October 26, 2017

To: Ryan Fogle, EPA Manager, ENERGY STAR for IT and Data Center Products;
John Clinger, ICF International

Re: ITI Comments on ENERGY STAR Version 7.0 Computers Draft 2 Specification

Thank you for the opportunity to comment on the ENERGY STAR Version 7.0 Computers Draft 2 Specification. As the global voice of the tech sector ("Industry"), ITI has been a long-standing partner in the ENERGY STAR process and has collaborated with governmental agencies on related regulatory efforts, like the recently adopted California Energy Commission (CEC) Energy Efficiency Standards for Computers and Computer Monitors ("CEC regulation").

After reviewing the Draft 2 Specification and participating in the October 12th Webinar, our priority concerns include (1) harmonization with existing standards, (2) the product categorization approach, (3) limits/adders, (4) the power management and (5) the product definition/ scope. The comments below expound upon these concerns and provide detailed feedback to the EPA's Draft 2 proposal.

Summary of key issues:

Desktop Workstation Definition:

The Version 7.0 definition for Desktop Workstations does not incorporate industry recommendations to EPA and California Energy Commission. The proposed definition below was a result of months of collaboration effort between the industry, advocates and the Commission, while keeping EPA informed of significant updates. Industry recommends harmonization of the Desktop Workstations definition and proposes the following definition, as detailed in the California Energy Commission's *2nd 15 Day Language*.

> "Workstation" means a computer used for graphics, computer-aided design (CAD), software development, financial, or scientific applications, among other computation intensive tasks. A workstation covered by this specification must meet the following criteria:
>
> (1) Product as shipped does not support altering frequency or voltage beyond the computer processing unit and GPU manufacturers' operating specifications;
>
> (2) Has system hardware that supports error-correcting code (ECC) that detects and corrects errors with dedicated circuitry on and across the CPU, interconnect, and system memory; and
>
> (3) Meets two or more of the following criteria:

(A) Supports one or more discrete GPU or discrete compute accelerators.

(B) Supports four or more lanes of PCI-express, other than discrete GPU, connected to accessory expansion slots or ports where each lane has a bandwidth of 8 gigabits per second (Gb/s) or more.

(C) Provides multi-processor support for two or more physically separate processor packages or sockets. This requirement cannot be met with support for a single multi-core processor.

(D) Has qualified or is currently being reviewed for qualification by two or more independent software vendor (ISV) product certifications.

Mobile Workstations:

Mobile workstation definition: Industry appreciates EPA to define a mobile workstation which is largely aligned with the CEC definition. Since the definition includes system memory bandwidth as one of the optional requirement, industry request EPA to define system memory bandwidth in alignment with CEC definition below: :

"System Memory Bandwidth" means the rate at which data can be read from or stored into computer system's memory, expressed in gigabytes per second(GB/s)

Industry has worked with CEC to develop an FAQ to address, among other things, qualification for mobile workstation system memory bandwidth. This is provided in Appendix A for EPA's consideration

Mobile workstation criteria: While ITI agrees with mobile workstation definition, it does not agree with draft 2 proposal to keep mobile workstations out of scope for ENERGY STAR v7.0 specification, pending data collection in ENERGY STAR v8.0 to inform the mobile workstation criteria. As discussed during the Draft 2 webinar, there are government and institutional customers for mobile workstation, who would prefer mobile workstations to be ENERGY STAR certified. ITI would like to work with EPA to agree on certification criteria.

ITI would reiterate its recommendation in its Draft 1 response, that EPA adopt CEC's criteria to qualify mobile workstation under ENERGY STAR, as outlined in CEC's Computers and Displays standard {(Chapter 8)(1605.3)(60}. The criteria requires use of external power supply that meets federally regulated level VI efficiency criteria, incorporates energy-efficiency Ethernet functionality (Note: IEEE 802.3az is specific to a physical port – not wireless connection), and power management to transition connected display and system in to sleep mode or alternative sleep mode with a maximum power demand (per Table V-6).

ITI further recommends that the manufacturers report mobile workstation TEC data (based on Notebooks mode weightings), not as a pass/fail criteria but to inform the future ENERGY STAR v8.0 discussion toward mobile workstation criterion development. This exercise is for data gathering only as it is premature to establish TEC limits for mobile workstation. ITI welcomes further discussion on this topic, should EPA disagree with ITI's proposal for mobile workstation certification.

Discrete Graphics Definition:

Industry agrees with the draft 2 proposal to return to the definition of discrete graphics that is used in the current ENERGY STAR PC specification Discrete graphics are distinguished from integrated graphics, by the inclusion of a local memory controller interface and local graphics specific memory. The proposed additional language, i.e. "*Discrete GPUs are not packaged on the same die or substrate as the CPU"* would have created an arbitrary distinction based on packaging design rather than whether discrete graphics are present. To ensure the availability of future packaging design innovations, industry is available for future discussions on this topic as needed.

Mode Weightings and Network Connectivity

ITI appreciates EPA intention to make full connectivity mode weightings less restrictive to allow products to take advantage of alternative implementations with similar energy savings as the existing solutions. However, the language under Full Network Connectivity definition [section E(3)] on page 6 of 22, and in section 3.5.1(iii) on pages 12 of 22 & 13 of 22 needs to be clarified.

Industry believes the intention is to provide two options for meeting the requirements to make use of the full connectivity mode weightings:

Option 1: Computers that maintain network presence while in sleep mode (as defined in ENERGY STAR) or in alternative low power or alternative sleep mode, and intelligently wake up when further processing is required. While in low power mode they need to meet *'Network Proxy – Full Capability'* definition. These computers, while power managed, **do not** have a power demand in sleep mode or in alternative low power or alternative sleep mode, as long as they meet the '*Network Proxy – Full Capability'* definition.

Option 2: Computers that do not have a sleep mode (as defined in ENERGY STAR) and have an alternative low power mode or alternative sleep mode with power demand less than or equal to 2 Watts. In alternative low power or sleep mode these computers are **not** subject to specific protocols such as 'network proxy' functionality as described ion Ecma-393 standard. These computers also do not need to meet *'Network Proxy – Full Capability'* definition *(while in LPM, the system supports Base Capability, remote Wake, and Service Discovery/name Services)*

In summary, option 1 requires computers meeting *'Network Proxy – Full Capability'* definition without any power demand in sleep mode or in alternative low power, while option 2 requires computers having alternative low power or alternative sleep mode with power demand less than or equal to 2 Watts, but are not are not subject to specific protocols such as 'network proxy' functionality or not need to meet *'Network Proxy – Full Capability'* definition

While EPA's intention has changed, the same language has been carried over from ENERGY STAR v6.1 to ENERGY STAR v7.0 draft 2 (except 10W for alternative low power mode is replaced with 2W).

ITI recommends that EPA rephrase section 3 of Full Networking definition and section 3.5.1 (iii) addressing certification, to lay out these options clearly along with the requirements. Current

language does not meet EPA's intention to make '*full connectivity mode weightings less restrictive to incentivize manufacturers to take advantage of alternative solutions'* as articulated during the draft 2 webinar.

Internal Power Supply Requirement

Regarding Internal Power Supplies (IPS), ITI would like to reiterate its long standing position that ENERGY STAR focus should be on the system level energy consumption (TEC), and not IPS efficiency levels. IPS selection is one of the tools the system makers use for system design consideration for a given market segment. To illustrate this issue, there are many consumer desktop systems in the market that meet the ENERGY STAR TEC requirements but could not be qualified for ENERGY STAR label, for lacking an 80Plus Bronze or higher IPS. The system maker's decision not to design-in a more expensive higher grade IPS is based on energy efficiency and cost trade-offs for a given market segment. These systems are already highly energy efficient (meeting ENERGY STAR limits) and adding a higher grade IPS is not warranted as cost-effective energy efficient solution. CEC agreed with this approach and decided not to regulate IPS for mainstream desktop PC systems, leaving it up to the system makers to decide, based on the system BOM to meet the TEC requirements.

Should the EPA not agree with this approach, ITI requests the potential changes to the internal power supplies efficiency levels. While ITI appreciates EPA proposed changes in draft 2 to set two levels of IPS efficiency criteria i.e. 80Plus Bronze levels for IPS with a nameplate rating 500W and below, and 80Plus Gold level for IPS with a nameplate rating greater than 500W, industry believes 80Plus Gold level are stringent and EPA has not provided data to justify its proposal to jump 2 levels from the current 80Plus Bronze to 80Plus Gold level. The Load Rating for Power Factor Correction (PFC) at 0.9 should be at 50% Load not at 100% load for both 80Plus criteria, to harmonize with California Energy Commission and Ecova 80Plus Internal Power Supply efficiency requirements, as discussed during the EPA's October 12th webinar. It appears that IPS efficiency allowance table 6 is not aligned with 80Plus program. The error is in efficiency requirements at 100% load levels. EPA has ratcheted up the incentive requirements from ENERGY STAR v6.1 to make it difficult to earn TEC incentive points plus made efficiency at 100% load levels higher than 80Plus requirements.

Industry recommendations on IPS:

a) Set 80Plus Silver levels for IPS with a nameplate rating greater than 500W, while maintaining 80Plus Bronze levels for IPS with a nameplate rating 500W and below
b) Adjust the Load Rating for Power Factor Correction (PFC) at 0.9 to be at 50% Load not at 100% load for both 80Plus Gold (Industry prefers 80Plus Silver) and 80Plus Bronze criteria
c) Revisit the incentive levels commensurate with the changes made to IPS efficiency level in Draft 3
d) Align efficiencies at 100% load levels with 80Plus program criteria (see below to illustrate the issue

Efficiency level certifications [edit]

80 Plus test type[4]	115V internal non-redundant				230V internal redundant				230V EU internal non-redundant			
Percentage of rated load	10%	20%	50%	100%	10%	20%	50%	100%	10%	20%	50%	100%
80 Plus		80%	80%	80%						82%	85%	82%
80 Plus Bronze		82%	85%	82%		81%	85%	81%		85%	88%	85%
80 Plus Silver		85%	88%	85%		85%	89%	85%		87%	90%	87%
80 Plus Gold		87%	90%	87%		88%	92%	88%		90%	92%	89%
80 Plus Platinum		90%	92%	89%		90%	94%	91%		92%	94%	90%
80 Plus Titanium	90%	92%	94%	90%	90%	94%	96%	91%	90%	94%	96%	94%

Table 6: Internal Power Supply Efficiency Allowance

Power Supply Type	Computer Type	Minimum Efficiency at Specified Proportion of Rated Output Current[ii]				Minimum Average Efficiency[iii]	$Allowance_{PSU}$
		10%	20%	50%	100%		
IPS	Desktop	0.86	0.90	0.92	0.90	-	0.015
		0.90	0.92	0.94	0.92	-	0.03
	Integrated Desktop	0.86	0.90	0.92	0.90	-	0.015
		0.90	0.92	0.94	0.92	-	0.04

TEC Base for Thin Clients:

ITI identified a number of errors and uncertainty related to the requirements specified for Thin Client computers in the Draft 1 of Ver. 7.0 specification that have not been corrected in Draft 2. Specific problems remaining in Draft 2 include the following items:

- In Table 3 *Power Management Requirements*, the requirements for the power saving states are outlined. The outline of requirements for Sleep Mode states that "*The speed of any active 1 Gb/s or faster Ethernet network links shall be reduced when transitioning to Sleep Mode or Off Mode.*" However requirements for Fiber Networks are not addressed.
- The title for Table 9 *Functional Adders* for computers includes Thin Clients and the table contains functional adders for Thin Clients, including a Memory Adder. However Equation 6 (ETEC-MAX) for Thin Clients does not include the Memory Adder, nor does Table 11 "*Adder Allowances for Thin Clients*".

Given the issues outlined above, and the fact that there is no categorization to distinguish low end configurations from high end Thin Client configurations, ITI recommends the following changes for Thin Client requirements for Ver. 7.0:

a) Increase the Base TEC value from the proposed value of 31 kWh to 35 kWh

b) Include an Adder of 20 kWh for Fiber Optic NICs

Confirmation of the adders that can be applied for Desktop Thin Clients (consistent with the recommendations we provided in response to EPA's Draft #1 and as outlined above.

TEC Limits for Notebooks

Proposal for Base TEC limits for Notebooks: ITI has analyzed the data used to set new Notebooks categories and TEC limits/adders, and has the following observations and recommendation:

1. **Categorization**: The scatter plot in Figure 1(P-score vs. Base TEC) reveals the following issues:

    - While EPA has made changes to performance score bands for notebook categories, there still remains a minor gap.
    - P-Score vs. Base TEC does not show a good correlation. This was pointed out by ITI in its earlier comments to EPA.
    - While category cut-off point is difficult to assess, the biggest gap between NB1 and NB2 occurs between P Score values of 7.3-8.0, which is shown with the orange arrow is Figure 1.
    - ITI recommends the following P-Score (P) values for the proposed 3 categories.
        i. NB0: $P \leq 2$
        ii. NB1: $2<P<8$
        iii. NB2: $P \geq 8$

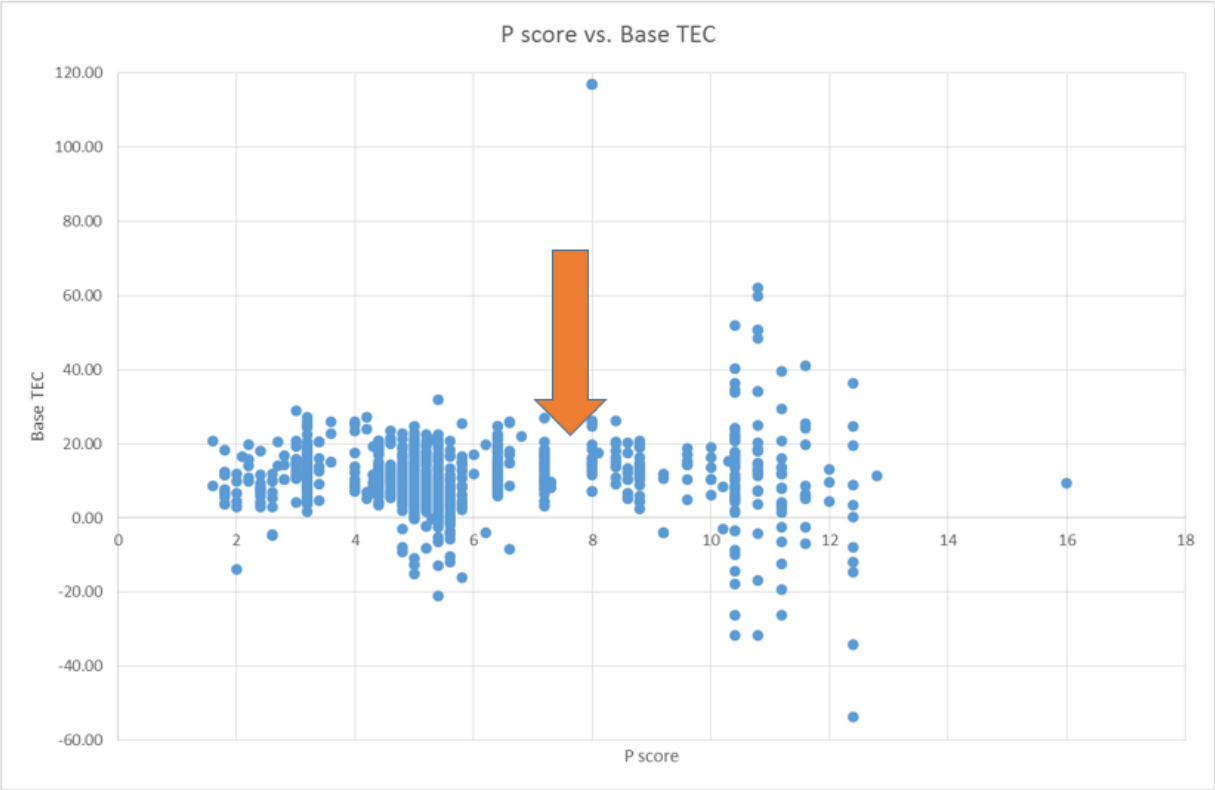


Figure 1

2. **Base TEC limits assessment**:

- Base TEC limits: While EPA has made significant changes in Draft 2 to adjust TEC limits there still appears to be an issue on NB2 category limits, since the dataset does not adequately take into account non-ENERGY STAR high-end notebooks in the market. EPA in its initial discussion document had claimed that 95% of the laptops in the market already meet or exceed ENERGY STAR notebook requirements. However, ENERGY STAR® Unit Shipment and Market Penetration Report, Calendar Year 2016 Summary[1] reports 81% ENERGY STAR penetration for Notebooks and 51% penetration for desktop computers. ITI believes 19% of Notebooks that do not meet ENERGY STAR are likely higher-end notebook systems. Once these systems are added to the NB2 category the 25% cut-off point for ENERGY STAR target will shift up, as more number of systems will be in top 25 percentile population.

[1]https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2016_USD_Summary_Report.pdf?7166-cd80

- **Recommendation**: ITI has performed independent analysis on the dataset EPA provided and recommends the following:

	Draft 1	ITI Draft 1 proposal	Draft 2	ITI Draft 2 proposal
Memory adder	2.5+ (0.4*GB) (error)	0.4*GB	0.4*GB	0.4*GB
Display Adder	ES V7 D1 (error)	ES V7 D1 (error fixed)	ES V7 D1 (error fixed)	ES V7 D1 (error fixed)
dGPU adder (NB)	G1-G7	N/A	Aligned with Tier 1 CEC	Aligned with Tier 1 CEC
NB0 Base TEC	4 kWh (P≤ 2)	6.5 kWh (P≤ 2)	6.5 kWh (P≤ 2) {26.3%}**	6.5 kWh (P≤ 2)
NB1 Base TEC	7 kWh (2<P≤ 9)	8.5 kWh (2<P< 8)	8.0 kWh (2<P≤ 8) {25.6%} **	8.5 kWh (2<P< 8)
NB2 Base TEC	11 kWh (P> 9)	12 kWh (P≥ 8)	12 kWh (P> 8) {24.5%} **	14 kWh (P≥ 8)

*** Pass rate based on 2015 and after certified systems*

Table 1

3. **Base TEC/Adders Discussion**:

EPA's proposal even after correcting for errors calls for significantly reducing the Notebooks base TEC limits from ENERGY STAR v6.1 to ENERGY STAR v7.0. This will put additional constraint on rest of the notebook system to ensure the capability adders are properly sized.

- **Ethernet ports**: Most consumer notebooks have removed Ethernet cards and rely on WLAN only for connectivity. However commercial notebooks still require both WLAN and Ethernet card support for connectivity customers require. The ENERGY STAR test methods require connecting an Ethernet card to a live network. Therefore it will be appropriate if EPA eliminates the Ethernet connection requirement and only require use of WLAN in ENERGY STAR test procedure. As an alternative, ITI recommends that EPA adopt 3.5 kWh adder for notebooks that support wired Ethernet . This is based on ~1W AC measured power difference between wired LAN vs. wireless without Energy Efficient Ethernet link.

- **Storage adder:** Since EPA has proposed to drastically reduce Notebook base TEC targets, the impact of additional storage on Notebooks measured TEC will be significant without appropriate allowances. Current draft 2 allows storage adder of 2.6 kWh to be

applied only once when the system has additional storage elements. ITI recommends that EPA to make a change to allow storage adder of 2.6kWh to be applied for each additional storage device in the system. This will enable systems with one or more additional storage devices to get an allowance for each device.

- **Wired Ethernet or Fiber card:** ITI recommends that EPA to align with CEC on 12.5kWh/card adder for notebooks that have wired Ethernet or Fiber card with a transmit rate of 10 Gb/s or greater. These adders are necessary to account for future implementations and the fact that the Notebook base TEC has been cut by 50-60%.

- **Integrated Display adder Note Omission:** In Draft 2 of the Computer Spec at the bottom of Table 9 (page 16-17) the "xii" note that describes what the variables "r" and "A" are in the equation was removed. This looks to just be an accident with the Note from the EPA directly below the "TEC – INT_DISPLAY" adder. Please make sure that this note is added back into the next draft of the specification so it is clear what these variables mean.

- **Effective Date**: ITI recommends the effective date for ENERGY STAR v7.0 implementation to be on October 1, 2018 or later, after the close of prior fiscal year.

In summary, while the basic category definition is CPU P score dependent, while there are many other features like dGPU option, display, storage, memory, connectivity, etc. that define the configuration. Since not all platforms pick all features, reducing base TEC may be appropriate only if there are appropriate allowances for additional features on the platform, given that none of the features have zero power consumption. For example, LOM (Ethernet on the motherboard) requires additional power allowance. Because of customer needs involving cost and hard drive capacity, we still need to provide many customers with computers configured with HDDs. If we cut the base TEC too much without providing additional adders, this will inhibit innovation by precluding such features on the system.

We appreciate your consideration of our comments.

Sincerely,

Alexandria McBride
Director, Environment and Sustainability
ITI
amcbride@itic.org
(202) 626-5753

APPENDIX A

Criterion for Mobile Workstation memory bandwidth qualification:

Question: For computers to qualify for certain system memory bandwidth criterion for mobile workstation, please provide clarity on how to properly apply both memory bandwidth and capacity criteria.

Answer: The manufacturer needs to determine whether their system meets both a memory capacity and system memory bandwidth criteria, with a simple example below:

#	Product type	Qualifying Bandwidth Criterion	Qualifying Capacity Criterion
1	Mobile Workstation definition	134 GB/s or more	4 gigabytes or more

1) To determine if the system meets both the system bandwidth and system memory capacity criteria, apply the following steps:

   A. For systems with a single channel of memory, directly compare the system memory bandwidth and capacity against the criterion. No further steps are needed.

   B. For systems with two or more memory channels, sum the memory capacities of only the memory channels that individually meet the bandwidth criterion. If this sum meets the capacity criterion, it meets the overall criteria and no further steps are needed.

   C. In all remaining cases, the sum of the bandwidth of all of the memory channels must meet the bandwidth criterion and the each memory channel must meet the a minimum capacity based on the following:

   Total SystemMem_BW ≥ System memory bandwidth criterion ❶

   Where:

$$Total\ SystemMem_BW = \sum_{i=1}^{N} SystemMem_{BW\,i}$$

$$Capacity_i \geq Capacity_Criterion \times \frac{SystemMem_BW_i}{Total\ SystemMem_BW} \quad ❷$$

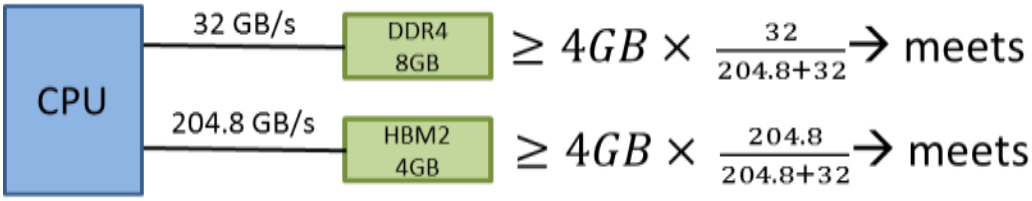
Example: Mobile workstation definition

A computer with an integrated GPU and a system memory configuration comprised of 8GB of DDR4-2000 with 128-bit channel width and one 4GB HBM2 1600MT/s device of 1024-bit channel width can be classified as a mobile workstation if it meets all of the requirements stipulated in the mobile workstation definition. To determine if (3)(ii) is met, apply the steps outlined in the ***[insert citation for section #]*** of the FAQ:

$$BW_{DDR4} = 2000 * 128 / (8 * 1000) = 32\ GB/s$$

$$BW_{HBM2_\#1} = 1600 * 1024 / (8 * 1000) = 204.8\ GB/s$$

A. System is not comprised solely of a single channel → Go to step B.
B. There is no single channel that meets the memory bandwidth criterion → Go to step C.
C. Summing the memory bandwidth of all of the memory channels yield 236.8 GB/s and meets the bandwidth requirement of 134GB/s. Next, determine if each channel meets its minimum capacity requirement as follows:



$$\geq 4GB \times \frac{32}{204.8+32} \rightarrow \text{meets}$$

$$\geq 4GB \times \frac{204.8}{204.8+32} \rightarrow \text{meets}$$