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Enhancements Missing in 2022 Energy Code

See attached memo of comments.

Additional submitted attachment is included below.

Memorandum

To: CEC 2022 Docket Number: 22-BSTD-02
From: Neil Bulger, Red Car Analytics
Date: 4/25/2022
Subject: T24 2022 Software Review Feedback
Subject: Enhancements Missing in 2022 Energy Code Compliance Software & Supporting Documents

Dear Building Energy Standards Office,

I would like to thank the CEC for their continued effort to develop a pathway by which buildings can demonstrate performance compliance for energy cost effectiveness.
Over the years of developing the Alternative Compliance Manual and associated compliance software engine and rulesets, the CBECC software enhancements only focus on new functionalities without identifying where in the existing rules and interpretation there are areas which could be enhanced significantly. While the latest version of the 2022 CBECC software has made improvements such as the integration of multi-family buildings or new technologies such as radiant cooling and heating, there remain significant gaps in the basic elements and functionalities of the software in representing how buildings use energy. These gaps, if left unchanged, will result in energy models that misrepresent the reality of how buildings use energy. Three items identified and discussed in this memo are as follows:

1. Revised commercial space use internal loads to modern uses
2. Simulation rulesets for modeling demand control ventilation
3. Updated HVAC part load efficiency boundaries and performance

None of the items are directly set by the energy code, instead they are interpretations or legacy assumptions made by the CEC's software vendors in the rules of how CBECC is built. Some buildings need to use compliance software for code permit approval and while these changes may not impede that us of an energy model, the lack of these changes will over time erode confidence in further use cases of energy modeling in general.
While energy codes will likely remain comparative in nature, the ability to show similar energy differences and savings as would be seen in outcome-based energy modeling is important to maintaining a level of representativeness. Having a significant difference between code models and real building operations means that some technologies get unfair and unrealistic advantages while other technologies' savings are underleveraged or simple not represented. It should be noted that in other energy standards where performance compliance is allowed (ASHRAE 90.1, IECC 2021) all these items have been addressed or, they are options within the compliance pathway to some degree.

1. Commercial Building Space Internal Uses

Commercial space internal load assumptions are outdated and lead to over estimating cooling energy and under estimating heating energy. The result of this includes:

A. Creating a direct barrier to the electrification of space heating. If a building representation does not utilize heat, the time value of saving heat or using a more efficient heating system such as a heat pump cannot demonstrate relative value.

B. Creating an over-emphasis on cooling system efficiency savings. This can result in building designs primarily focusing on cooling efficiency and overlooking many other key building energy uses.
C. Changes in requirements for the size of prescriptive solar PV for buildings. Code energy models are intended to be used as a relative comparison. However, the CBECC software, while supporting this method of analysis used to set the physical size requirements for buildings using solar PV in different California climate zones, uses this model to justify absolute sizes and limits of an energy code. It may work out to be reasonable, though it will only be due to sheer luck.

2. Ventilation Demand Control Rulesets

The current compliance ruleset and CBECC software does not allow for demand control ventilation to be simulated. This has frequently been considered not worth implementing, since the controls are mandatory for certain space types and certain system configurations, regardless of whether or not the energy code mandates it. However, the lack of rulesets and inability to account for varying ventilation can result in underrepresenting dedicated ventilation systems, which only vary airflow by DCV and otherwise do not reduce airflow. In mixed-air systems where airflow is primarily varied by changes in thermal cooling and heating needs, the further accounting of DCV fan energy use will be minor, though in dedicated ventilation systems, the difference in fan energy use when including DCV can be substantial. Even in buildings where DCV is only implemented in the required spaces, this level of variation in fan airflow and resultant fan power is substantial. While ventilation control is primarily a mandatory measure it is also a component which is optional for building HVAC to use as a means to save energy.

3. Unrealistic HVAC Efficiencies

Part-load efficiency performance information used to represent air conditioning components are also a part of the compliance process which are not explicitly defined by the energy code though are included in the example software references. This includes everything from fan efficiency part-load limits to compressor DX limits and efficiencies. The current set of DX performance curves used for small and mid-sized air conditioning equipment provide often unrealistic and unbounded HVAC efficiencies, holding most systems at the same efficiency regardless of the current part load. In an evaluation of the medium commercial prototype for offices, three observations can be stated which demonstrate unrealistic operations for any commercial building HVAC system:

A. Systems with supply air resets were at the highest reset 99% of the time.
B. DX cooling systems run at 25% to 30% capacity and maintain the same efficiency at this part load compared to full load.
C. Variable volume fan systems on average sit at 20% or less power, rarely demonstrating a need for more than 60% airflow.

While some of these items do not have simple solutions, they remain gaps in how HVAC systems are represented accurately and should be addressed.

We are open to supporting the enhancements of any of these items and providing any resources we have available on our consulting practices.

Regards,

Neil Bulger | PE | LEED AP
Co-Founder | Principal

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