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Better ways to decarbonize buildings

Additional submitted attachment is included below.

I strongly support the significant efforts and leadership that the Great State of California has provided in advancing energy efficiency since the 1974 passing of the Warren-Alquist Act. I am proud to have been a resident of and to pay taxes in California, and also to have professionally participated in California-funded building energy efficiency research efforts. I am deeply concerned about the environmental impact that we humans have on our planet, including climate change, and I am very much supportive of efforts that can reduce our carbon footprint, particularly within the building sector since that is my personal area of interest. The comments below reflect my personal opinions alone, and not of any organization with which I may be affiliated.

I am not personally supportive of the proposed nonresidential multizone heat pump baselines in 140.4(a)3. When applied correctly for a particular application, heat pumps may be a great solution for energy efficiency and decarbonization. But not all heat pumps are equal, not all applications are the same, and heat pumps are not the end-all-be-all solution for decarbonizing buildings. There are a great number of supportive comments in this docket from environmental organizations and their members. I am a past or present member of many of those organizations, and align strongly with their missions. But I also have professional experience in building systems to know that heat pumps alone are not the solution to addressing the primary challenge of decarbonizing the building industry. When misapplied, heat pump systems may have higher embodied and operational carbon intensity, as well as increased first and operating costs compared to fossil fuel alternatives.

Let's use cars as an analogy. Electric cars are great. Everyone loves them. They are smart, they are sexy, they are uber green, and they are uber popular. Therefore, we should only allow electric cars on our roads, and we shall mandate that only one car be used: an all-electric GMC EV Hummer. No matter that it is expensive, weighs 4.5 tons, and is bigger than any human should ever need in civilian life. It is all-electric and has zero tailpipe emissions. But wait, it does matter, and these are not actually uber green. There is an incredible environmental and social cost somewhere far, far away associated with mining of the materials used for those batteries and electronics. There is an incredible amount of embodied energy and carbon in the manufacturing of the giant EV vehicle. There is an incredible amount of weight that we drag along with us as we humans individually drive to do all of the little things in daily life, 50 times more than an average human. And, much of the time, there is an incredible amount of carbon that is emitted somewhere far, far away to generate the electricity used to charge those batteries. I work from home, I walk my kids to school, I try to ride my bike for errands. Mandating that I do all of this instead with an EV Hummer will not reduce my energy or carbon footprint, and certainly would not be cost effective.

All-electric is not the same as energy efficient (or energy conservation), and all-electric is also not the same as zero carbon. Whether for cars or for buildings. Many people don't realize that decarbonization and electrification are not the same thing, that there are many ways to significantly reduce the operational carbon intensity of our buildings without electrifying them, and that sometimes these other ways may actually provide deeper and more cost-effective decarbonization than electrification.

Air-to-water heat pumps are very big, very heavy, and very expensive. They require a lot of copper, a lot of electricity, and a lot of refrigerant. And those refrigerants do leak and do contribute significantly to global warming. It is a tremendous amount of work to take the tiny bit of heat that exists in the cold ambient air and "push it uphill" to make moderately hot water – in other words, they are also not very

efficient at heating buildings when it gets cold, which is when we need to do the most heating. They are not a great way to heat buildings and the laws of thermodynamics will not get better over time.

California generates more electricity from solar than any other state, and has strong wind, hydro, and nuclear generation as well, but our deep dark secret is that much of the dispatchable power in our grid in the winter and in the early mornings when we need to heat our buildings comes from natural gas power plants. And these natural gas power plants consume fossil fuels and generate carbon emissions, somewhere far, far away. If you turn the thermostat up or down on your heat pump in the winter or early morning, it is probably a gas-fired power plant that is responding. Someone else has probably already purchased and claimed the credits for the hydro and wind power at that hour. The late Arthur Rosenfeld would agree that a kilowatt-hour is a kilowatt-hour, and we need to conserve each and every one of them. There is significant and growing concern whether renewable energy can meet and overcome the growing demand from all-electric cars and buildings and new AI data centers. Let's get back to focusing on real energy efficiency/conservation and expanding on the Rosenfeld effect.

I very much value the mission of California's building energy efficiency standard but it is clear to me, again personally, that it often fails to achieve its intended goal today. Title 24, Part 6 is very long and very complicated, and it gets even longer and even more complicated every three years. Even those of us who are paying attention, and are paid to pay attention, have trouble keeping track of it. Most don't keep track of it that closely, including designers, installers, plan checkers, and inspectors, and the gaps only gets wider and wider every three years. Who can blame them? With our limited resources, better to make sure a building will stay standing in an earthquake. The mandatory and prescriptive code requirements are deeply complicated, and constantly changing. The performance approach is even more so, developed with an opaque process with little opportunity for public input, and executed through clumsy software tools that most design engineers consider to be deeply flawed and severely limited in capability. Plan checkers and inspectors also generally lack the resources and/or expertise and/or will to do deep energy reviews or enforcement. And many, perhaps most, participants in the documentation process will agree that compliance and acceptance documentation do little more than to create extra busywork. And yet we are all subject to this deeply complex and onerous process that unfortunately does not always improve the energy performance outcome of our buildings.

Most in the trade will acknowledge a significant compliance gap, and some studies have even documented it (it is not a problem unique to California). There is a legitimate question whether real building performance improves when the code and compliance processes become more and more complex, or if the gap is simply growing wider and wider. But there are many other ways that we can improve the energy and carbon performance of our buildings.

- A few years ago, a large demonstration study funded by the California Energy Commission showed the opportunity for significant HVAC energy savings associated with improving how HVAC systems are controlled. Up to about 25% HVAC energy savings were achieved when updating even recently constructed buildings to follow applicable code requirements (i.e. closing the compliance gap). Up to 60% HVAC energy savings were achieved when also addressing deferred maintenance in existing buildings. These improvements were all very feasible, had simple paybacks of less than 10 years, and represented major decarbonization opportunities.
- Another recently completed demonstration study funded by the California Energy Commission achieved 70% natural gas and carbon savings across two buildings from simple upgrades to the

boiler plant and HVAC controls (final results are still unfortunately in draft, unpublished form). The existing non-condensing boiler plants likely operated at efficiencies of 50% or lower that we now believe to be typical, and the existing HVAC controls were incorrectly implemented to achieve the intended and code-required performance. We believe these simple upgrades to raise performance up to basic design intent and code-minimum performance are broadly applicable to a large portion of the commercial building stock.

- Other states and jurisdictions have or are in the process of establishing building performance standards that focus on how buildings are operated, not just designed. That a theoretical and unrealistic (and deeply flawed) compliance model shows energy savings on paper is worthless if it is not reflective of the actual building performance in real operation. Energy benchmarking presents an opportunity for transparent monitoring of real building energy performance and BPS's may be a mechanism for enforcing real energy efficiency. California is uncharacteristically behind on establishing a BPS.

We have a lot of work to do to reduce the energy and carbon intensity of our new and existing building stock. Creating onerous prescriptive requirements for heat pumps is not the way, particularly ones that are so misaligned with market forces. With the utmost respect for those who are trying to make better buildings, thanks for your consideration.