June 13, 2012

Mr. Robert Meyers
United States Environmental Protection Agency
Office of Air and Radiation
1200 Pennsylvania Ave NW
Washington, DC 20460

Subject: Comments regarding Version 6.0 Draft 2 Computer Specification

Dear Mr. Meyers,

The Natural Resources Defense Council (NRDC) and Northwest Energy Efficiency Alliance (NEEA) respectfully submit the following comments in regards to the ENERGY STAR Version 6.0 Draft 2 Computer Specification issued May 15th, 2012.

The Natural Resources Defense Council (NRDC) is an international nonprofit environmental organization with more than 1.3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC's top institutional priorities are curbing climate change and creating a clean energy future. Energy efficiency is the quickest, cleanest, cheapest solution to climate change and other energy-related problems. Cost-effective energy efficiency labels and standards help to ensure that consumer and commercial products provide the same level of comfort and service using less energy, with benefits for consumers, the environment and the electricity grid.

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit organization working to maximize energy efficiency to meet our future energy needs. NEEA is supported by, and works in collaboration with, the Bonneville Power Administration, Energy Trust of Oregon and more than 100 Northwest utilities on behalf of more than 12 million energy consumers.

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Introduction

Desktop and notebook computers represent one of the largest sources of electricity use of all electronics devices. They consume over 70 TWh annually in the U.S., the equivalent output of 25 medium-size 500 MW coal-fired power plants. This represents approximately 2% of US electricity use, and is equivalent to all data centers and server rooms in the country. In context of continued growth of the computer market in the US and globally, capturing energy saving opportunities in computers is critical in reducing mercury emissions and other harmful pollutants from power generation, as well as to support the shift towards a low-carbon society.

Desktop computers use the most energy and present the largest opportunity for energy savings per unit. A typical desktop consumes approximately three times more energy as a notebook of equivalent performance capability. However notebooks are growing the fastest; notebooks sales overtook desktop sales in 2008 in the US, and their aggregate energy use is catching up, making it equally important to capture notebook energy savings opportunities.

While Version 5.0 Computer Specification has been very effective at increasing the energy efficiency of notebooks with an ENERGY STAR market share of 74%[1], it has been less successful with desktops, at only 27% market share. With the proper adjustments and revisions, Version 6.0 can succeed at leading the market transformation and efficiency optimization of all form factors.

Summary of Recommendations

Our comments cover the following areas:

1. **ENERGY STAR 6.0 Draft 2 dataset**: We urge EPA to include the market introduction date of Version 5.0 systems in the dataset, to help identify market trends and ensure data is not skewed by systems which may no longer be on the market for over 2 years. We also point out an apparent inconsistency in the Version 5.0 data conversion assumptions;

2. **Discrete graphics adders**: EPA's proposed desktop discrete graphics adders are generally consistent with our revised test results, except in the G5 category where they appear significantly too high. We are concerned that this creates a loophole which could have serious negative impacts on the effectiveness of the overall specification;

3. **Base Total Energy Consumption (TEC) allowances**: We urge EPA to set TEC allowances that align with its Vision and Guiding Principles by incorporating projections for natural market improvements between the date products are submitted to ENERGY STAR and the specification effective date;

4. **Computer System Categories**: We support the separation of traditional and integrated desktop categories, and integrated and discrete graphics categories;

5. **Mode weighting**: We are still concerned that the Version 6.0 Specification is not accurately representing the market average unit's duty cycle, and therefore underestimates energy use of desktops. We recommend EPA develop a sector-weighted duty cycle average for active/idle mode, and provide a proposal of how to calculate these values based on the available data

[1] 2009 ENERGY STAR Unit Shipment Data, Computers Version 6.0 Discussion Document, EPA

6. **Integrated displays**: We support EPA's decision to streamline the Computers specification by harmonizing the enhanced performance display adder with the ENERGY STAR Display specification. Further revisions to the enhanced performance display adder should be resolved as part of the Displays specification;

7. **Premium Efficiency Power Supply Incentive**: We elaborate on our proposal in Draft 1 comments for an incentive mechanism for premium efficiency internal and external power supplies;

8. **Desktops Without Sleep Mode**: We still advocate against allowing computers that lack a discrete Sleep Mode to qualify;

9. **Thin clients**: We recommend EPA set the Thin Client wattage levels for Category A and Category B to the 25% estimate of the market at effective date, using its test data as a baseline for the current market

10. **Slate computers**: We support EPA's approach to cover slates based on their battery charger efficiency, and we recommend that specific battery charging efficiency requirements be set for slates at the median of the current slate market instead of using the standard requirements of the battery charger specification.

Detailed Comments

1. ENERGY STAR 6.0 Draft 2 Dataset

We urge EPA to include the market introduction date of Version 5.0 systems in the dataset, to help identify market trends and ensure data is not skewed by systems which may no longer be on the market for over 2 years. We also point out an apparent inconsistency in the Version 5.0 data conversion assumptions.

a) Market Introduction Date

We again urge EPA to include the "Market Introduction Date" in the Version 6.0 dataset, at least for those products coming from the Version 5.0 Qualified Product List (QPL), as published in the Televisions and Displays Specifications.

Market Introduction Date is necessary for taking into account the product age when analyzing proposed levels. We understand that manufacturers are supposed to remove products from the QPL when no longer sold, however we suspect this does not happen in many cases. We believe that many of the products on the QPL were no longer sold as of September 2011, and may have been retired from the market for up to 2 years prior to that date. The Market Introduction Date would help ensure that Version 6.0 data analysis is not skewed by systems using legacy technology that is no longer relevant in today's market.

Moreover, having available the Market Introduction Date would also enable a more accurate estimate of the market by the effective date, with the specifications can be established accordingly.

b) VERSION 5.0 Short Idle Assumption

EPA stated that Version 5.0 data is based on Long Idle only and estimated Short Idle using assumptions derived from the v6 data collection process. The ENERGY STAR Program Requirements for Computers Version 5.0 referenced below seems to contradict that statement for desktops, though not for notebooks and integrated displays:

Figure 1: Excerpt from Version 5.0 Test Procedure

> 10. * The following guidelines should be followed to configure power settings for computer displays (adjusting no other power management settings):
>   a. For computers with external computer displays (most desktops): use the computer display power management settings to prevent the display from powering down to ensure it stays on for the full length of the Idle test as described below.
>   b. For computers with integrated computer displays (notebooks and integrated systems): use the power management settings to set the display to power down after 1 minute.

Given that the definition of short and long idle mode in Version 6.0 draft 2 are based on the display being powered on vs. in a low-power mode, the desktop idle mode in Version 5.0 seems to correspond to short idle instead of long idle.

Fortunately, this issue does not currently impact EPA's analysis as long as EPA retains the assumption that short idle and long idle are equal for desktops, though we still recommend correcting this discrepancy.

2. Discrete Graphics Adders

In early 2012, CLASP and NRDC retained Ecova to measure the power consumption of a sample of 12 recent discrete graphics cards (dGfx) for desktop computers in idle mode. The purpose of the project was to assist government agencies in the US and abroad set appropriate dGfx adders for both voluntary and mandatory standards.

EPA's proposed desktop dGfx adders are generally consistent with these test results, except in the G5 category where they appear unacceptably too high. We are concerned that this creates a loophole which could have serious negative impacts on the effectiveness of the overall specification as explained below.

a) Update of Preliminary Results Submitted In Draft 1 Comments

Preliminary results from the project were published in mid-March 2012 and can be found at http://www.clasponline.org/WhereWeWork/CurrentProgramLocations/UnitedStates/CurrentActivities.

Since then, the analysis was updated to remove one of the 6 test PCs from the results (PC4). The test data showed that this PC used significantly more power in baseline configuration than others units in the dataset possibly due to poor iGfx power management in idle. This resulted in significantly lower dGfx adders with this PC compared to others, lowering the median results across the 6 test PCs. While this PC is a valid market configuration, including it in the median value could have penalized PCs with effective iGfx power management.

CLASP-NRDC revised test results excluding PC4 give the following values:

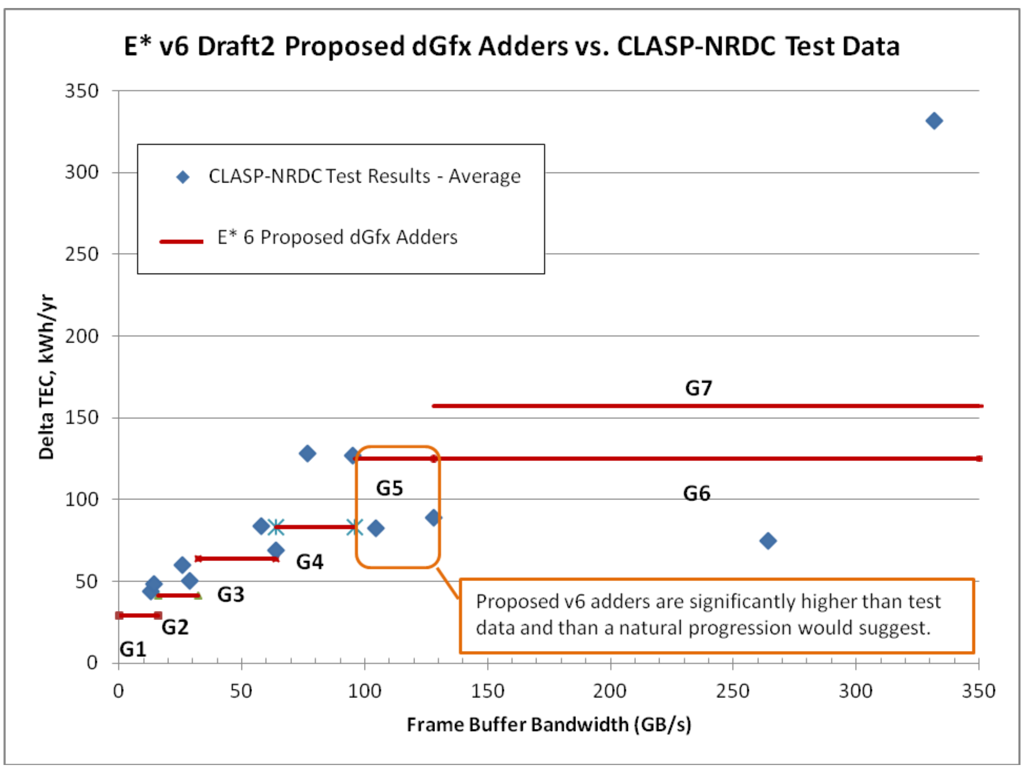
Table 1: CLASP-NRDC Test Results - dGfx Net Impact Excluding PC4 (kWh/yr)

ECMA-383 Category	25th Percentile[2] (kWh/yr)	Average (kWh/yr)
G1	37.9	46.1
G2	46.9	55.2
G3	66.2	76.5
G4	116.4	127.6
G5	73.7	85.8
G6	-	-
G7 (AMD 7970)	62.7	74.8
G7 (NVIDIA GTX 590)	328.9	331.5

b) Draft 2 Proposed Desktop Graphics Adders

As shown by Figure 1 below, EPA's proposed dGfx desktop adders are generally consistent with the test results, except in the G5 category where they are significantly higher than what the test data indicates and outside the linear extrapolation of the other ECMA-383 categories.

Figure 2: ENERGY STAR Draft 2 Proposed Desktop Graphics Adders vs. CLASP-NRDC Test Data (Excluding PC4)



2 25th percentile and average of net impact test data for dGfx cards in each ECMA category

We are concerned that this creates a loophole which could have serious negative impacts on the effectiveness of the overall specification.

EPA's proposal would give manufacturers 40 kWh/yr more energy than the data suggests is necessary. This is over half of the DT0 TEC allowance (74 KWh) and approximately a third of the DT1 and DT2 TEC allowances. As a result, the proposed G5 adder is in effect giving DT0, DT1, and DT2 desktops between one half and one third extra TEC allowance, allowing potentially inefficient computers using G5 discreet graphics to quality for the ENERGY STAR label.

While G5 cards only represented approximately 5% of dGfx in 2010, we project that the G5 market share may have increased to approximately 10% of dGfx in 2012 and will be even higher over the Version 6.0 specification effective period of 2013-2015. Moreover, the proposed G5 adder is much higher than G1-G4 adders, creating an incentive for manufacturers to use higher energy G5 cards in PCs that would otherwise be equipped with G3 and G4 cards. This loophole could result in a significant increase, instead of a reduction, in graphics-enabled desktop computer energy consumption due to the Energy Star specification.

If all US desktop computers with G5 dGfx used the entire extra 40 kWh/yr allowance, approximately 60 GWh/yr of additional energy could be consumed. This would generate an additional 40,000 metric tons of CO_2, which is equivalent to the annual electricity consumption of 13,000 Americans.

We urge EPA to reduce the G5 adder in line with our test data and a natural progression of the G1 – G4 adders.

We also urge EPA to maintain the proposed G4 adder, despite the test data being higher than the proposed G4 adder (See Figure 2). The two G5 cards tested are able to meet the G4 adder, indicating the technology is readily available for G4 cards to meet the specification.

c) Adders for Additional Graphics Cards

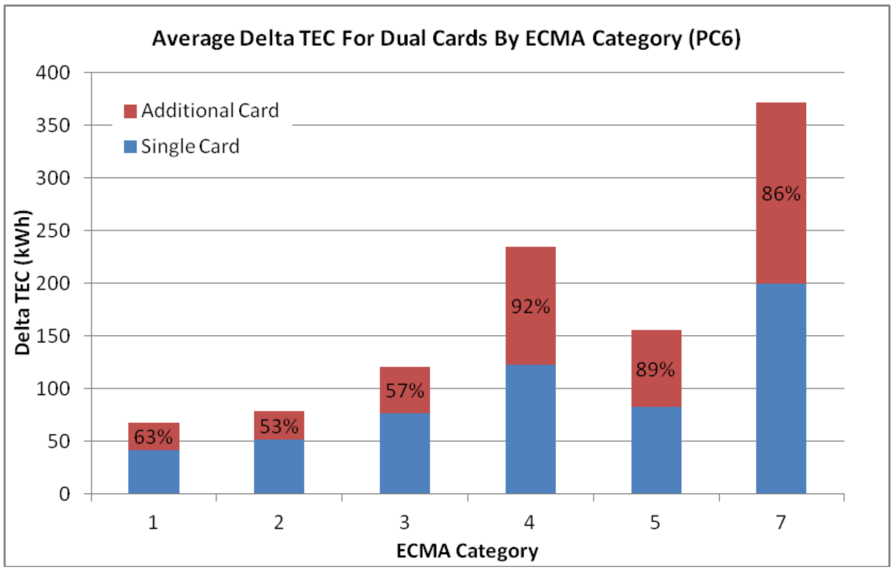
Draft 2 does not address more than one installed graphics card. Desktop computers equipped with multiple dGfx are common and need to be addressed by the specification. If the final specification does not give computers with multiple dGfx cards additional adders, these configurations will not be able to qualify. On the other hand, if additional graphics cards are given the same allowance as the first dGfx, this will create a perverse incentive for manufacturers to use higher energy consuming graphics cards in multiple dGfx configurations to benefit from a higher adder.

We recommend that adders for additional graphics cards be set at approximately 73% of single card adders.

Additional graphics cards (such as CrossFire X and SLI configurations) have different energy requirements from the first card: part of the energy requirements for the first card consists in additional activity in the host system such as motherboard, CPU and memory. This system overhead caused by the first card does not increase proportionally with multiple cards. On the other hand, the energy use of integrated graphics is only avoided once by the first card. The tested dual card configurations twere evaluated to determine which of these two effects prevailed.

As presented in the preliminary testing results, the testing shows that adders for second cards are on average 73% of single card adders within each category and therefore that should dictate the second card adder.

Figure 3: Adders for Second Card vs. Single Card Adders



In the mid-term, the latest low-power idle technology, such as AMD's ZeroCore Power, is marketed as having the capability to completely switch off the second card when it is not required, such as idle mode, which could completely eliminate the need for additional graphics adders (Smith 2011). The NRDC testing used the Radeon HD 7970 and did not test this functionality indicating a need for additional research and testing to determine if this capability can inform a policy decision.

d) Switchable Graphics

Computers equipped with "switchable graphics" are able to switch from discrete graphics (dGfx) to integrated graphics (iGfx) when the computer is in idle mode. This allows the computer to completely switch off the discrete graphics in idle mode and use only as much power as a computer with integrated graphics.

This raises the question of whether computers with switchable graphics require a dGfx adder though it is acknowledged that this may dis-incent manufacturers from implementing the technology. In cases where the dGfx cards consume significantly less power than the category adder, this difference provides manufacturers an unwarranted allowance to qualify the rest of the system. This situation may become increasingly common over time as dGfx implement very low-power mode technology such as AMD's ZeroCore Power.

In order to incentivize switchable graphics which represent a promising solution for much lower-energy computers, we propose to give computers that implement switchable graphics, and have it enabled by default, and do not encourage the user to disable it upon initial setup, to benefit from an adder equal to 20% of the graphics category adder. We believe that 20% is high enough to provide a significant incentive to implement switchable graphics, while still saving 80% of the energy compared to the standard category adder.

e) Notebook Graphics Adders

The graphics testing project performed in collaboration with CLASP did not test notebook discrete graphics as these are not modular and cannot be tested in the same manner as desktop dGfx.

In the absence of independent data for notebook discrete graphics, we generally support EPA's approach to set notebook dGfx adders to a given percentage of desktop dGfx adders, with that percentage to be determined based on the dataset.

f) Base Graphics

EPA defines DT3 desktops as having G5 discrete graphics as a baseline configuration, instead of integrated graphics. This raises the question of whether a DT3 desktop with G5 graphics should still be able to claim the G5 adder or whether that adder is already included in the base DT3 TEC allowance.

If DT3 desktops can still claim a G5 adder, EPA should ensure that the DT3 base allowance does not include an allowance for the G5 base graphics, otherwise this G5 allowance would be counted twice: once in the DT3 base allowance and once in the graphics adder.

The same question applies to NB4 notebooks with G3 base graphics.

Either way, we recommend EPA clarifies this point in the specification.

3. Base Total Energy Consumption (TEC) Allowances

We urge EPA set TEC allowances that align with its Vision and Guiding Principles by incorporating projections for natural market improvements between the date products are submitted to ENERGY STAR and the specification effective date.

Now that EPA has a final version of its Vision and Guiding Principles document, released May 14, 2012, we emphasize the importance of the Computer Version 6.0 Specification to align with the stated objective: to "select efficiency levels reflective of the top 25% of models available on the market when the specification goes into effect".

It is important that EPA set base allowances that anticipate the rapid rate of technology evolution in the computer industry so that the pass-rate can be as close to 25% as possible by the time the specification becomes effective. Otherwise the Version 6.0 specification would rapidly become ineffective and fail to differentiate the most efficient models on the market.

We recommend EPA uses the “Market Introduction Date” in the Version 5.0 Qualified Product List to estimate the rate of efficiency improvement in the market and project it to 2013 in order to set limits that will result in a 25% pass rate by the effective date. Alternatively EPA could set Version 6.0 limits at 15-20% of the Version 6.0 dataset as an approximation of future trends.

4. Computer System Categories

We support the separation of traditional and integrated desktop categories, and integrated and discrete graphics categories.

ITI proposed to revise categories using the following principles:

- Define category boundaries based on a single metric of number of processor cores multiplied by frequency;
- Separating integrated from discrete graphics;
- Separating desktops from integrated desktops.

We support the first point for simplicity reasons, as long as it does not discriminate against non-x86 architectures. We encourage EPA to validate with non-x86 technology providers before adopting a categorization based on this metric.

Whether or not the new metrics based categorization is adopted by EPA we are particularly supportive of the separation of integrated graphics (iGfx) from discrete graphics (dGfx), and standard desktops (DT) from integrated desktops (iDT). The separation allows appropriate allowances to be set for each type of computer without the risk of the market being skewed towards one system type over another.

Separate Integrated and Discrete Graphics

Since both display and dGfx adders are relatively large compared to base TEC allowances, the TEC system very sensitive to adder values; if the adders are too low, systems with dGfx are penalized, as was the case initially with the Version 5.0 specification. Conversely, unnecessarily high adders would incentivize manufacturers to offer more systems with dGfx than they otherwise would be based on pure market demand.

Even if adders are set at the appropriate levels at the time of the specification data collection and development, they may no longer be appropriate one to two years later due to rapid technology evolution. For example, low-power idle graphics technology such as AMD ZeroCore Power will likely make the dGfx adders currently proposed for the Version 6.0 specification much higher than necessary for cards using that or similar technology, favoring these discrete graphics solutions over potential integrated graphics solutions of equivalent performance.

Separate Desktops from Integrated Desktops

Similarly, advances in display energy efficiency could rapidly make the display adder artificially favor integrated desktops over traditional desktops, even though in reality a traditional desktop could use an external display of the same efficiency and not get the adder.

In theory, ENERGY STAR’s TEC equation should allow both traditional and integrated desktops, and iGfx and dGfx, to compete with each other in a feature and performance-neutral manner. In reality, functionality adders are difficult to set at exactly the right level, and technology evolves faster than EPA can update specifications, resulting in a situation where the specification can unduly encourage one type of system over another. This is especially a concern for adders that represent a large portion of the TEC such as the display and dGfx adders.

We therefore recommend separate categories which allow EPA to set levels that qualify the top 25% of each type of system, encouraging energy efficiency innovation for each type of computer. We envisage that in a future specification, if and when dGfx and displays no longer represent a large share of the system energy use in idle mode, the categories could be combined again. In the current situation, however, separate categories will be most effective in driving energy efficiency across the computer market.

5. Mode Weighting

We are still concerned that the Version 6.0 Specification is underestimating energy use of desktops, given that the limited data used to develop the average duty cycle does not definitively represent the statistical average unit for all sectors: enterprise, non-enterprise commercial, and residential. We recommend EPA develop a weighted duty cycle average for active/idle mode, based on the available data.

Developing a weighted average of the market by incorporating both the computer usage differential between sectors and the market percentage of units between sectors is essential for estimating the average unit duty cycle. To that end, we've compared the studies (See Table 2).

Table 2: Cross-Study Duty Cycle Comparison (1)

	Desktop			Notebook			Date	Segment	Sample size	Methodology
	Active-idle	Sleep	Off	Active-idle	Sleep	Off				
Barr et al., QDI (2)	85%	5%	11%	48%	9%	38%	2010	Enterprise	110,000	Automated tracking and collection.
Ecma-383, 3rd Edition, Annex B	50%	5%	45%	40%	35%	25%	2010	Enterprise	500	
Microsoft Transition Report	41%	5%	54%	27%	9%	64%	2008	???	75,000	Automated tracking and collection.
Pigg & Bensch 2010	49%	51%		29%	71%		2010	Residential	81 computers in 50 homes	Automated tracking and collection.
Fraunhofer / CEA 2010	39%	25%	36%	33%	25%	42%	2010	Residential	1,000 homes	Phone survey
Chetty et al.	75%	25%		36%	64%		2009	Residential	59 computers in 20 homes	Logging, surveys, interviews

(1) Short and Long Idle modes were combined for the purposes of these calculations.

(2) U.S. sector weighted estimates based on NAICS codes developed from study results.

We recognize that there are merits and limitations to all of the studies, particularly regarding the survey methodologies and sample selection. The largest gap is in the non-enterprise commercial sector, where there is no definitive data. We have evaluated the limitations for each of the commercial-focused studies:

- **ECMA-383**: The data is isolated to information technology enterprise units (Intel, Lenovo, Lexmark and Sony), and there is a small sample size. No information is provided about the method for data collection, whether or not corporate management was enabled, or how the companies surveyed were selected.

- **Microsoft Transition Report:** No information is provided regarding percentage residential and commercial sector, or corporate management enablement. Two other studies (Pigg & Bensch 2010, Fraunhofer / CEA 2010) support the conclusion that the Microsoft Power Transition Report is heavily weighted towards the residential sector; the percentage of active/idle for residential notebooks from the Microsoft Report (27%) more closely align with these other studies (29% and 33%, respectively), than with the percentages from other commercial studies (Ecma, at 40% and Barr et al. 48%).

- **Barr et al.** No information is provided about how the companies surveyed were selected. The "On" times appear to vastly different from the other data, though given the 24-7 business environments these numbers do seem possible. Enterprise commercial only.

With none of the studies clearly indicating whether they have collected data for non-enterprise commercial, the Barr et al. (2010) numbers, despite the study's limitations appear to be the best proxy given: 1) the range of sub-sectors, 2) the number of entities surveyed, and 3) the assessment of duty cycle without corporate power management. Using the sector-specific duty cycles (see Table 3), we developed weighted average using national NAICS code data for percentage of sectors, assuming an equal number of computers per business on average nationally.

Table 3: Desktop Duty Cycle by Form Factor and Sector

ALL INDUSTRIES						
Desktop Computer						
Workday, Weekends, and Holidays (All Industry Baseline)						
Industry	**Computer On**	**Computer Suspend/Sleep**	**Computer Off**	**Total**	**Industry**	**Baseline Data Hours by Industry**
Education	97.0%	0.1%	3.0%	100.0%	Education	7.9%
Finance	94.3%	1.3%	4.4%	100.0%	Finance	40.8%
Financial	96.2%	0.1%	3.7%	100.0%	Financial	7.9%
Government	88.1%	0.4%	11.5%	100.0%	Government	9.8%
Healthcare	93.4%	0.6%	6.0%	100.0%	Healthcare	29.2%
Higher Ed	76.5%	0.8%	22.7%	100.0%	Higher Ed	0.4%
Manufacturing	86.6%	0.1%	13.3%	100.0%	Manufacturing	3.1%
Retail	71.8%	0.4%	27.8%	100.0%	Retail	0.7%
Transportation	68.7%	21.5%	9.8%	100.0%	Transportation	0.2%
Total	93.3%	0.8%	5.9%	100.0%	Total	100%

Source: Barr 2012.

ALL INDUSTRIES						
Portable Computer						
Workday, Weekends, and Holidays (All Industry Baseline)						
Industry	Computer On	Computer Suspend/Sleep	Computer Off	Total	Industry	Baseline Data Hours by Industry
Education	49.4%	4.4%	46.1%	100.0%	Education	4.8%
Finance	54.5%	33.7%	11.8%	100.0%	Finance	0.0%
Financial	35.8%	2.1%	62.0%	100.0%	Financial	10.5%
Government	28.2%	14.6%	57.3%	100.0%	Government	3.6%
Healthcare	60.4%	16.4%	23.2%	100.0%	Healthcare	64.0%
Higher Ed	46.5%	7.0%	46.5%	100.0%	Higher Ed	0.3%
Manufacturing	51.0%	7.6%	41.4%	100.0%	Manufacturing	3.7%
Retail	49.1%	8.7%	42.2%	100.0%	Retail	13.1%
Transportation	20.4%	8.6%	71.1%	100.0%	Transportation	0.0%
Total	54.3%	12.9%	32.8%	100.0%	Total	100%

Source: Barr 2012.

Incorporating all of these studies, we then developed a revised mode weighting. Table 4 demonstrates our calculations to develop the weighted average. We assumed that PC's with no corporate power management enabled have a 75% saturation rate. Note how using this methodology results in a slightly lower active mode for notebooks than the proposed Version 6.0 mode weighting.

Table 4: Sector-Average Mode Weighting

Desktop				
	Market %		**On Mode**	**Sector %**
Commercial	60%	No Corporate PM	85%	75%
		Corporate PM	50%	25%
Residential	40%	All	45%	100%
	Weighted Market Avg. (Active)		**63.6%**	
Notebooks				
	Market %		**On Mode**	**Sector %**
Commercial	60%	No Corporate	48%	75%
		Corporate PM	33%	25%
Residential	40%	All	27%	100%
	Weighted Market Avg. (Active)		**37.3%**	

Unless there is additional data to support the estimate for the non-enterprise commercial sector, we recommend that ENERGY STAR utilize this value for idle (divided between short and idle) mode for desktops and notebooks.

6. Integrated Displays

We support EPA's decision to streamline the Computers specification by harmonizing the enhanced performance display adder with the ENERGY STAR Display specification. Further revisions to the enhanced performance display adder should be resolved as part of the Displays specification.

7. Premium Efficiency Power Supply Incentive

Adopt a TEC adder to incentivize premium efficiency power supplies that achieve high efficiency ratings at the 10% load factor level. This section elaborates on our concept proposal made in Draft 1 comments for an incentive mechanism for premium efficiency internal and external power supplies. It proposes revised requirements and incentive levels for both internal and external power supplies.

In Draft 2, EPA refers to NRDC and NEEA's proposed incentive to encourage manufacturers to include power supplies that are more efficient than the minimum ENERGY STAR requirement (referred to as "premium efficiency" hereto after).

We believe it is important to encourage premium efficiency power supplies, despite the fact that power supply efficiency is already factored in the ENERGY STAR TEC equation through the idle, sleep and off mode power values, for the following reasons:

1. Even when complying with ENERGY STAR's minimum requirements, power supplies remain one of the largest sources of energy use within computers. This is because 80-PLUS Bronze or External Power Supply (EPS) Level V power supplies typically operate in the 77%-83% actual efficiency range at a computer's idle load point, and an even lower efficiency level at the Sleep and Off load points. This means approximately 20% of the energy used by computers equipped with these power supplies is wasted in the power supply;

2. Technology for premium efficiency power supplies currently exists and is already broadly adopted by some market segments. For example, 25% of the latest 80 Plus dataset is rated at higher than Bronze level based on 80-PLUS 2012;

3. ENERGY STAR has a critical role to play in scaling adoption of high efficiency technology and driving innovation so that this technology becomes more affordable and readily available for the majority of the market;

4. With several jurisdictions such as the European Union considering making Bronze and Level V mandatory minimum requirements for computers, these levels will become a de facto world standard. This makes it more important for ENERGY STAR to encourage the next level of efficiency;

5. Continuing to increase power supply efficiency is one of the necessary steps on the journey towards highly efficient computers, in support of science-based GHG reduction targets.

As requested by EPA, we propose an approach where computers using premium efficiency power supplies receive an incentive in the form of an extra TEC allowance to help them meet the specification. At the same time, this proposal does not mandate the use of premium efficiency power supplies and computers can continue to meet TEC requirements through other means.

We propose the following efficiency requirements and incentive levels:

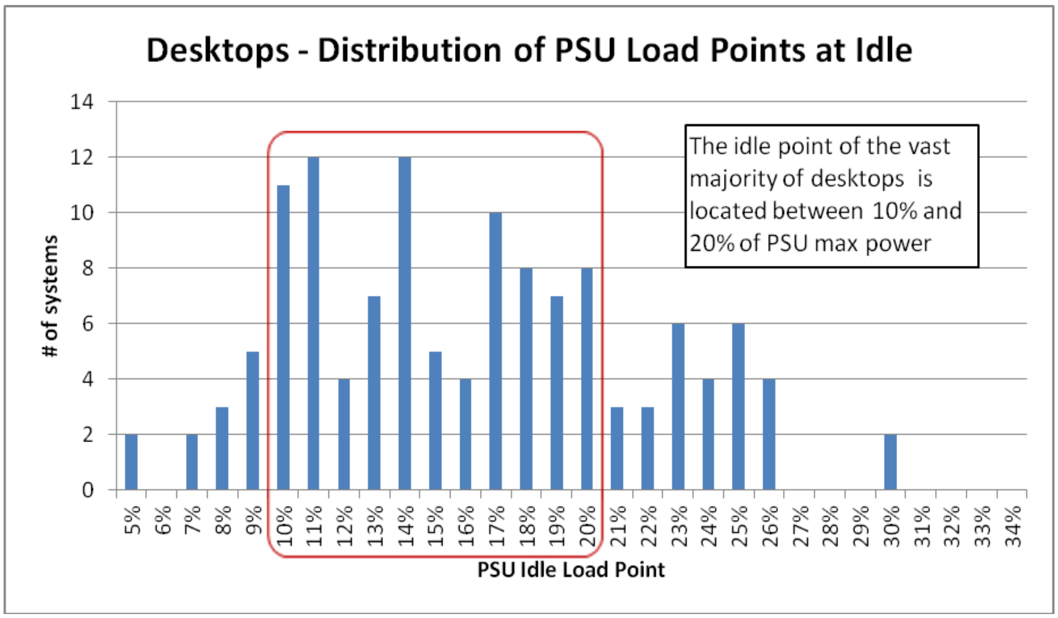
Table 5: Proposed Efficiency Requirements and Incentive Levels

Power Supply Type	Level Name	Requirements		Incentive (% TEC with adders)
		Standard metric	10%-load	
IPS	Silver +	80-PLUS Silver	81.0%	2%
	Gold +	80-PLUS Gold	84.0%	4%
EPS	88%+	88% average efficiency[3]	83.0%	1%
	89%+	89% average efficiency	84.0%	2%

Why 10%-Load Efficiency Requirements

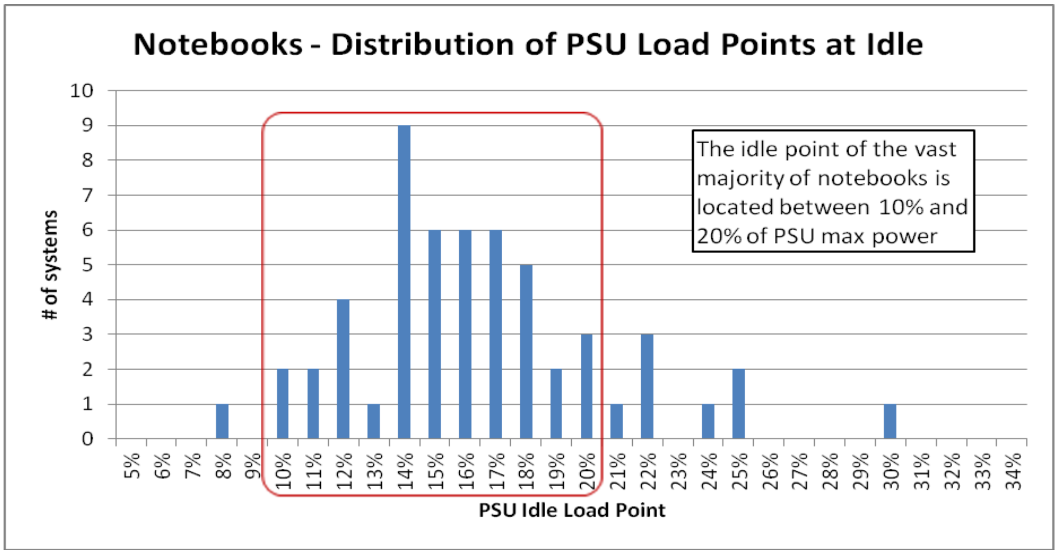
The ENERGY STAR Version 6.0 dataset shows that the majority of computers now have idle PSU load points between 10% and 20%, with an average of 16% for standard desktops and notebooks (see Figure 4 and Figure 5). Therefore, we propose adding a 10%-load efficiency requirement to the standard 80-PLUS and EPS marking protocols.

Figure 4: Distribution of PSU Load Points at Idle for Desktops[4]



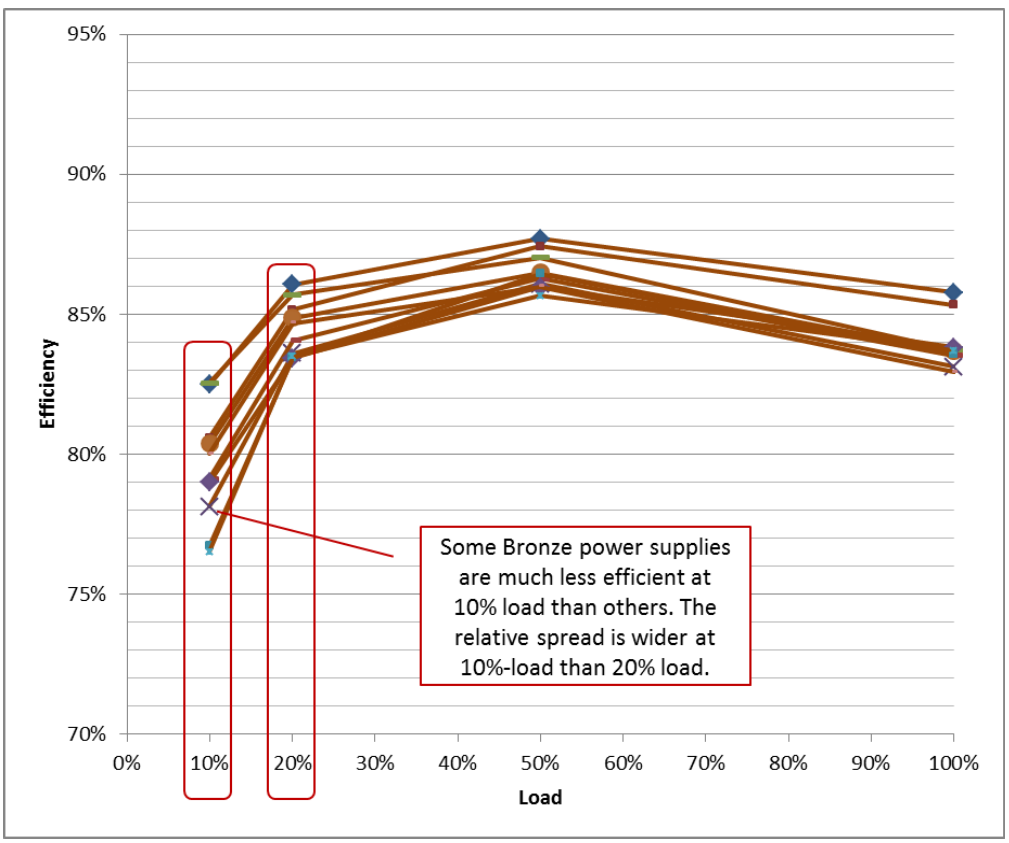
[3] Average of 25%, 50%, 75%, 100% efficiency per the standard single output EPS test protocol.
[4] Data Collection items of the dataset only.

Figure 5: Distribution of PSU Load Points at Idle for Notebooks



80-PLUS information and test results for internal power supplies show that PSU efficiencies at 10% load vary significantly. For example, Figure 6 below shows a wider range of efficiency at 10% load than at other load points.

Figure 6: Efficiency Curves of a Random Sample of 10 80-PLUS Bronze Power Supplies

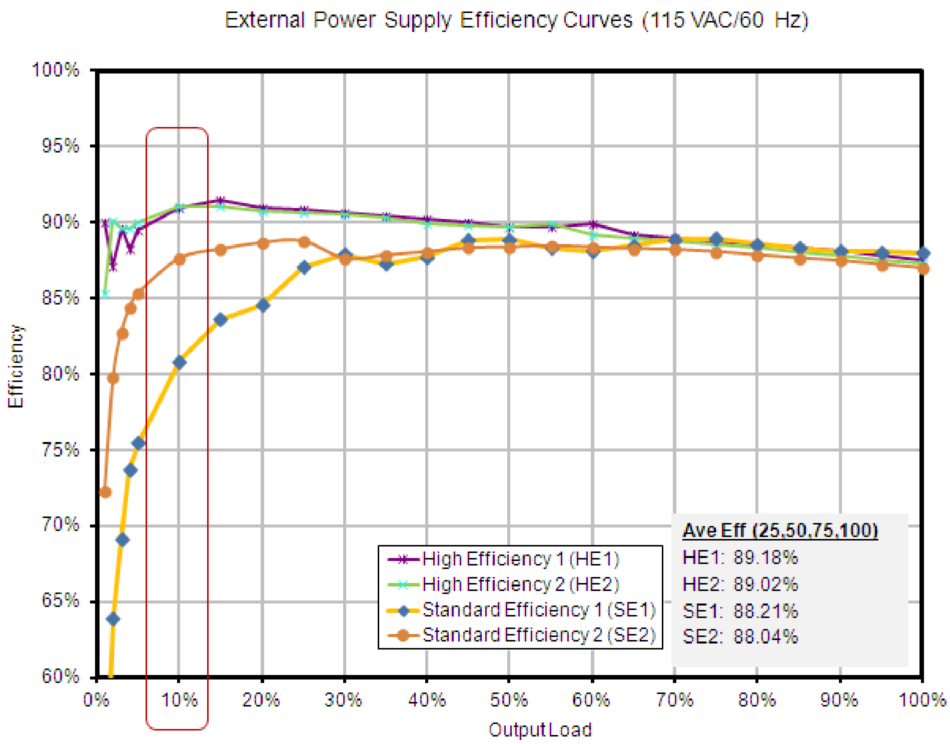


Minimum efficiency requirements at 10% load will ensure that power supplies are designed to perform adequately in the entire 10-20% range, which corresponds to the PSU load point of most modern computers. This will become especially important as computers become more power scalable. For example, computers with discrete graphics will continue to require high-power power supplies to run discrete graphics cards in active mode, but will only require a diminishing fraction of that power as they incorporate very-low idle mode graphics technology.

While not part of the 80-PLUS requirements, Ecova started to measure and report 10%-load efficiency for internal power supplies on Jan 1, 2012[5]. The standard test method for external power supplies (EPS) can be used to measure a 10% load efficiency level.

Figure 7 shows 4 EPSs that have similar efficiencies using the average of 25%, 50%, 75%,100% load metric, but quite different 10%-load efficiencies: 2 models using high efficiency controllers and topologies have 10%-load efficiencies higher than 90%, the other 2 have 10%-load efficiencies of 81% and 87%.

Figure 7: Efficiency Curves of High Efficiency and Standard Efficiency External Power Supplies



Determination of 10%-Load Efficiency Levels/Requirements

We propose efficiency requirements at 10%-load based on the following:

For internal power supplies, the recommended 10% load efficiency levels are intended to represent approximately the median of power supplies that meet the 80-PLUS requirements. Since this level of efficiency is already achieved by half of the market it should not be viewed as a difficult requirement

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5 http://www.plugloadsolutions.com/80PlusPowerSuppliesDetail.aspx?id=0&type=2

to achieve. This will ensure that power supplies that qualify for the premium efficiency incentive have 10%-load efficiencies better than half of the market.

For external power supplies, we did not have a large enough sample to calculate a median, so internal power supply efficiency levels were extrapolated. Discussions with industry representatives confirmed that current technologies, such as smart controllers, enable efficiency levels very similar and at equivalent costs to the internal power supply proposal referenced above. If anything, EPSs might be able to reach the same efficiency slightly more easily due to the fact that some IPSs have fans active at 10% load and EPSs don't have fans, so this is a conservative approach.

Industry representatives also confirmed that factors such as wattage, power factor correction (PFC), and voltage (115/230V) are no longer barriers to the efficiency levels proposed at the 10%-load when using current technology.

Justification of Proposed Incentives Levels

The proposed incentive levels of 2% and 4% for IPS and 1% and 2% for EPS correspond approximately to the average unit savings expected from the adoption of each of the premium efficiency power supply levels.

We recommend that ENERGY STAR levels be calculated after applying the incentive, so that the incentive is "pass-rate neutral", i.e. it does not increase the overall number of qualifying systems at the effective date, and therefore does not reduce the stringency of the specification. However it is also possible to calculate ENERGY STAR levels before applying the incentive, in which case the incentive would increase the initial pass-rate by helping additional units qualify without disqualifying any systems. This would result in a less stringent specification.

Impact of the DOE Rulemaking on External Power Supplies

The DOE published a Notice of Proposed Rulemaking on March 27, 2012[6] proposing to set a mandatory average efficiency level of 88% (Level VI) for external power supplies. This is higher than the current ENERGY STAR requirement of 87% average efficiency for computers, and equivalent to our first proposed incentive level, albeit without the 10%-load efficiency requirement. Until DOE adopts a final rule, the required levels and implementation date are uncertain.

We've responded to the uncertainty with a conservative approach, proposing EPS incentive levels that assume the mandatory federal standard of 88% average efficiency is already in effect. While this federal standard adoption would appear to reduce the effect of the incentive (with the market baseline above the 87% for ENERGY STAR), the proposed 10% load efficiency requirement will have the greater benefit on average unit energy savings. We recommend that EPA adopt our proposal based on the assumptions of an 88% federal standard going in effect.

[6] http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/bceps_nopr.pdf

8. Power Management: Desktops Without Sleep Mode

We still advocate against allowing computers that lack a discrete Sleep Mode to qualify.

We strongly support EPA's intent to encourage industry to take advantage of low-power technology from the mobile space in more traditional computer platforms, and to find innovative ways to reduce computer energy use even if they require adjusting existing specifications.

However we are concerned with allowing computers to qualify without an effective Sleep mode when not in use, on the basis of their idle mode power alone. Allowing systems without Sleep mode to qualify means desktops could remain On 24x7, wasting up to 87 kWh annually when not in active use. This is more than the proposed 67 kWh allowance for category DT0 desktops, and it is more than twice as high as the most energy efficient desktops that use mobile technology AND include a sleep mode for less than 40 kWh/yr. The difference of up to 47 kWh/yr multiplied by millions of devices represents too much energy to waste when this waste could easily be minimized.

Power management is a key strategy to reduce energy waste by electronic devices when not in use. We believe it is critical to continue to require devices that qualify for ENERGY STAR to implement effective power management. We are not aware of a dependency between achieving very low power in idle mode and implementing effective sleep mode functionality: the most efficient computers should do both.

If it is the case that Sleep mode as currently defined by Version 6.0 does not meet the needs of these computers, we think this is an opportunity to adjust the definition of Sleep mode to ensure it corresponds to the capabilities of current technology, while still scaling power consumption to the level of service provided. In some cases exemptions could be granted for specific applications where sleep mode does not meet the needs of the application. However the level of power in Long Idle should not be the determining criterion for exempting computers from implementing effective power management.

9. Thin Clients

We again recommend EPA set the Thin Client wattage levels for Category A and Category B to the 25% estimate of the market at effective date, using its test data as a baseline for the current market.

We support EPA's proposed new categorization based on Sleep mode capability instead of local multimedia encoding or decoding capability. However the proposed limits of 12 W for Category A and 15 W for Category B appear high, as 60% of existing Category B products are capable of meeting the lower category A limit. We recommend EPA set the Thin Client wattage levels for Category A and Category B using the same top 25% approach consistent with the rest of ENERGY STAR methodology and the Vision and Guiding Principles, but estimating future wattage levels using the ENERGY STAR Thin Client test data.

10. Slate Computers

We support EPA's approach to cover slates based on their battery charger efficiency, and we recommend that specific battery charging efficiency requirements be set for slates at the median of the current slate market instead of using the standard requirements of the battery charger specification.

EPA proposes to introduce appropriate sections of the ENERGY STAR Battery Charging System test procedure into the Computer Specification in order to evaluate a slate product's battery charging system and serve as its only requirement for ENERGY STAR qualification.

We support this approach. While slate computers' value proposition requires high energy efficiency to maximize battery life, there is not a strong market incentive driving efficiency of the charging system. A slate computer's almost absolute reliance on battery power during use makes charging efficiency the most important specification consideration.

Because the variations in equipment specifications regarding battery technology for slates are narrow, a more focused specification than the general ENERGY STAR Battery Charger (BC) specification is warranted. The BC specification covers all battery chemistries, capacities, sizes and weights. In contrast, all currently available slates use lithium-ion batteries and range in capacity from approximately 10 Wh to 50 Wh with known duty cycles. Slates should therefore meet battery charging efficiency requirements set specifically for their usage pattern. We propose the pass-rate target at implementation date be set at the median of the current dataset rather than the typical 25% to compensate for the limited number of products currently available.

Thank you for considering our comments.

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11. References

1. Barr, Harty & Nero. 2010. “Thin Client Investigation including PC and Imaging State Data” DRAFT. Emerging Technologies Program., Pacific Gas & Electric Company, July 10.

2. Barr. 2012. Email to Nate Dewart, Energy Solutions. 2012.

3. Chetty, Marshini, A.J. Bernheim Brush, Brian Meyers, and Paul Johns. 2009. It’s Not Easy Being Green: Understanding Home Computer Power Management. Paper presented at CHI 2009 Conference in Boston, MA, 4-9 April

4. 80-Plus. 2012. Plug load Solutions. “80 PLUS® Certified Power Supplies and Manufacturers; PowerSupplyExport” Excel. Accessed March 29, 2012. http://www.plugloadsolutions.com/80PlusPowerSupplies.aspx.

5. Pigg & Bensch. 2010. “Electricity Savings Opportunities for Home Electronic and Other Plug-In Devices in Minnesota Homes: a technical and behavioral field assessment.” Prepared by the Energy Center of Wisconsin.

6. Smith, Ryan. 2011. “AMD Radeon HD 7970 Review: 28nm And Graphics Core Next, Together As One.” Accessed March 26, 2012. http://www.anandtech.com/show/5261/amd-radeon-hd-7970-review/11

7. TIAX. 2007. “Energy Consumption by Consumer Electronics in U.S. Residences: Final report to Consumer Electronics Association (CEA).” K. W. Roth and K. McKenney. Cambridge MA, TIAX LLC.