Meeting Notes

Notes from 2022 Title 24, Part 6 Code Cycle
Utility-Sponsored Stakeholder Meeting for:

Multifamily and Nonresidential Water Heating

Posted: October 29, 2019

Meeting Information

Meeting Date: October 3, 2019
Meeting Time: 8:30 am – 11:15 am
Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Time	Topic	Presenter
10 minutes prior to call	Live Attendee Poll	
8:30–8:35	Meeting Guidelines	Rebecca Aviles (Energy Solutions)
8:35–8:40	Opening Remarks from the California Energy Commission	Energy Commission Staff
8:40-8:45	Overview and Welcome	Kelly Cunningham (Pacific Gas & Electric)
8:45-10:40	CASE Presentation I: Multifamily Domestic Hot Water • Solar Thermal • Domestic Hot Water Distribution • Central Heat Pump Water Heating	John Arent (NORESCO) Gwelen Paliaga (TRC) Jingjuan (Dove) Feng (TRC)
10:40 – 10:45	*5 Minute Break*	
10:45-11:20	CASE Presentation II: Multifamily Drainwater Heat Recovery	Jingjuan (Dove) Feng (TRC)
11:20-11:45	CASE Presentation III: Nonresidential Drainwater Heat Recovery	Eric Martin (Energy Solutions)
11:45-12:00	Wrap Up and Action Items	
12:00	Closing	Alanna Torres (Energy Solutions)

Meeting Attendees

First Name	Last Name	Email	Affiliation
Statewide Utility Codes and Standards Team			
Utility Staff			
Kelly	Cunningham	KACV@pge.com	Pacific Gas & Electric
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John	Barbour	JBarbour@semprautilities.com	San Diego Gas & Electric
James	Kemper	James.Kemper@ladwp.com	Los Angeles Department of Power and Water
Codes and Standards Enhancement (CASE) Team Members			
Alanna	Torres	atorres@energy-solution.com	Energy Solutions
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Simon	Lee	Simon.Lee@energy.ca.gov	Energy Commission
Other			
Gypsy	Achong		2050 Partners
Tim	Rooney		AO Smith
Ben	Brannon		ARUP Group
Dan	Johnson		Beyond Efficiency
Peter	Grant		Beyond Efficiency
Alexander	Reed		Bradford White
Roy	Eads		CalCERTS

Andrew	Kosydar		California Building Industry Association (CBIA)
Greg	Mahoney		City of Davis
James	Domanski		CLEAResult
Tom	Paine		ConSol
Bob	Hitchner		EcoDrain
Meg	Waltner		Energy 350
Kelly	Morairty		Energy Commission
Gabriel	Ayala		Enovative Group
George	Nesbitt		Environmental Design/Build
Avery	Colter		FARD Engineers
Alea	German		Frontier Energy
Bill	Dakin		Frontier Energy
Chris	Bradt		Frontier Energy
Gina	Rodda		Gabel Energy
Marina	Blanco		Gabel Energy
Gary	Klein		Gary Klein and Associates
Palani	Ammasai		Hartzell
Ole	Pilgaard		Heliodyne
Liam	Buckley		IESVE
Jennifer	Rennick		In Balance Green Consulting
Nick	Grahf		International Center for Appropriate and Sustainable Technology
Geoffrey	Vamasaki		Katerra
Bo	White		NegaWatt Consulting
Amruta	Khanolkar		New Buildings Institute
Sean	Denniston		New Buildings Institute
James	Lyons		Newport Partners LLC
Erica	DiLello		NORESCO
Judie	Porter		NORESCO
Nikhil	Kapur		NORESCO
Rahul	Athalye		NORESCO
Sally	Blair		NORESCO
Silas	Taylor		NORESCO
Dan	O'Donnell		Resideo
Vrushali	Mendon		Resource Refocus
Anna	LaRue		Resource Refocus

Margaret	Pigman		Resource Refocus
Josh	Rasin		Sacramento Municipal Utility District
Owen	Howlett		Sacramento Municipal Utility District
Eduardo	Reynoso		Sempra Energy
Tristan	de Frondeville		Sky Centrics
Nehemiah	Stone		Stone Energy Association
Dan	Erben		SummerHill Homes
Adam	Chrisman		Sun Earth Inc.
Martin	Morehouse		Sun Light and Power
Farhad	Farahmand		TRC Companies
Neil	Perry		TRC Companies

Resources

- Presentation
- Multifamily Water Heating Submeasure Summaries
- Nonresidential Water Heating Submeasure Summary
- Title24Stakeholders.com
- EnergyCodeAce.com
- LocalEnergyCodes.com
- 2019 Code Cleanup Form

Action Items

1. Dove Feng (TRC, Statewide CASE Team) to follow up with Sean Denniston (New Buildings Institute) on solar thermal with multi-pass HP-WH.
2. Julianna Wei (TRC, Statewide CASE Team) to follow up with Martin Morehouse (Sun Light and Power) on Solar Thermal TDV calculations.
3. Action item: Elizabeth McCollum (TRC, Statewide CASE Team) will forward Bo White's (NegaWatt Consulting) question on CBECC-Res switching to EnergyPlus to the software team.
4. Gwelen Paliaga (TRC, Statewide CASE Team) will follow up with Martin Morehouse (Sun Light and Power) on water usage for modeling purposes.
5. Dove Feng (TRC, Statewide CASE Team) will follow up with Avery Colter (FARD Engineers) on heat pump water heater data from projects they are working on.
6. Dove Feng (TRC, Statewide CASE Team) will look at potential cost savings from water heater peak capacity reduction enabled by DWHR, as suggested by Meg Waltner (Energy 350).
7. Eric Martin (Energy Solutions, Statewide CASE Team) will look into why nonresidential recirculation of domestic hot water has no code requirements, and is not modeled in CBECC?

Meeting Notes

1.1 Welcome and Meeting Ground Rules

- Alanna Torres (Energy Solutions, Statewide CASE Team) presented.

1.2 2022 Process Overview

- Payam Bozorgchami (California Energy Commission) presented.
- Kelly Cunningham (PG&E, Statewide Utility Codes & Standards Team) presented.

1.3 CASE Presentation I: Multifamily Domestic Water Heating

- Presenters
    - Jon Arent (NORESCO, Statewide CASE Team)
    - Gwelen Paliaga (TRC, Statewide CASE Team)
    - Jingjuan (Dove) Feng (TRC, Statewide CASE Team)

1.3.1 Solar Thermal

- Josh Rasin (Sacramento Municipal Utility District): The solar thermal exception if PV is installed should only apply if the water heating system is electric, is that the case?
    - Jon Arent (NORESCO, Statewide CASE Team): That is the intention here, I suppose if you have a building that you are not using electric water heating and you wish to install PV as a means of providing energy production to offset water heating energy use that might be appropriate. We would have to determine an appropriate procedure for that.
- Gabriel Ayala (Enovative Group): Are non-pressurized, non-glycol solar thermal systems permissible? Such as a drain back system?
    - Jon Arent (NORESCO, Statewide CASE Team): I think they are allowed, I do not think they are common in California. They are more common in Florida or other temperate areas. Whenever you can get within a few degrees of freezing, like in the winter in California, you would use a glycol mix in the system.
- Sean Denniston (New Buildings Institute): When solar thermal is paired with heat-pump water-heaters (HP-WH), the efficiency of the HP-WH frequently plummets. Most HP-WHs just are not nearly as efficient when heating warm water as compared to when heating cold make-up water. There are newer multi-pass systems that do a better job. Whatever is adopted should account for this system interaction.
    - Dove Feng (TRC, Statewide CASE Team) to follow up with Sean Denniston (New Buildings Institute) on solar thermal with multi-pass HP-WH.
- Danny Tam (Energy Commission): Because of the agreement with the California Building Industry Association (CBIA), we cannot increase the stringency of the low-rise multifamily requirement, but we can hold the proposal until 2025
- Martin Morehouse (Sun Light and Power): In current code, the water heating code applies for both low rise and high-rise residences. Is this going to continue moving forward?
    - Martin Morehouse (Sun Light and Power): We are installing a 30 percent solar fraction system on a 45 story building. We are also installing a 70 percent solar fraction system on a 20 story building. I would recommend applying a different scale to the high rise. Above 8 stories would have 20 percent to 35 percent solar fraction.
    - Danny Tam (Energy Commission): The same water heating requirements apply to both low rise and high rise. Moving forward we might need to make some reasonable splits.
    - Rahul Athalye (NORESCO): Martin, thank you! The CASE Team would like to connect with you and learn more about your high-rise recommendations.

    - Martin Morehouse (Sun Light and Power): I support 50 percent solar fraction for 7 stories and below. For 8 stories and above a 20 percent or 35 percent fraction is feasible and easily achievable.
- Sean Denniston (New Buildings Institute): Is the goal to facilitate installation or encourage installation of solar thermal (ST)? Photo voltaic (PV) paired with a HP-WH is generally more cost-effective than ST.
    - Danny Tam (Energy Commission): Solar thermal is an existing requirement. Before the HPWH pairing with PV is common, we are considering PV offset with HPWH only.
- Dan Johnson (Beyond Efficiency): Solar thermal displaces gas, but we are moving across the board to electric water heating, please provide a solar PV water-heating offset pathway
    - Dan Johnson (Beyond Efficiency): If we are interested in cost effectiveness, I think it's shown that solar PV + HPWH is lower cost than solar thermal with gas, for the same TDV.
    - Dan Johnson (Beyond Efficiency): Just require 35 percent solar offset of water heating, and let the designer choose Thermal or PV to meet this requirement, depending on the water heater fuel source.
    - Rahul Athalye (NORESCO): Dan, do you have a reference we can go look at for the cost-effectiveness of PV versus solar thermal with HPWH?
- Martin Morehouse (Sun Light and Power): Just so you are aware, many apartment building owners prefer to have water heating systems on the roof. The concern for high rise is not applicable.
- Jennifer Rennick (In Balance Green Consulting): Climate zones 5&6 seem to do anything to avoid ST, so PV options are a necessity.
- George Nesbitt (Environmental Design/Build): Solar Thermal displaces both gas & electric water heating. Arguments can be had on cost effectiveness of displacing gas vs electric (with heat pump being less cost effective).
- Sean Denniston (New Buildings Institute): I think that facilitating the choice for solar thermal is a good idea. However, I don't think it makes sense to try to encourage wider adoption through the code. Give solar thermal systems due credit for what they do, but they just aren't always the best choice so the code should not actually favor them.
- Martin Morehouse (Sun Light and Power): Costs of collectors is fairly low versus the overall balance of system on typical systems.
- Ole Pilgaard (Heliodyne): Solar Thermal panels have a higher output per ft^2 than PV panels, roughly 3:1. Unlike heat pumps, solar thermal reduces the demand for auxiliary heating to only 20-30 percent. The residual demand for heating the hot water can be done with gas boilers, heat pumps, electrical resistance heating etc. So, heat pumps are not a substitute for solar thermal.
- Dan Johnson (Beyond Efficiency): Real solar thermal bids are around $10k for a single family home, plus maintenance calls. Ask Danny Parker, FSEC for more information.
- Martin Morehouse (Sun Light and Power): What is the methodology for making sure solar thermal gets a fair shake with TDV calculations?
    - Julianna Wei (TRC, Statewide CASE Team) to follow up with Martin Morehouse (Sun Light and Power) on Solar Thermal TDV calculations.
    - Dan Johnson (Beyond Efficiency): Solar thermal model in CSE Appendix B needs to be hourly, not an annual average for every single draw. A solar thermal system with electric backup is penalized during high-TDV hours when SSF would be >100 percent.
    - Danny Tam (Energy Commission): Dan, absolutely the calculation needs to be hourly instead of annual. We are working on that.

    - Dan Johnson (Beyond Efficiency): Thanks Danny Tam. Can we address the fact that the CSE Appendix B engine has a built-in recirculation waste of about 40 percent? If I put in 100 percent SSF, I only get 60 percent savings. Allowing engineers to tackle this waste is going to be far more cost effective than the ST or PV offset.
    - Martin Morehouse (Sun Light and Power): Julianna, Wei, I would be happy to contribute.
    - Danny Tam (Energy Commission): Dan are you talking about multifamily central systems? The distribution losses are a major issue, and you will never be able to put in 100 percent SSF anyway because that's an annual fraction, and getting 100 percent means it is way oversized for the summer.
    - Dan Johnson (Beyond Efficiency): Danny Tam, yes, central multifamily recirculation. Put in 100 percent to see the built in waste that is not exposed in CBECC for designer to conserve. Put in 50 percent, put in 35 percent, the trendline is linear
    - Dan Johnson (Beyond Efficiency): Please run at least one case with central heat pump water heater, rather than gas. Gas is not part of the CA 2045 Zero Carbon pathway, needs to go away
    - Dan Johnson (Beyond Efficiency): Gas is already banned in many jurisdictions now in 2019, these markets need cost effectiveness for electric water heating considered.
- James Lyons (Newport Partners LLC): When individual water heaters are assumed, how is the piping system design characterized for cost?
- George Nesbitt (Environmental Design/Build): when we say multifamily what do we mean? Triplex and Larger? Difference between vertically integrated town home vs. corridor. Easier to do central hot water system than by apartment. There is a segment of the market, especially affordable housing, where they are forced to have every tenant on separate meters. With multifamily it is a little difficult because we have low rise and high rise. Now just because you have concrete and 3 stories and above. Solar hot water displaces energy. Details will vary if you are displacing gas or electric resistance or heat pumps, might not leave any space for solar hot water.
    - Jon Arent (NORESCO, Statewide CASE Team): There is a question of competing roof space between ST and PV and the choice of renewables. Our primary focus on this topic is evaluating solar thermal and there a lot of people that want to focus on PV. There are a lot of merits of both. ST in terms of product/sq. ft is attractive in terms of a resource and availability of storage and for PV the availability. Both are being weighed for buildings.
- George Nesbitt (Environmental Design/Build): California Solar Initiative (CSI) installs on most affordable projects should be "prevailing wage"
- George Nesbitt (Environmental Design/Build): Have you found anyone who is/has done individual Solar Thermal Hot Water (STHW) systems on multifamily (with dwelling based domestic hot water (DHW))?
    - Julianna Wei (TRC, Statewide CASE Team): George, we have not found much data on individual (dwelling specific) solar thermal systems for MF
    - Dove Feng (TRC, Statewide CASE Team): There is one individual ST+HPWH project we know, it is one of the EPIC demonstration projects Build it Green worked on
    - George Nesbitt (Environmental Design/Build): SDHW systems are done on MF retrofits too. When Solar Domestic Hot Water systems fail and are abandoned they will no longer reduce energy use.
    - Ole Pilgaard (Heliodyne): Evacuated tubes are not feasible in California for heating hot water. Flat plates are much more efficient at the delta T of 50 F. And the use of evacuated tubes is not a function of building size

    - Jon Arent (NORESCO, Statewide CASE Team): We are finding that flat plates are the dominant system type, so we are basing our cost estimates on flat plates.
- Bo White (NegaWatt Consulting): In reference to the new multifamily (MF) code section, are there also related plans to update CBECC-Res and CBECC-Com? Since there will be one code section for low and high rise MF, it would be nice if they could both be modeled in the same software.
    - Elizabeth McCollum (TRC, Statewide CASE Team): Bo White, there is a team working with the Energy Commission to find an appropriate software solution for 2022. In the meantime, we are working on creating greater consistency in the modeling of low-rise and high-rise buildings in CBECC-Res and CBECC-Com.
    - Bo White (NegaWatt Consulting): Elizabeth McCollum, thanks for the info. Do you know if there is any chance CBECC-Res would change their modeling engine to EnergyPlus like CBECC-Com? That would be a big change but it could help improve consistency across the board.
    - Elizabeth McCollum (TRC, Statewide CASE Team) will forward Bo White's (NegaWatt Consulting) question on CBECC-Res switching to EnergyPlus to the software team.
    - Payam Bozorgchami (Energy Commission): Bo, we are looking and evaluating our modeling engine as we move forward to future standard development
- Martin Morehouse (Sun Light and Power): Dan and Danny Tam, is there a way to allow solar thermal to contribute to recirculation losses? On higher solar fraction systems, we do a tie-in to help contribute. We did a study with Davis energy group on effectiveness of this contribution from solar.
    - Martin Morehouse (Sun Light and Power): I'm happy to discuss the inspection protocols off line. martin@sunlightandpower.com
    - Bill Dakin (Frontier Energy): Using solar thermal to offset central water heating recirculation losses should be investigated. We can provide the results of the Building America research that was done on this.
- Adam Chrisman (Sun Earth Inc.): It should be noted that IOU incentives through CSI thermal are expiring June 2020.
    - Danny Tam (Energy Commission): It's a fundamental issue with the current calculation, the SSF is a separate calculator and the distribution is a separate term. It's a known issue.
- George Nesbitt (Environmental Design/Build): The SDHW is a "prescriptive" measure, so you can choose to not do it, but it is part of the calculation for your energy budget. At some point (we may already be there) the budget will be low enough that you will be forced to do such measures.
- Avery Colter (FARD Engineers): Have any designs been proposed to use, say, thermostatic mixing valves to keep cold water input into HPWHs, then to mix with solar thermal heated water?
    - Martin Morehouse (Sun Light and Power): Avery we have some solutions for the HPWH combined system performance, let's chat
    - Julianna Wei (TRC, Statewide CASE Team): Avery, incorporating thermostatic mixing valves for recirculation return water back into HPWH is undergoing lab testing efforts; the CASE team will consider implications with incorporating solar thermal and HPWH.
    - Avery Colter (FARD Engineers): One other problem for coders is that there are no HPWHs in the commercial side of the AHRI directory for water heaters.

    - Julianna Wei (TRC, Statewide CASE Team): Avery, noted and we observed the same on AHRI database. NEEA maintains a database for HPWH by "tier" designations, with limitations
- Sean Denniston (New Buildings Institute): Using solar thermal for loop maintenance and then pairing it with HP-WH for make-up water is a good technology pairing that avoids some of the potential negatives of pairing those two approaches.
- Martin Morehouse (Sun Light and Power): PV increase to offset gas should not be allowed.
- George Nesbitt (Environmental Design/Build): SDHW reduces energy use, PV generates energy (both often lead to increased use).
    - Dan Johnson (Beyond Efficiency): George, if PV powers a HPWH in real time (see FSEC work) then this is functionally equivalent to solar thermal, with no maintenance, plus power generation when HW is satisfied; solar thermal excess capacity is lost.
    - Adam Chrisman (Sun Earth Inc.): Heat pump water heaters require maintenance of filter anodes and backup elements. They are not maintenance free.
- Jon Arent (NORESCO, Statewide CASE Team), addressing comments generally: We are looking at reducing energy and energy consumption, maybe in the form of gas and electric. There are workshops coming up on how the energy metric evaluates gas and electricity. There are some benefits to PV, some benefits to solar thermal based on energy/ft^2, availability of storage, and cost. We are mainly looking at solar thermal but want to leave flexibility.
- Adam Chrisman (Sun Earth Inc.): I had a question regarding individual units for multifamily. There is a possibility to use heat pumps and then oversizing PV arrays. Is the PV going to be tied in to those heat pumps directly? Otherwise it is not a direct offset.
    - Jon Arent (NORESCO, Statewide CASE Team): I don't know if it makes sense to tie in directly to the heaters, but with having PV offset the gas there is the question of metering and if there is a direct offset.
- Danny Tam (Energy Commission): Shouldn't there be some limit to high rise requirements? For the sake of argument is 35 percent feasible and cost effective for a 100 story high rise?
    - Jon Arent (NORESCO, Statewide CASE Team): Good point, that comes into roof space and feasibly. We are looking to see where that limit should be, especially when we are looking at increasing the solar fraction requirement. If there is a 25 or 30 percent requirement but people are putting in 50 percent we want to make sure that the load requirements are not too costly. Looking to see what a reasonable requirement is for that.
    - Martin Morehouse (Sun Light and Power): 50 stories is feasible, we are installing this right now.

1.3.2 Domestic Hot Water Distribution

- Martin Morehouse (Sun Light and Power): General hot water load question: Are any changes going to be made for different unit types? Currently the water usage calculation over estimates the load for low bed count/unit housing and under estimates high bed count/unit housing.
    - Gwelen Paliaga (TRC, Statewide CASE Team): That is the water draw profile, I do not have an immediate answer to your question. There has been a lot of work done to make sure the water draw profile is realistic. Maybe someone else from the CASE Team can address this.
    - Peter Grant (Beyond Efficiency): Martin - Could you talk about the over/underestimate of the water usage calculations a bit more? What data have you seen?
- George Nesbitt (Environmental Design/Build): 1" of fiberglass pipe insulation has a lower R-Value than 1" of elastomeric foam. Do we want to increase the thickness or R-Value?

    - George Nesbitt (Environmental Design/Build): There are too many breaks in pipe insulation. It should be required to insulate under pipe clamps/straps.
    - Gwelen Paliaga (TRC, Statewide CASE Team): The intent is to increase the R value. There are requirements in that table for R-value or K-value of insulation. We are increasing the requirements to reduce energy consumption.
    - George Nesbitt (Environmental Design/Build): the pipe insulation tables should be expressed in R-value, because most of it is labeled that way when we buy it. I've been asking for this change for 3 code cycles I believe.
    - Peter Strait (Energy Commission): The 2019 code does have R-values.
    - Julianna Wei (TRC, Statewide CASE Team): George Nesbitt, noted, though the table format comes from the CPC.
- Gary Klein (Gary Klein and Associates): Why not accept the insulation requirements in the CA Plumbing Code? Wall thickness at least equal to the nominal diameter of the pipe. How do the rules apply to the pipe insulation within each unit?
    - Gwelen Paliaga (TRC, Statewide CASE Team): That is part of our alignment issue. Residential section refers to the plumbing code, for larger pipes in the plumbing code it requires thicker insulation. We would increase stringency in some buildings if we referred to the plumbing code rather than the table.
    - Peter Strait (Energy Commission): Only place we break with Plumbing Code is on sub-1" pipe, as our existing minimum insulation of 1" was greater than the 0.75" or 0.5" that CPC would require.
- Owen Howlett (Sacramento Municipal Utility District): Does modeling show that hot water pipe insulation saves energy in parallel piped systems? My understanding is that these are the most common in residential new construction.
    - Gwelen Paliaga (TRC, Statewide CASE Team): I am not sure I understand, the CASE Team will answer, or we will get back to you.
    - Peter Grant (Beyond Efficiency): Owen - Do you know of good modelling tools to address that question? I'm not aware of high quality, experimentally validated hot water distribution models.
    - Danny Tam (Energy Commission): Owen - Frontier/Marc Hoeschele might know this answer.
    - Owen Howlett (Sacramento Municipal Utility District): Peter Grant, I don't know of a tool that could do that. I guess I'm skeptical that it's worth doing in parallel systems, especially given how much complexity and volume it will add to pipe / electrical routing.
    - Danny Tam (Energy Commission): Owen, even if we are doing something in part 6 for parallel piping, the plumbing code requires all hot water pipe to be insulated.
    - Owen Howlett (Sacramento Municipal Utility District): Oh, thanks Danny, I didn't know that.
    - Martin Morehouse (Sun Light and Power): Peter Grant, current CEC ACM calculation for water heating usage assumes 21.4 gallons per unit/day and .0069 gallons per square foot/day. In actual practice a senior housing complex with studios will have low occupancy and only uses 14 gallons per day/unit usage, while an affordable 3-bedroom building has much higher occupancy with higher than 60 GPD/unit.
    - Danny Tam (Energy Commission): Martin, are you talking about the assumption in the solar hot water calculator? That is a fixed value and we have moved away from that in the rest of the water heating calculations.

- Sean Denniston (New Buildings Institute): One approach to "super insulating" pipes is to layer pipe insulation. The ID of the first layer is matched to the ID of another layer. However, I don't know if there might be issues with this kind of layering.
- Owen Howlett (Sacramento Municipal Utility District): I suspect there's a big difference between insulation quality in single family and multifamily.
    - Peter Grant (Beyond Efficiency): Owen - Sounds like a good question to ask. I'm looking to create new simulation models that would be appropriate for this kind of task. Let's talk offline if you're interested
    - Owen Howlett (Sacramento Municipal Utility District): Peter Grant, sure, I'm interested. This isn't directly my field anymore, but I'll put you in touch with our R&D guy Josh Rasin.
    - George Nesbitt (Environmental Design/Build): Insulation installation quality does not differ between single family, multifamily & nonresidential in my experience.
- Gina Rodda (Gabel Energy): Are you talking all occupancies in terms of HERS verification or just residential? You are applying a feature only in play for residential right now.
- Dan Johnson (Beyond Efficiency): Why are we giving a 15 percent credit just for meeting CPC code minimum?
- Martin Morehouse (Sun Light and Power): Following Appendix M will be cheaper to install. Is there a reason not to make it a mandatory measure?
    - Gwelen Paliaga (TRC, Statewide CASE Team): If we made it mandatory or prescriptive it would trump the California plumbing code which is not viable. Plumbers follow the CPC, longer term it could be considered for future code cycles. This is very new and has not seen much market adoption. Designers we have talked to have just seen it.
    - Peter Grant (Beyond Efficiency): Martin - I think the hot water draw profiles have changed since that was true. Check out this document, providing a high-level description of the new hot water draw profile assumptions: http://www.bwilcox.com/BEES/docs/Kruis percent20- percent20Dhw percent20Analysis percent205.docx
    - Dan Johnson (Beyond Efficiency): Market adoption immaturity did not stop "on-demand" multifamily recirculation control from becoming standard design.
    - Nehemiah Stone (Stone Energy Association): Gwelen, if costs go down with using Appendix M, why trade off insulation?
    - Gwelen Paliaga (TRC, Statewide CASE Team): We don't really know what we would tradeoff with this. We are trying to create multiple compliance paths to make it easier to comply with the standard. We would probably trade it off for measures that are hard to implement in some cases, to say there is another path where you don't have to do that and it saves you first cost.
    - Nehemiah Stone (Stone Energy Association): Why trade off anything if the costs are less?
    - Gina Rodda (Gabel Energy): That is what the performance method is for.
- Owen Howlett (Sacramento Municipal Utility District): For recirculation systems, what does anyone think about requiring a minimum COP of 3 for at least one device providing hot water to the recirculation loop?
    - Nehemiah Stone (Stone Energy Association): Owen, how would you avoid the preemption issue?
    - Owen Howlett (Sacramento Municipal Utility District): Nehemiah if it's just a performance requirement there's no preemption problem, right? We could even lower the COP to 1.2 to allow gas heat pumps.

    - Julianna Wei (TRC, Statewide CASE Team): Owen and Nehemiah, the CASE team has a separate HPWH measure (next in line in ppt).
    - Julianna Wei (TRC, Statewide CASE Team): the preemption issue is valid, and is the reason why HPWH will likely be incorporated as an alternative prescriptive path
    - Julianna Wei (TRC, Statewide CASE Team): We will have to address the COP issue delicately.
    - Danny Tam (Energy Commission): Owen, is your proposal to require HPWH for the temperature maintenance even if the main WH is gas? It's an interesting idea but the current software wouldn't be able to handle that.
    - Gina Rodda (Gabel Energy): Only because we can't model central heat pump right now and we have REACH code issues.
    - Gary Klein (Gary Klein and Associates): It is technically difficult to reheat water with high COP water heating equipment. In general, the high COPs come when the incoming water temperature is cold. Recirculation return water temperatures tend to be quite warm. This lowers the efficiency of both condensing gas and electric heat pump water heaters. Generally better to heat the bulk water with high efficiency heaters and use standard efficiency equipment to maintain the loop temperatures.
    - Owen Howlett (Sacramento Municipal Utility District): Danny that's the gist of it. I'd like to explore a requirement for heat pump-only systems too, but I suspect that the required tank volume might be an issue. If so, we could at least get one HPWH in there to serve the loop losses.
- Danny Tam (Energy Commission): Another reason we have to move away from a separate solar water heater calculator and incorporate the solar thermal calculation into CBECC.
    - Peter Grant (Beyond Efficiency): Danny - I think including a detailed model of solar water heaters in CSE is a great idea. Let the model show the impacts, and let people make decisions based off that best estimate
- Gary Klein (Gary Klein and Associates): Cluster design without recirculation. Cluster is locating near the source of hot water. It doesn't know the source, just that it needs to be close. Defining cluster will be important and interesting. The key to analyzing the energy impacts correctly is to make sure that the water volume is the same for each piping system to compare the impacts. If you want to assume that hot water will arrive within 10 seconds, then you need to have less than 10 seconds of cold water in the pipe before the hot water arrives. The analysis should not assume the benefit, it should assume worse case, where the piping cools back down to the ambient temperature of the piping in the building. Establish a baseline of time to tap and that will allow comparison of the different strategies.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Good point, we will note that. We are developing plumbing designs for prototype buildings. To your point they should be the same.
    - Gary Klein (Gary Klein and Associates): The water volumes have to be the same to compare. If you assume that you want hot water within 10 seconds, then it means that all sources have to be within 5 seconds at that flow rate within that source. So that the riser goes up vertically. It really drives clustering of the architecture in order to have clustering of the hot water device. It is up to the architecture to get clustering, not the plumber, and then we get better energy.
    - Gwelen Paliaga (TRC, Statewide CASE Team): You are mentioning a number of points that we could add and criteria we could add. There are no specific requirements except to serve less than 8 units around wait times. That would be a change from what we have anticipated. The other thing is we need to be clearer about the term clustered. You are

talking about the fixtures and we are talking about grouping a water heater with a group of units.
    - Gary Klein (Gary Klein and Associates): How close to the source is a simple way of letting anybody figure out how to do clustering.
    - Jennifer Rennick (In Balance Green Consulting): Architects will need to "know" the Title 24, part 6 compliance benefits in order to get them to cluster the plumbing designs.
- Martin Morehouse (Sun Light and Power): 90 percent of the multifamily recirculation systems I see are using aquastats that are not wired correctly so that the pump stays on the whole time. Is there a verification option for this?
    - Gwelen Paliaga (TRC, Statewide CASE Team): This is something we could consider adding to the field verification requirements. The code prescriptively requires it but if they are not working, verifying functionality would be worthwhile.
    - George Nesbitt (Environmental Design/Build): Distribution systems in general, waste water & energy, the code often rewards this.
    - George Nesbitt (Environmental Design/Build): Recirculation pumps are often installed but not modeled (single family or townhomes, many "tankless" systems).
    - Danny Tam (Energy Commission): Currently no HERS verification for central recirculation. You touched on a point I heard, that in practice demand system is left on all the time because of occupant complains. There is always someone who showers at 3am.
    - Peter Grant (Beyond Efficiency): In my opinion, aquastat based systems should be treated as continuous recirculation because of exactly what you just pointed out Danny.
    - George Nesbitt (Environmental Design/Build): All on or temp controlled recirculation pumps are the dominant types installed.
    - Gabriel Ayala (Enovative Group): The reason there can be issues with recirculation controls, such as aquastats or demand controls, can be as a result of insufficient system balancing. There needs to be a requirement to PROHIBIT the use of ball valves to balance the system, which is currently a standard practice.
    - Dan Johnson (Beyond Efficiency): We've had HERS raters pass Aquastat (~always on) pumps as meeting requirements for "on-demand".
    - Peter Grant (Beyond Efficiency): Gabriel - How would prohibiting ball valves help? What do you think should be installed instead?
    - Gabriel Ayala (Enovative Group): Thermostatic balance valves should be installed.
    - Danny Tam (Energy Commission): Sounds like we need a better definition of what central demand recirculation really is, with additional installation criteria.
    - George Nesbitt (Environmental Design/Build): the code needs to penalize all recirculation pumps except demand (especially in single family). Demand pumps usually can't be set up to all on or temp.
    - Peter Strait (Energy Commission): The code currently does penalize non-demand recirculation.
    - Nehemiah Stone (Stone Energy Association): It does, when it is enforced. It is more of an enforcement issues than code language issue.
    - Dan Johnson (Beyond Efficiency): In our experience, no developer will put in "on-demand" recirculation activation, because the person wanting a hot shower at 4am would run the tap a long time to get hot water (recirculation loop will be cold at this time).
    - Nehemiah Stone (Stone Energy Association): Dan, not true. a well-designed demand-controlled system should get the last apt in the line hot water within much less than a minute.

- Dan Johnson (Beyond Efficiency): Nehemiah, typical recirculation is not "well designed".

1.3.3 Central Heat Pump Water Heating

- Gabriel Ayala (Enovative Group): Point of clarification: Demand controls for multifamily are different than for single family.
- Martin Morehouse (Sun Light and Power): Are these testing measures including any derate for refrigerant leakage and the GHG impacts?
  - Julianna Wei (TRC, Statewide CASE Team): Martin, there are ongoing lab testing efforts in parallel to the CASE study; neither is expressly exploring refrigerant leakage or GHG impacts at the moment.
- George Nesbitt (Environmental Design/Build): I've seen dwelling unit domestic hot water systems on 4+ story multifamily.
- Gary Klein (Gary Klein and Associates): Different circulation loop control strategies work better on some piping designs more than others. Title 24, part 6 should analyze these. To properly compare the energy implications, the volume from the loop to the fixtures within each unit should be the same. This will make the water volume requirements of each strategy the same. Then add the energy needed by each loop strategy to the baseline energy needed for the hot water uses to get system energy use.
- Avery Colter (FARD Engineers): R134a models would be neat for getting LEED credit for enhanced fridge mgmt.
  - Dove Feng (TRC, Statewide CASE Team) will follow up with Avery Colter (FARD Engineers) on heat pump water heater data from projects they are working on.
- Martin Morehouse (Sun Light and Power): There are solutions for combing with solar thermal.
- Martin Morehouse (Sun Light and Power): Will electric backup be allowed in the proposed measure?
- Jennifer Rennick (In Balance Green Consulting): Engineer's and builder's perceptions of availability and ease of install has led to AO Smith HPWH as the most typical in our area.
  - Julianna Wei (TRC, Statewide CASE Team): Jennifer, thank you for the feedback
- Regarding poll 8 on backup systems:
  - Nehemiah Stone (Stone Energy Association): The electric resistance "back up" is included in the HPWHs themselves.
  - Gary Klein (Gary Klein and Associates): Backup implies that the intention is to heat the tank. What about heating the actual load for a relatively short duration
  - Danny Tam (Energy Commission): Not for these big central systems or Sandens.
  - Dan Johnson (Beyond Efficiency): I think "backup" in this context refers to an option when the HPWH is down for maintenance or repair, not as a supplement.
  - George Nesbitt (Environmental Design/Build): should we limit (how much or when) or ban "back up" electric resistance heating?
  - Dan Johnson (Beyond Efficiency): Ecotope's first central HPWH plants in the Pacific Northwest used resistance "backup" to mean alternate heater because the HPWH was new and experimental and required down time.
  - Gary Klein (Gary Klein and Associates): The question implies a certain design strategy for HPWH. Hot water use tends to be less peaky in quantity than anyone would likely expect. The peak for 100 units is usually 10-20 units at a time. Implies a relatively small peak. Use a swing tank with some resistance heating, its primary purpose is to heat that volume and maintain that temperature. It is getting warmish water from the heat pumps. Another good strategy is to have electric elements in that tank or have a tankless unit to address that peakiness. If it is allowed to modulate as it should be it is really only

meant for that peakiness. Yes, there needs to be backup but it needs to be rethought a lot by engineers. For engineers their numbers are way out of date, usually very oversized and peakiness needs to be recalculated as well.
    - Dove Feng (TRC, Statewide CASE Team): HPWH needs a backup system. One concern is when the unit is outdoors, you will not have enough capacity when it is cold out. So, you need extra capacity when it is really cold outside, and you need electric resistance to keep up. Really depends on the controls of the HPWH, if the compressor is not well turned up there can be issues, that's a concern on the control side. That is a good point about the sizing.
    - George Nesbitt (Environmental Design/Build): Gary, we don't have a way to model (calculate) the secondary electric resistance water heater (with a heat pump or gas), and I have seen such systems installed.
    - Julianna Wei (TRC, Statewide CASE Team): George, we are considering what level of electric resistance heating may be appropriate.
    - Julianna Wei (TRC, Statewide CASE Team): Gary K's point on relatively short period of use (as designed) is a consideration as well.
    - Dan Johnson (Beyond Efficiency): Backup as in supplemental electric resistance for space heating heat-pumps is a thing, but is ignored by ACM for nonresidential? There are no inputs for this in ACM-Res. Why not broaden the backup means supplement concern to these cases too?
    - George Nesbitt (Environmental Design/Build): Dan, the ACM does account for back up based on the heat pump outputs at outdoor temperatures. I'm not sure about assumptions for HPWH "backup".
- Martin Morehouse (Sun Light and Power): Given the complexity of controls, is there a way to required verification of the installation with the HPWH pathway?
    - Dove Feng (TRC, Statewide CASE Team): That is the plan, but it is a challenging task in terms of what type of verification and testing would be required in terms of performance. The CASE Team is trying to figure that out now.
- George Nesbitt (Environmental Design/Build): Electric resistance water heater would absorb or store more excess PV than a HPWH.
- Martin Morehouse (Sun Light and Power): When performing modelling are there ways to incorporate PV generation and/or demand response control for the HPWH?
    - Avery Colter (FARD Engineers): The only way I know of to incorporate PV dedicated to a water heater is that there are a few PV-based products which are certified as OG-300 systems.
- Gabriel Ayala (Enovative Group): From a plumber's point of view, commercial heat pump water heaters introduce electrical requirements that in some cases will exceed the capabilities of a C-36 or C-4 licensed contractor. Something to consider
    - Dove Feng (TRC, Statewide CASE Team): Great, thank you for the comment.
- Martin Morehouse (Sun Light and Power): Relying on authority having jurisdiction (AHJ) inspectors to verify plumbing installation is not really feasible.
    - George Nesbitt (Environmental Design/Build): Martin, HPWH and demand control is being looked at, might be able to model with the research version of CBEC-RES, not code yet, maybe 2022?
    - Peter Grant (Beyond Efficiency): Martin - I've seen the test plans as part of the TAC, and to my knowledge load shifting & demand response are not being included in this round. I'm advocating to update it to include load shifting in the next round

- Gary Klein (Gary Klein and Associates): The AHJs might be able to spot check the volume from the source to the uses. Volume can be converted into length and this is easily measurable. Select one on each floor and portion of the building at random. Building passes if all those measured are within the requirement. If one or more fails, then all must be tested and an additional fee could be applied.
- Julianna Wei (TRC, Statewide CASE Team): Peter, thank you for comment on load shifting and DR capabilities.
- Kelly Cunningham (Pacific Gas and Electric, Statewide CASE Team): Peter Grant, the IOU team is pursuing other load shifting opportunities on quasi-central systems. Also, once we have the larger central systems at the lab, it will be easier to perform other tests.
- Danny Tam (Energy Commission): HPWH DR will be a compliance option, documents will be available soon for review.
    - Danny Tam (Energy Commission): I'm working on creating a new docket and putting out a notice of availability. Since all the discussion has already happened, we should be able to fast track this.
    - Nehemiah Stone (Stone Energy Association): Danny, the research I am doing with Build It Green/AEA/Redwood Energy tells me that DR with HPWHs is complex enough that it should require (a) commissioning and (b) monitoring/maintenance requirements. Let's talk.
    - Danny Tam (Energy Commission): This compliance option is only for DR capability for single family HPWH.
    - Nehemiah Stone (Stone Energy Association): So, no application to multifamily? either central of individual HPWHs?
    - Danny Tam (Energy Commission): If there is individual water heater then yes, the credit is for having the capability like OCST, not for actually being part of a DR program.
    - Martin Morehouse (Sun Light and Power): Nehemiah and Danny, monitoring was a requirement of the solar thermal rebate program and it fairly easy to implement (<$1500) but it is a rare building operator that has the interest or capability. However, monitoring systems could be used for HERS verification?
    - Gabriel Taylor: Nehemiah, I'd like to join that discussion about DR please.
    - Amruta Khanolkar (New Buildings Institute): Danny, approximately when will be the DR documents be available for review? this year?
    - Danny Tam (Energy Commission): I'll be creating the new docket soon, notice of availability needs to be routed internally first, so that might be a week or 2. After that we will post all the documents we received from NRDC. Staff report will come later.
- Owen Howlett (Sacramento Municipal Utility District): Would this prescriptive pathway be one among several, or would this be the only prescriptive pathway, with the performance model being based on it?
- Liam Buckley (IESVE): Hi Dove - do you know where we can access the 4 new prototype models?
    - Dove Feng (TRC, Statewide CASE Team): It should be released soon.
    - Elizabeth: Anyone who is interested in these models, please email me. NORESCO is likely to include them in the release of the CBECC-Com software.
    - Elizabeth McCollum (TRC, Statewide CASE Team): If you are interested in receiving updates on the multifamily prototypes, please email Elizabeth McCollum (TRC, Statewide CASE Team) at emccollum@trccompanies.com

- Amruta Khanolkar (New Buildings Institute): What are the controls and connectivity (DR) requirements in the next code? is JA13 out yet?
- Martin Morehouse (Sun Light and Power): Will the HPWH measure be in addition to or instead of solar water heating requirement?
    - Julianna Wei (TRC, Statewide CASE Team): Martin, the pairing of various technologies - between HPWH, solar thermal, and other measures being studied - are to be decided, based on feasibility and cost-effectiveness results.
- Avery Colter (FARD Engineers): Thanks, by the way, to all those who work in the field, I certainly lean on your experiences a lot when considering how things can be coded or should be able to, going forward.

1.4 CASE Presentation II: Multifamily Drainwater Heat Recovery

- Presenter: Jingjuan (Dove) Feng (TRC, Statewide CASE Team)
- Gary Klein (Gary Klein and Associates): Drain Water Heat Recovery (DWHR) is also more applicable in locations with single family homes that have basements. These are not typical in California.
    - Peter Grant (Beyond Efficiency): Gary - horizontal devices can solve that issue.
    - George Nesbitt (Environmental Design/Build): Single family hillside houses, multi-story houses are relevant.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Regarding challenges for heat recovery from first floor: the CASE team recognizes that DWHR is more practical and cost effective in taller buildings.
- Gary Klein (Gary Klein and Associates): DWHR units need to be permanently accessible so that the integrity of the double-wall vented to air feature can be inspected. This is independent of orientation of the DWHR. If DWHR is installed horizontally in a floor (concrete or framed) the access must be built into the floor or, if available, the ceiling.
    - Bob Hitchner (EcoDrain): A horizontal DWHR device could be accessible in a lidded trench, for example. Accessibility can be addressed.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Regarding horizontal DWHR units: The CASE Team does not anticipate any requirements that would mandate the use of horizontal units. First floors would be exempted. There is limited product availability for horizontal devices.
    - Gary Klein (Gary Klein and Associates): You can use units intended for vertical installation in a horizontal installation. You need to increase the length to get the same performance.
- Bo White (NegaWatt Consulting): Since submetering is now in the 2019 CPC, it seems worthwhile to talk to others in addition to HCD, such as other Building Standards members or IAPMO. I wonder whether there is opportunity to modify the 2019 CPC at this late stage.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Bo White, the 2019 CPC is undergoing a mid-cycle update. The CASE team is advocating for a water meter exemption for that update.
- Bob Hitchner (EcoDrain): What is the cost of a water submeter, per unit implemented?
- George Nesbitt (Environmental Design/Build): Plumbing distribution systems need to be done well the 1st time, because most of it is buried in walls & floors (crawlspaces, basements & attics are rare) and difficult & expensive to repair, fix, upgrade later.
- Regarding poll 9:

    - Gary Klein (Gary Klein and Associates): might even suggest putting the toilets on the same drain stack with the sinks.
- Gary Klein (Gary Klein and Associates): You said a few minutes ago that there is only one manufacturer of horizontal units. You can take a vertical unit and install it horizontally so I do not think that should be a limiting factor, energy savings calculations should make the decision. There is a ruling in Canada that units be tested in the orientation that they will be installed.
    - Dove Feng (TRC, Statewide CASE Team): I agree that vertical units can be installed horizontally and if the vertical units are installed horizontally, they should be tested in that orientation.
    - Danny Tam (Energy Commission): That is already in the RA. If the device is the same but orientation is different you need to test it again.
    - Bob Hitchner (EcoDrain): One reason that horizontal devices have not been developed is because the main technical standard (CSA) in the category only recognized vertical solutions. At long last they are addressing this, so we might see the vertical units manufacturers come up with new designs, too.
- Nehemiah Stone (Stone Energy Association): Would the pipes from the DWHR device and the showers be required to insulated even if inside interior walls?
    - George Nesbitt (Environmental Design/Build): do the cold pipes to the showers need to be insulated?
    - Peter Grant (Beyond Efficiency): Nehemiah - We're about to start testing around insulation & DWHR devices. Right now, the plan is to not require insulation, partly because we anticipate them being installed in walls that have insulation for sound mitigation purposes anyway
    - Peter Grant (Beyond Efficiency): Oh, the pipes. Sorry. I miss-read
- Bo White (NegaWatt Consulting): It doesn't seem like there are any DWHR manufacturers on this webinar. The team should probably bug them before the next webinar.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Bo White, DWHR manufacturers were all invited and a number registered. Good point that we should remind them in the future. We will continue to get their input.
    - Bob Hitchner (EcoDrain): I am here on behalf of EcoDrain. so at least one of us showed up!
- George Nesbitt (Environmental Design/Build): Has anyone done a good study on the effectiveness between pipe insulation and pipes in typically insulated assemblies?
    - George Nesbitt (Environmental Design/Build): If the cold water line to the shower is warmer than the ambient temperature, than it should be insulated, if not then it can pick up more heat.
- Meg Waltner (Energy 350): I'd recommend that you also look at potential cost savings from water heater peak capacity reduction enabled by DWHR.
    - Peter Grant (Beyond Efficiency): Meg - I think that's a great suggestion. Especially looking at how they synergize with HPWHs. A reduction in peak load can avoid resistance element use, which would be very beneficial in terms of grid stress, occupant electricity costs, and TDV.
    - Dove (TRC, Statewide CASE Team): Thank you for the comment. We will look at that for the CASE work.
- Bob Hitchner (EcoDrain): We recommend including access to the unit.
    - Peter Grant (Beyond Efficiency): Bob - Can you provide more information on why?
    - Bob Hitchner (EcoDrain): Actually, in most current installations, which is in basements, no special access needs to be designed, because they are installed in basements.

- Bo White (NegaWatt Consulting): Bob, has EcoDrain officially certified their horizontal products to the IAPMO test procedure yet, and are those results public?
    - Bob Hitchner (EcoDrain): No, we have not certified using the IAPMO test standard. The market continues to be focused on vertical solutions. We are once again updating our assessment of the market opportunity for certified horizontal solutions.
    - Bo White (NegaWatt Consulting): Bob, thanks. Have you certified your vertical units to CSA or IAPMO?
    - Bob Hitchner (EcoDrain): CSA.
- Nehemiah Stone (Stone Energy Association): Will there be a degradation factor based on the number of feet between the DWHR and the shower(s) above? It seems that a higher amount of heat would be saved if it only goes two stories versus if it goes four stories
    - Peter Grant (Beyond Efficiency): Nehemiah - That's one of the topics we're about to test and study. The likely answer is "Yes".

1.5 CASE Presentation II: Nonresidential Drainwater Heat Recovery

- Presenter: Eric Martin (Energy Solutions)
- Martin Morehouse (Sun Light and Power): Aren't hospitals exempt from energy code compliance?
    - Heidi Werner (Energy Solutions, Statewide CASE Team): Martin, health care facilities, including hospitals, will be covered by the California Energy Code starting with the 2019 code.
- Martin Morehouse (Sun Light and Power): Just want to point out that some commercial dishwashers do chemical sanitization instead of hot water, which from an energy perspective is better than using hot water.
    - Marisa Lee (Energy Solutions, Statewide CASE Team): Martin, that's a good point regarding commercial dishwashers, thank you.
- Bob Hitchner (EcoDrain): Field verification is currently required to make certain that the device is installed per manufacturer's requirements. Is this the same question you are asking?
    - Marisa Lee (Energy Solutions, Statewide CASE Team): Bob, we have some time carved out for additional discussion re: field verification. We'd like to address your question then, thanks!
    - Heidi Werner (Energy Solutions, Statewide CASE Team): Bob, if we don't have time, field verification is required when installing DWHR for single family and low-rise multifamily. We are looking for input on whether field verification should also be required for nonresidential applications.
- George Nesbitt (Environmental Design/Build): Field verification is needed due to the complexity of how these are plumbed (beyond the building dept).
- Dan Johnson (Beyond Efficiency): I might have missed it, but it appears that nonresidential domestic water heating recirculation is not even modeled in CBECC. There is huge waste in these systems typically.
- Gary Klein (Gary Klein and Associates): Do you have tables showing the breakdown of the proportion of hot water that is applied by drain water heat recovery in each application? In the multifamily topic you were proposing not to meter. It would be helpful for all of us to have the table, not just the percentages.
    - Dove Feng (TRC, Statewide CASE Team): Thank you, that is a good comment. We can follow up with the assumptions for that calculation. We only did it for one climate zone.

We only did it with the connected shower. We looked at the draw schedule from CBECC-Res for the assumptions of the water draw from the shower and assume that the drain water heat recovery is warming up the cold water so you would need more cold water.

- Dan Johnson (Beyond Efficiency): Can Energy Solutions and TRC address why nonresidential recirculation of domestic hot water has no code requirements, and is not modeled in CBECC? There is an opportunity to apply the same conservation measures being proposed for residential recirculation loops.
    - Heidi Werner (Energy Solutions, Statewide CASE Team): Dan, this is a good question. The CASE Team will look into the history of why this is the case and get back to you with our findings.
- Martin Morehouse (Sun Light and Power): Thanks all! I'm curious what further nonresidential measures are being proposed. Is there a reason not to have a prescriptive inclusion in the new code for measures proposed for multifamily?
- Gary Klein (Gary Klein and Associates): Question on Appendix M: I am very supportive of this being used and have done modeling on my own. How far into the dwelling unit are you preparing to have the conversation? Clearly there is a big reason to look at the main trunk lines but when you get into the dwelling units you get into pipe-size step-downs. The CPC has requirements. My question is how far into the dwelling unit are you looking for Appendix M? It might be worth looking separately into the dwelling unit.
    - Gwelen Paliaga (TRC, Statewide CASE Team): We appreciate that there may be a difference in savings by focusing on the central distribution and we will follow your point on separating the two. I thought there were requirements around ½ inch piping.
    - Gary Klein (Gary Klein and Associates): A plumbing engineer can put their stamp on it and say they want alternative methods and means. ½ inch is considered the minimum, but you could size down to 1/8 inch if possible.
    - Gary Klein (Gary Klein and Associates): Flow rate needs to be looked at in showers on each side of the piping because they do not have full flow rates. And really need to look at flow rates for washing machines and tub spout fillers because they are allowed to be pretty high, but they can be any number and it just doesn't matter. They will slow down how fast they fill if other water systems are on. There is a good case to put aerators and pressure regulators on showers and other devices that are fixed orifice, as they will not be affected.
    - Gwelen Paliaga (TRC, Statewide CASE Team): Thank you, look forward to offline comments.
- Martin Morehouse (Sun Light and Power): In addition to looking at recirculation impacts for Appendix M, is there also a reduction on the load (less water waste means less hot water use).
    - Heidi Werner (Energy Solutions, Statewide CASE Team): Martin, hot water use in multifamily buildings and nonresidential buildings are quite different. We would need to take a careful look at each proposal we are developing for multifamily to determine if applying to nonresidential buildings would be appropriate. Doing so is not currently in the scope of the Statewide CASE Team's advocacy activities for the 2022 code cycle.
    - Martin Morehouse (Sun Light and Power): Heidi, understood. Nursing homes and other OSHPOD residential facilities could easily be understood as having multifamily loads, similar to hotels being included in the multifamily regulations.

Poll Results

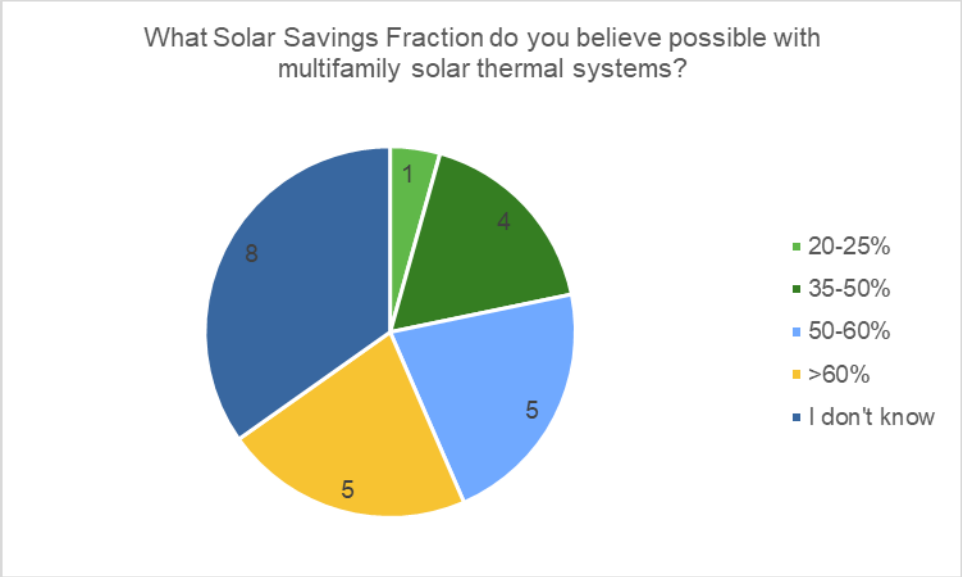

Figure 1: Results of Poll 1, Multiple Choice/Single Answer

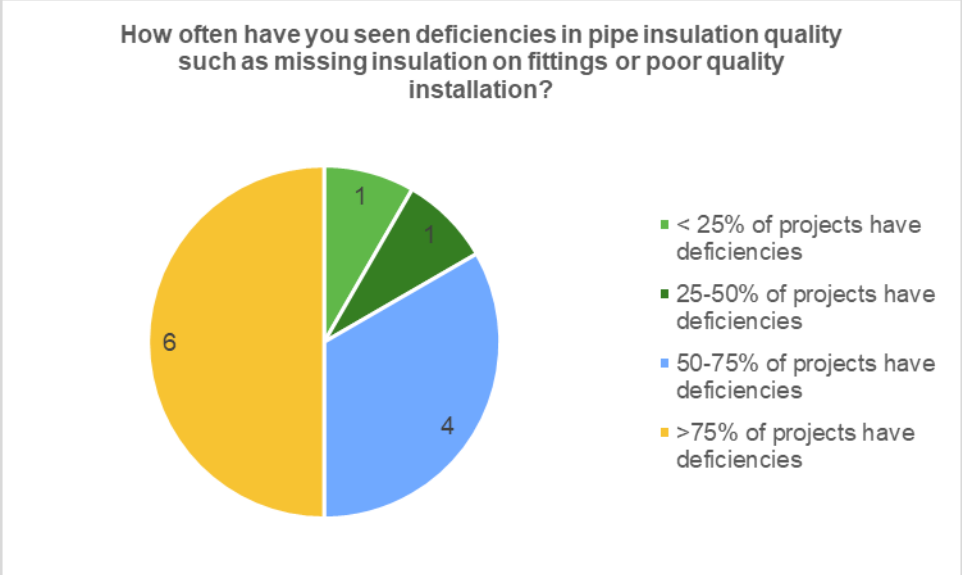

Figure 2: Results of Poll 2, Multiple Choice/Single Answer

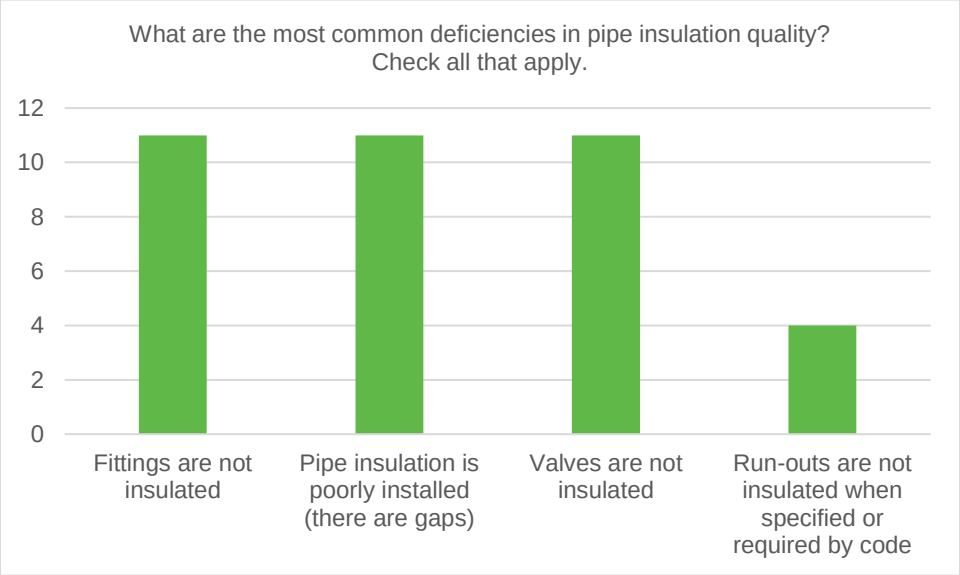

Figure 3: Results of Poll 3, Multiple Choice/All That Apply

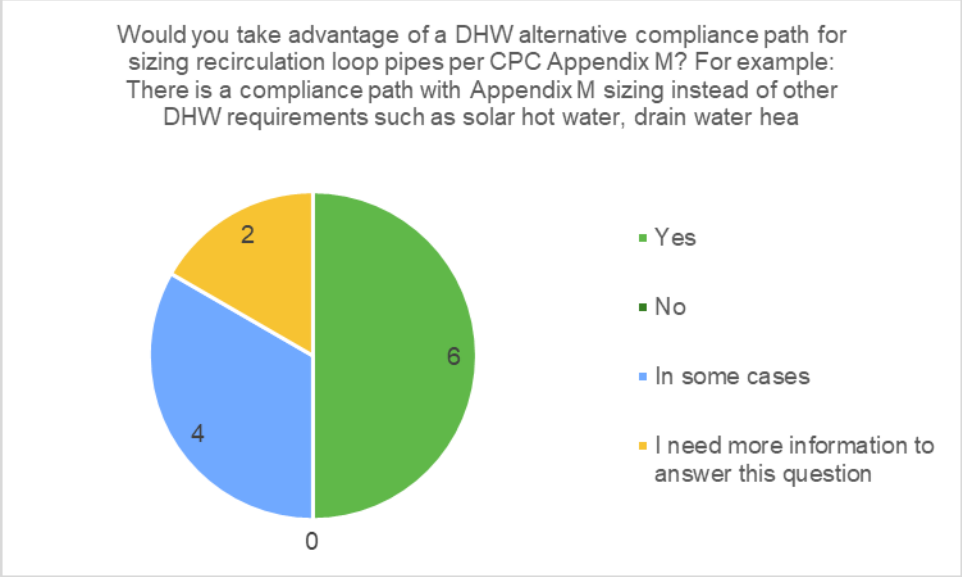

Figure 4: Results of Poll 4, Multiple Choice/Single Answer

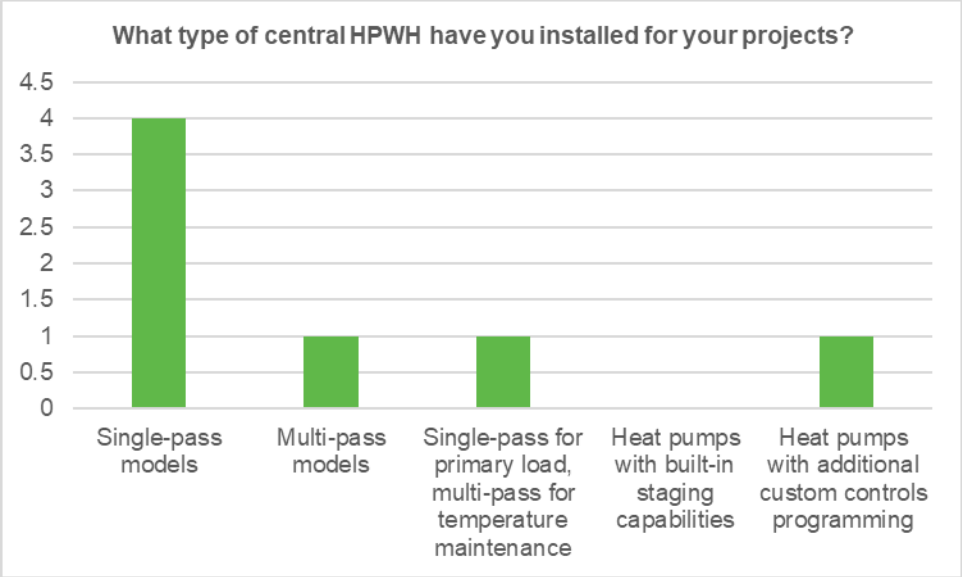

Figure 5: Results of Poll 5, Multiple Choice/All That Apply

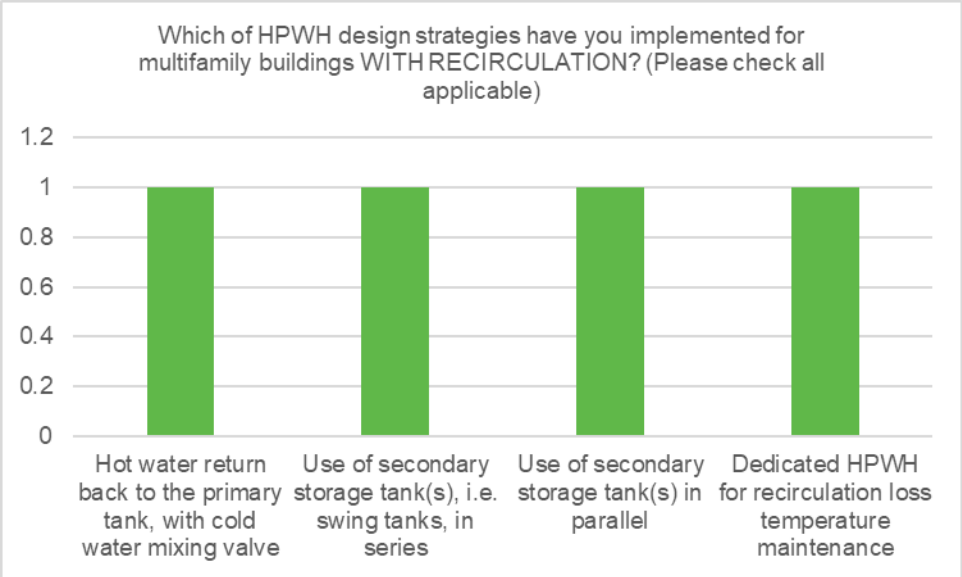

Figure 6: Results of Poll 6, Multiple Choice/All That Apply

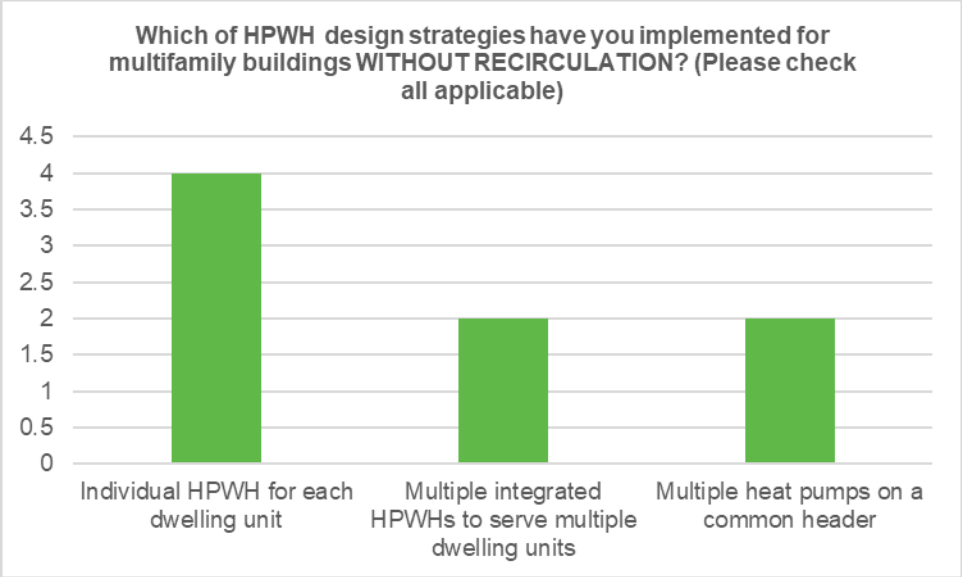

Figure 7: Results of Poll 7, Multiple Choice/All That Apply

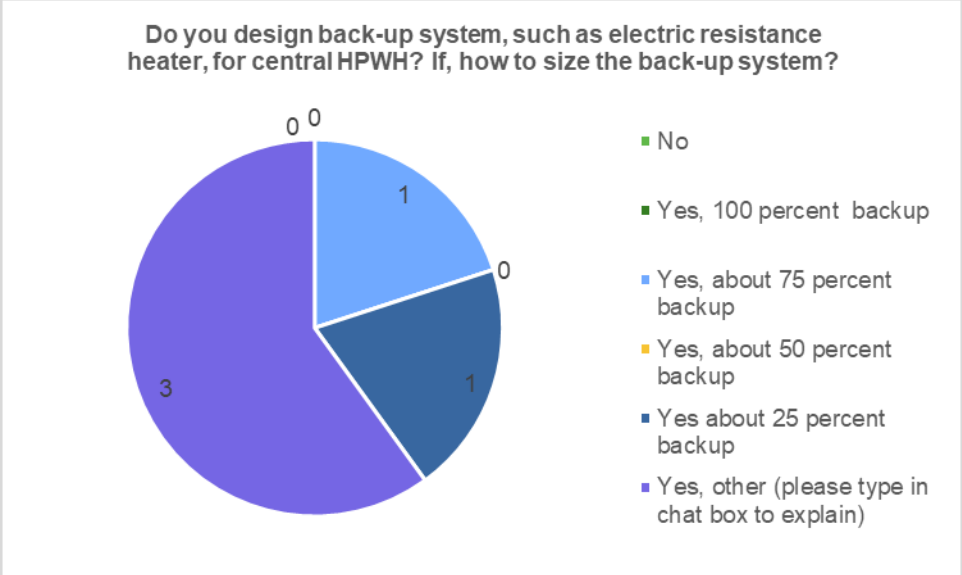

Figure 8: Results of Poll 8, Multiple Choice/Single Answer

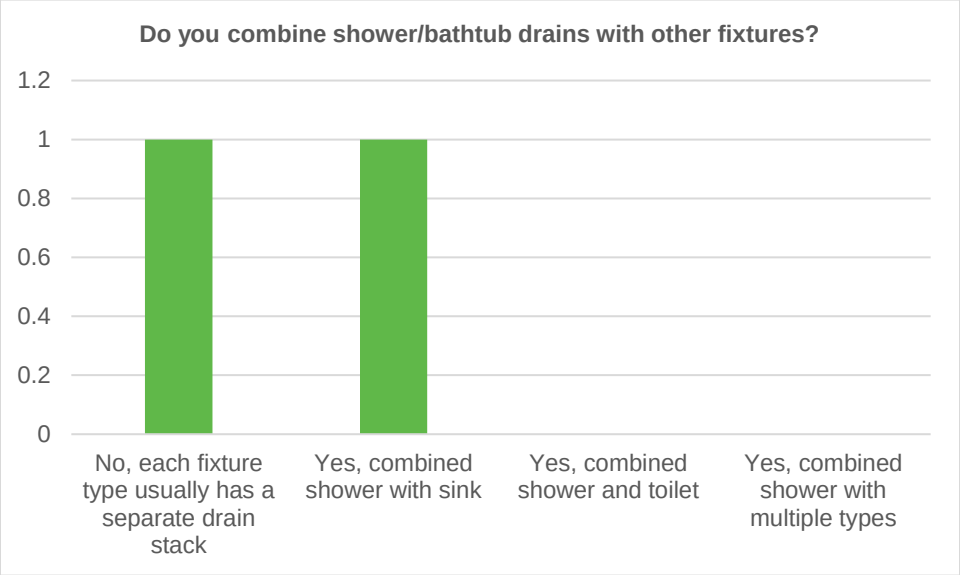

Figure 9: Results of Poll 9, Multiple Choice/All That Apply

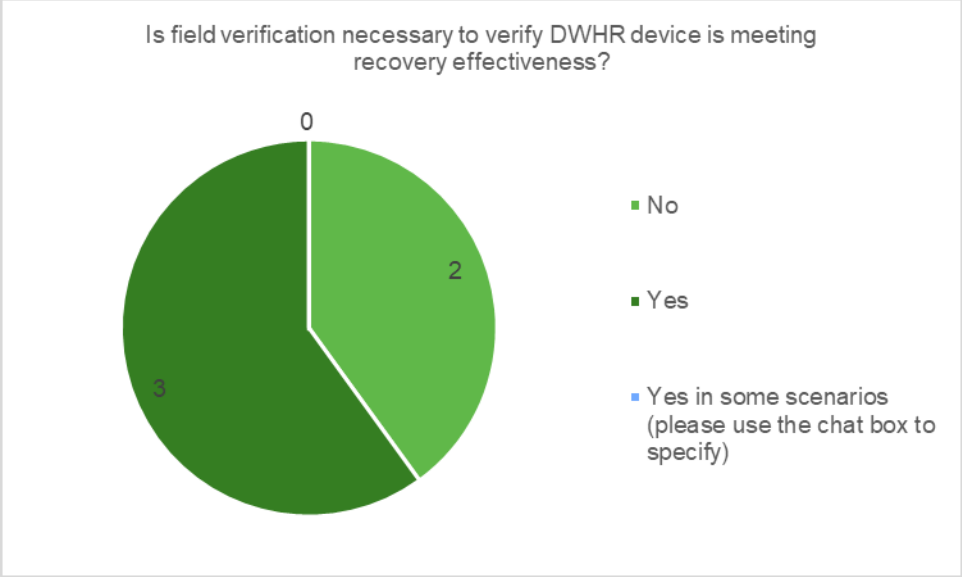

Figure 10: Results of Poll 10, Multiple Choice/Single Answer