



# **Massachusetts Consumer Electronics Potential Qualitative Research Study**

***FINAL***

**10/23/2012**

**Submitted to:**

**Cape Light Compact**

**National Grid**

**NSTAR**

**Unitil**

**Western Massachusetts Electric**

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# 1 Executive Summary

The Massachusetts program administrators commissioned this study in order to (1) identify current factors affecting the energy efficiency of consumer electronics products and related savings opportunities, (2) better understand the current state of the market for these products, and (3) assess opportunities for the Massachusetts ENERGY STAR Appliances and Products Program (“the Program”) to address through program activities. A secondary goal of the study was to identify regulatory approaches to improving the energy efficiency of consumer electronics at the federal level, in California, and in other nations with an eye to how these can inform Massachusetts program planning.

The study focuses on technologies and interventions that represent the greatest source of potential savings from consumer electronics because together they represent over three-quarters of the total national energy consumption of consumer electronics: televisions (TVs), set-top boxes (STBs), video game consoles, personal computers (PCs), and displays.<sup>1</sup> Since Massachusetts electric program administrators have expressed interest in assessing savings opportunities for “smart” power strips (also known as advanced power strips [APSs]), this class of products is also addressed in this study.

The literature review for this study was conducted in April and May, 2012.<sup>2</sup> In-depth interviews were conducted between June and August 2012. The research methods included a review of current literature and in-depth interviews. The literature reviewed was chosen based on relevance to the topic, recentness, and the research team’s perceptions of quality and reliability. The team conducted in-depth interviews with 21 organizations and 26 individuals representing five different types of organizations: (1) Program Administrators running leading consumer electronics programs, (2) Stakeholders and policymakers involved in setting specifications or regulations related to the energy efficiency of consumer electronics, (3) Retailers of consumer electronics, (4) Manufacturers of consumer electronics, and (5) Media Service Providers and Media Industry Representatives. Given the small number of interviewees per group, the results are meant to be illustrative of different perspectives, not to yield statistically defensible quantitative generalizations.

## 1.1 Summary of Program Options & Related Recommendations

The findings from the literature review and observations from the in-depth interviews raise some fundamental questions about the place of consumer electronics in the Massachusetts ENERGY STAR Appliances and Products program. As the Program’s name implies, consumer electronics is addressed via this program in conjunction with residential appliances such as refrigerators,

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<sup>1</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.” December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>2</sup> Citations to reports published after May 2012 are due to the report authors making them available to the research team in advance in draft form.

freezers, room air conditioners and cleaners, and pool pumps. The program approach is products-focused, with upstream incentives offered to retailers, and mail-in rebates to consumers, to encourage the purchase of specific high-efficiency products. Yet the findings from this research suggest that, while a products-focused program approach may be appropriate for refrigerators, freezers, room air conditioners and cleaners, and pool pumps, it may not be appropriate for consumer electronics products. Observations from the literature and interviews suggest four basic options to consider as alternatives to the current approach of the Program for consumer electronics:

1. Abandoning program support for consumer electronics.
2. Limiting support for consumer electronics to encouraging the development of more rigorous energy efficiency specifications and standards.
3. Changing the focus for the consumer electronics portion of the Program from individual products to overall reduction of miscellaneous plug load energy use intensity (EUI) through market transformation efforts, including but not limited to consumer education and behavior change.
4. Maintaining the current product-focused program, but with modifications to improve effectiveness.

### 1.1.1 Option 1: Abandon Program Support for Consumer Electronics

Evidence from the research begs the question of whether the Massachusetts program administrators should bother with program support for consumer electronics. However, despite the legitimacy of this question, the research team does *not* recommend that the Massachusetts program administrators abandon program support for consumer electronics.

### 1.1.2 Option 2: Support Development of More Rigorous Specifications & Standards

Observations from the literature and opinions expressed by interviewees point to the importance of programs and program administrators in furthering energy efficiency specifications for consumer electronics, which in turn help drive markets toward greater efficiency of these products. For products without a built-in driver for energy efficiency (that is, all the products addressed in this report except for mobile PCs<sup>3</sup>) there is little reason to expect manufacturers to make, or retailers to promote, energy efficient products without programs and without voluntary specifications such as ENERGY STAR to encourage these activities. There is room for improvement of consumer electronics specifications, and program administrator input can drive more rigorous specifications.

- **Recommendation.** The minimum level of support for consumer electronics that the Massachusetts program administrators should consider is (1) become more involved in the specification-setting process for consumer electronics to enhance the likelihood of

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<sup>3</sup> Mobile PCs are those that are intended for use in multiple locations. Laptops, netbooks, and tablets are generally the products that comprise the mobile PC category.

achieving more rigorous ENERGY STAR specifications while maintaining flexibility, and (2) follow and, as appropriate, provide comments on and support for energy efficiency standards for consumer electronics. (This recommendation is not meant to imply that this is the only level of support that the program administrators should consider—just the floor.)

### 1.1.3 Option 3: Re-focus the Program on Miscellaneous Plug Load EUI

While furthering energy efficiency specifications and standards is important work, this approach alone will not provide Massachusetts with measurable savings to count toward ambitious program administrator program savings goals. An alternative program approach that is not product-focused but could yield measureable savings has been suggested by RIA and EMI for a California program: taking a long-term market transformation approach to reducing miscellaneous plug loads as a broad category rather than product-by-product, with a focus on reducing the overall EUI of plug loads.<sup>4</sup> In considering either refocusing the Program (Option 3) or maintaining the current Program with modifications (Option 4 below), the Massachusetts program administrators should keep in mind the challenges associated with claiming savings from consumer electronics programs.

- **Recommendation:** The Massachusetts program administrators may wish to consider the possibility of changing the focus of the consumer electronics portion of the Program from individual consumer electronics products to reduction of miscellaneous plug load EUI overall through market transformation efforts, including but not limited to consumer education and behavior change.
- **Recommendation.** If the Massachusetts program administrators choose to refocus the program on reducing miscellaneous plug load EUI, the program administrators may wish to explore the prospects of bundling products for upstream program support as a possible program tactic.
- **Recommendation.** Either as part of a refocus of the program, or as part of Option 4, Maintaining the Current Program with Modifications (discussed below), the Massachusetts program administrators may wish to explore the possibility of developing a more targeted consumer education campaign that focuses on specific energy-saving actions related to consumer electronics.
- **Recommendation.** The Massachusetts program administrators may wish to identify and prioritize research topics which, if addressed, would be instrumental in allowing the program administrators to claim savings from plug load reduction or from a wider array of consumer electronics products, or to claim savings with greater confidence. The program administrators may wish to explore the possibility of conducting high-priority

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<sup>4</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”



research on this topic jointly with other program administrators facing the same set of issues, possibly through a regional or national industry organization such as NEEP or CEE. Research to better understand and quantify savings from miscellaneous plug load, including how to improve consumer use of APSs and measurement of savings with these devices, is particularly important, especially if the Massachusetts program administrators choose to pursue Option 3.

#### 1.1.4 Option 4: Maintain the Current Program, with Modifications

The Massachusetts program administrators' plan for the 2013-2015 program years describes a product-focused approach for consumer electronics that is similar to the 2010-2012 Program. If the program administrators choose to continue along the product-focused program path for consumer electronics, the following observations and associated recommendations could help the program administrators to increase the effectiveness of the product-focused approach.

- **The Massachusetts ENERGY STAR Appliances & Products Program is one of the few programs offering downstream incentives for desktop PCs and displays. In general, downstream incentives may not be appropriate for consumer electronics.**
  - **Recommendation.** The Massachusetts program administrators may wish to consider eliminating downstream incentives. If the program administrators choose to continue to offer downstream incentives, at a minimum the program administrators should investigate the costs and risks associated with offering online incentives for consumer electronics in conjunction with online purchases.
- **Continue to provide midstream incentives. Encourage creative retailer marketing.**
  - **Recommendation:** The Massachusetts program administrators may wish to examine the logistics of encouraging retailers to offer creative retail strategies via the use of incentives, possibility involving a solicitation.
- **Removing inefficient electronics from the grid appears to be a promising program approach, particularly for TVs.** In considering removing inefficient electronics from the grid, the Massachusetts program administrators would need to think about how to avoid removing inefficient electronics that are not actually in use.
  - **Recommendation.** The Massachusetts program administrators may wish to consider adding an electronics recycling effort to the Program, as there is a sizable number of older, less efficient TV models in Massachusetts that the Program could target for replacing or retiring. As part of this, thought would need to be given as to how to ensure that the electronics removed are those that would otherwise be in use.
- **Understanding of industry production and buying cycles is essential to program success.**
  - **Recommendation.** Consumer electronics programs that are designed with an understanding of the typical design, production, and sales cycle of each product are more likely to be successful. For this reason, the Program should continue its

efforts to engage with the consumer electronics industry and to learn more about the industry's practices. This might involve learning more about the production and buying cycles for various consumer electronics products, which would then help to inform program designs that are in sync with these cycles.

- **Collaboration between the Massachusetts program administrators and a broad range of other programs and stakeholders can increase the likelihood of Program engagement with larger retailers and manufacturers.**
  - **Recommendation.** The Massachusetts program administrators may wish to consider joining the Business and Consumer Electronics Alliance to address TVs and possibly also other products. While the Massachusetts program administrators could consider developing a similar collaborative in the Northeast region, this may not be as effective as joining a larger, existing collaborative.
  - **Recommendation.** The Massachusetts program administrators may wish to assess if the Program is sufficiently involved with various industry and other groups that could yield support for or leverage its consumer electronics efforts, and where the most impact could be had given limited resources.
- **If sales data are to be collected from retailers, third parties can facilitate this.**
  - **Recommendation.** If the Program is not doing so already, the Massachusetts Program Administrators may wish to consider using a third party to collect retailer data.
- **Retailers may need substantial assistance and training.**
  - **Recommendation.** The Massachusetts program administrators may wish to assess the comprehensiveness of its consumer electronics retailer training, and whether this training could, or should, be made more comprehensive, given program goals and resource limitations.
- **Online or mobile tools can help guide consumers to program-eligible products and to retailers selling such products.**
  - **Recommendation.** The Program may wish to investigate the costs and risks associated with developing mobile or Internet-based applications for identifying energy-efficient consumer electronics products and participating retailers.
- **The speed at which the consumer electronics market changes may facilitate rapid saturation and the possibility of free ridership if consumers would have purchased efficient models without incentives. Updating program criteria frequently and relying on more rigorous specifications may diminish free ridership.**
  - **Recommendation.** The Massachusetts program administrators may wish to consider the following activities to ensure that the Program stays ahead of the market: (1) Collect the most accurate, timely market information it can given resource limitations to help the Program predict when a specification may become obsolete or irrelevant. (2) Update Program criteria regularly and frequently. (3) Investigate the possibility of utilizing tiers or percentages above ENERGY STAR,

Most Efficient, or TopTen USA in its consumer electronics program (while bearing in mind the drawbacks associated with TopTen USA described in this report).<sup>5</sup>

## 1.2 Summary of Product-specific Conclusions & Recommendations

### 1.2.1 Televisions

- **TV efficiency is not expected to dramatically increase.**
- **Energy efficiency is a low priority in market actors' TV usage, purchasing patterns, promotion techniques, and design approaches.**
  - **Recommendation.** Changing consumers' viewing behaviors may be too challenging for the Program to address. The Program might want to continue directing midstream and upstream incentives to retailers and manufacturers to make changes that do not require major technological advances, such as enabling auto-power-down (APD).
- **Market trends point to the possibility of TV free ridership.**
  - **Recommendation.** The Massachusetts program administrators would do well to stay abreast of market trends in order to minimize the possibility of free ridership in this quickly changing market. Keeping up to date on retailer stocking patterns, manufacturers' product development, and regional and national TV regulation transitions will help limit opportunities for free ridership.

### 1.2.2 Set-top Boxes

- **STB efficiency cannot be addressed through increasing the efficiency of the device alone. Incorporating STB functions into thin-client boxes or TVs to decrease the number of STBs per home can reduce STB energy consumption.**
  - **Recommendation.** The Massachusetts program administrators may wish to consider supporting a transition to thin-client boxes, or the integration of STBs within TVs, rather than supporting STBs themselves.
- **Partnering with media service providers to reduce STB energy consumption has been effective for some programs.** However, the Massachusetts program administrators have tried this approach in a previous program with little success.
  - **Recommendation.** If the Massachusetts program administrators choose to pursue savings from STBs through the Program, they may wish to reconsider the possibility of partnering with media service providers.

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<sup>5</sup> According to NSTAR, the Program has since incorporated tiers above ENERGY STAR.

### 1.2.3 Video Game Consoles

- **There is no current ENERGY STAR specification for game consoles, and it is not clear when one will be developed.**
- **The Natural Resources Defense Council (NRDC) may be negotiating with manufacturers to promote advancing game console flexibility to increase efficiency.**
  - **Recommendation.** The Massachusetts program administrators may wish to reach out to NRDC to find out how, if at all, the program administrators might be able encourage this change.
- **Potential European regulation changes could increase game console efficiency.**
  - **Recommendation.** The research did not yield a clear path for the Program to address game consoles. Until one emerges, the Massachusetts program administrators may wish to keep an eye on progress toward European efficiency standards, and to examine and consider supporting any ENERGY STAR gaming platform that emerges in the market.

### 1.2.4 Computers

- **Desktop PCs are a shrinking market.**
- **Cost is a major market barrier to advancing energy efficiency for desktop PCs.**
- **PC programs have been unsuccessful.**
- **ENERGY STAR has penetrated the mobile PC market.**
- **The growth of cloud computing may reduce home PC energy consumption shifting power requirements to data centers.**
  - **Recommendation.** The Program may want consider removing desktop PCs from its product mix given the shrinking market for this product and evidence of limited success with this product category by other programs. Given the far lower average energy use of mobile PCs, there may be little savings to gain from a program focus simply on ENERGY STAR mobile PCs. If the Program ultimately addresses mobile PCs, it should consider focusing on tiers above ENERGY STAR or on other, more rigorous specifications, such as TopTen USA.
  - **Recommendation.** If PC applications continue to migrate to the cloud, some energy consumption will be displaced to large data centers. Researching program opportunities for commercial data centers was outside of the scope of this study. If they have not done so already, the Massachusetts program administrators may wish to consider the extent to which savings can be obtained from increasing the energy efficiency of data centers in the state.

### 1.2.5 Displays

- **Consumer behavior may inhibit savings from displays.**
  - **Recommendation.** In addition to encouraging the purchase of smaller displays, the Program may wish to consider offering a display recycling opportunity as a

way to claim savings from removing less efficient models from the grid. The Program may also want to consider upstream incentives for power management default settings.

- **Displays may be an irrelevant product category.**
  - **Recommendation.** The Program may wish to consider removing this product category given that the market appears to be a shrinking.<sup>6</sup>

### 1.2.6 Advanced Power Strips

- **Savings from APSs will diminish as other devices become more efficient and the savings associated with APSs are nebulous.**
- **APSs may not be appropriate for use with mobile PCs.**
  - **Recommendation.** The Program might consider warning consumers that APSs are not appropriate for use with mobile PCs.
- **There is a lack of consumer awareness around APSs and how to use them.**
  - **Recommendation.** The Program should continue to address APSs in its marketing materials. Messaging at point of purchase (POP) may help consumers understand exactly what makes APSs superior to standard power strips from an energy efficiency standpoint.
- **Direct install approaches may be effective.**
  - **Recommendation.** The Massachusetts program administrators may wish to continue using a direct sales approach and consider exploring the applicability to Massachusetts of a direct install approach through manufacturers. In exploring a direct install approach, the program administrators should bear in mind that there may be additional cost associated with this type of approach that could jeopardize the cost effectiveness of this measure.

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<sup>6</sup> According to National Grid, the Massachusetts electric utilities plan to stop offering rebates on monitors for the 2013-2015 Program.

## 2 Introduction and Background

NMR conducted this consumer electronics qualitative potential study in 2012 for the Massachusetts program administrators. Currently, the Massachusetts' ENERGY STAR Appliances and Products Program ("the Program") administers an initiative addressing consumer electronics.

The primary goal of the potential study is to identify factors affecting consumer electronics energy efficiency that the Program could address directly through program activities. For example, these could include the potential for efficiency improvements resulting from user behavior, technology advancements in product components (e.g., display options, hard-disk resizing, etc.), or general efficiency measures (e.g., smart strips). A secondary goal was to identify regulatory approaches to improving the energy efficiency of consumer electronics at the federal level, in California, and in other nations with an eye to how these can inform Massachusetts program planning. The study focuses on identifying and understanding program opportunities for, and barriers to, technologies and interventions that represent the greatest source of potential savings from consumer electronics.

The research team focused on televisions (TVs), set-top boxes (STBs), video game consoles, personal computers (PCs), and displays because they individually consume the greatest shares of consumer electronics energy consumption. Together they represent three-quarters of the total energy consumption of consumer electronics (77%).<sup>7</sup> Since Massachusetts electric program administrators have expressed interest in assessing savings opportunities for "smart" power strips (also known as advanced power strips [APSs]), this class of products is also addressed in this study. As part of a broader research effort on behalf of the Massachusetts program administrators, NMR recently conducted a saturation study of residential retail products in Massachusetts.<sup>8</sup> This study included information on the rate at which different consumer electronics products addressed in this report were found in 150 households in Massachusetts homes between February and April 2012. Throughout this report, the research team references findings from this earlier study to put the findings in context for the state.

This report begins with a high level discussion of regulations and specifications, and then discusses the major product categories of interest. Within each product category section, the report details the product's energy consumption, any existing or developing specifications related to it, associated technical barriers and opportunities, and associated market barriers and opportunities relevant to the Program. The three sections that follow describe the designs of leading programs, general program barriers, and general program opportunities. These sections

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<sup>7</sup> Fraunhofer Center for Sustainable Energy Systems. "Energy Consumption of Consumer Electronics in U.S. Homes in 2010." December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>8</sup> NMR Group, Inc. "Massachusetts Residential Retail Products: Consumer Electronics Saturation." Draft. September 7, 2012.

detail topics such as program partnerships, specifications as they relate to programs, marketing and outreach efforts, and incentive mechanisms, etc.

### 3 Methodology

For the potential study the research team collected data via two methods: a review of current literature and in-depth interviews. The literature review for this study was conducted in April and May, 2012.<sup>9</sup> In-depth interviews were conducted between June and August 2012.

#### 3.1 Literature Review

Literature sources were chosen based on their relevance to the topic, recentness<sup>10</sup>, and the team's perceptions of their quality and reliability. Literature was primarily obtained from energy efficiency program administrator Websites and from the following organizations' resource libraries, conference proceedings, or Websites:

- ENERGY STAR®
- U.S. Department of Energy (DOE)
- International Energy Program Evaluation Conference (IEPEC)
- American Council for an Energy Efficient Economy (ACEEE)
- Association of Energy Services Professionals (AESP)
- Consortium for Energy Efficiency (CEE)
- Natural Resources Defense Council (NRDC)
- Consumer Electronics Association (CEA)
- International Energy Agency (IEA)

Given the fast-changing nature of the consumer electronics market, the team also collected information from some less traditional sources, such as the Websites of manufacturers and trade associations. The literature review was conducted between April and September of 2012.

#### 3.2 In-Depth Interviews

The team conducted in-depth interviews with 21 organizations and 26 individuals representing five different types of organizations:

- **Program administrators outside Massachusetts** running leading consumer electronics programs, and staff of the implementation contractor responsible for running the Massachusetts Program. The research team identified "leading" consumer electronics programs based on the literature review and input from other interviewees.

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<sup>9</sup> Citations to reports published after May 2012 are due to the report authors making them available to the research team in advance in draft form.

<sup>10</sup> NMR used literature published in 2010 or later with the exception of the Consortium for Energy Efficiency's (CEE) "Consumer Electronics Program Guide," which was published in 2008 and has not been updated. NMR determined this publication would be particularly useful for this research effort because it provides an extensive analysis of consumer electronics programs in the U.S. and Canada. However, NMR did not draw any conclusions from the Guide that it believed had a high likelihood of being outdated.



- **Stakeholders and policymakers** involved in setting specifications or regulations related to the energy efficiency of consumer electronics, including advocacy organizations working on consumer electronics energy efficiency.
- **Retailers** of consumer electronics. Since Massachusetts Program efforts have targeted larger retailers, the research team interviewed representatives from large chain retailers.
- **Manufacturers** of consumer electronics.
- **Media Service Providers and Media Industry Representatives.** Media service providers control media transport through cable, satellite, or Internet networks.<sup>11</sup>

Table 3-1 presents the total number of interviews by organization type.

**Table 3-1. Completed In-Depth Interviews by Organization Type**

<b>Organization Type</b>	<b>Completed Interviews</b>
Program Administrator (both within & outside of Massachusetts)*	5
Stakeholder	7
Retailer	3
Manufacturer	4
Media Service Provider	2
<b>Total</b>	<b>21</b>

\* The research team conducted five separate interviews with representatives from four different program administrators, including Massachusetts.

Given the small number of interviewees per group, the results are meant to be illustrative of different perspectives, not to yield statistically defensible quantitative generalizations.

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<sup>11</sup> The team also sought to interview media content providers, but had no success despite numerous attempts through multiple avenues to secure interviews.

## **4 Regulatory and Voluntary Approaches to Increasing the Energy Efficiency of Consumer Electronics**

The following section outlines at a high level the existing and developing energy efficiency regulations and specifications for consumer electronics. Most commonly, regulations and specifications address TVs and PCs. The Massachusetts Program currently incentivizes both of these products.

The literature and interviews all pointed to the fast-paced nature of the consumer electronics market. By comparison, the collaborative specification-setting process moves slowly. As a result, specifications for consumer electronics can quickly be outpaced by technological developments. (See Section 9.3 for more information on this subject.)

### **4.1 Regulations**

The following sub-section outlines the rules and standards set by regulatory bodies about the energy efficiency of consumer electronics. The research team collected information regarding the regulations set by U.S. government agencies, individual states within the United States, and countries with progressive energy policies, such as European countries.

Most commonly, consumer electronics regulations address TVs. At this time, there is little regulation of the energy efficiency of consumer electronics set by U.S. government agencies or agreed upon internationally. Several U.S. states have developed standards more rigorous than those of the federal government, and a number of countries are addressing consumer electronics.

#### **4.1.1 U.S. Federal Regulation**

NMR identified two primary components of the U.S. federal government's efforts to regulate consumer electronics: energy performance standards and energy labeling standards. Performance standards address the efficiency level of products manufactured for sale within the country. Energy labeling standards outline energy consumption labeling requirements.

##### ***4.1.1.1 Energy Performance Standards***

The U.S. DOE's Building Technologies Program is responsible for setting minimum energy performance standards for various products for residential and commercial use manufactured for

sale in the United States.<sup>12</sup> This includes the following consumer electronics products: TVs, STBs and network devices, battery chargers, and external power supplies.<sup>13</sup>

#### **4.1.1.2 Energy Labeling Standards**

Section 325 of the Energy Independence & Security Act of 2007 (EISA, Pub. L. 110-140)<sup>14</sup> gives authority to the Federal Trade Commission (FTC) to promulgate energy labeling rules for the following consumer electronics: TVs, PCs, cable or satellite STBs, stand-alone digital video recorder boxes (DVRs), and PC monitors. The EnergyGuide label displays a product's estimated annual energy cost and compares it with the annual energy cost of like products,<sup>15</sup> but unlike a standard it does not set a floor for energy use.

While the FTC has the *authority* to require these classes of products to carry an EnergyGuide label, this does not necessarily mean that it must require these classes of products to carry a label. In 2009 the FTC sought comments on whether to require energy disclosures for the consumer electronics products listed above. The outcome of this comment period was to require the EnergyGuide label for TVs manufactured after May 10, 2011, but not for the other consumer electronics over which the FTC has labeling authority.<sup>16</sup>

It is not clear at this time whether the FTC has plans to require the EnergyGuide label for PCs, cable or satellite STBs, stand-alone DVRs, or PC monitors in the future. As is explained in greater detail in Section 5.2.3, STBs are typically chosen by the service provider rather than by consumers.<sup>17</sup> It seems likely that the reason the FTC has not required the EnergyGuide label on STBs is that the audience for EnergyGuide is consumers.

#### **4.1.2 U.S. State Regulation**

California has emerged as a leader in codes and standards by setting standards that are more rigorous than those of the U.S. DOE. California's regulatory body, the California Energy Commission (CEC), sets regulations for products sold or offered for sale in California. According to the Appliance Standards Awareness Project and a CEC representative interviewed

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<sup>12</sup> U.S. Department of Energy, Energy Efficiency & Renewable Energy, Building Technologies Program. 2012. "Laws and Regulations." Accessed August 30, 2012 from [http://www1.eere.energy.gov/buildings/appliance\\_standards/laws\\_regs.html](http://www1.eere.energy.gov/buildings/appliance_standards/laws_regs.html).

<sup>13</sup> U.S. Department of Energy, Energy Efficiency & Renewable Energy, Building Technologies Program. 2012. "Residential Products." Accessed August 30, 2012 from [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential\\_products.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential_products.html).

<sup>14</sup> 110th Congress Public Law 140. Energy Independence And Security Act Of 2007. Accessed August 30, 2012 from <http://www.gpo.gov/fdsys/pkg/PLAW-110publ140/html/PLAW-110publ140.htm>.

<sup>15</sup> FTC. 2010. "Starting in 2011, FTC Will Require EnergyGuide Labels for Televisions" Accessed April 26, 2012 from <http://www.ftc.gov/opa/2010/10/tvlabeling.shtm>.

<sup>16</sup> 16 CFR Part 305, RIN 3084-AB15 "Rule Concerning Disclosures Regarding Energy Consumption and Water Use of Certain Home Appliances and Other Products Required Under the Energy Policy and Conservation Act ("Appliance Labeling Rule"). 2011. Accessed April 26, 2012 from <http://www.ftc.gov/os/fedreg/2010/march/100311energyconsumption.pdf>.

<sup>17</sup> Natural Resources Defense Council. 2011. "Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Television Set-Top Boxes." Accessed April 26, 2012 from <http://www.nrdc.org/energy/files/settopboxes.pdf>.

for this study, the CEC's standards for TVs are more rigorous than the federal standards. Connecticut has a similar, more rigorous standard for TVs as well, and both states have set more rigorous standards for DVRs than the DOE.<sup>18</sup> *PC World*, a global computer magazine, points out that the effect of the California TV standard is similar to setting the ENERGY STAR TV *specification* as the *standard* for the state.<sup>19</sup>

California, Connecticut and Oregon have also set standards for certain consumer electronics products that are not currently regulated by DOE. These include battery chargers for laptops and cellphones, external power supplies, digital video disk (DVD) players, and compact audio systems. For a listing of states that have passed standards for various products, see Table 4-1. As of June 2012, the CEC was in the process of developing standards for PCs, monitors, and STBs.

**Table 4-1. States with Consumer Electronics Efficiency Standards**

Product Category	State
TVs	California and Connecticut
External Power Supplies	California
DVD Players and Recorders	California, Connecticut, and Oregon
Compact Audio Equipment	California, Connecticut, and Oregon
Battery Chargers	California

Source: Appliance Standards Awareness Project (ASAP). "State Standards." Accessed May 23, 2012. <http://www.appliance-standards.org/states>.

### 4.1.3 International Regulation

The research team found three major entities overseeing international regulations for consumer electronics: the Super-efficient Equipment and Appliance Deployment Initiative (SEAD), the International Electrotechnical Commission (IEC), and the European Commission (EC). In addition, individual countries, such as Japan and Australia, undertake their own efforts to regulate the efficiency level of the consumer electronics manufactured and/or sold within the country.

#### 4.1.3.1 Super-efficient Equipment and Appliance Deployment Initiative

Through its Collaborative Labeling and Appliance Standards Program (CLASP), the SEAD engages governments around the world and the private sector to bolster policies for standards and for labeling of appliances and electronics. For consumer electronics, it has initiated a standards and labeling "collaboration" for PCs and TVs. The United States, Australia, Canada, Korea, and the United Kingdom participate in both of these collaborative efforts. France

<sup>18</sup> Appliance Standards Awareness Project (ASAP). "State Standards." Accessed May 23, 2012. <http://www.appliance-standards.org/states>.

<sup>19</sup> Spector, Lincoln. 2010. "New, Tougher HDTV Energy Star Standard Takes Effect." *PC World*. May 1. Accessed April 26, 2012 from [http://www.pcworld.com/article/195361/new\\_tougher\\_hdtv\\_energy\\_star\\_standard\\_takes\\_effect.html](http://www.pcworld.com/article/195361/new_tougher_hdtv_energy_star_standard_takes_effect.html).

participates in the TV initiative as well.<sup>20</sup> It was unclear from the information the research team was able to obtain exactly how rigorous these standards are in relation to those set by the U.S. DOE.

#### **4.1.3.2 The International Electrotechnical Commission**

The IEC<sup>21</sup> prepares and publishes International Standards for electrical, electronic and related technologies. Its 60 member countries develop these standards through a consensus-building process.<sup>22</sup> It appears that the IEC has published only two standards related to the energy efficiency of consumer electronics, both for TVs:

- According to Geneva International Cooperation, in 2010 the IEC developed a standard to limit standby power consumption of TVs and other appliances to one Watt/hour.<sup>23</sup>
- In 2005, NRDC reported that the IEC held the only international standard related to TV active mode power testing methods.<sup>24</sup>

#### **4.1.3.3 The European Commission**

The European Commission (EC), one of the main institutions of the European Union, represents and upholds the interests of the European Union. It drafts proposals for new European laws, regulations and directives.<sup>25</sup> This includes regulations and directives related to energy efficiency of products. In 2010 the EC issued “Directive 2010/30/EU” that requires labels on energy-consuming equipment indicating the model’s consumption attributes. Targeted at a number of household products, it includes a supplemental directive requiring the labeling of TVs, specifically.<sup>26</sup> The EC also issued a directive in 2005, “Directive 2005/32/EC,” aimed at limiting the energy consumption of TVs and STBs. A number of EU countries have begun to implement their own policies in line with Directive 2010/30/EU:

- **Hungary**, for example, has set out to achieve the directive through its National Energy Efficiency Plan by setting labeling requirements and minimum energy performance standards (MEPs) in standby power mode for STBs and digital TV adaptors.

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<sup>20</sup>Super-efficient Equipment and Appliance Deployment Initiative Website. “Superefficient.org.” Accessed August 27, 2012. <http://www.superefficient.org/en.aspx>.

<sup>21</sup> The IEC has two global sister organizations with whom it develops international standards for the world: the International Organization for Standardization (ISO) and International Telecommunication Union (ITU). Together the three ensure that International Standards align with and complement each other. In the U.S., the ISO is arguably the best-known sister organization.

<sup>22</sup> International Electrotechnical Commission (IEC) Website. Accessed May 10, 2012. <http://www.iec.ch/standardsdev>.

<sup>23</sup> Geneva International Cooperation. “Increasing the energy efficiency of our TV & household appliances.” Accessed May 10, 2012. <http://www.cooperationinternationalegeneve.ch/en/increasing-energy-efficiency-our-tv-household-appliances>.

<sup>24</sup> Natural Resources Defense Council (NRDC). “Televisions: Active Mode Energy Use and Opportunities for Energy Savings.” March 2005. Accessed May 10, 2012. <http://www.nrdc.org/air/energy/energyeff/tv.pdf>.

<sup>25</sup> European Union (EU). “EU Institutions and Other Bodies.” Accessed August 30, 2012 from [http://europa.eu/about-eu/institutions-bodies/index\\_en.htm](http://europa.eu/about-eu/institutions-bodies/index_en.htm).

<sup>26</sup> European Commission (EC). “Energy Efficiency: Household appliances – Labelling.” Accessed May 10, 2012. [http://ec.europa.eu/energy/efficiency/labelling/labelling\\_en.htm](http://ec.europa.eu/energy/efficiency/labelling/labelling_en.htm).

- *Ireland* has implemented a similar policy that also incorporates standards around test procedures.<sup>27</sup>

#### 4.1.3.4 Country-Specific Regulations

In its 2011 evaluation of its member-countries' energy efficiency policy developments, the International Energy Agency (IEA) reports that the member countries have strong energy efficiency policies targeted at TVs and STBs. For example,

- *Australia* introduced STB energy labeling requirements and MEPs,
- *Canada* amended its Energy Efficiency Act to regulate the energy consumption of STBs, and
- *Japan* revised its Top Runner Program standards for TVs to require greater rigor with regard to LED backlights.

IEA also reports that a number of countries made significant progress in planning for a one-Watt standby limit requirement where products (including TVs) must use low amounts of energy when in standby mode (like the IEC standard). For example:

- *Korea*, in 2011, developed a mandatory one Watt standard targeted at about thirty products. It also requires that other products carry warning labels if they consume more than one Watt; and
- *Australia* plans to implement a one-Watt standard for standby mode in 2013.<sup>29</sup>

In comparison to other countries, Japan's energy efficiency regulations are quite aggressive. Its Top Runner Program, by which it identifies the most efficient products in the market at a given time and then requires that all manufacturers reach that efficiency level within a certain timeframe, currently includes seven consumer electronics products: TVs, videocassette recorders (VCRs), digital video disc players (DVDs), PCs, magnetic disk units, copying machines, and routers.<sup>30</sup>

## 4.2 Specifications

The following section outlines specifications for energy-efficient consumer electronics. Programs often use specifications to identify products eligible for program incentives. Currently, two primary entities maintain specifications for consumer electronics in the United States: ENERGY STAR and TopTen USA.

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<sup>27</sup> International Energy Agency (IEA). "Progress Implementing the IEA 25 Energy Efficiency Policy Recommendations: 2011 Evaluation." 2012. Accessed May 10, 2012. <http://www.iea.org>.

<sup>28</sup> IEA's 25 member-countries largely include highly developed countries: the U.S., Australia, New Zealand, Canada, Japan, the Republic of Korea, most European countries.

<sup>29</sup> International Energy Agency (IEA). "Progress Implementing the IEA 25 Energy Efficiency Policy Recommendations: 2011 Evaluation." 2012. Accessed May 10, 2012. <http://www.iea.org>.

<sup>30</sup> Japan Ministry of Economy, Trade and Industry Agency for Natural Resources and Energy. "Top Runner Program: Developing the World's Best Energy-Efficient Appliances." March 2010. Accessed May 10, 2012. <http://www.enecho.meti.go.jp/policy/saveenergy/toprunner2010.03en.pdf>.

ENERGY STAR addresses a host of consumer electronics, and is developing more rigorous specifications for a number of them. TopTen USA addresses only monitors, TVs and PCs.

#### **4.2.1.1 ENERGY STAR Specifications**

ENERGY STAR sets voluntary specifications for levels of energy efficiency above mandatory standards for a wide variety of products. As of March 2011, there were voluntary ENERGY STAR specifications for the following consumer electronics products of relevance to this study:<sup>31</sup>

- Imaging Equipment:
  - copiers and fax machines
  - digital duplicators
  - printers, scanners and multi-function devices
- Personal Computers:
  - Desktop computers
  - Integrated desktop computers
  - Notebook computers
  - Game consoles
  - Thin clients
- Displays:
  - Monitors
- Audio/visual (A/V) equipment:
  - Home-theater-in-a-box systems
  - Audio amplifiers
  - A/V receivers
  - Shelf systems
  - DVD players/recorders and Blue-ray disc players/recorders<sup>32</sup>
  - Docking stations for audio amplification or optical disc drive functions
- STBs
- TVs

Specifications for the product categories of interest are described in Sections 5 through 7.

A representative of the U.S. ENERGY STAR program interviewed for this study reported that ENERGY STAR is currently developing specifications for a new product category, uninterruptable power supplies (UPSs), as well as a recognition program for game consoles.

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<sup>31</sup> For a full listing of consumer electronics products addressed by ENERGY STAR specifications, see “ENERGY STAR Product Specifications.” Accessed August 28, 2012.

[http://www.energystar.gov/index.cfm?c=product\\_specs.pt\\_product\\_specs](http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs).

<sup>32</sup> The “ENERGY STAR® Program Requirements for Audio/Video” indicate that there are requirements for recording capabilities of DVD and Blue-ray players.

[http://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/Audio\\_Video\\_Program\\_Requirements.pdf?8d1d-f3f2](http://www.energystar.gov/ia/partners/product_specs/program_reqs/Audio_Video_Program_Requirements.pdf?8d1d-f3f2)

ENERGY STAR is also in the process of advancing many existing specifications for products listed above and is considering addressing projectors.

ENERGY STAR develops product tiers that differentiate among its qualified products. Products that qualify for higher tiers are more efficient than those that qualify only for lower tiers. ENERGY STAR currently has tiers for A/V equipment and displays.<sup>33</sup>

In 2011 ENERGY STAR established “ENERGY STAR Most Efficient,” which recognizes the most efficient models for certain qualified product categories. Currently, TVs are the only consumer electronics device addressed by ENERGY STAR Most Efficient.<sup>34</sup> ENERGY STAR recently proposed including PC monitors as well.<sup>35</sup>

#### ***4.2.1.2 TopTen USA Specifications***

TopTen USA, a non-profit organization, identifies and lists the most energy-efficient products on the market. Of consumer electronics products, TopTen USA evaluates monitors, TVs, and PCs. Generally, TopTen USA uses ENERGY STAR criteria and test methods as a framework for its lists; however, it provides greater precision than ENERGY STAR Most Efficient in that it identifies the most highly efficient models by ranking the products within various categories for the product type. For example, it bins TVs into three categories and monitors into two categories based on screen size and then ranks models within each subcategory. Desktop PCs are ranked separately from mobile PCs.<sup>36</sup>

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<sup>33</sup> ENERGY STAR®. “ENERGY STAR® Program Requirements for Displays: Partner Commitments.” Version 5.1. Accessed August 28, 2012. [http://www.energystar.gov/index.cfm?c=product\\_specs.pt\\_product\\_specs#hom](http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs#hom).

<sup>34</sup> U.S. Environmental Protection Agency (U.S. EPA). "January 19, 2012 EPA Memo to Stakeholders." January 19, 2012. Accessed May 11, 2012. [http://www.energystar.gov/ia/partners/downloads/EPA\\_Cover\\_Letter\\_ME\\_2012.pdf?2622-c99e](http://www.energystar.gov/ia/partners/downloads/EPA_Cover_Letter_ME_2012.pdf?2622-c99e).

<sup>35</sup> U.S. Environmental Protection Agency. Letter to ENERGY STAR Partners and Stakeholders. September 14, 2012.

<sup>36</sup> TopTen USA. Website. Accessed May 14, 2012. <http://www.toptenusa.org>.



## 5 Home Entertainment Products

This section focuses on two important home entertainment product categories: TVs and STBs. The team also provides some details regarding other A/V products. While video game consoles may also be considered home entertainment products, they are addressed in the Home Office section, since they are computer-like devices.

### 5.1 Televisions

According to the Massachusetts saturation study recently conducted by NMR, the average Massachusetts home uses two TVs, and one-third of homes have three or more TVs.<sup>37</sup>

This section discusses the factors involved in TV energy consumption, TV specifications, the technical barriers and opportunities related to achieving greater TV energy efficiency, and the multitude of market barriers, opportunities, and trends relevant to program implementation for this product.

#### 5.1.1 TV Energy Consumption

As of 2010, TVs represented the largest share of consumer electronics' annual energy consumption in the United States, at 34%. TV energy consumption is primarily a function of the unit's screen size, display type and brightness. As screen sizes increase, consumption increases; as brightness increases, consumption increases.<sup>38</sup> There are five common types of TV displays:

- Cathode Ray Tube (CRT)
- Rear projection
- Plasma
- Liquid Crystal Display (LCD)<sup>39</sup>
- Organic Light Emitting Diode (OLED)

While TV energy consumption is impacted by a number of variables, the TV display types listed above are ordered from those that are *generally* least efficient to those that are *generally* most efficient. Nonetheless, this order could quickly change if an LCD screen is significantly larger than a plasma screen, for example.<sup>40, 41, 42</sup> The NMR Massachusetts saturation study found that

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<sup>37</sup> NMR Group, Inc. "Massachusetts Residential Retail Products: Consumer Electronics Saturation." Draft. September 7, 2012.

<sup>38</sup> Fraunhofer Center for Sustainable Energy Systems. "Energy Consumption of Consumer Electronics in U.S. Homes in 2010." December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>39</sup> LCD displays can have two different types of backlights: light emitting diode (LED) or cold cathode fluorescent lamps (CCFL). LED backlights are more efficient than CCFL backlights.

<sup>40</sup> Consumer Electronics Association. "Power Consumption Trends in Digital TVs Produced Since 2003." February 2011. Accessed September 12, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Power-Consumption-Trends-in-Digital-TVs.pdf>

<sup>41</sup> Natural Resources Defense Council. "The Energy Efficiency of Televisions in Active Mode." April 2004. Accessed September 12, 2012. [http://www.efficientproducts.org/reports/tvs/NRDC\\_TV-efficiency\\_2004.pdf](http://www.efficientproducts.org/reports/tvs/NRDC_TV-efficiency_2004.pdf)

the majority of TVs in Massachusetts have an LCD screen (56%). More than a third (37%) are CRT. The remainder are rear projection types (6%) or plasma screens (1%). About two-thirds (66%) of the displays are smaller than 40 inches. In Massachusetts homes, LCD, rear projection, and plasma TVs are larger than TVs with CRT screens.<sup>43</sup>

A number of other features and functionalities can increase the energy consumption of TVs:

- **3-D TVs.** 3DTVs add depth perception to programming, generally with the aid of special viewing glasses, through 3D display technology.
- **Smart TVs.** Smart TVs combine information from the Internet with content from TV providers. Smart TVs can consist of a stand-alone TV with integrated Internet capabilities or it can consist of a STB that provides any TV with Internet capabilities. On average they . . .
- **High Definition TV (HDTV).** HDTVs create greater resolution on the display than a standard definition TV display.
- **Ultra-High Definition TVs (UHDTVs).** UHDTVs are TVs with displays that have resolutions even higher than those of HDTVs.
- Peripheral devices can increase the energy consumption of TVs as well. High-consuming peripheral devices, such as STBs, video game consoles, and DVD players, are discussed in later sections of the report.<sup>44</sup>

### 5.1.2 TV Specifications

The current ENERGY STAR TV specification, Version 5.3, requires that TVs be configured with Automatic Brightness Control (ABC)<sup>45</sup> as their default; consume one Watt or less in sleep mode, meet on mode power and luminance requirements for their screen area and Download Acquisition Mode (DAM)<sup>46</sup> consumption levels; and if they have external power supplies, these power supplies meet level V performance requirements under the International Efficiency Marking Protocol.<sup>47</sup> Version 6.0 ENERGY STAR specification for TVs will be effective June 1, 2013.<sup>48</sup>

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<sup>42</sup> Lawrence Berkeley National Laboratory. “TV Energy Consumption Trends and Energy-Efficiency Improvement Options.” July 1, 2011. Accessed September 12, 2012.

<http://superefficient.org/en/Activities/~media/Files/SEAD%20Televisions%20Technical%20Analysis.pdf>

<sup>43</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.” Draft. September 7, 2012.

<sup>44</sup> Ernest Orlando Lawrence Berkeley National Laboratory. “TV Energy Consumption Trends and Energy-Efficiency Improvement Options.” July 1, 2011. Accessed October 15, 2012.

<http://www.superefficient.org/~media/Files/SEAD%20Televisions%20Technical%20Analysis.pdf>

<sup>45</sup> The automatic brightness control (ABC) is a circuit used in a display that keeps the average brightness of the image constant.

<sup>46</sup> Download acquisition mode (DAM) is where a product actively communicates through a network protocol, downloading information and messages, while connected to a main power source, but not producing sound or a picture.

<sup>47</sup> ENERGY STAR®. “ENERGY STAR® Program Requirements for Televisions: Partner Commitments.” Version 5.3. Accessed August 28, 2012.

### 5.1.3 TV Trends, Opportunities and Barriers

This section begins with a discussion of the barriers that might limit the technical potential to increase the efficiency of TVs and the mechanisms that represent technical opportunities to increasing the efficiency of TVs. It then describes the market barriers that the Program will need to overcome to implement TV incentives and trends and opportunities that need to be considered.

Many barriers and opportunities overarch across product categories. To reduce redundancy, the team describes these in Sections 9 and 10.

#### 5.1.3.1 TV - Technical Barriers and Opportunities

The literature and interviews pointed to the substantial improvements that have been made in TV energy efficiency in recent years; however, they also indicated some barriers to increasing TV efficiency.

- **Increases in efficiency will not be as steep in the future as they have been in the past.** As one interviewee noted, there is now a TV over 70 inches that uses less energy than a standard light bulb. Even plasma TVs have become more efficient. Observations from the interviews suggest that the opportunities for squeezing greater efficiency from TVs with basic functionalities may be reaching a limit. One retailer interviewee opined that improvements in TV efficiency in the coming years will not be as steep as they have been in the past. The retailer representative explained that the advances in TV efficiency in recent years have been the result of fairly simple design changes. Further advances would require considerable cost and time to design. In recent research conducted on behalf of Pacific Gas & Electric (PG&E) and Southern California Edison, Research into Action (RIA) and Energy Market Innovations (EMI) noted that the limitations involved in advancing TV efficiency present a problem for programs that are largely dependent on TVs for savings prompting some program administrators to consider alternative product categories.<sup>49</sup>
- **New technologies are increasing TV consumption.** Just as standard TVs may be reaching the point where greater efficiency is more difficult to achieve, new TV technologies, including 3-D TVs, Smart TVs, HDTVs and UHD TVs, could reduce the

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[http://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/Televisions\\_Program\\_Requirements\\_V5\\_3.pdf?0c80-129a](http://www.energystar.gov/ia/partners/product_specs/program_reqs/Televisions_Program_Requirements_V5_3.pdf?0c80-129a).

<sup>48</sup> ENERGY STAR®. “ENERGY STAR® Program Requirements for Televisions: Partner Commitments.” Version 6.0. Accessed October 15, 2012.

[https://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/television/Final\\_Version\\_6.0\\_TV\\_s\\_Program\\_Requirements.pdf?8bcb-370a](https://www.energystar.gov/ia/partners/prod_development/revisions/downloads/television/Final_Version_6.0_TV_s_Program_Requirements.pdf?8bcb-370a)

<sup>49</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).” Study ID SCE0306.01. August 30. Accessed October 9, 2012 from [http://www.calmac.org/publications/HEER\\_\\_BCE\\_083012\\_FINAL.pdf](http://www.calmac.org/publications/HEER__BCE_083012_FINAL.pdf).

efficiency of TVs as a category overall because they require more power than standard TVs to operate.<sup>50</sup>

In a 2011 study conducted on behalf of the Northwest Energy Efficiency Alliance (NEEA), RIA and Ecos identified energy-saving opportunities for TVs for the Northwest.<sup>51</sup> These opportunities, listed in order of the percentage of total estimated energy savings from TVs in the region, were:

- **Occupancy sensing.** Include occupancy sensing technology in TVs that turns the TV off if no one is in the room (at the time of publication only one manufacturer included this feature) (30%).
- **Brightness optimizing.** Directly install brightness optimizing settings on TVs already in use so they are only as bright as they need to be and will effectively use less energy (27%).
- **Energy efficiency tips.** Add tips for energy efficiency to TV settings menus (18%).
- **ABC testing improvement.** Increase the stringency of ABC testing into the final ENERGY STAR V6 test procedures so that devices with ABC set as the default are also tested at certain ambient light levels (11%).<sup>52</sup>
- **Newer models.** Overhaul existing TV fleets to replace older less efficient models with newer more efficient models (8%).
- **Enhanced ABC.** Make ABC that responds to the brightness of the room a more common TV feature (this has the potential to reduce TV consumption by 20%) (3%).
- **Auto-Power-Down.** Include APD<sup>53</sup> capability where TVs automatically turn off when they are not receiving a signal from other devices (e.g., DVD players, STBs, etc.) as default (3%).

Interviewees echoed the benefits of many of these opportunities. A stakeholder interviewee pointed out that changing the default settings on TVs so that more efficient settings are automatically chosen would help TV efficiency, and that some manufacturers are already shipping TVs with such settings. Several interviewees identified a potential source of future savings from encouraging consumers to replace (rather than supplement) older CRT TVs and projection screen TVs with more efficient TVs.

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<sup>50</sup> <sup>50</sup> Lawrence Berkeley National Laboratory. "TV Energy Consumption Trends and Energy-Efficiency Improvement Options." July 1, 2011. Accessed September 12, 2012.

<sup>51</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products." August 2011. Accessed March 20, 2012.

[http://neea.org/research/reports/10-219\\_Combined.pdf](http://neea.org/research/reports/10-219_Combined.pdf)

ENERGY STAR V6 TV test procedures are not yet finalized.<sup>53</sup> Auto power down (APD) is the capability to automatically switch a device from on mode to sleep mode after a predetermined period of time has elapsed.

<sup>53</sup> Auto power down (APD) is the capability to automatically switch a device from on mode to sleep mode after a predetermined period of time has elapsed.

**5.1.3.2 TV - Market and Program Barriers**

Table 5-1 outlines 11 market barriers signaling ten implications for the Program to consider.

**Table 5-1. Market Barriers to Advancing TV Efficiency**

Implication*	Finding	Source
Consumers are purchasing TVs with functionalities and features that are more energy consumptive than traditional TVs.	According to one of the manufacturer interviewees, Smart TV and 3-D TV demand and supply are both increasing. One media service provider interviewee saw the TV market moving to HDTV and UHD TV, and also expects Smart TVs to take over the market. In Massachusetts this already appears to be the trend. Most of the TVs in Massachusetts (62%) are already HD.	Manufacturer interviewee; NMR <sup>54</sup>
Consumers are expected to start watching more TV with the increasing opportunities to stream video content.	Stakeholders expect that as streaming media is integrated into TVs hours of TV use will increase—despite the fact that consumers will also be able to access streaming media through other devices, such as tablet PCs and phones, as well.	2 Stakeholder interviewees
Consumers are more concerned about other TV features than the energy consumption of their TVs.	Several research efforts conclude that customers value the energy efficiency of TVs less than they do other product attributes such as size, resolution, and price.	ODC <sup>55</sup> ; CEE <sup>56</sup> ; NEEA <sup>57</sup>
Consumers’ preferences for larger TVs may offset technology advances that incorporate energy efficiency.	In recent years the market has been shifting to lower-consuming LCD TVs from CRT TVs, but when consumers make this shift they often are opting for larger TVs—possibly offsetting any of the benefits of the savings potential in the shift in display types.	PA Consulting and NMR Group, Inc. <sup>58</sup>
	TVs generally have become less expensive—larger TVs in particular— so larger TVs are gaining market share.	NEEA <sup>59</sup>
Adding efficient TV models does not remove less efficient models from the grid.	Customers will often simply turn the CRT TV into a secondary TV instead of removing it from the grid entirely.	PA Consulting and NMR Group, Inc. <sup>60</sup>
Consumers are more tuned into the consumption of larger home appliances.	One manufacturer’s consumer research indicates that energy efficiency is not a concern for TVs the way it is for larger home appliances, such as washing machines.	Manufacturer interviewee

<sup>54</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>55</sup> Opinion Dynamics Corporation (ODC). “The Market for Energy Efficient Electronics, November 2010: Pre-Program findings on consumer perceptions and retail shelf stocking practices.” November 1, 2010. Accessed April 24, 2012. <http://neea.org/docs/reports/themarketforenergyefficientelectronics1cba99cd20561.pdf>.

<sup>56</sup> Consortium for Energy Efficiency (CEE). 2008. “Consumer Electronics Program Guide.” Accessed May 3, 2012 from <http://www.cee1.org/files/CEEConsumerElectronicsProgramGuide.pdf>.

<sup>57</sup> NEEA. “Residential: Our Work.” Accessed May 4, 2012. <http://neea.org/ourwork/residential.aspx>.

<sup>58</sup> PA Consulting Group and NMR Group, Inc. “Analysis of Consumer Electronics in Homes.” February 19, 2010. Accessed March 29, 2012. [http://www.focusonenergy.com/files/Document\\_Management\\_System/Evaluation/analysisofconsumerelectronicshomes\\_evaluationreport.pdf](http://www.focusonenergy.com/files/Document_Management_System/Evaluation/analysisofconsumerelectronicshomes_evaluationreport.pdf).

<sup>59</sup> NEEA. “Residential: Our Work.” Accessed May 4, 2012. <http://neea.org/ourwork/residential.aspx>.

<sup>60</sup> PA Consulting Group and NMR Group, Inc. “Analysis of Consumer Electronics in Homes.” February 19, 2010. Accessed March 29, 2012. [http://www.focusonenergy.com/files/Document\\_Management\\_System/Evaluation/analysisofconsumerelectronicshomes\\_evaluationreport.pdf](http://www.focusonenergy.com/files/Document_Management_System/Evaluation/analysisofconsumerelectronicshomes_evaluationreport.pdf).

Implication*	Finding	Source
Sales associates place limited emphasis on TV efficiency.	Based on ODC’s research, sales associates often will show customers ENERGY STAR TVs but will considerably less frequently discuss energy efficiency as an important attribute or even mention ENERGY STAR. RIA and Ecos found that retailers do not think that efficiency is worth-while to emphasize in sales pitches.	ODC <sup>61</sup> ; RIA and Ecos <sup>62</sup>
Despite evidence from ENERGY STAR market penetration data that manufacturers have adapted quickly to specifications, they do not place a great deal of emphasis on advancing TV efficiency given consumer demands.	RIA and Ecos learned that cost and picture quality remain more important to manufacturers than energy efficiency. CEE points out that “lack of a sustained, strong consumer demand” plays a large role in limiting manufacturer desire to produce efficient products or incorporate that as a goal into their policies or as a prominent feature in their marketing efforts.	RIA and Ecos <sup>63</sup> ; CEE <sup>64</sup>
Older less efficient TV models may take a considerable amount of time to remove from the grid.	It was the opinion of one manufacturer interviewee that compared to other consumer electronics, consumers purchase new TVs, and manufacturers develop new TV models, relatively infrequently.	Manufacturer interviewee
Due to rapid market changes, TV savings estimates are not always reliable.	Since the TV market changes rapidly, savings estimated from baseline data cannot always be trusted.	RIA and EMI <sup>65</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

**5.1.3.3 TV – Market Trends and Program Opportunities**

Table 5-2 presents seven trends implying six opportunities for the Program to note.

<sup>61</sup> Opinion Dynamics Corporation (ODC). “The Market for Energy Efficient Electronics, November 2010: Pre-Program findings on consumer perceptions and retail shelf stocking practices.” November 1, 2010. Accessed April 24, 2012. <http://neea.org/docs/reports/themarketforenergyefficientelectronics1cba99cd20561.pdf>.

<sup>62</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.” August 2011. Accessed March 20, 2012. [http://neea.org/research/reports/10-219\\_Combined.pdf](http://neea.org/research/reports/10-219_Combined.pdf)

<sup>63</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.” August 2011. Accessed March 20, 2012. [http://neea.org/research/reports/10-219\\_Combined.pdf](http://neea.org/research/reports/10-219_Combined.pdf)

<sup>64</sup> Consortium for Energy Efficiency (CEE). 2008. “Consumer Electronics Program Guide.” Accessed May 3, 2012 from <http://www.cee1.org/files/CEEConsumerElectronicsProgramGuide.pdf>.

<sup>65</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

**Table 5-2. Opportunities and Trends towards Advancing TV Efficiency**

Implication*	Finding	Source
There is a sizable number of less efficient TV models in Massachusetts that the Program could target for replacing or retiring.	As one manufacturer interviewee reports, there are still many CRT TVs in use. In fact, as noted above, over one-third of Massachusetts TVs (37%) are still CRT TVs. <sup>66</sup>	Manufacturer interviewee; NMR <sup>67</sup>
Engaging retailers in energy efficiency provides an opportunity to influence customers’ purchasing decisions	Consumers often rely on retailers in determining what TV to purchase.	ODC <sup>68</sup>
ENERGY STAR TV ownership builds brand loyalty	Customers in the Northwest that had previously bought ENERGY STAR TVs said they were more likely to do so in the future.	
Retailers are stocking energy-efficient models	In the Northwest over half of the TV models on shelves met ENERGY STAR specifications.	
Manufacturers quickly adapt to TV specifications.	In 2011, the estimated ENERGY STAR market penetration rate for ENERGY STAR TVs was 96%.	ENERGY STAR <sup>69</sup>
	TV technology is meeting specifications for energy efficiency even more quickly than ENERGY STAR anticipates.	RIA and Ecos <sup>70</sup>
State-level TV regulations continue to become more rigorous.	Interest in regulation of TV energy consumption is growing, with Massachusetts, New York, Washington and Wisconsin attempting to integrate California’s TV standards into their own regulatory framework.	

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

The literature and interviews suggest that while challenges exist to advancing energy efficiency of TVs, there are opportunities among the market trends above that the Program could potentially leverage to help transform the TV market—particularly expediting the replacement, rather than supplementation, of older, less efficient TVs. One program administrator interviewee asserted that TVs have been one of the most successfully addressed consumer electronics products. One of the stakeholders added that there is a great opportunity for the Program to leverage the emergence of highly efficient large screen TV models.

<sup>66</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>67</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>68</sup> Opinion Dynamics Corporation (ODC). “The Market for Energy Efficient Electronics, November 2010: Pre-Program findings on consumer perceptions and retail shelf stocking practices.”

<sup>69</sup> ENERGY STAR. “ENERGY STAR Unit Shipment and Market Penetration Report: Calendar Year 2011 Summary.” 2012.

<sup>70</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

## 5.2 Set-top Boxes

According to ENERGY STAR, “a ‘set-top box’ is a cable, satellite, Internet Protocol or other device the primary function of which is to receive television signals from a specific source and deliver them to a consumer display and or recording device, such as a television or DVR.” STBs are usually provided to consumers as part of a contract with a service provider, such as a cable company, rather than being sold to customers in stores.<sup>71</sup> Configurations and type of functionality of STBs are varied:

- **Satellite STB.** Satellite STBs provide live programming by turning a satellite signal into content in a form that can be shown on a TV or display.
- **Cable STB.** Cable STBs provide live programming by turning signals transmitted through cables into content in a form that can be shown on a TV or display.
- **Internet-Protocol TV (IPTV) STB.** IPTV STBs provide live programming using the Internet protocol suite over a network instead of being delivered through traditional TV formats, either live or on-demand. IPTV has an ongoing standardization process, which distinguishes it from Internet TV.
- **Media Streaming STBs.** Media streaming STBs connect to a TV and wireless network to stream (as opposed to download) audio and video entertainment without having to store any video files on a computer or hard drive. Roku and Apple-TV are examples of media streaming STBs.
- **Smart TV.** Smart TVs, also described in Section 5.1.1, combine information from the Internet with content from TV providers. These devices can be either a TV with integrated Internet capabilities or a STB for TV that offers more advanced functionality than a regular TV.
- **Digital Video Recorder (DVR).** A DVR is an STB that compresses incoming information and stores it for later viewing. While consumers often use DVRs provided by their cable or satellite providers (sometimes as a combined cable box/DVR unit), consumers can buy DVRs and pay for the service from other sources, such as TiVo.
- **Multi-room STB.** A Multi-room STB allows viewers to watch a program recorded on a DVR and other TVs in the home that are connected to a regular (non-DVR) STB.
- **Thin-client or remote STB.** A thin-client STB is a secondary-TV STB that can receive content from the home’s primary-TV’s STB.
- **HD STB.** HD can also be a functionality of STBs. As noted previously, HD allows displays to provide greater resolution.

The following section describes the energy consumption associated with STBs, the specifications that apply to them, and the technical barriers and opportunities toward advancing their

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<sup>71</sup> ENERGY STAR. 2012. “Set-top Boxes & Cable Boxes.” Accessed August 29, 2012 from [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=ST](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=ST).



efficiency. Lastly it discusses market barriers and opportunities and their implications for the Massachusetts Program.

### 5.2.1 Set-Top Box Energy Consumption

The saturation study indicates that the majority of homes in Massachusetts (91%) have STBs.<sup>72</sup> The energy use of STBs in a home is on par with that of some major appliances. For example, according to the NRDC, the typical household STB configuration (one HD DVR and one HD STB) uses more electricity than a new ENERGY STAR refrigerator (446 kWh/year versus 415 kWh/year).<sup>73</sup> These facts signal that STBs are an important product category for Massachusetts to consider.

STBs continue to draw substantial power when not in use. Using market data and energy use data of pay-TV households (which represent 90% of the total energy consumption of STBs in the country), Hardy et al. developed a national STB energy use model: Four primary variables involved in estimating STB energy consumption are on mode power, sleep mode power, duty cycle, and network architecture.<sup>74</sup> NRDC reported that DVRs and other STBs draw almost as much power when not in use as they do when in use. Because they are not in use most of the time, two-thirds of total energy consumption occurs when the boxes are not in use. In addition, DVRs are less efficient than non-DVR STBs, with the former using about 40% more electricity than the latter.

The literature and interviews suggest that the complex relationship between STBs and TVs can make it difficult to discern the savings opportunities from STBs.

### 5.2.2 Set-Top Box Specifications

STBs are currently covered by Version 3.0 ENERGY STAR Program Requirements; Version 4.0 Program Requirements are due to become effective on July 1, 2013; and Version 4.1 Program Requirements are currently under review.<sup>75</sup>

The typical energy consumption requirements of STB Version 3.0 specifications are a function of external power supplies, maintenance activities, APD, and deep sleep. The annual energy allowances are dependent on two primary features of the STB:

- **Base Functionality.** Base functionality tailors energy allowances to the type of media service the STB is configured for, such as cable, satellite, and IP, etc.

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<sup>72</sup> NMR Group, Inc. "Massachusetts Residential Retail Products: Consumer Electronics Saturation."

<sup>73</sup> Natural Resources Defense Council. 2011. "Energy Facts. Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Television Set-Top Boxes." June. Accessed May 4, 2012 from <http://www.nrdc.org/energy/files/settopboxes.pdf>.

<sup>74</sup> Gregg Hardy, Aaron Phillips, Debbie Driscoll, Philip Walters and Jeffrey Swofford. "Pay-Television In-Home Equipment: National Energy Consumption, Savings Potential, and Policy Barriers and Opportunities." Presentation at American Council for an Energy Efficient Economy Summer Study, Pacific Grove, CA, August 17, 2012.

<sup>75</sup> ENERGY STAR. "Set-top Box & Cable Boxes for Partners." Accessed September 12, 2012. [https://www.energystar.gov/index.cfm?fuseaction=products\\_for\\_partners.showSetTopBoxes](https://www.energystar.gov/index.cfm?fuseaction=products_for_partners.showSetTopBoxes).

- **Additional Functionality.** Version 3.0 specifications identify energy allowances for functionalities such as DVR, HD, and multi-room STB configurations, etc.

Smart TV functionality is not directly addressed in current or developing TV and STB ENERGY STAR Program Requirements.<sup>76</sup>

Version 3.0 extends opportunities for partnerships to both manufacturers and to media service providers. The media service provider partnership agreement requires that service providers who become ENERGY STAR partners provide staff training and consumer education around product efficiency, minimize the number of DVRs distributed to its customers, and ensure that 50% of new STBs that they purchase are ENERGY STAR-qualified *or* that 25% of all of their deployed STBs are ENERGY STAR-qualified.<sup>77</sup>

To date, there are 17 manufacturing ENERGY STAR Partners for STBs and six media service provider ENERGY STAR Partners for STBs.<sup>78</sup>

Updated test procedures for STBs are due from DOE in 2013.<sup>79, 80</sup>

It was the belief of one media service provider representative that CableLabs<sup>81</sup> is in the process of developing its own specification for STBs. The new specifications, expected to be completed by the end of 2012, call for greater efficiency during standby.

### 5.2.3 Set-Top Box Trends, Opportunities and Barriers

This section begins with a discussion of the technical barriers that might limit the efficiency of STBs and the technical opportunities to reduce STB energy consumption. It then presents the market barriers that the Program would need to overcome if it ultimately addresses STBs. Finally, the market trends and opportunities for STBs are provided for Program consideration.

#### 5.2.3.1 Set-Top Box – Technical Barriers

<sup>76</sup> ENERGY STAR. ENERGY STAR® Program Requirements for Set-top Boxes: Partner Commitments.” Version 3.0. Effective September 1, 2011. Accessed August 28, 2012.

[http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/settop\\_boxes/STB\\_Version\\_3\\_Program\\_Requirements\\_Manufacturer.pdf?8c4c-1c80](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/settop_boxes/STB_Version_3_Program_Requirements_Manufacturer.pdf?8c4c-1c80).

<sup>77</sup> ENERGY STAR. “ENERGY STAR® Program Requirements for Set-top Box Service Providers: Partner Commitments.” Version 3.0. Effective September 1, 2011. Accessed August 29, 2012.

[http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/settop\\_boxes/STB\\_Version\\_3\\_Program\\_Requirements\\_Service\\_Provider.pdf?e698-60c3](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/settop_boxes/STB_Version_3_Program_Requirements_Service_Provider.pdf?e698-60c3).

<sup>78</sup> ENERGY STAR. “ENERGY STAR® Partner List.” Accessed August 29, 2012.

[http://www.energystar.gov/index.cfm?&startnum=1&resultsperpage=17&fuseaction=estar\\_partner\\_list.showPartnerResults&s\\_code=ALL&partner\\_type\\_id=MANUFACTURER&cntry\\_code=ALL&award\\_search=N&locality\\_name=All%20Cities&country\\_id=All&category\\_id\\_list=1%2C2%2C3%2C4%2C5%2C6%2C7%2C8&award\\_category=ALL&award\\_year=ALL&category\\_id4=SETTOP&letter=ALL&current\\_sort\\_column=NAME&current\\_sort\\_order=ASC&layout=default](http://www.energystar.gov/index.cfm?&startnum=1&resultsperpage=17&fuseaction=estar_partner_list.showPartnerResults&s_code=ALL&partner_type_id=MANUFACTURER&cntry_code=ALL&award_search=N&locality_name=All%20Cities&country_id=All&category_id_list=1%2C2%2C3%2C4%2C5%2C6%2C7%2C8&award_category=ALL&award_year=ALL&category_id4=SETTOP&letter=ALL&current_sort_column=NAME&current_sort_order=ASC&layout=default).

<sup>79</sup> Appliance Standards Awareness Project. 2012. “Set-Top Boxes and Network Equipment.” Accessed May 22, 2012 from <http://www.appliance-standards.org/product/set-top-boxes-and-network-equipment>.

<sup>80</sup> NMR research team has not yet investigated DOE’s planned test procedures.

<sup>81</sup> CableLabs is a non-profit consortium devoted to helping cable operators.

Literature and interview findings suggest that there is limited technical potential for reducing the consumption of STB devices:

- **New features may be increasing STB consumption levels.** According to one media service provider interviewee, while STBs have grown in efficiency over the years, added features such as HD and DVR mean that the devices produced now consume more than twice the electricity of older boxes.
- **Addressing device efficiency alone is inadequate.** Both a stakeholder and a manufacturer representative explained that STB efficiency cannot be addressed through increasing the efficiency of the device alone, because the service provider controls the efficiency level through software changes in the network that can override the device's efficient features.
- **Less consumptive modes limit functionality.** According to several interviewees and Fraunhofer, STBs cannot enter less consumptive modes without risking a loss of data, such as a show recording or a network update. For example, DVRs might not record programming if they are in standby mode. Given this, functions like APD are unattractive to users.<sup>82</sup>
- **Addressing active-mode consumption provides limited savings.** Bolioli et al. believe the possibility for reducing the active-mode-consumption of individual STB units is limited given the minimal hours of use (HOU) of the device and the required amount of power for high-speed connections.<sup>83</sup>
- **Per-unit savings are limited.** In a recent AESP Brown Bag Webinar, DIRECTV representative Steve Dulac noted that given the limited per-unit savings opportunities compared to the return on investment, STBs are not worthy of including in an efficiency program.<sup>84</sup>

### 5.2.3.2 Set-Top Box – Technical Opportunities

Evidence points to the technical possibilities for reducing the energy consumption of STBs. In fact, one stakeholder interviewee believed that addressing STBs (along with video game consoles) presents the greatest opportunity for reducing energy consumption of consumer electronics. NRDC estimates the potential reduction of energy consumption by STB as between 30% and 50% by 2020. For example, European STBs draw less energy when not in use than do STBs used in the United States, demonstrating that it is possible technologically for these

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<sup>82</sup> Fraunhofer Center for Sustainable Energy Systems. "Energy Consumption of Consumer Electronics in U.S. Homes in 2010." December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>83</sup> Thomas Bolioli, David Beavers, and Mark Michalski. "Can We Talk? Utilities to Cable, Satellite and IP Service Providers: Is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes?" Presentation at American Council for an Energy Efficient Economy Summer Study, Pacific Grove, CA, August 17, 2012.

<sup>84</sup> Dulac, Steve. 2012. Presentation made at AESP Brown Bag Webinar, "The Elephant in the Residential Program Designers Room: Set-Top Boxes." May 31.

devices to draw less energy when not in use.<sup>85</sup> NMR's review of literature and in-depth interviews yielded a number of key mechanisms for achieving greater energy savings from STBs:

- **Eliminate STBs by incorporating functions into thin-client boxes or TVs.** NRDC, along with RIA and Ecos, believe a major opportunity for savings is to replace secondary STBs with low-power thin-client boxes.<sup>86</sup> Bolioli et al. agree. They project that decreasing the number of boxes per home will create considerable savings. Moreover, if STB-clients are contained within TVs it will provide a great deal of savings and would add a negligible amount of energy draw from TVs.<sup>87</sup> In his AESP Brown Bag Webinar, Dulac described the RVU Alliance's Remote User Interface (RUI), which is an emerging software tool for Smart TVs. Dulac explained the RUI's incorporation of STB functionality into TVs or thin-clients reduces the need for a home to have multiple STBs.<sup>88</sup> During NMR's in-depth interviews, one retailer interviewee and one stakeholder also commented on the considerable savings benefits that are possible as a result of RUI. One of the manufacturers interviewed described a product that they are developing along these lines, with a multi-room DVR that could work either with that manufacturer's energy-efficient thin-client boxes or with other manufacturers' boxes. Overall, NMR interviewees emphasized the savings opportunities presented by the move to streaming content, the integration of STBs into TVs (Smart TVs) or another central device, and the resulting elimination of STBs.
- **Reduce power level in sleep mode.** The second major savings opportunity that NRDC and RIA and Ecos suggest is designing boxes to reduce power consumption to much lower levels when not in use.<sup>89,90</sup> Bolioli et al. note that advances in sleep mode are where the greatest savings potential lies. They project that such advances could comprise 80-90% of potential savings. If media service providers implement a "high-speed, high-reliability, two-way data connection to communicate when needed," then units would not need to remain on at all times and the per-unit savings potential is more likely to be realized.<sup>91</sup> According to one media service provider interviewee, STBs are now capable of "light sleep," a mode allowing for a 20-30% reduction in energy consumption when the box is not providing its primary service; however, older STBs need to have light sleep

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<sup>85</sup> Natural Resources Defense Council. 2011. "Energy Facts."

<sup>86</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products." August 2011. Accessed March 20, 2012. [http://nea.org/research/reports/10-219\\_Combined.pdf](http://nea.org/research/reports/10-219_Combined.pdf).

<sup>87</sup> Thomas Bolioli, David Beavers, and Mark Michalski. "Can We Talk?"

<sup>88</sup> Dulac, Steve. 2012. Presentation made at AESP Brown Bag Webinar, "The Elephant in the Residential Program Designers Room: Set-Top Boxes." May 31.

<sup>89</sup> Natural Resources Defense Council. 2011. "Energy Facts."

<sup>90</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products."

<sup>91</sup> Thomas Bolioli, David Beavers, and Mark Michalski. "Can We Talk?"

enabled through remote software changes. Additionally, NRDC points out that IPTV, specifically, permits the use of lower-power boxes than other signal providers’ STBs.<sup>92</sup>

- **Use media streaming devices.** Internet video streaming STBs tend to use less power than cable and satellite STBs, including ENERGY STAR-qualified models, with Apple TV consuming 2 Watts in on mode, or 7 kWh/year. Apple TV is currently the only ENERGY STAR-qualified streaming device, but competing devices also consume less electricity than typical STBs.)<sup>93</sup> Hardy et al. suggest that service providers should stream from “the cloud”<sup>94</sup> instead of storing the programs on local DVRs—they call this a “network DVR model” and believe it would provide overall savings (specifically on the part of the consumer). Their model indicates that this system change—in addition to reducing on mode power levels, sleep mode power levels, and/or the time boxes spend in high-power modes—could result in 30-50% of savings over current levels, depending on the effectiveness of implementation.<sup>95</sup>

**5.2.3.3 Set-Top Box- Market and Program Barriers**

While NMR discovered extensive technical possibilities for increasing efficiency from STBs, the team found ten market barriers to increasing the efficiency of STBs and identified six program implications associated with these barriers. Table 5-3 provides details.

**Table 5-3. Market Barriers to Advancing STB Efficiency**

Implication*	Finding	Source
Media service providers have been hesitant to engage in energy efficiency efforts.	It is challenging and risky for media service providers to experiment with their product line given that their customer base is usually very large and their product line is usually standardized across it.	Montrichard <sup>96</sup> ; Dulac <sup>97</sup>
	Service providers have not been inclined to participate in ENERGY STAR’s STB partnership effort because of concerns of the cost of changing their practices. Further, their perceptions of the uncertainty of the specification process coupled with the time involved in deploying a new STB fleet makes this investment	Bolioli et al. <sup>98</sup>

<sup>92</sup> Natural Resources Defense Council. 2011. “Energy Facts.”

<sup>93</sup> Gigaom.com, 2011. “How Green Are the Devices That Stream Netflix & Hulu?”. Accessed May 10, 2012 from <http://gigaom.com/video/energy-consumption-of-connected-devices/>.

<sup>94</sup> Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network, typically the Internet, storing a user’s data and software that can then be accessed through an Internet browser or mobile application.

<sup>95</sup> Gregg Hardy, Aaron Phillips, Debbie Driscoll, Philip Walters and Jeffrey Swofford. “Pay-Television In-Home Equipment: National Energy Consumption, Savings Potential, and Policy Barriers and Opportunities.” Presentation at American Council for an Energy Efficient Economy Summer Study, Pacific Grove, CA, August 17, 2012.

<sup>96</sup> Montrichard, Kari. 2012. Presentation made at AESP Brown Bag Webinar, “The Elephant in the Residential Program Designers Room: Set-Top Boxes.” May 31.

<sup>97</sup> Dulac, Steve. 2012. Presentation made at AESP Brown Bag Webinar, “The Elephant in the Residential Program Designers Room: Set-Top Boxes.” May 31.

<sup>98</sup> Thomas Bolioli, David Beavers, and Mark Michalski. “Can We Talk? Utilities to Cable, Satellite and IP Service Providers: Is Better Dialogue Needed to Achieve Energy Savings with Set-Top Boxes?” Presentation

Implication*	Finding	Source
	riskier where the upgrades could quickly be made obsolete. Given that the service provider industry has been subject to many unique regional regulations over the years <sup>†</sup> , they have hesitation about complying with additional requirements and view ENERGY STAR as another regulatory effort, despite its voluntary designation. ENERGY STAR’s effort to partner with media service providers has not been as effective as its effect on the efforts of manufacturers to develop more energy-efficient models: Limited partnerships with media service providers have emerged.	
Partnering with media service providers may not reach the territory of interest. Program efforts need to account for this and for potential variations in equipment.	Media service providers’ territories are often disaggregated. Additionally, the equipment they install differs across providers and regions.	RIA and EMI <sup>99</sup>
Regulations limit media service providers’ opportunities to take advantage of technology advances.	Copyright law currently mandates cable service providers to save individual copies of programs for each of its customers. This storage model requires considerable energy to operate.	Hardy et al. <sup>100</sup>
Customers have limited choice when it comes to the efficiency of their STB	Media service providers elect the STB products, the products’ configurations, and other details about them that can affect the energy efficiency of these devices.	NRDC <sup>101</sup> ; Bolioli et al.
	Manufacturers of set-top boxes, servers, and game consoles lag behind a bit as they are not producing efficient products.	RIA <sup>102</sup>
Even if STBs advance in energy efficiency, it does not guarantee that customers will use energy-efficient options.	Customers often will avoid powering their STBs down to avoid losing data, such as a show recording.	RIA and Ecos <sup>103</sup>
	Customers may not take advantage of energy efficiency features available even if the media service provider provides them.	Manufacturer interviewee
Given that ENERGY STAR-qualified STBs have penetrated the market in Massachusetts and nationally, incentivizing them might result in free ridership.	In 2012 NMR found that over one-third (37%) of the STBs in Massachusetts are ENERGY STAR qualified. In 2011 ENERGY STAR found a national market penetration of 62% for ENERGY STAR STBs.	NMR <sup>104</sup> ; ENERGY STAR <sup>105</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

<sup>99</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>100</sup> Gregg Hardy, Aaron Phillips, Debbie Driscoll, Philip Walters and Jeffrey Swofford. “Pay-Television In-Home Equipment: National Energy Consumption, Savings Potential, and Policy Barriers and Opportunities.”

<sup>101</sup> Natural Resources Defense Council. 2011. “Energy Facts. Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Television Set-Top Boxes.”

<sup>102</sup> Research Into Action, Inc (RIA). “Electronics and Energy Efficiency: A Plug Load Characterization Study.” SCE0284. January 29, 2010. Accessed April 25, 2012. <http://www.calmac.org/search.asp>.

<sup>103</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>104</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>105</sup> ENERGY STAR. “ENERGY STAR Unit Shipment and Market Penetration Report: Calendar Year 2011 Summary.” 2012.

† In fact, Bolioli et al. share that there are 351 town cable commissions independently regulating the cable providers in Massachusetts; thus, likely making compliance in Massachusetts even more challenging.

Two interviewees cautioned against the inclusion of STBs in consumer electronics programs. One stakeholder noted that the complexity of STBs and the varied market actors and technologies make them challenging for programs to address. A program administrator interviewee was of the opinion that a rigorous market characterization of STBs has not yet been carried out, making program and evaluation design that would pass regulatory scrutiny a challenge. One media service provider interviewee added that the STB energy consumption data used by the energy efficiency industry is antiquated.

### 5.2.3.4 Set-Top Box-Market Trends and Program Opportunities

Table 5-4 includes seven STB market trends. The team identified six program implications associated with them.

**Table 5-4. Opportunities and Trends towards Advancing STB Efficiency**

Implication*	Finding	Source
STB manufacturers are engaging in energy efficiency efforts.	The defaults on STBs, TVs, and game consoles appear to be changing towards efficient settings.	Stakeholder interviewee
Opportunities exist for upgrading the current fleet of STBs.	When media service providers expand their service territory it generally leads to new STB purchases, according to one manufacturer interviewee.	Manufacturer interviewee
Partnerships with media service providers are likely more effective at advancing efficiency than efforts targeting customers or manufacturers.	Media service providers have more power than manufacturers and consumers when it comes to the installation and configuration of STBs.	Hardy et al. <sup>106</sup>
Media service providers are already engaging in energy efficiency efforts.	The six largest members of the National Cable Television Association (NCTA) have committed that by December of 2013 90% of the STBs they put into service will be ENERGY STAR Version 3.0 compliant and that the STBs they distribute (10 million by the end of 2012) will have “light sleep” enabled. It was the belief of the media service provider interviewee that this will represent a \$44 million annual energy savings across the country. However, this only applies to the deployed boxes that are capable of light sleep. This interviewee noted that about 90% of cable STBs currently deployed are not capable of light sleep.	Media Service Provider Interviewee; NCTA <sup>107</sup>

<sup>106</sup> Gregg Hardy, Aaron Phillips, Debbie Driscoll, Philip Walters and Jeffrey Swofford. “Pay-Television In-Home Equipment: National Energy Consumption, Savings Potential, and Policy Barriers and Opportunities.”

<sup>107</sup> National Cable Television Association (NCTA). “U.S. Cable Industry Launches New Energy Efficiency Initiative.” November 18, 2011. Accessed September 12, 2012. <http://www.ncta.com/ReleaseType/MediaRelease/US-Cable-Industry-Launches-New-Energy-Efficiency-Initiative.aspx>.

Implication*	Finding	Source
IPTV could present an effective avenue for more energy efficient media delivery than cable or satellite (NMR could not find evidence of the availability in Massachusetts of American programming transmitted through IPTV, however).	In Massachusetts the majority of STBs are not comprised of IPTV customers: cable service is the most common signal type for STBs (65%), followed by satellite (21%), and fiber optic (12%).	NMR <sup>108</sup> ; 2 Manufacturer interviewees
	While cable Media service providers are required to broadcast all channels to all customers at a given time, IPTV regulations do not.	Bolioli <sup>109</sup>
	IPTV is quickly gaining market share. RIA and EMI cite CEA survey findings indicating that 10% of households they interviewed were “likely” or “very likely” to cancel their cable or satellite service, presumably because they have IPTV capability.	NRDC <sup>110</sup> ; 2 Manufacturer interviewees; RIA and EMI <sup>111</sup>
Streaming devices are gaining in popularity and present a potential market to target.	The popularity of streaming video services is growing rapidly, with 24 million streaming subscribers in the United States in Q2 of 2012.	Netflix <sup>112</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the research team believes are applicable to the topic.

Despite the market barriers that exist, market trends indicate there are many opportunities for the Massachusetts Program to tackle the energy consumption of STBs. As with TVs, programs need to take into consideration free ridership and program attribution when targeting entities that are already incorporating efficiency into their practices. Representatives from two program administrators recommended including STBs in consumer electronics programs. One stakeholder asserted that among consumer electronics, STBs have the *greatest* opportunity for program success.

### 5.3 Other Audio/Visual Equipment

ENERGY STAR considers the following products to constitute the Home Audio & DVD category: “all mains-connected products that offer audio amplification and/or optical disc drive functions and do not meet the definition of a Dedicated Audio DSP Device shall be classified as A/V Products and subject to the requirements specified in this document.” A Dedicated Audio DSP Device is one that “meets all of the following criteria:

- i provides audio digital signal processing as its primary function;

<sup>108</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>109</sup> Bolioli, Tom. 2012. Presentation made at AESP Brown Bag Webinar, “The Elephant in the Residential Program Designers Room: Set-Top Boxes.” May 31.

<sup>110</sup> Natural Resources Defense Council. 2011. “Energy Facts. Better Viewing, Lower Energy Bills, and Less Pollution: Improving the Efficiency of Television Set-Top Boxes.”

<sup>111</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>112</sup> Netflix, “Q2 12 Letter to shareholders,” Accessed September 6, 2012, <http://ir.netflix.com/#>.



- ii provides support for one or more networking / control protocols; and,
- iii does not provide audio amplification.”<sup>113</sup>

These products generally include home-theater-in-a-box systems, audio amplifiers, audio visual receivers, shelf systems, DVD players, Blu-ray disc players, and docking stations for audio amplification or optical disc drive functions. The Massachusetts Program is not currently addressing any of these products, nor is it considering doing so.

In Massachusetts, next to STBs, DVD players are the most common peripheral device connected to TVs. NMR found DVD players in 70% of homes with an average of about one DVD player per household.<sup>114</sup>

Nonetheless, the research team decided not to focus on these products in this study because the preliminary literature review did not yield information suggesting that these products warranted program consideration. Specifically:

- **The energy consumption of these products *individually* is minimal.** As of 2010 these A/V products *individually* comprised limited shares of total consumer electronics energy use. For example, A/V receivers comprised 3%, DVD players comprised 3%, and Blu-ray disk players comprised only 0.1% of total consumer electronics energy use. As such, the team determined that pursuing these products individually would provide very limited savings and thus did not warrant consideration.<sup>115</sup>
- **These products represent declining categories.** While RIA and EMI report that MP3 docking station and TV speaker sales are increasing,<sup>116</sup> the Digital Entertainment Group (DEG) found that *overall* spending on consumer home entertainment<sup>117</sup> has declined every year from its peak of \$21.8 billion in 2004 to \$18 billion in 2011. Both groups note that DVD sales and rentals have been decreasing. DEG indicates that Blu-ray disc sales and rentals are increasing, but they are still far below the amount spent on DVDs (\$2.3 billion vs. \$14 billion in 2010).<sup>118, 119</sup> There seem to be two major reasons why sales are decreasing. First, media content is now more commonly digitally distributed, such as through the Internet. Digital distribution sales and rentals exceed those for Blu-ray and

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<sup>114</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>114</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>115</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

<sup>116</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>117</sup> According to this author, consumer home entertainment includes rentals and sales of VHS products, DVD product, Blu-ray products, and digital videos.

<sup>118</sup> The Digital Entertainment Group (DEG). “DEG Year-End 2010 Home Entertainment Report.” Accessed September 12, 2012. [http://www.degonline.org/pressreleases/2011/f\\_Q410.pdf](http://www.degonline.org/pressreleases/2011/f_Q410.pdf).

<sup>119</sup> The Digital Entertainment Group (DEG). “2011 U.S. Home Entertainment Consumer Spending by Format.” Accessed September 12, 2012.

[http://www.degonline.org/pressreleases/2012/DEG\\_2011\\_US\\_CONSUMER\\_SPENDING\\_CHART.pdf](http://www.degonline.org/pressreleases/2012/DEG_2011_US_CONSUMER_SPENDING_CHART.pdf).

are increasing much more rapidly. In the first half of 2012 digital distribution sales and rentals increased 77% from the first half of 2011.<sup>120</sup> Second, sales and rentals are declining because these products are more commonly being integrated in other devices—for example, DVD and Blu-ray disc players are being incorporated into game consoles and TVs.<sup>121</sup>

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<sup>120</sup> The Digital Entertainment Group (DEG). “2012 U.S. Home Entertainment Consumer Spending by Format – First Half 2012.” Accessed September 12, 2012. [http://www.degonline.org/pressreleases/2012/DEG\\_FIRST\\_HALF\\_2012\\_HOME\\_ENTERTAINMENT\\_REPORT\\_Final\\_EXT\\_7\\_29\\_12.pdf](http://www.degonline.org/pressreleases/2012/DEG_FIRST_HALF_2012_HOME_ENTERTAINMENT_REPORT_Final_EXT_7_29_12.pdf).

<sup>121</sup> U.S. Environmental Protection Agency. “ENERGY STAR Audio/Video Product List.” September, 4, 2012. Accessed September 12, 2012. [http://www.energystar.gov/ia/products/prod\\_lists/audio\\_video\\_prod\\_list.pdf](http://www.energystar.gov/ia/products/prod_lists/audio_video_prod_list.pdf).

## 6 Home Office Equipment & Video Game Consoles

The team also looked at video game consoles (referred to from here forward as “game consoles”). We report on game consoles in conjunction with home office equipment because they are computer-like devices and are often found in home offices in Massachusetts. In fact, nearly one-half of home offices in Massachusetts (45%) include game consoles.<sup>122</sup>

Home office products account for 30% of a typical U.S. household’s plug-load consumption—the second greatest share of the plug-load consumption after home entertainment.<sup>123</sup> As part of this potential study, NMR investigated two primary home office equipment product categories in addition to game consoles: PCs and displays (also known as monitors).

This section provides information regarding the three products’ energy consumption, the specifications associated with them, the technical barriers and opportunities related to advancing their efficiency, and related market barriers and opportunities and associated implications for programs.

### 6.1 Video Game Consoles

A game console is “a standalone computer-like device whose primary use is to play video games.” A game console has many of the components found in a computer, but instead of using a mouse for input it typically uses a special hand held controller. Game consoles often perform a variety of multimedia functions, such as playing back a digital picture, movie, or music. A game console is different from a handheld gaming device, which is typically battery powered and has its own display.<sup>124</sup> Game consoles typically display video on TVs and PC monitors. In Massachusetts, the average home used 0.4 game consoles per TV, but had 0.7 game consoles located with home office equipment.<sup>125</sup>

Fraunhofer explains that game consoles operate in four modes<sup>126</sup>:

- **Active-gaming.** A video game is being played
- **Active-other.** A game is not being played, but the device is being used (e.g., replaying)
- **Navigation.** Neither a game nor video are being played, but the game is being managed (e.g., pausing)

<sup>122</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>123</sup> Lockheed Martin, Inc. and Energy Solutions. “Advanced Power Strip Research Report.” August 2011. Accessed March 20, 2012. <http://www.nysersda.ny.gov/en/Page-Sections/Residential/Energy-Efficient-and-ENERGY-STAR-Products/~media/Files/EERP/Residential/Energy%20Efficient%20and%20ENERGY%20STAR%20Products/12-03-Power-Management-Research-Report.ashx>

<sup>124</sup> ENERGY STAR. 2010. “ENERGY STAR Program Requirements for Computers, Version 5.0.” Accessed May 8, 2012 from [http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/computer/Version5.0\\_Computer\\_Spec.pdf?bf5d-6266](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Version5.0_Computer_Spec.pdf?bf5d-6266).

<sup>125</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>126</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

- **Off.** The user has switched off the system, but it is still plugged in

### 6.1.1 Video Game Console Energy Consumption

Fraunhofer estimates that nearly 8% of the total energy consumption used by consumer electronics in the United States is from game consoles—the third largest portion after TVs and desktop PCs. Some popular brands of this product type include Sony PlayStation, Microsoft Xbox, and Nintendo Wii. The number of game consoles in use in the United States increased by 70% from 2007 to 2010, and it seems likely that this market will continue to grow.<sup>127</sup> Hittinger, Mullins, and Azevedo estimate that U.S. game console total energy consumption grew by 50% from roughly 11 TWh in 2007 to 16 TWh in 2010.<sup>128</sup>

The energy consumption of game consoles increases when consumers use them to watch DVDs or Blu-ray disks.<sup>129</sup>

### 6.1.2 Video Game Console Specifications

While game consoles were included in the ENERGY STAR Version 5.0 Computer Program Requirements, no requirements have been set. The stated reason is that time is needed to refine requirements and commence efforts to engage game publishers in the ENERGY STAR process.<sup>130</sup> EPA launched development of recognition criteria for game console manufacturers in August 2011,<sup>131</sup> and is currently in the process of developing test methods and performance requirements.<sup>132</sup>

### 6.1.3 Video Game Console Trends, Opportunities, and Barriers

This section begins with a discussion of the technical barriers that limit the efficiency of game consoles, and outlines the technical opportunities to reduce the energy consumption of game consoles. It then presents the market barriers that the Program would need to overcome if it addresses game consoles. Finally, the market trends and opportunities for game consoles are provided for Program consideration.

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<sup>127</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.” December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>128</sup> Eric Hittinger, Kimberley A. Mullins, and Inês L. Azevedo. “Electricity consumption and energy savings potential of video game consoles in the United States.” Springer Science+Business Media. March 31, 2012. Accessed May 22, 2012. [http://www.andrew.cmu.edu/user/kmullins/VG\\_energy\\_savings\\_potential.pdf](http://www.andrew.cmu.edu/user/kmullins/VG_energy_savings_potential.pdf).

<sup>129</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.” August 2011. Accessed March 20, 2012. [http://neea.org/research/reports/10-219\\_Combined.pdf](http://neea.org/research/reports/10-219_Combined.pdf)

<sup>130</sup> ENERGY STAR. “ENERGY STAR Program Requirements for Computers, Version 5.0.” 2010. Accessed May 8, 2012 from [http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/computer/Version5.0\\_Computer\\_Spec.pdf?bf5d-6266](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Version5.0_Computer_Spec.pdf?bf5d-6266).

<sup>131</sup> ENERGY STAR. “ENERGY STAR Specifications At-A-Glance.” November 11, 2011. Accessed May 8, 2012 from [http://www.energystar.gov/ia/partners/prod\\_development/downloads/Spec\\_At-A-Glance\\_PD.pdf?b1fc-f790](http://www.energystar.gov/ia/partners/prod_development/downloads/Spec_At-A-Glance_PD.pdf?b1fc-f790).

<sup>132</sup> ENERGY STAR. “Game Console Performance Requirements.” Accessed August 30, 2012. [http://www.energystar.gov/index.cfm?c=revisions.game\\_console\\_spec](http://www.energystar.gov/index.cfm?c=revisions.game_console_spec).

### 6.1.3.1 Video Game Console - Technical Barriers and Opportunities

The key challenge of game consoles is that game console energy consumption does not vary during the different operation modes.<sup>133</sup> When game consoles are in the navigation mode they use as much power as in the active-gaming mode. When they are being used for non-gaming (active-other), the systems draw either the same or more energy than in active-gaming mode. Of the 135 kWh/year unit energy consumption of gaming systems, Fraunhofer found that a little more than half (68 kWh/year) derive from active-other, navigation, and off modes combined.<sup>134</sup>

NMR's review of the literature yielded two technical opportunities to increase game console efficiency: (1) setting game consoles to default to the APD function, and (2) increasing the flexibility of hardware to allow for power use to vary from task to task:

- **Defaulting to the APD function.** RIA and Ecos suggest setting game consoles to an APD default of one hour, which would result in devices turning themselves off after extended periods without use. The study did not obtain any data to identify the rate at which game console users set the APD as default on their games. However, RIA and Ecos estimate that considerable savings could be achieved with APD enabled. They conjecture that this change could save 17GWh over the course of 2012-2014 in the Northwest states served by the Northeast Energy Efficiency Alliance.<sup>135</sup> Hittinger et al. point out that the APD default need not be applied only to new consoles. Units already in use could be set to APD default through software updates.<sup>136</sup>
- **Increasing the flexibility of hardware.** Hittinger et al. explain that game console power consumption could also be achieved through “increasing hardware flexibility so that less computationally intensive tasks can be performed with some of the processing resources disabled.” In other words, hardware could be adjusted so that it is not calling on the same level of power it needs for some tasks during less power-intensive events. One stakeholder interviewee reported that NRDC is negotiating with gaming software manufacturers to alter game console designs to save power during the active-gaming mode. According to the stakeholder, NRDC has also been in the process of advocating that game consoles be designed using power scaling based on functionality. For example, a DVD player integrated into a game console would be required to use the same (lower) number of Watts as a standalone DVD player.

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<sup>133</sup> Eric Hittinger, Kimberley A. Mullins, and Inês L. Azevedo. “Electricity consumption and energy savings potential of video game consoles in the United States.” Springer Science+Business Media. March 31, 2012. Accessed May 22, 2012. [http://www.andrew.cmu.edu/user/kmullins/VG\\_energy\\_savings\\_potential.pdf](http://www.andrew.cmu.edu/user/kmullins/VG_energy_savings_potential.pdf).

<sup>134</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.” December 2011. Accessed April 26, 2012. <http://www.ce.org/CorporateSite/media/Government-Media/Green/Energy-Consumption-of-CE-in-U-S-Homes-in-2010.pdf>.

<sup>135</sup> RIA and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.” August 2011. Accessed March 20, 2012. [http://neea.org/research/reports/10-219\\_Combined.pdf](http://neea.org/research/reports/10-219_Combined.pdf)

<sup>136</sup> Hittinger, Kimberley A. Mullins, and Inês L. Azevedo. “Electricity consumption and energy savings potential of video game consoles in the United States.” Springer Science+Business Media. March 31, 2012. Accessed May 22, 2012. [http://www.andrew.cmu.edu/user/kmullins/VG\\_energy\\_savings\\_potential.pdf](http://www.andrew.cmu.edu/user/kmullins/VG_energy_savings_potential.pdf).

**6.1.3.2 Video Game Console - Market and Program Barriers**

Table 6-1 shows nine market barriers to advancing the energy efficiency of game consoles gleaned from the literature review and in-depth interviews. NMR identified four major implications associated with these market barriers.

**Table 6-1. Market Barriers to Advancing Game Console Efficiency**

Implication*	Finding	Source	
Game console manufacturers are not inclined to engage in energy efficiency efforts.	The functionality of game consoles is more important to manufacturers than energy efficiency. Per-unit incentives are not significant enough to encourage manufacturers to prioritize efficiency.	RIA and Ecos <sup>137</sup>	
Overhauling the existing market will be challenging given manufacturers’ limited interest in developing new product lines and consumers’ purchasing patterns.	Manufacturers only release new game consoles every 5-10 years. Given the cost of developing new game consoles manufacturers are not interested in quickly advancing this timeline.	Program Administrator interviewee	
	Game console technology and opportunities differ from other consumer electronics products in that once a consumer purchases a game console it is likely to be some years before they upgrade the product.		
Energy consumption associated with game consoles is becoming harder to harness given the expanding market, diversifying functionality expectations of the devices, and existing consumer usage behavior.	In the intervening time between consumers’ game console upgrades, they purchase peripheral products to increase the functionality of their existing system.	RIA and Ecos <sup>138</sup> ; RIA and EMI <sup>139</sup>	
	RIA and Ecos found that sales of game consoles consistently increased from 2005-2010. More recently, RIA and EMI report that sales are expected to grow from 2012 forward, as well.		
	Consumers are more frequently using their game consoles for purposes other than games: watching DVDs, Blu-ray disks, and browsing the Internet. Game consoles are less efficient than the devices through which these functions are traditionally employed.		RIA and Ecos <sup>140</sup>
	While advances are being made to the efficiency level of game consoles, the addition of HD capability offsets those gains, requiring additional energy.		Retailer interview
	Many consumers leave game consoles turned on when not in use to save unfinished games they wish to resume.		RIA and EMI <sup>141</sup> ; NRDC <sup>142</sup>
Consumers lack education around energy saving behaviors for game consoles.	Only 14% of game console users surveyed indicated they are aware that their systems have power management options.	Fraunhofer <sup>143</sup>	

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

<sup>137</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>138</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>139</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>140</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>141</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>142</sup> Natural Resource Defense Council (NRDC). “Lowering the Cost of Play: Improving the Energy Efficiency of Video Game Consoles.” November 2008.

<sup>143</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

### 6.1.3.3 Video Game Console - Market Trends and Program Opportunities

NMR found four major market trends related to advancing energy efficiency for game consoles. Table 6-2 lists these alongside associated implications identified by the research team.

**Table 6-2. Opportunities and Trends towards Advancing Game Console Efficiency**

Implication*	Finding	Source
Engaging a large share of manufacturers is easier than in other product categories.	Few manufacturers are producing game consoles.	RIA and Ecos <sup>144</sup>
Opportunities for engaging manufacturers exist.	RIA and Ecos assert that game console efficiency has continuously improved since 2006, and is currently a high priority for manufacturers as they are designing their latest product lines. One stakeholder interview believed that APD set as the default is becoming more common.	RIA and Ecos; <sup>145</sup> Stakeholder interviewee
Consumer interests are coincidentally shifting to more energy-efficient game consoles.	Movement gaming, such as Nintendo Wii, is becoming more popular and is suspected to use less energy than other game consoles.	RIA and Ecos <sup>146</sup>
International standards have the potential to advance the efficiency of the product lines that are offered within the U.S. market.	While current U.S. federal regulations do not address game consoles, the EU is attempting to address them. If these changes take place it will change the products that are available in the United States given that manufacturers do not develop different products for different international markets.	

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

## 6.2 Computers

NMR investigated the two primary types of PCs: desktop and mobile. Desktop PCs are those that are designed to remain in a stationary location, whereas mobile PCs are those that are intended for use in multiple locations. Laptops, netbooks, and tablets are generally the products that comprise the mobile PC category.

### 6.2.1 Computer Energy Consumption

Fraunhofer reports that desktop PCs comprised 12% of total consumer electronics energy use in 2010 in the United States —the second largest share after TVs. Mobile PCs comprised 4% of total consumer electronics energy use.<sup>147</sup> On average, mobile PCs are more energy efficient than desktop PCs. For example, researchers in the UK determined that a laptop PC's yearly average

<sup>144</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products."

<sup>145</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products."

<sup>146</sup> Research into Action (RIA) and Ecos. "Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products."

<sup>147</sup> Fraunhofer Center for Sustainable Energy Systems. "Energy Consumption of Consumer Electronics in U.S. Homes in 2010."



consumption was 29 kWh, while a desktop PC used 166 kWh per year, almost six times the energy required to power a laptop PC.<sup>148</sup>

## 6.2.2 Computer Specifications

The ENERGY STAR Computers Program Requirements currently in use are Version 5.0, effective October 2009. Version 6.0 is under development.<sup>149</sup> Qualifying PC equipment “must meet stringent requirements for either low [Typical Electricity Consumption] or low power consumption in off, sleep, and idle modes of operation, with additional requirements covering use of efficient power supplies and automatic computer/display power management settings.”<sup>150</sup>

## 6.2.3 Computer Trends, Opportunities, and Barriers

This section begins with a discussion of the technical barriers that limit the efficiency of PCs, and outlines some technical opportunities to reduce their energy consumption. It then presents the market barriers that the Program is likely facing, or will face, in its implementation of its PC incentives. Finally, the market trends and opportunities related to PCs are provided for Program consideration.

### 6.2.3.1 Computer - Technical Barriers and Opportunities

Given that mobile PCs are more energy efficient than desktop PCs, NMR believes it is implied that a movement away from desktop PCs towards mobile PCs presents a savings opportunity.

Power management continues to be a key mechanism for reducing the energy consumption of PCs, despite previous efforts to reduce it. (For example, ENERGY STAR has long promoted enabling power management for desktop PCs, as for example with its “Sleep is Good” advertising campaign.<sup>151</sup>) Fraunhofer found that half of the time that mobile PCs are in on mode they are not being used, due to the devices’ power management being disabled. This accounts for 24kWh of annual energy use in the United States per computer on average. In addition, 10% of

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<sup>148</sup> Energy Saving Trust. “Powering the Nation: Household electricity-using habits revealed.” June 2012. Accessed September 5, 2012 from <http://www.energysavingtrust.org.uk/Publications2/Corporate/Research-and-insights/Powering-the-nation-household-electricity-using-habits-revealed>.

<sup>149</sup> ENERGY STAR. 2012. “Computer Specification.” Accessed August 30, 2012 from [http://www.energystar.gov/index.cfm?c=revisions.computer\\_spec](http://www.energystar.gov/index.cfm?c=revisions.computer_spec).

<sup>150</sup> ENERGY STAR. 2011. “ENERGY STAR Specifications At-A-Glance.” November 11. Accessed May 8, 2012 from [http://www.energystar.gov/ia/partners/prod\\_development/downloads/Spec\\_At-A-Glance\\_PD.pdf?b1fc-f790](http://www.energystar.gov/ia/partners/prod_development/downloads/Spec_At-A-Glance_PD.pdf?b1fc-f790).

<sup>151</sup> “The ENERGY STAR Low Carbon IT Campaign is a nationwide effort to assist and recognize organizations for reducing the energy consumed by their information technology equipment.” *Source*: ENERGY STAR, “Welcome to ENERGY STAR Low Carbon IT,” Accessed September 10, 2012, [http://www.energystar.gov/index.cfm?c=power\\_mgt.pr\\_power\\_mgt\\_low\\_carbon](http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_low_carbon).

mobile PC energy use is expended during standby or off mode—an even greater share than with desktop PCs, which expend 7% of their energy use in standby or off modes.<sup>152, 153</sup>

RIA and Ecos also identify power management among a host of technical opportunities to reduce energy consumption among desktop PCs in the Northwest. (The NMR research team notes that many of these opportunities could also be relevant to mobile PCs.) The technical issues RIA and Ecos suggest overcoming are the lack of enabling of power management and the lack of efficiency of internal power supplies,<sup>154</sup> voltage regulators<sup>155</sup> and hard drives. They estimate that if certain mechanisms are adopted within or saturate the Northwest market they could save up to 37GWh from 2012-2014. These mechanisms are:

- **Power management.** Achieve optimal power management on residential installed bases (56% of the anticipated total savings for this product category).
- **Internal power supply efficiency.** Increase the efficiency of internal power supplies that convert AC power from the outlet to the DC power that is used by the PC (19% of the anticipated total savings for this product category).
- **Voltage regulator efficiency.** Increase the efficiency of voltage regulators by switching from the typical linear type of voltage regulator to a switching type (16% of the anticipated total savings for this product category).
- **Hard drive adjustments.** Minimize the size of hard drives (from 3.5” to 2.5”) and lower their rotational speed to reduce the energy required to read them (8% of the anticipated total savings for this product category).<sup>156</sup>

Cloud computing has the potential to reduce the energy consumption of PCs as well. It is likely that due to the increasing availability of cloud computing, home PCs will need less storage and computing power—and thus less energy—in the future. Cloud computing is expected to shift power requirements from PCs in the home to data centers housed in commercial settings.<sup>157, 158, 159</sup>

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<sup>152</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

<sup>153</sup> NMR has yet to find evidence comparing the power management savings impact for mobile PCs against that for desktop PCs.

<sup>154</sup> An internal power supply unit converts alternating current (AC) from a wall socket to low-voltage direct current (DC) power and is need to operate a PC.

<sup>155</sup> A voltage regulator maintains a constant voltage level in PC power supplies.

<sup>156</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>157</sup> Michael Armbrust, Armando Fox, Rean Griffith, et al. “A View of Cloud Computing.” *Communications of the ACM*. April 2010, pgs 50-58.

<sup>158</sup> Andres Berl, Erol Gelenbe, Marco Di Girolamo, et al. “Energy-Efficient Cloud Computing,” *The Computer Journal* 53, no. 7 (2010): 1045-1051. doi:10.1093/comjnl/bxp080.

<sup>159</sup> Hayes, Brian. “Cloud Computing.” *Communications of the ACM*. July 2008, pgs 9-11.

**6.2.3.2 Computer - Market and Program Barriers**

Table 6-3 details four market barriers and their implications for the Program in its efforts to address PCs.

**Table 6-3. Market Barriers to Advancing Computer Efficiency**

Implication*	Finding	Source
Manufacturers may be deterred from producing energy-efficient PCs given the added costs of producing them.	The components required for efficient PCs can be more expensive than those used in less efficient PCs.	RIA and Ecos <sup>160</sup>
The home PC market appears to be very price sensitive. Consumers may have little interest in energy-efficient PCs given the cost associated with them coupled with the limited savings they provide.		Stakeholder interviewee
Consumers’ perceptions about the limited functionality of energy-efficient PCs as opposed to standard PCs may dissuade them from purchasing energy-efficient PCs. This limited demand will in turn deter industry from promoting energy-efficient PCs.	CEE says that consumers believe that efficiency may limit PCs’ quality or usability. In some cases, consumers see turning off one device is unattractive because other devices depend on it being left on. One retailer interviewee added that, given that customers are usually focused on the power of a desktop PC, an efficiency message can deter the customer from purchasing an energy-efficient model.	CEE <sup>161</sup> ; Retailer interviewee
Manufacturers are already incorporating desired efficiency practices. As such, engaging manufacturers in this practice may be irrelevant.	Consumers in Massachusetts rarely reported using the power management functions (e.g., sleep and hibernate modes) on their home office equipment. However, in recent years PCs have begun to ship with power management enabled by default.	Fraunhofer <sup>162</sup> ; NMR <sup>163</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

<sup>160</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>161</sup> Consortium for Energy Efficiency (CEE). 2008. “Consumer Electronics Program Guide.”

<sup>162</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

<sup>163</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

### 6.2.3.3 Computer - Market Trends and Program Opportunities

Table 6-4 shows six major market trends and opportunities for energy-efficient PCs. NMR identified five program implications associated with these.

**Table 6-4. Market Trends and Opportunities towards Advancing Computer Efficiency**

Implication*	Finding	Source
ENERGY STAR is penetrating the mobile PC market in Massachusetts.	NMR observed the ENERGY STAR label on over one-quarter of the laptop PCs in Massachusetts (27%).	NMR <sup>164</sup>
Energy-efficient PCs are available for purchase. Program efforts focusing on changing stocking practices may need to focus on products with the greatest level of efficiency to avoid free ridership.	In the Northwest retailers regularly stock energy-efficient models of PCs.	ODC <sup>165</sup>
Market demand for mobile computing is likely to continue to drive decreases in PC size, and thus greater efficiency, especially for mobile PCs.	As desktop and mobile PCs decrease in physical size they become more energy efficient. Mobile PCs in particular are becoming more energy efficient because of decreases in their battery sizes and changes to their central processing units, display types, and hard drives.	RIA and EMI <sup>166</sup>
Mobile PC sales are surging as home desktop sales decline. In Massachusetts the market has already shifted in this direction. Given this and that mobile PCs are more energy efficient than desktop PCs, focusing on the mobile, rather than desktop, PC category appears more relevant.	One stakeholder argued there will always be a market for desktops. Nonetheless, the interviewee and others agreed that people are moving away from desktop PCs towards mobile PCs. In Massachusetts more homes have mobile PCs than they do desktop PCs: about 42% of homes had at least one desktop PC, and 65% had at least one laptop PC.	2 Stakeholder interviewees; Program Administrator interviewee; NMR <sup>167</sup>
	RIA and EMI report that the market share of mobile PCs is increasing relative to that of desktop PCs. eTForecasts indicates that desktop PC sales are slowly declining in the United States. Mobile PC sales are estimated to be 20 times greater than desktop PC sales by 2015.	RIA and EMI <sup>168</sup> ; eTForecasts <sup>169</sup>

<sup>164</sup> NMR Group, Inc. "Massachusetts Residential Retail Products: Consumer Electronics Saturation."

<sup>165</sup> Opinion Dynamics Corporation (ODC). "The Market for Energy Efficient Electronics, November 2010: Pre-Program findings on consumer perceptions and retail shelf stocking practices."

<sup>166</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>167</sup> NMR Group, Inc. "Massachusetts Residential Retail Products: Consumer Electronics Saturation."

<sup>168</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>169</sup> eTForecasts. "Worldwide PC Market: A market research report with perspectives and a top-down view of the PC industry - past, present and future trends." Accessed August 31, 2012.

[http://www.etforecasts.com/products/ES\\_pcww1203.htm#1.0](http://www.etforecasts.com/products/ES_pcww1203.htm#1.0).

Implication*	Finding	Source
A movement from PC storage to data center storage will likely decrease the energy consumption of PCs. Focusing on improving the per-unit savings of PCs may become irrelevant if this shift continues as predicted. <sup>170</sup>	Cloud computing is a growing trend.	Armbrust et al. <sup>171</sup> ; Berl et al. <sup>172</sup> ; Hayes <sup>173</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

Four interviewees pointed to the challenges of including PCs in consumer electronics programs. Two program administrator representatives said that their programs had previously incented PCs, but stopped due to poor results. Their incentive opportunities for desktop PCs in particular appeared to be ineffective because the market for desktop PCs is shrinking. A third program administrator interviewee explained that the incentive for a PC is generally negligible in comparison to the product’s price. If the incentive is offered as a mail-in rebate, it is reported to be even less of a motivator, given the effort required to submit the rebate.

### 6.3 Displays (Monitors)

ENERGY STAR considers displays, also known as monitors, as products that have a display screen that are used with electronic devices. A display’s primary function must be to provide visual information, either from a PC, USB flash drive, memory card or Internet. For the purposes of this report, NMR uses the same definition for displays as ENERGY STAR.

While ENERGY STAR addresses digital picture frames, NMR did not research them. Given their limited energy consumption compared to PC displays and their disappearing popularity, the research team does not believe these are relevant for program concern.

#### 6.3.1 Display Energy Consumption

Fraunhofer estimates that nearly 7% of the total energy consumption used by consumer electronics in the United States is from monitors. The total annual energy consumption of monitors in the United States is 12.7 TWh. When in the on mode, monitors’ energy consumption

<sup>170</sup> The benefits and challenges related to this trend, and its implications for the growing energy consumption of commercial data centers, are popular topics for white papers, conferences, and other reports. This growing cache of literature, however, is too substantial to delve into here and is outside the scope of this study.

<sup>171</sup> Michael Armbrust, Armando Fox, Rean Griffith, et al. “A View of Cloud Computing.” *Communications of the ACM*. April 2010, pgs 50-58.

<sup>172</sup> Andres Berl, Erol Gelenbe, Marco Di Girolamo, et al. “Energy-Efficient Cloud Computing,” *The Computer Journal* 53, no. 7 (2010): 1045-1051. doi:10.1093/comjnl/bxp080.

<sup>173</sup> Hayes, Brian. “Cloud Computing.” *Communications of the ACM*. July 2008, pgs 9-11.

largely depends on three variables: display type, screen size, and unit age (see Section 5.1.1 for further discussion of the relationship between display type and efficiency). Like the other consumer electronics addressed in this report, such as TVs and STBs, the level of displays' energy consumption also depends on their mode: active, standby, and off. Fraunhofer reports 6% of monitors' total energy consumption per year comes from standby and off modes combined.<sup>174</sup>

### 6.3.2 Display Specifications

PC monitors are addressed separately from PCs in ENERGY STAR specifications. Version 5.1 Program Requirements went into effect on January 30, 2010.<sup>175</sup> A revision and Version 6.0 specification are both in progress,<sup>176</sup> but appear to be somewhat behind schedule.

Product requirements vary by display size. The specification identifies maximum allowable active mode power consumption in relation to monitor resolution and screen size, and sets maximum allowed sleep and off mode power consumption levels. Displays greater than 60 inches are not considered for qualification.<sup>177</sup>

### 6.3.3 Display Trends, Opportunities, and Barriers

This section presents some technical opportunities for reducing the energy consumption of displays. It then outlines market barriers that the Program likely faces in its implementation of its display incentives. Finally, this section lists some display market trends and their Program implications.

#### 6.3.3.1 Display – Technical Barriers and Opportunities

As mentioned, Fraunhofer points to three primary variables that determine a display's energy consumption. The variations within each of these variables imply opportunities for achieving energy efficiency. For example,

- **Upgrading display type.** As mentioned in Section 5.1.1, displays vary in energy consumption by their type.
- **Reducing screen size.** Display energy consumption increases as screen size increases.

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<sup>174</sup> Fraunhofer Center for Sustainable Energy Systems. "Energy Consumption of Consumer Electronics in U.S. Homes in 2010."

<sup>175</sup> ENERGY STAR®. "ENERGY STAR® Program Requirements for Displays: Partner Commitments." Version 5.1. Accessed August 28, 2012. [http://www.energystar.gov/index.cfm?c=product\\_specs.pt\\_product\\_specs#hom](http://www.energystar.gov/index.cfm?c=product_specs.pt_product_specs#hom).

<sup>176</sup> ENERGY STAR. 2012. "Displays." Accessed April 26, 2012 from [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product.showProductGroup&pgw\\_code=MO](http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=MO).

<sup>177</sup> ENERGY STAR. 2011. "ENERGY STAR Specifications At-A-Glance." November 11. Accessed August 31, 2012 from [http://www.energystar.gov/ia/partners/prod\\_development/downloads/Spec\\_At-A-Glance\\_PD.pdf?b1fc-f790](http://www.energystar.gov/ia/partners/prod_development/downloads/Spec_At-A-Glance_PD.pdf?b1fc-f790).

- **Upgrading to newer displays.** Older displays consume more energy than new ones, so replacing older displays with newer displays will increase efficiency.

Like with other consumer electronics, one stakeholder interviewee also referenced the importance of powering down displays to save energy. RIA and EMI note that enabling displays’ power management settings presents a savings opportunity.<sup>178</sup>

**6.3.3.2 Display – Market and Program Barriers**

The interviews and literature review yielded three Program implications associated with four major market barriers to achieving greater display energy efficiency. Table 6-5 presents these in detail.

**Table 6-5. Market Barriers to Advancing Display Efficiency**

Implication*	Finding	Source
Consumers are not practicing energy-efficient behavior with their monitors. Thus, even if the Program is incentivizing more efficient displays, it may not be yielding significant savings given consumer behavior.	In a consumer survey, power management settings for displays were reported to be enabled in 68% of PC stations—in other words, nearly a third of monitors did not have the settings enabled. Only 36% of monitors are estimated to be entirely off at night, and nearly half (49%) are in standby.	Fraunhofer <sup>179</sup>
Less efficient models of displays are gaining in popularity.	From 2006 to 2010 the screen sizes of monitors, as measured diagonally, have increased by one inch on average.	Manufacturer interviewee
	Video game-players desire larger screens sizes.	
Efficiency is a low priority for manufacturers due to consumer priorities.	As with TVs, cost and picture quality remain more important to manufacturers than energy efficiency. CEE points out that “lack of a sustained, strong consumer demand” plays a large role in limiting manufacturer desire to produce efficient products or incorporate that as a goal into their policies. Manufacturers at times will even <i>omit</i> energy use information on product labels.	RIA and Ecos <sup>180</sup> ; CEE <sup>181</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

<sup>178</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>179</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

<sup>180</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>181</sup> Consortium for Energy Efficiency (CEE). 2008. “Consumer Electronics Program Guide.”

### 6.3.3.3 Displays – Market Trends and Program Opportunities

Table 6-6 shows three market trends and two related implications for the Program’s consideration.

**Table 6-6. Market Trends and Opportunities for Advancing Display Efficiency**

Implication*	Finding	Source
Efficient display types are gaining in popularity. While this could indicate that Program efforts to replace less efficient display types may happen in absence of the program, it may not offset consumers’ growing desire for larger displays.	From 2005 to 2010 there was a market shift in Wisconsin and Indiana from CRT to LCD monitors.	PA Consulting and NMR Group <sup>182</sup>
	Fraunhofer reports that the rate of LCD monitors in U.S. homes has grown in recent years. One manufacturer interviewee noted that LCD-LED monitors are becoming more popular.	Fraunhofer <sup>183</sup> ; Manufacturer interviewee
Overall sales of displays are possibly decreasing, suggesting that this product category could potentially lose relevance.	While RIA and EMI found unclear sales trends for displays, interviewees observed that consumers are not purchasing new monitors as frequently as in the past given shifts to mobile PC ownership from desktop PC ownership.	RIA and EMI <sup>184</sup> ; Retailer interviewee; Manufacturer interviewee; Program Administrator interviewee

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the research team believes are applicable to the topic.

Two interviewees were of the opinion that displays are a poor choice to include in programs. One, a retailer representative, explained that like PCs, incentives for displays are usually negligible in comparison to their price. The other interviewee, a program administrator representative, noted that displays had been removed from the program administrator’s program due to shrinking sales, which this interviewee attributed to the market shift from desktop PCs to mobile PCs.

## 6.4 Imaging Equipment

NMR found limited evidence indicating that imaging equipment is a product category worthy of extensive investigation. These devices are often referred to as peripheral devices that connect primary equipment such as PCs. On its own, imaging equipment does not consume significant energy. For example, in 2010 imaging equipment, including printers, scanners, copiers, and fax

<sup>182</sup> PA Consulting Group and NMR Group, Inc. “Analysis of Consumer Electronics in Homes.”

<sup>183</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

<sup>184</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”



machines, comprised a negligible share of total consumer electronics energy consumption (0.7%).<sup>185</sup>

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<sup>185</sup> Fraunhofer Center for Sustainable Energy Systems. “Energy Consumption of Consumer Electronics in U.S. Homes in 2010.”

## 7 Other Products

This section focuses primarily on APSs. NMR's in-depth interviews and literature review indicated that APSs are an important area of focus for consumer electronics energy efficiency programs. However, NMR also investigated External Power Supplies (EPSs) as part of this research, and learned about one promising product that is currently under development.

### 7.1 Advanced Power Strips

APSs provide savings over standard power strips through some form of master switch that turns power outlets on or off.

Lockheed Martin, Inc. and Energy Solutions list seven different types of APSs:

- **Master control strips.** These have one master control outlet that will power off all outlets when the user switches off the master control. This is the most common type of strip.
- **Load sensing strips.** When the user turns off the primary device plugged into the strip, or this device powers down with power management, the strip disconnects power to the other devices plugged into the strip.
- **Occupancy sensing strips.** These strips automatically turn power to equipment on and off depending on whether they sense someone in the room with the strip.
- **Timer-based strips.** Timer-based strips turn themselves on and off at specific times.
- **Remote control strips.** These are a wireless version of a master control strip.
- **USB interface strips.** USB interface strips are plugged into a PC USB outlet, and turn off power to peripherals plugged into the strip when the PC is turned off.
- **Informational strips.** These are master control strips that provide power-use information to users in addition to master control.<sup>186</sup>

This section outlines APS specification developments, APSs' technical potential, and the program implications of their market potential.

#### 7.1.1 Advanced Power Strip Specifications

While ENERGY STAR does not currently hold specifications for power strips, according to the Northeast Energy Efficiency Partnerships (NEEP), ENERGY STAR has been working with NEEP to develop a labeling effort for APSs based on behavior metrics. NEEP noted the National Renewable Energy Laboratory (NREL) has drafted a testing specification for APSs. As of September 2012, the future of the APS labeling effort is unclear.<sup>187</sup>

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<sup>186</sup> Lockheed Martin, Inc. and Energy Solutions. "Advanced Power Strip Research Report." August 2011. Accessed March 20, 2012. <http://www.nyserda.ny.gov/en/Page-Sections/Residential/Energy-Efficient-and-ENERGY-STAR-Products/~media/Files/EERP/Residential/Energy%20Efficient%20and%20ENERGY%20STAR%20Products/12-03-Power-Management-Research-Report.ashx>

<sup>187</sup> Linda Malik, personal communication, June 29, 2012 and September 13, 2012.

As one manufacturer interviewee explained, this is a difficult product category for ENERGY STAR to address because APSs are intended to *save* energy and cannot be identified as more or less efficient. Nonetheless, NEEP underscored the need for ENERGY STAR to recognize or endorse APSs based on their savings capacity.

### 7.1.2 Advanced Power Strip Trends, Opportunities, and Barriers

NMR's 2012 study of product saturation in Massachusetts homes found a total of 286 power strips in homes— only 13, or less than 5%, of which were APSs. All of the APSs in use were in the home office or associated with the main TV in the home. For the most part, the APSs were being used correctly; that is, the householders had the TV or main PC plugged into the “control” outlet and the peripheral devices into the “controlled” outlets. STBs were used with only three of the APSs, and in each of these the STB was in a dependent slot. The low use of STBs with APSs suggests that Massachusetts consumers plug STBs into other outlets, likely in order to keep them at least in a standby mode at all times.<sup>188</sup>

#### 7.1.2.1 Advanced Power Strip - Technical Opportunities and Barriers

Through the research team's in-depth interviews, two technical barriers emerged regarding the energy savings of APSs:

- **Diminishing savings opportunities.** Two stakeholders pointed out APSs are not effective in the long run. One explained that the savings possibilities with APSs will decrease as the devices that are plugged into them become more efficient.
- **Uncertain savings opportunities.** A manufacturer noted that determining APSs' savings is too challenging because of the importance of user behavior as a variable in determining energy efficiency. One program administrator reported that the uncertainties associated with the savings APSs provide make them challenging to include as a program component.

Nonetheless, APSs have been proven to provide energy savings. In late 2009 and early 2010, Lockheed Martin, Inc. and Energy Solutions conducted research to estimate the energy savings potential of master control APSs in New York state, a number of other regions, and the United States overall, and estimated that a typical household in the United States could save an average of 106.1 kWh/year using one APS each for home entertainment equipment and home electronics. Over the expected 10 year life-cycle of an APS, the researchers estimate this move could save the typical household nearly \$79 in total.<sup>189</sup> According to one manufacturer interviewee, APSs

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<sup>188</sup> Although we did not ask why, this is most likely because STBs must download programming information from cable, satellite, and fiber optic providers each time the STB fully loses power. Similarly, STBs that also act as DVRs would need to be drawing power in order to record shows at desired times even with the television off.

<sup>189</sup> Lockheed Martin, Inc. and Energy Solutions. “Advanced Power Strip Research Report.” August 2011. Accessed March 20, 2012. <http://www.nyserda.ny.gov/en/Page-Sections/Residential/Energy-Efficient-and-ENERGY-STAR-Products/~media/Files/EERP/Residential/Energy%20Efficient%20and%20ENERGY%20STAR%20Products/12-03-Power-Management-Research-Report.ashx>

provide the most standby savings in situations where there is a cluster of devices—particularly with home entertainment equipment. A program administrator representative added that APSs present the opportunity for programs to address active *and* passive energy consumption.

### **7.1.2.2 Advanced Power Strip – Market Trends and Program Opportunities and Barriers**

Interviewees discussed market barriers that they perceive will limit the advancement of APSs in the market. Some of these were also supported by findings from NMR’s research and previous literature.

- **Lack of consumer awareness and understanding of APSs.** In NMR’s saturation study, about one-third of telephone survey respondents (36%) were aware of APSs; further, a negligible share of those that were aware (11%) could describe with accuracy the purpose of an APS.<sup>190</sup> This finding is very much in line with RIA and EMI’s finding that consumers tend not to understand plug-load management products such as APS, and thus can be hesitant to purchase them.<sup>191</sup> Three in-depth interviewees from this study—one retailer, one manufacturer, and one program administrator—concurred that consumers are unaware of APSs and their benefits, with one explaining that consumers generally do not distinguish between the features of different types of power strips in general. The program administrator interviewee noted that despite rebating APSs for several years, they had failed to create “buzz” around them in their service area. As such, this interviewee warned against including APSs in the Massachusetts program.
- **Low manufacturer incentive.** One program administrator interviewee cautioned against addressing APSs in the Massachusetts Program because in their experience, the revenue margins are low on APSs. In this interviewee’s experience even when they are rebated manufacturers do not push them.
- **Functional deficiency.** While APSs were identified by a manufacturer representative as most effective in clusters of devices, according to one stakeholder, laptop PCs draw so little energy that APSs sometimes automatically shut off the PC’s peripheral devices, making the APS unattractive to use. The manufacturer pointed out that the shift in the market toward mobile PCs (see Section 0) makes this APS functional deficit increasingly relevant as a market barrier.

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<sup>190</sup> NMR Group, Inc. “Massachusetts Residential Retail Products: Consumer Electronics Saturation.”

<sup>191</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

## 7.2 External Power Supplies

EPSs are stand-alone devices providing power to electronics. ENERGY STAR no longer maintains an EPS specification, and NMR found little evidence to suggest that EPSs by themselves are a promising product category for energy savings. The reasons contributing to ENERGY STAR's decision to end the specification include the following: "(1) relatively high ENERGY STAR market penetration; (2) existing U.S. federal minimum efficiency standards for EPSs; (3) diminishing scope of the End-Use Products Using EPSs program because of new ENERGY STAR product specifications, such as small network equipment; and (4) ability to maintain and add EPS requirements to the existing suite of ENERGY STAR product categories." EPSs are now addressed through specifications for individual ENERGY STAR products that *use* external EPSs.<sup>192</sup>

Based on this, NMR did not do further investigation into EPSs for this study. NMR believes the Program can best address EPS energy consumption through other product categories.

## 7.3 Products under Development

In-depth interviews indicated one emerging power management product that may be worthy of future research. Specifically, Lawrence Berkley National Laboratory is in the process of developing a product that could potentially detect an electronic device's power mode at a given time, and limit the device's power draw to only the level that is required for that mode. No additional information about the product was available at the time of the research.

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<sup>192</sup> U.S. Environmental Protection Agency. Letter to Manufacturers and Stakeholders. July 19, 2010. Accessed August 31, 2012.  
[http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/eps\\_eup\\_sunset\\_decision\\_july2010.pdf?5902-6b3a](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/eps_eup_sunset_decision_july2010.pdf?5902-6b3a).

## 8 Approaches of Leading Consumer Electronics Programs

A goal of this research was to gain insight into strategies and lessons learned from leading consumer electronics programs. This section summarizes components, incentive mechanisms, relationships with industry, and marketing and outreach of three leading programs outside of Massachusetts. Sections 9 and 10 follow up by providing the barriers, challenges, successes, and opportunities related to the program characteristics discussed here.

For reference, the team interviewed representatives from the Massachusetts' ENERGY STAR Appliances and Products Program's consumer electronics initiative as well as representatives of programs outside the state. Findings represent the Massachusetts Program characteristics at the time of interviews. Planned changes to the Massachusetts Program are not reflected here.

The research team chose programs for interviews based on CEE's July 2011 Consumer Electronics Efficiency Program Summary<sup>193</sup> and insights from in-depth interviews and the literature review. The programs chosen were the Business & Consumer Electronics (BCE) Program as administered by Pacific Gas & Electric PG&E in California; B.C. Hydro Power Smart Program administered by B.C. Hydro in British Columbia, Canada; and the New York Energy \$mart<sup>sm</sup> Products Initiative administered by New York State Energy Research and Development Authority (NYSERDA). The research team also gained insights into other leading programs through interviews with stakeholders.

### 8.1 Integration with Other Program Efforts

NMR asked program administrator interviewees how consumer electronics are integrated into other energy efficiency programs, if at all. The program administrators described a variety of different approaches. The Massachusetts consumer electronics effort is part of the ENERGY STAR Appliances and Products Program and is jointly administered with the ENERGY STAR Lighting Program. NYSERDA similarly addresses consumer electronics as an initiative within a residential products program, which includes appliances and lighting. By contrast, PG&E bundles consumer and commercial electronics together, and B.C. Hydro treats consumer electronics as a stand-alone program.

None of the program administrators interviewed integrated consumer electronics with other residential non-products programs, such as new construction or home energy assessment programs, and the literature review did not mention such programs. However NYSERDA's representative reported that NYSERDA directly installs APSs as part of home visits for their low income home energy assessment program, and pointed out that a benefit of this approach is that it ensures the APSs are properly set up. PG&E is currently considering a pilot effort that includes altering TV settings to more efficient levels during home visits.

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<sup>193</sup> Consortium for Energy Efficiency (CEE). "Consumer Electronics Efficiency Program Summary." July 2011. Accessed May 2012. [http://www.cee1.org/resid/rs-ce/consumer\\_electronics\\_prog\\_sum.php3](http://www.cee1.org/resid/rs-ce/consumer_electronics_prog_sum.php3).

## 8.2 Incentives

Massachusetts currently addresses the following products in the Program: TVs, displays, desktop PCs, and APSs.<sup>194</sup> According to one of the program administrators interviewed, this particular mix of products is common among Northeast consumer electronics programs. In Massachusetts, these products were chosen based on total resource cost (TRC) tests<sup>195</sup> and current and predicted market penetration of high efficiency products with the potential for claimable savings. Massachusetts is also considering STBs for inclusion in the program.<sup>196</sup>

Table 8-1 outlines the major measures addressed by the interviewees' programs, and the way in which they address them. Interviewees' programs typically address the same products as Massachusetts, with TVs being the product that is most commonly incented. Massachusetts stands out in that it is currently the only program that is providing an incentive for PCs and displays. NYSERDA's program is unique in that its TV efforts focus on providing promotional and marketing support, with incentives offered only for APSs.

The CEE July 2011 Consumer Electronics Efficiency Program Summary<sup>197</sup> implies that the interviewee programs' product mixtures are fairly representative of those of program administrators across the United States and Canada: TVs are the most commonly included products, some programs include PCs, displays, and APSs, while STBs are included the least; products are generally *incented* as opposed to only *promoted*.<sup>198</sup> However, by the time NMR conducted interviews two of the programs included had already changed, so this may no longer be the case.

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<sup>194</sup> National Grid, NSTAR, Unitil, Western Massachusetts Electric Company, Cape Light Compact, Berkshire Gas, Columbia Gas of Massachusetts, Blackstone Gas Company, New England Gas Company. "Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures." October 2010. Accessed May 7, 2012. [http://www.ma-eeac.org/docs/MA%20TRM\\_2011%20PLAN%20VERSION.PDF](http://www.ma-eeac.org/docs/MA%20TRM_2011%20PLAN%20VERSION.PDF).

<sup>195</sup> Total resource costs (TRC) tests measure the net benefits of the energy efficiency program to all customers (participants and non-participants) in the region as a whole. Costs included in the TRC are costs to purchase and install the energy efficiency measure and overhead costs of the program; benefits included are the avoided costs of energy. Generally, these tests are used a tool in determining what measures to include in a program portfolio.

<sup>196</sup> The Commonwealth of Massachusetts Department of Public Utilities. D.P.U 09-116. January 28, 2010. Accessed May 7, 2012. <http://www.env.state.ma.us/dpu/docs/electric/09-116/12810dpuord.pdf>

<sup>197</sup> Consortium for Energy Efficiency (CEE). "Consumer Electronics Efficiency Program Summary."

<sup>198</sup> The reader should be reminded that the CEE Consumer Electronics Efficiency Program Summary was over one-year old at the time of this study. NMR observed that some of the information within the CEE summary had already changed by the time of this study.

**Table 8-1. Major Product and Program Component Inclusion by Program**

<b>Program Administrator Interviewee*</b>	<b>TV</b>	<b>STB</b>	<b>Game Console</b>	<b>PC</b>	<b>Display</b>	<b>APS</b>	<b>Electronics Recycling</b>
Massachusetts	Incent	**		Incent	Incent	Incent	Promote
NYSERDA	Promote <sup>†</sup>	Promote		Promote		Incent	
PG&E	Incent	**	**			Promote	**
B.C. Hydro	Incent	Incent				**	Offer TV recycling

\* While the bulk of the information presented here was provided during in-depth interviews, the research team complemented this information with secondary research on the program administrator Websites.

\*\* Program representatives indicate that the program is currently considering addressing this product.

† This program administrator is currently considering incentivizing TVs.

Of the programs that offer incentives, currently, the Massachusetts Program is using standard ENERGY STAR specifications for its program criteria for TVs, PCs, and display incentives. PG&E and B.C. Hydro use more rigorous criteria for their TV incentives. PG&E requires 20% beyond the standard ENERGY STAR specification and B.C. Hydro requires 35% beyond it.

The interviewees' programs commonly direct incentives midstream to retailers and upstream to manufacturers. The incentives are either based on actual product sales or on product stocking. B.C. Hydro has partnered with one of the three major media service providers in the province, and is providing the media service provider with an incentive for transitioning its service signal, which is responsible for software updates, to an ENERGY STAR-compliant format that would enable ENERGY STAR-qualified STBs to enter APD mode. Unlike Massachusetts, none of the interviewees offer downstream incentives to consumers for electronics products. Further, assuming that CEE's 2011 Program Summary is still reasonably representative of the programs listed, it appears that as of 2011 Massachusetts was one of the only program administrators offering downstream incentives to consumers for electronics.<sup>199</sup> Table 8-2 lists the type of incentive by program administrator interviewee.

<sup>199</sup> Consortium for Energy Efficiency (CEE). "Consumer Electronics Efficiency Program Summary."



**Table 8-2. Incentive Mechanisms by Program**

Program Administrator Interviewee*	TV	STB	PC	Display	APS	TV Recycling
Massachusetts	Midstream - Retailer Incentive		Customer incentive	Customer incentive	Midstream - Retailer & Upstream - Manufacturer Incentives	
NYSERDA					Midstream - Retailer & Upstream - Manufacturer Incentives and Low Income Direct Install	
PG&E	Midstream - Retailer Incentive	N.A.				
B.C. Hydro	Midstream - Retailer Incentive	Upstream - Media Service Provider Incentive				Free consumer service

\* While the bulk of the information presented here was provided during in-depth interviews, the research team complemented this information with secondary research.

Program administrator interviewees discussed consumer electronics program incentive approaches that others are experimenting with or considering undertaking to increase program participation:

- **Online program administration.** One of the interviewees noted that an Efficiency Vermont consumer electronics program focus is online sales. Rather than stirring awareness of the program online, as appears to be a common approach, Efficiency Vermont is making participation possible through online *purchases*.
- **Use of quick response codes.** A program administrator interviewee noted that one APS manufacturer has worked with a program implementer to enable the use of quick response (QR) codes<sup>200</sup> that offer customers the opportunity to choose how they want to redeem program incentives in ways other than at POS. For example, customers could choose to donate their incentives through the QR mechanism.

Section 10.4 will discuss the relevance of these incentive approaches for the Massachusetts Program along with other more common suggested incentive approaches that may have already proven to be effective.<sup>201</sup>

<sup>200</sup> QR Code is the trademark for a matrix barcode that consists of square black dots arranged in a square pattern on a white background. It has a large storage capacity and fast readability compared to the standard UPC barcodes.

<sup>201</sup> NMR did not pursue and interview with a representative from this program administrator given that Massachusetts is not a primarily rural state.

### 8.3 Industry Partnerships

The consumer electronics program efforts investigated generally emphasize industry partnerships to effectively drive participation. Program administrator interviewees described the programs as being in frequent communication with retailers to influence retailers' stocking practices and manufacturers to influence manufacturers' product design and pricing. They also described the sales training and marketing support they provide to their industry partners. NYSERDA, for example, conducts market research and provides the research to its industry partners. In B.C. Hydro's efforts to transition a media service provider's system to ENERGY STAR-compliant, it worked with the media service provider to promote the fact that the media service provider was taking energy efficiency actions, thus making participation more attractive to them.

PG&E interviewees described PG&E's approaches to working with retailers and manufacturers. With the intent of connecting with national and larger industry members with customer bases beyond PG&E's service territory practices, PG&E and other California investor-owned utilities developed a collaborative, the Business and Consumer Electronics (BCE) Alliance. The BCE Alliance is currently comprised of a number of program administrators in Western states. Its efforts involve two major activities intended to develop greater partnerships with industry members:

- **A single point of contact.** First, the BCE Alliance hired an implementation contractor to act as a single point of contact for retailers and manufacturers to reduce the burden of program relationships on the industry members.
- **Third party data collection.** In an effort to manage an issue of data propriety (see Section 9.1), the BCE Alliance hired a third party to collect retailer data. The third party allows program administrators to access retailer data essential to program administration. It does not risk retailer privacy because the third party is not under the same regulatory requirements to make its documentation public as program administrators.

While all of the BCE Alliance's current members are located in Western states, one of the PG&E representatives pointed out that the opportunity to participate is not limited to Western states. The benefits of its program approaches are discussed in greater detail in Section 10.2.2.

In-depth interviewees identified barriers and opportunities related to industry relationships overall. These are discussed in greater detail in later sections of the report (in particular Sections 9.1 and 10.2).

### 8.4 Marketing and Outreach

The marketing and outreach of the Massachusetts consumer electronics program is fairly similar to that of the other programs NMR researched (including but not limited to the program administrators interviewed.) According to interviews with Massachusetts implementation contractor staff, the Massachusetts Program conducts the following marketing and outreach efforts:

- Develop and deploy some traditional media including, print, online banners, and point of purchase (POP) materials;
- Utilize some less traditional media like online interactive tools and social media like Facebook;
- Hold consumer events stirring product interest;
- Perform market research by conducting surveys;
- Conduct outreach to solicit retailers and manufacturer participation;
- Monitor promotions at retailers—for example, ensuring that floor pricing matches agreements; and
- Perform co-operative advertising with retailers.

Two of the leading program administrators described approaches to marketing program-supported products—or to increasing their marketing—that are not currently being taken in Massachusetts. To help drive sales of program-discounted models, the PG&E program created a short video that plays two times per hour on the TVs on display at key participating retailers. B.C. Hydro encourages retailers participating in their program to market program-discounted models by offering performance bonuses based on specific marketing metrics. It collects these metrics by monitoring the amount of advertising the retailers conduct.

NMR also reviewed the portions of various program administrators' Websites featuring consumer electronics and compared them with the consumer electronics portion of the MassSave Website. Below is a listing of the features that Massachusetts shares—and does not share—with other programs' Websites.

Similar to other program administrators, the MassSave Website:

- Includes an education component, its Learning Center, with information related to reducing energy consumption resulting from vampire energy<sup>202</sup> and an emphasis on the benefits of APSs;<sup>203</sup>
- Directs customers to purchase ENERGY STAR products, such as TVs; and
- Directs customers to incentive opportunities, such as discounted APSs and downstream rebates

A feature lacking from the MassSave Website was lists of participating retailers. For example, NYSERDA's Website contains a database including retailers by region and by product that offer the respective ENERGY STAR product.<sup>204</sup>

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<sup>202</sup> Vampire power refers to the electric power consumed by appliances and equipment while switched off or not performing their primary function and are left in standby mode

<sup>203</sup> Mass Save. "Learning Center." Accessed September 4, 2012. <http://www.masssave.com/residential/learning-center>.

<sup>204</sup> The products within the database are APSs, TVs by display-type, mobile and desktop PCs, and DVD players. *Source:* New York State Energy Research Development Authority (NYSERDA). "Home Electronics." Last

The MassSave Website is unique in that it includes a comprehensive and engaging virtual whole-house tour presenting facts about home energy consumption from consumer electronics.

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modified January 18, 2012. Accessed May 4, 2012. <http://www.nyserda.ny.gov/en/Page-Sections/Residential/Energy-Efficient-and-ENERGY-STAR-Products/Home-Electronics.aspx>.

## 9 General Program Barriers

The following section summarizes challenges inherent to the administration of consumer electronics programs: industry partnerships, consumer preferences and behaviors, specifications and regulations, etc. These are not specific to particular products. The barriers include both challenges the Program should seek to overcome and those that could be viewed as caveats against integrating certain program components or approaches.

### 9.1 Program Barriers –Industry Partnerships

The literature review and in-depth interviews highlighted several barriers to programs effectively partnering with industry to achieve consumer electronics program goals. As noted in Sections 8.2 and 8.3, it appears to be common for program administrators to utilize upstream and midstream incentives for their consumer electronics programs. This requires that they partner with industry to implement programs and obtain industry sales data to support evaluation and the use of incentives. Clearly, good relationships with industry partners are critical to the success of such an approach.

Table 9-1 describes 14 barriers and ten related implications identified by the research team.

**Table 9-1. Barriers to Effectively Engaging with Industry**

Implication*	Finding	Source
Retailers’ policies, practices, and level of awareness of product energy efficiency can prevent and/or limit sales of energy-efficient equipment.	According to CEE, sales associates are generally uninformed about energy efficiency or the distinction between products’ efficiency levels. ODC found that sales associates often had a limited understanding of ENERGY STAR. NEEA points out that the high turnover among sales associates can also influence overall awareness.	ODC <sup>205</sup> ; CEE <sup>206</sup> ; NEEA
	CEE sees that retailers do not always stock efficient products (or a variety of them), may have corporate policies about POP materials that prevent program messaging, and do not provide energy information about products. A program administrator interviewee agreed that corporate policy preventing program POP materials acts as a barrier.	CEE <sup>207</sup> ; Program Administrator interviewee
Programs cannot rely on industry sales data to help in designing and evaluating their programs.	Program administrators explained that because they may be required to make their documentation publicly available, retailers are hesitant or unwilling to provide their sales data. One manufacturer informed the team they have no data regarding the ultimate disposition of their STBs after they sell them to a media service provider.	3 Program Administrator interviewees; Manufacturer interviewees

<sup>205</sup> Opinion Dynamics Corporation (ODC). “The Market for Energy Efficient Electronics, November 2010: Pre-Program findings on consumer perceptions and retail shelf stocking practices.”

<sup>206</sup> Consortium for Energy Efficiency (CEE). “Consumer Electronics Program Guide.”

<sup>207</sup> Consortium for Energy Efficiency (CEE). “Consumer Electronics Program Guide.”

Implication*	Finding	Source
<p>While working with national retailers appears to be important to change the market, larger industry players’ bureaucracies and policies can make it difficult for programs to intervene or engage with them.</p>	<p>Customers are increasingly purchasing consumer electronics from national retailers more than from local retailers. Therefore, programs may need to influence national markets to change local markets.</p>	<p>RIA and EMI<sup>208</sup></p>
	<p>Two program administrator interviewees noted that larger retailers and manufacturers make decisions at corporate levels and can be difficult for a single program to transform the retailers’ and manufacturers’ approaches, and get their attention no less.</p>	<p>2 Program Administrator interviewees</p>
<p>Industry members may need larger incentives than program administrators are able to provide in order to be willing to partner with programs.</p>	<p>Given the size of media service providers’ operating budgets and the variables that are involved in their business decisions the chances of program administrator DSM incentive funds being a significant parameter within a media service provider’s business model are small.</p>	<p>Program Administrator interviewee</p>
	<p>The cost of energy-efficient models are more expensive, and the resources that the programs provide, such as POP materials and staff training, do not provide enough support to offset the potential risk of participation on behalf of the retailer—especially because these purchases are economy-dependent.</p>	<p>Retailer interviewee</p>
<p>The cost and difficulty involved in producing and selling energy-efficient equipment can act as a deterrent for manufacturers and retailers.</p>	<p>The components required to produce efficient products can sometimes be hard for manufacturers to find, and as a result more expensive. A retailer interviewee offered the opinion that programs do not provide enough support to offset the potential risk of participation on behalf of the retailer, especially because these purchases are economy-dependent. This interviewee added that POS reductions only artificially reduce top-line revenues which they see as unattractive for public companies, and tax models vary across state lines, thus complicating the situation further.</p>	<p>RIA<sup>209</sup>; Retailer interviewee</p>
<p>The timing of manufacturer production cycles and program and specification cycles can be difficult to reconcile, impeding industry participation in programs.</p>	<p>While program administrator programs may follow the fiscal year, retailers and manufacturers plan around the holiday season; as a result, by the time program administrators announce program opportunities, retailers and manufacturers may have already made manufacturing or purchase plans for the coming season.</p>	<p>Program Administrator interviewee</p>
	<p>The specification changing model of programs also causes confusion on the part of retailers that might simply want to stock as many of the latest qualifying products as possible, but are then frustrated when the specifications increase and the models are no longer program-eligible.</p>	<p>Program Administrator interviewee</p>
<p>Manufacturers prioritize developing products with greater functionality than efficiency, creating an overarching market barrier limiting the advancement of</p>	<p>While products continue to become more efficient, manufacturers generally see that that creates an opportunity to add greater functionality, and in turn, do not ultimately produce products with greater efficiency.</p>	<p>Program Administrator interviewee</p>

<sup>208</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>209</sup> Research Into Action, Inc (RIA). “Electronics and Energy Efficiency: A Plug Load Characterization Study.”

Implication*	Finding	Source
energy efficiency		
Industry members and energy efficiency programs' limited knowledge of each other's practices can present challenges to successful partnerships.	Retailers and manufacturers have limited knowledge about how efficiency programs function, and program administrators are unfamiliar with manufacturers' and retailers' processes and priorities. In fact one manufacturer interviewee indicated that the interviewee's company wants to participate in programs but does not know how.	CEE <sup>210</sup> ; Manufacturer interviewee
Media service providers' business structure does not make it easy or attractive to partner with programs	A program administrator representative pointed out that media service providers often need to make changes for their entire customer base that generally expand beyond the program administrator's service area. A media service provider representative said that this latter point makes it difficult to claim savings. Further, according to the media service provider representative, upsetting customers through system-wide changes is a risk for providers.	Media Service Provider interviewee; Program Administrator interviewee
Sales associates lack incentive to promote energy-efficient behaviors.	Sales associates are generally more concerned with selling products than they are with the customers' long term use of the product.	CEE <sup>211</sup>

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

## 9.2 Program Barriers - Consumer Preferences and Patterns

The research brought to light consumer preferences and purchasing and behavior patterns that could impede the implementation of consumer electronics programs. In some instances consumer preferences and patterns appeared to be barriers only for programs, while in others they might discourage industry from promoting, producing, or selling energy-efficient consumer electronics.

Table 9-2 shows the six barriers and implications the team found.

**Table 9-2. Barriers for Program Administrators and Industry in Stimulating Consumer Demand**

Implication*	Finding	Source
Consumers' increasing usage of integrated devices may be increasing total consumer electronics energy consumption even if the number of devices	According to CEA, the number of consumer electronics devices per household decreased from 25 to 24, on average, from 2010 to 2011. RIA and EMI attribute this change to customers' increasing usage of integrated devices where content is wirelessly transmitted to a number of mobile devices. The integration of these devices can often increase	CEA <sup>212</sup> ; RIA and EMI <sup>213</sup>

<sup>210</sup> Consortium for Energy Efficiency (CEE). "Consumer Electronics Program Guide."

<sup>211</sup> Consortium for Energy Efficiency (CEE). "Consumer Electronics Program Guide."

<sup>212</sup> Consumer Electronics Association (CEA). "American Households Spend More Than \$1,100 Annually On Consumer Electronics, CEA Study Finds." Accessed October 11, 2012 from [http://www.cea.org/News/News-Releases/Press-Releases/2011-Press-Releases/20110523-American-Households-Spend-More-Than-\\$1,100.aspx](http://www.cea.org/News/News-Releases/Press-Releases/2011-Press-Releases/20110523-American-Households-Spend-More-Than-$1,100.aspx).

<sup>213</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

Implication*	Finding	Source
per home decreases.	energy consumption because if one device is active it may force another integrated device to remain active as well.	
Consumers lack awareness about energy saving behavior.	RIA, CEE, and a manufacturer interviewee found that customers are unaware of energy efficiency’s importance and how mode use can impact power draw. Further, customers often do not know how to use the power management settings on devices. Energy Center of Wisconsin and CEE both note that customers are uninformed about <i>which</i> of their electronics’ energy consumption matters most and which practices will <i>really</i> reduce their overall usage.	RIA <sup>214</sup> ; Energy Center of Wisconsin <sup>215</sup> ; CEE <sup>216</sup> ; Manufacturer interviewee
Mail-in rebates may deter consumer participation.	Customers dislike mail-in rebates.	Retailer interviewee
Consumers may be impeded in choosing energy-efficient equipment because the information they receive is conflicting or too complex to understand.	Customers often do not know how to interpret efficiency labels. Additionally, the disparate messages customers receive about energy efficiency can create more confusion. One program administrator interviewee explained that the lack of energy labeling on consumer electronics also can act as a barrier in that consumers have little understanding of the energy consumption of the products.	CEE <sup>217</sup> ; RIA and Ecos <sup>218</sup> ; Program Administrator interviewee
Saving energy is not a priority for consumers.	A retailer interviewee noted that in general energy efficiency is lower on the list of customer desires for consumer electronics, especially when compared with appliances. A program administrator representative and a stakeholder representative concurred explaining that people are more enticed by “shinier” products. A stakeholder added that even if energy efficiency is a feature it is not going to compel a customer to make a purchase.	Retailer, Program Administrator, Stakeholder interviewees
Consumers are less inclined to purchase energy-efficient products if they cost more than standard efficiency products in the same category.	RIA estimates that efficient products are more expensive to manufacture, and as a result the price to the end-user is also higher. A program administrator representative and a manufacturer representative added that consumers perceive the savings per unit for energy-efficient consumer electronics to be small over standard efficiency products and that a small incremental savings amount does not outweigh the increased cost.	RIA <sup>219</sup> ; Program Administrator interviewee; Manufacturer interviewee

\* The implications presented here do not represent the conclusions necessarily drawn by the researchers cited, but are the conclusions the NMR research team believes are applicable to the topic.

### 9.3 Program Barriers – Specifications and Regulations

Program administrators rely heavily on specifications in determining what products should be eligible for their programs. In-depth interviews revealed a host of limitations and challenges

<sup>214</sup> Research Into Action, Inc (RIA). “Electronics and Energy Efficiency: A Plug Load Characterization Study.”

<sup>215</sup> Energy Center of Wisconsin. 2010. “Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes: A technical and behavioral field assessment.” May. Accessed April 26, 2012 from [http://www.state.mn.us/mn/externalDocs/Commerce/CARD\\_Plugging\\_into\\_Savings\\_Study\\_052710014507\\_MN\\_Home\\_Elect\\_Devices.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/CARD_Plugging_into_Savings_Study_052710014507_MN_Home_Elect_Devices.pdf)

<sup>216</sup> Consortium for Energy Efficiency (CEE). “Consumer Electronics Program Guide.”

<sup>217</sup> Consortium for Energy Efficiency (CEE). “Consumer Electronics Program Guide.”

<sup>218</sup> RIA and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>219</sup> Research Into Action, Inc (RIA). “Electronics and Energy Efficiency: A Plug Load Characterization Study.”



related to specifications that Massachusetts program administrators may wish to take into consideration:

- **Speed of market leads to rapid saturation and possible free ridership.** The RIA and EMI study,<sup>220</sup> four interviewees, two program administrator and two stakeholder representatives noted that in a fast-moving market like electronics, products evolve so quickly that specifications can quickly become irrelevant. If specifications cannot be advanced as quickly as the products in the market, then market saturation of qualified products can increase drastically. One stakeholder explained that while ENERGY STAR seeks to differentiate the top 25% of the market, this target is reached—and surpassed—very quickly for consumer electronics. For example, ENERGY STAR partner manufacturers reported that 96% of the TVs they shipped nationally in 2011 were ENERGY STAR-qualified, as were 62% of STBs.<sup>221</sup> As one program administrator interviewee described, by the time ENERGY STAR publishes its voluntary specifications for some consumer electronics, they are relatively easy to meet. As a result, interviewees emphasize that programs need to be wary of the free ridership that can accompany this dynamic.

Given the challenges for specifications to keep pace with this rapidly changing market, interviewees pointed to the value of more rigorous specifications like ENERGY STAR Most Efficient and TopTen USA (the opportunities associated with these are discussed in Section 10.3). They also identified some related challenges:

- **Lack of labeling for ENERGY STAR Most Efficient and TopTen USA.** A program administrator and a stakeholder representative explain that ENERGY STAR's Most Efficient and TopTen USA's lack of labeling makes it difficult for customers to differentiate those products from less efficient ENERGY STAR-qualified models.
- **Programs might perceive that TopTen USA product lists change too frequently for programs to use.** According to a TopTen USA representative, TopTen USA updates their product lists for TVs and PCs quarterly.<sup>222</sup> One program administrator interviewee expressed hesitation to use the lists due to their own planning cycles and concerns about whether retailers can plan to stock products that will still be program-eligible by the time they hit the shelves.

Some aspects of specifications can act as hurdles for industry members, thus reducing their inclination or opportunity to participate in or engage with programs.

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<sup>220</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>221</sup> ENERGY STAR. "ENERGY STAR Unit Shipment and Market Penetration Report: Calendar Year 2011 Summary." 2012.

<sup>222</sup> Seth Bauer, personal communication, October 10, 2012.

- **Specifications may not be sufficiently flexible.** ENERGY STAR specifications can sometimes discourage manufacturers from integrating technologically feasible features that may reduce overall consumption. One manufacturer interviewee stated, for example, that while incorporating a wireless router into an STB would reduce overall consumption, the integration would make the STB model ineligible for ENERGY STAR labeling under the current specification. This issue could pose limitations for programs seeking to achieve greater savings through promoting integrated devices.
- **Investments in labeling seen as useless.** Manufacturers may not bother to have their eligible products labeled with ENERGY STAR because they perceive that the resources required to gain the label may not be offset by the value it provides. Some believe they can be market leaders without gaining this accreditation.
- **Rapidity of updates for certain parts of the industry.** As with programs, frequent updating of specifications can be a barrier for certain parts of the industry. A media service provider interviewee was of the understanding that ENERGY STAR's timeline for issuing updates to STB specifications is every one to two years. In this interviewee's opinion, this is *too* frequent, given that manufacturers redesign their STBs every three to four years.

Some interviewees' comments indicated their skepticism of voluntary efforts for consumer electronics. Their responses implied that when it comes to consumer electronics, specifications' ability to transform the market is negligible in comparison to the magnitude of regulations' ability to do so. In fact, one interviewee suggested that for most consumer electronics products, it might make more sense to address them through regulation than through voluntary programs. For example, in the case of STBs, one stakeholder interviewee asserted that addressing this product through specifications will not change the market, given the limited consumer choice associated with them. A cable industry representative was of the opposite opinion, believing that the National Cable Television Association's (NCTA) energy initiative<sup>223</sup> for STBs will yield results more quickly than regulatory approaches on the part of CEC and DOE.

## 9.4 Program Barriers - Other

Interviewees and the literature identified other program barriers to effective administration of consumer electronics efforts.

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<sup>223</sup> NCTA's energy initiative promotes research and development of STBs and other devices that will allow cable users to reduce and manage home energy consumption. The initiative also requires a reduction of power consumption when subscribers are not actively watching TV; additionally, cable operators have pledged that at least 90% of all set-to-boxes they install will be ENERGY STAR 3.0 devices by the end of 2013. **Source:** National Cable Television Association, "US Cable Industry Launches New Energy Efficiency Initiative," news release, November 18, 2011, <http://www.ncta.com/ReleaseType/MediaRelease/US-Cable-Industry-Launches-New-Energy-Efficiency-Initiative.aspx>.

- **Diminishing savings opportunities.** RIA and EMI note that many consumer electronics product categories are becoming more energy efficient without program intervention. While program interventions may drive savings at the present time, the study questions the relevance of program interventions in the long-term given technological innovations and advancements in standards and specifications.<sup>224</sup>
- **Difficulties claiming savings.** RIA and EMI<sup>225</sup> and the program administrator interviewees referenced the challenges involved in claiming savings from consumer electronics programs. For example, spillover from midstream and upstream incentives can be a reason for program administrators *not* to pursue savings from consumer electronics. In a small region, spillover from others' programs nearby may be enough to make a neighboring state's program unnecessary or not cost-effective. The global nature of the markets is also a challenge for program attribution. Interviewees emphasized the challenge of identifying the savings associated with specific products given the broad range of variables associated with each product's energy consumption. For example, the variations in consumption associated with user behavior or the numerous possible combinations of peripheral devices that could increase a device's consumption makes identifying deemed savings a challenge. Moreover, interviewees discussed how little is known about the market across the numerous product categories, thus making it even harder to quantify program savings.
- **Limited per-unit savings.** CEE found that when compared to other measure-categories, the small per-unit energy savings differences between efficient and inefficient models was a limiting factor for consumer electronics.<sup>226</sup> Two program administrator representatives noted that while in aggregate consumer electronics consume a considerable amount of energy, each of the numerous small products uses little energy on an individual basis. One believed that creative approaches are needed to bundle products in order to achieve more meaningful savings from individual purchases.
- **Lack of factors typical of effective product-based programs.** According to the RIA and EMI study, a number of factors are typically needed for product-based programs to be successful. These are: "a stable market with slow adoption of new technologies, long-term energy savings with significant economic value to the customer, clearly differentiated energy efficient product options, incremental up-front cost as a barrier to

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<sup>224</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>225</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>226</sup> Consortium for Energy Efficiency (CEE). 2008. "Consumer Electronics Program Guide." Accessed May 3, 2012 from <http://www.cee1.org/files/CEEConsumerElectronicsProgramGuide.pdf>.

adoption, and creation of influence through local retail markets.”<sup>227</sup> The study authors note that these factors are lacking for consumer electronics, and conclude that given this, a product-focused approach—even one aimed mid-stream, at retailers—may not be appropriate for consumer electronics.

- **Downstream incentive costs.** It was one retailer representative’s belief that programs see high processing costs from downstream incentives that are not necessarily effective for consumer electronics products. This concern is relevant to the Massachusetts Program given its current use of downstream incentives for PCs and displays.
- **The constraints of the state regulatory framework.** One program administrator interviewee noted that state regulatory commissions typically move far more slowly than the consumer electronics market. As a result, by the time program work papers or plans are approved, they may be irrelevant. This is supported by the RIA and EMI study observation that consumer electronics programs need to have a great deal of flexibility with their product selection given the rapidly changing market. This study also noted that a regulatory environment that requires per-measure cost-effectiveness may hinder a program’s ability to quickly adapt to changes in the market.<sup>228</sup>

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<sup>227</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE),” pg. 203.

<sup>228</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

## 10 General Program Opportunities

As part of this research, NMR investigated program opportunities for effectively administering energy efficiency consumer electronics programs. The opportunities and trends described below focus on potential new product categories, effective and suggested incentive mechanisms, overall market shifts, effective relationships with industry and other entities, potential or needed specification changes, and overall program approaches.

### 10.1 Program Opportunities - Suggested Marketing and Outreach Efforts

While the Massachusetts consumer electronics program already undertakes many of the marketing and outreach activities practiced by the leading consumer electronics programs interviewed for this study, some additional marketing and outreach ideas for consideration came to light from interviews and the literature. These are listed below.

- **Providing midstream incentives and encouraging creative retailer marketing.** The RIA and EMI study suggests that in addition to POS marketing support which is already among the Massachusetts utilities' offerings, utilities offer retailers marketing support in the form of short-term incentives, particularly for products with a new ENERGY STAR specification, that meet higher levels of efficiency than ENERGY STAR, or that are new technologies or new to energy efficiency programs. The study also suggests providing retailers with incentives for "creative" retail strategies that could yield large energy savings.<sup>229</sup>
- **Offering consumer incentives online.** As mentioned in Section 8.2, Efficiency Vermont administers its consumer electronics program online through manufacturer or retailer Websites. RIA and EMI<sup>230</sup> along with multiple interviewees noted the value of this undertaking, pointing out that online incentive mechanisms encourage a whole subset of people who may never visit a brick-and-mortar store to purchase efficient consumer electronics. At the same time, other consumers increasingly conduct product research online prior to visiting a brick-and-mortar store, especially for TVs and PCs. Even if these consumers do not actually purchase online, their awareness of energy efficiency and the availability of incentives can be increased this way.
- **Developing online applications to guide consumers to program-eligible products.** One program administrator interviewee suggested the possibility of developing Internet-based applications that could help consumers identify energy-efficient, program-eligible

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<sup>229</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>230</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

models of consumer electronics—much as Massachusetts utilities already offer for light bulbs.

- **Consumer education campaigns.** A recent study of home electronics use in Minnesota found that a substantial share of households were interested in saving energy, but lacked good, easy-to-use information on which of their home’s devices truly matter, and didn’t know what practices would make a real difference. The study recommended a consumer education campaign with “well-designed consumer education with specific and narrow messages from credible sources” to promote PC power management.<sup>231 232</sup> The RIA and EMI study suggests focusing on changing consumer awareness, attitudes and behavior around the topic of plug loads specifically, through activities such as offering plug load energy audits, in-home monitors, APSs, and rewards programs for customers reducing plug-load consumption.<sup>233</sup> While one manufacturer interviewee applauded the Massachusetts Program’s “proactive” educational efforts, and MassSave maintains an online Learning Center that addresses consumer electronics energy use among other topics, this falls short of the kind of concerted, specific educational campaign recommended for Minnesota or specific focus such as plug loads.
- **Teaming with trade organizations.** A stakeholder interviewee suggested teaming with consumer electronics manufacturer and retailer trade associations in undertaking any consumer education campaign to leverage resources.
- **Refocusing messaging.** Thinking farther ahead, one stakeholder commented that in the future utilities in Massachusetts and elsewhere may want to attempt APS-style energy use reductions for consumer electronics via the smart grid.<sup>234</sup> This stakeholder noted that current messaging around smart grid is all about the benefits to the utility, and was of the opinion that if this is to come to pass, the messaging to encourage it must focus on benefits to the *customer*, not the grid or the utility.

## 10.2 Program Opportunities – Partnerships

The following section provides a discussion of the partnerships that interviewees view as essential to implementing a successful consumer electronics program. Given that industry members were most commonly identified as vital partners, the section goes outlines some suggested approaches for developing relationships with industry members involved in consumer electronics.

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<sup>231</sup> Energy Center of Wisconsin. 2010. “Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes: A technical and behavioral field assessment.”

<sup>233</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>234</sup> The smart grid is the integration of modern information technology with the electric delivery network, and is characterized by a two-way flow of electricity and information.

### 10.2.1 Essential Partnerships

Observations from the interviews and literature review point to the importance of partnering with the following groups when addressing consumer electronics via energy efficiency programs:

- **Other Program Administrators.** RIA and EMI<sup>235</sup> along with interviewees noted the value of collaborating with other program administrators to more easily sway industry. RIA and EMI assert that collaborative program efforts have the potential to change the market. The PG&E interviewee suggested that the Massachusetts program administrators consider joining the BCE Alliance that was spearheaded by the California investor-owned utilities and has since been joined by other utilities outside of California. (This effort is describe in more detail in Section 8.3.)
- **Stakeholder groups.** Interviewees also discussed the importance of working with trade associations such as the Consumer Electronics Association, energy efficiency industry associations such as CEE, specification-setting groups like ENERGY STAR and TopTen, and regulatory bodies charged with setting standards for consumer electronics. CEE, for example, has recently developed a Consumer Electronics Energy Efficiency Center. It offers its members' information to identify consumer electronics program opportunities, conducts cost effectiveness tests, collects industry data, educates industry members about consumer electronics programs, and offers a forum for information exchange among programs.<sup>236</sup>
- **Industry overall.** Interviewees and researchers focused on the importance of developing good working relationships with industry members. Among other things, they pointed out that these relationships could potentially result in providing the Massachusetts Program with valuable industry data that can inform critical decision-making and can provide connections with customers that might not be possible otherwise.
- **Media Service Providers.** Most commonly, interviewees and the literature focused on the opportunities that media service providers can provide. Hardy et al. explain that partnering with providers is ideal given a variety of factors. First, media service providers have access to customer homes and frequently communicate with their customers. Second, media service providers are informed about the current STB fleet's configuration and characteristics and in what mode units are operating in at a given time. Third, media service providers have control over the distribution system.<sup>237</sup> Steve Dulac echoed the value of media service provider's home access and communication with customers. He

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<sup>235</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>236</sup> Lynch, Margie. "Consumer Electronics Energy Efficiency Program Center." Presentation at CEE Winter Program Meeting, Costa Mesa, CA, January 26, 2011.

<sup>237</sup> Gregg Hardy, Aaron Phillips, Debbie Driscoll, Philip Walters and Jeffrey Swofford. "Pay-Television In-Home Equipment: National Energy Consumption, Savings Potential, and Policy Barriers and Opportunities." Presentation at American Council for an Energy Efficient Economy Summer Study, Pacific Grove, CA, August 17, 2012.

noted that a unique marketing opportunity exists for on-screen program administrator advertising because of the media service provider's access to programming.<sup>238</sup>

- **Manufacturers and retailers.** Interviewees emphasized the significance of relationships with manufacturers and retailers. Two interviewees suggested leveraging a direct sales approach through manufacturers for APSs in particular. They believed the direct sales approach is a good way to sell this product at a lower retail price and incite participation. One program administrator interviewee believes that manufacturers are the “most aggressive” in pushing the sale of APSs, and as such the manufacturers tend to yield the greatest sales volumes. Interviewees also indicated the opportunities that exist with retailers—specifically with pop-up, online, and value added retailers.

### 10.2.2 Developing Industry Partnerships

The research findings suggest a variety of potentially effective approaches for the Program to consider in furthering its relationships with industry:

- **Use program staff effectively.** ENERGY STAR considers NYSERDA's products program an example of best practices for upstream incentive program implementation. A key factor in ENERGY STAR's determination is NYSERDA's field staff, which is dedicated to providing retailer support.<sup>239</sup> Two program administrator interviewees underscored the value of having field staff members that are dedicated to serving this function. The interviewees asserted that, like the approach of the BCE Alliance, identifying a single point of contact for the program within a residential portfolio or across a region makes program participation less burdensome for industry. One program administrator interviewee noted this is especially true in the case of data sharing, where less effort would be required on the part of the retailer or manufacturer if just one contact collects data for multiple programs.
- **Use third parties for data collection.** PG&E program representatives noted their use of a third party to collect data has been successful in allowing program administrators to access retailer sales data. The third party is able to both provide anonymity for retailers and can shield the data from demands for public access.
- **Recognize the value of the program.** A stakeholder interviewee noted that consumer electronics programs have real value for retailers—they are essentially providing a unique marketing service for the retailers. Recognizing this strength, and developing a stronger presence with the retailers, allows program administrators to better leverage their relationships with retailers.
- **Provide comprehensive training to retailers.** ENERGY STAR commends NYSERDA's in-store trainings, calling them a best practice. Within 30 days of becoming

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<sup>238</sup> Dulac, Steve. 2012. Presentation made at AESP Brown Bag Webinar, “The Elephant in the Residential Program Designers Room: Set-Top Boxes.” May 31.

<sup>239</sup> ENERGY STAR. “Training Resources: New York State Energy Research Development Authority.” Accessed May 4, 2012. [http://www.energystar.gov/index.cfm?c=pt\\_univ.eeps\\_sites\\_nyserda](http://www.energystar.gov/index.cfm?c=pt_univ.eeps_sites_nyserda).



a participating retailer, NYSEDA provides the retailer with sales skills training, ongoing refresher trainings, and product trainings.<sup>240</sup> One manufacturer interviewee explained that retailers need a great deal of assistance in adapting to efficiency program needs echoing the value of comprehensive trainings. The Massachusetts Program currently conducts retailer trainings.

- **Foster a trusting working relationship with retailers.** RIA and EMI emphasize the value of developing long-term relationships with retailers. They explain that adequate communication around program participation guidelines will entice retailers to continue working with programs. Further, they emphasize that if program expectations change too frequently retailers may be disinclined to participate; moreover, retailers will be less likely to make any substantial changes if they cannot trust that the program will be available in the long-term.<sup>241</sup>
- **Develop awareness of industry production and buying cycles.** It is important for programs to develop an understanding of the typical cycle of each consumer electronics product, from production through wholesale buying through retail sales, if programs and industry partnerships are to be successful. One program administrator representative indicated that understanding the buying cycles of consumer electronics retailers is especially important given the rapidly changing consumer electronics market. The interviewee added that maintaining sensitivity to retailers' needs is essential for collaboration. In an AESP presentation, Kari Montrichard of B.C. Hydro echoed this statement. Montrichard noted that an understanding of a media service provider's business allows for effective collaboration with this group.<sup>242</sup>

Other interviewees commented on the importance of being in regular communication with industry members; on allowing retailers the freedom to market in their own ways; and on the fact that while programs need to be supportive of retailers, they also need to be assertive about what they expect from retailers as participants.

Industry member interviewees also expressed signs of their interest in energy efficiency. Their attitudes indicate opportunities for the Massachusetts Program to leverage. That said, the Massachusetts program administrators should bear in mind the potential for free ridership. If industry members plan to take on energy-efficient practices prior to involvement in programs, then programs risk investing in actions that could have occurred in the program's absence.

Interviewees cited the following examples of industry members' interest in energy efficiency:

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<sup>240</sup> ENERGY STAR. "Training Resources: New York State Energy Research Development Authority." Accessed May 4, 2012. [http://www.energystar.gov/index.cfm?c=pt\\_univ.eeps\\_sites\\_nyserda](http://www.energystar.gov/index.cfm?c=pt_univ.eeps_sites_nyserda).

<sup>241</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

<sup>242</sup> Montrichard, Kari. 2012. Presentation made at AESP Brown Bag Webinar, "The Elephant in the Residential Program Designers Room: Set-Top Boxes." May 31.

- **Trainings.** One retailer representative and one manufacturer representative reported that their companies are training their staff around communicating the benefits of energy efficiency.
- **Collaboration.** Several program administrator and industry member interviewees discussed how manufacturers have become more collaborative in working with programs and ENERGY STAR. For example, one program administrator noted how manufacturers now contact the program to learn what the program criteria are. Moreover, manufacturers are even developing their own energy efficiency initiatives.
- **Commitment.** Interviewees reported that media service providers are making commitments to becoming ENERGY STAR partners. In fact, one media service provider interviewee said that the media service provider wants their brand to be associated with ENERGY STAR. Additionally, the media service provider already sets minimum energy efficiency specifications for its STBs. Other industry interviewees, one from a retailer and one from a manufacturer, emphasized the importance of ENERGY STAR to their companies' missions, as well.

## 10.3 Program Opportunities – Evolving Specifications

This section describes interviewees' thoughts regarding opportunities to advance energy efficiency specifications for consumer electronics. Interviewees shared the upcoming consumer electronics specification changes that programs should prepare for, the changes they believe are needed and possible, and their suggestions for how the Massachusetts Program can best manage future changes to consumer electronics specifications.

### 10.3.1 Upcoming Specification Changes

Interviewees highlighted upcoming specification changes that the Program should be aware of in its planning:<sup>243</sup>

- **ENERGY STAR updates.** As noted in Section 4.2.1.1, the ENERGY STAR representative reported that ENERGY STAR's specifications are being updated for TVs, displays, imaging equipment, STBs, PCs, and commercial office equipment.
- **New ENERGY STAR specifications.** ENERGY STAR is currently developing specifications for a new product category, uninterruptable power supplies, and a recognition program for game consoles. According to a stakeholder, ENERGY STAR is also in the process of working with NEEP to develop a labeling effort for APSs based on behavior metrics; however, the future of that effort is still uncertain (see Section 7.1.1).
- **Internet testing.** The ENERGY STAR representative reported that ENERGY STAR is paying special attention to consumers' growing desires for Internet-connectivity in its consumer electronics product specifications. For example, they have added an Internet

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<sup>243</sup> More details of product-specific specification are shown in the product-specific discussions earlier in this study.

test to their TV specification in Version 6.0 (under development), and are currently considering doing the same for the STB specification.

- **CableLabs Energy Initiative.** One media service provider representative indicated that CableLabs<sup>244</sup> is in the process of developing its own specification for STBs. The new specifications, expected to be completed by the end of 2012, call for greater efficiency during standby.

### 10.3.2 Potential Specification Changes

One stakeholder suggested that consumer electronics specifications should be “dynamic” to manage this rapidly changing market—that is, specifications for consumer electronics should be less specific than for other types of products to allow for greater flexibility. This flexibility, according to the interviewee, would permit innovation and still drive efficiency. Other interviewees suggested the following specification additions that they view as essential:

- **APS specifications.** Two program administrator interviewees emphasized the value of adding specifications for APSs given their ability to eliminate standby energy consumption.
- **Internet connectivity.** One stakeholder noted the importance of developing specifications that will not stifle electronics’ ability to connect to the Internet, especially considering consumers’ growing desire for Internet-enabled devices.
- **Device integration.** As noted in Section 5.2.3.2, interviewees underscored the savings opportunities involved in the integration of STBs into TVs (Smart TVs) or another central device. One stakeholder noted that integration of STBs should somehow be incorporated into a specification.

### 10.3.3 Programs and Specifications

Interviewees provided advice for effective engagement with and use of specifications to advance consumer electronics energy efficiency in Massachusetts:

- **Engage in specification development.** As noted previously, the ENERGY STAR representative indicated that support on behalf of utilities has been crucial in developing the TV Most Efficient specifications. RIA and EMI assert that program administrators have a strong influence on ENERGY STAR specifications, noting that California program sponsors had an important role in advancing TV specifications.<sup>245</sup> A stakeholder emphasized that programs need to stay engaged in the specification setting process to push for rigorous and relevant specifications.

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<sup>244</sup> CableLabs is a non-profit consortium devoted to helping cable operators.

<sup>245</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

- **Update criteria regularly.** Interviewees indicated that programs need to update their criteria regularly and stay aware of what specifications exist to limit free ridership. One stakeholder explained that one of the most important activities for a program is to collect market information that is as accurate as possible so the program can predict when a specification may become obsolete or irrelevant.
- **Use rigorous specifications.** A stakeholder asserted that programs should be focusing on the very “high end” of specifications. The interviewee suggested that programs utilize lists such as those of Most Efficient or TopTen USA for the program criteria. Currently, the Massachusetts Program is using standard ENERGY STAR specifications for its program criteria while programs, such as those of B.C. Hydro and PG&E, use more rigorous specifications.

## 10.4 Program Opportunities – Other Suggested Program Strategies

Interviewees and researchers also recommended numerous overarching strategies for the Program to consider:

- **Focus on reducing miscellaneous plug load EUI via a market transformation approach.** For a California program, RIA and EMI recommended focusing on reducing the overall energy use intensity (EUI) of miscellaneous plug loads. In this approach, program designers would develop a forecast of miscellaneous plug load use in the state (e.g., kWh per household, occupant, or square foot) and compare this over time to actual plug load use. The rationale behind using a plug load EUI is that while a plug load energy intensity forecast might be difficult to create, it would likely be more stable, accurate and reliable than forecasts of baselines for individual consumer electronics products. The plug load EUI forecast could be used in setting program targets. This study also recommended taking a long-term market transformation approach to reducing miscellaneous plug loads as a broad category, not by individual products.<sup>246</sup>
- **Renew programs regularly.** Interviewees focused on the relevance of keeping program criteria fresh for consumer electronics programs given the fast changing nature of the consumer electronics market. One stakeholder suggested that a consumer electronics program update its criteria annually. RIA and EMI recommend incorporating a program “roadmap” outlining points at which program measures, criteria, and strategies should be reconsidered.<sup>247</sup>

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<sup>246</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>247</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

- **Focus savings on standby.** Interviewees emphasized the savings opportunities present in standby power. One stakeholder suggested that the Massachusetts Program focus its saving around settings like APD.
- **Bundle products.** A stakeholder suggested that savings could be boosted by bundling a number of small products, and that program administrators should consider engaging with retailers to determine how best to bundle products.
- **Focus on behavior change.** Another stakeholder suggested that the program focus its activities on changing consumer behavior by incorporating a large education component within the program.
- **Identify savings impacts.** Interviewees commented on the unknown savings possibilities with consumer electronics, especially given variations in user behavior. One program administrator representative suggested that consumer electronics energy efficiency program administrators and stakeholder programs need to conduct more robust research to identify more accurate savings impacts.
- **Remove inefficient products from the grid.** A program administrator interviewee suggested that the Program offer an electronics recycling program focusing on removing PCs and TVs “off the grid.” RIA and Ecos estimate that a program retiring older TVs with newer more efficient models through a retirement program has the potential to save 8% of total TV consumption within the Northwest.<sup>248</sup> RIA and EMI believe that retiring STBs and TVs in California would provide that state with significant savings.<sup>249</sup> Kari Montrichard of B.C. Hydro has suggested that potential exists in developing a replacement strategy for STBs.<sup>250</sup> The Canadian program administrator interviewee noted that while a program for free TV recycling functioned well, a TV buyback program, in which the program provides an incentive for the service, did not pass a TRC test. A stakeholder added that a program that encourages integrated devices could also claim the removal of a product; for example, programs that encourage TVs with STB functionality could potentially claim the savings of the removal of an STB. Some consumer electronic stores, such as Best Buy, already offer recycling services.<sup>251</sup> Partnering with such services could facilitate program entry into TV recycling.

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<sup>248</sup> Research into Action (RIA) and Ecos. “Energy Savings Opportunities and Market Descriptions for Four Residential Consumer Electronics Products.”

<sup>249</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. “Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE).”

<sup>250</sup> Montrichard, Kari. 2012. Presentation made at AESP Brown Bag Webinar, “The Elephant in the Residential Program Designers Room: Set-Top Boxes.” May 31.

<sup>251</sup> Best Buy. 2012. “Recycle.” Accessed October 18, 2012 from <http://www.bestbuy.com/site/Global-Promotions/Recycling-Electronics/pcmcat149900050025.c?id=pcmcat149900050025>.

## 11 Conclusions and Recommendations

In this section, we draw conclusions based on the findings and observations described above, taking into consideration the current design and anticipated future needs of the Massachusetts Program. We also offer related recommendations for Program consideration. Since this research was conducted, Massachusetts Program Administrators have released the 2013-2015 Electric and Gas Energy Efficiency Plan.<sup>252</sup> Where the 2013-2015 Plan indicates that a recommendation will be addressed by the Program in the 2013-2015 program period, this is noted below.

### 11.1 Program Options & Related Recommendations

The findings from the literature review and observations from the in-depth interviews raise some fundamental questions about the place of consumer electronics in the Massachusetts ENERGY STAR Appliances and Products program. As the Program's name implies, consumer electronics is addressed via this program in conjunction with residential appliances such as refrigerators, freezers, room air conditioners and cleaners, and pool pumps. The program approach is products-focused, with upstream incentives offered to retailers, and mail-in rebates to consumers, to encourage the purchase of specific high-efficiency products. Yet the findings from this research suggest that while a products-focused program approach may be appropriate for refrigerators, freezers, room air conditioners and cleaners, and pool pumps, it may not be appropriate for consumer electronics products. This is because unlike the other products, individual consumer electronics lack the factors that are typically needed for products-focused programs to be successful such as a stable slow-moving market, long-term energy savings per unit with significant economic value to the consumer, and incremental up-front cost as a barrier to adoption. Given this, the Massachusetts program administrators may wish to reconsider whether a products-focused program approach is the most appropriate way to address consumer electronics in the state.

- **Recommendation.** The Massachusetts program administrators may wish to reconsider whether a products-focused program approach is the most appropriate way to address consumer electronics in the state.

If the Massachusetts program administrators should choose to reconsider the products-focused program approach for consumer electronics, what are the alternatives? Observations from the literature and interviews suggest four basic options to consider:

1. Abandoning program support for consumer electronics.

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<sup>252</sup> National Grid, NSTAR Electric & Gas, Columbia Gas of Massachusetts, Western Massachusetts Electric, Cape Light Compact, Berkshire Gas, New England Gas Company, Unitil, Blackstone Gas Company. 2012. "2013-2015 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan September 19, 2012 Submission to EEAC." Accessed October 16, 2012 from <http://www.ma-eeac.org/docs/9.19.12/Gas%20and%20Electric%20PAs%20Sept%20Plan%209-19-12%20FINAL.pdf>.

2. Limiting support for consumer electronics to encouraging the development of more rigorous energy efficiency specifications and standards.
3. Changing the focus for the consumer electronics portion of the Program from individual products to overall reduction of miscellaneous plug load energy use intensity (EUI) through market transformation efforts, including but not limited to consumer education and behavior change.
4. Maintaining the current products-focused program, but with modifications to improve effectiveness.

### **11.1.1 Option 1: Abandon Program Support for Consumer Electronics**

As the research shows, the consumer electronics market moves at a pace that is markedly faster than that of most other product areas addressed by energy efficiency programs and that of the utility regulatory environment. As a result, programs risk lagging behind the market and incentivizing free riders. For some products, such as mobile PCs, energy efficiency is driven by consumer desire for a product with long battery life, so program support seems unnecessary. The trend toward cloud-based computing suggests that energy use from certain products, such as desktop PCs, will be shifted to servers, which must be addressed from a commercial program perspective. ENERGY STAR market penetration data suggest that market transformation is well underway for some products. For example, ENERGY STAR partner manufacturers reported that 96% of 2011 TV shipments were ENERGY STAR-qualified. ENERGY STAR partner STB manufacturers reported that 62% of 2011 STB shipments were ENERGY STAR-qualified—and the research findings offer reasons to expect the presence of STBs to diminish in homes as they are integrated into televisions. This begs the question of whether, in the face of this evidence, the Massachusetts program administrators should bother with program support for consumer electronics.

Despite the legitimacy of this question, the research team does *not* recommend that the Massachusetts program administrators abandon program support for consumer electronics. The reasoning for this is explained below in Section 1.1.2.

### **11.1.2 Option 2: Support Development of More Rigorous Specifications & Standards**

Observations from the literature and opinions expressed by interviewees point to the importance of programs and program administrators in furthering energy efficiency specifications for consumer electronics, which in turn help drive markets toward greater efficiency of these products. For example, according to the ENERGY STAR interviewee utility support has been crucial in driving ENERGY STAR's TV Most Efficient specifications. The RIA-EMI study asserts that program administrators have a strong influence on the advancement of ENERGY STAR specifications. As CEE notes, a "sustained, strong consumer demand" is important to encourage manufacturers to make energy efficient consumer electronics products and promote

product efficiency.<sup>253</sup> However, energy efficiency is not typically among the characteristics consumers seek when shopping for consumer electronics. Thus, for products without a built-in driver for energy efficiency (that is, all the products addressed in this report except for mobile PCs) there is little reason to expect manufacturers to make, or retailers to promote, energy efficient products without programs, and without voluntary specifications such as ENERGY STAR, to encourage these activities. At the same time, the research suggests that ENERGY STAR specifications for consumer electronics may not always be as flexible as needed to accommodate this rapidly changing market. For example, specifications ideally should be able to accommodate commonly anticipated future needs, such as an ability to connect to the Internet given consumers' growing design for internet-enabled devices, but currently do not. Clearly, there is room for improvement of consumer electronics specifications, and program administrator input can drive more rigorous specifications. At a minimum, the Massachusetts program administrators can play a role in furthering the energy efficiency of this product area by continuing to advocate for, engage in, and lend support to efforts to set or increase energy efficiency specifications and standards for consumer electronics.

- **Recommendation.** The minimum level of support for consumer electronics that the Massachusetts program administrators should consider is (1) become more involved in the specification-setting process for consumer electronics to enhance the likelihood of achieving more rigorous ENERGY STAR specifications while maintaining flexibility, and (2) follow and, as appropriate, provide comments on and support for energy efficiency standards for consumer electronics. (This recommendation is not meant to imply that this is the only level of support that the program administrators should consider—just the floor.)

### 11.1.3 Option 3: Re-focus the Program on Miscellaneous Plug Load EUI

While furthering energy efficiency specifications and standards is important work, this approach alone will not provide Massachusetts with measurable savings to count toward ambitious program savings goals. An alternative program approach that is not product-focused but could yield measureable savings has been suggested by RIA and EMI for a California program: taking a long-term market transformation approach to reducing miscellaneous plug loads as a broad category rather than product-by-product, with a focus on reducing the overall EUI of plug loads. This approach is described in more detail in Section **Error! Reference source not found.**<sup>254</sup>

Other observations from the research offer support for this approach. For example, there was evidence from the literature on consumer electronics that a substantial share of households is interested in saving energy, but lack good, easy-to-use information on which of their home's

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<sup>253</sup> Consortium for Energy Efficiency (CEE). 2008. "Consumer Electronics Program Guide." Accessed May 3, 2012 from <http://www.cee1.org/files/CEEConsumerElectronicsProgramGuide.pdf>.

<sup>254</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."



devices truly matter and do not know what practices would make a real difference. One study recommended addressing this with “well-designed consumer education with specific and narrow messages from credible sources” to promote PC power management.<sup>255</sup> (While the Massachusetts Program’s educational efforts and MassSave’s online Learning Center have been applauded, they do not comprise a concerted educational campaign focused on consumer electronics.) One tactic suggested by an interviewee for addressing the problem of low energy savings per unit for consumer electronics products was to boost savings by bundling a number of small products, with input from retailers as to the most promising bundles. This tactic could work well with the Option 3 approach.

- **Recommendation:** The Massachusetts program administrators may wish to consider the possibility of changing the focus of the consumer electronics portion of the Program from individual consumer electronics products to reduction of miscellaneous plug load EUI overall through market transformation efforts, including but not limited to consumer education and behavior change.
- **Recommendation.** If the Massachusetts program administrators choose to refocus the program on reducing miscellaneous plug load EUI, the program administrators may wish to explore the prospects of bundling products for upstream program support as a possible program tactic.
- **Recommendation.** Either as part of a refocus of the program, or as part of Option 4, Maintaining the Current Program with Modifications (discussed below), the Massachusetts program administrators may wish to explore the possibility of developing a more targeted consumer education campaign that focuses on specific energy-saving actions related to consumer electronics.

In considering either refocusing the Program (Option 3) or maintaining the current Program with modifications (Option 4 below), the Massachusetts program administrators should keep in mind the challenges associated with claiming savings from consumer electronics programs. Program administrator interviewees from outside Massachusetts referenced challenges applicable to Massachusetts, including that (1) the global nature of the markets is a challenge for program attribution; (2) the variations in consumption associated with user behavior, and the numerous possible combinations of peripheral devices that could increase a product’s consumption, make identifying deemed savings and reductions from miscellaneous plug load a challenge; and (3) little is known about the market across the numerous product categories, making it even harder to quantify program savings.

- **Recommendation.** The Massachusetts program administrators may wish to identify and prioritize research topics which, if addressed, would be instrumental in allowing the program administrators to claim savings from plug load reduction or from a wider array of consumer electronics products, or to claim savings with greater confidence. The

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<sup>255</sup> Energy Center of Wisconsin. 2010. “Electricity Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes: A technical and behavioral field assessment.”

program administrators may wish to explore the possibility of conducting high-priority research on this topic jointly with other program administrators facing the same set of issues, possibly through a regional or national industry organization such as NEEP or CEE. Research to better understand and quantify savings from miscellaneous plug load, including how to improve consumer use of APSs and measurement of savings with these devices, is particularly important, especially if the Massachusetts program administrators choose to pursue Option 3.

#### 11.1.4 Option 4: Maintain the Current Program, with Modifications

The Massachusetts program administrators' plan for the 2013-2015 program years describes a product-focused approach for consumer electronics that is similar to the 2010-2012 Program. If the program administrators choose to continue along the product-focused program path for consumer electronics, there are a number of observations from the literature and interviews that could help the program administrators to increase the effectiveness of the product-focused approach. The rest of the Conclusions is devoted to a summary of these and related recommendations, ordered from those that are broadly applicable to the Program to those that are specific to certain products.

- **The Massachusetts ENERGY STAR Appliances & Products Program is one of the few programs offering downstream incentives for desktop PCs and displays. In general, downstream incentives may not be appropriate for consumer electronics.** The Massachusetts Program addresses a common product mix that appears to be in line with that of other consumer electronics programs examined for the study. However, Massachusetts appears to be one of the few programs in the United States or Canada that offers incentives to consumers for the purchase of desktop PCs and displays. The consumer electronics programs examined for the study more commonly offer incentives midstream to retailers and upstream to manufacturers. Interviewees noted that the processing costs for consumer incentives are high compared to those for retailers and manufacturers, and were generally of the opinion that consumer incentives are not particularly effective for consumer electronics. Mail-in rebates, especially for products with low savings opportunities, were singled out as a less effective consumer incentive mechanism. At the same time, at least one state program, Efficiency Vermont, appears to be enjoying some success offering downstream program incentives to consumers online. Interviewees perceived this undertaking as valuable because online incentive mechanisms channel a whole subset of people that may never visit a brick-and-mortar store to purchase consumer electronics. Additionally, it provides an opportunity to reach consumers as they conduct product research online prior to visiting a brick-and-mortar store.
  - **Recommendation.** The Massachusetts program administrators may wish to consider eliminating downstream incentives. If the program administrators choose to continue to offer downstream incentives, at a minimum the program

administrators should investigate the costs and risks associated with offering online incentives for consumer electronics in conjunction with online purchases.

- **Continue to provide midstream incentives. Encourage creative retailer marketing.** The RIA-EMI study encourages program administrators to offer retailers marketing support in the form of short-term incentives, particularly for products with a new ENERGY STAR specification, that meet higher levels of efficiency than ENERGY STAR, or that are new technologies or new to energy efficiency programs. The study also suggests that in addition to POS marketing support, which is already among the Massachusetts program administrators' offerings, program administrators provide retailers with incentives for "creative" retail strategies that could yield large energy savings.<sup>256</sup>
  - **Recommendation:** The Massachusetts program administrators may wish to examine the logistics of encouraging retailers to offer creative retail strategies via the use of incentives, possibility involving a solicitation.
- **Removing inefficient electronics from the grid appears to be a promising program approach, particularly for TVs.** When a consumer takes home an efficient newer model of consumer electronics, it does not necessarily mean that an older, inefficient model is removed from use. The research suggests that this is especially the case with TVs, with CRT TVs often being turned into secondary or tertiary units instead of being discarded. This suggests an opportunity for programs to expedite the replacement, rather than supplementation, of older, less efficient electronics. Insights from interviewees and the literature suggest that PCs, TVs and other types of displays, and STBs are the best candidates for removal. One program administrator interviewed for the study experienced success with a free TV recycling program, but cautioned that when an incentive was provided, the program did not pass a TRC test. Encouraging simultaneous removal of old, inefficient STBs may be a way to improve the cost-effectiveness of TV recycling, as could partnering with retailers that already offer electronics recycling. The Massachusetts ENERGY STAR Appliances and Products Program does not currently include any activities designed to remove consumer electronics products from use, nor are any such activities described in the 2013-2015 Plan.

It should be noted that the Program may have difficulty with cost-effectiveness if it primarily removes inefficient electronics that are not actually in use. In considering removing inefficient electronics from the grid, the Massachusetts program administrators would need to think about how to avoid this situation.

- **Recommendation.** The Massachusetts program administrators may wish to consider adding an electronics recycling effort to the Program, as there is a sizable number of older, less efficient TV models in Massachusetts that the Program

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<sup>256</sup> Research into Action (RIA) and Energy Market Innovations (EMI). 2012. "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)."

could target for replacing or retiring. As part of this, thought would need to be given as to how to ensure that the electronics removed are those that would otherwise be in use.

- **Understanding of industry production and buying cycles is essential to program success.** Industry members and energy efficiency programs' limited knowledge of each other's practices and challenges can impede successful partnerships. It can be difficult to reconcile the timing of manufacturer production cycles with program and specification cycles for any product, but the fast-paced nature of consumer electronics suggests that the problem may be particularly pronounced for this product area. Consumer electronics programs that are designed with an understanding of the typical cycle of each consumer electronics product, from production through wholesale buying through retail sales, are more likely to be successful.
  - **Recommendation.** Consumer electronics programs that are designed with an understanding of the typical design, production, and sales cycle of each product are more likely to be successful. For this reason, the Program should continue its efforts to engage with the consumer electronics industry and to learn more about the industry's practices. This might involve learning more about the production and buying cycles for various consumer electronics products, which would then help to inform program designs that are in sync with these cycles.
- **Collaboration between the Massachusetts program administrators and a broad range of other programs and stakeholders can increase the likelihood of Program engagement with larger retailers and manufacturers.** Consumer electronics manufacturers produce for a global market, and many of the retailers that carry these products are national. A single state's program may not be enough to warrant the attention of larger industry players. The greater levels of bureaucracy and more stringent policies about engagement that the research suggests are commonly found among large manufacturers and retailers of consumer electronics also make it difficult for programs to engage with these players. The findings suggest that collaborating with program administrators from other states and regions would help the Program achieve success with upstream approaches. Interviewees noted that identifying a single point of contact for consumer electronics programs across a region makes program participation less burdensome for industry. The Business and Consumer Alliance, described in Section 8.3, is an example of a collaborative organization that represents a particular product offering of multiple consumer electronics programs through a single point of contact. Interviewees discussed the importance of working with consumer electronics industry associations such as the Consumer Electronics Association, energy efficiency industry associations such as CEE, specification-setting groups like ENERGY STAR and TopTen, and regulatory bodies charged with setting standards for consumer electronics. The Program is already working with CEE, which brings manufacturers and other stakeholders to the table to further activities such as specification setting.

- **Recommendation.** The Massachusetts program administrators may wish to consider joining the Business and Consumer Electronics Alliance to address TVs and possibly also other products. While the Massachusetts program administrators could consider developing a similar collaborative in the Northeast region, this may not be as effective as joining a larger, existing collaborative.
- **Recommendation.** The Massachusetts program administrators may wish to assess if the Program is sufficiently involved with various industry and other groups that could yield support for or leverage its consumer electronics efforts, and where the most impact could be had given limited resources.
- **If sales data are to be collected from retailers, third parties can facilitate this.** Retailer sales data are important to assessing market effects from programs and can help in calculating program savings. It is the research team's experience that obtaining these data and ensuring their usability is fraught with difficulties, and that this problem is widely acknowledged in the energy efficiency industry. The Massachusetts program administrators have been working on obtaining consumer electronics sales data from retailers, but not surprisingly have found this to be a very challenging task. The findings show that one reason retailers are disinclined to share sales data with programs is that programs may be mandated to make records public upon request. The Business and Consumer Electronics Alliance uses a third party to collect retailer data. This allows program administrators to access retailer data without risking retailer privacy.
  - **Recommendation.** If the Program does not doing so already, Massachusetts program administrators may wish to consider using a third party to collect retailer data.
- **Retailers may need substantial assistance and training.** The research findings suggest that retailers need considerable assistance in working with efficiency programs and training sales staff about energy efficiency and efficient products. The findings also bring to light the value of comprehensive trainings. One interviewee pointed to NYSERDA's in-store trainings as an example of best practices for consumer electronics.
  - **Recommendation.** The Massachusetts program administrators may wish to assess the comprehensiveness of its consumer electronics retailer training, and whether this training could, or should, be made more comprehensive, given program goals and resource limitations.
- **Online or mobile tools can help guide consumers to program-eligible products and to retailers selling such products.** Consumers may be impeded in choosing energy-efficient equipment because the information they receive is conflicting or too complex to understand. One program administrator interviewee suggested that Internet-based applications could help consumers identify energy-efficient, program-eligible models of consumer electronics. Examples of such tools exist for other product types, such as lighting and appliances.

- **Recommendation.** The Program may wish to investigate the costs and risks associated with developing mobile or Internet-based applications for identifying energy-efficient consumer electronics products and participating retailers.
- **The speed at which the consumer electronics market changes may facilitate rapid saturation and the possibility of free ridership if consumers would have purchased efficient models without incentives. Updating program criteria frequently and relying on more rigorous specifications may diminish free ridership.** In a fast-moving market like consumer electronics, products evolve so fast that specifications can quickly become irrelevant and saturation of qualified products can increase rapidly. The research suggests that for some products, by the time ENERGY STAR publishes voluntary specifications, meeting them is no longer a stretch for manufacturers. To avoid inadvertently subsidizing the purchase of high-efficiency products after they have become the norm, consumer electronics programs should update their criteria regularly and frequently, stay abreast of specification development, and consider relying on more rigorous specifications, such as tiers or percentages above ENERGY STAR, to limit the possibility of free ridership. Currently, the Massachusetts Program is using standard ENERGY STAR specifications for its program criteria.
  - **Recommendation.** The Massachusetts program administrators may wish to consider the following activities to ensure that the Program stays ahead of the market: (1) Collect the most accurate, timely market information it can given resource limitations to help the Program predict when a specification may become obsolete or irrelevant. (2) Update Program criteria regularly and frequently. (3) Investigate the possibility of utilizing tiers or percentages above ENERGY STAR, Most Efficient, or TopTen USA in its consumer electronics program (while bearing in mind the drawbacks associated with TopTen USA described earlier in this report).<sup>257</sup>

## 11.2 Product-Specific Conclusions & Related Recommendations

### 11.2.1 Televisions

- **TV efficiency is not expected to dramatically increase.** Increases in TV efficiency are not expected to be as steep in the future as they have been in the past; further, new technologies, such as HDTV, are increasing TV consumption. Researchers have suggested some technical mechanisms that can increase TV energy efficiency such as improving occupancy settings, optimizing the brightness setting, incorporating energy efficiency tips in TV settings menus, replacing older models, enhancing ABC, and enabling APD.

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<sup>257</sup> According to NSTAR, the Program has since incorporated tiers above ENERGY STAR.

- **Energy efficiency is a low priority in market actors' TV usage, purchasing patterns, promotion techniques, and design approaches.** The Program needs to overcome several obstacles related to market actors' motivations: consumers' TV HOU's are expected to increase with the rise of streaming media; consumers are more concerned with enhanced TV features than they are with energy efficiency; and retailers and manufacturers find limited value in TV's energy efficiency.
  - **Recommendation.** Changing consumers' viewing behaviors may be too challenging for the Program to address. The Program might want to continue directing midstream and upstream incentives to retailers and manufacturers to make changes that do not require major technological advances, such as enabling APD.
- **Market trends point to the possibility of TV free ridership.** Retailers appear to be stocking more energy-efficient models and manufacturers appear to adapt quickly to higher specifications, raising the specter of possible free ridership. Additionally, TV regulations continue to become more rigorous, reducing prospects for savings from program efforts.
  - **Recommendation.** The Massachusetts program administrators would do well to stay abreast of market trends in order to minimize the possibility of free ridership in this quickly changing market. Keeping up to date on retailer stocking patterns, manufacturers' product development, and regional and national TV regulation transitions will help limit opportunities for free ridership.

### 11.2.2 Set-top Boxes

- **STB efficiency cannot be addressed through increasing the efficiency of the device alone. Incorporating STB functions into thin-client boxes or TVs to decrease the number of STBs per home can reduce STB energy consumption.** While STBs have grown in efficiency over the years, added features such as HD and DVR have served to increase their consumption. At the same time, STBs cannot enter less consumptive modes without risking a loss of data, such as a show recording or network update, and STB efficiency cannot be addressed through increasing the efficiency of the device alone, because media service providers' software updates can override STBs' efficiency features. That said, the research suggests several ways to reduce STB energy consumption: incorporating STB functions into thin-client boxes or TVs to decrease the number of STBs per home; reducing power levels in sleep mode, such as through light sleep; and utilizing of streaming devices and IPTV instead of cable and satellite STBs.
  - **Recommendation.** The Massachusetts program administrators may wish to consider supporting a transition to thin-client boxes, or the integration of STBs within TVs, rather than supporting STBs themselves.
- **Partnering with media service providers to reduce STB energy consumption has been effective for some programs.** Research indicates that media service providers are a

sensible channel for addressing STB energy consumption because they have access to customer homes, frequently communicate with their clients, track deployed STBs' configurations and characteristics, have control over distribution, and generally dictate which STB unit customers use. B.C. Hydro's unique approach to STB installation incentivizes media service providers to transition their service signal to an ENERGY STAR-compliant format. However, research suggests that providers are hesitant to engage in energy efficiency programs because of the time, cost, and risk involved in participation. Indeed, the Massachusetts program administrators have tried this approach in a previous program with little success.<sup>258</sup>

- **Recommendation.** If the Massachusetts program administrators choose to pursue savings from STBs through the Program, they may wish to reconsider the possibility of partnering with media service providers.

### 11.2.3 Video Game Consoles

- **There is no current ENERGY STAR specification for game consoles, and it is not clear when one will be developed.**
- **NRDC may be negotiating with manufacturers to advance game console efficiency.** Research suggests that setting game consoles to an APD default of one hour would provide considerable savings and could even be applied to units already in use through software updates. Given that the energy consumption of game consoles does not vary during the different operation modes, increasing the flexibility of hardware to allow for power use to vary from task to task could provide savings as well. It is reported that NRDC is already negotiating with gaming software manufacturers to promote this.
  - **Recommendation.** The Massachusetts program administrators may wish to reach out to NRDC to find out how, if at all, the utilities might be able encourage this change.
- **Potential European regulation changes could increase game console efficiency.** The EU is considering energy efficiency standards for game consoles. These have the potential to advance the efficiency of products in the U.S. market because manufacturers do not vary their products across countries.
  - **Recommendation.** The research did not yield a clear path for the Program to address game consoles. Until one emerges, the Massachusetts program administrators may wish to keep an eye on progress toward European efficiency standards, and to examine and consider supporting any ENERGY STAR gaming platform or feature that emerges in the market..

### 11.2.4 Computers

- **Desktop PCs are a shrinking market.** Mobile PC sales are surging as home desktop PC sales decline. In Massachusetts the market has already shifted in this direction.

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<sup>258</sup> Wendy Todd, National Grid. Personal communication, October 11, 2012.



- **Cost is a major market barrier to advancing energy efficiency for desktop PCs.** Manufacturers may be deterred from producing energy-efficient desktop PCs given the added costs of producing them and the price sensitivity of the home PC market. The research findings suggest that in the eyes of consumers, PC incentives or rebates are usually perceived as negligible in comparison to product price.
- **PC programs have been unsuccessful.** With the exception of Massachusetts, none of the other program administrators NMR interviewed offer incentives or rebates for PCs—in fact, two that had stopped due to poor results.
- **ENERGY STAR has penetrated the mobile PC market.** In a recent study, NMR observed the ENERGY STAR label on over one-quarter of the laptop PCs in Massachusetts (27%).
- **The growth of cloud computing may shift home PC energy consumption to data centers.** It is likely that that home PCs will need less storage and computing power—and thus less energy—in the future. Cloud computing is expected to shift power requirements from PCs in the home to data centers housed in commercial settings.
  - **Recommendation.** The Program may want consider removing desktop PCs from its product mix given the shrinking market for this product and evidence of limited success with this product category by other programs. Given the far lower average energy use of mobile PCs, there may be little savings to gain from a program focus simply on ENERGY STAR mobile PCs. If the Program ultimately addresses mobile PCs, it should consider focusing on tiers above ENERGY STAR or on other, more rigorous specifications, such as TopTen USA.
  - **Recommendation.** If PC applications continue to migrate to the cloud, some energy consumption will be displaced to large data centers. Researching program opportunities for commercial data centers was outside of the scope of this study. If they have not done so already, the Massachusetts program administrators may wish to consider the extent to which savings can be obtained from increasing the energy efficiency of data centers in the state.

### 11.2.5 Displays

- **Consumer behavior may inhibit savings from displays.** Upgrading display type, reducing screen size, replacing older displays, and proper power management all could reduce display energy consumption. While efficient display types, such as LCD, are gaining in popularity, these gains are offset somewhat by a trend toward the purchase of larger displays. Further, most consumers are not powering down their displays when not in use. Thus, while the Program incentivizes more efficient displays, the savings may not be as great as would be expected due to consumer behavior.
  - **Recommendation.** In addition to encouraging the purchase of smaller displays, the Program may wish to consider offering a display recycling opportunity as a way to claim savings from removing less efficient models from the grid. The

Program may also want to consider upstream incentives for power management default settings.

- **Displays may be an irrelevant product category.** The trend from desktop to mobile PCs means that consumers have less need for displays. Furthermore, few programs encountered during the course of this research address displays, suggesting that other programs may not find the product area worthy of attention.
  - **Recommendation.** The Program may wish to consider removing this product category given that the market appears to be a shrinking.<sup>259</sup>

### 11.2.6 Advanced Power Strips

- **Savings from APSs will diminish as other devices become more efficient. The savings associated with APSs are nebulous.** First, the research suggests that savings from APSs will diminish in the future as the devices that are plugged into them become more efficient. Second, APSs have uncertain savings opportunities making them difficult for claiming program savings. Nonetheless, APSs have been proven to provide energy savings and present the opportunity for programs to address active and passive energy consumption.
- **APSs may not be appropriate for use with mobile PCs.** APSs are most effective with clusters of devices. Because mobile PCs draw relatively little energy, APSs may automatically shut off the peripheral devices of a mobile PC plugged into the main APS socket. This makes APSs inappropriate for use with mobile PCs. The shift in the market toward mobile PCs makes this barrier increasingly important.
  - **Recommendation.** The Program might consider warning consumers that APSs are not appropriate for use with mobile PCs.
- **There is a lack of consumer awareness around APSs and how to use them.** In general, consumers appear to be unaware of what APSs are and what benefits they provide. One program administrator interviewee noted that despite rebating APSs for several years, they had failed to create “buzz” around them in their service area. This interviewee warned against including APSs in the Massachusetts Program.
  - **Recommendation.** The Program should continue to address APSs in its marketing materials. Messaging at POP may help consumers understand exactly what makes APSs superior to standard power strips from an energy efficiency standpoint.
- **Direct install approaches may be effective.** APS manufacturers reportedly have little desire to participate in programs or promote APSs because of their low revenue margin. One Massachusetts implementation contractor indicated that the program has seen success partnering with a retailer using a direct sales approach, thus allowing for a lower

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<sup>259</sup> According to National Grid, the Massachusetts electric utilities plan to stop offering rebates on monitors for the 2013-2015 Program.

retail price to incite participation. Two interviewees suggested that direct install work for APSs are effective given that the retailer is entirely removed from the equation.

- **Recommendation.** The Massachusetts program administrators may wish to continue using a direct sales approach and consider exploring the applicability to Massachusetts of a direct install approach through manufacturers. In exploring a direct install approach, the utilities should bear in mind that there may be additional cost associated with this type of approach that could jeopardize the cost effectiveness of this measure.

## 12 Appendix A

### 12.1 Glossary of Acronyms

A/V	Audio Visual
ABC	Automatic Brightness Control
ACEEE	American Council for an Energy Efficient Economy
AESP	Association of Energy Services Professionals
APD	Auto-Power-Down
APS	Advanced Power Strip
ASAP	Appliance Standards Awareness Project
BCE	Business and Consumer Electronics
CEA	Consumer Electronics Association
CEC	California Energy Commission
CEE	Consortium for Energy Efficiency
CLASP	Collaborative Labeling and Appliance Standards Program
CRT	Cathode Ray Tube
DAM	Download Acquisition Mode
DEG	Digital Entertainment Group
U.S. DOE	U.S. Department of Energy
DVD	Digital Video Disk
DVR	Digital Video Recorder
EC	European Commission
EISA	Energy Independence and Security Act of 2007
EMI	Energy Market Innovations
EPS	External Power Supply
EUI	Energy Use Intensity
FTC	Federal Trade Commission
HDTV	High Definition Television
HOU	Hours of Use
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IEPEC	International Energy Program Evaluation Conference

IPTV	Internet-Protocol Television
kWh	Kilowatt hour
LCD	Liquid Crystal Display
MEP	Minimum Energy Performance
NCTA	National Cable Television Association
NEEA	Northwest Energy Efficiency Alliance
NEEP	Northeast Energy Efficiency Partnerships
NMR	NMR Group, Inc.
NRDC	Natural Resources Defense Council
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research & Development Authority
OLED	Organic Light Emitting Diode
PC	Personal Computer
PG&E	Pacific Gas & Electric
POP	Point of Purchase
QR	Quick Response
RIA	Research into Action
RUI	Remote User Interface
SCE	Southern California Edison
SEAD	Super-efficient Equipment and Appliance Deployment Initiative
STB	Set-Top Box
TRC	Total Resource Cost
TV	Television
UHDTV	Ultra-High Definition Television
UPS	Uninterruptable Power Supply

## 13 Appendix B

### 13.1 Program Administrator In-Depth Interview Guide

#### MA Residential Retail Products 2011 and 2012 Evaluation

#### **FINAL Interview Guide: Consumer Electronics – PROGRAM ADMINISTRATORS**

**Purpose:** *To assess, in a qualitative way, the market potential for improving the efficiency of key consumer electronics technologies and plug loads through energy efficiency programs in Massachusetts.*

Interviewer: \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Time Begun \_\_\_\_\_ Time Ended \_\_\_\_\_

Respondent Name: \_\_\_\_\_

Respondent Title: \_\_\_\_\_

Contact Information:

Phone Number(s): \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Interview was:    \_\_\_\_\_ By phone  
                          \_\_\_\_\_ In person

[NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE WILL NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW. IN ADDITION, THE INTERVIEWERS MAY SKIP QUESTIONS THAT ARE LESS RELEVANT TO A PARTICULAR INTERVIEW]

I am \_\_\_\_ from NMR Group.

My team is conducting a study to help energy efficiency program administrators in the state of Massachusetts take a more innovative approach to consumer electronics. We are interviewing program administrators that we've heard are on the cutting edge in addressing consumer electronics, which is why I've contacted you. Thank you for taking the time to help out the Massachusetts program administrators by talking with me.

We will make every effort to keep your responses confidential. No comments will be attributed to any individual without their express permission.

With your permission, I would like to record the interview. We will use the recording for transcription purposes only; in order to make sure we accurately represent your responses. No one but NMR staff members will have access to the recording. Do I have your permission to record the interview?

\_\_\_\_\_ Yes \_\_\_\_\_ No

### **Background**

- 1) What is your role at [organization]?
- 2) How does [PA] address consumer electronics? (*Probe: integration with plug-load programs, program name*)
  - a. Does [PA] address consumer electronics outside of retail programs? How/Which programs? [probe for ways that consumer electronics may be addressed through residential programs such as plug-load products (non-entertainment/non-communications products), existing home, new construction, low income, or multifamily]
  - b. (*If integrated with a plug-load program*) What plug-load measures are included in that program?
  - c. Are advanced power strips or smart strips ever installed during home visits? [probe for details if yes]
- 3) What is your role in [PA's program name]? What other parties are involved with the implementation of the program? (*If needed*) What are their roles?
- 4) How long has [PA] been running this program?

### **Program Design and Implementation**

- 5) Please describe how the [PA's program name] is meant to work.

- a. What products does [PA's program name] currently address?
  - b. At what points in the market—upstream, midstream or downstream—does the [program name] intervene, and how? (*Probe for activities/offerings at each point and target audiences, and specific interventions.*)
  - c. What marketing and outreach activities are associated with the program?
  - d. In what ways, if at all, does [PA] partner with industry players to carry out its goals? (*Probe: With manufacturers? Retailers? Media service providers? Any others?*)
  - e. In what ways has [PA] partnered or collaborated with other entities such as ENERGY STAR or other energy efficiency industry organizations to carry out its goals? (*If examples requested: CEE, NEEP.*)
- 6) Why did [PA] decide to include the products you mentioned in [program name]?
- 7) What challenges has [PA] experienced in its implementation of the [program name]?
- a. Are there specific consumer electronics products that have not had as great of success as anticipated in the program design? (*If yes*) Have any of these been removed from the program? What happened?
  - b. Have there been any challenges in partnering with industry members or other entities? (*If yes*) What are they?
- 8) The consumer electronics market changes rapidly. This can result in specifications not always keeping up with the market and high free ridership. How does [PA] address this program challenge for consumer electronics? [Outside MA: Probe for use of tiers above ENERGY STAR, Top Ten, Most Efficient, or other tools/approaches]
- a. (*If they use both TopTen and Most Efficient*) Tell me about how the program has dealt with using both TopTen and Most Efficient?
- 9) What lessons has [PA] learned from the [program name] that would help other administrators to design effective consumer electronics programs?

## Regulations

- 10) What changes, if any, do you think might need to occur with regard to the energy efficient specifications for consumer electronics set by ENERGY STAR? Set by other organizations involved with setting specifications?
- a. Are there specifications that do not exist for any specific products that you think should be added?
  - b. Removed?
  - c. Amended?



- 11) Has [PA] attempted to address consumer electronics through codes and standards in any way? [Probe for engaging cable regulators on STBs and other devices]

### **Market Potential**

- 12) Before the interview, we sent you two lists. One was of market barriers that our search of the literature suggests might prevent or promote the sale of high efficiency consumer electronics or make it harder to change how consumers use certain types of electronics equipment. Can you think of any market barriers not on the list?
- 13) The other list we sent was of market trends or opportunities that could help in increasing the energy efficiency of consumer electronics products now or in the future. Can you think of any market trends or opportunities not on this list?

### **Program Design Considerations**

- 14) What products, if any, is [PA] considering adding to its list of [program name] products? *(If any)*? Why these products?
- 15) In your opinion, what products, if any, should [PA] consider including in the [program name] that it currently is not? *(If any)* Why these products?
- 16) What products, if any, is [PA] considering removing from the program? *(If any)* Why is that?

### **Closing**

- 17) Are there other entities or individuals that you suggest we speak with to fully understand the market for energy efficient consumer electronics?

*On behalf of the Massachusetts energy efficiency program administrators, thank you for taking the time to speak with us.*

### 13.2 Stakeholder In-Depth Interview Guide

#### MA Residential Retail Products 2011 and 2012 Evaluation

#### **FINAL Interview Guide: Consumer Electronics – *STAKEHOLDERS (NON-ENERGY STAR)***

**Purpose:** *To assess, in a qualitative way, the market potential for improving the energy efficiency of key consumer electronics technologies and plug loads through energy efficiency programs in Massachusetts.*

Interviewer: \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Time Begun \_\_\_\_\_ Time Ended \_\_\_\_\_

Respondent Name: \_\_\_\_\_

Respondent Title: \_\_\_\_\_

Contact Information:

Phone Number(s): \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Interview was:    \_\_\_\_\_ By phone

                  \_\_\_\_\_ In person

[NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE WILL NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW. IN ADDITION, THE INTERVIEWERS MAY SKIP QUESTIONS THAT ARE LESS RELEVANT TO A PARTICULAR INTERVIEW]

I am \_\_\_\_ from NMR Group.

My team is currently conducting a study to help energy efficiency program administrators in the state of Massachusetts take a more innovative approach to consumer electronics. We want to be sure to have [organization]’s insight into this challenging market, which is why I’ve contacted

you. Thank you for taking the time to help out the Massachusetts program administrators by talking with me.

We will make every effort to keep your responses confidential. No comments will be attributed to any individual without their express permission.

With your permission, I would like to record the interview. We will use the recording for transcription purposes only; in order to make sure we accurately represent your responses. No one but NMR staff members will have access to the recording. Do I have your permission to record the interview?

\_\_\_\_\_ Yes \_\_\_\_\_ No

### Background

- 1) What is your role at [organization]?
- 2) What role does [organization] play with regard to energy efficiency of consumer electronics?
- 3) Does the organization have a goal or mandate related to the energy efficiency of consumer electronics? If yes: Please describe the [goal/ mandate].
  - a. What specific activities does [organization] undertake to address this [goal/mandate]?

### Regulations

- 4) (*If TopTen Representative*) Other than ENERGY STAR and TopTen, and FTC for the EnergyGuide labels for TVs, what other organizations set specifications for consumer electronics?
- 5) What changes, if any, do you think might need to occur with regard to the energy efficient specifications for consumer electronics (1) set by ENERGY STAR; (2) set by [name of other organization named by respondent as setting specifications]?
  - a. Are there specifications that do not exist for any specific products, and are not currently under development, that you think should be added? Why these products?
  - b. Removed?
  - c. Amended?

- 6) What kinds of changes, if any, do you think might need to be made with regard to standards and regulations related to the energy efficiency of consumer electronics?
- 7) (*If unclear*) Are you familiar with ENERGY STAR's "Most Efficient" products lists and TopTen USA's product lists? (If familiar with both)
  - a. How do TopTen specifications compare with or integrate with ENERGY STAR's "Most Efficient" TV products lists?
  - b. What makes TopTen specifications different from ENERGY STAR?
  - c. Are they in any way redundant? (If yes) How so?

### Market Potential

- 8) How do you see the consumer electronics market changing in response to changing viewing habits and the rise of streaming media? (Probe for changes to the kinds of equipment that we can expect consumers to want/need going forward)
- 9) Before the interview, we sent you two lists. One was of market barriers that our search of the literature suggests might prevent or promote the sale of high efficiency consumer electronics or make it harder to change how consumers use certain types of electronic equipment. Can you think of any market barriers not on the list?
- 10) The other list we sent was of market trends or opportunities that could help in increasing the energy efficiency of consumer electronics products now or in the future. Can you think of any market trends or opportunities not on this list?
- 11) Do you see opportunities in the market that programs are not currently taking advantage of that could advance the production and sale of energy efficient consumer electronics? That could help in changing consumer behavior?

### Program Design Considerations

- 12) Our research suggests that the quickly changing technologies, lagging specifications, and high free ridership, make this an especially difficult sector in which to run a program.
  - a. Based on your knowledge of existing consumer electronics DSM programs, are there strategies, approaches or activities that you think are essential for programs to be successful? (*If yes*) What are these approaches or activities?
  - b. What programs, specifically, would you say have been relatively successful in the face of these challenges? (*If any*) Is/are there any particular person/people or group(s) involved with the design or implementation of that program you might suggest we contact?

- 13) What organizations, if any, should administrators of energy efficiency programs consider partnering with to encourage participation in their consumer electronics programs?  
(*Probe*: names of organizations)

**Closing**

- 14) Are there other entities or individuals that you suggest we speak with to fully understand the market for energy efficient consumer electronics?

*On behalf of the Massachusetts energy efficiency program administrators, thank you for taking the time to speak with us.*

### 13.3 ENERGY STAR In-Depth Interview Guide

#### MA Residential Retail Products 2011 and 2012 Evaluation

#### FINAL Interview Guide: Consumer Electronics – ENERGY STAR Representative

**Purpose:** *To assess, in a qualitative way, the market potential for improving the efficiency of key consumer electronic technologies and plug loads through energy efficiency programs in Massachusetts.*

Interviewer: \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Time Begun \_\_\_\_\_ Time Ended \_\_\_\_\_

Respondent Name: \_\_\_\_\_

Respondent Title: \_\_\_\_\_

Contact Information:

Phone Number(s): \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Interview was:    \_\_\_\_\_ By phone  
                          \_\_\_\_\_ In person

[NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE WILL NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW. IN ADDITION, THE INTERVIEWERS MAY SKIP QUESTIONS THAT ARE LESS RELEVANT TO A PARTICULAR INTERVIEW]

I am \_\_\_\_ from NMR Group.

My team is conducting a study to help energy efficiency program administrators in the state of Massachusetts take a more innovative approach to consumer electronics. We want to be sure to

have ENERGY STAR's insight into this challenging market, which is why I've contacted you. Thank you for taking the time to help out the Massachusetts program administrators by talking with me.

We will make every effort to keep your responses confidential. No comments will be attributed to any individual without their express permission.

With your permission, I would like to record the interview. We will use the recording for transcription purposes only; in order to make sure we accurately represent your responses. No one but NMR staff members will have access to the recording. Do I have your permission to record the interview?

\_\_\_\_\_ Yes \_\_\_\_\_ No

### Background

15) What is your role at [organization]?

16) Does the organization have a goal or mandate related to the energy efficiency of consumer electronics? If yes: Please describe the [goal/ mandate].

### Regulations

17) We have reviewed the specifications that ENERGY STAR sets for consumer electronics products, including the most recent update in the "Specifications-at-a-Glance" document, which was dated November 2011.

- a. Have any more changes been planned to the specifications since November? In particular, are there any consumer electronics products for which ENERGY STAR plans to retire specifications? (*If any*)Why is that?
- b. Are there any new consumer electronics products for which it is developing specifications?
- c. Are there any existing specifications that it is amending? (*If any*)Why is that?
- d. How, if at all, does ENERGY STAR plan to address the rise of streaming media and SmartTVs? [Probe for implications for STBs, addressing integrated access devices like AppleTV]
- e. Will any other consumer electronics products begin to be recognized by the "Most Efficient" effort in the future? (*Time permitting*) Are there any changes planned for ENERGY STAR's "Most Efficient" products lists for TVs? [Probe for frequency of planned updates]

- 18) We understand that the organization, TopTen USA is also involved with recognizing energy efficient products...
- How do TopTen specifications compare with or integrate with ENERGY STAR's "Most Efficient" TV products lists?
  - What makes TopTen specifications different from ENERGY STAR?
  - Are they in any way redundant? (If yes) How so?
- 19) Other than ENERGY STAR and TopTen, and FTC for the EnergyGuide labels for TVs, what other organizations set specifications for consumer electronics?
- 20) *(If offers the name of a spec-setting organization, then ask #2 but not #1)* What changes, if any, do you think might need to occur with regard to the energy efficient specifications for consumer electronics (1) set by ENERGY STAR; (2) set by [name of other organization named by respondent as setting specifications]?

**LOWER PRIORITY**

- Are there specifications that do not exist for any specific products, and are not currently under development, that you think should be added? Why these products?
- Removed?
- Amended?

**Market Potential**

- 21) Before the interview, we sent you two lists. One was of market barriers that our search of the literature suggests might prevent or promote the sale of high efficiency consumer electronics or make it harder to change how consumers use certain types of electronic equipment. Can you think of any market barriers not on the list? *(If they have not read the list)* What do you think are the key market barriers are?
- 22) The other list we sent was of market trends or opportunities that could help in increasing the energy efficiency of consumer electronics products now or in the future. Can you think of any market trends or opportunities not on this list? *(If they have not read the list)* What do you think are the key market trends or opportunities are?
- 23) **LOWER PRIORITY:** Do you see opportunities in the market that programs are not currently taking advantage of that could advance the production and sale of energy efficient consumer electronics? That could help in changing consumer behavior?

**Program Design Considerations**



- 24) Our research suggests that quickly changing technologies, high free ridership, and delays in updating specifications make this an especially difficult sector in which to run a program.
- a. Based on your knowledge of existing consumer electronics DSM programs, are there strategies, approaches or activities that you think are essential for programs to be successful? (*If yes*) What are these approaches or activities? [Probe for suggested approaches to deal with specifications that are unable to keep up with the quickly changing market]
  - b. What programs, specifically, would you say have been relatively successful in the face of these challenges? (*If any*) Is/are there any particular person/people or group(s) involved with the design or implementation of that program you might suggest we contact?
- 25) **LOWER PRIORITY:** What organizations, if any, should administrators of energy efficiency programs consider partnering with to encourage participation in their consumer electronics programs? (*Probe:* names of organizations)

### Closing

- 26) Are there other entities or individuals that you suggest we speak with to fully understand the market for energy efficient consumer electronics?

*On behalf of the Massachusetts energy efficiency program administrators, thank you for taking the time to speak with us.*

### 13.4 Manufacturer and Retailer In-Depth Interview Guide

#### MA Residential Retail Products 2011 and 2012 Evaluation

#### **FINAL Interview Guide: Consumer Electronics – *MANUFACTURERS AND RETAILERS***

**Purpose:** *To assess, in a qualitative way, the market potential for improving the efficiency of key consumer electronics technologies and plug loads through energy efficiency programs in Massachusetts.*

Interviewer: \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Time Begun \_\_\_\_\_ Time Ended \_\_\_\_\_

Respondent Name: \_\_\_\_\_

Respondent Title: \_\_\_\_\_

Contact Information:

Phone Number(s): \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Interview was:    \_\_\_\_\_ By phone

                  \_\_\_\_\_ In person

[NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE WILL NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW. IN ADDITION, THE INTERVIEWERS MAY SKIP QUESTIONS THAT ARE LESS RELEVANT TO A PARTICULAR INTERVIEW]

I am \_\_\_\_\_ from NMR Group.

My team is conducting a study to help energy efficiency program administrators in the state of Massachusetts take a more innovative approach to helping improve the efficiency of the consumer electronics purchased in the state. We are interviewing just a few

[retailers/manufacturers] of consumer electronics to help us better understand this market. Thank you for taking the time to help out the Massachusetts energy efficiency program administrators by talking with me.

We will make every effort to keep your responses confidential. No comments will be attributed to any individual without their express permission.

With your permission, I would like to record the interview. We will use the recording for transcription purposes only; in order to make sure we accurately represent your responses. No one but NMR staff members will have access to the recording. Do I have your permission to record the interview?

\_\_\_\_\_ Yes \_\_\_\_\_ No

### Background/Company Information

- 1) What is your role at [company]?

### Market Potential

- 2) Massachusetts energy efficiency programs are trying to identify the most important consumer electronics products on which to focus in order to maximize the potential energy savings as the consumer electronics markets change. I'm going to ask you about a number of different products. If I ask you about a product that your company doesn't [produce/sell], just let me know and we'll move on to the next question. For each of the products, tell me where you see the market heading? (*Interviewer: record if they don't produce/sell a particular product*)
  - a. TVs, smartTVs, and integrated access devices such as Roku and AppleTV (*Probe for changes in screen types, screen sizes, size of installed base, efficiency levels, relative market share*)
  - b. (*Manufacturers only*) Set-top Boxes of all types (cable, satellite, standalone, & telco [e.g. Verizon FiOS]) and related equipment, such as DVRs & thin clients . How do you see the consumer electronics market changing in response to changing viewing habits and the rise of streaming media? (*Probe for changes to the kinds of equipment that we can expect consumers to want/need going forward*)
  - c. Video game consoles
  - d. Routers & modems
  - e. Monitors (*Probe for changes in screen types, screen sizes, size of installed base, efficiency levels*)
  - f. Desktop computers & portable computers
- 3) What percentage of your company's overall TV sales would you estimate are ENERGY STAR models?

## Programs

- 4) Are you familiar with any of the energy efficiency programs, typically run by organizations like utility companies or state agencies, that offer incentives to organizations like yours to help promote energy efficient versions of [consumer electronics/STBs or related] products?
- (If familiar)*
- a. Are there any specific programs your company is involved with related to the [sale/use/production] of energy efficient [consumer electronics/STBs or related] products?
    - i. *(If yes and retailer)* Does your *company* ever receive incentives from the programs for selling (or stocking) energy efficient consumer electronics? *(If needed: As opposed to just your customers receiving rebates from energy efficiency programs when they purchase ENERGY STAR consumer electronics.)*
  - b. To your knowledge, have any of these programs influenced your company's sales, goals [or production plans]?
    - i. *(If yes)* How, if at all, has this varied across products?
  - c. *(If involved)* Of the energy efficiency programs with which your organization has been involved, from your perspective, which seem the most effective? Why?
- 5) How could energy efficiency programs more effectively engage companies like yours?
- 6) *(If retailer and receive mid-stream incentives)* You said earlier that your company receives incentives for selling (stocking) energy efficient consumer electronics. Sometimes energy efficiency programs offer opportunities where they provide *additional* incentives to retailers like you rewarding them for increased *sales* of the *most* efficient products.
- a. Do you think your company would be willing to engage in an agreement like this? *(If no)* Why not?
  - b. *(If yes)* Do you think your sales of highly efficient consumer electronics would increase as a result? Why or why not?
  - c. How, if at all, would this vary across products?

## Regulations/Specifications

- 7) Are you familiar with any state's regulations over the *energy efficiency* of consumer electronics products that your company [sells /produces] such as those of California? *(Probe for which states' regulations, addressing which equipment types.) (If needed: Our*

goal is simply to understand the impact of these regulations on your business, not to identify your compliance with them.)

- a. *If yes:* How have these regulations affected the way your company does business or the products it [sells/produces]? (*probe for effects of regulation*)
- 8) Are you familiar with the voluntary ENERGY STAR specifications for consumer electronics products that your company [sells/ produces]?
- a. Are you familiar with ENERGY STAR's "Most Efficient" TV products list? (*If familiar*) Does your company in any way address this list?
  - b. Are you familiar with the TopTenUSA lists identifying the most efficient products on the market? (*If familiar*) Does your company in any way address these lists?
- 9) (*If retailer*) What changes, if any, do you think might be needed to any of the voluntary ENERGY STAR specifications that are not already planned?
- 10) (*If manufacturer*) What changes, if any, do you think might need to occur with regard to the energy efficiency specifications for consumer electronics (1) set by ENERGY STAR; (2) set by [name of other organization named by respondent as setting specifications]?
- 11) In general, how well do energy efficiency specifications keep up with the consumer electronics market? *If not well:* What changes to the specification-setting process could help improve this?
- 12) (*If manufacturer*) What collaborative efforts, if any, is your company involved with related to specification setting? (*If needed:* That is, collaboration with government or utility entities that are promoting energy efficiency)
- a. (*If any*) In your opinion, are there aspects of this collaboration that need to change to encourage companies like yours to [produce/sell] energy efficient products? (*probe for what*)

### **Role of Energy Efficiency**

- 13) (*If manufacturer*) How important is it to your company that its products meet ENERGY STAR specifications?
- 14) (*If retailer*) How important is it to your company that the products it carries meet ENERGY STAR specifications?
- 15) (*If manufacturer of STBs*) Do your media service provider customers set expectations about the energy efficiency of the set-top boxes or other equipment that they purchase from you? [Probe for ENERGY STAR requirements]

- 16) What policies or goals does [company] have related to the [sale/production] of *energy efficient* consumer electronics?
- a. Does it market its products' energy efficiency to its customers? (*If yes*) How?

### **Closing**

- 17) (*If not already involved with MA programs*) As you likely know, the Massachusetts electric utilities are generally interested in collaborating with companies like yours to improve their programs and learn how to tailor their programs to facilitate partnerships with industry members. Would you be interested in speaking with any of the representatives from the utilities to explore working with them? (*If yes*) Excellent. Do I have your permission to pass along your contact information to the energy efficiency program staff at the Massachusetts electric utilities?

- 18) Are there other entities or individuals that you suggest we speak with to fully understand the market for energy efficient consumer electronics?

*On behalf of the Massachusetts energy efficiency program administrators, thank you for taking the time to speak with us.*

### **13.5 Media Service Provider In-Depth Interview Guide MA Residential Retail Products 2011 and 2012 Evaluation**

#### **FINAL Interview Guide: Consumer Electronics – *MEDIA AND CONTENT SERVICE PROVIDERS***

**Purpose:** *To assess, in a qualitative way, the market potential for improving the efficiency of key consumer electronics technologies and plug loads through energy efficiency programs in Massachusetts.*

Interviewer: \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Time Begun \_\_\_\_\_ Time Ended \_\_\_\_\_

Respondent Name: \_\_\_\_\_

Respondent Title: \_\_\_\_\_

Contact Information:

Phone Number(s): \_\_\_\_\_

Fax Number: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Interview was:    \_\_\_\_\_ By phone

                  \_\_\_\_\_ In person

[NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE WILL NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW. IN ADDITION, THE INTERVIEWERS MAY SKIP QUESTIONS THAT ARE LESS RELEVANT TO A PARTICULAR INTERVIEW]

I am \_\_\_\_ from NMR Group.

My team is conducting a study to help energy efficiency program administrators in the state of Massachusetts take a more innovative approach to helping improve the efficiency of the consumer electronics used in the state. We are interviewing just a few [media service

providers/media content providers] to help us better understand this market. Thank you for taking the time to help out the Massachusetts energy efficiency program administrators by talking with me.

We will make every effort to keep your responses confidential. No comments will be attributed to any individual without their express permission.

With your permission, I would like to record the interview. We will use the recording for transcription purposes only; in order to make sure we accurately represent your responses. No one but NMR staff members will have access to the recording. Do I have your permission to record the interview?

\_\_\_\_\_ Yes \_\_\_\_\_ No

### Background/Company Information

- 19) What is your role at [company]?
- 20) In addition to a TV, what types of devices do residential customers need to have in order to use your company's [services/streaming content]?
- Does your company **ever** provide customers with the devices? Do the customers **ever** provide their own devices? (IF BOTH: Probe to get percentage of customer-versus company-provided devices.)
  - What choice does the customer have as far as renting, purchasing, or providing their own device?
  - IF COMPANY PROVIDES SOME OR ALL: Are the types of devices that your company provides most often sold to OR rented by your customers?
  - IF DEVICES SOLD OR RENTED: For each type of device that you sell or rent to customers, what choices do you give the customers? For example, do you offer multiple choices of set-top box or DVR? (FOR EACH: And do you sell or rent this product type?)
- 21) How many residential customers would you estimate obtain pay-TV service through cable and through satellite in total in Massachusetts? (*probe for counts and percentages, try to get ratio. If they can't give MA, ask for whole country.*)
- Is this likely to change any time soon?
  - IF YES: How do you think this is likely to change over the next five years?
  - (If time) Are the percentages and expectations different for commercial customers? If so, please describe.



- d. *(If service requires set-top boxes)* What share of the set-top boxes among your customers in Massachusetts would you estimate are ENERGY STAR models?

### Role of Energy Efficiency

- 22) *(If company sells or rents equipment)* How does your company select which models of [set-top box/other equipment] it sells or rents to customers? *(Probe)*:
  - a. How often does your company change the “standard” set top box models rented or provided with the service?
  - b. At what level of the organization are these decisions made?
  - c. To your knowledge, what factors are the most important in the selection of models?
  - d. How important is energy efficiency in this selection?
  - e. Why might a company like yours *not* [sell/rent/produce] energy efficient models of [set-top box/other equipment]?
- 23) *(If time)* What policies or goals does [company] have related to the [sale/rental] *energy efficient* consumer electronics for customer use?
  - a. *(If any)* What specific activities does [company] undertake to address these?

### Market Potential

- 24) Massachusetts energy efficiency programs are trying to identify the most important consumer electronics products on which to focus in order to maximize the potential energy savings as the consumer electronics markets change. Now I’m going to read you a list of consumer electronics products. For each of these products, tell me where you see the market heading?
  - a. Set-top Boxes of all types (cable, satellite, standalone, & telco [e.g. Verizon FiOS]) and related equipment, such as DVRs & thin clients *(If relevant)* How do you see the consumer electronics market changing in response to changing viewing habits and the rise of streaming media? *(Probe for changes to the kinds of equipment that we can expect consumers to want/need going forward)*
  - b. *Smart TVs (Probe for changes in screen types, screen sizes, size of installed base, efficiency levels)*
    - i. With new technologies such as Smart TVs coming onto the market, how do you expect this to affect the types of devices that customers will use to access your company’s [TV service/streaming content]? *[probe to understand where the market is going with new access technologies]*

- ii. IF COMPANY PROVIDES SOME OR ALL DEVICES: How much longer do you expect to provide [list devices they currently provide] to your customers?
- c. Integrated access devices (*If asked: Such as Roku & Apple TV*)
- d. Video game consoles

## Programs

25) (*If sell or rent any equipment*) Are you familiar with any of the energy efficiency programs, typically run by organizations like utility companies or state agencies, that offer incentives to organizations like yours to help promote energy efficient versions of [consumer electronics/STBs or related] products?

(*If familiar*)

- a. Are there any specific programs your company is involved with related to the [sale/use] of energy efficient [consumer electronics/STBs or related] products?
- b. To your knowledge, have any of these programs influenced your company's sales, goals or other plans? (*If yes*) How?
- c. (*If involved*) Of the energy efficiency programs with which your organization has been involved, from your perspective, which seem the most effective? Why?
- d. What else do *you* think organizations that run energy efficiency programs could do to encourage the [sale/use/production] of energy efficient [consumer electronics/STBs or related] products?
  - i. Why that activity?

26) How could energy efficiency programs more effectively engage companies like yours to partner in improving the energy efficiency of home electronics?

27) What could energy efficiency programs do to get consumers to take energy efficiency into consideration when they purchase consumer electronics?

- a. Does this vary by product type? How?
- b. [Probe: What could they do to speed up the replacement of old set-top boxes with ENERGY STAR models? Is there any point to doing this?]
- c. (*If company sells or rents equipment*) Do ENERGY STAR's specifications in any way influence which set-top box models your company purchases from manufacturers? (*If yes*) How so?

## Regulations & Specifications

- 28) (*Media service providers only*) What kinds of regulatory authority, if any, do state agencies have over the choice of equipment you provide to your customers?
- 29) (*If time*) (*If company sells or rents equipment*) Are you familiar with any state's regulations over the *energy efficiency* of consumer electronics products that your company [sells/rents] such as those of California? (*Probe for which states' regulations, addressing which equipment types.*) (*If needed: Our goal is simply to understand the impact of these regulations on your business, not to identify your compliance with them.*)
- a. *If yes: How have these regulations affected the way your company does business or the products it [sells/produces]? (probe for effects of regulation)*
- 30) Are you at all familiar with the details of the U.S. Department of Energy's development of regulations related to energy efficiency for set-top boxes and network equipment?
- a. (*If familiar*) How, if at all, do you think these regulations might affect your company or its products?
- 31) Does your company in any way address the ENERGY STAR label for the products is [sells/rents/produces]? How? (*Probe for description.*)
- 32) Are you familiar with the TopTenUSA lists identifying the most efficient products on the market?
- a. (*If familiar*) Does your company in any way address these lists?
- 33) (*If time*) What type of collaborative efforts, if any, is your company involved with related to specification setting? (*If needed: That is, collaboration with government or utility entities that are promoting energy efficiency*)
- a. (*If any*) In your opinion, are there aspects of this collaboration that need to change to encourage companies like yours to [produce/sell/rent] energy efficient products? (*probe for what*)

## Closing

- 34) (*If not already involved with MA programs*) As you likely know, the Massachusetts electric utilities are generally interested in collaborating with companies like yours to improve their programs and learn how to tailor their programs to facilitate partnerships with industry members. Would you be interested in speaking with any of the representatives from the utilities to explore working with them? (*If yes*) Excellent. Do I have your permission to pass along your contact information to the energy efficiency program staff at the Massachusetts electric utilities?

35) Are there other entities or individuals that you suggest we speak with to fully understand the market for energy efficient consumer electronics?

*On behalf of the Massachusetts energy efficiency program administrators, thank you for taking the time to speak with us.*