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CEC Draft Computer Standards (Docket #14-AAER-2)

2014 Appliance Efficiency Pre-Rulemaking

ITI/TechNet Comments on CEC Staff Report

Authors.

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1. EXECUTIVE SUMMARY

ITI and Technet have the privilege of representing the most innovative and productive companies in the world. This includes their incredible work on energy productivity. As the American Council for an Energy-Efficient Economy (ACEEE) wrote back in 2008, "Information and communication technologies have transformed our economy and our lives, but they also have revolutionized the relationship between economic production and energy consumption."

Companies within our industry vigorously compete to offer customers products that meet performance needs and do so with the highest levels of energy efficiency. We are proud of our 20+ year partnership with the EPA on ENERGY STAR (with our strong support, computers and computer monitors were some of the original ENERGY STAR products), and our work with governments worldwide in improving energy efficiency. We are not newcomers to this policy area, and we are accustomed to constructive partnership and collaboration with governments and other stakeholders.

As was made clear at the April 15th Workshop, ITI and Technet see the initial staff draft proposals as raising very serious concerns. If promulgated, they would be detrimental to California's interests, posing a significant threat to the productivity and other capabilities that California end users demand from our products, especially those that rely on high end products to run their businesses.

Fortunately, we are not at the point of promulgation, but rather still in pre-rulemaking, and so while ITI and Technet believe the staff draft proposals err on a number of fronts, we remain committed to working with the CEC and other stakeholders on getting this rulemaking right.

A great deal of the gulf between us seems to be the underlying data and data analysis, much of which we haven't seen. Our detailed comments delve deeper into this gulf, as do the separate comments submitted by Intel and Dell on the badly misleading Aggios report. While we appreciate the additional information that has been made available since the Workshop (see the Dave Ashuckian letter of May 6th), fundamental gaps and difficulties remain and require significant near-term attention and dialogue.

At the Workshop, ITI and Technet offered to host a "deep-dive" technical meeting to ensure that such a dialogue can indeed occur, and occur on a timely basis. We appreciate the willingness of the CEC and other key stakeholders to participate in the meeting now being planned for June 9 and 10 in Folsom.

In our detailed comments, ITI and Technet also provide other important criticisms of the staff draft proposals. That said, our comments are not just about criticisms. We are looking for ways forward. We especially believe that near-term progress can be made on framework and scope. In this regard, ITI and Technet are making the following recommendations:

- Product Scope: Mainstream Desktops, Integrated desktops, Notebooks, Small-scale servers, Workstations
- Framework: ENERGY STAR v6.1 framework, including definitions (except Workstations to be revised), TEC mode weightings including full network connectivity, etc.
- Power management: In addition to traditional power management CEC must address the two issues we raise in our comments in section 2.1.

  - *First, CEC must address manufacturers need to ship computers with a basic OS (without any power management). Because this non-power managed OS is intended for one time use by customers to boot up the computer so that they can install their own custom software image.*
  - *Finally, CEC must address the need for the power management requirements to include non-traditional power management technologies, like the dynamic power management in the idle state (provided by Android and Chrome OSs).*

- Categories: ENERGY STAR v6.1 category system for products in scope
- Adders: ENERGY STAR v6.1 adders plus adders for discrete TV Tuner and discrete audio card (per ErP Lot 3 directive). Industry will propose process for graphics adders including discrete graphics and high-end integrated graphics. Industry will further propose adders for systems with additional security and manageability features.
- Exemptions: High-end professional desktops and Gaming desktops; Mobile workstations and Gaming notebooks. ITI and Technet will follow-up with proposed definitions and key usages for such systems. In addition ITI and Technet propose power management exemption for Small-scale servers.

As regards next steps, fully consistent with the opportunities for dialogue contemplated by the "Appliance Energy Efficiency Rulemaking Process" at this stage of the pre-rulemaking, we expect and request that: (1) meaningful dialogue continue between CEC and stakeholders following the June 9-10 meeting; (2) the CEC issue a 2nd staff draft report based on this dialogue and the corrected factual underpinnings on technical feasibility and cost effectiveness; (3) the CEC then host a 2nd stakeholders workshop, and (4) that this process continue until there is sufficient agreed basis for moving forward into the formal regulatory process.

Also, there would also seem to be further research and new educational activities that could be pursued, building on the research already conducted in association with CalPlug, regarding consumer and enterprise power management settings and practices. This is non-regulatory activity on which we should be collaborating.

Finally, and again as was mentioned at the Workshop, ITI and Technet believe that non-regulatory partnership opportunities exist for very significant energy savings and clean energy productivity in California. We do not cite these opportunities as potential replacements for CEC regulatory action on computers and displays, but rather as very important supplements to be pursued in support of Governor Brown's larger economic and environmental goals. Recent ACEEE reports on intelligent efficiency are instructive in this regard, as is a recent Skip Laitner report commissioned by the Digital Energy and Sustainability Solutions Campaign (DESSC), which is available at http://www.digitalenergysolutions.org/dotAsset/06dcd855-1ba0-4dc5-b3f3-bb4a5d0ce0c8.pdf.

2. SUMMARY OF KEY ISSUES

Scope of CEC Computer Regulation:
The scope of California's Computer energy efficiency regulations should target "mainstream" high shipment volume computers, and should exclude from scope "high performance" low shipment volume computers that provide customers with higher performance and as a result consume more power (including while computer is in an idle state).
Computers that should be excluded from scope of the CEC energy efficiency regulation include:

- Performance Desktop Computers
- Gaming Desktops
- Mobile workstations
- Gaming Notebooks

Industry plans to propose definitions and key usages, for these high-end classes of computers. Since the workstation as defined by ENERGY STAR has evolved, Industry would also have a proposal on changes to workstation definitions in our next submittal.

2.1 Broad Customer/Product Impact :

A. Wide Range of Customers, With Wide Range of Needs:

Energy efficiency regulations should be specified such that all customer needs are considered, not adversely impacting and cost of more efficient products are justified from a return on investment standpoint.

The energy efficiency requirements proposed for computers in CEC's Staff Report are not structured to accommodate the wide range of California customers who use computers. In that, CEC's proposed computer energy efficiency requirements are excessively restrictive, with the net result being that a significant proportion of consumer and commercial customers will not be able to purchase computers with appropriate the performance needed.

The types of customers, and the activities that they perform with computers, are diverse and manufacturers have developed a wide range of computing products segmented in response to these customers and their computing needs. ITI has already provided CEC with information in the May 15, 2015 hearing discussing the wide range of consumer and commercial customers who are using IT computing products to perform a wide array of productive activities. Productive activities that consumer and commercial customers in California perform include a) basic computing activities such as drafting emails, documents, searching the internet, etc. b) mid and high level home and office users involved in activities including all of the basic activities, plus viewing and processing images, graphics, animation, video, basic, intermediate and advance productivity software (Office, databases, engineering, statistics, modeling, animation, etc.), collaboration, etc. c) Lastly, there is a category "Extreme Home Users" who purchase very high performance, richly configured computers (similar to Workstations in capability) that are used for activities including online gaming, and other evolutionary computing processes (including development and programming of gaming software) that use computing products, and will be impacted by the energy efficiency regulations proposed by CEC.

B. Computers are unique among power consuming "appliances" in several important ways:

- First, computers provide users with the ability to perform a wide range of productive work and activities discussed above.
- Secondly, the range of computing solutions is very broad. There are different types of computing solutions offered; ranging from the very basic (and low power consuming) computing solutions at one end of the spectrum, to very complex, feature rich and high performing computer solutions at the other end of the spectrum (that typically consume more power than more basic, simpler computing solutions). And manufacturers offer a broad range of computing solutions to the market in between these two ends of the computing spectrum.
- Thirdly, and within most "Computer Model Families", these products are highly configurable to enable customers to select among many different hardware and software choices that best suit the customer's individual computing, performance, and cost related needs.

C. Computers Come in Many Forms, Models, and Configurations:

When the numbers of different types/forms of computing solutions, different computer "Model Families" and combinations of configurations customers can choose select among are considered, the number of unique computer configurations a given manufacturer offers to the market per year can number in the thousands. The example of unique HP Desktop Computers offered to the market in a given year was conservatively estimated to be 55,400[1] as an example of the large number of different computing solutions, models, and configurations one manufacturer offers to commercial and consumer customers with a very broad range of computing needs.

The reason this is important in the context of energy efficiency regulations targeting computers, is that computer manufacturers offer this wide range in the types of computing solutions, computer models and customer selectable hardware and software configurations in response to the very broad range of customer needs.

Regulations seeking to limit the power consumption of computers must accommodate the very diverse range of customers' computing needs. Specifically, the regulatory framework and parameters selected for regulation (such as the Idle Mode) must recognize and provide for the fact that power consumption of computers varies depending on the configuration and performance offered.

[1] . Number of individual configurations consists of hardware and operating system (OS) combinations, but does not include additional configurations required for multiple languages (multiplier of > 25 languages / keyboards worldwide)

D. CEC Regulatory Proposal Not Based on Internationally Recognized Standards:

CEC's regulatory proposal for computers does not recognize the importance of using internationally recognized standards when developing the framework for specifying computer energy efficiency requirements. Specifically, CEC proposed a "one-sized-fits-all" Base TEC limit for Desktop Computers and Base TEC limit for Notebook Computers) with no discrete graphics adders I.e. CEC's Computer requirements do not include the categorization framework specified in ENERGY STAR and energy regulations worldwide. Additional information about the purpose for a standards based framework (including categorizing different types of computers according to the configuration and performance provided) is addressed later in this response.

E. CEC Regulatory Proposal Power Management Requirements Problematic As Specified:

Many models and configurations will be eliminated from the California market as a result of the computer power management requirements specified in the CEC Staff Report. There are two basic problems with CEC's proposed power management requirements specified in the Staff Report.

- First, CEC must address manufacturers need to ship computers with a basic OS (without any power management). Because this non-power managed OS is intended for one time use by customers to boot up the computer so that they can install their own custom software image.

- Finally, CEC must address the need for the power management requirements to include non-traditional power management technologies, like the dynamic power management in the idle state (provided by Android and Chrome OSs).

Details:

- **Systems without power management**: Many commercial customers purchase computers with a non-power managed operating system (OS) for use one time after purchase to boot up the computer for installation of the customer's own software image. In this instance, a basic, no cost, non-power managed operating system must be installed on the computer, to enable customers booting up the computer one time, and install their own operating system. Many customers develop and install their own operating system on computers upon receipt that often includes a third party software company's operating system (such as Microsoft Windows®). Customers do not want to be forced to purchase computers and pay for an operating system twice. To avoid having to pay for the operating system twice, they enter into an agreement to pay royalties for the third party operating system software when they include the code within their custom software image (installed by an IT organization after purchase). These customers then purchase their computers with a basic, no-cost operating system (that does not include power management) for use one time for the first boot and installation of the customer's software image (that includes power management capability). Industry can assist CEC solve this problem by drafting regulatory text that allows manufacturers to test all computers shipped to CA with a traditional power management capable operating system (with power management enabled). This is the solution industry has recommended to regulators in other countries / regions to solve this problem.

- **Power management using alternative low power mode**: Second, the computer power management requirements CEC specified, do not recognize other types of power management that save energy in lieu of requiring all computers to provide an ACPI S3 type Low Power “Sleep Mode”. There are many types of computers on the CA market that do not offer a traditional ACPI S3 type Low Power “Sleep Mode”. I.e. Chrome, Android, etc. However, computers configured operating systems without a traditional S3 type Low Power “Sleep Mode”, do actively manage the power consumption of the computer when computing resources are not being demanded / used. Computers with these types of operating systems, “dynamically” limit the power consumption by quickly reducing the power of the product into a “Long Idle State”. Computers configured with these non-traditional operating systems, conserve power similar to traditional power managed computers, and CEC’s regulatory proposal must accommodate a broader range in power management solutions, or additional types and configurations of computing solutions will needlessly be removed from the California market.

While we still do not have access to nor understand the underlying data CEC used in formulating their energy efficiency regulatory proposal, we are able to quantify the impact to computing products we sell and identify the resulting impacts to our customers who rely upon these computing products.

F. CEC Regulation Must Recognize the Need for Discrete Graphics Adders

The Staff Report proposed that no adders be provided for discrete graphics; however, during the discussion at the April 15, 2015 workshop, CEC staff acknowledged the need for some level of power consumption[2],

Graphics adders must take into account that discrete graphics undergo limited updates once they are introduced to the market, compared to other processors based on manufacturing constraints and other considerations. Discrete graphics also tend to be longer lived; as a result, discrete graphics introduced in 2015-2016 are planned to continue serving the California market as lower cost solutions in 2018 and beyond.

Graphics manufacturers continue to make efforts to reduce power consumption. At the same time, regulations must take into account design and market constraints, and also recognize the limitations to what is cost effective or technically feasible in 2017-2018 timeframe.

G. Impact Proposed TEC Limit on Desktop Computers:

Additionally CEC’s regulatory proposal for computers proposes a Base Total Energy Consumption (TEC) limit for Desktop Computers and compliance timeframe that is extremely aggressive and will eliminate a substantial proportion of desktop computers from the market.

The proposed TEC limit for Desktop Computers, will limit customer choice, limit performance, increase cost, and potentially impact availability of computers for CA customers.

[2] “Staff Workshop Draft Computer Standards”, April 15, 2015

Conservatively, approximately 60% of Commercial and Consumer Desktop Computer configurations sold today will be eliminated from the CA market as a result of the TEC limits CEC has proposed. And this estimate of the impact does not include the additional models and configurations that will be removed from the market as a result of the power management requirements specified in the CEC Staff Report.

We do not agree with many of the assumptions in the Staff report concluding that Desktop Computers can be redesigned to comply with the limits CEC proposed. And in cases where it might be possible to redesign Desktop Computers to comply with the TEC limit CES proposed, the cost impact would be substantially greater than CEC assumes, and the time to implement changes would be substantially longer than CEC assumes is possible.
More details on industry's concerns re lack of data and assumptions behind CEC's proposed energy efficiency limits, and barriers to complying by date CEC proposed, are provided later in this response.

Summary of Key Issues

2.2 PCs – Methodology & Framework

- **Overview/Global Landscape:**
  - CEC staff report states (page 13) that 'Energy Commission is using the ENERGY STAR v6.1 framework. The comparison below illustrates that this is not the case. In fact CEC methodology precludes use of categorization which is the heart of the ENERGY STAR computers program to compare like products within category and establish appropriate TEC targets within each category.

TechNet ENERGY STAR v6.1 vs. CEC proposal (PCs) ITI

Key Focus	Energy Star v6.1 (Voluntary)	CEC Staff Report (MEPs)
Duty cycles – Mode weighting	Aligned with Ecma 383/IEC new duty cycle (NB & DT/AIO)	✓
TEC Equation	Aligned with IEC 62623 standard	✓
Definitions	Aligned with IEC 62623 standard	✓
Prod. Categories	New performance score based category system ; 6 DT/AIO & 6 NB categories	One category for all DT/AIO and one category for all NB PCs
TEC Targets	Based on top 25% in each category (shipping products)	Based on cost effectiveness; More stringent than ENERGY STAR v6.1
TEC adders	Based on measured and analytical approach	Based on ENERGY STAR v6.1 (Except no adder for dGfx)
Spec Revision	Based on E* penetration/product shifts	TBD – Need more information
Test procedure	Aligned with IEC with plus enhancements for new products	TBD - Need more information
Conformity assessment	Accredited labs/CB scheme	TBD – Need more information
Product labeling	E* label (physical or electronic)	TBD – Need more information

Key concerns: No PC product categories and more stringent TEC targets

Figure 1

- Why Categorize? Categories are used to group systems with similar capability together
- Allows a consumption (TEC) comparison based on their capabilities (see a simple motor vehicle analogy)

Motor vehicle analogy

		Consumption	Transportation Uses	Computer Uses
	Tablet/ Slate	Motorbike: 120 mpg Tablet: 5W	Transport a person A→B	Web Browsing, consumption
	Notebook	Car: 45 mpg Notebook: 9W	Transport people A→B	Content creation
	High-end Notebook	Pickup: 18 mpg HE Notebook: 25W	Transport people and things A→B	Games, Media creation, computational analysis

Figure 2

- Since CEC is planning to use ENERGY STAR v6.1 framework, it is useful to understand that US EPA worked with industry to establish the category system based on shipping configuration and adjusted over time based on computer form factor evolution. (See ENERGY STAR category evolution from ENERGY STAR v4.0 through v6.1 (last 8 years).

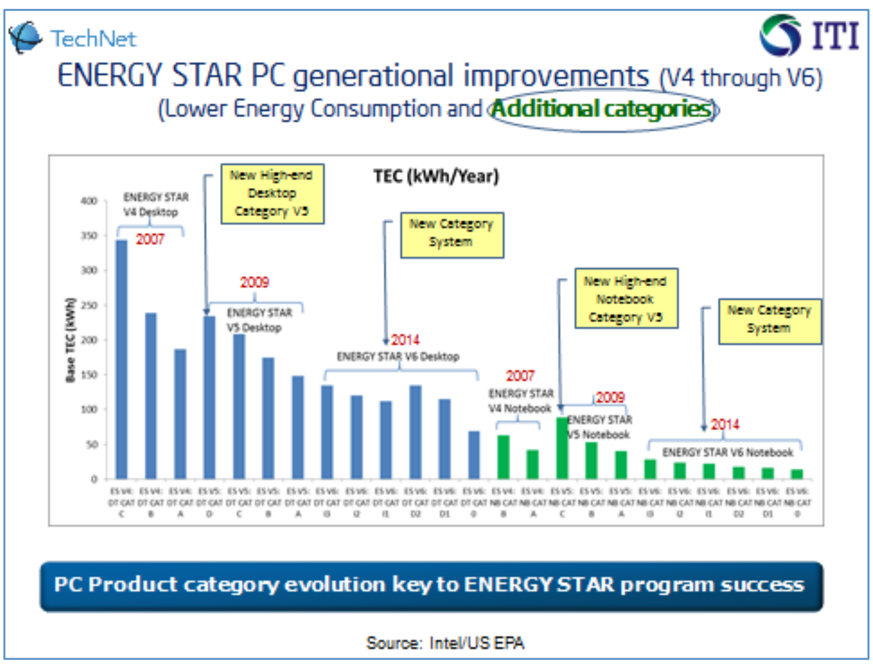
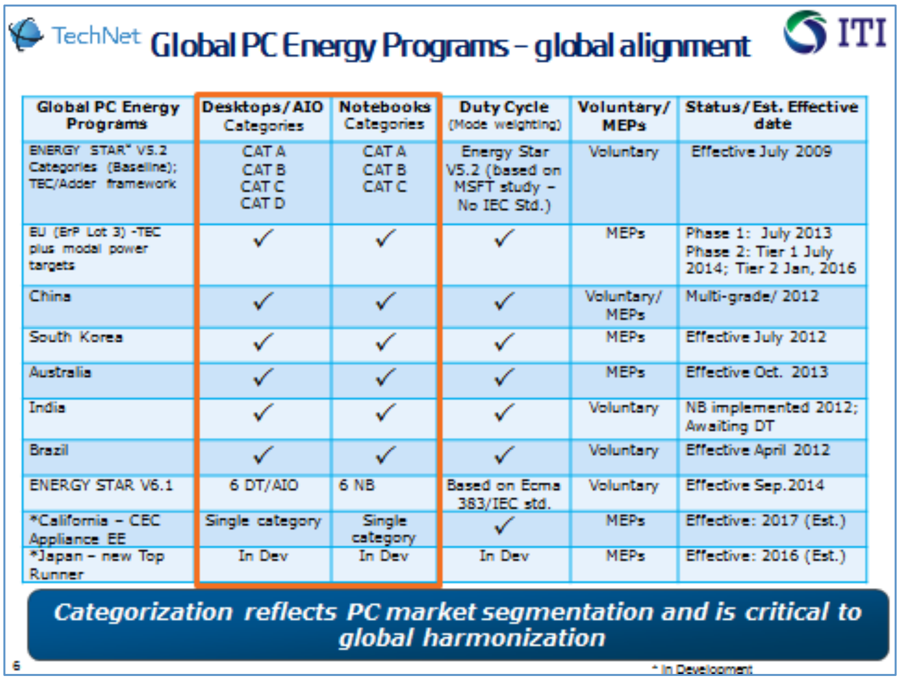


Figure 3

- Global perspective: One size-fits-all approach not reflective of international standards, and globally accepted PC category approach (comparing like products within a product category). There is a history behind it with global recognition of importance of category systems for computers (see below). Global regulators generally followed ENERGY STAR categories (with minor changes) instead of developing their own categories (since computers are designed for global markets with minor differences in hardware configuration.



Global PC Energy Programs	Desktops/AIO Categories	Notebooks Categories	Duty Cycle (Mode weighting)	Voluntary/ MEPs	Status/Est. Effective date
ENERGY STAR® V5.2 Categories (Baseline); TEC/Adder framework	CAT A CAT B CAT C CAT D	CAT A CAT B CAT C	Energy Star V5.2 (based on MSFT study – No IEC Std.)	Voluntary	Effective July 2009
EU (ErP Lot 3) -TEC plus modal power targets	✓	✓	✓	MEPs	Phase 1: July 2013 Phase 2: Tier 1 July 2014; Tier 2 Jan, 2016
China	✓	✓	✓	Voluntary/ MEPs	Multi-grade/ 2012
South Korea	✓	✓	✓	MEPs	Effective July 2012
Australia	✓	✓	✓	MEPs	Effective Oct. 2013
India	✓	✓	✓	Voluntary	NB implemented 2012; Awaiting DT
Brazil	✓	✓	✓	Voluntary	Effective April 2012
ENERGY STAR V6.1	6 DT/AIO	6 NB	Based on Ecma 383/IEC std.	Voluntary	Effective Sep.2014
*California – CEC Appliance EE	Single category	Single category	✓	MEPs	Effective: 2017 (Est.)
*Japan – new Top Runner	In Dev	In Dev	In Dev	MEPs	Effective: 2016 (Est.)

Figure 4

- Computers segmentation: (This section will be built up with figures and tables)
  - What drives segmentation? PCs are complex – with hundreds of configurations across many consumer and corporate segments (different applications, capabilities and power profiles)

  - Key Applications by Segment: A typical desktop PC market segmentation and % units (US shipments estimates) and market uses are shown below.

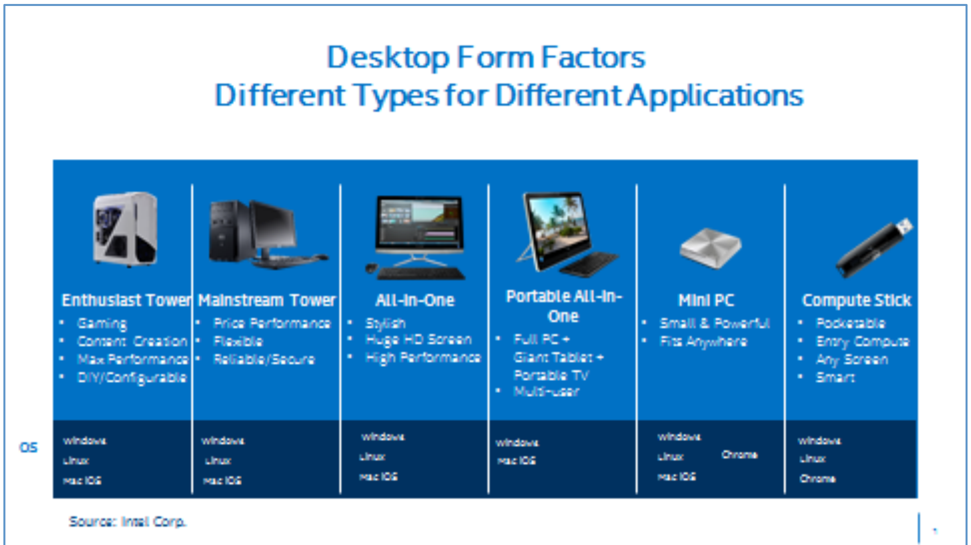


Figure 5

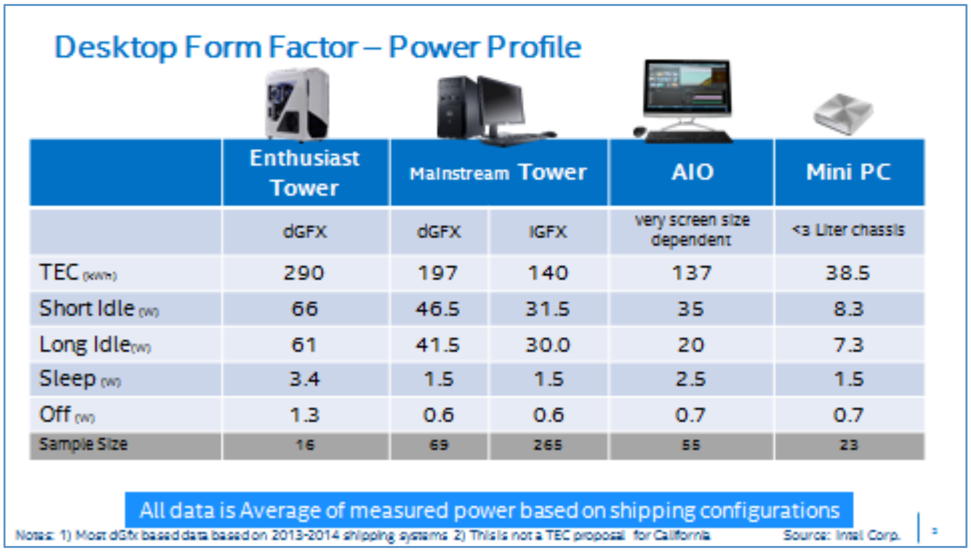
Desktop Form Factor – Market Segment 2014 Data (US)

% units US-DT Market	Enthusiast Tower	Mainstream Tower		AIO		Mini PC (<3 Liter chassis)	
		Consumer	Business	Consumer	Business	Consumer	Business
Intel (est.)	11%	16.4%	51.4%	7.6%	7.3%	1.4%	4.7%
IDC (est.)	Normal Tower = 47% Small tower = 30%			16.5%		6.5%	
Market Uses	High End Animation Special Effects Creation High End Graphic Art & Design Auto CAD High End Consumer Gaming High End Video Editing	Large Enterprise Deployment Manufacturing and Design Education & Research Government Purchases Broad Consumer Adoption Affordable Systems for Entry buyers		Broad Consumer adoption Graphic Artists and Design Touch Interface		Business Conference Rooms Consumer Video Streaming Commercial video displays Inventors and Innovators	

Source: Intel Corp./IDC

Figure 6

- Typical power profile: The power profile of systems in each segment varies depending on the market uses and application demand for a given segment. (See example of measured power by segment).



Desktop Form Factor – Power Profile

	Enthusiast Tower	Mainstream Tower		AIO	Mini PC
	dGFX	dGFX	IGFX	very screen size dependent	<3 Liter chassis
TEC (kWh)	290	197	140	137	38.5
Short Idle (W)	66	46.5	31.5	35	8.3
Long Idle (W)	61	41.5	30.0	20	7.3
Sleep (W)	3.4	1.5	1.5	2.5	1.5
Off (W)	1.3	0.6	0.6	0.7	0.7
Sample Size	16	69	265	55	23

All data is Average of measured power based on shipping configurations

Notes: 1) Most dGfx based data based on 2013-2014 shipping systems 2) This is not a TEC proposal for California

Source: Intel Corp.

Figure 7

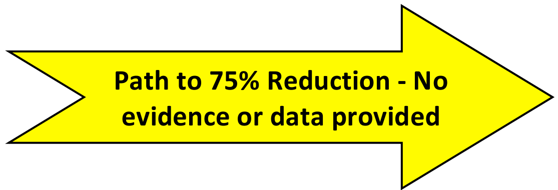
- CEC Target setting:
  - ENERGY STAR process:
    - ENERGY STAR spec revision process driven by increase in penetration rate ~50%, and based of product transformations (Typical: 3-5 year after effective dates).
  - CEC process/Impact: Target setting based on cost effectiveness and technical feasibility
    - Industry generally agrees that establishing TEC baseline by using ENERGY STAR v5.2 QPL is the right approach. It is also understandable that for sake of simplicity CEC collapsed all category TEC data into a single average TEC value to estimate average energy savings opportunity by desktop and notebook PC form factors. The issue is that CEC continued to use the single TEC, single category approach to come up with proposed targets, instead of reconstructing the new TEC targets for each of the desktop and notebook PC categories.
    - CEC staff relied on IOU Technical reports of Jan 21, 2014 and a subsequent supplement submitted on Oct. 27, 2014. While industry disagrees with IOU assumptions and the resulting Cost-effective System TEC (Table 14), and most-efficient system TEC (Table 15), we agree with the category approach IOUs used to establish targets. IOUs Cost-effective System TEC (Table 14) proposed range of TEC targets from 88 kWh/year for DT0 and TEC target at 278 kWh/year for a new highest category DT D3, with proposed annual energy savings of 23% and 25% respectively. Subsequently IOUs most-efficient System TEC (Table 15) proposed range of TEC targets from 78 kWh/year for DT0 and TEC target at 275 kWh/year for the highest

category DT D3 with proposed annual energy savings of 29% and 25% respectively.

- It now appears that CEC staff report did not use IOU methodology or its proposed targets to set its TEC targets. However, it appears CEC solely relied on Aggios analysis [in Appendix C (Notebook Demonstration Project) submitted as part of IOUs supplement on Oct. 27, 2014], to arrive at incremental cost adder in order meeting CEC target. Industry will provide a vigorous technical rebuttal of Aggios report separately. Please note that much of the work in Appendix C appears speculative, and by Aggios own statement on page C-27 first para,

  "The hardware and software modifications and engineering design procedures necessary to reach the savings in the short idle consumption of 25% and long idle of 50% were estimated based on qualitative energy analysis using the available data sheets, as well the results were achieved on the IPTV set top project".

- If one is to believe Aggios assumptions for a moment, let's understand how CEC used some of that data in their staff report and the April 15 presentation. CEC reported in Appendix A of the staff report and slides 12-22 of the CEC presentation on April 15 a pathway to getting to 50 kWh TEC target for desktop PCs, by stating opportunity exists for Industry to reduce desktop system idle from 50W to 12.2 W (75% reduction – see below). However CEC did not provide a real shipping system scenario, or any measured system data along with BOM cost to establishing such aggressive targets. Even IOUs cost effective and most efficient system targets for the lowest category DT system target is 78-88 kWh/year. Even Aggios analysis which the Industry disagrees with, speculates savings in the short idle consumption of 25% and long idle of 50%. While CEC addresses reducing system idle target from 25W to 13 W based on ENERGY STAR V6.1 (page 20 of staff report), in reality the target setting is based on using ENERGY STAR v5.2 QPL TEC baseline of 143.2 kWh and reducing it to 56.8 kWh for compliant system (slide 33 presentation and page 22 of staff report – See below). This constitutes 60% reduction in TEC without any analysis or measured data provided by CEC. When the Industry further brought this issue, CEC responded in its May 20, 2015 communication by simply stating*, "Getting from power levels in ENERGYSTAR5 to proposal levels is a combination of inherent improvements already rolling out in hardware, and then fully realizing those savings and further innovating the desktop idle states in software".* CEC did not provide any data as an evidence of a system BOM that could comply with CEC requirements with hardware improvements and '*innovating the desktop idle states in software'*.
  In the subsequent sections Industry will provide data on year over year desktop PC system TEC improvement trends including the future projections.



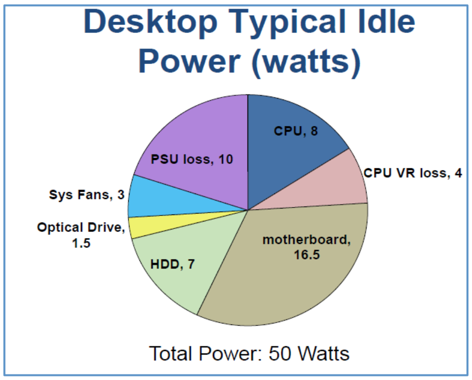


Figure 8

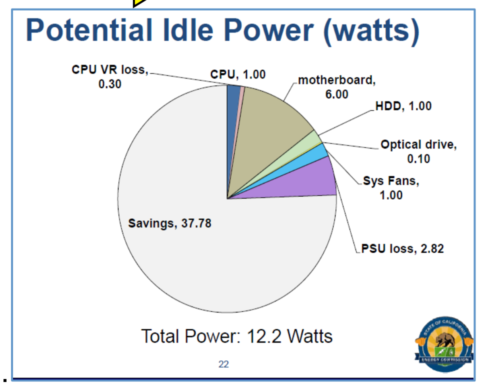


Figure 9

Energy Savings and Cost Effectiveness

Product Type	Average Energy Use – Baseline (kWh/yr)	Average Energy Use – Compliant (kWh/yr)	Design Life (yr)	Life Cycle Savings (kWh/yr)	Life Cycle Savings ($)	Incremental Cost ($)
Desktop	143.2	56.8	5	432	$69.12	$2.00
Notebook	33.4	29.8	4	14.4	$2.30	$1.00
Small-Scale Server	302.0	278.0	5	120	$19.20	$13.00
Workstation	469.3	431.9	5	187	$29.92	$13.00

Figure 10

- If CEC used any measured data to come to certain conclusions it was not shared with the Industry and Industry does not have access to such CEC dataset to evaluate and provide constructive input
- While CEC staff report references ENERGY STAR V6.1 qualified product list (QPL) and % of systems that may meet CEC targets, it's not clear if CEC used that data to establish targets (since the baseline

data is based on taking the average TEC of ENERGY STAR v5.2 systems.

- ENERGY STAR QPL is a limited dataset of only ENERGY STAR qualified systems – not reflective of all shipping systems in the US/CA.
- California MEPs approach should be based on all shipping systems (ENERGY STAR and Non-ENERGY STAR)
-

- **Industry Impact:**

  - Proposed targets more stringent than voluntary ENERGY STAR V6.1 (~75 % reduction based on ENERGY STAR v5.2 baseline and ~50% reduction based on ENERGY STAR v6.1 QPL in idle power for all Desktop/AIO PCs --one-size-fits-all approach)
  - Analysis of ENERGY STAR v6.1 QPL shows high failure rate for desktop and AIO systems (see below), Analysis using ENERGY STAR v5.2 QPL will likely yield higher failure rate, since the TEC baseline is higher in v5.2 than v6.1 QPL.
  - The actual hurdle to complying with CEC proposed limits will likely to be higher, since 100% of shipping systems by 2018 are not likely to even be ENERGY STAR v6.1 compliant. ENERGY STAR QPL comprises of limited dataset (by design) and is never reflective of all shipping systems in the US/CA marketplace.
  - There is likely to be disproportionate impact on higher-end desktops and notebooks PCs, as these types of systems are not designed to comply with voluntary ENERGY STAR labeling program. Under CEC proposals these will have to meet the same TEC requirements as an entry level desktop or notebook system.

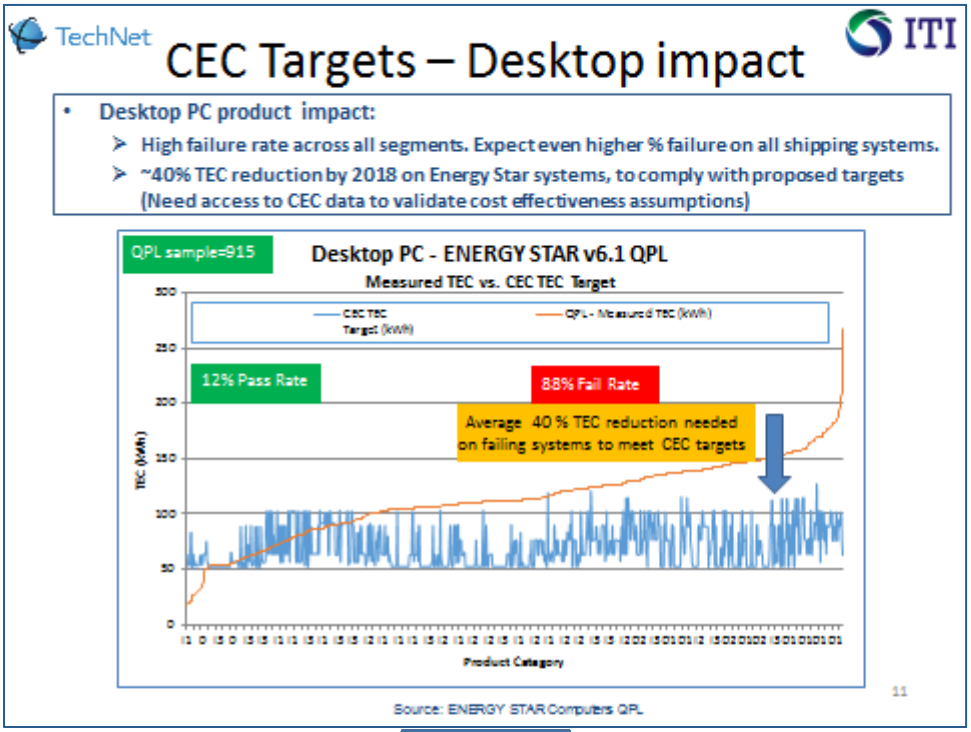


Figure 11

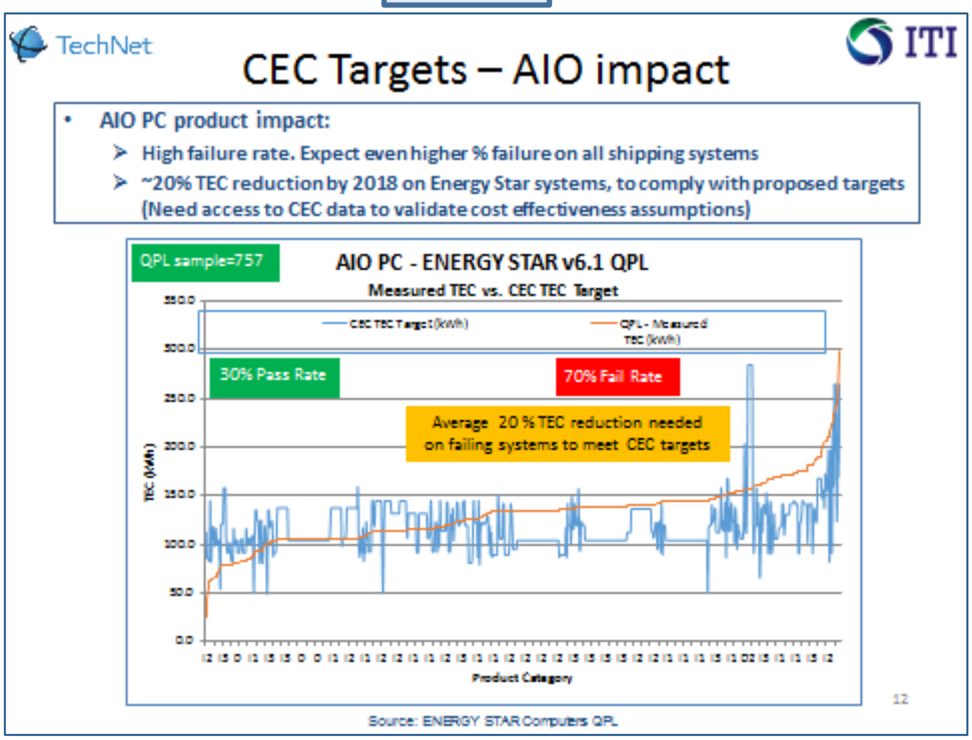


Figure 12

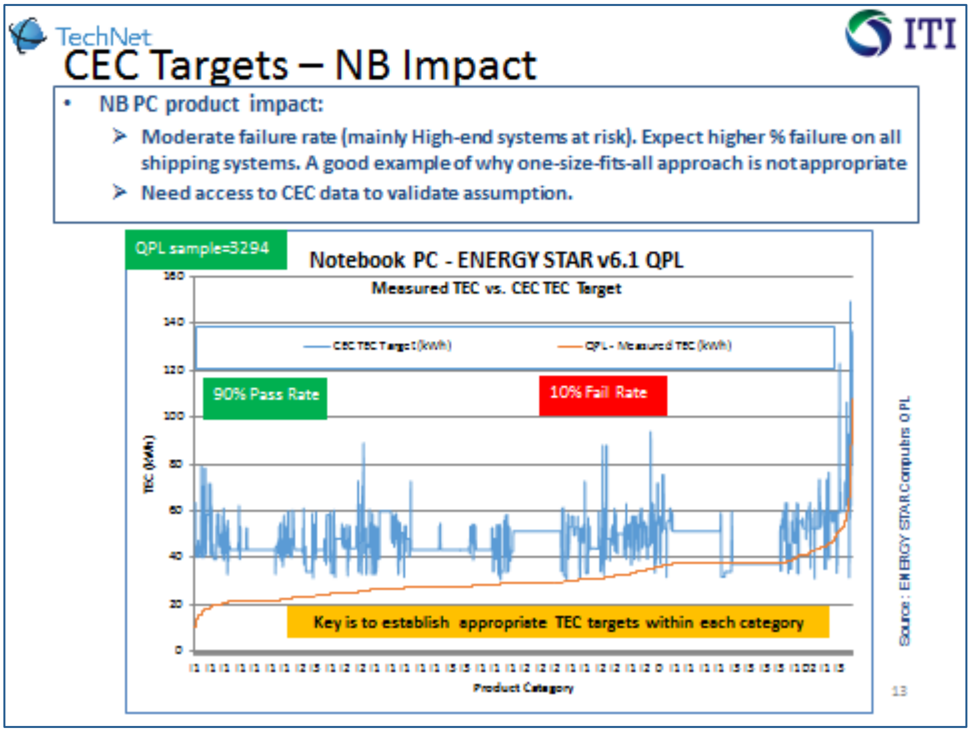


Figure 13

- Framework/Methodology Summary:
  - One size-fits-all approach not reflective of international standards, and globally accepted PC category approach (comparing like products within a product category)
  - Industry does not have access to CEC dataset to evaluate and provide constructive input; outcome not reflective of PC technical barriers, industry economics and PC ecosystem impact
  - It appears that CEC staff report solely relied on Aggios analysis for incremental cost analysis, which itself is deeply flawed. However, it is unclear how CEC established the new TEC targets. CEC simply established new sub-system level idle power goals including CPU, motherboard, hard disk drive, optical drive, system fans, and PSU efficiency. CEC, however, did not provide any evidence, proof point or measured data to demonstrate path to achieving 75% reduction in idle power and ~60% TEC reduction using ENERGY STAR v5.2 baseline. Industry will systemically layout technical, cost and eco-system barriers to achieve such drastic reductions.
  - Proposed targets are more stringent than voluntary ENERGY STAR V6.1 (~75 % reduction based on ENERGY STAR v5.2 baseline and ~50% reduction based on ENERGY STAR v6.1 QPL in idle power for all Desktop/AIO PCs --one-size-fits-all approach)
  - Disproportionate impact on higher-end desktops and notebooks PCs

        - CEC target setting and cost effectiveness criteria should be based on all shipping products (not just ENERGY STAR QPL)

2 SUMMARY OF KEY ISSUES

2.3 Technical Feasibility and Cost effectiveness

Technical feasibility:

- Energy Savings and cost effectiveness analysis in draft report is based upon non-public calculations, apparent multiple false assumptions and misunderstandings of PC industry economics, power management of PCs and proper test methodology.
    - CEC methodology for getting from IOU studies to conclusions and draft proposals is not presented or made public
    - IOU's supplemental report does not show any cost effective systems meeting CEC proposed limits and methodology and justification for how CEC bridges the gap between this and final draft is not provided
- Energy reduction potential of highest energy consuming machines apparently being applied to best machines
    - CEC assumes all systems can achieve percentage gain of going from low efficiency PSU to high efficiency PSU
        - All ENERGY STAR compliant systems already have high efficiency PSU's
    - Assumes potential gains from processor power management can be applied to ENERGY STAR qualified products
        - All ENERGY STAR qualified products already have these features enabled
- Absolutely no provision was made for end user performance and feature needs
    - Security (Example: TPM, VPRO, TrustZone, DMTF DASH, etc.)
    - Discrete Graphics
        - Hybrid graphics capabilities add ~$5 to DT cards and have limited OS support
- California IOU's supplemental technical report to CEC power savings issues with part replacement analysis:
        - No correlation was established between IOU test data and PCs in the hands of end users in California

        - It is inappropriate to first modify a device and then measure the modified device and attempt to conclude anything about the original device. No conclusions can be drawn on magnitude of potential savings in the industry without first proving correlation between measured devices and those shipped into California.
        - Clean OS install Wipes out OEM power management enhancements in OS and drivers and guarantees measurement inaccuracy.

    - Without proper "Aging" a clean OS install will give high and erroneous idle power data for first 2 to 6 hours depending on the OS and system
        - Relationship of test results and real world energy use is unknown
        - Some cases will yield very stable but high power idle due to .net deferred compile
    - Ability to achieve power levels by component swap on one or two machines is inadequate to predict mass production capabilities
        - Sample Size is statistically insignificant
    - Desk Top energy reduction potential based upon Low power/performance processors, high efficiency power supplies and energy efficient and or 2.5in hard disk drives
        - Even IOU parts replacement studies did not achieve CEC proposed Limits so CEC must be assuming other unreported improvements
        - ENERGY STAR data set already has at least 2 of these three and passing yield is poor for most categories
    - Component supply capabilities and price changes associated with volume shift from many parts/suppliers to few parts/suppliers are not accounted for in the analysis
    - Performance of systems / CPU's not appropriately accounted for
    - PSU right sizing analysis completely missing minimum PSU requirements determination
        - Customers who upgrade could create non-functional system

CEC cost effectiveness Analysis:

CEC bases entire cost of implementation for cost effectiveness analysis on APPENDIX C pages C-27 and C-28 of the October 27, 2014 comment letter from the investor-owned utilities (IOUs) and NRDC available here[3]:

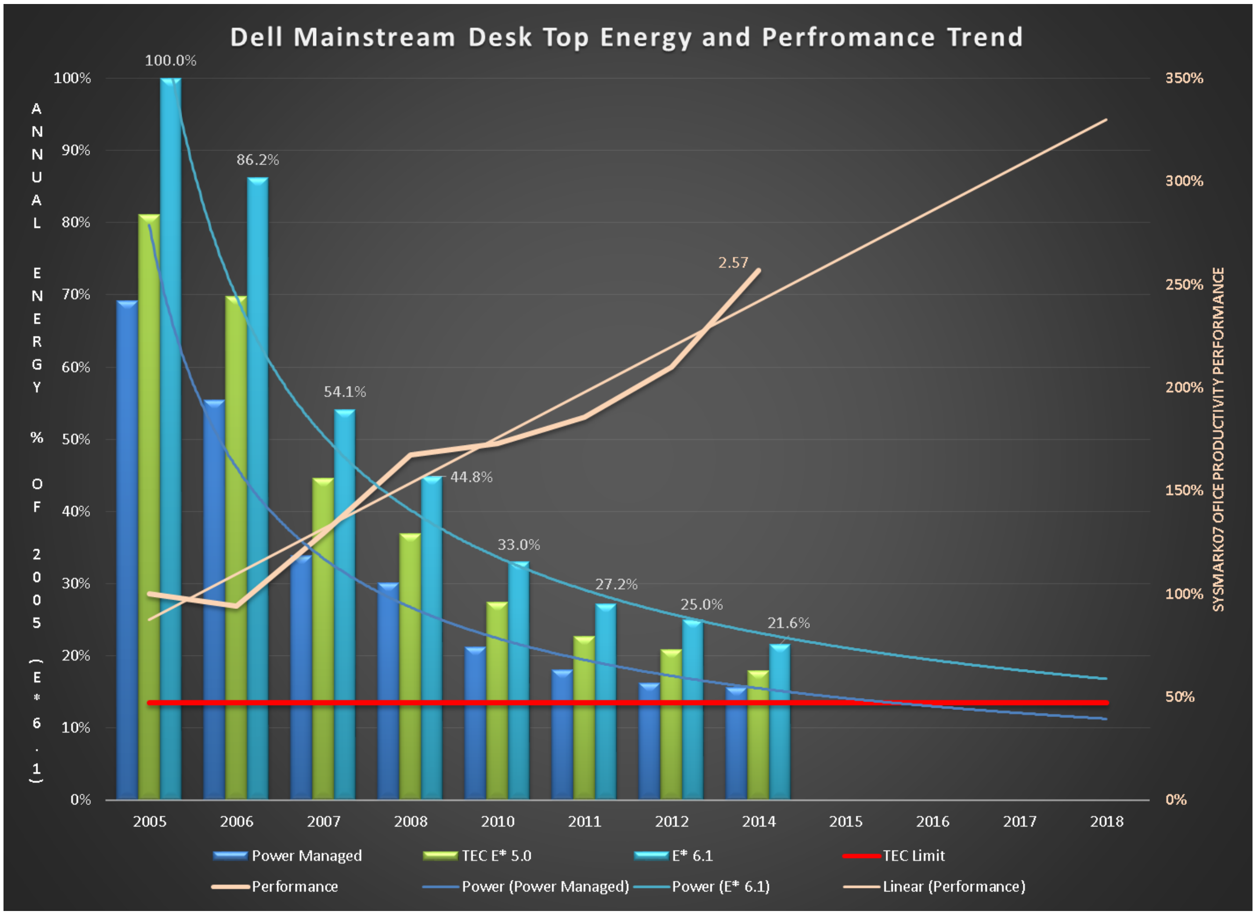
Industry insists the analysis and conclusions of this appendix are fundamentally flawed and are providing separate detailed response related to these findings. In addition to a 100% reliance on a value from a fundamentally flawed report the CEC also completely fails to consider that the necessary timeline for implementation of the Appendix C proposal would be at least 6 to 10 years from the time industry would begin such a process.

CEC's entire cost effectiveness and probably a significant portion of its technical feasibility is reliant on implementation of a capability at least four years prior to it being theoretically possible to implement into production products.

Energy consumption and performance trends:

The PC Industry has a long history of performance gains, energy reduction, feature addition, feature enhancement and simultaneous cost reductions. One example is shown in the graph below for mainstream business desk top computers from 2005 to 2014. In this 9 year period the representative desk top systems have achieved a 75% reduction in annual energy use and increased performance to 260% of the original.

[3] http://www.energy.ca.gov/appliances/2014-AAER-01/prerulemaking/documents/comments_12-AAER-2A/California_IOUs_Standards_Proposal_Addendum_Computers_2014-10-27_TN-73899.pdf



Note: Data based upon average of mainstream desk top computers populating the Dell online Client Energy Calculator for given year using expected high volume system configuration. Performance based upon average performance of given systems running SysMark 2007 Office Productivity workload.

The above graph also shows several different annual energy consumption calculation methodologies including the ENERGY STAR 6.1 method currently proposed to be adopted by the CEC. It is interesting to consider that the lowest annual energy consumption model assumes 7 hours per day running high performance office productivity workload and one hour of maximum performance workload for 250 days per year. It does account for power management capabilities which energy reduction activists insisted be implemented and progressively made more aggressive. The highest annual consumption model does not account for any work but assumes significantly longer active time which is represented as idle and long idle.

Component Replacement Options and costs to Achieve CEC limits:

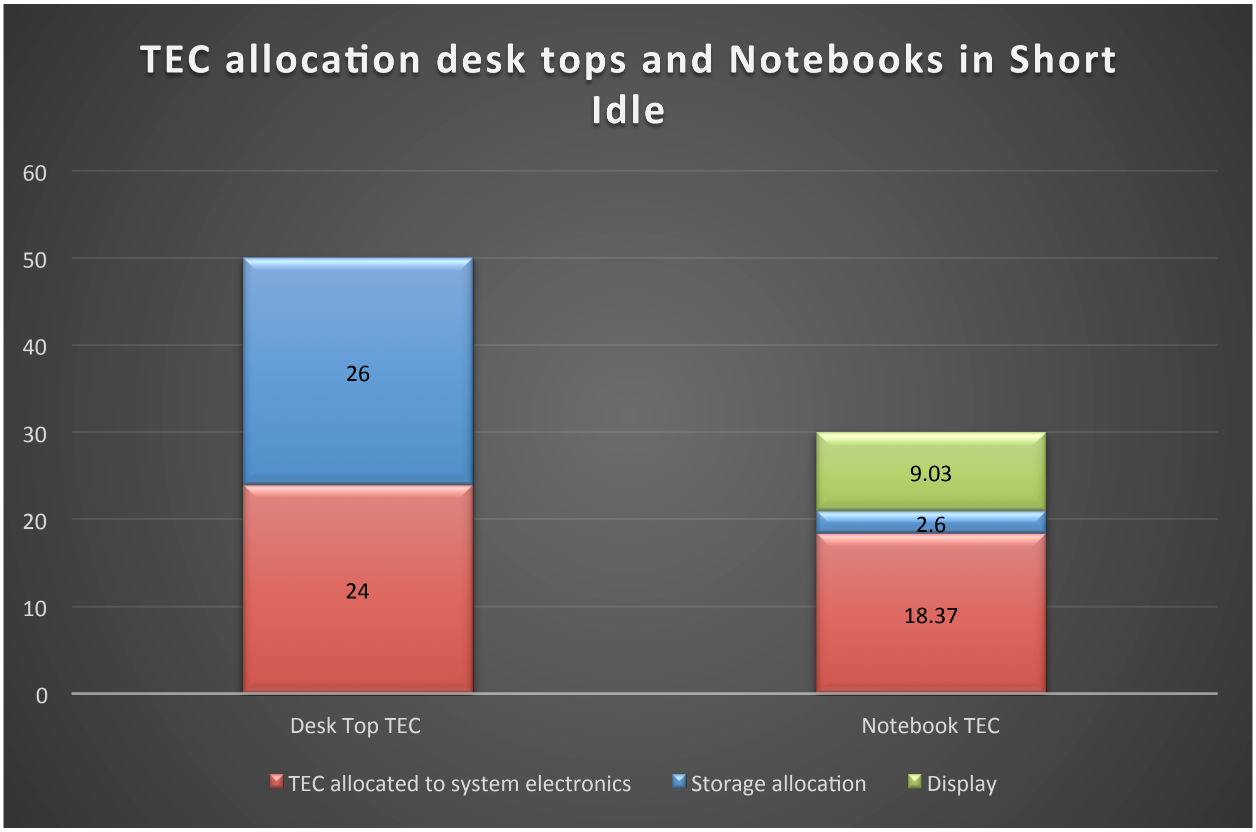
In the time frame allowed by this proposed regulation there are very limited options to change systems to meet the CEC limits. Much of this was addressed in the IOU supplemental report to the CEC found here[4]

This section will address the IOU proposal that significant energy savings can be achieved through parts replacement as low to no cost adders to the system. All the analysis in this section assumes an 80% efficient power supply when converting between AC and DC power levels.

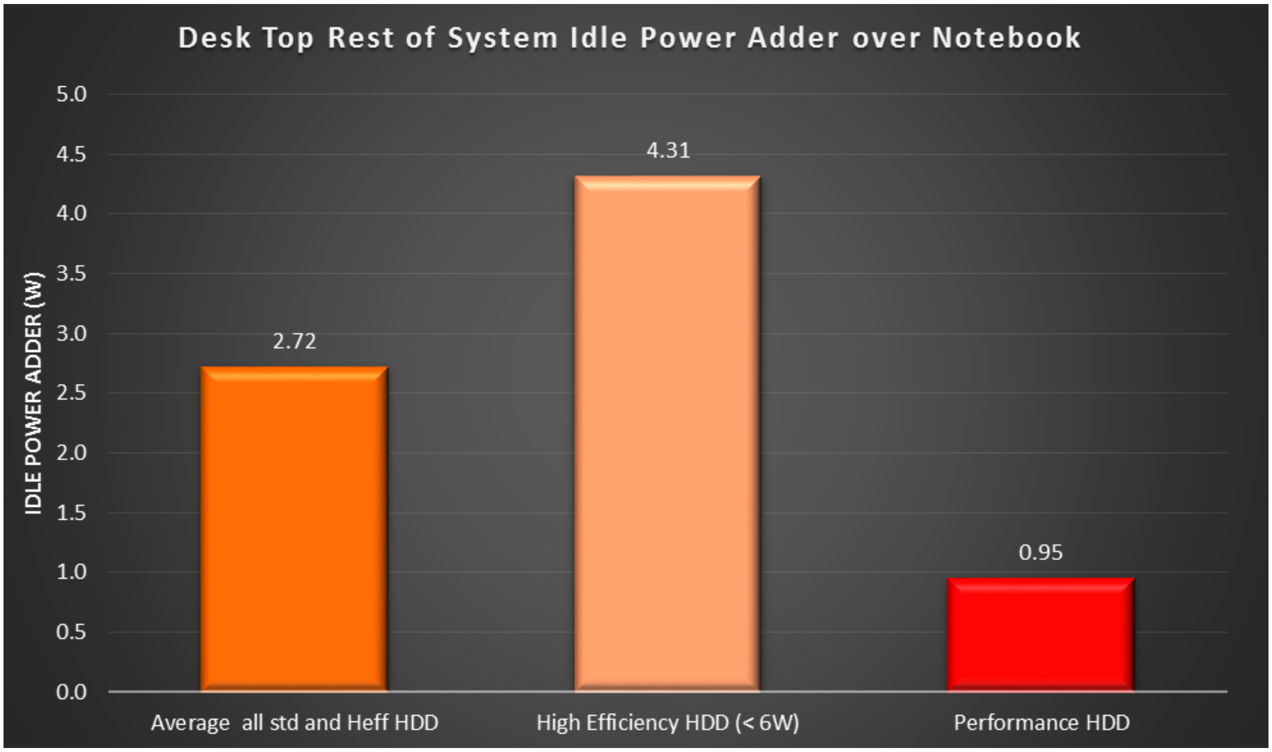
The CEC indicates that the proposed desk top limits can be achieved without expensive components or the use of mobile parts and is thus cost effective but relies on IOU reports that fail to properly consider key customer requirement restrictions that would occur as a result of the IOU component replacement choices.

If we calculate the available idle power adder for a desk top over a notebook that results from the relative TEC for the two products in the proposed draft (50-DT, 30-NB) we can how a relative TEC adder for the desk top system electronics by subtracting out the display and HDD in the mobile and the HDD in the desk top using the allocated adders. The below graph illustrates this.

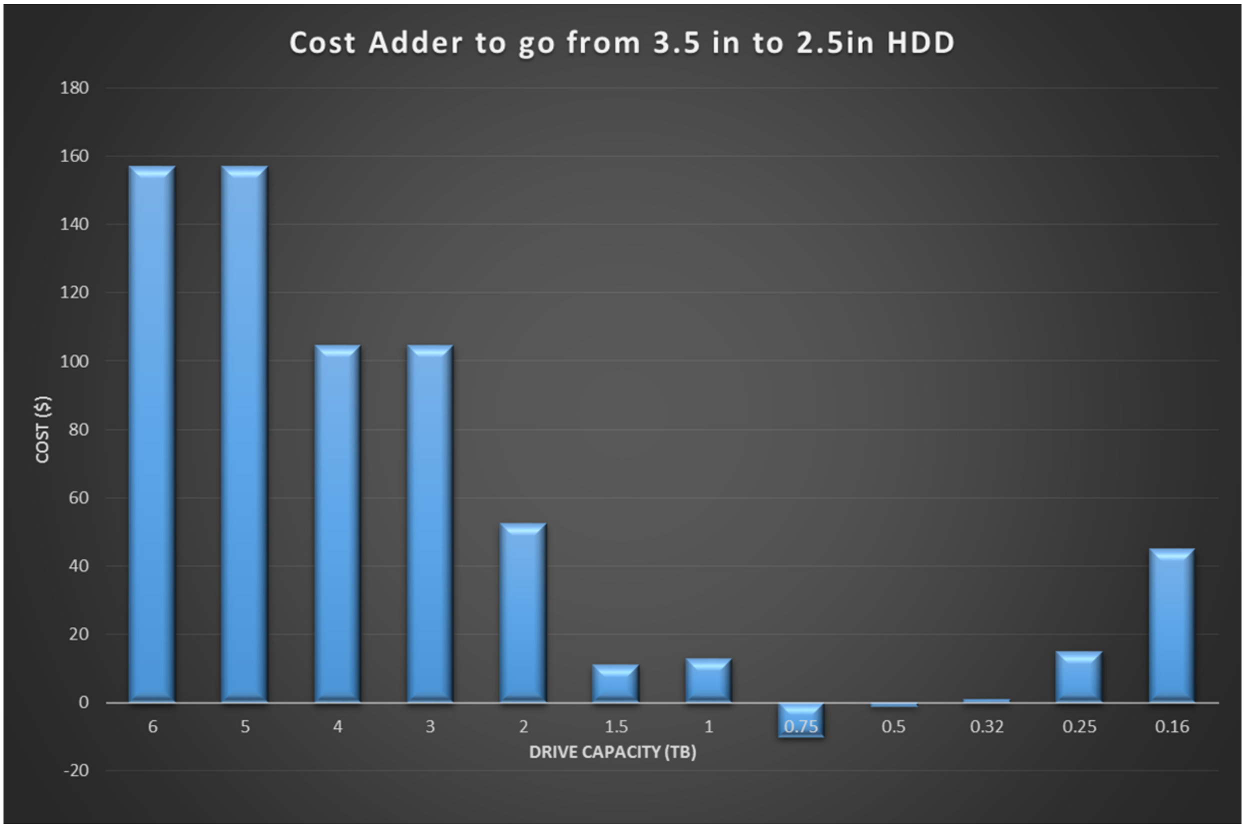
[4] http://www.energy.ca.gov/appliances/2013rulemaking/documents/proposals/12-AAER-2A_Consumer_Electronics/California_IOUs_Supplemental_Technical_Report_Computers_12-AAER-2A.pdf



We see that the desktop system has a 15.63 kWh higher allocation than the notebook system. This calculation assumes a 3W display for the notebook. Of particular note is that if an end user needs a performance hard disk drive that the desk top only has an allocation of 0.95 W above that of a notebook to meet the CEC limits. This is impossible to achieve without using mobile processors and chipsets.



The CEC and IOU's have stated that idle power reductions can be achieved by changing to energy efficient 3.5in HDD's or 2.5in HDD's without sacrificing performance. This analysis completely ignores the fact that 2.5in disk drives are only cost effective over a limited range, and in particular do not support near the same total capacities that 3.5in drives do. The following graph illustrates the system cost adder required to transition to 2.5in drives over a range of disk capacities.

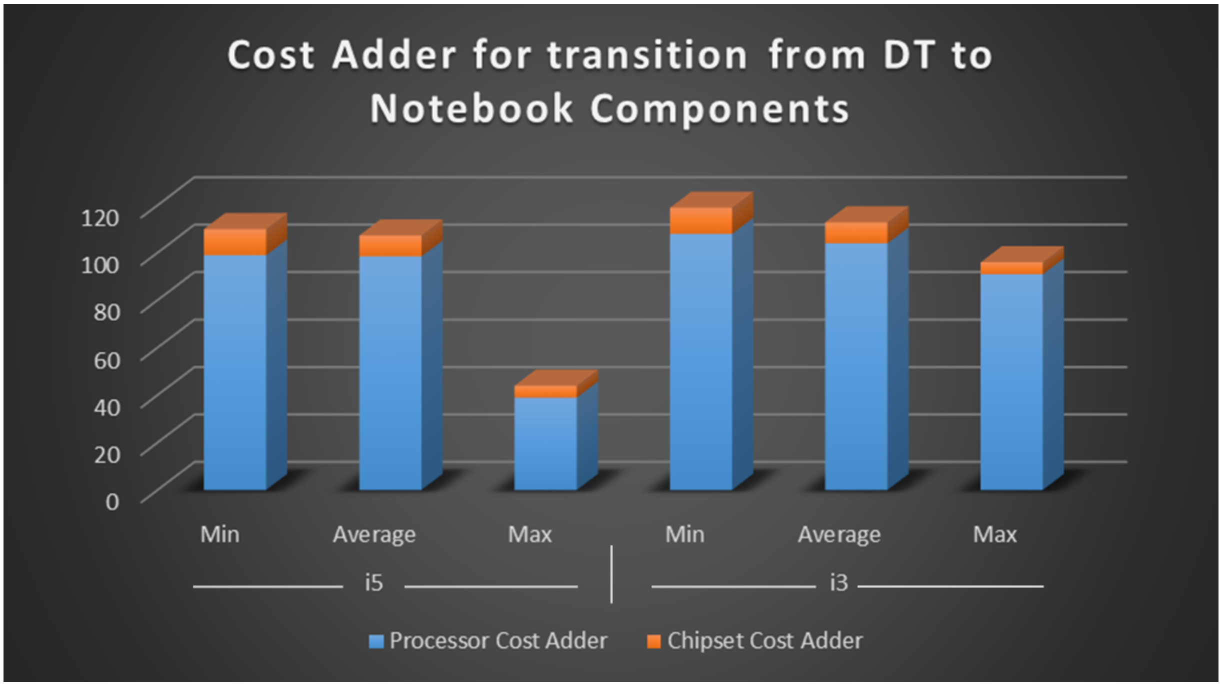


Note: Cost analysis uses lowest cost advertised on Amazon.com for available HDD's using Western Digital and Seagate current production drives.

It should be obvious from this that the proposed cost effectiveness completely falls apart if end users need drive capacities of 1TB or above. Users needing 2 TB capacities or above would need to spend from $52 at 2 TB to $157 at 6TB. These end users would incur cost significantly greater than the CEC $2 cost estimate.

An aggressive CEC proposal as exists now without appropriate categories will force desk top systems to use more expensive mobile components to achieve these excessively low idle power requirements. The following graph illustrates the relative cost adders incurred by a desk top system by transitioning to mobile processor and shipset components based upon i3/i5 processor and chipset pricing from the Intel.com website. The graph compares the minimum, average, and maximum price listed for desk top and mobile components.

Costs will range from $40 per system to $119 per system which is far greater than the CEC value of $2.



CEC proposal penalizes end users that leave sleep and hibernate enabled:

The CEC proposal uses an estimated average usage profile based upon ENERGY STAR 6.1 to determine annual energy costs of systems and to calculate savings of proposed lower limits. The proposal has systems spending 35% of the year in short idle mode. Since long idle occurs within a very few minutes of user not being present, the implication is short idle equates to end user present at the system. 35% of 8760 hours in the year, which yields 3066 hours of end user presence or about 8.2 hours per day 365 days per year. Since it is extremely unlikely that this is the normal way PC's are used it should be obvious that these numbers are an average which accounts for those systems that have disabled power management and spend all non-user presence in idle.

What has not been considered is that those users that implement power management will actually consume significantly less energy over the course of a year and will thus have a completely different cost threshold to be cost neutral or cost effective.

The following table illustrates a comparison of the CEC TEC calculation formula vs a power managed TEC calculation for a typical mainstream business desk top. The table power values are an average of the actual measured power values across a range of processors from data collected for an online energy calculator. The power managed model assumes 250 work days per year and 7 hours per day doing office productivity work, 1 hour per day doing high performance tasks and factors in ENERGY STAR 6.1 timeouts into sleep and hibernate/off. For the 8 hours of actual use in the work day this model uses power levels much higher than the idle power used in the CEC calculations.

	Comparison of Energy Savings for current system and CEC passing system if Power Management is enabled (Dell Energy Calculator model 8hrs/day 250 days/yr active)					
	Current Average Business DT	New System Meeting CEC Limit	Power reduction to Hit Limit	% reduciton in power	Modified System Meeting CEC Limits	
Hibernate (W)	0.44	0.44	0.00	0%	Lifetime (4yrs) Energy Savings of New System (kWh)	Lifetime (4yrs) Energy Cost Savings of new system @ 0.16/kWh ($)
Sleep (W)	1.36	1.36	0.00	0%		
Short Idle (W)	19.80	12.15	7.65	39%		
Long Idle (assume delta of 2.0W)	18.53	10.88	7.65	41%		
SysMark Office Productivity 2007 (W)	23.77	22.82	0.95	4%		
3DMark 06 (W)	49.45	48.96	0.49	1%		
CEC TEC calculation (kWh)	128.22	53.88			297	$47.58
TEC if Power Managed (kWh)	59.74	56.10			15	$2.33
CEC TEC calculation annual Energy Cost @ 0.16/kWh	20.52	8.62				
Power Managed System Annual Energy Cost (kWh)	9.56	8.98				

The analysis compares the current system to one that meets the CEC limits by reducing both short and long idle sufficient to hit the CEC limit for this configuration.

Using the CEC calculations the end user saves $47.58 over the life of the product while the power managed implementation saves only $2.33 over the 4 year life of the product. In fact it is highly likely that end users that do allow their systems to sleep and hibernate would see only about 5% of the CEC projected savings while paying the same cost burden.

CEC should be aware that those users that leave system sleep states enabled will suffer all the cost of any required changes while obtaining a very small portion of the projected benefits. The more aggressive CEC is in the TEC limits the more cost end users will bear and the more likely it is that users that do the “right” thing will have a negative return from the CEC forced investment.

2 SUMMARY OF KEY ISSUES

2.4 High Performance PCs

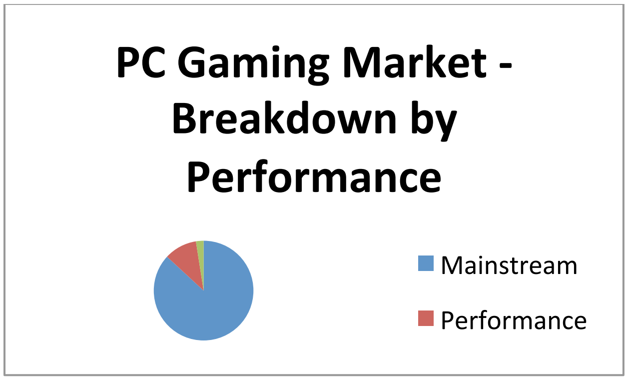
High performance computers provide increased functionality to California consumers and businesses compared to entry-level and mainstream computers. The proposal as written in the CEC Staff Report would harm these users because of failures to accurately assess cost effectiveness, technical feasibility and impacts on increased functionality.

- **High performance computers will contain some combination of the following features or characteristics**:
  - Higher performance processors, graphics, etc. (can be similar to workstation)
  - Customizable (memory, hard drives, processor, graphics, OS)
  - Enhanced security features (central management, encryption)
  - Durability
  - Expandability/extended life (desktop PC)
  - Enhanced management
  - Use with larger diameter, high resolution displays, e.g. 5K

- **Users**
  - **Consumers**
    - CA. consumers, productivity & entertainment applications
    - CA. students
    - CA. gamers
  - **Commercial** (examples)
    - Hollywood, Bay Area - animation, entertainment
    - Silicon Valley & other CA. engineers, architects - 3D modeling, prototyping
    - So. & No. CA. aerospace, defense - simulations
    - CA. small businesses, e.g. real estate, medical offices, interior design
    - CA. universities, hand-on learning
    - CA. corporate space planning, construction
    - CA. business productivity applications

Performance or "Extreme Home Users" purchase very high performance, richly configured computers (similar to workstations in capability) that are used for activities including online gaming or evolutionary computing processes (including development and programming of gaming software.) Other activities performed by these users include manipulating photos for special effects, shooting and editing of videos or films, creating, recording and producing music, and on-line distribution of user-created digital content.

For PC gaming, the PC market is typically broken down into three categories determined by user performance requirements: mainstream, performance and enthusiast. The number of mainstream PC gamers is estimated at around 87% of the market and far exceeds the combined numbers of performance and enthusiast gamers. PC systems utilized by mainstream gamers can incorporate either integrated or discrete graphics.



PC gamers support a large ecosystem of suppliers that provide add-in-boards, specialized peripherals like steering wheels and joy sticks, audio subsystems, and gaming software in addition to the PC hardware – many of these suppliers are California companies.

There are also many commercial applications where high performance PCs enables enhanced functionality. Examples of commercial users of performance PCs include engineers and other professionals engaged in product design often with the use of multiple displays, defense or academic researchers performing enhanced physics simulations, software game developers and film animators, professions performing modeling, or businesses requiring the creation and analysis of high quality 3D images.

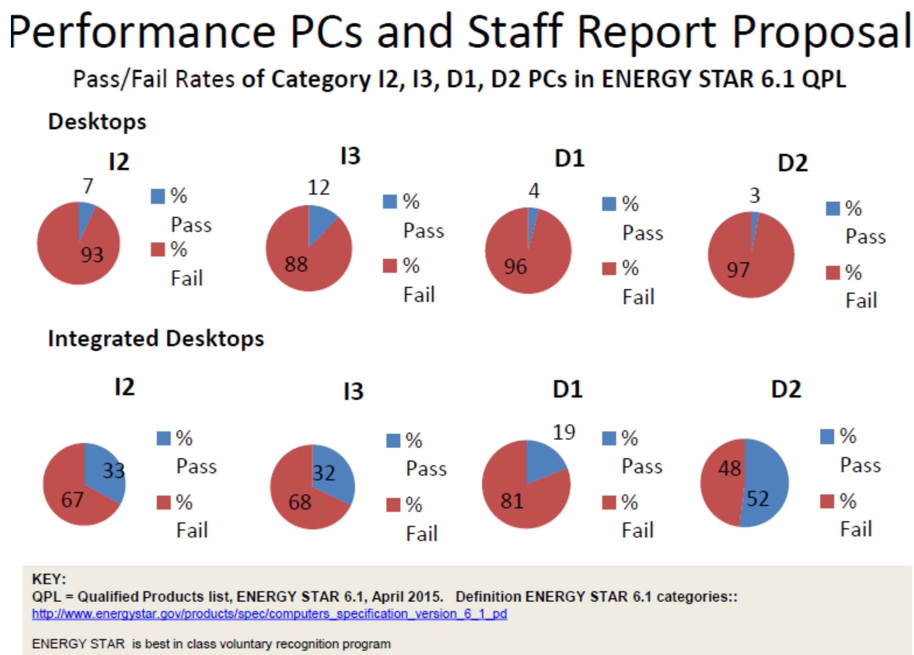
Technical Feasibility

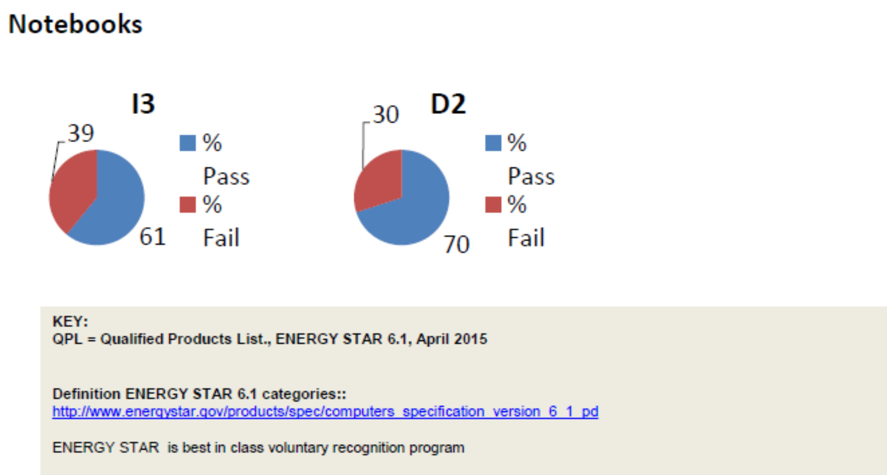
The Staff Report fails to identify the large percentages of high performance PCs that are unable to meet the proposed CEC limits.

Comparing the CEC proposal to the current ENERGY STAR 6.1 computers specification; high performance desktops with discrete graphics, would require redesign so that they consume up to 77% less energy, i.e. 215 kWh, (Desktop Category D2, G7 graphics) compared to the existing ENERGY STAR 6.1 PC specification.

Few performance desktop PCs that are certified to the current ENERGY STAR 6.1 PC specification, are capable of meeting the proposed CEC limits; only 3-4% of desktops with discrete graphics could qualify while 7-12% of performance desktops with integrated graphics could qualify. When considering the large number of PCs that do not receive ENERGY STAR certification, it is evident that that the CEC regulation would remove the great majority of current performance desktops from the California market.

Large numbers of performance integrated desktops and notebook PCs that are certified to the current ENERGY STAR 6.1 specification are also not capable of meeting the proposed CEC limits.





Discrete GPUs: In performance PCs, discrete GPUs are often used as mainstream computing devices. Discrete GPUs contain more transistors and compute units than integrated GPUS, and can enable faster processing of display frames when applying shader processors[5] Use of dGPU

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[5] Shader processors enable computer programs to do shading, produce gradients of color in an image and create different special effects.

simulation technology can also enable more lifelike and 3D images. Discrete graphics cards can allow for faster transcoding[6] and rendering, and enable the use of multiple displays for enhanced productivity, e.g. allowing a researcher to write a report on one display while reviewing spreadsheet data on another screen. Also, as display pixel resolutions continue to increase, discrete graphics can also improve image quality especially when doing photo editing or other detailed image manipulations.

High performance discrete graphics can also enable game play frame rates that are 20x higher than integrated graphics, as measured by a graphics benchmark such as Futuremark 3D Mark[7]. For many PC gamers, perception of slow frame rate speeds will negatively impact their overall game-playing experience.

Manufacturers have a long history of improving energy efficiency, as well as active and idle power for discrete processors. Power management to reduce long and short idle now exists and efforts to improve graphics and system power and efficiency are ongoing.

It should be noted that the use case for automatic switchable graphics technology is based on a use model where significant time is spent performing mainstream tasks such as word processing and reading and responding to emails. It is driven in mobile platforms by the desire to save battery life. This switching technology will automatically **power on** the discrete GPU during applications such as 3D gaming, video playback, and other DirectX applications. As a result, for performance PCs that are intended to perform PC gaming or media applications as the predominant usage model, the use case for incorporating automatic switchable graphics technology no longer exists.

Because of the added functionality that discrete graphics provide to California businesses and consumers, they should not be excluded or limited in computers placed on the California market because of overly aggressive idle limits and/or timeframes.

Performance PCs Summary

- Performance PCs offer increased functionality to California consumers and businesses.
- There are technical feasibility & cost effectiveness concerns with the limits and schedule in the Staff Report, that are not adequately addressed for performance PCs. For example, an analysis of desktop PCs qualified to ENERGY STAR 6.1 indicates that only

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[6] Transcoding is the process of converting media files or objects from one format to another.

[7] The identification of any benchmarks in this report does not imply ITI or Technet endorsement of that benchmark. Software and workloads used in performance tests are sometimes optimized for performance on specific processors. Performance tests are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary.

a small percentage of the performance PCs currently on the market would be able to comply with the CEC proposal.

- As noted in the Executive Summary, an exclusion of performance desktops and notebooks from the regulation is proposed. These PCs are used in prescribed niche markets where higher functionality is required by specific users.

- As noted in the Executive Summary, an exclusion of performance gaming PCs from the regulation is proposed. Performance gaming PCs are utilized by a small section of the overall gaming market.

- A "one size fits all" regulation is not appropriate for computers. If exclusions are not granted; a scaled approach is needed and can be achieved by platform categorization and the application of discrete graphics adders.

INDUSTRY RECOMMENDATIONS & WAY FORWARD

- Product Scope: Mainstream Desktops, Integrated desktops, Notebooks, Small-scale servers, Workstations

- Framework: ENERGY STAR v6.1 framework, including definitions (except Workstations to be revised), TEC mode weightings including full network connectivity, etc.

- Power management: In addition to traditional power management CEC must address the two issues we raised in our comments in section 2.1.

    - *First, CEC must address manufacturers need to ship computers with a basic OS (without any power management). Because this non-power managed OS is intended for one time use by customers to boot up the computer so that they can install their own custom software image.*

    - *Finally, CEC must address the need for the power management requirements to include non-traditional power management technologies. Like the dynamic power management in the idle state (provided by Android and Chrome OSs).*

- Categories: ENERGY STAR v6.1 category system for products in scope

- Adders: ENERGY STAR v6.1 adders plus adders for discrete TV Tuner and discrete audio card (per ErP Lot 3 directive). Industry will propose process for graphics adders including discrete graphics and high-end integrated graphics. Industry will further propose adders for systems with additional security and manageability features.

- Exemptions: High-end professional desktops and Gaming desktops; Mobile workstations and Gaming notebooks. As stated earlier Industry will follow-up with proposed definitions and key usages for such systems. In addition Industry proposes power management exemption for Small-scale servers.

APPENDIX 1

4. DETAILED COMMENTS ON STAFF REPORT

4.1. Chapter 4 – Regulatory Approaches

Description	Page	CEC Comments /Proposal	Industry Comments
ENERGY STAR	13	Energy Commission staff is using ENERGY STAR v6.1 framework over the 5.2 framework for the same reason given by ITI in its development and by the IOUs and the NRDC in their comments to the commission.	ENERGY STAR v6.1 framework includes a category system which is the heart of any computers specification development. CEC's single category (one-size-fits-all) approach is a significant departure from International standards as categorization approach has been adopted globally.
International Standards	13-14	CEC describes Australian, Chinese and EU computer standards and approaches	Industry worked very closely with these countries to drive convergence on MEPs approach. Limits based on older ENERGY STAR v5.2 version and targeted exemption was a reasonable compromise in lieu of in-country data collection. MEPs goal should be to remove 15-25% least energy efficient systems from the market.
Staff Proposal	16-17	The scope of the proposal does not include larger-scale servers, blade servers, industrial computers and controllers, video game consoles, tablets, smart appliances, Televisions, over-the top boxes, and portable gaming devices.	Can CEC describe what an over the top box is?
Desk Top Computers	16-17	To set the 2018 proposed standard, staff evaluated the best practices in hardware and software in today's market that also provide higher-end functionality. In effect, staff looked at best practices in power scaling along the lines discussed in Appendix C of the IOU Case Addendum.29	Appendix C of IOU case study is filled with serious misconceptions of PC power management draws numerous totally unfounded and false assumptions and generalizations and continually describes the state of the industry incorrectly. CEC should be aware that should such a project be undertaken it would be 6 to 10 years to actually

			get product with power levels proposed by the Staff Report into consumer's hands. Example schedule: • Develop unified hardware / software power specifications: 2-3 yrs. • Design Hardware and software supporting new requirements 18-24 months for new silicon maybe 12 months software. • Put hardware and software together and get it all working 6 to 12 months. • Design into platforms 12 months. If CEC used other data to support its decisions and proposal it should disclose this information. CEC is relying on implementation of features years before they could possibly be made available. This does not meet CEC obligation to provide technical feasibility and cost effectiveness. More detailed inputs on Appendix Care provided in a separate document

4.2. Chapter 5 – Technical Feasibility

Description	Page	CEC Comments /Proposal	Industry Comments
Introduction	18	The proposed computer standards are feasible as there is an array of computers across performance categories that already meet the standards today. Even the more stringent proposed desktop standards can be met in a straightforward manner.	No straight forward manner is ever presented to support the more stringent desktop standards.
Small-Scale Servers and Workstations	18-19	The IOU incremental cost estimate was $5-$13, decidedly between the two more extreme bounds of the ITI and Green Tech Leadership Group estimates. Staff incorporated the higher cost IOU cost in the small-scale server and workstation cost-effectiveness analysis to be conservative.	CEC fails to provide any analysis that justifies cost effectiveness using the "higher cost IOU cost". Where are the calculations?
Desktop PCs	19-21	While the power consumption of some components show positive relationships between performance and power, there are some where these are not so directly proportional. This is particularly true when considering the energy consumption of hardware components, as that consideration allows tradeoff of higher active power in exchange for lower power idle states.	CEC here and in multiple places refers to power consumption which is technically incorrect. Power is the rate of consumption of energy. Difficult to understand the point CEC is trying to make here. It seems CEC is trying to say that sometimes power and performance have positive correlations. Is this the case?
	19-21	There are also many software and firmware enhancements that can be implemented that would save large quantities of energy without changing the components	CEC should list at least 5 to 10 if there are so many. There are some software and firmware features identified in IOU reports, however it is never validated whether these are or are not enabled on shipping PC systems in the California market. It appears CEC is double dipping on these features by assuming the gains can be achieved when applying them to systems that already have the features enabled. CEC should validate the expected magnitude

			of these improvements and whether or not these features are enabled on the baseline from which the 50kWH/yr. TEC is calculated.
	19-21	The IOUs tested the effects and cost-effectiveness of direct part replacements, primarily focusing on choosing more efficient hard disks and power supplies.36 This was a simple exercise of choosing one part with the same performance over another.	IOU failed to provide any supporting evidence that performance was unchanged after component swaps. Please provide the data that shows the performance was unchanged between original and replaced parts. Example: ENERGY STAR processor performance metric is not adequate to determine like functionality in a system. It is intended to bin processor performance for purposes of categorizing systems not as an actual measure of performance capabilities of the processors.

4.3. Chapter 6 – Energy Savings and Cost-Effectiveness

Description	Page	CEC Comments /Proposal	Industry Comments
Table 2:Units energy savings and Cost-Effectiveness	22		While the table showed the math to show unit energy savings and cost effectiveness, it did not demonstrate if energy savings and incremental cost is achievable with real system BOM
Table 3:Potential Energy Savings for One Year of Sales and Future Stock	23		Table address stock savings (GWh/yr.) without addressing the assumptions on stock turn-over rate and number of years it will take for full stock depletion.

4.4 Chapter 7 – Environmental Impacts

Description	Page	CEC Comments /Proposal	Industry Comments
Environmental impacts	24	Some approaches to reducing idle can lead to reductions in active power	Short idle is an active state for the GPU (screen display) and for other components (applications are running in background, HDDs are spinning). In general, Idle power is a result of device leakage. Active power results from application performance demands Some approaches to increasing idle (timewise) lead to reductions in active power. Increased time in idle mode is actually a result of technologies that decrease the time spent running active applications because of technology that promotes “race to idle.” Modern chips are able to power gate in between 33 ms video frames, so that up to 70% of frame time is spent in idle or near-zero power states. Relation of idle to active mode is not adequately understood by IOUs/NRDC or addressed by CEC
	24	Proposal will lead to saved energy	If regulation removes certain components/platforms from the market, it will decrease throughput of certain workloads which will increase energy consumption in the state (even if power is decreased.) For example, discrete GPUs decrease the time required to complete certain workloads like video transcode compared to a CPU, and as a result decrease energy consumption, an issue not addressed by CEC
	24	Proposal will not lead to increase in e-waste	Proposal does not take into account the normal power distribution associated with manufacturing. It should not limit selection of components and sub-

			systems to only those that are capable of achieving the lowest power profiles.

4.5 Appendix A

Description	Page	CEC Comments /Proposal	Industry Comments
Figure 9: Idle Mode Power with Efficient Components (W)	55	However given current technologies the profile in idle mode can look much more like this, using only a bit more than 1/3 the power:	Many issues with the values proposed in this table per details in following sections.
CPU	56	The introduction of C7 states such as that found in Haswell chips allows lower power consumption states while in idle mode. Figure 9 estimated a current draw of 2/3 of an amp to represent a low level working state. The power to the processor is provided by voltage regulators that translate the 12 volts provided by the power supply to the final CPU voltage. The associated voltage regulator is thereby rendered practically to its standby-state, reducing the conversion losses to essentially the regulator's fixed losses. The voltage regulator fixed losses are estimated at about 0.3 watts.	CEC is using circular logic in this analysis; In figure 9 they state the advancements that enable the values in Figure 9 are found below then in the CPU section they reference the graph as validation of the proposal. The 2/3 of an amp is completely unjustified and no detail provided on how value achieved and how CEC gets from 2/3 amp to 1W CPU power in the graph.
Hard Drive	56	However with new SATA standard power management features even full-sized 3.5" disks are able to achieve idle consumption of less than 1 watt.	The idle power value mentioned in the HDD data sheets is not the power level of the HDD during a system idle test. The CEC is using the wrong HDD power state in system idle. Less than 1W is not achievable in 3.5 inch HDD's while the platter motor is spinning. By definition in ENERGY STAR 6.1 idle state the HDD is spinning. CEC is assuming an HDD state that is in violation of referenced idle state definitions. Forcing a ~ 5 minute HDD spin down in desk top systems will cause inconsistent end user experience and may

			even increase the annual energy consumption of desk top systems in California due to excessive spin down and spin up of HDD motors.
Optical Drive	56	SATA 3.1 specifications allow for zero power optical drive idle consumption. Optical drive idle power can be brought to zero, although staff modeled it at 0.1 watts to be conservative.	CEC incorrectly assumes that if the interface spec for an ODD provides for the possibility of a zero power state that all optical drives support the state at no cost adder. Absolutely no data provided to support the existence of .1W in production drives or the cost effectiveness of obtaining .1W in production optical disk drives in the needed time frame.
Motherboard	56	Many features allow motherboard power consumption to be reduced. DC-DC conversion losses are reduced by lowering overall component loads. Ethernet idle power is reduced by Energy Efficient Ethernet. BUS and other clock can be reduced, thereby lowering the power consumption of associated chips and processes. New SATA and USB standards lower standby. Losses can also be reduced by minimizing the motherboards unused capacity by either using smaller form-factor motherboards or by ensuring that unused expansion capabilities do not yield higher idle mode power.	CEC provides a list of current PC system and device power management capabilities with absolutely no information on how this list relates to the 6W motherboard proposal. The 6W motherboard proposal
Power Supply Losses	56	Power supply idle can be reduced to levels considerably lower than 10 watts. The idle is naturally reduced by the reduction of system load, as discussed in previous sections. Reduction of system load will reduce the conversion losses in the power supply as less overall power must be delivered. This number can be further reduced both by increasing the conversion efficiency at small loads and also by addressing standby loads within the power supply itself. Desktops	Paragraph begins with a sentence that references a completely undefined and unknown parameter (power supply idle). CEC then lists a series of very basic facts about PSU design and operational relationships to conversion losses. Although factual there is no correlation established between these minor facts and CEC establishment of TEC limits on PC's. The last two sentences of this paragraph beginning with

		are capable of achieving lower idle power well below 3 watts in sleep modes where the power supply must still provide power along with its fixed losses. The entire computer system is drawing less than 2 or 3 watts while the power supply is providing power to sustain system RAM and other components.	"Desktops are capable" exhibit a serious misunderstanding and or lack of knowledge of PC system operation. During system sleep and hibernate/off states the main power supply is not operating and all system power is provided by a small auxiliary power supply. It is impossible to draw any conclusions about PSU losses in PC system idle state based upon AC power loads during system sleep state.
Idle in Graphics Processing Units	57		CEC states a series of opinions, facts and conclusions but never establishes a relationship between comments being made and the analysis that proves the technical feasibility and cost effectiveness of the zero idle power graphics allocation in Figure 9.