



# Computer Categorization: Expandability Score System

March 12, 2018

Soheila Pasha, Ph.D.

California Energy Commission



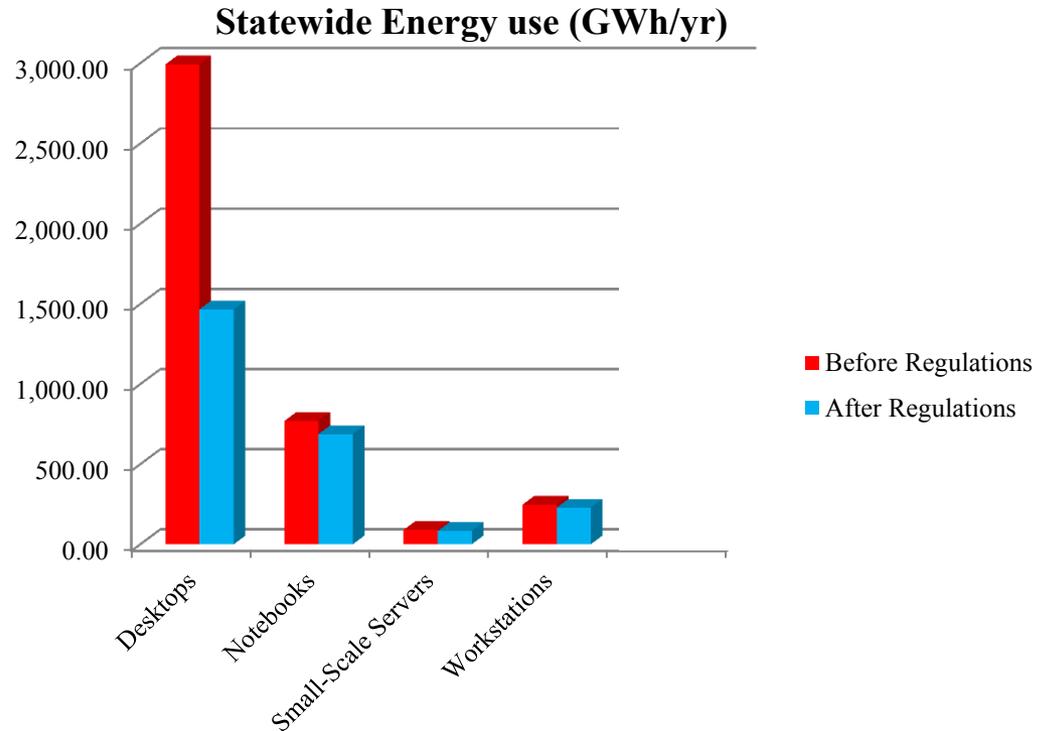
# Agenda

- California Computer Regulations
- Background
- Expandability Score System
- Expandability Score and Energy Consumption
- Advantages of Applying Expandability Score System to Energy Star Rev8.0



# California Computer Regulations: Statewide Benefits

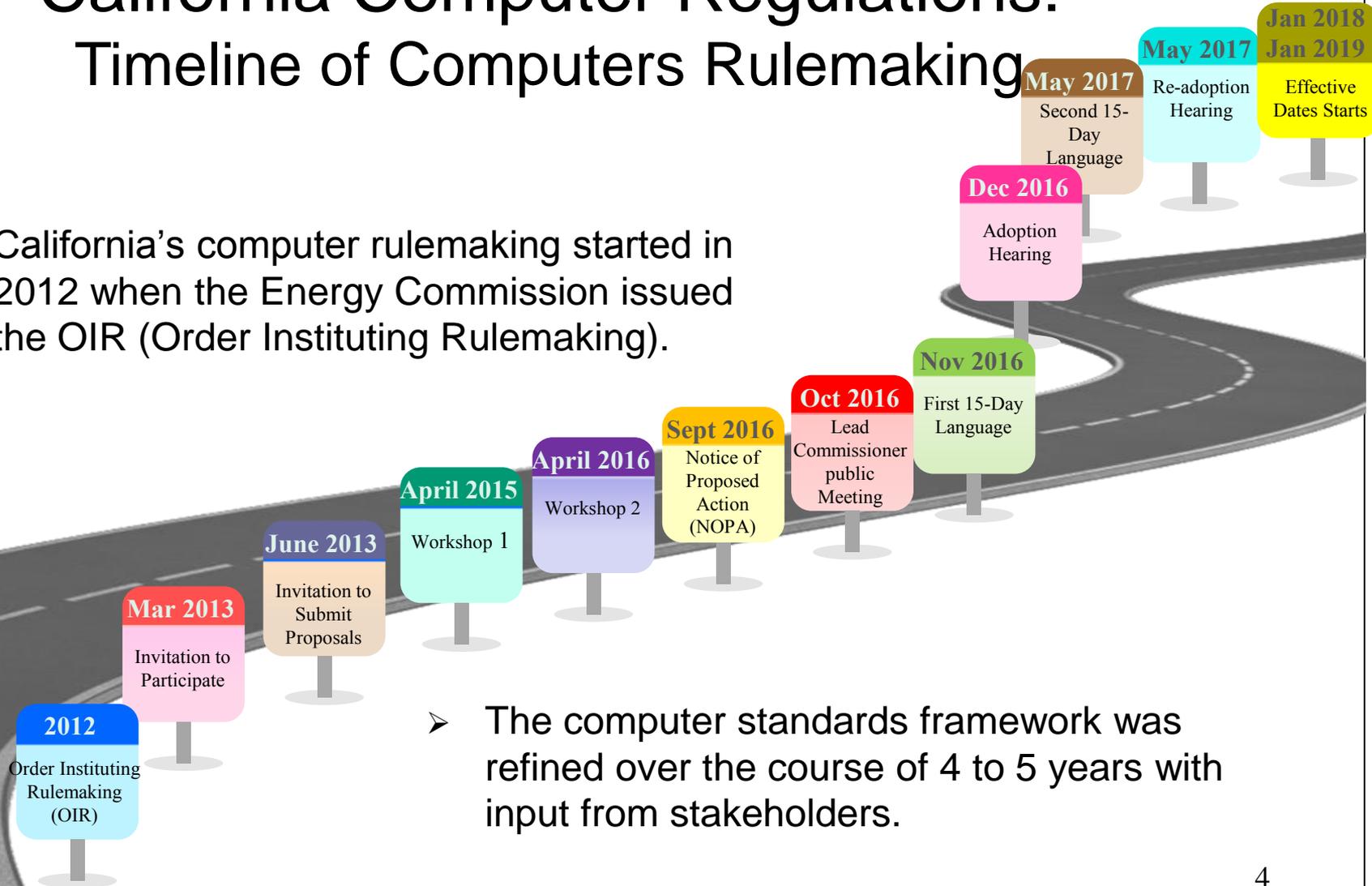
- In California, there are more than 44 million computers.
- Reduced electricity demand by **1,636 GWh/yr.**
- Consumer utility bill savings of over **\$261 Million** per year.
- Computer regulations apply to idle, sleep, and off modes and **do not** set a limit for active mode; Performance is not impacted.
- Proposed standards are cost effective and provide the flexibility to comply in the most cost effective way.





# California Computer Regulations: Timeline of Computers Rulemaking

- California’s computer rulemaking started in 2012 when the Energy Commission issued the OIR (Order Instituting Rulemaking).



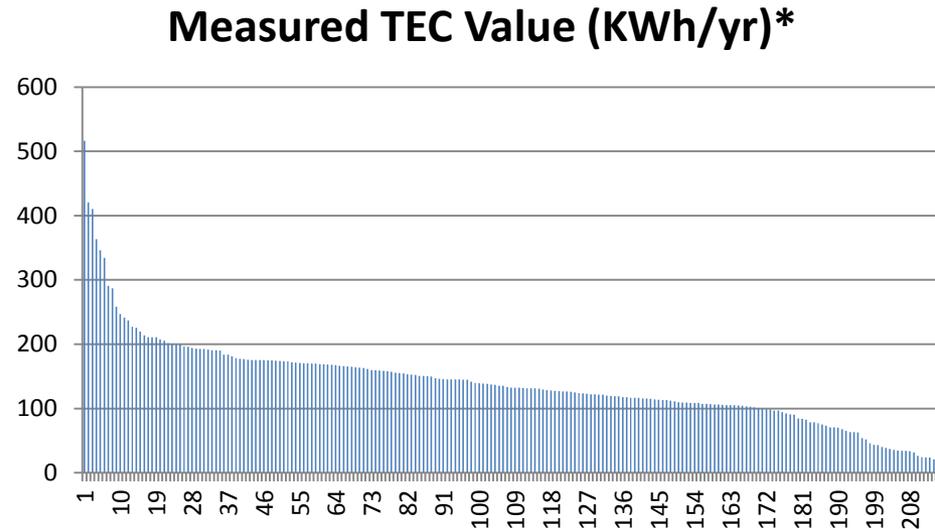
- The computer standards framework was refined over the course of 4 to 5 years with input from stakeholders.



# Background:

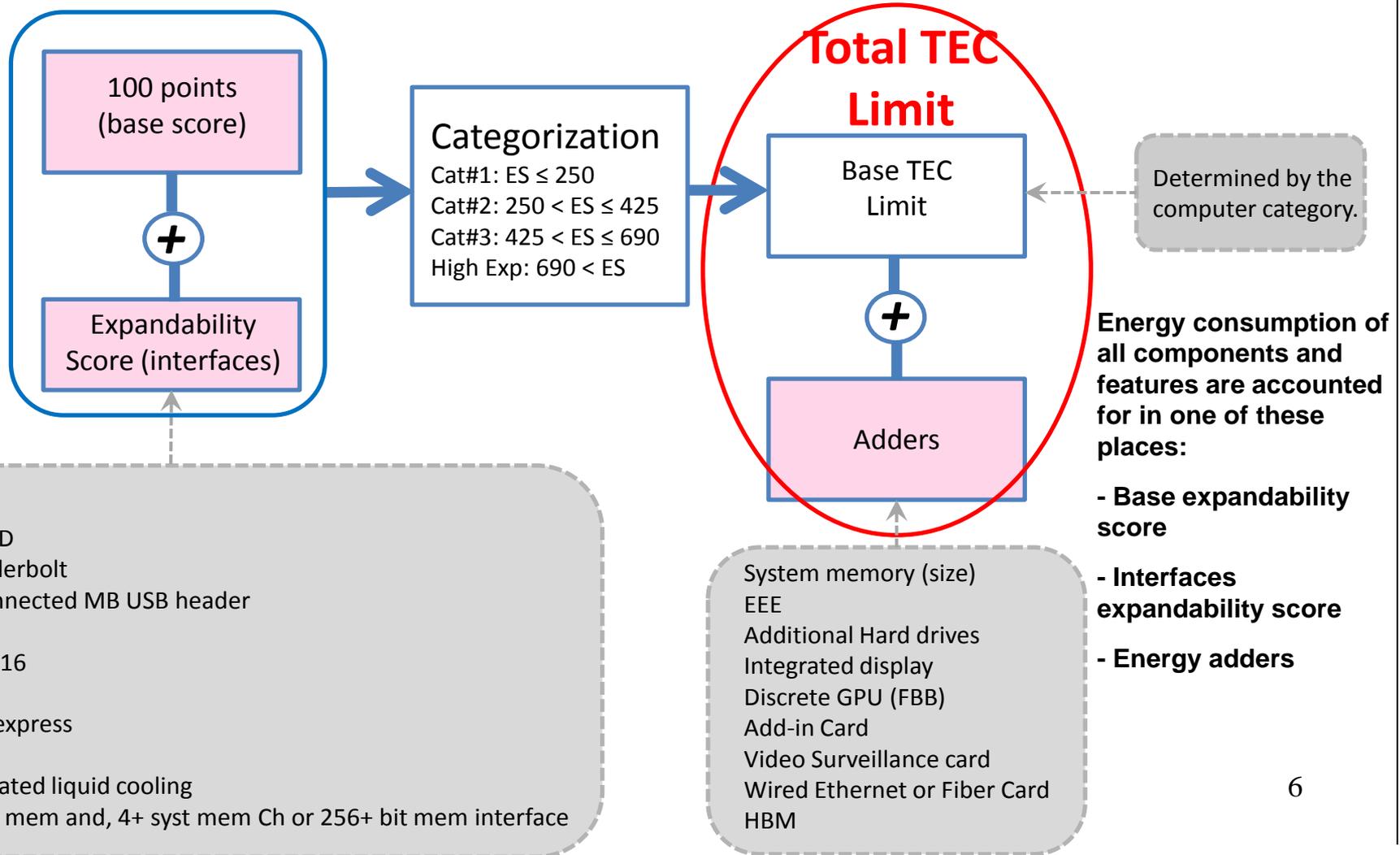
## Measured TEC for Desktop & AIO Computers

- Measured energy consumptions of 214 desktop and all-in-one computer indicates large variation in TEC values.
- Computer categorization is needed in order to implement TEC limits.





# Background: Framework





# Expandability Score System: Calculation

- To calculate the expandability score:
  - Identify the score for each individual interface type from table V-1
  - Multiply by the total number of occurrences of that particular interface type
  - Sum the subtotals for all interface types
  - Add 100 to the score
  
- Base score of 100 is added in order to account for basic components and interfaces that are included in most desktop computers.



# Expandability Score System: Table V-1

Future proofing aspect: next generation interfaces that improve the performance of the current generation, may require new rulemaking or they can use the expandability score of their current generation.

Interface Type	Interface Score
USB 2.0 or less	5
USB 3.0 or 3.1 Gen 1	10
USB 3.1 Gen 2	15
USB ports or Thunderbolt 3.0 or greater that can provide 100 or more watts of power	100
USB ports or Thunderbolt 3.0 or greater that can provide from 60 or more to less than 100 watts of power	60
USB ports or Thunderbolt 3.0 or greater that can provide from 30 or more to less than 60 watts of power	30
Thunderbolt 3.0 or greater or USB ports that are not otherwise addressed in Table V-1 and that cannot provide 30 or more watts of power	20
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
M.2 (except key M)	10
IDE, SATA, eSATA	15
M.2 key M, SATA express, U.2	25
Integrated liquid cooling	50
Either: 1) CPU and motherboard support for 4 or more channels of system memory and at least 8 GB of installed and compatible system memory; or 2) At least 8 GB of system memory installed on a 256 bit or greater memory interface.	100



# Expandability Score System: Base TEC Limit

- Variations in CPU power and speed have minimal effect on power consumption in idle states as reducing core voltage to near zero negates transistor leakage.
- Expandability score approximates how much energy a computer needs based on its hardware peripherals.
- Base energy consumption limits depend on which category the computer belongs to. Computer categories are determined by “expandability score.”

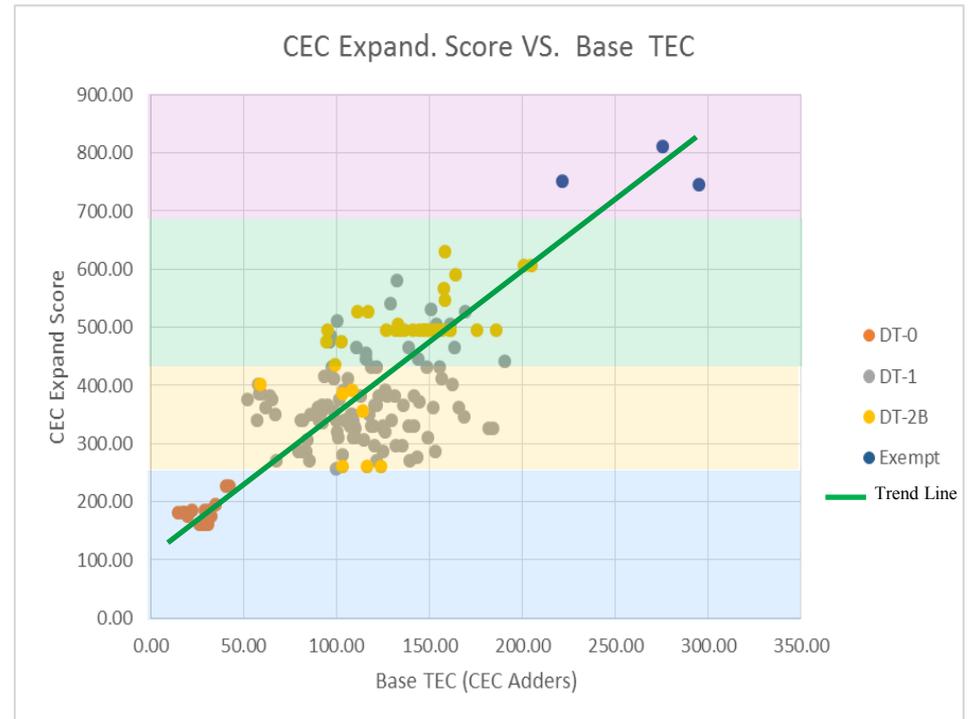


“Basic model” of a computer means a group of computer models that are made by a single manufacturer and that have the same chassis, power supply, motherboard, and expandability score. The chassis shall be considered the same if the energy use characteristics are not modified by variations in the chassis, such as a change in color.



# Expandability Score and Energy Consumption

- Color coded data are industry categorization based on CPU performance and other factors.
- Computers categorized based on expandability score are in four shaded areas.
- Trend shows strong correlation between base TEC and expandability score which supports the use of expandability score to set base energy consumption limits.





# Advantages of Applying Expandability Score System to Energy Star Rev8.0

- It is based on actual energy consumptions:
  - Energy consumption for all computer components are accounted for either through expandability score or energy adders.
- Expandability score system better tracks with computers over time compared to P-score system as new generation of CPUs become available. It reduces number of revisions necessary to Energy Star's framework.
- Reduces number of differing domestic standards for computer efficiency.
- Using the expandability score framework and setting more stringent TEC levels can save significant energy above the baseline in California.



# Advantages of Applying Expandability Score System to Energy Star Rev8.0

- Harmonizing with Title 20 expandability score framework:
  - Reduces the cost of computer testing for manufacturers.
  - Saves more energy by increasing the Title 20 compliance rate.
  - Simplifies data collection and submission by test labs and manufacturers as they have to focus on the same data for both Energy Star and CEC.
  - Reduces manufacturer confusion in tracking two different systems, reduces number of correspondences to questions, and leads to more efficient outreach and education.
  - Increases compatibility between CEC and Energy Star databases to track and calculate energy savings.