CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Notes from 2019 Title 24 Part 6 Code Development Cycle Utility-Sponsored Stakeholder Meeting for Nonresidential HVAC (2 of 2)

Posted July 27, 2017

Meeting Information

Meeting Date: March 29, 2017

Meeting Time: 9:00am – 12:00pm

Meeting Host: California Statewide Utility Codes and Standards Team

Attendees

First Name	Last Name	Contact	Organization
Statewide Utility Codes and Standards Team			
Utility Staff			
Neha	Arora	Neha.Arora@sce.com	Southern California Edison (SCE)
John	Barbour	JBarbour@semprautilities.com	San Diego Gas & Electric (SDG&E)
Kevin	Chan	kevin.chan@sce.com	Southern California Edison (SCE)
Kelly	Cunningham	KACV@pge.com	Pacific Gas & Electric (PG&E)
Sean	Gouw	sean.gouw@sce.com	Southern California Edison (SCE)
Scott	Higa	Randall.Higa@sce.com	Southern California Edison (SCE)
Marshall	Higa	scott.higa@sce.com	Southern California Edison (SCE)
Randall	Hunt	mbh9@pge.com	Pacific Gas & Electric (PG&E)
Chris	Kuch	christopher.kuch@sce.com	Southern California Edison (SCE)
Jim	Kemper	James.Kemper@ladwp.com	Los Angeles Department of Water & Power (LADWP)
Jeremy	Reefe	jmreefe@semprautilities.com	San Diego Gas & Electric (SDG&E)
Codes and Standards Enhancement (CASE) Team Members			
John	Arent	jarent@noresco.com	NORESCO
Matt	Dahlhausen	mdahlhausen@integralgroup.com	Integral Group
Matt	Dehgani	mdehghani@integralgroup.com	Integral Group
Farhad	Farahmand	ffarahmand@trcsolutions.com	TRC Solutions
Stefan	Gracik	sgracik@integralgroup.com	Integral Group
Heidi	Hauenstein	hhauenstein@energy-solution.com	Energy Solutions
Jared	Landsman	jlandsman@integralgroup.com	Integral Group
Erin	Linney	elinney@energy-solution.com	Energy Solutions
Gwelen	Paliaga	GPaliaga@trcsolutions.com	TRC Solutions
Ken	Takahashi	ktakahashi@integralgroup.com	Integral Group
Jeff	Stein	jstein@taylor-engineering.com	Taylor Engineering
Hilary	Weitze	hweitze@integralgroup.com	Integral Group
California Energy Commission Participants			
Joe	Loyer	joe.loyer@energy.ca.gov	California Energy Commission (CEC)
Jeff	Miller	Jeff.Miller@energy.ca.gov	California Energy Commission (CEC)
Kelly	Morairty	kelly.morairty@energy.ca.gov	California Energy Commission (CEC)
Adrian	Ownby	adrian.ownby@energy.ca.gov	California Energy Commission (CEC)

Alex	Pineda	alex.pineda@energy.ca.gov	California Energy Commission (CEC)
Peter	Strait	Peter.Strait@energy.ca.gov	California Energy Commission (CEC)
Other Participants			
John	Bade		Johnson Controls
Panos	Bakos		Arup
David	Bernett		NEMIC Industrial Supply
Beth	Braddy		Trane
Walter	Bujak		ALC/Carrier Corp
Larry	Burdick		SPX
Gregory	Collins		Zero Envy
Ruth Ann	Davis		Williams
Darryl	DeAngelis		BELIMO Americas
Harold	Dubensky		Johnson Controls Inc
Jim	Edelson		National Buildings Institute
Eric	Erdman		Greenheck Fan Corporation
Skip	Ernst		Daikin Applied
Jeanne	Fricot		Center for Sustainable Energy
Luis	Garcia		LDI Mechanical
Armin	Hauer		ebm-papst Inc.
Diane	Jakobs		Rheem
Peggy	Jenkins		California Air Resources Board (CARB)
Kyle	Landis		Disneyland Resort
Jacky	Ly		P2S Engineering
Mark	Lyles		National Buildings Institute (NBI)
Juvenal	Martinez		EnerCal Solutions
Karen	Meyers		Rheem
Arthur	Miller		Refrigeration Service Engineers Society
Joe	Mizrahi		AACE, Inc.
George	Nesbitt		Environmental Design / Build
Gwelen	Paliaga		TRC Energy Services
Gregory	Partch		CaPipeTrades Council
Chuck	Pesci		Hawaiian Air Corporation
Laura	Petrillo-Groh		Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
Mike	Pouchak		Honeywell
Danny	Quezada		JJATC
Rebecca	Rice		NORESCO
Aniruddh	Roy		Goodman
Glenn	Savage		LG Electronics (HVAC)
David	Stephens		Johnson Controls
Kevin	Stockton		Johnson Controls
Phillip	Tan		P2S Engineering
Phillip	Trafton		Donald F. Dickerson Associates
Douglas	Tucker		Mitsubishi Electric US
Joe	Vadder		Evapco
Chris	Walker		Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
Kyra	Weinkle		NORESCO

Eric	Werner		Johnson Controls
Chris	Whitesides		Johnson Controls
Mike	Wolf		Greenheck
Chad	Worth		Energy Solutions
Ed	Wuesthoff		HTPG

Meeting Agenda

Time*	Topic	Presenter
9:00 – 9:25	Introduction	Kelly Cunningham (PG&E)
9:25 – 10:40	Proposals Based on ASHRAE 90.1-2016: • Equipment Efficiency • Transfer Air • Demand Control Ventilation • Occupant Sensor Ventilation	Stefan Gracik (Integral Group) Matt Dahlhausen (Integral Group) Jared Landsman (Integral Group) Jeff Stein (Taylor Engineering)
10:40 – 11:55	Proposals Based on ASHRAE 90.1-2016: • Fan System Power • Exhaust Air Heat Recovery	Ken Takahashi (Integral Group)
11:55 – 12:00	Review and wrap-up, next steps	Kelly Cunningham (PG&E)

Key Takeaways and Action Items

1. **Introduction**
    a. There are no key takeaways.
2. **Equipment Efficiency**
    a. There are no key takeaways
3. **Transfer Air**
    a. There are no key takeaways
4. **Demand Control Ventilation**
    a. There are no key takeaways
5. **Occupant Sensor Ventilation**
    a. There are IAQ concerns about shutting off ventilation completely to unoccupied rooms
        i. Previous studies have shown that the purge cycle required by Title 24 will maintain acceptable indoor air quality if ventilation is at times completely shut off
6. **Fan System Power**
    a. There are no key takeaways
7. **Exhaust Air Heat Recovery**
    a. The energy recovery ratio requirement at 70% is too stringent

i. The requirement has been reduced to 60% to allow more available products to meet the requirement

b. Clarify if using “effectiveness" per ASHRAE 84 or "energy recovery ratio”.
   i. The report has been updated to use "energy recovery ratio" based on AHRI Standard 1060/1061 certification.

c. Heat recovery systems are only applicable for a limited amount of climate zones and outside air ratios
   i. This measure will not be cost effective in all climate zones. Title 24 will only require HRV in cost effective climate zones.

Meeting Notes

Introduction

- Kelly Cunningham (Pacific Gas & Electric Company) presented.
- Presentation available here.

Comments and Feedback

1. No comments or questions.

Equipment Efficiency

- Jared Landsman (Integral group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

1. No comments or questions.

Transfer Air

- Jeff Stein (Taylor Engineering, Utility CASE Team), Stefan Gracik (Integral Group, Utility CASE Team) and Matt Dahlhausen (Integral Group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

1. Peggy Jenkins Jenkins (CARB): Transfer air for bathrooms needs to be ducted.
   a. Jeff Stein (Taylor Engineering, Utility CASE Team): Transfer air – there are some very specific requirements for transfer air. We can look some more into how we would monitor that.
2. Gregory Collins (Zero Envy): As part of the analysis for transfer air to restrooms, what are the associated savings? With CBECC, there are more savings for kitchen transfer air and the software does not fully capture restrooms.
   a. Jeff Stein (Taylor Engineering, Utility CASE Team): That is a valid point, you do not have to model every toilet room. You can model one as a representative toilet room. Perhaps there could be check box that specifies if transfer air requirements are met prescriptively and then modeling is not required.
   b. Gregory Collins (Zero Envy): That seems like a reasonable option.

3. Diane Jakobs (Rheem): Is there no need for the air that you are transferring from another area?
    a. Utility CASE Team will follow up with stakeholder after the meeting.
4. Phillip Tan (P2S Engineering): Perhaps enhance the compliance by modifying the NRCC-CXR-04E form.
    a. Utility CASE Team will follow up with stakeholder after the meeting.
5. Diane Jakobs (Rheem): How is the office air made up?
    a. Utility CASE Team will follow up with stakeholder after the meeting.
6. Diane Jakobs (Rheem): If you do not take the ventilation air into the bathroom, you will have to take it from somewhere else. You may end up with negative pressure in the building.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): This would only be required if you have excess ventilation air that you are already releasing. Instead of releasing that air immediately, you use the air that is slated for venting for transfer air in another room before it is released. It fits with the definition of available transfer air. That is air that is not required for ventilation or pressurization of adjacent spaces. For example, an office building with a ventilation requirement for the entire building of 5000 cfm, and a bathroom requirement of 500 cfm. If you use 100% transfer air, you still have 4,500 cfm of ventilation air to relieve. It is only required where there is excess ventilation air.

Demand Control Ventilation (DCV) for Classrooms

- Jeff Stein (Taylor Engineering, Utility CASE Team), Stefan Gracik (Integral Group, Utility CASE Team) and Matt Dahlhausen (Integral group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

2. Chris Walker (SMACNA): Have you evaluated the indoor air quality impacts of DCV?
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): We have not looked at indoor air quality impacts. This does not change ventilation code requirements. We are following ASHRAE 90.1 lead on this measure.
3. David Bernett (NEMIC Industrial Supply): I have a concern with indoor air quality, specifically mold and air contaminants laying above ceiling – any disruption sends mold spores and dirt airborne and feeding into adjacent room unfiltered. Are you taking air from the ceiling space and moving it into a room? There are often contaminants above the ceiling, and air near the ceiling can be contaminated with mold spores or other contaminants.
    a. Chris Walker (SMACNA): Jeff, can you address the indoor air quality issues raised by David Bernett?
    b. Jeff Stein (Taylor Engineering, Utility CASE Team): It would only apply to return air plenum. It would only apply if the celling space is already being used as an air plenum – in which case the air from the ceiling space is already being circulated to.
4. David Bernett (NEMIC Industrial Supply): What if there is a pressure shift? There is the potential for bathroom air to move into adjacent spaces. If it is a sealed system with duct work, there is not that potential.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): You have a constant exhaust rate from the bathroom. If supply air is less than the exhaust rate, the balance of the exhaust will come from transfer air. We are saying do not over supply toilet room, let it be negative and pull air from adjacent spaces.

5. Peggy Jenkins (CARB): Schools did not have DCV in previous code cycles, because CARB and Cal/OSHA did not support them. There were some cases many years ago where DCV was installed in schools, and they had to be removed later, because there were some very serious issues. Control systems are crucial.
    a. Peggy Jenkins (CARB): We get the calls when there are issues. The control systems have improved in recent years, which is good. There are studies that have found a relationship between ventilation/indoor air quality and cognitive ability.
    b. Jeff Stein (Taylor Engineering, Utility CASE Team): There are a lot of systems that are not bringing in ventilation. So, this would lead to improvements.
    c. Peggy Jenkins (CARB): I agree.
6. Adrian Ownby (CEC): Why is bowling alley seating included in this proposal? If it is associated with smoking, then it may not be applicable to California.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): I do not think it is a smoking issue. It has been included in 90.1 for almost 20 years, perhaps it is grouped in. We can look into that.
7. Peggy Jenkins (CARB): Implementing all these transfer changes requires careful mathematics. Bathrooms are sealed tightly. Do you have enough transfer air coming in? Also, you want to make sure that there is sufficient outdoor air in other spaces. I suggest additional monitoring of air in these spaces to make sure things are working out the way you think they are.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): Monitoring – DCV it is required that the spaces be monitored, the data be available and visually displayed. This is already in most classrooms, so this proposal will be picking up the bottom percentage of designs that are not already monitoring.
8. Phillip Tan (P2S Engineering): What is the difference between air side economizer and modulating outside air? "Air economizer" is ideally in practice equivalent to "modulating outside air control".
    a. Utility CASE Team will follow up with stakeholder after the meeting.
9. Glenn Savage (LG Electronics): Why are we looking at FDD for economizers if we will get the same result from these DCV requirements?
    a. Utility CASE Team will follow up with stakeholder after the meeting.
10. Ed Wuesthoff (HTPG): Consider the designers are investigating effects of moderately flammable refrigerants and any impact to transfer air creating low flammable limit conditions.
    a. Utility CASE Team will follow up with stakeholder after the meeting.
11. Walter Bujak (ALC/Carrier Corp): Install a two-position damper on the transfer inlet, tied to the toilet exhaust fan to prevent reverse flow should the exhaust fan be off for any reason.
    a. Utility CASE Team will follow up with stakeholder after the meeting.
12. Chris Walker (SMACNA): Perhaps explore filtered outdoor air in PM nonattainment areas.
    a. Utility CASE Team will follow up with stakeholder after the meeting.
13. John Bade (Johnson Controls): If you are going to make a proposal do you have a concern if the bathroom exhaust remains running, the adjoining room that is supplying transfer air becomes unoccupied and is not being ventilated, then the bathroom is pulling air from all adjoining spaces making the entire area negative pressure. I am referring to the standby unoccupied mode.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): It comes down to available transfer air. The standby unoccupied does not affect the intake air at the building level. The toilet

exhaust will probably have multiple offices within the whole building, so I cannot imagine that scenario.

Occupant Sensor Ventilation Requirements

- Jeff Stein (Taylor Engineering, Utility CASE Team), Stefan Gracik (Integral Group, Utility CASE Team) and Matt Dahlhausen (Integral group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

1. John Bade (Johnson Controls): Since the code would not require the total outdoor air coming into the building to be reduced, then the outdoor air would just go to other spaces. Without a requirement to reduce total outdoor air flow how does this save energy?
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): Suppose you are in economizer and SAT = 55F. Other spaces can use all the min outdoor air and more outdoor air. If you also supply 55F to an unoccupied space, then you must reheat it to 70F since there is no load in the space. If you do not supply to an unoccupied space, then you save that reheat energy and fan energy and often cooling energy.
    b. John Bade (Johnson Controls): What about when you are not in economizer. Say it is cold outside; any air you bring in has to be heated, and not every building has economizer.
    c. Jeff Stein (Taylor Engineering, Utility CASE Team): The economizer is still active when it is cold, but regardless of economizer status, there are still savings from not cooling the supply air to that zone down to 55F and then reheating it to 70F. This will be captured in the energy modeling for this proposal.
2. Peggy Jenkins (CARB): I am not clear on the rotating schedules that were just presented (slide 48).
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): Currently the modeling rules assume every zone is always fully occupied. That is not how real buildings operate. People come in late, go to meetings, go to lunch, go on vacation, go into the conference room, etc. The rotating schedule is to make the models more realistic by using realistic schedules.
    b. Peggy Jenkins (CARB): But, are the schedules based on actual occupancy schedules for that building? And what if they change? It sounded as though the schedules were not connected to what goes on in the building.
    c. Jeff Stein (Taylor Engineering, Utility CASE Team): The schedules are based on realistic schedules for typical buildings of that type.
    d. Peggy Jenkins (CARB): Since we have DCV, why not base schedules on actual schedules of each building? I can see issues arising with assuming each building will be operated like the "typical" building type.
    e. Peggy Jenkins (CARB): Maybe I do not understand your comment, but the building does not exist yet, so how would we use the schedules for that building for code compliance? Even if it did exist, there is no easy way to capture the occupancy schedules, and they change over the life of the building.
    f. Stefan Gracik (Integral Group, Utility CASE Team): As a simplification, energy models assume something like 75% occupancy throughout the day. Since our proposed measure only turns off ventilation when the zone is fully unoccupied, we need to adjust these

schedules to represent certain rooms becoming fully unoccupied at points during the day so that we can shut off ventilation air. The schedules are for the energy modeling; it is how we show that the building will save energy.

g. Peggy Jenkins (CARB): I remain concerned about any assumptions/plans to completely shut off ventilation from any given area of the building that is occupied at least part of the day.

3. Walter Bujak (ALC/Carrier Corp): If using DCV, then would not the case be if occupants left the room, CO_2 level would detect that, and ventilation would drop to minimum, which would still be required to meet the base ventilation rate portion of ASHRAE 62 for occupied zones? Even though the zone is in standby, it is still occupied.
    a. Jeff Stein (Taylor Engineering, Utility CASE Team): You are correct. If a space has DCV and occupied standby, then the occupied standby only saves the minimum ventilation (area based vent), not the maximum ventilation (occupant based ventilation). But saving the min vent is sufficient to pay for the incremental costs (which are very low), just as it is sufficient to pay for it for private offices where you are also only saving the min vent. Again, this only applies to spaces where Standard 62.1 says the minimum ventilation is zero when the space is unoccupied.

Fan System Power

- Ken Takahashi (Integral Group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

1. Skip Ernst (Daikin Applied): Why are 90.1 adjustments for return/exhaust systems excluded?
    a. Ken Takahashi (Integral Group, Utility CASE Team): This has been included back into the exceptions for ducted return and exhaust systems.
2. John Bade (Johnson Controls): One barrier is that there are CCM integral motor fans that are becoming popular. If they are not tested for brake input horsepower. Some manufactures have a way to estimate, but it is not tested.
    a. Ken Takahashi (Integral Group, Utility CASE Team): How is ASHRAE 90.1 addressing this?
    b. John Bade (Johnson Controls): I am not sure. We have not come to a resolution in ASHRAE 90.1 yet. We are thinking about creating a table based on total maximum power input that correlated to brake horsepower.
3. Phillip Tan (P2S Engineering): Has the pressure drop across the air handler dampers been considered for fan system power proposal? The dampers can be significant portions of the fan pressure drop.
    a. Utility CASE Team will follow up with stakeholder after the meeting.
4. Laura Petrillo-Groh (AHRI): Why are the calculations of fan power limitations different than 90.1-2016? Specifically, proposed Table 140.4-A-1 in draft Title 24 code language compared to 90.1-2016 Table 6.5.3.1-1.
    a. Mike Wolf (Greenheck): I have noticed similar items in other areas. Best I can tell this looks like ASHRAE 90.1-2013 not 2016. I need to dig further though.
    b. Utility CASE Team will follow up with stakeholder after the meeting.

5. Kyle Landis (Disneyland Resort): In regards to the question regarding watts/cfm for ECM motors - ECM motors are typically fractional HP. The proposed measure would only affect 5 HP and above, so should not be applicable to ECM motors?

Exhaust Air Heat Recovery

- Ken Takahashi (Integral Group, Utility CASE Team) presented.
- Presentation available here.

Comments and Feedback

1. John Bade (Johnson Controls): ASHRAE 90.1 has a requirement for 50% energy recovery ratio, not 70%.
    a. Ken Takahashi (Integral Group, Utility CASE Team): The 70% is more attainable for California.
    b. John Bade (Johnson Controls): 70% in real world conditions is difficult. The definition of the energy recovery ratio from ASHRAE considers that there are no airflows. The best I could obtain with even airflows is 60%. To get a 70% energy recovery ratio, you would need a 95% efficient heat exchanger, and that is difficult to find.
    c. Ken Takahashi (Integral Group, Utility CASE Team): Thank you, we will explore changing the ratio.
    d. John Bade (Johnson Controls): I have a thorough understanding of that ASHRAE requirement and can provide more information.
    e. Eric Erdman (Greenheck Fan Corporation): I second John's comments. Obtaining 70% recovery in applications is extremely difficult even with balanced airflows. 80% is "max-tech" with balanced airflows.
    f. Stefan Gracik (Integral Group, Utility CASE Team): We will take another look at our product selections and costs for these higher effectiveness units. If you want follow up, please email one of us and we can continue the discussion
2. John Bade (Johnson Controls): I am in favor of requirements for heat recovery, but we received some surprising results with 90.1 that came out in 2010. We expected the requirements to move the market, but that has not occurred. We need to think about the following when modeling: In many buildings, especially those with high outdoor air requirements, you will have a difficult time getting 70% of air back to the heat recovery unit. You are not getting that much air coming back to your air handling unit. Do not just assume that you always get 70, 80, 90% of air back through the air handler. In many cases that is not true. There are applications where you can get a very high percentage of air back to the heat recovery unit – labs, for example.
    a. Stefan Gracik (Integral Group, Utility CASE Team): Thank you. We will take that into consideration.
    b. Walter Bujak (ALC/Carrier Corp): Even in labs, most air is exhausted via fume hoods, so the same issues need to be considered since the return air is both less in volume, and in many cases, is a potential concern for cross contamination.
3. John Bade (Johnson Controls): Be careful not to confuse "effectiveness" per ASHRAE 84 and "energy recovery ratio". They are two different things. ERV software does not report energy recovery ratio.
4. John Arent (NORESCO, Utility CASE Team): When will heat recovery be required?

   a. Jacky Ly (P2S Engineering): It appears that the heat recovery systems are only applicable for a limited amount of climate zones. Is Title 24 just going to limited to just those zones? Some climate zones based on the results of the cost-effectiveness analysis.
   b. Stefan Gracik (Integral Group, Utility CASE Team): That is the plan. With additional modeling, we will refine exactly which climate zones and which outside air fractions it will be required for, similar to ASHRAE 90.1.
5. John Bade (Johnson Controls): What climate zones are heat recovery effective?
   a. Ken Takahashi (Integral Group, Utility CASE Team): Climate Zone 15 and 11 are the only two that are found to be cost-effective.
   b. John Bade (Johnson Controls): Would it make sense to include an exemption if you have an evaporative air conditioning system?
   c. Ken Takahashi (Integral Group, Utility CASE Team): Perhaps, but this is a measure that can be modeled. Since it is prescriptive under Title 24, if they can prove it is as cost-effective as heat recovery then it should be allowed.
   d. Heidi Hauenstein (Energy Solutions, Utility CASE Team): http://www.energy.ca.gov/maps/renewable/building_climate_zones.html
6. John Bade (Johnson Controls): The exception to the heat recovery proposal creates a loophole. I suggest revisiting the language to avoid the loophole.

All Measures

1. Chris Walker (SMACNA): Will these training modules be made available with sufficient time for code implementation?
2. Phillip Tan (P2S Engineering): Commissioning. Title 24, Part 11 and Title 24, Part 6 both have commissioning requirements. There seems to be a gap. CALGreen does not require commissioning in alterations, even if there is significant work. I think the intention of Part 6 is to require commissioning on alterations. Has anybody else identified this discrepancy or know of a resolution?
   a. Heidi Hauenstein (Energy Solutions, Utility CASE Team): We can connect you with the Energy Commission Staff.