their TV consumption habits.
- **An analysis of market availability for Most Efficient and TopTen USA certified computer monitors and laptops** should be completed to determine whether there

183 Urban, B., Tiefenbeck, V., and Roth, K. (2011, December). Energy Consumption of Consumer Electronics in U.S. Homes in 2010; Fraunhofer, USA. Retrieved from http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf.

184 Deloitte. 2012. Devices, Consumption, and the Digital Landscape 2012. Retrieved from http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/us_tmt_Executive_Summary_Devices_Study_052112.pdf

is enough available product in stock to warrant pursuing the marginal energy savings from this product.

- **The length of time that game consoles are left in idle mode.** This will help to determine the energy savings potential of game consoles.
- **A reassessment of energy savings opportunities for multifunction devices after the new specification is enacted.** The disparity in energy consumption of certified products and 100 percent market penetration will require a supplemental market assessment after the new specification has been introduced.
- Assessment of energy use associated with wireless communication system/infrastructure.

APPENDIX

Table 26: Overview of Existing BCE Programs

Utility Example	Televisions		Computers	Monitors	APS	Set-Top Boxes	Participating Retailers						Marketing Efforts
	Efficiency Criteria	*Incentive Level*	*ES 5.0*	*ES 5.0* / *ES 5.0 +10%*	*Varies*	*ES 4 and software upgrades*	*Best Buy*	*Walmart*	*Sears*	*Kmart*	*Costco*	*Others*	
AEP Ohio	ES 5.3+20%	$25.00	-------	-------	$9.00	---------	•	•	•		•		Print, radio, and TV ads, In-store POP
BC Hydro	As of July 2012, ES 5.3 +25%.	$15.00[186]	-------	-------	Up to $10.00[187]	Varies	•		•		•	FutureShop, Visions, London Drugs, Sony-Style, regional retailers	POP, retail flyers, social media, blogging, web-sites, TV
DTE Energy	ES 5.3 + 20% and above		$5.00	$10.00	--------	---------	•						Website, POP, E-communications
	ES v. 5.3+20% Qualified TVs (0-40") $7.50												
	ES v. 5.3+20% Qualified TVs (41-60") $17.50												
	ES v. 5.3+20% Qualified TVs (>60") $22.50												
	ES v. 6.1 Qualified TVs (0-40") $7.50												
	ES v. 6.1 Qualified TVs (41-60") $17.50												
	ES v. 6.1 Qualified TVs (>60") $22.50												
	ES v. 6.1+20% Qualified TVs (0-40") $10.00												
	ES v. 6.1+20% Qualified TVs (41-60") $20.00												
	ES v. 6.1+20% Qualified TVs (>60") $25.00												

185 Plus bonus margin for media elements (flyers, enewsletters, POP, social media, special offers)
186 With manufacturer or retailer matching to further reduce consumer price.

Utility Example	Televisions		Computers	Monitors	APS	Set-Top Boxes	Participating Retailers						Marketing Efforts
	Efficiency Criteria	*Incentive Level*	*ES 5.0*	*ES 5.0* / *ES 5.0 +10%*	*Varies*	*ES 4 and software upgrades*	*Best Buy*	*Walmart*	*Sears*	*Kmart*	*Costco*	*Others*	
Efficiency Maine	NA	NA	-------	-------	$15.00	---------							Limited POP
Efficiency Vermont	ES 4.1 (1.1.11-3.31.11)	$6-$30	$7.00	$5.00	$7.00 - $10.00	---------	•		•		•	Various local retailers	POP, Promotional events with retail partners and community organization, website, newsletters, social media, and web ads. Retailer may be eligible with additional efforts
	ES 5.1 (4.1.11-7.31.12)												
	ES 5.1 +20% (7.1.12-7.31.12)												
	ES 5.3 (8.1.12)												
	ES 5.3 +10% (8.1.12)												
	ES 5.3 +35% (8.1.12)												
	ES 6.1 Most Efficient Top Ten (8.1.12)												
Long Island Power Authority	ES 5.3 or higher	$10.00	-------	-------	$10.00	---------	•		•	•			POP, Print ads, Bill inserts, Website
MA ENERGY STAR Consumer Products Initiative[3]	ES 5.3 or higher	$20.00	$10 Mail-in	$20 Mail-in	$10.00	---------	•	•	•	•	•	TechniArt	POP, Promotional events with retail partners and community organization, Website and flyers to customers

Utility Example	Televisions		Computers	Monitors	APS	Set-Top Boxes	Participating Retailers						Marketing Efforts
	Efficiency Criteria	*Incentive Level*	*ES 5.0*	*ES 5.0* *ES 5.0 +10%*	*Varies*	*ES 4 and software upgrades*	*Best Buy*	*Walmart*	*Sears*	*Kmart*	*Costco*	*Others*	
Products Initiative													
National Grid (Rhode Island)	ES 5.3	$10.00	$10 Mail-in	$20 Mail-in	$10.00	---------	•	•	•			Independent retailers, TechniArt	POP, Promotional events with retail partners and community organization, Website and flyers to customers
New Hampshire Programs	N/A	N/A	-------	-------	$10 Mail-in	---------	•	•	•	•		Lowe, Home Depot, Abuchon, Belletetes	Pop, Website, Bill inserts, Online catalogues, "Cut the Carbon" kits at local libraries, Live demos on product usage
NYSERDA	N/A	N/A	-------	-------	Retail promos; $80,000 for manuf.	---------	•	Pending	Pending	Pending	Pending	PC Richards, other major retailers, and many independent retailers	POP

Utility Example	Televisions		Computers	Monitors	APS	Set-Top Boxes	Participating Retailers						Marketing Efforts
	Efficiency Criteria	*Incentive Level*	*ES 5.0*	*ES 5.0* / *ES 5.0 +10%*	*Varies*	*ES 4 and software upgrades*	*Best Buy*	*Walmart*	*Sears*	*Kmart*	*Costco*	*Others*	
Northwest Energy Efficiency Alliance (NEEA)	January 1-March 31, 2013		-------	-------	--------	---------	•	•	•	•	•	Fry's, Target, Sam's Club, Brandsource/ HES, Nation-wide, Vanns	POP, Media adviso-ries and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.
	ES 5+20% Under 50" $4.00												
	ES 5+20% Over 50" $8.00												
	ES 5+35% Under 50" $8.00												
	ES 5+35% Over 50" 15.00												
	April 1-December 31, 2013												
	ES 6+20% Under 50" $5.00												
	ES 6+20% Over 50" $8.00												
	ES 6 Most Efficient Under 50" $8.00												
	ES 6 Most Efficient Over 50" $20.00												
NV Energy	ES 4.1 and 5.1	4.1-$4	-------	-------	--------	---------	•	•	•		•	Fry's, Target, Sam's Club , Brandsource/ HES, Nation-wide, Dell, Lenovo, HP, Synnex, Ingram Micro, Vanns	POP, Media adviso-ries and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.
	ES 5.1 and 5.1+20%	5.1-$12.50											
Ontario Power Authority	N/A	N/A	-------	-------	$5.00	---------	Any retailer can apply for reimbursement						

Utility Example	Televisions		Computers	Monitors	APS	Set-Top Boxes	Participating Retailers						Marketing Efforts
	Efficiency Criteria	*Incentive Level*	*ES 5.0*	*ES 5.0*	*Varies*	*ES 4 and software upgrades*	*Best Buy*	*Walmart*	*Sears*	*Kmart*	*Costco*	*Others*	
				ES 5.0 +10%									
Pacific Gas and Electric	ES (5.1) TV Size: 10" - 35" -$4.50 ES (5.1) TV Size: 36" – 49" - $9.50 ES (5.1) TV Size: >50" - $17 ES (5.1 +20%) TV Size: 10" – 35" - $9 ES (5.1 +20%) TV Size: 36" – 49" - $23 ES (5.1 +20%) TV Size: >50" - $29		-------	-------	--------	---------	•	•	•	•	•	Fry's, Target, Sam's Club , Brandsource/ HES, Nationwide	POP, Media advisories and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.
Sacramento Municipal Utility District	ES 5.0 (1/31/12-3/31/12) ES 5.0 +20% (1/1/12-2/31/12)	ES 5 (1/1/12-3/31/12) $4.50-$17.00 ES 5+20% - $9.00-$29	-------	-------	--------	---------	•	•	•	•	•	Fry's, Target, Sam's Club, Brandsource/ HES, Nationwide	POP, Media advisories and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.
San Diego Gas and Electric	TBD	TBD	-------	-------	--------	---------	•		•	•	•		POP, Media advisories and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.
Southern California Edison	ES (5.1) TV Size: 10" – 35" -$6		-------	-------	--------	---------	•		•	•	•	Fry's, Target, Sam's Club, Brandsource/ HES, Nationwide, Howards, and Flat Screens	POP, Media advisories and community outreach, Micro-site, Materials train Sales Associates in energy efficient Electronics promotion.

Northeast ENERGY STAR® Business and Consumer Electronics (BCE) Initiative

Administrators of ENERGY STAR BCE Programs in the Northeast invite business and consumer electronics industry representatives to participate in our 2013 Program efforts.

Goals and Plans for 2013

- Sponsors encourage manufacturers, distributors, retailers, and other allies to participate in joint promotional efforts (via marketing, retailer support activities, consumer incentives, and consumer education, etc). Programs are looking to continue expansion of BCE offerings with the assistance of consumer electronics manufacturers and retailers in 2013.
- Support efforts to increase ENERGY STAR brand awareness, quality, and understanding.
- Develop and implement promotional activities that may target specific products or market channels, (e.g., TopTen USA, ENERGY STAR Most Efficient, web-based marketplaces, etc).
- Actively promote ENERGY STAR certified Televisions (Version 5.3). Select programs will be looking to promote the highest performing ENERGY STAR certified televisions through ENERGY STAR's Most Efficient and TopTen USA.
- Initial research has been conducted by NEEP's Advanced Power Strips (APS) Working Group to develop estimated energy savings associated with a specific type of APS technology (master/slave). NEEP is currently working to develop further funding to conduct additional research to support the launch and/or expansion of efficiency program promotions for APS.
- Develop a reliable and accurate store level sales tracking system for BCE.
- NEEP, with input from the regional program Sponsors, will be creating a Regional BCE Roadmap in 2013. NEEP will be soliciting participation from a diverse selection of stakeholders to participate as an advisory group to lead this process and produce a strategy document. Please contact NEEP If interested in participating in this process.

Initiative Accomplishments

In 2012, NEEP sponsor efficiency programs incentivized 64,000 high efficiency business and consumer electronics products—a total of over $1,000,000 in incentives.

2013 Northeast ENERGY STAR Business & Consumer Electronics (BCE) Initiative Partners

2013 Northeast Regonal ENERGY STAR Business and Consumer Electronics (BCE) Programs

State	Utility/Energy Efficiency Service Provider	Television	Computers	Monitors/ Display	Plug Load/ APS
CT	Connecticut Light & Power The United Illuminating Co.				
DC	DCSEU				
MA	Cape Light Compact National Grid NSTAR Electric Unitil Western Mass Electric	$5-$25 / $10-$50 for TopTen	$5/$10 for TopTen		$15
NH	Unitil Liberty Utilities New Hampshire Electric Co-op Public Service of New Hampshire				$10
NY	Long Island Power Authority				$10 through online catalog. No retailer partipation.
NY	NYSERDA	TopTen, or ENERGY STAR Most Efficient. Varies*			Varies*
RI	National Grid (RI)	$5-$25/$10-$50 for TopTen	$5/$10 for TopTen		$15
VT	Efficiency Vermont	$4 - $20	$7-$10	$3-$7	$7 - $10

***Other NYSERDA Activities include mid-stream and up-stream incentive programs dedicated to introducing power managing products, such as advanced power strips and in-home control devices, into the New York State markets. This program is open enrollment for retailers and manufacturers that meet eligibility requirements.**

If you are interested in working with the Northeast, or would like more information, please contact one of the following individuals working on behalf of the regional program Sponsors:

State	Contact Information
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