Meeting Notes

Posted April 7, 2023

Notes from 2025 Title 24, Part 6 Code Cycle Utility-Sponsored Stakeholder Meeting for:

Nonresidential Cooling Towers

Meeting Information

Meeting Date: 2/13/2023
Meeting Time: 10:00 am – 12:00 pm PT
Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Time	Topic	Presenter
10:00 AM	Welcome and Meeting Directions	Cosimina Panetti Javier Perez Kelly Cunningham
10:20 AM	Cooling Tower Efficiency	Sean Wynne
10:45 AM	Blowdown Controls	Sean Wynne
11:10 AM	Air-Cooled Chiller Threshold	Sean Wynne
11:35 AM	Discussion & Wrap Up	Sean Wynne
12:00 PM	Adjourn	Sean Wynne

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Meeting Participants (available upon request by emailing info@title24stakeholders.com)

Action Items from Meeting

- The Statewide CASE TEAM followed up on all questions or comments that required a response and were not discussed during the meeting.

Key Points from Meeting

This proposal for HVAC systems in both nonresidential and MF residences is important because cooling towers:

- Use significant energy and water.
- Account for 20-50% of water use at a site, and 9-16% of chilled water plant energy.

Since initial requirements were put in place, efficiency technology and understanding has improved, so the code should be updated. This proposal is focused on three measures: increasing prescriptive minimum cooling tower efficiency requirements and increasing individual minimums per CZ based on cost effectiveness; updating the mandatory requirements for blowdown controls to achieve water savings; and revising the prescriptive limitation on air-cooled chiller capacity to achieve water savings.

MEETING NOTES

During the meeting, questions and comments were submitted in three distinct formats which are provided in these meeting notes in these [hyperlinked for quick access] sections:

1. **In-Meeting Questions / Comments:** Questions and comments submitted verbally during the meeting via the 'raise hand' function in GoTo Webinar, where participants were unmuted to speak, or in some cases, comments submitted in writing were discussed verbally during the meeting (in which case the person that commented may not be identified in these notes).
2. **Questions / Comments Submitted Via GoTo Webinar:** See this section for questions and comments submitted in written format via the GoTo Webinar question pane.
3. **Public Input Submitted Via Mentimeter:** This section includes public comments and questions, including screen shots of the polls that were conducted during the meeting, and responses to those polls.

Not all written questions and comments were discussed during the meeting but all have responses available in these meeting notes.

In-Meeting Questions / Comments

1. **Audience question: Why no maximum wetbulb temperature approach for the cooled water temperature? Without this requirement manufacturers or installers can just flow more water to make a low efficiency fan cooling tower meet the standard. With no 80 gpm/hp cooling tower.**
    a. CASE Team response (Sean Wynne): The proposal is based on efficiency at rated conditions as defined by the Cooling Technology Institute's standards. The CASE team looked at a variation of efficiency requirements and approach temperatures based on climate zone and found minimal variation in optimal approach temperatures. Due to the increased complication of varying efficiency based on approach and climate zone, combined with the anticipated limited impact, the CASE team is not pursuing this at this time.
2. **Audience question: The efficiencies are based on a standard range approach/approach/wb condition, efficiency varies at other conditions. Oversimplified, it looks like.**
    a. CASE Team response (Sean Wynne): The proposal is based on efficiency at rated conditions and modeling of tower performance in EnergyPlus. We will look at our analysis and think through how we are accounting for the various range, approach, and wet bulb conditions.

3. **Audience question: Potential market shift to less efficient cooling systems from substantially increased cost of higher efficiency cooling towers.**
    a. CASE Team response (Sean Wynne): This was something that was taken into account when both the 2005 and 2019 requirements were developed and something that the CASE team is currently considering. The CASE team is analyzing what efficiency levels are cost-effective and feasible in terms of increased efficiency and looking at the potential shifts between system types. The requirements would be prescriptive, allowing lower efficiency cooling towers to still be selected under the performance path.
4. **Audience question: Water-cooled plants require more upfront cost, more long term maintenance, more sophisticated installing contractor, much more complex controls etc. It is great that you are considering accommodating ultra high efficiency air-cooled machines.**
    a. CASE Team response (Sean Wynne): Thank you for this comment. This is what we're seeing, there is a big cost and complexity difference between the two systems.
5. **Audience question: (verbal, by Skip Ernst (Daikin) I understand the reason for this 300-ton limit that was established but if you have to consider that some customers are just not ready to handle water treatment and are going to do everything they can do to avoid it, if you limit chillers you just push to another system which might not be as efficient.**
    a. CASE Team response (Sean Wynne): Clarification: you're seeing ways people work around the current 300-ton limit to select air cooled equipment above 300 tons of capacity?
    b. **Skip Ernst followed up:** Yes: packaged rooftops.
    c. CASE Team response (Sean Wynne): Thanks, that's good feedback. I take it that you are "pro-increasing the 300 ton to allow selection of air-cooled chillers"
    d. **Skip Ernst followed up:** It's overly prescriptive, you can do your calculations and say 300 tons is justified on the average, but every job is different.
    e. CASE Team response (Sean Wynne): I understand the potential to push customers away from using a chiller at all, so we'll need to look at that about how it can inform our decision
6. **Audience question: (verbal, by Ben Cohen (Baltimore Aircoil Company) There could be a substantial chiller energy increase as well – are you considering any of the increased cost of the inability to optimize entire chiller plant?**
    a. CASE Team response (Sean Wynne): Clarifying question - by increasing cooling tower EE (from 60-80 horse power for examples) it carries through to the decision making process for the chiller capacity.

b. **Ben Cohen follow up:** Yes, if there's a certain budget that needs to be achieved, or a size, footprint limitation. Now you're going to a lower horsepower and you've maximized on footprint, there could be impacts on chiller sizing. Based on my experience any increase in GPM per horsepower will limit flexibility. For example a project we worked on, an ASHRAE 90.1 rating of 41.2 gpm/hp requirement limited on our 125 horsepower model and put us in a position where it was hard to solve a problem with a specific system because of footprint and other limitation. From a chiller optimization standpoint, it limits the ability to optimize the total system. Have you thought about it? What do others think?

c. CASE Team response (Sean Wynne): We will look into what happens if we lock the footprint in place and how it carries into chiller optimization. I've not looked at available cooling towers on a per footprint basis. I appreciate the feedback and we'll look into it. As for maintenance cost, that will be captured separately. If you have info on how cooling tower efficiency impacts maintenance cost we'd be interested in seeing that. Currently we don't see it increasing maintenance costs, but since they're bigger, there could be additional maintenance costs. Chillers, air-cooled chillers, other we'd love to see.

d. **Ben Cohen follow up:** If you go from 12x20 or 22 to a 14x20 tower you have more basin to clean, more filler, so yes maintenance increases.

e. CASE Team response (Sean Wynne): Great, we'll look into that.

7. **Audience question: (verbal, by Darren Cline, Evapco) I've been involved in these analysis for 20 years. Every time you're looking at cooling towers, the most efficient way of removing heat from buildings… I don't see where you're looking at the energy use of air-cooled chillers – want to make sure that energy use is being included.**
    a. CASE Team response (Sean Wynne): A few slides back show standard design vs. proposed design which includes the assumptions for energy use of air-cooled chillers – that's what we start with.
    b. **Darren Cline followed up:** I don't see that you're requiring increased efficiency for air-cooled chillers like you're doing with cooling towers, and I wouldn't want to pick and choose so others should improve their efficiency as well. Would like to see us look at increased chiller efficiency as well.

8. **Liam Buckley, IES software. There was a bug in CBECC's EnergyPlus cooling tower model (phantom heat rejection). Was this resolved for your analysis?**
    a. CASE Team response (Meg Waltner): We were not aware of the bug, so thank you for raising this. The CASE Team will follow up with Liam for more information on this issue.

9. **Verbal question asked by Ben Cohen (Baltimore Aircoil Company): Concerned with the increase from the already high 60 gpm/hp-- thinks 60 is higher than what's warranted. Anytime there's restrictions it limits things for designers and owners and**

can unfairly penalize cooling tower manufacturers. Darren mentioned ensuring there's equity in comparison between systems; this potentially could shift systems to air cooled when that's not necessarily the intent. The increase to 80 or up to 120 seems very high. Why so high?

a. CASE Team response (Sean Wynne): At this stage we're working through energy modeling results at those different levels to assess what is cost-effective. Want to save energy and make sure it's cost-effective so that's how the values are being looked at. Regarding flexibility, one thing to consider is that it's a prescriptive requirement and people can use performance approach to comply with code. We anticipate that a lot of the buildings of the size that use cooling towers are likely already doing energy modeling.

b. **Ben Cohen followed up:** We shouldn't be picking winners and losers in the market place - any type of technology should be considered.

c. CASE Team response (Sean Wynne): yes, we agree that selecting different systems type should be weighed, we appreciate your insight.

10. **Comment submitted: Assuming it applies to industrial side**

    a. CASE Team response (Sean Wynne): We're not looking at process loaded cooling towers.

11. **Audience question: Is additional water use at the power plant being considered?**

    a. CASE Team response (Sean Wynne): Water use at the plant is not being considered in our analysis.

    b. CASE Team response (Meg Waltner) added: there's currently not a methodology but is something we're looking into so any data you have to share would be helpful.

Wrap-Up

- All Draft CASE Reports will be posted March through June at title24stakeholders.com
- Round 2 meetings begin in April
- Meeting adjourned at 12:00 PST

Questions / Comments Submitted Via GoTo Webinar

The questions and comments below are provided verbatim (as-submitted) in the GoTo Webinar Question pane.

Name	Time Asked	Question / Comment	CASE Team Response
Liam Buckley	11:22:33 AM	Sean, there was a significant bug in the 2019 code cycle, in CBECC's EnergyPlus cooling tower model (phantom heat rejection). Was this fixed for your analyses or did you use an alternative energy simulation engine to compare?	Meg W.: We were not aware of the bug, so thank you for raising this.
Daryn Cline	10:33:19 AM	Will there be a similar required efficiency improvement of air-cooled chillers, similar to what is required of cooling towers, ie a 33% to 100% performance improvement?	The CASE Team is currently evaluating whether there will be an increased efficiency requirement for air-cooled chillers above the current 300-ton threshold.
Daryn Cline	10:45:20 AM	Cooling towers are the most efficient method of removing heat from a building, air cooled chillers use twice the energy, and have not been looked at for efficiency improvements over many code cycles	Thank you for your input. The CASE Team will take this comment into consideration as we continue our work on this measure. CASE Team Response Re: The air-cooled chiller market is larger than you show. Thank you for your input. We would appreciate any data that you can provide on the market size for both air- and water-cooled chillers.
Daryn Cline	10:55:09 AM	Thanks, considering that the market is 64% or more air cooled, will save more energy and reduce greenhouse gases, more than putting restrictions on cooling towers and increasing their efficiency	Thank you for your input.
Blaine Conner	11:18:07 AM	Will there be an Cooling Tower efficiency exemption for high-rise buildings with limited roof / site space? Specifically laboratories or other high cooling load density occupancies.	Thank you for your comment. The CASE Team will consider this comment in its analysis.
Jon McHugh	10:46:45 AM	Should there be prescriptive cooling tower requirements in Section 140.9 for computer rooms? Perhaps just reference all of 140.4(h)	Thank you for your input. The CASE Team will take this comment into consideration as we continue our work on this measure.
Jon McHugh	10:53:29 AM	Should a higher efficiency gpm/hp be required for water side economizers when they displace an air-cooled economizer as there is more load on the chilled water system?	Thank you for this comment. This is something that the CASE team is currently evaluating.

Name	Time Asked	Question / Comment	CASE Team Response
Jon McHugh	10:58:43 AM	If gpm/hp is increased in Section 140.4(h)5 for open axial fan cooling towers, does this encourage the use of less efficient centrifugal fan cooling towers allowed by Section 140.4(h)3 up to 900 tons?	Thank you for your comment, Jon. The CASE Team will look into this question further and follow up.
Jon McHugh	11:42:02 AM	Section 120.6 has requirements for adiabatic condensers for refrigeration systems to balance lower air cooled efficiency during milder hours and make use of wetbulb depression during hot ambient hours. Does this technology make sense for certain climate zones?	Thanks for this comment, Jon. We will look into this and follow up as needed.
Mark Pfeifer	11:41:13 AM	You will need to consider an exception in max cycles when silica is present and limits COC before the LSI calculator does	Thank you for your comment, Mark. The CASE Team will consider this feedback as we complete our analysis and will follow up as needed.
Mark Pfeifer	11:45:51 AM	Need to consider water usage at the power plant when switching to air cooled. Some customers or municipalities lower their water consumption at the site and place all the water reduction burden on the power plant. Concerned we are moving to more water consumption vs lower.	Thank you for your comment. This is something that the CASE Team is looking at in our analysis.
Steve Taylor	11:28:16 AM	One element that is missing from the tower selection: approach to design wetbulb. It is almost critical to include a maximum approach temperature as was proposed for 90.1 using a correlation to CDD50. Otherwise, one could use the high gpm/hp tower but to make the selection cost- and space-neutral, one could simply increase the approach to wetbulb. This would negate most of the energy improvement by making the chillers less efficient.	Thank you for your comment, Steve. The CASE Team will consider this in our analysis and follow up as necessary.
Skip Ernst	11:01:04 AM	how will you compare the air cooled advantages [water savings] and water cooled advantages [power savings?]	The CASE Team will look at energy and water costs, first costs, and statewide energy and water use and will look to the CEC for guidance on how to weigh the results.

Public Input Submitted Via Mentimeter

Note: all questions and comments submitted via Mentimeter are anonymous. **Those that were discussed during the meeting are incorporated into the 'In-Meeting Questions / Comments' section above; others are shown below.**

Comment submitted on slide 25: Need to consider silica when limiting COC as LSI max cannot always be used.

a. CASE Team Response: Thank you for this comment. The CASE team is considering adding a silica-based requirement in addition to LSI.

Comment submitted on slide 25: Another major technical consideration of using air cooled chillers is the high energy use on site vs cooling towers, and the number of electrical connections.

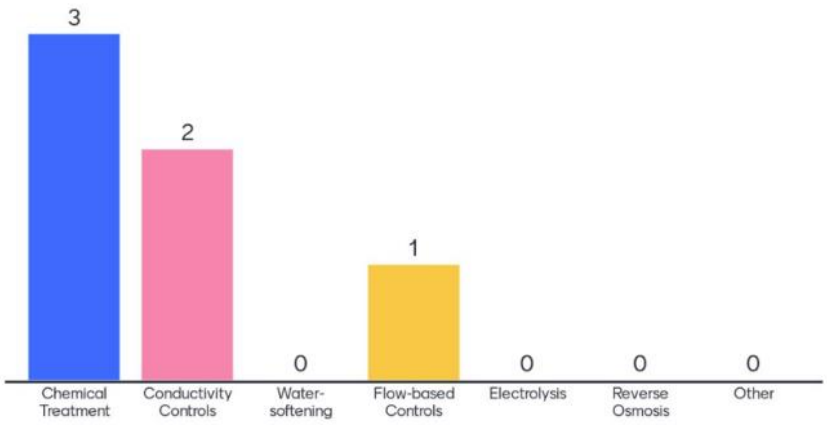
a. CASE Team Response: Thank you for the input. Yes, the energy use of an air-cooled chiller as opposed to a water-cooled plant is being included in the analysis. We are examining both energy and water impacts of each, to see if there is an ideal capacity and/or efficiency level for which the balance between energy and water savings and utility costs versus installation costs are optimized. In that effort, we are working to ensure that the installed costs are representative of each system.

Asked on Slide 33: There was a significant bug in the 2019 code cycle, in CBECC's EnergyPlus cooling tower model (phantom heat rejection). Was this fixed for your analyses? -Liam

a. CASE Team Response: We were not aware of the bug, so thank you for raising this. We will reach out to the developers of the software to determine the status of this issue.

Mentimeter Polls & Responses

What methods do you typically use to control water quality in your buildings/facilities?



What methods do you typically use to limit blowdown in your buildings/facilities?

- Cooling tower materials and water treatment methods
- Water softener
- We use many of the options from the last survey, but I could only check one. Water analysis is key to getting it right. Think about power plant water use in the analysis.
- I got CA sales data from NEII that I can share.
- Load reduction strategies

Do you agree with the market overview description? What else should be known?

The air-cooled chiller market is larger than you show

Larger cooling towers with smaller motors have increased "efficiency" so size, weight, cost, etc. increase as you call for increased efficiency

Water cooled will always be quieter.

Yes. Consider power plant water use in your evaluation. Jeff.G.Boldt@IMEGcorp.com.

What rating point was used for your efficiency chart?

Recycling cooling tower water can increase cycles of concentration greatly at low cost. All you need is a a sump pump.

if a water treatment specialist is used then max cycles is likely achieved

The efficiency is at the rating point of 95/85/75 wet bulb

90.1 requirements are vastly different for AC vs WC chillers.

RSI is probably better than LSI for determining water quality. PSI is even better, but I'm not sure my workbook has it completely worked out. LSI was developed for city domestic systems.

Do you agree with this assessment? What additional considerations drive selection of higher efficiency units?

Higher efficiency towers are typically selected to optimize chiller selection/performance or to increase free cooling on buildings with WSEs

Consider the units that could not be selected due to ratings requirements. There can be significant footprint challenges by limiting models.

Reduced sound levels

layout space availability

Why no maximum wetbulb temperature approach for the cooled water temperature? Without this requirement manufacturers or installers can just flow more water to make a low efficiency fan cooling tower meet the standard. With no 80 gpm/hp cooling tower

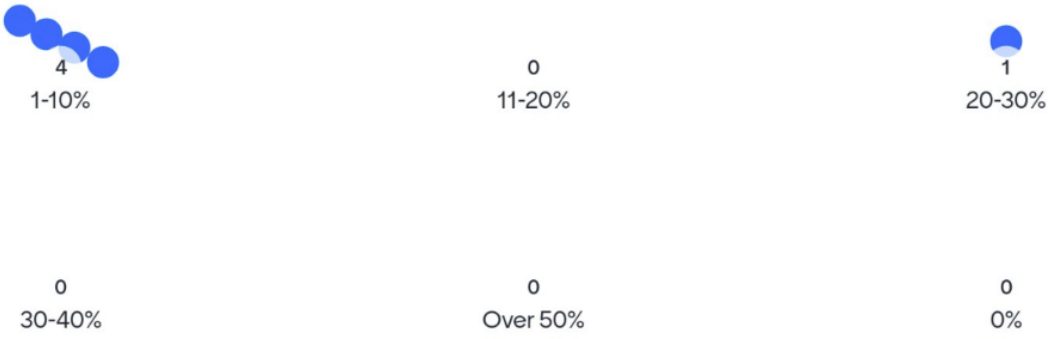
The efficiencies are based on a standard range/approach/wb condition, efficiency varies at other conditions. Oversimplified, it looks like

Reduction of greenhouse gas/lower carbon footprint

Are there additional market barriers to consider?

- Overall available space, weight, height
- Water-cooled plants require more upfront cost, more long term maintenance, more sophisticated installing contractor, much more complex controls, etc. It is great that you are considering accommodating ultra high efficiency air-cooled machines.
- No space/infrastructure in Commercial buildings for water treatment installation
- Space availability, achieving low enough process temps
- climate zones make conclusions harder to develop
- Increase in peak load on the electrical grid
- Potential market shift to less efficient cooling systems from substantially increased cost of higher efficiency cooling towers
- Have water cooled chillers also increased in efficiency?
- Air-cooled turbocor machines by Smardt and Trane also make air-cooled more appealing.

Approximately what portion of your multifamily buildings use cooling towers?



We want to hear from you! Please provide any last comments or feedback...

If Sean needs cooling tower cycle of concentration calculation data, I think I can help.

Is there any special considerations / exemption for Process Loaded towers?

CA has a goal of reducing carbon emissions, especially on site, cooling towers will be an important of helping you achieve these goals.

is additional water use at the power plant considered

Meg – the EnergyPlus bug is between the chiller and CWL. There is missing heat unaccounted for, so the tower doesn't see the full heat rejection demand. We think it is still there in the 2022 code, but yet to confirm that. -Liam

Sean - please share email address. Jeff.G.Boldt@IMEGcorp.comI'm the cycles of concentration guy.