

Commercial Electrification Working Group

Meeting #2

May 24th, 2022

3 p.m. – 4 p.m.

Introductions:

1. CASR: Katrina Managan, Courtney Anderson, Tom Gleason
2. CPD: Chuck Bartel, Antonio Navarra, Carol Pafford, Josh Armstrong, Danny Boncich, Antonio Navarra
3. Attendees: Sean Denniston (NBI), Taylor Roberts (Group 14), Christine Brinker (Southwest Energy Efficiency Partnership), Darin Ramirez (RJA Engineering), Mark Jelinske (RMH), Mike Reynolds (Nava Real Estate), Mark Snyder (4240 Architecture), Teresa Gray (RJA) Engineering, Erik Johnson (Boulder Housing Owners Rep), Mike Fulton (Western Mechanical Solutions), Matt Joens (Melinder White)

Present Updated Proposal:

1. [#P40](#): IECC C403.2 – Commercial Partial Space Heating Electrification
 - a. Set up buildings for success with Energize Denver – prohibits warm air furnaces and prohibits electric resistance except for 3 exceptions: 1) make-up air systems serving health care facility 2) electric resistance heat used for supplementary heat in accordance with C403.4.1.1 3) Up to 1.35 W/sf of conditioned floor area of electric resistance space heating (small and modest loads)

Summary of Topics Discussed:

1. Limits for electric resistance heating
2. Not picking winners or losers, while also making sure to disincentivize or discontinue use of fossil fuel-powered and inefficient equipment
3. Providing flexibility for building/design teams
4. Exceptions to these requirements
5. Aquatherms

Detailed Notes on Partial Space Heating Electrification Proposal:

1. Limits for electric resistance heating
 - a. Sean: One thing I think we would want to discuss today, electric resistance that is integrated into unitary heat pump equipment. Basically, this equipment automatically complies with this because that's how it's configured to work, but do we need to explicitly say it's exempt or can we keep the proposal as is?
 - b. Mike F: If you're doing thermal storage via electric resistance, that would be limited by this proposal. Making this too narrow would also prevent thermal storage and battery storage. As Xcel has more solar and wind come online, they will need to dump power

and thermal storage and batteries may become economical systems, like the "saver switch" it might be the "use it now" switch where a strategy will be storing heating, cooling, or electricity.

2. Providing flexibility for building/design teams - Not picking winners or losers, while also making sure to disincentivize or discontinue use of fossil fuel-powered and inefficient equipment

- a. Taylor: from a high-level, this is a mandatory section, so if you're doing model pathway, you're going to have to do all of this. VAV with reheat is very common – you could do an electric heat pump and energy recovery at VAV system and that takes care of the majority of the heating load. This is saying you can't do electric reheat at the VAV boxes, but you could do a gas boiler and reheat hot water with gas which seems crazy to me. Requiring heating to be electric isn't that big of a deal, but specifying how people do it, I think there will be push back. Prescriptively, I think it totally makes sense, but if you can meet the goals and be electric why do you have to tell the project how to do it? And my last comment, which maybe isn't a big deal, but the 20-degree heat pump that's totally fine for everything but PTACs and VTACs. There's really only one manufacturer of a vtac and one manufacturer of a ptac that we've found that can meet that. Most are around the 40 to 32 degrees. Again, I don't know if that's that big of a deal, because we should probably be getting away from those anyways, but that's really going to limit the manufacturers available.
 - Sean: Depends on the PTAC. Letting the electric resistance kick in at above 20 really begins to impact affordability. Since packaged terminal units are used primarily in housing and hotels, that becomes an issue of having that expense. We have been thinking about how to address PTACs – there are both efficiency and electrification issues with them. I have a question for you (Taylor) about the VAV with heat recovery. In the systems that you see, are they including more electric resistance than this 1.35 watts per square foot of conditioned area?
 - Darin: I would just jump in and say there that it almost always would be above that 1.3 even when doing it parallel fan powered system or something similar.
- b. Taylor: There are two places of heat, and I think that's important. The heat at the VAV RTU or unit, which is heating the outside air, which is the majority of the heating load, which I think makes sense to be a heat pump or even and have energy recovery in a lot of cases. And then there's reheat at the VAV box. So those are two separate heating portions. Another issue comes from a project we're working on that's looking to be net zero. They're doing a VRF system which meets all these requirements, but they have certain spaces that they have such a big occupant load that they have to do an airside system, right. They need that immediate response that an airside system gives them. For those certain areas, they're doing a VAV a with a heat pump with electric reheat. And my first review of this is that wouldn't be allowed either, which I think that's kind of a step below. And the step above is that it's a really common system. If you're heating using a heat pump for the outside air and still not being able to do it for the reheat, I think it's a big push.
 - Sean: in that targeted system I think it would depend on how much of that building. The allowance right now is based on the whole building, so as long as that area is small enough, you would still be able to do it on a limited basis.
- c. Mike F: It seems like you're kind of picking winners and losers to jump on what Taylor saying. You're saying you have to do a system this way instead of just saying our goal is

to get rid of electric. And the second thing is the exception at 1.35. I think it is super onerous and needs to be updated. We did a project – this was exterior skin, not interior, so I recognize it's over the whole building and not just at the skin, but it was 16 watts per square foot.

- d. Katrina: What I think I heard both from you and Taylor is that you (Denver) should just tell us to do all electric and let us figure it out. But we had heard sort of the opposite from the group last time because in some cases there's not good plug and play alternatives. You're requiring very different designs because the plug and play alternative for like a PTAC is a PTHP and there aren't very many of those available, and they have a cut off under 40 degrees. We're trying to strike that balance, so where does that balance lie? Do you have something else you would propose?
- Mike F: If Denver is using EUI targets for buildings, why not make this more general to allow for new technology and flexibility for designers to come up with creative solutions. Don't get too specific and miss out on new products that come to market.
- e. Mark: 1.35 watts per square foot of conditioned floor area should be clarified/stated that it's 1.5 square feet of the conditioned floor area applied over the whole building. Recommend you go into chapter 5 and address which portions of C403 and IEBC do get applied. Healthcare needs to be defined or clarified (ex. all of I occupancies, B occupancy with ambulatory surgery center) – expand to allow for other occupancies. Mark wants this addressed through C406. I think C406 provisions are perfect for this – designers need flexibility to allow for innovation. Highly disincentivize using gas.
- Sean: healthcare facilities is a term used through the code, but not a defined term. Number one could be rephrased to say “any systems serving any occupancy required by law or regulation to have back-up power
 - Taylor: That's exactly right is to use an all-electric resistance system. There's no way you're going to meet code, so it's just in those instances of reheat or certain areas, To meet code, especially what we're talking about with the new modeling pathway, it's going to be have to be really high performance system that probably has energy recovery and heat pumps and all those things already. So it's just like that reheat or others. But that's where your exception for that you added in there I think handles that perfectly.
- f. Chuck: I like incentives and driving towards performance and low energy designs. Concerned about additional refrigerants being used. We could be picking winners and losers and could be creating unintentional consequences. Also brought up the issue of furnace needed to be defined or clarified
- Katrina: we noted refrigerants in the comments. That's another reason we leaned towards warm air furnaces because the plug and play options for these systems generally didn't have a lot of refrigerant. By picking this one system, the plug and play systems have less refrigerants.
 - Sean: furnace is a term already used by ICC. We'll have to see if a used term needs to be specifically defined.

3. Exceptions

- a. Darin: Sean, can you explain that again just how the allowance is based on the entire building square footage, I'm not sure I followed
- Sean: The allowance is an amount of resistance heat that is allowed on the entire conditioned floor area of the building. That means that it could be a very

large load for a small place, or a very light load spread out over the building. You could concentrate it all in one place. It really is meant to give a certain amount of flexibility, one that we can have these low energy buildings where they can satisfy all their heating and then the other is just that, sometimes you have these peaking loads in buildings that are asymmetrical, unusual. Sometimes the responsiveness of something like electric resistance is needed so we wanted to provide some flexibility for that as well.

- b. Katrina: Taylor does that get at the intent of your concerns/address your questions?
 - Taylor: Yes, but I think the 1.35 is so low that it only helps in one specific part of the building. I'm even thinking for major renovations, if they have VAV with electric reheat in there, they can't reuse that, they can't just put a heat pump at the RTU. I think it really brings up a lot of issues. Again, I would rather see this proposal be stronger in saying no gas but provide more flexibility on how to do it.
- c. Katrina: This is supposed to be new buildings and major renovations. Energize Denver only covers equipment replacement, so this needs to cover all major renovations also.
 - Sean to make this change for policy alignment
- d. Erik: In Boulder, he originally thought they wouldn't fit under his requirement because we did have some electric resistance heat, it was devoted to the bathrooms, and there was there's no interconnection between that little bit of baseboard heat and the multi zone heat pumps. In other words, the electric resistance is not on board. However, as the discussion went on, it seems that we would actually fit under exception #3 if we are allowed 1.35 watts over the entire floor area of the unit – that might be 2-3 feet of electric resistance heat which is all it takes for a bathroom.
- e. Darin: Can we have an exception that says "if it's all electric and meets the performance criteria, then it's okay."
 - Mike F: I like that
- f. Sean: the big question around exceptions is if we have option #2, do we need option #3 if we need #3, what is that capacity threshold? (in regards to C403.2.4 exception options)
 - Taylor: I like option #2 better because it's cleaner.
 - Katrina: checked with group – take option #3 out?

4. Aquatherms

- a. Katrina: let's discuss Elizabeth Gillmor's comments around aquatherms being difficult to electrify
- b. Sean: Elizabeth's concern was that aquatherms, which use the domestic water heating system in a fan coil to provide space heating as well. And so thought that was one of the systems that Denver should be looking at to try to prohibit. And I'm curious what the group thinks about those systems.
 - Darin: aquatherm question is a good point. Super common to see aquatherms in multifamily and we might be unintentionally steering people towards them. If aquatherm is the one cheap exemption left, then people will choose that. Picking winners and losers by specifically targeting warm air furnaces vs targeting systems that get heating from natural gas.
- c. Courtney: Elizabeth's notes talked about prohibiting space heating via the domestic hot water system to prevent the aquatherms. I'm just wondering if the group thinks that that's appropriate or if we're missing anything if we do that. Is that the right solution?

- Taylor: I think the concern would be that you could do it with a heat pump. We are starting to see projects smaller projects look at having a heat pump water heater, provide heating to an aquatherm type system, which I think is a slam dunk for Denver's goals and for performance. Maybe if you just added gas in there or something?
 - Katrina: We could prohibit space heating from gas domestic hot water. We did consider requiring electrification for all systems under a certain capacity. It's really the large ones that tend to be those boiler systems that are harder to electrify. It gets really tricky to define the capacity for the building for the per the system. There's a lot of little supplementary systems. Do those contribute to the capacity? It was hard to draft and it was hard to be really clear. And it doesn't exactly align with energized Denver. And we know neither of those formulations are perfect. If we want to exclude the large boiler-based systems for now from electrification requirements. Is this the better of those options? Is there another option? I want to get a gut check on that because this could be reformulated in that way, but we chose this because it seemed like a more graceful formulation.
- d. Sean: Is there a way we can formulate it in a way that doesn't impact these commercial systems where siphoning a little hot water off your space heating system for service water heating it actually makes sense.

5. Other Topics Discussed

- a. Darin: If the goal is no gas, the language could be simplified – why are we talking about warm air furnaces. Concerned about the makeup air systems. It's going to be very difficult to totally electrify small makeup air type units even with heat pumps and would come at a substantial cost for tons of small restaurants and things like that.
- Katrina: we leaned toward warm air furnaces because that's what Energize Denver covers, and larger and taller buildings tend to have boilers and hydronic systems and are harder to electrify. Darin are you proposing making the makeup air systems and exception in all cases?
 - Darin: Perhaps, and I wonder, too, if there's a size limitation, where that does or doesn't make sense.
 - Taylor: I do think you have to be specific on that language, because it could be a multifamily where they're providing air like ventilation air. I don't know if that's what you want to exclude or not, but then that would be excluded.
- b. Sean: One thing that had been considered before is only exempting makeup air systems for applications where the mechanical code prohibits energy recovery ventilation. ERV is another way to deal with makeup.
- Darin: it does seem to make a lot of sense.
 - Sean: would that adequately cover concerns?
 - Katrina: Sean do you want to work on looking at that? Even if it's very rough, we don't have to get final language. I think it's going to help folks. Sean, if you're able to put some options in to consider - placeholders on concepts that we're going to refine as a group where we get into somewhere where you might be able to do that.
- c. Katrina: check to see if we're getting close on this proposal. Scale of 1-5 where do folks feel we are (5 is you love it, 1 is you hate it) – group responded primary with 3's and 4's
- d. Katrina: we'll follow up on the small things and it's great to know that folks think this

proposal is workable. If there are other things you think we need to work on send us feedback offline

Next Steps & Upcoming Agenda:

- e. 6/7 – [#P38](#) Commercial Partial Space Water Heating Electrification
- f. 6/21 – Finalize both working group commercial partial space and water heating electrification proposals to be voted on in upcoming IECC/DGC Energy Code Committees

Meeting adjourned