DOCKETED	
Docket Number:	21-BSTD-01
Project Title:	2022 Energy Code Update Rulemaking
TN #:	238411
Document Title:	Taylor Engineering Comments on Title 24 DCV
Description:	N/A
Filer:	System
Organization:	Taylor Engineering/Hwakong Cheng
Submitter Role:	Public
Submission Date:	6/21/2021 11:24:11 PM
Docketed Date:	6/21/2021

Comment Received From: Hwakong Cheng
Submitted On: 6/21/2021
Docket Number: 21-BSTD-01

Comment on Title 24 DCV

Please see attached file.

Additional submitted attachment is included below.

Comment on Title 24 2022 Express Terms – Demand Controlled Ventilation:

Demand controlled ventilation (DCV) is an energy efficiency strategy that reduces ventilation during periods of partial occupancy. Section 120.1(d)4 narrowly defines the mandatory requirements for DCV such that they can only be met through the use of CO2 sensors. Though CO2 measurement has been this predominant industry approach for achieving this control strategy, this very restrictive definition precludes emerging alternative options for monitoring partial occupancy, such as through the use of people counting sensors, security RFID badges, ticket sales, and other digital strategies.

4. **Demand Control Ventilation Devices.**

   A. For each system with demand control ventilation (DCV), CO_2 sensors shall be installed in each room that meets the criteria of Section 120.1(d)3 with no less than one sensor per 10,000 ft² of floor space. When a zone or a space is served by more than one sensor, a signal from any sensor indicating that CO_2 is near or at the setpoint within the zone or space shall trigger an increase in ventilation.

   B. CO_2 sensors shall be located in the room between 3 ft and 6 ft above the floor or at the anticipated height of the occupants' heads.

   C. Demand ventilation controls shall maintain CO_2 concentrations less than or equal to 600 ppm plus the outdoor air CO_2 concentration in all rooms with CO_2 sensors.

      EXCEPTION to Section 120.1(d)4C: The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section 120.1(c)3 regardless of CO_2 concentration.

   D. Outdoor air CO_2 concentration shall be determined by one of the following:

      i. CO_2 concentration shall be assumed to be 400 ppm without any direct measurement; or

      ii. CO_2 concentration shall be dynamically measured using a CO_2 sensor located within 4 ft of the outdoor air intake.

   E. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in Table 120.1-A for DCV, times the conditioned floor area for spaces with CO_2 sensors, plus the rate required by Section 120.1(c)3 for other spaces served by the system, or the exhaust air rate whichever is greater.

   F. CO_2 sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to levels required by Section 120.1(c)3 to the zone serviced by the sensor at all times that the zone is occupied.

   G. The CO_2 sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with DDC to the zone level.

By contrast, ASHRAE Standard 90.1-2019 simply defines DCV as "a ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy" (paragraph 3.2, Definitions) and the conditions where it is required (paragraph 6.4.3.8, Mandatory Controls and Diagnostics).

The U.S. Department of Energy's ARPA-E program has sponsored the SENSOR program (Saving Energy Nationwide in Structures with Occupancy Recognition), which aims to dramatically reduce energy use in commercial and residential buildings, and includes efforts to accelerate research and development efforts around low-cost, high accuracy occupant-counting sensors for commercial buildings, as well as efforts to validate sensor performance (disclosure: Taylor Engineering is a subrecipient of this ARPA-E

program). In addition to existing commercial-off-the-shelf occupant-counting products that utilize LIDAR/depth (e.g. www.density.io), video cameras (www.trafsys.com), and many others, the narrow definition of DCV in Title 24 precludes new emerging approaches such as floor mats, RFID backscattering, time of flight, and sensor fusion.

Furthermore, in addition to precluding emerging occupant-counting technologies, the current DCV language is incompatible with applications where other non-human CO2 sources prevent the traditional deployment of DCV. For example, wholesale flower markets, like the San Francisco Flower Mart, include refrigerated spaces with high occupant densities that trigger DCV requirements, but where CO2-based DCV would be confounded by respiration of CO2 by plants and cut flowers. Alternative occupant-counting sensors may be more suitable for applications like these.

Please consider revising the Title 24 definition to match that of ASHRAE Standard 90.1, or including an exception to allow for alternative occupant-counting strategies, such as:

“EXCEPTION to Section 120.1(d)4: CO2 sensors are not required in spaces where occupant-counting devices are installed and integrated with the system controls. When the system is operating during hours of expected occupancy, the controls shall maintain the outdoor airflow rate to the zone at the higher of the area-based rate determined by Equation 120.1-F or the population-based rate determined by Equation 120.1-G, where Pz is the current number of occupants determined by the occupant-counting device.”