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RESPONSE TO COMMENTS

APPLIANCE EFFICIENCY RULEMAKING
FOR
COMPUTERS, COMPUTER MONITORS, AND SIGNAGE DISPLAYS

DOCKET #16-AAER-02

Comments on 45-Day Language

Comment #	Company	Comments	Responses
1	Consumer Federation of America TN#214156	• Comment supports the standards as being long-term effect, product neutral, Technology neutral, responsive to industry needs, responsive to consumer needs, and procompetitive with significant benefits to consumers, the economy and the environment. • The Electricity Consumption of Household Digital Devices is a Particularly Difficult Problem for the Marketplace to Solve. • Standards can play an important role. They address all four of the barriers identified: Standards don't dictate which technologies can be utilized, Consumers do not have to master the economics of the level of energy consumption of the device, Because all manufacturers must abide by the same rule, there is less risk of adding the cost of the energy savings technology to the product, Producers who are better at adding technology at lower cost may benefit, Competition can be stimulated around the standard and may even go beyond it as the standard raises awareness. • California's role in moving the nation forward in setting standards for these devices is also appropriate for a number of reasons. • These standards are effective because they are: product neutral, technology neutral, still competitive, sets a standard, but lets the	Thank you for your comment. No change is requested. The resolution adopted for these standards states that "The market for computers and monitors is evolving" and directs staff to "Conduct rigorous market monitoring of specific features and types of computers" that "may significantly reduce the energy savings projected during this rulemaking."

		marketplace work to achieve that standard. • Having arrived at a nuanced approach that allows more flexibility, some are concerned about how these complex incentives will affect manufacturer behavior. The Commission must be vigilant about how it will play out in the marketplace. We believe the vast majority of the members of the industry will not abuse that flexibility or game the system, as the significant support expressed by the industry suggests. Even so, the CEC should adopt an aggressive market monitoring program that estimates and subsequently tracks the "normal" rate of increase in niche or exempt products and those entities that have been afforded flexibility.	
2a	NEEA (Northwest Energy Efficiency Alliance) TN#214154	Some of the proposed allowance levels and exemptions may be too generous given historical power reduction curves for new computer and monitor technologies. NEEA recommends a) tighter levels, particularly for Tier 2, for the allowances and exemptions identified by NRDC in their written comments dated October 24, 2016, and b) a pro-active mechanism—or off-ramp—to reevaluate and adjust levels if needed as technologies evolve.	For specific allowances and exemptions identified by NRDC, please refer to Comment 5.
2b	NEEA (Northwest Energy Efficiency Alliance) TN#214154	NEEA supports NRDC's proposed off-ramp concept, which would involve sun-setting allowances 12 months after a feature achieved significant, perhaps 10%, market share. NEEA also requests additional transparency into the assumed market adoption rates and data set analysis used to develop proposed adders and exemptions. NEEA's technical	Please refer to Comment 5-o. Setting a cap like 10% on the marketshare for products such as high expandability computers would require knowing the marketshare, its trend, and other relevant data for those products today. This information is not available. The Energy Commission is collecting the

		consultants have performed market and technical analyses of enhanced performance displays (EPD) and very high performance monitors and have worked with NRDC to integrate the findings of this research into NRDC's comprehensive comments dated October 24, 2016.	necessary data in its database for all computers, including those that have certain exemptions, to monitor the market, its shift, and potential impacts to energy savings. The resolution adopted for the computers and monitors standards includes the statement that directs staff to "Conduct rigorous market monitoring of specific features and types of computers and monitors through reporting to the Modernized Appliance Efficiency Database System (MAEDBS)." "Staff shall consider proposing revisions to the computer and monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for computers and monitors, respectively, are obtaining rapidly increasing marketshare and may significantly reduce the energy savings projected during this rulemaking."
2c	NEEA (Northwest Energy Efficiency Alliance) TN#214154	NEEA views this rulemaking as an important step in our collective efforts to mitigate the effects of climate change and encourages the Commission to look more carefully at ways to increase the confidence level that needed energy savings will occur in future years.	Please refer to the comment 2b.
3a	ITI & TechNet, TN#214166	Add-in Card Definition: The problem is mainly with the last sentence of the CEC proposed definition "It also does not include cards that split, physically extend, or convert a slot type". There are several examples of cards that do convert a slot (like PCIe to USB, PCIe to Ethernet slot, PCIe to SATA slots/RAID	The definition for the add-in cards has been modified to address ITI's concerns.

		cards, etc.) which will have unique power delivery requirements and hence will need an adder. After understanding the CEC staff industry had proposed to include the term "riser cards" within the definition to ensure the concern is addressed. Including riser cards as part of the excluded items should ensure cards that split or physically extend slots are not used for Add-in card TEC adder.	
3b	ITI & TechNet, TN#214166	High expandability Computer definition: CEC did not separate the agreed system memory bandwidth and frame buffer bandwidth requirements. This creates confusion and ambiguity since the terms system memory bandwidth and frame buffer bandwidth have different definition and different proposed values. Further system memory bandwidth and frame buffer bandwidth have different equations to compute kWh capability allowance. Industry proposes to add two additional clauses, pertaining to systems memory bandwidth to the clauses (Please refer to proposed changes to the regulatory language in section 6 of this document).	The definition for the high expandability computer has been modified to address ITI's concerns.
3c	ITI & TechNet, TN#214166	Schedule issue: Compliance for computers meeting the high expandability criteria (per definition) start January 1, 2018. However the dates for discrete graphics and power supply requirements built into the definition are on a different timeline ("before January 1, 2020" and "on or after January 1, 2020"). It is confusing and unnecessary to track these dates. This could inadvertently lead to potential non-compliance. Industry Proposal: Modify High expandability computer criteria (2) to remove the following language "If the computer is manufactured before January 1, 2020", and align with January 1,	High expandability computers have specific exemption from the standards. One of the ways a computer can be qualified as a high expandability computer is to have a discrete graphics with a frame buffer bandwidth higher than the specified minimum bandwidth along with a power supply with a minimum of 600 watts. The specified minimum frame buffer bandwidth is raised from 400 GB/s to 600 GB/s on and after January 1, 2020. It is technically feasible to meet the currently specified speeds at these

		2018 effective date, and modify (3) to change from "on or after Jan 1, 2020" to "on or after July 1, 2021" to align with computer Tier 2 dates.	dates. Pushing the cut-off date by 18 months, will result in unjustified exemption of computers and loss of energy savings.
3d	ITI & TechNet, TN#214166	Workstation definition: Industry is recommending a minor change to correct bandwidth unit of measure from 'Gigabytes/sec' to 'Giga transfers/sec' under workstation definition (3)(B).	The typo of Gigabytes per second is fixed and changed to Gigabits per second. "Gigabits per second" is a more well-defined and common unit than Giga transfer per second and therefore it is used.
3e	ITI & TechNet, TN#214166	• Defining the largest drive as the Primary storage is not technically appropriate. There are many times when the system designer and users will decide to install the key system files that are required for the primary operation of the system on a smaller and faster drive. This will significantly speed up the system and makes it more responsive, without losing storage space. Also, if the operating system is on a different installation and gets corrupt it won't damage data files. • Removing the drive with the OS will make the system non-functional hence we need to define this drive as the primary one. • Additionally, identifying the drive with the OS installed is a quick and easy check.	• Storage devices other than "main storage" (formerly known as primary storage) receive adders while the main storage doesn't. This is because the main storage is considered as one of the essential components and is accounted for in the base energy consumption of the computer. The base energy is derived assuming that the main storage is a 3.5-inch drive. In the cases where a computer has other storage devices besides a 3.5-inch drive, it is most likely that the 3.5-inch drive has a larger capacity than others. For this reason and because it is accounted for in the base energy estimates, the main storage device is defined as the storage with the largest capacity. • The main storage device is defined for the purposes of energy allocation and functionality. • Identifying the capacities of the storages is straight forward.

3f	ITI & TechNet, TN#214166	Data should only be collected when there is an actual compliance requirement. This will reduce unnecessary data collection burden. Further with this approach there will be minimal changes needed to section 1604 (v)(5)(B).	Some test and list requirements are not part of compliance verification, but they are necessary for data collection. The Energy Commission will be monitoring the market for shifts in technologies or features that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of these products or features such as jumping categories, staff will consider proposing changes to the standards that will prevent these market changes from significantly reducing the overall energy savings projected in this rulemaking.
3g	ITI & TechNet, TN#214166	CEC will need to make reference to the correct TEC equations in ENERGY STAR sections 3.7 – 3.9, with additional guidance for form factors and equations not defined in the ENERGY STAR program.	The recommended change has been made.
3h	ITI & TechNet, TN#214166	• Industry has confirmed that not all OS and hardware suppliers support the Full Capability requirements. • Industry believes OS and hardware suppliers do support the "remote wake" capability and recommends replacing "Full capability" mode weighting with "remote wake". The proposed change would insure all computer manufacturers would have the option of choosing between either Conventional or Remote Wake mode weightings.	ITI's concern has been addressed in 15-day language by allowing manufacturers to use "remote wake" or "full capability" mode weightings for computers manufactured before July 1, 2021, if they meet their specified criteria.
3g	ITI & TechNet,	Expandability score table: Industry proposes to amend the expandability score Table V-1 to remove	Table V-1 has been amended to remove overlaps and address the expandability score

	TN#214166	overlapping criteria and add new criteria for USB ports that can provide between 15 and up to 29 watts of power.	for the USB and Thunderbolts ports with less than 30 Watts of power.
3h	ITI & TechNet, TN#214166	• NRDC's Comments on CEC's Proposed Computer Energy Efficiency Standards by Pierre Delforge - TN # 213957, specifically slide #4 USB standards, would like to call attention to the referenced ITI - Computer, Computer Monitors, and Electronic Displays by Chris Hankin, Information Technology Industry Council Comments: June Deep Dive Meeting, ITI/TechNet Computers Presentation -- Dell Corp – TN# 205339, specifically slide #9. Information related to PSU sizing referenced in NRDC presentation is out of context. The information provided was specifically related to manufacturer design requirements for determining the size of the power supply and does not take into account data provided by industry was in DC and associated losses when measuring AC total power required and correlation to the associated expandability score adders. • Industry is of the view that expandability score is a settled issue after months of engagement with the stakeholders and reaching a compromise. In fact the whole power savings model is built on the scores currently laid out, and further rehashing it will unravel months of work. There will be cases where industry may be disadvantaged, i.e. get lower score than what the power consumption could end up being (For Ex: USB PD between 60-99W gives us only 60 points).	See response to comment 4c.

		Industry recommends CEC leave the USB Expandability score adders as currently defined.	
3i	ITI & TechNet, TN#214166	• NRDC presentation slide #5 states High-expandability exemption related to HBM (high-bandwidth memory) for discrete graphics cards as a potential loophole for models not achieving a high expandability score of greater than 690 points. The statement that 400GBs will be at mainstream, is unfounded. If mainstream as defined by NRDC is interpreted as highest volume sales, discrete graphics offered in the 2019 timeframe will probably start about 128GB/s in 2019 (4x GDDR5 8gbps). • Further the comments that "High-bandwidth cards don't need an exemption, graphics adders are sufficient" are not supported by future market trends or data. The one energy data point that was cited to support this proposal does not align with the CEC testing methodology. NRDC computer presentation slide #6 identified the Radeon AMD R9 Fury X Reference drawing 5W at idle. This result will not be achieved using the test and duty cycle requirements in the CA. regulation. One possible explanation for the result is that testing was performed without a display or with the display turned off. Testing of this chip has found ~20W in a short idle test running Windows 7 and using a 1920x1080 monitor. Weighted idle power is above the Tier 1 adder for discrete graphics, when measured according to the test requirements	See response to comment 4h.

		of the CA. regulation	
3j	ITI & TechNet, TN#214166	Referring to NRDC's computer presentation slide #5 that states specifying a 600W power supply along with the Frame Buffer Bandwidth of the graphic card "would encourage power supply upsizing, increasing energy use". The added costs to upsizing a power supply is not in the best interest of the industry or our customers. Also note that upsizing a power supply affects the efficiencies it will operate at.	See response to comment 4i.
3k	ITI & TechNet, TN#214166	The intent of the discrete graphics high expandability exemption is to exempt from TEC reporting a limited set of future desktop systems using very high end GPUs which present idle power design risks by using newer process nodes and newer features. Linking very high-end GPUs with a high-end power supply ensures the exemption is only for high-end systems. Exempting such systems will be the key for California to maintain its rate of innovations and to avoid a situation where California and its businesses become disadvantaged competitively should these systems be excluded from the California market. The frame buffer bandwidth limits found in the current CEC regulation Express Terms document represent and will continue to represent high-end 384-bit or higher GDDRx based graphics subsystems as well as HBM based solutions. The complexity of the HBM memory technology makes it difficult to build (3-dimensional, DRAM stacks, use silicon interposer, etc.) and its additional costs compared to other memory technologies will limit the HBM usage to the higher end of the spectrum. If the market and technology changes in regards to both cost and idle power	No change is requested by this comment.

		consumption, these issues can be revisited.	
3l	ITI & TechNet, TN#214166	Additionally, the assertion to drop adders for Tier II and change Tier I to with much higher threshold of 1,000 GB/s is unfounded. Industry provided CEC with proposed definitions for Gaming Systems that was not adopted for this rule making. Instead an Expandability Score approach was put forward by CEC and Industry agreed to this alternative approach to classify models that require additional power allowances. CEC has proposed power savings by mandating power management enablement, energy efficient Ethernet, and 80 PLUS Gold level energy efficient internal power supplies. The current proposed measures will provide significant benefits to Californians and do not require further modifications.	No change is requested by this comment.
3m	ITI & TechNet, TN#214166	NRDC presentation slide #7 – Computers: 256-bit memory interface: Provide extra expandability points to system memory only, not chip-integrated memory. Industry is of the view that It is unlikely HBM memory requirements will be mainstream in desktops.	No change is requested by this comment. See response to comment 4k.
3n	ITI & TechNet, TN#214166	Provision for aging of OS installation: Industry recommends to amend 1604 (G) to add the following sentence at the end of current provision, to allow 24 hour OS stabilization prior to start of power testing: 'Prior to testing, a covered computer is allowed to connect to the internet and have at least 24 hours to run software and driver updates with sleep disabled to allow for proper "aging" and OS stabilization'.	All test setups and configurations are aligned with Energy Star unless it is necessary to modify a test to collect a correct value because of the impact that the adopted standards has on that particular test. This requested change is not implemented because the aging and operating system stabilization should be applied in the same way for all standards and specifications.

			Moreover, tests are mostly performed in an "as shipped" configuration and software updates could affect this condition. Therefore, this part of the test procedure is aligned with Energy Star.
30	ITI & TechNet, TN#214166	• Sleep Mode Measurement: Industry recommends that 1604 (5) (H) allow an alternate test method for long-idle and sleep-mode for computers that use alternate to ACPI S3 sleep mode. • Rationale: Computers that use alternate to ACPI S3 sleep typically remain in ACPI S0. However, the operating system reduces power to system components with control of each component separately. This reduces the overall power consumption of the system to levels similar to ACPI S3 sleep while allowing the system to have brief periods of activity to update applications and to respond to incoming Skype calls or IM requests. Systems with these alternate low-power modes are able to return to normal operation instantaneously. This allows the computer to have a behavior similar to long-idle while having power consumption similar to S3 sleep. This typically allows the computer manufacturer to set the default time-out for sleep to 10 or 15 minutes without an impact to the user's productivity. • The use of an alternative to ACPI S3 sleep mode poses another complication. As noted, the system can have brief periods of activity to update applications. These periods of activity only last a few seconds and may occur	Sleep mode definition and test measurements are modified from the Energy Star definitions and test method to accommodate both traditional (ACPI S3) and alternative sleep modes, including those similar to what ITI has described in its comment. This test procedure ensures the consistency, reliability and repeatability of the sleep mode power measurement. Test duration to measure the sleep power is 30 to 31 minutes which is consistent with ITI's recommendation for achieving more accurate results. It satisfies both of ITI's requests: the 5 minutes test duration for the ACPI S3 sleep mode and 30 minutes test duration for alternative sleep mode. However, ITI' recommendation to vary the test duration per manufacturer's discretion or alignment to ACPI S3 state, will introduce variability in the test results and was not adopted.

		over varying periods depending on the configuration of the installed applications. Measuring the average power over 5 minutes can give varying results depending on whether one of these periods of activity occurs during that 5-minute period. This can lead to inconsistent measurements. Measuring the average power over 30 minutes will give more repeatable and accurate measurements of the power consumed in the alternate to ACPI S3 sleep mode. A shorter time period may be used if specified by the manufacturer. • Recommendation: - if the Unit Under Test (UUT) uses ACPI S3 sleep mode accumulate power values for 5 min and record the average (arithmetic mean) value observed during that 5 min period as Psleep; - if the UUT uses an alternative to ACPI S3 sleep mode, (e.g., low power long Idle, Modern Standby, etc.), then accumulate power values for 30 min and record the average (arithmetic mean) value observed during that 30 min period as Psleep. A time period shorter than 30 min may be used if specified by the manufacturer. Such systems shall enter the alternative to ACPI S3 sleep mode directly from short idle without a period of long idle. The measured value shall be used for both sleep and long idle in the TEC calculations.	
3p	ITI & TechNet, TN#214166	Median power factor measurement during long-idle mode for Desktops and Integrated Desktops that utilize an internal power supply is not part of the	Power factor data is collected during the short-idle mode and with the intent to collect power factor at low loads. Power

		Generalized Test Protocol. Power Supplies are tested as standalone equipment not attached/connected to the computer during testing of efficiency and/or power factor. Industry does not support median power factor testing and reporting as long-idle mode measurements are configuration dependent.	factor samples are taken in concurrence with the real power measurements.
3q	ITI & TechNet, TN#214166	The requirements for measuring Power Factor for Small-scale Servers, High expandability Computers, and Workstations require 0.9 when measured at 50% load as well as 0.9 Power Factor at Full or 100% load. These covered categories are not subject to modal and/or TEC limits thus are not subject to testing for Long Idle mode nor testing and reporting power factor during Long Idle mode.	Although high expandability computers, small-scale servers, and workstations are not subject to TEC limits, all computers including the aforementioned computer types are required to be tested and reported. Power factor is required to be measured during short-idle mode for data collection purposes. However, the test and report is not requiring power factor measurements during the long-idle mode.
3r	ITI & TechNet, TN#214166	Collecting Power Factor data for both desktop computers and integrated desktops during Long Idle will not provide a foundation for future regulations. These computers will require new designs and behaviors to support lower power Long Idle mode to achieve the aggressive power reduction targets. As stated above in relation to Alternative sleep mode (non-ACPI-S3), computers implementing similar solutions will greatly reduce the loading on the internal power supply and more closely resemble loading similar to ACPI-S3 during Long Idle mode. Collecting power factor during long idle mode will vary greatly depending on the manufacturer's solution. In fact, the mode weightings (time spent in mode expressed as a percentage) for Long Idle is only 15% annually of the total 8760 hours. Industry strongly recommends CEC abandon the requirement	Staff acknowledges that for future rulemakings, computers most likely will require new designs to lower their power consumption in short-idle. However, collecting power factor in short-idle provides an indication to what is the range of power factors at low loads and whether it should be included as part of regulations in the future rulemakings. In the 15-day language, in response to this comment, staff changed the power factor collection from the long-idle to short-idle which has a 35% time weighting and is more substantial than long-idle. The Commission is interested to know the power factor and their variations at the actual low loads that computers use.

		for measuring and reporting power factor during Long Idle mode. If CEC deems it necessary to collect power factor data that is not covered by existing test procedures, industry recommends CEC identify a fixed loading point (% of the maximum output) of the covered internal power supply so that information collected is comparable, repeatable, and relevant.	Collecting the power factor at a fixed low load does not provide data pertaining to the real world. The variation is a good indication on how bad or good power factor in actual short-idle modes can get.
3s	ITI & TechNet, TN#214166	There is an issue that was not addressed before. It has to do with the sale of 'Zero Thin Clients' class of products in California that do not support system sleep mode. Industry has observed in the ENERGY STAR Computers QPL data, that Zero thin clients (that do not have an operating system local to the device) also do not support system sleep mode. While the thin clients with alternative to ACPI S3 sleep mode are addressed as part of Table V-6, the system without the OS are not addressed in the draft language. • We would recommend thin client systems without an OS or a hard drive present, be exempt from system sleep mode (i.e. not required to comply with 1605.3(v)(5)(B) under power management section). • For Thin Clients without ACPI S3 sleep mode or alternative to ACPI S3 sleep mode, power in long idle shall be used in place of power in sleep mode in the TEC equation. No sleep mode power limit is required for these thin clients.	• Section 1605.3(v)(5)(C) provides an exemption to the power management and sleep mode power limits for computers that don't have an operating system. In response to this comment, staff added another criterion in order to qualify computers, such as "Zero thin clients", that are not capable of having an operating system for this exemption: " … or if the model is not capable of having an operating system". • Sleep mode definition and test measurements are modified from the ENERGY STAR definitions and test method to accommodate both traditional (ACPI S3) and alternative sleep modes, including those similar to what ITI has described in its comment. This test procedure ensures the consistency, reliability and repeatability of the sleep mode power measurement. No compelling reason was presented to exempt thin clients from the sleep power limits and

<table>
<tr><td></td><td></td><td></td><td>therefore they are subject to comply with sleep mode power limits.</td></tr>
<tr><td>3t</td><td>ITI & TechNet, TN#214166</td><td>Industry reviewed the Alternative Sleep Mode Power Limits 1605.3 (V)(5) (Table V-6) in Express Terms and determined the memory capacity scaling factor of 0.03 or 30 mW/GB memory capacity is not adequate. Industry looked through memory supplier datasheets for DDR4 IDD power values (See table A below). Industry believes 45mW/GB is a more realistic approach over CEC's proposal of 30 mW/GB of memory capacity. Not knowing where DDR5 power will land in the future – at this point it is safe to assume it's no better than DDR4. We also looked at the spec sheet from Hynix as well and the numbers are in line to what is shown below. Industry Recommendation: Change scaling factor in Table V-6 from 0.03 to 0.045 for all computer types (3 line items) consistent with the analysis below. (Please refer to proposed changes to the regulatory language in section 6 of this document)
DC Power: 16 GB Hynix Normal temp: 0.672 W (DC)
32 GB Hynix Normal temp: 1.327 W (DC)
1.327 W - 0.672 W = 0.7W/16GB = 43.75 mW/GB (DC)
Assuming AC/DC conversion is 80% = 54.7mW/GB (this is even higher than what is below)
<u>Table A</u>
<table>
<tr><th></th><th colspan="3">AC Watts/GB (80% AC-> DC efficiency)</th><th>Comments</th></tr>
<tr><th>DDR Capacity (GB)</th><th>Vendor A</th><th>Vendor A</th><th>Vendor B</th><th></th></tr>
<tr><td>8</td><td>0.048</td><td>0.048</td><td>0.039</td><td></td></tr>
<tr><td>16</td><td>0.042</td><td>0.045</td><td>0.043</td><td>NB Scalar (> 8GB)</td></tr>
<tr><td>32</td><td>0.04</td><td>0.043</td><td>0.04</td><td></td></tr>
<tr><td>64</td><td>0.039</td><td>0.039</td><td>0.04</td><td>DT/AIO Scalar (> 32 GB)</td></tr>
</table>
</td><td>From table V-6, the coefficient of 0.03 watts/GB applies to system memories larger than 32 GB. This coefficient is based on the data provided and docketed by the investor owned utilities: http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214540_20161121T151917_California_Investor_Owned_Utilities_Comments_CA_IOUs_Report__Im.pdf
IOU's data includes more data points in the range of more than 32 GB and includes other tests such as effect of the DDR's frequency on the power consumption. 0.03 Watts per GB is the maximum AC power per GB from that data.

For future DDR technologies, if the power consumption in sleep mode is significantly higher, interested parties can petition for an amendment. A clause has been included in the adoption order that if staff receives a petition for rulemaking to change or create an adder or allowance related to a new feature or technology that was not considered as part of this rulemaking, staff will commit to presenting to the Commission potential regulatory changes within six months of the petition being granted by the Commission. The rulemaking petition received by the Commission will need to include sufficient information to show that the new feature or technology was</td></tr>
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			not considered during this rulemaking, what the energy consumption levels are or will need to be, and may include confidential business information, submitted under the Commission's confidentiality process, to support the need for a rulemaking.
3u	ITI & TechNet, TN#214166	Industry had proposed to amend 'Majority of system memory capacity….' in Table V-8 (3) to include a lower bandwidth bound of 17GB/s to ensure that the majority of system memory has sufficient bandwidth to drive the display. (Please refer to proposed changes to the regulatory language in section 6 of this document).	The adder for high bandwidth system memory in Table V-8, does not apply if at least 4 GB of the system memory doesn't have speeds of 146 GB/s or higher which is much higher than 17 GB/s that is needed to drive the display. Adding the recommended lower bandwidth will essentially qualify system memories with speeds lower than 17 GB/s for an adder which is not what is intended.
3v	ITI & TechNet, TN#214166	Table X: Industry strongly suggests CEC require Model Name & Model Number be mandatory reporting requirements for covered computers and displays. Model Name & Model Number are needed to differentiate between covered computers and Displays.	Manufacturer's name, brand name, and model number are part of Table X for all appliance products including computers and monitors.
3w	ITI & TechNet, TN#214166	CEC must include Internal Power Supplies "size" similar to information reported for models using External Power Supplies: AC Adapter Size (watts) (notebook computers only) so that models meeting High Expandability Score by either • A power supply of 600 watts or greater and a discrete graphics with a frame buffer bandwidth of 400 gigabytes per second (GB/s)	Size of the internal power supply is added to Table X. For system memory and integrated issue see response to comment 3al.

		or greater or integrated graphics with a system memory bandwidth of ≥ 434 GB/s; and/or • A power supply of 600 watts or greater and a discrete graphics with frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater or integrated graphics with a system memory bandwidth of ≥ 634 GB/s can be properly ascertained.	
3x	ITI & TechNet, TN#214166	Enhanced performance (EP) display dates: EP Tier 1 and Tier 2 requirements are aligned with computer monitor effective dates (Table V-8). However, the same EP requirements apply to integrated desktop computers that have different effective dates. This date misalignment is confusing and unworkable for computers. EP Industry Proposal: Modify Table V-8 to align EP requirements dates with computers effective dates respectively (Tier 1: Jan 1, 2019, and Tier 2: July 1, 2021).	The recommended change has been made.
3y	ITI & TechNet, TN#214166	High expandability computer (dGfx dates alignment): Already addressed above under definition.	See response to the comment 3c.
3z	ITI & TechNet, TN#214166	Staff Report Final Analysis: • Cost Effectiveness (Table 7, Page 44) Industry is of the position that the component cost estimates are significantly underestimated. Industry had already provided its component cost estimates based on 3rd party quotes, in earlier submissions to California Energy Commission. • Add-in cards (Page 47): The add-in card allowance	• Recommended changes are in regards to the staff report and not to the regulatory language. However, cost estimates presented in the staff report were based on staff's evaluations of the cost of computer parts on the market at the time, and taking the least cost compliance pathway possible to achieve the

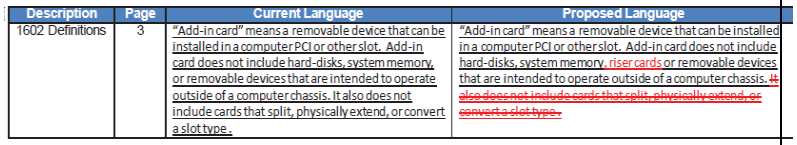
		is incorrectly stated in watts instead of kWh, while the separation should also be in kWh. The transmission rate should be gigabits/sec (Gb/s) and not Gigabytes/sec (GB/s). These corrections are necessary for consistency.	efficiency levels, as this is the approach the Commission expects manufacturers to take in manufacturing compliant products. In addition, these cost levels incorporate expected decreases in component costs over time, as is common in computer trends. In contrast, industry has provided average, current costs of component parts, even though these costs do not represent the least-cost compliance pathway and do not take into account the later effective dates of the regulations. Therefore, the Energy Commission chose to rely on staff's analysis of compliance costs as the better representative example of actual costs that the industry will incur in compliance with the standards. • Please see response to comment 3ba.
3aa	ITI & TechNet, TN#214166	During the last year of discussions with the CEC and other stakeholders, we have often speculated on how to best "future-proof" the standards. For industry, this has in particular involved the desire to make sure that as yet unknown future technologies – for instance, not yet invented but needed cyber-security protections -- are not unintentionally hampered or prevented from entering the California marketplace. In the "Future Technologies" section (page 49) of the Final Staff Analysis, the CEC staff have offered the observation that for such technologies – ones "that	This request has been considered in the resolution adopting regulations: "The market for computers and monitors is evolving and changing rapidly due to new technologies and innovations; therefore, to ensure that the Appliance Efficiency Regulations adopted today do not unduly restrict the computers and monitors market, and also to ensure that the regulations achieve the energy savings projected for that market, the Energy Commission hereby directs staff to:

		did not exist at the time of the adoption hearing for the regulation" – any person may petition the Commission "to request a rulemaking hearing under Section 1221 of Title 20 to consider adding an interface score (for calculating expandability) or functionality adder." The Staff Report also helpfully notes that the Commission has a process to handle trade secrets or confidential business information that could be used in conjunction with such petitions. As industry stated at the October 10th Public Meeting, we strongly support this intended use of the Section 1221 petition process for future technologies, except in one important aspect. The Staff Analysis seems to contemplate business as usual, but the existing petition process could dampen, stall or even inhibit future innovation from occurring in California. Our discussions have emphasized the importance of expeditious consideration for these future technologies all the while allowing these technologies to continue to advance and be available for California consumers, business and government entities. ITI/TechNet Request: Industry requests that the CEC Executive Director take steps to ensure expedition, committing to a process of no more than 6 months for future technologies petitions. Industry requests that the CEC Executive Director take steps to ensure expedition, committing to a process of no more than 6 months for future technologies petitions.	1. Conduct rigorous market monitoring of specific features and types of computers and monitors through reporting to the Modernized Appliance Efficiency Database System (MAEDBS). Staff shall consider proposing revisions to the computer and monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for computers and monitors, respectively, are obtaining rapidly increasing marketshare and may significantly reduce the energy savings projected during this rulemaking. 2. Present to the Commission for adoption proposed changes to these regulations within six months in response to a petition for rulemaking proceeding submitted under Section 1221 of Title 20 of the California Code of Regulations that is granted by the Energy Commission for the purpose of addressing a new technology, interface, or feature that was not considered at the time of this rulemaking."
3ab	ITI & TechNet,	In preparation for the scheduled January 1, 2017 expansion of scope of the CEC Battery Charger	The recommended change to clarify the battery charger systems has been

	TN#214166	Systems regulation (CEC-400-2012-011-CMF), industry identified substantive concerns about the inclusion of non-consumer small battery chargers and requested clarification from CEC. The expanded regulation qualifies many non-consumer products as battery chargers and battery charger systems, but for which there is no appropriate test procedure in place, and would restrict those products from sale in the State of California. The products of concern are non-consumer products with battery charger and battery charger systems that include rechargeable batteries as defined by the regulation but do not support primary function of the product when the AC power is not present. Examples of these products vary and include a majority of servers and storage controllers. ITI worked closely with CEC staff to clarify the definition of what it means "to provide electrical energy to a product," and the definition stated in Section 1601(w)(7) fully clarifies CEC's intent and addresses industry concerns. ITI supports the CEC proposed language in Section 1601(w)(7) and strongly urges the CEC move forward with this definition before the Battery Charger System regulation becomes effective on January 1, 2017.	implemented. The effective date of this regulation cannot be sooner than one year from the date of adoption and is January 1, 2018.
3ac	ITI & TechNet, TN#214166	ITI and TechNet (also referred to hereafter as "industry") have been honored to participate in a constructive dialogue with CEC staff since the beginning of the Computers and Displays Standards Rulemaking in Spring 2012. Our collaborative and data-driven discussions have resulted in a historic rulemaking that achieves the highest energy efficiency standards possible without undermining the innovation powering California's economic	Thank you for your supporting comment.

		engine. The standards proposed in this rulemaking are ambitious, but given the industry's history of creating increasingly energy-efficient technologies, we are certain that they are achievable. As stated during the October 10th Public Meeting, ITI and TechNet support the proposed standards, provided CEC staff's consideration of the comments contained herein.	
3ad	ITI & TechNet, TN#214166	ITI and TechNet are committed to continued engagement with CEC and other stakeholders to drive further improvements to the rule, even after the rulemaking process is complete. As CEC plans for implementation of this rule, we strongly suggest that CEC provide clear, accurate and timely guidance to industry (and other stakeholders) as the standards come into effect. For example, a CEC announcement letter with corresponding webinars, guidance documents and FAQs should be released at least six months before the effective date to allow stakeholders to make critical adjustments to their business and/or manufacturing processes and ask technical questions to CEC staff. We are certainly open to providing further feedback on implementation as we approach that phase of the process.	Although the Energy Commission cannot make a commitment to comply with the requested timeline, staff is working to provide outreach and education for computer manufacturers and other stakeholders in a timely manner and well in advance of the effective dates. In the meantime, questions about these adopted standards can be directed to: **Email** Appliances@energy.ca.gov **Phone** In California: (888) 838-1467 Outside California: (916) 651-7100.
3ae	ITI & TechNet, TN#214166	Mobile workstation definition: CEC did not separate the agreed system memory bandwidth and frame buffer bandwidth requirements. This creates confusion and ambiguity since the terms system memory bandwidth and frame buffer bandwidth have different definition and different proposed values. Further system memory bandwidth and frame buffer bandwidth have different equations to	See response to comment 4a.

		compute kWh capability allowance. Industry proposes to edit an existing clause (3) under Mobile workstation definition.	
3af	ITI & TechNet, TN#214166	ENERGY STAR Equation 1 applicability: Express terms incorrectly states in section 1604(v)(5)(B), "The total energy consumption of a computer shall be calculated using Equation 1 in Section 3 ENERGY STAR Program Requirements for Computers Eligibility Criteria Version 6.1 (Rev. March-2016)" The equation being referred to here, is applicable only for TEC Calculations (ETEC) for Desktop, Integrated Desktop, Thin Client and Notebook Computers. It is not intended for other form factors like workstations, small-scale servers, mobile workstation and high expandability computer. There are several issues here: • There are separate ENERGY STAR TEC equations for small-scale servers, and workstations, while no TEC equations exist for mobile gaming systems, mobile workstations and high expandability computers.	Changes were made to specify the correct equations and mode weightings in the Energy Star's test method that must be used for small-scale servers, high expandability computers, mobile workstations, and workstations when calculating annual energy consumption.
3ag	ITI & TechNet, TN#214166	CEC made changes to ENERGY STAR workstation definition in alignment with the industry and other stakeholders. US EPA has not established if there should be any changes to workstation TEC equation should EPA agree to adopt the new definition.	This comment is in reference to comment 3af. Please see response to 3af.
3ah	ITI & TechNet, TN#214166	CEC modified ErP Lot 3 definition for mobile workstation and established new definitions for mobile gaming systems and high expandability computers. While mobile gaming system is to comply with integrated desktop criteria, mobile workstation and high expandability computer are	This comment is in reference to comment 3af. Please see response to 3af.

		not part of ENERGY STAR and hence there is no direct applicability to above referenced TEC equation, since these system usage profiles may be different from mainstream notebooks and desktops systems.	
3ai	ITI & TechNet, TN#214166	CEC is requiring power modes and TEC data gathering (Table X) for all computers in scope, whether or not there is conformity assessment requirement. As such the Equation 1 referenced above does not apply.	This comment is in reference to comment 3af. Please see response to 3af.
3aj	ITI & TechNet, TN#214166	Industry recommend amending 1604 (5) (I) with the following: (I) The power factor and efficiency of products covered in Table V-9 in Section 1605.3(v)(6) shall both be determined by the following test procedure: Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7 (March 1, 2014).	This recommendation was not made because of the reasons stated in response to comments 3p through 3r.
3ak	ITI & TechNet, TN#214166		Please see response to comment 3a.

Description	Page	Current Language	Proposed Language
1602 Definitions	3	"Add-in card" means a removable device that can be installed in a computer PCI or other slot. Add-in card does not include hard-disks, system memory, or removable devices that are intended to operate outside of a computer chassis. It also does not include cards that split, physically extend, or convert a slot type.	"Add-in card" means a removable device that can be installed in a computer PCI or other slot. Add-in card does not include hard-disks, system memory, riser cards or removable devices that are intended to operate outside of a computer chassis. ~~It also does not include cards that split, physically extend, or convert a slot type.~~

3al	ITI & TechNet, TN#214166	1602 Definitions 4 "High expandability computer" means a computer with any of the following: (1) An expandability score of more than 690; (2) If the computer is manufactured before January 1, 2020, a power supply of 600 watts or greater and a discrete graphics with a frame buffer bandwidth of 400 gigabytes per second (GB/s) or greater; or (3) If the computer is manufactured on or after January 1, 2020, a power supply of 600 watts or greater and a discrete graphics with frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater. "High expandability computer" means a computer with any of the following: (1) An expandability score of more than 690; or (2) ~~If the computer is manufactured before January 1, 2020, a~~ A power supply of 600 watts or greater and a discrete graphics with a frame buffer bandwidth of 400 gigabytes per second (GB/s) or greater starting January 1, 2018; or (3) A power supply of 600W or greater and a system memory bandwidth of ≥434 GB/s starting January 1, 2018; or (4) ~~If the computer is manufactured on or after January 1, 2020, a~~ A power supply of 600 watts or greater and a discrete graphics with frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater, starting July 1, 2021; or (5) A power supply of 600W or greater and a system memory bandwidth of ≥634 GB/s starting July 1, 2021	Please refer to comment 3c with regards to the requested timeline change. In terms of the memory requirement, in order to qualify computers with powerful integrated graphics that also have a 600 Watts or greater power supply, a similar provision is added. In this new provision, computer must also have at least 8 gigabytes of such high-bandwidth system memory in order to meet the qualification. Please see responses to comments 5l and 9i for reasons behind this requirement.
3am	ITI & TechNet, TN#214166	"Mobile workstation "…….. (3) Has at least one integrated GPU meeting the minimum system memory bandwidth of ≥ 134 GB/sec or discrete GPU(s) providing a frame buffer bandwidth ≥ 96 GB/sec per GPU. ~~Has at least one integrated or discrete graphic processing unit with frame buffer bandwidth of 134 gigabytes per second or greater~~ ;	Energy Commission agrees with the proposed change for the frame buffer bandwidth for the mobile workstation with discrete GPU. Changes were made to accomplish a similar result to what was requested.
3an	ITI & TechNet, TN#214166	"Primary storage" means the largest capacity non-volatile storage device present in the system "Primary storage" means the ~~largest capacity~~ non-volatile storage device with the operating system installed ~~present~~ in the system	Please see response to comment 3e.
3ao	ITI & TechNet, TN#214166	"Workstation" means…….. (3)…….. B) Supports 4 or more lanes of PCI-express, other than discrete graphics, connected to accessory expansion slots or ports where each lane has a bandwidth of 8 gigabytes per second (GB/s) or more. "Workstation" means…….. (3)…….. B) Supports 4 or more lanes of PCI-express, other than discrete graphics, connected to accessory expansion slots or ports where each lane has a bandwidth of ~~8 gigabytes per second (GB/s)~~ 8 giga transfers per second (GT/s)or more.	Please see response to comment 3d.

3ap	ITI & TechNet, TN#214166	1604(v)(5)(B) The total energy consumption of a computer shall be calculated using Equation 1 in Section 3 ENERGY STAR Program Requirements for Computers Eligibility Criteria Version 6.1 (Rev. March-2016) 1604(v)(5)(B) The total energy consumption of a computer shall be calculated using appropriate equations in sections 3.7-3.9 of ~~Equation 1 in Section 2~~ ENERGY STAR Program Requirements for Computers Eligibility Criteria Version 6.1 (Rev. March-2016) *Note: Per earlier industry explanation, CEC will need to provide additional guidance for form factors and equations not defined in the ENERGY STAR program.*	Please see response to comment 3af.
3aq	ITI & TechNet, TN#214166	1604(v)(50(B) 1. '…. unless they meet the criteria to use "full capability" mode weightings, below.' 2. In order to use the "full capability" mode weighting a computer shall have the following features enabled as shipped: i. Maintain Ethernet (IEEE 802.3-2015) or wireless (IEEE 802.11-2012) network addresses and network connection capability while in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode; ii. Resume from ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode upon request from outside the local network; and iii. Support advertising host services and network name while in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode. 1604(v)(50(B) 1. '…. unless they meet the criteria to use ~~"full capability"~~ "remote wake" mode weightings, below.' 2. In order to use the ~~"full capability"~~ "remote wake" mode weighting a computer shall have the following features enabled as shipped: ii. Maintain Ethernet (IEEE 802.3-2015) or wireless (IEEE 802.11-2012) network addresses and network connection capability while in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode ; and iii. ~~Resume from ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode upon request from outside the local network.~~ While in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep, the system is capable of remotely waking upon request from outside the local network. ~~and~~ ~~iv. Support advertising host services and network name while in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode.~~	Please see response to comment 3h.
3ar	ITI & TechNet, TN#214166	Table V-1 (Interface Type and Scores for Expandability Scores Calculations) Please Refer to Industry proposed amendments in Appendix A of this document	Please see response to comment 3bb.
3as	ITI & TechNet, TN#214166	1604(G) For purposes of providing data as required in Section 1606, desktop computers, thin clients, mobile gaming systems, notebook computers, and portable all-in-ones shall be tested by selecting the configuration that has the greatest allowable energy consumption as provided for in Section 1605.3(v)(5). If multiple configurations exist that meet this criteria, select the configuration that will yield the greatest annual energy consumption as measured by the test procedure. 1604(G) For purposes of providing data as required in Section 1606, desktop computers, thin clients, mobile gaming systems, notebook computers, and portable all-in-ones shall be tested by selecting the configuration that has the greatest allowable energy consumption as provided for in Section 1605.3(v)(5). If multiple configurations exist that meet this criteria, select the configuration that will yield the greatest annual energy consumption as measured by the test procedure. Prior to testing, a covered computer is allowed to connect to the internet and have at least 24 hours to run software and driver updates with sleep disabled to allow for proper "aging" and OS stabilization.	Please see response to comment 3n.

3at	ITI & TechNet, TN#214166	1604(H) The sleep mode power measurement shall be tested in a modified manner from the test procedure described in IEC 62623: 2012. Instead of measuring power after manually entering sleep mode, the power measurement shall begin no sooner than 30 minutes and no later than 31 minutes of user inactivity on the unit under test. This measurement shall follow the long-idle test without altering the unit under test.	1604(H) The sleep mode power measurement shall be tested in a modified manner from the test procedure described in IEC 62623:2012: - if the Unit Under Test (UUT) uses ACPI S3 sleep mode accumulate power values for 5 min and record the average (arithmetic mean) value observed during that 5 min period as P_{sleep}; - if the UUT uses an alternative to ACPI S3 sleep mode (e.g., low power long Idle, Modern Standby, etc.), then accumulate power values for 30 min and record the average (arithmetic mean) value observed during that 30 min period as P_{sleep}. A time period shorter than 30 min may be used if specified by the manufacturer. Such systems shall enter the alternative to ACPI S3 sleep mode directly from short idle without a period of long idle. - The measured value shall be used or both sleep and long idle in the TEC calculations.	Please see response to comment 3o.
3au	ITI & TechNet, TN#214166	1604(I) The power factor of a computer and compliance with Table V-9 in Section 1605.3(v)(6) shall both be determined by the following test procedure: *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies* Revision 6.7 (March 1, 2014). In addition the median power factor during long-idle measurements shall be recorded in the test report.	1604(I) (I) The power factor and efficiency of products covered in Table V-9 in Section 1605.3(v)(6) shall both be determined by the following test procedure: *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7 (March 1, 2014).* ~~In addition the median power factor during long-idle measurements shall be recorded in the test report.~~	Please see responses to comments 3p through 3r.
3av	ITI & TechNet, TN#214166	1605.3 (v)(5)(C) If the model is shipped at the purchaser's request with either a limited capability operating system or without an operating system , the model is not required to comply with Section 1605.3(v)(5)(B).	*Note:1605.3 (v)(5)(C) does not include Thin Clients exemption from 1605.3 (v)(5)(B), for systems with a limited capability operating system or internal storage. Industry proposes the following addition to 1605.3 (v)(5)(C) to help clarify the Total Energy Consumption (TEC) procedure and avoid confusion* If the model is shipped at the purchaser's request with either a limited capability operating system or without an operating system or without internal storage, the model is not required to comply with Section 1605.3(v)(5)(B). Further the model may substitute the power in long idle mode with power in sleep mode in Typical Energy Consumption (TEC) equation, when calculating TEC.	Please see response to comment 3s.
3aw	ITI & TechNet, TN#214166			Please see response to comment 3t.

		Table V-6 (Alternative Sleep Mode Power Limits) Maximum Power Consumption (watts) 10+ 0.03*C..... 5 + 0.03*C ..... 2.5 + 0.03*C..... ********** 1605.3 (v)(5) (A) Comply with Table V-7; and Table V-6 (Alternative Sleep Mode Power Limits) Maximum Power Consumption (watts) 10+ ~~0.03~~ 0.045*C..... 5 + ~~0.03~~ 0.045*C ..... 2.5 + ~~0.03~~ 0.045*C..... ********** 1605.3 (v)(5)(A) did not address Table V-8 (adders) (A) Comply with Table V-7 and Table V-8; and	
3ax	ITI & TechNet, TN#214166	1605.3 – Table V-8 On or after July 1, 2019; EP=0.3..... On or after January 1, 2021; EP =0.2..... 1605.3 – Table V-8 (modify to align with computers Tier 1 & Tier 2) On or after ~~July 1, 2019~~ January 1, 2019; EP=0.3..... On or after ~~January 1, 2021~~ July 1, 2021; EP =0.2.....	Please see response to comment 3x.
3ay	ITI & TechNet, TN#214166	Table V-8 High bandwidth system memory… This adder does not apply …. 3) Majority of system memory capacity (in gigabytes) has bandwidth has a bandwidth less than 134 GB/s… Table V-8 High bandwidth system memory… This adder does not apply …. 3) Majority of system memory capacity (in gigabytes) has bandwidth greater than 17GB/s but ~~has~~ less than 134 GB/s…..	Please see response to comment 3u.
3az	ITI & TechNet, TN#214166	1605.3 – Table V-9 (Header) Power Supply Requirements for Small-scale Servers, High expandability Computers, Mobile Workstations, and Workstations 1605.3 – Table V-9 (Remove Mobile Workstations from Header) Power Supply Requirements for Small-scale Servers, High expandability Computers, ~~Mobile Workstations~~, and Workstations	Table V-9 header has been corrected.
3ba	ITI & TechNet, TN#214166		Please see responses to comments 3v, 3w, and 9aa for the response to model name and mode number, as well as power supply. - "Total battery capacity" is consistent with the entries for other appliances such as the battery charger systems and therefore

		Table X Data Submittal Requirements		wasn't changed. - Data on whether "power supply meets Table V-9 or Level VI" is collected for all computers although "true" response is required for only some computer types. This is for both compliance verification and for data collection purposes. - Although the error regarding wired Ethernet or fiber card transmit rate unit was corrected in the language, it was overlooked in Table X. The Energy Commission has made the necessary correction. - Motherboard is part of the definition for the "basic model" of a computer. Therefore, its model number must be collected to verify computers that have the same basic model. - Information regarding the type of sleep mode that computer uses (ACPI S3 or alternative sleep mode), are collected. However, because sleep mode test is the same for both, this information is not collected.
		Total Battery Capacity (watt-hours) (notebook computers only)	Total rated battery capacity (watt-hours) (notebook computers only)[5]	
		Power supply Meets Table V-9 or Level VI	Power supply Meets Table V-9 or Level VI (only required as 'True' for Small-scale servers, high expandability computers, mobile workstations, and workstations. Small-scale servers, high expandability computers, mobile workstations, and workstations)[6]	
		Wired Ethernet or Fiber Card with a transmit rate of 10 GB/s or greater	Wired Ethernet or Fiber Card with a transmit rate of 10 Gb/s or greater[7]	
		Motherboard model number	~~Motherboard model number~~ (DELETE)[8]	
		None	Product model number (ADD)[9]	
		None	Product model name (ADD)[10]	
		None	Alternative to ACPI S3 sleep mode test method used (Yes/No) (Add)[10]	

3bb	ITI & TechNet, TN#214166	**Interface Type and Scores for Expandability Scores Calculations** | Interface Type	Interface Score
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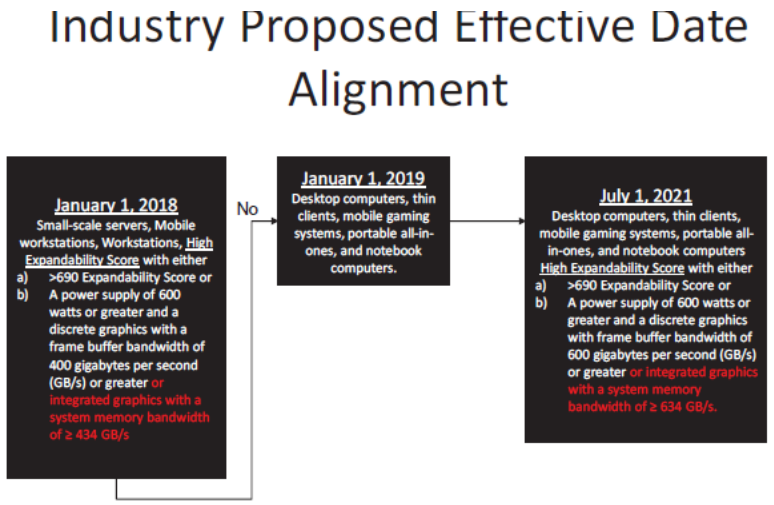
USB 2.0 or less	5
USB 3.0 or 3.1 Gen 1	10
USB 3.1 Gen 2	15
USB ports that can provide 100 or more watts of power	100
USB ports that can provide between 60 and up to ~~100~~ 99 watts of power	60
USB ports that can provide between 30 and up to ~~60~~ 59 watts of power	30
USB ports that can provide between 15 and up to 29 watts of power	15
Unconnected USB 2.0 motherboard header	10 per header
Unconnected USB 3.0 or 3.1 Gen 1 motherboard header	20 per header
PCI slot other than PCIe x16 (only count mechanical slots)	25
PCIe x16 or higher (only count mechanical slots)	75
Thunderbolt 2.0 or less	20
Thunderbolt 3.0 or greater	100
M.2 (except key M)	10
IDE, SATA, eSATA	15
M.2 key M, SATA express, U.2	25
Integrated liquid cooling	50
CPU Support for 4-channels of memory or a 256 bit or greater memory interface	100		Please see response to comment 3g.
3bc	ITI & TechNet, TN#214166		Please see response to comment 3c for the response to this comment and change of the effective dates for the graphics.

3bd	ITI & TechNet, TN#214166	Treatment of display adders: Industry Concerns: • During all of the Industry's presentations and feedback, for Monitors and Computers alike, we have emphasized that in cases an allowance is needed, such an allowance be additive to any other additional power needs. • The concept of the adders for allowances was a compromise to the original request by the industry to have the product "out of scope" instead. • On the Computers Regulation, it is understood and accepted by CEC that Industry will get capability based adders for attributes like system memory, discrete GPU, additional storage, add-in cards, etc. • The same situation exists for Monitors, where the individual allowances should be additive, if a product incorporates more than one of the capabilities for which an adder has been identified (not accounted for in the base "ON" mode limit) • For reference, other Monitor related regulations like ENERGY STAR4 also incorporate the concept of adding allowances to the "ON Power" as capability is added to the baseline monitor definition.	The Energy Commission made this change in 15-day language.
3be	ITI & TechNet, TN#214166	Testing, Certification, & Marking Requirements for non-regulated products: • During the webinar on October 10th, 2016, the commission indicated this requirement was placed to gather and collect data about market penetration of these devices. While industry	The Energy Commission disagrees with ITI's recommendation to remove KVM, KMM, and very high performance monitors from the testing and certification requirements for monitors. One concern raised by several commenters is that products that are exempted from the

		understands the need to collect data, the proposal as it stands represents a huge burden to manufacturers of products that may not increase the market penetration at a considerable rate and therefore represent an insignificant impact to the grid. • Medical monitors that are classified for use as medical devices by the United States Food and Drug Administration represent a small fraction of a percent of all monitors on the market today based on data from Display Search and sales data provided by a manufacturer. These products are sold through special medical sales channels for the medical industry at prices starting in the thousands of dollars. Due to the specific applications of these products in Radiology, Mammography, and Surgical operations these devices are subject more rigorous and precise calibrations to DICOM gray scale standard display function (GSDF) for matched performance with endoscopic cameras. Performance in the gray scale as compared to performance in the color spectrum is of vital importance for detection and display of pathological disorders. Any proposed reduction in power consumption in the on-mode for these devices would require a reduction in display luminance. Reductions in luminance impact performance in the gray scale rendering these devices incapable. Industry believes these professional devices may never be candidates for energy efficiency regulations. • KVM/KMM monitors are not marketed as consumer products but are intended for use in data centers. KVM/KMM does not include a	efficiency standards, such as KVM, KMM, very high performance monitors, and medical monitors, may gain significant marketshare either as a result of natural market adoption or due to exploitation of the loophole in the standards to provide these products at lower cost than more efficient products. This in turn would mean that the savings expected from the efficiency standards would not occur. To alleviate this concern, the Energy Commission has chosen to monitor the market for both increase in sales volume and changes in the efficiency of different features and types of monitors. The appropriate way for the Commission to do this is through testing and reporting to the Modernized Appliance Efficiency Database System (MAEDBS), which will indicate whether a large number of model numbers unexpectedly increase in a given category or whether a particular feature is increasing energy consumption. Sales data from manufacturers or subscription services could be used to verify the trends identified in MAEDBS, but it is not a substitute for reporting to MAEDBS. Therefore, the Energy Commission did not make the requested change. For medical monitors, the Energy Commission agrees that these products have features different from other monitor types and are very unlikely to become

		stand mechanism to use on a desk surface or in an office environment. To access and activate the KVM/KMM, an individual must have security access to the data center. The server rack must be opened, and the tray extended for the KVM/KMM to exit sleep mode. • Although KVM/KMM monitors are available for purchase by consumers, costs range from $800 to $6,000. They are targeted for use in data centers to allow a single console to manage multiple servers. KVM/KMM save power by reducing the number of keyboards, monitors, and mice needed to administer servers and save time by allowing access to multiple servers from a single console. • As an alternative to testing, certification, and marking requirements; industry proposes continued dialogue with the commission to provide product sales on yearly basis. We request these dialogs start in the near future and outside this rulemaking. Once industry and the commission define a formal process, the data collection process will be carried out. The sales data will assist the commission achieve its intended goal to monitor market penetration while removing the unnecessary burden to manufacturers. • To ensure this proposal by industry is applied in other sections of this document, industry also asks the commission to revise Table X and remove KVMs, KMMs, and Very High Performance from the list of permissible answer.	consumer products or "loopholes" in the market. Nonetheless, the Energy Commission find it important to track the model numbers for these products to understand their marketshare, and to monitor for any major shifts in this marketshare that may indicate the need to regulate these types of monitors for efficiency. Therefore, in 15-day language, the Energy Commission removed the testing requirements for medical monitors but continues to require that the model numbers be reported to MAEDBS.
3bf	ITI & TechNet,	Proposed changes to Table V-4 and Table V-5 in Section 1605.3 to make allowances additive instead	The Energy Commission made changes in 15-day language that achieved the same

	TN#214166	of mutually exclusive (see pages 27 and 32-33 for proposed changes)	purpose as the proposed changes from ITI.
3bg	ITI & TechNet, TN#214166	Remove reporting requirements for KMM, KVM, and Very High Performance monitors from Table X in Section 1606.	See response to Comment 3be.
3bh	ITI & TechNet, TN#214166	Commenter provides a table of data from DisplaySearch for consumer displays, showing the estimated percent of marketshare for each monitor type by size and resolution, as well as share of EPDs, touch-screen monitors, and medical devices.	This comment supports the regulations in demonstrating that monitors less than 17 inches, which are excluded from the regulations, have a very small marketshare (0.4%) compared with other sizes of monitors. The market data generally supports the Energy Commission's proposed regulations, including the allowances for EPDs and touch screen monitors, which have a relatively low (less than 10%) marketshare.
4a	California Delivers, TN# 214000	The CEC's proposal is generally strong and balanced; it requires manufacturers to upgrade their less efficient products to achieve minimum levels of efficiency. The proposed standards are performance-based and technology-neutral, and will foster innovation and minimize compliance costs. The CEC's projected savings of $370 million annually will put money back in consumers' pockets and boost California's economy, while also reducing power plant pollution and helping to bring the state closer to its climate goals.	This comment supports the regulations and does not request changes to the regulations.
4b	California Delivers, TN# 214000	CEC faces a real challenge in ensuring that the standards actually deliver these promised savings: given the rapid pace of evolution in computer technology, for these efficiency standards to be	Predicting the future market for monitors is a difficult task. In crafting the regulations, the Energy Commission focused on driving energy efficiency in the

		effective, it is critical that you minimize potential loopholes. As the standard is currently written, some machines are exempted or given a large allowance because they have premium or emerging features. While these features often are rare in today's market, and the initial implementation often draws a little extra power, they could be commonplace, or even ubiquitous, four years from now when the second stage of the standard goes into effect, and no longer require any extra power. Continuing to give them an overly generous allowance has the potential to drastically reduce the standard's benefits, and is a point of serious concern. For example, the allowance for "variable refresh rate", a feature that provides for smoother motion scenes on monitors that are specialized for gaming applications, gives away a 35 percent extra energy allowance for all monitors that have this feature. While only a small number of models on the market today have this feature, it may become common across a large share of the monitor market over the next few years. By that time, it will most likely require no extra power (35 percent is already overly generous today), which will effectively relax the standard by 35 percent for many monitors, creating a potentially large loophole in the standards which would wipe out much of the expected savings.	majority of products in the market, and limiting the growth in energy consumption from products that are currently fringe or niche products, that is, products without a significant market-share. The allowances provided in the regulations are reasonable and based on the data and information available today, on projections from manufacturers about the future market-share of these products, and on the staff report's assumptions about the future monitor market. Nonetheless, the Energy Commission is committed to rigorous market monitoring of specific features and types of computers and monitors through reporting to the Modernized Appliance Efficiency Database System (MAEDBS), which will indicate whether a large number of model numbers unexpectedly increase in a given category, and through the procurement of market data, which will be used to verify any trends identified in MAEDBS. The Energy Commission will consider proposing revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market share and may significantly reduce the energy savings projected during this rulemaking.

4c	California Delivers, TN #214000	While CEC's proposed computer and monitor standard contains many good elements, more remains to be done to ensure projected savings materialize. As such, we are asking the Commission to do the following: • Minimize long-term exemptions and allowances. When the second stage of the standards comes into effect four years after adoption, manufacturers will have had plenty of time to integrate these features into their typical designs in a way that requires no additional energy. Technology evolution has shown time and again that most new features don't require much, if any, additional energy once optimized and integrated into chips. • Include an "off-ramp" mechanism for any exemption or allowance that is no longer warranted and develops into a major loophole. The CEC will monitor the market, and when pre-determined and clearly communicated conditions are met, initiate a rulemaking to adjust the standards to phase out exemptions and allowances within 12 months. This would give industry time to adjust while avoiding a major loss in savings	See response to comment 14c.
5a	NRDC TN#214153	NRDC strongly supports CEC's initiative to develop energy efficiency standards for computers and displays. Realizing cost-effective energy savings in plug-in equipment, which represent approximately two thirds of building electricity use in California, is a critical strategy to help achieve the state's clean energy and carbon reduction goals.	Thank you for your comment. No change is requested.
5b	NRDC	NRDC and its partners demonstrated that CEC's	• Effective date of the standards is

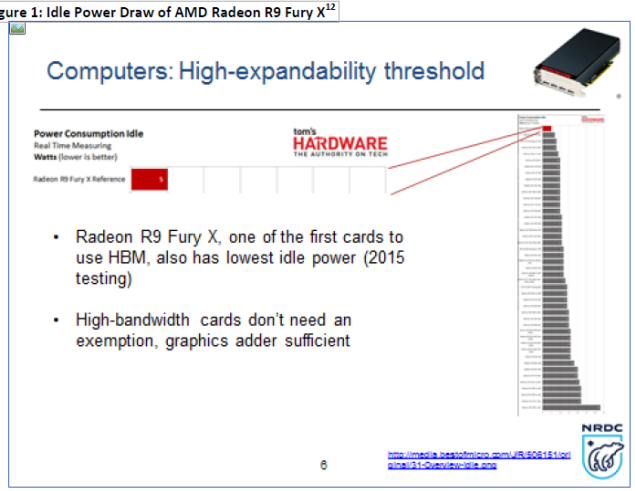
	TN#214153	proposed computer standards are technically feasible and cost-effective today. The 4.5-year tier 2 timeline is unnecessarily long and creates a high risk of growing loopholes in the standards, which could cause the loss of much of the expected energy savings. NRDC, the California investor-owned utilities (IOUs) and their consultants, and industry partners such as Aggios, Power Integrations and Rohm Semiconductor, have demonstrated through two prototypes, a tear-down project, and in-depth research and analysis that CEC's proposed tier 2 standards are technically feasible and cost-effective today, using commonly available off-the-shelf components. The first prototype demonstrated in April 2015, reduced idle power by 54 percent and 61 percent on two desktop computers through fine-tuning of the motherboard, operating system configuration changes, and an inexpensive power supply upgrade. The second prototype demonstrated in April 2016, cut idle power in half on a higher performance desktop, and featured a commercial-grade prototype of a two-stage power supply that achieves high efficiency at very low load, developed by Power Integrations and Rohm Semiconductor-Powervation. This was achieved with no compromise on performance and user convenience, and at no significant additional cost.	different for different types of computers. For example, standards for workstations, small-scale servers, and high expandability computers start January 1, 2018, and for notebooks is January 1, 2019. The standards for desktops are implemented in two tiers with effective date of January 1, 2019, for tier-1 and July 1, 2021, for tier-2 standards. Standards for each type of computers are implemented with a timeline that maximizes energy savings and provides a smoother supply chain transition. • The energy savings shown through prototype demonstrations is for one particular computer and cannot be generalized as an average energy savings for all desktop computers. Also, staff disagrees that the prototype for the two-stage power supply is an "off-the-shelf" component as it is not available in the market today.
5c	NRDC TN#214153	NRDC and Aggios also performed a comparative tear-down of two All-in-One computers, and found that one of these computers used half the energy of the other in short idle mode, and a third in long-idle mode, demonstrating the feasibility of achieving CEC's tier 2 standards with 2014 technology.	While improving the efficiency of one particular system to comply with standards might be feasible today, it cannot be generalized for all computers especially for those with advanced functions and features. Standards and their time line for compliance are developed in a way that all computers comply by their effective date and no

			function or utility is eliminated to comply.
5d	NRDC TN#214153	Some machines are exempted or given a large allowance because they have premium or emerging features. While these features may be rare in today's market, and the initial implementation often draws a little extra power, they could be commonplace, or even ubiquitous, four years from now when the second stage of the standard goes into effect, and no longer require any extra power.	While staff agrees with such a trend in technology improvements in general, the trend cannot be projected precisely for several years from today. Staff has proposed standards that are flexible enough to allow for continued innovation and growth while stringent enough to ensure that manufacturers prioritize energy efficiency in their products. However, our regulations may not have completely predicted the future market. Therefore, the Energy Commission will be monitoring the market for shifts in technologies or features that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of these products or features, staff will consider proposing changes to the standards that will prevent these market changes from significantly reducing the overall energy savings projected in this rulemaking.
5e	NRDC TN#214153	Enhanced performance displays, both for monitors and for the integrated monitors of all-in- one desktops and notebooks, are given an extra allowance of up to 75 percent in tier 1 and 60 percent in tier 2. While only a small number of models on the market today achieve this level of image quality, display technology has historically been trending toward steady increases in resolution, contrast and color gamut, while drawing the same or less power. By the 2021 tier 2 effective date, what is	The enhanced performance display allowances for computers with integrated monitors are intended to align with the allowances for stand-alone monitors, as the technologies are the same. For the Energy Commission's reasoning behind the allowances for enhanced performance displays for monitors, see responses to comments 5v through 5y.

		defined today as "enhanced performance" will likely will likely be common or even standard, and require little or no extra power (60 percent is already overly generous today), which will effectively relax the standard by up to 60 percent for many monitors, creating a potentially large loophole in the standards which would wipe out much of the expected savings.	
5f	NRDC TN#214153	While tier 1 allowances for such features may also be unnecessary, the risk is more limited due to the shorter timeline. We recommend CEC focus on limiting the risk of loophole in tier 2 as this tier is most critical to realize the majority of savings.	Allowances and exemptions are more stringent for tier-2 than tier-1. To prevent potential loopholes, the Energy Commission will be monitoring the market for shifts in technologies or features that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of these products or features, staff will consider proposing changes to the standards that will prevent these market changes from significantly reducing the overall energy savings projected in this rulemaking.
5g	NRDC TN#214153	• The expandability score for USB 2.0/3.x ports and headers are twice as much as they need to be based on their actual power consumptions that are verified through technical USB standards and comments from ITI in July 2015. This could boost the expandability score by 10 to 15 percent. • To illustrate the impacts of this overly generous USB allowance, two of three sample desktops below would move to a higher category, getting 20 to 30 kWh (tier 1) or 10 to 15 kWh (tier 2) or unwarranted allowance.	• USB energy allowance is based on original evaluation into each component's power consumption. Categorization system and its energy consumption allowances for the desktop computers are developed based on a computer's dataset that used the original components' power consumptions in its calculations for the base energies. Adjusting the USB 2.0/3.x power would have to be followed by adjusting the energy

		<table><tr><td>Lenovo ThinkCenter M83</td><td>HP EliteDesk 705 SFF</td><td>Alienware Aurora R5</td></tr><tr><td>220 (**Cat 1**) → 255 (**Cat 2**)</td><td>257 (Cat 2) → 290 (=)</td><td>410 (**Cat 2**) → 460 (**Cat 3**)</td></tr></table> • We recommend aligning CEC's expandability scores for USB 2.0 and 3.1 ports with the USB technical standard as referenced in Tables 7-7 and 11-2, and the scores for unconnected USB headers accordingly to 5 and 10 watts.	allowance levels of desktop categories in order to maintain the energy equivalency. Therefore, it does not result in any additional energy savings. • The Energy Commission will be monitoring the market for shifts in technologies or features that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of these products or features such as jumping categories, staff will consider proposing changes to the standards that will prevent these market changes from significantly reducing the overall energy savings projected in this rulemaking.
5h	NRDC TN#214153	• High expandability exemption: One of the criteria for exemption is the presence of a graphics processing unit (GPU) with a frame buffer bandwidth of 400 GB/s (Jan 1, 2019), and 600 GB/s (Jan 1, 2021). These thresholds for the graphic cards will likely be common in the computer market by 2019 and 2021. AMD and NVIDIA'S product roadmaps show planned introductions of top-end GPUs that exceed both thresholds by 2017, two years before tier 1 and 4 years before tier 2. • In addition, power data from the AMD R9 Fury X, the GPU that has the highest frame buffer bandwidth on the market currently, is also the most efficient of high-end GPUs currently on	While staff agrees with such a trend in technology improvements in general, the future is not precisely predictable. For this reason, the Energy Commission will be monitoring the market for shifts in technologies or features that were not expected at the time of the rulemaking such as the case that NRDC has described in this comment and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of these products or features, staff will consider proposing changes to the standards that will prevent these market changes from significantly reducing the overall energy savings

		the market. Therefore there is no evidence that discrete GPUs with high frame buffer bandwidth need an exemption, on the contrary the only power data currently available shows that they can achieve standards levels with the discrete graphics adder.	projected in this rulemaking.
5i	NRDC TN#214153	• Low-cost HBM technology makes the prospect of widespread high-bandwidth memory adoption by tier 2 and potentially even tier 1 more likely: cost has been the main factor of uncertainty around the speed of HBM adoption. But Samsung recently announced low-cost HBM memory that could accelerate HBM adoption across mainstream computers starting in 2019. • By including integrated graphics in the scope of the exemption, CEC risks making this loophole larger, as it could then apply to all computers on the market, vs. only those with discrete graphics. The lack of evidence on the need for an exemption discussed above applies to integrated graphics too. CEC's proposal already provides an adder for high-bandwidth memory, and these forms of memory tend to be more efficient than conventional types of memory, therefore the HBM adder is sufficient. • Low-cost HBM technology makes the prospect of widespread high-bandwidth memory adoption by tier 2 and potentially even tier 1 more likely. Cost has been the main factor of uncertainty around the speed of HBM adoption. But Samsung recently announced	Although the stated examples demonstrate the recent innovations of the integrated graphics, they are very new (some of them are not in the market yet) and therefore there is not enough data to support a definite conclusion. Moreover, they are currently too expensive to be implemented for typical computers and we cannot precisely predict the curve of their market adoption. However, a clause has been included in the adoption order for such cases where an exclusive feature has a potential to become mainstream after the standards become effective. The Commission will monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking.

		low-cost HBM memory that could accelerate HBM adoption across mainstream computers starting in 2019. Figure 1: Idle Power Draw of AMD Radeon R9 Fury X[12]  • Why this matters: overly generous exemptions threshold could result in exempting a large number of gaming computers, which are the highest-energy using segment of the market, with roughly 20 percent of all computer energy use	
5j	NRDC TN#214153	Frame buffer bandwidth is not the only criterion; high-expandability computers must also have a 600 W-rated power supply. If the GPU bandwidth criterion became too weak, this would provide an incentive for manufacturers to oversize power supplies to meet exemption criteria, potentially leading to lower efficiencies and higher energy use.	High-expandability computers are not completely exempt from the standards. They are required to have an 80 plus gold power supply, high efficiency Ethernet, and apply power management. 80 plus power supplies are more efficient and more expensive than regular power supplies. The higher cost of the upsized power supply in addition to the cost of other upgrades should discourage manufacturers from unnecessarily using a larger power supply. Furthermore, the

			Commission has included a clause in its adoption order to monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking.
5k	NRDC TN#214153	• The AMD roadmap shows a doubling of frame buffer bandwidth each year over the past 3 years. While this pace will not necessarily be sustained, if continued it would lead to the top-end GPUs to have 2TB/s in 2019, 4TB/s in 2020, and 8 TB/s in 2021. Given the uncertainty in projecting this performance characteristic several years out, and the lack of evidence that these cards require an exemption and cannot achieve the standards with the normal graphics adder (market data suggests they can per the AMD Fury X GPU), NRDC recommends the following exemption thresholds: – Tier 1 (Jan.1, 2019): 1 TB/s, for GDDRx memory only – Tier 2 (Jan 1, 2021): No exemption • NRDC agrees with ITI's proposal to align the tier 2 date for this GPU exemption with the tier 2 data for computer standards but only with the above revised exemption thresholds. Otherwise a one-year tier 2 delay with an	• As it is stated, there is no certain way to predict that the past frame buffer bandwidth (FBB) rate trend of one product will be held for all future products. Also, there is no measured data available for the GPUs with the projected FBB to know that the GPU adder is adequate for those products. However, the Commission has included a clause in its adoption order to monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the

		inappropriate exemption would further increase this loophole in the standards.	rulemaking. • Staff disagrees with aligning tier 2 GPU with tier-2 of computer standards in general because it will extend less stringent GPU tier-1 standards by 18 months. Also, see response to comment 3c.
5l	NRDC TN#214153	• CEC's proposal would provide a 100-point expandability allowance to computers with CPU support for a 256-bit memory interface. This is problematic for three reasons: – 1. First, the definition of memory interface is too vague and opens the door for unintended uses of this provision, such as cache memories. – 2. Second, these thresholds will likely be achieved on many products in the near future given new technologies such as HBM, Wide I/O and HMC. – 3. Third, memory interface width and channels are unrelated to expendability and should be managed through an adder if at all, rather than through an expandability allowance. • 256-bit memory already receives an adder through the HBM adder. While the commission proposal includes language to avoid "double-dipping," this language does not cover the memory interface. • NRDC proposal: Given that memory interface does not correlate with expandability, we	– 1. Cache memory is a smaller and faster memory than RAM and is typically placed closer to the CPU for the CPU to access the data faster than the data stored in the main memory (RAM). Because the real estate close to the CPU is constrained, the amount of Cache memory is much smaller than RAM memory. Therefore this criterion is used to exclude the cache memory from the scope of the high bandwidth system memory. High bandwidth system memory is used in two places in this regulation: first as part of criteria for a computer to be qualified as a high expandability computer and second in table V-8 for adders. In both places a requirement for a minimum amount of such memories is added. For the high expandability computer the minimum is set at 8 GB, while to qualify for the high bandwidth memory adder the minimum is 4GB. – 2. There is no certain way to predict the exact roadmap for the future products. Therefore, the Commission

		recommend that CEC eliminate the expandability allowance for 256-bit and 4-channel memory, and rely solely on the HBM adder instead.	has included a clause in its adoption order to monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking. – 3. There is no measured data available to determine an adequate adder for future technologies. Because these components are expensive they are expected inclusively for very high-end computers. Therefore, it is more reasonable to assign an expandability score to them than an adder.
5m	NRDC TN#214153	The enhanced performance display adders for integrated displays are too high per our comments on monitors. They should be adjusted consistently with our recommendation for monitors.	See responses to comments 5e and 5v through 5y.
5n	NRDC TN#214153	• "Other" Secondary Storage Adder: NRDC supports the IOUs analysis and recommendation docketed on May 23, 2016 that the allowance for 3.5-inch drives should be 12 kWh, or at most 17, instead of 26. But the biggest risk of loophole is the open-ended "Other" allowance of 26 kWh, given to any	• 3.5-inch drive's energy allowance is based on original investigation into each component's power consumption. The categorization system and its energy consumption allowances for the desktop computers were developed based on a

		type of secondary storage that doesn't meet existing storage types. • Intel's upcoming "Optane" storage devices could for example be considered Other. While we don't know the power consumption of these devices, it will most likely be much lower, and the setting of an appropriate allowance, if necessary, would be better managed through CEC's petition process rather than give a very large allowance that is not based on any power data for any specific technology. • NRDC proposal: Ideally 12 kWh for 3.5-inch and 0.5 kWh for "Other" secondary storage. 17 and 1 kWh would be reasonable compromises.	computer's dataset that used the original components' power consumptions in its calculations for the base energies. Adjusting the 3.5-inch drive's power would have to be followed by adjusting the energy allowance levels of desktop categories in order to maintain the energy equivalency. Therefore, it does not result in any additional energy savings. • The Energy consumption levels for the "Other" types of the secondary storage is set at the 3.5-inch drive's level in order to not limit future technology innovations for storage devices. The Commission's petition process works both ways and can be applied if a standard becomes a loophole.
5o	NRDC TN#214153	NRDC recommends that CEC set up a clear process to monitor the market and take action as necessary to preserve projected energy savings from potential loopholes. Scope: Give that it is impossible to predict which loopholes may develop, the scope of the process should be kept broad in order to give CEC flexibility to apply it as needed. It should apply in particular to: • Tier 1 and tier 2: tier 1 will be in effect until 2021, which is enough time for the market share of certain features to grow significantly and warrant reducing or eliminating an adder before tier 2. • All adders, expandability allowances, and	• The Energy Commission has included a clause, similar to NRDC's recommendation, in its adoption order for cases where an exclusive feature has a potential to become mainstream after the standards become effective. The Commission will monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features,

		exemptions, whether given to rare features, or to common features such as computer memory and integrated display. **Adders and exemptions in scope** **Computers** / **Monitors** **Adders** / **Adders** All adders in Table V-8 / All adders in Table V-5 Touch screen capability **Exemptions** / **Exemptions** High-expandability computers / Very high performance monitor Workstations **Expandability allowance** All interface types listed in Table V-1 • Market Monitoring: The market share of specific features of computers and monitors is not publicly available information and NRDC is not aware that such detailed information can even be obtained from industry analysts. Instead we recommend that CEC use product model information from its registration database as a proxy for market share. While model information may be different from sales, it is a commonly used proxy for policy purposes, such as by the ENERGY STAR program. • Trigger: For uncommon/emerging features, we recommend CEC sets the trigger threshold for opening a rulemaking at 20 percent of models registered in the database over the last 6 months. It is important to react early because of the rapid pace of evolution of the computer market, and the 18 to 24-month expected time lag between opening a rulemaking and the rule going into effect. For common features that get adders, such as	staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking. • The Commission has not set a predetermined trigger limit for the shift in technology; rather the determination is based on shifts in energy savings. Furthermore, there is no data to show how common each particular feature is right now. Therefore, it needs to be reviewed and decided based on the observation after the effective dates of these regulations.

		integrated displays and memory, if 75 percent of models registered in the database over the last 6 months pass without the adder or with a significantly reduced adder, CEC should reopen a rulemaking to assess the adder.	
5p	NRDC TN#214153	1. CEC's proposal goes in the right direction toward establishing cost-effective, performance-based energy efficiency standards for computer and monitors. 2. However, NRDC cannot support CEC's proposal as it currently stands because the extended compliance timelines and overly generous allowances and exemptions pose a high risk that projected energy savings and environmental, health, and financial benefits from the standards will not materialize. NRDC is confident CEC can address our concerns through limited and reasonable changes to CEC's proposal. We do not challenge the core components of the standards, such as categorization framework and base allowances. 3. The compliance timeline is unnecessarily long but we think it could still work and achieve the desired savings if the risk of major loopholes were minimized. We believe it is critical for CEC to take the following steps to reduce the risk of losing much of the expected savings through major loopholes due to the combination of extended timelines and overly generous allowances and exemptions. 4. Limit adders/exemptions: Reduce the risk of major loopholes by eliminating or adjusting unwarranted padding of allowances and exemptions criteria for tier 2 (2021), based on	1. Thank you for your supporting comment. 2. Please see responses to comments 5a through 5o for specific proposed changes and responses. 3. Please see response to comment 5b. 4. & 5. Please see responses to comments 5c through 5o.

<table>
<tr><td></td><td></td><td>actual power requirements, as detailed further down and summarized at the end of these comments.
5. Set up an off-ramp for allowance and exemption with clear thresholds: Set clear expectations, e.g. in the adoption resolution, that CEC will monitor the market and take action as necessary to preserve projected energy savings from the unexpected market growth of features that are uncommon today but could result in a major loss of savings if they became widespread.</td><td></td></tr>
<tr><td>5q</td><td>NRDC
TN#214153</td><td>“High expandability computer” means a computer with any of the following:
(1) An expandability score of more than 690;
(2) If the computer is manufactured before January 1, 2020, a power supply of 600 watts or greater and a discrete ~~or integrated~~ graphics with a frame buffer bandwidth of ~~400 gigabytes per second (GB/s)~~ 1 terabytes per second (TB/s) or greater.~~; or~~
~~(3) If the computer is manufactured on or after January 1, 2020, a power supply of 600 watts or greater and a discrete or integrated graphics with frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater.~~</td><td>See responses to comments 5h through 5k.</td></tr>
<tr><td>5r</td><td>NRDC
TN#214153</td><td>Table V-1 - Interface Types and Scores for Expandability Score Calculation
<table><tr><th>Interface Type</th><th>Interface Score</th></tr><tr><td>USB 2.0 or less</td><td>~~5~~ 2.5</td></tr><tr><td>USB 3.0 or 3.1 Gen 1</td><td>~~10~~ 4.5</td></tr><tr><td>Unconnected USB 2.0 motherboard header</td><td>~~10~~ 5 per header</td></tr><tr><td>Unconnected USB 3.0 or 3.1 Gen 1 motherboard</td><td>~~20~~ 10 per header</td></tr><tr><td>…</td><td></td></tr><tr><td>~~CPU Support for 4 channels of memory or a 256 bit or greater memory interface~~</td><td>~~100~~</td></tr></table></td><td>See response to comment 5g.</td></tr>
</table>

5s	NRDC TN#214153	Table V-8 – List of Potentially Applicable Adders *Function* / *Desktop Computer, Mobile Gaming System, and Thin Client Adder (kWh/yr)* / *Notebook Computers and Portable All-In-One Adder (kWh/yr)* Storage device other than primary storage device 3.5-inch Drive: ~~26~~ 12 2.5-inch Drive: 4.5 Solid-State Drive (SSD): 0.5 Solid-State Hybrid Drive (SSHD): 1.0 Other: ~~26~~ 0.5 per storage device Integrated Display Where: "d" is the diagonal measurement of the display in inches "r" is the megapixel resolution of the display "A" is the viewable screen area in square inches EP=0 for displays that are not enhanced performance displays For d≤20: (8.76*0.35*(1+EP)* [(4.2*r)+5.7])*0.8 For 20<d<23: (8.76*0.35*(1+EP)* [(4.2*r)+(0.02*A)+2.2])*0.8 For 23≤d<25: (8.76*0.35*(1+EP)* [(4.2*r)+(0.04*A)-2.4])*0.8 For 25≤d: (8.76*0.35*(1+EP)* [(4.2*r)+(0.07*A)-10.2])*0.8 Resolutions greater than 6 megapixels shall use 6 for r. On or after July 1, 2019: EP=~~0.3~~ 0.1 for displays with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors); and EP=~~0.75~~ 0.5 for displays with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors). On or after January 1, 2021: EP=~~0.2~~ 0 for displays with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors); and EP=~~0.6~~ 0.25 for displays with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors).	See responses to comment 5l and 5n.

5t	NRDC, TN #214153	Gaming monitors: CEC's proposed standard would give adders of 30% to 35% (tier 1) and 20% to 35% (tier 2) for monitors that can adjust their refresh rate to match that of the GPU, providing for smoother display of gaming action scenes. This adder is unwarranted for the following reasons: • The test method doesn't exercise the variable refresh rate functionality. The test method specifies the use of a test computer with fixed refresh rate. There is no processing to do by the monitor to adjust the refresh rate and therefore no reason for the monitor to draw more power than a standard monitor in a world of silicon-level power scaling.	The intent of the variable refresh rate description is to distinguish gaming monitors, which are a niche and high-end product, from more mainstream monitors. Monitors with a variable refresh rate are more costly and a smaller share of the market than other types of monitors. The Energy Commission intended to target its energy efficiency standards to address energy consumption in mainstream monitors, and to limit the growth in energy consumption from niche products, like gaming monitors. The allowances established for these products are based on currently available market and test data about the consumption from gaming monitors. In addition, the Energy Commission reviewed available data and determined that a lower allowance for gaming monitors with incremental hardware-based assistance in tier 2 was warranted to drive further technically feasible and cost-effective efficiencies in these products.
5u	NRDC, TN #214153	• A majority of gaming monitors currently on the market already complies with no adder. NRDC analyzed the ENERGY STAR version 6 qualified products list (QPL), cross-referencing with lists of monitors that support FreeSync and Gsync technologies. ENERGY STAR v6 had over 90 percent penetration rate by July 2016 and is therefore representative of the entire market. We found that 73% of Gsync and 57% FreeSync	NRDC's assertion that most gaming monitors already comply misinterprets the available ENERGY STAR data because the certified models represent only a few of the total gaming monitors available on the market. The energy savings generated by this category of product is very small as there are few products and the market size is small. Industry pointed out the

		monitors on the market today already comply with CEC proposed levels <u>with no adder</u>. This demonstrates that gaming monitors need no adder today, and certainly not 2.5 years and 4 years after standards adoption. NRDC recommends eliminating the gaming monitor adder for both Tier 1 and Tier 2. But given the shorter timeline, we could accept a reduced 10% adder for Tier 1 as a reasonable compromise.	burden of meeting the stringent energy standards will adversely affect product availability. As a result, the Energy Commission focused on driving energy savings from more mainstream monitors and setting allowance levels for gaming monitors that would prevent these products from significantly increasing energy consumption beyond what is consumed today. In addition, the Energy Commission will conduct rigorous market monitoring of all monitor types, including what are currently niche products like gaming monitors, through reporting to the Modernized Appliance Efficiency Database System (MAEDBS). The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.
5v	NRDC, TN #214153	<u>Enhanced Performance Displays (EPD) Adder:</u> CEC's proposal would give adders ranging from 20 to 75% to enhanced-performance displays. While there are few such displays currently on the market, NRDC's analysis shows that 63% of sRGB, and 48% of Adobe-RGB ENERGY-STAR v6-qualified EPDs already achieve CEC's tier 2 levels today (with proposed adders), and 100% of ENERGY STAR v7-qualified Adobe-RGB EPDs pass CEC tier2. This gives a strong indication that in 4.5 years from now, most or all would qualify without any power optimizations.	While NRDC correctly points out that 63% of sRGB and 48% Adobe RGB monitors that are certified to ENERGY STAR meet the ENERGY STAR v.6.0 specification, this does not properly interpret the available data because these models represent only a small portion of the total EPD market – many EPDs are not certified to ENERGY STAR. Industry pointed out that the burden of meeting the stringent energy standards will adversely affect the product availability. As a result,

			the Energy Commission focused on driving energy savings from more mainstream monitors and setting allowance levels for EPDs that would prevent these products from significantly increasing energy consumption beyond what is consumed today. In addition, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market share and may significantly reduce the energy savings projected during this rulemaking.
5w	NRDC, TN #214153	CEC proposed adders are much higher than ENERGY STAR v7: According to analysis by the Northwest Energy Efficiency Alliance (NEEA), the ENERGY STAR v7 adders of 15% and 65% are applied after subtracting the resolution component of TEC, whereas CEC's proposal applies to total system power. Applying the ENERGY STAR adders using CEC's approach would result in adders of roughly 9% for sRGB (vs. 30% tier 1 and 20% tier 2 for CEC), and 37% for Adobe-RGB (vs. 75% tier 1 and 60% tier 2 for CEC), less than half the values proposed by CEC. [Table of ENERGY STAR v.7.0 EPD adders omitted.]	The Energy Commission did not intend to align its adders for EPDs with ENERGY STAR version 7.0.[1] First, the number of total EPDs in the market that meet ENERGY STAR v.7.0 is unknown, and likely small. While the goal of the Energy Commission is to set efficiency standards, it chose to do this by driving efficiency improvements in mainstream monitors, and simply setting maximum levels for niche products, like EPDs, to avoid an increase in the energy consumption of these products over the baseline today. ENERGY STAR v.7.0 represents only the top

[1] Singh, Harinder, Soheila Pasha, Ken Rider. 2016. Final Staff Analysis of Computers, Computer Monitors, and Signage Displays. California Energy Commission. Publication Number: CEC-400-2016-016, at pp. 79-80. Available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548_20160909T092318__2016_Appliance_Efficiency_Rulemaking_Docket_Number_16AAER02Sta.pdf.

			of the market for efficiency for EPDs, so aligning with ENERGY STAR v.7.0 for EPDs would not match the policy approach taken by the Energy Commission to achieve energy savings in these products overall.
5x	NRDC, TN #214153	EPDs are likely to become much more common: Display technology has historically evolved toward higher quality (resolution, color gamut, contrast), while using the same or less energy. As technology evolves, the EPD criteria are become relatively easier to achieve and we can expect EPDs to become more common, while using less energy. The currently proposed adders constitute a very large potential loophole in the standards.	NRDC asserts that display technology has historically evolved toward higher quality (resolution, color gamut, contrast), while using the same or less energy, but does not present any data to support this assertion. The Energy Commission relied on market projections and assessments of the current monitor market in developing its standards and assessing the distinctions between mainstream monitors and niche or small-volume monitor types. This data showed that while EPDs would grow somewhat in market share, it was not likely to become mainstream due to the high cost of the product and the limited need for the added functionality of a wide color gamut.[2] Therefore, the Energy Commission did not modify the adders in response to this comment.
5y	NRDC, TN #214153	NEEA market research has revealed the following publicly posted wide color gamut (WCG) research summary by IHS: *According to the IHS Wide Color Gamut Market Tracker, aside from OLED and quantum dot (QD),*	The Energy Commission disagrees with the NRDC's comment because there is limited data to support the comment. While the NEEA market research projected one direction for EPDs, the information provided by manufacturers suggests that EPDs are

[2] Singh, Harinder, Soheila Pasha, Ken Rider. 2016. Final Staff Analysis of Computers, Computer Monitors, and Signage Displays. California Energy Commission. Publication Number: CEC-400-2016-016, at pp. 70-71. Available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548_20160909T092318__2016_Appliance_Efficiency_Rulemaking_Docket_Number_16AAER02Sta.pdf.

		technologies like light-emitting diode (LED)—LED packages and color filters—have been improved by panel makers. LED solutions are still deemed the most competitive wide color gamut technology in terms of production cost. LED TVs have failed to attract the attention of consumers in the past, probably because of high prices and low interest in color reproduction. *Nowadays, however, phosphors with high purity and high performance are being applied to mass-produced products, and considerable improvements have been made in terms of color reproduction. Therefore, there has been growing adoption of LED solutions in the mid-range TV, monitor, and notebook PC market where price competition is especially fierce.* *Furthermore, along with wide color gamut solutions, high dynamic range (HDR) technology began to be used as a selling point in the TV market in 2015, receiving favorable responses from consumers. The growing attention to new technologies like HDR will also likely contribute to the expansion of the wide color gamut display market.* *Simply put, driven by three factors—improved understanding among consumers, enhanced technologies such as OLED and QD, and marketing campaigns focusing on premium displays— the wide color gamut display market is forecast to grow steadily. The share of wide color gamut displays hovered around 3% in 2015, but it is projected to be*	unlikely to enter the mainstream market due to the higher cost to produce monitors with wide color gamut and the limited need or utility of such features outside of a small segment of the market.[3] For example, a typical office setting does not require a monitor with a wide color gamut. As a result, the Energy Commission determined to provide allowances for EPDs that would limit their energy consumption going forward while demanding improved efficiency from monitors that are mainstream today. Nonetheless, the Energy Commission is committed to conducting rigorous market monitoring of gaming monitors through reporting to the MAEDBS and analyzing the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.

[3] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, pages 8-9.

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<td>27% of the total display market in 2021. Wide color gamut technology will become a key requirement in the high-end display market.
[Charts showing marketshare of wide color gamut monitors omitted]

Research by NEEA shows that the three monitors #1, 2, 18 in Tables 1 and 2 [see comment for tables] below cost less than $450—compared to $100-150 price range for volume LCD monitors—and two of them offer 99% of the Adobe RGB color space. There is still a significant price gap between WCG and volume displays, but WCG prices have fallen well below the four figure price tags for yesterday's professional displays with WCG and are approaching the price range which would allow them to go main stream.

NRDC proposal: In the tier 2 timeframe, we think it is really important to give no adder to sRGB EPDs, and a much more limited adder to Adobe-RGB EPDs. In the tier 1 timeframe, we are open to adders more in line with ENERGY STAR v7 adders as proposed below:
<table>
<tr><th></th><th>EPD with 32.9% of CIELUV(sRGB)</th><th>EPD with 38.4% of CIELUV (Adobe RGB)</th></tr>
<tr><td>Tier 1</td><td>10%</td><td>50%</td></tr>
<tr><td>Tier 2</td><td>0%</td><td>25%</td></tr>
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<td></td>
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<tr>
<td>5z</td>
<td>NRDC, TN #214153</td>
<td><u>Very High Performance Monitors Exemption:</u> CEC's proposal would exempt monitors that meet all of the following criteria:
• Diagonal size greater than 27-in
• Resolution greater than 3840x2160 pixels or 8.2 MP (4K)</td>
<td>The Energy Commission disagrees with the NRDC's comment. NRDC attempts to break apart the criteria and show that the market is already significant for each separate criterion instead of all of the criteria together. Very high performance monitors</td>
</tr>
</table>

		• Color space greater than 99% Adobe-RGB or DCI-P3 NRDC is not opposed to an exemption for the truly very high-performance products, but the proposed criteria are not a very high-bar and will likely cover a significant share of the market by 2019 and 2021: 1. Diagonal size greater than 27-in: 20 percent of ENERGY STAR v7-qualified monitors already meet this requirement today [chart omitted] 2. Resolution greater than 3840x2160 pixels or 8.2 MP: this is equivalent to 4K, which is rapidly becoming the new standard in the market and will be by 2019. With just 3 more inches diagonal size, the 4k monitor in Tables 1 and 2 above—the Dell P2415Q—would qualify for this exemption, and at $350 it is priced for volume sales. 3. Color space greater than 99% Adobe-RGB or DCI-P3: as discussed in the previous section on EPDs, historical technology trends suggest this will no longer be a high bar by 2019, and definitely by 2021. It is possible that low cost WCG twisted nematic (TN) displays popular with gamers for their wide color gamut will qualify for this exemption. Walmart offers a 22 inch, 2.1 megapixel TN. display with 99% Adobe RGB for $90 (Model E2280SWDN). TN displays have poor off-angle viewing, so the application of the off-angle contrast requirement used in the definition of EPDs would mitigate the risk of low cost, volume TN displays qualifying for this exemption.	must meet all of the criteria to qualify for the exemption, making it a higher bar than NRDC suggests. In addition, some of NRDC's comments reflect disagreement with the Energy Commission about what the future market might look like for certain characteristics, such as EPDs. The rulemaking record demonstrates that very high-performance monitors meeting these criteria are likely to continue to be a very small part of the market given their high cost and the limited applications where such features are worth the higher cost.[4] Nonetheless, the Energy Commission will conduct rigorous market monitoring of very high performance monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.

[4] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, page 8.

		In addition, monitors larger than 30-inch are already getting a very lenient limit equivalent to ENERGY STAR v6, rather than ENERGY STAR v7, they should be able to meet this limit easily. The proposed exemption is more justified for 27- to 30-inch monitors due to the higher stringency of proposed standards (ENERGY STAR v7-equivalent levels), and as a short-term measure (tier 1 only, not tier 2) to give manufacturers time to reengineer their products. NRDC proposal: Limit the exemption to tier 1, eliminate it for tier 2. And add the following off-angle contrast requirement: A contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85º, with or without a screen cover glass. This would significant[ly] reduce the risk of too many monitors getting exempted. While NRDC opposes a very high performance exemption in tier 2 as currently defined, if there must be one, it should be more selective than currently defined in order to limit the risk of savings loss. At a minimum the threshold should be raised to 30-inch diagonal size, and the contrast ratio and viewing angle requirements added for both Tier 1 and Tier 2.	
5aa	NRDC, TN #214153	<u>Curved Monitors Adder:</u> CEC's proposed standard would give adders of 30% (tier 1) and 20% (tier 2) for curved monitors. Curved monitors could become relatively common for large size monitors: NRDC found 24 models on just two online retail sites (Amazon and BestBuy),	The Energy Commission disagrees with the NRDC's comment because there is little data to support the NRDC's position. NRDC and the Energy Commission disagree on the projected market for specialty monitor types, such as curved monitors. NRDC

		half of them in the 33-36 inch size range, and another 30 percent of them in 27-30 inch size range. 10 of these 24 models (42%) qualified for ENERGY STAR version 6, 8 of them (33%) could meet CEC proposed levels without an adder. If one third can already meet levels without an adder, we can expect that many more will by 2019 and 2021. From a technology perspective, curved monitors are no less efficient than flat ones: they use a curved light guide plate which emits light perpendicular to its surface, just as a flat one does. The 8 existing curved monitors that meet CEC levels without an adder are a demonstration of their technical feasibility. NRDC recommends CEC provides no adder for curved monitors in Tier 2, and potentially a reduced 10% adder for Tier 1 although current data suggests this is not necessary.	projects that it will grow, and that it therefore should be treated as a "mainstream" monitor subject to stringent standards. The Energy Commission, based on data in the rulemaking record, finds that curved monitors are a niche product and therefore should be subject to less stringent standards to ensure that manufacturers focus on improving the efficiency of mainstream products. Nonetheless, the Energy Commission will conduct rigorous market monitoring of curved monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market share and may significantly reduce the energy savings projected during this rulemaking.
5ab	NRDC, TN #214153	Touch Screen Capability Adder: CEC's proposal would give monitors with touch screen capability an additional 1 watt allowance per mode in on, sleep, and off modes. NRDC is not opposed to this allowance in modes where the touch functionality is enabled, but there is no reason to give it to off and sleep modes if the functionality is not enabled in those modes. NRDC proposal: apply the 1 W extra allowance only to modes where touch functions are available.	The Energy Commission made this change in 15-day language.
5ac	NRDC, TN	Cumulative Adders (Adder Stacking): CEC proposed	NRDC argues that the monitor allowances

	#214153	that no more than one adder can be applied per unit. Industry requested that adders can be cumulated across certain categories. While NRDC supports this proposal in principle, it only works in practice if adders are right-sized. When adders are higher than warranted (as they currently are in CEC's proposal per these comments), or become higher than warranted over time as manufacturers optimize the energy efficiency of emerging features, then a monitor could end up with a power allowance of 3x (1.75 for EPD * 1.30 for gaming * 1.30 for curved + 1 watt for touch) which is far higher than is actually required for these monitors. NRDC proposal: NRDC would agree with cumulative adders only if they were right-sized, and mostly sunset for tier 2, as recommended in these comments.	should not be additive because the allowances are too high. However, NRDC does agree with the concept of adding allowances together where, as here, additional features would ordinarily require more power. NRDC appears, then, to disagree with the allowance levels for monitors generally, whether separate or added together. The Energy Commission disagrees that the allowances, whether individual or added together, are too high, as the allowances were established based on substantial evidence in that record that the levels are necessary to allow the continued sale of these niche, high-end products after the standards take effect. Each individual allowance is based on data from ENERGY STAR that shows what is necessary for each type of monitor to comply today, so that energy consumption does not increase from these products, but allowing manufacturers to focus efficiency improvements on mainstream monitors that have a larger share of the market and therefore will provide more energy savings. As each feature for which the Energy Commission provided an allowance would separately require power draw to operate, it conceptually makes sense to add these allowances together for monitors with multiple features. Reducing these allowances or eliminating the ability to add them together would instead force manufacturers to make efficiency improvements to these

<table>
<tr><td></td><td></td><td></td><td>products in tier 2, raising the costs of complying with the standard, or prevent these low-volume products from being sold in California at all. Neither of these results is the intent of the standards. Therefore, the Energy Commission did not make the suggested changes.</td></tr>
<tr><td>5ad</td><td>NRDC, TN #214153</td><td><u>Testing of Exempted Products:</u> In the October 10, 2016 public meeting, industry proposed that “Exempted Computer Monitors should not be required to test and report power consumption information (no value add)”. NRDC strongly disagrees: testing and reporting power draw is important to enable CEC to monitor the market, evaluate if the exemptions are still needed, and adjust the standards as needed. It helps provide valuable comprehensive market information as well as with enforcement. If the exemptions only apply to a very small portion of the market as intended, this should not constitute a significant burden for industry, and the policy benefits clearly outweigh the small burden on industry.</td><td>The Energy Commission agrees with the NRDC that testing of products will help track the energy consumption of products that are not required to meet the standard. The Energy Commission has only exempted a very limited class of products – medical monitors – from testing but continues to require that the model numbers be certified to get a sense of the size of the market. No change is necessary in response to this comment.</td></tr>
<tr><td>5ae</td><td>NRDC, TN #214153</td><td>Monitors, Table V-5 – List of Potentially Applicable Adders [proposed changes in red underline & strikeout]

<table><tr><th>Computer Monitor Type</th><th>Tier 1</th><th>Tier 2</th></tr><tr><td>EPD with color gamut ≥ 32.9% of CIELUV</td><td><s>1.30</s> <u>1.10</u></td><td><s>1.20</s></td></tr><tr><td>EPD with color gamut ≥ 38.4% of</td><td><s>1.75</s> <u>1.50</u></td><td><s>1.60</s> <u>1.25</u></td></tr></table></td><td>The Energy Commission disagrees with reducing the allowances to the levels suggested by NRDC, as these levels are not supported by substantial evidence to allow the continued sale of these niche, high-end products after the standards take effect. Each allowance is based on data from ENERGY STAR that shows what is necessary for these monitors to comply today, so that energy consumption does not increase from these products, but allowing manufacturers</td></tr>
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<tr><td>CIELUV</td><td></td><td></td></tr>
<tr><td>Gaming Monitors ~~without incremental hardware-based assistance~~</td><td>~~1.30~~ 1.1</td><td>~~1.20~~</td></tr>
<tr><td>~~Gaming Monitors with incremental hardware-based assistance~~</td><td>~~1.35~~</td><td>~~1.35~~</td></tr>
<tr><td>Curved Monitors</td><td>~~1.30~~ 1.10</td><td>~~1.20~~</td></tr>
</table>
</td>
<td>to focus efficiency improvements on mainstream monitors that have a larger share of the market and therefore will provide more energy savings. The NRDC's proposed allowances would instead force manufacturers to make efficiency improvements to these products in tier 2, raising the costs of complying with the standard, or prevent these low-volume products from being sold in California. Neither of these results is the intent of the standards. Therefore, the Energy Commission did not make the suggested changes.</td>
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<td>5af</td>
<td>NRDC, TN #214153</td>
<td>(4) Computer monitors. Computer monitors manufactured on or after July 1, 2019, shall comply with all of the following:
A. Comply with the maximum on-mode standards in Table V-4.
B. Comply with at least one of the following requirements:
1. Consume less than or equal to 0.7 watt in sleep mode and less than or equal to 0.5 watt in off mode; or
2. Consume less than or equal to 1.2 watts in sleep mode and off mode power combined.
(C) Be shipped with a screen luminance less than or equal to 200 cd/m2 ± 35 percent. A manufacturer may ship with additional features enabled, even if they were turned off in testing.
(D) Computer monitors with touch screen capability are allowed an additional 1 watt allowance per mode in ~~on, sleep, and off~~ modes where the touch functionality is enabled.</td>
<td>The Energy Commission made the recommended change in 15-day language.</td>
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5ag	NRDC, TN #214153	"Very high performance monitors" means a computer monitor that meets all of the following criteria: (1) Has a diagonal screen size of between 27 and 30 inches ~~or greater~~; (2) Has a resolution equal to or greater than either 3840x2160 pixels or 8.2 Megapixels; and (3) (3) Has a color space greater than 99 percent of defined AdobeRGB color or greater than 99 percent of Digital Cinema Initiative (DCI)-P3 colors; (4) Has a contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85°, with or without a screen cover glass.	The Energy Commission disagrees with limiting the diagonal screen size to 30 inches, as a very high performance monitor that meets the remaining criteria should be exempted from the energy consumption targets in the regulations as they are a very small share of the market. NRDC's proposed limitation would virtually eliminate the exemption for these products, many of which are very large in screen size to serve the needs of the film and engineering industries. However, the Energy Commission agrees that adding a contrast ratio and viewing angle limitation better describes these products and has therefore made that change in 15-day language.
5ah	NRDC, TN #214153	1605.3 (v) (4) (F) EXCEPTIONS to Section 1605.3(v)(4): The following computer monitors are not required to comply with Section 1605.3(v)(4) but shall comply with the test procedures in Section 1604(v)(4), the certification requirements in Section 1606, and the marking requirements in Section 1607: 1. KVMs. 2. KMMs. 3. Computer monitors that are classified for use as medical devices by the United States Food and Drug Administration. 4. Very high performance monitors before January 1, 2021.	The intent of this proposed change is to eliminate the exemption for very high performance monitors in tier 2. NRDC has not provided any data or evidence demonstrating that these types of monitors can meet the energy efficiency levels for other types of monitors, nor that doing so will save a significant amount of energy rather than simply eliminating these products from the market. Therefore, the Energy Commission proposes to continue the exemption in tier 2 but will monitor the market through MAEDBS certifications to determine if the exemption has become a loophole for mainstream products. If this happens, the Energy Commission may reopen a rulemaking to consider standard

			levels for very high performance monitors.
6a	SMART, TN #214160	SMART Technologies strongly supports the California Energy Commission's (CEC's) Appliance Efficiency Rulemaking for Computers, Computer Monitors and Signage Displays. The intent and overall approach are solid and the legislation will make a very real contribution to achieving the state's carbon reduction goals.	This comment supports the standards and does not request changes to the standards.
6b	SMART, TN #214160	Under ENERGY STAR® for Displays 7.0, this category [for signage displays] covers information displays in airports and kiosks in malls. It also covers large interactive flat panels (IFPs) used in classrooms and conference rooms. These differ from televisions in several significant ways. First, signage displays are usually brighter than home televisions. Televisions are frequently used in darkened rooms. Airports, malls, classrooms and boardrooms are much brighter and the display must also be brighter to be visible. An IFP luminance of 300 nits (candela/m^2) is common. With respect to On consumption, SMART commends the CEC for its simple On power equation that is a direct function of the area. We observe, though, that IFPs with a 300 nit luminance can meet the numbers. Therefore, there may be an opportunity to reduce the allowed maximum for dimmer televisions. This could be done by adding luminance into the maximum calculation as is done by ENERGY STAR.	The purpose of including the signage display in this proceeding was to clarify the definition of signage displays. Signage displays are currently covered under television regulations. This clarification was necessary to ensure effective enforcement of signage display and television standards. SMART recommends a change to the regulations for televisions by adding luminance into the maximum calculation. While this may save energy, the television efficiency standards are outside the scope of this rulemaking. Therefore, no change is recommended.
6c	SMART, TN # 214160	Second, IFP use is centered around touch. The touch circuitry requires much less power than the display but it is not zero. The current draft allows 1W for	This comment suggests a change to the standard for televisions, which are outside the scope of this rulemaking. Therefore, no

		computer monitors, but nothing for signage displays which require significantly more power for touch because of their much larger size. For consistency, if there is an On touch allowance for computer monitors, there should be one for signage displays. That said, the basic On power mode is achievable without the allowance.	change was made in response to this comment.
6d	SMART, TN # 214160	Third, IFPs may be networked and may have wake-on-touch or wake-on-proximity technology. ENERGY STAR for Displays 7.0 recognizes the differences between televisions, monitors and signage displays and provides the following adders for Sleep (Standby) mode: By contrast, the current draft allows 3.0W in Standby-passive mode. The first large (>61") interactive flat panel signage displays to be certified under ENERGY STAR for Displays 7.0 are SMART Technologies', so we deeply understand what is required to achieve certification. In our experience, 3.0W is very generous—perhaps overly generous—for a display without the listed adders, although achievable with both wake on touch and wake on proximity. An IFP with all three adders would be allowed 5.3W under ENERGY STAR, which only the top ~20% of products are expected to win. It is difficult to see how every IFP can be expected to draw at 57% of this best-in-class power in Standby. To properly reflect functionality, the base Standby-passive allowance should be reduced (perhaps to 1W) and adders for the functionalities listed above should be incorporated. The NRDC has made some good observations about stacking adders for monitors, but those comments	This comment suggests a change to the standard for televisions, which are outside the scope of this rulemaking. Therefore, no change was made in response to this comment.

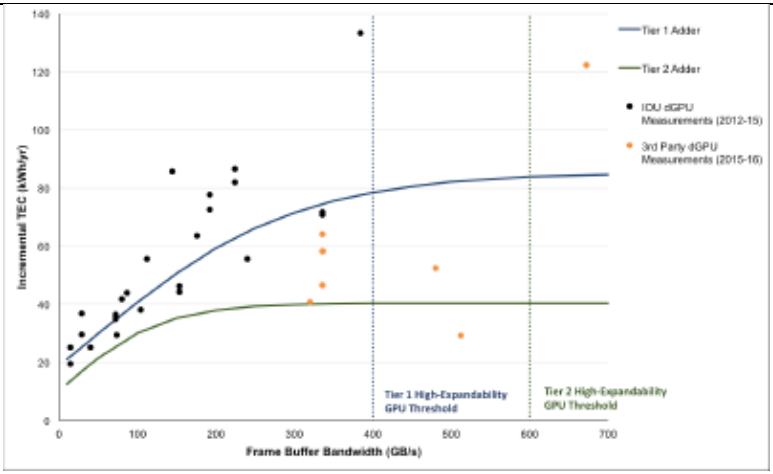
		don't apply to the above table—each functionality really does require the power listed above. SMART appreciates this opportunity to provide feedback. We hope that our practical experience with certifying the first large interactive flat panels under ENERGY STAR will help CEC adopt standards that are both stringent and achievable.	
7a	Christopher Price on behalf of Console Enterprises TN#214157	• The Small Volume Manufacturer exemption's device cap is arbitrary, and prohibitively low. With a 40 device cap, the very startup model that built Silicon Valley in California, will have a major compliance and remediation incentive to leave the state. • A per-device cap also can impact new device types that may be subject to this rule, but are relatively inexpensive such as devices branded as "PCs" that have been sold for as little as $9 publicly. • The small PC retailers that build their own machines, will now have to possibly retest each and every custom-built machine sold over their 40th unit cap. These rules would be imposed on a very small business selling as few as four PCs per month, possibly even less. • While ITI has noted the testing cost is approximately $600 per product, this is not a comprehensive cost estimate in our view. It first does not include the real-world costs to initiate testing, both in-house and to source, and contract with a testing firm. Further, it also fails to take into account remediation costs if a small business is already manufacturing a device, or has to change	• The cap on the number of computers of the same basic model that qualify for specific exemptions for small volume manufacturers is based on a calculation that balances an average cost of compliance test with the energy cost savings. In order to avoid significant impacts to small businesses, the following changes have been made: – The cap on the number of basic models is increased from 40 to 50. – The cap is removed for small-scale servers and notebooks. • No specific model is provided and staff was not able to find $9 personal computers in the market to verify whether they are in the scope of the standards. • Small volume manufacturers are required to test the computers and fully comply if they build more than 50 units of the same "basic model". That means desktop and workstation

		production/design plans as a result of issues determined in testing - those costs could easily bankrupt a small startup, particularly one that operates without venture backing.	computers that have the same chassis, power supply, motherboard, and expandability score. Because small manufacturers custom-build the systems, they typically manufacture more variety than one basic model. • No estimate has been presented to support the comment about the testing and its overhead costs. The cost of remediation is accounted for in the incremental cost estimates.
7b	Christopher Price on behalf of Console Enterprises TN#214157	We also encourage the Energy Commission to be broad in its exemption list, and include major fields of products such as Virtual Reality and products that utilize 3D cameras. This will further help ensure that startups can continue to innovate, without impossible regulatory burdens that no small startup, lacking venture backing, could comply with.	Broad exemptions create loopholes that can erase the efficiency gains of appliance standards. Nonetheless, the Commission has taken steps to create narrow exemptions and ensure that the standards do not stifle innovation. For example, desktop computers receive expandability score for most of their features and ports. If a computer is highly specialized with advanced features that shift its expandability score above 690, it will be subject to ”high expandability computer” standards that have fewer requirements than those for typical desktops. If it is not qualified for the “high expandability computer” category, it will receive adequate power consumption allowances through placement in an appropriate computer category and adders.
8a	ASAP, NEEP, ACEEE TN#214158	The large and cost-effective potential savings from CEC computer and display standards promise both energy bill savings for consumers and businesses and significant environmental benefits.	Thank you for your comment.

8b	ASAP, NEEP, ACEEE TN#214158	• We are concerned that allowances and exemptions in the proposed standards create a significant risk to the projected energy savings from future changes in both computer and monitor technologies and changes in the relative popularity of these products. Computer and monitor energy efficiency is challenging to address through minimum efficiency standards because the technologies evolve so rapidly that it is difficult to project what products and features will dominate in the market place over the length of the relevant standards cycle. • CEC should limit the proposed functional allowances and exemptions and number of categories for computers and monitors, and support the comments of NRDC in this regard. • We strongly recommend that the CEC add market tracking and regulatory response mechanisms to the proposed standards. We particularly support the concept of a "post-adoption off-ramp." Building market monitoring and regulatory triggers into minimum energy efficiency standards is a proven way to make standards more relevant to rapidly changing technologies.	Allowances and exemptions to the standards are necessary to ensure that the standards are flexible enough to adapt to a changing market and do not stifle new innovative technologies, while stringent enough to drive efficiency improvements in computers and monitors. The allowances and exemptions are based on substantial evidence in the record and numerous public meetings. On specific recommendations from NRDC, please see the response to those comments. Staff agrees that semiconductor and computer technologies are rapidly evolving and it is difficult to predict the full extent of future shifts in products and features. Therefore, the Commission has included a clause in its adoption order for cases where an exclusive feature has a potential to become mainstream after the standards become effective. The Commission will monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking.

9a	California Investor Owned Utilities TN#214159	• The CASE team generally supports the energy efficiency standards for computers proposed by the CEC. We support CEC's cost-effective and feasible base allowances and expandability adder levels for desktops and thin clients, discrete graphics adder levels, as well as the power supply and power management requirements for workstations and small-scale servers. • The CASE team also recommends important modifications with supporting analysis in order to ensure the forecasted energy savings are achieved.	Thank you for your supportive comment. No change is proposed in this comment. For detailed responses to the proposed modifications and their respective analysis, please refer to the subsequent comments and responses.
9b	California Investor Owned Utilities TN#214159	• GPU definitions and exemption criteria for the high expandability computers need to be tightened to eliminate potential loopholes: – This exemption should be for discrete graphics only. The intent was to recognize the need for additional power draw for computers with the expanded functionality, in this case the discrete graphics card. IOUs don't support including separate system memory bandwidth limits for integrated graphics products as part of this exemption. There is no data to support the inclusion of the integrated GPU as part of this exemption. To the contrary, industry's new architects, such as Gen-Z consortium, provide means to include high bandwidth memory solutions into computer architectures that minimizes data movement, reduces power consumption, reduces latency, and increases data access parallelism. This	High expandability computers are desk top computers that are beyond and above mainstream and support a large number of specialty functions and features. One way to be qualified as a high expandability computer is to have high-end graphics along with a high-power power supply. Other mainstream graphics, either integrated or discrete, earn appropriate adders. Features that define a high expandability computer are determined based on their cutting edge technology and exclusivity. This means that there is a lack of sufficient data to determine an adequate adder for them. Although the stated examples demonstrate the recent innovations of the integrated graphics, they are very new (some of them are not in the market yet) and therefore there is not enough data to support a reasonable conclusion. Moreover, they are currently too expensive to be implemented for typical

		translates into, as an example, low-cost HBM at 200 GB/s per stack with a likely minimum of 2 stacks, being mainstream products that will easily meet the thresholds for exemption of 400 GB/s by, if not before 2019. Additionally, examples of discrete graphics with HBM, such as the Radeon R9 Fury X and Titan X Maxwell, shows that it results in enhancement of the performance and reduction in idle power draw. Similarly, integrated graphics with HBM are expected to draw less power than traditional integrated graphics. Moreover, additional current technological advantages of the integrated graphics over discrete graphics, such as multiplane overlay (MPO), duty cycle control, and panel self-refresh, further justifies that no exemption should be granted due to integrated graphics.	computers and we cannot precisely predict the curve of their market adoption. However, the Commission has included a clause in its adoption order for such cases where an exclusive feature has a potential to become mainstream after the standards become effective. The Commission will monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking.
9c	California Investor Owned Utilities TN#214159	• Increase high expandability computer discrete GPU thresholds from 400 and 600 GB/s to 800 and 1,200 GB/s, respectively. - Recent third-party measurements (attached figure-1) indicate that today's highest bandwidth GPUs can already easily be accommodated by CEC's proposed GPU adders. Figure 1: Desktop dGPU Dataset, Adders and FBB Exemption Thresholds	-Figure 1 contains a large number of data points for frame buffer speeds below 400 GB/s and therefore justifies the Commission's approach to calculate an appropriate adder for the discrete GPUs that fall into this range. However, the same plot shows only two data points between 400GB/s and 600 GB/s and one above 600 GB/s with no consistent trend to draw a reasonable conclusion as to what the appropriate adder should be for those ranges. This further justifies Commission's approach to include GPU speed above the aforementioned ranges as part of the criteria for high expandability exemption. However,

		 - A step change in GPU frame buffer bandwidth (FBB) is rapidly approaching due to the advent of GDDR5x and high bandwidth memory (HBM) as well as growing interest in GPU intensive applications like virtual reality (VR). CEC's GPU thresholds may be outdated by the time of the standard as a result. As VR undergoes dramatic growth prior to the standard's adoption —with annual VR headset shipments expected to eclipse 100 million units by 2020 — GPU vendors and memory suppliers will prepare to push increasingly high-bandwidth products. Samsung is already producing second-generation HBM products (HBM2), enabling discrete GPUs with 1,024 GB/s of FBB. The company plans to double achievable memory densities in the next year, increasing potential FBBs to 2,048 GB/s. Recent memory forecasts released by Samsung estimate that the mainstream GPU market will support FBBs in the range of 725 GB/s by the time CEC's standard would go into effect in 2019. This is	the Commission has included a clause in its adoption order for such cases where an exclusive feature has a potential to become mainstream after the standards become effective. The Commission will monitor the market for shifts in technology or feature that were not expected at the time of the rulemaking and that could impact the energy savings expected from this rulemaking. If there is a shift toward one of those products or features, staff will consider proposing changes to the standards that will prevent those market changes from significantly reducing the overall energy savings projected in the rulemaking. Furthermore, high expandability computers are not completely exempted from the standards; they rather have prescriptive requirements for more efficient power supply and Ethernet as well as power management requirements. Such requirements are determined to significantly improve the efficiency of a computer.

		80% above the proposed 400 GB/s threshold. The high-end GPU market would support approximately 1,000 GB/s, which is 150% above the proposed threshold of the Tier 1 exemption. - Regarding costs, although the first generation of GPUs integrating higher bandwidth memory will come at a price premium, they will quickly drop in price and become tomorrow's mainstream cards. NVIDIA's discrete GPU cards: Titan X, GTX 980, GTX 1070, and GTX1080 are examples of improved performance and reduced cost year over year. Another example, the AMD Radeon Fury X has a FBB of 512 GB/s which is very close to the Tier 2 threshold today and is priced at $389. Based on IOUs' tracking of products tested in 2010-2012, where prices dropped on average 15% per year, the price would be ~$230 by 2020, slightly above the upper range of "midrange, mainstream" cards and lower than the range of the "enthusiast" cards, and significantly below the range for the "high-end" cards, according to Priceonomics.com. For the reasons above, we recommend that CEC double its current GPU thresholds from 400 to 800 GB/s (until January 2020) and from 600 to 1,200 GB/s (after January 2020). We have illustrated our proposal in Figure 2 with Samsung's memory market forecast plotted alongside. The proposed thresholds are still expected to exclude the high-end GPU market segment, allowing the latest, highest bandwidth cards to clear the GPU requirements for the high expandability computer exemption.	

9d	California Investor Owned Utilities TN#214159	Tighten definitions for discrete and integrated graphics as well as frame buffer bandwidth to ensure that next-generation integrated graphics cannot erroneously be counted as discrete graphics. 1. Discrete and integrated graphics: CEC currently defines a discrete GPU based on the presence of two key components: a local memory controller and dedicated graphics memory. This definition is sufficiently vague that it could allow future integrated GPUs (for example, AMD's Zen processors) with these attributes to be treated as discrete GPUs and earn the associated adder, weakening the standard for mainstream computers. We suggest modifications to the discrete GPU definition, integrated graphics for clarity, and the GPU to simplify its definition and to remove confusion. we suggest the following modifications to the discrete GPU definition: "Discrete Graphics" or "Discrete Graphics GPU" means ~~a graphics processing unit (GPU)~~ a discrete hardware component containing one or more graphics processing units (GPUs) with a local memory controller interface and local graphics-specific memory. Discrete GPUs are not packaged on the same die or substrate as the CPU. 2. A small and related adjustment to the integrated graphics definition is required for clarity: "Integrated graphics" or "Integrated Graphics Processing Unit (GPU)" means a ~~graphics solution~~ GPU that ~~does not contain~~ is not a discrete ~~graphics~~ GPU.	Some of the definitions as listed below are modified for clarification. Although the revised language might not exactly align with the proposed definitions in this comment, it has been modified to resolve the issue. 1. The Energy Commission recognizes and agrees that a clarification in the definition for discrete GPU is needed so that integrated graphics do not qualify as discrete graphics. Therefore the definition is modified to address this issue by stating that "…. Discrete GPUs are not packaged on the same die or substrate as the CPU." 2. We have made changes to the "integrated graphics" definition including changing its name to "integrated GPU". Some other minor changes are also made for consistency. This definition, however, keeps the wording of "does not contain discrete GPU" instead of the recommended change in order to distinguish "hybrid graphics" from integrated GPU. 3. The definition for GPU is modified to remove the redundant and confusing phrase "separate from the CPU". 4. The definition of the "Frame buffer bandwidth" is modified to address both issues. The language is changed to "… the amount of data that is processed

		3. Additionally, the current language for GPU is confusing, because it states that a GPU is separate from the CPU, and then later suggests that it can be integrated with the CPU. Our simplified definition removes this confusion: "Graphics processing unit (GPU)" means an integrated circuit, separate from the CPU, a computer component that is designed to accelerate the rendering of two-dimensional or three-dimensional content to displays. A GPU may be either integrated with the CPU or discrete. 4. Frame buffer bandwidth: current express terms need to be more clear on how frame buffer bandwidth is defined and calculated, for clarity and to prevent double-counting of integrated and discrete GPU bandwidth. We recommend the following definition changes: "Frame buffer bandwidth" means the rate at which data can be ~~read from or stored~~ exchanged between a GPU's local memory controller and graphics-specific memory ~~within discrete, integrated, or hybrid graphics~~, expressed in gigabytes per second (GB/s). It is calculated by: (graphics memory data width [bits] x graphics memory data rate [MHz]) / (8 x 1000).	per second …" which is consistent with the calculation method and prevents double counting the speed. It also refers to the ECMA international standards for the calculation method.
9e	California Investor Owned Utilities TN#214159	• Expandability score calculation requires more explicit wording to ensure correct summing of interfaces. To clarify the calculation and prevent such confusion, we suggest the	The Energy Commission agreed with both suggestions and made the changes.

		following wording: " ~~Sum the product of~~ Identify the score for each individual interface type ~~score~~ as determined by Table V-1 and then multiply by the total number of occurrences of that particular interface type ~~multiplied by the number of such interfaces~~ present in the system as sold or offered for sale. Finally, sum the subtotals for all interface types." • We suggest the following modification for clarity: "Each instance of an ~~individual~~ interface may only receive one score."	
9f	California Investor Owned Utilities TN#214159	• Since Thunderbolt 3.0 implements USB Power Delivery, its expandability score should be updated to reflect the multi-level approach already taken for USB Power Delivery. There is no guarantee that all Thunderbolt controllers will provide power to peripherals up to the maximum 100W (it depends on the USB-PD power profile supported by the controller). The IOUs recommend striking the Thunderbolt 3.0 row of the table entirely, allowing manufacturers to elect the USB-PD level that best fits their implementation of Thunderbolt. • Thunderbolt 2 and below would still retain their own 20W expandability score.	- Expandability score of the Thunderbolt 3.0 or greater is updated and now is implemented in a tiered approach similar to USB power delivery. - Expandability score of Thunderbolt 2.0 or less remains unchanged at 20.
9g	California Investor Owned Utilities TN#214159	PCI Express-related interfaces should be described clearly in terms of the number of supported PCIe lanes (wired lanes), not just the physical size of the PCIe slot. For example PCIe x16 port may only be wired for 8 PCIe lanes, even though it could	PCI and PCIe x 16 interfaces, where their mechanical slots are counted, are listed in Table V-1: "Interface Types and Scores for Expandability Score Calculation." The expandability score is designed to correlate

		physically be connected to 16 lanes. This provides far less expandability. CEC should clarify language in Table V-8 as follows: PCIe port with 16 or more PCIe lanes fully supported ~~x16 or higher (only count mechanical slots)~~	with the power supply sizing necessary for a system to be able to power the core system plus potential expansions through externally and internally available ports and interfaces such as a PCI Express port in this case. It is the industry standard to count the mechanical size of the PCI Express for the power supply size calculations and therefore it is used for the expandability score calculations as well.
9h	California Investor Owned Utilities TN#214159	CEC should clarify that an individual piece of computer hardware (e.g. system memory) can only receive one TEC adder (e.g. system memory adder or high-bandwidth system memory adder, but not both).	To prevent receiving an adder when it is not warranted, the "Add-in Card" and " High bandwidth system memory" languages in table V-8 have been modified (refer to sections 9i and 9j). However, in the case of system memory, total energy consumption (TEC) is directly related to both memory size and memory speed (for high bandwidth system memory). Therefore, both adders can be applied at the same time if the system memory meets the criteria stated in the table V-8 for high bandwidth system memory.
9i	California Investor Owned Utilities TN#214159	The calculation method for system memory bandwidth should be clearly defined, and its scope should be limited to system memory (RAM) and not higher level CPU cache memory or graphics-specific memory. We suggest a definition that clarifies the technical underpinnings of system memory bandwidth and provides clear instructions on how it is to be calculated: "System memory bandwidth" means the rate ~~at which data can be read from or stored into the~~ of data transfer between an integrated GPU's memory	System memory bandwidth is an industry-wide known factor and Energy Commission staff does not consider its calculation subject to multiple interpretations and therefore, this calculation method has not been added. For the purposes of this regulation, system memory's scope includes conventional system memory which is also known as RAM (Random Access Memory) and the memory that is specific to the integrated graphics.

		controller and any on-package, graphics-specific memory, expressed in gigabytes per second (GB/s). It is calculated by: (memory data width [bits] x memory data rate [MHz]) / (8 x 1000)."	However, system memory does not include the higher level central processing unit (CPU) memory known as cache memory. Cache memory is a smaller and faster memory than RAM and is typically placed closer to the CPU in order for the CPU to access the data faster than the data stored in the main memory (RAM). Because the real estate close to the CPU is very constrained, the amount of cache memory is much smaller than RAM. Therefore this criterion is used to exclude the cache memory from the scope of the high bandwidth system memory. High bandwidth system memory is used in two places in this regulation: first, as part of criteria for a computer to be qualified as a high expandability computer and second in table V-8 for adders. In both places a requirement for a minimum amount of such memories is added in order to exclude other system memories such as Cache. For the high expandability computer the minimum is set at 8 GB, while to qualify for the high bandwidth memory adder the minimum is 4GB.
9j	California Investor Owned Utilities TN#214159	• The add-in card definition should explicitly exclude any add-in card hardware that already receives other TEC adders. These include discrete GPU add-in cards, video surveillance cards, and wired Ethernet/fiber cards with a transmit rate of 10 Gb/s or greater. In addition to clarifying that hardware devices may only qualify for one TEC adder (see further comments on the stringency of new	To prevent double counting the adders the suggested phrase was added to the definition of the add-in cards: "Add-in card does not include … or other components that are listed in Table V-8." Furthermore, to prevent applying both adders and expandability score, the following conditions were added in Table V-8 for the add-in cards: "This adder does not apply if either of the

		standard elements), we recommend revising the add-in card definition as follows: • "Add-in card" means a removable, internal hardware device that can be installed in a computer peripheral component interconnect (PCI) or other ~~slot~~ physical port. Add-in card does not include hard disks, system memory, or removable devices that are intended to operate outside of a computer chassis, or components that are explicitly listed elsewhere in Table V-8. It also does not include cards that split, physically extend, or convert a slot type.	following criteria is met: 1) An adder is claimed for a device connected through this add-in card; or 2) An interface score from Table V-1 applies to a slot or interface provided by this add-in card."
9k	California Investor Owned Utilities TN#214159	• The workstation definition should be modified to ensure that only workstations receive the workstation exemption. The CA IOUs, NRDC, and ITI docketed a joint proposal on the workstation definition in October 2015. This definition was better aligned with ENERGY STAR and required that workstation products meet at least 3 of the 5 listed "additional criteria." CEC staff maintained this basic definition in the Revised Analysis of Computers, Computer Monitors, and Signage Displays, but dropped the criteria involving "five or more logical expansion ports" and reduced the requirement to meeting 2 of the 4 remaining additional criteria. • The IOUs recommend that CEC tighten its definition by either: 1) reinstating language equivalent to the agreed-upon definition from October 2015 or 2) revising the current Criteria 3B as suggested below. If this is not adjusted, most products (i.e. all desktops and	The criterion "contains five or more logical expansion ports (PCI, PCI Express, PCI-X, Thunderbolt, >USB 3.1, or equivalent)" was removed from pre-rulemaking language because it appeared to be redundant to the criterion that a workstation have 4 PCI Express slots and a graphics or PCI –X slot. In other words if one criterion were met, then the other would also be met and therefore, the language was not necessary. The removed criteria was less specific and open ended due to the inclusion of thunderbolt and later versions of USB and was therefore less useful at identifying a workstation versus a more generic computer. The definition as adopted is clear that these slots should be installed, as it calls for the PCI lanes to be "connected to accessory expansion slots or ports." In addition the

		even notebooks) would meet the PCIe requirement. • ~~Supports~~ Includes four or more ~~lanes of~~ PCI-Express (PCIe) slots, ~~other than discrete graphics, connected to accessory expansion slots or ports~~ one of which must support at least 16 PCIe lanes, where each lane has a bandwidth of 8 gigabits per second (Gb/s) or more. • Additionally, the IOUs recommend that for Criteria 2, CEC change the language from "supports" to "has installed." Error Correcting Code (ECC) is the primary criterion that determines whether a system is considered workstation. There is now evidence that some desktops can already support ECC18 and that HBM2 supports ECC. • Finally, an additional requirement could be for the products to be marketed as "workstations" as well. This should not preclude the other changes, but it could provide some additional differentiation from traditional desktops.	phrase "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" also means that it must be installed because it has the "system hardware." The criterion as adopted is expected to be sufficient to differentiate workstations from other computers. However the resolution adopted for these standards includes the statement that – "The market for computers and monitors is evolving" and directs staff to "Conduct rigorous market monitoring of specific features and types of computers" that "may significantly reduce the energy savings projected during this rulemaking." If the evolution of the market causes the definition of a workstation to behave outside of expectation staff has been directed to detect it and propose modification to the definition.
9L	California Investor Owned Utilities TN#214159	• The mode weighting should not include "remote wake," as ITI has proposed on the October 10th public hearing. The IOUs are opposed to ITI's proposal to alter the requirements of section 1604(v)(5)(B)(2) from "full capability" to "remote wake". CEC's current language requires that systems provide several key network services while in sleep in order to use the more forgiving full capability duty cycle weighting. ITI has	During tier-1 effective dates of the regulation, manufacturers are allowed to use "full capability" and "remote wake" modal weightings in addition to the "conventional" mode weightings in the test procedure to calculate total energy consumption TEC. However, they have to meet a set of specific criteria for each of those modes in order to be able to apply it. The specified mode weightings and their corresponding criteria are consistent with the Energy Star 6.1

		requested that those requirements be limited to “remote wake” capability, because remote wake functionality is supported by all OS and hardware suppliers. ITI’s proposal would, in effect, allow all computers to use a less stringent duty cycle. This would weaken TEC requirements for the entire standard by about 16% (the proposed remote wake duty cycle contains 16% fewer idle hours than the conventional duty cycle, effectively giving systems a 16% credit). • Today, implementation of sleep in computers is shifting through the use of alternative operating systems (Chrome, Android, etc.) and Microsoft’s adoption of “Modern Standby” in Windows 10. These sleep implementations offer a level of functionality that is a blend between today’s ACPI S3 sleep and long idle states and were expressly designed to preserve network connectivity in a low power state. These sleep alternatives do not require additional incentives to maintain network connectivity, especially since CEC has already accommodated them through a broader sleep mode definition and alternative sleep mode power limits. • The IOUs encourage CEC to remove all references to alternative sleep mode in this particular provision: In order to use the “full capability” mode weighting a computer shall have the following features enabled as shipped: i. Maintain Ethernet (IEEE 802.3-2015) or wireless (IEEE 802.11-2012) network addresses and network connection capability	specifications. During the 45-day language the proposed standards only allowed “Full capability” and “conventional” modal weightings for tier-1 and we received comments that the “full capability” mode weighting did not apply to many operating systems, and recommending that “remote wake” mode weighting be used instead. However, to ensure a technology neutral approach for the regulations, the Energy Commission added the “remote wake” modal weighting rather than replacing the “Full capability” with it. The Energy Commission disagrees with the statement that “remote wake” duty cycle weakens the standards by 16%. Duty cycle percentile comparison doesn’t directly convert into energy consumption differences because the functions of the systems using conventional and remote wake mode weightings during idle and sleep times are different and therefore they consume different amounts of energy in each mode. In regard to the references to alternative sleep mode in this provision, “full capability” and “Remote Wake” modes apply mostly to the systems with an alternative sleep mode because they maintain network connection at all times and therefore are expected to spend more time in the alternative sleep mode. Removing references to “alternative sleep mode” would contradict its purpose.

		while in ACPI System Level S3 Sleep Mode ~~or an alternative to ACPI S3 sleep mode~~; ii. Resume from ACPI System Level S3 Sleep Mode ~~or an alternative to ACPI S3 sleep mode~~ upon request from outside the local network; and iii. Support advertising host services and network name while in ACPI System Level S3 Sleep Mode ~~or an alternative to ACPI S3 sleep mode.~~	
9m	California Investor Owned Utilities TN#214159	Workstations and high-expandability computers should be required to be tested and report TEC to ensure CEC can assess a growing portion of statewide energy use, and to remove the additional incentive to receive the exemption. The IOUs highly recommend that the language be clarified to ensure that workstation and high expandability computer TEC measurements are tested and reported. While these products are exempted from the TEC requirement, it is important that CEC have the data to assess a growing portion of statewide energy use. The proposed language is as follows: (5) The test method for computers is the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016), with the following modifications: … (B) The total power consumption of a computer shall be calculated using Equation 1 in Section 3 of the ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016). 1. Computers manufactured before July 1, 2021 shall use the “conventional” mode weighting of Table 3	Workstations and high-expandability computers are required to be tested and reported. The language has been modified in 1604(5)(B)(1), 1604(5)(B)(4), and 1604(5)(B)(5) to clarify which duty cycle should be used to calculate the TECfor different types of computers including workstations and high expandability computers. The modified language addresses the concerns from this comment although it is different from the recommended language because workstations use a different weighting than other computers in Energy Star.

		for a desktop computer, a high-expandability computer, a workstation, a mobile gaming system, or a thin client, or Table 4 for a notebook computer or portable all-in-one computer, contained within Section 3 of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016), unless they meet the criteria to use "full capability" mode weighting, below.	
9n	California Investor Owned Utilities TN#214159	• We believe CEC's intent is that a limited capability operating system cannot provide any of the four features listed in its definition. This is an important distinction, since under the current definition, one might interpret an operating system without, for example, support for multiple user profiles as a limited capability operating system. We suggest: • "Limited capability operating system" means an operating system that performs basic operations and that does not meet any of the following: (1) Have automatic power management features; (2) Support USB devices; (3) Have Graphical User Interface (GUI); or (4) Support multiple user profiles or distinguish between users.	The language was modified to ensure clarity. Although the modified language is different from the suggested text, its intent is clear now.
9o	California Investor Owned Utilities TN#214159	• Hybrid graphics may be a confusing term, as manufacturers often market graphics solutions that simply share memory between discrete and integrated GPUs as hybrid graphics. Switchable graphics is a clearer term that more directly speaks to the technology's power management capabilities.	The name, hybrid graphics, is clear and represents the device precisely as a hybrid of integrated and discrete graphics. Therefore, the name is not changed. Clarifying language was added to the text to identify that the process of switching between integrated and discrete graphics is

		• We would like to ensure that the definition recognizes that the control, power management, and coordination of the discrete and integrated GPUs is an automated process (i.e. it cannot be accomplished manually through configuration changes or swapping monitor connections). • Our revised definition is: "~~Hybrid~~ Switchable graphics" means a functionality that ~~allows~~ automatically places the system's primary or master Discrete Graphics ~~to enter~~ in a low-power state when not required in favor of Integrated Graphics. The functionality also supports automatic waking of a primary or master discrete GPU from a low-power state. ~~This functionality allows graphics rendering by lower power and lower capability integrated GPUs while on battery or when the output graphics are not overly complex while then allowing the more power consumptive but more capable discrete GPU to provide rendering capability when the system requires it.~~	automated.
9p	California Investor Owned Utilities TN#214159	CEC's current definition does not clarify that the off mode referenced on page 6 of the express terms applies only to computers. As the regulatory language is intermingled with computer monitors, televisions, and consumer audio and video equipment. We recommend that this be titled "Computer Off Mode."	The Commission agrees and made the change.
9q	California Investor Owned	We recommend new definition for "PCI Express Lane" in order to ensure that exemptions and adders are properly allocated. PCI Express (PCIe) lanes are	PCI express lane is a sufficiently known term in the computer industry and doesn't need to be defined.

	Utilities TN#214159	used to describe interfaces eligible for the expandability score in Table V-8 as well as in other key definitions in the standard. For clarity, we recommend adding the following definition: "PCI Express Lane" refers to a set of wire pairs, one pair for transmission and one for reception, that are used to send and receive data between a computer system and a peripheral hardware device according to the PCI Express standard.	
9r	California Investor Owned Utilities TN#214159	PCI Express (PCIe) ports are used to describe interfaces eligible for the expandability score in Table V-8 as well as in other key definitions in the standard. For clarity, we recommend adding the following definition of PCIe ports: "PCI Express Port" means a connector on the motherboard that allows for the installation of PCI Express hardware devices and communication with the computer system over PCI Express Lanes. PCI Express Ports must conform to the form factor specifications of the PCI Express standard.	PCI express port is a sufficiently known term in the computer industry and doesn't need to be defined.
9s	California Investor Owned Utilities TN#214159	As integrated liquid cooling may count toward a system's expandability adder score, it needs to be defined. We suggest: "Integrated liquid cooling" means a closed system that cools electronic components, such as a CPU or GPU, using heat transfer liquid that is mechanically pumped.	Integrated liquid cooling is a self-explanatory term that is sufficiently known in the computer industry and doesn't need a definition.
9t	California Investor Owned Utilities TN#214159	USB motherboard headers currently may count toward the expandability score, but have not been clearly defined. We suggest the following definition for clarity: "USB Motherboard header" means a physical	USB motherboard header is a self-explanatory term that is sufficiently known in the computer industry and doesn't need a definition.

		connector located on a computer's motherboard that provides data and power connections for 2 or more downstream USB ports.	
9u	California Investor Owned Utilities TN#214159	Currently, the effective date for integrated display EPD adders is listed as July 1, 2019. This date should be corrected to align with the effectiveness date of the computer standard (January 1, 2019) rather than the computer monitors standard. If this is not corrected, integrated EPDs will not receive any adder for the first 6 months of the computer standard.	The Commission agrees and made the change.
9v	California Investor Owned Utilities TN#214159	CEC's test guidance for desktops requires testers to connect a computer monitor with 1920 x 1080 (Full HD) native resolution; however, it is possible that monitors with this native resolution will no longer be sold during the useful life of the standard. To future-proof the standard, we recommend adapting the language as follows: (D) A computer monitor used in the testing of desktop computers shall have a native resolution of <u>at least</u> 1920x1080 pixels and use progressive scanning. The computer operating system shall be set to operate at <u>a minimum of</u> 1920x1080 pixels and progressive scanning.	The Commission agrees and made the change.
9w	California Investor Owned Utilities TN#214159	CEC also provides useful guidance on the display port to which testers must connect the computer monitor. Given our recommendations on switchable graphics, we suggest altering the wording in 1604(v)(5)(D)(1) to: 1. If ~~hybrid~~ <u>switchable</u> graphics are available, choose the port that ~~enables hybrid graphics~~ <u>supports this functionality.</u>	This change was not made because the name of the "hybrid graphics" didn't change. See response to comment 9o.

9x	California Investor Owned Utilities TN#214159	CEC has provided a prioritized list of display ports for situations in which the system supports multiple varieties of display connectors. To future-proof the language, we suggest adding Thunderbolt and USB to the list, both of which already or soon will support display connectivity. We assume that CEC's intent is to require testers to connect the display to the connector that supports the highest resolution and bandwidth: 4. If there are multiple connector ports to choose from pursuant to subdivisions (D)(1) through (D)(3) of this section, connect the display to the port supporting the highest display resolution, or ~~port using~~ the first available from the port types listed below: i. Thunderbolt ii. Display Port iii. HDMI iv. DVI v. USB vi. VGA vii. Other	USB and Thunderbolt were not added to the list because they are not exclusively used for display connection. In the absence of other ports that are listed, USB or Thunderbolt can be used to connect the display as the "Other" category.
9y	California Investor Owned Utilities TN#214159	CEC's express terms in this section instruct testers to ignore section 5.2(A)(1) of the ENERGY STAR test method, which CEC says requires testers to "not disable" automatic brightness control for integrated displays. However, section 5.2(A)(1) in the ENERGY STAR test procedure requires testers to "disable display dimming," which reads contrary to CEC's interpretation. We request that CEC clarify its intent and suggest the following correction, assuming that CEC intends for testers not to follow ENERGY STAR's requirements in section 5.2(A)(1): During testing, a notebook computer, mobile gaming system, portable all-in-one, or integrated desktop	The Energy Commission intended to measure the actual energy consumption associated with ABC. However, in response to the comments received and after reviewing the available data on ABC testing and "real world" conditions, staff concluded that more comprehensive research and data collection was needed to develop a test procedure that is repeatable, reliable, and accurately reflects ABC's energy-saving benefits. Therefore, the Commission decided that the best approach was to amend the test procedure for computers

		shall proceed using Section 5.2(A)(1) and ignore the direction not to disable automatic brightness control as described in Section 5.2(A) of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016). <u>If automatic brightness control is supported, position a light source such that 300 lux directly enters the ABC sensor.</u>	with integrated displays to align with the Energy Star's test procedure for computers v.6.1. Therefore, this comment is no longer applicable.
9z	California Investor Owned Utilities TN#214159	CEC's requirements for sleep mode testing appear to reference the long idle mode test provisions from IEC 62623:2012 rather than the sleep mode provisions. We suggest the following modified language to clarify: (H) The sleep mode power measurement shall be tested in a modified manner from the <u>sleep mode</u> test procedure described in IEC 62623:2012, <u>section 5.5.3</u>. Instead of measuring power after manually entering sleep mode, the power measurement shall begin no sooner than 30 minutes and no later than 31 minutes of user inactivity on the unit under test. This measurement shall follow the ~~long-idle~~ <u>sleep mode</u> test without altering the unit under test.	CEC recognized from this comment that the text needed to be clarified since "shall follow" meant as "starts after" and did not mean "do as". The text has been reworded to clarify.
9aa	California Investor Owned Utilities TN#214159	• The IOUs recommend that power supply size be added to the reporting requirements in Table X, given that this is a criterion for the high expandability computer TEC exemption. While power supply model number is a good start, it does not guarantee that the power supply size will be included, and even if it is, there are often other numbers included in the model number as well which can make the sizing difficult to recognize. Requiring both would be helpful for compliance. • In addition, we suggest the following wording	• Power supply size was added to the data collected in the Table X. • Number of cores was clarified to reference CPU cores. • "AC Adaptor size" was changed to "Nameplate output power of the external Power Supply". • Portable all-in-ones and gaming systems have been added to the list for the total battery capacity data collection.

		changes for clarity and accuracy: - Number of CPU Cores - ~~AC Adapter Size~~ External Power Supply (EPS) Rated Output (watts) (notebook computers) - Total Battery Capacity (watt-hours) (notebook computers and Portable All-In-Ones only)	
10	LG Electronics USA, Inc., TN #214171	On September 9, 2016, the Commission published its current proposal on sleep mode energy consumption requirements for computer monitors that are manufactured on or after July 1, 2019 in Proposed Regulatory Language [45-day language omitted]. However, it is understood, with careful examination, that devices with USB-C were not considered when the Commission determined these proposed sleep mode regulations for computer monitors: in its Final Analysis the Commission noted that the proposed wattage limits were chosen based on the Commission's analysis (refer to below Table 18) on an ENERGY STAR Display Version 6.0 qualified product list (specification finalized on September 4, 2012), an obsolete data which dates prior to the release of USB-C's first specification (published on August 11, 2014). Likely, USB-C's new Alternate Modes that were released after the finalization of ENERGY STAR Version 6.0, such [as] Thunderbolt (unveiled on June 2, 2015), were altogether excluded from the aforementioned ENERGY STAR data. We at LG therefore would like to request the following for computer monitors with USB-C and/or USB-C with new Alternate Modes: 1) Exemption from sleep mode energy consumption requirements, or	This comment was received after the end of the comment period for the 45-day language. Although the Energy Commission is not obligated to respond to late comments, the Energy Commission has chosen to respond to this comment. The Energy Commission disagrees with LG's comment because the sleep mode and off mode standards are based on the current ENERGY STAR data (that shows the sleep mode compliance at 0.35 watts and off mode at 0.25 watts), not just previous ENERGY STAR version 6.0 data. Commenter does not show a relationship between the USB-C and sleep mode or why additional power consumption might be needed for USB-C in sleep mode, and has failed to provide any convincing argument or data to support an exemption to USB-C for sleep mode. Therefore, the Energy Commission has made no change in response to this comment.

		2) New sleep mode consumption requirements/limits distinct and separate from the current proposal	
11	Sierra Club TN#214172	• The CEC's proposal is generally strong and balanced; it requires manufacturers to upgrade their less efficient products to achieve minimum levels of efficiency. • However, we share the views of NRDC and the Greenlining Institute that the CEC faces a challenge in ensuring that the standards actually deliver these promised savings: given the rapid pace of evolution in computer technology, for these efficiency standards to be effective, it is critical that you minimize potential loopholes. • we are asking the Commission to do the following: · Minimize long-term exemptions and allowances. When the second stage of the standards comes into effect four years after adoption, manufacturers will have had plenty of time to integrate these features into their typical designs in a way that requires no additional energy. Technology evolution has shown time and again that most new features don't require much, if any, additional energy once optimized and integrated into chips. · Include an "off-ramp" mechanism for any exemption or allowance that is no longer warranted and develops into a major loophole. The CEC will monitor the market, and when pre-determined and clearly communicated conditions are met, initiate a rulemaking to adjust the standards to phase out exemptions and allowances within 12	This comment was received after the end of the comment period for the 45-day language. Although the Commission is not obligated to respond to late comments, the Commission has chosen to respond to this comment. Thank you for your comment. Please see responses to comments 5a through 5o.

		months. This would give industry time to adjust while avoiding a major loss in savings due to growing loopholes.	
12	NEEP TN#214165	While NEEP is very supportive of the CEC for taking this rulemaking on, we echo the concerns that have been expressed through comment letters from the Natural Resources Defense Council (NRDC) and the Appliance Standards Awareness Project (ASAP).	Thank you for your comment. Please refer to the comments 5a through 5o, 9a, and 9b.
13a	Entertainment Software Association TN#214161	We agree that game consoles are distinct from computers and should not be subject to an energy efficiency standard applicable to PCs. We support the express (terms) exception for game consoles from the definition of "Computer."	Thank you for your comment. No change is requested by this comment.
13b	Entertainment Software Association TN#214161	For purposes of that exception, the Commission has proposed to define "game console" as follows: "Game console" means a device that is designed and marketed primarily for video game usage and that does not have the ability to add or remove system memory or a central processing unit. While our preference remains for a definition of "game console" that more closely tracks our prior suggested language, we recognize the Commission's interest in a more streamlined approach. The Commission's proposed definition of "game console" is acceptable to us, subject to one caveat. We infer that the limitation on upgrades is intended to apply to post-sale modifications by the user and not, for example, a situation where a specific console model may be offered at the point of sale in different configurations. We request that the Commission include in the final rule clarifying commentary that the limitation applies only to post-sale modifications.	Game consoles and desktop computers have very similar capabilities and component structures. The definition of the game console is drafted in a way to distinguish game consoles from desktop computers. One major distinction between a desktop and a game console is that consumers can upgrade or change system memory or CPU in desktops but don't have that capability for game consoles. The definition of the game console has been modified to address this comment: "… and that the consumer does not have the ability to add or remove system memory or a central processing unit."

13c	Entertainment Software Association TN#214161	In the prior staff report, the Commission expressly excluded "handheld gaming devices" from the definition of "computer." However, in the latest proposed regulatory language, the Commission has omitted that exclusion. In its place, it has added one for "small computer device." We are concerned that the shift in terminology creates ambiguity over the treatment of "handheld gaming devices," some of which may not otherwise qualify as a "small computer device" if the handheld has a screen size greater than 20 square inches. Both NRDC and ESA are in agreement that handhelds should not be subject to the final rule and have been working on a possible solution to this problem. Specifically, we have been discussing a separate carve-out from the definition of "computer" for "handheld gaming devices." NRDC has proposed to define the term this way: "Handheld gaming device" means a handheld product whose primary function is to play video games with an integrated display as the primary game-play display, and which primarily operates on an integrated battery or other portable power source rather than via a direct connection to an AC power source.	This issue is resolved per email received on 11/11/2016 from Mr. Michael Warnecke (TN#214561): " After giving the issue further thought, we think that the exclusion and definition for "small computer device" as set forth in the Proposed Regulatory Language: Express Terms released 9/9 by the Commission should be sufficient for excluding handheld game consoles. Accordingly, we've decided that a separate, explicit exception for handhelds is not necessary." Thank you for revisiting this issue.
13d	Entertainment Software Association TN#214161	Mobile Gaming Systems ESA takes no position on the proposed energy efficiency standards that would apply to gaming laptops vis-à-vis the term "mobile gaming system." However, we are concerned about the label itself, which is suggestive of handheld gaming devices. For	"Mobile gaming systems" are explicitly defined in the 15-day express terms. Any system that meets the definition must comply with the standards. Changing the name of the product does not affect the scope or the standards that these systems

		this reason, we suggest that the term "mobile gaming laptops" might be more appropriate.	are subject to.
14a	California Investor-owned Utilities, TN #214155	Energy use in California from electronic displays – computer monitors and signage displays – is significant and has been growing in some sectors. Computer monitors are ubiquitous in homes, offices, and other commercial settings. They are increasingly used as second screens with notebooks and in extended desktop display setups in home and office environments. Additionally, higher resolutions models (4K and 5K) are being introduced on the market, which can consume as much as five times as much power as a similarly sized regular high-definition model. Monitors account for a significant portion of electricity consumed in computing use. Signage displays are a growing presence in commercial settings, such as retail, restaurant, transit, and hospitality. The California Investor Owned Utilities (CASE Team) generally support the energy efficiency standards for electronic displays proposed by the California Energy Commission (CEC) in the updated staff report and express terms.	This comment supports the standards and does not request changes to the standards.
14b	California Investor-owned Utilities, TN #214155	Definitions: To clarify what is meant by "incremental hardware" the CASE Team suggests the following changes (strike-through indicates deletion of original language, bold italics indicates additional language throughout this document): "Gaming monitor" means a computer monitor that is capable of adjusting the monitor refresh rate with the frame rate of the video content, and supports a continuously variable refresh rate	The IOUs did not submit information to demonstrate that there is a lack of clarity with respect to "incremental hardware-based assistance." The distinction relevant to the standards is clearly between hardware- versus software-based implementations of variable refresh rates characteristic of gaming monitors. Therefore, the Energy Commission did not make the proposed changes.

		ranging across a factor of at least 1.75 times the minimum supported (for example a variable refresh rate of at least 40 Hz to 70 Hz if the minimum supported refresh rate is 40 Hz~~); the monitor may include an incremental hardware-based assistance~~. *Hardware-based implementations include a dedicated processor that receives frames from the discrete graphics card in the attached computer and dedicated memory that stores frames.*	
14c	California Investor-owned Utilities, TN #214155	The CASE Team suggests a definition based on signage display attributes such as size, brightness, and pixel density, such as that used by ENERGY STAR: "Signage display' means an electronic display intended for multiple people to view in non-desk based environments, such as retail or department stores, museums, hotels, outdoor venues, airports, conference rooms, or classrooms, and meets two or more of the following criteria: 1. Diagonal screen size is greater than 30 inches; • Maximum luminance is greater than 400 candelas per square meter; • Pixel density is less than or equal to 5,000 pixels per square inch; or 4. Ships without a mounting stand."	The Energy Commission disagrees with the proposed change as the current language is sufficient and clear. Adding more criteria to the definition as the IOUs suggest here would create potential loopholes in the definition. In contrast, the Energy Commission designed the signage display definition so that the entire scope of display-related standards (televisions, monitors, signage displays) is covered, and exemptions are clearly identified rather than created through inadvertent loopholes. Therefore, no change was made.
14d	California Investor-owned Utilities, TN #214155	The CASE Team suggests the following addition to clarify the definition and close the loophole: "Keyboard, video, and mouse (KVM)" or "keyboard, mouse, and monitor (KMM)" means a computer monitor that *can operate with a KVM switch and* is designed to be used in a server rack for use solely in a data center.	The Energy Commission agrees that this adds clarity to the regulations and made the recommended change in 15-day language.

14e	California Investor-owned Utilities, TN #214155	The CASE Team provides the following updates to reflect the industry standard definition: "Digital Cinema Initiative (DCI)-P3" means a red-green-blue (RGB) color space that *covers 41.7% of the CIELUV color space*~~features the widest color gamut of all the emulated color spaces and that is wider than standard RGB (sRGB).~~	The Energy Commission agrees that this adds clarity to the regulations and made the recommended change in 15-day language.
14f	California Investor-owned Utilities, TN #214155	To avoid ambiguity, the CASE Team suggests the following change: "Computer monitor" means an analog or digital device of *diagonal screen* size greater than or equal to 17 inches and less than or equal to 61 inches,	The Energy Commission agrees that this adds clarity to the regulations and made the recommended change in 15-day language.
14g	California Investor-owned Utilities, TN #214155	The CASE Team recommends specifying that this distinction refers to the native resolution and updating the megapixel distinction [in the definition of "Very high performance monitor"] to appropriately reflect 8.29 MPs (3840 pixels times 2160 pixels) by adding the following clarifying edits in the resolution criteria of the very high performance monitor definition: (2) Has a *native* resolution equal to or greater than either 3840x2160 pixels or 8.2*9* Megapixels; and …	The Energy Commission agrees that this adds clarity to the regulations and made the recommended change in 15-day language.
14h	California Investor-owned Utilities, TN #214155	Test Method: We suggest the following updates to the language: (B) A computer monitor shall be tested as required by the test procedure ~~only~~ for each of the following: • On mode power ~~consumption~~ *draw.* • Sleep mode power ~~consumption~~ *draw.* • Off mode power ~~consumption~~ *draw.* 4. Screen luminance in default as-shipped setting. 5. *Screen luminance in maximum luminance setting.*	The Energy Commission made the recommended clarifications to delete "only" and change "consumption" to "draw" in the test procedure language. However, the Energy Commission is not requiring screen luminance to be tested, either in the "as-shipped" or "maximum luminance" setting as the test procedure requires that the on-mode power draw be measured at a specific luminance, that is, 200 candelas per square

			meter (cd/m^2 or nits).[5] Because the screen luminance is not a relevant part of the on-mode energy consumption, requiring the testing of screen luminance in as-shipped and maximum modes would have added a test requirement without a corresponding benefit. Therefore, the Energy Commission declined to impose the additional testing burden.
14i	California Investor-owned Utilities, TN #214155	The instruction to "turn off" any feature that is not related to displaying an image is confusing. Monitors generally do not have user options to turn off items like USB and network ports or even speakers. A more appropriate instruction is to ensure that these features are "not in use". In addition, since an allowance for touch screen functions is provided in Section 1605.3(v)(4)(D), the regulatory language must state that the touch-screen function must be on during testing.	The Energy Commission disagrees with the IOUs' comment because the existing language is clear in having these items turned off *or disconnected* so that any additional power draw for these items is not included in the test results that form the basis for determining whether the monitor complies with the applicable efficiency standards. The instruction is directed to the manufacturer, and does not reflect whether the user can disable the feature. Regarding touch, because touch receives an allowance, it is not a feature unrelated to the display of images and must be turned on during testing if the allowance for a touch screen is claimed. Therefore, no change is necessary in response to this comment.
14j	California Investor-	Finally, the CASE Team has shown previously that network and hub connections with little or no data	The IOUs' proposed change to the test procedure would effectively increase the

[5] See ENERGY STAR Test Method for Displays (Sept. 2015), section 6.3(A)(2).

	owned Utilities, TN #214155	transfer can draw very small amounts of power and that most monitors can comply with sleep and off mode power requirements even with network and/or hub connections enabled (CA CASE Team 2016). The CASE Team recommends the CEC require these connections to be enabled during the tests, as ENERGY STAR requires. Not only will this requirement better capture the actual usage conditions of the monitor, but it will also encourage manufacturers to utilize readily available power management techniques to minimize power draw of idling USB and network ports. With the current language in the CEC Express Terms, there is no incentive for manufacturers to minimize the power draw for network connections. The actual power draw of a monitor, out of the box, without any user modifications will almost certainly be greater than the reported value on the CEC appliance database. This could lead to consumer confusion in the marketplace. Furthermore, since ENERGY STAR requires network and hub connections to be present during testing and have been requiring this testing for years, these CEC requirements will significantly increase manufacturers' testing burden. Additionally, two sets of reported power draw will exist for each ENERGY STAR monitor sold in California: one for CEC compliance and another for ENERGY STAR compliance.	stringency of the efficiency standards for computer monitors by requiring that more components of the monitor be measured for energy consumption and included in the total on-mode power draw subject to the standards. While this would likely have saved more energy, the Energy Commission did not have analysis in the record on the technical feasibility of making improvements to the non-display components of monitors, or of the cost-effectiveness for doing so. Rather, the Energy Commission focused on encouraging energy efficiency in the display technology itself, which is analyzed throughout the final staff report.[6] Therefore, the Energy Commission did not adopt this proposed change to the test procedure.

[6] Singh, Harinder, Soheila Pasha, Ken Rider. 2016. Final Staff Analysis of Computers, Computer Monitors, and Signage Displays. California Energy Commission. Publication Number: CEC-400-2016-016, at pp. 61-65, 83-87. Available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548_20160909T092318__2016_Appliance_Efficiency_Rulemaking_Docket_Number_16AAER02Sta.pdf.

		The regulatory language in this section should be updated to: (D) ~~Before starting the test procedure for measuring on mode power consumption, any f~~ *Touch screen, network connection, and USB hub features shall be tested according to the ENERGY STAR test method. Other f*eatures unrelated to the display of images (for example ~~USB hubs,~~ webcams, speakers, ~~LAN connections,~~ and SD card readers) shall *not be in use during the measurement of on mode power* ~~be turned off~~.	
14k	California Investor-owned Utilities, TN #214155	The CEC asked for comment on the implications of the replacement of the IEC test procedure 62087:2011 with the updated version 62087:2015. The ENERGY STAR test method uses IEC 62087:2011 methods and signals for on mode power measurements, as well as the test signals from 62087:2011 for luminance measurements. The CASE team has reviewed IEC 62087:2015 and found no significant changes in the on mode power measurement and the test signals.	IEC 62087 2011 is publicly available and given that there are no significant changes between the 2011 and 2015 versions and ENERGY STAR references the 2011 version, there is no reason to update it in these regulations.
14l	California Investor-owned Utilities, TN #214155	Figure 4.1 [see comment for figure] shows the historically rapid uptake of the ENERGY STAR monitor specification. In the three specification revisions since 2005, over 80% of the market has met the ENERGY STAR specification by Year 2. Assuming past trends continue, the CASE Team projects high market adoption of the Version 7 specification by July 2019, the proposed effective date of the Tier 1 standard. CEC On Mode levels are similar or less stringent than the ENERGY STAR Version 7 specification *before* the application of any CEC	This comment appears to request both that base efficiency levels be made more stringent and that the allowances be reduced. The Energy Commission did not make either proposed change as a more stringent standard could have a significant impact on lower income markets and because the purposes of ENERGY STAR and mandatory standards are different. Currently, 20 percent of the monitors meet

		proposed adders in almost every case, as shown in Figure 4.2 [see comment for figure]. Given past ENERGY STAR uptake rates and the On Mode allowances proposed by CEC, the CASE Team anticipates most of the market will already be meeting the CEC levels without any additional modifications by the effective date.	ENERGY STAR 7.0. Unlike ENERGY STAR, which is a voluntary program designed to improve the efficiency of the top end of the market, mandatory regulations affect the entire market and are based on 100% conversion of that market. In order to ensure that the entire market can transition to higher efficiency, the Energy Commission had to set levels that could be met by both low-end products, which are not typically able to meet ENERGY STAR levels due to the incremental cost of efficiency improvements, and high-end products, which are not usually included in ENERGY STAR because their consumers are not price-sensitive to energy or monitor costs, but demand other features regardless of efficiency. The Energy Commission did this through a set of scaling power limits based on screen size, allowances for special features, and exemptions for niche products. IOUs have not presented analysis demonstrating that higher efficiency levels and lower allowances would be more effective at transforming this market or more cost-effective than the proposed standards. Therefore, the Energy Commission did not make the changes alluded to in this comment.
14m	California Investor-owned Utilities, TN #214155	4.2 Adders: General: At the October 10 hearing, stakeholders presented the need for multiple adders to apply to a given product. In the following section, the CASE Team outlines how the current adders are generous and more than sufficient for monitors with	The Energy Commission disagrees with the IOUs' comment. The ENERGY STAR program is a voluntary program and non-ENERGY STAR units can be sold in the market, whereas the Energy Commission's

		additional features and/or functions. The CASE Team supports CEC's proposal to include gaming, OLED, and curved monitors in the scope of this rulemaking. We also agree that these monitors are currently a relatively small part of the market and there is limited power data available. However it is not clear to the CASE Team what the technical rationale is for newly proposed power allowances for OLED, gaming, and curved monitors. It should be noted that the ENERGY STAR Version 7 specification was updated with industry input within the past year, and there were no accommodations for extra power allowances for gaming, curved, or OLED features. By July 1, 2019, a vast majority of monitors will meet the ENERGY STAR specification, given historical uptake rates and industry projections, with no adders for these features. These significant allowances in the CEC Express Terms could be used as potential loopholes to increase power consumption by up to 35% unnecessarily.	regulations are mandatory and apply to the entire market - requiring more stringent standards could eliminate many of the special feature products from the market. Sales and market-share for these special-feature monitors, including OLED, curved, and gaming, is small and does not have a significant impact on the energy savings expected from these standards. While the Energy Commission agrees with the IOUs' comment that efficiency improvements for these monitors are technically feasible, the IOUs' comment ignores the market and sales reality – manufacturers would not invest in efficient technologies for these products because there is not enough profit in it, and energy savings generated from these units are not significant due to their low sales volumes. To address the possibility that these standards are creating loopholes for these high-end products, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.
14n	California Investor-	Enhanced Performance Display (EPD) Adders: In the Express Terms, CEC increased the EPD adders	The intent of the monitor standards is to drive improvements in mainstream monitors

	owned Utilities, TN #214155	proposed in the April 2016 Staff Report from 10% to 30% for sRGB monitors and from 50% to 75% for Adobe RGB in Tier 1. Table 4.1 and Figure 4.3 [see comment for Table and Figure] compare the updated CEC proposal for EPDs with the ENERGY STAR Version 7 specification that recently took effect in July 2016. In order to compare the ENERGY STAR specification, which uses a Typical Energy Consumption (TEC) value, with CEC's modal power approach, we used the same duty cycle assumptions as ENERGY STAR to calculate a hypothetical CEC TEC value. Please note that at the largest sizes, the CEC proposed On Mode allowances for EPDs is over double the allowance provided by ENERGY STAR. Given most of the monitor market will meet the ENERGY STAR Version 7 regulation by the July 1, 2019 effective date, the CEC limit of applying a single adder is more than sufficient for EPDs to meet the proposed regulation.	that reduce energy consumption for the majority of products on the market. Enhanced performance displays are not mainstream monitors – for these products, the Energy Commission established levels that would cap their energy consumption but continue to allow these products to be sold in California. The Energy Commission evaluated ENERGY STAR and non-ENERGY STAR data for enhanced performance displays and adjusted the standard levels to ensure the availability of these units in the market. Proposed lower limits would have removed many of these products from the market. The limits are lowered in the second tier to drive some improvement in these products after major improvements are made in mainstream monitors. Nonetheless, adders for enhanced performance displays could become a potential loophole if these products enter more of the mainstream market. To avoid this result, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.
14o	California	4.2.2 Gaming Monitor Adders: The CASE Team	The Energy Commission agrees that the

	Investor-owned Utilities, TN #214155	supports including gaming monitors within the scope of this rulemaking. These monitors are gaining in popularity as indicated by "Gaming Monitors" being a feature a consumer can use to filter models on popular retailer websites, such as Best Buy and Amazon. We agree with CEC that it is very likely that gaming monitors consume more power as operated in the home given the variable refresh rates and brighter backlight settings preferred for operating graphics-intensive video games. However, in the test procedure, based on the ENERGY STAR test method, On Mode power is measured at a calibrated brightness of 200 cd/m^2 and a calibrated refresh rate set at 60 Hertz (Hz). Since the higher brightness and the variable refresh rate features of gaming monitors would not be utilized by the test procedure, the intent of the 30% and 35% adders for this equipment as proposed in Table V-5 is not clear. These significant allowances could be used as potential loopholes to increase power consumption by up to 35% unnecessarily for units that meet the definition of gaming monitors.	ENERGY STAR test procedure for monitors, which is incorporated by reference as the Energy Commission's test procedure, does not test variable refresh rate. However, the higher allowance for gaming monitors is based on the fact that these are niche and high-end products rather than mainstream products. The Energy Commission intended to regulate mainstream monitors and limit the growth in consumption from high end monitors, like gaming monitors. The Energy Commission evaluated ENERGY STAR and non-ENERGY STAR data for gaming monitors and adjusted the standard levels to ensure the availability of these units in the market. Lowering the power limits on these monitors would have removed many of these products from the market. Instead, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.
14p	California Investor-owned Utilities, TN #214155	4.3 Multiple Adders: Since the currently proposed CEC adders are generous, there is no technical reason for multiple adders to apply to a given monitor. Table 4.2 [see comment for Table] shows actual examples of monitor models that could be	While the specific monitor models provided by the IOUs would meet the standards, the Energy Commission found that generally, each additional feature in the monitor requires an additional allowance as these

		eligible for more than one adder outlined in Table V-5 of the Express Terms and the calculated CEC On Mode Limits with and without adders. In these examples of a product available today, these monitors would easily meet the CEC proposed limits without any adders applied. These models would not have to make any additional updates in order to meet the On Mode proposals.	features operate independently of one another, and require additional hardware to operate. These adders are necessary to ensure that the Energy Commission does not inadvertently remove these niche products from the market while driving efficiency (and deriving energy savings) from the mainstream market. Nonetheless, the Energy Commission will conduct rigorous market monitoring of monitors through reporting to the MAEDBS and analyze the data as it becomes available. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market shares and may significantly reduce the energy savings projected during this rulemaking.
14q	California Investor-owned Utilities, TN #214155	4.4 On Mode Power Allowance: Correction We believe CEC should make a correction in Table V-4. For consistency among the size bins, the following should be corrected in Table V-4 for both the regular resolution (≤ 5MP) sizes and the high resolution (> 5 MP) sizes as shown in Table 4.3 [see comment for Table]. Currently, if 20-inch monitors are subject to the On Mode requirements in the lowest size bin, based from the ENERGY STAR Version 6 requirements, all 20-inch models that were manufactured since 2012 would be able to meet the level with no modifications necessary as shown in Figure 4.4 [see comment for Figure]. This would mean that there will be no savings for consumers associated with these models. Given that all 20-inch	The Energy Commission disagrees with the IOUs' comment because the on mode power allowances in Table V-4 were adjusted to ensure 20 inch or smaller size monitors, which make up a small and shrinking segment of the market and have lower sales price, remain available for sale. The energy savings loss is minimal in this category, but adjustment to the size bins ensures the availability of these products in the market. The Energy Commission agrees with IOUs' point that there are many monitors in this size bin that already meet more stringent requirement, however the Energy Commission made the adjustment to the

		models would meet the current CEC proposal and given that there are cost effective strategies available today for these models to be more efficient, the CASE Team recommends CEC update current screen size bins according to Table 4.3.	standards to ensures the availability of low cost units. No change was made as a result of this comment. The Energy Commission also deliberately included monitors with a diagonal screen size of 61 inches. This will yield additional savings for very large monitors and reduce the risk of a loophole through larger and larger monitors. Therefore, the Energy Commission did not make the IOUs' proposed change to the largest size bin of monitors.
14r	California Investor-owned Utilities, TN #214155	4.5 On Mode Power Allowances for High Resolution Monitors: We believe there is another correction needed in Table V-4 in the Express Terms (and corresponding Table 15 of the Staff Report). For higher resolution monitors, in previous drafts, CEC proposed an equation that did not include resolution as a variable in the On Mode power allowances similar to the current proposal in Table V-4. However, for these high resolution models, in previous drafts CEC proposed a constant 21 Watt (W) allowance in the equation regardless of resolution. We understand that the constant term was determined by multiplying 4.2 by 5.0 (the megapixel [MP] resolution that was the cutoff at the time). This way, there would be a gradual increase in the resolution adder up to a certain resolution. In the Express Terms, CEC proposes the same resolution cutoff (i.e., 5.0 MP) but increased the constant allowance to 25 W. Keeping the equation as-is would mean that models with a resolution between 5.0 MP to 6.0MP could get an additional allowance of up to 20%, which would be in effect another adder.	The Energy Commission disagrees with the IOUs' comment to change the 25 watts allowance to 21 watts or 4.2X5.0. This change was made so that high resolution monitors, which are a smaller part of the monitor market, remain available after the efficiency standards take effect. Many monitors that already comply with the regulations would not comply under the more stringent 21 watt limit suggested by the IOUs. The Energy Commission evaluated the sale of these units and concluded that there is not enough profit or incentive for manufacturers to make energy efficiency improvements in these units because of the lower sales volume and lower price of these monitors. The energy savings from making the proposed change is insignificant given the lower shipments of these products. Therefore, the Energy Commission did not make a change in response to this comment.

14s	California Investor-owned Utilities, TN #214155	Data Submittal Requirements: The Data Submittal Requirements in Table X must include all information required to determine the power requirements, adders, or exceptions for each monitor. The CASE Team notes the following additions, clarifications, and correction that need to [be] made to provide complete information. We have also provided an updated Table X with these updates incorporated in Appendix A. Technology Type: Two elements of the technology should be recorded: the display type and the backlight type (if present). The most common display type is the liquid crystal display (LCD). Organic light emitting diode (OLED) emissive and quantum dot (QD) emissive displays have been in development and may be prominent on the market when the standard is in place. To add to the confusion, however, OLEDs can potentially be used as the backlight in an LCD display, and QDs can be put on a film to increase color gamut (e.g., 3M's quantum dot film.). To provide unambiguous information, therefore, the CASE Team suggests breaking the "Technology Type" category into "Display Type" with permissible answers "LCD, OLED Emissive Display, Quantum Dot Emissive Display" and "Backlight Type" with permissible answers "CCFL, LED, OLED, None." Monitor Type: The CASE Team recommends editing the permissible answers so that only one may apply to a given monitor, and that answer indicates what kind of adders or exclusions the product qualifies for. We recommend permissible answers of Computer Monitor, EPD, OLED, Gaming	The Energy Commission made some of the requested changes and rejected others as follows: Technology Type: The Energy Commission agrees that "technology type" may be too vague for reporting in Table X. Therefore, in 15-day language, the Energy Commission changed "Technology Type" to "Backlight Type" with the associated potential backlight technologies. The Energy Commission did not add a field for "Display Type" because it is not necessary to ensure compliance with the regulations and would not provide data helpful to the consumer in choosing a monitor. Monitor Type: The Energy Commission made changes in 15-day language to Table X to clarify the "Monitor Type" reporting requirements similar to what is suggested by the IOUs so that it would be clear what adders would apply to the product. Screen Luminance: The Energy Commission did not adopt the additional testing requirements for screen luminance suggested by the IOUs for the reasons stated above, and therefore cannot collect information about those features in Table X. Native Resolution: Aspect ratio is not a component of the efficiency levels. Therefore, collecting information on aspect ratio is not necessary for purposes of

		Monitor with Dedicated Hardware, Gaming Monitor without Dedicated Hardware, KVM/KMM, Medical Display, Very High Performance Display. Screen Luminance: The CASE Team suggests measurements of both as-shipped and maximum luminance. Both should be captured in Table X. Native Resolution: The CASE Team recommends reporting resolution in terms of horizontal and vertical pixel count, for example 1920 x 1080, to capture information on aspect ratio. Resolution in megapixels is easily calculated as the product of horizontal and vertical pixel count divided by one million. Curved Monitor: Because the CEC has proposed an adder for curved monitors, the fact that a monitor is curved must be recorded.	enforcing the standards. In contrast, megapixels are a component of determining which standards apply and are therefore necessary to collect to compare the appropriate efficiency standard with the reported energy consumption. Curved Monitor: The Energy Commission agrees and added curved monitors as a reporting requirement in 15-day language.
14t	California Investor-owned Utilities, TN #214155	There are several areas on the regulation where CEC should examine available performance and technical data provided to the CEC throughout the electronic displays dockets. The CASE Team has provided robust testing, market, and performance data analysis to support cost-effective levels originally proposed by CEC in the previous staff report. The CASE team encourages CEC to further examine some aspects of the power proposals now proposed in the Express Terms, especially in regards to adders and other areas where the proposals are less stringent. While we agree that some of the specialty monitors alone are relatively a small share of the overall market currently, given gaining popularity of higher resolution and featured equipment, by 2019 or 2021 these monitor types could become mainstream. In reviewing the regulatory language, the CASE Team	This comment is a summary of the other comments in the document. The Energy Commission based its regulations on substantial evidence in the record, and has carefully reviewed the entire docket, both pre-rulemaking and during the formal rulemaking, to ensure that its regulations were supported. For specific responses, see responses to comments 14b through 14s.

		recommends modifications with supporting analysis in order to optimize energy savings and ensure robust compliance. Addressing these elements will allow California to even further address some of the statewide policy objectives of Zero Net Energy California Long Term Energy Efficiency Strategic Plan and AB32 energy efficiency goals. We appreciate careful consideration of the following comments.	
15	CA IOUs, TN #214540	IOUs conducted testing of computers to determine whether RAM size would impact sleep power consumption. The analysis demonstrated that the biggest factor determining consumption is the total amount of memory. Additionally, IOUs found that an increase in the number of DIMMs used also caused a small increase in sleep-mode power consumption. The size and type of the power supply did not affect sleep mode efficiency as long as the power supply was at least 80+.	This comment was received after the end of the comment period for the 45-day language. Although the Commission is not obligated to respond to late comments, the Commission has chosen to respond to this comment. The results of this study were used to verify that sleep power limits listed in Table V-6 in relation with system memory capacity are accurate. It was also used in response to comment 3t.
21a	Donna Sadowy, AMD	Display Test Procedure: NRDC is stating that that the test method uses fixed refresh rate, not variable therefore there is no need for any extra allowance for gaming monitors (both FreeSync & Gsync). Energy Star 7 display test procedure states that for fixed pixel displays (non-CRT):, *refresh rate shall be set to 60 Hz, unless a different default refresh rate is specified in the product manual, in which case the specified default refresh rate shall be used* We were not able to complete research on the Energy Star display test clip in one day. If I can find any additional information over the weekend I will	This comment supports the regulations and does not request changes to the regulations.

		provide it to you. We suggest discussing this issue further with [omitted specific names] OEMs who sell gaming monitors. We would be concerned about any removal of the adder, since high-end gaming displays are a niche market, where we expect additional functionality will be added to displays going forward.	
21b	Donna Sadowy, AMD	Treatment of FreeSync and G-Sync Using the Same Performance Standard: NRDC recommended that "Gsync: Hold to same standard (performance-based standards)" …as FreeSync. We agree with the recommendation. Providing no adder or a smaller adder for FreeSync is not supported by the data from the IOUs/NRDC own study (below). [Proprietary information redacted.] We would be concerned if CA. gave preferential treatment to a proprietary technology, and we hope that the regulation will not create harm to uptake of FreeSync or any other new refresh rate technologies in the marketplace.	The Energy Commission agrees that software-based implementations (like FreeSync) of variable refresh rates characteristic of gaming monitors, require an additional allowance (as presented in 45-day language), but disagrees that these implementations require the same amount of power as one with incremental hardware-based assistance, like Gsync. However, the Energy Commission agrees that because these are proprietary technologies, it is more appropriate to distinguish them based on whether they are hardware or software implementations for gaming monitors. This is consistent with the approach taken in the 45-day language. Therefore no change is necessary in response to this comment.
21c	Donna Sadowy, AMD	FreeSync and Power Consumption: NRDC states that FreeSync is purely software-based, all work in GPU, no extra power draw in monitor. This understanding of FreeSync is not correct. FreeSync monitors use hardware located in the monitor which is provided by other component manufacturers. MStar, Novatek and Realtek are	This comment supports the regulations and does not request changes to the regulations.

		examples of partner companies providing specialized scaler chips which work with FreeSync to synchronize display refresh rates and GPU framerates. FreeSync scaler chips are not standardized monitor components. These chips enable features that are not available with other dynamic refresh rate technologies, including: picture scaling, on-screen display (OSD), HDMI®/DVI inputs for legacy users and DisplayPort™ High Bit Rate Audio. Additional information is available here: http://ir.amd.com/phoenix.zhtml?c=74093&p=irol-newsArticle&ID=1969277	
21d	Donna Sadowy, AMD	Power consumption FreeSync vs. Gsync Monitors: NRDC States that 73% of GSync, 57% of FreeSync monitors on market today already comply with no adder. NRDC's own data shows that fewer FreeSync monitors are able to comply with the power limits, compared to the competing technology. In addition to the scaler component described above, FreeSync allows monitor manufacturers to make their own customizations which can result in additional power consumption. One example of gaming monitor customization is "Smart Insight" technology provided by a company called Eizo. This technology adjusts monitor brightness in real time so that gamers have better visibility in light and dark areas. This technology is enabled by a customized chip [. . .]	This comment supports the regulations and does not request changes to the regulations.

		http://gaming.eizo.com/news/eizo-brings-competitive-advantage-to-gamers-with-23-foris-fs2333-led-backlit-monitor/	
22a	Humberto Fossati, HP	This comment provides a chart of industry estimated marketshare of various monitor types through 2022.	This comment supports the regulations and does not request changes to the regulations.
22b	Humberto Fossati, HP	Regarding OLED monitors, the Industry needs to highlight that it does not recommend a change in the ON power allowance for OLED monitors manufactured after Jan 1,2021. As stated by both the Advocates and Industry, the main levers that we can employ on monitors to improve power efficiency are: - Improvement in the LED efficiency of the back-light - Improvement in the Optical Film Stack on the panel (DBEF films and the like) - Improvement in the efficiency of the power supply For OLED monitors, the first two are non-applicable, and currently we are using EPA approved Class-VI EPS (87%+ efficiencies already) For this emerging technology, we currently do not have “line of sight” to any “new” power efficiency improvement opportunities. The current risk of reducing the allowance by Jan 1, 2021, is that we can have a situation where the Industry introduces product, which by 2021 needs to be removed because it no longer meets CEC’s max ON power limit.	This comment supports the regulations and does not request changes to the regulations.

22c	Humberto Fossati, HP	Regarding market sales data from the Industry. The Industry recommends that CEC do not request market sales data for the different product offerings discussed above for the following reasons: - Not really feasible for the Industry to provide "California Specific" sales data; we do not have it. - Consumer monitors: example: bulk deliveries to a centralized hub operation for Best Buy for example, would not include information of how much of that volume Best Buy would plan to ship to its CA stores for sale there (same for other major retailers) - Commercial/business monitors: example: bulk deliveries to a centralized hub operation for BM or Citibank for example, would not include information of how much of that volume they would plan to deploy/allocate to their CA offices for use there (same for other major corporations) - All the "Internet" based sales… no idea how much volume eBay, Amazon, CDW, and many other companies like these get products shipped to CA. Thus, Industry will not be able to provide market share data for CA, for any of the specific products discussed.	This comment supports the regulations and does not request changes to the regulations. The inability of manufacturers to provide California-specific shipment/sales information for various monitor types confirms the need to collect this information through MAEDBS and verify any trends identified using subscription sales data.
October 10, 2016 Lead Commissioner Meeting Comments			
T1-a	ITI & Technet, TN #213959	Hankin: ITI and TechNet support the standards proposed. We've issued a press release saying that exact same thing. I'll come back to the asterisk. Our oral and written comments will address certain	The Energy Commission appreciates the support for the regulations.

		omissions, clarifications, and adjustments that we've discussed with CEC staff. The other two speakers will go into these in more detail. Indeed, this is my only slide.	
T1-b	ITI & Technet, TN #213959	Hankin: One final comment, in Slide No. 13 of the staff slide set there's reference to the rechargeable battery subsystem's language that's in the rule. That correction is a vital one. Indeed it's vital that it occur before January 1, 2017. And that the proposal fully aligns with the conversations we've had and we appreciate the action being taken by the CEC. It just needs to get done this year and I'll stop there.	The Energy Commission appreciates the support for the regulations.
T1-c	ITI & Technet, TN #213959	Fossati: The item of question was the sentence that got added on the 45-day regulatory language. It states that, "Manufacturers shall apply no more than one applicable adder from the list of Table V-5 to determine the maximum on-power (sic) wattage." The concern from the industry is on the use of "one applicable adder," as it is not a standard with other regulations or our own site regulation on the computer side. Let me explain that. During all of our industry presentations and feedback for monitors and computers alike, we have emphasized that in cases an allowance is needed, an allowance is additive to other additional power. Initially, the industry had proposed to exclude from the regulation many types of monitors due to their specialty status or due to their low market share, in California. As a compromise to those, instead of excluding them, it was agreed that instead we would have a system of allowances similar in fashion to what was done on the computer regulation, and similar in fashion to what was done by ENERGY STAR 6.0 and ENERGY STAR	The Energy Commission made this change in 15-day language.

		7.0. So for example, in the computer regulations, it is understood and accepted by the CEC that the industry will get capability-based status for attributes on that computer. For example, if the computer has more system memory or it has one of those powerful discrete graphics cards or additional hard drives or additional add-in cards, all of those get added into the suitability score and eventually provide a[n] increased amount of power for that system to be tested against. The same situation exists in monitors where we have a difference in individual allowances that should be additive and for things that incorporate more capability or technology. And normally those are not included on the on or base power limit. For illustration purposes, this is an excerpt of the ENERGY STAR 7.0 Regulation. It's a little bit different than ENERGY STAR 6.0, because ENERGY STAR went into their own decision for absolute power numbers to the total energy consumption numbers. But you can see on that regulation how they also add the different capabilities that a monitor in this case could have. So for example, to the base power they add the extra power for an enhanced performance display, which we also have on the CEC regulation. They also allow extra power for automatic brightness control, for network connectivity, for occupancy sensors, for touch, etcetera, etcetera. So like on that regulation when we are working the regulation for the CEC, we have some of those allowances. And then again as I mentioned before, in order not to have to exclude or take out of scope some product, we agreed that we were going to provide some additional allowances to other categories of displays. The area that we want to emphasize, and also to be fair to the industry and the advocates, is that there [are] some instances where we	

		do agree that the allowances are mutually exclusive. For example, in the category of the enhanced displays we get an allowance for meeting the minimum of an sRGB level of a color gamut. And we get a different allowance for meeting the minimum spec for an AdobeRGB type panel. We do not expect to get both allowances. It's a situation where it's either one or the other. So the way that we are proposing to structure the table in the regulation is add one more column where we would put a category, and we would bundle those two together into one single category. The same thing is expected for gaming monitors. We have two different allowances there, one for monitors that included additional hardware for a hardware-assisted performance, and has mentioned one that did not. In this case, we do agree that those two also would be mutually exclusive, so you would not get an allowance for both. You get one or the other. The other categories are emerging technologies that we're starting to see more and more and we hope that we are going to be able to provide products to California and the rest of the world. And those include things like OLED, Curved or Touch. The way that we are proposing to structure the table is to simply add that category and then change the wording on Section E to say that, "Manufacturers shall apply the applicable adder(s) from Table V-5." And that, "Only one adder can be applied from each," of the five categories shown. And for completeness the original table did not have the last category. The last category was just described in wording, in a previous page. But we wanted to make sure that all of the allowances were comprehended in the same table, so we added the one watt allowance for Touch as the last item on this table. And then to clarify, like we did in some of the definitions we just put this clarifying statement here	

		that says that for example, if you were to have a gaming monitor that were also a Curved monitor, that in that case you would get the allowance for the additional hardware needed for the gaming solution. And you would get an allowance for the additional power needed for the less efficient Curved solution, just as you were getting individually.	
T1-d	ITI & Technet, TN #213959	Fossati: With that we have a minor correction to Table V- 6. In Table V-4, the formulas were specifying that you would multiply the adders. You should just add them. If you multiply them you carry the probability that you have additional error, because you will be compounding the adders. We do not need that. So the suggestion is to just change the multiplier to a plus, on the Table.	This change was made in 15-day language.
T1-e	ITI & Technet, TN #213959	Fossati: So this one was a question that we were having in general and it applies in a sense to both displays and computers. It's been requested that we test on, sleep, and off modes. The request from industry is that product that does not meet ENERGY STAR or does not meet the CEC; we don't even bother to send it for the labs, for testing. So the proposal is for us to have the exempted monitors exempted from testing. That there is no need to go through the expense and through the expense and through the book keeping of all of the product that we will not be able to qualify for sale in California or we will not qualify for ENERGY STAR.	The Energy Commission requires testing and reporting of exempted monitor types, such as KVM, KMM, and very high performance monitors, to be able to monitor the energy consumption of these products and determine if their exemptions have become a loophole in the regulations that leads to dramatically increased market-share of these products and, thus, lost energy savings from the staff analysis. Therefore, the Energy Commission did not make this recommended change. The Energy Commission exempted medical monitors from testing requirements but requires that they report the model number to better track the availability of these products in the market to monitor for

			potential loopholes from this exemption.
T1-f	NRDC, Transcript & TN #213960	The main issue that we have with the proposed standards is the timeline, the extended timeline, which is much longer than originally envisioned. And with that timeline comes a risk of major loopholes developing if things which are not common today -- no allowances or exemptions are given for emerging features or rare features, which make sense compared to today's market or even last year's when we collected most of the data for this rulemaking -- become very significant and [a]ffect many products and would potentially wipe out a large part of the savings that are being projected here. So looking at the timeline we have, assuming adoption by the end of the year -- and looking at when the data that was used for the analysis for this standard was collected, which was mostly in 2015 and early 2016 -- we're looking at a three-to-four years timeline between data collection and Tier 1, and five-to-six years between data collection and analysis and Tier 2. And this is a really long timeline in computer technology terms. You know, we're talking about several generations of product. If you think back to where computers were six years ago they were very different from what -- at least in terms technology. The form package may not be that different, but the technology inside them was very different to what it is today. So let's project ourselves and see where we're going. A lot of the things that today may be emerging features are likely or is actually a high probability that they will be much more common, if not standard, by the time Tier 1 and particularly Tier 2 go into effect. So if you have a significant lot allowance or an exemption given to a	The Energy Commission updated its data from 2015 to use the most recent ENERGY STAR data available in July 2016 for its rulemaking. Thus, the data is not stale as suggested by this comment, but relevant and the best data available at the time of this rulemaking. This data demonstrates that while some monitors are already able to meet the proposed efficiency levels, many are not. The goal of the Energy Commission's mandatory standards are to move the entire monitor market to more efficient technologies, rather than to simply eliminate types of monitors from the market. To ensure that manufacturers have sufficient time to design and manufacture more efficient monitors, the Energy Commission established effective dates that align with when manufacturers are expected to produce new products that meet the efficiency levels. NRDC does not present any information or data to suggest that an earlier effective date might be as effective in achieving 100 percent market transformation for monitors while yielding energy savings. NRDC predicts that the future monitor market might have more features subject to allowances or exemptions than the Energy Commission predicts will occur. Because NRDC does not present any market

		feature, then this feature becomes common and your allowance is no longer warranted because of the time -- it has been integrated into silicone and doesn't need to be or now doesn't require any extra power -- then you end up having a large loss of savings in the standard. And that's one major concern and I'm going to point out a few of those.	projections to demonstrate that this might be the case, the Energy Commission chose to rely on the market projections available in the record[7] and did not make a change in response to this comment.
T1-g	NRDC, Transcript & TN #213960	But before we do that I want to emphasize this issue of allowances, because it is a little bit arcane if you haven't been involved in the detailed negotiations. So I want to take an example of a monitor of a 27-inch diagonal size, 2 megapixels so fairly standard would get, under the proposed standards a 21 1/2 watt on mode allowance. So that corresponds right out to 50 kWh/y. If this monitor met the AdobeRGB enhanced performance display threshold it would get an extra 60 percent in Tier 2 and a 75 percent in Tier 1. I've just done the math for the 60 percent here in Tier 2. That means an extra 30 kWh/y allowance. And that 30 kWh/y, we know that the technology trend are towards increased display quality at no additional power requirements. And if within four years this becomes much more common -- so again I don't know for sure, but let's just for the sake of the argument imagine that it is -- it gives an extra 30 kWh/y for the displays. And this is pretty much what we're hoping to save on the displays. I mean, we know we're saving 30 to 50 percent energy and this is 30 percent energy, so these could wipe out savings for all the monitors that achieve this functionality. So that's what I call	NRDC predicts that the future monitor market might have more features subject to allowances or exemptions than the Energy Commission predicts will occur. Because NRDC does not present any market projections to demonstrate that this might be the case, the Energy Commission chose to rely on the market projections available in the record[8] and did not make a change in response to this comment. The Energy Commission also notes that a 27-inch, 2 MP monitor would not qualify as an enhanced-performance display even if it has AdobeRGB levels because the definition of an EPD requires that it have a native resolution of at least 2.3 MP. The Energy Commission carefully crafted allowances and exemptions to be specific and narrow, and relevant only to the technology that requires these allowances. Nonetheless, the Energy Commission has

[7] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, page 8.

[8] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, page 8.

		the loophole here. For those who watched the debate last night know they talked about loopholes as well. So here we are. So and this is not about one or two of these issues. This is the six areas that we have identified and that actually reminded me of the seventh one, with the Touch, which wasn't on this table where we have very significant allowances or weaker requirements or an exemption.	included testing data reporting requirements that it will use to monitor the market to determine if monitors using the allowances and exemptions grow significantly in market-share such that the anticipated energy savings would not materialize. If this occurs, the Energy Commission will consider new efficiency levels or reduced allowances for these products to ensure that the savings expected from this rulemaking materialize and that manufacturers incorporate the cost-effective and technologically feasible efficiencies in the design and manufacture of their mainstream products.
T1-h	NRDC, Transcript & TN #213960	What we're talking of here in Tier 2 -- and I'm focusing on Tier 2, because I realize that for Tier 1 there's a limited time for industry to reengineer products to be able to meet stringent requirements. But for Tier 2, we have four-and-a-half years from adoption -- depending on computer and displays -- between four and four-and-a-half years from adoption to reengineer products and achieve these levels. And giving 35 percent, you know, 20 or 35 or 60 percent is potentially a high risk of loss of savings. And the problem is I don't know which one -- I don't know for sure myself, which one of those are going to become common across the market. But what I know is that the law of probability is if any of those has a 20 percent chance of becoming much more common that gives a 75 chance of or probability of at least one of those becoming common, just compounding all probabilities.	NRDC predicts that the future monitor market might have more features subject to allowances or exemptions than the Energy Commission predicts will occur. The NRDC presents probabilities, but because the Energy Commission had market projections in the record from manufacturers, it chose to rely on those market projections[9] and did not make a change in response to this comment.

[9] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, page 8.

T1-i	NRDC, Transcript & TN #213960	All right so we have a very high chance here that at least one if not several will become common. And I'm going to take this opportunity to respond to Humberto's proposal that these should not be additive or they should be additive. And I can't agree with that when there's such a risk that at least one or several of those would happen because these are already extremely high. If you end up being able to add those levels, then you don't have any settings left. So I might be able to agree with that with much lower allowances, but not with the current levels.	Information in the record contradicts NRDC's assertion that monitors with special features, like EPDs, gaming, or OLED, will become common enough that the efficiency standards will no longer result in savings.[10] NRDC argues that the monitor allowances should not be additive because the allowances are too high. However, NRDC does agree with the concept of adding allowances together where, as here, additional features would ordinarily require more power. NRDC appears, then, to disagree with the allowance levels for monitors generally, whether separate or added together. The Energy Commission disagrees that the allowances, whether individual or added together, are too high, as the allowances were established based on substantial evidence in that record that the levels are necessary to allow the continued sale of these niche, high-end products after the standards take effect. Each individual allowance is based on data from ENERGY STAR that shows what is necessary for each type of monitor to comply today, so that energy consumption does not increase from these products, but allowing manufacturers to focus efficiency improvements on mainstream monitors that have a larger

[10] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, pages 8-9.

			share of the market and therefore will provide more energy savings. As each feature for which the Energy Commission provided an allowance would separately require power draw to operate, it conceptually makes sense to add these allowances together for monitors with multiple features. Reducing these allowances or eliminating the ability to add them together would instead force manufacturers to make efficiency improvements to these products in Tier 2, raising the costs of complying with the standard, or prevent these low-volume products from being sold in California at all. Neither of these results is the intent of the standards. Therefore, the Energy Commission did not make the suggested changes.
T1-j	NRDC, Transcript & TN #213960	Gaming monitors, so these are functionality which allow the display to adjust the refresh rate to that of the graphics card in order to smooth out a display, particularly for motion sync and gaming. Given a 35 percent adder in to Tier 1 and 20 percent in Tier 2, the problem is the test method for displays doesn't use variable content, variable rate content. It's fixed. If you read the test procedure it's fixed content. So why should there be an allowance given for content that's not being -- full functionality that is not being used? You know, I mean there is absolutely no reason for it. In addition, if we look at the two technologies that provide this from the two companies, AMD and DDR (phonetic) that are represented here today. One of them is software based. The other one is hardware based. The software version doesn't require any additional power in a display. It's basically adjusted	NRDC argues that because variable refresh rates are not tested under the test procedure, monitors with the hardware or software to allow for variable refresh rates do not need an adder. This is not the case. The variable refresh rate is a way to identify whether a monitor is a gaming monitor or not, and the allowances are provided because these monitors have additional features that require more power and that are related to the display technologies, and therefore would be enabled in testing. Therefore, the Energy Commission has provided allowances for these features. The Energy Commission provides an allowance for software-based

		to what the GPU sends to the display, so we don't see any reason why technically it needs to be an extra power, even if the content were variable in the test method, which as I said is not. And this is a performance-based standard, so we have two different solutions to do the same thing, which we think should be held to the same standard. It shouldn't be a technology-based standard. It should be a performance- based standard with two solutions having the same benchmark to meet. And lastly, if we've looked at the ENERGY STAR Version 6.0 list of qualified products, which represents pretty much all the market. And so now we're on Version 7, so Version 6 just before it, the end of its life had pretty much all the market. And we found that 75 percent, 73 percent, and 57 percent of freezing monitors already comply with no adder. So if today they can comply with no adder, why are we giving them an adder for two and four years from now? To us it doesn't make sense. This is a high risk, because especially for the software based solution where there's no additional hardware cost to make these products. We don't know, but there's a pretty good probability that these will become common by the time the standards go into effect. So to just run that little loophole test with three criteria, how many products are affected by effective date, or a high risk that many products will be, what's the impact for product? It was 20 and 35 percent. That's very significant. That's most of the savings that you can get for each product. And then is it warranted by effective date? Well, it's not warranted today, so we don't see why it's warranted by effective date. So that's a high risk of a loophole. Recommendation is no adder at all for Tier 2. We don't think we need an adder for Tier 1, but we're open just for the spirit of	implementations of gaming monitors to ensure that the standards are technology neutral with respect to how the variable refresh rate is achieved. The Energy Commission disagrees with NRDC's recommendation to eliminate Tier 2 adders for gaming monitors. NRDC bases its recommendation on two arguments: (1) That gaming monitors today meet the standards with the allowances, which means they will not need to improve their efficiency; (2) That gaming monitors will be common in the future, which means there will be lost energy savings from not regulating these products. The Energy Commission agrees that gaming monitors today may meet the proposed standards, but the purpose of the standards is not to drive significant efficiency improvements in high-end gaming monitors, but rather to drive efficiency improvements in mainstream monitors, which make up a significant share of the market. This is a disagreement as to the purpose and policy of the regulations, not the regulations themselves. The Energy Commission disagrees that gaming monitors are likely to be more common in the future. NRDC does not provide data to support its assertion that these products will become more relevant. Gaming monitors, which support a variable

		compromise and given no further timeline to have a low adder, a 10 percent adder if necessary, although again we don't think it's necessary. Also, I want to caution the Commission against exempting those. I agree that there should be an adder, at least for Tier 1 and not an exemption, because that would make a loophole even bigger.	refresh rate, cost more and have a more specialized purpose than mainstream monitors, which are primarily used for word processing and playback, which do not require a variable refresh rate. Data in the record[11] indicates that these are not likely to become "mainstream" by the effective date of the regulations, and therefore aren't going to be a source of lost energy savings. Nonetheless, the Energy Commission is committed to monitoring the market to determine if any exemptions or allowances become loopholes, and to reopening the regulations to make adjustments if this market monitoring indicates that it is necessary.
T1-k	NRDC, Transcript & TN #213960	The second point is on enhanced performance displays, so those are displays that have higher color quality, color gamut contrast, resolution and that requires more power today to do this. The proposed adder that we've seen before is between 20 and 30 percent for standard RGB. And standard RGB is actually a fairly low bar. It's not very far from where we are today and it's not very difficult to meet them within two or four years. We know the technology is evolving towards better quality. It's actually fairly likely that this will be achieved. AdobeRGB is a higher bar, but still not that -- in terms of in four years it could also easily be achieved. And if we look at the market penetration today, we run against ENERGY STAR Version 6.0, we found 63 percent of standard RGB and nearly 50 percent of AdobeRGB, able to meet	While NRDC correctly points out that 63% of sRGB and 48% Adobe RGB meet the ENERGY STAR v.6.0 specification, this does not properly interpret the available data because these models represent only a small portion of the total EPD market – many EPDs are not certified to ENERGY STAR. Industry pointed out that the burden of meeting the stringent energy standards will adversely affect product availability by requiring them to stop selling EPDs, as they couldn't be made more efficient in the same timeframe as mainstream monitors. As a result, the Energy Commission focused on driving energy savings from more mainstream monitors and setting

[11] See, e.g., e-mail from Humberto Fossati to Harinder Singh, Oct. 21, 2016, available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN214561_20161123T145401_Addl_Documents_Relied_Upon_15day.pdf, page 8.

		the Tier 2 level today. So four-and-a-half years before effective date we already have two-thirds and half of the market meeting these two levels. And Version 7.0, which is the basically the latest products on the market at the moment is 100 percent. I mean, still it's a recent spec, but it's 100 percent today that meet it. So in four year's time it's very likely that every enhanced-performance display will meet the levels with absolutely zero problems as they can already do it today. And market share, as I said, it's a pretty high likelihood that this is going to become very common. So our recommendation is to for standard RGB is to have a lower adder of 10 percent in Tier 1 and zero in Tier 2. And for Adobe RGB, 50 percent in Tier 1 and 25 percent in Tier 2 and again, avoid the exemption.	allowance levels for EPDs that would prevent these products from significantly increasing energy consumption beyond what is consumed today. In addition, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS. The Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market share and may significantly reduce the energy savings projected during this rulemaking.
T1-l	NRDC, Transcript & TN #213960	We think it's important to test and list all products, even those which are exempted from TEC (phonetic) requirements, because it's important to see where the technology is going, and whether these products have the potential to achieve standards that they have been exempted from. And if these are truly exemptions and low volume, there shouldn't be a significant burden on the industry. And if it's a high volume they should be covered. So I think there's a trade-off here. If they warranted to be exempted then it should be a low volume and shouldn't be an issue for industry to test them.	The Energy Commission agrees and requires that all monitors, except medical monitors, be tested and certified to the Energy Commission.
T1-m	NRDC, Transcript & TN #213960	So let me conclude here, so in terms of what we [are] asking CEC to do, which I think would address these issues. First is to tighten or close the loopholes or all the potential loopholes that we've identified as recommended in this presentation, and in our comments, even though we only covered two	As described earlier, the Energy Commission disagrees that the regulations have created or include loopholes. Nonetheless, the Energy Commission will conduct rigorous market monitoring of gaming monitors through reporting to the MAEDBS. The

		loopholes in this presentation.	Energy Commission will consider revisions to the monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for monitors are obtaining rapidly increasing market share and may significantly reduce the energy savings projected during this rulemaking.
T1-n	NRDC, Transcript & TN #213960	The other thing, which I think is really important, because nobody knows -- and you know I don't know and Commission probably doesn't and the industry may have a better idea in terms of road map -- but doesn't know where the market is going. So we don't know where the technology is going. And I think it's important that we can adjust the standards as the market evolves. And as we have new information on how this market is evolving, to see that if some of these loopholes emerge and develop to be much more common than expected. And they are at risk of wiping out most of the savings from the standard or significant share of the savings on the standard, the Commission should reopen a sub-rulemaking and phase out the adders or allowances or exemptions that are causing the loopholes in the standards in order to preserve the savings and make sure that Californians do get the benefits as expected. I think a lot is at stake here if then here if half of the projected savings do not materialize of course both computers and monitors due to various loopholes. We're talking about $1 billion over six years, because roughly the expected life of the standard and two million tons of unnecessary CO2 emissions. So it's really important that Californians do get the benefits which are being projected in this rulemaking.	The Energy Commission agrees that monitoring the changes in this market will be important to ensuring that the standards remain relevant and effective in reducing energy consumption from computer monitors.

T1-o	NRDC, Transcript & TN #213960	And just a final word, we are not here challenging -- even if we don't agree with everything and where the levels have been proposed -- we're not challenging the overall framework and the core pillars of the standard. We only asking for reasonable minor tweaks that would ensure, that would guarantee that we don't lose the savings by the time the standards go into effect.	See previous responses on specific tweaks.
T1-p	California Investor-owned Utilities, Transcript	Kim: So once again, I'm standing here to honor what is on the table and be thankful to CEC, various stakeholders, NRDC and all the California IOUs. And in my thankful heart extend to all staff, our consultants who worked very diligently for the last four years pushing, pushing for more and more data.	The Energy Commission appreciates the support.
T1-q	Appliance Standards Awareness Project	Granda: ASAP commends the CEC for its work on this rulemaking, and commends all of the stakeholders for their consistent efforts in support of the process. ASAP is particularly interested in this rulemaking, because we believe that it will have a substantial impact on the energy consumption of computers and monitors in California, and also across the entire country. We support the proposed CA standards for computers and monitors, with some adjustments. We do not challenge the overall framework, dates or efficiency levels in the proposed for either computers or monitors.	The Energy Commission appreciates the supportive comments.
T1-r	Appliance Standards Awareness Project	Granda: However, for both types of equipment we recommend minor adjustments to the proposed standards to reduce the risk that their effectiveness will be significantly reduced by changes in technology and in the market before natural revision cycle and adjustments. And computers and monitors like	As these comments recommend following the suggestions from NRDC, please see responses to comments T1-f through T1-n.

		consumer electronics in general, are challenging for energy efficiency standards, because the technology evolves so rapidly that it is difficult to project what products and features will be in the marketplace over the relevant standards development limitation before revision. As we saw in Pierre Delforge's presentation that three to four years for Tier 1 and five to six years for Tier 2, during that period we should expect technology for both monitors and computers to change significantly. The risk posed by the currently proposed adders and exemptions, and the potential effects of the proposed categorizations for computers specifically, allows significant growth in power consumption. And that would have a significant cost to both consumers and the environment. As Pierre noted, if those adders, exemptions and categorizations ending being that half of the projected savings are not realized, Californians would spend an additional $1 billion over six years, and there'd be an additional 2 million tons of CO2 emitted for California. And the effect on the national level would be, of course, much greater. So for specific recommendations on how to address these concerns are in line with NRDC's and I won't repeat them here. Pierre's done a great job of that, but in summary we ask that the Commission take reasonable steps to ensure the success of the proposed standards. You know, the industry, monitor and computer manufacturers have demonstrated an excellent ability to simultaneously improve both the performance and the energy efficiency of their products. We have no doubt that they will be able to bring out the next generation or two of their products under standards that a bit more constrained with regards to the adders and exemptions, and for computers with adjustments to the categorizations,	

		as proposed by NRDC.	
T1-s	Gregg Hardy, NEEA	NEEA applauds the efforts by the California Energy Commission, the industry and advocacy stake holders and develop a Title 20 proposal for computers and monitors that shows signs of broad stakeholder support. The proposed base allowance levels and several key adders are more stringent than ENERGY STAR levels and the CEC proposal includes important test method improvements. NEEA also appreciates the Natural Resource Defense Council, their efforts to identify and mitigate specific risks associated with the proposal for monitors and computers.	These comments support the general approach in the standards and do not request changes to the regulations.
T1-t	Gregg Hardy, NEEA	Like NRDC, NEEA is concerned that some of the proposed allowance levels and exemptions may be too generous at the time of the 2019 Tier 1 and 2021 Tier 2 effective dates, given historical power reduction curves for new computer and monitor technologies. To mitigate this risk, NEEA recommends a) tighter levels, particularly for Tier 2, for the allowances and exemptions identified by NRDC. And b) a proactive mechanism or off-ramp to evaluate and adjust levels if needed as technologies evolves. NRDC's proposed off-ramp would involve sunsetting allowances 12 months after a feature achieves significant, perhaps 10 percent, market share. NEEA also requests additional transparency into data use to develop proposed levels, for example, data behind the proposed adder for OLED displays.	For specific allowances and exemptions identified by NRDC, please see responses to comments 5a through 5ah. Please see response to comment 5o regarding NRDC's off-ramp proposal. Setting a cap like 10% on the marketshare for products such as high expandability computers would require knowing the marketshare , its trend, and other relevant data for those products today. This information is not available. The Energy Commission is collecting the necessary data in its database for all computers including the ones that have certain exemptions in order to monitor the market, its shift, and potential impacts to the energy savings. The resolution adopted for the computers and monitors standards includes the statement

		Once again, NEEA views this rulemaking as an important step in our collective efforts to mitigate the effects of climate change and encourages the Commission to look more carefully at how we can increase the confidence that needed energy savings will occur in future years.	that directs staff to "Conduct rigorous market monitoring of specific features and types of computers and monitors through reporting to the MAEDBS. Staff shall consider proposing revisions to the computer and monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for computers and monitors, respectively, are obtaining rapidly increasing marketshare and may significantly reduce the energy savings projected during this rulemaking." Data behind the energy consumption limits and adders are based on the CASE report, Energy Star data, or data provided and submitted to the Energy Commission docket.
T1-u	Shahid Sheikh on behalf of ITI, & TN #213959	ITI proposes to separate the system memory bandwidth and the frame buffer bandwidth in the requirements for high-expandability computers and mobile workstations since they have slightly different definitions.	The recommended change has been implemented.
T1-v	Shahid Sheikh on behalf of ITI, & TN #213959	Under the workstation definition, industry recommends to correct unit of measuring bandwidth, from gigabytes/sec to giga transfers/sec	The typo of Gigabytes per second is fixed and changed to Gigabits per second. Gigabits per second is a more well-defined and common unit than Giga transfer per second and therefore it is used.
T1-w	Shahid Sheikh on behalf of ITI, & TN	For the limited capability (zero) thin client treatment, ITI recommends to add "or without internal storage" to 1605.3(V)(5)(C) in order to exclude zero thin clients from complying with 1605.3(B).	A phrase has been added to Section 1605.3(V)(5)(C) that reads "… or if the model is not capable of having an operating system …" This criteria is inclusive of computers

	#213959		that don't have internal storage and therefore they cannot have an operating system. See response to comment 3s.
T1-x	Shahid Sheikh on behalf of ITI, & TN #213959	For the limited capability (zero) thin client treatment, ITI recommends to add "further, the model may substitute the power in long idle mode with power in sleep mode in typical energy consumption (TEC) equation, when calculating TEC" to 1605.3(V)(5)(C) in order to have a substitute since there is no sleep mode here.	See response to comment 3s.
T1-y	Shahid Sheikh on behalf of ITI, & TN #213959	• 1604(B) allows for conventional and full capability duty cycles. ITI has confirmed that not all OS and hardware suppliers support the full capability requirements. • OS and hardware suppliers do support one of the other capabilities called remote wake capabilities. Proposed changes would ensure all computer manufacturers would have the option of choosing between conventional or remote wake duty cycle weightings.	See response to comment 3h.
T1-z	Shahid Sheikh on behalf of ITI, & TN #213959	• Effective dates: EP adder for integrated displays; Two tiers of EP requirements are aligned with computer monitor effective dates. However, the same EP requirements apply to integrated desktop computers that have different effective dates. This date misalignment is confusing and unworkable. • EP Industry Proposal: Modify Table V-8 to align EP requirements dates with computers effective dates respectively (Tier 1: Jan 1, 2019, and Tier 2: July 1, 2021)	See response to comment 3x.

T1-aa	Shahid Sheikh on behalf of ITI, & TN #213959	Effective dates: High Expandability Computers; Compliance for computers meeting the high expandability criteria start January 1, 2018. However, the dates for discrete graphics and power supply requirements are on a different timeline ("before January 1, 2020" and "on or after January 1, 2020"). It is confusing and unnecessary to track these dates and could inadvertently lead to potential non-compliance. Change the dates to better align with computer tier dates.	See response to comment 3c.
T1-ab	Shahid Sheikh on behalf of ITI, & TN #213959	In the staff report, the add-in card allowance is incorrectly stated in watts instead of kWh or the separation should also be in kWh. The transmission rate should be in Gb/s second and not GB/s. I know this is minor stuff, but these are necessary for consistency.	Thank you for the comment. Although the staff report has some typographical errors as has been mentioned in this comment, these units are correct in the regulatory language text.
T1-ac	Shahid Sheikh on behalf of ITI, & TN #213959	Future Technologies: The reference to the petition process under Section 1221 of Title 20 seems to contemplate business as usual, whereas our discussions have emphasized the importance of expeditious consideration for these future technologies. New technologies coming to market should not be held unnecessarily hostage to a prolonged petition process. We request that CEC Executive Director take steps to ensure expedition, committing to a process of no more than 6 months	See response to comment 3aa.
T1-ad	Mark Cooper Consumer Federation of America,	We have participated in this proceeding along with several of our California members for several years now. We view this proceeding as a landmark for consumers in a number of ways. Over the course of three years, we have articulated the consumer view of performance standards as we	Thank you for your participation and for your comment.

	TN#213958	have applied to many, many consumer durables, energy consuming durables, and in this case computers. Are there potential consumer savings? In this case, we definitely think there are.	
T1-ae	Pierre Delforge, Natural Resources Defense Council, Presentation TN # 213957	And I'm going to start by highlighting that there is another risk of loophole or type of loophole that we didn't have on monitors, and that's around categorization. With computers the categories, there's four depths of category as Soheila showed early on, based on how expandable the computer is. If you have a highly expandable computer you can add cards and also the peripherals. You have to provide for that power, so you have to oversize the power supply to be able to provide for that power even if the computer is not sold with this add-in equipment. And that results in having a power supply, which is less efficient. And to recognize that and to recognize the power used by the additional interfaces on the motherboard, though CEC provided additional allowances in Categories 2 and 3 and even an exemption in Category 4, but the problem -- and we support that. We think it's actually a good way to handle categorization and a good progress from where we were in previous specifications and regulations like ENERGY STAR in the EU. However, this can also be a risk of potentially losing savings if computers can go from one category where they should really be to another one just because there is an unwarranted expandability score, which is what drives this category. So let me give you an example of that and I'm going to dive into about two examples of that, actually.	See response to comment 5j for the comment regarding concerns about oversizing the power supply. See response to comment 5g for the comment regarding category jumping and USB expandability score.

		…we're here focused on seven issues, seven potential loopholes that we identified on computers.	
T1-af	Pierre Delforge, Natural Resources Defense Council, Presentation TN # 213957	I'm going to dive into three of those, but want to mention them very briefly, so USB ports 2.0/3.x and I'm going to talk about this in a minute. High expandability exemption, and [Shahid] added a proposal on that for integrated graphics that we weren't aware of, which I think makes that even a bigger concern from our side. A 256-bit memory interface, and I'm sorry for being in the weeds here, but unfortunately this is a technical topic. So we have to if you want to -- you know, details matter in this case -- so we have to go to that level. 4-channel memory, HBM adder, enhanced-performance displays for all-in-ones is another issue, which now we have the same concerns as we have with monitors and then a secondary storage adder for "other" undefined. And that's an open door for having potentially new types of storage, which are not exactly as the ones which have been defined in the regulation, which will get 26 kWh/h, which is 10 potentially far too high compared to where they might only need 1 or 2 or, you know, just a much lower adder. And contrary to the monitors, these are additive. And I think we appreciated the fact that there weren't additives in the monitor proposal and I still want to propose, on the computer side, that they follow the same principle. And if you get one of these adders,	See response to comments 5g, 5h, 5j, 9c, and 5l.

		you know, you don't actually need more than that. I mean, they're substantial enough there shouldn't be more than one adder to be able to meet the standards. Risk compounding is the same issue. You know, if you have the chance of any one of these seven issues takes place, individually for each loophole it isn't that high. Or may or may not be that high, but the risk that any one of those or several of those happen is really high. I mean, I'm talking about 75 or 80 percent for monitors and here we have one more, so it's probably more than that, about 80 to 90 percent probability that at least one of those loopholes may occur. So let's start with USB 2.0/3.x port, so we're talking about the little outlets where you can plug in your USB mouse or phone or whatever you need in the computer. And the CEC proposes to give 5 and 10 watts, the 5 watts to USB 2.0 and 10 watts to 3.x. And that doesn't seem like very much, it's only 5 or 10, but you have to realize that you can have 10 or 15 or more of those on a computer, so they really add up. And it's actually inconsistent with the definition of USB. If you look at the technical USB standard they say 2.50 watts for 2.0 and 4.50 watts for 3.x. So that's really is more than half of those were actually in the standard. And actually looking back to ITI's comments from July 2015, we actually agree on what these should be. So unless ITI has changed position since then at least we'd like to understand why. And we don't see a reason for it.	

		In terms of impact, so having this unwarranted expandability allowance for USBs can boost the expandability score by 10 to 15 percent. And if you take some examples, we have three computers we had examined as part of the analysis I know the IOUs had examined. And if you apply the expandability, the overhead or the additional allowance is not warranted here. Two of these three would jump category and would therefore get a 20 to 30 kWhs additional allowance in Tier 1 and 10 to 15 in Tier 2. So and this is significant enough that 20 to 30 kWhs is the majority of the savings that we're hoping to get from these computers. So if you give them an unwarranted allowance of that much, basically you're saying I'm not going to get any savings from this particular computer. And then the question is how many of those are going to be in that situation? And it's a little bit hard to estimate, because it depends whether they are close to a category boundary and whether they're going to go to the next category or not. But let's just say about 30 percent of those are in that situation, you know, we're talking a very substantial savings for the standard. So we'll make more detailed recommendations in our written comments, but basically all we're asking for is to align with the technical USB standards, so that should be something that we should be able to agree on. We're not asking for something that's more stringent than that.	
T1-ag	Pierre Delforge, Natural Resources	Let's move to the second issue, which is the high-expandability exemption. And here when you have a compute that is considered high expandability you can have it in several ways. One is to have an	See responses to comments 5h, 5j and 9c.

	Defense Council, Presentation TN # 213957	expandability score of more than 690, but also by having a graphics card of more than 400 GB/s in January 2019 or 600 GB/s in January 2020. The problem is these thresholds -- and actually now to be honest we had talked about this with our industry colleagues. And at the time when we talked about it that seemed reasonable, but we did a little more digging based on the latest proposal. And we now see on the market we have AMD in particular, and I don't know -- I actually didn't do the same investigation on the video side -- but AMD has a card, which is already over the first threshold three years before Tier 1. And we'll see in a minute that this card actually doesn't even need the exemption. It's actually lower, so that the card has the lowest power in idle than many of these cards on the market. Let me actually go through that point right now. So here on the right, you can't read it, but it's basically a list of about 30 different graphics cards that were tested by Tom's Hardware. The one at the very top is that particular card with that HBM memory that I was talking about. It exceeds these thresholds and only uses 5 watts in idle. So you wonder why do we need an exemption when it can meet it and hands down beat the levels with just the normal adder. So going back to the previous slide on this, and sorry I think I went to too far here, so going back to the previous on high expandability. The thresholds are 400 and 600 when you compare it with the road maps that we looked at. There again on the AMD side we're seeing a vaguer architecture with 1,000 GB/s next year, 2017. Two years before the standard goes into effect. And Samsung is already producing HBM2	

		memory at 2,000 GB/s again three years before the standard goes into effect. So 400 is very likely to be mainstream by Tier 1 and 600 by Tier 2 and so we really don't see a need for it. The impact would be that -- I mean, this is not the only criterion. Again, we have to have in addition to this, there needs to be a 600 watt power supply, which is a pretty high power supply. So only those computers with those power supplies with those power supplies would be exempted, but with a memory bandwidth or sorry, this framework bandwidth adder is not meaningful as it is proposed today. And it could also have a perverse incentive to encourage to encourage power supply upsizing. If that's the only criterion to be able to get at that exemption then a manufacturer could go from the 500 to a 600 power supply just to be able to get at the exemption. And that would result in a 600 power supply would be less efficient, so it actually would result in an increased energy use in these computers. So for Tier 2 we don't see the need for any exemption. For Tier 1 we're open to looking at how do we make sure, given the shorter time, how do we provide some language, which truly meets the needs of niche products and which are already in the pipeline. But we want to make sure that these don't become an open-ended loophole for many products to go through by Tier 1.	
T1-ah	Pierre Delforge,	Okay. And the last point I wanted to mention is that 256-bit memory, so that feature, that's pretty high	See response to comment 5l.

	Natural Resources Defense Council, Presentation TN # 213957	right? I mean, it's today 128 is already high, so 256 seems really high. But and for that they would get 100 expandability points, which is really high and would very much help with jumping to the next category and getting this extra allowance. But with HBM, and HBM means High-Bandwidth Memory, which is a step change in memory bandwidth. You know this not the curve in memory increase that we've seen in the last few years, this is a step change and we're seeing a huge increase in memory bandwidth. You know, high-bandwidth memory is when you stack different layers of memory into a single package. And with those, as I said on the previous slide, we're seeing bandwidth up to 2,000 GB/s already coming on to the market today. And those will achieve this criterion of 256 by default, so it means that this criterion is going to result in giving all HBM platforms an extra 100 points of expandability score. And we don't see the reason for it, because there's no correlation that we can see between that HBM memory and high expandability. So we think that this is not warranted. This is, again another significant risk of loophole. I think it would be already more limited and controlled if it were given only to system memory and not to chip-integrated memory, because a lot of graphics cards for example are going to having on die HBM. And that would be the biggest loophole. And the system memory, we don't think it's necessary, but that would be a narrower one.	
T1-ai	Pierre Delforge,	So with this I only just want to finish with the last two slides I already mentioned. But the one point I	The resolution adopted for the computers and monitors standards includes a

	Natural Resources Defense Council, Presentation TN # 213957	want to emphasize is we need to have the CEC tighten or close these loopholes as we suggested. And I would very much encourage the CEC -- and one point I actually agree with you, Shahid, when you asked for a[n] expeditious petition process to be able to address the standards. You know, I encourage CEC to set clear expectations in terms of any of these potential loopholes growing beyond what is expected. To have the CEC intervene or first monitor the market very closely as Mark mentioned, but also intervene and through a very rapid rulemaking be able to close the loopholes before they wipe out most of the savings that are being expected from these standards. And that the California consumers and businesses are expecting.	statement that directs staff to "Conduct rigorous market monitoring of specific features and types of computers and monitors through reporting to the MAEDBS. Staff shall consider proposing revisions to the computer and monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for computers and monitors, respectively, are obtaining rapidly increasing marketshare and may significantly reduce the energy savings projected during this rulemaking."
T1-aj	Vojin Zivojnovic, AGGIOS	• Supporting the proposed standards and acknowledging the lasting effect that it has in California and in the nation, and even worldwide. • Pointing out some issues that we soon will face when products become multi-purpose and could be in the scope of multiple regulations. Also, more Products are connected and spend more time in active mode and less in traditional sleep mode. Suggesting the need for standards that apply in the active mode as well as horizontally across multiple relevant product categories.	Thank you for your comment. No change is requested for this rulemaking.
T1-ak	Charles Kim on behalf of Southern	• Acknowledging the difficulty of this task to set standards for such a complex and fast evolving technology and praising the work done by CEC staffs and the cooperation of all	Thank you for your comment. No change is requested for this rulemaking.

	California Edison Company	stakeholders involved. • Loopholes are small, and potential savings are huge, as long as industry complies; IOUs are expecting very high compliance with the rulemaking	
T1-aL	Shahid Sheikh, ITI	Referring to comments made by NRDC, part of it is that all these loopholes cost the industry. I don't think the industry would just try to put additional ports just to get a higher expandability score and get to the next category. Sense there's some level of pessimism and potential risk. But I think you have to give industry a chance to make sure that we can make it happen. And we expect compliance standards to be meeting the CEC's requirements and in some cases exceeding.	This comment supports the standards and does not request changes to the regulations.
T1-am	Pierre Delforge, NRDC, Transcript & TN #213960	I want to start by thanking the Commissioner and staff for all this hard work over the last four-plus years to get us to this point. This is, as you've noted, a significant rulemaking, an important rulemaking, with significant savings potential with three quarters of a million tons of carbon reduction potential annually by stock turnover. That's a few non-[trivial] contributions to California's efforts to reduce carbon emissions and address climate change. And we actually, as we've commented on before at previous workshops, we're actually seeing that these are low estimates. If you look at the Energy Information Administration's estimate of computer and monitor energy use it's nearly twice as high as the Commission's estimates, so it makes it even more significant.	This comment supports the regulations.

		I'd like to note my appreciation of not only the Commission and staff's work to get us to this point on this rulemaking, but also our industry colleagues and their constructive and collaborative attitude and engagement over the past four years. And I know we don't always see eye-to-eye on everything, but I think we've been able to achieve compromises and I appreciate that approach. I also want to recognize the IOUs and their consultants for all the investment in research and analysis that has been made over the past four years, that have been instrumental in getting us to this point.	
T1-an	Pierre Delforge, NRDC, Transcript & TN #213960	We're close to the finish line, but we're not quite there yet. And at this point as it is, unfortunately NRDC is not able to support this proposal as it currently is. We don't think we're very far and we're hopeful that we can find solutions to be able to get to a position that we can support. And what I'd like to do today is walk you through some of the major concerns that we still have.	This comment summarizes the concerns that NRDC has with loopholes from the allowances and exemptions. For specific responses on these topics, see responses to comments T1-f through T1-o.
T1 -ao	Humberto Fossati, HP/ITI, Transcript	The one thing that I wanted to emphasize is that industry is also looking at the long term. And we're trying to look into our crystal ball and to what things may happen, but it's not that good. And there has to be a certain amount of leeway in our attempts to have as much product as possible available for California. One of the things that we have explained before, for example, is that just it's likely that we will not be able to invest too many resources or money on the low end of the monitor product line, because there is no	These comments support the regulations and do not request changes to the regulations.

		room for cost additions to those products. That we have to also be knowledgeable that we don't have infinite amounts of resources or money to invest on all of the technologies that are coming over the next five-to-seven years, so part of the decision on industry has to also be into where is it worth investing the most to get the most return on that investment? And the goal that we have stated from the beginning is that we're going to try to be compliant on as much as we can on the mainstream, on what represents the 80 to 85 percent of the product line. One of the things that I wanted to also clarify, and the reason why we had requested and agreed on some of these categories, is because during the next five-to-seven years, there may be other technologies that could fall into some of those categories as well. That's, for example, why on gaming monitors we had the case for hardware-assisted versus non-hardware-assisted. Because even though today we have two large companies that are supporting one or the other type of technology, we are already seeing other companies that are going to try to get into the market with other new technologies that could fall into one or the other. And those are things that we have to evaluate. As regards to some of the comments on enhanced displays, we should note that enhanced displays are not just being sRGB or AdobeRGB. The requirements for an enhanced display include other factors that will shrink the market size even more. And that's why, when we were proposing and discussing about the different allowances, we were taking that into	

		account -- the projections from independent research industry that projected from 2016 through 2019 and 2021. That's where we showed that for example, the small-sized monitors are going to keep on decreasing in size, while some of these other new growth areas are going to, yes increase some, but not significantly. We are still pressured on a business, where desktops are selling in smaller quantities. People are moving to notebooks and tablets. And monitors are trying to find their way somewhere in between. So with all that, as I said, we will take all those comments in stride and we will provide detailed written comments in response to some of the proposals made. Thank you.	
Comments on 15-Day Language			
16	CSA group, TN#214766	The way the above section of the test method is currently worded, if the product has ABC enabled by default then ABC is not disabled and 300 lux is fed into the ABC sensor. If after feeding in the 300 lux the luminance of the display is > 90 or >150 cd/m2 (whichever is required) then it is tested at that luminance level. If the required luminance of 90 or 150 cd/m2 is not attained after feeding in the 300 lux then the brightness of the display is increased to achieve the required 90 or 150 cd/m2. I believe that if ABC is enabled by default on a product then ABC should be disabled per the ENERGY STAR test procedure in order to obtain repeatable and reproducible test results. Since the	The Energy Commission intended to measure the actual energy consumption associated with ABC. However, in response to the comments received and after reviewing the available data on ABC testing and "real world" conditions, staff concluded that more comprehensive research and data collection was needed in order to develop a test procedure that is repeatable, reliable, and accurately reflects ABC's energy-saving benefits. Therefore, staff believes that the best approach is to amend the test procedure for computers with integrated displays to align with the ENERGY STAR's test procedure for computers v.6.1.

		implementation and calibration of ABC will vary among manufacturers, changes in the lighting to which the ABC sensor is initially subjected will yield different results in different test labs with potentially large variations. ABC calibration may also vary for each of the different product types included in the scope of the rulemaking.	
17a	California Investor-owned Utilities, TN #214779	The CASE Team generally supports adoption of the first-in-the-nation energy efficiency standards for computers proposed by the California Energy Commission (CEC) in the 15- day Language Express Terms. The CASE Team also strongly supports the resolution adopted by the CEC to closely track the market to ensure that the regulations achieve the energy savings projected for that market.	This comment supports the standards and does not request changes to the regulations.
17b	California Investor-owned Utilities, TN #214779	After the adoption of this 15-day language, The CASE Team recommends three areas of focus: 1) Monitoring the data submitted to the database for model-weighted average TEC and compare that to the CEC Staff Report analysis, with special attention to: • % distribution of desktop computers, mobile gaming systems and thin clients in the three computer types defined by expandability score • # of models reported as high expandability and workstations computers • o % of computers utilizing the "remote wake" duty cycle	The resolution adopted for the computers and monitors standards includes the statement that directs staff to "Conduct rigorous market monitoring of specific features and types of computers and monitors through reporting to the MAEDBS. Staff shall consider proposing revisions to the computer and monitor regulations if the market monitoring demonstrates that products utilizing the adders, allowances, and exemptions for computers and monitors, respectively, are obtaining rapidly increasing marketshare and may significantly reduce the energy savings projected during this rulemaking." The Energy Commission, in its database, collects the data related to the recommended list of areas to focus and will

			be able to monitor and detect a market shift that affects energy savings as described in the adoption order.
17c	California Investor-owned Utilities, TN #214779	2) Modifications that clarify the regulatory language not previously recommended by the CASE Team to ensure that savings from these cost-effective and feasible standards are achieved: - define "system memory" - add clarity about what test procedure to use for "high expandability computers" etc.	- See response to comment 5l regarding clarification language for system memory in order to prevent unintended use of system memory's adders and expandability scores. - Clarifying text has been added to describe what test configuration and mode weightings must be used for computers that are not defined in the Energy Star 6.1 including high expandability computers.
17d	California Investor-owned Utilities, TN #214779	3) Modifications recommended in previous comments submitted in response to the CEC's Staff Report and 45-day language regarding key items including the high expandability desktop definition and exemption thresholds, workstation definition and PCI Express-related interfaces definition.	See responses to comments 9c, 9k, and 9g.
18a	ITI & TechNet, TN #214783	ITI and TechNet support the proposed standards and have some industry recommendations to address in the final standard and implementation.	This comment supports the standards and does not request changes to the regulations.
18b	ITI & TechNet, TN #214783	Industry recommends that CEC abandon its proposal for testing systems with ABC supported and enabled by default, as the proposed test procedure yields highly variable measurements, and would affect whether identified computers would meet the TEC levels, when those computer measurements were used to set TEC limits without ABC measured.	The Energy Commission removed the modified test procedure for ABC to align with the Energy Star's test procedure in additional 15-day language.
18c	ITI & TechNet,	Industry recommends an alternate test method for long-idle and sleep-mode for computers that use	See response to comment 3o.

	TN #214783	alternate to ACPI S3 sleep mode, to give a more accurate reading for the power consumed without changing the total time required for the test.	
18d	ITI & TechNet, TN #214783	**Proposed Language** 1604(V)(5) (F) During testing, a notebook computer, mobile gaming system, portable all-in-one, or integrated desktop shall proceed using Section 5.2(A)(1) ~~and ignore the direction not to disable automatic brightness control as described in Section 5.2(A) of~~ the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016). ~~If automatic brightness control is supported and is enabled by default, position a light such that 300 lux directly enters the automatic brightness control sensor. If automatic brightness control is not enabled by default or the luminous emittance of the display is less than described in the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016) Section 5.2(E), then configure luminous emittance of the display per Section 5.2(E) of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016~~).	See response to comment 18b.

18e	ITI & TechNet, TN #214783	**Proposed Language** 1604(H) The sleep mode power measurement shall be tested in a modified manner from the test procedure described in IEC 62623:2012: - if the Unit Under Test (UUT) uses ACPI S3 sleep mode accumulate power values for 5 min and record the average (arithmetic mean) value observed during that 5 min period as P_{sleep}; - if the UUT uses an alternative to ACPI S3 sleep mode, (e.g., low power long Idle, Modern Standby, etc.), then accumulate power values for 30 min and record the average (arithmetic mean) value observed during that 30 min period as P_{sleep}. A time period shorter than 30 min may be used if specified by the manufacturer. Such systems shall enter the alternative to ACPI S3 sleep mode directly from short idle without a period of long idle. o The measured value shall be used for both sleep and long idle in the TEC calculations.	Refer to comment "3o".
19a	California Investor-owned Utilities, TN #214780	Energy use in California from electronic displays – computer monitors and signage displays – is significant and has been growing in some sectors. Computer monitors are ubiquitous in homes, offices, and other commercial settings. They are increasingly used as second screens with notebooks and in extended desktop display setups in home and office environments. Additionally, higher resolutions and feature-rich models are being introduced on the market. These models can consume as much as five times as much power as similarly sized regular high-definition models. The California Investor Owned Utilities (CASE Team) has provided robust testing, market, and performance data analysis to support this CEC rulemaking since 2013. The CASE Team generally supports adoption of the first-in-the-nation	This comment supports the need for standards and does not request changes to the regulations.

		energy efficiency standards for computer monitors proposed by the California Energy Commission (CEC) in the 15-day Language Express Terms.	
19b	California Investor-owned Utilities, TN #214780	The CASE Team also strongly supports the resolution adopted by the CEC to closely track the market to ensure that the regulations achieve the energy savings projected for that market. Based on industry estimates, Table 1.1 [see comment for Table] outlines the market share of certain monitors that will receive allowances, exemptions, or lenient on mode requirements due to limited market shares. If market shares for these monitors increase significantly, thereby reducing the energy savings realized from the regulations, CEC should act swiftly to update the regulations. For instance, based on model count, gaming monitors are already 18% of all new monitors available from a popular retailer.	This comment supports the regulations and does not request changes in the regulations.
19c	California Investor-owned Utilities, TN #214780	In addition to the monitors that are receiving extra allowances or exemptions, there are two provisions in the test method that deviate from the current industry-accepted ENERGY STAR® test method and will add to manufacturers' testing burden: • CEC is proposing that features and functions not specifically addressed by the test method "shall be turned off or disconnected." ENERGY STAR requires that these features and functions must be configured in the as-shipped power configuration. CEC is proposing that USB hubs be turned off, whereas ENERGY STAR has required network and hub	The IOUs correctly note that the test procedure for displays adopted in this rulemaking differs from the ENERGY STAR test procedure as noted. This is because the Energy Commission's efficiency standards for displays were simplified to eliminate adders for technologies, like USB, that are not essential to displaying images on the screen and to ensure that innovations in display technologies, including new features and functions unrelated to the display itself, are not stifled by the mandatory standards. In contrast, ENERGY STAR requires these features to be tested, but then provides an adder for these features, lending complexity

		connections to be present during testing for years.	to the regulations. This will drive manufacturers to make technologically feasible improvements in the energy efficiency of the display, such as more efficient backlighting, as analyzed in the staff report.[12] The Energy Commission disagrees with the IOUs' comment that turning off features and functions not specifically addressed by the test method will add to manufacturers' test burden. ENERGY STAR is not a mandatory program, so manufacturers are not required to test twice. Moreover, to the extent that manufacturers are participating in ENERGY STAR as well as selling into California, it is likely that they would need to test twice given the long lead times for testing and certification under the ENERGY STAR program. Therefore, there is not an increase in manufacturer test burden by having deviations from the ENERGY STAR test. Therefore, the Energy Commission made no change to the regulations in response to this comment.
19d	California Investor-owned Utilities, TN #214780	As with the market monitoring provisions, it will be important for CEC to track these features that are being disabled only for the CEC test method, but enabled upon shipping, to ensure there is no resulting loss of energy savings to the consumer. Additionally, for compliance testing, it will be important for the CEC to require the reporting of	The Energy Commission did not make changes to Table X to require manufacturers to report features that have been disabled in testing, as an open-ended field of disabled features is not appropriate for a database. However, the Energy Commission has the ability to

[12] Singh, Harinder, Soheila Pasha, Ken Rider. 2016. Final Staff Analysis of Computers, Computer Monitors, and Signage Displays. California Energy Commission. Publication Number: CEC-400-2016-016, at pp. 61-65, 83-87. Available at http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548_20160909T092318__2016_Appliance_Efficiency_Rulemaking_Docket_Number_16AAER02Sta.pdf.

		which features were disabled for the test method in Table X.	request test reports from manufacturers to verify compliance, and those test reports would indicate whether features are enabled or disabled for testing. Moreover, the Energy Commission can and does regularly procure and test product models to verify that they comply with the efficiency standards.
19e	California Investor-owned Utilities, TN #214780	To realize further technically-feasible, cost-effective energy savings for the consumer, CEC should consider recommendations previously docketed by the CASE Team in future updates to these regulations, namely: more stringent on mode power limits for monitors 30-inches and greater to align with the currently effective (Version 7) ENERGY STAR level (Section 4.1); the ability to apply multiple adders to a single unit (Section 4.3); and elimination of on mode adders altogether due to leniency of current adders (Section 4.2). Incorporating these elements into a future standards update will allow California to even further address some of the statewide policy objectives of the Zero Net Energy California Long Term Energy Efficiency Strategic Plan and AB32 energy efficiency goals. We appreciate careful consideration of these recommendations.	This comment is about future regulations, not the current rulemaking, therefore is outside the scope of the current proceeding.
December 14, 2016, Adoption Hearing Comments			
T2-a	Charles Kim, Southern	Southern California Edison has been leading this advocacy effort since the year 2012 and we are here today. I'm standing before you, Chair and	This comment supports the standards and does not request changes to the standards.

	California Edison on behalf of CA IOUs	Commissioners, with a thankful heart and in support of proposed energy efficiency regulations on computers and displays. I'm also standing in front of incredible industries who started an IT revolution right here in California. So once again, thanks so much. And I'm here once again in full support of adapting proposed languages for regulating energy efficiency for computers and displays. Thanks so much.	
T2-b	Alexandria McBride, ITI & TechNet	We're proud of our 20-plus year partnership with the EPA on ENERGY STAR and with our work with governments around the world. We are particularly proud of the work we've been doing with the Commission and the four-year partnership and collaboration that we've had in drafting this historic rulemaking on computers and displays. The regulation meets the goal of reducing desktop's idle power by 50 percent over five years, while also allowing our industry to continue to provide top tier products to our customers in the California market and beyond. For these reasons, ITI and Tech Net support the ruling and support the standard as has been proposed today. Although the standards and the rulemaking are ambitious, we are confident that our industry will continue to create energy efficient technologies and will meet the requirements stated in the standard.	This comment supports the standards and does not request changes to the regulations.
T2-c	Alexandria McBride, ITI & TechNet	Still there's one important condition of our support to this rulemaking and that is the commitment from the CEC staff to ensure all test procedures are accurate and repeatable. We provided more detail in	The Energy Commission addressed this issue in revised 15-day language.

		our written comments, but in short the CEC has proposed test procedures for PC systems with automatic brightness control needs improvement. We're extremely encouraged by the initial discussions we've had with the CEC staff on correcting the issue in the next few months. And I would appreciate your dialogue today to reaffirm your commitment to make these improvements.	
T2-d	Pierre Delforge, Natural Resources Defense Council	These are the first mandatory standards for computers in the United States. This product category is perhaps one of the most challenging that the Commission has ever tacked under Title 20. And the pace of technology evolution makes it very challenging to set standards for these products. Despite these challenges the proposed standards are strong and will lead manufacturers to adjust their product road maps and to design significantly more efficient products than they would otherwise. The standards will result in significant bill savings consumers and businesses in California, in cutting carbon pollution, carbon emissions throughout the state, and beyond the state borders given the ripple effect that we expect from these standards across the country and across the globe. In our comments on the CEC's previous proposal, and obviously other advocates flag the risk that major loopholes could develop if features that are rare today, become common faster than expected. And the allowances and exemptions for these features could result in major loss of the savings. So we really appreciate the Commission addressing this issue by directing staff to conduct rigorous market monitoring and to propose revisions to the standards should	These comments support the standards and do not request changes to the regulations. Changes to the auto-brightness control test procedure were made through Additional 15-day language, allowing for proper consideration and public comment.

		these major loopholes develop. While the standards, in our opinion, could be tighter in some areas such as for high-end and specialty models we think the Commission's proposal is a fair compromise. And NRDC is happy to support adoption of these standards today. However, we do oppose last-minute amendments, which has on the auto-brightness control test procedure. And recommend that any changes be considered in a public process that allows proper consideration and stakeholder input on these changes. We urge the Commission to be vigilant in its market monitoring and to move quickly should any exemptions and allowances need to be tightened. So in closing NRDC calls for adoption as proposed, and we look forward to continuing to work with the Commission to tap into the energy efficiency potential of plug-in equipment. To provide some of the cheapest energy savings available and help achieve California's goal to double energy efficiency savings by 2030. Thank you very much.	
Comments on Revised 15-Day Language			
20a	ITI & TechNet, TN #217515	The proposed "Additional 15 Day Language" makes important clarifications around the test procedure and specifically the use of automatic brightness control-enabled systems. ITI and TechNet support the proposed language and appreciate the prompt resolution to this issue.	This comment supports the standards and does not request changes to the regulations.
20b	ITI &	Industry recommends modifying the definition of	The requirement is intentional in order to

	TechNet, TN #217515	"mobile workstation" from "has either at least one discrete GPU…or a total of 4 gigabytes or more of system memory…" to "**supports** either". The reason for this change is to allow mobile workstations that support these features but that are not necessarily sold to the customer with these features to qualify as mobile workstations.	prevent regular notebooks from receiving generous energy allowances. Therefore, no additional change was made to the regulations.
20c	ITI & TechNet, TN #217515	Industry recommends modifying the definition of "mobile gaming system" to require a total battery capacity of 68 watt-hours or greater, instead of 90 watt-hours or greater. The reason for this change is to allow more gaming notebooks to be covered as mobile gaming systems.	The requirement is intentional in order to prevent regular notebooks from receiving generous energy allowances. This threshold for the battery capacity is set based on a market study of the current gaming notebooks. Therefore, no additional change was made to the regulations.
20d	ITI & TechNet, TN #217515	Industry recommends removing the following sentence from the definition of "discrete GPU": "Discrete GPUs are not packaged on the same die or substrate as the CPU." The reason for this change is because the limiting language may limit future product innovation and customer choice in California.	Energy adder allowances for discrete graphics are set based on the data that was received for the discrete GPUs that were on a separate package from the CPU. However, for future innovations, the Commission has included a clause in its adoption order that if staff receives a petition for rulemaking to change or create an adder or allowance related to a new feature or technology that was not considered as part of this rulemaking, staff will commit to presenting to the Commission potential regulatory changes within six months of the petition being granted by the Commission. The rulemaking petition received by the Commission will need to include sufficient information to show that the new feature or technology was not considered during this rulemaking, what

			the energy consumption levels are or will need to be, and may include confidential business information, submitted under the Commission's confidentiality process, to support the need for a rulemaking.
May 10, 2017 Re-Adoption Hearing Comments			
T3-a	ITI & TechNet	After approximately four years of constructive dialogue with the CEC and other stakeholders ITI and TechNet supported the adoption of the computers, computer monitors and signage displays regulation on December 14, 2016. As part of industry support of the regulation, CEC staff committed to address an issue regarding test procedures for the automatic brightness control for computers with integrated displays. The proposed additional 15-day language makes important clarifications around the test procedure, and we support this proposed language. And we really appreciate the CEC staff's prompt resolution to the issue.	These comments support the standards and do not request changes to the regulations.
T3-b	ITI & TechNet	We are committed to continue engagement with the CEC and as part of this engagement, ITI and TechNet, we've identified three areas where additional clarifications are needed within the existing regulations. These recommendations are detailed in our written comments submitted to the docket on May 9th, 2017. And we look forward to discussing these comments further with CEC staff.	See responses to comments 20b through 20d.