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STATE OF CALIFORNIA — NATURAL RESOURCES AGENCY Gavin Newsom, *Governor*

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CEC-057 (Revised 1/21)

Notice of Availability

REVISION TO 2019 NONRESIDENTIAL AND RESIDENTIAL ALTERNATIVE CALCULATION METHOD (ACM) REFERENCE MANUALS AND UPDATED COMPLIANCE SOFTWARE, CBECC-COM 2019.2.0 AND CBECC-RES 2019.2.0

Docket # 19-BSTD-01

California Energy Commission (CEC) staff is posting a revision to the 2019 Nonresidential and Residential ACM Reference Manuals and updating the accompanying compliance software, California Building Energy Code Compliance Commercial (CBECC-Com) and Residential (CBECC-Res). The revised ACM Reference Manuals and updated software will be presented for approval at the May 12, 2021, Business Meeting. Written comments should be submitted to the Docket Unit by 5:00 p.m. on May 7, 2021.

Background

Nonresidential Heating Ventilation and Air Conditioning (HVAC) System Map Revision

The Nonresidential ACM Reference Manual and accompanying software, CBECC-Com 2019.1.0, were approved in May 2019, to show compliance with the 2019 Building Energy Efficiency Standards (Energy Code). Subsequent to their approval, CEC staff received feedback from stakeholders regarding the HVAC standard design (also known as the HVAC System Map) for high-rise residential dwelling units and hotel/motel guestrooms in a building eight stories and greater.

The HVAC System Map for this type of building is described in the Nonresidential ACM Reference Manual as using System 2, Four Pipe Fan Coil (FPFC), as the standard design HVAC system:

Stakeholders have commented and presented data that shows a System 2 – FPFC is not a common HVAC system type used in the majority of new construction high-rise residential buildings eight stories and greater. The data indicate the most common HVAC system type installed is a single zone system, either furnace or heat pump based, and a System 2 – FPFC is not suitable to be used as the standard design HVAC system type. Therefore, CEC staff has revised the Nonresidential ACM Reference Manual and CBECC-Com software to remove the System 2 – FPFC as a standard design HVAC system type for high-rise residential buildings eight stories and greater and instead use the System 1, Single Zone Air Conditioner (SZAC). This means that all high-rise residential dwelling units and hotel/motel guestrooms in a building will have a System 1 – SZAC as the standard design HVAC system.

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

System 2 – FPFC is described as:

Table 5: System Descriptions

System Type	Description	Detail
System 2 – FPFC	Four-Pipe Fan Coil	Central plant with terminal units with hot water and chilled water coils, with separate ventilation source

System 1 – SZAC is described as:

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

CEC staff proposes using System 1 – SZAC instead of System 2 – FPFC. This maintains consistency with the development of the 2019 Nonresidential ACM Reference Manual that uses gas for space heating in all buildings as the standard design.

Heat Recovery Ventilators

Following the May 2019 release of CBECC-Com 2019.1.0 and CBECC-Res 2019.1.0, CEC staff discovered that heat recovery ventilators (HRV) and energy recovery ventilators (ERV) (henceforth collectively referred to as HRVs), receive a unintentionally disproportionate compliance credit.

Unlike high performance attics and walls, which can reliably save energy over the lifetime of the building (30 plus years), it is not certain that HRVs will save the same amount of energy as the building envelope features they will be trading away. HRVs are occupant-dependent mechanical devices with typical warranties of five years, easily accessible on/off switches, and fans that are supposed to operate constantly to provide the required ventilation. Furthermore, HRVs require regular maintenance (filter replacement, heat exchanger coil cleaning, etc.) several times a year which, if not performed, could result in performance losses or premature equipment failure and abandonment. Due to these uncertainties, staff is concerned that the relatively large compliance credit HRVs currently receive may not be representative of real-world energy savings. Because of this, staff began investigating the rulesets used in the compliance software for HRV performance modeling, identified several issues, and is proposing the following changes.

Historically, compliance software performance has been neutral for ventilation fan energy, giving no credit or penalty, based on fan efficacy, watts per cubic foot of airflow per minute (W/CFM), or design ventilation airflow (up to 150 percent of code required airflow). The lack of a standard design fan efficacy is one of the reasons why HRVs receive compliance credit despite using significantly more fan energy than balanced or unbalanced systems, which have comparatively higher fan efficacy.

For single and multifamily buildings, staff's proposal is to set the Standard Design exhaust type based on the proposed design where an unbalanced system gets an unbalanced Standard Design with 0.35 W/CFM and a balanced system with or without heat recovery gets a balanced system Standard Design with 0.70 W/CFM fan efficacy.

To determine the 0.35 W/CFM unbalanced fan efficacy, staff surveyed the Home Ventilating Institute (HVI) database and found that greater than 80 percent of exhaust fans met or exceeded this efficacy level. For balanced systems, fan efficacy is based on double the energy of a single fan unbalanced system. To supplement this research, staff looked at industry standards such as ENERGY STAR and ANSI/RESNET/ICC-301-2019 and found both comparable to the proposed Standard Design. To qualify for the ENERGY STAR Residential Ventilating Fan Program, bathroom and utility fans must have a minimum fan efficacy of 0.35 W/CFM and inline fans must meet a more stringent efficacy of 0.26 W/CFM. For RESNET, the Standard Design fan efficacy for unbalanced, balanced, and HRV/ERV is set to 0.35, 0.70, and 1.00 W/CFM respectively.

The next issue with the current indoor air quality (IAQ) ventilation ruleset is the lack of Home Energy Rating System (HERS) verification of system wattage, Sensible Recovery Efficiency (SRE), and Adjusted Sensible Recovery Efficiency (ASRE). The convention of the Residential ACM Reference Manual is to model proposed building components at an unverified, de-rated, state unless field verification is performed. Due to oversight, HRVs and other IAQ system types were not subject to field verification of heat recovery efficiency or fan wattage in past code cycles, and this went unnoticed due to the relatively less common installation of HRVs than other large compliance credit devices. To account for the lack of field verification of equipment efficiency, staff is recommending that IAQ credit be de-rated by applying a five percent increase to the design system wattage and a five percent reduction to the ASRE and SRE (if applicable). This is consistent with other compliance credits like whole house fans, which are de-rated when HERS verification of airflow and wattage is not performed.

Another issue identified by staff is performance reduction of IAQ systems with supply air ducts due to incorrect installation and incomplete or delayed routine maintenance. To address this, staff is proposing an additional de-rating factor equal to a ten percent increase in the simulated proposed system wattage and a ten percent decrease in SRE and ASRE (if applicable) for all systems with supply air ducts (balanced with or without heat recovery, and supply-only systems).

Further, to address the contributing factors for delayed or incomplete maintenance of IAQ systems staff is proposing installation criteria in order to receive compliance credit. Staff recognized inaccessible system maintenance components as a contributing factor to lacking maintenance, IAQ system failures, and reduced performance. To address this, staff is proposing that in order to receive compliance credit, supply, balanced, or HRV IAQ systems must have accessible supply air filters, outside air inlets, and heat/energy recovery cores (if applicable). Alternatively, if the system design is not readily accessible, the energy modeler can de-select this option and the system can be installed with no credit for the IAQ system.

Table 1: IAQ System Component Accessibility Criteria

Dwelling Unit Ventilation System Component	**Location**	**Accessible Determination**
Outdoor Air Intake	Exterior wall with a louver, grille, or screen intake opening nominal size < ½ inch	A point on the perimeter of the outdoor air intake shall be located within 10 feet of a walking surface or grade or within 4 feet of a point on the perimeter of a window or door opening
Outdoor Air Intake	Soffit	Complies
Outdoor Air Intake	Roof	Access shall be provided in accordance with California Mechanical Code Section 304.3.1 requirements for appliances

Filters and Heat Exchangers	Serviceable from conditioned space	The HRVs or supply ventilation system access panel shall be located within 9.5 feet of the finished floor surface
Filters and Heat Exchangers	Roof	For multifamily, access shall be provided in accordance with California Mechanical Code Section 304.31 requirements for appliances

Finally, the current software gives heat recovery credit on the full amount of proposed airflow, and sets the standard design airflow equal to the proposed up to 150 percent of the code minimum. This improperly increases the maximum possible heat recovery credit and encourages increased design airflow rates that are not shown to be necessary or effective. Staff proposes limiting standard design airflow to 110 percent of the code required airflow. This revision eliminates credit for oversizing HRVs while still allowing for design flexibility and gaps between fan airflow settings.

Table 2: Example EDR Credit for Proposed HRV Revisions: Multifamily Prototype

	Multifamily Standard Design: Standard = Balanced, 0.7 W/CFM Proposed = HRV, 1.0 W/CFM, 75 SRE, 81 ASRE Proposed (simulated) = HRV, 1.15 W/CFM, 63.75 SRE, 68.85 ASRE	
	Efficiency EDR Credit	
	6960 ft^2 Prototype	
	Natural Gas	Electric
CZ1	2.8	3.5
CZ2	0.8	1.5
CZ3	-0.3	-0.1
CZ4	-0.4	0.6
CZ5	-0.6	0.1
CZ6	-3	-1.2
CZ7	-4.1	-2.3
CZ8	-2.6	-1.7
CZ9	-1.3	-0.5
CZ10	-0.8	0
CZ11	1.3	1.9
CZ12	0.8	1.2
CZ13	1	1.4
CZ14	1.3	2
CZ15	0.2	0.7
CZ16	2	3.8
Average	-0.18	0.68
Min	-4.1	-2.3
Max	2.8	3.8
Average: all climate zones and fuel types =		0.25

Table 3: Example EDR Credit for Proposed HRV Revisions: Single-Family Prototype

	Single-Family Standard Design: Standard = Balanced, 0.70 W/CFM Proposed = HRV, 1.0 W/CFM, 75 SRE, 81 ASRE Proposed (simulated) = HRV, 1.15 W/CFM, 63.75 SRE, 68.85 ASRE			
	kTDV/ft^2-yr Margin			
	2100 ft^2 Prototype		2700 ft^2 Prototype	
	Natural Gas	Electric	Natural Gas	Electric
CZ1	3.7	5	3.3	4.6
CZ2	1.6	2	1.3	1.6
CZ3	1.5	1.8	1.2	1.6
CZ4	1.1	1.2	0.4	1.4
CZ5	1.7	2.5	1.4	2.1
CZ6	-0.1	0	-0.3	-0.2
CZ7	-1.1	-0.3	-1.3	-1.3
CZ8	-1.1	-1.2	-1.2	-1.2
CZ9	-0.1	-0.2	-0.1	-0.1
CZ10	0.3	0.3	0.2	0.2
CZ11	1.5	1.7	1.4	1.6
CZ12	1.4	1.3	1.2	1.2
CZ13	1.4	1.5	1.2	1.3
CZ14	1.6	1.9	1.4	1.6
CZ15	0.5	0.6	0.5	0.7
CZ16	2.3	3.7	2	3.7
Average	1.01	1.36	0.79	1.18
Min	-1.1	-1.2	-1.3	-1.3
Max	3.7	5	3.3	4.6
Average: all climate zones and fuel types =				1.08

Revised Software Availability

The revised 2019 Nonresidential and Residential ACM Reference Manuals and the updated software, CBECC-Com 2019.2.0 and CBECC-Res 2019.2.0, will be posted to the ACM Reference Manuals and Compliance Software Tools Docket for review, which can be found at (https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=19-BSTD-01).

Public Comment

Written comments: Written comments should be submitted to the Docket Unit by 5:00 p.m. on May 7, 2021.

Written comments, attachments, and associated contact information (e.g., address, phone number, email address) become part of the viewable public record. This information may also become available via any internet search engine.

The CEC encourages use of its electronic commenting system. The electronic comment page for the ACM Reference Manuals and Compliance Software Tools Docket is available at (https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=19-BSTD-01). Select or enter a proceeding to be taken to the "Add Comment" page. Enter your contact information and a comment title describing the subject of your comment(s). Comments may be included in the "Comment Text" box or attached in a downloadable, searchable Microsoft® Word (.doc, .docx) or Adobe® Acrobat® (.pdf) file. Maximum file size is 10 MB.

Written comments may also be submitted by email. Include the docket number 19-BSTD-01 and revision to 2019 NONRESIDENTIAL AND RESIDENTIAL ALTERNATIVE CALCULATION METHOD (ACM) REFERENCE MANUALS AND COMPLIANCE SOFTWARE, CBECC-COM 2019.2.0 AND CBECC-RES 2019.2.0 in the subject line and send to docket@energy.ca.gov.

If preferred, a paper copy may be submitted to:

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Docket Unit, MS-4
Re: Docket No. 19-BSTD-01
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