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**Guttman & Blaevoet Consulting Engineers Dec 8th workshop
Comments**

Please consider the attached comment letter.

Additional submitted attachment is included below.



To: California Energy Commissioners & Staff
 December 24, 2020

Guttman & Blaevoet Consulting Engineers Comments for 2022 Energy Code

Dear Commissioners and Staff-

Please allow me to thank and congratulate you all on all the very hard work you have put in on updating the software and quickly enabling the electrification technology. The improvements are welcomed and hope to see more of that as we progress. The Electrification workshop revealed a few elements that I think need further development and I hope you consider these detailed elements in the work plan.

1. Heat pump baselines were considered for most occupancies but should be expanded for large schools and large offices.
2. All occupancies should have a fuel neutral option for domestic hot water – heat pump storage option.
3. All occupancies should that cannot have a reasonably cost-effective heat pump baseline should have an alternate fuel neutral option available in the CBECC-Com software to eliminate the penalty in the performance approach. There should be a prescriptively allowed fuel neutral baseline applied in the performance approach similar to what is allowed in ASHRAE 90.1-2010 standards. VRF/VRV are one of those particular system types that rarely can show compliance through the performance approach. The alignment to ASHRAE 90.1-2016 baselines have caused havoc in California and around the nation for electrification. We are calling on ASHRAE and the CEC to take a step back and reinstate a fuel neutral baseline for those occupancies where a single high efficiency heat pump baseline is not currently cost effective, either due to modeling capability or current time of use rate structures.

TABLE G3.1.1A Baseline HVAC System Types

Building Type	Fossil Fuel, Fossil/Electric Hybrid, and Purchased Heat	Electric and Other
Residential	System 1—PTAC	System 2—PTHP
Nonresidential and 3 Floors or Less and <25,000 ft ²	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft ² or 5 Floors or Less and 25,000 ft ² to 150,000 ft ²	System 5—Packaged VAV with Reheat	System 6—Packaged VAV with PFP Boxes
Nonresidential and More than 5 Floors or >150,000 ft ²	System 7—VAV with Reheat	System 8—VAV with PFP Boxes
Heated Only Storage	System 9—Heating and Ventilation	System 10—Heating and Ventilation

Notes:
Residential building types include dormitory, hotel, motel, and multifamily. *Residential space* types include guest rooms, living quarters, private living space, and sleeping quarters. Other building and space types are considered *nonresidential*.
 Where no heating system is to be provided or no heating energy source is specified, use the “Electric and Other” heating source classification.
 Where attributes make a building eligible for more than one baseline system type, use the predominant condition to determine the system type for the entire building except as noted in Exception a to Section G3.1.1.
 For laboratory spaces in a building having a total laboratory exhaust rate greater than 5000 cfm, use a single system of type 5 or 7 serving only those spaces. For all-electric buildings, the heating shall be electric resistance

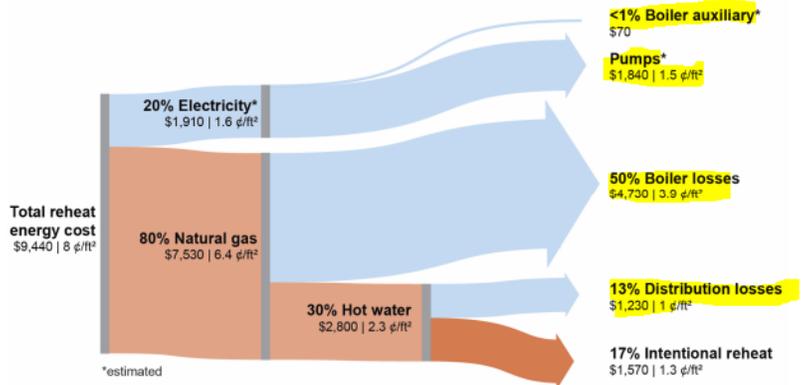
4. VAV electric reheat should be explored and reported on. Why was this ignored as an option for large non-residential buildings? Taylor Engineers (a long-time advocate and consultant for the CEC) has published extensive research on the distribution losses and efficiency

comparisons to the electric reheat system versus a gas boiler that should be fully considered. There is no reason an effective VAV design that limits the need for reheat shouldn't be an effective baseline. This could also be considered with PV+ Electric reheat as the baseline that would effectively drive heat recovery chillers or staged heat pump design for the thermal loops (if and when we can model them).

https://ggashrae.org/downloads/ashrae_electric_reheat_cbe.pdf

Conclusions

- VAV reheat systems typically operate at ultra-low part load. Especially true with:
 - Modern controls (dual-maximum logic)
 - Low minimum airflow rates
 - Mild winter climates
- Hot water distribution losses are significant in practice; 44% in this building
- Boiler operation, sizing, and efficiency at part load critical to overall efficiency; 37% in this building
- **Electric reheat with PV may save on installation and operation costs while reducing (site and source) energy use.**



Flow of operating energy costs in a hot water reheat system.
 Annual gas consumption for this building: 7 kBTU/ft²
 California Commercial End Use Survey average for offices in same climate : 17 kBTU/ft²

5. Heat pump central plant modeling, especially on the heating water loop functions need to be expanded. We know there are EnergyPlus limitations on these functions but all efforts should be made to update the engine, enable the full COP for heat pump central plants to be modeled. The results from the October meeting noted in NORESKO's presentation for the heat pump boiler results are likely reflecting a COP of around 1.0 similar to an electric boiler. This option was again notably absent in NORESKO's presentation at the Dec 8th meeting because of the modeling limitation. Roger Hedrick noted in verbal responses to questions that heat pumps aren't common in the market but indeed they are with multiple manufactures providing both heat recovery chillers and staged heat pump plants. We have provided multiple specs on these in the past and will continue to provide support on these elements as they develop the modeling capability.

DHW & LARGE CENTRAL HEATING/COOLING PLANTS

Air-Cooled

Water-Cooled



Aermec NRP/NRL
50 to 130 TR



Climacool UCA
20 to 420 TR



Multistack DRHC
10 to 1,320 TR

LARGE PROJECTS

HEAT RECOVERY CHILLER PLANTS

6. Heating and chilled water storage needs to be enabled and allowed to be scheduled for TDV savings. Currently DHW load modeling and other thermal storage cannot be scheduled to take advantage of low TDV and high TDV values. The functions of the CBECC-RES battery storage credits (Basic, TOU, Advanced DR) should be minimally enabled for thermal storage systems in CBECC-Com including DHW systems.
7. Enable Photovoltaic and battery storage in the non-residential software. With the latest software release the minimum prescriptive PV system is allowed for central heat pump water heating. There is still a discrepancy from the current solar thermal credit above the 20% or 35% SSF for thermal that PV systems do not get currently. PV generation should be treated as the equivalent “efficiency” measure as the solar thermal system currently is. The ability to pair the solar generation from PV and run the heat pumps to store the energy in the thermal tanks should be a credit enabled by the software and roundly credited by the TDV and TDS metrics. Currently there is no way to take advantage of that TDV or TDS credit enabled in the software. Battery Storage systems should be enabled for this same reason. This capability balances both self-utilization for PV generation but also drastically impacts the cost effectiveness equations with cost management with TOU rate structures.
8. The presentations on battery and thermal storage options for decarbonization and grid harmonization needs to be enabled for all load shifting technologies equally and given the TDV credit when designed for. Most of the workshop “cost effectiveness” and results for modeling in TDV still don’t reflect that cost savings potential or the TDV savings for thermal storage technology. We encourage enabling these whenever possible to show the full value of thermal response whether its battery storage, thermal storage, or building mass enabled by the architectural design.
9. In future workshops on electrification we need to have further understanding of how the two EDR approach is going to be utilized with the TDV metric and the Time Dependent Source (or Carbon) metrics. The cost effectiveness and TDV only results presented in this workshop are going to be incredibly more complicated with the two EDR approach noted in earlier workshops. We need to have this analysis publicly available to inform decision

making. I know Mazi said it would not be considered for this the October workshop but it wasn't mentioned again in the Dec 8th workshop. It's critical to the overall decarbonization discussion to have this detailed analysis completed and clarified from earlier workshops. The baseline plays an important part in the two EDR approach because as I suspect a gas fired baseline will force challenges for the TDV baseline and show compliance with the TDS metric only--- resulting in a non-compliant electric building no matter how efficient. Without public access to the prototype models used by NORESKO and others there is no way to prove the theories but anecdotal evidence is present and is a current barrier to electrification in the 2019 applications.

Again, thank you for all your hard work on decarbonization. We look forward to talking with you more about these issues and working with the Commissioners and Staff to get a really robust update to the 2022 Standards.

Sincerely,



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