Residential consumer electronics electricity consumption in the United States

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consumer electronics, home, computer, PC, television, electricity consumption, usage, standby

Abstract
TIAX carried out a study to develop an up-to-date understanding of consumer electronics (CE) energy consumption in U.S. residences in 2006. This study used a bottom-up methodology to characterize the energy consumption of sixteen CE devices in detail and includes preliminary estimates for the annual electricity consumption (AEC) of thirteen other devices. It excludes, however, the energy consumed by digital televisions (DTV) because a standard test procedure that accurately characterizes DTV active mode power draw has yet to be developed. To address uncertainties in prior estimates of CE usage, the study incorporated results from a phone survey to develop more refined and up-to-date estimates for the usage of ten CE devices. In addition, the analyses incorporated numerous measurements of recent vintage CE devices. Excluding DTV, CE consumed about 147 TWh of electricity in U.S. homes in 2006. Analog TVs accounted for 36 percent of the total, PCs and monitors 21 percent, set-top boxes 13 percent, and audio products 12 percent. This translates into about 11 percent of U.S. residential electricity consumption and 4 percent of total U.S. electricity consumption (EIA 2006) and, in primary energy terms, about 7.3 percent and 1.6 percent of residential and total U.S. primary energy consumption, respectively.

Introduction
Over the past several decades, consumer electronics (CE) have played an increasingly greater role in peoples' lives and, as a result, the number of CE devices in peoples' homes has grown. Furthermore, CE has gone from a small portion of US residential electricity consumption in the mid-1970s (Sanchez et al. 1998), to a distinct energy consumption end use. In addition, in recent years, CE increasingly has been a focus of energy efficiency programs and initiatives in the United States and around the world.

The Consumer Electronics Association (CEA) has noted the use and publication of inconsistent – and potentially misleading – estimates of consumer electronics' (CE) electricity and energy consumption. The CEA and its member companies are concerned that this can result in sub-optimal policy decisions and lead to erroneous perceptions of the contributions of CE to national energy consumption. Specifically, the CEA has noted that some recent articles about and analyses of CE energy consumption used outdated information about CE power draw by mode to characterize CE unit electricity consumption (UEC). Relative to other residential energy-consuming products, such as white goods (e.g., refrigerators, dryers, etc,), reliance upon data for CE products that are even a few years old can have a substantial and adverse impact on the accuracy of UEC estimates. That is, due to much shorter product life times for CE products (e.g., an approximate average of five years versus 10+ years for white goods) and the very rapid pace of change in CE product technology and features. This makes quantification of CE energy consumption more challenging and time intensive, because an accurate analysis inherently requires collection of up-to-date data.

Table 1. List of Consumer Electronics – Products Analyzed in Further Detail in Bold

Cable Set-top Box (STB)	**Digital Versatile Disk (DVD) Player**	Printer
Caller ID Equipment	**DVD Recorder**	Radios (home)
Camcorder	Facsimile Machine	**Satellite Set-top Box (STB)**
CD Boombox	**Home Theater in a Box (HTIB)**	**Telephone Answering Device (TAD)**
Cellular Telephone	Modem (Cable and DSL)	**Television, Analog**
Compact Audio	**Monitor**	**Television, Digital**
Component Stereo	**Notebook Personal Computer (PC)**	**Video Game System**
Cordless Telephone	Pager	**Video Cassette Recorder (VCR)**
Desktop Personal Computer (PC)	**Personal Video Recorder (PVR)**	
Digital Camera	Portable Audio (MP3, CD Players)	

For example, the documents relied upon by the California Energy Commission (CEC) to support regulation of the standby[1] mode power draw of TVs, compact audio, and DVD players and recorders drew heavily upon power draw data from the late 1990s (TIAX 2006a). Since the late 1990s, the average standby mode power draw of all of these products appears to have decreased appreciably as a sizeable portion of products manufactured since that time meet the EnergyStar® performance levels that came into effect in 1999. Similarly, until recently[2], much of the characterization of CE energy consumption by the U.S. Department of Energy's Energy Information Administration (EIA) relied upon much of the same data to quantity the electricity consumption of many CE products.

Furthermore, for several CE devices, few data have existed to accurately quantify the average annual time they spend in key energy-consuming modes. For example, the authors of the studies cited in the aforementioned CEC rulemaking allocated "inactive" time between idle and off modes for compact audio, DVD players, and VCRs based on their informed estimates, noting that they could not find data for time spent in idle or off mode (Rosen and Meier 1999a, Rosen and Meier 1999b). TIAX appreciates the clarity and openness of those researchers, as well as the challenges of gathering representative usage data for these products. Regardless, the uncertainty in annual usage by mode represents a major data gap that results in significant uncertainties in unit energy consumption estimates for several CE products.

To ensure that high-quality data exist to inform public policy decisions related to CE products' energy consumption, the CEA contracted TIAX LLC to analyze the energy consumption of CE products in U.S. residences in 2006. This report presents the full assessment and its key findings.

Approach and Methodology

To develop an up-to-date estimate for the energy consumed by CE products in U.S. homes in 2006, TIAX and CEA agreed upon the following approach to the project:

1. Generate a list of equipment types and collect existing data from literature.
2. Develop a preliminary estimate of national energy consumption for each equipment type.
3. Select up to 15 equipment types for further evaluation, based upon preliminary calculations and the degree to which prior studies had quantified their AEC.
4. Develop refined bottom-up estimates of national energy consumption of each selected equipment type in 2006. This included composing and carrying out a consumer survey funded by CEA to help fill key data gaps that impact energy consumption, such as product installed base and annual usage by mode.
5. Compare the current results with the results of other studies.
6. Publish the findings in a peer-reviewed report.

EQUIPMENT ANALYZED

Ideally, this study would have developed detailed assessments of the energy consumed by all CE products used in residences. In practice, project scope limitations dictated that we analyze a subset of CE products. Two factors drove the selection process. First and foremost, we wanted to include products that account for most of total CE energy consumption based on preliminary estimates of their annual electricity consumption (AEC). In addition, we also gave greater weight to CE products that had not been studied as thoroughly in the past, as an evaluation of these products would result in a marginally greater increased understanding of total CE energy consumption. For example, stand-alone PVRs were selected for further study even though they were not expected to account for a significant portion of residential CE AEC because their energy consumption has not been evaluated in detail. Using these guidelines and in conjunction with the CEA, we selected the sixteen products shown in bold in *Table 1* for further analysis.

The current study does not, however, include a characterization of digital television (DTV) energy consumption. An international effort is underway to develop a test procedure that accurately measures TV active mode power draw; this procedure is expected to be finalized in 2007. After the test procedure is determined, CEA and its members will measure the power draw of their best-selling DTVs in all relevant modes. We will synthesize these power draw measurements to characterize DTV annual electricity consumption (AEC). These findings will be integrated into an updated version of TIAX (2007). All subsequent references to CE energy consumption in this report exclude DTV energy consumption. Assuming that the test procedure development and measurement process moves ahead in

1. "Standby" refers to the mode drawing the lowest level of power that a device can enter into while still plugged in. For many CE products, consumers would perceive the standby mode to be when the product is turned off.

2. In 2006, TIAX developed new estimates for the current and future AEC of several key residential CE products for the EIA (see TIAX 2006c). Those estimates were completed before this current analysis and, thus, do not incorporate the latest data presented in this study. The findings of this study were presented to the EIA to enable updating of the EIA AEC estimates and projections.

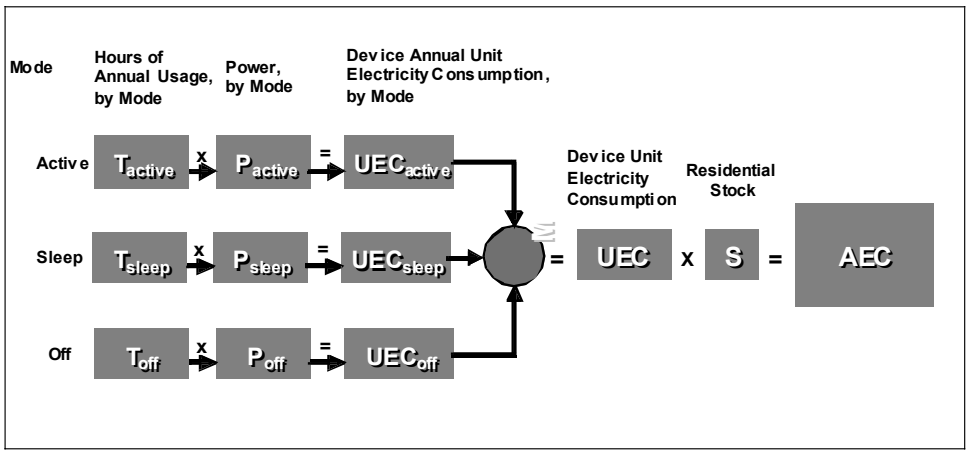

Figure 1: Annual Energy Consumption Calculation Methodology

a timely manner, we anticipate that the conference presentation will include an estimate for DTV energy consumption.

ENERGY CONSUMPTION CALCULATION METHODOLOGY

Figure 1 shows the basic methodology used to develop the annual energy consumption (AEC) estimates; the modes shown are illustrative and vary by product.

For each product type analyzed, we calculated the average annual unit energy consumption (UEC, in kWh) of a single device (e.g., a desktop PC) for an entire year. The UEC equals the sum of the products of the approximate average number of hours that each device operates in a residential setting in each power mode relevant to that product and the average power draw in each mode. The product of the estimated device stock (i.e., installed base) and the device UEC yields the total annual energy consumption (AEC, in TWh) for that equipment type. The following sections describe our approach to develop values for the different components of AEC calculations and present the estimates for each key component, for each equipment type.

RESIDENTIAL EQUIPMENT STOCK

The residential building equipment stock equals the number of devices in use (i.e., plugged in) in residential buildings. Stock estimates primarily came from published estimates, such as industry market reports (most notably carried out by the CEA), the residential consumer electronics (CE) survey carried out for this study, CEA shipment data, and other research reports. Overall, residential stock estimates appear to have the smallest uncertainty of all three components of product AEC calculations. *Figure 2* summarizes the residential stock estimates for the key equipment types; TIAX (2007) provides complete explanations and references for development of the estimates.

Overall, we estimate that there are approximately 2.1 billion CE products in U.S. residences, including approximately 870 million "other" CE products (TIAX 2007).

USAGE PATTERNS

A device's usage pattern refers to the number of hours per week that, on average, a device operates in a given mode. Most CE products have at least two distinct operational modes, i.e., on and off, while many have more. In general, very few measure-

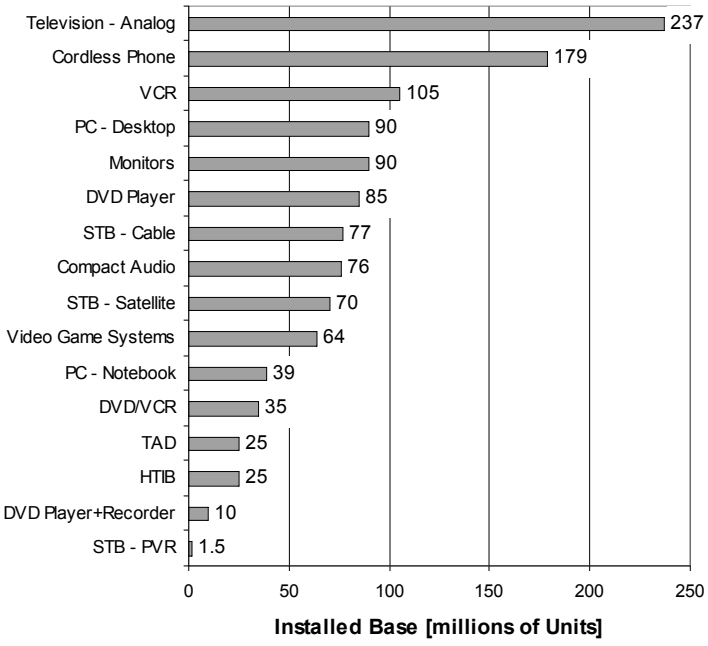

Figure 2. Installed Base of Residential CE Products (TIAX 2007)

Table 2: Consumer Electronics Products Included in the CEA Survey

Cable Set-top Box
Compact Audio
Digital Versatile Disk Player
Digital Versatile Disk Recorder
Home Theatre in a Box (HTIB)
Personal Video Recorder (stand-alone)
Satellite Set-top Box
Television, Analog
Television, Digital
Video Cassette Recorder (VCR)
Video Game Systems

Table 3: Summary of Usage by Mode Estimates (TIAX 2007)

Product	Active	Idle / Sleep	Off	Charging
Compact Audio	840	730	7,190	
Cordless Phone	350	7,710*		700
DVD Player	318	900	7,542	
DVD Player+Recorder	270	900	7,590	
HTIB	1,580	730	6,450	
Monitors	1,865	875	6,020	
PC – Desktop	2,954	350	5,456	
PC – Notebook	2,368	935	5,457	
STB – Cable	2,729		6,031	
STB – PVR	2,082		6,678	
STB – Satellite	3,239		5,521	
TAD		8,760		
Television – Analog	1,882		6,878	
VCR	156	793	7,811	
Video Game Systems	406	558	7,796	
*Includes Maintenance and Handset Removed modes				

Table 4: Average Power Draw by Mode Estimates

Product	Active	Idle / Sleep	Off	Charging
Compact Audio	23	16	7	
Cordless Phone	3.4	3.1*		4.1
DVD Player	14	10	3	
DVD Player+Recorder	20	15	2	
HTIB	38	34	0.6	
Monitors	42	1	1	
PC - Desktop	75	4	2	
PC - Notebook	25	2	2	
STB - Cable	16		15	
STB - PVR	27		27	
STB - Satellite	15		14	
TAD	4	4		
Television - Analog	98		4	
VCR	16	12	4.5	
Video Game Systems	36	36	1	
*Includes Maintenance and Handset Removed modes				

culations. Although consumers may have a reasonable idea of how much they have actively used various CE devices recently, they likely are not as aware of the time that the products spend in idle instead of off mode. Similarly, despite an appreciable investment of effort by the project team and helpful feedback received by reviewers to clarify the definitions of usage modes (see the "Acknowledgements" section), many respondents may not fully understand the distinction among different modes. Despite these sources of uncertainty, we think that the survey yields an improved understanding of CE usage relative to prior studies whose usage estimates were based on educated estimates. *Table 3* presents the usage breakdowns for the key equipment types; TIAX (2007) details the derivation of these estimates.

POWER DRAW BY MODE

The AEC estimates incorporated power draw data for different product types and segments for each mode of operation. For each mode, the power draw value represents the best estimate for the average power draw of all of the different devices included in a single equipment type or segment. This estimate assumes that annual usage by mode does not vary appreciably with power draw by mode, e.g., desktop PCs that draw 120 W in active mode do not spend appreciably more hours in active mode per year than desktop PCs that draw 50 W in active mode. We investigated this effect for analog TVs, the device that we expected to have the largest deviation from this assumption. On average, larger, more powerful TVs were used more, but energy consumption only increased by 5 percent when accounting for the power/usage correlation. We did not analyze this effect for the other CE products since the magnitude of the error introduced by this simplification is likely on the order of or less than that of the magnitude of other uncertainties in usage patterns.

For all products analyzed, the power draw values for all modes reflect power draw measurements of devices instead of rated power draw values. Rated power draws represent the maximum power that the device's power supply can handle and often exceed typical active power draw values by at least a factor of three. Ideally, the power draw values would come from measurements of a statistically representative sample of products that reflect the installed base of equipment for the entire U.S., i.e., accounting for make, model, and vintage[3]. When this information was available for product categories, this strategy

3. For example, the Australia Greenhouse Office has carried out invasive surveys of more than 100 Australian homes where they measured the power draw by mode of all plug loads in the homes (see Energy Efficient Strategies 2006). Assuming that the homes sampled were truly a representative sample of Australian homes, that sample could approach statistical significance.

Table 5: Summary of Consumer Electronics Annual Electricity Consumption in U.S. Residences

Category / Product	UEC [kWh]	Installed Base [millions]	AEC [TWh]
Audio Products			8.4
Compact Audio	81	76	6.2
Home Theater in a Box (HTIB)	89	25	2.2
Cordless Telephone	28	179	5.0
Monitors	85	90	7.6
Personal Computer			24
Desktop	237	90	21
Notebook	72	39	2.8
Set-Top Boxes			22
Cable	133	77	10
Satellite	129	70	9.0
Video Game System	36	64	2.4
Stand-alone Personal Video Recorder (PVR)	237	1.5	0.4
Telephone Answering Devices (TADs)	35	25	0.9
Television			53
Analog	222	237	53
Digital	Not Included	Not Included	Not Included
Video Products			9.4
DVD Player and DVD/VCR Combo	36	110	4.1
DVD Player and Recorder	34	10	0.3
VCR	47	105	5.0
Other			17
TOTAL			**147**

was employed. However, this level of accuracy was not achieved for most equipment types analyzed. The sources of power draw data for this study vary by product type, but in general, come from current CEA measurements, current manufacturer measurements, and measurements from prior analyses. Notably, the CEA measurements of units primarily sold in 2006 attempted to represent the best-selling products for 2006 by sampling units of the best-selling brands. For each product, we determined the most accurate approach to characterize power draws based on the data available; the specific approach taken for each product is described in the report section dedicated to that product. Overall, we concluded that the uncertainty in the average power draw by mode values is probably smaller than uncertainties in annual usage for all modes except active mode for many key equipment types. *Table 4* summarizes the estimates for power draw by mode for the key equipment types; TIAX (2007) explains the methodology and data used to derive the estimates for each product type.

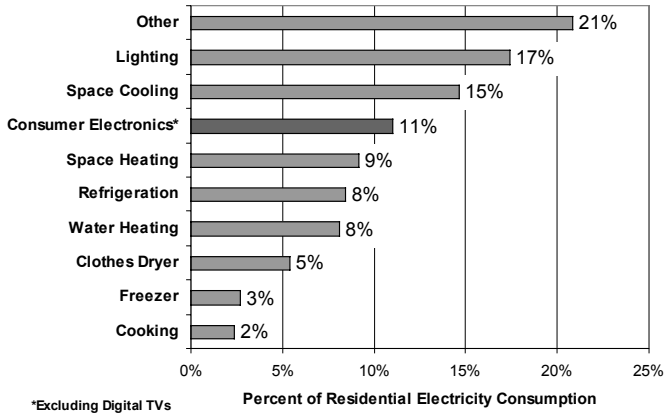

Figure 3. U.S Residential Electricity Consumption (EIA 2006, TIAX 2007)

Findings

Consumer electronics, excluding digital televisions, in U.S. residences consumed about 147 TWh of electricity in 2006 (see *Table 5*).

The average unit electricity consumption (UEC) of CE also varies significantly between product types. For example, the products with the highest UEC, desktop PCs, stand-alone PVRs, and analog televisions, consumed almost an order of magnitude more electricity per unit than the product type with the lowest UEC, cordless phones.

CE products accounted for about 11 percent of U.S. residential electricity consumption and 4 percent of all U.S. electricity consumption (see *Figure 3*). For comparison, Schlomann et al. (2005) estimated that CE accounted for around 19 percent of residential electricity consumption in Germany and around 5 percent of total German electricity consumption in 2004 (IEA 2007).

In primary energy[4] terms, this represents for about 7.3 and 1.6 percent of residential and total U.S. primary energy consumption, respectively (EIA 2006).

A few products account for a large portion of total CE energy consumption. Specifically, analog TVs accounted for 36 percent of the total, PCs and monitors 21 percent, and set-top boxes, including cable, satellite, and stand-alone units, 13 percent (see *Figure 4*). Although "other" units represent about 40 percent of

4. Primary energy, as opposed to site energy, takes into account the energy consumed at the power plant to generate the electricity. On average, each delivered kWh of electricity in the U.S. in 2006 was estimated to consume 10,815 Btus to generate (i.e., including transmission and distribution losses; EIA 2006).

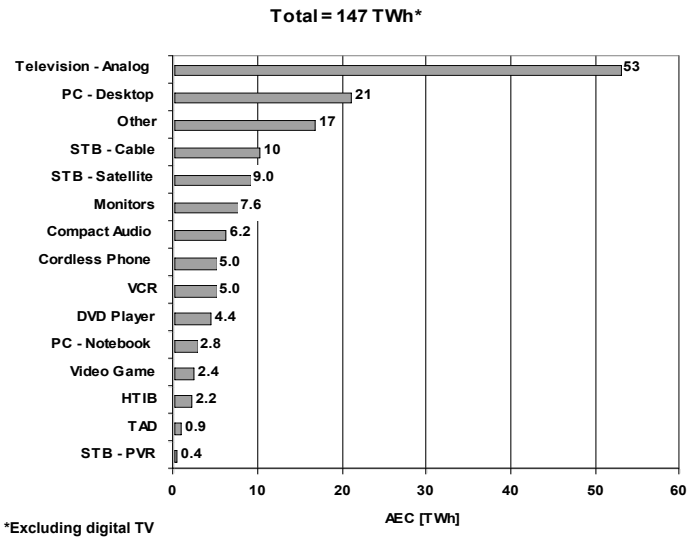

Figure 4. U.S Residential Electricity Consumption by Key Equipment Types (TIAX 2007)

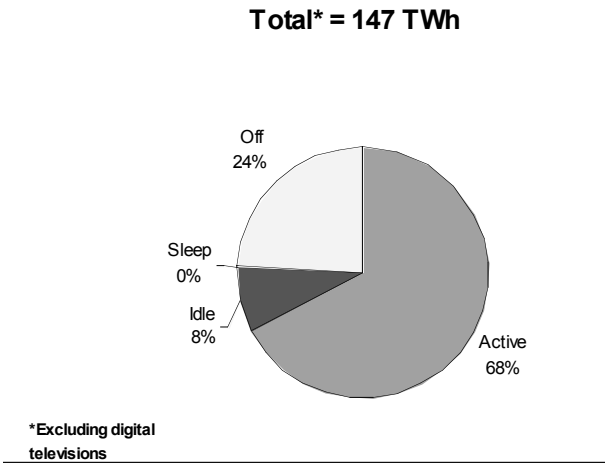

Figure 5: Residential CE AEC by Mode (for Products Analyzed in Further Detail)

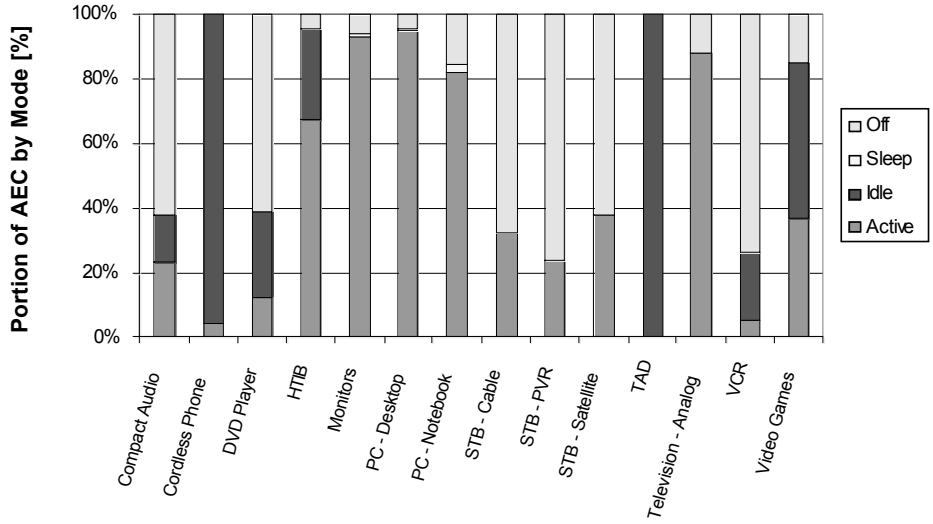

Figure 6: UEC by Mode for Products Analyzed in Further Detail

the estimated 2.1 billion CE devices in use in U.S. residences, we estimate that they account for only about 11 percent of CE AEC.

The active mode dominates CE energy consumption and accounts for almost 70 percent of the total AEC of the products analyzed in further detail (see *Figure 5*). Off mode accounts for about one quarter of total AEC, while the idle (8 percent) and sleep (<1 percent) are much smaller portions of total AEC.

In practice, the UEC breakdown by mode varies greatly from one product type to another (see *Figure 6)*. For example, the active mode energy consumption dominates (>80 percent of UEC) for monitors, PCs, and analog televisions, while the off mode consumption accounts for the majority of compact audio, DVD player, VCR, and set-top box UEC. The idle mode energy consumption is most important for cordless phones and telephone answering devices (TADs), devices that remain on all of the time but are only actively used a small portion of that time.

KEY TRENDS

Without question, the electricity consumption of residential CE has grown appreciably over the past five to ten years. Due to data challenges with prior studies (discussed below), we found it, however, difficult to develop a precise estimate for the magnitude of the increase of CE energy consumption. With this important caveat in mind, relative to prior estimates made five (EIA 2001) and nine (Sanchez et al. 1998, ADL 1998) years ago, the current estimate is approximately 2 and 2.5 times greater, respectively.

Nonetheless, several key trends have had major impacts on all three key factors that impact CE electricity consumption: installed base, power draw by mode, and usage by mode.

Installed Base

The installed base of CE products continued to grow over time, with some products experiencing dramatic growth over the past decade and new products coming to market. The estimated installed base of the products shown in *Figure 7* has approximately doubled since 1997.

Power Draw by Mode

The power draw characteristics of some CE products have changed appreciably. The trend for the active mode power draw of CE products, which accounts for about two-thirds of CE energy consumption, varies appreciably from one product to another (see *Table 6*). All of these trends have occurred while the performance and range of features offered in CE products has generally increased.

In contrast, the average sleep and off (also referred to as standby) mode power draw for most CE products has decreased over the past decade, as manufacturers have produced products that meet the maximum power draw criteria established by the EnergyStar® program. In general, the decrease in off mode power draw of typical new units has been greater than the change in the average installed base off mode power draw shown in *Figure 8*. Furthermore, the average sleep mode power draw of desktop PCs (not shown in Figure) has decreased dramatically, from about 25 W circa 1996 to approximately 4 W. The trend for set-top boxes, which do not currently have an EnergyStar® specification, is less clear. Generally, there is only a slight difference between the active mode and off mode power draws. The power draw of simple STBs in both modes has generally declined. However, the recent rise in popularity of STBs with HD and PVR capability is causing an increase in both active and off mode power draw.

Usage by Mode

Potential changes in CE usage are most challenging to assess. Relative to prior studies, the current study estimates that many products spend significantly more time per year in both active and off modes and, hence, less time in idle/sleep modes. It is not, however, completely clear what portion of these changes are real and what portion reflects the availability of new data characterizing CE usage by mode. Specifically, this study draws extensively from a consumer phone survey developed by the CEA with input from TIAX and outside reviewers to gener-

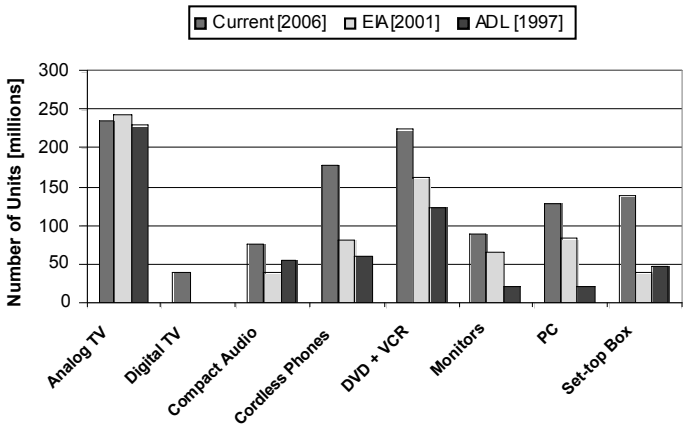

Figure 7: Comparison of Current and Prior Estimates for the Installed Base of Selected CE Products

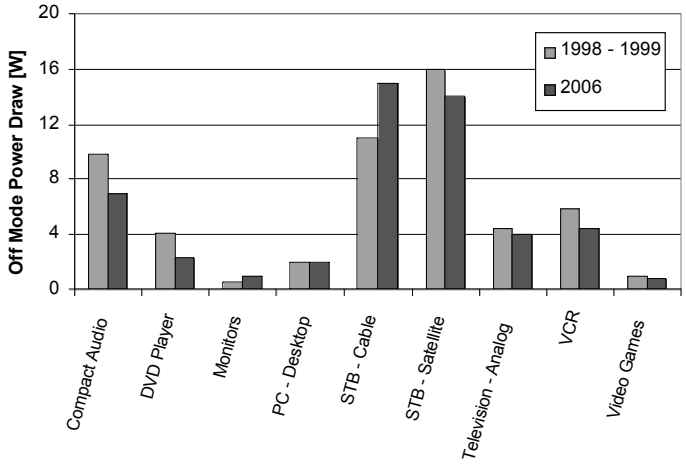

Figure 8: Comparison of Off Mode Average Power Draw Estimates for the Installed Bases of CE Products in 2006 and 1998/1999 (Rosen and Meier 1999a,b, Rosen et al. 2001)

Table 6: Power Trends in CE Products' Active Mode Power Draw

Increase	*TVs*: Growth in screen sizes *Video Game Systems*: Increased processing power *PCs** : Increased processing power
Decrease	*Monitors*: Market move to LCDs *VCR*: Not fully clear, likely technological progress
Ambiguous	*Cordless Phones*: Generally down for basic units, inclusion of answering functionality and multiple handsets increase power draw *Set-top Boxes*: Although basic unit power draw has generally decreased, power draw has increased in units with PVR and HD functionality
*The average power draw of both desktop and notebook PCs has grown. On the other hand, notebook PCs account for an increasingly larger portion of the installed base and this, in turn, has decreased the average growth rate in *total* (i.e., desktop and notebook combined) PC active power draw. Overall, the UEC of *all* PCs plus monitors has decreased over time due to the greater market share of notebook PCs and LCD monitors.	

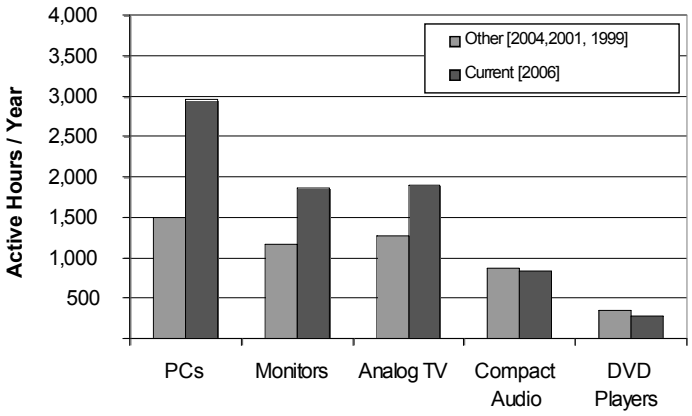

Figure 9: Current and Prior Active Mode Usage Estimates for Selected CE (Nordman and Meier 2004, Rosen and Meier 1999a, 1999b, Ostendorp et al. 2005)

ate more refined and up-to-date estimates for the usage of CE products. The survey posed several questions to 2,000 demographically-representative households about the usage, quantity, and characteristics of ten CE products for (up to) the five most-used devices per product type, per household.

Prior estimates for annual time spent in active mode for TVs, video products, and audio products were developed using credible methodologies and data. Thus, the active mode usage estimates should be generally comparable. Taking this to be the case, this study suggests analog TVs, PCs, and monitors spend appreciably more time in active mode than in the past (see *Figure 9*). As active mode power draw for analog TVs, PCs, and monitors is much greater than in other modes, increased usage tends to significantly increase device UEC and total AEC. Indeed, increased active mode usage account for most of the growth in analog TV UEC relative to Ostendorp et al. (2005).

Apparent decreases in active mode usage for compact audio and DVD players have, however, relatively little impact on their UEC values because energy consumed in idle and off modes dominate their UECs. In the case of PCs and monitors, this study uses estimates of usage derived from a recent targeted survey that are more accurate than prior estimates (see TIAX 2006b).

Unfortunately, developing meaningful comparisons of current and prior estimates of idle and off mode usage for audio and video products is more challenging. Prior estimates subtracted the active mode usage from the total number of hours in a year and dividing the remaining time between idle and off modes based upon, in essence, personal estimates (Rosen and Meier 1999a, 1999b). For all audio and video products, the current usage survey yielded lower estimates for time spent in idle mode and higher estimates for time spent in off mode than prior estimates. Although we think that the survey-based estimates represent an improvement over prior estimates, we believe that the idle-off split values presented still may have significant uncertainty because some portion of survey respondents may not be aware of whether they have turned off audio and video devices or left them on. The probability of this scenario increases for units that the respondents' personally operate less frequently (i.e., when the respondent answers for a household with multiple occupants).

For some products, namely cable STBs, PVR STBs, satellite STBs, TADs, and, to a lesser extent, cordless phones, power draw by mode does not vary appreciably. As a result, these products are relatively insensitive to the allocation of time by usage mode.

Finally, portable devices account for more than 22 percent of all residential CE products, but less than 4 percent of CE AEC, with notebook PCs and CD boomboxes representing more than 80 percent of the AEC. Products such as mobile phones, digital cameras, and other rechargeable electronics have a large installed base, but consume relatively little energy.

Conclusions

TIAX carried out a study to develop an up-to-date understanding of CE energy consumption in U.S. residences in 2006. This study used a bottom-up methodology to characterize the energy consumption of sixteen CE products in detail and includes preliminary estimates for the annual electricity consumption (AEC) of thirteen other products. It does not, however, include the energy consumed by digital televisions (DTV) because a standard test procedure that accurately characterizes DTV active mode power draw does not yet exist. To address uncertainties in prior estimates of CE usage, the study incorporated results from a phone survey to develop more refined and up-to-date estimates for the usage of ten CE products. In addition, the analyses incorporated numerous measurements of recent vintage CE devices.

Excluding DTV, the approximately 2.1 billion CE devices consumed about 147 TWh of electricity in U.S. homes in 2006. Analog TVs accounted for 36 percent of the total, PCs and monitors 21 percent, set-top boxes 13 percent, and audio products 12 percent. To place this in a national context, CE represents about 11 percent of U.S. residential electricity consumption and 4 percent of total U.S. electricity consumption (EIA 2006). This translates into about 7.3 percent and 1.6 percent of residential and total U.S. primary energy consumption, respectively.

The active mode[5] dominates CE energy consumption and accounts almost 70 percent of the total AEC of the products analyzed in further detail. Off mode accounts for about one quarter of total AEC, while the idle (8 percent) and sleep (<1 percent) are much smaller portions of total AEC. The annual unit electricity consumption (UEC) breakdown by mode varies greatly from one product type to another, with the active mode energy consumption dominating (>80 percent of UEC) for monitors, PCs, and analog televisions. In contrast, the off mode accounts for the majority of compact audio, DVD player, VCR, and set-top box UEC. The idle mode energy consumption is most important for devices that remain on all of the time but are only actively used a small portion of that time, such as cordless phones and telephone answering devices (TADs).

The average UEC varies significantly between CE products. For example, the devices with the highest UEC, desktop PCs, stand-alone PVRs, and analogue televisions, consumed about an order of magnitude (i.e., ten times) more electricity per unit

5. The product-specific sections of TIAX (2007) include more detailed discussions of the different modes for each product.

than the product analyzed in further detail with the lowest UEC, cordless phones.

The electricity consumption of residential CE has grown appreciably over the past five to ten years, but data challenges with prior studies make it difficult to precisely quantify the magnitude of the growth. Relative to prior estimates for five (EIA 2001), nine (ADL 1998), and eleven (Sanchez et al. 1998) years ago, the current estimate is approximately 2 and 2.5 times greater, respectively.

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