NRDC Input on ENERGY STAR Draft 1Version 8.0 Specification for Televisions

March 31, 2017

On behalf of the Natural Resources Defense Council (NRDC) we respectfully submit our feedback on the EPA's draft 1 Version 8.0 product specification for televisions.

In summary, we are very supportive of the direction EPA is taking and we provide detailed comments on each of the following topics:

- Increasing the effectiveness of and consumer satisfaction of the energy savings feature automatic brightness control (ABC) and adding language to increase its persistence;
- Adding clarifying language around the definition/performance of the Motion Detection Dimming feature and its persistence to ensure that it provides energy savings not only during laboratory during testing but also when "typical" real world content is played;
- Reassessing the size of the power adder for ultra-high definition (UHD) TVs, which is currently 50% above the power consumed by same sized high definition (HD) TVs;
- Testing and reporting TV energy use when the feature HDR effect or HDR upscaling is enabled;
- Adding language regarding software updates and their potential impact on TV energy use and qualification for the ENERGY STAR label; and
- Timing of Version 8.0 and the next specification revision.

I. NRDC supports EPA's proposal to tighten the performance requirements and persistence of the Automatic Brightness Control (ABC) energy saving

feature subject to a few additional requirements/modifications.

When properly implemented, ABC has the potential to significantly reduce the energy use of new TVs, especially when the TV is viewed in rooms with low light levels, which commonly occurs during night time viewing in consumers' homes. As such, EPA has historically encouraged the deployment of the ABC feature in new TVs by allowing it to be on during on mode power testing and for determining qualification for ENERGY STAR provided the feature was enabled when the user sets up their new TV.

Unfortunately some TV manufacturers have exploited this energy saving "credit" by:

- poorly implementing ABC whereby the screen is unacceptably dim during viewing at low ambient light levels causing viewers to have a less than satisfactory experience. In this case, the viewer may be motivated to change the picture settings which typically results in a significant increase in a TV's annual energy use.

- programing their TVs to automatically disable the energy saving ABC feature whenever the user selects a picture setting other than the home setting, also referred to as normal or standard setting. Previous testing done by NRDC found that many of the TVs previously sold by LG, Samsung and Vizio exhibited this phenomena and for some Samsung TVs even a small change by the consumer to the backlight setting caused ABC to be disabled.

In its draft specification, EPA has included language intended to: a) help ensure the consumer has a good experience when ABC is enabled and is less likely to be motivated to manually disable ABC or increase screen brightness, and b) prevent manufacturers from automatically disabling ABC except under very limited circumstances. We agree with EPA's approach and proposal, subject to a few additional improvements which are described below.

1. *We support EPA's proposal to add new screen luminance requirements to the ABC requirements.*

To help ensure consumer satisfaction when viewing TVs with ABC enabled, EPA has proposed the following additional requirements:

EPA proposes two additional luminance requirements to ensure that the experience with ABC is a good one. The requirement that the average luminance at 3, 12, 35, and 100 lux with ABC enabled shall be greater than or equal to 50% of the TV's luminance in the Brightest Selectable Preset Picture Setting intends to ensure that the luminance in the Default Picture Setting is acceptable to users and the ENERGY STAR certified picture setting will persist in the home. EPA also proposes that the luminance at 3 lux

in the Default Picture Setting, with ABC enabled, should be greater than or equal to 150 nits, given that illuminance at 3 lux is similar to the illuminance of a dark room. The Imaging Science Foundation (ISF) advocates that ABC should not dim the TV's screen brightness below 150 nits in a dark room and "ISF Expert" dark room picture settings typically deliver a screen brightness of at least 150 nits.

NRDC is very supportive of these two requirements, including establishment of a minimum screen brightness level during dark room viewing.

2. *We support EPA's efforts to increase the persistence of ABC but request EPA remove its proposal to allow TVs to automatically disable ABC for 1 or 2 of the preset picture modes. We also recommend EPA add language prohibiting the use of on screen prompts that would encourage ABC to be disabled.*

EPA has added requirements to help increase the persistence of the ABC feature after the TV is initially set up. EPA is proposing to allow manufacturers to program their TVs such that ABC may be automatically disabled when the retail mode is selected, when high dynamic range (HDR) content is being viewed, and in one or two additional picture modes depending on the total number of picture modes the TV has. While we accept EPA's proposal to allow ABC to be temporarily overridden when the TV is in retail mode or when HDR content is being played, we oppose allowing ABC to be automatically disabled for one or two additional preset picture modes (one if TV has ≤ 4 preset picture modes, and two if TV has > 4). We fail to understand why manufacturers should be allowed to receive the ABC credit if their TV is designed to automatically disable ABC for one or two of the preset picture modes. During limited testing done by NRDC we found that the ABC feature in TVs from leading manufacturers such as Sony and Philips remained on regardless of the picture mode or picture setting selected. In addition, LG has since updated their TVs such that ABC remains on for all picture mode settings except retail or when HDR content is being played.

If EPA does not modify its proposal, one can easily imagine a scenario whereby a manufacturer adds a preset picture mode called "best picture" or "optimal" where ABC is automatically disabled. In this mode, the backlight is at higher brightness levels and the TV uses significantly more energy each year. We have already seen in some Vizio TVs "on screen" text that says *"Select from preset picture modes. Standard picture mode meets ENERGY STAR® requirements. For the best picture, use Calibrated mode."* This type of implementation must be prevented as it encourages the user to select a picture mode that used more energy and where ABC is always disabled.

3. *We recommend EPA develop language that ensures the ABC feature behaves similarly in all preset picture modes (except for retail mode and when HDR content is being played) in terms of consumer experience and energy savings.*

In addition to taking steps to ensure the ABC feature remains on, we urge EPA to also include some language that requires the ABC feature to perform in a roughly similar manner when preset picture modes other than the default home setting are selected. This language would specifically prevent a scenario whereby the ABC feature appears to be on in the drop down menus, but in reality is doing very little or having no effect when certain picture modes are selected. While we don't have specific language to offer at this point, we encourage EPA to include language that addresses this concern. (We also recognize that the power savings or % savings due to ABC will vary from the default home picture setting to other picture settings, and that the slope/shape of the power vs room illuminance curves with ABC on will vary over different picture settings.)

Coming up with the right language may require additional dialogue with interested stakeholders and NRDC is available to participate in such discussions.

4. *EPA should add language requiring ABC to default back to on after the user switches out of retail mode, and after HDR content has been played.*

5. *The user may be allowed to manually disable ABC, pick a different picture mode, or change a picture setting such as brightness after the TV has been set up, but the TV should not do this automatically for them.*

While most users may decide not to change any of the default settings, some may be interested in changing some of the settings. To be clear, our recommendations fully accommodate these users, as well as those who may choose to hire a professional or refer to online recommendations to further calibrate their TV. If they want to make these changes they can. We are simply recommending a scheme whereby the energy savings features are not automatically disabled for the user, nor is a user provided with prompts during or after the initial set up encouraging them to take certain actions that would increase TV power use.

II. NRDC supports EPA's proposed language regarding Energy Savings Features in Section 3.2.3 and we recommend further clarification regarding the definition of popular programming and that EPA apply the same principles for persistence to Motion Detection Dimming as for ABC.

1. *We recommend EPA add language to better define what "typical viewing" experience means.*

The 2016 NRDC study showed that the IEC test clip referenced by DOE in its

test method for measuring on mode power, and which is also used by ENERGY STAR, has abnormally short scenes. Many TVs manufactured by LG and Samsung have a Motion Detection Dimming (MDD) feature, which when enabled causes the TV's power to drop significantly when content with this characteristic is observed. Most real world content contains longer scenes/less frequent scene changes, and when more representative content was played during testing performed by NRDC's consultant, Ecos Research and by DOE, the effect of MDD was much lower.

In Section 3.2.3, EPA states that features like MDD must deliver comparable energy savings during typical viewing experiences (i.e. the duration of a variety of popular programming) as to those realized when using the IEC test clip. While we strongly support these criteria directionally, we recommend EPA develop additional language regarding what popular programming means. This would include language along the lines that the popular content contains scene lengths and scene changes that are representative of typical content, e.g. average scene lengths of at least x seconds. Without this additional language EPA leaves itself open to endless debates with a manufacturer about what "typical content" is whereby the manufacturer could hand pick content that delivers significant savings because it has abnormally short scenes and a very high frequency of scene changes as one might experience during a chase scene or music video, both of which are edge cases and are not representative of typical viewing.

2. *We recommend EPA apply the same approach to other energy savings features, such as MDD, as it does for ABC.*

The two manufacturers that we are aware of that offer a MDD feature, LG and Samsung, have programmed many of their TVs to automatically disable this feature whenever the user changes the picture setting from the default home mode. If the MDD feature is indeed designed to produce an improved consumer experience (and energy savings) when rapid motion is encountered, we fail to understand why this feature is disabled in other picture modes, such as sports mode. After all, one would expect a lot of rapid motion during car racing, portions of a basketball or hockey game, etc.

As such, we recommend EPA employ a similar approach to MDD as we proposed for ABC. In other words, this energy savings feature must: a) be enabled by default and remain on after the initial setup (unless the user chooses on their own to opt out at a later time) in order for this feature to be on during the test, b) remain on for all other preset picture modes (except when retail mode is selected or HDR content is being viewed), and may not be automatically disabled due to changes in other picture settings, and c) perform similarly in all preset picture modes.

3. *EPA should also add language that addresses software updates to ensure*

that the TV still meets the ENERGY STAR requirements after the update has been downloaded.

Many of the TVs sold today are "smart TVs" that are connected to the internet and are able to receive software updates that are periodically pushed from the TV manufacturer. In some cases, the TV receives an update the first time it is connected to the internet.

It's conceivable that a manufacturer could ship a TV such that it meets ENERGY STAR out of the box, but then sends out a software update a day later that modifies some of the settings or disables some of the energy savings features such that the TVs energy use rises and it no longer qualifies for ENERGY STAR. To prevent this from happening we recommend EPA add additional language in section 3.2 regarding software updates that sets the expectation that the TV must continue to meet ENERGY STAR even after software updates have been sent to the user.

III. NRDC supports ENERGY STAR's proposal to require manufacturers to report the power use of their TVs when the high dynamic range (HDR) effect or HDR upscaling type feature is selected and that this data should be used by ENERGY STAR to inform its next specification.

In 2018 and beyond, an increasing percentage of new TVs will be HDR ready, whereby the TV can display content rendered in HDR. As native HDR content is currently extremely rare, many of these TVs will ship with a feature called HDR effect or HDR upscaling. This feature converts the incoming video into content that looks as if it were shot in HDR. The quality of the upscaled image will vary by manufacturer. It's unclear what fraction of these TVs will ship their TVs with this feature enabled and which will require the user to opt-in at a later time if they want this feature to be on.

1. *EPA should require manufacturers that include a HDR effect type feature to report the energy use of their TVs when this feature is selected, and for EPA to make this data publicly available.*

As there is a scarcity of data available at this time about the incremental power use of HDR effect, we support EPA's proposal to require: a) HDR effect be on during testing if it is enabled by default or the user is presented with the option to turn it on during testing, or b) if HDR effect is not enabled, to require it to be turned on and for the TV to be tested per the DOE test method (i.e. with all features and settings as the TV was shipped) and for this data to be reported to EPA as part of the qualification process. <u>We request that this model specific data be made available on the ENERGY STAR QPL page or at a minimum on the partner tab of the ENERGY STAR website.</u> This data will be useful in assessing

the energy impacts of HDR effect and inform the next specification.

2. *EPA should commit to set a power limit for TVs when HDR effect is in use in its next specification revision*

Per the current draft, TVs will not have any limitations on how much power they can use if HDR effect is selected after the initial set up. This puts a lot of the energy savings at risk and we believe compels EPA to remedy this situation in its next specification. The above data collection and reporting requirements are the building blocks for this next step.

3. *EPA needs to include power limits for TVs when HDR content is being played in its next specification revision.*

NRDC's limited testing of TV energy use when native HDR content is played on a HDR ready TV and found that it increased TV energy use by 25 to 40% compared to the power used when viewing the UHD version of the same movie. (We don't have any visibility into how this incremental energy use may change in 2018 models.) The current IEC test method does not include UHD or HDR content and efforts are supposed to be underway to develop an updated test clip that includes video rendered in these formats.

As HDR content becomes more widely available, an HDR TV's annual energy use will increase as this content is viewed more frequently. It's important therefore for the next version of the specification to include HDR content.

We recommend EPA carefully monitor the test clip development process and to be willing to develop its own test clip, in consultation with DOE, if the process is not moving fast enough.

IV. The power adder for UHD TVs needs to be reassessed

During the specification development process for ENERGY STAR Version 7 there was a scarcity of publicly available data on the incremental energy use of UHD TVs. In order to bring UHD TVs into the program and to prevent the least efficient models from qualifying, EPA created a generous power adder of 50% for UHD TVs compared to equivalent sized HD TVs. A recent analysis done in Europe by CLASP shows that the delta in power use between HD and UHD has declined dramatically and is now down to around 13%.

2. New CLASP 2016 Model Database

CLASP compiled a database of European television models by visiting the websites of popular manufacturers across Europe, including: LG, Loewe, Panasonic, Philips, Samsung, Sharp, Sony, Thomson and Toshiba. The television product fiche files for models currently available on these manufacturer's websites were downloaded and imported into Microsoft Excel. A copy of this database can be found in Annex A to this report, and is also available in spreadsheet format on the CLASP website.

The table below presents a summary of the TV models in the 2016 database and broken down by resolution – high definition (HD) and ultra high definition (UHD). The average specific power[1] was found to be 1.06 for HD displays and 1.20 for UHD displays. This shows that for current televisions on the European market in 2016, UHD requires an average of approximately 13% more power per unit screen area when compared to HD displays.

Table 3. 2016 European TV model database prepared from product fiche files

Screen Resolution	Average specific power (W/dm^2)	Model Count
High Definition (HD)	1.06 W/dm^2	n = 304
Ultra High Definition (UHD)	1.20 W/dm^2	n = 274
All Models	1.13 W/dm^2	n = 578

The graph below presents the average power of HD and UHD televisions by screen size.

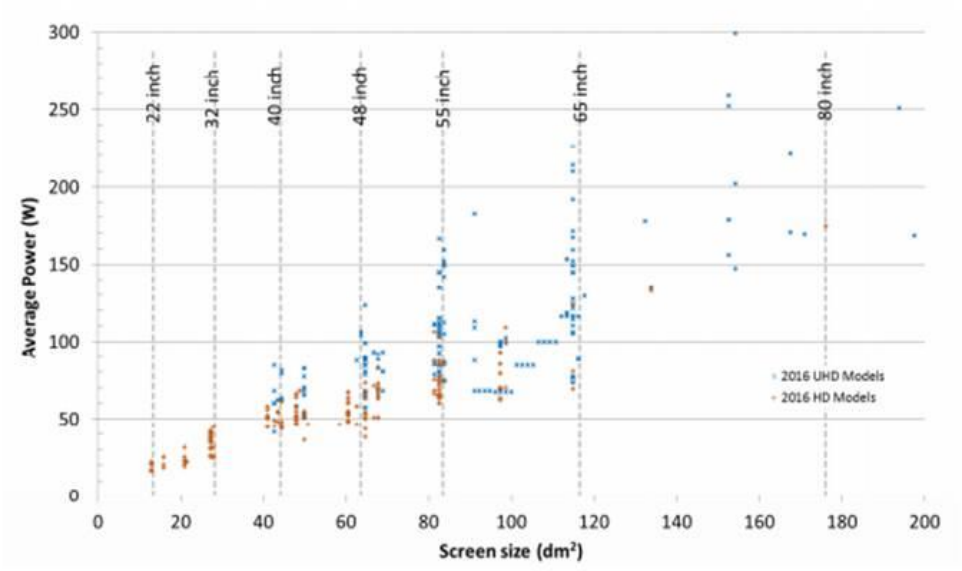


Figure 1. Scatter plot of average power vs. screen size, 2016 European Televisions

[1] Specific power is a measure of average watts of power consumed while playing the IEC 62087 test video divided by the screen area. In the above table, the data show that combining HD and UHD, approximately 1.13 watts of power are needed per square decimetre (100 square centimetres) of screen area.

While we recognize that the new requirements that were added around ABC and MDD may result in higher reported power values for new TVs it's unclear how

many TVs will no longer qualify or how large of a UHD adder remains warranted.

1. *We recommend EPA take a closer look at its data set and consider reducing the adder down to a level around 25%, which is roughly double the level seen in European TVs.*

2. *If EPA is unable to adjust the adder as part of this specification process we suggest at a minimum that EPA call out in Section 7, Considerations for Future Revision, its intention to review and reduce, as appropriate the UHD adder in its next revision.*

V. **Timing of the next ENERGY STAR specification for TVs**

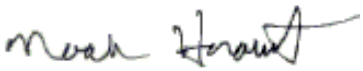
Based on comments made during the webinar it appears EPA may elect to focus Version 8 revisions on "cleaning up" issues related to improving the performance/user experience and persistence of energy savings features, and to defer revisions to on mode power requirements till the next specification.

To the extent EPA completes its specification on time and commits to its data collection plans and schedule to initiate Version 9, we would not oppose this approach.

If however completion of Version 8.0 does not happen in a timely manner, we would urge EPA to spend the additional time to gather the additional data on HDR effect and UHD power use and to include a power cap on HDR effect On mode power use and to reduce the size of the UHD adder based on the new data.

We appreciate EPA's efforts to update the ENERGY STAR specification for TVs and the opportunity to provide our comments and recommendations.

Sincerely,



Noah Horowitz
Director, Center for Energy Efficiency Standards
Natural Resources Defense Council
nhorowitz@nrdc.org