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2019 Alternative Calculation Methods (ACM) Reference Manual and Software Update

Nonresidential

February 13, 2019
California Energy Commission

General Workshop Information

- Broadcast using WebEx
  - The meeting is being recorded
  - In person participants: please sign in
- Online participants
  - Will remain muted unless they request to comment
  - Online comments will be taken after in-person participants and in alphabetical order

Agenda

- Overview of ACM, manual, and software
- Envelope
- Lighting
- HVAC
- *Public Comment*
- Covered Process
- Water Heating
- Miscellaneous
- *Public Comment*
- Conclusion, Adjourn

Nonresidential ACM Overview

- Defines the standard design for a proposed building based on prescriptive requirements, but also addresses parameters not described in the Standards
- Provides a set of software tests (the Reference Method) that set criteria for compliance software seeking approval for use in Title 24 part 6 compliance
- Includes the Reference Manual and Appendices
  - Appendix 3: Reference Method tests
  - Appendix 5.4A: Space Use Data
  - Appendix 5.4B: Schedules
  - Appendix 5.5: Construction Data
  - Appendix 5.7: Performance Curve

Nonresidential ACM Overview cont'd

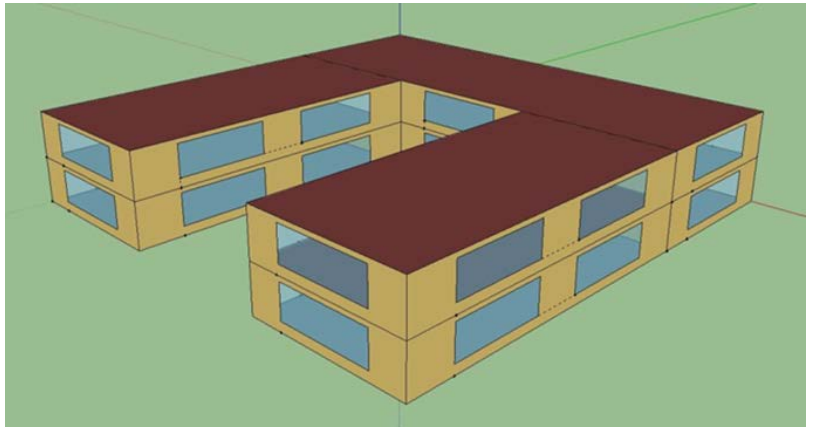
- Specifies input restrictions on proposed design
- Each input specifies a standard design as a reference for comparison
  - Some inputs are fixed for both baseline and proposed (setpoints, equipment schedules, design occupancy)
  - Neutral inputs are allowed to vary, but the baseline matches or "tracks" the proposed (window-wall ratio if less than 40%, building geometry, space use type)
  - Variable inputs are allowed to vary in proposed for compliance credit or penalty (lighting power density, equipment efficiency, U-factor, pump power)
- Some mandatory requirements are not modeled

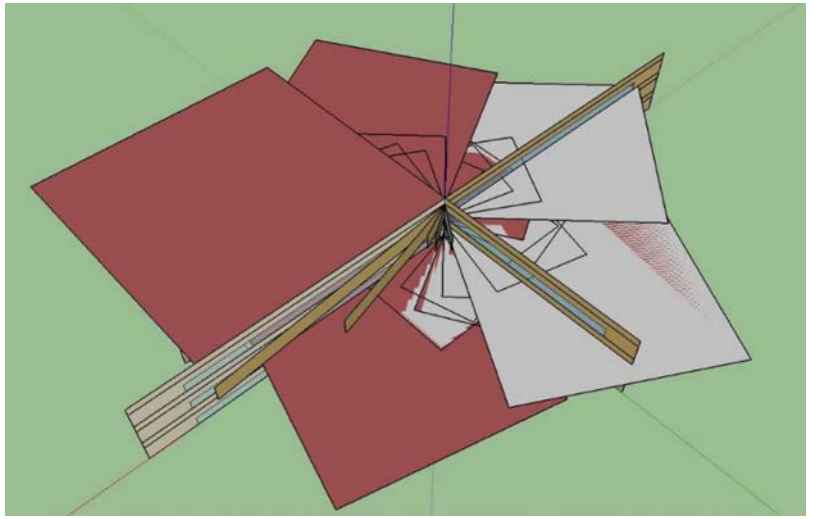
Nonresidential ACM Overview cont'd

- Performance method is an **alternate** method of compliance
  - Many buildings that pass performance compliance won't pass prescriptive compliance (Window-Wall-Ratio, opaque envelope, lighting power density, etc.)
- The goal is to provide a fair method that accommodates design flexibility while ensuring that a minimum performance level is met
- A secondary goal is to allow for the modeling of alternate designs not specified in Title 24 part 6 (Chilled beams, thermal energy storage, etc.)

Nonresidential ACM Overview cont'd

- Two different flavors of CBECC-Com
  - Detailed Geometry
    - 3-D envelope geometry input. Free, bare-bones, option is SketchUp 8. Other, more advanced, options are available.
    - Advantages over 2-D: Daylighting simulation can give credit for secondary daylighting controls, building self shading is accounted for, and more accurate energy use.
  - Simplified Geometry
    - 2-D envelope geometry input. Manual entry of building envelope take-offs (length, height, area, etc.)





Envelope

- No substantial changes to the envelope U-Factors or values
- Advanced Daylighting Options for Compliance Credit
  - Allows daylighting power adjustment factors (PAF) for envelope features
    - Clerestory, Horizontal Slats, Light Shelves (explained next in Lighting Updates)
- Modeling Approach Updates
  - Ability to model staggered/double metal stud walls
    - Allows 2 composite layers in construction assembly
- Healthcare facilities required to comply

Lighting

- Lighting power allowance updates to match Tables in §140.6
  - Expanded primary function areas (“Space Function” in software)
- Advanced Daylighting Options for Compliance Credit
  - Allows daylighting power adjustment factor (PAF) for envelope features
    - Clerestory, Horizontal Slats and Light Shelves PAFs can be selected in software
    - Detailed geometry model automatically detects clerestory and simulates actual performance
    - Multiple PAFs can be combined per Table 140.6-A
- Healthcare facilities required to comply

Lighting cont'd

TABLE 140.6-A LIGHTING POWER ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL	TYPE OF AREA		FACTOR
a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2 b. Only one PAF may be used for each qualifying luminaire unless combined below. c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF			
1. Daylight Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone		0.10
2. Occupant Sensing Controls in Large Open Plan Offices	In open plan offices > 250 square feet: One sensor controlling an area that is:	No larger than 125 square feet	0.40
		From 126 to 250 square feet	0.30
		From 251 to 500 square feet	0.20
3.Institutional Tuning	Luminaires in non-daylit areas.~~-~~ Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		0.10
	Luminaires in daylit areas.~~-~~ Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.		0.05
4. Demand Responsive Control	All building types ~~less than~~ of 10,000 square feet or smaller~~.~~. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF		0.05
5. Clerestory Fenestration	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.		0.05
6. Horizontal Slats	Luminaires in daylit areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.		0.05
7.Light Shelves	Luminaires in daylit areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF		0.10

HVAC

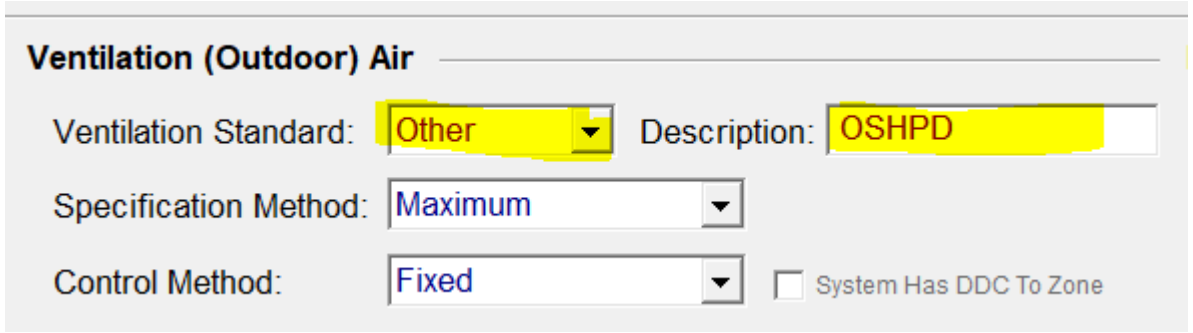
- Ventilation rate updates per §120.1
  - Expanded occupancy categories (new “Vent. Function” in software)
  - New exhaust ventilation requirement - Table 120.1-B
  - Air classification is not used by the software
  - High-rise Residential
    - Rate calculated per ASHRAE 62.2 (# bedrooms and floor area)
    - Supply-only, exhaust-only, or balanced ventilation system (natural ventilation not allowed)
  - Other Ventilation Standard – allows for other agency ventilation requirements
    - Such as OSHPD, ASPCA, ANSI - Standard design matches proposed rate
  - Healthcare facilities ventilation rate per California Mechanical Code chapter 4
    - Standard design matches proposed rate

HVAC cont'd

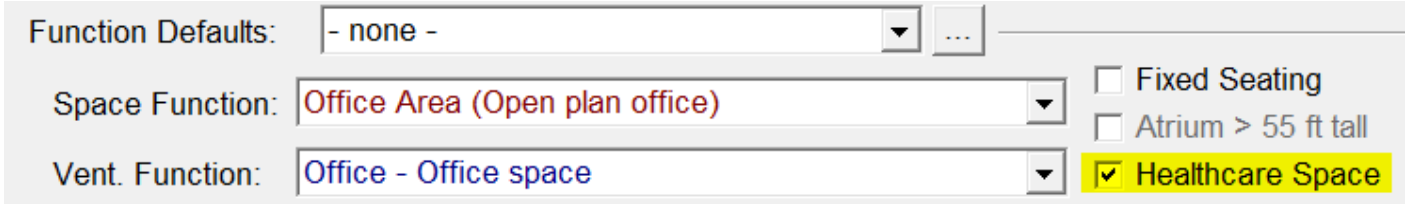
High-rise Ventilation
(Dwelling Unit Data tab)

	Number of Units	Average Floor Area per Unit	
Studio Apartment:	0	0.0	ft2
1 Bedroom:	0	0.0	ft2
2 Bedrooms:	0	0.0	ft2
3 Bedrooms:	0	0.0	ft2
4 Bedrooms:	0	0.0	ft2
5 or more Bedrooms:	0	0.0	ft2
Total Count:	0	Tot Area: 0.0	ft2

Other Ventilation
(Thermal Zone – Ventilation and Exhaust tab)



Healthcare Space
(Space Data tab)



HVAC cont'd

- Transfer Air Limits for Exhaust Air Makeup
  - Limits on minimum and maximum ventilation air per floor relative to code requirement
  - Allows spaces with no dedicated ventilation supply to have outside ventilation air treated per floor
- Mechanical System Shut-off (Window Interlock) §140.4(n)
  - Only applies to nonresidential buildings
  - High-rise residential exempt
  - Healthcare facilities exempt

HVAC cont'd

- HVAC System Map Revised
  - Updated to align more with ASHRAE 90.1 Appendix G but with California requirements
  - Asterisk (*) indicates the standard design will be Constant Volume if less than 65 kBtu/h cooling capacity, and without economizer if less than 54 kBtu/h cooling capacity.

Table 2: HVAC System Map

Building Type	Standard Design
Residential or hotel/motel guestrooms in a building with seven or fewer floors above grade	System 1 - SZAC
Residential or hotel/motel guestrooms in a building with eight or more floors above grade	System 2 - FPFC
Retail building 2 floors or fewer	System 7 - SZVAV*
Warehouse and light manufacturing space types (per the Appendix 5.4A Schedule column) that do not include cooling in the proposed design	System 9 - HEATVENT
Covered process	See Table 4: System Map for Covered Processes
Healthcare Facilities	Same as the Proposed Design
All other space types	See Table 3: Nonresidential Spaces (Not Including Covered Processes)

Table 3: Nonresidential Spaces (Not Including Covered Processes)

Building Area	Floors	Standard Design	Description
< 25,000 ft²	≤ 3 floors	System 7 - SZVAV*	Single Zone VAV
	4 or 5 floors	System 5 - PVAV	Packaged VAV Unit
	> 5 floors	System 6 - VAVS	Built-up VAV Unit
25,000 ft²–150,000 ft²	≤ 5 floors	System 5 - PVAV	Packaged VAV Unit
	> 5 floors	System 6 - VAVS	Built-up VAV Unit
>150,000 ft²	Any	System 6 - VAVS	Built-up VAV Unit

* Single zone VAV system (SZVAV) shall have a minimum fan speed ratio of 0.5 if the standard design total cooling capacity ≥ 65 kBtu/h, and a minimum fan speed ratio of 1 (constant volume) for a standard design total cooling capacity less than 65 kBtu/hr; system shall have an integrated economizer if the standard design cooling capacity exceeds 54 kBtu/h.

Retail building Standard Design rules shall apply to zones on floors (building stories) whose predominant space type is retail.

HVAC cont'd

Table 5: System Descriptions

System Type	Description	Detail
System 1 – SZAC	Residential Air Conditioner	Single zone system with constant volume fan, no economizer, DX cooling and furnace
System 2 – FPFC	Four-Pipe Fan Coil	Central plant with terminal units with hot water and chilled water coils, with separate ventilation source
System 3 – PSZ	Packaged Single Zone	Single-zone constant volume DX unit with gas heating
System 4 – RESERVED		
System 5 – PVAV	Packaged VAV Unit	VAV reheat system; packaged variable volume DX unit with gas heating and with hot water reheat terminal units
System 6 – VAVS	Built-up VAV Unit	Variable volume system with chilled water and hot water coils, water-cooled chiller, tower and central boiler
System 7 – SZVAV	Packaged Single-Zone VAV Unit	Single-zone variable volume DX unit with variable-speed drive and gas heating
System 8 – RESERVED		
System 9 – HEATVENT	Heating and Ventilation Only	Gas heating and ventilation
System 10 – CRAH	Computer Room Air Handler	Built-up variable volume unit with chilled water, no heating
System 11 – CRAC	Computer Room Air Conditioner	Packaged variable volume DX unit with no heating
System 12 – LAB	Laboratory HVAC System	For buildings with a total lab floor area less than 10,000 sf: a single zone VAV system (SZVAV), with variable-speed drive for supply fan, DX cooling and a gas furnace For buildings with lab floor area of 10,000 sf or greater: For building floor area < 150,000 ft^2:packaged variable volume system with 100% OA and minimum ventilation rate of 6 ACH For building Floor Area>= 150,000 ft^2, built-up VAV (VAVS) with water-cooled chiller and central boiler Gas furnace heating if building floor area is 10,000 ft^2 or less; hot water coils/boiler if greater than 10,000 ft^2
System 13 – KITCH	Kitchen HVAC System	Dedicated makeup air unit (MAU) – CHW if building is VAVS, DX otherwise. Dedicated exhaust fan Gas furnace heating if building floor area is 10,000 ft^2 or less; hot water coils/boiler if greater than 10,000 ft^2

HVAC cont'd

- Fan System power updated to §140.4(c) for systems with nameplate horsepower exceeding 5 HP
  - Exhaust Fan Power in Standard Design has the same proportion of system fan power as the proposed
  - Standard Design System has Relief Fans Only, not directly modeled
  - Fan Power Adjustments allowed per Table 140.4-B

Table 140.4-B Fan Power Limitation Pressure Drop Adjustment

Device	Adjustment Credits
Return or exhaust systems required by code to be fully ducted	0.5" w.g.
Exhaust filters, scrubbers, or other exhaust treatment	The pressure drop of the proposed design
Particulate filtration credit: MERV 16 or greater and electronically enhanced filters	Pressure drop calculated at 2 x clean filter pressure drop at fan system design condition
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition
Biosafety cabinet	Pressure drop of device at fan system design condition

HVAC cont'd

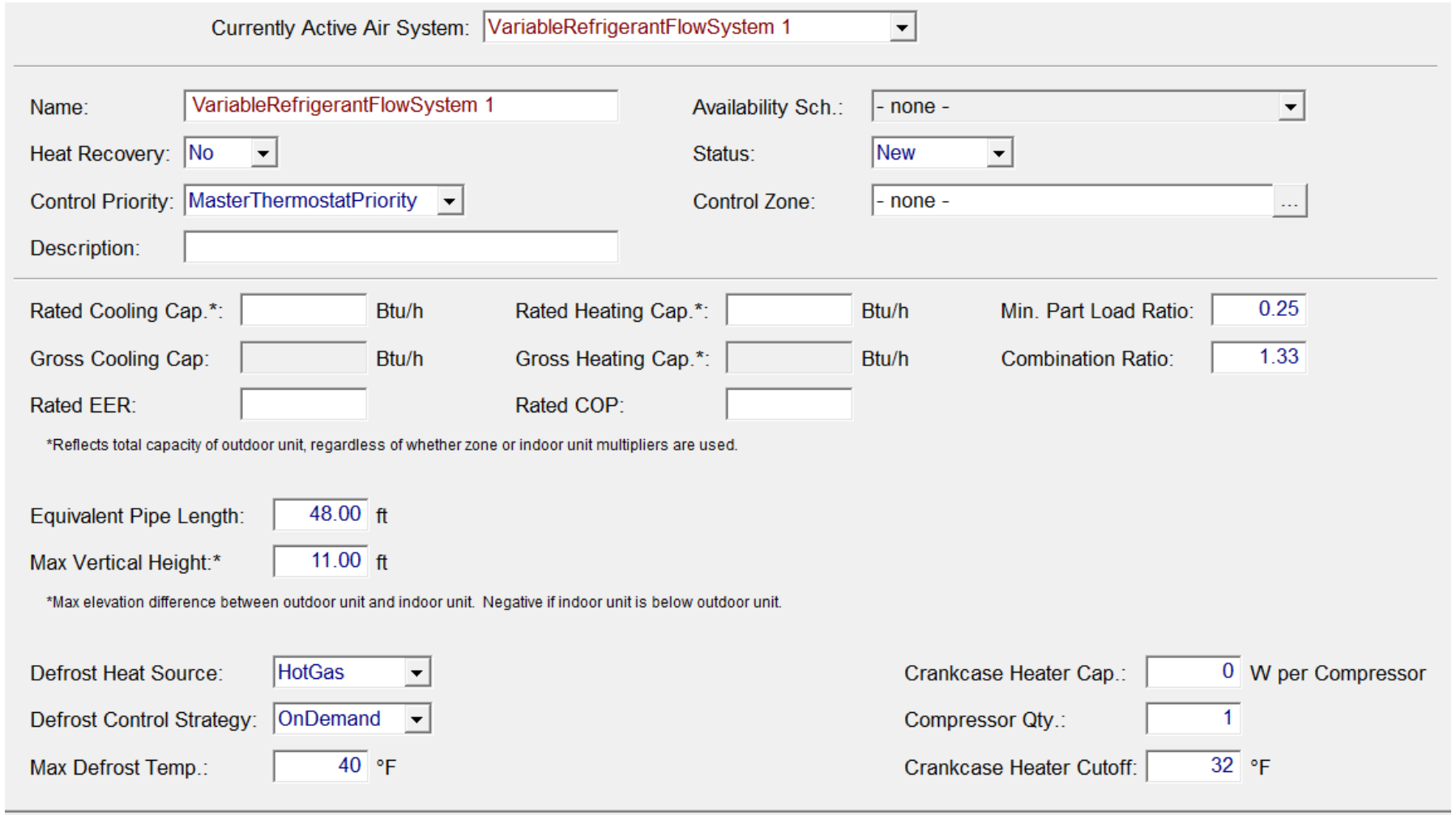
- Cooling Tower efficiency §140.4(h)5
  - Axial fan, open circuit, serving chilled water plant
  - 60 gpm/HP when total condenser water flow is 900 gpm or greater (Climate zones 2-15)
  - 42.1 gpm/HP for climate zones 1 and 16, or when less than 900 gpm
- Healthcare facilities
  - Exempt from space conditioning requirements except for equipment efficiencies
  - Standard design HVAC system parameters match proposed
  - Air System and Thermal Zone must only contain healthcare space types (dedicated HVAC system)

HVAC cont'd

- Variable Refrigerant Flow (VRF) equipment for compliance
  - Allows modeling of an outdoor condensing unit with multiple VRF indoor units
  - Indoor Unit Inputs:
    - Design SAT, Cooling capacity, Heating Capacity, Supply Fan Capacity in Cooling, Heating and Deadband, Auxiliary Power when On, Auxiliary Power When Off
  - Outdoor Unit Inputs:
    - COP, Heat Recovery, Control Priority of Master Thermostat, or Load Priority
  - Performance curves based on Florida Solar Energy Center (FSEC) report supported by the Department of Energy.
  - Standard design based on HVAC System Map

HVAC cont'd

VRF Input tab



HVAC cont'd

- Unmet Load Hours (UMLH) - Reinstate checks for nonresidential spaces
  - UMLH "..represents the number of hours during a year when the HVAC system serving the thermal zone is unable to maintain the setpoint temperatures for heating and/or cooling"
  - Abort compliance run if UMLH is greater than 150 hours in any zone
  - Some spaces not impacted by UMLH (non-normally occupied spaces)
  - Uniform loads, setpoints and schedules ensure that there is a fair comparison between the proposed design and standard design building
  - UMLH not enforced in Alpha version

HVAC cont'd

- Software has option for zones designed with excessive *cooling* UMLH
  - Adds a phantom DX cooling system to proposed model to meet load

Add Cooling
(Thermal Zone tab)

Covered Process

- Fume Hood Automatic Sash Controls
  - New Prescriptive requirements: §140.9(c)4
  - New schedule developed for automatic sash controls
  - New inputs: Fume Hood Length, Sash Control Fraction, and Min Exhaust ACH
  - Standard design has sash control if proposed has VAV exhaust and fume hood dominated airflow
- Laboratory and Factory Exhaust Systems
  - New Prescriptive requirements: §140.9(c)3
  - New inputs: Checkboxes for anemometer control, contaminant control, and exhaust treatment devices
  - Anemometer or contaminant based control is modeled as meeting fan power requirement (no credit or penalty)

Water Heating

- Service Hot Water (SHW) System Assignment
  - Each space can be defined as having gas or electric water heating system
  - Standard design fuel source can now be gas, electricity, or a combination, based on space type (similar to ASHRAE 90.1 Appendix G)
- Sizing
  - Based on total hot water loads of spaces
  - Capacity (heat input rate plus volume) is limited to that of the proposed
    - Set to be at least equal to a 30-gallon storage water heater
- Healthcare facilities required to comply

Water Heating cont'd

- High-Rise Residential
  - Updated rules to follow residential multifamily modeling guidelines and software
    - Uses California Simulation Engine (CSE) to calculate hot water energy
  - Individual electric water heating system
    - Standard design uses 2.0 UEF heat pump water heater with basic compact hot water distribution and drain water heat recovery system.
  - Central electric water heating system with recirculation loop
    - Standard design uses gas water heater
  - Compliance credits
    - Compact hot water distribution system - basic or enhanced
    - Drain water heat recovery system

Miscellaneous

- Field Verifications
  - High-rise residential
    - Mandatory - IAQ ventilation airflow and kitchen range hood
    - Optional – enhanced compact hot water distribution, drain water heat recovery system
- CBECC-Com Engine update (April 2019)
  - Upgrade OpenStudio to version 2.7.0
  - Update EnergyPlus to version 9.0.1
- Reporting
  - Onscreen Energy Use Summary accurate in Alpha version
  - PRF-01 (PDF Report) not accurate in Alpha version

ACM and CBECC-Com Schedule

Release	Scheduled ACM Date	Scheduled CBECC-Com Date
2019 Alpha *Public Workshop*	January 2019	January 2019
2019 Release Candidate *Engine Upgrade* *UMLH Implementation*	April 2019	April 2019
2019 1.0 (certified) *PRF-01 (PDF Report)*	May 2019	May 2019

How to Submit Written Comments

We strongly encourage submitting written comments via e-file by March 1, 2019.

Comments on the Draft 2019 Alternative Calculation Method Reference Manuals and Compliance Software Tools can be submitted to:

https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=19-BSTD-01

Comments can also be submitted physically or by e-mail, here:

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