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Comment: The California Energy Commission Efficiency Committee

2008 Rulemaking Proceeding on Appliance Efficiency Regulations

Arthur Rosenfeld, Commissioner and Presiding Member
Jackalyne Pfannenstiel, Chairman

Dear Commissioner Rosenfeld and Chairman Pfannenstiel:

We are an emerging technology provider to the LCD industry and the purpose of this memorandum is to state our support for the California Energy Commission Tier 1 and Tier 2 active power regulations that are being proposed for TV display technologies. We are confident that the regulation can be achieved at no manufacturing cost impact and in fact, at an overall cost savings to the industry.

We understand there is some concern for whether the Tier 2 active power level can be realized by LCD manufacturers in the 2013 time period and in a manner that does not increase the cost of LCD TV's. There are four generic technologies that are either currently in development or could be developed that would enable manufacturers to meet the Tier 2 requirements in 2013. In addition to these four, there are other technologies that can be developed and utilized. We believe that the adoption of one or more of these energy-saving technologies would lead to lower manufacturing costs and higher gross margins for the LCD manufacturers. It should be noted that the four technologies are applicable to all LCD TV's without regard to size.

The four power consumption reduction approaches are listed below, along with estimates of the power savings that each should provide when compared to a current baseline LCD TV. These techniques can be combined, but due to various interactions, the aggregate reduction in power consumption will be less than the sum of the individual techniques. These technologies are described in the attached Appendix and further explained in a whitepaper that is available from Agoura.

- Polarization Recycling ……....30%
- Backlight Dimming ….....…… 30%
- LED Illumination ……..... 20%
- Color Sequential Illumination……40%

Polarization recycling is the easiest of the four technologies to implement and should be considered fundamental to achieving energy efficiency in LCD TV's. Polarization recycling re-baselines LCD energy efficiency and will be used by all LCD's in meeting Tier 2 requirements. Agoura provides a solution to polarization recycling that does not require an expensive additive film that is currently required to implement this functionality. For this reason, today it is only selectively deployed.

Given that energy-efficiency is a current design objective of TV manufacturers, we believe that both Tier 1 and Tier 2 regulation levels will be easily achieved in their stipulated time periods. Many TV's now meet Tier 1 requirements and are being shipped in a very high brightness mode, without regard to power consumption. Tier 2 levels can undoubtedly be accelerated by as much as 18 months. The current Tier 2 requirements set the stage for more aggressive "Tier 3" levels. We strongly believe that the Tier 2 levels will likely be viewed in hindsight, to not have been sufficiently aggressive, given the number of energy efficiency technologies that are being developed and already being willingly demonstrated, such as at CES 2009. Some of these TV's already meet Tier 2 requirements.

It is possible that LCD manufacturers will independently develop these technologies and deploy them independent of regulation. However, in three of the four technology choices, independent technology suppliers need to be developed and the establishment of regulation lowers the risk of investment in these new technologies. It is much more likely that independent LCD energy efficiency technology suppliers will receive the investment they require to develop new innovative technologies with the establishment of this TV energy efficiency regulation being proposed by the California Energy Commission.

Respectfully submitted,

Steve Stephansen
CEO
Agoura Technologies, Inc.

Appendix: LCD Energy Efficiency Improvement Technologies

The five power consumption reduction approaches are listed below along with estimates of the power savings that each might provide when compared to a current baseline LCD TV:

- Polarization Recycling ……....30%
- Backlight Dimming ….....…… 30%
- LED Illumination ……..... 20%

- Color Sequential Illumination…...40%
- RGBW Sub-Pixels ……...20%

The power consumption reduction approaches described here can be combined, i.e. they are not mutually exclusive. However, due to interactions among these approaches, if several or all of these approaches are combined, the aggregate reduction in power consumption will be mitigated by the interactions.

Polarization recycling is the easiest of the four technologies to implement and should be considered fundamental to achieving energy efficiency in LCD TV's. 3M has been marketing, under their Vikuiti brand, the DBEF polarization recycling film. This is a standalone film that is used in over 50% of TV's today (many of the TV's meeting Tier 1 specifications today utilize DBEF polarization recycling). DBEF is relatively easy to implement and the only issue that stands in the way of it being used in all TV's is its' significant cost.

Agoura Technologies is bringing to market a second generation polarization recycling film with a different technical approach based on a nano-scale wire grid polarizer. Agoura's PolarBrite product integrates the polarization recycling functionality with the rear polarizer in a film that is less costly to manufacture than either of the single films it replaces. It will be offered at the same price as the existing rear polarizer and enable every TV to employ polarization recycling with no added films cost. Agoura is pursuing a business model of both licensing and direct sale for broad distribution and ease of insertion into the supply chain and is engaged with polarizer and LCD manufacturers. For those TV models that currently use polarization recycling, the cost savings associated with PolarBrite will help mitigate, if not eliminate the additional costs associated with implementing any of the other energy saving that could provide additional energy savings, particularly in meeting Tier 2 requirements.

The second major technology that can be employed for power consumption reduction is backlight dimming. This technology, while being deployed at a first generational level, offers considerable promise. Backlight dimming was originally introduced to provide a higher dynamic range to the display contrast; for scenes with a low brightness level, the backlight is dimmed and the pixel voltages adjusted to correspond to a lower brightness illumination source. Backlight dimming and the related power savings is dependent upon the average image content brightness and is subject to user configurability. There is an opportunity to integrate greater intelligence in the backlight dimming algorithms and achieve more consistent power savings.

The third major energy efficiency technology that will be deployed in LCD TV's in the coming years is LED backlighting. The cost, performance, and power savings of LED illumination has enabled LEDs to dominant LCD backlight for the smaller sized display screens, 5" diagonal and less. Recent progress in LED design and manufacturing has enabled several LCD TV manufacturers to develop LCD TVs with LED illumination. In one demonstration by Samsung the power consumption of a LED illuminated 40" LCD TV was 41% lower that the same panel illuminated with the standard CCFLs (100 watts vs. 170 watts). The optical efficiency of LEDs has been also been improved to be slightly better than CCFLs (43 watts/lumen vs. 40 watts/lumen).

While the technical challenges in producing large area screen sizes with uniform illumination have largely been solved, the cost of LEDs remains an issue to their widespread use in large area LCD TVs. LEDs offer many additional benefits beyond power savings, such as easy integration with backlight dimming and a much wider color gamut.

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The fourth energy efficiency technology that can be implemented to meet Tier 2 requirements is “color sequential illumination”. Currently, each color of the color filter of a LCD TV absorbs approximately 67% of the incident light. The color sequential illumination technology eliminates color filters in the LCD panel and transfers the color generation function to the backlight by utilizing color LED’s. This approach results in significant power savings and should also lower the cost of a LCD TV when fully implemented in the supply chain.

Samsung, when demonstrating LCD TVs with color sequential illumination in 32”, 40” and 42” screen sizes measured a 40% reduction in TV power consumption.

To achieve this major reduction in power consumption, Samsung used individual R-G-B LEDs as the illuminant. At the present time, the cost of implementing an R-G-B LED illumination system is more expensive than the traditional CCFL illuminants; however, several LED companies are aggressively pursing cost reduction strategies. It is expected that the scale of the demand for R-G-B LED illumination systems for LCD TV will result in the desired price reductions.

The technologies described above are clearly available to bring about significant energy savings in LCD TV’s to levels that would comfortably meet the Tier 2 requirements being proposed and with investment, cost efficiencies can be achieved that permit meeting this regulation at considerably lower manufacturing costs.

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