DOCKETED

Docket Number:	17-BSTD-01
Project Title:	2019 Building Energy Efficiency Standards PreRulemaking
TN #:	217492
Document Title:	Balanced Ventilation Requirement for Multifamily Dwelling Units
Description:	This comment supports the proposed requirement for balanced outdoor air ventilation systems in multifamily dwelling units. This requirement should not be limited to non-attainment areas, but should extend to all multifamily dwelling units, based on the inability of alternative outdoor air ventilation systems to provide acceptable IAQ in multifamily applications.
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Submitter Role:	Public
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NEWPORT VENTURES

May 9, 2017

California Energy Commission
1516 Ninth Street, MS-34
Sacramento, CA 95814

Re: Docket 17-BSTD-01, Proposed Balanced Ventilation Requirement for Multifamily Dwelling Units

Dear CEC Staff and CASE Initiative Team:

This comment supports the proposed requirement for balanced outdoor air ventilation systems in multifamily dwelling units. This requirement should not be limited to non-attainment areas, but should extend to all multifamily dwelling units, based on the inability of alternative outdoor air ventilation systems to provide acceptable IAQ in multifamily applications. A discussion of system options for providing IAQ follows.

Exhaust-only outdoor air systems should not be permitted in any multifamily dwelling units. Such systems establish pressure imbalances across dwelling units and promote contaminant and odor transfer, not delivery of fresh outdoor air. CEC's interpretation issued on this matter on June 22, 2015[1] effectively banned these systems for high-rise multifamily, and the same logic should be applied to low-rise multifamily.

Exhaust outdoor air systems with dedicated makeup air inlets should also not be permitted in any multifamily dwelling unit, because research has shown that these systems fail to provide the targeted outdoor air flow rates. Industry experience with dedicated makeup air inlets, and a recent study conducted by NEEA,[2] have demonstrated that occupants generally keep inlets closed. The same study concluded that, "the analysis of inlet vents failed to show clear benefits from their usage." A separate study also found dedicated makeup air inlets to be ineffective: "airflow from the passive vents was 13%–36% of the exhaust ventilation rate…. most of the makeup air comes from unintentional sources—from leaks in the exterior envelope, neighboring apartments, or the corridor."[3] Currently, CEC's interpretation addressing this subject only permits exhaust outdoor air systems with dedicated makeup air in high-rise multifamily dwelling units when the outdoor air ventilation rate can be field-verified at the dedicated outdoor air inlet. This has resulted in a de-facto, code-driven prohibition of exhaust outdoor air systems with dedicated makeup air, because makeup air inlets do not deliver the required outdoor air flow rate. For this reason, leading MPE specifiers have stopped specifying exhaust outdoor air with dedicated makeup air inlets in California. Based on recent research and California's current requirements, there is no good reason to start approving these systems again, whether in high-rise or low-rise dwelling units.

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[1] CEC. 2015. Letter to Building Industry. http://www.energy.ca.gov/title24/attcp/documents/supporting_documentation/2015-07-02_Outside_Air_Compliance-Exhaust_Fan_with_Inlet_Damper.pdf.

[2] Eklund, K., Kunkle, R., Banks, A., and Hales, D. 2015. Pacific Northwest Residential Ventilation Effectiveness Study. WSUEEP14-020.

[3] Maxwell, S., Berger, D., and Zuluaga, M. 2016. Evaluation of Passive Vents in New Construction Multifamily Buildings. (Subcontractor Report, NREL/SR-5500-64758). Golden, CO: National Renewable Energy Laboratory.

Supply-only outdoor air systems solve some of the problems with exhaust systems (e.g., providing a known source of outdoor air), but they too induce pressure differentials across units that can lead to transfer of odors and pollutants across dwelling units and between dwelling units and corridors/common areas, greatly diminishing the benefit of providing filtered outdoor air. This induced pressure differential created by supply systems is in direct opposition to footnote G of Table 402.1 of the California Mechanical Code, which states, "air from one dwelling unit shall not be recirculated or transferred to other spaces outside of that dwelling." Further, use of a central fan integrated (CFI) ventilation system to provide supply air can easily consume 1000 kWh more in fan energy than an H/ERV, and supply-only outdoor air systems do not provide any energy recovery benefit (see Exhibit A for more information).

Unlike exhaust-only systems, exhaust with dedicated outdoor air inlets, and supply-only systems, **balanced outdoor air systems** do not induce pressure differentials between dwelling units. By not inducing pressure differentials, they are the only systems that comply with footnote G of Table 402.1 of the California Mechanical Code. Similarly, IMC Section 403.3.1.5 requires that high-rise dwelling unit mechanical ventilation systems "shall be balanced". Reducing pressure differentials not only reduces the transfer of odor and pollutants between dwelling units and corridors/common areas, but it also limits the migration of moisture through building assemblies via air leakage, which can lead to condensation, mold, and durability problems. Additionally, balanced systems are able to provide filtered air directly from the outdoors and to temper the outdoor air (if provided with a heat or energy recovery core), increasing the likelihood of system operation by occupants.

Based on these considerations, at a minimum, balanced outdoor air ventilation systems should be required for all multifamily residential dwelling units to support the provision of minimum acceptable IAQ. As CEC and CASE contractors deliberate over where to require balanced ventilation systems in multifamily dwelling units, the following considerations are recommended:

A. Where specified, balanced systems typically replace at least one bathroom exhaust fan. So, if an economic analysis is needed to justify requiring a balanced outdoor air ventilation system in multifamily dwelling units, the analysis should reduce the incremental cost of the balanced system by the cost of at least one ENERGY STAR bathroom exhaust fans and associated ducting (as required in California).
B. Unless CEC's proposed changes to multifamily ventilation requirements specifically includes heat or energy recovery, any economic analysis needed to justify requiring a balanced ventilation system in multifamily dwelling units should use the lesser of the cost of balanced ventilation without a heat/energy recovery core and balanced ventilation with a heat/energy recovery core.
C. If it is necessary to model the energy use associated with balanced ventilation systems, CEC should consider reducing the balanced systems' required flow (as proposed on slide 13 of the Second Stakeholder Meeting for Residential Indoor Air Quality, March 16 pre-rulemaking presentation).
D. Finally, this rulemaking should consider the cost effectiveness of H/ERVs in multifamily dwelling units with respect to using a balanced system without energy recovery as the baseline ventilation system.

Thank you for the opportunity to comment.

Sincerely,

Mike Moore

Mike Moore, P.E.
ASHRAE 62.2 Indoor Air Quality Subcommittee Chair

Exhibit A – Estimation of Fan Energy Use for a Typical CFI System

CFI ventilation systems are typically designed to limit the outdoor air fraction to 5-20% of the total fan flow. When a call for ventilation overlaps a heating or cooling call, the fan power used for ventilation can be calculated as the total fan power multiplied by the fraction of outdoor air flow to recirculated air flow. When there is no need for heating or cooling, however, the fan power used to provide ventilation is the total fan power.

For example, suppose a 1000 sqft apartment has a 1 ton central heating and cooling system with a central fan that moves 400 cfm/ton at an efficacy of 0.58 W/cfm (typical efficacy based on CA studies). ASHRAE 62.2-2016 would require 52.5 cfm of outdoor air for this dwelling unit on a continuous basis or as a time-weighted average over any four-hour block of time.

Suppose the engineer specifies 60 cfm of outdoor air (i.e., 15% of the total 400 cfm air flow through the air handler) for 3.5 out of every four hours (i.e., the run time required to be considered equivalent to a continuous ventilation rate of 52.5 cfm).

For this system, total central fan run time is 8760*(3.5/4) = 7665 hours/year. Assuming that there is a call for heating or cooling 7.8% of the year (as documented on slide 20 of the Second Stakeholder Meeting for Residential Indoor Air Quality, March 16 pre-rulemaking presentation), the fan energy used for providing outdoor air in heating and cooling modes can be estimated as:
(7.8%)*(7665 hours)*(0.58 W/cfm)*(400 cfm/ton)*(1 ton)*(60 cfm OA/400 cfm total) = 21 kWh.
The fan energy used for providing outdoor air in ventilation-only mode can be estimated as:
(1-7.8%)*(7665 hours)*(0.58 W/cfm)*(400 cfm/ton) = 1639 kWh.
Total fan energy use for ventilation = 1660 kWh.

Alternatively, if an ERV is specified that provides 52.5 cfm continuously at a fan efficacy of 1.2 cfm/W (the minimum permitted by the 2018 IECC, residential), the total fan energy use can be calculated as: (52.5 cfm)*(1/1.2 W/cfm)*(8760 hours) = 383 kWh. This fan energy use is further offset by the ERV's energy recovery.