THE COLLABORATIVE LABELING AND APPLIANCE STANDARDS PROGRAM

Techno-economic Analysis for Labeling Color Televisions in India

Prepared by

Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division

&

ICF International
India Office

September 2008

This work was supported by the U.S. Environmental Protection Agency through a Cooperative Agreement with CLASP.

Table of Contents

1. Introduction

The analysis summarized in this report supports the ongoing work of the Bureau of Energy Efficiency (BEE) in India in its mandate to implement a standards and labeling program for consumer electronics in India. US EPA actively supports the S&L program of the BEE. The analysis deals with establishing an efficiency threshold for an endorsement label. The purpose of endorsement labeling is to indicate clearly to the consumer that the labeled product saves energy compared to others on the market. The endorsement levels can be set on the basis of their relative place in the efficiency distribution. Typically, these levels are applied to the top tier (e.g., the top 15 to 25%) of energy-efficient products in a market. One example of an endorsement label for energy efficiency is the U.S. ENERGY STAR label. These levels can also be designed to target a specific efficiency level, as is mostly done with thresholds for standby power ratings.

Labeling aims to shift markets for energy-using products and appliances toward greater energy efficiency. Energy-labeling programs help consumers understand which products are most efficient and what the benefits of this efficiency are. Labels not only influence consumers to choose more efficient products but also create competition among manufacturers to produce and market the most energy-efficient models, which engages retailers in promoting efficiency

The goal of this techno-economic analysis is to assess the net benefits that efficiency-based endorsement labels for consumer electronics can bring to India. The study focuses on color televisions as the first major product in a series of products within the consumer electronics product category in India. Color televisions form the biggest share of the consumer electronics market in India. And with the increasing ownership of this product in the country, in addition to a growth in the product range, this product is an important target for efficiency improvement in India.

The analysis consists of two components:

- Establishing the endorsement levels as a non-regulatory efficiency policy and assessing their impact on the current market.
- National energy and financial impacts.

The analysis relied on detailed and up-to-date market and technology data made available by ICF India. Technical parameters were used in conjunction with knowledge about television use patterns in the residential and commercial sectors, and prevailing marginal electricity prices, in order to give an estimate of per-unit financial impacts. In addition, the overall impact of the program was evaluated by combining unit savings with market forecasts in order to yield national impacts.

This study estimates potential efficiency savings from implementing an endorsement label for color televisions. Thus, the estimated benefits represent only part of the total that might be realized through a comprehensive program of efficiency improvement that

follows the endorsement label with the setting of a minimum energy performance standard (MEPS) applied to all the consumer electronics products. The focus in the current task is to provide the most specific and technically accurate analysis for establishing efficiency levels for an endorsement label that would generate the maximum savings while creating the appropriate market pull for moving the baseline efficiency upwards.

2. Methodological Approach

The analysis makes use of the Policy Analysis Modeling System (PAMS) labeling tool for conducting the technical analysis for establishing endorsement levels for color televisions. The main input to this exercise is the current market distribution of efficiency. The analysis constituting national energy impact is based on several estimated parameters, including annual color TV growth rate, stock, the proportion of different kinds of color TVs, and the growth rate of electricity prices. Given these parameters, we estimate energy, environmental and financial impacts from implementation of endorsement labels.

Our analysis covers the time period from 2010 to 2020, with the assumption that the labels would be go into effect in 2010. Energy and operating cost savings in the policy case, relative to the base case, scale with the number of units operating at any given time after the implementation of policy. The base case shipments forecast is the means by which impacts are scaled to the national level. The base case shipments model includes historical shipments data, which in our case were provided by ICF India. These are used to provide continuity and calibration of the forecast.

3. Forecast of Product Sales

The overall growth in the television market continues to be high in India as the saturation of this product is still low compared to some of the other industrialized countries. The market for televisions in India is changing rapidly from the conventional CRT technology to flat panel displays in the form of flat panel CRTs, LCDs and Plasma televisions. Currently the split between CRT based products and LCDs is 98% CRT and 2% LCD. However, that is expected to change rather rapidly as the industry forecasts suggest LCDs' share of the market will increase to 10% by 2010 as shown in Figure 3.1. The shipment forecasts assume that the share of CRTs will drop further to less than 10% by the year 2020.

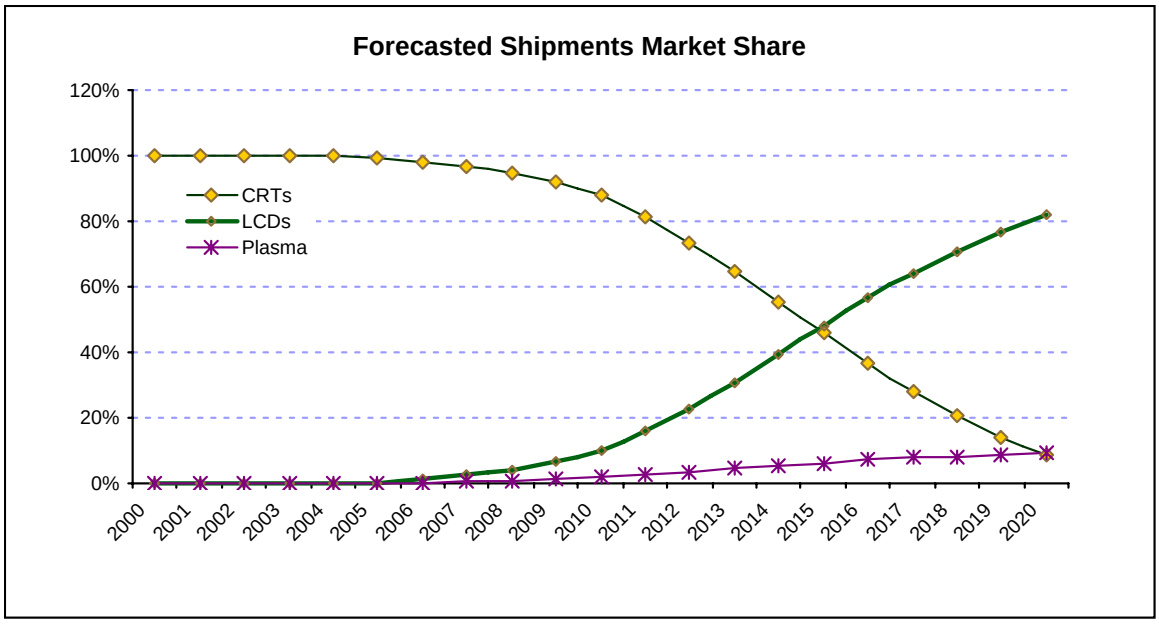

Figure 3.1 Forecast of Shipments Market Share by Technology

We can see from Figure 3.2 that CRTs will still be in use as part of the stock through 2030, however, since the sales would have considerably reduced in comparison to LCD and Plasma technologies by 2020, the stock will quickly decline. Another underlying assumption in the shipments forecast is that LCD televisions will replace CRTs in the small and medium size categories and become reasonably competitive with Plasma technology in the large screen size category.

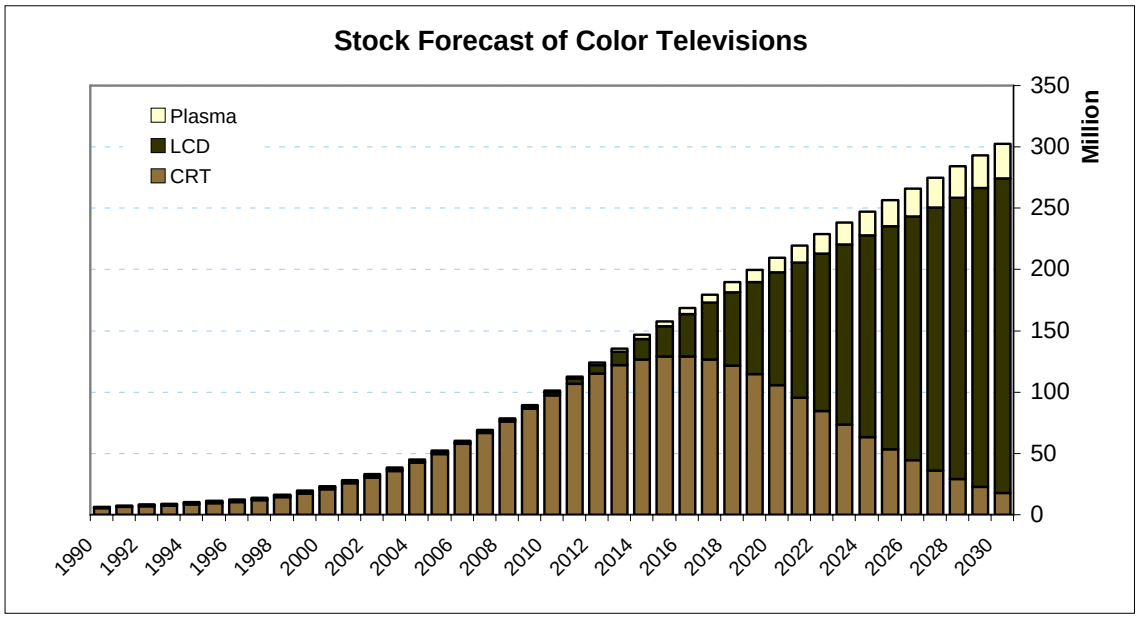

Figure 3.2 Shipment forecast of Color Televisions

4. Analysis of Indian Color Television Energy Consumption Data

In addition to being sensitive to usage patterns, energy use by televisions is sensitive to both screen size and technology type. Based on manufacturers' data, Figure 4.1 presents television energy consumption in active mode by varying screen size.

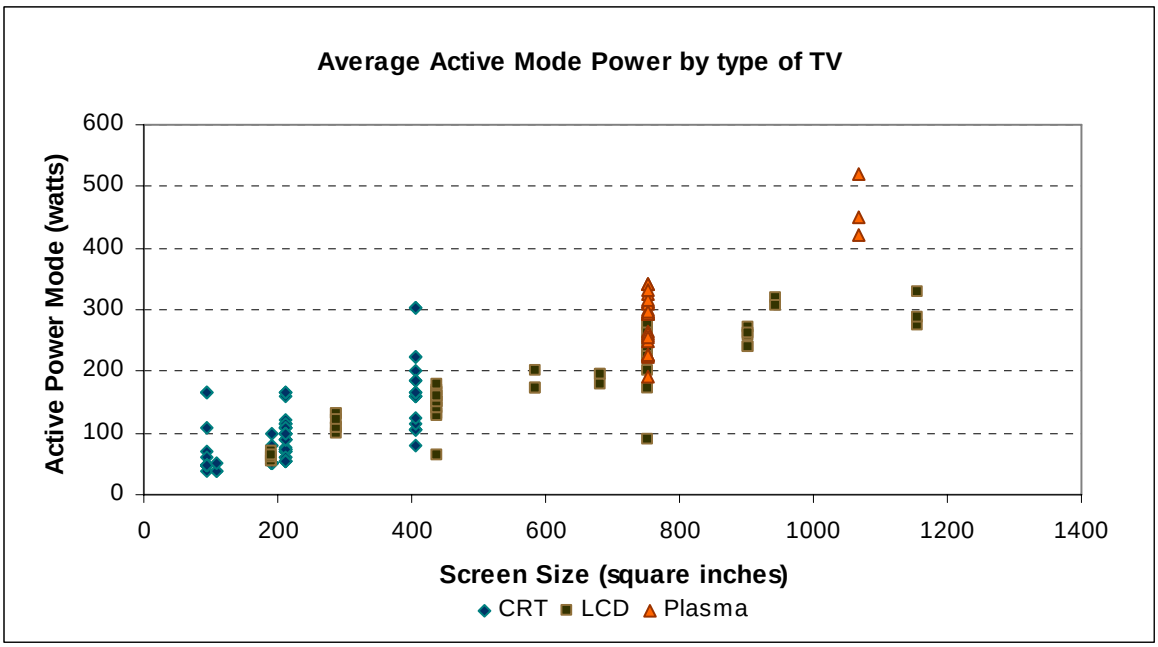

Figure 4.1. Active Mode Power Consumption by type of Television

Figure 4.1 shows penetration of LCD televisions into both the smaller and larger screen sizes. We can see a clear domination of CRT televisions in the smaller screen sizes and Plasma televisions are reasonably restricted to larger screen sizes. The figure also shows that for any given screen size a large spread exists between the better and worse performing televisions. The spread varies from over 75% for the smaller and medium screen sizes to over 50% for the larger screen sizes. If we compare the spread found in the Indian market with that currently existing in the US market, we find a much lower spread over a wider range of screen sizes. For smaller screens the spread is 38%. For medium size screens 54% and larger screens 23% (US EPA 2007). The significant spread in the Indian case indicates a large potential to improve the performance efficiency across types and sizes of televisions.

Figure 4.2 normalizes energy consumption of televisions by screen size to allow for a reasonable comparison of their performance. The figure plots the energy consumed by televisions per sq. inch against the screen size for all three product classes. The data makes it clear that on average CRTs do not perform as well as LCD. In fact, two of the worst performing televisions are smaller size CRTs. In general, a significant proportion

of the CRT models do show higher energy consumption. It is, however, noteworthy that this figure illustrates an energy efficiency index and, although some of the smaller size CRTs have higher energy intensities per square inch, their smaller size results in consumption of far less absolute power than larger screen size TVs. Another significant aspect of this illustration is the higher energy consumption by Plasma televisions. Based on the sample points, Plasma televisions tend to be at least three times more energy consuming than an LCD television of a similar size even on a per square inch basis. This dispels the notion that larger screen size is the primary contributing factor to the energy consumption of Plasma televisions. Although Plasma televisions currently seem restricted to medium screen sizes in the Indian market, their continued growth could lead to significant energy consumption, thus being a product with greater potential for savings through endorsement labels.

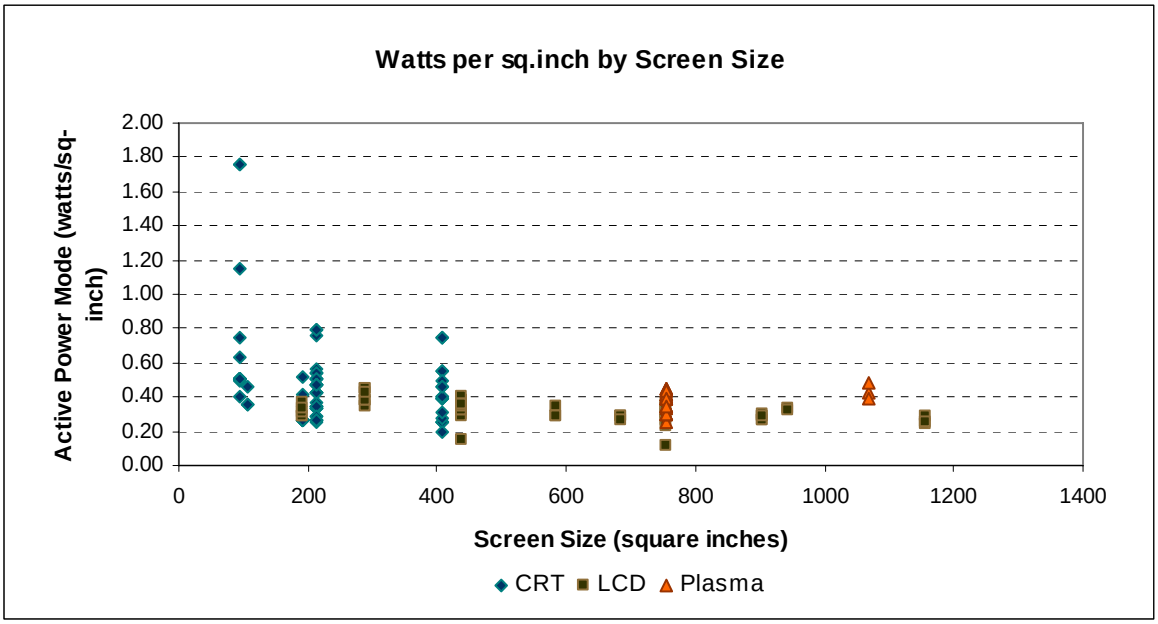

Figure 4.2. Active Power Mode Energy Intensity by Screen Size

An important aspect in the energy consumption of televisions is energy consumed in Standby Mode. Standby Mode is a lower power mode where the equipment consumes energy in 'off mode' (i.e., where the equipment has been turned off, remotely or otherwise, and is still connected to the power supply). Figure 4.3 plots the standby power against the screen size of the available television models. The aspect that distinguishes operational energy consumption from that of standby is the screen size. While energy consumption during active mode depends to great extent on screen size, standby power has no relationship to the size of the television. The data clearly shows that LCDs and Plasma televisions have uniformly lower standby power ratings than most CRTs. The figure also suggests that there is significant savings potential through a lowering of the standby power levels.

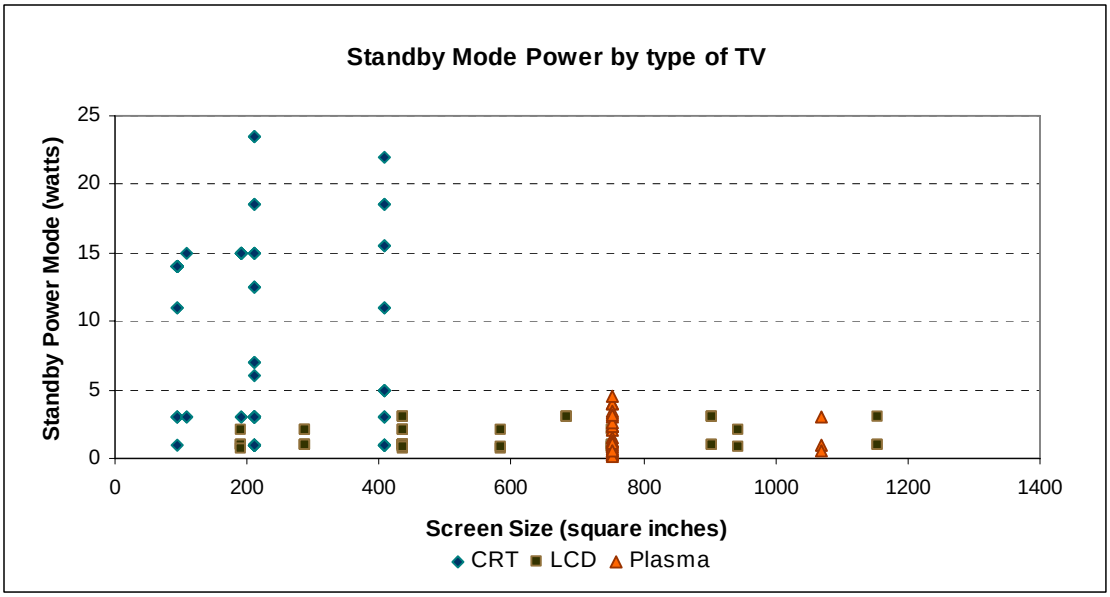

Figure 4.3. Standby Mode Power by Television Type

4.1 Unit Energy Consumption

Unit Energy Consumption (UEC), an essential input to PAMS, is calculated by utilizing the number of hours per day the television is in use. Personal communications with ICF India revealed 8 hours of operational or active use of television and 7 hours of standby use on average daily (ICF 2007). The annual UEC for active and standby usage is calculated by combining the hours of operation in active power and standby power modes with the manufacturer submitted power consumption in the two modes.

As discussed in the preceding section, screen size has a significant impact on the energy consumption ratings of active power modes. In order to avoid differentiating between technologies, the current analysis for setting active mode operation normalizes the UEC for screen size.

5. International Comparison of Programs to Reduce Energy Consumption of Televisions

5.1 Voluntary Programs

Voluntary programs that address standby and active-mode power consumption have been in existence internationally for a long time. The Energy Star® Program is a voluntary program that operates in the USA, Canada, and Australia and is recognized in New Zealand. It addresses standby power consumption of most consumer electronics and office equipment but not the active-mode power consumption.
In Europe, there are a number of initiatives that target power consumption in televisions. The Group for Energy Efficient Appliances (GEEA), which is made up of representatives from European national energy agencies and government departments, encourages industry best practice through a voluntary energy labeling scheme, which uses an Energy

Efficiency Index (EEI) that considers active-mode energy consumption. The EEI is a formula that takes into account several factors such as on mode consumption, standby consumption and screen size, format, and type. The European Commission (EC) also funds a pan-European effort of energy efficient appliances called HomeSpeed. The EC's Eco-Label is the only environmental certification scheme that is both certified by an independent organization and is valid throughout Europe and it applies to more environmentally friendly products and services. This label too addresses both standby and active-mode power consumption in addition to conditions on materials use.

The International Energy Agency (IEA) launched a "One Watt Initiative" energy saving program to reduce worldwide electricity losses from appliances in stand-by mode. Several countries have endorsed the initiative, which aims to encourage equipment manufacturers towards consuming no more than one watt when the equipment is in standby mode.

Japan has a voluntary labeling scheme that allows consumers to determine a unit compares in relation to the Top Runner standard. The labels are color coded to indicate the models that are below the efficiency target level and those above it. The label also displays the annual energy consumption of the unit for given usage level.

The Chinese 2005 MEPS announcement included energy conservation evaluation values for voluntary energy efficiency labeling specifications. The energy efficiency labeling criteria sets the threshold for standby power for CRTs, plasma, LCD and rear projection televisions at 3W. The CRTs are also subject to active-mode threshold level criteria of 1.1 EEI.

South Korea has a voluntary labeling scheme for standby power consumption for televisions called the e-standby program. The energy-saving label is an endorsement label with eligibility requirements similar to the International Energy Star program. The energy-saving label is popularly known as "Energy Boy". This label is attached to those products that meet the standards for standby power. The aim of the program is to reduce standby power below 1W by 2010.

5.2 Mandatory Programs

China is one of the few countries having a mandatory program that sets minimum standards for TV energy efficiency. The country announced a labeling and MEPS program called "The minimum allowable values of energy efficiency and energy conservation labeling values for color television broadcasting receivers" (GB12021.7-2005) in 2005. The MEPS provides maximum allowable values of energy consumption; energy efficiency grades including thresholds for the mandatory energy information label categories, and energy consumption test methods. The standard includes minimum energy values and energy efficiency criteria for 2006 implementation of standards and labels, as well as "reach" values for 2009 implementation. The MEPS applies to all screen types including CRT, rear projection, LCD, and plasma, but the active mode requirement applies only to color CRTs while flat-screen technology is subject only to

standby power limits. The MEPS level requires passive standby no greater than 9W, and an EEI of 1.5.

Japan has a Top Runner program, which is based around target standard values for energy consumption efficiency in accordance with the Energy Conservation Law, and is obligatory for manufacturers to adhere to them to improve the performance efficiency of their products on a weighted average basis. In contrast to regulations elsewhere,

Japanese standards do not exclude from the market equipment that fails to satisfy the standards. In the case of India, it will be important to ensure that the MEPS scheme is compatible with other such schemes, with a larger manufacturing or consumer base.

The following table summarizes the programs in other countries:

Table 5.1 Summary of Energy Efficiency Programs for Color Televisions.

Equipment	**Region/Country**	**Program Name**	**Mode**	**Target**
Voluntary Programs				
Televisions	USA/Canada/Australia	Energy Star	Standby only	Standby ≤ 1W
Televisions	Europe	GEEA Energy tick	Standby only	Passive Standby ≤ 1W; Active Standby: IRD-Terrestrial ≤ 7 W (+ max 9 W*) IRD-Cable ≤8 W (+ max 8 W*) IRD-Satellite ≤ 9 W (+ max 7 W*)
Televisions	Europe	Eco-label	All	Passive standby ≤ 1W Active Standby for TVs with IRD ≤ 9W On-mode EEI < 0.65
Televisions	South Korea	Energy Boy Label	Standby only	Standby ≤ 1W by 2010.
All	International	IEA "One Watt Initiative"	Standby only	Standby ≤ 1W
Mandatory Programs				
Televisions – CRT	China	Endorsement Label	All	EEI ≤ 1.1; Standby ≤ 3W
Televisions – Plasma, LCD, Rear Projection	China	Endorsement Label	Standby only	Standby ≤ 3W
Televisions - CRTs	China	MEPS	Active-mode power consumption	On mode EEI < 1.5

Televisions - CRT	Japan	Top Runner	All	Sales weighted MEPS levels based on formula

* Additional power allowance to the basic configuration (total maximum 16 W).

6. Shift in Efficiency Baselines through Labeling

In the current analysis, we establish endorsement efficiency levels for both standby and active power modes, for there is significant savings potential in both cases.

6.1 Standby Power Mode

The efficiency distribution of the available models for the three product classes – CRTs, LCDs, and Plasma technology, reveal a wide variation in the standby power ratings for CRTs. In Table 6.1, the distribution shows that 47% of the market falls below the 3W power rating, while more than 45% of the market is above the 9W level. This indicates a significant potential for savings even from setting the endorsement level at ≤ 3W.

To enable a consistent comparison of the national impact of an endorsement label across power ratings, we analyze a scenario where market share of the qualifying products increases by 25% over a period of five years from the implementation date.

Figure 6.1 illustrates the shift in baseline efficiency and a change in efficiency distribution of standby power in the CRT market by setting the endorsement levels at ≤ 3W and ≤ 1W. Setting the endorsement level at ≤ 1W will not only garner energy savings, it would also bring the Indian market towards the global 1W standby power initiative in this category of products.

Table 6.1. Efficiency Distribution of CRTs

W	% Market
24	4%
21	5%
18	2%
15	30%
12	5%
9	2%
6	5%
3	28%
1	19%
0.4	0%

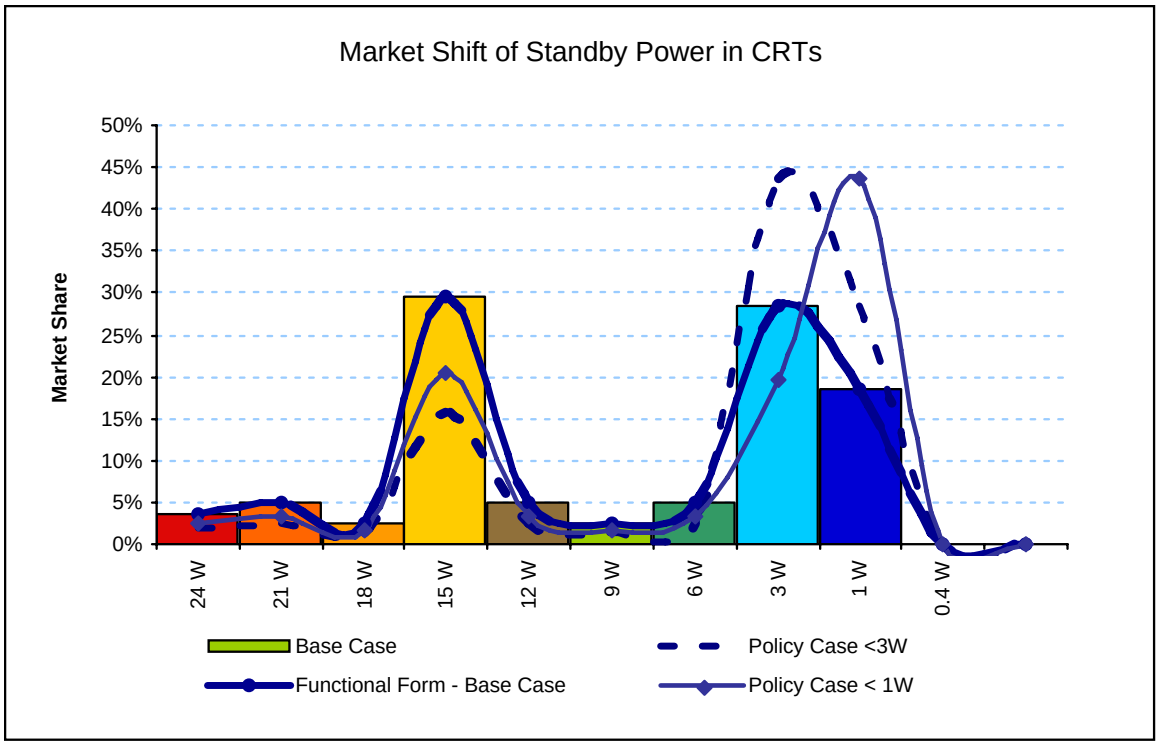

Figure 6.1 Market shift of Standby Power in CRTs

The efficiency distribution in the case of LCDs (see Table 6.2) shows that over 63% of the market is in the ≤1.2 W category, of which nearly 60% is in the ≤0.9W category. Figure 6.2 illustrates how the baseline efficiency and efficiency distribution could change by setting the endorsement level at ≤1.2W with the aim of moving the efficiency of the entire market by 25% in 5 years.

Table 6.2. Efficiency Distribution of LCDs.

W	% Market
3.00	19%
2.70	0%
2.40	0%
2.10	19%
1.80	0%
1.50	0%
1.20	25%
0.90	38%
0.60	0%

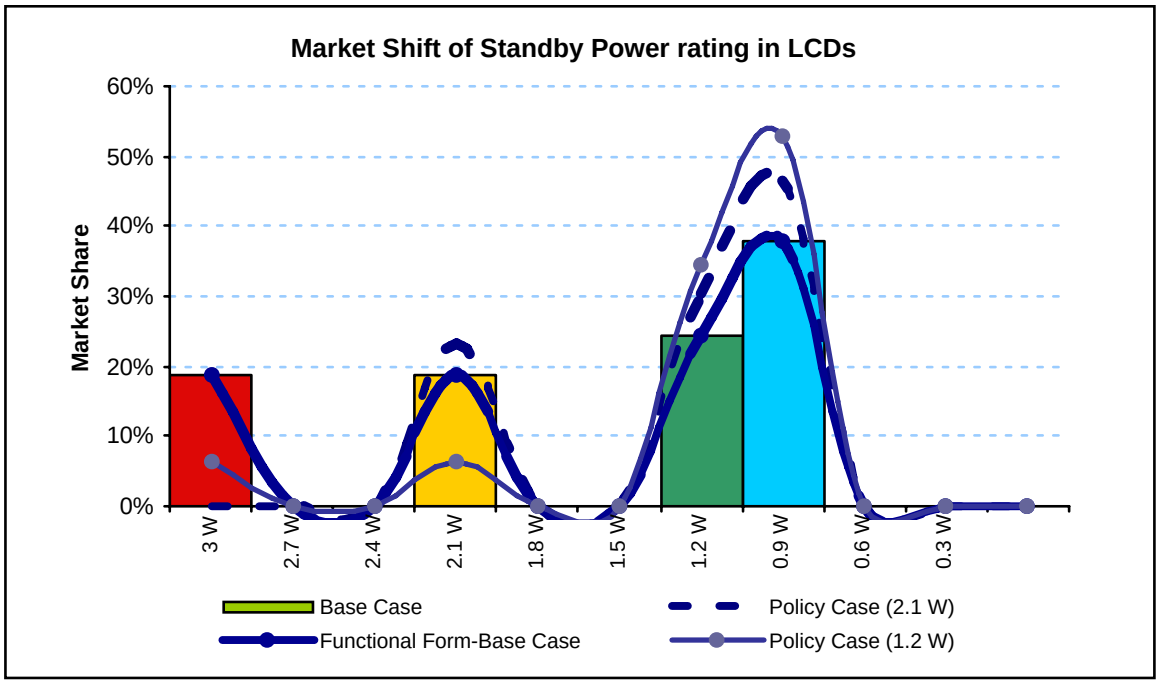

Figure 6.2 Market shift of Standby Power in LCDs

Table 6.3 presents the efficiency distribution of standby power for Plasma televisions in the Indian market. The distribution reveals that, respectively, about 41% and 24% of the market already lie below the ≤1 W and ≤0.5 W levels. These two rating levels could be analyzed for their impact on national energy consumption. Figure 6.3 illustrates the shift in efficiency distribution if the endorsement level is set at the ≤1W and ≤0.5W levels for this category of televisions.

Table 6.3. Efficiency Distribution of Plasma TV

W	% Market
4.6	3%
4.5	0%
4	7%
3.5	10%
3	10%
2.5	14%
2	0%
1.5	14%
1	17%
0.5	24%
0.1	0%

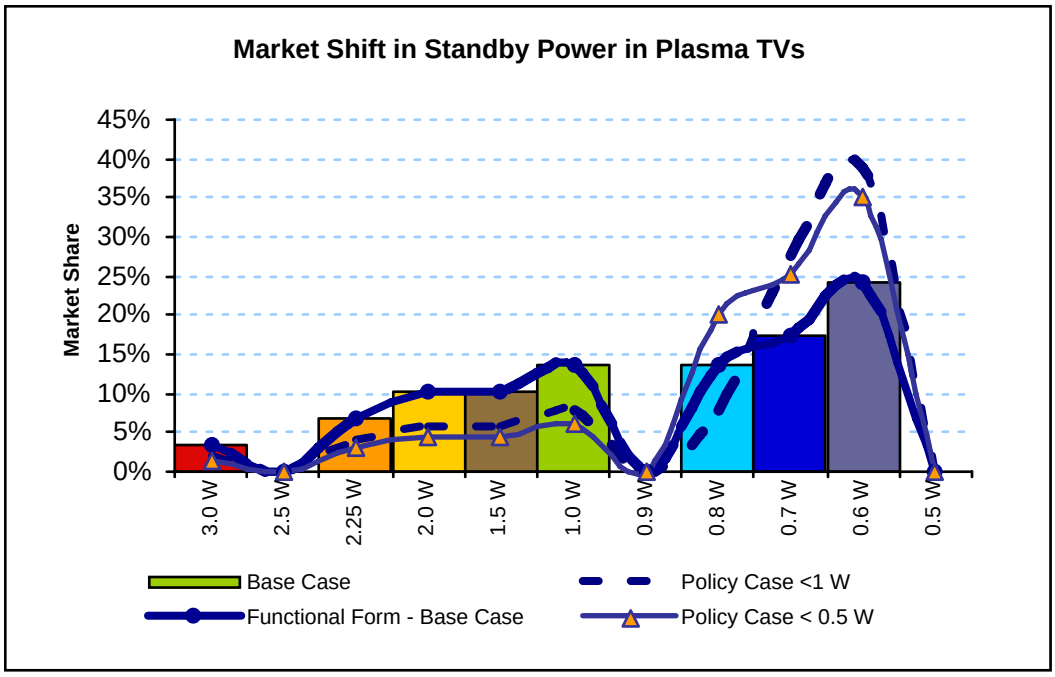

Figure 6.3 Market Shift of Standby Power in Plasma Televisions

6.2 Active Power

In order to develop endorsement levels that are performance-based and technology neutral, the analysis normalized the energy consumption ratings for screen size. As shown in Table 6.4, efficiency distribution of all the available models in all three product categories (CRTs, LCD, and Plasma) revealed that, respectively, nearly 80%, 60%, and 26% of the market fall below the 0.5, 0.4, and 0.3 w/ sq.inch efficiency metric. We thus developed our three scenarios for determining endorsement efficiency levels for active power usage of the three products separately for these three consumption levels. The impacts are presented in the next section.

Table 6.4 Efficiency Distribution of Active Power Rating of All CTVs.

W/sq.inch	% Market
1.2	0.6%
0.9	0.0%
0.8	3.7%
0.7	0.6%
0.6	13.7%
0.5	20.5%
0.4	34.2%
0.3	24.8%
0.2	1.9%
0.1	0.0%

7. National Impact Assessment of Endorsement Labels

Energy savings in the television market from an endorsement label depends on the response of the market as a whole. Although it is not possible to predict the behavior of the market with certainty, we are able to assess policy impacts resulting from movement of the market towards higher efficiency based on the maximum consumption level chosen for endorsement. In this section we present the impact of market transformation attributable to endorsement labels. We define this quantitatively as a shift in the efficiency distribution of the market, where the baseline moves to the defined efficiency target level. Unlike a Minimum Energy Performance Standard (MEPS), where the entire market moves to the newer standard, an endorsement label pulls a portion of the market towards higher efficiency over a given period of time. This effect translates into significant energy savings as the average performance efficiency of the unit moves up in the market.

Tables 7.1 and 7.2 present the energy and carbon saved from setting the standby and active power endorsement ratings at those levels that seemed justifiable on the basis of the available models and their distribution of efficiency. We calculate savings over a period of 10 years from 2010-2020, even though the savings would likely continue beyond the year 2020. We choose 2020 as the end year for savings calculations to avoid long-term forecasts of a technology that is extremely dynamic. Further, it will be reasonable for BEE to reassess the efficiency levels in ten years to keep up with industry trends. Table 7.1 reveals that the maximum savings potential through an endorsement label for standby power consumption for CRTs is at ≤ 1W. This is not surprising given the large variation that we saw in the models currently available in the market in India. Since CRTs are likely to remain in the market for a longer time in India, being a growing market, this product will be critical in the overall energy equation.

As for LCD and Plasma technologies, although the market seems ready to go beyond the 1W level, it may be simpler and more straightforward to have a single and consistent endorsement level at ≤1W.

Table 7.1 Summary of Savings from endorsement Labels for Standby Power Consumption

Product Category	Standby Mode	Energy Savings (2010-2020)	Financial Impact (2010-2020)	Carbon Saved (2010-2020)
		mtoe	Million US$	MT CO 2
CRT	[2] 3 W	1.345	58.47	3.42
	[2] 1 W	1.919	83.73	4.88
LCD	[2] 2.1 W	0.086	3.47	0.22
	[2] 1.2 W	0.118	4.79	0.30
Plasma	[2] 1 W	0.036	1.49	0.09
	[2] 0.5 W	0.043	1.76	0.11

Note: The energy savings in the table are at the source (the savings here account for generation fuel mix and incorporates site to source conversion factor).

Table 7.2 summarizes the savings from implementing an endorsement level for active power consumption. We have developed three scenarios at $0.5W/in^2$, $0.4W/in^2$, and $0.3W/in^2$ as the three possible levels with significant potential for impacting energy consumption. Since LCDs and Plasma televisions are already above Level 1, savings for these two product categories are zero at this level. The program may thus do well to start the endorsement labeling at Level 2. Alternatively, the program may consider implementing a labeling scheme where, labeling for active power ratings are implemented in a tiered fashion to reap maximum benefit while giving enough time for the industry to respond to the incentive of distinguishing their product from the rest of the market through an endorsement label. The tier levels could be based on the three levels analyzed for active power. Regardless of how the program may decide to implement their endorsement scheme, there are significant savings from all three levels.

Table 7.2 Summary of Savings from endorsement Labels for Active Power Consumption

Product Category	Active Power	Market Leaders	Energy Savings (2010-2020)	Financial Impact (2010-2020)	Carbon Saved (2010-2020)
			mtoe	Million US$	MT CO_2
CRT	Level 1 0.5 W/sq.in	61%	14.01	602.52	35.62
	Level 2 0.4 W/sq.in	38%	16.80	722.94	42.72
	Level 3 0.3 W/sq.in	22%	19.24	828.18	48.91
LCD	Level 1 0.5 W/sq.in	100%	0.00	0.00	0.00
	Level 2 0.4 W/sq.in	92%	1.29	52.01	3.29
	Level 3 0.3 W/sq.in	43%	4.28	172.07	10.87
Plasma	Level 1 0.5 W/sq.in	100%	0.00	0.00	0.00
	Level 2 0.4 W/sq.in	62%	0.76	30.78	1.92
	Level 3 0.3 W/sq.in	7%	1.26	51.50	3.21
All	Level 1 0.5 W/sq.in	81%	14.01	602.52	35.62
	Level 2 0.4 W/sq.in	61%	18.85	805.73	47.93
	Level 3 0.3 W/sq.in	27%	24.78	1051.74	63.00

Note: The energy Savings in the table are at the source (the savings here account for generation fuel mix and incorporates site to source conversion factor).

Figures 7.1 and 7.2 below show the annual stream of site energy savings (not accounting for site to source conversion) from implementing the endorsement labels for active power consumption at Levels 2 and 3.

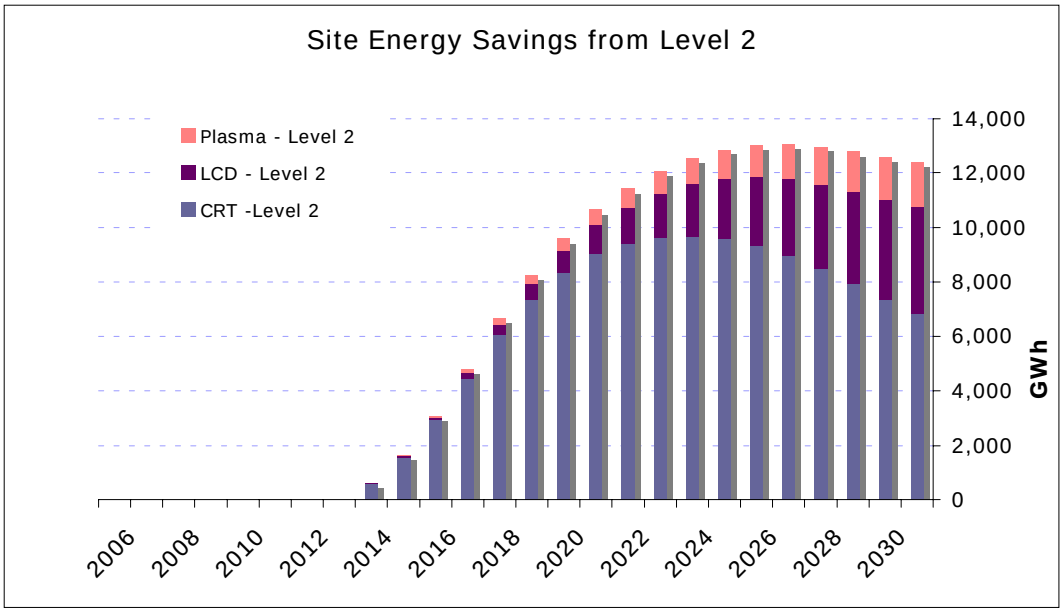

Figure 7.1 Annual Site Energy Savings from Level 2 (≤ 0.4 W/in^2) Labels for Active Power Mode.

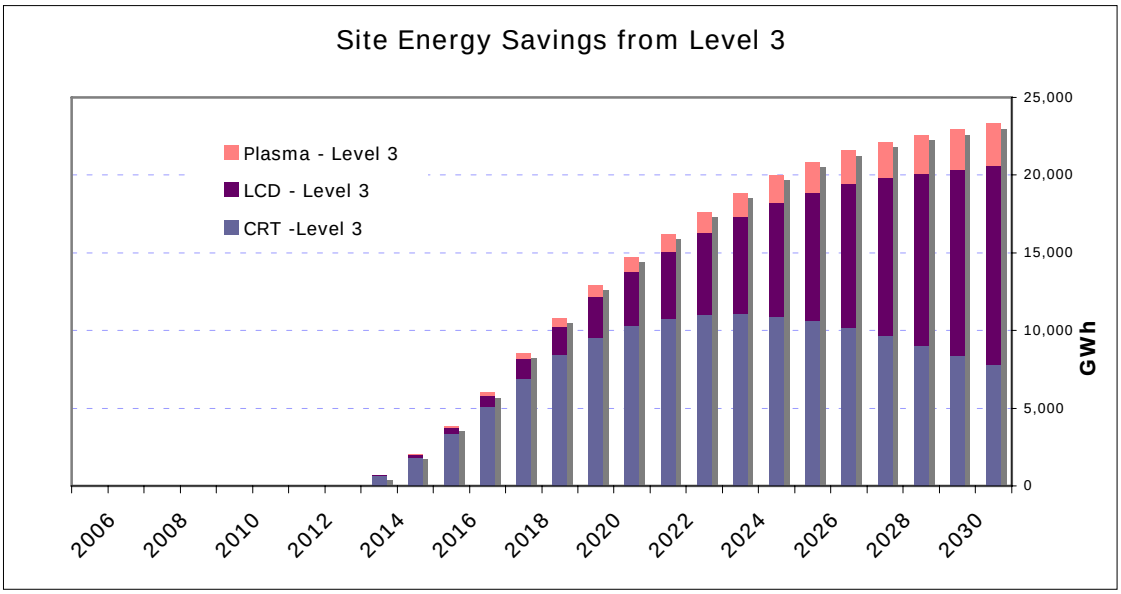

Figure 7.2 Annual Site Energy Savings from Level 2 (≤ 0.4 W/in^2) Labels for Active Power Mode.

8. Proposed Star Labeling Program for TVs

The Bureau of Energy Efficiency (BEE) may also adopt a comparative / star labeling scheme for TVs. Public awareness and recognition of a comparative labeling program already exist through the established refrigerators and air conditioners labeling programs in the Indian market. A comparative / star labeling program for TVs may also help transform the market rapidly since it has got a larger brand value among the consumers.

Considering BEE's decision to have a star labeling program for CTV's, the star ratings for each star is decided on the basis of criteria's discussed in paragraphs below. BEE will use a 5-star label for labeling of CTV's (CRT, LCD and Plasma technologies).

8.1 Qualification Criteria

To qualify as a BEE labeled product, CRT TVs must not exceed a power consumption of 5 watt till December 2009 and 1 watt from January 2010 onwards in Standby Mode. LCD, and Plasma TVs must not exceed a power consumption of 1 watt in Standby Mode with immediate effect.

8.2 Energy Efficiency Criteria

TV Units must not exceed the maximum "Annual Power Consumption" found from the equations in the following table based on the unit's native vertical resolution and visible screen area. The maximum annual power consumption is expressed in kilo watts per year and rounded to the nearest whole number. In the following equations, 'A' is the viewable screen area of the product, found by multiplying the display width by the display height.

Table 8.1: Star Rating Equations for CRT TV's till 31st December 2009

Star Rating	Maximum Annual Power Consumption
1 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.964 x A) + 21.92
2 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.876 x A) + 21.92
3 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.788 x A) + 21.92
4 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.701 x A) + 21.92
5 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.613 x A) + 21.92

Table 8.2: Star Rating Equations for CRT TV's from 1st January 2010 onwards

Star Rating	Maximum Annual Power Consumption
1 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.964 x A) + 4.38
2 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.876 x A) + 4.38

3 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.788 x A) + 4.38
4 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.701 x A) + 4.38
5 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.613 x A) + 4.38

Table 8.3: Star Rating Equations for LCD and Plasma TVs

Star Rating	Maximum Annual Power Consumption
1 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.964 x A) + 4.38
2 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.876 x A) + 4.38
3 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.788 x A) + 4.38
4 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.701 x A) + 4.38
5 – Star (Max Annual Power Consumption in kWh/Year)	P = (0.613 x A) + 4.38

Where A = Screen area in square inches

These equations have been developed on the basis of the proposed endorsement labeling criteria. The 0.4 watts per square inch value has been adopted as a base for 2 star label and the equations for other star labels have been developed based on this. Each star label level is 10% better in terms of active mode power consumption when compared to the previous level. The national impact analysis can also be done in a similar way for the comparative labeling scheme.

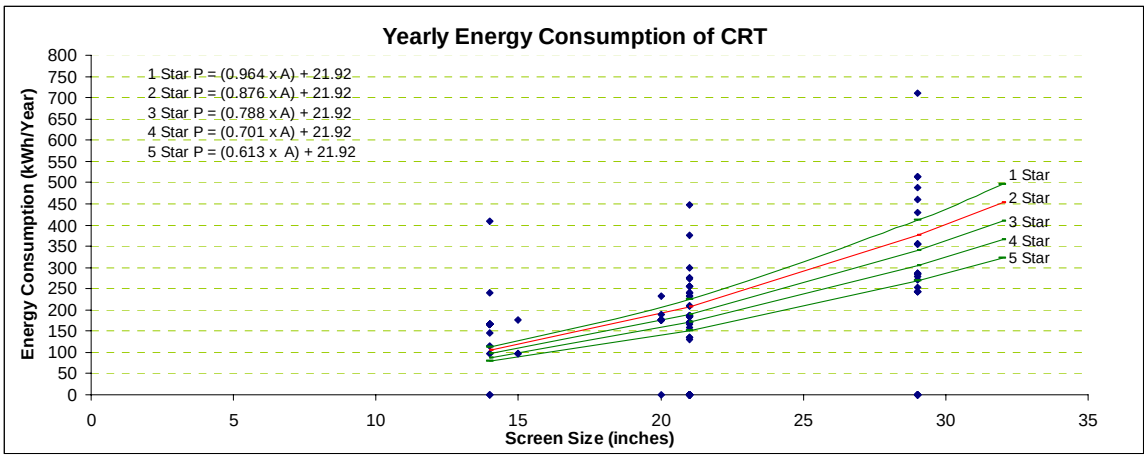

Figure 8.1 Star rating equations mapped on various models of CRT TVs

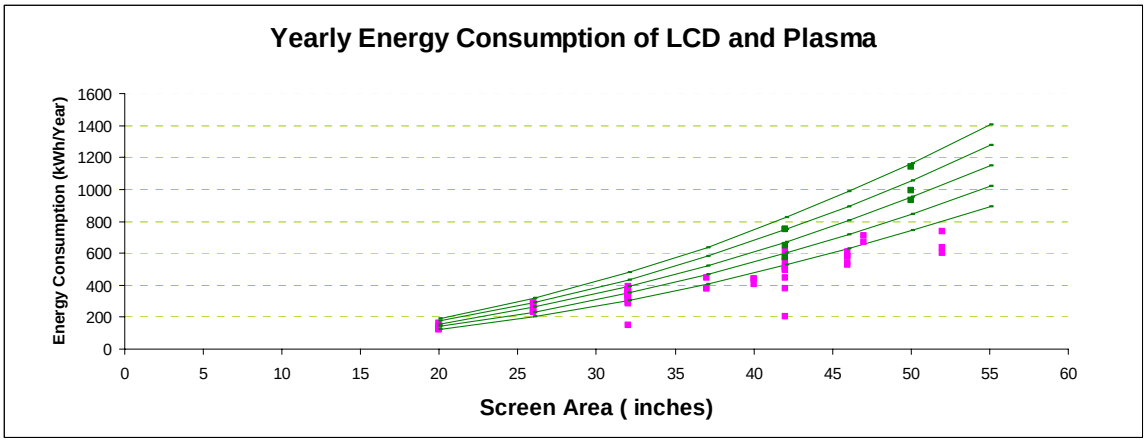

Figure 8.2 Star rating equations mapped on various models of LCD and Plasma TVs

9. Conclusions

Overall, this analysis finds that there is significant savings potential from implementing an endorsement labeling scheme for the color television market for both standby and active power consumption in India. The techno-economic analysis shows the chosen level of ≤ 1W for standby power will boost the overall efficiency of the market and bring it closer to the international best practice. Savings are expected to be further reinforced by following up the labeling program with MEPS.

As part of the analysis, we examined three power ratings for setting the endorsement level for active power consumption. We find that Level 2 produces the maximum benefit to the nation in terms of saved energy and money. Alternatively, BEE may also consider implementing a tiered labeling scheme with a time period of two years between the tier levels. Ratcheting up the endorsement levels in a tiered fashion allows enough time for the market to catch up, thus providing a greater push to efficiency improvement.

10. References

U.S. EPA 2007 - Energy Star Data
http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/tv_vcr/Data-set.xls

ICF 2007. Personal Communication with ICF India, on their market study of television usage patterns.