# Turning HDTVs Green

## Automatic light sensing helps televisions use less power

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Have you ever thought about street lamps? They are off during the day, but as dusk falls, they turn on. We no longer rely on lamplighters to stroll through the town in the evening turning them on, and then off again in the morning.

Instead, electrical components known as "photosensors" detect the amount of light in the sky, and automatically turn the lamps on in the evening and off in the morning. These simple little components save a lot electricity that would be wasted if the lamps were simply left on all day.

The same principle can be applied to your television, saving a measurable amount of electricity every month. And when you multiply these savings by the millions and millions of televisions in use worldwide, the savings can make a big difference.

## Energy Conservation and Televisions

Energy consumption is growing worldwide. The statistics are staggering, but it boils down to this. The vast majority of our energy comes from the burning of fossil fuels: coal, oil, and natural gas. This releases an enormous amount of carbon dioxide into the atmosphere, which many scientists believe is a significant greenhouse gas that contributes to global warming.

We also need to slow down our consumption of fossil fuels in order to help make our resources last longer, while we develop renewable energy sources — such as biofuels, wind, and solar — to replace our traditional fuels.

## Television Energy Consumption Grows

What may surprise you is the role that televisions play in energy consumption.

Ten years ago, almost all the televisions in use worldwide were picture tube models. These relied on a large vacuum tube — known as a CRT — to produce an image.

*We used to rely on picture tube televisions that made inefficient use of energy.*

These sets were very inefficient in their use of electricity. According to one study, in 2004 picture tube sets accounted for 21 terawatt hours (TWh) of the 23 TWh consumed worldwide by televisions that year.[1] That's about 277 times the total residential use of electricity in California that year.[2]

Let's put that in some perspective. A bright household incandescent light bulb uses 100 watts per hour. One TWh is the equivalent of a trillion light bulbs — one million million — burning at the same time.

For 2008, picture tube TVs were estimated to consume less than 15 TWh, and were

surpassed for the first time by LCD and plasma flat panel TVs at a combined 21 TWh. And the forecast for 2009 has flat panel TV energy consumption jumping to 28 TWh as picture tube consumption drops to about 13 TW.[3]

*LCD and plasma flat panel televisions are more efficient than picture tube TVs, but they are also larger.*

For TVs of similar size, LCDs and plasmas are far more energy efficient than picture tube models. The problem is that the sets are not of similar size. For standard definition picture tube sets, the average size has been about 23 inches or smaller. For LCDs, the average size is forecast to be about 30 inches this year, while the average plasma panel is expected to be 48 inches.[4]

The larger average size means that the sets are likely to draw more power than the less-efficient but smaller sets that they replace. And as a result, power consumption for home television increases.

Energy Star is a voluntary certification program for consumer electronics and other products, run jointly by the U.S. Department of Energy and Environmental Protection Agency. According to the Energy Star program, televisions account for 4 percent of the residential electricity consumption in the United States, or about 50 TWh a year.[5]

Using 11.5 cents per kilowatt hour as an average cost for electricity in the U.S. in 2009[6], that comes to about $5.75 billion annually spent on electricity for television use alone. And that number is climbing.

## Environmentally Friendly TVs

Flat panel television makers devote huge amounts of time and money to make their products friendlier to the environment.

The companies are not focusing just on operating power consumption, but also on the entire “birth to earth” life cycle of their products. They are looking to use component materials that are more energy efficient and less polluting to produce. They are finding ways to make their manufacturing procedures more efficient and friendly to the environment. They are developing lighter packaging that relies more on renewable materials so that they can save energy when shipping their products, and then the packaging can be recycled easily.

They have removed most of the hazardous materials from their products, and are working hard to eliminate the rest. And they are making it easier to recycle and recover materials from the sets at the end of their useful life, ten to 15 years from now.

## Making TVs More Energy Efficient

A key focus for these efforts, however, is improving the energy efficiency. A number of new technologies are already in use in flat panel televisions that help cut energy consumption.

For example, LCD flat panel TVs need a light source behind the liquid crystal layer in

order to create an image. Instead of the typical fluorescent tubes, a growing number of LCD TVs now use LEDs (light emitting diodes) as the light source. These solid state lights are more energy efficient and can actually be turned on and off in dark areas of the picture, which saves energy while improving the image contrast.

Plasma makers have improved their technology, including using new chemical combinations that can extract more light from the electricity used to make an image. The result is a brighter image with no increase in energy consumption.

## Automatic Brightness Control

One feature that helps make both plasma and LCD HDTVs more energy efficient is automatic brightness control.

*You need the brightest image you can get from your flat panel television when you are viewing it in a room with bright lighting.*

If you're watching television in a brightly lit room, you'll probably want it set to produce as bright an image as it can. This will help prevent the colors from looking washed out, and will help the dark portions of the images look darker.

However, you won't want to have the brightness turned all the way up when you view the same television in a dimly lit room, as it would be too bright.

*In a room with low lighting, you will want the brightness on the television turned down.*

Perhaps you've driven past one of the new LED electronic signs that some businesses put up next to the road. A sign that is bright enough to read during the daylight hours turns out to be painfully bright at night. (In fact, the professional organization for the large electronic billboards requires that they automatically dim at night to compensate for this effect.)

The same holds for the television in your family room, bedroom, or media room. When the lights go low at night, you'll want to dim the image on the screen so that it's not too bright.

One way to achieve this is to adjust the brightness control on your TV as the lighting conditions change. Some flat panel HDTVs

now also have an “eco-mode” setting that lets you choose a lower brightness level.

The best way, however, is to have the TV make the change for you automatically so you don’t have to think about it. As the room lighting changes, the set senses this and adjusts the brightness of the image for you.

This convenient magic is achieved through the use of a relatively low-cost component known as an automatic light sensor (ALS). These devices measure the amount of light in the room, and send an appropriate signal to the TV’s controlling circuitry.

Older models use analog ALS components, but the newer models use digital versions. The digital components, pioneered by TAOS, Inc., have a number of advantages, including a more even response across a broader range of light levels, ranging from very dim to very bright. It is also easier to devise a system that can accurately measure visible light without being thrown off by light in the invisible infra-red or ultraviolet ends of the spectrum.

And best of all, the digital ALS components draw less power, so they help save even more energy. Their low-power circuitry can signal when there is a light change, unlike analog devices which must be monitored constantly.

## Does It Make a Difference?

The Energy Star program recognizes the benefits of an automatic brightness control feature in the measurement specifications for Version 3.0 of the standard. Sets that do not have this feature are evaluated at their maximum brightness level. If there is an automatic brightness control, however, then the maximum brightness accounts for 55 percent of the total power consumption score, and the remaining 45 percent is based on a measurement taken in a room with no lights.[7]

For a plasma flat panel TV, lowering the brightness level means that less energy is used to drive the panel. Plasma power consumption depends on the image on the screen; bright images use more power than those with dark scenes. Automatic brightness control will save more power on bright scenes than dark ones.

For an LCD, the bulk of the energy consumption comes from powering the backlight, and this remains constant no matter whether the screen image is bright or dark (unless it uses LED backlights with local dimming). According to the LCD TV Association (www.lcdtvAssociation.org), automatic brightness control can cut the backlight power consumption by as much as 30% over normal usage patterns.[8]

According to LG Electronics, their LG60 Scarlet LCD HDTV uses automatic light sensing and other energy-saving features to save up to 69.5 percent of the energy that would be used by a comparable model without those features.[9]

The LCD TV Association believes in the power savings of automatic brightness control to such a great degree that they made it the basis of their “Green TV” certification program.

Automatic brightness control clearly makes a difference. Of all the flat panel televisions that meet the stringent qualifications of the Energy Star Version 3.0 requirements, 40% of the LCD models and 40% of the plasma models have some form of automatic brightness control.[10]

## What's Next for Energy-Saving TVs?

A number of changes are on the horizon that will further reduce energy consumption by televisions. Energy Star has already set Version 4.0 and 5.0 standards that are set to take effect in May 2010 and May 2012. Each version lowers the amount of power that a television can use and still qualify for the Energy Star certification.

Other groups in the U.S. and worldwide are also working on developing energy consumption and other environmental standards for flat panel televisions.

Manufacturers aren't waiting for new rules and regulations, however. For example, Vizio is a leading LCD HDTV manufacturer that is incorporating ALS technology in its future models.

And Sony has already come out with the Bravia WE5 that has two innovative energy saving features. First, it has a standby mode that consumes no power, yet when you turn it back on, it powers up almost instantly.

The other innovative feature is that the set has a proximity sensor that can tell when someone is in the room watching it. If you leave the room, the set will turn the picture off and then back on again when you return. The sound remains on so that you can still hear your show from the other room.

## Making a Difference

Televisions remain a major factor in the average home's electrical power consumption. And as set prices drop, it's likely that we'll continue to move up to larger and larger screens.

Fortunately, manufacturers, companies like TAOS that make ALS components, and other groups are hard at work, finding ways to minimize the power used by our televisions, and making them smarter so that they can automatically make adjustments to save energy. And at the same time, many of these improvements also make the image quality even better.

We'll never get to the point where our televisions use no power, but we are continually making them more efficient.

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[1] Jones, Keith, and Bob Harrison, "The Impact of Changing TV technologies and Market Trends on the Energy Consumption on TVs and the needfor a better TV Energy Test Method", eceee 2007 Summer Study Conference Proceedings, 2007; http://www.eceee.org/conference_proceedings/eceee/2007/Panel_6/6.010/

[2] California residential 2004 83,361 million KWh; http://www.eia.doe.gov/emeu/states/hf.jsp?incfile=sep_use/res/use_res_cax.html&mstate=CALIFORNIA

[3] Jones, Keith, and Bob Harrison, "The Impact of Changing TV technologies and Market Trends on the Energy Consumption on TVs and the needfor a better TV Energy Test Method", eceee 2007 Summer Study Conference Proceedings, 2007; http://www.eceee.org/conference_proceedings/eceee/2007/Panel_6/6.010/

[4] DisplaySearch (presentation at SID Display Business Conference, 2009)

[5] Energy Star Web site; http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=TV

[6] http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html

[7] Energy Star Program Requirements for Televisions, Partner Commitments, Versions 4.0 and 5.0, 2009; http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/television/Final_Version%204_5_TV_Program_Requirements.pdf

[8] LCD-TV Association White Paper #2: TV Power Consumption: Is There a Problem? (and Can LCD TVs Help?), 2008; http://www.lcdtvassociation.org/images/TV_Power_Consumption_White_Paper_LCD_TV_Association.pdf

[9] LG press release, 2008; http://www.lge.com/about/press_release/print/20897.jhtml

[10] Energy Star Television Product List, List Current as of October 02, 2009; http://downloads.energystar.gov/bi/qplist/tv_prod_list.pdf

**About TAOS, Inc. (Texas Advanced Optoelectronic Solutions)**

With more than a decade of analog mixed-signal technology innovation and market leadership, Texas Advanced Optoelectronic Solutions (TAOS), Inc. designs and manufacturers digital and analog light-sensing solutions that deliver increased system integration, design flexibility and functionality to a wide range of products in the consumer, computer, industrial, medical and automotive markets. Integrated ambient light sensing and proximity detection solutions enable "Green" displays by reducing system power consumption. An expanding portfolio of programmable analog and digital RGB color sensors provides accurate color discrimination, determination and measurement.


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