TITLE 24, PART 6 | 2025 CODE CYCLE

Demand Control Kitchen Ventilation (DCKV)

Codes and Standards Enhancement (CASE) Proposal

Nonresidential | Commercial Kitchens

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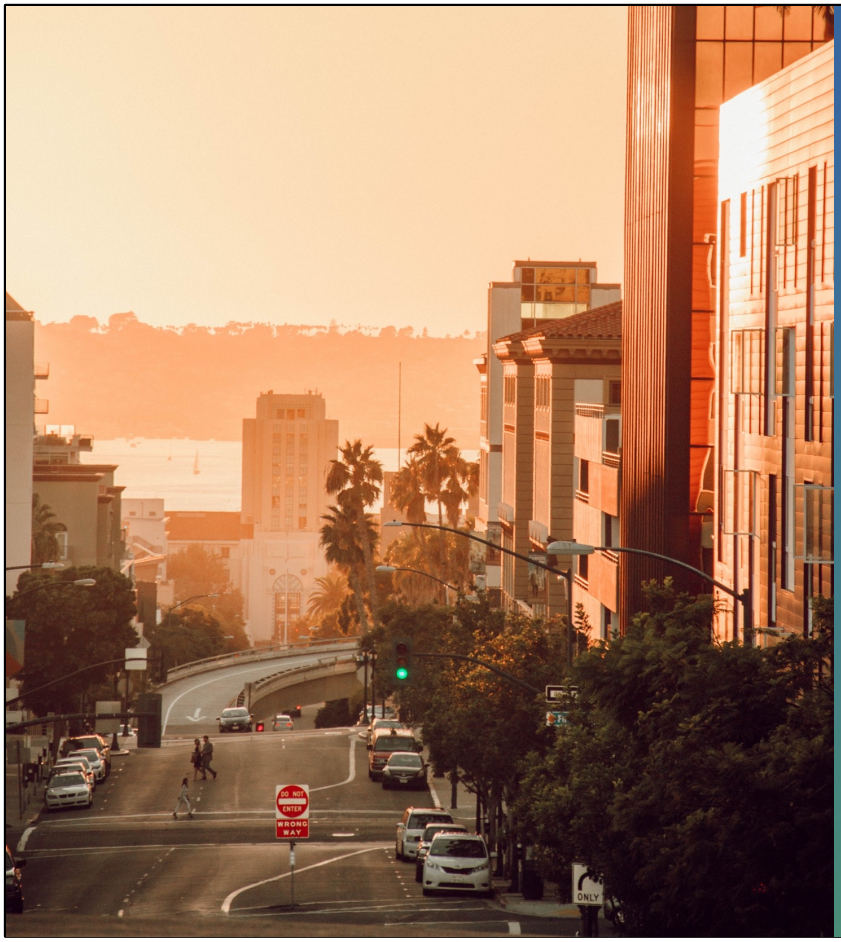
CALIFORNIA ENERGY CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

Agenda

Background	*5 min*
Market Overview and Analysis	*5 min*
Technical Feasibility	*5 min*
Cost and Energy Methodology	*2 min*
Compliance and Enforcement	*2 min*
Proposed Code Changes	*2 min*
Discussion & Next Steps	*10 min*



Background

- Code Change Proposal
- 2022 Code Requirements
- Context and History

Proposed Code Change

Proposing to make DCKV systems a requirement for kitchen ventilation hood systems with exhaust flow rates exceeding 5,000 cfm

- Implementing DCKV is currently listed as 1 of 4 options for kitchen hood systems that exhaust greater than 5,000 cfm
- Explicit language to establish what constitutes a "kitchen/dining facility" and how it contributes to the 5,000 cfm — total exhaust airflow under a single fan, or for an entire kitchen facility, or for a single hood?
- Modification of Section 140.9 - Kitchen Ventilation

Current Code Requirements

Kitchen hood systems with exhaust airflow greater than 5,000 cfm must meet **one of the following conditions**:

i. Use a DCKV system

ii. Reuse transfer air for the replacement air

iii. Use heat recovery devices

iv. Use makeup air that is minimally heated or cooled

Current Code Requirements

Existing Requirements in Title 24, Part 6:

- Required outdoor air-ventilation and air-distribution system design must be identified on plans
- All air supplied to occupiable spaces through mechanical systems must be filtered before thermal conditioning
- Natural ventilation allowable spaces are determined by the location and opening size for the ventilation, and the ceiling height of the space to be ventilated

Context and History

Demand Controlled Kitchen Ventilation (DCKV):
A system that automatically adjusts the airflow of a ventilation hood to match the needs of the kitchen. This reduces energy use when there is light or no cooking activity.

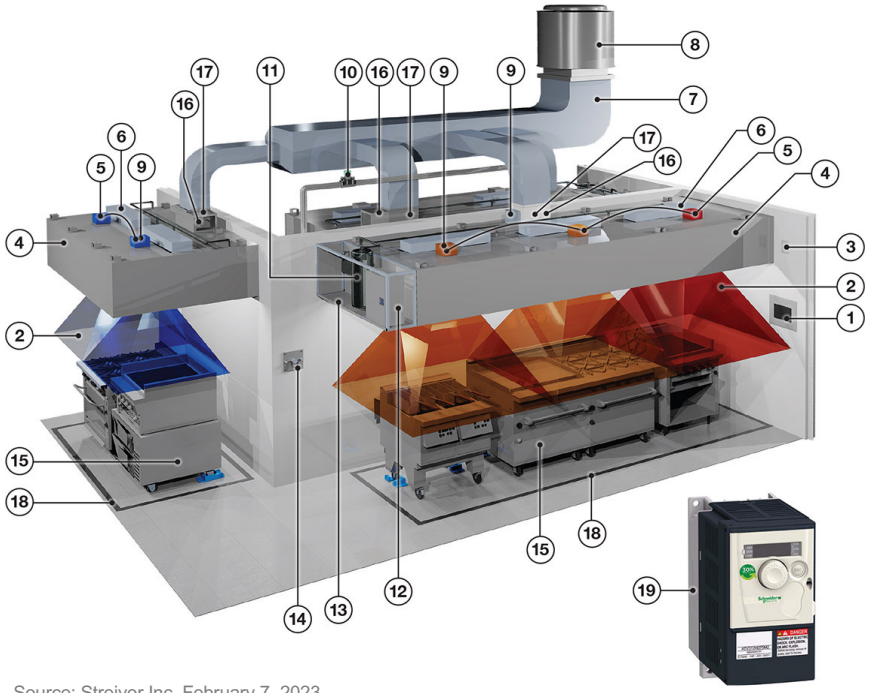
There are various technologies for determining kitchen demands:

- Temperature sensors
- Infrared sensors
- Optical sensors
- Direct appliance communication

Context and History

Why are we proposing this measure?

- **Significant savings opportunity**
- **Reduced noise level**
- **Improved comfort**
- **Advancements in technology**



Source: Streivor Inc. February 7, 2023. https://www.streivor.com/ventilation/demand-control-kitchen-ventilation/demandaire-platinum/

Market Overview

- Current Market Conditions
- Market Trends
- Potential Market Barriers and Solutions

Market Overview and Analysis

Current Market

- Utility incentive programs are currently available for this measure, which have shown that current participation is strongly driven by rebates given the high cost of systems

Market Trends

- Kitchen consultants are increasingly adopting DCKV into their designs, with some interviewed consultants specifying DCKV in all designs

Do you agree with this description? What else should be known?

Market Overview and Analysis

Market Barriers and Potential Solutions

- Initial purchase and install cost:
  - → *Solution:* Rebate programs and dissemination of payback analysis results, to inform the public on how costs could be offset with energy savings
- Lack of DCKV familiarity and concerns on ventilation efficacy
  - → *Solution:* Educational programs and outreach that detail the savings potential and ventilation performance of DCKV units

Do you agree with this description? What else should be known?

Technical Considerations

- Technical Considerations
- Potential Barriers and Solutions

Technical Considerations

Technical Considerations

- Proposal codifies what is becoming standard design practice, implementing DCKV on any ventilation hoods greater than 5000 cfm
- Numerous options available for integrated DCKV or add-on control units for ventilation hoods without DCKV options

Technical Barriers and Potential Solutions

- Possible need for regular maintenance and calibration of sensors
- System reliability, such as clogged sensors
  → *Solution:* Require that all DCKV systems have manual override capability in case the demand control is having issues
- Potential for users to continuously override sensor functions
  → *Solution:* Ensure that DCKV always maintains sufficient airflow to maintain capture performance

Do you agree with this description? What else should we know?

Energy and Cost Impacts Per Fan Horsepower (HP)

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
  - Incremental costs
  - Energy cost savings

Methodology for Energy Impacts Analysis

Methodology for per-HP energy and demand impacts:

$$UEC_{yr\text{-}BL} - UEC_{yr\text{-}M}$$

Yearly Baseline Unit Energy Consumption

Yearly Measure Unit Energy Consumption

$$UEC_{yr} = UEC_{yr\text{-}supply} + UEC_{yr\text{-}exhaust} + UEC_{yr\text{-}heating} + UEC_{yr\text{-}cooling}$$

16 climate zones considered, normalized by California restaurants per climate zone.

Climate zone data: https://cedars.sound-data.com/deer-resources/tools/mas-control/resource/5/history

Assumptions for Standard and Proposed Designs

Standard Design

- Single speed exhaust fan system with simple on/off control
- 6000 cfm ventilation hood, driven by 2HP fan motor at 1” static pressure
- Fan efficiency = 50%, motor efficiency = 84%
- 65°F heating setpoint, heating efficiency = 80%

Proposed Design

- DCKV system with manual override option
- 6000 cfm ventilation hood, driven by 2HP fan motor at 1” static pressure
- Fan efficiency = 50%, motor efficiency = 84%
- 65°F heating setpoint, heating efficiency = 80%

Preliminary Energy Savings Estimates Per HP

Annual Electricity Savings (kWh/yr)	5,927
Annual Natural Gas Savings (therms/yr)	67
Peak Demand Reduction (W)	590
Annual Life Cycle Energy Cost Savings (kBTU/yr)	?
Annual Source Energy Savings (kBTU/yr)	?

Key Assumptions:

- 339 days of operation per year
- Ventilation operating an average 14 hours per day (9am - 11pm)

Variation per Climate Zone

Climate Zone	Heating Energy (therms/yr)	Expected Heating Energy Savings (therms/yr)
1	3,623	627
2	1,906	330
3	1,762	305
4	1,254	217
5	1,594	276
6	735	127
7	633	110
8	570	99
9	757	131
10	861	149
11	1,647	285
12	1,567	271
13	1,404	243
14	1,555	269
15	371	64
16	4,110	711

Incremental Cost Information

We collected costs of base case technology and proposed technology through interviews with manufacturers, distributors or contractors

What was included in the costs (still looking for installation and maintenance costs)

Costs were found to be...

Baseline Cost:
$6,151 per HP

DCKV Cost:
$9,462 per HP

Are there any costs that are unaccounted for or look inaccurate?

Prompts for discussion:

- What components of costs did we leave out?
- Do you find these costs to be reasonable?
    - Willing to discuss costs individually.

Incremental Per HP Cost Over 15 Year Period of Analysis

Incremental First Cost	
Equipment	$3,311
Installation	$900.00
Commissioning	$x,xxx.xx
Other	$x,xxx.xx
Total	**$4,211.00**

Incremental Maintenance Cost	
Equipment Replacement	$x,xxx.xx
Annual Maintenance	($x,xxx.xx)
	$x,xxx.xx
	$x,xxx.xx
Total	**$x,xxx.xx**

Cost data came from:

- Stakeholders
- SCE Data (2013-2017)

Highlight what we need from stakeholders.

Total incremental cost over 15-year period of analysis: **$X,XXX.XX**

Statewide Energy Impacts

Methodology and Assumptions

- Statewide Energy Impacts Methodology

Statewide Energy Impacts Methodology

The Statewide CASE Team estimates annual statewide impacts by multiplying **A x B x C**:

A. per-unit energy impacts (discussed in previous section)

B. number of units of new construction/additions/alterations of each applicable building type

C. portion of affected units in each climate zone

Example:

Per Unit Impacts

Savings type	**Savings** per square foot
Electricity	[X] kWh
Peak demand	[X] Watts
Natural gas	[X] Therms
GHG emissions	[X] Tons CO_2e

×

Affected New Construction

Climate Zone	**Large Office** sq ft	**Assembly** sq ft
1	100	20
2	1,000	1,500
…		
16	5,000	3,000

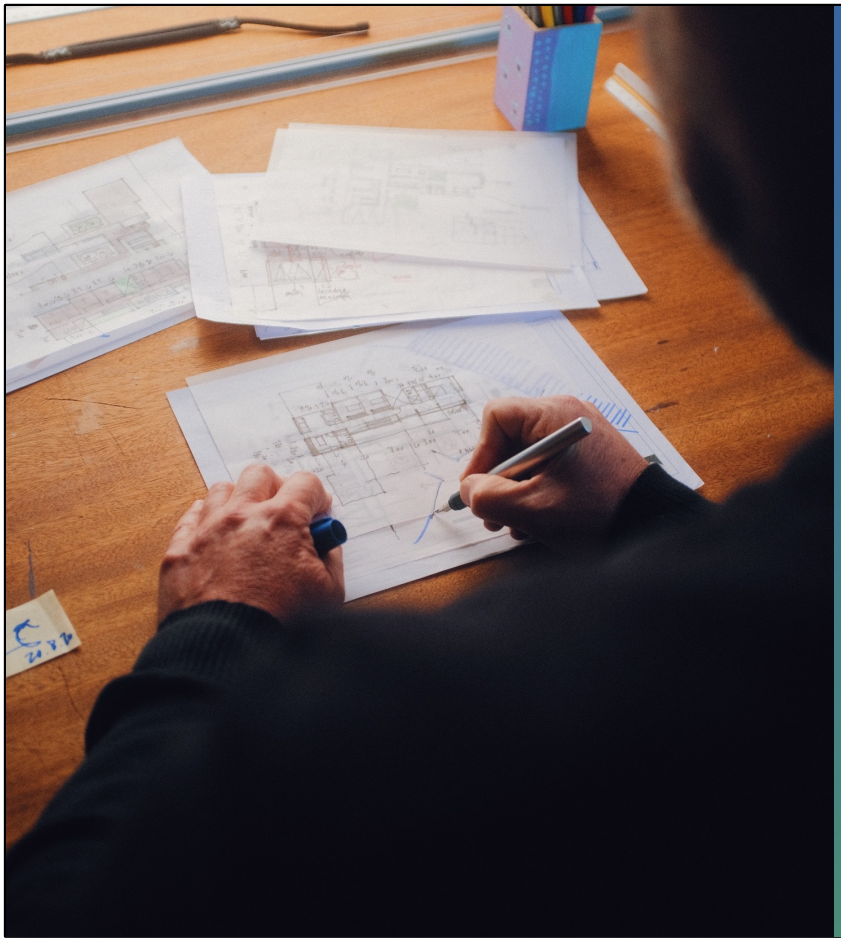
=

Statewide Energy Impacts

Climate Zone	**Elec Savings** (GWh)	…	**GHG savings** (MT CO_2e)
1	20		1,500
2	50		3,000
…			
16	100		2,000

2026 Construction Forecast

Construction Forecast Building Type	Percent of Newly Constructed Floorspace Impacted
Education	100%
Health Care	100%
Correctional Facilities	100%
Military Installment	100%
Recreational Services	100%
Lodging	100%
Commercial Cafeteria	100%
Grocery Retail	100%
Quick Service Restaurants	80%
Full Service Restaurants	90%



Compliance and Enforcement

- Design
- Permit Application
- Construction
- Inspection
- Revisions to Compliance Software

Compliance and Verification Process

1. Design Phase

- Facility or designers size kitchen exhaust hood(s) flow capacity based on appliance lineup and expected effluent.
- Kitchen exhaust designs with greater than 5000 cfm operating under a single fan required to implement DCKV.

2. Permit Application Phase

- Summarize what happens in Permit Application phase
- **Design review for hood systems below 5000 cfm?**

Compliance and Verification Process

3. Construction Phase

- DCKV system installed in accordance with all minimum requirements listed in section 140.9 (b)

4. Inspection Phase

- *Existing* – Kitchen exhaust systems with greater than 5000 cfm operating under a single fan not required to implement DCKV.
- *New* – Kitchen exhaust systems with greater than 5000 cfm operating under a single fan must demonstrate functional implementation of DCKV and must be capable of conforming with all fail safe measures.

Market Actors

Market actors involved in implementing this measure include:

- Manufacturers (eg. Hood mfrs., retrofit mfrs.)
- Building Designers – Kitchen Designers
- Building Owners
- HVAC designers and contractors

What we need from market actors:

- Concerns with adoption of proposed DCKV codes and standards changes
- Price information for hood systems w/ and w/out DCKV systems as well as retrofit solutions
- Data regarding efficacy of DCKV implementation

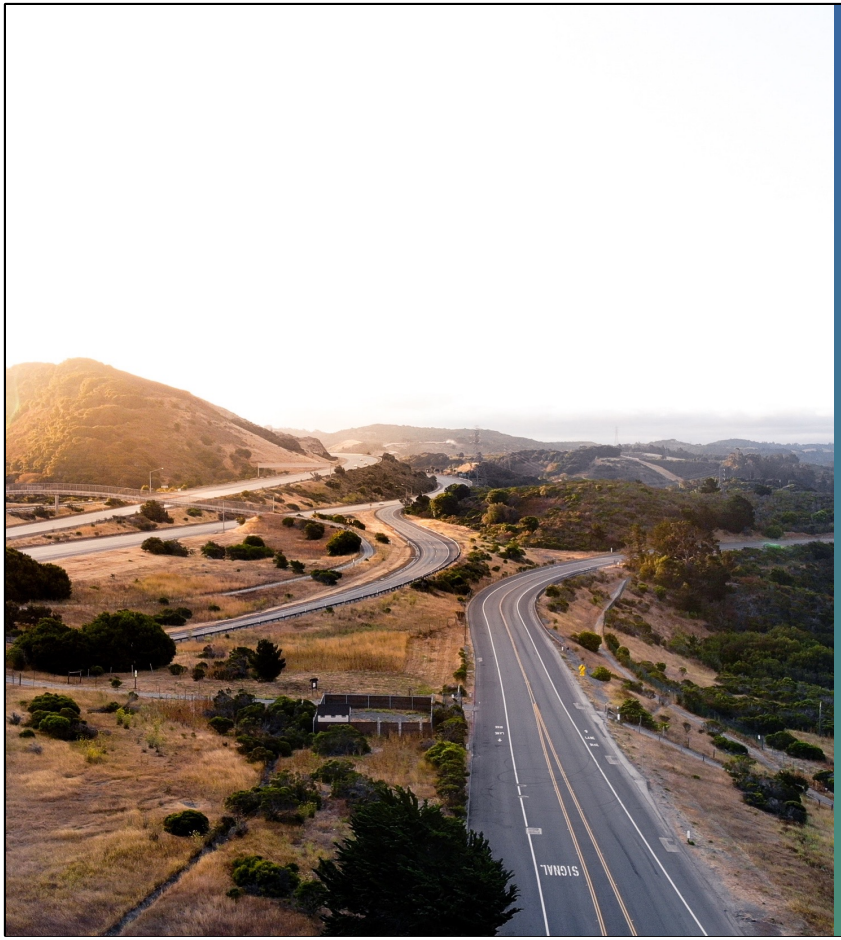
Review of Code Language Markup

- Draft Code Change Language

Draft Code Change Language

Draft code language available for review in the Handouts tab and downloadable.

Provide Feedback to CASE Author by [Date – coordination team to update].



Discussion and Next Steps

We want to hear from you!

- Provide **any last comments or feedback** on this presentation now verbally or over the chat
- More information on pre-rulemaking for the 2025 Energy Code at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency

Comments on this measure are due by xx. Please send comments to info@title24stakeholders.com and copy CASE Authors (see contact info on following slide).

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Thank You

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