

# Energy-Saving Technologies for LC-30BV5 LCD TV

Kiyoshi Hosoda\*

\* Engineering Department III, LCD Digital Systems Division, Audio Visual Systems Group

## Abstract

The flat panel TV market is growing rapidly at the turn of the century, coinciding with the launch of BS digital broadcasting in Japan. LCD and plasma TVs are replacing the conventional CRT TVs and becoming the mainstream. These market and technological trends have led to a shift in consumer demands toward thin-profile and environment-friendliness as well as high picture quality.

Sharp started development of LCD TVs early as it was aware of their desirable qualities such as thin-profile, light-weight, low energy- and natural-resource- consumption, long life and eye-friendly luminescence characteristics. Today, Sharp has launched 25 models of AQUOS LCD TV series into the market, ranging from 13 inch 4:3 format to 37 inch wide-screen.

This paper outlines Sharp's energy-saving technologies, a part of its resource-saving technologies that support AQUOS LCD TV series.

## Introduction

We at Sharp were aware of the benefits of LCD TVs from an early stage, such as high-resolution performance and environmental friendliness, and have been carrying out many long years of research and development. In August 1998 we set a goal as a company to make “all TVs sold in Japan LCD TVs by 2005”. In January 2003 we currently carry LCD models with 10- to 37-inch displays. Through this broad range of products we are looking to develop the LCD TV as the mainstay of the entertainment TV world.

If we look at recent trends in the market, proliferation of LCD TVs has picked up speed recently, with demand in fiscal 2002 topping 1.5 million units. As demand continues to increase we can almost see the day when the word “TV” will refer to an LCD unit.

This is because LCD TVs have caught the eye of the consumer with their high levels of performance and environmental consciousness (low energy consumption)—functionality that has developed and matured over the years.

In the future, the LCD TV will form the core TV unit for the home. Consumers will demand further-increased functionality, still-larger screen size and increased environmental performance.

In particular the field of environmental technology will prove to be a crucial factor in the future of the TV market.

This paper takes a look at the energy-saving technologies developed for LCD TVs, by using the LC-30BV5, an LCD TV with a built-in BS digital tuner, which went on sale in October of last year, as an example.

# 1. Development of Energy-Saving Technologies

## 1.1 High-Brightness, High-Contrast Technologies

The display unit of the LC-30BV5, a 30V-inch wide-screen LCD TV, employs a direct backlight system as shown in Fig. 1, so that even with a large screen, the brightness remains high and power consumption low.

The construction is very simple. The unit assembles as follows—from the rear of the display, the first panel is the reflector. Next up are the fluorescent backlight tubes (cold cathode fluorescent tubes), then the diffuser followed by several types of optical sheeting. Finally, the liquid crystal panel completes the set.

The backlight is assembled from 12 high-efficiency cold cathode fluorescent tubes designed for large-screen LCD TVs, each measuring 669 mm in length and 4 mm thick.

The LCD panel uses an Advanced Super View low-reflection black TFT LCD, which provides a high-contrast image with sharp black tones even in a brightly lit room.

Fig. 2 shows a contrast comparison between a conventional CRT and the Advanced Super View low-reflection black TFT LCD. In a dark room with ambient lighting of less than 30 lx, the CRT scored a contrast ratio exceeding 500:1. However in a brighter environment (normal use/living environment), the LCD's contrast ratio ranked higher than that of the CRT.

Thanks to these elements in its construction, the display section of the LC-30BV5 wide-screen LCD TV can realize higher resolution images, higher brightness and lower energy consumption compared to other types of displays. The LCD has a contrast ratio of more than 500:1, maximum brightness of 450 cd/m<sup>2</sup>, viewing angles of 170° horizontally and vertically, and a total unit width of 90 mm.

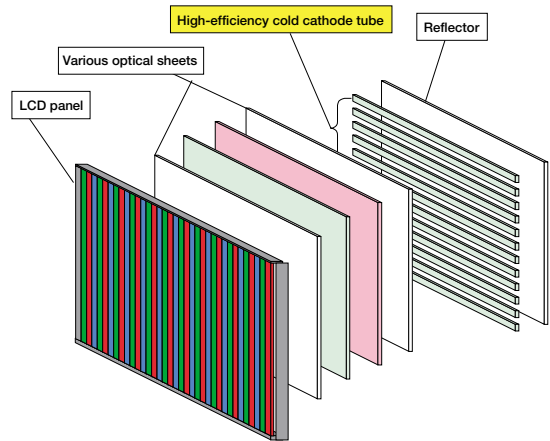


Fig. 1 Backlight construction

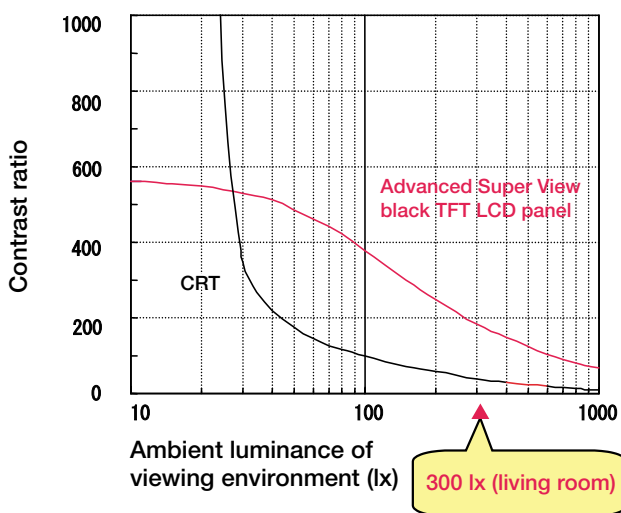


Fig. 2 Contrast comparison

The LC-30BV5 LCD TV, boasting a 30V-inch LCD wide-screen display, comes equipped with a BS/110° CS digital HDTV tuner and yet still only consumes a mere 144W when operating. The LCD TV components explained above contribute greatly to this low energy consumption.

## 1.2 Development of a Low Energy Consumption Platform

A BS decoder unit, which features a one-chip LSI capable of decoding full-fledged BS/110° CS digital broadcasts, and a multi-scan converter circuitry using a one-chip image processing LSI that can display high-resolution images on a fixed-pixel display, contribute greatly to attaining higher image quality and keeping energy consumption to a minimum. The current configuration, using these two LSI chips, has

shaved up to 10W off the power consumption of earlier platforms.

**Fig. 3** is a schematic diagram detailing the platform construction of the LC-30BV5.

### 1.3 Reducing Power Consumption during Standby Mode

When an LCD TV with a built-in BS digital tuner is placed on standby mode, the tuner is still processing program and account information. Therefore, if you compare with other units that do not have an on-board digital tuner, the amount of electricity consumed on standby by the digital tuner LCD TV is greater. However, as we have managed to reduce the amount of circuit current in the LC-30BV5 when in standby, we have reduced the power consumption by 29% from 0.7W to 0.5W, compared with conventional LCD TVs with a built-in BS digital tuner.

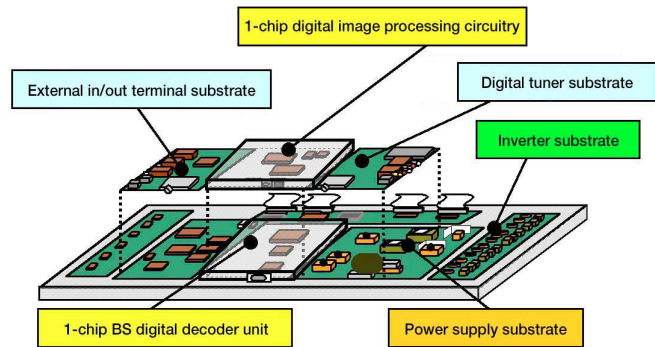


Fig. 3 Platform construction

### 1.4 Other Power Consumption Reduction Measures

#### 1.4.1 Power Consumption Reduced by the Auto-Save Function

The Auto-Save function, which detects the intensity of illumination irradiated on the display screen, automatically controls the illumination duty ratio of the backlight and adjusts the brightness of the screen, thus reducing backlight power consumption. Therefore, when watching the screen in a dark room, this function reduces unnecessary screen brightness and adjusts it to an optimum brightness, reducing total power consumption.

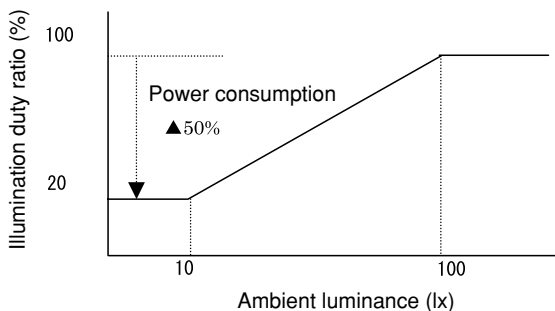


Fig. 4 Auto-Save function

Moreover, as this function is fully automatic, people are able to contribute to the reduction of energy consumption without even realizing it. Also, as is shown in **Fig. 4**, this function can reduce rated electricity consumption by as much as 50%.

## 2. Energy Conservation Performance

### 2.1 Comparison of Annual Power Consumption

**Table 1** shows a comparison of power consumption, power consumption during standby mode and annual power consumption\* between three types of TVs: the LC-30BV5 LCD TV, a Sharp CRT TV having the same effective screen size of the LC-30BV5, and a typical plasma TV made by a company other than Sharp. In every category, the LCD TV scored better than their counterparts.

The LC-30BV5 consumes 64% of the power of an equivalent Sharp CRT TV (model number 32C-HE1) and only 48% (less than half) of a plasma TV. Even on standby mode, the LC-30BV5 consumes 71% of the power of a CRT TV and only 20% of a plasma TV.

According to an interpretation of the “Rational Use of Energy” legislation by the former Electronic

Table 1 Comparison of power consumption

	Model name	Screen size (H x V) (mm) (Comparison ratio with 32C-HE1)	Power consumption (W) (Comparison ratio with 32C-HE1)	Standby power consumption (W) (Comparison ratio with 32C-HE1)	Annual power consumption (kWh/year) (Comparison ratio with 32C-HE1)
LCD TV	LC-30BV5	643.2 x 384.2 (100%)	144 (64%)	0.5 (71%)	191 (70%)
CRT TV	32C-HE1	662.4 x 373.6 (100%)	224 (100%)	0.7 (100%)	271 (100%)
Plasma TV (other manufacturer)	32V-inch wide-screen	716.0 x 399.0 (115%)	300 (134%)	2.5 (357%)	456 (168%)

Industries Association of Japan (EIAJ), annual power consumption is calculated by using values for power consumption, standby power consumption, hours of use (4.5 hours), hours in standby (19.5 hours) and 1/4 of the power saved with the power-save function. Annual power consumption of the LC-30BV5 is 70% of a CRT TV and 42% of a plasma TV.

If you calculate the difference in annual power consumption between the LCD TV, the CRT TV and the plasma TV featured in Table 1, the difference with the CRT TV comes in at 80 kWh/year and 265 kWh/year for the plasma TV. If we take the base rate electricity charge to be ¥23/kWh, then the CRT TV costs ¥1,840 more per year and the plasma TV adds ¥6,095 a year in electricity charges.

In this way, when discussing the TV of the future, a comparison of LCD TVs with CRT TVs and plasma TVs reveals that in a society that values environmental issues and resource preservation, the LCD TV, in terms of energy conservation, answers all of the questions put before it.

\*Annual power consumption was measured in this fashion:

$$E = \{(Po - Pa/4) \times 1,642.5 + Ps \times 7,117.5\} / 1,000$$

E: Annual power consumption (unit: Kilowatt hour)

Po: Power consumed during normal 'on' mode (unit: Watt)

Ps: Power consumed during standby mode (unit: Watt)

Pa: Reduction in power consumed due to power-save function (unit: Watt)

Time 'on': 1,642.5 hours a year, equivalent to 4.5 hours a day

Time on standby mode: 7,117.5 hours a year, equivalent to 19.5 hours a day

## Conclusion

Due to our efforts to shape the fundamental performance of our LCD TVs to mesh with our concerns for the global environment, we have managed to develop the Advanced Super View TFT LCD and a highly efficient backlight system, resulting in energy saving performance and long operating life that is particular to LCD.

The power consumption of the LC-30BV5 is 144W, a 35% saving compared to a Sharp CRT TV with approximately the same size screen. Though having a built-in BS digital tuner, the advanced all-in-one design of this TV achieves a thickness of only 90 mm and a weight of 17.9 kg (not including the stand). It is one-sixth the thickness and one-third the weight of a 32-inch CRT TV so you have many choices in where to place it.

If we look at the projected demand for LCD TVs with displays larger than 10 inches, 2 million units will be sold in Japan during fiscal 2003, with global demand reaching 3 million during the same period.

Increasingly it looks like the market will turn toward LCD TVs.

This is all down to the fact that LCD TVs combine high performance with a thin, light design, conserve energy and resources and allow for a long operating life. In the future, we believe LCD TVs will grow to become products that match consumer preferences more than ever before and move to be at the center of home entertainment. We will continue to work towards the greater proliferation of LCD TV media, developing LCD TVs that can save more and more energy.

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