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RACM Proposed Revisions to IAQ Ventilation

Additional submitted attachment is included below.

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California Energy Commission

Docket Number: 19-BSTD-01

RE: 2019 Alternative Calculation Method Reference Manuals and Compliance Software Tools

To Whom It May Concern:

The CABEC Advocacy committee is writing (and belatedly submitting) this letter to comment on the proposed changes to Heat/Enthalpy Recovery Ventilation credits. Building science has long been challenged with minimizing energy flows across building assemblies while properly managing moisture, indoor air quality, and combustion safety and also meeting cost budgets. Ventilation is both a critical element to indoor air quality and environmental health for human occupants, but is also in tension with energy efficiency. This is captured in the aphorism "build tight, ventilate right."

The obvious way to reconcile this tension is with heat/enthalpy recovery ventilation (HRV) along with good filtration and distribution. The minimum requirement for IAQ ventilation incorporated into the current 2019 Energy Code is an exhaust-only ventilation system, which brings in fresh air with no heat recovery and no generally predictable level of filtration and distribution. That said, the success of federal air quality standards and poorly regulated indoor source emissions makes the exhaust-only approach crudely productive in improving IAQ. This exhaust-only approach is common in the residential building industry at present given its negligible capital cost, but among the available technologies and system types, we believe it's non-controversial to note that it is the poorest approach. Specifically with regards to energy efficiency, it is a weak link in the building enclosure system, which is partially why HRV's perform well as a credit in performance compliance.

As implied by the proposed changes, HRV's aren't a trivial design element to consider. A good HRV system should provide adequate ventilation airflow with filtration and distribute well across the conditioned space. The additional filtration and distribution effectiveness comes with some added static pressure, and therefore some fan energy investment over what an exhaust-only approach would consume. But the fan energy cost is compensated by sensible (and maybe latent) heat recovery that would otherwise be additional load to the space conditioning system. To maintain the performance of the IAQ system, filters must be changed (just as they would at the space conditioning systems), and intake air grilles cleaned on occasion. In the end, a well implemented HRV system will provide a more efficient, but more importantly, a *healthier* and *more resilient* overall indoor environment for the lifetime of the building. And it is difficult to conceive of a more energy efficient system to do so in practice.

High performance buildings need maintenance, and that fact should not be a reason to discount the technologies that make it high performance.

Codes generally establish a minimum standard for performance for any building system. Furthermore, credits in the Title 24 Performance path generally have clearly defined criteria for qualification that reflect 'good,' if not 'best' practice. In this context, **we support the IAQ System Component Accessibility Criteria** as this provides guidance within the code for how designers and installers can implement high-performance ventilation systems.

But curiously, this is the extent of the positive guidance offered in this proposed revision. The tenor of the remainder of the proposed changes cast numerous doubts on the performance of HRV systems, but offers no pathways or guidance for reconciliation. Instead of continuing to define key performance and testing criteria that could be vetted at plancheck and HERS, the proposal simply proposes to handicap these systems. Furthermore, the Proposed changes entirely ignore the primary reason for the compliance credit: the exhaust-only Standard design. If the Commission sees an issue with efficiency credits and HRVs, we entreaty the Commission to instead cast their jaundiced eye towards exhaust-only IAQ ventilation.

We will outline some of the proposals and the supporting claims along with our responses:

1. <u>HRV's installed at the expense of high-performance building enclosures</u>
    a. We believe that this is a false antagonism-- HRVs (and balanced ventilation more broadly) are an integral part of a high-performance building enclosure. We observe that the exhaust-only fan system that meets the minimum ventilation requirements exacerbates unaccounted deficiencies in the building enclosure (presumably high-performance) by ventilating via induced infiltration. This infiltration presumably comes through the same high-performance building enclosures that are being QII'd and therefore visually verified to be airsealed. With this in mind, it seems apt to describe HRVs as a <u>part</u> of a high-performance building enclosure system akin to air-sealing.
2. <u>HRV's and maintenance</u>
    a. Generally, the claim that HRV's are not as reliable as other efficiency measures is a plausible one, but unsubstantiated in the Proposed changes. The same logic that applies to concerns about maintenance and neglect apply to all other energy efficiency measures (and that includes insulation). Our concern here is not that this is being considered, but that it is not considered rigorously and extensively throughout all energy efficiency measures, and thus has the effect here of being an ad hoc argument. How reliable is an HRV relative to argon/krypton gas in vinyl windows, or a variable capacity heat pump, or a solar PV system that never gets cleaned? These should not be rhetorical questions, but actual research questions that can be answered via research.
        i. We understand that these are complex questions and that formal quantitative answers would involve a lot of research and perhaps above and beyond the capacities and budget of the Commission at the present moment.
    b. The Proposal furthermore claims that HRVs are occupant-dependant mechanical devices with accessible on/off switches. To be sure, 'occupant-dependant' and

'accessible' are not formally defined, but compared to exhaust-only ventilation where building departments simply require a sign indicating that the fan is supposed to run continuously, this claim does not seem consistent with operational practice. Furthermore, it conflicts with arguments presented elsewhere in the Proposal that these systems are neglected and unmaintained with the implication that they are out of reach or otherwise inaccessible.

c. In response to the durability and maintenance question, it is more difficult and costly to retrofit HRV's later than to install it in the first place. Even a neglected HRV can be easily repaired or replaced so long as the supporting infrastructure is there, and it still has efficiency value to the building asset far greater than an exhaust only system-- not to mention the value for non-energy IAQ benefits.

3. Recovery Efficiency derating:
   a. *"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. IAQ system types were not subject to field verification of heat recovery efficiency or fan wattage in past code cycles, and this went unnoticed"*
      i. Heat Recovery SRE and ASRE can be reviewed and verified at plancheck as the data can be reasonably reviewed via cut sheet and/or HVI lookup. Verification by planchecker is sufficient as would HERS verification.
      ii. Fan efficacy necessarily include system effects, and so is better performed as a field verification. RA3.7 describes the general process and we encourage this to be an additional HERS measure similar to space conditioning systems.
   b. As we understand this, the Commission is proposing a derating of HRVs unless the units are HERS-verified, but has not yet promulgated such HERS procedures.
      i. As the proposal mentions that this comes as a result of an 'oversight', then it seems more appropriate that the Commission propose to implement the de-rating concurrently with the implementation of HERS verification procedures for all ventilation systems.
      ii. We also recommend the Commission to include field verification of fan efficacy for all IAQ systems, and not just HRVs.
4. Fan Energy:
   a. The impact of fan energy is indeed an important consideration for energy efficiency. The Proposal is that double of the exhaust fan (i.e. 0.70 Watts/CFM) is set as the standard design to account for both supply and return fans. This gives no allowance for mandatory filtration and the distribution system that would be indicative of a high-performance ventilation system. RESNET, in its standards, does give some reasonable allowance here, and we encourage the Commission to follow RESNET's approach of 1.0 W/CFM.
5. Total Flowrate 110% vs. 150% of ASHRAE 62.2:

a. The proposal claims that increased design airflow beyond 110% of ASHRAE 62.2 minimum is 'not shown to be necessary or effective'. This claim bears further inquiry and substantiation.
    i. At the core of this debate is the fundamental tension described before-- a tradeoff of occupant health (via indoor air quality) and energy. These are cost/benefits that are not easily comparable in common metrics. In other words, we appreciate that this is not easy policymaking.
    ii. ASHRAE 62.2, in its first *sentence* indicates that it *'defines the roles and <u>minimum</u> requirements for mechanical and natural ventilation.'* (emphasis added). Then it proceeds to articulate all the factors which would make the requirements insufficient in maintaining acceptable indoor air quality, and the more and better would be warranted. Nowhere does it claim that acceptable indoor air quality is always achieved at a range of 100%-110% of the prescribed flowrates.
    iii. California Mechanical Code table 402.1 also prescribes ventilation rates (and are being enforced for single-family housing in lieu of ASHRAE 62.2) that are notably greater than ASHRAE 62.2 rates (5 CFM per person and 0.06 CFM/ft^2).
    iv. Passive House, which is internationally recognized as the highest performance building efficiency standard requires ~0.30 air changes per hour, which is also generally greater than ASHRAE 62.2 flowrates.
    v. The variety of standards around flowrates for IAQ at least demonstrates that the minimum flowrate for acceptable air quality is a complex question and one that continues to evolve. As another for instance-- ASHRAE 62.2 (2016) requires significantly more mechanical airflow than previous standards. And it is possible that even current ASHRAE 62.2 (2016) standards will be deemed insufficient for buildings permitted under future codes cycles.
b. As implied previously in the proposal, if the intent is to limit the credit for HRVs we find the arguments used to support the changes to be poorly substantiated. Given the complexity of the issue, there is reasonable debate for what the correct flowrate should be for optimal IAQ both in a general sense, and ever more in any particular case. But that can be a different question from how much compliance credit HRV's get in the asset rating. And it's clear that there should be some sort of cap, whether it be 10% over ASHRAE, or 50%, or more (or less).
c. The proposed software changes for interpolations (which is an appreciated development) make the argument that the 10% allowance for fan settings unnecessary. Furthermore, there are many small ADUs, where the difference of 10% in flowrate is at the margin of error for many flowhoods, regardless of HRV fan settings.

Summary remarks:

We will once again highlight some of the themes running through our review. Ventilation is an important and challenging topic for energy efficiency. A high-performance ventilation system that does not compromise the building enclosure is pressure balanced with heat recovery, and it

is a technology that deserves to be properly supported in code and credited in the performance approach pursuant to criteria for qualification. This is a ripe opportunity for the Commission Performance compliance to incentivize high-performance ventilation systems and continue the work of evolving the building industry beyond an exhaust-only approach.

Sincerely,

Lucas Morton, on behalf of the
CABEC Advocacy Committee