Tuning in to Energy Efficiency:

Prospects for Saving Energy in Televisions

February 2006

Trends indicate that residential energy consumption from televisions (TVs) is on the rise. **Today's TVs, when coupled with related devices like set top boxes and DVD players, can comprise up to 10% of a household's electricity bill.** U.S. policymakers and industry can help stem the rising tide of TV energy use by defining a consistent means of measuring and labeling TV energy use and actively promoting the most efficient designs to buyers. **Reducing the power consumed by TVs when they are turned on by 25% could save the U.S. over 10 billion kWh annually—enough energy to power Delaware for a year.**

Background

American consumers are accustomed to seeing comparative energy use information for appliances when they go shopping. That same type of information is not currently available for TVs, even though 260 million TVs are now in use and some of the newer, larger models consume as much energy per year as a new refrigerator.

Current U.S. efforts to encourage energy efficiency in TVs, such as the ENERGY STAR® program, only label products based on the amount of power they consume in standby mode (when the user believes the TV is "off") and do not consider the TV's power consumption when it is turned "on." As a result, consumers can select a TV they believe is energy-efficient, and then discover that it actually uses the same or more energy per year than a non-ENERGY STAR TV of similar size.

What is missing is consideration of the total annual energy use of televisions. Active mode—the time when the TV is turned on and displaying a picture—accounts for 80% to 95% of a TV's annual energy use, even though consumers only leave their TVs turned on for a few hours each day. As Figure 1 demonstrates, TVs draw many times more power when operating than when off.

We estimate that U.S. televisions consume over 46 billion kWh per year, or about 4% of residential electricity use. As a basis of comparison, this is roughly the same amount of energy used annually by all the households in the state of New York. Reducing active mode power consumption in TVs by 25% would save over 10 billion kWh per year once fully implemented. Annually, this would cut energy bills by nearly $1 billion and prevent emissions of about 7 million tons of CO_2. Once given attention by labeling programs, we believe that active mode energy efficiency will become a useful selling point for undecided TV buyers.

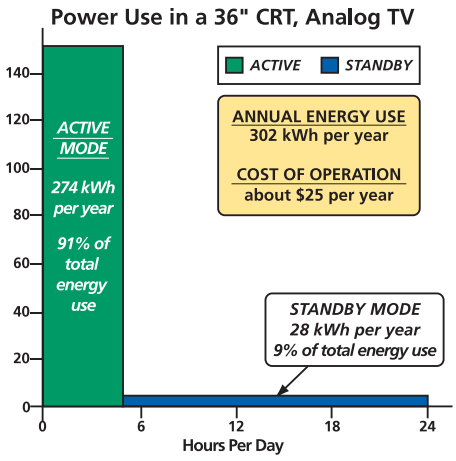

Figure 1

Market Summary

NRDC identified five major trends driving rising TV energy use in the U.S.:

1. **The number of TVs in operation in the U.S. is growing.** At present rates of growth, there will be more TVs than people in the U.S. by 2010.
2. **Consumers continue to purchase larger TVs.** Power consumption tends to rise with screen size.
3. **Sales of digital televisions (DTV) are growing, especially high definition (HDTV) units.** Our measurements revealed HDTVs tend to consume more power than conventional analog units. The DTV revolution will drive up energy use unless technology responds to counteract the growth.
4. **Sales of cathode ray tube (CRT) TVs are quickly being displaced by newer technologies.** Our measurements confirm that many of the newer and larger HDTVs can consume 2 to 3 times the power in active mode as the smaller analog TVs they are replacing.

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For more information, contact the Project Manager, Noah Horowitz, at nhorowitz@nrdc.org or (415) 875-6100.

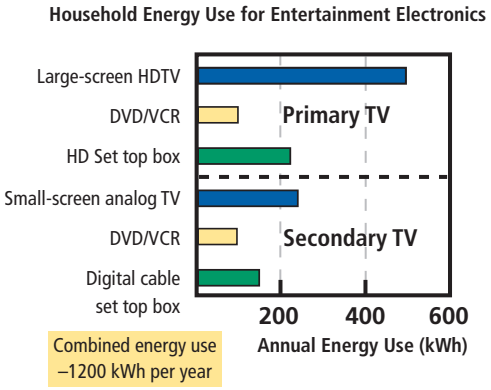

Figure 2

5. **Americans are watching more hours of TV per day from more sources, making the active mode component of a TV's overall energy consumption even more important, mostly due to the advent of cable/satellite services, home video (VCRs and DVDs), and video games.** These additional services usually require extra power-consuming audiovisual equipment such as set top boxes and video game consoles. Figure 2 underscores the importance of the overall category of "entertainment electronics" by showing the energy a household might consume to power these devices in the future. The TV and associated electronics amount to 1200 kWh per year—over 10% of the average household's annual electricity bill.

These trends together suggest that no policy measures are likely to reduce nationwide TV energy consumption in the near future. However, it may be possible to trim expected growth in that energy consumption by defining consistent means of measuring and labeling TV energy use and actively promoting the most efficient designs to buyers.

Test Methods

A handful of test methods have been developed to measure active mode power in TVs. The United States Department of Energy (DOE) national standard for TV power measurement dates back to the year 1977 and is only meant to be used on black-and-white CRTs. The procedure is so outdated that no manufacturers use it in their reporting of power consumption to UL.

The International Electrotechnical Commission (IEC) maintains a standard for measuring power in audiovisual electronics—IEC 62087. This method measures the active mode power use of current screen technologies (LCD, plasma, etc.) in a fair way by using an industry-approved video test pattern to calibrate a TV's brightness settings. Mandatory and voluntary labeling programs in Europe, Australia, Japan and China have adopted and written national standards in harmony with IEC 62087.

However, technical experts still feel that there is room for improvement in IEC 62087. The specified screen calibration levels are known to be lower than typical user settings and significantly below factory settings, underestimating actual energy use in a home setting. Such estimates are absolutely essential in providing consumers with information to compare their expected annual energy use and operating costs.

Recent TV Measurements

Our research was necessarily limited in scope and budget, so we attempted to scout the range of expected energy use in televisions of various sizes, resolutions and technology types. Rather than following IEC 62087 setup and measurement procedures for a handful of models in the laboratory, we measured the average active mode power use of a larger number of retail models using audio and visual inputs that were available on site. The screen settings were left at their factory defaults. Our data are generally indicative of real world TV power consumption, but still subject to some uncertainty relative to more costly and time-consuming laboratory measurements.

Three key factors influence the amount of power TVs consume in operation. Listed in descending order of importance, they are: screen area, display technology and resolution level.

Display technology is the main factor manufacturers can control to increase the energy efficiency of TVs with a given set of features. Figure 3 shows a wide array of HDTVs of different sizes and display technologies and the amount of power that they consume when operating. Several conclusions can be drawn from the figure:

- In direct view TVs, the larger the screen, the more power the TV consumes. Projection TVs, on the other hand, consume roughly the same amount of power regardless of size. In larger TV sizes (above 40 inches), projection TVs consume far less power than similarly sized direct view TVs.
- Plasma TVs consume more power than rear projection TVs of similar or greater size. More measurements are needed to determine how plasma displays compare to similarly sized LCD flat panel displays, but anecdotal data reported by third parties suggests that

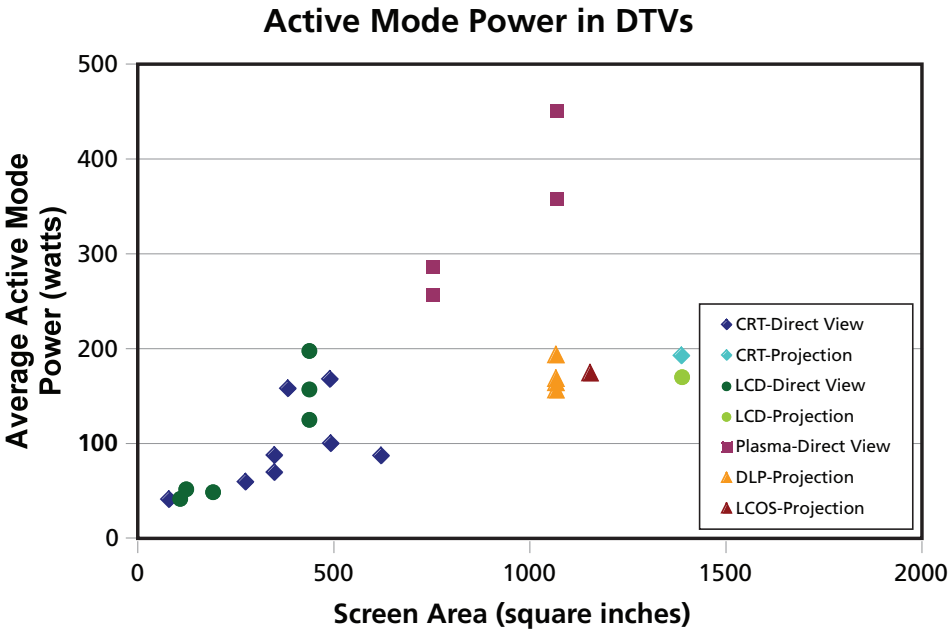

Figure 3

they follow a similar power consumption trend in these larger sizes. Major plasma TV manufacturers are currently introducing more efficient models into the market.

- There is great variation in power consumption even within TVs of the same size and screen display technologies.

Energy Use and Savings Estimates

We estimate that the U.S. uses over 46 billion kWh every year to power TVs, which represents over 1% of all U.S. electricity use. It means consumers are spending more than $13 billion each year to buy new TVs, and almost $4 billion each year to operate the ones they have.

Our research shows that the U.S. could save billions of kWh of electricity in the near future if a nationwide voluntary labeling program like ENERGY STAR adopted a 25% reduction in active mode power from measured average values in a future TV specification. Figure 4 shows how the expected growth of TV energy use could be trimmed depending on the share of new TV sales that comply with such energy efficiency guidelines. Because of the rise in DTV products and the ever-increasing number of TVs in operation in the U.S., these active mode savings become increasingly important in the future. Once fully implemented, the U.S. could save over 10 billion kWh and $800 million in energy bills per year through such efficiency targets.

Policy Review

Programs addressing standby mode energy use have been around for several years, but a number of international programs addressing active mode power use will soon raise the bar for TV energy efficiency. These programs use the IEC 62087 test procedure to measure active mode power consumption in TVs. Most also use a performance metric known as the energy efficiency index (EEI) to rank TVs by various functional attributes. In addition, some nations have minimum energy performance standards (MEPS) for TVs that set mandatory minimum efficiency levels for TVs. Australia will even begin mandatory energy efficiency labeling for TVs through its Energy Rating program, currently used to provide energy efficiency information to consumers for other high-power appliances like refrigerators and furnaces.

U.S. consumers are generally unaware of the energy efficiency of their TVs because they lack information about the total annual energy consumption of the product. The

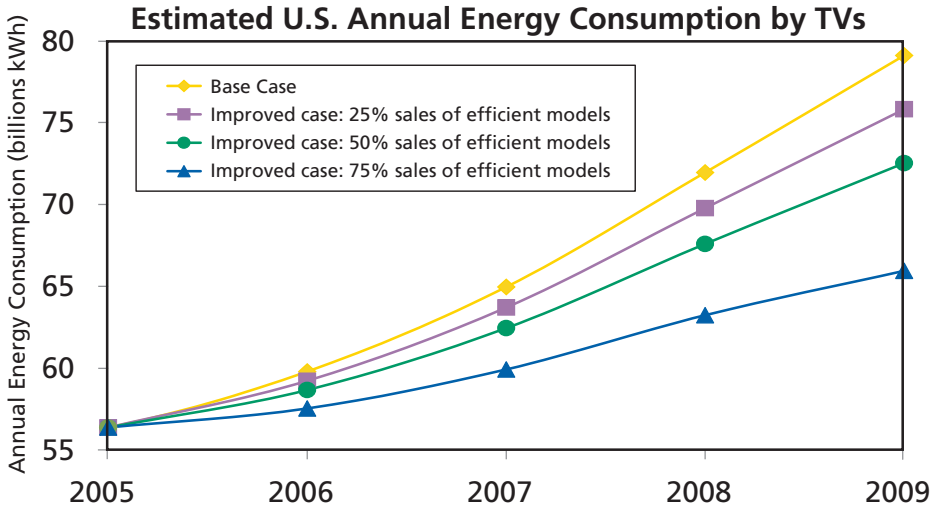

Figure 4

ENERGY STAR voluntary labeling program is currently the only U.S. program that promotes energy efficiency in TVs. ENERGY STAR's standby mode limits range from 1 to 15 watts depending on the technology type, with most requirements dropping to 1 watt or less on July 1, 2005. The ENERGY STAR Web site provides a list of qualifying products, but does not disclose the range of measured standby mode power levels, active mode power levels or estimated total annual energy use for each model. Even magazines, like *Consumer Reports,* and most manufacturers do not report active mode power use or estimated annual electricity use for televisions.

As a result, we have a market in which consumers can purchase TVs using 500 or even 1,000 kWh per year—far more than a new refrigerator, dishwasher, or clothes washer—without ever knowing the impact such a purchase will have on their electricity bills. This is a recipe for ever-increasing television energy use, because consumers and electric utilities can only take action to improve television energy efficiency if they first know how energy-efficient televisions are.

Recommendations

NRDC recommends three important actions to help the U.S. improve the active mode energy efficiency of TVs without sacrificing quality or performance, and to provide consumers with the information they need to make energy-efficient buying decisions:

Technical preparations—It is essential to the success of future TV energy efficiency measures that the DOE replace its antiquated TV test procedure and adopt a national TV test standard based on IEC 62087. We recommend that the U.S. take a leading role in revising IEC 62087's screen calibration settings to more accurately reflect real world use and energy consumption. Analysts and policymakers also need to come to consensus on TV operation patterns.

The energy efficiency community and industry need to agree upon a metric for comparing television energy consumption. We recommend that TVs of similar size and picture resolution (SD, ED, HD, etc.) be compared to each other using their estimated annual energy consumption in kWh. This metric relates directly to a consumer's energy bill and would easily gain acceptance because energy efficiency labeling is already standard practice for large appliances.

Mandatory labeling—The U.S. Department of Energy (DOE) and the Federal Trade Commission (FTC) should take advantage of their existing authority to extend EnergyGuide labeling beyond traditional appliances to televisions and other major consumer electronics products.

As illustrated in Figure 5, the new EnergyGuide label for TVs should provide information on:

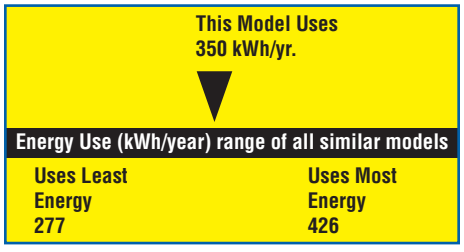

Figure 5

- the amount of energy used to operate the TV annually, based on a standard duty cycle
- the cost to operate the TV annually, based on energy use and typical electricity prices
- the range of annual energy consumption for other TVs of comparable size and resolution.

Voluntary labeling—We recommend that the ENERGY STAR program revise its TV specification to include active mode efficiency. The new specification should evaluate TV energy efficiency based on the amount of functional performance provided (screen area and picture resolution) per kWh of total annual electricity use. The annual energy consumption of a TV would be determined the same way DOE would determine it for mandatory labeling—by measuring average standby and active mode power consumption and multiplying by typical hours of operation in each mode.

The specification should grant allowances for additional electronic functions like CableCARDs™ that result in fixed increases in energy consumption. Having separate specifications for different screen technologies like CRTs, LCDs, plasma, DLP, etc. is not recommended, as consumers should be encouraged to buy the most efficient TV not just the most efficient TV of a given technology type. Specification curves drawn on a graph of annual energy use vs. screen area could account for different levels of resolution, features and performance.

Project managed by Noah Horowitz, NRDC Senior Scientist. Prepared by Peter Ostendorp of Ecos Consulting. This document presents the abridged findings of a larger NRDC report on TV energy efficiency, available at http://www.nrdc.org/air/energy/energyeff/tv.pdf.