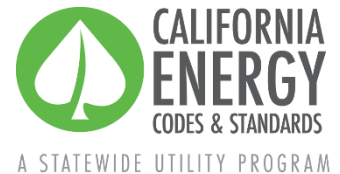


# Proposal Summary



## 2022 California Energy Code (Title 24, Part 6)

### Computer Room Efficiency

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### Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during the utility-sponsored stakeholder meeting on March 12, 2020. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. To provide your comments, email [info@title24stakeholders.com](mailto:info@title24stakeholders.com).

### Measure Description

The computer room efficiency CASE Report will improve energy performance of computer room mechanical and electrical systems by including the following submeasures:

- **Uninterruptible Power Supply (UPS) Efficiency**  
This submeasure proposes adding minimum UPS prescriptive efficiency requirements and testing requirements, based on ENERGY STAR, for AC-output UPS units used in computer rooms. The minimum average UPS efficiency considers UPS efficiency at 100%, 75%, 50%, and 25% load factors.
- **Increased Temperature Threshold for Economizers**  
This submeasure proposes simplifying the Title 24, Part 6, 140.9(a) prescriptive economizing requirements to a single outdoor air temperature condition for any economizer type, increasing the minimum outdoor temperatures for 100% economizing to 65°F dry-bulb or 50°F wet-bulb for any economizer type, and decreasing the computer room equipment load threshold for when air containment is required to 15 kW per room.
- **Computer Room Heat Recovery**  
Computer rooms produce constant heat (24 hours per day, seven days per week). When a computer room is located in a facility that also has a heating load, recovered heat from the computer room can provide heating for the other facility heating loads while also reducing the cooling load on the computer room cooling system.

This submeasure proposes adding prescriptive requirements for new computer rooms to include heat recovery if they fit into one of the following cases:



- *Case 1 (computer room with nearby zones):* Buildings with a total ITE<sup>1</sup> design load exceeding 50 kW and with a design heating load greater than 200,000 Btu/hr where the heating zones are within 50 feet of the computer room.
- *Case 2 (large computer room in building with large load):* Buildings with a total ITE design load and a design heating load exceeding certain thresholds based on climate zone.

- **Power Usage Effectiveness (PUE) Monitoring**

This submeasure proposes a mandatory requirement for computer rooms exceeding 2,000 kW ITE design load served by UPS to have metering installed to calculate Power Usage Effectiveness (PUE) and to provide this data to the building operator in an accessible manner.

- **Mandatory Requirements**

This submeasure proposes the following 2019 Title 24, Part 6 prescriptive requirements become mandatory requirements:

- 140.9(a)2: Reheat
- 140.9(a)3: Humidification
- 140.9(a)5: Fan Control.

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<sup>1</sup> According to ASHRAE 90.4, information technology equipment (ITE) includes computers, data storage, servers, and network/communication equipment located in a computer room. ITE design load is the combined power of all the ITE loads for which the ITE system is designed.

## Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

### Standards

#### 100 – DEFINITIONS AND RULES OF CONSTRUCTION

(b) **Definitions.** Terms, phrases, words and their derivatives in Part 6 shall be defined as specified in Section 100.1. Terms, phrases, words and their derivatives not found in Section 100.1 shall be defined as specified in the “Definitions” chapters of Title 24, Parts 1 through 5 of the California Code of Regulations. Where terms, phrases, words and their derivatives are not defined in any of the references above, they shall be defined as specified in *Webster's Third New International Dictionary of the English Language, Unabridged* (1961 edition, through the 2002 addenda), unless the context requires otherwise.

**ALTERNATING CURRENT-OUTPUT UNINTERRUPTIBLE POWER SUPPLY (AC-output UPS):** is a combination of convertors, switches, and energy storage devices (such as batteries) constituting a power system for maintaining continuity of load power in case of input power failure. Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands or when distortion or interruptions are outside the limits specified for the UPS. An AC-output UPS is a UPS that supplies power with a continuous flow of electric charge that periodically reverses direction.

**ANSI/NEMA WD 6** is the National Electrical Manufacturers Association Document titled, “Wiring Devices—Dimensional Specifications,” 2016 (ANSI/NEMA WD 6-2016).

**COEFFICIENT OF PERFORMANCE (COP), COMPUTER ROOM HEAT RECOVERY** is the ratio of heat transferred from the computer room to the rate of energy input of the *computer room heat recovery* system, calculated under *design conditions* and expressed in consistent units.

**COMPUTER ROOM** is a room within a building whose primary function is to house electronic equipment and that has a design *information technology equipment (ITE)* power density exceeding 20 watts/ft<sup>2</sup> (215 watts/m<sup>2</sup>) of conditioned floor area.

**COMPUTER ROOM HEAT RECOVERY** is a mechanical system that transfers heat from *computer room* return air to provide heating to other zones in the building demanding heating.

**INFORMATION TECHNOLOGY EQUIPMENT (ITE)** includes computers, data storage, servers, and network/communication equipment located in a computer room.

**ITE DESIGN LOAD** is the combined power of all the ITE loads for which the ITE system is designed.

## SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

Nonresidential, high-rise residential, and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(gh).

### (h) Mandatory Requirements for Computer Rooms

Space conditioning systems serving a computer room shall conform to the following requirements:

1. **Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.
2. **Humidification.** Any humidification shall be adiabatic. ~~Nonadiabatic humidification (e.g. steam, infrared) is prohibited. Only adiabatic humidification (e.g. direct evaporative, ultrasonic) is permitted.~~
3. **Fan Control.** Each unitary air conditioner with mechanical cooling capacity exceeding 60,000 Btu/hr and each chilled water fan system shall be designed to continuously vary the airflow rate as a function of actual load and shall have controls and/or devices (such as variable frequency drives or electronically commutated motors) that will result in fan motor demand of no more than 50 percent of design wattage at 66 percent of design fan speed.
4. **Power Usage Effectiveness (PUE) Benchmarking.** Data centers with at least 2,000 kW of *ITE design load* and where at least 80 percent of the total building cooling capacity serves computer rooms or associated electrical rooms and where IT equipment loads are served by an *AC-output UPS* shall include a power usage effectiveness monitoring system with the following minimum requirements:
  - A. **True root mean square (RMS) power measurements of total computer room *ITE* power demand and total building power demand. *ITE* power shall be measured immediately downstream of any UPS, such that UPS losses are not included in *ITE* energy.**
  - B. **Data transfer on a server capable of trending and storing data for a minimum of 18 months, with data collected at 15-minute intervals or less.**
  - C. **Time series plots of hourly, daily, and monthly cumulative PUE are displayed on a visual dashboard visible to the building operator. Cumulative PUE is equal to total building cumulative electricity use (measured in kilowatt hours) in the time period divided by total cumulative *ITE* electricity use (measured in kilowatt hours) in that time period. Total building cumulative electricity use includes electricity produced on site (e.g., by photovoltaics) that is consumed on site. If electricity produced and consumed on site is not included in the whole building electricity meter then it shall be metered and included in the total building electricity use.**
5. **Computer Room System Acceptance.** Before an occupancy permit is granted for a new computer room, or before a new computer room is operated for normal use, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified in the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:

- A. Computer Room Heat Recovery Controls shall be tested in accordance with NA7.19.1.
- B. PUE Monitoring equipment shall be tested in accordance with NA7.19.2.
- C. All other applicable requirements listed in Section 120.5 and 130.4.

**EXCEPTION to Section 120.6(h):** Computer rooms located in healthcare facilities.

## **SECTION 140.9 – PRESCRIPTIVE REQUIREMENTS FOR COVERED PROCESSES**

**(a) Prescriptive Requirements for Computer Rooms.** ~~Space conditioning systems serving a computer room with a power density greater than 20 W/ft<sup>2</sup> shall comply with this section by being designed with and having constructed and installed a cooling system that meets the requirements of Subsections 1 through 6.~~

1. **Economizers.** Each individual cooling system primarily serving computer rooms shall include either:
  - A. ~~An integrated air economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 56°5°F dry-bulb and below or 75°F wet-bulb and below, and be equipped with a fault detection and diagnostic system as specified by Section 120.2(i); or~~
  - B. ~~An integrated water economizer capable of providing 100 percent of the expected system cooling load as calculated in accordance with a method approved by the Commission, at outside air temperatures of 40°F dry-bulb/35°F wet-bulb and below.~~

**EXCEPTION 1 to Section 140.9(a)1:** Individual computer rooms with an ITE design load under 5 tons in a building that does not have any economizers.

**EXCEPTION 2 to Section 140.9(a)1:** New cooling systems serving an existing computer room in an existing building with an ITE design load up to a total of 50 tons ~~of new cooling equipment per building.~~

**EXCEPTION 3 to Section 140.9(a)1:** New cooling systems serving a new computer room in an existing building with an ITE design load up to a total of 20 tons ~~of new cooling equipment per building.~~

**EXCEPTION 4 to Section 140.9(a)1:** A computer room with an ITE design load less than 50 tons may be served by a fan system without an economizer if it is also served by a fan system with an economizer that also serves other spaces within the building provided that all of the following are met:

- i. ~~The economizer system is sized to meet the design cooling load of the computer room when the other spaces within the building are at 50 percent of their design load; and~~
- ii. The economizer system has the ability to serve only the computer room, e.g. shut off flow to other spaces within the building when unoccupied; and
- ii. The economizer system can deliver either (a) the computer room load ITE design load, or (b) the available economizer capacity, to the computer room at all times. Available economizer capacity is the total cooling capacity of the economizer system on the same

floor as the computer room and within 30 ft of the computer room minus the current cooling load of other spaces on that floor.

iii. The economizer system can deliver either (a) the computer room *ITE design load*, or (b) at least 5 tons, to the computer room when there is no cooling load in other spaces on the floor.

~~iii. The noneconomizer system does not operate when the outside air drybulb temperatures is below 60.5°F and, the cooling load of other spaces within the building served by the economizer system is less than 50 percent of design load.~~

**EXCEPTION 5 to Section 140.9(a)1:** Computer rooms where at least 80 percent of annual computer room heat output is recovered by a heat recovery system with a *computer room heat recovery COP* at design conditions of at least 4.0.

- ~~2. **Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems.~~
- ~~3. **Humidification.** Nonadiabatic humidification (e.g. steam, infrared) is prohibited. Only adiabatic humidification (e.g. direct evaporative, ultrasonic) is permitted.~~
42. **Power Consumption of Fans.** The total fan power at design conditions of each fan system serving a computer room shall not exceed 27 W/kBtu·h of net sensible cooling capacity.
- ~~5. **Fan Control.** Each unitary air conditioner with mechanical cooling capacity exceeding 60,000 Btu/hr and each chilled water fan system shall be designed to continuously vary the airflow rate as a function of actual load and shall have controls and/or devices (such as two-speed or variable-speed control) that will result in fan motor demand of no more than 50 percent of design wattage at 66 percent of design fan speed.~~
63. **Air Containment.** Computer rooms with air-cooled computers in racks and with a design *ITE design load* exceeding ~~175~~15 kW per /room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to computer inlets without passing through a cooling system.

**EXCEPTION 1 to Section 140.9(a)63:** Expansions of existing computer rooms.

**EXCEPTION 2 to Section 140.9(a)63:** Computer racks with a design load less than 1 kW per /rack.

**EXCEPTION 3 to Section 140.9(a)63:** Equivalent energy performance based on computational fluid dynamics or other analysis.

4. **Heat Recovery.** New buildings with a total *ITE design load* and heating design load exceeding the values in Table 140.9-A shall have a *computer room heat recovery system* with a *heat recovery COP* of at least 3.0 at design conditions that complies with one of the following options.
  - a. Option 1: Computer room heat is recovered from all computer rooms with *ITE design loads* over 50 kW on the same floor level as, and within 50 feet of zones with design heating loads exceeding 5,000 Btu/hr. The heat recovery system shall be capable of meeting at least 80 percent of the design heating load of the applicable zones.

- b. Option 2: The computer room heat recovery system shall be capable of transferring at least 50 percent of the total building ITE design load or at least 50 percent of the total building design heating load from the computer room(s) to conditioned space requiring heating outside computer room(s).

TABLE 140.9-A: COMPUTER ROOM HEAT RECOVERY

<u>Climate Zone</u>	<u>Total ITE Design Load</u>	<u>Building Heating Design Load <sup>a</sup></u>
<u>All</u>	<u>&gt; 50 kW</u>	<u>&gt; 200,000 Btu/hr</u>
<u>1, 2, 3, 4, 5, 11, 12, 13, 14, 16</u>	<u>&gt; 200 kW</u>	<u>&gt; 4,000,000 Btu/hr</u>
<u>1, 2, 3, 4, 5, 11, 12, 13, 14, 16</u>	<u>&gt; 500 kW</u>	<u>&gt; 2,500,000 Btu/hr</u>
<u>6, 7, 8, 9, 10, 15</u>	<u>&gt; 300 kW</u>	<u>&gt; 5,000,000 Btu/hr</u>

- a. Includes heating load for comfort and process loads.

EXCEPTION to Section 140.9(a)4: Buildings that use electric heating equipment with a heating COP of 3.5 or greater.

5. Uninterruptible Power Supplies (UPS). Alternating Current-output UPS systems serving a computer room shall be ENERGY STAR certified in accordance with ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs) - Eligibility Criteria Version 2.0.

EXCEPTION to 140.9(a)5: UPS that utilizes a standardized NEMA 1-15P or NEMA 5-15P input plug, as specified in ANSI/NEMA WD-6-2016.

**EXCEPTION to Section 140.9(a):** Computer rooms located in healthcare facilities.

## Reference Appendices

The following Reference Appendices will be modified:

### JOINT APPENDICES

**JA1 – Definitions:** The proposed requirements add new definitions for UPS, computer room load, heat recovery, and PUE terms.

### NONRESIDENTIAL APPENDICES

**NA7.19 – Computer Room Acceptance Tests:** A new section for a Computer Room Heat Recovery Acceptance Test and PUE Monitoring Acceptance Test will be added as NA7.19.