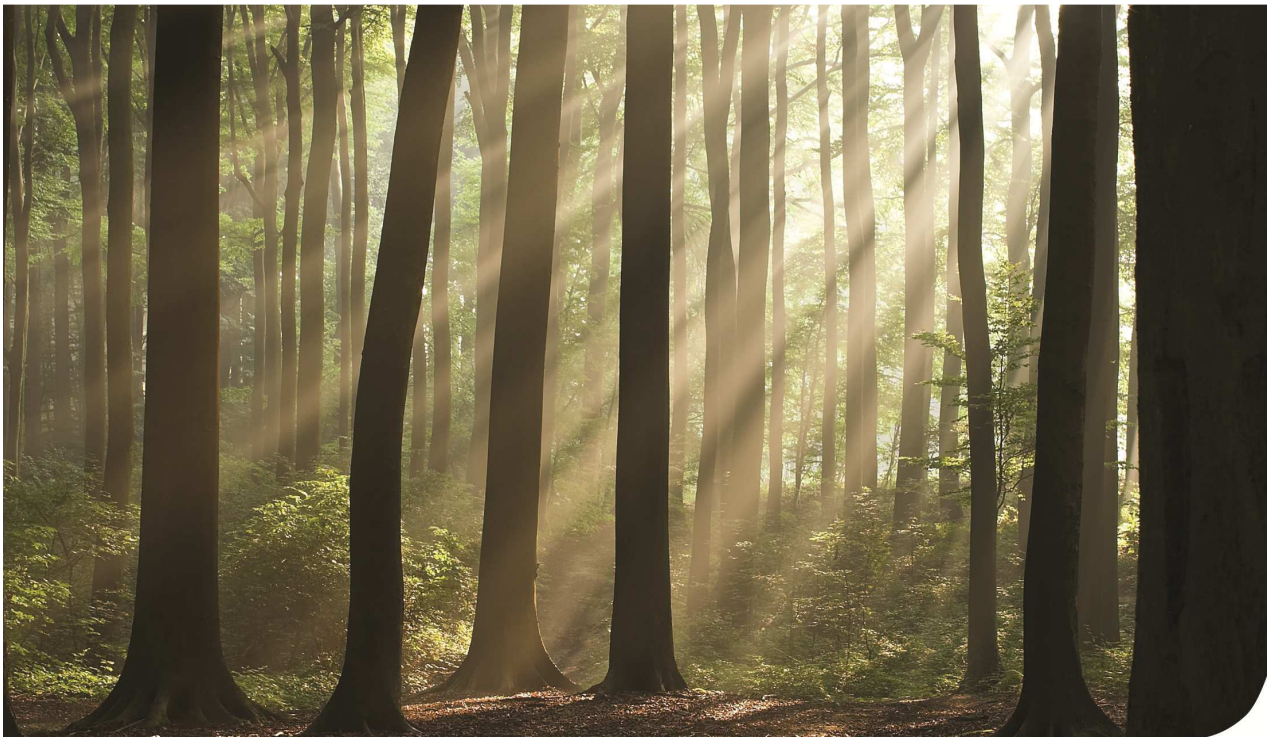
# Impact Evaluation Report

## Business and Consumer Electronics Program (WO34)



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# 1 Executive Summary

This is the evaluation report for the Business and Consumer Electronics (BCE) programs implemented by the states three investor owned utilities (IOU): Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E) as part of their 2010-2012 energy efficiency program portfolio.

The impact evaluation can adjust four parameters to determine ex-post savings: installation rate, unit energy savings, net to gross (NTG) ratio, and effective useful life. This BCE evaluation focuses only on the NTG ratio applied to televisions. The goal of this evaluation is to determine the degree to which the BCE programs, as implemented by the IOUs, changed the market share – and overall savings - for televisions in California above ENERGY STAR specifications.

For the BCE program, retailers, not consumers, receive per unit incentives from the program. Any energy savings accrues to the end consumer. Since the consumer (e.g. end-user) in the BCE program is not known, energy and demand impacts cannot be assessed using the California Evaluation Protocols' Direct Impact Protocol. In addition, consumers have no way of knowing about the IOU incentives and may not even be aware of any energy savings impacts associated with the TVs they select.

Due to the nature of the BCE program, clear baseline data does not exist. To compensate a Delphi approach was selected to determine the "counterfactual" energy saving, and compare that to the energy savings reported by the California IOU BCE programs over the same quarterly periods. A single net-to-gross value represents this level of influence over the entire State. Free ridership and spillover effects for California are not estimated separately in this evaluation, but they are included in the net-to-gross ratio.

The evaluation does however consider the program's potential "spillover" to the remainder of the US. In addition this evaluation touches on the effectiveness of BCE lobbying efforts on standards by reviewing PG&E supplied email correspondence and public comments from the ENERGY STAR specification setting process.

## 1.1 Study Approach

The evaluation team used five main data sources to construct a narrative for the BCE program. These were,

- **IOU program staff** - Conducting interviews to record program operations, perceptions of the market, and interactions with target market actors
- **Regional and national retail TV buyers** - Conducting interviews to understand retailers' product purchase decision criteria, process for procurement, and perceptions of the program.

- **Panel of experts (Delphi)** - Soliciting and facilitating an anonymous panel using a hypothetical scenario to gather and understand their insights and opinions about the programs influence on the market.
- **NPD sales data** - Purchasing retailer point of sale data from NPD for analysis of TV model market shares, feature sets, energy use, and sales trends before and during the program period.
- **IOU program tracking data** - reviewing IOU data for reasonableness and to apply the net to gross value that emerged from the interviews, data and panel.

## 1.2 Key study findings

### 1.2.1 Interviews

IOU program staff and consultants actively recruited retailer participants and were proactive in discussions with multiple manufacturers to understand the timing and performance of upcoming television models.

Retailers were generally enthusiastic about the BCE program, but were concerned about its longevity and consistency based on their experience with other consumer appliance rebate programs. In the interviews, retail buyers were relatively consistent in stating that energy efficiency, as a product feature, was a consideration but not very important relative to other product features. The existence of a rebate however caused a few retail buyers to look more closely at energy efficiency during product selection.

### 1.2.2 Sales Data

An analysis of NPD sales data shows that market share of high efficiency units in California and the rest of the US are similar in 2009, diverge in 2010 (with CA being higher) and begin to converge again at a lower level in 2011. The sales data shows that television models sold in California tend to be slightly more efficient on a Watts per square inch bases than in the remainder of the US. This is directly attributable to the types of display technologies used in larger televisions as discussed in section 4. These data also illustrate that televisions sold in California tend to have slightly higher energy consumption than the rest of the US. This is due most likely to the fact that more models sold in California have larger screen sizes and more energy consuming features than their counterparts in the rest of the country.

### 1.2.3 IOU Tracking Data

The evaluation team used IOU data for the periods from the first quarter of 2010 (the first quarter of IOU data) to the third quarter of 2011 (the last quarter with comparable market sales data). Savings data for Pacific Gas and Electric, Southern California Edison and San Diego Gas and Electric were aggregated to represent BCE as a statewide program. Market sales data was not available by service territory boundaries.

### 1.2.4 Delphi Panel

This impact evaluation derives the overall influence on the market for high efficiency TVs that can be attributed to the program. Expert opinions were divided on the level of influence the BCE program had on the composition of sales and on the standard setting process. Perspectives ranged from no influence at all to a significant level of influence.

Based on the combined opinions of the nine panel members (five of which provided quantitative estimates) the evaluation team calculated a mean weighted average market share impact of 0.114. In other words, of all high efficiency televisions sold in California that met BCE program criteria, the BCE program caused 11.4 percent of these to be higher efficiency than they otherwise would have been.

Panelists who credited the program for changing the market share composition also placed slightly more importance for this change on the incentives paid to retailers rather than on any IOU advocacy efforts for stricter ENERGY STAR standards.

## 1.3 Net to Gross

The net-to-gross ratio was developed in seven steps. These are discussed in more detail in section 7.

Step 1. Calculate the observed market share of BCE qualified units with the program in place. These quarterly values come from the NPD actual sales data.

Step 2. Estimate the market share of BCE qualified units without the program. These quarterly estimates come from the Delphi process.

Step 3. The difference in market share between step 1 and step 2 is the level of BCE impact.

Step 4. Generate savings per unit (by technology type) for each quarter using NPD sales data. Savings is the difference between the BCE program qualified efficiency and the average of non-qualified units for that quarter.

Step 5. Calculate total estimated BCE program savings by multiplying the market shares from Step 2 by the savings per unit from Step 4. This becomes the net savings for the analysis.[1]

Step 6. Extract total program units and savings from the IOU BCE quarterly submissions of savings claims.[2] This is a gross savings. However, the evaluation team applied the

[1] Net savings are calculated using several scenarios for market share; mean, median and alternate baseline

[2] The draft report used the dataset submitted Q2, 2012. The final report uses data submitted March 15, 2013.

weighted average ex-post unit savings (from step 4) to the IOU reported units before calculating the NTG ratio.

Step 7. Generate the net-to-gross ratio by comparing total savings attributed to the program by the Delphi panel with total savings from all IOU BCE program units.

These steps generated the net-to-gross ratio for the statewide BCE program. Initially two NTG ratios were calculated using the mean and median market share estimates by the Delphi panel. Alternate NTG ratios were calculated by adjusting the underlying assumptions. The associated net-to-gross values based on kWh savings are shown in Table 1-1.

Table 1-1: Net-to-Gross ratios

| Scenario | Net to Gross |
|---|---|
| 1) **Delphi Mean (no adjustment)** | 0.437 |
| 2) **Delphi Mean with sales adjusted** | 0.393 |
| 3) **Delphi Mean (ES 4.0 vs. ES 5.0)** | 0.223 |
| 4) **Delphi Median (no adjustments)** | 0.203 |
| 5) **CA vs. Rest of US** | 0.058 |

## 1.4 Conclusion

The primary purpose of this study was to develop a net-to-gross impact value to quantify the influence on changes in market shares of energy efficient televisions by the BCE program. Given the lack of existing data to perform a more traditional pre/post impact evaluation, the evaluation leveraged a facilitated panel of experts to estimate the impact of the BCE program on market share. To prepare materials for the panel the evaluation team conducted interviews with IOU program staff and retail buyers, and analyzed national and California specific sales data. In addition the team considered the pace and development of TV technologies and standards. Finally, the expert panel, nominated by the IOUs and the evaluation team, reviewed much of this information and, combined with their experience and expertise, provided their perspectives and estimates on how, and to what degree, BCE activities influenced the market. These estimates culminated in a net-to-gross ratio of 43.7 percent for the BCE program.

The uncertainties around a point estimate necessitate running the basic model with alternate assumptions. The resulting NTG ranged from 6 percent to 43.7 percent with the unadjusted Delphi mean (43.7%) representing the top of the range.

The purpose of the program was to advance TV efficiency beyond what was available in the market. The program however was still paying rebates on ES 4.0 televisions after the ES 4.0

specification was effective and after ES 5.0 units were being introduced into the market. As a result, the evaluation team recommends not counting ES 4.0 qualified units from Q3, 2010 through Q1, 2011. Omitting these units results in a statewide NTG for the BCE program of 0.223.

The Delphi experts did not reach consensus in this panel. In fact they failed to even approach consensus. As such, the resulting NTG should be applied with caution. However the research did highlight several facts. Based on the IOU program manager interviews, a review of PG&E's email and the retailer interviews, the IOU program managers did an effective job of outreach and recruiting with retailers. In addition, while the panelists could not agree on the degree of influence, they did agree that the collaborative relationship between the IOUs and ENERGY STAR was mutually reinforcing in two ways,

1. The availability of rebate and marketing programs nationally helped ENERGY STAR push more stringent specifications and,
2. Advance notice by ENERGY STAR of future ENERGY STAR specification timing aided IOUs in setting rebate levels.

The BCE program evaluated here was active at a time of rapid evolution for television technology – particularly displays. Simultaneously, the growing demand for product performance such as mobile device battery life and chip processing power were pushing manufacturers to incorporate more energy efficiency into their designs. Even though the BCE program played a role in encouraging the TV stocking decisions of some retailers, it was not the driving force in changing the overall efficiency levels available in the market.

# 2 Introduction

This is the impact evaluation report for the Business and Consumer Electronics (BCE) programs implemented by Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E) as part of their 2010-2012 energy efficiency program portfolio.

The evaluation focused primarily on identifying the degree to which the BCE programs, as implemented by the IOUs, changed the market share of televisions above ENERGY STAR specifications in California. A single market lift value represents this level of influence. The evaluation then translates this market lift into units, then savings, and finally into a net-to-gross ratio for policy purposes.

The evaluation does however consider the program's potential "spillover" to the remainder of the US. In addition this evaluation touches on the effectiveness of BCE lobbying efforts on standards by reviewing PG&E supplied email correspondence and public comments from the ENERGY STAR specification setting process.

The California Statewide Program for Residential Energy Efficiency (CalSPREE) contains eight sub-core programs, which are independently implemented by PG&E, SCE, and SDG&E under the program IDs of PGE2100, SCE-SW-001, and SDGE-SW-Res, respectively. The BCE program elements are represented by program IDs PGE21006, SCE-SW-001F, and SDGE-SW-ResG.

The BCE program is a new core sub-program to CalSPREE. According to the IOU Program Implementation Plans (PIP), Jan. 2011, the PG&E and SCE programs provide *"…midstream incentives to retailers to increase the stocking level and promotion activities of high-efficiency (i.e., ENERGY STAR®) electronic products including computers, computer monitors, cable and satellite set-top boxes, televisions and additional business and consumer electronics as they become available to the market."*

According to the program implementation plans (PIPs) filed with the CPUC, the BCE programs generate energy savings by paying rebates to retailers on televisions that are least 15 percent more energy efficient than the prevailing ENERGY STAR standard. Influenced by these rebates retailers alter their inventory and increase the percentage of these qualifying units in stock. This leads to unit sales that are more efficient than they would have been without the program influence. An alternate hypothesis on why efficiency has been increasing in stated in Appendix C.

During the course of operation the program also added two market transformation elements. First, IOUs claim that the program influences the efficiency levels of televisions sold throughout the remaining US due to national purchasing practices and second, it encouraged ENERGY STAR to adopt more aggressive standards through lobbying efforts aimed at ENERGY STAR and television manufacturers.

## 2.1 Organization of report

This report starts with the definitions for the net-to-gross ratio. BCE has market transformation elements also and these are highlighted throughout the report.

Section 3 provides an overview of the BCE program and section 4 highlights television technologies and components that influence energy consumption. Section 5 discusses the various mixed methods used in this evaluation to understand the environment the program operates in, the perceptions of market actors and any influence the program has on these actors or the market. Section 6 presents findings from the methods described in Section 5. Section 7 combines results from these qualitative data collection activities to uncover the savings generated as a result of the program. A single net-to-gross ratio represents the level of savings attributed to the California wide BCE program. The report concludes in Section 8 with a summary of the evaluation and recommendations.

## 2.2 Net to Gross and Market Lift Definitions

Impact evaluations can adjust four parameters to determine ex-post savings: installation rate, unit energy savings, net-to-gross ratio (NTG), and effective useful life. This BCE evaluation focuses only on the NTG ratio applied to televisions. The goal of this evaluation is to calculate the net-to-gross ratio for the BCE program.

To do this we first determine the change in market share of TVs more efficient than ENERGY STAR standards attributable to the BCE program. Once the change or “market lift” is known, the energy savings from the market lift can be calculated.

For this evaluation the net-to-gross is derived from the ratio of the “counterfactual” savings determined through a Delphi panel process relative to the savings reported by the BCE program. This evaluation does not estimate spillover effects for California separately, but they are included due to the nature of the data. The Methods section discusses the steps used in generating the NTG ratio.

In a parallel effort, the workpaper disposition addresses the Unit Energy Savings (UES) and Effective Useful Life (EUL) parameters. Both the IOU research and this evaluation assume that the installation rate is 100 percent for each TV sold.

### 2.2.1 Market Transformation

This evaluation does not attempt to quantify any market transformation effects from the program outside the California market. We do however explore any connections between the California market and the national market and national efficiency standards setting to understand how practices of retailers, manufacturers and standard setting bodies have changed as a result of program activities. We do this through interviews with buyers for national retail chains, analysis of CA specific and national market share data, and as part of the Delphi panel process.

### 2.2.2 Data Sources

The evaluation team combined several data sources with qualitative research to develop the net-to-gross value and construct an overview of the influence of the BCE program on the television market in California and the United States. These data sources were,

- in depth interviews with IOU program managers and retail buyers
- analysis of NPD sales data for California and the remaining US
- documentation on BCE program activities provided by the IOUs
- ENERGY STAR records of public comments on performance specifications
- an expert panel nominated by the IOUs and other stakeholders with final selection made by DNV KEMA
- review and analysis of IOU tracking data for the BCE programs
- publicly available third party technology reviews and forecasts

# 3 BCE Program Overview

As filed, BCE is a resource program and therefore this evaluation focuses on energy savings directly attributable to the program. The long-term objective of BCE is to reduce the growth of plug-load energy consumption through changes in energy standards that TVs must adhere to.

One impetus for the program comes from a 2006 study by Foster Porter et. al. "*…home entertainment and information technology products dominate the electric energy use for plug loads making up 60% and 31% respectively of plug load energy use and together represent more than 90% of total residential plug load energy use…*"

The BCE program also has varying quantitative targets for energy savings depending on IOU. The respective IOU program implementation plans (PIPs)[3] provide these targets. Table 3-1 summarizes these projected budgets and savings impacts.

[3] Current PIPs can be found at http://eega.cpuc.ca.gov/Main2010PIPs.aspx

Table 3-1: Program Budgets and Projected Savings by IOU

| Statewide Energy Efficiency Program | IOU | Program ID | Total Admin Cost | Total M&O | Total Direct Implementation | Total Budget by Program | 2010-12 Program Gross kWh Savings | 2010-12 Gross kW Savings | 2010-12 Gross Therm Savings |
|---|---|---|---|---|---|---|---|---|---|
| BCE | PG&E | PGE21006 | $3,234,911 | $3,748,421 | $24,022,904 | $31,006,237 | 152,874,976 | 16,238 | NA |
| BCE | SCE | SCE-SW-001F | $783,782 | $3,287,520 | $7,784,041 | $11,855,343 | 51,622,602 | 5,334 | NA |
| BCE/Plug Load | SDG&E | SDGE-SW-ResG | $306,863 | $1,008,871 | $1,049,507 | $2,365,240 | 709,706 | 105 | NA |

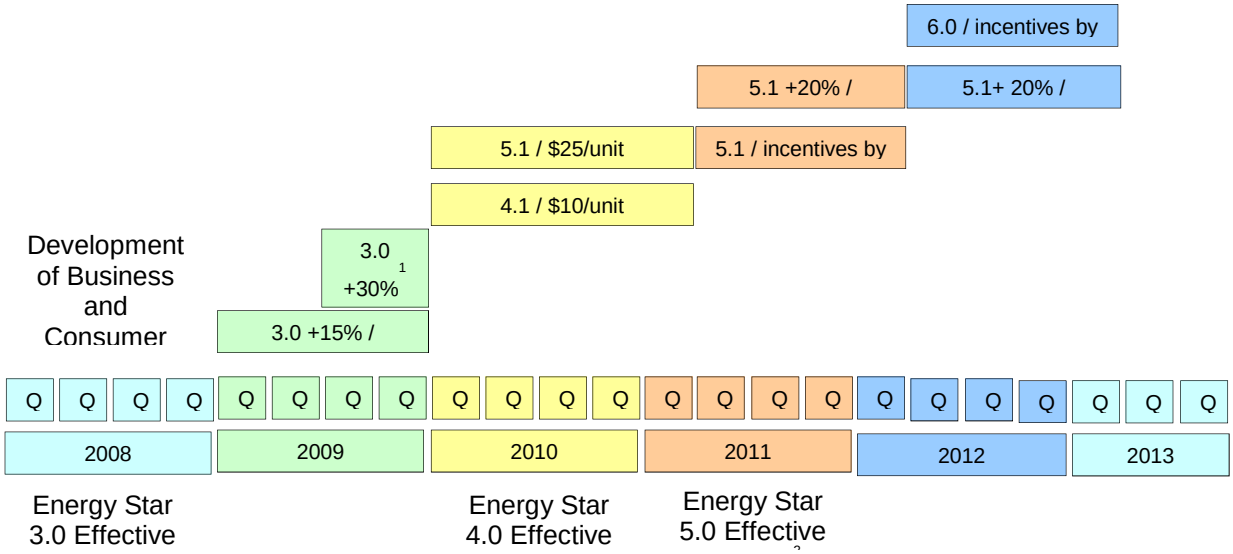
Common targets for the programs include increased retailer and manufacturer participation, increased knowledge of ENERGY STAR by retailer staff, increased stocking of program-qualified units, expanded customer awareness, and the collection of point-of-sale (POS) data.

The individual IOU programs launched concurrently with the ENERGY STAR 3.0 TV specifications in November 2008. This specification was the first on-mode power specification for TVs. In the first quarter of 2009 IOUs began paying rebates to retailers. Through 2012 the IOUs increased the minimum efficiency specification multiple times to promote TVs rated at ENERGY STAR 4.0, 5.0, and finally ENERGY STAR 5.0 +20 percent. As the program adopted each new specification, adjustments were made to incentives for the new specifications. Incentives for older specifications were eliminated or reduced but the program did maintain a two-tiered rebate approach and as a result the program paid rebates concurrently on units meeting the existing or future ES specifications.

For example, in January 2010, prior to the announcement of the ENERGY STAR 4.0 and 5.0 specifications in May 2010, the BCE utilities were paying incentives on ES 4.0 and higher incentives for ENERGY STAR 5.0 TVs, even though this specification was not scheduled to go into effect until May 2012. Figure 3-1 provides a timeline depicting program incentive offerings and corresponding efficiency levels. In 2011, the incentive paid to retailers became variable based on screen size and ranged from 6 dollars to 30 dollars from the utilities offering retailer incentives. The expectation by the IOUs was that the incentives were economically meaningful to the retail store buyers because, "*…while the incentive is a small percentage of the selling price ($20 on a $700 TV = 2.8%), the incentives are a larger percentage of the GROSS margin (the margin is estimated at 18 percent, thus 18% x $700 = $126 of gross profit, and the incentive of $20 would constitute 15.8% of gross profit). NET operating profits are estimated at around 1.2 percent, so the net operating profit would be 1.2% of $700 = $8.40. A 20 dollar rebate is 138 percent greater than the net profit, which is significant in an industry with thin profit margins.*"[4]

[4] These calculations are from the Early Feedback Report: BCE Program Efficacy: Activities, Outputs and Outcomes, Rick Ridge and Associates for PG&E, 2012. That report bases the calculation on a March 2007 Telsey Advisory Group research, "Making Money in Televisions."

Figure 3-1: Timeline of rebate specification levels[5]




The program operated primarily through physical stores located in IOU service territories. The PIP filed by PG&E targeted 10 participating retail firms and seven internet retailers by 2012. By 2012 participants included eleven retailers and three on-line sellers. Internet sales recruitment was limited however because most on-line sites do not have the capability to track sales back to locations.

In addition to the California IOUs, Sacramento Municipal Utility District (SMUD) also offered retailer incentives. In 2009 the Northwest Energy Efficiency Alliance[6] (NEEA) began a similar program for ES 3.0 and ES 3.0+15%. In April 2011 these entities partnered with PG&E and SDG&E to comment on proposed ES 6.0 standards.

### 3.1.1 Program Theory and Logic Model

The program theory posits that if retailers include a higher percentage of program qualified TV models in their floor stock then the likelihood that consumers will purchase higher efficiency TVs increases. The short-term result is kW and kWh savings over ENERGY STAR standards. As higher efficiency units become more available this will in turn help drive more stringent specifications for energy consumption by standard setting entities such as ENERGY STAR.

The implications from this theory are that if retailers stock (and sell) a higher proportion of EE TVs, retailers will demand more models to comply with these higher efficiency requirements.

[5] Graphic provided by PG&E

[6] NEEA includes the states of Washington, Oregon, Idaho, and Montana.

Manufacturers will respond by incorporating energy efficiency into more products. Ultimately these products will be sold outside the program area (i.e. outside California) and this "spillover" will be due to BCE activities. An alternate hypothesis to increasing efficiency levels is expressed in Appendix C.

The BCE logic model, approved in Commission resolution E-4385 (Dec 2010) is presented in the appendix of this report. The utilities claim to share the same program theory, design and goals with differences only in implementation. For example the SCE program puts more emphasis on customer outreach and education than the PG&E program. An extract from the program logic model, as it pertains directly to energy savings, is listed below (letters reference points within the model). Appendix A provides the full model.

Table 3-2: BCE Logic model for energy savings

| Category | Result |
|---|---|
| **Activities** | (A) IOUs provide $$ incentives to retailers to sell qualified units |
| **Outputs** | None linked to (A) |
| **Short-term Outcomes** | (L) The proportion of retail floor stock for qualifying products increases<br>(M) A greater proportion of qualifying products are sold (because that's what's on the floor)<br>(N) Program creates kW and kWh energy savings from what would have been sold without BCE program<br>(Q) More stringent standards for qualifying products are imposed (based on IOU program criteria) |

### 3.1.2 Geography

The BCE program is considered a "statewide" program in California but it was really a set of three independent IOU programs with similar elements. Simultaneously various programs targeting similar measures were in progress throughout the United States.[7] In the Western US retailers' responded to a consortium of seven utilities and organizations comprising five states. For example, The BCE alliance stared in 2009 with PG&E, Sacramento Municipal Utility District (SMUD) and the Northwest Energy Efficiency Alliance (NEEA). Later the alliance included Nevada Power and Arizona Public Service (APS). These entities participated in joint advocacy for stricter ENERGY STAR standards and ran similar, but different, programs in their respective areas. Retailers however perceived this coalition as one entity. See section 6 for findings from retailer interviews.

[7] This file is included in the Delphi Background Package.
ES_CEE_ConsumerElectronics_ProgramSUmmary_Jul2011.xls

Finally, in California each IOU ran BCE programs that employed differing requirements for participation. As a result, retailers with stores in all three IOU service territories did not necessarily participate in every service territory. For example, PG&E did not require the purchasing customer's zip code to process a rebate application. SCE did. As a result, more stores participated in PG&E's service area than in SCE's.

# 4 Television Market Overview

Technological change for televisions is a recurring theme in discussions about attribution of the BCE program. Parties central to the BCE program assert the program is advancing the technology while parties outside BCE believe global market forces are exerting a greater influence on technology than any regional program could. A ten year inforgraphic on TV technology evolution is provided in Appendix B.

This section offers an overview of the television market. The purpose is to establish a neutral, fact-based context for evaluating the BCE programs. This section first reviews a typical retailer buying cycle. Next this section discusses television technologies, components in a television, and the energy use of components. Then the section summarizes energy efficiency for televisions with particular attention to the ENERGY STAR program.

The assertion that TV technology is rapidly evolving and as a result is complicating any attempts to set program baselines or conduct program evaluations has been an issue for the BCE program since its inception. To illustrate potential differences between "stable" and "rapidly evolving" technologies in Appendix E we provide a comparison between efficiency standards and model efficiency for refrigerators (considered a stable technology) and televisions (a dynamic technology).

## 4.1 TV Technology

This section presents an overview of television technologies with a focus on television technologies and components that use or save significant amounts of energy. This overview provides context for the discussions of energy use and efficiency in subsequent sections.

In 2007, the Liquid Crystal Display (LCD) television surpassed the sales of Cathode Ray Tubes (CRT) televisions for the first time. Up until that time, the technology that powered televisions was the same basic technology that powered the first television sets introduced in the late 1920s. Now, televisions connect to the internet, include computer processors, and adjust their brightness to ambient light. The television market is a market undergoing a technology transformation.

### 4.1.1 Display Technologies

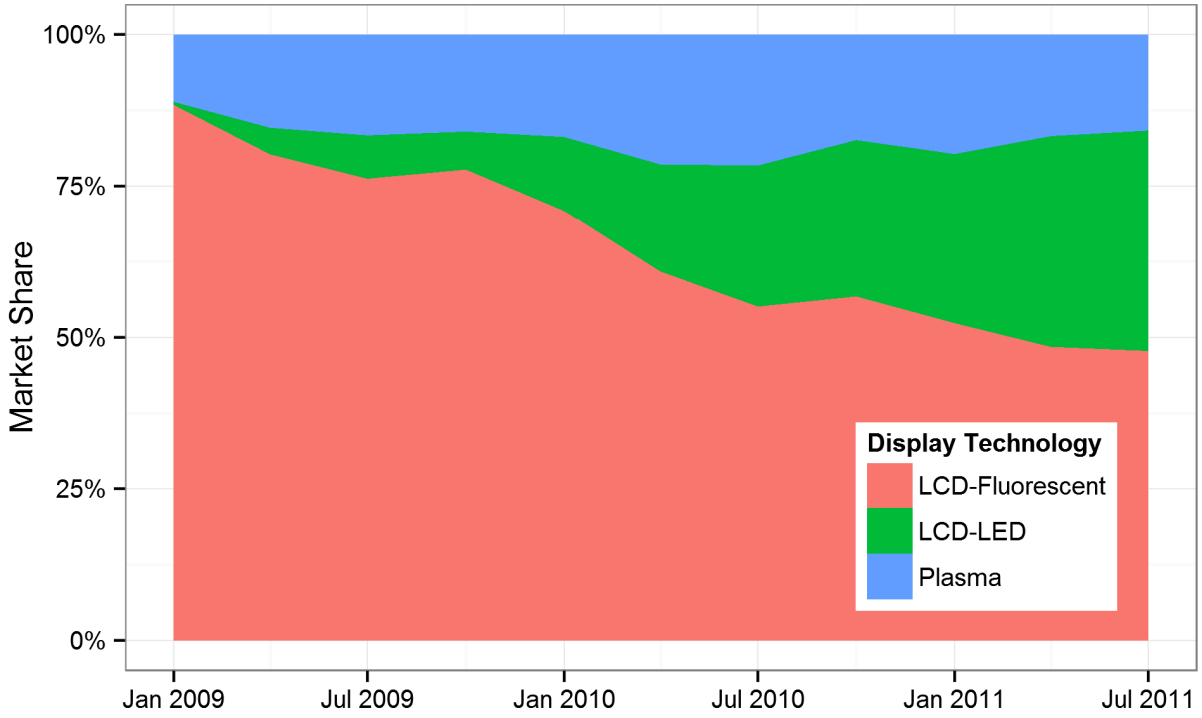
Figure 4-1 shows the market shares for units sold in California by display technology over time. These data are from the National Product Database (NPD)[8]. The graph omits displays using organic light emitting diodes (OLED) technology for clarity as these televisions account for less than 2 percent of the market. The following gives definitions for each of the display technologies:

- **Plasma** televisions use cells of electronically charged ionized gas to generate a picture. Plasma technologies are typically in the larger sized television. As shown in Figure 4-1, plasma televisions were consistently larger than other technologies with a sales-weighted average size over 50 inches.
- **Liquid Crystal Display** (LCD) televisions use modulating liquid crystals to shutter colored light and produce a display. The term *backlighting* refers to the light source behind the liquid crystal. There are two dominant backlighting technologies in the market:
    - *Cold cathode fluorescent lamp* (CCFL) that emits electrons from electrodes without using a heat-based process and mercury.
    - *Light Emitting Diode (LED)* that emits photons through the interactions of semiconductor material and electricity.
- **Organic Light Emitting Diodes (OLED)** televisions use a matrix organic semiconductor material to generate a display. Unlike LCD televisions, OLED televisions do not require backlighting. The NPD includes only OLED television models during the program period.

Note that televisions using cathode ray tubes, the original display technology, are no longer commonly sold in retail channels and are only available for niche applications.

[8] NPD covers about 70 percent of the television market. The data do not include brands specific to particular store. The data do not include energy consumption data for products that do not meet Energy Star standards.

Figure 4-1: California Market Shares by Display Technology




As shown in Figure 4-1, LED backlighting is displacing fluorescent backlighting. According to an online monitor and television buying guide[9], LED backlighting offers some advantages over fluorescent backlighting which explain the increasing market shares. These advantages are:

- **Superior color**. LED covers 114 percent of the National Television System Committee (NTSC) defined color space while fluorescent covers 72 percent.
- **Thinner design**. There is high consumer demand for the thinner profiles the LED backlighting allows. Computer laptops also utilize LED backlighting to achieve a thin profile.
- **Environmental**. Unlike fluorescent backlighting, LED backlighting does not use mercury and LED-lit TVs are easier to recycle.
- **Energy Efficiency**. LED backlighting has a 35-40 percent energy savings over fluorescent backlighting.

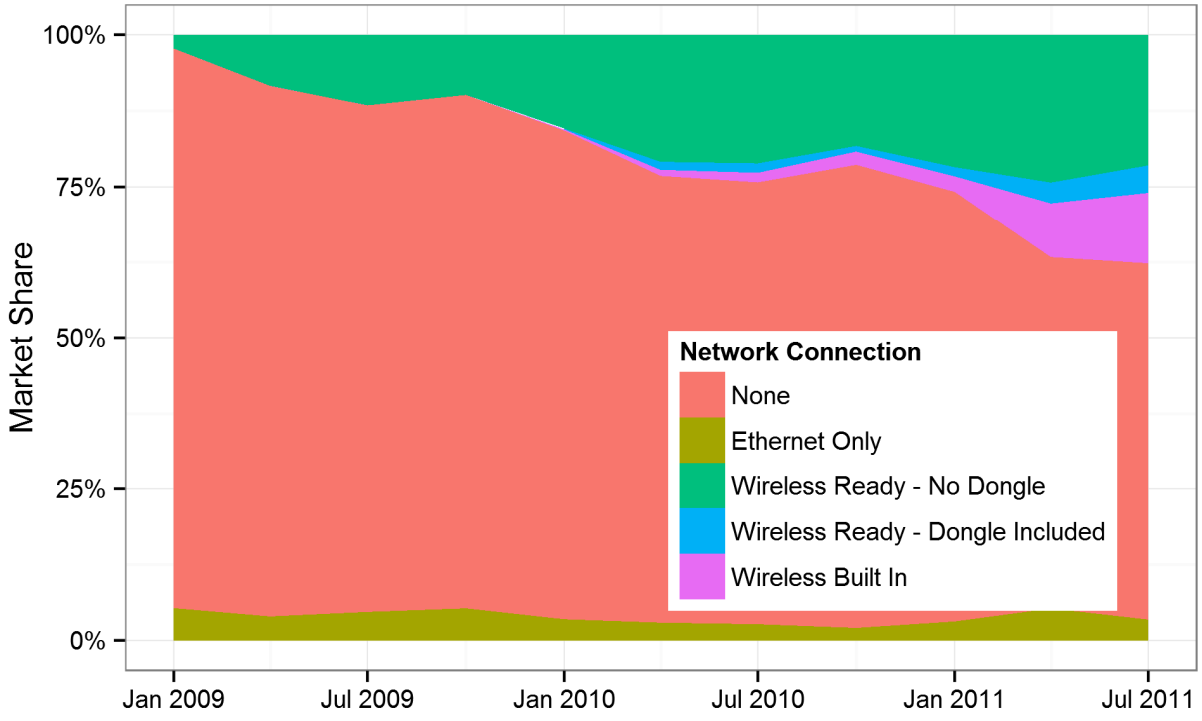
[9] http://www.tftcentral.co.uk/articles/led_backlighting.htm, accessed 2012-10-09 20:09:00

### 4.1.2 Other Technologies

In addition to the display, there are several other technologies that impact energy use:

- **Network connectivity**. Figure 4-2 documents the emergence of network connection technology. By July 2011 nearly half of all televisions were network capable, up from less than 10 percent in January 2009.
- **On-board processors.** Processors perform digital signal processing and interpret user interactions. Manufactures equip televisions with processors similar to those found in mobile devices since these are lighter and thinner than regular processors to save space. They also are more energy efficient to preserve battery life.
- **Power level setting**. Televisions operate on multiple power settings. A television that appears "off" may be processing data or keeping the display in a "warmed" state.
- **Ambient brightness detection** allows televisions to adapt the display brightness level in accordance ambient lighting levels. Televisions can lower the brightness level in darker lighting conditions without loss of picture quality.

Figure 4-2: Network connection




## 4.2 Energy Use

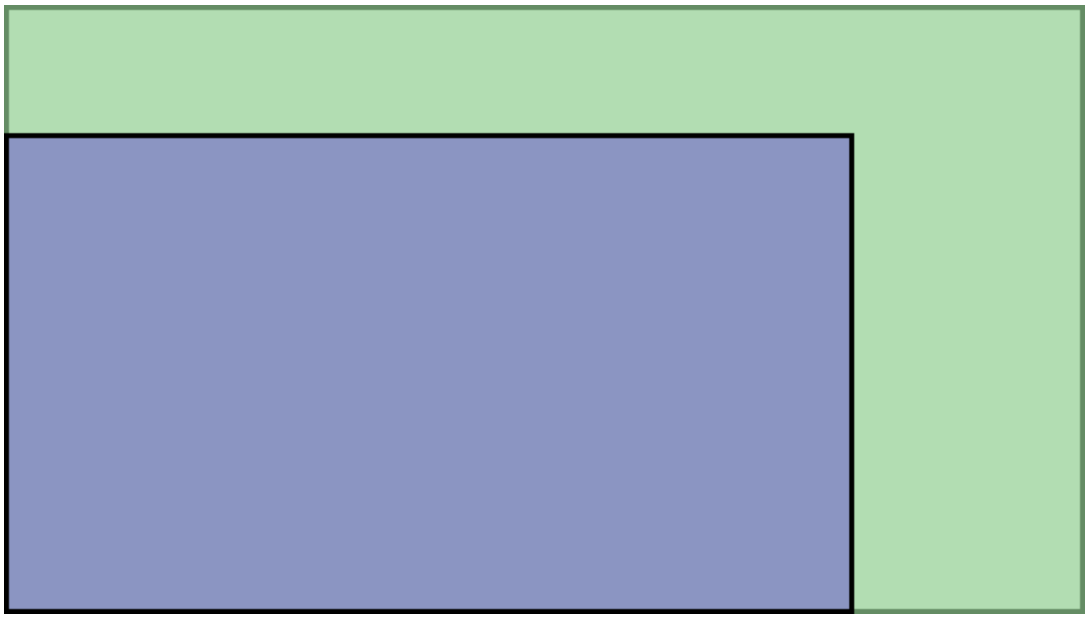
Televisions account for about 4 percent of residential electric load. Researchers at Lawrence Berkeley National Lab model television power consumption as a combination of the display

area and a fixed factor. The fixed factor reflects power requirements of digital signal processing, the power supply, and other components. The average power consumption for non-display components in a television is about 20 Watts.[10] The power consumption from the display is a function of the display size and technology. The amount of energy a television uses depends on the total power consumption and television viewing habits.

### 4.2.1 Screen size

Even as technologies become more efficient, those efficient technologies are evolving into larger screens. Energy use is a function not only of the technology and how it creates a picture, but how big that picture needs to be. Figure 4-3 provides a perspective on how screen sizes are growing. In 1997, the average screen size was 22 diagonal inches. During the program period from 2010 through 2011 average diagonal screen size for an LCD TV was 35 inches and climbing to about 45 inches. Plasma TV averages are about 10 inches larger than LEDs. Industry expects that screen size will continue to grow by approximately 0.5 inches per year over the next several years.[11]

Figure 4-3: Screen sizes 35 inch vs. 45 inch

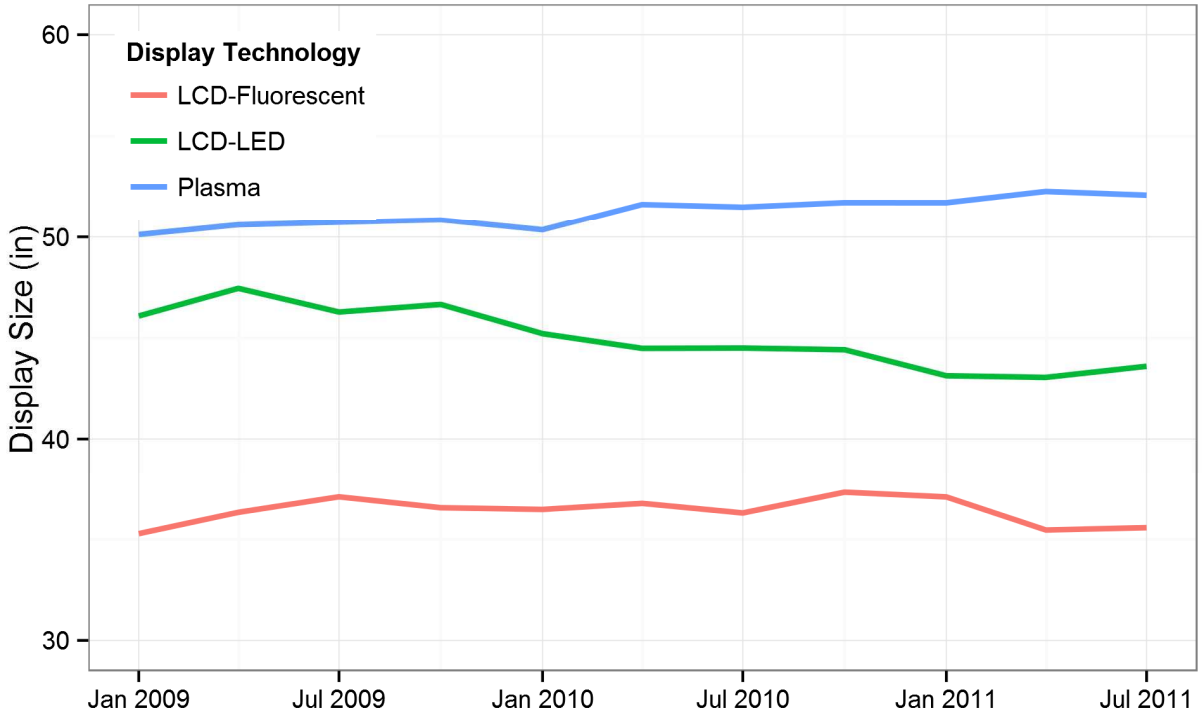


[10] Park, Won Young, Amol Phadke, Nihar Shah, Virginie Letschert. *TV Energy Consumption Trends and Energy-Efficiency Improvement Options*. Ernest Orlando Lawrence Berkeley National Laboratory, July 1, 2011. http://superefficient.org/en/Activities/~/media/Files/SEAD%20Televisions%20Technical%20Analysis.pdf

[11] http://www.aceee.org/files/proceedings/2012/data/papers/0193-000292.pdf

Figure 4-4 presents the sales-weighted average screen size using data from the NPD. According to these data plasma televisions tend to be much larger. During the BCE program period, the market transformed from plasma televisions for larger displays to a mix of LED and fluorescent technologies for smaller units. The average size of LCD-LED televisions is trending downward as plasma technology continues to take market share from fluorescents.

Figure 4-4: Sales-weighted average display size by display technology




## 4.2.2 Display technology

Each of the display technologies generates a picture using process with different efficiency levels. Figure 4-5 presents sales-weighted average power consumption using data from NPD. Each of the display technologies shows a trend of decreasing power consumption over time. This decrease runs counter to the trend in Figure 4-4 toward larger displays. Figure 4-6 shows the efficiency as power per size in units of Watts per inch.

The two graphs show several trends:

- Plasma televisions use considerably more power than other technologies. This is partially due to plasma televisions being larger. However, plasma televisions are also less efficient.
- The plasma televisions show the largest efficiency gains.

- LCD-LED and LCD-Fluorescent televisions use a similar amount of power. This is partially due to LED backlit televisions being on average larger.
- The LCD-LED televisions show stronger efficiency gains than the fluorescent backlit televisions. Both started near 3.25 Watts per square inch. LCD-LED televisions improved their efficiency to 1.7 Watts per square inch while LCD-fluorescent improved to 2.3 Watts per square inch.

Figure 4-5: Sales-Weighted Average Power Consumption by Display Technology

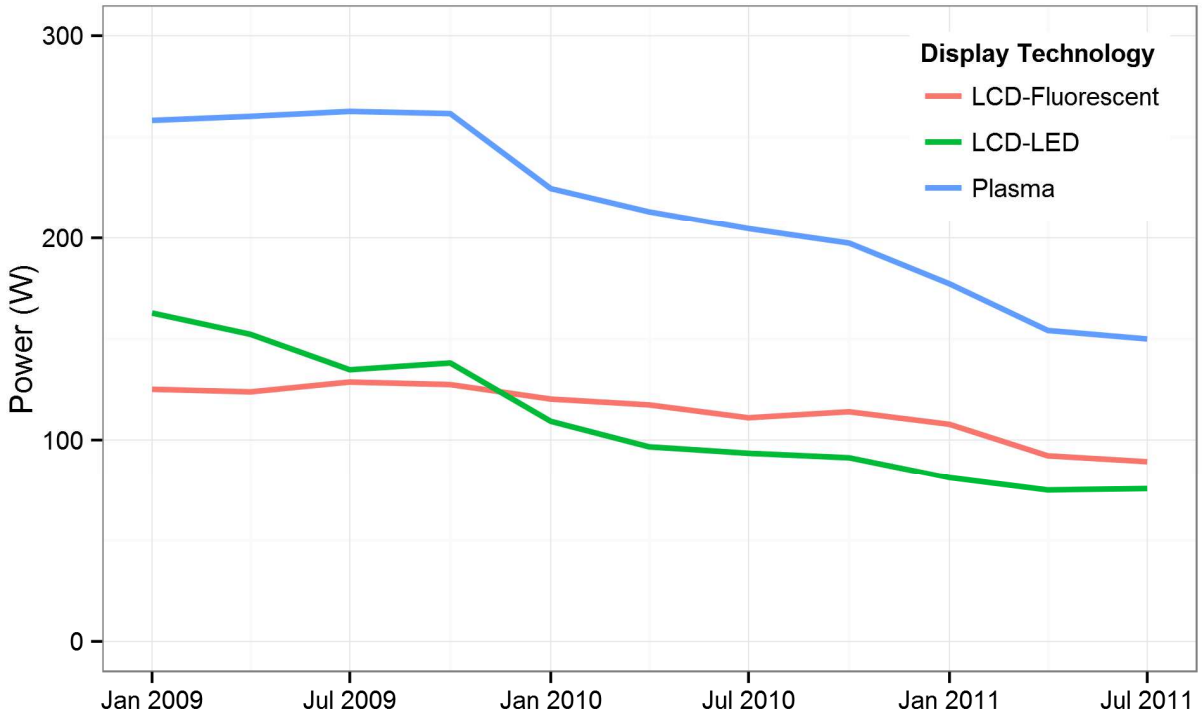
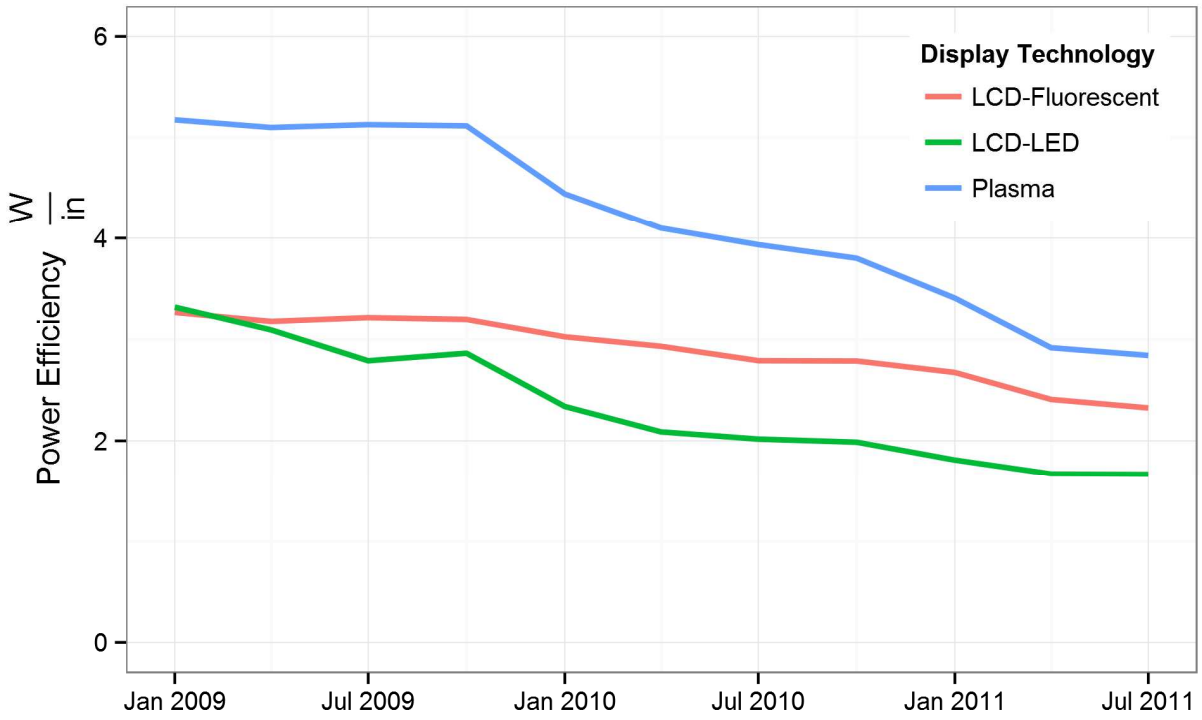


Figure 4-6: Sales-Weighted Display Efficiency




### 4.2.3 Hours of use

Television energy consumption is a product of changing technologies and changing viewing habits. Television viewers are less reliant on fixed programming time. Viewers make use of video on demand features to time-shift programming to suit their schedule. The television viewership tracking firm Nielsen attributes a 2 minute per day increase in viewership to the lack of schedule constraints.[12] Nielsen estimates that the average household watches approximately 5 hours of television per day.

## 4.3 Energy Efficiency

### 4.3.1 Legislation, Regulation, and Standards

Televisions are a covered product under the Energy Policy and Conservation Act of 1975 (EPCA), as amended by the 1987 National Energy Conservation Policy Act (NECPA). EPCA provides the

[12] http://blog.nielsen.com/nielsenwire/wp-content/uploads/2011/04/State-of-the-Media-2011-TV-Upfronts.pdf

Secretary of Energy with discretion to establish an energy conservation standard for TVs by rule, although there is no prescribed schedule tied to such a rulemaking.

Currently, there are no mandatory Federal energy efficiency standards for TV sets. There are, however, voluntary standards developed through ENERGY STAR, and some states (including California) also have mandatory standards for TVs. In California, the California Energy Commission (Energy Commission) sets mandatory standards for appliances through Title 20. The Energy Commission adopted TV standards in July 2010. These represent the minimum efficiency level required for TVs sold in California. This standard is presently comparable to ENERGY STAR 3.0.

At the national level, the Department of Energy (DOE) is currently developing a relevant test procedure as a prerequisite to setting mandatory federal standards, and is analyzing measures available to reduce the energy consumption of TV sets. Once a Federal standard is adopted however, it preempts any existing state standards regardless of the efficiency level of the state standard. This is not currently applicable in the case of California energy-efficient TV standards.

The Consumer Electronics Association and individual manufacturers are consistently against mandated standards claiming they reduce customer choice and increase manufacturing costs which is passed on to consumers in the form of higher retail prices[13]. They support the voluntary nature of ENERGY STAR but continue to advocate against more stringent specifications.

### 4.3.2 Energy Star Specifications

Televisions originally qualified for the voluntary ENERGY STAR label in 1998. Currently, ENERGY STAR-qualified TVs must consume 1 Watt or less in Sleep Mode, and On Mode power requirements vary according to screen area. External power supplies (EPSs) packaged with TV products must meet performance requirements under the International Efficiency Marking Protocol.[14]

ENERGY STAR launched the 3.0 specification on November 1, 2008. When it launched, 75 percent of TVs sold in that month met this specification. The ENERGY STAR target was to set a specification stringent enough so that only 25 percent of sales qualified.[15]

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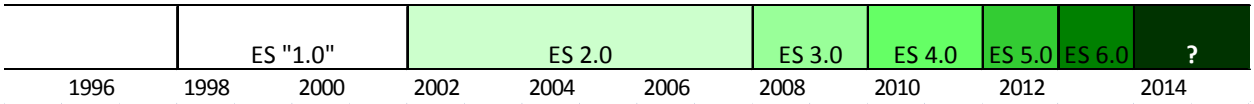
[13] For a discussion of the rational see C. Paul Wazzan, Ph.D. and Dawn Eash, M.S., "A Review of the 2011 and 2013 Digital Television Energy Efficiency Regulations Developed and Adopted by the California Energy Commission", Berkeley Research Group in Los Angeles, CA. Their paper is based in part on research conducted for the Consumer Electronics Association.

[14] Televisions: ENERGY STAR, 2012.

[15] Early Feedback Report: Rick Ridge and Associates for PG&E, 2012.

Figure 4-7 shows the duration between ENERGY STAR specifications from 1998 through 2013. Since the initial standard in 2008 the frequency of the updates has increased. Two factors account for this in varying degrees. First ENERGY STAR specifications for televisions have been advancing more frequently to keep pace with television technology. Simultaneously a consortium comprising the three California IOUs (PG&E, SCE, and SDG&E) along with NEEA, SMUD and Arizona Public Service began discussing more aggressive specifications with EPA in 2010.

Figure 4-7: Time period for each ENERGY STAR standard



# 5 Methods and Data Sources

This section describes the approaches to construct the final statewide net-to-gross ratio for the BCE program as applied to televisions. This evaluation is limited to energy efficient televisions since they were the major component of BCE program energy savings, spending for rebates, marketing and training.

Conventional impact evaluations often involve quasi-experimental designs and participant self-reports to attribute causality of program intervention. For the BCE program, retailers, not consumers, receive per unit incentives from the program. Any energy savings accrues to the end consumer. Since the consumer (e.g. end-user) in the BCE program is not known, energy and demand impacts cannot be assessed using the California Evaluation Protocols' Direct Impact Protocol. In addition, consumers have no way of knowing about the IOU incentives and may not even be aware of any energy savings impacts associated with the TVs they select.

There are also relatively few participants (retailers) compared to traditional downstream programs, but these participants have a large influence on the market. To construct a narrative and understand what happened during the 2010-2012 program years requires a combination of methods and several data sources.

Due to the nature of the BCE program, clear baseline data does not exist. In fact, both Energy Market Innovations[16] and Opinion Dynamics Corporation[17] have documented the difficulty in measuring and setting a true baseline using only sales data or Unit Energy Consumption. Consumer electronic technology is currently advancing at a rapid pace such that appropriate baseline product specification and performance can change quickly - even through single program years. The infographic in Appendix B shows this evolution. Capturing the interactive effects of rapid technology changes, multiple programs targeting TVs, accelerating ENERGY STAR levels, and retailer buying practices requires a mixed methods approach. Even using only product sales data outside the program area may not be ideal since the BCE program purports influence beyond the program's operating borders.

All of these key "non-program" influences and the time in which they occur relative to program actions and influences need to be identified and incorporated into the analysis of program effects.

[16] Program & technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEERS) / Business and Consumer Electronics (BCE), Study #SCE0306, August 30,2012

[17] Statewide Business and Consumer Electronics Baseline Study Vol I and II, Study # PGE0283.01, Opinion Dynamics, Dec 2009

The evaluation team used five main data sources to construct a narrative for the BCE program. These were,

- **IOU program staff** - Conducting interviews to record program operations, perceptions of the market, and interactions with target market actors
- **Regional and national retail TV buyers** - Conducting interviews to understand retailers' product purchase decision criteria, process for procurement, and perceptions of the program.
- **Panel of experts (Delphi)** - Soliciting and facilitating an anonymous panel using a hypothetical scenario to gather and understand their insights and opinions about the programs influence on the market.
- **NPD sales data** - Purchasing retailer point of sale data from NPD for analysis of TV model market shares, feature sets, energy use, and sales trends before and during the program period.
- **IOU program tracking data** - reviewing IOU data for reasonableness and to apply the net-to-gross value that emerged from the interviews, data and panel.

Each of these is discussed below. Detailed interview results are presented in the APPENDIX.

## 5.1 IOU program staff interviews

In October and November 2011, the evaluation team interviewed eight IOU program staff from PG&E and SCE to understand the mechanics and dynamics of the program. Questions ranged from purpose of the program, to rebate setting and data tracking.

In addition to interviews, PG&E provided an extract of their Salesforce database from early 2009 through mid-year 2011. The files document email contacts between PG&E staff and their consultants with retailers, manufactures, and the EPA. Retailer emails revolve around program recruiting efforts.

## 5.2 Retail buyer interviews

For 2010 there were 11 retailers participating in the PG&E BCE program and several were major retailers such as Best Buy, Wal-Mart, Costco and Sears. By 2011 the number of participating retailers had grown to 14 including Fry's Electronics, another large TV retailer in California. In March 2012 the evaluation team contacted buyers from 15 national and regional retailers to understand their decision and buying practices for consumer electronics and televisions in particular. Eight buyers agreed to participate and six completed the telephone interviews.

All interviewed retailers were participating in the program to varying degrees. Best Buy is one of the largest consumer electronics retailers in the country and according the PG&E Salesforce records, Best Buy had 80 locations participating out of 123 stores in the state in 2010. Fry's Electronics, a large regional retailer had six participating stores out of 34 California locations in

2011. Two factors may explain less than 100 percent location participation. First, all CA store locations are not in IOU service territories. Second, program requirements varied across IOU service territories. Retailers participated only in territories where they perceived the benefits of incentives outweighed the costs of participating. For example, PG&E did not require zip codes of TV buyers to process rebates. SCE did require this information and the reporting burden contributed to the lower store participation levels in SCE's service territory.

## 5.3 Sales data

For this evaluation DNV KEMA purchased sales data from NPD Group[18] for the periods Q1 2009 through Q3 2011 (the most recent quarter available at the time). The BCE program's activity was concentrated in 2010 and early 2011, but having a broader time range for the dataset provided context for the analysis.

These market share data are for California, California Designated Marketing Area (DMA)[19], and the remaining US. A DMA is a regional geographic market defined and used by Nielsen Media Research to identify TV stations that have the best reach in an area and attract the most viewers. These DMAs are similar is geography to metropolitan statistical areas (MSA) used by the US Census Bureau. DMAs also map well to IOU service territories providing a higher resolution of sales throughout California. Details of the data set used in this evaluation are presented in the following tables.

NPD sales data includes sales data by model for the majority of retail program participants, categorized to identify market share by technology type and ENERGY STAR level from 2009 to 2011. QDI Strategies[20] estimates that the national NPD data alone supplies model-level data on sales for about 50 percent of the market.[21]

The NPD data used in the BCE impact evaluation includes quarterly unit market share, dollar market share and average sales price. The data set also includes TV unit attributes such as technology type, rated Wattage, and screen size. A full listing of reported attributes is shown below.[22]

[18] Originally know as Nation Purchase Diary (NPD). NPD collects and reports point-of-sale information from retailers worldwide for a variety of products across multiple industries.

[19] Q1 2009 – Q3 2011 and includes 8 CA DMAs

[20] QDI Strategies is a global marketing firm marketing the BCE program for PG&E. www.qdistrategies.com

[21] As discussed in the document, "QDI Data Characterization Proposal 9-15-11.doc", delivered to PG&E

[22] Due to confidentiality agreements with NPD, this report does not include market volume data for California.

Table 5-1: California DMAs included in the NPD dataset

| CA DMA | |
|---|---|
| Los Angeles | Fresno-Visalia |
| San Francisco-Oakland-San Jose | Monterey-Salinas |
| Sacramento-Stockton-Modesto | Santa Barbara-Santa Maria-San Luis Obispo |
| San Diego | Eureka |

Table 5-2: Quarterly data for CA, CA DMA and the US

| Data Element and Product Attribute Summary |
|---|
| Unit share of TVs |
| Dollar share of TVs by quarter, for CA |
| Average Selling Price |
| Display Size (diagonal) |
| Type (LCD, Plasma) |
| ENERGY STAR Version |
| ENERGY STAR On Mode Power Consumption (ENERGY STAR compliant models only) |
| ENERGY STAR Sleep Mode Power Consumption (ENERGY STAR compliant models only) |
| Connected TV Type |
| Display resolution |
| Hard drive recorder included |
| DVD included |
| Backlight source |

From this dataset a model was fit using nine attributes from the dataset. These attributes were,

1. Brand
2. Item
3. Energy Star level
4. Size in inches
5. Vertical resolution
6. Horizontal resolution
7. Power usage when in use in watts for Energy Star compliant televisions
8. Display technology—either LCD or Plasma

9. Backlight technology for LCD displays—either CCFL or LED[23]

The procedure for calculating savings per unit is outlined below.

1. Compute display types as Plasma, LCD-CCFL, and LCD-LED from the display technology and backlight technology variables.
2. Assign product information to the appropriate quarterly market share.
3. Compute the ENERGY STAR standard for each television unit by ENERGY STAR level using the formula in the respective ENERGY STAR program requirement documentation.
4. Compute the percentage each television exceeds the applicable ENERGY STAR level.
5. Mark each unit with a BCE qualifying status by quarter. For example according to Figure 3-1[24],
   a. Energy Star 3 televisions that exceeded the standard by 15 percent or more qualified for the BCE program when sold in all four quarters of 2009.
   b. Energy Star 4 televisions qualified for the BCE program when sold from 2010 Q1 through 2011 Q1.
   c. Energy Star 5 televisions qualified for the BCE program when sold in 2010 Q1 or later.
6. Fit a log-linear model for each display type by quarter in the form of $\log(\text{power}) = \beta_0 + \beta_1 \text{size}$ to all televisions sold in the quarter that did not meet the BCE qualifying standard. The model estimates baseline energy consumption.
7. Estimate the power savings for each qualified television as the difference between the estimated consumption using the models in step 6 and the rated power consumption of the unit.[25]
8. Compute the sales-weighted savings by quarter for each display technology. This value is the average power savings per television unit by quarter and display type in watts. Multiply by hours of use to compute energy.

[23] The data include one record with OLED backlighting. The analysis ignores LCD-OLED displays due to its insignificant market share during the program activity period.

[24] The BCE program continued to pay rebates on ES 4.0 model after ES 5.0 went into effect. The alternate scenario adjusts baselines to coincide with the quarter the ENERGY STAR specifications became effective.

[25] Interactive effects due to television display heat output are not included in this savings analysis. These interactive effects are included in the IOU workpaper savings calculations.

9. Compute the market shares of BCE qualified units by quarter and display type.
10. Calculate the number of BCE qualifying units sold by quarter as the product of the total television units sold by quarter and the total market share of BCE qualifying units by quarter in step 9 .
11. Calculate the market "lift" for BCE qualifying units due to the program using the Delphi panel responses by quarter.
12. Calculate the number of program-attributable BCE qualifying units as the product of the market lift in step 11 and the BCE qualifying units sold in step 10 by quarter.
13. Distribute the program-attributable televisions units from step 12 into display types using the market shares from step 9 by quarter.
14. Calculate the energy savings by display type and quarter as the product of program-attributable units by display type and quarter in step 13 and the energy savings by display type and quarter in step 13.
15. Sum the energy savings from step 14 over quarters and display types to compute the total net savings.

## 5.4 BCE Program tracking data (IOU)

IOU BCE program tracking data used for this analysis ranges from Q1, 2010 through Q3, 2012. DNV KEMA received data from the IOUs that included number of program units sold, date sold, ex-ante unit kW and kWh savings, and rebate amount paid. These data contain the savings reported by the program and are used in this evaluation to calculate the gross program savings.

## 5.5 Delphi panel

As noted earlier, data to perform a complete impact analysis is not available. To compensate for this data limitation a key method employed to conduct the evaluation was expert judging to develop quantitative estimates of the net benefits attributable to the BCE Program. Structured expert judgment studies assemble panels of individuals with close working knowledge of the technology, infrastructure systems, markets, and political environments addressed by a project measure to estimate baseline market share and, in some cases, forecast the development of the market with and without the program in place.

For this project, DNV KEMA deployed a Delphi process, which is the most widely known and documented expert judging approach. The Delphi process produces the best available answers to these hypothetical, "what-if" questions by assessing expert opinions in a structured, methodical, and refined manner. Another advantage of this approach is that a small number of relatively straightforward questions can capture the information needed for the analysis.

## 5.6 Panel Selection

KEMA began the Delphi panel selection process by compiling a list of potential candidates nominated from, IOUs, Energy Divisions consultants and KEMA staff. The initial list of candidates totaled twenty-nine individuals. Of these, seventeen were nominated by the IOUs. The KEMA evaluation team and Energy Division consultants identified twelve additional candidates. The evaluation team conducted a web-based search to verify titles, obtain biographical information to assess experience and qualifications, and identify any public statements, research, or publications by nominees. Nominees were then placed into one of four categories.

Two factors helped determine the categorical breakdown. First, this breakdown reflected a balanced distribution of interests across parties connected to the BCE Program with,

- **Industry** - as targets (manufacturers ) or participants (retailers) of the program
- **Energy Efficiency/Technology Expert** – these panelists were selected for their,
  a) extensive knowledge of the technical evolution of TVs and TV technology
  b) experience with EE in California as an implementer, stakeholder, or evaluator
  c) extensive experience with the TV industry and national market or,
  d) a combination of a), b), and c).
- **Regulators** - as market influencers and familiarity with the standard setting process
- **Program Managers** – these panelists had direct experience as part of the BCE coalition

Second, this classification closely approximated the positional breakdown evident in the pool of identified candidates. The pool was limited by the requirements of the Delphi method since experts, by definition, constitute a comparatively small pool of informed observers distinguished by their advanced knowledge of the subject matter, deep understanding of related technical and market issues, broad experience in the relevant field, and familiarity with multiple perspectives and opinions.

In assembling this expert panel, DNV KEMA sought to ensure a balanced distribution of interest, opinion, and experience. For example, panelists were familiar with the BCE program in California, all panelists had at least 10 years of experience in their professions, and perspectives were from inside and outside the state. Using these criteria combined with the candidate bios, the pool was reduced to 16 individuals as the first tier of candidates.

Nominees were assigned to segments based on their involvement with television technology, regulation or markets. These segments along with the number of candidates selected in each segment are reported in table 5-3.

Table 5-3: Delphi Nominee Segments

| Segment | Count |
|---|---|
| **EE/technology expert** | 6 |
| **Industry** | 5 |
| **Program manager** | 3 |
| **Regulator** | 2 |
| **Total** | 16 |

### 5.6.1 Potential Bias

In addition to classifying candidates based on segment, the evaluation team subjectively assigned scores to each candidate based on the Internet research to reflect their potential conflict of interest (COI) with the BCE program. Candidates also were asked to disclose potential conflict of interest in their disclosure forms.

The ranking scores were "HIGH", "MEDIUM" or "LOW" where "HIGH" represented a potential bias in favor of the program and "LOW" indicated no potential bias uncovered during the vetting process[26]. To receive a COI score of "HIGH" candidates or their employer had to derive some direct monetary benefit as a result of the program's ongoing operation. A "MEDIUM" score was assigned where panelists had direct involvement with BCE at one time, but were no longer connected to the program. A score of "LOW" was for panelists with no past or present involvement in the program and no disclosed plans to be involved in the future.

Invitations to participate were extended to all 16 candidates, with the aim of securing the participation of 8-10 individuals, a typical size for most Delphi panels. Invitations initially were extended via email with follow-up invitations via telephone. The recruiting concentrated its initial effort on candidates in each segment with "LOW" COI scores. The evaluation team approached each candidate several times using email and telephone to confirm receipt of the invitation, explain the context of the study, and answer questions. When "LOW" COI candidates were eliminated from participation, for any reason, the recruiters moved to "Medium" and then "High" candidates. Eventually nine candidates agreed to become panel members. Of these nine experts that agreed to participate on the panel, seven were nominated by the IOUs.

Of the nine panelist recruited, four had assigned COI scores of "HIGH". Two scored as "MEDIUM" and three were assigned scores of "LOW". As presented on page 5-27 of this report,

> *"There are relatively few individuals with the appropriate combination of knowledge and experience necessary to serve on a panel of experts focused on BCE Program impacts on the*

[26] Bias against the program was considered as part of the scoring, but no "anti-program" biases were detected.

*television market. This methodological constraint placed firm limits on the size and diversity of the panelist candidate pool. Having direct involvement in the program could be construed as a conflict of interest and bias results positively or negatively. In assembling the expert panel, DNV KEMA sought to ensure a balanced distribution of interest, opinion, and experience. For example, panelists were familiar with the BCE program in California, all panelists had at least 10 years of experience in their professions, and perspectives were from inside and outside the state."*

Using four panelists with "HIGH" COI scores was a concern for the evaluation team because of the potential for biased results. Due to the difficulty in recruiting for this panel however, the evaluation team elected to move forward and reiterate with panelists the call for objectivity. Table 5-4 presents brief bios of the resulting panel.

As a condition of their involvement, panel members were guaranteed anonymity and received a stipend directly or as a donation to a charity of their choosing. Panelist materials and responses received random numbers to track responses internally.

Table 5-4: Panel member bios

| Panelist | Segment | Description | COI | Nominator |
|---|---|---|---|---|
| 1 | EE/technology | Involved in Codes and Standards providing comprehensive technical, economic, market, political, and infrastructure information for energy policy decisions at a state, national, and international level. | High | IOU |
| 2 | Regulatory | Advisor within the State of California focusing on energy policy analysis including technology/society issues, technology adoption, consumer behavior, and social change applied to the problem of energy consumption. | Low | KEMA |
| 3 | EE/technology | Extensive experience at the executive-level in consumer electronics and retail marketing. | High | IOU |
| 4 | Program management | A senior evaluation consultant and past senior manager of market research and evaluation outside California. Panelist 4 has broad familiarity with the BCE Alliance, program processes, evaluation challenges, and industry perspectives. | Medium | IOU |
| 5 | Program management | A past residential sector program manager outside CA that included BCE and the BCE alliance. | Medium | KEMA |
| 6 | Industry | Sustainability manager for a large national consumer electronics retailer | High | IOU |
| 7 | EE/technology | Senior research associate working on technical analysis for TVs, identifying efficiency improvement options that are technologically feasible and practical to manufacture, including the relationship between options and incremental costs. | Low | IOU |
| 8 | EE/technology | Over 20 years of extensive experience in energy technology RD&D and energy management as a scientist, program manager, energy analyst, and educator. | Low | KEMA |
| 9 | Industry | National electronics buyer for a large national consumer products retailer | High | IOU |

Manufacturers are conspicuously absent from the panel. The evaluation team attempted to recruit representatives from major TV manufacturers & technology companies but this group declined to participate typically citing the required time commitment. DNV KEMA attempted to minimize this inherent potential for bias by making Delphi questionnaires as neutral in tone as

possible, and by stressing the importance of objectivity to panel members. Questionnaires for Rounds 1 and 2 are in Appendix D.

Once panelists agreed to participate, the Delphi process proceeded in two rounds:

- In Round 1, panelists were given an initial questionnaire, a background packet with relevant documentary evidence, a panel agreement form, and instructions. The main part of the questionnaire asked respondents to speculate about counterfactual scenarios under which the BCE Program did not exist in California. Participants had two weeks to complete the initial questionnaire and had the opportunity to ask follow-up questions related to the instructions or materials.
- In Round 2, panelists received a follow-up questionnaire, a summary of Round 1 results, and instructions. This second questionnaire duplicated the counterfactual questions posed in the first version, and provided participants an opportunity to revise their original answers in light of the collective results from the first round. Round 2 included an additional question about the relative importance of BCE program elements. As before, participants had two weeks to complete the follow-up questionnaire.

### 5.6.2 Background Packages

Each expert has their own level of knowledge and experience with consumer electronics (televisions in particular), the BCE market, the operation and interpretation of program effects, and non-program influences inherent to the product and its market. These differences bring about a necessity to create a benchmark of knowledge that the entire panel can acclimate to in order to enter the assessment process with the same level of comprehension while still being able to use their specific knowledge, experience, and insight to form individual judgments and forecasts. To prepare the individual panel experts, background packages were assembled with details on program logic and theory, an overview of retailer buying processes, historical California and national Codes and Standards (e.g., Title 20, ENERGY STAR, FTC), program sales data, BCE program process evaluation reports, and CEA listing of ongoing utility and agency programs supporting consumer electronics. Throughout the process, panelists were given the opportunity to contact the evaluation team with any questions regarding the instructions, the packet materials or the availability of additional data. The background packages had to provide enough detail to support each expert so that they could assemble useful and focused judgments, but had to be neutral enough to provide each expert the chance to use their own individual interpretations and assumptions of the subject to develop forecasts. The full background package is available as a separate volume from this report.

# 6 Findings

The results from the analysis methods discussed in Section 5 are presented here.

DNV KEMA conducted in-depth interviews with Program Managers from the IOU BCE programs and with participating retailers as background information for the evaluation and the Delphi panel. This section contains summaries of these interviews. Details are presented in the appendix, through relevant findings are referenced throughout.

## 6.1 IOU program staff interviews

The evaluation team conducted interviews with BCE Program staff to understand program theory, assess operational consistency with the program logic model (i.e. PIP), and to understand the process, accessibility, and consistency of the program and market data supplied under contract by participating retailers.

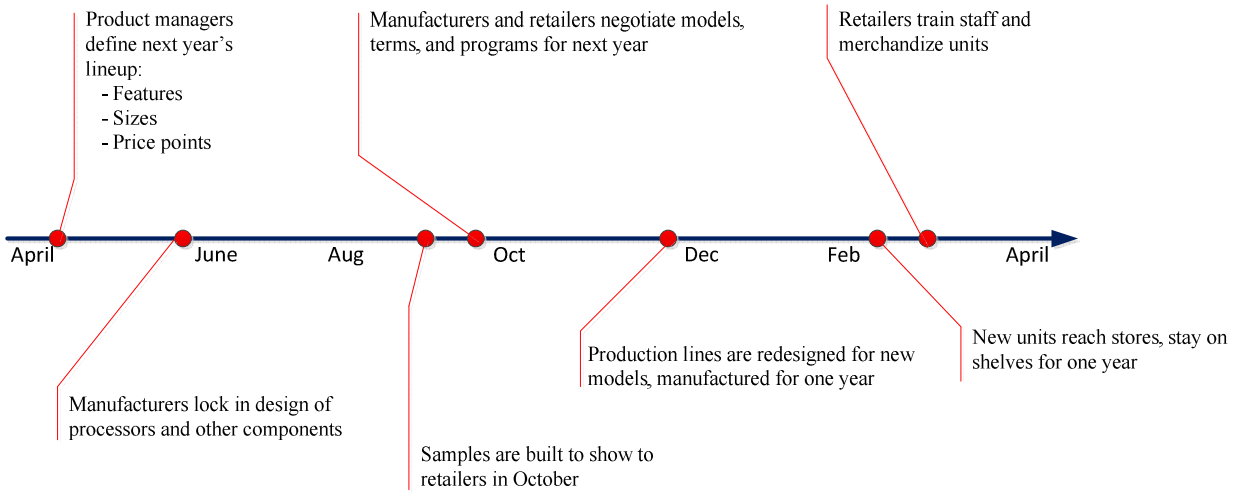
**Interaction and Timing** - These interviews highlight the continuous level of interaction IOU program staff have with retailers. In fact the program did increase the number of participating retailers and IOU staff reported that working with retailers so closely through the BCE program helped build and strengthen relationships with these retailers for other programs as well.

In additional to proactively recruiting retailers into the program, program mangers incorporated insights gained from retailer interactions to design the most effective programs. The most notable action was adjusting the program cycle to coincide with the same timeline followed by retailer decisions makers. The PG&E Salesforce extract also documents these adjustments. PG&E also cited informing manufacturers of the program and future ENERGY STAR levels at the Consumer Electronics Show in 2010, though no outcomes from this meeting are documented in the reviewed files.

Retailers' annual purchase cycles for TVs are illustrated in Figure 6-1.

In the fall (September through December) retail buyers actively engage with manufacturers to determine the vast majority of what they will stock/sell the following year. Retail buyers visit manufacturing plants in Asia and conduct negotiations with the TV manufacturers. This process is complete in time for the Consumer Electronics Show at the beginning of January.

Figure 6-1: Retail TV Industry Purchase Cycle




The retailer "sells out" prior year models – usually in January - and brings in the majority of new models during the first and second quarters of the year. Two-thirds of the new models are introduced during this timeframe. The retailer will continue to bring in new models in the third quarter, primarily in anticipation consumer buying for the coming holiday season.[27]

**Processing time** - Both PG&E and SCE realized that application processing time was important to retailers. To address this timing issue both utilities retained Energy Solutions to collect and process rebate applications. Energy Solutions qualified each application and maintained a database of qualified TV models.

**Program Emphasis** – The BCE programs were filed as energy savings programs even though later in the program they became focused on market transformation. As a result both programs include rebates and retailer education. SCE focuses on customer and retailer education and PG&E focuses more on rebates and advocating stricter ENERGY STAR standards.

**Technology** - Program staff also cited the difficulties of adjusting the program requirements to a rapidly changing market. As they gained knowledge of the industry they became better prepared to adapt the program in a timely manner.

## 6.2 Retailer buyer interviews

In March 2012 the evaluation team conducted telephone interviews with buyers from national and regional retailers to understand their decision and buying practices for televisions. Retailers also discussed their perceptions of the program and any influence it had on their buying decisions. A summary of the findings from these interviews follows.

[27] Discussion and figure adapted from Early Feedback Report, Rick Ridge and Associates for PG&E, 2012

### 6.2.1 Timeline and Decision Making for Purchasing and Stocking

National retailers centralize their television purchasing decisions at the corporate level. Regional and local stores of national chains do not have decision making authority on television purchasing, nor do they have influence on these purchase decisions. In some organizations multiple teams determine the selection of units. In some cases this may include a manager dealing specifically with sustainability or corporate responsibility issues. Other team members include representatives from operations, sourcing and, merchandising. As one national retailer put it,

> *"It's a cross functional effort… there's a merchandising team…, an operational team… a sourcing team…, our team is involved with the energy implications of products and systems".*

- This finding is consistent with the BCE program assertion that purchasing for national retailers is done at the national level.

Television purchases happen once per year in the March/April time frame, but stores receive "resets" two to four times per year. Resets change the inventory of floor display at the retail level. These occur typically around April and October. Resets are a consequence of the introduction of updated products, or adjustments for seasonal buying patterns. Many retailers reported changing their display configurations (planograms) as frequently as monthly, but this changes store layout only and not inventory.

> *"Two large resets during the year for electronics - April and October. Planogram changes monthly – but that is just switching around what is on the floor. Otherwise it is just two times per year."*

- Since the timing of resets is known, this may provide an opportunity for programs to reset rebate levels or other program elements as well.

While purchasing decisions are made at the national level, individual stores are stocked based on regional characteristics. Retailers have different store sizes and stock these differently to cater to the demographics of a specific location. For example, stores located in lower income areas or areas with less internet connectivity will carry similar inventory. Stores located in higher income areas or higher connectivity will maintain similar inventory.

> *"If Sony's generally sell better than VIZIOs, that's a data point."*

These types of stocking decisions are independent of existing regional utility programs or other promotions. Finally, retailers report offering the same, or similar, selection of TV models for both in-store and on-line sales channels.

### 6.2.2 Energy Efficiency and Qualified Unit Stocking

Retailer buyers are looking for products that will sell. They use multiple criteria to estimate the combinations of price and features to stock. Buyers were reluctant to divulge their specific decision criteria but generally report using up to twenty factors to screen products. These include screen size, price point, brand, technology type, connectivity options and manufacturer guarantee. By itself energy

efficiency is a positive factor but not a driving one. Most buyers rank it lower than size, price and other features on their list of attributes.

> *"Brand technology size manufacturer guarantee, connectivity… energy efficiency is ranked 9th out of 16 considerations. It's not a driver. Customers will not always choose an efficient product, unless done by default."*

Energy efficiency does become more important where two options may be identical but one has an efficiency rating (e.g. ENERGY STAR) and the alternative does not. This applies whether the unit qualifies for the BCE program or not. Retailers base this on the premise that consumers prefer energy efficient appliances over ones that are less efficient.

- On a practical level this finding affirms that consumers recognize the ENERGY STAR label and that it can be one of many selling points. This is independent of knowing the specific level of energy consumption or ENERGY STAR level.

### 6.2.3 BCE Program Awareness and Influence

While retail buyers reported knowing about energy efficiency and ENERGY STAR ratings for consumer electronics before the BCE program began paying rebates in 2009, many reported more seriously considering energy efficiency as part of their purchasing decisions once the rebate program became effective. In fact, energy efficiency teams didn't exist a few years ago. Now they are a part of the buying process with many retailers. These retailers expressed their belief that energy efficiency standards will become more stringent over time, but that the BCE program may have accelerated the process.

> *"That obviously is something that we looked at very strongly, just the program itself and the incentives we get back."*

Retailers were also aware of BCE related program activity throughout the US. The Consumer Electronics Association tracks programs on behalf of members and in October 2011 ENERGY STAR published an overview of ongoing and new consumer electronics programs in 2012. That report identified 116 incentive and promotion programs for a variety of consumer electronic products offered by 40 program sponsors.[28]

- While retailers acknowledged incorporating appliance or electronics incentive program where they could, overall most were reluctant to assign a high influence in decision making to these programs.

[28] ICF International, "ENERGY STAR Summary of Consumer Electronics Programs", October 2011

### 6.2.4 Use of Rebates

The BCE program pays financial incentives (rebates) directly to retailers for each program qualified unit sold. There is no program requirement on how these dollars are to be used by retailers. Retailers report using utility rebates from the BCE program as a factor in calculating profit margins for qualifying units. They do not pass rebate dollars through to consumers in the form of rebates or lower prices and they do not specifically allocate BCE dollars to promote energy efficient products or training of retail sales staff.

*"…part of the overall profit of the TV business"*

- Given that there are no restrictions on the rebate dollars, retailers view energy efficiency as they would any other product attribute - Is this an attribute customers are willing to pay for? During the BCE program period the answer is yes. In this case the IOU is the intermediate customer, not the final one.

## 6.3 Sales data

The sales data from NPD provided the necessary information to generate the overall market shares of qualified TV units for California and the rest of the nation.[29] These shares are shown in Section 7.5 of this report. Additional data is reported in the Technology Overview section. The rendering of data shown here describes Watts per unit and per square inch of screen size.

For example, Figure 6-3 shows that for most of the BCE program period televisions sold in California drew higher total wattage than televisions sold in the rest of the US. Even so, total Watts per unit has been decreasing steadily since 2009 due to the changes in technology discussed earlier, but it is most apparent with the change in ENERGY STAR specification and the resulting introduction of new models around January. Even though these are voluntary standards, manufactures use ENERGY STAR and CEE as a guide for designing future models.

Simultaneously Figure 6-2 illustrates that California televisions are at, or slightly below, the national average in Watts per square inch. These figures indicate that while efficiency levels are similar across the nation, television sold in California tend to use more energy. Using the technology overview as a guide, this higher consumption is most likely due to larger screen sizes and even a higher saturation of internet connectivity features.

[29] Unfortunately, at the time of purchase NPD did not provide unit values associated with these market shares due to confidentiality contracts with participating retailers.

Figure 6-3: Watts per Unit

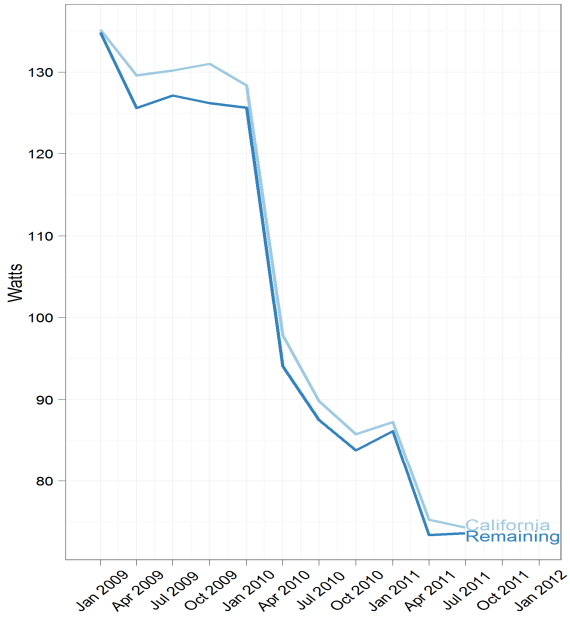
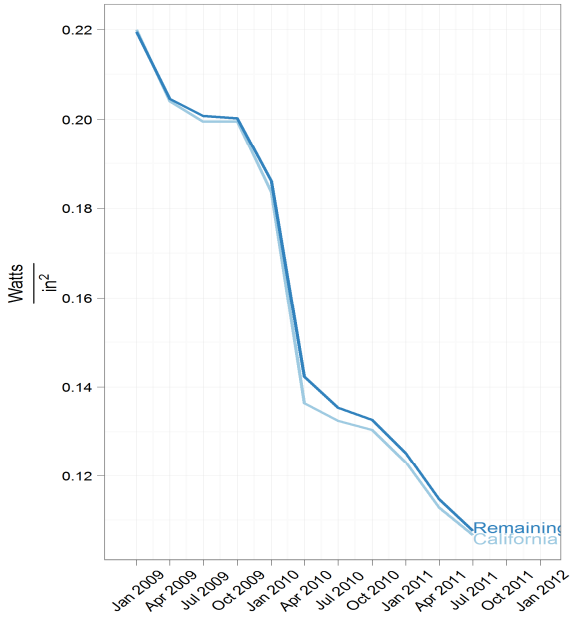



Figure 6-2: Watts per Square Inch




## 6.4 BCE Program tracking data (IOU)

The IOUs delivered tracking data to the evaluation team over the course of several months. Each IOU provided datasets with different structures and levels of completeness. DNV KEMA matched the variables in these datasets and processed these using SAS to develop a composite value for energy savings. **Error! Reference source not found.** presents a comparison for forecast and actual BCE savings from the Program Implementation Plans[30]. Data used in this report are from the IOU Tracking data Q4, 2013 delivered 3-15-13 and based on the field "*EDClaimYearQuarter*".

### Delphi Panel

#### 6.4.1 Applying Delphi Results

The Delphi results contribute to the counterfactual analysis by supplying market share of BCE qualified units along with timing that would have occurred in the absence of the program. Thus, the Delphi-constructed results become the counterfactual market shares compared with those observed and reported by the NPD sales data. The panel considered market trends in California and the US as separate questions.

[30] Current PIPs can be found at http://eega.cpuc.ca.gov/Main2010PIPs.aspx

## 6.5 Results – California Round 1 and Round 2

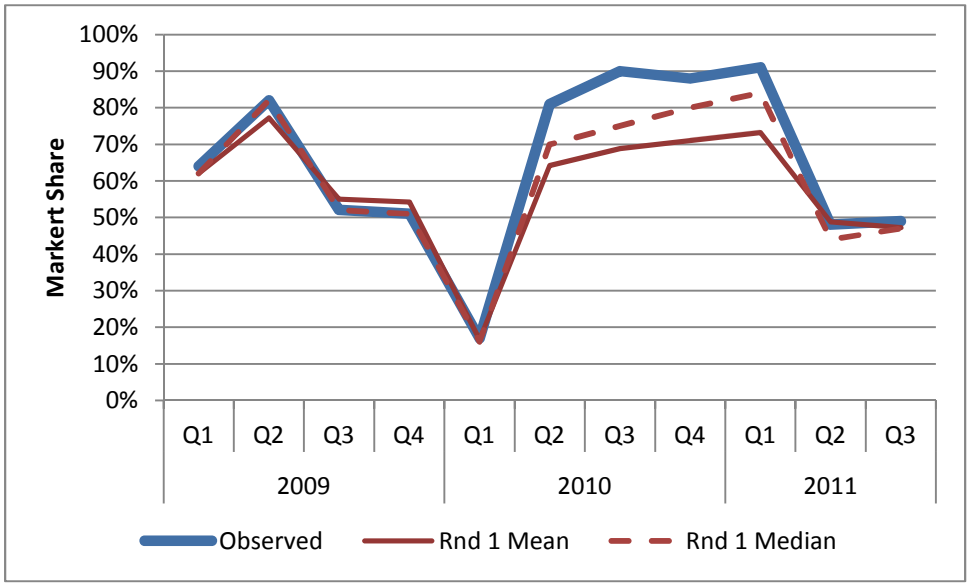
Panelist responses from Round 1 reflected multiple perspectives regarding BCE Program influence on the California television markets. Rows 2 and 3 in Table 6-1 below show hypothetical estimates derived from all counterfactual data provided by panelists. Specification changes went into effect during Q1, 2010 and Q2, 2011.

Table 6-1: CA Market Share of BCE-Qualified Units Sold – Round 1 Result

| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| **1. Observed** | 64% | 82% | 52% | 51% | 17% | 81% | 90% | 88% | 91% | 48% | 49% |
| **2. Panel Mean** | 62% | 77% | 55% | 54% | 17% | 60% | 64% | 67% | 69% | 49% | 47% |
| **3. Panel Median** | 63% | 82% | 52% | 51% | 17% | 73% | 80% | 81% | 85% | 46% | 48% |

Figure 6-4 presents available counterfactual data for the California market in graphic form. Observed and hypothetical market shares track each other fairly close starting from Q1 2009 until Q1 2010, at which point the average hypothetical estimate was substantially lower than actual observed estimates. From Q2 2010 until Q2 2011, mean counterfactual estimates of otherwise qualifying televisions in the absence of the BCE Program ranged from 17 percent to 21 percent less than what was obtained with the program in place. This period coincides with the introduction of ENERGY STAR 4.1 and 5.1 BCE Program incentives. Beginning in Q2 2011, observed and hypothetical estimates again track each other closely.

Figure 6-4: California Market Shares of BCE-Qualified Units Sold, Observed and Panel – Round 1



### 6.5.1 The Panel in Round 1

Estimates and responses from individual panelists fall into two distinct groups of thought. Group A, comprised of five panel members, asserts that the BCE program did have an influence on the market for program qualified TVs. These panel members do vary however, on the magnitude of the program's influence. Group B, three panel members, contends the program had little if any affect.

The summary for each group does not imply that all group members provided the exact same rational; only that one or more panelist provided at least one cause.

### 6.5.2 Group A

Group A contends that the BCE Program had a significant impact on the California market, contributing to increased market shares of BCE-qualified energy efficient televisions. Group A respondents identified two main causal mechanisms to explain this influence:

1) BCE Program incentives encouraged retailers to stock more BCE-qualified units, retailers communicated this interest to manufacturers, and manufacturers altered production lines accordingly; and

2) BCE Program interventions in the ENERGY STAR specification process resulted in higher-efficiency specifications, caused manufacturers to produce higher-efficiency models, and led to increased sales of more energy-efficient units, including BCE-qualified units.

Group A argues that the BCE Program had a significant impact on the rest of the US national market as well, due to the disproportionate influence of the California market on national retailer stocking decisions, and the effects of ENERGY STAR interventions. According to NPD data California represents approximately 8% percent of the national television market.

### 6.5.3 Group B

In contrast, Group B contends that the BCE Program had little impact on either the California market or the US national market. Group B respondents cited three key reasons why the program exerted minimal influence:

1) BCE Program incentives are not large enough to affect retailer stocking or manufacturer production decisions, and therefore cannot be responsible for changes in market shares of BCE-qualified units.

2) The TV design cycle requires retailers to make annual purchasing decisions prior to the specification of applicable incentive levels, so BCE Program incentives cannot significantly affect manufacturing or stocking practices.

3) The BCE Program has been in operational for too short a period of time to have produced any detectable changes in market share, and thus cannot be regarded as having a significant market impact to date.

Group B also argues that retailers make buying decisions on a national basis and not with specific consideration any one state.

### 6.5.4 The Panel in Round 2

To construct the Delphi panel the evaluation team and the IOUs nominated panel members with comparable professional credentials in their areas of expertise. As a result, all panel members' responses received equal weight to produce the aggregate attribution value.

Table 7-1 presents an overview of scores from the panel. These values represent the minimum and maximum attribution reported for any given quarter from Q1, 2010 when the program was fully operating to Q3, 2011 – the last quarter of the tracking data provided by the IOUs. The attribution is the difference between the market share of qualified TVs observed and the market share of qualified TVs estimated by Delphi panel.

Different panelists reported these maximum and minimum values across quarters. Panelists with closer ties to the program consistently reported higher values than panelists without connections to the program. Complete Round 2 estimates from all panel members are in Appendix E.

Table 6-2: Attribution ranges from Delphi panel for CA only

| Quarter 'Year | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 |
|---|---|---|---|---|---|---|---|
| **MAX** | 1% | 41% | 45% | 38% | 41% | 18% | 9% |
| **MIN** | 0% | 3% | 6% | 3% | 1% | 0% | 0% |
| **MEAN** | 0% | 16% | 21% | 18% | 19% | 4% | 1% |
| **MEDIAN** | 0% | 6% | 10% | 8% | 11% | 0% | 1% |

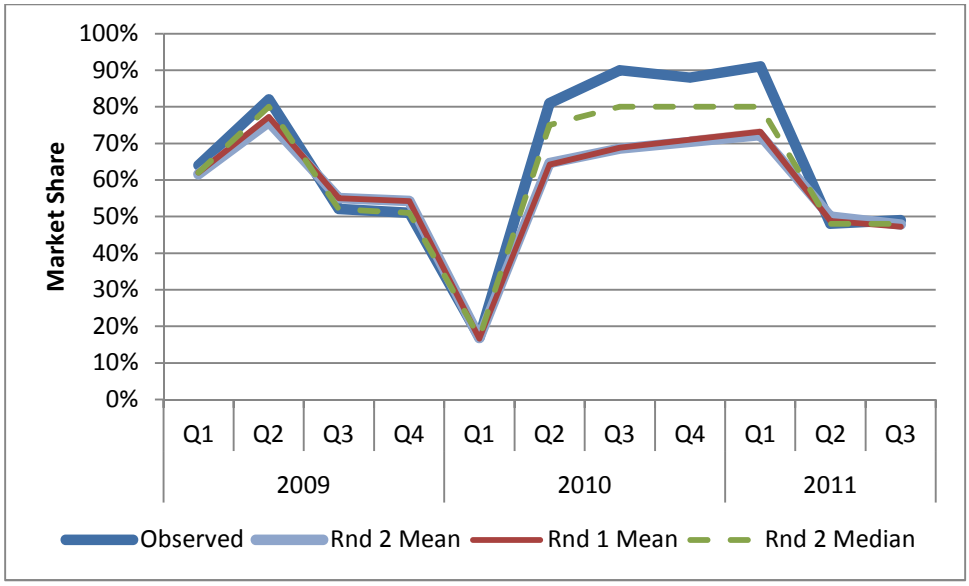
In Round 2 of the Delphi panel, participants were given the opportunity to revise their Round 1 responses in light of information contained in the Round 1 Results Summary. They also were asked additional questions relating to the relative causal weight exercised by different components of the BCE Program. Rows 2 and 3 in Table 6-3 show mean and median hypothetical estimates derived from all counterfactual data provided by panelists for Round 2.

Table 6-3: CA Market Share of BCE-Qualified Units Sold – Round 2 Results

| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| **1. Observed** | 64% | 82% | 52% | 51% | 17% | 81% | 90% | 88% | 91% | 48% | 49% |
| **2. Panel Mean** | 62% | 76% | 55% | 54% | 17% | 65% | 69% | 70% | 72% | 50% | 48% |
| **3. Panel Median** | 62% | 80% | 52% | 51% | 17% | 75% | 80% | 80% | 80% | 48% | 48% |

Figure 6-4 presents mean counterfactual data for the California market in graphic form for Round 1 and Round 2.

Figure 6-5: California Market Shares of BCE-Qualified Units Sold, Observed and Panel – Round 2




Comparing Round 1 and Round 2 results shows that participants made minimal changes to their original estimates of qualified units that would have been sold in the absence of the BCE Program. The average counterfactual estimate for the California market in Round 2 rose fractionally starting in Q2 2010 compared to Round 1. This was due to adjustments - in opposite directions - by two panelists. One panelist from Group A reduced their estimated level of BCE influence and one panelist from Group B increased their estimate of BCE influence.

Overall panelist reasoning and responses were consistent across both rounds, with experts in each group providing similar rationales for their market share estimates. Consequently, the two respondent clusters described above were equally evident in Round 2. Again, respondents in Group A believed that the BCE Program had an impact in California through pathways such as incentives and ENERGY STAR interventions. In contrast, panelists in Group B were skeptical of any substantive influence exercised by the BCE program, for a variety of reasons.

While it is always possible that opinions change over the course of the panel, when views are already firmly established, the likelihood of reconsideration and evolution declines. In the BCE case, panelist responses made clear that two diametrically opposed views on BCE influence strongly characterized expert opinion before the evaluation team began its work.

With neither position amenable to significant revision, the goal of convergence was very difficult to attain. Unfortunately, given the nature of the Delphi process, the evaluation team was able to confirm the stability of these views only *after* receiving results from the questionnaires. Prior to administering the panel, such bipolarity could necessarily only be a matter of informed speculation.

### 6.5.5 The Influence of Rebates vs. Lobbying

As noted earlier, in Round 2, panelists were asked additional questions about the varying significance of BCE Program elements. Specifically, panelists were asked to comment on the importance of

program incentives as opposed to strategic ENERGY STAR interventions by program actors. As would be expected, Group B respondents generally did not ascribe causal significance to any BCE Program component. Among Group A respondents, however, responses varied considerably. Some viewed program incentives as the key causal factor responsible for program influence in the market. By contrast, others saw ENERGY STAR interventions as the main driver. Most panelists emphasized a strong interconnectedness, however, between incentives and interventions as reinforcing any effect of the other.

## 6.6 Results – Remaining US Round 1 and Round 2

Panelist responses from Round 1 reflected multiple perspectives regarding BCE Program influence on US national television markets. Rows 2 and 3 in Table 6-4 below shows mean and median hypothetical estimates derived from all counterfactual data provided by panelists. Specification changes went into effect during Q1, 2010 and Q2, 2011. The green columns in the table show these.

Figure 6-5 presents available counterfactual data for the remainder of the US market in graphic form. A similar but less pronounced pattern is evident in these data, with panelists (on average) reporting a difference between actual and hypothetical market shares at the national level only over the period Q1 2010-Q2 2011. But this difference is smaller than the California estimates with averages ranging from 11% to 14% between Q2 2010 and Q1 2011. Nationally, this corresponds roughly to the period when ES 4.0 came into effect.

As with the California only estimates individual panel members landed in one of two distinct groups. Group A, comprised of five panel members, asserts that the BCE program did have an influence on the market for program qualified TVs. These panel members do vary however, on the magnitude of the program's influence. Group B, three panel members, contends it had little if any affect and are consistent in their estimates.

The summary for each group does not imply that all group members provided the exact same rational; only that one or more panelist provided at least one cause.

Table 6-4: Remaining US Market Share of BCE-Qualified Units Sold – Round 1

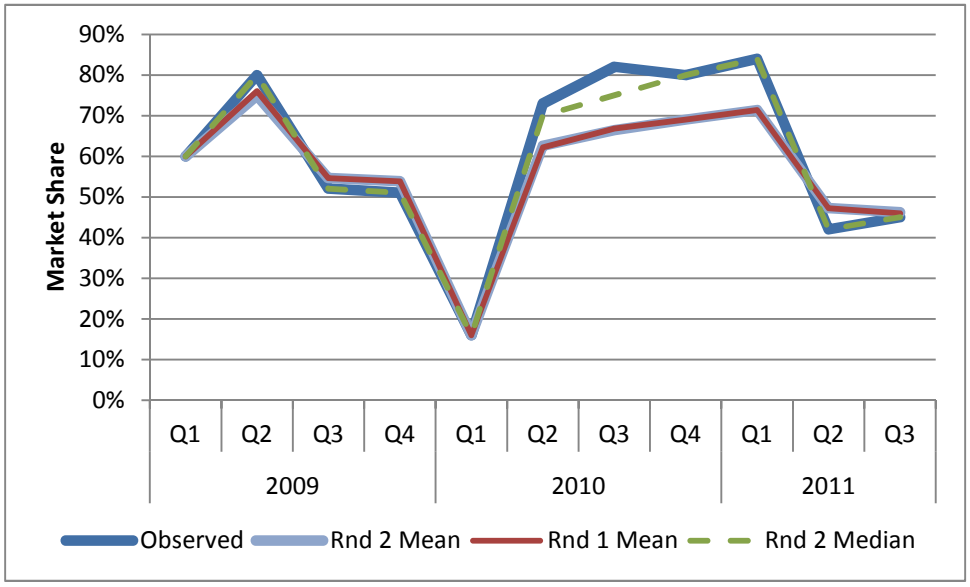
| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| **1. Observed** | 60% | 80% | 52% | 51% | 16% | 73% | 82% | 80% | 84% | 42% | 45% |
| **2. Panel Mean** | 60% | 76% | 52% | 51% | 16% | 62% | 67% | 69% | 71% | 47% | 46% |
| **3. Panel Median** | 60% | 80% | 52% | 51% | 16% | 70% | 75% | 80% | 84% | 42% | 45% |

In Round 2 of the Delphi panel, participants were given the opportunity to revise their Round 1 responses in light of information contained in the Round 1 Results Summary. Rows 2 and 3 in Table 6-3 shows mean and median panel estimates derived from all counterfactual data provided in Round 2. Figure 6-5 presents this same data in graphical form.

Table 6-5: Remaining US Market Share of BCE-Qualified Units Sold – Round 2

| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| **1. Observed** | 60% | 80% | 52% | 51% | 16% | 73% | 82% | 80% | 84% | 42% | 45% |
| **2. Panel Mean** | 60% | 75% | 55% | 54% | 16% | 63% | 68% | 69% | 71% | 47% | 46% |
| **3. Panel Median** | 60% | 80% | 52% | 51% | 16% | 73% | 80% | 80% | 84% | 42% | 45% |

Table 6-6: Remainder of US Market Shares of BCE-Qualified Units Sold, Observed and Panel – Round 2




Participant estimates were identical between Round 1 and Round 2. As a result, Round 2 results for the remainder of the US were indistinguishable from Round 1 results.

Individual panelist responses were also consistent across both rounds, with experts providing similar rationales for their market share estimates. Consequently, the two respondent clusters described above were equally evident in Round 2. Again, respondents in Group A believed that the BCE Program had an impact in the remainder of the US, due to the national buying structure of national retailers. In contrast, panelists in Group B were skeptical of any influence exercised by the BCE program precisely because buying is done at the national level.

## 6.7 Delphi Panel Detailed Responses

### 6.7.1 Panelists who view BCE as significant to retailer TV stocking decisions

Five of the eight experts on the panel expressed the basic view that the BCE Program exerted market influence in California and beyond. One panelist, for example, stated,

*"This program did influence and accelerate market share of energy efficient TVs in California, the Northwest, and the rest of the country. Without it, the market share would have been less."*

Different panelists emphasized different features of the program as well as different market attributes in explaining overall impact. However, all members of Group A stressed the mutually reinforcing nature of these variables, affirming the original underlying program logic.

As noted above, Group A respondents identified two main causal mechanisms to explain this influence. The first was retailer incentives, which in the view of these experts were substantial enough to affect retailer stocking decisions and to press manufacturers to produce more program-qualifying units. Respondents underlined the fact that TVs are typically low-margin products in retail consumer electronics. As a consequence, rebates available from the program figured prominently in retailer stocking and sales strategies, and were large enough (relative to normally low product margins) to induce major retailers to offer more energy-efficient TVs for sale and pressure upstream manufacturers accordingly. Panelist 3 summarized the process as follows:

*"The buyers at the largest retailers embraced the program and demanded / requested more EE TVs to increase the contribution to their bottom-line 'margin' through BCE incentives, thereby making the EE TVs more attractive to the retailers."*

Panelist 6 stated flatly that

*"The incentive amounts were in fact large enough to influence one of the largest retailer's assortment decisions. …and when they change assortment – so do competitors."*

Panelist 5 confirmed this influence on other retailers and manufacturers:

*"I heard first hand from both retailers and manufacturers the effect of the BCE program on stocking and manufacturing."*

Group A panelists offered detailed accounts of overseas manufacturers responding to downstream pressure by producing more energy-efficient, program-qualifying units for the California market (as well as the broader US, see below).

The second mechanism identified by Group A members was effective BCE Program interventions in the national ENERGY STAR standard-setting process. As Panelist 1 put it,

*"First and foremost, the BCE Program influenced ENERGY STAR to set more stringent specifications and to accelerate effective dates."*

According to Group A respondents, interventions at various points in the standard-setting process resulted in more ambitious ENERGY STAR standards than otherwise would have been adopted. BCE Program representatives intervened formally (meetings) and informally (back channels), directly (comment periods) and indirectly (via industry proxies and consultants). Because ENERGY STAR specifications exercise such a strong pull in the consumer electronics industry, more stringent and accelerated specifications caused TV manufacturers to enhance the energy-efficiency levels of their product lines. This generic effect was reinforced by tying program rebates directly to stronger

specifications, thereby creating direct incentives for retailers to push manufacturers to meet the new standards.

Experts from Group A gave the program particular credit for helping strengthen ENERGY STAR versions 4 and 5. Panelist 1 argued that prior BCE interventions had raised the bar for version 4.0 deliberations, setting the stage for more aggressive proposals:

> *"For a specific example, look at the version 4 proposals submitted by Panasonic, the CEA, and the Plasma Display Coalition. For a 50 inch TV, they proposed an "on mode" level roughly equal to 200 watts instead of the BCE proposal of 150 watts. You can argue that the BCE Program helped to achieve those 50 watts of increased stringency and therefore influenced the entire market, independent of the BCE program incentives."*

Panelist 5 described a more direct program intervention during ES version 5.0 discussions:

> *The BCE program also influenced and contributed to more stringent ENERGY STAR specifications, ENERGY STAR 5.0 in particular. The consumption cap was at risk – CEE did not support it – and the BCE program intentionally promoted the future 5.0 spec with a higher incentive for large TVs that met the cap with success. Market share for the higher efficiency models grew, and the ENERGY STAR specification not only stuck, but went into effect ahead of schedule."*

One expert generally aligned with Group A, however, disputed assertions that program representatives had intervened in the ENERGY STAR specification formulation process. Panelist 6 declared,

*"We do not believe the BCE Program had any direct interventions in the ENERGY STAR specification process. While the BCE sponsors were actively lobbying the EPA for stronger ENERGY STAR standards, the BCE program itself was new and at this time unproven."*[31]

As noted earlier, Group A experts gave mixed responses on the Round 2 follow-up question concerning whether program rebates or ENERGY STAR interventions were more responsible for raising energy-efficient TV market shares. Some experts regarded incentives as the most important program element. Panelist 5, for instance, declared straightforwardly

> *"…incentives to the retailers are by far the biggest influence."*

Other experts pointed to ENERGY STAR interventions as the key causal factor. In the words of Panelist 1,

[31] The IOUs and in particular PG&E did participate in comments and discussions with ENERGY STAR staff on next tier standards along with NRCD and the manufacturers. In April 2009 PG&E, on behalf of the BCE collaborative presented to the ENERGY STAR stakeholders strongly supporting Tier 2 and Tier 3 draft specifications.

*"I would say that the ENERGY STAR intervention was more effective because of the way the market responded to version 3, 4, and 5 (and soon to be 6). Pushing ENERGY STAR to set more stringent levels and to accelerate the timing of new specifications impacted the whole market—both nationally and globally—thus, the results are likely the most significant."*

However, most responses emphasized the essential interconnectedness of these two program activities. At the most basic level, retailer incentives were tied directly to ENERGY STAR specifications, so more rigorous specifications promoted the manufacture of more efficient units to enable retailers to take advantage of rebates. Similarly, higher rebate levels led to more sales of BCE-qualified, ENERGY STAR-labeled units. Respondents also identified other, more complex interactive causal pathways. Higher sales of efficient TVs driven by rebates enabled the BCE Program and others to lobby for more ambitious ENERGY STAR specifications and schedules. Higher standards resulted in manufacturers improving energy efficiency levels independent of events in California, which in turn made BCE rebates more accessible to California retailers, facilitated changes in stocking practices, and boosted the state incentive program. Encouraging BCE sales levels from retailers were important in making the case for even stricter ENERGY STAR standards, which when tied to more aggressive rebates increased the overall level of energy savings. As Panelist 6 summarized things,

*"We believe these two items are not mutually exclusive but rather chronologically related."*

Just as Group A identified two distinct causal mechanisms through which the BCE Program improved market shares of energy-efficient TVs in California, these experts also identified two distinct pathways via which the program had a positive influence on the US national market outside California. The first such pathway had as its source the disproportionate influence of the California market on national retailer stocking decisions. Put simply, because California forms such a large and important part of the national TV market, stocking decisions made by national retailers must necessarily take into account developments and trends in California—when major retailers responded to the BCE Program by increasing the availability of program-qualified units, this would inevitably have spilled over to similarly affect stocking practices in other regions and markets. As Panelist 9 described it,

*"The rest of the U.S. line-up was largely influenced by the buying decisions based on CPUC regions because it represents such a large portion of overall business. Merchandising philosophies and large buying volumes often dictated a similar line up in other regions of the US."*

Again, according to Panelist 1,

*"The BCE Program's incentives have an impact on the national market because of the nature of the TV retail market. Many retailers make stocking decisions on national basis, so if a retailer decides to stock a BCE-qualified TV over a non-qualified TV, it'll likely impact California and the remainder of the US."*

In regard to stocking decisions, one expert stressed the particular significance of a leading national retailer. For Panelist 6,

*"Absent the BCE program, [this retailer] would not have been working to influence the energy efficiency of televisions ...." and" … TV manufactures would not have the influence they needed to make investments in energy efficiency that would detract from their operating profit – as they did do when the BCE program was in effect."*

In addition to the spillover effects of stocking decisions, Group A panelists also cited BCE interventions in the Federal ENERGY STAR program as positively affecting the remainder of the national market. This occurred both directly, by boosting national efficiency standards leading to increased sales of ENERGY STAR-labeled units, and indirectly, by helping boost the ambition of other state and regional efficiency programs that were tied to the more aggressive national ENERGY STAR specifications. Panelist 1 elaborated on this point:

*"ENERGY STAR is a strong enough brand that many manufacturers will design to meet the levels with or without the BCE Program (the BCE Program gives them extra motivation). Therefore, the influence that the BCE Program has on the ENERGY STAR stringency is huge in influencing the entire market… The issue remains the same for both version 5 and 6, as the BCE Program helped to accelerate effective dates and supported more stringent levels."*

According to Panelist 3, PG&E played a unique role in promoting more stringent ENERGY STAR specifications nationally and exporting linked rebate programs modeled on the BCE Program to other states and regions. Specifically, this expert attributed rebate programs in Nevada, Vermont, and the Pacific Northwest (NEEA), as well as IOU programs sponsored by DTE and Xcel Energy, to evangelizing activity carried out by PG&E. As this expert declared,

*"It is my hypothesis that without CA leadership, specifically PG&E, the BCE type programs in other states would not have been launched."*

### 6.7.2 Panelists skeptical of BCE influence on retailer TV stocking decisions

Group B experts, consisting of three out of eight total panel participants, took the contrasting view that the BCE Program had little impact on either the California market or the US national market. As Panelist 4 summarized it,

*"The program did not have dramatic influence on the market share levels of qualifying models."*

According to these panelists, neither program rebates nor ENERGY STAR interventions were responsible for observed changes in energy-efficient TV market shares, in California or the US as a whole. Instead, members of Group B attributed increases in market share to alternative factors not identified by experts in Group A.

In making their case, Group B respondents cited three key reasons why the program exerted minimal influence (note that not all respondents offered the same three reasons). First, BCE Program incentives are not large enough to affect retailer stocking or manufacturer production decisions, and therefore cannot be responsible for changes in market shares of BCE-qualified units. Panelist 7 stated plainly,

*"BCE Program incentives are not large enough to affect retailer stocking or manufacturer production decisions."*

This panelist elaborated:

*"The incentives from the BCE Program have been provided only to retailers, not manufacturers. The BCE program could be attractive to retailers, but not to manufacturers. I doubt how consistently influential the incentive of $10-$20 per unit is on retailers' decision to assign shelf space for energy-efficient products."*

From this perspective, program incentives were simply insufficient to induce retailers to alter stocking decisions in favor of more energy-efficient products, regardless of typical industry margins. Little allowance is made for the possibility that retailers might have pressed upstream manufacturers to alter production lines in favor of more efficient, program-qualifying units. This conclusion stands in direct contrast to arguments made by experts in Group A.

The second argument made by Group B respondents was that the TV design cycle requires retailers to make annual purchasing decisions prior to the specification of applicable incentive levels, and so BCE Program incentives cannot significantly affect manufacturing or stocking practices. Panelist 4 elaborates this point:

*"The design cycle for consumer electronics is such that the products (TV's) would have to be designed, built and (commonly) shipped before the rebate structure was finalized in each year. In other words, the payment of California rebates would have played little role in what was actually shipped to and sold in the United States during that time period because manufacturers and retailers had to determine the product mix prior to any concrete knowledge of any benefit they might derive from the rebates."*

Since retailer stocking and purchasing decisions must be made prior to specification of rebate levels, these rebates cannot logically influence annual orders to manufacturers. This view rules out the sort of retailer engagement with the BCE Program that would provide retailers with a reliable set of expectations regarding upcoming rebate levels. This view also appears to rule out the possibility that retailers could communicate changes in stocking preferences quickly enough for manufacturers to modify production lines accordingly. As above, this point of view conflicts directly with arguments made by members of Group A.

The third point emphasized by some Group B respondents was that the BCE Program has been in operation for too short a period of time to have produced any detectable changes in market share, and thus cannot be regarded as having a significant market impact to date. For example, Panelist 8 stated,

*"The rest of the U.S. would not be directly influenced by CA behaviors for the time frame here."*

From this point of view, BCE Program incentives would need to have been available before 2009 in order to have influenced market dynamics over the period in question (Q1 2009 through Q3 2011). As rebates were only available starting in Q1 2009, the signal-to-noise ratio over the following 32 months would have been too low to regard any detected changes as significant.

Group B panelists disputed the suggestion that the California BCE Program generated any follow-on effects in other jurisdictions. Ironically, these experts referred to the nature of retailer stocking decisions to draw the opposite conclusion on this point than members of Group A. According to Panelist 4,

> *"Most retailers do not have state-specific or even region-specific stocking practices."*

Rather, major retailers generally have US national stocking strategies, a point also made by Group A. But instead of adjusting national stocking strategies to take account of important state and regional factors (the Group A position), experts from Group B argued that national stocking strategies do not reflect state-level developments. Panelist 7 argued,

> *"Regional and local stores of national chains such as Best Buy do not have decision making power on TV purchasing, nor do they have influence on these purchase decisions,"*

As a result,

*"I don't think that the BCE Program has an influence on the market share of energy-efficient TVs (i.e., ENERGY STAR qualified TVs) in the US market."*

Essentially, Group A conceives national stocking decisions as built on state and regional considerations, whereas Group B conceives such decisions being made independently of local features.

Instead of assigning causal power to the California BCE Program, Group B experts offered two alternative explanations to account for observed changes in market share for energy-efficient TVs. One explanation suggested that numerous attributes unique to California were responsible for positive market trends. Panelist 8 hypothesized that

*"Demographic and cultural difference may play a role in difference between CA and others."*

One important difference noted by Panelist 7 is that

> *"Public awareness of energy efficiency in California seems to be better than in the rest of the U.S."*

More broadly, California's "green" culture may have been responsible for energy-efficient market trends observable in TV sales data. Panelist 7 also pointed to the possibility of an "income effect" driving energy-efficient sales in California:

> *"Regardless of the BCE program, TV stocks in California stores may have higher performance and better energy efficiency than those in some other states where there are more low-income people than California."*

The other explanation centers on technology developments that took place in the market at the same time the BCE Program was operational. Specifically, advances in display technology, which occurred independently of BCE rebates or interventions, tilted the market toward higher-efficiency models. As Panelist 4 put it,

*"Technology developments in display technology, that happened to be more energy efficient, fit a feature set that was desirable to consumers. This was the primary goal of manufacturers and retailers and provided the basis for stocking practices during the period in question."*

Panelist 7 provided additional detail:

> *"It is also important to note that the historical development of ENERGY STAR specifications is in line with recent TV market transitions from 1) traditional CRT TVs to flat panel TVs and 2) conventional CCFL[32] backlit LCD TVs to LED-backlit LCD TVs. These transitions have made it easier for TV manufacturers to meet more stringent energy efficiency standards than before, and would have happened in the absence of the BCE Program, although stringent standards might have accelerated the technology transition. Market transformation programs still need to take into account such rapid developments in display technologies."*

From this perspective market changes (and energy savings) apparently attributable to the BCE Program were in fact the result of separate, unrelated technological developments. Crediting the program with gains in efficiency is mistaken, and overlooks the more fundamental technical and economic factors responsible for changes in sales and stocking practices.

## 6.8 Market Effects

The IOUs filed BCE programs as resource programs. In other words the program goals revolved around energy savings in CA. This evaluation focuses on these CA savings but there are two aspects related to market effects that deserve attention. These are,

1) Market lift outside California as a result of California BCE activity.
2) Influences on more stringent changes in ENERGY STAR standards as a result of BCE advocacy.

### 6.8.1 Market Lift outside California

BCE panel experts also provided estimates of sales patterns for high efficiency TVs for the remainder of the nation outside California. The net-to-gross emerged from the Delphi panel where experts provided quantitative estimates of the difference of the efficiency levels of televisions between the observed market shares of EE TVs in the remainder of the US and what "would have been" in the absence of the program. The process for eliciting responses on the US proceeded along with the Delphi process for the California market. Panel members, the amount of information available for consideration, and the timing were exactly the same for the both sets of estimates.

Table 7-5 presents scores from the panel. These values represent the minimum and maximum attribution reported for any given quarter from Q1, 2010 when the program was fully operating to Q3,

[32] CCFL = Cold Cathode Fluorescent Lamp

2011. As before different panelists reported these maximum and minimum values across quarters. This time however, only two panelists attributed any influence at all to BCE outside of California.

Table 6-7: Attribution ranges from Delphi panel for US excluding CA – Round 2

| Quarter 'Year | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 |
|---|---|---|---|---|---|---|---|
| **MAX** | 0% | 33% | 37% | 30% | 34% | 12% | 5% |
| **MIN** | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **MEDIAN** | 0% | 6% | 10% | 8% | 11% | 4% | 1% |
| **MEAN** | 0% | 10% | 14% | 11% | 13% | 0% | 1% |

Overall the Delphi panel was skeptical of any savings generated outside California as a result of the BCE program. Section 6.6 contains the detailed arguments made by panel members for and against BCE influence on retailer stocking behaviors.

### 6.8.2 BCE Influence on ENERGY STAR specifications

The BCE coalition, led by PG&E, simultaneously advocated for stricter ENERGY STAR specifications. This advocacy role included,

- Engaging manufactures through meetings at conferences and with correspondence
- Lobbying ENERGY STAR through meetings at conferences, email correspondence, presentations, and public comments.

PG&E provided the evaluation team with documentation of email correspondence from its Salesforce database. The database provides transcripts of email from PG&E and its consultants to market actors from 2009 through June 2011. It details the program recruitment effort with retailers, discussions to educate manufactures about the program, and interaction with EPA on TV specification formats and timing for release.

The BCE collaborative has actively engaged ENERGY STAR on specifications since 2009 when the BCE program began. It is clear that the BCE program was part of a movement lobbying for specification increases for televisions. There is little evidence however, to support the claim that BCE the main influence for changes in specifications. ENERGY STAR sets specification such that approximately 25 percent of expected models will at least meet the requirement. A review of public comments on ENERGY STAR specifications reveals that in addition the BCE other stakeholders were encouraging stricter standards and countering manufacture claims that specifications were too stringent. For example in July 2009 NRDC supported the EPA specifications for ES 4 and 5 noting,

> *"Preliminary data from Sharp shows that these models not only meet V 4.0 but also meet V 5.0, three years before its effective date."*[33]

[33] Noah Horowitz, "NRDC Comments to ENERGY STAR's July 20 Final Draft TV Specification", National Resource Defense Council, July 24, 2009.

During that same 2009 process when asked why ENERGY STAR did not adopt a separate less stringent specification for TV 60 diagonal inches and larger ENERGY STAR responded,

> *"…Further, manufacturer and other industry experts project significant reductions in TV energy consumption in the next year. Leading manufacturers have announced that half or more of the models they ship in the next year will make use of more efficient back lighting (LED) – between 50 and 100% of models. The models that meet or are close to the Version 5.0 requirements today use LED backlights. Trends suggest that as the prevalence of this lighting option increases and the cost decreases over the next nearly three years, there will be meaningful availability of LED back lighted sets for the consumer in the larger TV sizes. EPA will continue to closely monitor the marketplace over the coming years to verify these efficiency trends.*[34]

Finally, the BCE collaborative has actively engaged ENERGY STAR on specifications since 2009 when the BCE program began. As late as April 2011 however, ENERGY STAR was establishing new qualification levels through their 2011 Top Tier pilot program. In comments the BCE collaborative was requesting that ES match the BCE incentive tiers.

> *"...A preferred specification level aligned with existing programs such as ENERGY STAR version 5 +2x% would be consistent with how the BCE communicates qualifying specification levels to participating retailers."*[35]

In a September 2012 summary[36] ENERGY STAR stated they were rolling out the designation while acknowledging that some energy efficiency program sponsors also used other tier systems from CEE or the BCE collaborative.

No conclusion can be drawn based on one example, but this supports the contention from the Delphi that the BCE influence on ENERGY STAR may not be as strong as asserted by the IOUs.

# 7 Calculating the net-to-gross ratio

## 7.1 Program Influence on Sales from Delphi

For this impact evaluation the net-to-gross ratio is the "counterfactual" savings compared to the savings reported by the IOUs. Where,

[34] Final Draft Versions 4.0 and 5.0 ENERGY STAR® TV Specification, Comment Response Summary Document, September 2, 2009.

[35] PG&E, SDG&E, NEEA, SMUD, "Follow up Comments to the ENERGY STAR tier Proposal" to EPA, April 6, 2011

[36] ENERGY STAR MOST EFFICIENT: EARLY EXPERIENCE SUMMARY, September 25,2012, energystar.gov/ia/partners/downloads/ENERGY_STAR_Most_Efficient_Early_Experience_Summary_2012.pdf

- Gross savings and units are reported from the quarterly submissions of savings claims (Q4, 2012 delivered to KEMA on 3-15-2013). For NTG purposes, to create the gross savings KEMA applies the ex-post average savings per unit to the total units reported in the tracking data.
- Net savings is calculated by converting the "counterfactual" market share to units and applying ex-post average savings per unit.

This ratio encompasses the overall influence on the market for high efficiency TVs attributed to the program with a realization rate. The market share difference emerged from the Delphi panel where experts provided quantitative estimates of the difference between the observed market shares of EE TVs in California and what "would have been" in the absence of the program.

To develop a single net-to-gross number for the BCE program the evaluation team performed multiple steps to capture and quantify its main components.

The first step was to develop energy savings.

1. Unit savings in Watts for program qualified units in each quarter were compared to non-program qualified units in the same quarter. These savings were based on the NPD sales data market shares and were calculated by technology type at the model level. Table 7-1 presents average savings by technology type.
2. Watt savings was converted to kWh savings. The run hour assumptions of 5.16 hours per day came from PG&E's work papers for 2010 (PGECOAPP104).

The next step was to develop the TV unit sales attributed to the BCE program.

3. The counterfactual market share estimates from the Delphi panel were converted to number of TV units.
4. These units were multiplied by savings per unit.

Finally a net-to-gross ratio was generated by comparing total ex-post savings reported in the IOU tracking data with total savings generated via the Delphi panel market share estimates.

### 7.1.1 Unit Savings (Watts)

First, average Watt savings per unit by market share and technology type were calculated from the NPD sales data. Since the purpose of the program is to move unit efficiency beyond the ENERGY STAR level the baseline is not the ENERGY STAR specification. It is the difference between the average power draw of non-program qualified units sold in the market from program qualified units. These are sales weighted values by technology and screen size.

Table 7-1: TV unit Watt savings

| Quarter 'Year | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 |
|---|---|---|---|---|---|---|---|
| ***Program qualifying unit draw in Watts*** | | | | | | | |
| ***Average*** | ***92.8*** | ***90.3*** | ***89.0*** | ***86.8*** | ***87.6*** | ***68.0*** | ***68.3*** |
| **LCD-CCFL** | 86.2 | 80.9 | 77.5 | 78.7 | 79.7 | 59.2 | 57.3 |
| **LCD-LED** | 79.1 | 80.2 | 76.4 | 73.2 | 74.5 | 57.4 | 61.3 |
| **Plasma** | 122.1 | 123.2 | 129.8 | 130.7 | 125.4 | 103.3 | 102.3 |
| | | | | | | | |
| ***Non-program qualifying unit draw in Watts*** | | | | | | | |
| ***Average*** | ***143.8*** | ***145.2*** | ***140.2*** | ***134.0*** | ***141.2*** | ***92.2*** | ***92.3*** |
| **LCD-CCFL** | 119.9 | 115.6 | 104.4 | 106.5 | 114.4 | 83.9 | 79.2 |
| **LCD-LED** | 142.5 | 139.2 | 128.5 | 118.6 | 125.1 | 77.1 | 83.2 |
| **Plasma** | 223.2 | 226.5 | 236.5 | 236.2 | 228.1 | 136.8 | 134.9 |
| | | | | | | | |
| ***Unit savings in Watts*** | | | | | | | |
| ***Average*** | ***51.0*** | ***54.9*** | ***51.1*** | ***47.2*** | ***53.6*** | ***24.3*** | ***24.0*** |
| **LCD-CCFL** | 33.7 | 34.7 | 26.8 | 27.8 | 34.7 | 24.7 | 21.8 |
| **LCD-LED** | 63.4 | 58.9 | 52.1 | 45.5 | 50.6 | 19.7 | 21.9 |
| **Plasma** | 101.1 | 103.4 | 106.7 | 105.5 | 102.8 | 33.5 | 32.6 |
| | | | | | | | |
| ***Unit savings as a percent of baseline*** | | | | | | | |
| ***Average*** | ***34%*** | ***36%*** | ***34%*** | ***33%*** | ***36%*** | ***27%*** | ***26%*** |
| **LCD-CCFL** | 28% | 30% | 26% | 26% | 30% | 29% | 28% |
| **LCD-LED** | 45% | 42% | 41% | 38% | 40% | 26% | 26% |
| **Plasma** | 45% | 46% | 45% | 45% | 45% | 24% | 24% |

### 7.1.2 Unit Savings (kWh)

The conversion from kW to kWh assumes annual run hours of 1,882 (5.16 hours/day * 365 days) and matches the run hours documented in the PG&E workpapers[37]. For example, from Table 7-1 the average savings for LCD-CCFL units in Q1 '10 is 33.7 Watts. Dividing 33.7 Watts by 1,000 equals 0.0337 kW. Multiplying 0.0337 kW by 1,882 hours produces an average unit savings of 63.42 kWh savings for LCD-CCFL TVs. kWh savings between BCE qualified and non-qualified units are shown in table 7-3.

The PG&E IOU workpapers apply electric and gas interactive affects to the savings calculation, but we do not apply them in this analysis. Perhaps a case can be made for interactive effects on plasma TVs

[37] Work Paper PGECOAPP104 Energy Efficient Televisions Revision 3, page 10, July 20, 2010

that produce more heat than other display technologies, but as technologies designed for mobile devices become more prevalent in stationary home TVs, any interactive affects become insignificant for the energy savings calculation. By not including the negative natural gas savings from HVAC interactive affects, our analysis biases the savings per unit upward and in favor of the BCE program.

Table 7-2: Annual kWh savings per BCE qualified unit

| | Technology | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 |
|---|---|---|---|---|---|---|---|---|
| Average savings per unit (kWh) | LCD-CCFL | 63 | 65 | 51 | 52 | 65 | 46 | 41 |
| | LCD-LED | 119 | 111 | 98 | 86 | 95 | 37 | 41 |
| | Plasma | 190 | 195 | 201 | 199 | 193 | 63 | 61 |

### 7.1.3 Program Savings (Delphi)

The units attributed to the BCE program were derived by applying the resulting Delphi estimates (See table 7-1) to total sales in California as reported by NPD. One caveat is that the NPD data contains all sales in California. Due to this state level reporting the NPD sales dataset also contains sales data from retailers that did not participate in the BCE program. As a result of all California sales being included as the base, the estimate of sales attributed to BCE are overstated. Unfortunately the degree of overstatement is not known because NPD maintains confidentiality clauses with retailers that prevent publishing retailer market shares in specific regions. To compensate for this, section 7.2 of this report explores the sensitivity of NTG around total sales.

Units attributed to the BCE program are calculated by multiplying total observed California sales by the market shares estimated through the Delphi panel. Table 7-4 reports the resulting number of units sold, by technology type.

Table 7-3: Units attributed to the program

| Technology | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 | Total |
|---|---|---|---|---|---|---|---|---|
| **LCD-CCFL** | 879 | 53,216 | 59,744 | 103,243 | 61,986 | 6,845 | 1,970 | **287,883** |
| **LCD-LED** | 147 | 17,996 | 28,115 | 55,762 | 38,176 | 10,195 | 3,352 | **153,743** |
| **Plasma** | 267 | 20,691 | 25,573 | 36,153 | 26,194 | 4,746 | 1,324 | **114,948** |
| **Total** | **1,293** | **91,903** | **113,432** | **195,158** | **126,356** | **21,786** | **6,646** | **381,583** |

Multiplying Table 7-2 by Table 7-3provides the total savings attributed to the program by the Delphi experts. The resulting kWh savings are shown in Table 7-4.

Table 7-4: kWh savings attributed to the BCE program

| Technology | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 | Total |
|---|---|---|---|---|---|---|---|---|
| **LCD-CCFL** | 55,738 | 3,474,189 | 3,018,494 | 5,398,396 | 4,044,590 | 318,021 | 80,986 | **16,390,414** |
| **LCD-LED** | 17,523 | 1,995,738 | 2,757,897 | 4,769,788 | 3,632,159 | 377,893 | 138,135 | **13,689,133** |
| **Plasma** | 50,730 | 4,024,602 | 5,134,992 | 7,177,769 | 5,065,757 | 299,118 | 81,206 | **21,834,174** |
| **Total** | **123,991** | **9,494,529** | **10,911,383** | **17,345,953** | **12,742,506** | **995,032** | **300,327** | **51,913,721** |

### 7.1.4 Program Savings (IOU)

According to the IOU tracking data provided to KEMA, over this same period, the IOUs paid rebates on 1,435,494 units and reported ex-ante gross savings of 182,641,713 kWh. Table 7-5 shows reported savings by calendar quarter. Savings is reduced to 118,819,930 kWh when the ex-post savings per unit is applied to the reported program units. This adjustment equates to a statewide realization rate of 65.1 percent.

Table 7-5: kWh gross savings reported in the IOU tracking databases[38]

| Qtr | Q1 '10 | Q2 '10 | Q3 '10 | Q4 '10 | Q1 '11 | Q2 '11 | Q3 '11 | Total |
|---|---|---|---|---|---|---|---|---|
| **PG&E** | 649,850 | 6,105,782 | 13,540,880 | 51,467,983 | 14,929,047 | 11,315,895 | 12,703,736 | **110,713,173** |
| **SCE** | | 1,168,299 | 5,478,966 | 36,760,287 | 8,932,434 | 9,370,974 | 2,309,328 | **64,020,288** |
| **SDG&E** | | 816,998 | 1,675,531 | 3,706,358 | 987,925 | 503,321 | 218,119 | **7,908,252** |
| **Total** | **649,850** | **8,091,079** | **20,695,377** | **91,934,628** | **24,849,406** | **21,190,190** | **15,231,183** | **182,641,713** |

### 7.1.5 Net-to-Gross Calculated

Comparing the gross ex-post savings of the statewide BCE program (Table 7-5) to the net ex-post savings developed through the Delphi panel (Table 7-4) yields a net-to-gross of 43.7 percent for the program (51,913,721kWh / 118,819,930kWh = 0.437)[39].

Applying this same approach but substituting the Median market share value from the Delphi yields a net-to-gross of 20.3 percent for the program (24,162,904kWh / 118,819,930kWh = 0.203).

## 7.2 Selecting the appropriate market lift value

### 7.2.1 Central Tendency

The calculation of a single net-to-gross ratio relies on several variables that are imprecise. For example, total savings are determined by multiplying market lift units by Watt savings per unit. The Delphi panel estimates market lift percent. These estimates are applied to total number of units sold in California and this determines units sold due to the program.

For this study the panel did not trend toward consensus. In fact their opinions began at one extreme or the other and did not change despite exposure to all panelists' views.

Due to this variance in views, the resulting net-to-gross ranged from a minimum of 4.9 percent (essentially no effect), to a maximum of 100.4 percent (very influential). This range includes the

[38] IOU Tracking data Q4, 2013 delivered 3-15-13. Based on the field "EDClaimYearQuarter"

[39] This value incorporates a calculated statewide savings realization rate of 65.1%. The realization rate was developed by applying the estimated average unit savings across the three main technologies from the NPD sales data to the number of units reported by the IOUs.

maximum and minimum values from multiple panelists and not one single panelist's score. The extremes should not be considered as NTG candidates in any case, but they do illustrate the full range of panelist's views.

That leaves two measures - the mean and the median to represent the full panel's opinion. The median value eliminates any undue influence from extreme values. For the study, the views of the panelists may diverge, but they all should carry equal weight. As a result we selected the mean value as the better representation of the panel's collective opinion and as the basis for the net-to-gross calculation.

Table 7-6: Net-to-gross using Delphi estimates from Table 6-8

| Scenario | Savings | Market Lift | Net To Gross |
|---|---|---|---|
| 1 | 100% | Mean | 43.7% |
| 2 | 100% | Median | 20.3% |
| 3 | 100% | Max | 100.4% |
| 4 | 100% | Min | 5.9% |

### 7.2.2 Sensitivity

As discussed in section 7.2.1, there is a level of uncertainty surrounding the net-to-gross point estimate. Sensitivity to total California unit sales volume is shown in Table 7-7. Each scenario is in comparison to the values derived from the NPD sales data database.

Table 7-7: Sensitivity to unit sales volume estimate

| Scenario | CA Sales | Market Lift | Net to gross |
|---|---|---|---|
| 1 | 80% | Mean | 35.0% |
| 2 | 90% | Mean | 39.3% |
| 3 | 100% | Mean | 43.7% |
| 4 | 110% | Mean | 48.1% |

### 7.2.3 Alternate net to gross calculations

The evaluation team did generate alternate net to gross ratios using the same basic framework used in Section 7.1.5 of this report. The difference was that the mean Delphi estimate was replaced with other estimates of BCE influence. For example, a net-to gross ratio was developed using,

1. an analysis in light of the fact that the BCE program continued to pay incentives on ES 4.0 after ES 4.0 was effective and ES 5.0 qualified TVs began to enter the market
2. aggregate California sales adjusted to reflect participating retailers only
3. a comparison between California and the remaining US outside California

#### 7.2.3.1 ENERGY STAR 4.0 rebates during ENERGY STAR 5.0 specification period

One argument is that the BCE program actually hindered the market for high efficiency TVs by paying retailer rebates for ES 4.0 qualified televisions after the ES 4.0 specification went into effect. The result was that retailers were restocking inventory with ES 4.0 units when they should have been focused on ES 5.0. To account for this misalignment of rebates and ES specifications the ES 4.0 sales should be removed from any IOU credit. To apply this contention the evaluation team eliminated ES 4.0 qualified units from the third quarter of 2010 through the first quarter of 2011. This represents the period of overlap when ES 4.0 rebates should have ostensibly stopped in favor of the ES 5.0 TVs. Removing credit for ES 4.0 units produces a **NTG of 0.223.**

#### 7.2.3.2 Sales from participating retailers only

The calculation of the NTG uses total unit sales in California as a basis. Market share percentages (actual and estimated) are applied to this base and compared to unit volume in IOU tracking data. The values used in the report come from the NPD dataset and represents all units sold nationally and in California. The BCE program did not include all retail sales however. As a result the base, and therefore the units attributed to the program, may be overstated. Without detailed sales data we can only estimate the amount of overstatement. A conservative estimate is that sales from BCE participants are overestimated by 10 percent. Adjusting the base sales down by 10 percent produces a **NTG of 39.3 percent**. This is the same value shown for the sensitivity analysis in Table 7-7.

#### 7.2.3.3 California vs. the rest of US

The Delphi panel was split on the influence of BCE outside of California. Skeptics argue that the program did not have any influence outside CA. If the program did have some influence in CA, but not in the rest of the US, any difference could be considered BCE influence. Comparing NPD sales data for California only against the rest of the US produces a **NTG of 5.80 percent**. In this case, the BCE program accounted for 5.8 percent more energy savings in California than would have happened without the BCE program in place.

The net-to-gross values from using these different assumptions are listed in Table 7-8 along with the unadjusted mean and median NTG. These values are ranked in descending order and represent a range of BCE influence on sales of high efficiency TVs in California under various scenarios.

Table 7-8 Summary of NTG Scenarios

| Scenario | Net-to-Gross |
|---|---|
| **Delphi Mean (no adjustment)** | **0.437** |
| **Delphi Mean with sales adjusted** | **0.393** |
| **Delphi Mean (ES 4.0 vs. ES 5.0)** | **0.223** |

| Scenario | Net-to-Gross |
|---|---|
| **Delphi Median (no adjustments)** | **0.203** |
| **CA vs. Rest of US** | **0.058** |

# 8 Conclusion

BCE was filed as a resource program for the 2010-2012 program cycle. The goal of this impact evaluation is to develop a statewide program net-to-gross ratio. The net-to-gross selected for the program is based on the mean of the Delphi panel estimates adjusted for overpayment on ENERGY STAR 4.0 units and results in a net-to-gross of 22.3 percent. This net to gross ratio captures the program effect on market share of energy efficient TVs stocked and sold by retailers in California.

The market lift net-to-gross ratio reported in this impact evaluation emerged from the judgment of experts nominated by the IOUs and DNV KEMA. The findings in this report were derived based on activities and outcomes from 2009-2011. These results may overstate NTG in future program cycles for two reasons,

1. TV technologies continue to evolve rapidly with energy efficiency a by-product of this evolution and
2. all panelists assigned significantly less influence to the program in the latter quarters of the analysis period (Q2 and Q3, 2011) than in 2010.

The program also contains elements geared toward transforming the market for high efficiency televisions. The most cited paths to transforming the market are,

- paying rebates now changes retailer buying and stocking decisions inside and outside California and,
- by advocating for stricter specifications and earlier release of these specifications the IOUs induce ENERGY STAR to become more effective at advancing energy efficiency.

This report discusses these potential market effects but does not quantify them.

Finally, there was no attempt to include a process evaluation assessing the efficiency of program delivery. Due to the nature of the interviews however, some information may inform program processes in addition to impacts.

## 8.1 Summary of Findings

### 8.1.1 Interviews

IOU program staff and consultants actively recruited retailer participants and were proactive in discussions with multiple manufacturers to understand the timing and performance of upcoming television models.

Retailers were generally enthusiastic about the BCE program. They did express concerns about the longevity and consistency of the BCE program based on their experience with other consumer appliance rebate programs. In the interviews, retail buyers were relatively consistent in stating that energy efficiency, as a product feature, was a consideration but not very important relative to other product features. The existence of a rebate however caused retailers to look more closely at energy efficiency during product selection because rebates could flow directly to their bottom line as profits. As a result participating retailers did request units from manufactures that met at least the minimum BCE rebate requirements.

Manufactures on the other hand tend to target expected future CEE and ENERGY STAR standards regardless of current rebate programs. A review of the EPA product database shows two characteristics for televisions. First, TV models far exceed Energy Star +20% specifications. Second, tuning rapidly advancing component technologies involved in televisions to target standards may not be as easy as with more stable component technologies like those found in refrigerators.

### 8.1.2 Sales Data

An analysis of NPD sales data illustrates that televisions sold in California tend to have slightly higher energy consumption than the rest of the US. This is due most likely to the fact that more models sold in California have larger screen sizes and more energy consuming features than their counterparts in the rest of the country. The data also reveal that television models sold in California tend to be slightly more efficient on a Watts per square inch basis than in the remainder of the US. This could be due to a cultural bias for more efficient products, the fact that larger TV tend to be more efficient, a market intervention, or a combination of these.

### 8.1.3 Delphi Panel

Do to the lack of data to perform a more traditional impact evaluation this evaluation employed a facilitated panel to develop estimates of “what would have been” in the absence of the BCE program. Nine experts participated on the panel.

A few panelists attribute some degree of market share change in California to the BCE program. These experts disagree however on its level of influence. Experts understand the program logic but the majority of the panel remains skeptical that the program’s overall level of influence is significant. For example, expert estimates of increases in sales of BCE qualified units for any given quarter ranged from no influence (0 percent) to influencing nearly half of the sales (45 percent).

The majority did not however attribute the same level of influence to BCE when it came to influencing ENERGY STAR on specification levels. Most felt the program was too new or too small to have a real impact on a standard setting.

When asked to weight the importance of two program components: retailer rebates and lobbying ENERGY STAR for stricter standards, responses were mixed but centered on the interconnectedness of the two tactics.

### 8.1.4 Net-to-Gross Ratio

The evaluation team analyzed IOU program staff interviews, interviews with retailers, national and California specific sales data. In addition the team considered the development of TV technologies and standards. Finally, experts estimated the impact of the BCE program on market share through an anonymous facilitated panel. Averaging their estimates of market share without the program translated to approximately 11.4 percent of qualifying market share. In other words the BCE program increased the market share of energy efficient televisions in California on average by 11.4 percent.

To generate net savings for the program the evaluation team converted this 11.4 percent market share change into kWh savings of 51,913,723 kWh. IOU reported gross savings of 182,641,713 kWh over the same period. When the ex-ante savings are adjusted using the study findings this gross number is reduced to 118,641,713 kWh. Accepting the assertion that BCE paid rebates on ES 4.0 units longer than it should have and therefore slowed the uptake of ES 5.0 units further reduces the savings attributed to BCE. As a result of these adjustments, the net-to-gross ratio becomes 22.3 percent for the BCE program on a statewide basis based on kWh savings and using the mean estimate (adjusted) from the Delphi panel.

Due to the uncertainty around this point estimate alternate calculations for NTG were explored. These alternate approaches yield NTG results that range from 5.8 to 39.3 percent and are lower than the mean value from the Delphi panel at 43.7 percent.

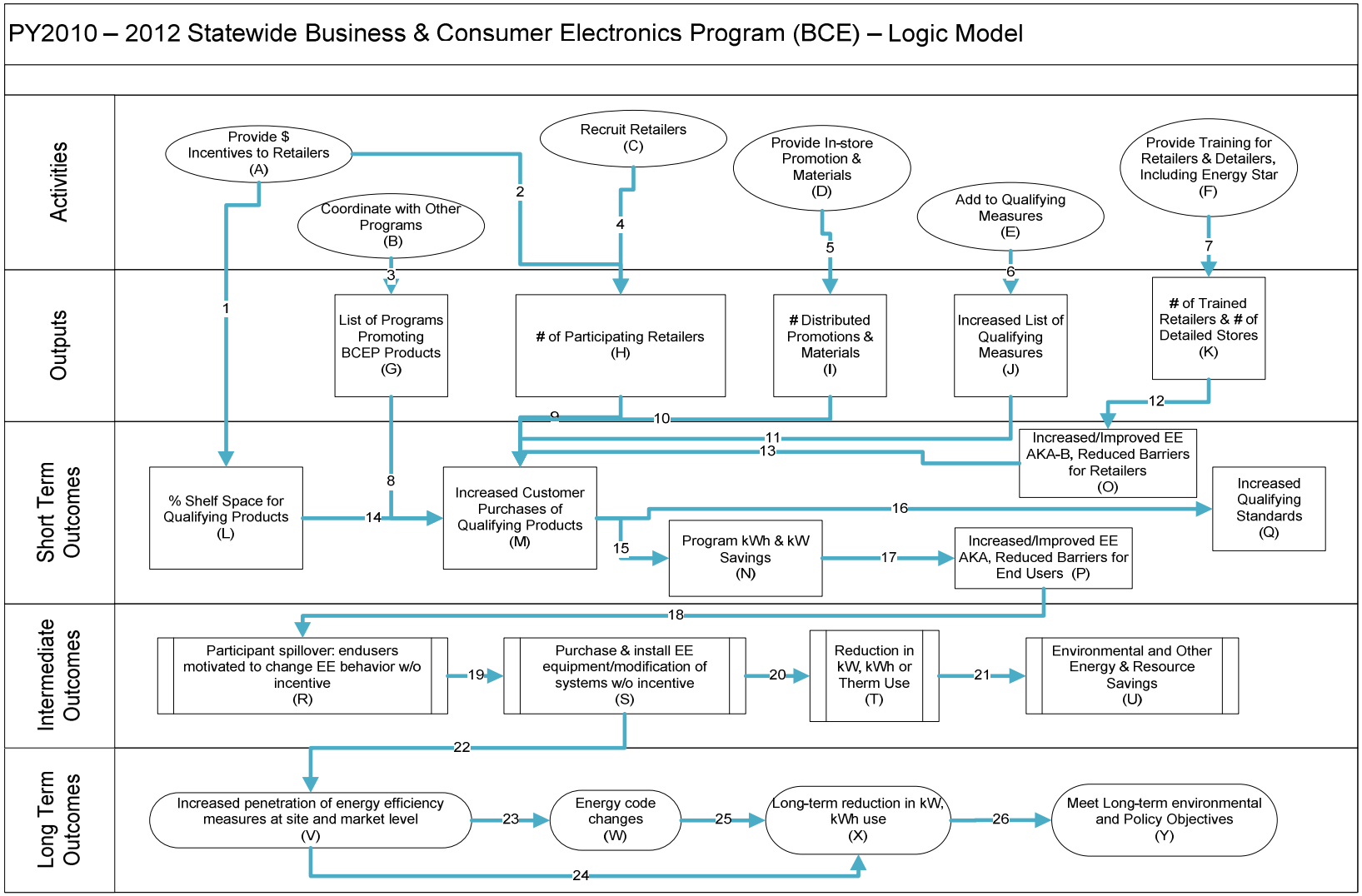
### 8.1.1 Applying Net-to-Gross

The evaluation team concedes that given the issues surrounding the panel (perceived upward and downward[40] bias, panelist attrition and failure to approach consensus) the uncertainty around the NTG recommendation of 22.3 percent limits its applicability to the 2010-2010 program cycle.

The results also are limited in their application to future programs. The panel focused on the program period from Q1, 2010 through Q3, 2011. Extrapolating the findings from this study to future periods may not be appropriate due to the rapid evolution of TV technology, the expectations for new ENERGY STAR specifications, or both.

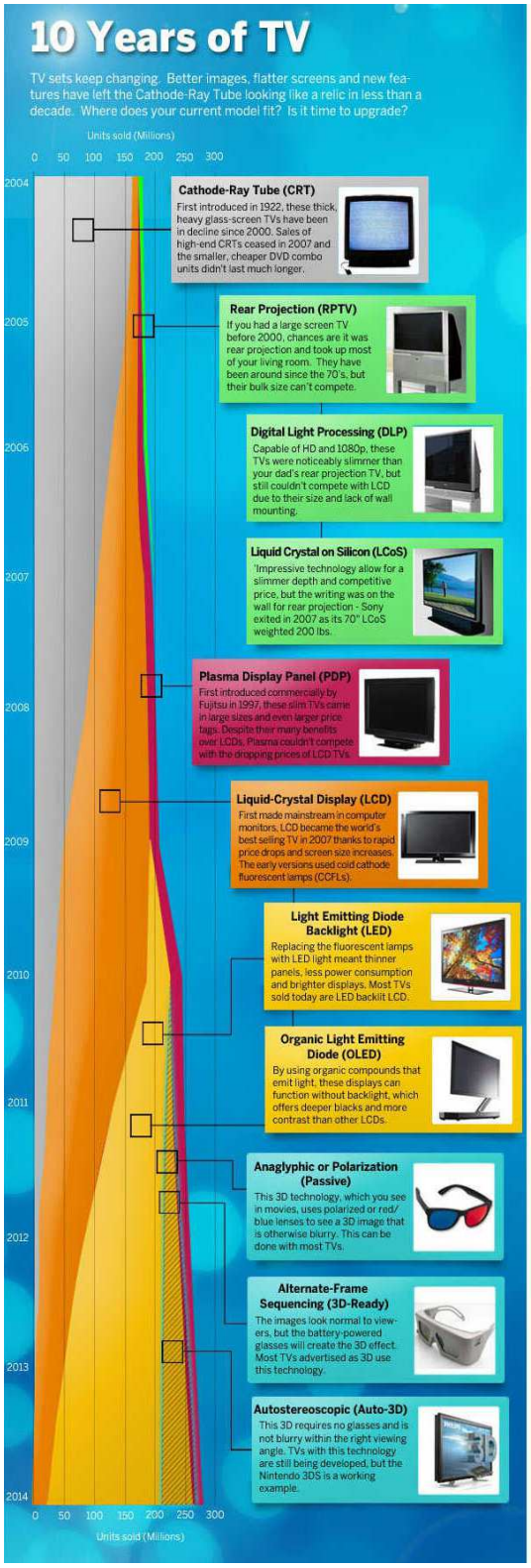
[40] NRDC asserted a downward bias of panelists in their comments to the CPUC, April 2013

# 9 APPENDIX A: BCE Logic Model



# 10 APPENDIX B: Evolution of Televisions Infographic

This infographic shows a timeline of TV technology advances.[41] Light Emitting Diode Backlight represents a big advance in television technology and energy efficiency. This advance coincidentally occurred during the same period when the BCE program actively began paying rebates.




[41] http://www.howtogeek.com/95459/the-evolution-of-television-infographic/

# 11 APPENDIX C: Stable vs. Dynamic Technology: Refrigerators and Televisions

The rapid development and dynamic nature of television technology is a consistent theme in discussions on the effectiveness of program interventions. Program managers from the IOUs to ENERGY STAR cite the difficulty in keeping pace with the energy profiles of these new technologies. Evaluators have pointed out their confounding effects on baselines. As manufactures push R&D to gain a competitive edge, and retailers must "reset" models more frequently to combine features sets and price points that consumers demand.

The argument is that the more dynamic a technology is the less influence a peripheral program intervention may have. What it means to be dynamic or stable however is not well defined. To gain some insight the evaluation team identified one technology in each category and compared their reported efficiency relative to the applicable standard. The hypothesis being that manufacturers of stable technologies can control efficiency levels more precisely than they can for dynamic ones.

In addition, mobile devices, such as smart phones and tablets, are gaining consumer's attention and market share. As a result, the focus of much research and development is 1) how to make devices thinner and how to increase battery life. One outcome is that components are becoming more energy efficient. More efficient components mean less heat output. Lower heat output allows more components to be placed in smaller spaces and a slower drain on batteries that power them. These components are finding their way into other consumer products such as TVs.

In addition, for appliances manufacturers tend to target expected future CEE and ENERGY STAR standards regardless of current rebate programs. A review of the EPA product database shows two characteristics for televisions. First TV models far exceed ENERGY STAR +20% specifications. Second the dispersion of these models suggests tuning the rapidly advancing component technologies involved in television design to target standards may not be as easy or necessary as with more stable component technologies like refrigerators.

## 11.1 Refrigerators

Congress first enacted performance standards for refrigerators in 1975 and most recently in 2007. [42] The legislation, and subsequent federal rule making, set mandatory minimum performance standards. Federal standards define the maximum allowed consumption as a

[42] The legislation includes the Energy Policy and Conservation Act of 1975, the National Energy Conservation Act of 1978, the National Appliance Energy Conservation Act of 1987, State Energy Efficiency Programs ACT of 1990, and the Energy Independence and Security Act of 2007.

function of the refrigerator-freezer adjusted volume. In addition, refrigerators are a component of the EPA's ENERGY STAR program and the Supper-Efficient House Appliance Initiative of Consortium for Energy Efficiency (CEE). [43]

During 2005 rulemaking, the Department of Energy (DOE) prepared a report to establish the economic and technological feasibility of new efficiency standards.[44] The technology assessment of the report listed key design options for improved efficiency:

- High-efficiency compressors
- Variable-capacity compressors
- More efficient evaporator and condenser fans
- Eliminating thermal shorts
- Improved door face frame/gasket design
- Smart defrost technology
- Additional insulation
- Use a blowing agent
- Vacuum panel insulation

In each case, the recommended measure was a proven technology and already available for commercial use.

### 11.1.1 Product Performance

Figure 11-1 compares the efficiency of refrigerator/freezer units in the September 2012 ENERGY STAR product list[45] to ENERGY STAR and CEE standards.[46] The horizontal axis records the qualification date of the unit. The product list mostly omits units that do not meet ENERGY STAR standards. Beginning in 2008, ENERGY STAR increased the unit energy consumption targets from 15 percent lower than federal standards to 20 percent. Concurrently the CEE maintains three levels of performance standards: 20 percent, 25 percent, and 30 percent more efficient than federal standards.

[43] http://www.cee1.org/resid/seha/refrig/refrig-main.php3

[44] http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/refrigerator_report_1.pdf

[45] This listing typically is updated monthly and includes only models that meet or exceed the existing ES standard for that period.

[46] http://downloads.energystar.gov/bi/qplist/commer_refrig_prod_list.xls?db8a-e6a7

Figure 11-2 compares television efficiency for products in the ENERGY STAR Product List database to the ENERGY STAR 5.0 standard.[47] The plot includes a horizontal line at 20 percent above the ENERGY STAR standard to denote BCE incentive levels.

The following graphs show all manufacturers and models in the database. LG and Samsung models have highlights because both participate in the television and refrigerator/freezer market, but exhibit different behavior in each.

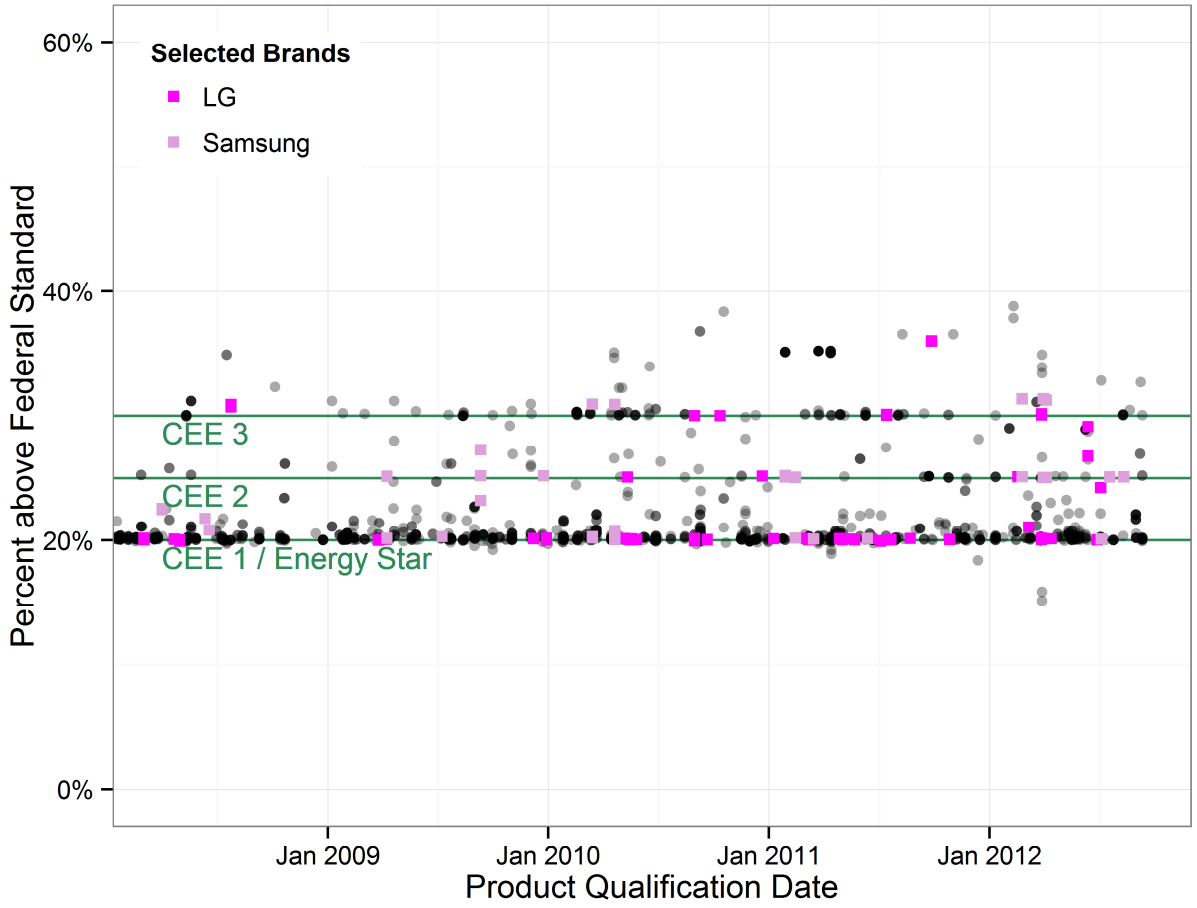
For a stable technology like refrigerator/freezers, manufactures appear to tune their product designs to meet targeted efficiency standards. The graph in Figure 11-1shows a strong relationship between the efficiency levels of units and standards. The overwhelming majority of products are near one of the three standard levels.

The response of refrigerator/freezer manufacturers and television manufactures to their respective standards is quite different. The graph of television efficiency in Figure 11-2 shows that manufactures well-exceeded ENERGY STAR standards. In this case, manufactures design TVs using energy efficient components in the hopes of meeting future standards, but they don't, or are not able to, target a specific standard.

Actual values in both figures are calculated using the appropriate specifications for each period even though the lines remain in the same position on the graphs.

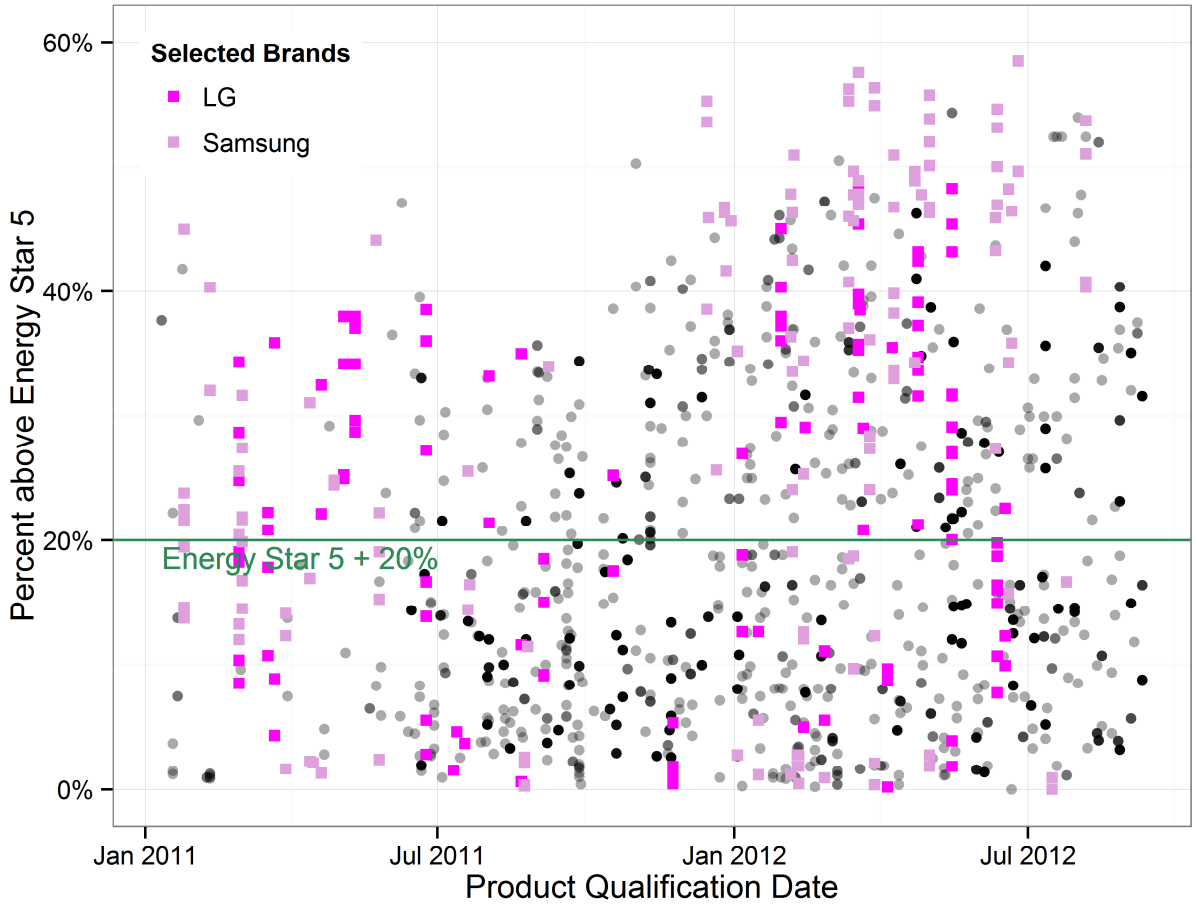
[47] http://downloads.energystar.gov/bi/qplist/tv_prod_list.xls?0a25-4a7e

Figure 11-1 Refrigerator-Freezers Efficiency Levels and Standards[48]




[48] The plot highlights LG and Samsung products as these manufactures also produce televisions

Figure 11-2 Televisions Power On Efficiency




From these figures it is clear that refrigerator manufactures target efficiency standards by tuning their products. Television manufactures on the other hand have target potential future standards, but build products with the latest features to meet consumer demand. One interpretation is that while most TV models meet even the most stringent criteria for financial incentive, these incentives are not influencing TV design.

APPENDIX D: IOU Program manager Interviews

This section provides the detailed responses from program managers. These are reported in aggregate unless a response refers to differences between IOU programs.

### 11.1.2 BCE Program Description and Goals

PG&E wanted to have the most leverage and the biggest impact on consumer behavior. A $10 rebate on a $1,000 TV was considered negligible to the consumer. A $10 rebate to the retailer however would lead to better margins, so PG&E ultimately decided to make BCE a mid-stream program to have the greatest impact. Although the BCE program is mid-stream, there are customer education components that focus on energy usage.

SCE wanted to push the market by only offering rebates on products above the Energy Star level. SCE also has a strong interest in changing consumer buying behavior by stressing the importance of energy efficiency and making customers aware of their energy usage when purchasing electronics. Like PG&E, SCE went with a mid-stream approach for BCE because of the smaller incentives offered for TVs.

### 11.1.3 Program operation

Learning how television retailers do business changed the timing of BCE program development. Rather than following a calendar year timeline (January-December), the program cycle starts in the second quarter for any given calendar year. A significant component of the ongoing program operation is updating efficiency standards. PG&E also collects sales data from retail partners on a regular basis in order to process incentives on a monthly basis.

With respect to maintaining relations with existing retail partners and expanding the program, PG&E is frequently in contact with its retail partners and also reaches out to new potential partners.

According to Program Managers, Costco is the only store currently participating that can sell BCE incentivized televisions online. They do this through online tagging, whereby customers visiting their website from a computer in PG&E service territory sees PG&E BCE program and ENERGY STAR information while they shop for televisions, whereas a customer on a computer outside of PG&E service territory does not see these tags.

SCE provides education to retailers so they can educate their customers about Energy Star TVs and BCE qualified TVs. At the end of each month, retailers submit their sales data to an Energy Solutions website. Energy Solutions filters the data to make sure that each transaction qualifies under SCE's guidelines. Once those transactions are approved, incentive money is sent out to retailers.

There are two main differences in how the programs operate.

1. SCE has a larger consumer outreach component than PG&E. The SCE program emphasizes customer and retailer education whereas PG&E focuses on retailer rebates.

2. SCE requires customer zip codes in order for retailers to claim rebates. If a BCE qualified TV is purchased at an SCE participating retailer, but the purchaser does not live in the SCE service territory, the participating retailer cannot claim a rebate for that transaction. Furthermore, to track customer zip codes, SCE requires that purchases be by credit card for the retailer to receive an incentive for a given transaction. For PG&E, as long as the participating store is located in PG&E's service territory, all BCE TV sales qualify regardless of where the customer lives.

### 11.1.4 IOU Staff Perception of the Program

PG&E BCE staff view the program as a truly cross-functional collaboration between groups rather than a more traditional utility program with one program manager designing an entire program. Everyone works together to develop the best program possible. According to staff BCE has been so successful that other utilities (e.g., other utilities in California, the Pacific Northwest, Nevada, and Utah) want to use the BCE model to impact other product categories. Furthermore, retailers and manufacturers are receptive to the BCE program due to its voluntary nature. As a result staff perceives television manufacturers and retailers as now having a genuine interest in energy efficiency. PG&E believes that the BCE program has played a key role in improving the efficiency of TVs.

SCE staff emphasized that the best part of the program has been working with the retailers and establishing relationships with them. SCE's relationships with retailers have grown since 2007 when utilities initially discussed potential rebate programs. The retailers showed no interest in a rebate program then. Retailers did not understand why utilities would even want to offer rebate program to help customers save energy. The mid-stream approach of the BCE program really opened up discussions with retailers. By the 2011 Energy Star conference, retailers had gained a good understanding of the BCE program goals and became far more engaged.

### 11.1.5 Retailer Interaction

Program managers stated that interaction with retailers can occur as frequently as daily. Interactions are particularly frequent during the buying season. PG&E partnered with SMUD and NEEA in 2008 in their interactions with retailer corporate decision makers. SCE worked independently. Those three utility territories represented roughly 15 percent of television sales nationally, which got the attention of major retailers. It was critical for utilities in the West to work together with retailers with one voice, rather than have 100 utilities communicating individually with retailers. This point regarding the value of IOU collaboration is reiterated in the retailer interviews results section.

SCE works independently from PG&E. SCE also has frequent communications with corporate retail teams from participating retailers. These consist of monthly call-ins and status check-ups with retailer teams. They also have meetings regarding annual TV allocations. SCE's relationships with retailers have expanded in general not due only to the BCE program, but also because of other SCE programs (e.g., refrigerator incentive program).

### 11.1.6 Interactions with Buyers and Suppliers

With respect to buyers, IOUs work with merchant teams who make buying decisions, but they do not work with component suppliers in China. According to the program managers however, some component suppliers, like 3M, have contacted PG&E independently. Program managers stressed the importance of working with the buyers, not the suppliers.

### 11.1.7 Interactions with Manufacturers

Manufacturers are aware of PG&E and other utilities with BCE-type programs. PG&E makes an effort to inform major manufacturers about the program at the annual Consumer Electronics Show (CES). In particular, PG&E makes an effort to inform manufacturers about future ENERGY STAR spec levels in order to help manufacturers prepare for program changes and avoid delays. The PG&E email document exchanges where retail buyers provide PG&E with model numbers to estimate which models will qualify for future BCE program rebates. IOU staff also participates in discussions with Consumer Electronics Association (CEA) members at the Consortium for Energy Efficiency (CEE) conference and at ENERGY STAR conferences.

According to IOUs who attended the 2010 International Consumer Electronics Show several leading manufacturers, including Panasonic, Samsung, and Sharp, indicated that all of their 2010 televisions (including plasmas) would qualify for ENERGY STAR Version 4.0/recommended CEE Tier 1. Based on the information collected at the CES, IOU staff expected a very high market penetration of ENERGY STAR Version 4.0/recommended CEE Tier 1 very soon after May 1, 2010. It is not clear how this information affected program incentive levels or timing.

### 11.1.8 Program challenges

According to IOU staff, there are four main challenges for the BCE program:

1. **Speed of the television marketplace**. The television market moves incredibly quickly. Whereas a room air conditioning unit may have one specification change in 15 years, a TV can have 3 or more specification changes in 2 years. It is difficult to react to such a fast moving market. PG&E has improved its understanding of the market over time and can now react better to this fast moving marketplace.
2. **Data management**. PG&E has a large amount of data to analyze from retailers in order to pay incentives. PG&E cannot pay incentives unless they know with certainty that a particular TV model qualifies for a rebate. When the program first began, it took a long time for PG&E to verify all of the qualified models. Because ENERGY STAR does not require a precise format for qualifying model numbers, PG&E had to do lots of manual sorting. PG&E ultimately decided to work with Energy Solutions to improve the quality and speed of data management.

3. **Workpaper approval**. Getting approval from Energy Division for updates to the BCE workpaper is a time-consuming and costly process. This is a huge challenge because the TV marketplace moves so quickly.
4. **Evaluation**. Because of the complex series of actors involved in the BCE program, the evaluation process is very challenging. The evaluation challenge creates uncertainty among program managers when considering modifications or adjusting rebate levels.

# 12 APPENDIX D: Delphi Questionnaires

## Expert Assessment Form, Round 1

Reviewer Number: 001 (assigned by DNV KEMA)

Date: _____

We are interested in your views regarding the influence of the BCE program on the market share of energy-efficient televisions in California and the nation. Please provide your best estimates in response to the questions below, along with supporting comments that explain your reasoning. If you feel you are unable to provide an estimate, please note "N/A" in the appropriate space and record your reasons.

Three California IOUs (PG&E, SCE, and SDG&E) began paying retailer rebates for sales of energy-efficient televisions under the BCE Program in Q1 2009. Table 1 presents observed market shares of BCE-qualified televisions sold between Q1 2009 and Q3 2011 in California and in the balance of the U.S, based on sales data from a sample of retailers. The green shaded cells represent quarters in which the program qualifying specifications were changed to higher efficiencies. See Figure 2 on the following page for details on those changes.

Table 1: Market Share of BCE-Qualified Units Sold

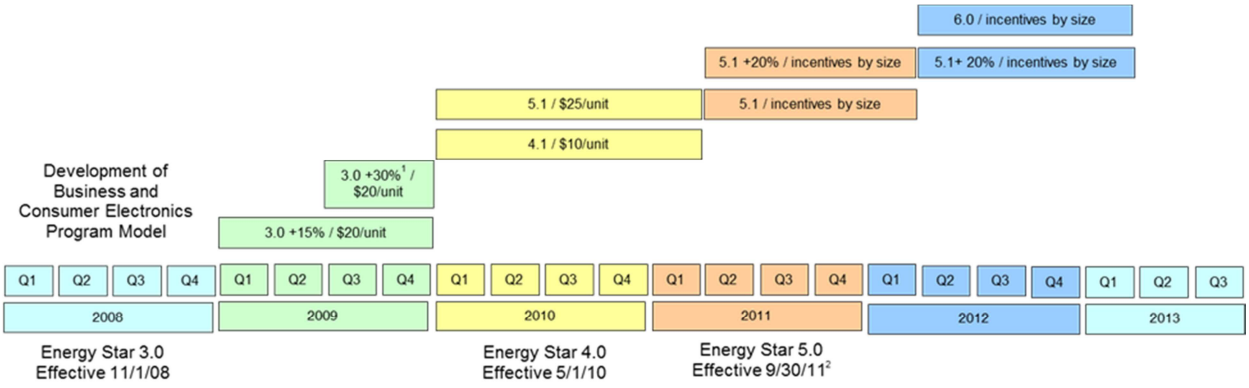
| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| | OBSERVED MARKET SHARE VALUES | | | | | | | | | | |
| 1. California | 64% | 82% | 52% | 51% | 17% | 81% | 90% | 88% | 91% | 48% | 49% |
| 2. Balance US | 60% | 80% | 52% | 51% | 16% | 73% | 82% | 80% | 84% | 42% | 45% |
| | HYPOTHETICAL MARKET SHARE VALUES ASSUMING NO BCE PROGRAM | | | | | | | | | | |
| 3. California | | | | | | | | | | | |
| 4. Balance US | | | | | | | | | | | |

**RECORD ANSWERS TO QUESTIONS 1 AND 2 IN THE GRID ABOVE**

1) If the BCE Program ***had not been in operation*** over this period, what is your best estimate of what market shares of BCE-qualified units sold in ***California would have been***? **Please enter your estimates in Row 3 of Table 1**. If you cannot render an estimate, please enter N/A.

2) If the BCE Program ***had not been*** in operation in California over this period, what is your best estimate of what market shares of BCE-qualified units sold in the ***rest of the U. S. would have been?*** **Please enter your estimates in Row 4 of Table 1.** If you cannot render an estimate, please enter n/a.

Figure 1. Timeline of rebate specification levels




3) In regard to your estimate of the of the **California** market share of qualifying units in the absence of the program.
   a) What was your main reason or line of reasoning for the estimates you gave?
   b) What other factors did you take into consideration?

4) In regard to your estimate of the of the market share of qualifying units for the **balance of the U.S.** in the absence of the program.
   a) What was your main reason or line of reasoning for the estimates you gave?
   b) What other factors did you take into consideration?

5) In your opinion, did the California BCE Program have any influence on the market share, price, or performance of energy-efficient televisions outside of California?
   a) **If YES**: What effects did the California BCE Program have on the television outside of California?
   b) What factors lead you to believe that these effects were attributable to the California BCE Program?

6) Do you believe the California BCE Program induced television manufacturers to accelerate the development and marketing of energy-efficient televisions?
   a) **If YES**: What information did you rely upon in coming to this conclusion?
   b) **If NO**: Which information did you rely upon in coming to that conclusion?

# Expert Assessment Form, Round 2

Reviewer Number: 001 (assigned by DNV KEMA)

Date: _____

Round 2 of the panel of experts process offers you the opportunity to revise your initial answers regarding counterfactual scenarios. The questions below are identical to the counterfactual questions posed in Round 1. After reading the Round 1 Results Summary, please consider whether you would like to revise your original estimates. If you would like to make changes, indicate any modifications in the spaces below along with supporting comments that explain your reasoning. If you remain satisfied with your original answers, leave the spaces below blank. **Please note that you are under no obligation to revise your initial responses.**

In addition, this Round 2 Questionnaire contains **one additional question (#6)** posed following evaluation team assessment of Round 1 responses. Please provide your answer to the question at the end of the questionnaire.

Table 1: Market Share of BCE-Qualified Units Sold

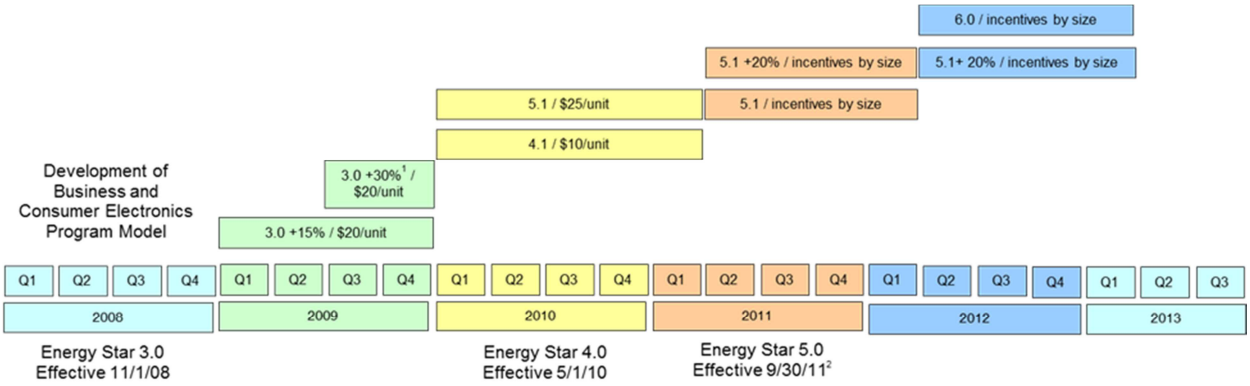
| Area | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| | OBSERVED MARKET SHARE VALUES | | | | | | | | | | |
| 1. California | 64% | 82% | 52% | 51% | 17% | 81% | 90% | 88% | 91% | 48% | 49% |
| 2. Balance US | 60% | 80% | 52% | 51% | 16% | 73% | 82% | 80% | 84% | 42% | 45% |
| | HYPOTHETICAL MARKET SHARE VALUES ASSUMING NO BCE PROGRAM | | | | | | | | | | |
| 3. California | | | | | | | | | | | |
| 4. Balance US | | | | | | | | | | | |

**RECORD ANSWERS TO QUESTIONS 1 AND 2 IN THE GRID ABOVE.**

1) If the BCE Program ***had not been in operation*** over this period, what is your best estimate of what market shares of BCE-qualified units sold in **California would have been? Please enter your estimates in Row 3 of Table 1.** If you cannot render an estimate, please enter N/A.

2) If the BCE Program ***had not been in operation*** in California over this period, what is your best estimate of what market shares of BCE-qualified units sold in the ***rest of the U. S. would have been?*** **Please enter your estimates in Row 4 of Table 1.** If you cannot render an estimate, please enter N/A.

Figure 1. Timeline of rebate specification levels




3) In regard to your estimate of the of the ***California*** market share of qualifying units in the absence of the program.
   a) What was your main reason or line of reasoning for the estimates you gave?
   b) What other factors did you take into consideration?
4) In regard to your estimate of the of the market share of qualifying units ***for the balance of the U.S.*** in the absence of the program.
   a) What was your main reason or line of reasoning for the estimates you gave?
   b) What other factors did you take into consideration?
5) In your opinion, did the California BCE Program have any influence on the market share, price, or performance of energy-efficient televisions outside of California?
   a) **If YES**: What effects did the California BCE Program have on the television outside of California?
   b) What factors lead you to believe that these effects were attributable to the California BCE Program?
6) Do you believe the California BCE Program induced television manufacturers to accelerate the development and marketing of energy-efficient televisions?
   a) **If YES**: What information did you rely upon in coming to this conclusion?
   b) **If NO**: Which information did you rely upon in coming to that conclusion?
7) To the degree that the California BCE Program had any impact on the California and/or US national television markets, which components of the program do you believe were most significant? Why?

a) When comparing BCE Program incentives versus BCE Program ENERGY STAR interventions, which of these two program components do you believe was more effective (if at all)? Why?

# 13 APPENDIX E: Delphi Panel Round 2 Full Scoring

Nine panelists participated in the Delphi process and offered comments. Of these nine participants only five elected to provide quantitative estimates of market shares. Summary values appear in section 6.5.2 of this report. Table 13-1 presents the full estimates for California from Round 2 of the Delphi. Values as presented round to the nearest whole percent.

Table 13-1 market share estimates for California only without the BCE program

| | 2009 | | | | 2010 | | | | 2011 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 |
| Observed | 64% | 82% | 52% | 51% | 17% | 81% | 90% | 88% | 91% | 48% | 49% |
| 3 | 60% | 60% | 52%* | 52%* | 16% | 40% | 45% | 55% | 55% | 30% | 40% |
| 4 | 62% | 82% | 52%* | 51%* | 17%* | 75% | 84% | 82% | 86% | 44% | 47% |
| 6 | 62% | 75% | 52% | 51% | 17% | 75% | 80% | 85% | 90% | 48% | 48% |
| 7 | 60% | 80% | 52% | 51% | 16% | 55% | 50% | 50% | 50% | 48%* | 49%* |
| 8 | 64% | 82% | 52% | 51% | 17% | 78% | 84% | 80% | 80% | 48% | 49% |
| Avg. without BCE | 62% | 76% | 52% | 51% | 17% | 65% | 69% | 70% | 72% | 44% | 47% |
| *Market Lift* | *2%* | *6%* | *0%* | *0%* | *0%* | *16%* | *21%* | *18%* | *19%* | *4%* | *2%* |

Reading the table:

Using Q2, 2010 as an example, the observed market share of high efficiency TVs was 81 percent. The average estimate of the panelists was 65 percent with no program in place. This means than of the 81 percent market share the BCE program contribution was 16 percent.

The greatest level of influence for the BCE program is reported in Q3, 2010. Without an active BCE program the market share would have been 45 percent. Since the measured market share for that period was 90 percent, BCE accounted for a 45 percent lift (90%-45% = 45%). The lowest in that quarter was 84 percent. In other words, this panelist assigned a 6 percent lift (90%-84%=6%)

* In cases where panelists inadvertently reported market shares higher without the program than with, the evaluation team followed-up with panelists or set estimated values equal to observed market share.