

## **Plug Load Programs– Success, Attribution and Where We Go From Here**

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### **ABSTRACT**

Business and Consumer electronics is a significant and growing electrical end-use category. In order to reduce this growing plug load, seven utility partners representing over 20% of the national electronics market implemented a Midstream electronics incentive program. In the first two years of the program, the average on-mode power of 40” TVs has decreased by 43%. In 2010 alone, the national market penetration of ENERGY STAR® 4 qualifying TVs increased by 70%.

This paper will examine successful Midstream program design elements, including online application processing, a two-tiered incentive structure, retailer relationships, and collaboration among a large group of utility partners. We will also address program challenges, including qualifying equipment identification and evolving evaluation needs.

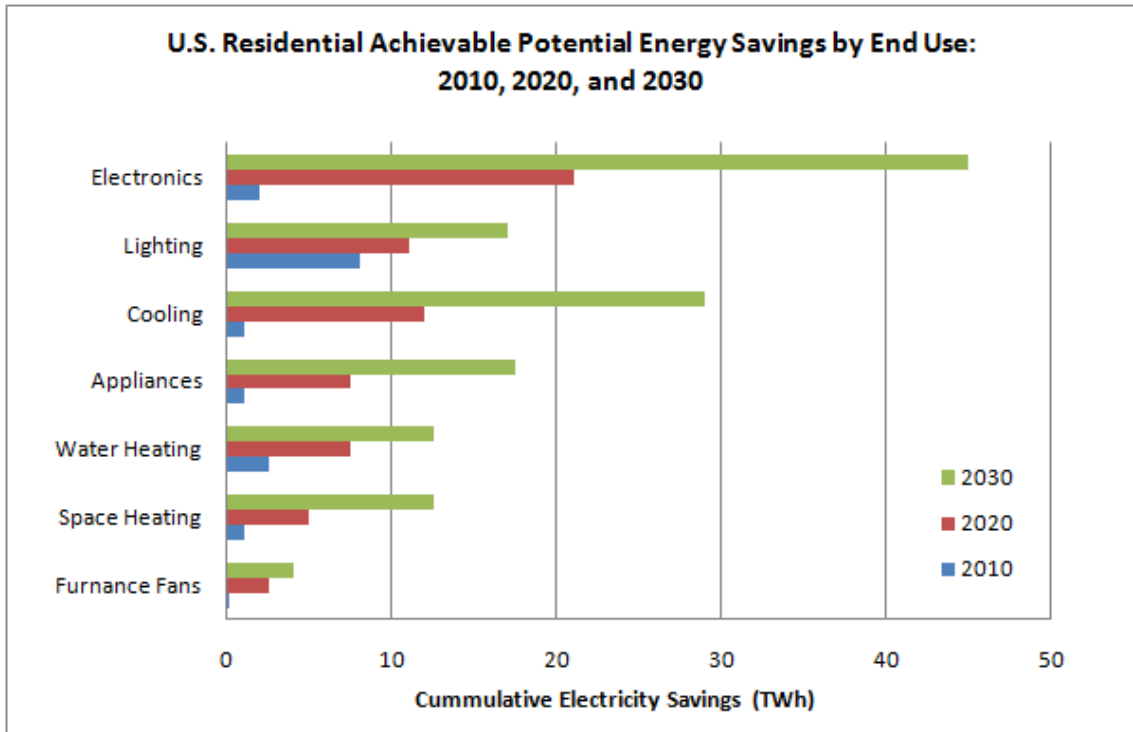
Evaluation of this new program type is complicated; the evaluators’ findings are very sensitive to EM&V approaches, assumptions and interpretations. When evaluated on a market penetration basis, this program has been wildly successful because of higher than historical adoption rates for ENERGY STAR-qualified products. This paper will discuss how the market transformation impacts are attributed to the program, ENERGY STAR, technology changes and other effects to objectively gauge program success.

Much has been learned from this innovative program’s design, and this paper explores how the Midstream model can be applied to future plug load programs, including: online data processing; close working relationships with retailers, manufacturers, and distributors selling directly to end-users; communication with government agencies and trade organizations, including ENERGY STAR; and collaboration between multiple utility partners representing a considerable portion of the national market.

### **Introduction**

Over the past 30 years, the number of televisions per US household has increased from a single unit to an average of 2.5 units, and is continuing to grow (EIA 2011). At 13% of a household’s average energy consumption, Consumer Electronics are currently third to space cooling and lighting in terms of total residential electricity consumption (Roth, Tiefenbeck & Urban 2011), and are projected to be the source of more achievable savings than any other residential end use in the US by the year 2020, as evidenced in Figure 1. Each of these facts highlights the tremendous opportunity for realizing energy savings through efficient consumer electronics technology adoption.

**Figure 1 US Residential Achievable Potential Energy Savings by End Use: 2010, 2020, and 2030**

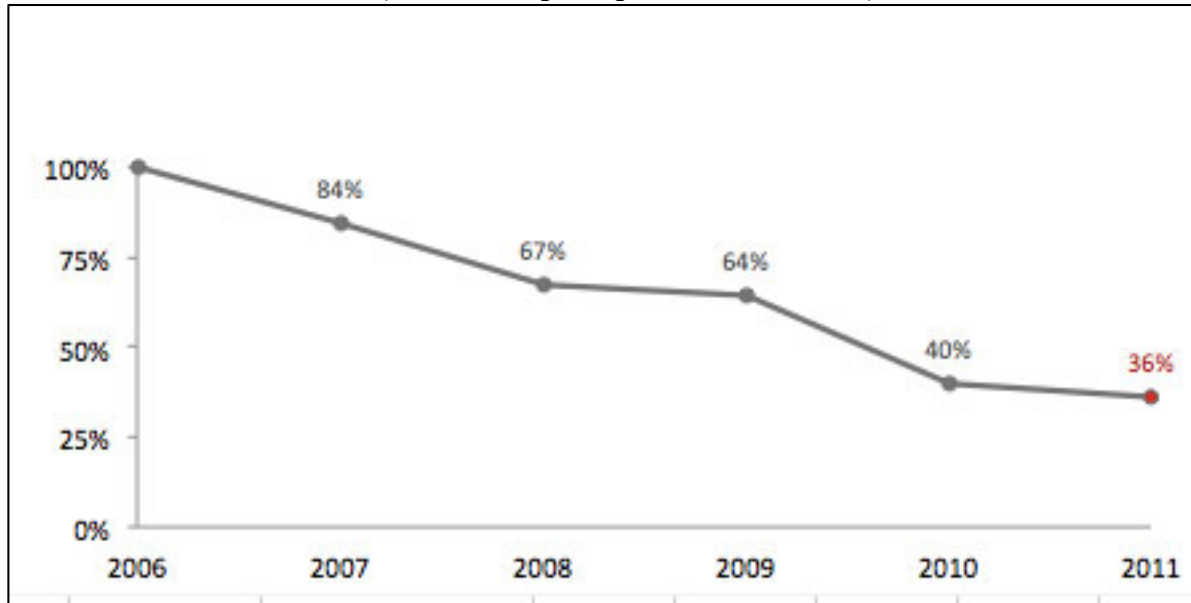


Source: Adapted from Rohmund et al. 2009

The Business and Consumer Electronics (BCE) program (Program) was established in 2008 to capitalize on the efficiency opportunities associated with electronics plug loads. Initially, the Program’s product offerings included highly efficient televisions (TVs), monitors, and desktop computers. While attribution (the quantification of energy savings directly resulting from a program’s efforts) of this Program has been incredibly complex, results over the past few years have shown TVs as the BCE program’s greatest success. The TV industry has seen significant gains in energy efficiency since the Program’s debut in late 2008. As illustrated in Figure 2, the average on-mode power of a TV purchased in 2011 is estimated to require only 36% of the power required by a TV purchased only 5 years prior (adapted from ENERGY STAR 2011; 2010; 2009; 2008).

Because the Midstream program design succeeded in the context of BCE, we believe this approach can be deployed successfully in other markets for other end use products. While the Midstream approach can be highly successful, it is not a simple solution and must be properly designed and executed in order to minimize risk, such as free-ridership and low retailer engagement. Below, we review the Program’s design elements, implementation strategies of note, evaluation issues, and lessons learned, all of which should be considered when designing future Midstream programs.

**Figure 2 TV Efficiency Improvements - Estimated Trend  
(2006 watts per square inch = 100%)**



Source: Adapted from ENERGY STAR® (2011; 2010; 2009; 2008)

## **Program Design**

With the goal of portfolio diversification and realization of plug load energy savings potential, Pacific Gas and Electric Company (PG&E) and Sacramento Municipal Utility District (SMUD) set forth to launch the first Midstream energy efficient electronics program pilot in 2008. Prior to this pilot, PG&E had spent three years conducting market & technology potential studies, and established a number of key program elements, including: Midstream incentives, utility collaboration, ease of participation (retailers and utility partners), and a retailer-driven program.

### **Midstream Incentives**

Traditionally, most energy efficient technology incentive programs have been structured to provide rebates either directly to customers (referred to as Downstream) or manufacturers and distributors (Upstream). The BCE Program, however, aims to reduce the growing consumer electronics plug load through a third rebate channel: the retailers, manufacturers, and distributors selling directly to end-users (Midstream).

The Downstream customer model incentivizes customers to select and install energy efficiency solutions in their homes and facilities. These programs focus on providing incentives directly to individuals or businesses to promote adoption of efficiency measures. An emerging technology study performed by PG&E in 2008 concluded that the cost-effective incentive rate for consumer electronics was small relative to the product price, and was not substantial enough to influence individual customers (PG&E 2008).

The Upstream model provides incentives to manufacturers for producing high efficiency equipment, which reduces incremental costs of additional energy efficient features in the manufacturing process and accelerates the introduction of efficiency equipment to the larger

Downstream market. In the consumer electronics industry, studies have concluded that retailers' stocking decisions have a greater impact on the market than manufacturers' (PG&E 2008).

Midstream programs provide incentives to retailers, manufacturers, and distributors who sell an assortment of different equipment directly to end customers. Following this model, the relatively small unit-based incentive amount that does not significantly influence individual consumers *does* catch the interest of retail buyers making mass purchasing decisions, and influences them to stock qualifying products. (PG&E 2008).

As an example of the impact the Midstream approach can have on manufacturers, Samsung, a large TV manufacturer, contacted utility partners in 2011 to request information regarding the upcoming program year qualifying level changes, stating that they were "planning [their] product lineup based on those rebates."

### **Utility Collaboration**

The involvement of multiple utility partners was essential for creating an incentive pool large enough to influence retailers' behavior. In the first quarter of 2008, PG&E had the infrastructure and organization in place to implement the Program and, along with SMUD, led the way in developing and launching the BCE Program in late 2008. Northwest Energy Efficiency Alliance (NEEA), which represents utilities in four states in the Northwest United States, recognized the energy savings potential of the Program and joined the BCE collaboration shortly after the Program's launch. San Diego Gas and Electric (SDG&E) launched the Program in 2009 and officially joined the collaboration in 2010. Around this time Nevada Energy (NVE) and Nevada Energy North (NVEN) also joined. Southern California Edison launched their Business and Consumer Electronics program in 2010, modeling it largely on the same Midstream approach as used by the other California investor-owned utilities (IOUs). These seven utility partners represent a potential retailer customer base that approached 20 percent of the U.S. market by the end of 2010.

### **Ease of Participation (Retailer and Utility)**

Ease of participation was a critical design element from the beginning, as it was clear that retailers would not become engaged and drive the Program unless it was easy to do so. The Program worked closely with retailers to establish reasonable data requirements that also provided utility partners with the information needed to justify the incentives and the savings.

A paperless online system to accept and process sales data was developed for the program, to help improve Program participation, enhance data integrity, reduce administrative processing costs, allow real-time data analysis, and expedite payment. One additional and unique advantage of this highly automated system is that retailers submit total sales data and allow the website to determine which sales qualify for incentives. This not only simplifies retailers' data submission tasks, it also improves the Program's ability to analyze market impact and comply with evaluation efforts.

### **Product Offerings**

In alignment with retailers' product stocking decision deadlines, PG&E and SMUD announced the initial product qualifying levels in the summer of 2008. These levels included TVs that were at least 15% more efficient than ENERGY STAR 3, monitors that were at least

25% more efficient than ENERGY STAR 3, and desktop computers that met the ENERGY STAR 4 specification.

When NEEA joined the Program in September 2009, their preliminary analysis concluded that the TV market had already begun to move due to PG&E and SMUD’s efforts. As NEEA’s imperative is to significantly influence the television market, their 2009 program only incented TVs that were at least 30% more efficient than the ENERGY STAR 3 specification. This led to the current 2-tiered incentive structure that was adopted by all utility partners in 2010, which sets the path for increased stringency by allowing utility partners to cap lower tier incentive totals and provide additional reward for retailers committed to energy efficiency gains.

The ENERGY STAR 5 TV specification was finalized in early 2011, and set a maximum on mode power cap at 108 Watts for all TVs greater than 50”. In order to encourage size diversity and very efficient large TVs, utility partners’ 2011 programs took TV size into account, and provided larger incentives for larger TV sizes. This strategy continues today. (NEEA 2011)

Some of the challenges associated with incenting monitors and desktop computers through the BCE Program include relatively low savings per unit, already high market penetration for business and government sales channels, and difficulty listing desktop computer models with ENERGY STAR (due to a high number of possible desktop computer configurations). For these reasons, all BCE utility partners have decided to eliminate desktop computers and monitors from their 2012 Midstream program offerings.

Alternatively, NEEA discovered that a successful leverage point for influencing the efficiency of personal computer (PC) technology resides upstream with the manufacturer, as they became the first funder of the 80 PLUS® Program in 2004. This program encourages PC manufacturers to improve the energy efficiency of their machines by installing power supplies – the devices that convert alternating current (AC) into direct current (DC) – that are at least 80% efficient. The EPA has credited NEEA and the 80 PLUS program with having a strong influence on the incorporation of 80 PLUS into the ENERGY STAR 4.0 specification. (NEEA 2011) While they discontinued participation in 80 Plus when they launched the BCE Program, PG&E is also recognized as an early adopter of 80 Plus, as they were among the first of its 14 North American sponsors.

The following table outlines how qualifying levels and incentives have changed over time:

**Table 1 BCE Program Product Qualifying levels and Incentive Amounts**

		PGE/SMUD				NEEA	
		TV - Tier 1	TV - Tier 2	Mon	PC	TV - Tier 1	TV - Tier 2
2008/ 2009 <sup>1</sup>	Qualifying Level	ENERGY STAR 3+15%		ENERGY STAR 4+25%	ENERGY STAR 4	ENERGY STAR 3+30%	
	Incentive / Unit	\$20		\$7.50	\$8.35	\$10	
2010 <sup>2</sup>	Qualifying Level	ENERGY STAR 4	ENERGY STAR 5	ENERGY STAR 5+10%	ENERGY STAR 5	ENERGY STAR 4	ENERGY STAR 5
	Incentive / Unit	\$10	\$25	\$6.50	\$7	\$4	\$10
2011 <sup>3</sup>	Qualifying Level	ENERGY STAR 5	ENERGY STAR 5+20%	ENERGY STAR 5+10%	ENERGY STAR 5	ENERGY STAR 5	ENERGY STAR 5+20%
	Incentive / Unit						

	<b>Incentive / Unit</b>	\$6 - \$25	\$10 - \$30	\$5 - \$6.5	\$7	\$4 - \$12	\$10 - \$18
<b>2012<sup>4,5</sup></b>	<b>Qualifying Level</b>	ENERGY STAR 5+20%	ENERGY STAR 5+35%			ENERGY STAR 5+20%	ENERGY STAR 5+35%
	<b>Incentive / Unit</b>	\$4.50 - \$17	\$9 - \$29			\$6 - \$12	\$12 - \$20

1 – PGE/SMUD 2008 Program began in Nov-08; NEEA 2009 Program ran from Sept-09 through Dec-09

2 - PGE/SMUD 2010 Program ran from Jan-10 through Mar-11

3 - PGE/SMUD 2011 Program ran from Apr-11 through Mar-12

4 - PGE/SMUD 2012 Program begins Apr-12

5 - ENERGY STAR 5+20% and 5+35% are proxies for ENERGY STAR 6 and 6+15%, as the ENERGY STAR 6 spec has not been finalized

## **In-Store and Online Presence**

The BCE Program design specifies that incentives go directly to the retailer, so it was important to the utility partners to ensure that customers saw that they were playing a key role in bringing this product to them. NEEA’s 2010 consumer perceptions research also showed that while energy efficiency is not a top priority for consumers purchasing electronics, it becomes an important factor in customers’ purchasing decisions when their primary purchase considerations (such as price, screen size, and memory) are already met. Providing clear in-store messaging to highlight the most energy efficient TVs allows the program to take advantage of these potential tie-breaker opportunities. (NEEA 2010)

Utility partners have implemented a number of different point of purchase (POP) messaging approaches. First, in-store signage is applied to all qualifying electronics. This signage includes utility and ENERGY STAR logos, as well as efficiency messaging. There are efforts in place to train retail store employees on the benefits of selecting products that qualify for the Program, and videos highlighting the benefits of the program are broadcast on TVs in select retail locations. Furthermore, PG&E worked with online marketers Content Solutions and CNET to implement web-based messaging, which includes qualifying TV signage on Costco’s website. The additional benefit of this online detailing approach is that participating retailers receive incentives for qualifying products purchased online by customers in the utility partners’ service territories.

## **Program Implementation**

### **Partnership Management and Meetings**

The seven participating BCE utility partners have various different program implementation requirements, ranging from product qualification specifications to participating retailers to eligible sales channels. The Program was designed to allow for great flexibility, and efforts are made to accommodate all requirements, where feasible. One of the factors that contribute to the success of the Program is the communication and collaboration that takes place. While this can be difficult at times, all utility partners have worked together to refine this process so that all parties have a better understanding of the total Program picture.

At a minimum of twice monthly, utility partners in the BCE collaboration meet to discuss the current state of the Program. Common topics include product offerings and qualifying levels for the upcoming program year, enhancements to the application processing system, reporting and communication with ENERGY STAR, and retailer management and strategy. In these meetings, retailer- and utility- specific requests are communicated, and pertinent needs are addressed.

### **Retailer Engagement**

Engagement with retailers began in parallel with the development of the BCE Program. In May 2008, Program representatives approached retailers to explain its structure and solicit participation. Within a year, eight of the most prominent consumer electronics retailers and Original Equipment Manufacturers in the nation had signed onto the Program, including Best Buy, Costco, Wal-Mart, Sam's Club, Sears, Kmart, Dell, and Lenovo. To date, there have been a total of 16 retailers and over 1,400 retail stores participating in the program, across California, Nevada, and the Northwest region.

One of the key strategies in establishing an acceptable value proposition for this unique energy efficient electronics program for each retailer was to gain support from their executive management, and to leverage that support to drive the coordination of effort between retailers' headquarters and regional operations. The BCE Program retained an implementation contractor with executive-level experience in consumer electronics and retailing to help satisfy the distinct business needs of both utilities and retailers. The Program and qualifying product specification communication process is in sync with retailers' business processes and buying cycles, and notification goes out to manufacturers prior to buyers' annual visits to China each fall, so that they are able to have meaningful discussions about the efficiency of their products with their retail clients. Furthermore, the marketing tools such as BCE Program labels and marketing flyers are developed to meet utility needs to educate consumers and promote the Program, without impeding on the business operations and merchandising requirements of the retailers.

### **Online Incentive Processing Model**

The online incentive submission process was implemented with consideration for retailer and utility participant ease of use, as mentioned in the previous "Program Design" section. Retailers securely upload batch files containing up to 20,000 separate transactions, using an ASCII text data file format. The system then validates the data input in each of the 17 required and optional fields, including sales date, product category, brand name, model number, transaction ID, ZIP Code, and store ID. Applications that pass all validations are automatically approved, and make their way onto system-generated invoices.

### **Product Qualification Model**

One unique challenge of an electronics incentive program addressed by the online system is that of qualified model matching. In order for a product to qualify for the BCE Program, it must be listed on ENERGY STAR's qualified product list and contain energy consumption specifications which meet one of the Program's current qualifying levels.

Given the fast evolving electronics marketplace, each new ENERGY STAR list (published bi-monthly) contains a substantial number of newly listed products. Through a highly

automated process, ENERGY STAR's qualifying product list is uploaded into the BCE system on a regular basis. The highest qualifying level of each product is established, given the current structure of the Program, and the correct incentive level is assigned to all associated applications.

One complexity of this process is that approximately 75% of the qualified model numbers provided by retailers are not exact matches to their associated ENERGY STAR listed model number. In order to resolve this issue, Energy Solutions conducts manual reviews and works with manufacturers to establish data standardization rules for their products. Examples of rules established through communication with electronics manufacturers such as LG, Samsung, Philips, Funai, and Lenovo include:

- characters including (and after) the hyphen or slash do not impact energy consumption,
- an asterisk or hash sign indicates that all alphanumeric characters in this position are part of a larger qualified product family, and
- two asterisks or hash signs imply that there may be 2 or more additional characters that are part of the broader product family.

## **Program Evaluation**

The evaluation of this Program has proven to be one of its most challenging aspects, as it could not follow any previously established evaluation models, due to the unique multi-utility structure and highly-dynamic electronics industry. Since its inception, there have been two main, distinct methods established to evaluate BCE utility partners on the success of this Program: market-share evaluation and unit-based evaluation. Irrespective of the method, it was not possible to use a traditional control area for evaluation because the Program works with national retailers. Retailers' assortments of consumer electronics (specifically TVs) are purchased on a nationwide basis and vary little by region. This results in the BCE Program affecting sales nationwide and, therefore, negating any useful comparisons to control areas or utilities.

NEEA's mission is to accelerate innovation and adoption of energy-efficient products, services, and practices using market power forces and therefore primarily evaluates cost effectiveness and market progress indicators to measure success in its TV initiative. NEEA's TV program ranks very high in regards to cost effectiveness with a Total Resource Net Levelized Cost less than \$0.01, and a Benefit to Cost ratio >5. Additionally, NEEA's market progress indicators measure shares of qualifying products sold in the Northwest, number of qualifying products available from manufacturers, coordinated marketing and merchandising efforts to drive awareness and help customers identify the most efficient TV, and stringency of future ENERGY STAR specifications.

NEEA completed the first Market Progress Evaluation in the fall of 2011. The evaluators made several recommendations in their report, which NEEA followed up on during the TV Initiatives Annual Implementation Review. The evaluation acknowledged a significant reduction in TV energy consumption over the Program performance period. Although no one thing can be credited for the rapid decline in this energy use, the Program is recognized as a contributing factor to increasing market adoption of the most efficient TVs.

In this evaluation, the four specific aspects of the television market credited for limiting the influence and measurability of the BCE Program include:



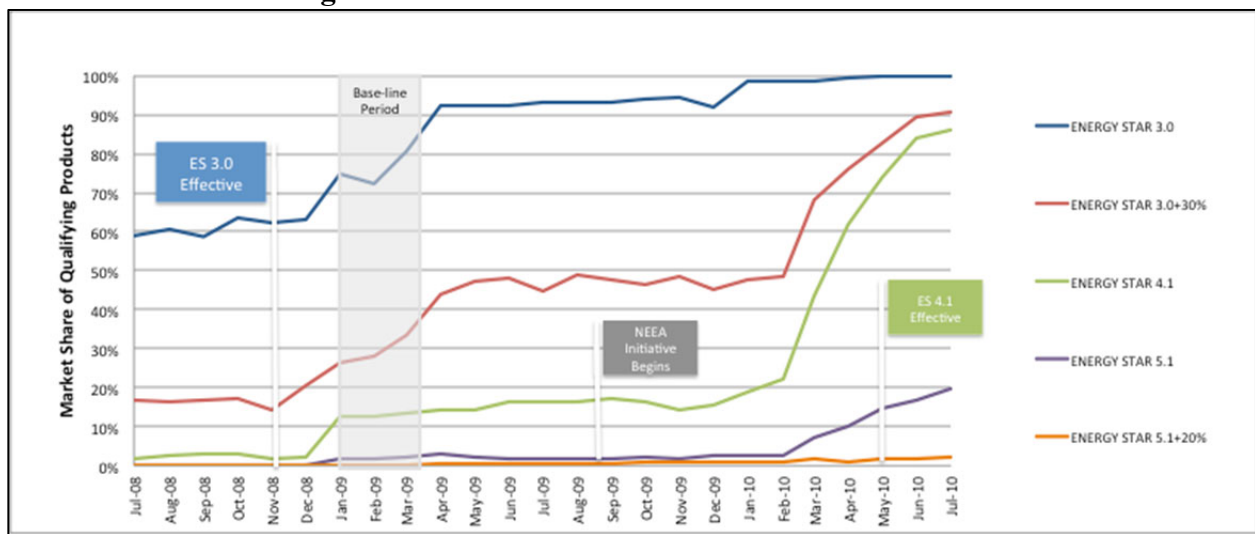
- The rapid degree of innovation in energy-efficient display technology, especially the current adoption of LED backlight technology,
- The market shift of sales to large national retailers (including online retailers),
- The annual product refresh cycle for televisions, and
- The strong influence of the federal ENERGY STAR program on manufacturers.

NEEA is recognized for contributing to the increased market adoption of the most efficient TVs through the BCE program in the following ways:

- Participating in and contributing to the ENERGY STAR specification setting process,
- Creating impactful marketing materials and retail services,
- Influencing manufacturers' decisions to produce Program-qualifying TVs, and
- Impacting retailers' product offering decisions

The graph in Figure 3 displays the Market Share of various BCE qualifying levels over time in the NEEA territory. Similar trends have been established across all BCE territories, and across the US, due to participating retailers' national purchasing decisions.

**Figure 3 Northwest TV Market Share Over Time**



Source: NEEA 2011

Outside of NEEA and SMUD, public BCE utility partners are evaluated periodically by Public Utilities Commissions (PUCs) using a unit-based process, which means that they receive a specific amount of energy savings credit based on the number of energy efficient products submitted and processed through the BCE Program, and each product's deemed energy savings contribution. The deemed energy savings calculations can be complex, and use market data analysis to understand unit energy change over time.

As with all programs that mature, the evaluation and program approval criteria for BCE has continued to grow in complexity. Factors which make this innovative program especially difficult to evaluate include: the impact ENERGY STAR has on TV efficiency, and the communication and collaboration between the BCE Program and ENERGY STAR; the usage profiles of homes with multiple TVs; and rapidly changing TV technologies, such as the

incorporation of LED backlighting. Due to challenges such as these, the California PUC (CPUC) gave conditional approval to work paper revisions for the 2011 TV qualifying levels, requesting further evaluation and refinement of analysis on market saturations, usage and performance of TVs that support the primary cost effectiveness parameters of the Program.

In their commitment to cost-effective programs with justifiable savings, the CPUC put similar conditions on work papers developed in 2011 for notebook computers, laser printers, and multi-function devices. This led to the decision by PG&E and, thereby, the BCE collaborators to delay incorporation of these products into the BCE Program.

The CPUC conditional work paper approvals are continuing to be reviewed and discussed by utility partners, and the final outcomes are due to be released in the summer of 2012. This work paper development and evaluation process, which focuses on deemed energy savings per unit, has proven to be slow and complex, and has made it challenging for the BCE Program to expand to include additional electronics technologies.

## **Conclusions and Future Opportunities**

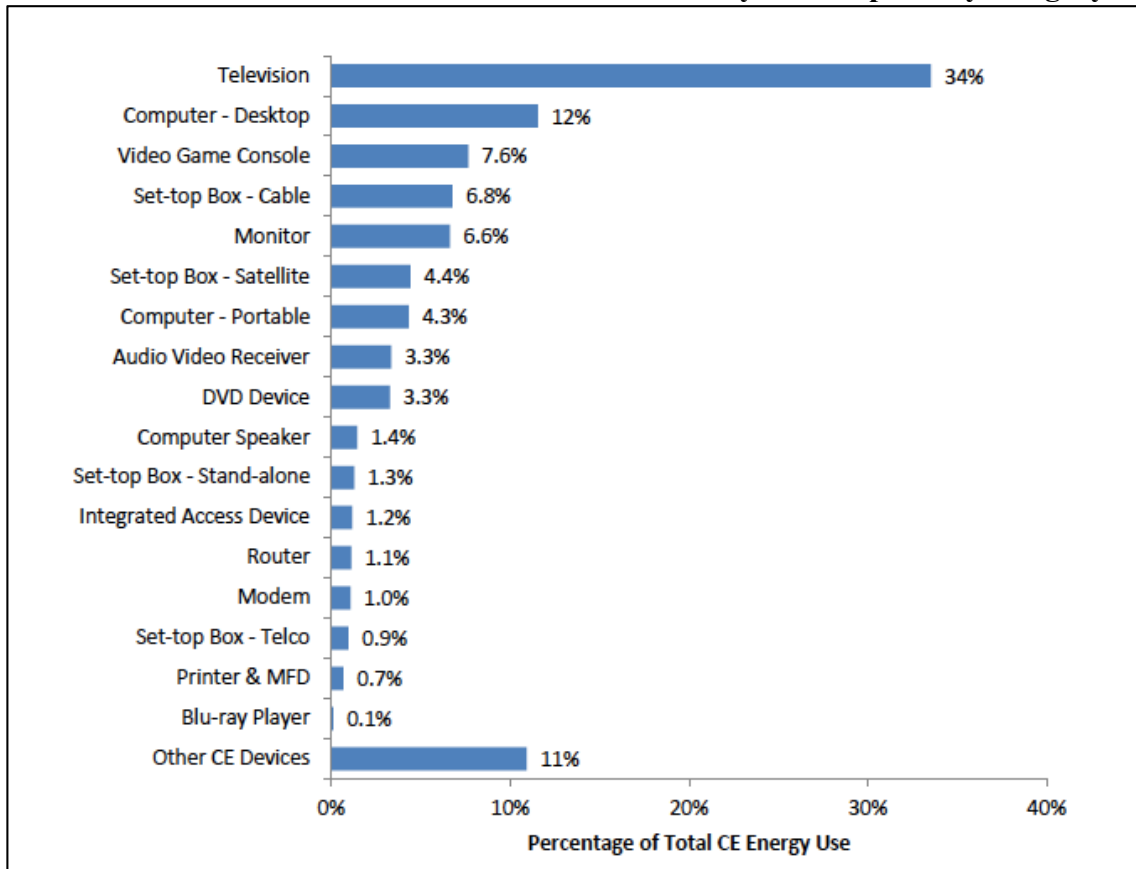
One key takeaway from the current state of BCE Program IOU evaluations is that any program aiming to take an aggressive and innovative approach to energy savings in a fast-paced market such as consumer electronics should work to ensure that the regulatory parties have a firm understanding of the program design, and can complete evaluations as quickly as possible. One recommendation to facilitate regulators' understanding of a program is to involve them in as many discussions and research initiatives that take place during program design and implementation as possible.

Overall the BCE Program- specifically its TV incentive strategy- has proven that this Midstream retailer incentive model can be successful, and that it has the potential to deliver significant energy savings for current and future utility partners in other end use technologies. Before next steps are taken, a handful of questions must be answered: what products and program elements should be emphasized, and what needs to be modified? Additionally, what new program elements will help the program achieve success in new markets and products?

Four successful elements of the BCE Program which should be leveraged in future programs include strategic retailer relationships, an online processing system, involvement in ENERGY STAR specification development, and the freedom for participating retailers to apply incentive funds however they deem best for driving sales.

As illustrated in Figure 4, video game consoles and set-top boxes are product categories representing a significant percentage of residential consumer electronics electricity consumption, and are currently being considered by some utility partners for future consumer electronics incentive programs. When determining the most appropriate products to pursue going forward, it must be acknowledged that there is currently no single product with a savings potential comparable to that of TVs at the beginning of the Program. In order to address this challenge, utility partners need to consider a portfolio-based program approach, which aims to reduce plug load through a variety of energy efficient consumer electronics. This will require innovations in program design and evaluation, and a strategic approach to channel management, as has been demonstrated by the BCE Program.

**Figure 4 2010 Residential Consumer Electronics electricity consumption by category**



Source: Roth, Tiefenbeck & Urban 2011, 119

Outside of consumer electronics, product families that utility partners are considering for incentive programs involving retailer engagement include white goods and lighting technologies. To address these new products, the program incentive structure and incentive channel may need to be modified. Some of the modifications either currently in process or being considered are:

- Incorporating buy-down (or POS) program elements into the Midstream model
- Engaging manufacturers with an Upstream incentive similar to the BCE Program
- Implementing dual stream or dual incentive structures to motivate multiple players in the market

The retailer-based Midstream program is not right for all products, but has proven to be a powerful tool in achieving savings with particular consumer electronics products. An important take-away from the BCE Program is that it was an innovative approach to providing energy efficiency incentives, and it succeeded. While incorporating the design elements outlined above may increase a program's changes for success, this Program should be used as a stepping-stone for further program design innovations.

One program design strategy currently being considered by utility partners, for example, is the utilization of voluntary incentive programs to strategically support codes and standards improvements, such as those outlined in California's Title 20. This is a great opportunity to design more holistic programs, and to evaluate an incentive program's cost effectiveness not by

TRC alone, but by its ability to implement voluntary product specifications that support product standards development, which leads to long-term energy savings across many product categories.

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