



Measure Power, Not Brightness

A recommendation for Energy Star
measurement of televisions

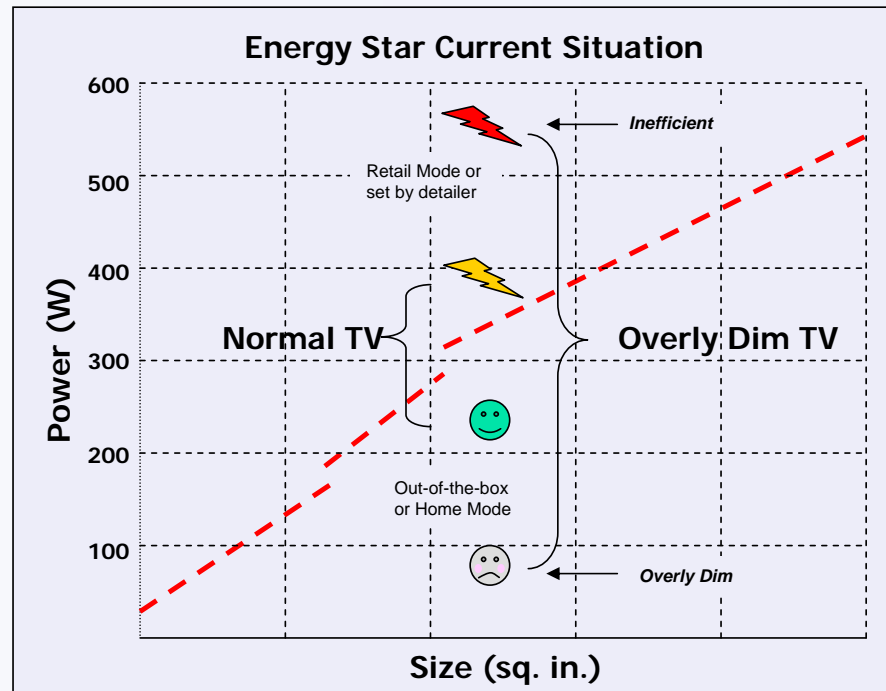
■ Goals for Energy Star TVs 3.0 Tier 2



- Save energy.
- Set the limits so 25% of today's products qualify.
- Ensure that higher compliance rates indicates real energy savings. (Don't allow the system to be gamed.)
- Remain technology neutral.
- Reward efficiency.
- Protect the Energy Star brand. (Don't allow products to misrepresent themselves at retail.)
- Gain support of all stakeholders.

Will we face a “dimness war”?

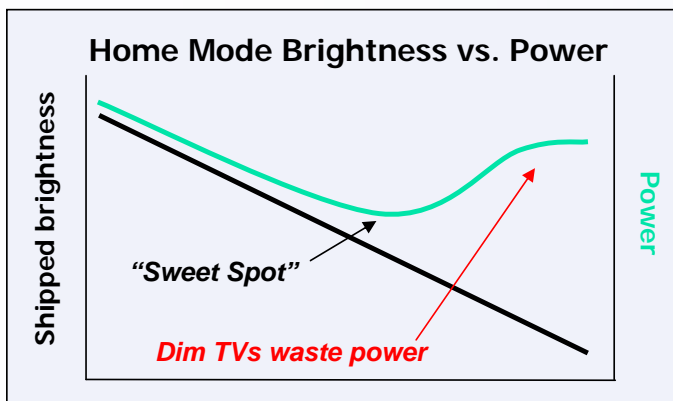
- Energy Star 3.0 Tier 1 requires that TVs be tested...
 - in the out-of-the-box condition, or
 - in Home Mode, if a forced menu exists.
- The theory is that manufacturers will not ship Overly Dim TVs because...
 - consumers will return the Overly Dim TVs, and
 - reviewers will give Overly Dim TVs bad reviews
- However, the current situation is unclear
 - Are manufacturers shipping Overly Dim TVs?
 - Are consumers happy with their TV brightness?
 - Are consumers turning up the brightness, or selecting brighter modes?
- If future policies decrease power thresholds, it is almost certain that some manufacturers will comply by delivering dimmer TVs.



- A Normal TV meets consumer expectations and saves energy.
- An Overly Dim TV tricks the consumer. If adjusted brighter, it could waste energy.

Why is a dimness war bad?

- Overly Dim TVs can harm the Energy Star brand
- Overly Dim TVs mislead consumers, harming the credibility of the consumer electronics industry
- Manufacturers who make efficient TVs cannot differentiate their products
 - If efficiency is not rewarded, investment in efficient TV technology will decrease



- Consumers might adjust Overly Dim TVs to higher power modes

Note: nobody knows where the "sweet spot" is. Maybe today's dimmest TVs are not too dim.

- It is impractical to measure the brightness over the entire screen over the ten minute test loop
- The brightness of the JEITA signals (black, colorbar, 3-bar, and white) is not correlated with IEC power
- It is trivial to “game the system”
 - Note that Plasma TVs already limit power by reducing brightness as the APL' increases.
 - Modern LCD TVs already control their backlights, based on the input signal.

10 minutes

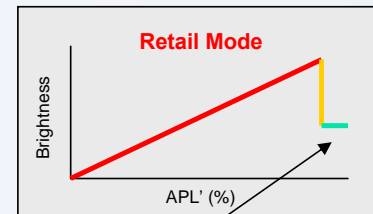
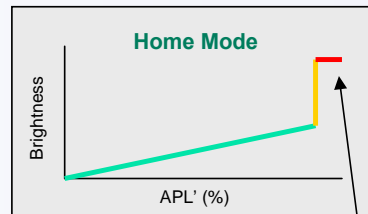
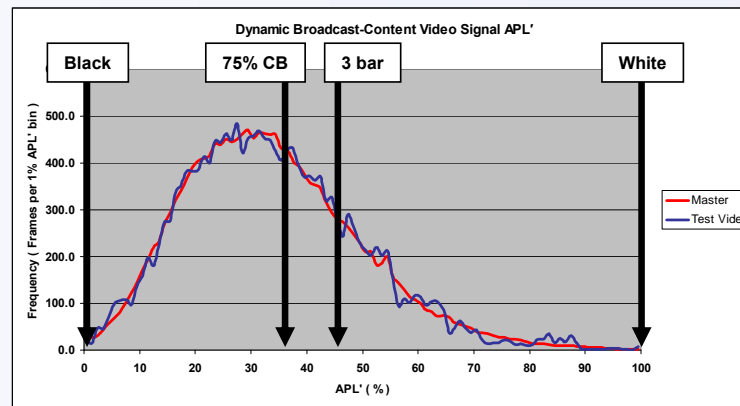


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Exactly corner to corner

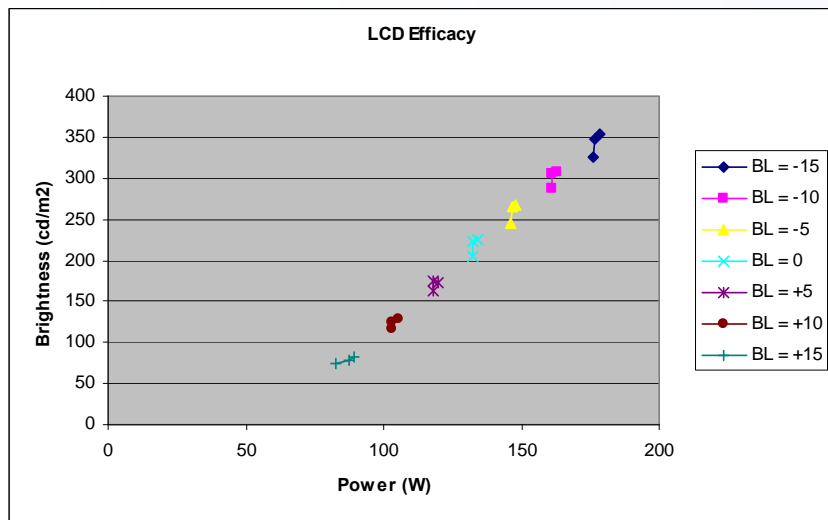


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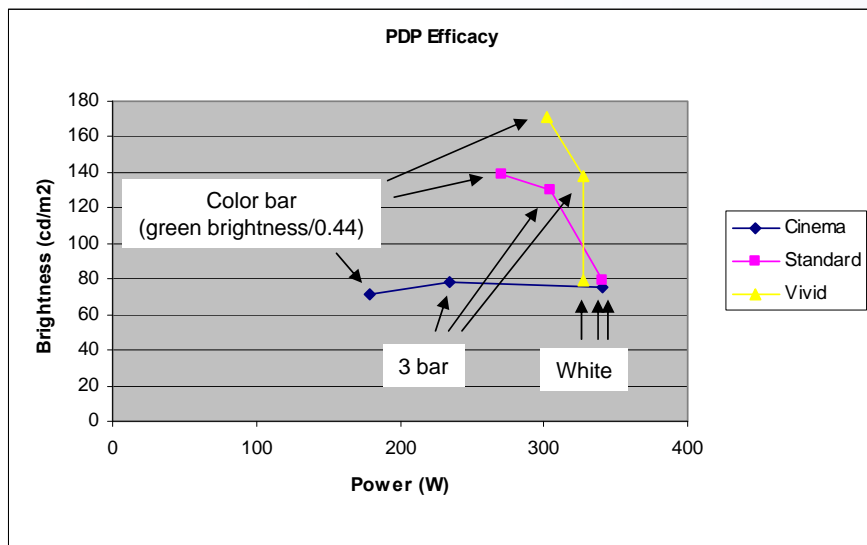
“gaming the system”

- LCD brightness is naturally linear with respect to the backlight power.



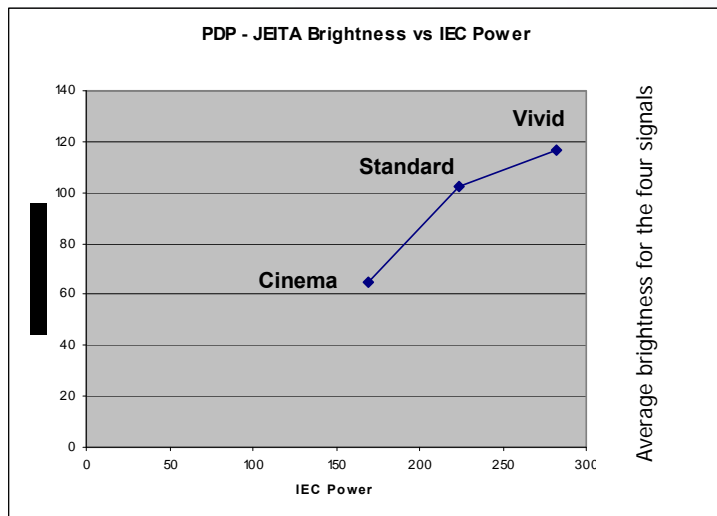
- The Test
 - 37-inch LCD TV
 - Roughly two years old – used regularly
 - Set in Standard Mode
 - IEC Blu-ray Disc and HDMI used
 - Backlight level adjusted manually
 - Compares brightness of white, 3-bar and green color bar/0.44
- IEC Results
 - This TV has simple backlight dimming for the darkest images
 - The IEC result for each backlight level is slightly lower than the power levels shown in the chart.
- Conclusion: For LCD TVs, more power allows higher peak brightness

- PDP brightness is non-linear with respect to its picture-level settings



- The Test
 - 42-inch PDP TV
 - Roughly two years old – used rarely
 - Reset; available modes measured
 - IEC Blu-ray Disc and HDMI used
 - Compares brightness of white, 3-bar and green color bar/0.44
- IEC Test Loop Results
 - Cinema: 169W
 - Standard: 224W
 - Vivid: 282W
- Conclusion: For PDP TVs, more power allows more mid brightness

- Using the proposed brightness measure, PDP efficiency appears to fall as power increases

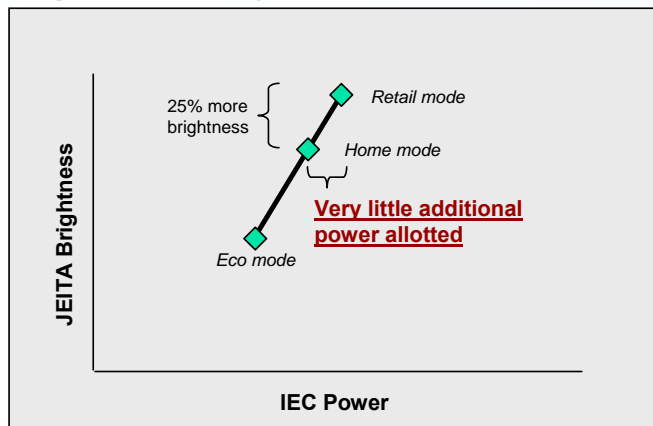


- From Cinema to Standard
 - Brightness increased by 59.1%
 - Power increased by 32.5%
- From Standard to Vivid
 - Brightness increased by 13.5%
 - Power increased by 25.9%
- Conclusion: PDP applies an increasing power budget to brightness of the mid tones (IEC test loop), rather than to high APL' signals (White, 3-Bar, Colorbar.)

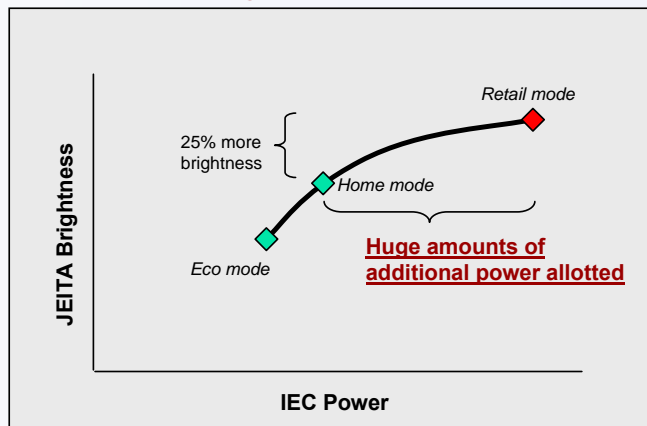
- Brightness is a performance measurement
- There are two ways to limit performance
 - Use less energy
 - Add inefficiency

i.e. You can reduce the performance of a Corvette by installing a smaller engine – or by adding lead weights!

High efficiency panel

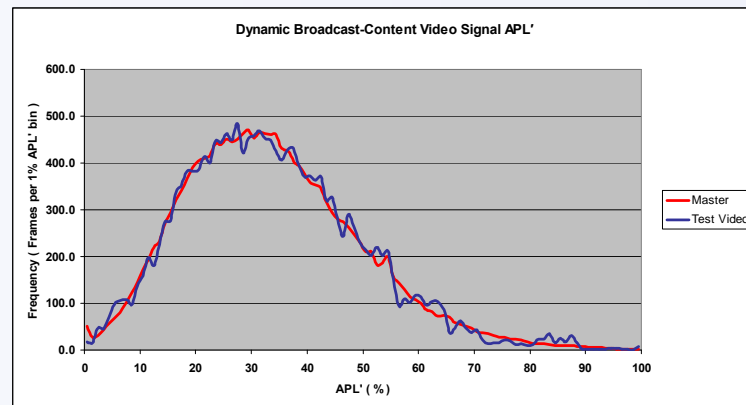


Low efficiency panel

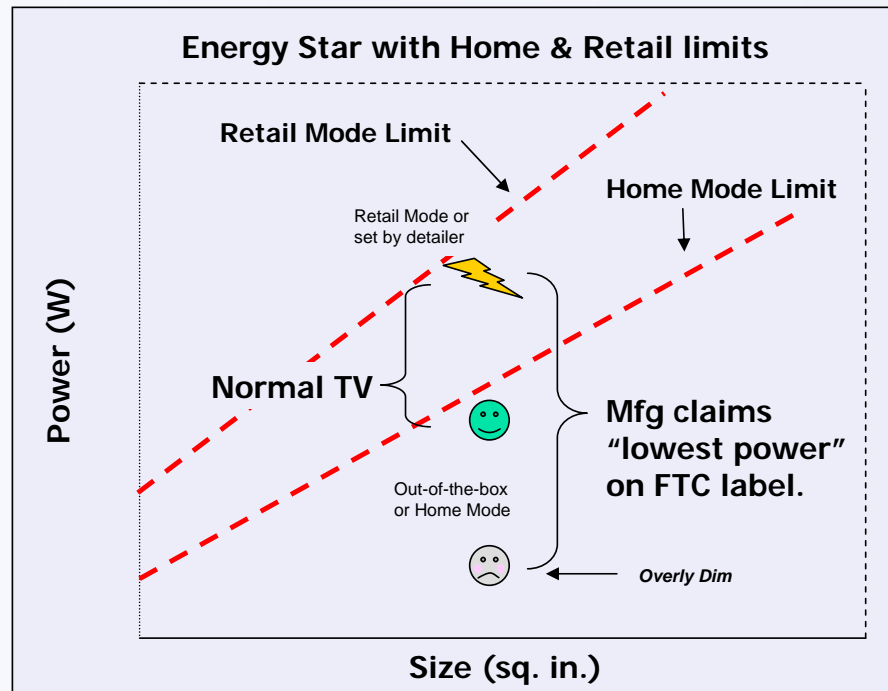


- High efficiency panels would be needlessly constrained.
 - This could eliminate efficient TVs viewable in direct sunlight from the market
- Low efficiency panels might have no power constraint whatsoever

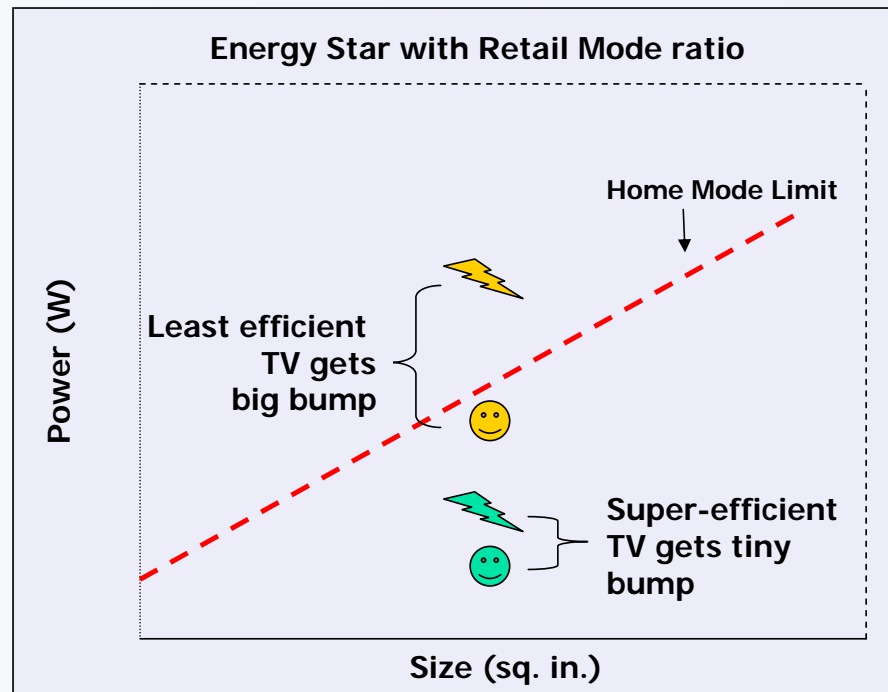
- Solution: Measure selectable mode power using the IEC 10-minute broadcast loop
 - It cannot be “gamed”
 - It correlates with real world power consumption
 - It is technology neutral
 - It rewards efficiency
 - It requires no new test equipment
 - The measurement can be performed at retail
 - The test loop has been internationally vetted
 - The test loop has been embraced by all stakeholders



- Idea: What if we set a Retail Mode power limit?
- Problem: a simple Retail Mode power limit will not prevent Overly Dim TVs.
 - The FTC label and marketing pressures will push manufacturers to claim the lowest possible power numbers.



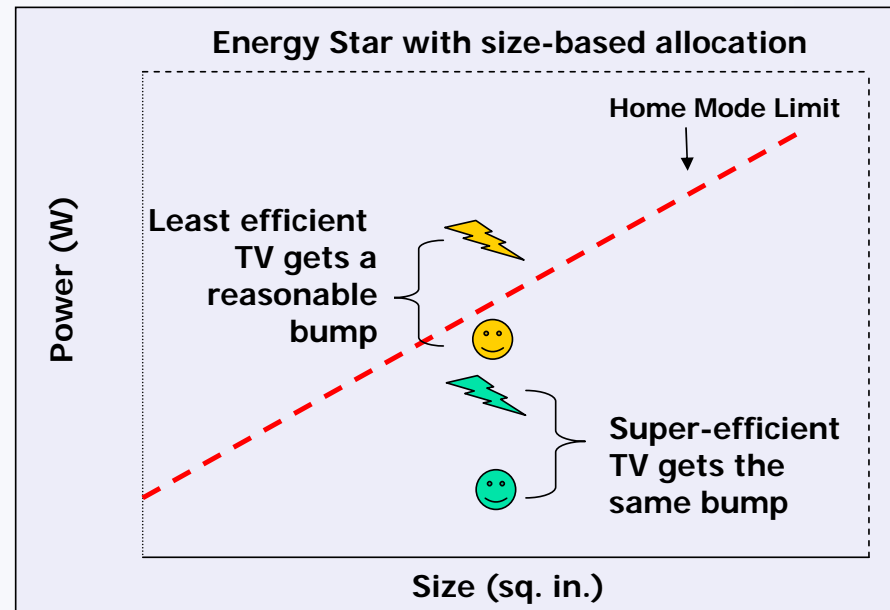
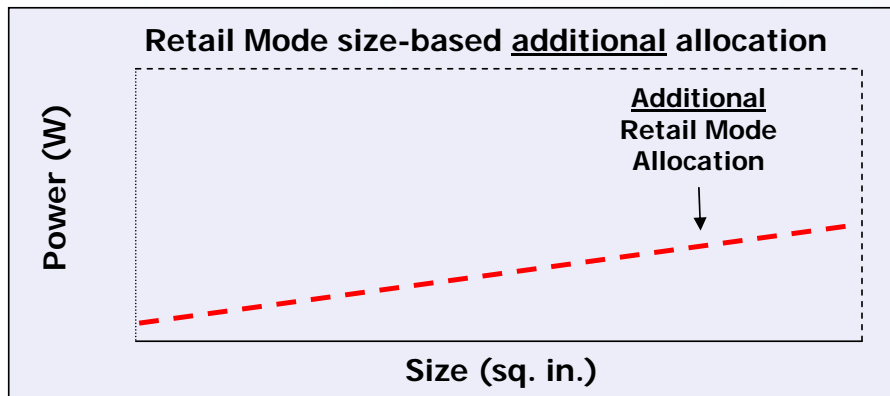
- Idea: What if we set a maximum ratio between Home and Retail mode power:
- Problem: a power ratio rewards inefficiency.
- Assuming an 80% ratio*...
 - A 200W TV would get 50 additional watts at retail
 - A 100W TV would get only 25 additional watts at retail
- For every watt removed from Home mode, 1.25 watts (or 2 watts – using the Australian ratio) must be removed from Retail mode



* EPA has proposed that Home mode must be at least 80% as bright as any other selectable mode.

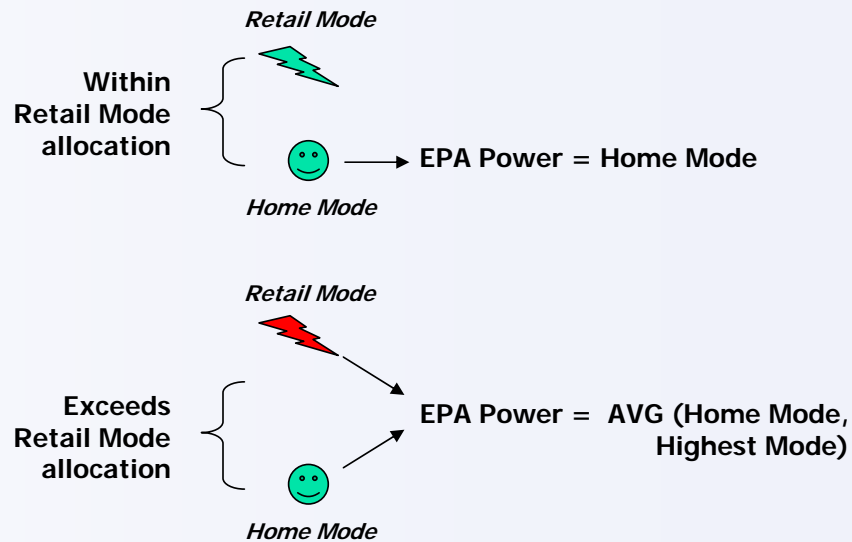
Set fixed allocation by screen size

- Solution: Set a fixed additional allocation for Retail mode, based on screen size
 - All TVs of a given size get the same additional Retail Mode power allocation
 - Retail and Home modes correlate
 - Overly Dim TV problem eliminated
- An decrease of 1W of Home Mode Power results in a decrease of 1W of Retail Mode Power

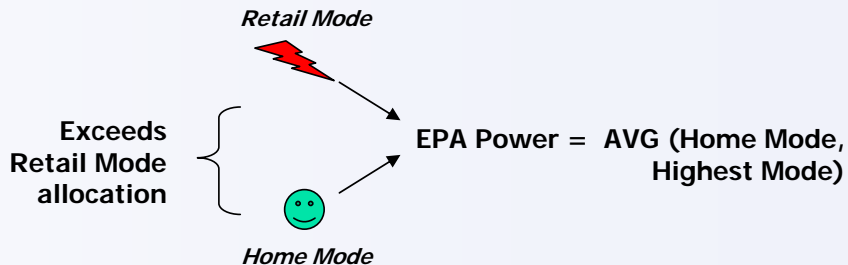
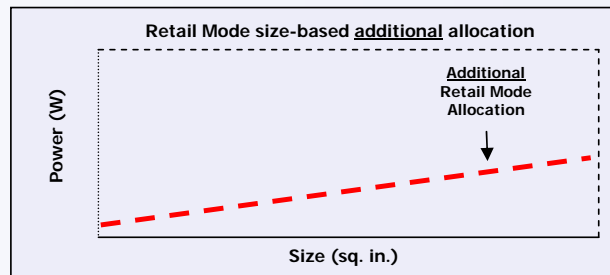
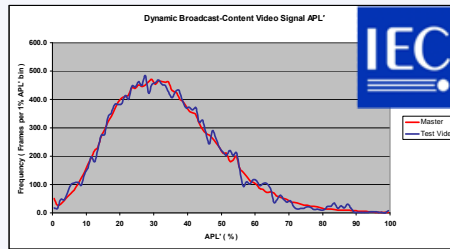


- The challenge
 - Energy Star will need more data to set the new Home Mode and Retail Mode allocation power limits and hit the 25% qualification target.










- If a TV exceeds the Retail Mode additional allocation, how does one rate its power?
 - The FTC will need a hard number for its labels
- Recommendation:
 - If within the Retail Mode allocation, the rated average power shall be the Home Mode power. (Should include allowance for automatic brightness control.)
 - If the TV exceeds the Retail Mode allocation, the rated power shall be the average of Home Mode power and the power of the highest consuming selectable mode. (Also includes automatic brightness control allowance.)



- Measure the power consumption in each mode, using the IEC broadcast test loop
- Give a fixed additional power allocation for Retail Mode (or all selectable modes), based on screen size
- Include a method for determining average power consumption, even for TVs that exceed the Energy Star limits



Power vs. brightness summary

Criteria	Power & allocation	Brightness & percentage
Cannot be "gamed"		
No new test equipment		
Correlates with IEC power		
Does not penalize efficiency		
Prevents a possible dimness war		 • <i>Can be gamed</i>
Correlates retail & home experience		 • <i>Not related to real broadcast APL'</i>
Technology neutral	