New York State Energy Research and Development Authority

Advanced Power Strip Research Report

Final Report

August 2011

No. 12-03

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Advanced Power Strip Research Report

Final Report

Prepared for the
New York State
Energy Research and
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NYSERDA
Report 12-03

August 2011

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EXECUTIVE SUMMARY

The New York State Energy Research and Development Authority (NYSERDA) has implemented a power management initiative that focuses on reducing energy consumption in residential markets. The use of advanced power strips (APS) is one approach to eliminate standby power loss from various electronic products commonly used in the home. Entertainment electronics make up 60% of all plug load consumption by home electronics while home office electronics make up 31% of all plug load consumption by home electronics (California 2008). With such a large percentage of home electronics plug load consumption, implementing APS for entertainment and home office electronics would reduce energy consumption across the residential market.

Data regarding the frequency of products in homes, their power consumption, and the average hours of use per day for televisions, television peripherals, computers, and computer peripherals were collected and analyzed to understand the power consumption of products in active, standby, and off modes. A total of 36 home electronics were analyzed to characterize the national and New York (NY) markets and savings potential for an APS program.

Consumer purchasing habits and behaviors were analyzed to understand the source of purchase, purchase influencers, electronics stewardship, resources for purchase decisions, and the role of energy efficiency in purchasing decisions. Based on this analysis, Lockheed Martin, Inc. (LM) learned that consumers most often shop for home electronics at large retailers like Best Buy, Wal-Mart, and Target (Schulz 2011) with price as the largest influencer of purchase and energy efficiency as the fifth largest influencer of purchase (Herbert 2009). When disposing of electronics, approximately 45% of consumers put products into storage or reuse them, while 44% dispose of them and about 11% recycle (EPA 2008). Most purchasing decisions within the nation, county size A, county size B, country size C/D, and residential homes are made with a spouse or partner. In New York State, New York City, and in Condominium/Apartments, however, most purchasing decisions are sole decisions (Experian).

Three separate analyses were completed to understand the average consumption and potential savings resulting from the use of APS; the typical household, the national market, and the New York State market[1]. A typical household in the United States has a Cathode Ray Tube (CRT) television, Liquid-Crystal Display (LCD) Television, cable set top box, DVD player, VCR, video game console, desktop computer, LCD monitor, and inkjet printer. For a typical household, the use of one APS for entertainment purposes and one for home office purposes would result in an estimated savings of 106.1 kWh (75.1 kWh home entertainment and 31 kWh home office) per year and $78.81 over the life of the APS. At the national level, with the average number of each type of electronic product taken into consideration, an estimated annual 91.9 kWh and $62.98 over the life of the APS would be saved. This estimate, when applied across all households that are willing to pay more upfront for environmentally friendly products would result in an estimated annual savings of 3,178,824,107 kWh and $2,177,419,564 over the life of the advanced power strip for the national market. Because results vary slightly for the national market and the New York market, LM calculated the potential savings for each segment. At the

[1] A typical household assumes that there is one of each of the following products in the household; CRT Television, LCD Television, cable set top box, DVD player, VCR, video game console, desktop computer, LCD monitor, and inkjet printer. The National and New York State markets analyses use the average number of each product per household in each market (e.g. there is an average of 0.9 DVD players per household for the national market). The analyses are described in more detail in Section 5.2 on page 27.

New York state level, if each household used one APS for entertainment purposes and another for home office purposes, LM estimates a combined annual 93.6 kWh and $123.88 savings over the life of the two APS. This estimate, when applied across households that are willing to pay more upfront for environmentally friendly products would result in an estimated annual savings of 266,533,039 kWh and $352,588,316 over the life of the APS for the New York State market.

The development of this study assisted the effort of the North East Energy Partner (NEEP) APS working group. With data exchanges and cross vetting opportunities the findings are consistent with the outcome of the NEEP APS Data group.

Based on the results of this study, LM has made several recommendations for moving forward. Our short term recommendation is to develop a Marketing Strategy and Promotions Plan in order to increase consumer and retailer awareness and the resulting sale of APS. Our medium-to-long term recommendations include:

- Conduct research for additional information on consumer behaviors and purchasing habits that was not readily available through secondary research for this study. This research may include how entertainment and home office products are configured, how often these products are used in conjunction or separately, and additional information on consumer comprehension of plug load
- Develop and implement a marketing strategy and promotions plan
- Develop a strong consumer education program about home electronics plug load
- Determine the awareness of APS among retailers and research into any advertising or promotions practices they are using
- Include APS in an EEPS midstream market share incentive program
- Enhance efforts to promote the recycling of electronic products
- Evaluate the increase of new electronics on the market, such as tablets and smart phones, and how it relates to plug loads and potential energy savings
- Perform a power management initiative study for the commercial market
- Frequently reassess the market
- Regional Market Development.

1. INTRODUCTION

NYSERDA has implemented a power management initiative that focuses on reducing energy consumption by providing consumers with solutions to eliminate standby power loss from various electronics commonly used in the home. An aspect of this initiative addresses the use of the APS and its potential to eliminate standby power loss from typical home electronics, in particular entertainment and home office electronics products. To advance this initiative, NYSERDA identified a need to characterize the United States and New York markets based on their energy consumption and purchasing behaviors and habits and determine a resulting potential plug-load energy savings from the use of APS in homes.

Table 1, below, lists the home electronics that are analyzed in this report.

Entertainment Home Electronics	Office/IT Home Electronics
CRT Television	Desktop Computer
LCD Television	Laptop Computer
Plasma Television	Modem
Projection Television	Router
Cable Set Top Box	CRT Monitor
Cable Set Top Box with DVR	LCD Monitor
Satellite Set Top Box	Inkjet Printer
Satellite Set Top Box with DVR	Laser Printer
DVR Set Top Box	Scanner
DVD Player	Copier
DVD Player/Recorder	Inkjet Facsimile Machine
VCR	Laser Facsimile Machine
DVD/VCR Player	External Hard Drive
BluRay Player	Powered Speakers
PlayStation 2	
PlayStation 3	
Nintendo Wii	
Xbox	
Xbox 360	
AV Receiver	
Powered Subwoofer	
Surround Sound Speakers	

Table 1: List of Entertainment and Office Home Electronics

This report presents the full assessment of the National and New York markets along with recommendations for future research and analysis.

1.1. OBJECTIVE

APS reduce home energy consumption by providing consumers with solutions to eliminate standby power loss from various electronics commonly used in the home. Therefore, the purpose of this power management market research study is to provide NYSERDA with product and market characterization information that will help to design a cost-effective program to promote the sale and use of APS. Specific research was conducted to characterize the national and New York markets to identify the potential plug load energy and dollar savings due to APS usage, and to determine consumer purchasing and product consumption habits in order to develop a marketing plan for APS.

To develop energy and dollar savings estimates from the use of APS within a household and across the various residential markets, the following approach was used:

1. Generate a list of home electronics and determine the plug load consumption, average number of home electronics products per household, and the hours of use in active, standby, and off modes using existing data and research.
2. Collect secondary research related to APS energy savings and characterizations and consumer purchasing habits and behaviors.
3. Identify gaps in the research data available.
4. Estimate the energy savings potential on a per household basis and by market segment.

1.2. REPORT ORGANIZATION

This report is structured with the following organization:

Section 1.3 Methodology explains the methodology used to conduct the research and extrapolate and analyze data for the report.

Section 2 Types of APS outlines the various types of APS available in the marketplace.

Section 3 Consumer Electronics Market Characterization presents the typical power consumption of various consumer electronics, the frequency of consumer electronics among consumers, and the typical hours of use of various consumer electronics in the national and New York markets.

Section 4 Consumer Purchasing Habits details typical consumer behaviors and purchasing habits for electronics products and consumers' comprehension of plug load.

Section 5 Program Potential estimates the energy savings potential by implementing a program that addresses plug load savings.

Section 6 Conclusions summarizes the report and provides conclusions to the reader.

Section 7 Recommendations offers recommendations to implement and improve a plug load savings program.

1.3. METHODOLOGY

The study findings are based on primary research conducted between late October 2009 and early December 2010 by Experian® Simmons℠, a commercial information services company, supplemented with secondary research focused on product power consumption and market characterization supplied by NYSERDA and researched online. Experian independently conducts and releases quarterly reports regarding American consumer behavior. Although NYSERDA and LM were not able to choose what was included in Experian's survey, the research was used to determine the frequency of products, hours of use of products, and various consumer purchasing habits and behaviors for various market sectors that were not available through secondary research. The methodology behind the Experian data collection process is further detailed in Appendix A. The Experian report included data regarding consumer electronics and consumer purchasing behaviors for the following markets:

- National
- New York State
- New York City

In addition to the national market as a whole, national data was further segmented to account for data in the following markets:

- National County Sizes A, B, and C/D (see below)
- Type of Residence: House or Condominium/Apartment

County Size A indicates counties that are in the largest metropolitan areas across the United States. These counties account for approximately 40% of U.S. households. County Size B refers to counties that are in the second next largest set of metropolitan areas. These counties account for approximately 30% of U.S. households. County Size C refers to counties that are in the third largest set of counties after County Sizes A and B. Size C counties account for approximately 15% of U.S. households. County Size D refers to all other counties that are not A, B, or C and account for the remaining 15% of U.S. households.[2]

In Figure 1, below, the counties in New York state that are considered County Size A are outlined in orange, County Size B are outlined in blue, and county size C are outlined in green. Counties that are considered County Size D include the remainder of the counties that are not outlined on the map.

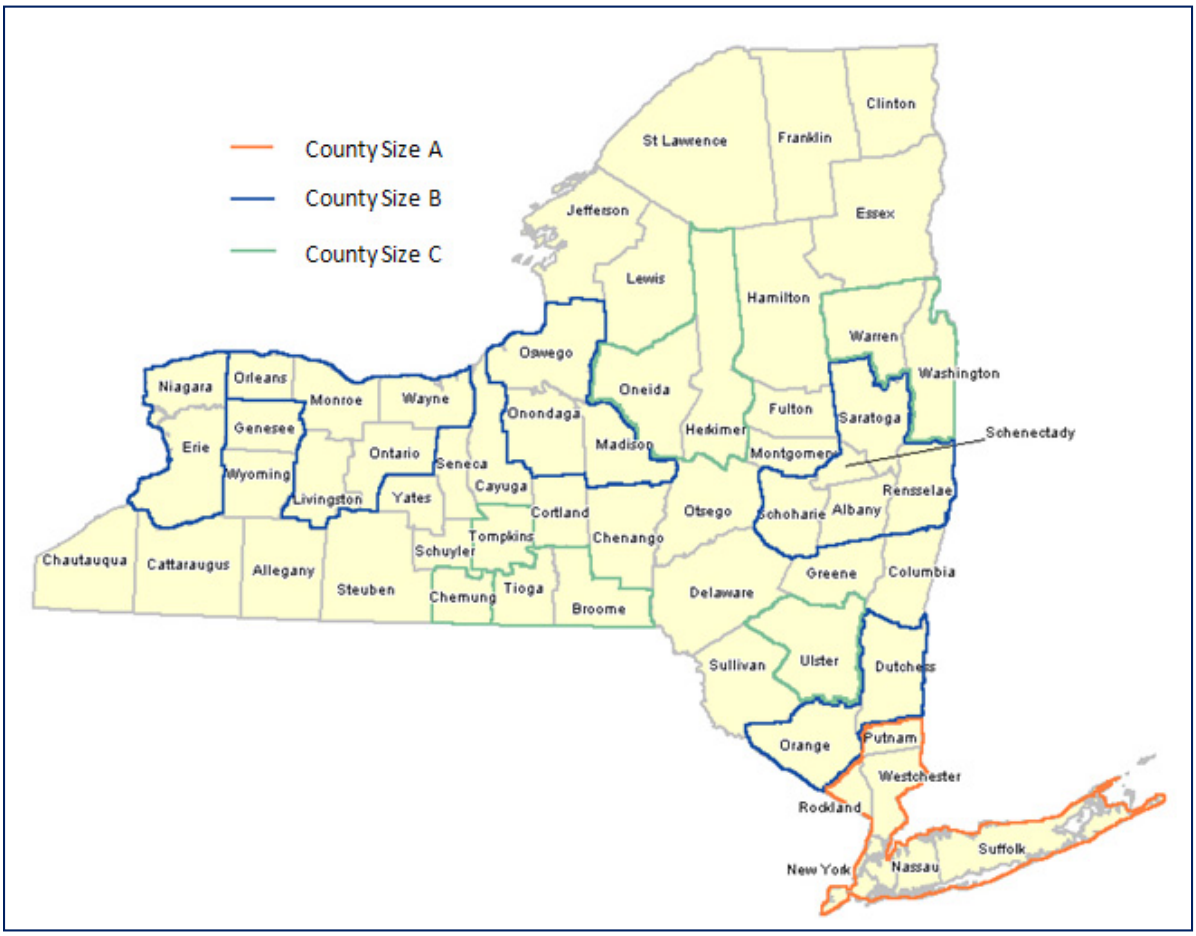

Figure 1: New York State County Sizes

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Appendix C: Experian Simmons Data Collection Methodology provides detailed information on county sizes.

In addition to determining the county sizes within New York State, the state was broken into urban, suburban, and rural areas. Using 2000 U.S. Census data, the urban metropolitan statistical areas (MSAs) within New York, the cities included in those MSAs, and the population within both the MSAs and the cities were determined. The MSAs within New York State are all of the regions in County Sizes A, B, and C in Figure 1, above. There are no MSAs in County Size D regions in New York State. The population of the New York MSAs within the NYSERDA territory and the cities within them are shown in Table 2, below.

Metropolitan Statistical Area (MSA)	MSA Population (within NYSERDA territory)	County Size	City Within MSA	City Population
New York-Newark, NY-NJ-CT	8,800,094	A	New York City	8,008,278
Buffalo, NY	976,703	B	Buffalo	292,648
Rochester, NY	694,396	B	Rochester	219,773
Albany, NY	558,947	B	Albany	95,658
Syracuse, NY	402,267	B	Syracuse	147,306
Poughkeepsie-Newburgh, NY	351,982	B	Poughkeepsie, Newburgh	58,130
Binghamton, NY	158,884	C	Binghamton	47,380
Utica, NY	113,409	C	Utica	60,651
Elmira, NY	67,159	C	Elmira	30,940
Glens Falls, NY	57,627	C	Glens Falls	14,354
Ithaca, NY	53,528	C	Ithaca	29,287
Kingston, NY	53,458	C	Kingston	23,456

Table 2: New York MSAs and City Population

Using this data, the urban areas in New York State are defined as the cities listed above in the "City within MSA" column. The suburban areas are the areas within the MSA in the "MSA" column above, but not within the city. The rural areas are the areas that are not geographically located within the listed MSAs.

As a result of this analysis, the New York market will be characterized in the following groups:

- New York State
- New York City
- Upstate New York
- Urban, Suburban, and Rural New York
- Type of Residence: House or Condominium/Apartment
- The National market will be characterized in the following groups:
  - National
  - County Sizes A, B, and C/D
  - Type of Residence: House or Condominium/Apartment

Secondary research was used to determine the power consumption of the consumer electronics products and some data regarding the frequency of products, hours of use of products, and various consumer purchasing habits and behaviors for various market sectors. Most of the data was at a national data level, while some sources were for New York State or other states, such as Vermont and Minnesota, and some sources were from other countries, such as Australia or Denmark. The overall results, however, reflect the national and New York market sectors discussed above. Nationally, the potential savings is lower for condominium/apartment residences compared to the rest of the markets. Due to the higher cost per kWh in New York, the potential savings for the New York market is higher than the national market. Additionally, the potential savings in upstate New York is slightly lower than New York City. Both the primary and secondary data was used together to produce the potential savings for the various markets by using an APS. As the most recent source, the primary data was used to determine potential savings where applicable. Whenever data could not be determined from the primary research, secondary data was used. Using all data together, potential savings estimates were calculated.

2. TYPES OF APS

APS resemble regular power strips, but include energy-saving capabilities for the connected products. Generally, the APS has one or two "master" power outlets which control the remaining outlets on the power strip and four to six controlled outlets. When a device plugged into the master outlet is in the off mode, the APS shuts power off to all of the controlled outlets. The APS will generally also have one or two uncontrolled outlets that are always energized regardless of the status of the device in the master outlet. The seven major types of APS available on the market are detailed below:

1. **Master control APS** have one master control outlet, four to six controlled outlets that will automatically power down designated devices when the control load is turned off by the user, and one or two uncontrolled outlets that are always on.
2. **Load sensing APS** sense the drop in current that occurs when the control device enters a low-power mode. A current sensing transformer attached to an outlet on the plug strip monitors the current draw of the designated device. When the current draw of this device drops below a certain threshold, power is disconnected from the controlled outlets on the plug strip. In other words, when the user turns off the device or the device powers down due to enabled power management, the smart plug strip disconnects power to the rest of the devices.
3. **Occupancy sensing APS** detect the presence or absence of a user, and automatically turn the attached equipment on and off accordingly.
4. **Timer APS** can turn equipment off based on a programmable timer.
5. **Remote control or wireless control APS** enable consumers to disconnect power to all devices plugged into the strip by using a designated remote that is programmed into the APS; i.e. TV remote control.
6. **USB interface or toggle control APS** plug into the computer via a USB connection. When the computer is turned off, a signal from the USB port shuts down the flow of power to peripherals.
7. **Informational APS** work similarly to master control APS, but have power meters and display screens that show the user the power of each device plugged into the outlets, voltage, power factors, and/or current.

The most common of the APS, the master control APS, is the type that was used to determine the data researched, analyzed, and reported in the following sections of this document. An APS typically costs approximately $35, with the five-plug strip costing approximately $30 and the seven-plug strip costing approximately $40. On average, a *standard* power strip (not an *advanced* power strip) costs approximately $15. This incremental cost difference of approximately $20 in standard versus advanced power strips will be applied when determining the overall cost savings with the use of APS.

3. CONSUMER ELECTRONICS MARKET CHARACTERIZATION

Plug loads are any electrical devices, e.g. televisions, which draw power through an electric outlet. The plug loads for household electronics in the United States account for almost 20% of all residential energy and that percentage is anticipated to increase as households purchase more electronics (California 2008). As depicted in Figure 2 below, of those household electronics, entertainment electronics, such as televisions, DVD players, video game consoles, etc., account for approximately 60% of the household plug load consumption. Information technology or home office products, such as computers and printers, account for the next highest household electronics plug load consumption at approximately 30%. A summary of the types of equipment making up the household electronics plug load consumption is detailed below.

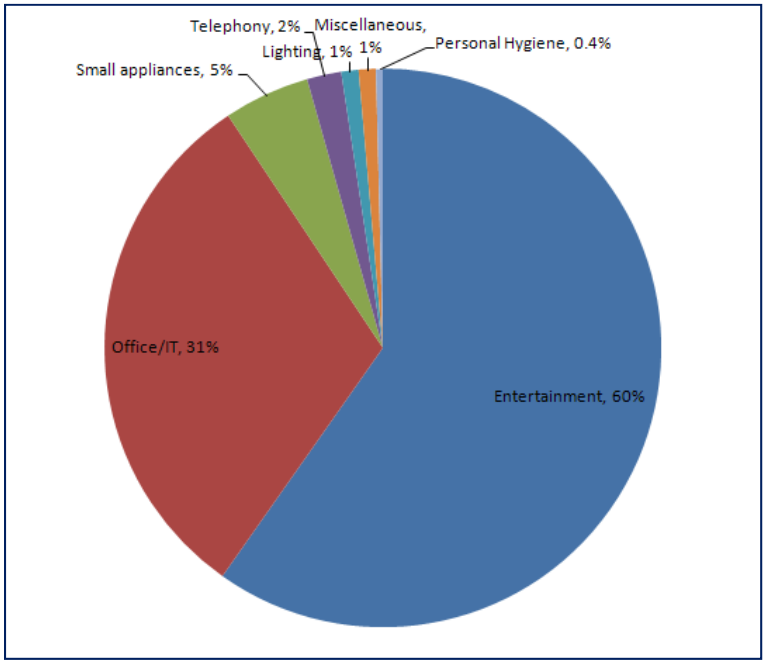

Figure 2: U.S. Household Electronics Plug Load Consumption

The following subsections describe the power consumption of various consumer electronics as well as the frequency and usage of products in households. The power consumption for each electronic product has been determined for when the device is plugged into a regular power strip or wall outlet, not an APS. As a result, there is power consumption listed for electronics in the standby and off modes. It is important to remember that if plugged into an APS, these devices would automatically be shut off and would use zero power consumption. The markets shown are characterized nationally and for New York State.

3.1. TELEVISIONS

As shown in Table 3, below, the average household in the United States has approximately 2.9 televisions with an average screen size of 32-39 inches. Cathode ray tube (CRT) televisions are the most prevalent type of television in homes nationally. Televisions on average are turned on for approximately 5.3 hours per day and are turned off for approximately 18.7 hours per day.

	Average Number of Televisions per Household	Average Hours of Use per Television per Day		Average Screen Size Television per Household
		Active	Off	
National:				
National	2.9	5.3	18.7	32-39 Inches
County Size A	2.9	5.3	18.7	40-49 Inches
County Size B	3.0	6.3	17.7	32-39 Inches
County Size C&D	2.8	4.0	20.0	32-39 Inches
House	3.0	5.7	18.3	32-39 Inches
Apartment/Condo	2.1	3.5	20.5	32-39 Inches
New York:				
New York State	2.7	4.9	19.1	32-39 Inches
New York City	2.6	4.9	19.1	32-39 Inches
Upstate New York	2.8	4.9	19.1	32-39 Inches
Urban New York	2.9	5.4	18.6	32-39 Inches
Suburban New York	2.9	5.9	18.1	32-39 Inches
Rural New York	2.9	5.0	19.0	32-39 Inches
House	2.8	4.9	19.1	32-39 Inches
Apartment/Condo	2.7	4.9	19.1	21-31 Inches

Table 3: Average Number and Size of Televisions per Household, National and New York

Since, on average, there is more than one television found per household, the percent of each type of television found in households is normalized[3] in order to compare the different types. Figure 3, below, shows the normalized percentage of each type of television that households own in each national segment. Figure 4, following, shows the normalized percentage of each type of television that households own in each New York State segment. Households in each segment have more CRT televisions than any other type of television and account for approximately half of the televisions in each segment. The second most popular type of television found in households are liquid crystal display (LCD) televisions, followed by plasma televisions, and finally big screen projection televisions.

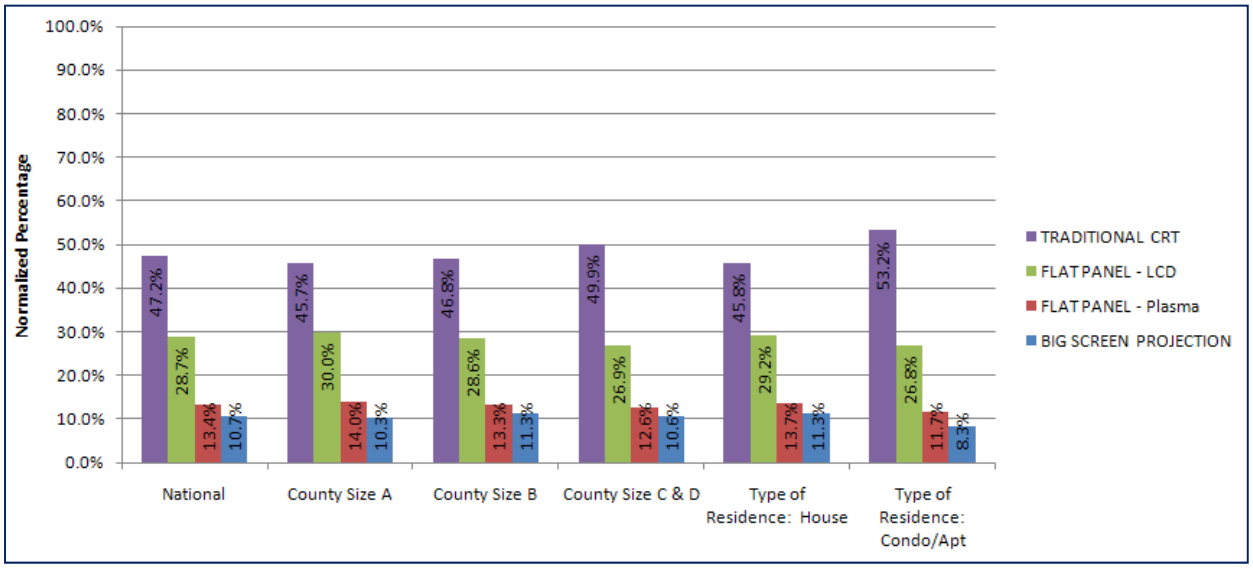

Figure 3: Types of Televisions in U.S. Households

[3] Normalization is the process of isolating statistical error in repeated measured data. The normalized percentages were determined with the equation $\frac{\#\ Television\ Type}{\sum \#\ Television\ Types}$ where the television types are CRTs, LCDs, plasmas, and big screen projections.

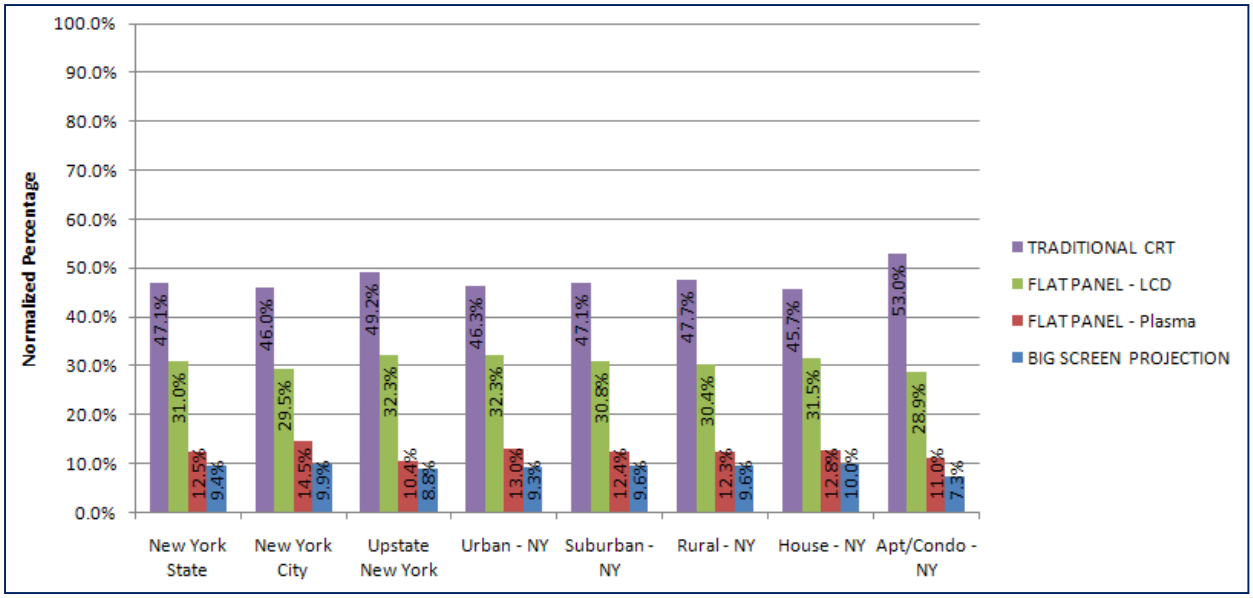

Figure 4: Types of Televisions in New York State Households

For each television type and various sizes, the active, standby, and off mode power use is displayed in Table 4, below. The range of television sizes often depends on the television type. For example, most plasma televisions are 42" or larger, and thus there are no data displayed in the table for smaller sizes. Types of televisions and the respective sizes for which data are not available are colored gray in Table 4. Power consumptions labeled NA indicate that, although there are television types in the respective size in the table, secondary data was not available. The operating modes are defined as:

- **Active Mode:** The television is turned on and is displaying an image.
- **Standby Mode:** The television is turned off by the remote control and is not displaying an image but still remains plugged in.
- **Off Mode:** The television is turned off by a power button/switch on the television and is not displaying an image but still remains plugged in.

			Type			
			CRT	LCD	Plasma	Projection
Size	Average —All Sizes	Active	79.3	69.9	245.9	230
		Standby	5.3	2.2	0.9	4.4
		Off	1.6	0.5	0.6	7.0
	<18"	Active	47.2	35.1		
		Standby	3.1	0.6		
		Off	2.6	<0.1		
	18"-25"	Active	53.7	64.5 (Non ENERGY STAR) 58.3 (ENERGY STAR)		
		Standby	1.7	0.3		
		Off	NA	<0.1		
	26"-31"	Active	79.6	72.7 (Non ENERGY STAR) 62 (ENERGY STAR)		
		Standby	3.8	<1		
		Off	3.0	0.8		

			Type			
			CRT	LCD	Plasma	Projection
	32”	Active	79.9	155.9 (Non ENERGY STAR) 65 (ENERGY STAR)		165.6
		Standby	5.3	2.2 (Non ENERGY STAR) 0.4 (ENERGY STAR)		4.4
		Off	NA	0.5 (Non ENERGY STAR)		7.0
	42”-50”	Active		102.4 (ENERGY STAR)	307.0 (Non ENERGY STAR) 134.0 (ENERGY STAR)	
		Standby		0.3 (ENERGY STAR)	3.1 (Non ENERGY STAR) 0.4 (ENERGY STAR)	
		Off		NA	0.6 (Non ENERGY STAR)	
	50”	Active			407.0 (Non ENERGY STAR) 226.8 (ENERGY STAR)	213.7 (ENERGY STAR)
		Standby			3.1 (Non ENERGY STAR) 0.4 (ENERGY STAR)	2.2 (ENERGY STAR)
		Off			0.6 (Non ENERGY STAR)	NA

Table 4: Power Consumption of Types of Televisions (Watts) in U.S. Households

3.2. TELEVISION PERIPHERALS

A variety of television peripherals contribute to the power consumption of home entertainment products. Television peripherals may include, but are not limited to, set top boxes, media players, and gaming systems.

3.2.1 Set Top Boxes

As shown in Table 5, below, set-top boxes (STBs) operate in households either to receive and display television signals transmitted by cable and satellite video service providers or as stand-alone digital video recorder devices. The average household in the United States owns approximately 1.1 cable STBs and approximately 0.5 satellite STBs. The off mode for STBs refers to an “off-ready” mode. This mode indicates that the STB is plugged in and switched off by the user, but continues to receive and/or send data to the service provider (Roth 2007). Cable STBs are turned on for approximately 7.5 hours per day and are turned off for approximately 16.5 hours per day. Satellite STBs are turned on for approximately 8.9 hours per day and are turned off for approximately 15.1 hours per day. Standalone DVRs are turned on for approximately 5.7 hours per day and are turned off for approximately 18.3 hours per day.[4]

[4] Note that the hours active per day for set top boxes is higher than the average hours per day for televisions. This may be due to users turning off televisions but leaving the set top boxes turned on.

	Average Number per Household			Average Hours of Use per STB per Day	
	Cable STB	Satellite STB	Stand alone DVR STB	Active	Off
National:					
National	1.1	0.5	0.1	Cable: 7.5 Satellite: 8.9 DVR: 5.7	Cable: 16.5 Satellite: 15.1 DVR: 18.3
County Size A	0.7	0.4	0.1	Cable: 7.5 Satellite: 9.0 DVR: 5.7	Cable: 16.5 Satellite: 15.1 DVR: 18.3
County Size B	0.7	0.4	0.1	Cable: 9.0 Satellite: 10.6 DVR: 6.8	Cable: 15.0 Satellite: 13.4 DVR: 17.2
County Size C&D	0.4	0.6	0.1	Cable: 5.7 Satellite: 6.7 DVR: 4.3	Cable: 18.3 Satellite: 17.3 DVR: 19.7
House	1.2	0.6	0.1	Cable: 8.1 Satellite: 9.6 DVR: 6.1	Cable: 15.9 Satellite: 14.4 DVR: 17.9
Apartment/Condo	0.9	0.3	0.1	Cable: 4.9 Satellite: 5.8 DVR: 3.7	Cable: 19.1 Satellite: 18.2 DVR: 20.3
New York:					
New York State	1.6	0.2	0.1	Cable: 6.9 Satellite: 8.2 DVR: 5.3	Cable: 17.1 Satellite: 15.8 DVR: 18.7
New York City	0.8	0.3	0.1	Cable: 6.9 Satellite: 8.2 DVR: 5.3	Cable: 17.1 Satellite: 15.8 DVR: 18.7
Upstate New York	2.3	0.1	0.1	Cable: 6.9 Satellite: 8.2 DVR: 5.3	Cable: 17.1 Satellite: 15.8 DVR: 18.7
Urban New York	0.7	0.4	0.1	Cable: 7.6 Satellite: 9.1 DVR: 5.8	Cable: 16.4 Satellite: 14.9 DVR: 18.2
Suburban New York	0.7	0.4	0.1	Cable: 8.3 Satellite: 9.9 DVR: 6.3	Cable: 15.7 Satellite: 14.1 DVR: 17.7
Rural New York	0.6	0.5	0.1	Cable: 7.0 Satellite: 8.3 DVR: 5.3	Cable: 17.0 Satellite: 15.7 DVR: 18.7
House	2.0	0.2	0.1	Cable: 6.9 Satellite: 8.2 DVR: 5.3	Cable: 17.1 Satellite: 15.8 DVR: 18.7
Apartment/Condo	1.2	0.3	0.1	Cable: 6.9 Satellite: 8.2 DVR: 5.3	Cable: 17.1 Satellite: 15.8 DVR: 18.7

Table 5: Average Number and Hours of Use of Set Top Boxes per Household, National and New York

For each STB, the active, standby, and off modes are defined as:

- **Active Mode:** The STB is turned on and provides video signal processing, DVR recording or playing, and provides signals to television(s).
- **Standby Mode:** The STB is turned on and provides signal processing and may be downloading data, but is not communicating with the television unit (the television is turned off while the STB is turned on).[5]
- **Off Mode:** The STB is turned off by the user but still remains plugged in. When in this mode, the STB continues to receive data from and send data to the service provider.

[5] There is very little difference between the power consumption in active mode versus standby mode. In both modes, the set top box is still turned on, so the power consumption remains about the same. The only big difference is the mode of the television that the STB is connected to.

Type	Power Active	Power Standby	Power Off
STB—Average	12.7	10.35	NA
STB—Cable	24	25	16
STB—Cable with DVR	44	45	43
STB—Satellite	18	10	15
STB—Satellite with DVR	30	27	28
STB—Stand alone DVR	27	27	27

Table 6: Power Consumption of Set Top Boxes (Watts)

3.2.2 Media Players

The average household in the United States owns approximately 0.9 standalone DVD Players and approximately 1.2 VCRs. Still, only about 48% of consumers who own VCRs still claim to use them. Therefore, there are approximately 0.6 VCRs in use per household in the United States. For the various types of media players available, the average number per household, the hours of use per day, and data on the power draw was collected and is displayed in Table 7, below. Other than the national market, data was not available for the hours of use for each media player. Rather, the average hours in each mode per day is for an average media player and is applied to each media player in savings calculations.

	Average Number per Household					Average Hours of Use per Media Player per Day		
	DVD Player	DVDR	VCR	DVD/ VCR Player	BluRay Player	Active	Standby	Off
National:								
National	0.9	0.3	0.6	0.1	0.2	DVD Player: 0.7 DVDR: 0.7 VCR: 0.4 DVD/VCR: 1.2 BluRay: 0.7	DVD Player: 2.5 DVDR: 2.5 VCR: 2.2 DVD/VCR: 2.5 BluRay: 2.5	DVD Player: 20.8 DVDR: 20.8 VCR: 21.4 DVD/VCR: 20.4 BluRay: 20.8
County Size A	0.9	0.4	0.5	0.1	0.2	0.6	1.7	21.7
County Size B	0.9	0.3	0.6	0.1	0.2	0.7	2.0	21.3
County Size C&D	0.8	0.3	0.6	0.1	0.2	0.4	1.0	22.6
House	0.9	0.4	0.6	0.1	0.2	0.6	1.6	21.8
Apartment/Condo	0.7	0.2	0.4	0.1	0.2	0.4	1.2	22.3
New York:								
New York State	1.3	0.3	0.5	0.1	0.2	0.6	1.7	21.7
New York City	1.7	0.3	0.4	0.1	0.1	0.6	1.7	21.7
Upstate New York	0.9	0.3	0.5	0.1	0.1	0.6	1.8	21.6
Urban New York	0.9	0.4	0.5	0.1	0.2	0.6	1.7	21.7
Suburban New York	0.9	0.3	0.6	0.1	0.2	0.7	1.8	21.5
Rural New York	0.9	0.3	0.6	0.1	0.2	0.5	1.4	22.1
House	1.1	0.3	0.5	0.1	0.1	0.6	1.7	21.6
Apartment/Condo	1.5	0.3	0.5	0.1	0.1	0.6	1.7	21.7

Table 7: Average Number and Hours of Use of Media Players per Household, National and New York

For each media playing device, the active, standby, and off modes are defined as:

- **Active Mode:** The media device is in use
- **Standby Mode:** The media device is on, but not in use
- **Off Mode:** The media device is turned off, but remains plugged in.

Type	Power Active	Power Standby	Power Off
DVD Player	10	5	2
DVD Player/Recorder	21	7	3
VCR	13	6	3
DVD/VCR Player	15	8	4
BluRay Player	14	7	0.1

Table 8: Power Consumption of Media Players (Watts)

3.2.3 Gaming Systems

The average household in the United States owns approximately 0.7 gaming systems. Of the U.S. households that own a video game console, the percentages in Figure 5 indicate the normalized percentage of households that own each specific type of console. The Nintendo Wii is the most prevalent of all the consoles, and the Nintendo Wii, Sony PlayStation 2, and the Microsoft Xbox 360 together make up over half of the consoles found in U.S. households.

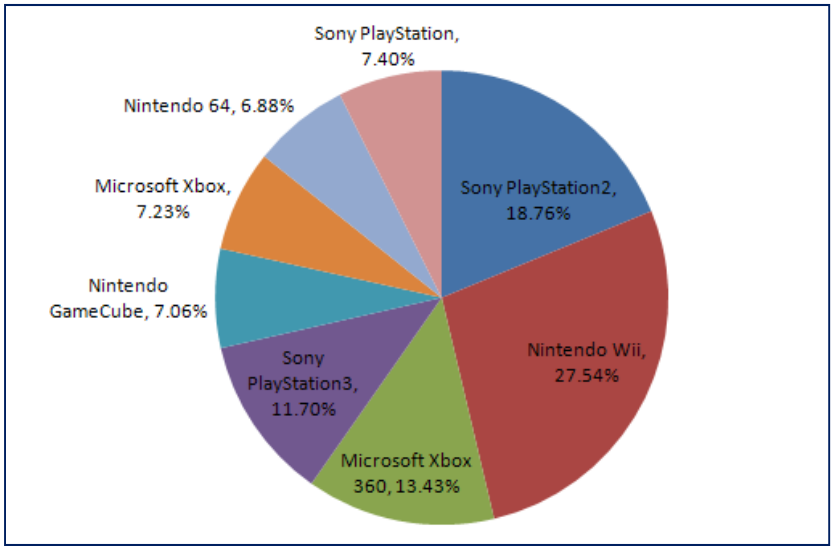

Figure 5: Video Game Consoles in U.S. Households

Nationally, gaming systems are active for approximately 1.1 hours per day, in standby for approximately 1.5 hours per day and are turned off for approximately 21.4 hours per day. Table 9, below, shows the average number of all video game consoles and specific consoles, as well as the average hours of use per day. Other than the Microsoft Xbox, the gaming systems with small percentages of household penetration are not included for further calculations and analysis. As with VCRs, households owning these systems are a small percentage, but they have been phased out over the years and are often no longer used. The average hours of use shown per day are for an average gaming system and not separated out by each type of gaming system, assuming that the user of one system would use a different system for approximately the same amount of time.

	Average Number per Household						Average Hours of Use per Video Game Console per Day		
	Total	PlayStation 2	PlayStation 3	Nintendo Wii	Xbox	Xbox 360	Active	Standby	Off
National:									
National	.58	.11	.07	.16	.04	.08	1.1	1.5	21.4
County Size A	.55	.10	.07	.16	.04	.08	1.0	1.5	21.5
County Size B	.58	.11	.07	.17	.04	.08	1.0	1.5	21.5
County Size C&D	.62	.12	.07	.16	.05	.07	0.9	1.5	21.6
House	.60	.11	.07	.18	.04	.08	1.2	1.5	21.3
Apartment/Condo	.52	.10	.07	.10	.04	.08	0.6	1.6	21.9
New York:									
New York State	.55	.10	.08	.14	.03	.09	1.4	1.5	21.1
New York City	.56	.11	.07	.13	.05	.07	1.0	1.5	21.5
Upstate New York	.50	.09	.09	.15	.01	.11	1.8	1.5	20.7
Urban New York	.56	.10	.07	.13	.04	.08	1.0	1.5	21.5
Suburban New York	.53	.08	.10	.13	.04	.11	1.0	1.5	21.5
Rural New York	.55	.08	.10	.12	.04	.10	1.0	1.5	21.5
House	.56	.05	.08	.15	.02	.09	1.6	1.5	20.9
Apartment/Condo	.50	.05	.07	.08	.04	.08	1.2	1.5	21.3

Table 9: Average Number and Hours of Use of Video Game Consoles per Household, National and New York

For each video game console, the active, standby, and off modes are defined as

- **Active Mode:** The gaming console is turned on with a disc loaded and the user is actually playing
- **Standby Mode:** The gaming console is turned on with a disc loaded but is not being played by the user. This may occur when the game is on the main menu screen, paused, or the user is just not actively playing while the game is turned on[6]
- **Off Mode:** The gaming console is turned off either manually by the user or turned off automatically with a power management feature built into the gaming system but still remains plugged in.

Type	Power Active	Power Standby	Power Off
PlayStation2	18	17	0.2
PlayStation3	150.1	152.9	1.1
Nintendo Wii	16.4	10.5	1.9
Xbox	68	68	2
Xbox 360	118.8	117.5	3.1

Table 10: Power Consumption of Gaming Systems (Watts)

3.2.4 Audio Equipment

Audio Equipment is often used along with other entertainment electronics such as televisions and media players. Home theater systems with surround sound: A home theater system is a system is defined as having surround sound (speakers). The average number of audio equipment devices per household and average hours of use is shown in Table 11, below. The audio equipment specified in the table includes receivers, subwoofers, and speakers, which are estimated to be the same number and hours of use per household.

[6] Note that the power consumption of the various video game consoles are close to the same in active versus standby modes.

	Average Number per Household	Average Hours of Use per Audio Equipment Item per Day	
		Active	Off
National:			
National	0.17	6.0	18.0
County Size A	0.17	6.0	18.0
County Size B	0.16	7.1	16.9
County Size C&D	0.16	4.5	19.5
House	0.18	6.5	19.5
Apartment/Condo	0.11	4.0	20.0
New York:			
New York State	0.16	5.6	18.4
New York City	0.16	5.6	18.4
Upstate New York	0.16	5.6	18.4
Urban New York	0.17	6.1	17.9
Suburban New York	0.16	6.7	17.3
Rural New York	0.16	5.7	18.3
House	0.16	5.6	18.4
Apartment/Condo	0.16	5.6	18.4

Table 11: Average Number and Hours of Use of Audio Equipment per Household, National and New York

For each audio equipment item, the active, standby, and off modes are defined as:

- **Active Mode:** The audio product is turned on and actively playing sound
- **Standby Mode:** The audio product is turned on but not playing any sound
- **Off Mode:** The audio product is turned off and not playing any sound, but is still plugged in.

Type	Power Active	Power Standby	Power Off
AV Receiver	45.2	19.2	3.1
Powered Subwoofer	10.1	7.8	0.6
Surround Sound Speakers	6.0	3.0	0.0

Table 12: Power Consumption of Audio Equipment (Watts)

3.3. COMPUTERS

The average household in the United States has approximately 1.3 computers. Of those 1.3 computers, there are approximately 0.8 desktop models and 0.5 laptop models per household. The average number of all computers, desktops, and laptops as well as the average hours of use per day in active, standby, and off modes for various segments nationally and in New York State is shown in Table 13, below.

	Average Number per Household			Average Hours of Use per Computer per Day		
	All Computers	Desktops	Laptops	Active	Standby	Off
National:						
National	1.3	0.8	0.5	3.2	4.1	16.7
County Size A	1.3	1.0	0.3	3.5	4.6	15.9
County Size B	1.3	1.0	0.3	3.5	4.6	15.9
County Size C&D	1.3	1.0	0.3	1.8	2.3	20.0
House	1.5	0.9	0.6	3.6	4.6	15.8
Apartment/Condo	1.0	0.5	0.5	1.3	1.7	21.0
New York:						
New York State	1.2	0.7	0.5	4.0	5.2	14.8
New York City	1.2	0.6	0.6	3.3	4.3	16.3
Upstate New York	1.3	0.8	0.5	4.7	6.0	13.3
Urban New York	1.3	1.0	0.3	3.5	4.5	15.9
Suburban New York	1.3	1.0	0.3	3.4	4.4	16.3
Rural New York	1.3	1.0	0.3	2.6	3.4	18.1
House	1.2	0.7	0.5	4.4	5.7	13.9
Apartment/Condo	1.2	0.6	0.6	3.7	4.8	15.5

Table 13: Average Number and Hours of Use of Computers per Household, National and New York

For desktop and laptop computers, the active, standby, and off modes are defined as:

- **Active Mode:** The computer is turned on and actively being used or is not being used but has not yet entered into a standby mode
- **Idle Mode:** The computer is turned on and has entered a power saving mode
- **Off Mode:** The computer is turned off but is still plugged in.

Type	Power Active	Power Standby	Power Off
Desktop	71.5	11.6	3.3
Laptop	29.7	7.6	4.4

Table 14: Power Consumption of Computers (Watts)

3.4. COMPUTER PERIPHERALS

A variety of computer peripherals, both required and optional for computer use, contribute to the power consumption of home office products. Some computer peripherals include, but are not limited to: monitors, modems, routers, printers, and facsimile (fax) machines.

3.4.1 Monitors

The average household in the United States has approximately 0.8 monitors, assuming that every desktop computer has a monitor. On average, monitors are turned on for approximately 5.1 hours per day, standby for approximately 2.4 hours per day and are turned off for approximately 16.5 hours per day.[7]

[7] Not that, on average, monitors are in active mode longer than computers. Users may be turning off their computers but leaving the monitor turned on.

	Average Number per Household			Average Hours of Use per Monitor per Day		
	Monitors	CRT Monitors	LCD Monitors	Active	Standby	Off
National:						
National	0.8	0.2	0.6	5.1	2.4	16.5
County Size A	1.0	0.2	0.8	5.7	2.7	15.6
County Size B	1.0	0.2	0.8	5.6	2.6	15.7
County Size C&D	1.0	0.2	0.8	2.8	1.3	19.9
House	0.9	0.2	0.7	5.7	2.7	15.6
Apartment/Condo	0.5	0.1	0.4	2.1	1.0	20.9
New York:						
New York State	0.8	0.2	0.6	6.4	3.0	14.6
New York City	0.6	0.1	0.5	5.3	2.0	16.7
Upstate New York	1.0	0.2	0.8	7.4	4.0	12.6
Urban New York	1.0	0.2	0.8	5.6	2.6	15.8
Suburban New York	1.0	0.2	0.8	5.4	2.5	16.1
Rural New York	1.0	0.2	0.8	4.1	1.9	17.9
House	0.9	0.2	0.7	7.0	3.6	13.4
Apartment/Condo	0.7	0.1	0.6	5.9	2.6	15.5

Table 15: Average Number and Hours of Use of Monitors per Household, National and New York

For each monitor, the active, standby, and off modes are defined as:

- **Active Mode:** The monitor is turned on and displaying an image
- **Standby Mode:** The monitor is turned on but is not being used. The monitor enters a reduced power state after a certain amount of time of no activity. The monitor returns to active when it senses activity of the user
- **Off Mode:** The monitor is turned off and not displaying an image but still remains plugged in. The power switch must be used to put the monitor back into active mode.

Type	Power Active	Power Standby	Power Off
CRT Monitor	65.7	7.6	1.5
LCD Monitor	28.0	1.9	1.1

Table 16: Power Consumption of Monitors (Watts)

3.4.2 Modems and Routers

There is an average of approximately 0.33 modems and 0.28 routers per household in the United States. If the household owns these two items, they are generally turned on 24 hours a day and are never in standby mode or turned off.

	Average Number per Household	
	Modems	Routers
National		
National	0.33	0.28
County Size A	0.38	0.31
County Size B	0.33	0.28
County Size C&D	0.27	0.23
House	0.36	0.31
Apartment/Condo	0.22	0.16
New York		
New York State	0.33	0.27
New York City	0.41	0.34
Upstate New York	0.50	0.30
Urban New York	0.37	0.31
Suburban New York	0.34	0.28
Rural New York	0.30	0.26
House	0.48	0.31
Apartment/Condo	0.44	0.33

Table 17: Average Number of Modems and Routers per Household, National and New York

Table 18, below, shows the power consumption for modems and routers. Modems may be cable modems, which deliver the Internet in the form of cable, or DSL modems, which connect a computer or router to a telephone circuit that has digital subscriber line service. Routers do not have a standby mode, but some modems have a standby button that will cause the modem to stop functioning without disconnecting the unit, eliminating the need for a startup procedure when put back into active mode. For each modem, the active, standby, and off modes are defined as:

- **Active Mode:** The modem is turned on and actively transmitting an internet connection
- **Standby Mode:** The modem is switched into standby by the user and is not transmitting an internet connection, but does not disconnect the unit
- **Off Mode:** The modem is turned off.

Type	Power Active	Power Standby	Power Off
Modem—Average	6.4	4.6	2.7
Cable Modem	7.0	5.6	3.8
DSL Modem	6.3	4.8	1.4
Router	10.5		1.7

Table 18: Power Consumption of Modems and Routers (Watts)

3.4.3 Printers

As shown in Table 19, below, the average household in the United States has approximately 0.62 printers (0.46 inkjet printers and 0.16 laser printers). On average, printers are turned on (meaning that the printer is turned on and actively printing) for approximately 0.14 hours per day; on standby (meaning that the printer is turned on but is not being used) for approximately 4.4 hours per day; and turned off for approximately 19.5 hours per day. It is assumed that the hours in each mode do not vary greatly by region or residence type, and thus remain the same for all segments.

	Average Number per Household		
	All Printers	Inkjet	Laser
National:			
National	0.62	0.46	0.16
County Size A	0.63	0.46	0.17
County Size B	0.63	0.48	0.16
County Size C&D	0.57	0.44	0.13
House	0.67	0.50	0.17
Apartment/Condo	0.43	0.32	0.11
New York:			
New York State	0.60	0.42	0.18
New York City	0.52	0.36	0.16
Upstate New York	0.68	0.48	0.20
Urban New York	0.63	0.46	0.17
Suburban New York	0.63	0.47	0.16
Rural New York	0.60	0.45	0.15
House	0.65	0.46	0.19
Apartment/Condo	0.56	0.39	0.17

Table 19: Average Number of Printers per Household, National and New York

For each printer, the active, standby, and off mode power use is recorded in Table 20, below. Laser printers use much more power than inkjet printers in all modes. The operating modes are defined as:

- **Active Mode:** The printer is turned on and actively printing
- **Standby Mode:** The printer is turned on but not printing
- **Off Mode:** The printer is turned off but still remains plugged in.

Type	Power Active	Power Standby	Power Off
Printer—Average	12.5	4.3	NA
Printer—Inkjet	9.1	2.5	1.3
Printer—Laser	173.4	9	3.3

Table 20: Power Consumption of Printers (Watts)

3.4.4 Facsimile (Fax) Machines

As listed in Table 21, below, the average household in the United States has approximately 0.23 fax machines. Although a household may own a fax machine, most are no longer used. Most households have <0.1 fax machines that are actually used. For the <0.1 fax machines that are used, they are only active for 0.24 hours per day, on standby (meaning that the fax machine is turned on but not actively faxing) for 0.5 hours per day, and are turned off for approximately 23.3 hours per day. It is assumed that the hours in each mode do not vary greatly by region or residence type, and thus remain the same for all segments.

	Average Number of Fax Machines per Household	Average Number of Fax Machines per Household in Use
National:		
National	0.23	<0.1
County Size A	0.29	<0.1
County Size B	0.23	<0.1
County Size C&D	0.16	<0.1
House	0.25	<0.1
Apartment/Condo	0.17	<0.1
New York:		
New York State	0.26	<0.1
New York City	0.28	<0.1
Upstate New York	0.24	<0.1
Urban New York	0.28	<0.1
Suburban New York	0.24	<0.1
Rural New York	0.20	<0.1
House	0.29	<0.1
Apartment/Condo	0.20	<0.1

Table 21: Average Number of Fax Machines per Household, National and New York

For both inkjet and laser fax machines, the active, standby, and off mode power use was researched and is recorded in Table 22, below. The operating modes are defined as:

- **Active Mode:** The fax machine is turned on and actively faxing
- **Standby Mode:** The fax machine is turned on but not faxing
- **Off Mode:** The fax machine is turned off but still remains plugged in.

Type	Power Active	Power Standby	Power Off
Fax Machine—Inkjet	6.2	6.0	5.3
Fax Machine—Laser	28.4	5.3	2.2

Table 22: Power Consumption of Fax Machines (Watts)

3.4.5 Other

Several other home office electronics, including a scanner, copier, computer speakers, and external hard drive, can be plugged into an APS to reduce standby and off energy consumption. Table 23, below, shows the average number of each of these types of electronics per household and the average number of hours that computer speakers are spent in each mode. Hours of use data for scanners, copiers, and external hard drives are not shown since scanners and copiers are almost always turned off and external hard drives are almost always turned on for all national and New York segments.

	Average Number per Household				Average Hours of Use per Speaker per Day	
	Scanner	Copier	External Hard Drive	Speakers	Active	Off
National:						
National	0.17	0.09	0.05	0.43	5.3	18.7
County Size A	0.19	0.07	0.07	0.44	5.9	18.1
County Size B	0.17	0.18	0.07	0.44	5.8	18.2
County Size C&D	0.15	0.10	0.08	0.42	2.9	21.1
House	0.19	0.10	0.08	0.46	5.9	18.1
Apartment/Condo	0.11	0.05	0.07	0.32	2.2	21.8
New York:						
New York State	0.14	0.10	0.05	0.40	6.6	17.4
New York City	0.15	0.05	0.20	0.38	5.5	18.5
Upstate New York	0.05	0.15	0.05	0.41	7.7	16.3
Urban New York	0.19	0.08	0.07	0.43	5.8	18.2
Suburban New York	0.17	0.15	0.07	0.44	5.6	18.4
Rural New York	0.16	0.12	0.07	0.43	4.3	19.7
House	0.07	0.13	0.08	0.40	7.3	16.7
Apartment/Condo	0.12	0.08	0.16	0.39	6.1	17.9

Table 23: Average Number and Hours of Use of Other Home Office Electronics per Household, National and New York

For these home office products, the active, standby, and off mode power use is displayed in Table 24, below.

Type	Power Active	Power Standby	Power Off
Scanner	10.8	3.6	2.1
Copier	9.6	2.8	1.5
Computer Speakers	11.8	3.7	2.3
External Hard Drive	11.1	7.4	3.0

Table 24: Power Consumption of Other Home Office Products (Watts)

3.5. AUDIO EQUIPMENT

A list of audio equipment found in households across the nation and their power consumption in active, standby, and off modes is shown in Table 25, below. Frequently, most of the audio equipment is not connected to a television or computer, and is thus not accounted for when calculating the energy and money that can be saved by using an APS.

Type	Power Active	Power Standby	Power Off
Amplifier	45.8	12.5	0.2
Audio Interface	9.7	0	NA
Boom Box	5.1	2.5	NA
CD Player	9.9	3.8	5.0
CD Recorder	11.7	0	NA
Compact Stereo	17.4	6.5	4.3
Ipod Dock	31.2	NA	NA
Karaoke Machine	5.0	NA	NA
Radio	7.95	1.6	NA
Sound System	96.2	0	NA
Stereo/Cube	36.7	NA	NA
Tuner	7.3	6.3	1.1
Turntable	24.0	2.1	0.2
Weather Radio	1.6	NA	NA

Table 25: Power Consumption of Audio Equipment (Watts)

4. CONSUMER PURCHASING HABITS

A general understanding of consumer purchasing behaviors and habits for home electronic products will help to design a cost effective program to promote the sales of APS. Consumer behaviors, and habits are better understood by analyzing the source of purchase, purchase influencers, stewardship of home electronics, resources for decision, and the role of energy efficiency in purchasing decisions.

4.1. SOURCE OF PURCHASE

Wal-Mart, Kroger, and Target were ranked the top mass-market retailers based on 2010 sales (Schulz 2011). Mass-market retailers are considered to be large, big-box stores that sell general merchandise. Best Buy, Dell, and Hewlett Packard were ranked as the top three consumer electronics retailers based on 2010 sales (Dealerscope 2011). Consumer electronics retailers are retailers that specialize in consumer electronics. Table 26, below, shows the top ten mass-market retailers and the top ten consumer electronics retailers ranked by sales volume. Best Buy, Wal-Mart, and Target appear in both the mass-market retailers list and the consumer electronics retailers list as top retailers.

Rank	Top Ten Mass-Market Retailers (2009)	Top Ten Consumer Electronics Retailers (2010)
1	Wal-Mart	Best Buy
2	Kroger	Dell
3	Target	Hewlett Packard
4	Walgreens	Wal-Mart
5	The Home Depot	CDW
6	Costco	Amazon.com
7	CVS Caremark	Apple Computer Retail Stores
8	Lowe's	Staples
9	Best Buy	GameStop
10	Sears Holdings	Target

Table 26: 2009 and 2010 U.S. Top Retailers

The top ten consumer electronics manufacturers are shown in Table 27, below (Salisonline). The table indicates whether each manufacturer produces home entertainment equipment and/or office/information technology (IT) equipment.

Manufacturer	Home Entertainment	Office/IT
Samsung	X	X
Hewlett-Packard (HP)		X
Sony	X	X
LG	X	X
Toshiba	X	X
Panasonic	X	X
Apple		X
Dell		X
Acer		X
Sharp	X	X

Table 27: Top U.S. Consumer Electronics Manufacturers

4.2. INFLUENCERS

When shopping for and purchasing consumer electronics, price is the largest influencer among U.S. consumers. Other high ranking influencers include warranties, product features, and size. The Consumer Electronics Association surveyed 960 U.S. adults in September of 2008 asking what features will be important when making their next consumer electronics purchase decision. Figure 6, below, displays the result of the survey, indicating that price is the largest influencer of purchase decisions (Herbert 2009).

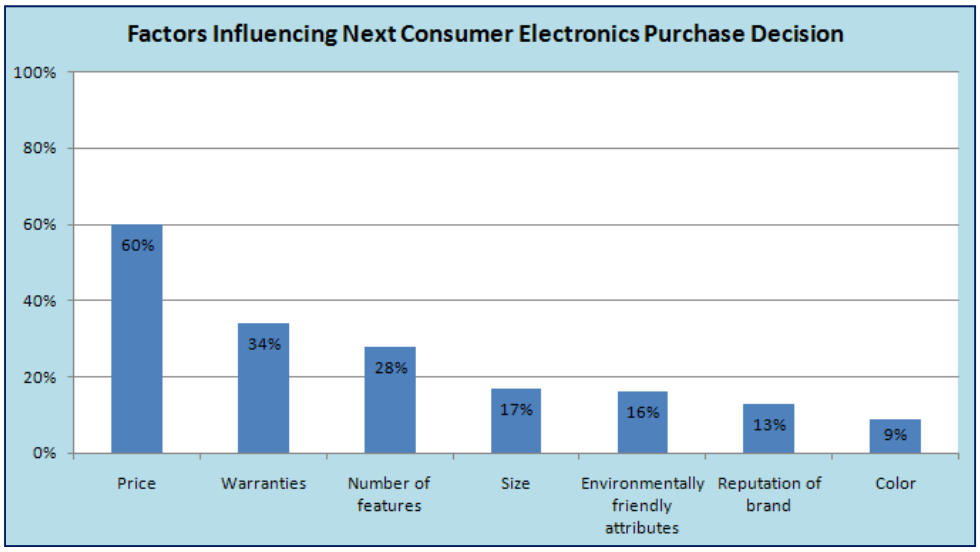

Figure 6: Influencing Next Consumer Electronics Purchase Decision

Sixty percent of consumers claim that price will influence their next consumer electronics purchase decision. Ranking as the fifth highest influencing factor, 16% of consumers claim that environmentally friendly attributes will influence their next consumer electronics purchasing decision. While environmentally friendly attributes are expected to include energy saving products, they may also include factors such as less pollution, recyclable, and other environmentally friendly factors. Thus, it is expected that slightly less than 16% of consumers claim that energy saving factors will influence their next consumer electronics purchasing decision.

4.3. STEWARDSHIP

According to data published by the United States Environmental Protection Agency (EPA) in 2005, approximately 45% of electronics products among residential, commercial, and institutional consumers that were no longer being used had been put into storage or reuse rather than being disposed of or recycled (EPA 2008). Approximately 44% of the electronic products had been disposed of, while 11% had been recycled (Figure 7, below).

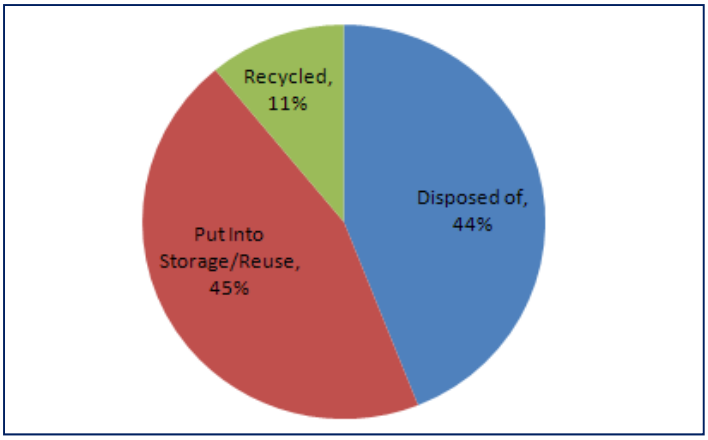

Figure 7: EPA Stewardship of U.S. Consumer Electronics, 2003-2005

Of the electronics put into storage, 34-52% of the units were televisions while approximately 24% were desktop personal computers. When looking solely at recycling versus disposal, 80-85% of products were disposed of, mostly to landfills, while only 15-20% were recycled.

In 2002, the Missouri Department of Natural Resources collected similar information regarding end-of-life computer equipment among residents in Missouri.[8] Based on the data collected for residential consumers, most consumers, approximately 55%, recycle or reuse their obsolete electronics either by reusing them for their own purposes, donating them, or selling them (Caplan 2011). Approximately 32% dispose of the products, 8% put them into storage, while 5% claimed they didn't know what they would do or have done in the past with their obsolete electronics (Figure 8, below).

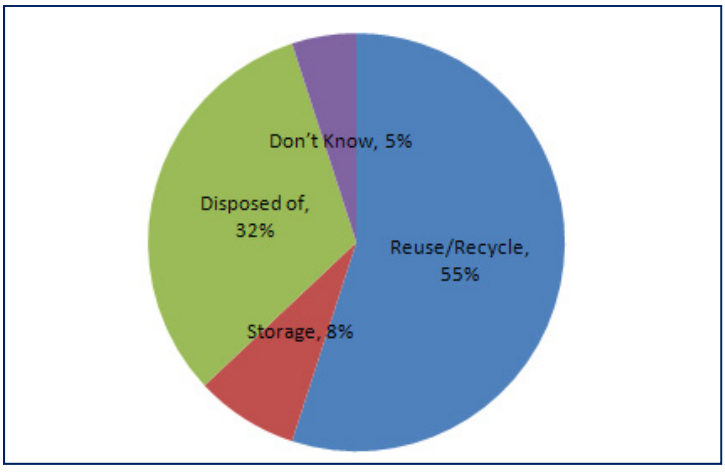

Figure 8: Disposal in Missouri of Consumer Electronics No Longer in Use, 2002

[8] Missouri is the only state for which more detailed information on stewardship of consumer electronics was available.

4.4. PURCHASING DECISION MAKER

The individual(s) considered to be the decision maker(s) in a household depends on the varied dynamics of the specific household. In fact, several individuals may influence a purchasing decision. Several options considered include (Experian 2011):

- Sole purchasing decision
- Joint decision with a spouse/partner
- Joint decision with children in the household
- Joint decision with another individual other than a spouse/partner or children.

Within a traditional family consisting of a husband and wife with children, the purchasing decisions regarding consumer electronics tend to be "husband-dominant", but are often still influenced by the wife. Still, as family dynamics continue to expand from the traditional family, the role of decision maker continues to expand with them. For example, as the marriage rate in the United States continues to decline, more households have single adults, with and without children. In these cases, the single adults will either make sole purchase decisions or decisions influenced by their children. As the number of one-parent households increase and the percent of households where all adults work increases, children are also having more influence on purchasing decisions than they have had in the past.

	Sole Purchasing Decision (Either Male or Female)	Joint Decision with spouse/partner	Joint decision with children in the household	Joint Decision with another individual other than a spouse/partner or children
National	17.0%	19.7%	1.2%	2.0%
New York State	18.7%	14.8%	2.0%	3.7%
New York City	19.0%	13.0%	2.0%	3.0%
County Size A	18.4%	18.5%	1.5%	2.1%
County Size B	17.5%	20.5%	1.3%	2.5%
County Size C&D	14.5%	20.6%	0.9%	1.5%
Residential Home	16.5%	21.5%	1.1%	1.9%
Condominium/Apartment	21.1%	11.3%	1.6%	2.8%

Table 28: Purchasing Decision Categories by Region and Residence Type

Looking at Table 28 above, most purchasing decisions within the nation, county size A, county size B, country size C/D, and residential homes are made with a spouse or partner. In New York State, New York City, and in Condominium/Apartments, however, most purchasing decisions are sole decisions.

In 2010, it was reported that men spent $969 on average on consumer electronics over the course of a year, while women spent $631 on average (CEA 2010). Although men tend to spend more on consumer electronics, the percentage that women spend on consumer electronics is trending upwards with a 13% increase from 2009 to 2010 compared to 7% increase in spending among men. Table 28, below, outlines the percentage of adults that fall into each home electronics purchasing decision category compared to the various geographic regions and residence types.

4.5. ROLE OF ENERGY EFFICIENCY

Generally speaking, energy efficiency does not play a major role in consumers' purchasing decisions. Price, warranties, product features, and size have the most influence on purchasing decisions, while energy efficiency tends to be a lesser consideration.

In comparison to other consumer products, home electronics are not seen by the consumer as using a lot of energy (PG&E 2008). Consumers consider energy efficiency as having more of an influence when purchasing household appliances, such as refrigerators or clothes washers. Home entertainment and office products, however, such as televisions and computers, are not viewed as using much energy by the consumer, thus causing energy efficiency to be less of a consideration in purchasing decisions. Home appliances are viewed by the consumer as being "big and noisy", used often, task oriented, working in the background, having lower performance expectations than entertainment products, and available with rebates. Home electronics, on the other hand, are viewed by the consumer as being quieter, used less frequently, entertainment oriented, and providing immediate gratification.

To increase the presence of energy-efficiency in home electronics purchasing decisions, the following steps could be taken to create more interest in energy efficient electronics.

- Build awareness about the availability of energy efficient home electronics.
- Education is key to dispelling common myths about energy efficiency.
- Communicate quantifiable benefits of energy efficiency.
- Provide suggested habit changes to reduce energy consumption.
- Broadcast the message through multiple media vehicles.

In order to make these steps effective, tactical considerations must be made in the areas of branding, consumer education, retailer education, and promotion.

4.6. CONSUMER COMPREHENSION OF PHANTOM LOAD AND APS

Phantom load is the electricity consumed by an appliance or electronic product when in a standby or off mode. The "Efficiency Vermont Consumer Electronics Survey" study asked adult consumers (18+ years old) across the state of Vermont in the summer of 2010 about their knowledge of phantom load on a scale from 1 to 5, with 1 being the lowest level and 5 being the highest level. The results are shown in Table 29, below.

What is your level of knowledge with phantom load?	Mean Values (on a scale from 1 to 5)
Full Sample—Adults 18+	1.65
Male Adults	1.93
Female Adults	1.50
Young	1.62
Old	1.68

Table 29: Consumer's Knowledge of Phantom Load

On average, the associated value with the level of knowledge of phantom load was only a 1.65 out of 5, indicating that there is great potential for consumers to learn more about phantom load.

The same study asked consumers about their familiarity with APSs. Although consumers are aware of which products are to be plugged into an outlet, they may not be aware of their considerable effect on electricity costs and how new technology, such as APS, can help reduce

costs. Table 30**,** below shows the distribution of responses from those consumers who participated in the survey.

How familiar are you with advanced power strips?	Percent (full sample)
Never heard of them	42.20%
Heard of them but know little about them	30.10%
Pretty familiar with them	22.30%
Know all about them	5.30%

Table 30: Consumer's Familiarity with Advanced Power Strips

The responses indicate that only 5.3% of consumers "know all about" APS, and over half of consumers have at least heard of them. Over 42%, on the other hand, have never heard of APS.

5. PROGRAM POTENTIAL

An Advanced Power Strip Savings Tool has been created by LM for NYSERDA and potentially consumers to identify the energy and dollar savings potential within a household and across various national and New York markets by using APS as the plug source for home electronics. An explanation of the tool and the resulting savings summary are outlined in this section.

5.1. APS SAVINGS TOOL

The APS Savings Tool allows the user to determine the estimated energy consumption and cost based on various criteria. In addition, the tool predicts the estimated potential energy savings resulting from the use of APS. Using this tool, estimates have been calculated for the following segments:

- National
- New York State
- New York City
- Upstate new York
- National County Size A, B, and C/D
- Urban, Suburban, and Rural Regions across New York State
- Type of Residence: House and Condominium/Apartment nationally and for New York State
- Households.

The household option allows the user to choose the electronics included in the estimate, while the other options provide an estimate based on the average number of products in a household for each segment.

5.2. SAVINGS SUMMARY

Savings resulting from the use of an APS in the home were determined for the typical household in the United States and for the entire National and New York markets. The typical household savings calculations took into account consumer electronics that are found in a typical household. The National and New York markets savings calculations used the average number of products per household for each consumer electronic product to estimate savings.

A Master Control APS will shut off power to products that are in the controlled outlets if the product in the master control outlet is turned off. Therefore, the savings resulting from using an APS will be dependent upon the product in the master control outlet, typically a television for entertainment configurations and a computer for home office configurations. When plugged into an APS, the power consumption of products plugged into controlled outlets will be shut off and draw zero watts of power. Therefore, the change in watts resulting from plugging peripherals into an APS rather than a standard power strip or wall outlet will result from reducing the power consumption in standby and off modes of the peripherals plugged into the standard power strip or wall outlet. Appendix A: APS Energy Savings Potential Equations gives a more detailed explanation on the equations that were used to calculate energy savings by using an APS.

5.2.1 Typical Household Savings Summary

To determine the estimated savings for a typical household in the United States, a typical configuration of home electronics along with the power consumption in each mode for each product and the average hours of use in each mode per day were used. A product was included in the typical configuration if the average number of products per household for the national market was 0.5 or greater. The products included for a typical household are shown in Table 31, below.

Home Entertainment	Home Office
CRT Television	Desktop Computer
LCD Television	LCD Monitor
Cable Set Top Box	Printer
DVD Player	
VCR	
Video Game Console	

Table 31: Consumer Electronics in a Typical Household

There are various types of video game consoles, including the Nintendo Wii, Sony PlayStation, and Microsoft Xbox, and two types of printers, (inkjet and laser) on the market today. Although there was a higher home penetration of some game consoles over others in 2010, the video game market is very dynamic. Therefore, each video game console was given equal weight and the power consumption in each mode of all video game consoles was used to calculate the average power consumption and potential energy savings from using an APS in a typical household. Similarly, although inkjet printers are found more often in households across the nation, laser printers are becoming more popular on the market. Therefore, for the typical household, the inkjet and laser printer were given equal weight and the power consumption in each model of both printers was used to calculate the average power consumption and energy savings potential for a typical household.

Using these home electronics as a typical configuration in a household, the total consumption, energy savings from using an APS, and the total dollar savings were calculated. To achieve these calculations, it is assumed that one APS is used for home entertainment and one is used for home office purposes; that the average cost per kWh is $.11 (EIA 2011); the difference in the cost of an APS and a standard power strip is $20; and the life expectancy of an APS is 10 years. The results for a typical household are shown in Table 32, below. The detailed calculations can be seen in the APS Savings Tool.

Total Annual Entertainment Energy Consumption per Household (kWh)	602.8
Total Annual IT Energy Consumption per Household (kWh)	197.9
Total Annual Consumer Electronics Energy Consumption per Household (kWh)	800.8
Total Annual Entertainment Change in Consumption with APS (Energy Savings in kWh)	75.1
Total Annual IT Change in Consumption with APS (Energy Savings in kWh)	31.0
Total Annual Change in Consumption with APS (Energy Savings in kWh)	106.1
Total Dollar Savings per Household over the Average Life of the APS	**$78.81**

Table 32: Estimated Power Consumption and Savings from using an APS, Typical Household

5.2.2 National and New York Markets Savings Summary

The estimated kWh and dollar savings from using an APS per household in each market is shown in Table 33, below. The calculations used to determine the estimated savings assumes that an average APS costs $35 while a *standard* power strip (not APS) costs $15, resulting in an incremental cost difference of $20. It also assumes that the average cost per kWh nationally is $0.11 and $0.175 for New York State (EIA 2011), the life expectancy of an APS is 10 years, and

there are two APSs per home, one for entertainment products and one for home office products. To determine the total estimated savings for the market, data regarding the percent of people that are willing to pay more for environmentally friendly products in each market sector is used as the percentage of people that would be willing to purchase an APS for their home. Estimated savings for 50% and 100% of each market are also outlined in Table 33, below.

	Estimated Annual kWh Savings per Household	Estimated Dollar Savings per Household over the Life of the APS	Estimated Annual kWh Savings for Market			Estimated Dollar Savings for Market over the Life of the APS using the percentage of people willing to purchase an APS
			With respect to the percentage of people willing to purchase an APS	50% of Market	100% of Market	
National:						
National	91.9	$62.98	3,178,824,107	5,177,237,959	10,354,475,919	$2,177,419,564
County Size A	92.9	$64.02	1,460,079,450	2,128,395,700	4,256,791,399	$1,006,464,491
County Size B	93.2	$64.34	921,986,422	1,584,169,109	3,168,338,219	$636,765,491
County Size C&D	91.0	$61.94	814,050,745	1,496,416,810	2,992,833,621	$553,976,105
House	94.4	$65.71	2,391,645,923	4,053,637,157	8,107,274,315	$1,665,026,525
Apartment/ Condo	70.8	$39.33	878,046,159	1,170,728,212	2,341,456,423	$487,546,198
New York:						
New York State	93.6	$123.88	266,533,039	372,252,847	744,505,695	$352,588,316
New York City	93.9	$124.30	125,037,289	156,296,611	312,593,221	$165,542,103
Upstate New York	87.1	$112.43	85,182,839	131,454,998	262,909,996	$109,950,558
Urban New York	92.9	$122.53	138,467,097	205,440,796	410,881,592	$182,679,284
Suburban New York	92.9	$122.64	44,627,924	73,887,292	147,774,583	$58,891,583
Rural New York	92.1	$121.17	51,136,094	88,777,941	177,555,882	$67,278,952
House	88.4	$114.71	111,950,303	165,118,441	330,236,882	$145,261,495
Apartment/ Condo	92.0	$120.95	139,742,686	184,357,106	368,714,212	$183,774,368

Table 33: Estimated Savings from using an Advanced Power Strip, National and New York

These savings indicate that the average household, regardless of market segment, would benefit with an energy and cost savings from using an APS in the home.

6. CONCLUSIONS

A typical household in the United States using one APS for entertainment purposes and one APS for home office purposes would save an estimated 106.1 kWh per year and about $78.81 over the life of the APS. At a national level, the resulting savings from the percentage of people that would be willing to purchase an APS would be an estimated 91.9 kWh annual savings and $62.98 savings over the life of the APS. Spreading this estimate across households that are willing to pay more up front for environmentally friendly products would result in an estimated annual savings of 3,178,824,107 kWh and $2,177,419,564 over the life of the APS for the national market. These results may vary by household and can be compared to the estimates using the APS Savings Tool. Although there is a large savings potential to be derived by using APS, the majority of the population is still not familiar with them and only an estimated 5.3% of the population claim to know “all about” APS. There is, therefore, great potential for growth in the sales of APS by providing education to consumers.

7. RECOMMENDATIONS

7.1. SHORT TERM RECOMMENDATIONS

Develop a marketing strategy and promotions plan for APS.

- In the short term, a marketing plan could be developed to target consumers who may benefit from purchasing APS. Focus should be placed on developing the marketing strategy and marketing promotions to increase awareness of APS benefits to the consumer. Incentives to mark down or buy down APS and point of purchase (POP) advertising should be created to encourage APS purchases. The use of the APS savings tool by consumers could also be promoted to understand the potential savings. Additional marketing activities may include, but are not limited to: live demonstrations; regional radio advertisements; video displays; end-cap videos; and brochures. By effectively communicating the energy and cost savings to be gained by APS use, consumers are more likely to purchase them for their homes.

7.2. LONG TERM RESEARCH NEEDS AND RECOMMENDATIONS

Conduct research for additional information on consumer purchasing habits and behaviors that was not available through secondary research for this study.

- Although not essential for estimating energy savings potential, the following information that was not available through secondary research may be helpful to understand coincident demand impacts and consumer behaviors in specific household segments.
    - Configuration of entertainment and home office electronics
    - Home electronics coincident usage
    - Standards and certifications that make a difference in purchase decisions
    - Consumer rate of purchase
    - Consumers' comprehension of plug load.

  Consumer surveys could be conducted to gain a better understanding of this information and help with promotion and advertising practices in the future.

Develop a strong consumer education program about standby power/phantom load*.

- Consumers were asked about their level of knowledge of standby power load on a scale from 1-5. The average value was only a 1.65 out of five in Vermont. To better educate consumers about phantom load and help them realize its effect on their electricity costs, it is recommended that a strong consumer education program about phantom load be developed and deployed.

**Power wastage derived from electronics in sleep or soft off mode is often referred to as standby load, phantom load, or vampire load*

Determine the awareness of APS among retailers and research into any advertising or promotions practices they are using.

- The consumer purchasing habits section of this report is focused on the consumer's behaviors and awareness of APS. In order for consumers to be aware of APS, the retailers that sell home electronics must also be made aware of APS. Research analyzing retailers' awareness of APS and any advertising or promotion practices should be conducted.

Include the APS in an EEPS midstream market share incentive program.

- With limited consumer awareness about APS and phantom load, it is recommended to include APS in the Energy Efficiency Portfolio Standard using a midstream model approach. The midstream model approach will provide incentives to the retailer for every APS sold to promote the sale of APS to the consumer. With incentives for the retailer to market the APS, consumers will learn more about the technology through the retailers and understand the benefits, thus promoting the sale.

Enhance efforts to promote the recycling of electronic products.

- In view of the anticipated shortage of rare earth elements for consumer electronics, a strong programmatic effort should be made to recycle electronics products. Only about 11% of consumer electronics among residential, commercial, and institutional consumers were recycled. More research would be needed to quantify that amounts of various elements that could be recovered by recycling these products.

Evaluate the increase of new electronics on the market, such as tablets and smart phones, and how it relates to plug loads and potential energy savings.

- Recent studies have indicated that the increase of new electronics on the market have led to an increase in plug load over the last several years. Research can be conducted to indicate if plug loads are, in fact, increasing and how they are charged, whether they are plugged into an outlet or a power strip. If plugged into a power strip, any phantom load from the chargers of these electronics could be reduced.

Perform a power management initiative study for the commercial market.

- The power management initiative study identified potential savings for the residential market. The same characterization approach used in this study could be used to identify a potential savings for the commercial market. Offices, in particular, may benefit greatly from implementing APS at work stations and conference rooms—particularly when considering the computers, monitors, printers, copiers, fans, and other electronics that are often left on or in standby mode overnight. Further research could provide an estimated savings for the commercial market both nationally and for New York State.

Reassess the market frequently to address changing markets, emerging products and technologies, and consumer behavior.

- Improved technologies are constantly changing the types of products that consumers are purchasing and using in the household. These products may consume more energy (larger television screens, more advanced gaming systems, etc.) or less energy (more energy efficient products televisions, computers, and monitors). These new technologies and increased availability of knowledge often cause consumer purchasing habits and behaviors to change. In order to keep accurate estimates of energy and cost savings, the market should be reassessed frequently to ensure the APS remains cost effective for the consumer.

Continue regional market development.

- Continued coordination with other states will help to better understand the APS market and potential for savings.

APPENDIX A: APS ENERGY SAVINGS POTENTIAL EQUATIONS

The equations to determine the change in kilowatt hours per year by using an APS in the home are shown and explained below. For a typical household, the differences between the amount of time a product in the master outlet and products in the controlled outlets are turned off is based on the national average values. To calculate an estimated savings, the savings in standby mode is calculated and the time the peripheral is in standby mode is subtracted from the time that the master product is in either standby or off mode. Any remaining time that the peripheral is in off mode is then determined and the savings while in off mode is calculated. The savings from standby and off modes is then added together to determine a total savings. When plugged into an APS, the power consumption of products plugged into controlled outlets will be shut off and draw zero watts. The resulting equation to determine the kWh savings for a typical household or for any given household using the calculator is

$$\frac{\Delta kWh_e}{Year} = \sum_m \left(SDW_{e,m} \times \frac{SDHrs_{e,m}}{Day} \times \frac{kW_e}{1000\ W_e} \times \frac{365\ Days}{Year} \right)$$

where:

e	=	type of home electronic equipment
m	=	shutdown mode (standby or off)
$SDW_{e,m}$	=	shutdown watts, the watts drawn by *e* in shutdown mode *m*
$SDHrs_{e,m}$	=	number of hours *e* is in shutdown mode *m* with respect to the number of hours the product in the master control is in shutdown mode

If the product in the master control outlet is in standby and turned off for a lesser number of hours during the day than the products in the controlled outlets, then the potential energy savings in kWh for each electronic device included in the APS Savings Tool can be determined with the equation

$$\frac{\Delta kWh_e}{Year} = \sum_m \left(SDW_{e,m} \times \frac{SDHrs_{i,m}}{Day} \times \frac{kW_e}{1000\ W_e} \times \frac{365\ Days}{Year} \right)$$

where:

e	=	type of home electronic equipment
i	=	type of home electronic equipment in the master control outlet
m	=	shutdown mode (standby or off)
$SDW_{e,m}$	=	shutdown watts, the watts drawn by *e* in shutdown mode *m*
$SDHrs_{i,m}$	=	number of hours *i* is in shutdown mode *m;* = 24—number of operating hrs

Before completing the summation, these equations can be multiplied by the average number of products per household in order to determine a savings for an entire market, if needed. The change in power consumption for each product is added over all home entertainment and home office products to determine the total potential savings by using an APS. The equations use the number of hours that the product in the master control outlet is in each mode.

APPENDIX B: POWER CONSUMPTION CALCULATION METHODOLOGY

Throughout this report, tables display the power consumption of consumer electronics in active, standby, and off modes. Data regarding the power consumption in different modes were used from the following sources:

- Energy Center of Wisconsin
- IT Energy - Denmark
- Ecos Consulting
- Lawrence Berkeley National Laboratory
- TIAX LLC
- Energy Efficient Strategies

The average power consumption values from these sources in the active, standby, and off modes was calculated and used as the values throughout this report.

APPENDIX C: EXPERIAN SIMMONS DATA COLLECTION METHODOLOGY

Experian[SM] Simmons, a commercial information services company, supplied the data used for the number of electronics per household, the electronics hours of use, and some consumer behavior analysis for this report. Experian compiled the data from their Fall 2010 Adult 12-Month Study regarding consumer electronics, consumer attitudes, opinions, and behaviors, and daily activities of consumers.

Experian's Fall 2010 Adult 12-Month Study uses a probability sample design that measures all American adults with a standard questionnaire and consistent data collection and data processing procedures. The study provides single-source measurement for products that consumers buy, brands they prefer, lifestyles and attitudes, and media preferences. All respondents—regardless of origin or language ability—are asked the full range of questions measured by the National Consumer Survey.

The data collection process occurs in two phases. The first phase consists of a telephone placement interview that is conducted with an adult 18+ in the contacted household. If an adult is contacted and agrees to the survey, the second phase occurs by mailing a survey package to the household. Incentives are provided if the adult participates by completing the personal booklet including the standard questionnaire and returning it to Experian.

The Fall 2010 Adult 12-Month Study is based on a sample of 24,463 interviews with English and Spanish speaking adults 18 years or older residing in the United States, excluding Alaska and Hawaii. Respondents participated between late October 2009 and early December 2010.

The Fall 2010 12-Month NCS study is comprised of four quarterly waves:

- Winter 2010 wave (fielded from late October 2009 through mid March 2010).
- Spring 2010 wave (fielded from early February 2010 through early June 2010)
- Summer 2010 wave (fielded from late April 2010 through early September 2010)
- Fall 2010 wave (fielded from late July 2010 through early December 2010)

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Advanced Power Strip Research Report

Final Report
August 2011

State of New York
Andrew M. Cuomo, Governor

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