TITLE 24, PART 6 | 2025 CODE CYCLE

Space Heating

Codes and Standards Enhancement (CASE) Proposal
Nonresidential HVAC

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CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Agenda

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Cost and Energy Methodology	*5 min*
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Proposed Code Changes	*5 min*
Discussion & Next Steps	*15 min*

Background

- Purpose
- Code Change Proposal
- 2022 Code Requirements

Purpose

- Electrification is accelerating for nonresidential buildings
- Large buildings are particularly challenging to electrify, with fewer options apparent to designers
- Our measures seek to **ensure hydronic electric readiness**, **broaden large building electrification options** and **prescriptively increase all-electric hydronic system efficiency**

- All-electric HVAC systems are rapidly becoming the norm for nonresidential buildings in California
  - Local energy codes, public and private sector sustainability goals are driving buildings toward all-electric
  - 2022 Title 24 Part 6 prescribed heat pumps for many single zone systems, potential expansion to MZ-VAV coming in an upcoming code cycle
- This CASE Report focuses on all-electric HVAC for large buildings
  - "Electric readiness" for hydronic systems: facilitate future retrofit of gas boiler systems to all-electric hydronics by limiting HWSTs.
  - Limit inefficient all-electric HVAC systems large buildings
    - Prevent inefficient design practices before they take hold among designers: e.g., air-to-water heat pumps sized to replace gas boilers, with equivalent (over)sizing and design setpoints as in the past

- Adapt and build on existing ASHRAE 90.1 language for hydronic heat recovery for sites with significant simultaneous cooling and heating
- Encourage designs (e.g., thermal energy storage, heat recovery chillers) that time-shift heating for sites with lower overlapping cooling and heating loads

Provide additional all-electric HVAC system flexibility to designers of large buildings

- Historically, T24 prescriptively prevented electric resistance zone heating
- U.C. Berkeley Center for Built Environment (CBE) research indicates that zone resistance heating might be appropriate for certain buildings

Proposed Code Change

CASE Report includes three measures:

A. **Mandatory hydronic hot water supply temperature (HWST) limit of 130°F**

B. **Prescriptively require heat recovery (HR) and/or thermal energy storage (TES) in large all-electric hydronic designs** (when triggering conditions are met)
   - 140.4(k)9 – Simultaneous Cooling and Heating
   - 140.4(k)10 – Time Independent Energy Recovery

C. **Prescriptively allow electric resistance zone heating in zones with:**
   1. Good (prescriptive) envelopes
   2. Low ventilation rates
   3. Heating decoupled from primary air (e.g., fan-powered boxes)
   4. Occupant sensor ventilation controls, if allowed
   5. Demand controlled ventilation (CO_2), if high density
   6. Computer room heat recovery, where available

Current Code Requirements

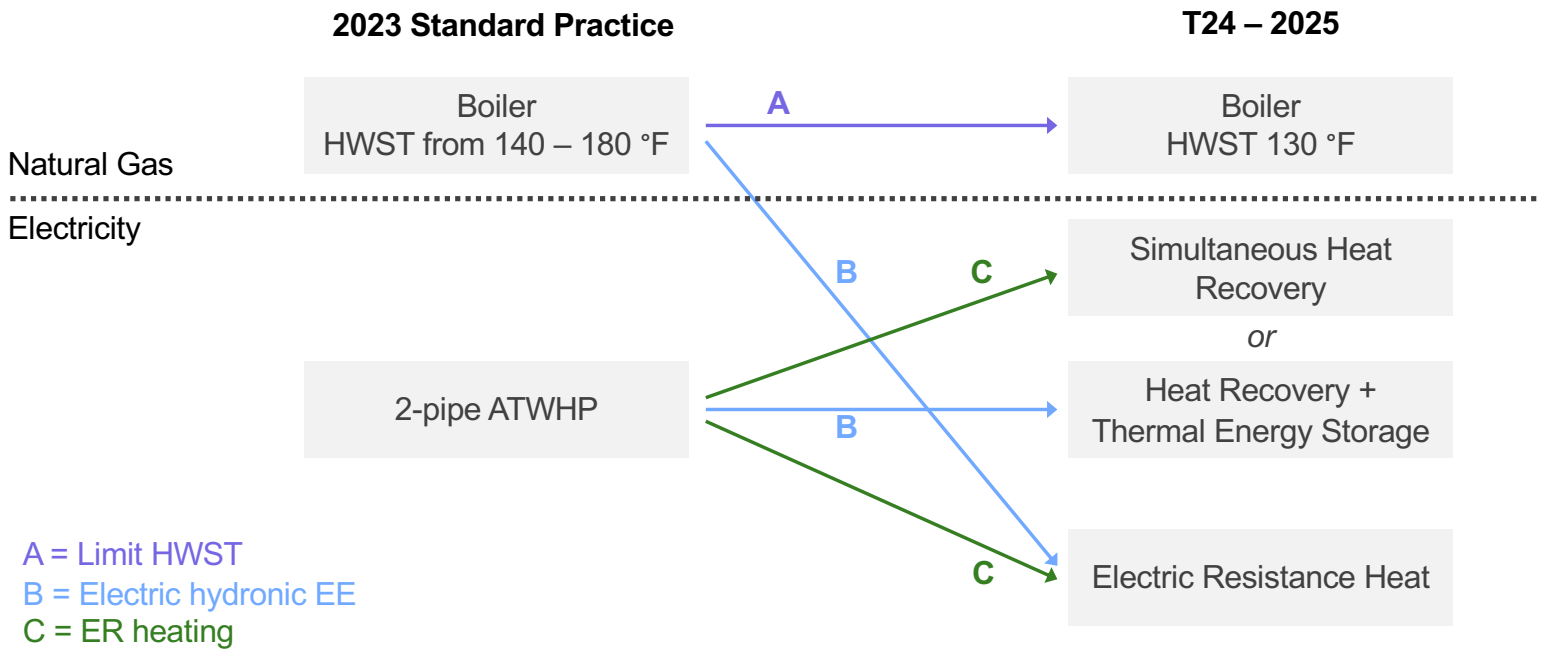
Existing Requirements in Title 24, Part 6

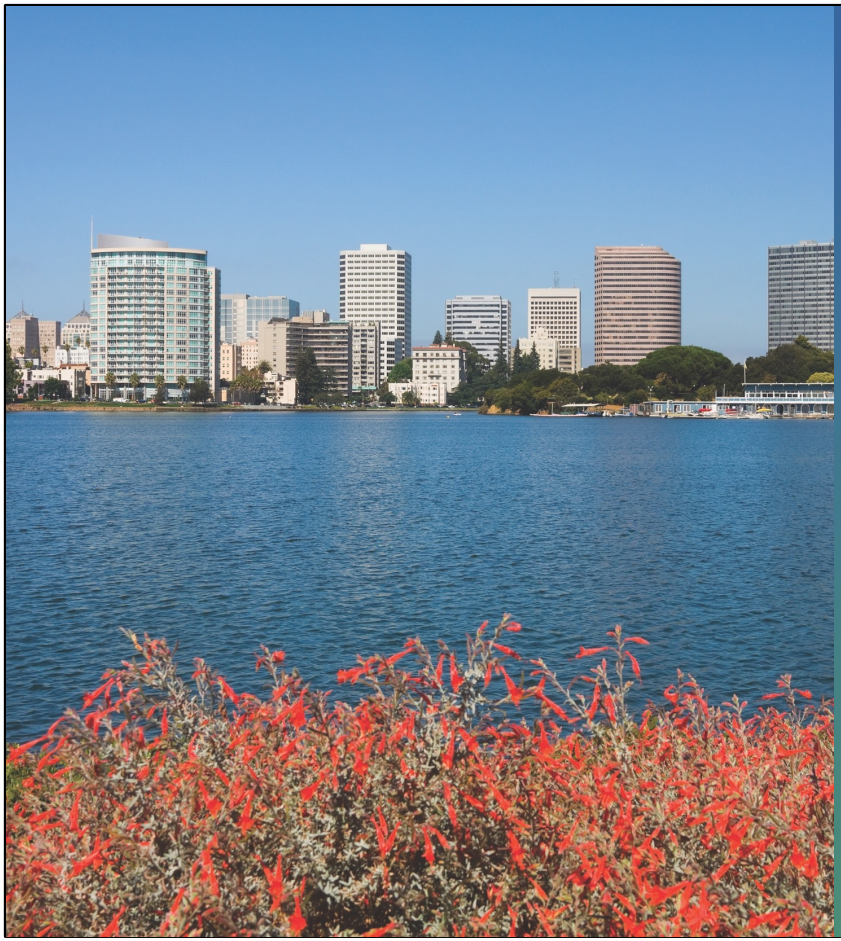
- 140.4(k)8 requires a return water temperature of 120°F or lower
- 140.4(g) prescriptive ban on electric resistance heating
- 140.4(k) hydronic system measures – does not currently speak to all-electric hydronic efficiency

Existing Model Code Requirements (ASHRAE, ICC, Other States)

- IECC 2024 proposal in development to limit HWST to 130°F
- ASHRAE 90.1 prescriptive hydronic heat recovery requirements:
  - 6.5.6.2: CW Heat Recovery for Service Water Heating
    - If CHW load > 500 tons and SHW load > 1MMBH
  - 6.5.6.3: CW Heat Recovery for Space Conditioning
    - For hospitals > 300 tons

Space Heating Base and Measure Cases





Market Overview

- Current Market Conditions
- Market Trends
- Potential Market Barriers and Solutions

Market Overview and Analysis

Current Market

- The 2012 Commercial Buildings Energy Consumption Survey (CBECS) indicates 6% of buildings and 18% of floor area is heated with boilers in the Pacific region (74% of which is CA)
- By the end of 2022, about 8 million Californians (20% of the state's population) live in a local jurisdiction where all-electric reach codes have been adopted (this number was 0% at the start of 2019)

Market Trends and Policy Drivers

- We expect all-electric new construction to approach 100% in the coming years in CA, even for large buildings

Market Barriers

- Large buildings face unique all-electric HVAC challenges: available space for outdoor (air source) units, first cost for 2-pipe systems, code limitations on electric resistance reheat
- Nearly all large buildings using hydronics would benefit by using some combination of heat recovery chillers and thermal energy storage, depending on how well cooling & heating loads align

What all electric hydronic system attributes are you seeing in CA?

Technical Considerations

- Technical Considerations
- Potential Barriers and Solutions

Technical Considerations – Limit HWST (Hot Water Supply Temperature)

Technical Considerations

- Impact of lower HWSTs on pipe sizing, coil sizing, and pump energy
- Impact on non-condensing boilers
- What HWST do you encounter today for NC and in existing buildings?

- Additions / Alterations would need to be designed for 130F HWST but might need to continue to operate at higher HWST to satisfy existing boilers, pipes, and coils.

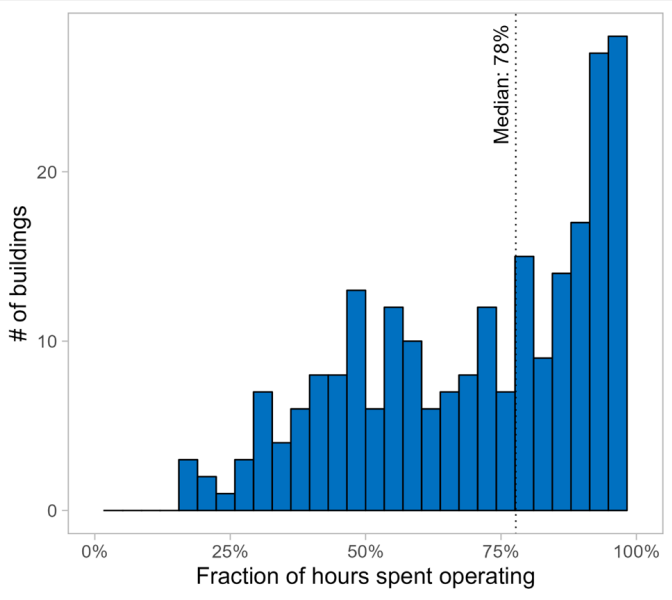
POLL QUESTION NEXT SLIDE

Poll

Do you agree with the technical description Hot Water Supply Temperature?
What else should we know?

Technical Considerations – Limit HWST

A recent survey of hundreds of buildings found the average HW system operates 78% of the time (that's 19 hours/day for every day of the year)



Source: UC Berkeley Center for the Built Environment

Technical Considerations – Limit HWST

Measured hot water piping losses are significant and vary based on hot water temperature.

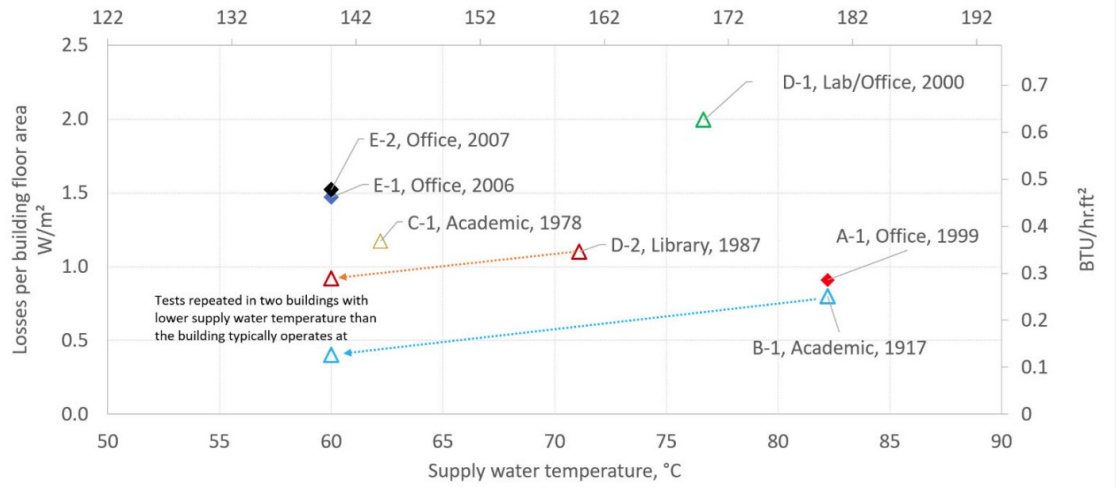


Figure 2: Measured hot water distribution losses in 7 buildings (indicated by color). Filled, diamond shapes indicate relatively new, high-quality instrumentation; unfilled triangular shapes indicate existing instrumentation.

Source: UC Berkeley Center for the Built Environment

Raftery, P., Vernon, D., Singla, R., and M. Nakajima. 2023. Measured Space Heating Hot Water Distribution Losses in Large Commercial Buildings. ASHRAE Transactions. 2023 ASHRAE Winter Conference – Atlanta.

Technical Considerations – All-Electric Hydronics

Technical Considerations

- 2-pipe ATWHP systems sized to meet peak heating loads are expensive and usually not the most efficient option
  - 4-pipe DHRC and TES tanks can be deployed to reduce 2-pipe ATWHP capacity
- Ideally, systems are configured to minimize “high lift” demand on heat pumps
  - Leveraging CW TES can be effective

Technical Barriers and Potential Solutions

- Oversizing all-electric hydronics carries a greater cost premium than it did for gas boilers
- Designer familiarity with DHRC and TES strategies for all-electric hydronic space heating

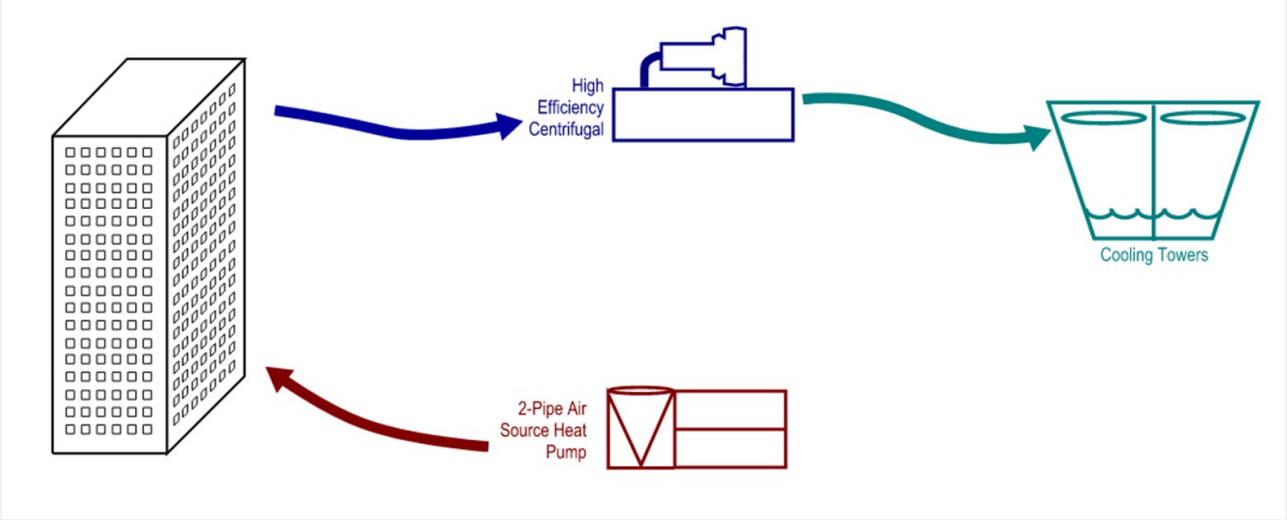
POLL QUESTION
NEXT SLIDE

ATWHP = Air to Water Heat Pump
DHRC = Dedicated Heat Recovery Chiller
TES = Thermal Energy Storage
CW TES = Condenser Water Thermal Energy Storage

Poll

Do you agree with the technical description given for All-Electric Hydronics? What else should we know?

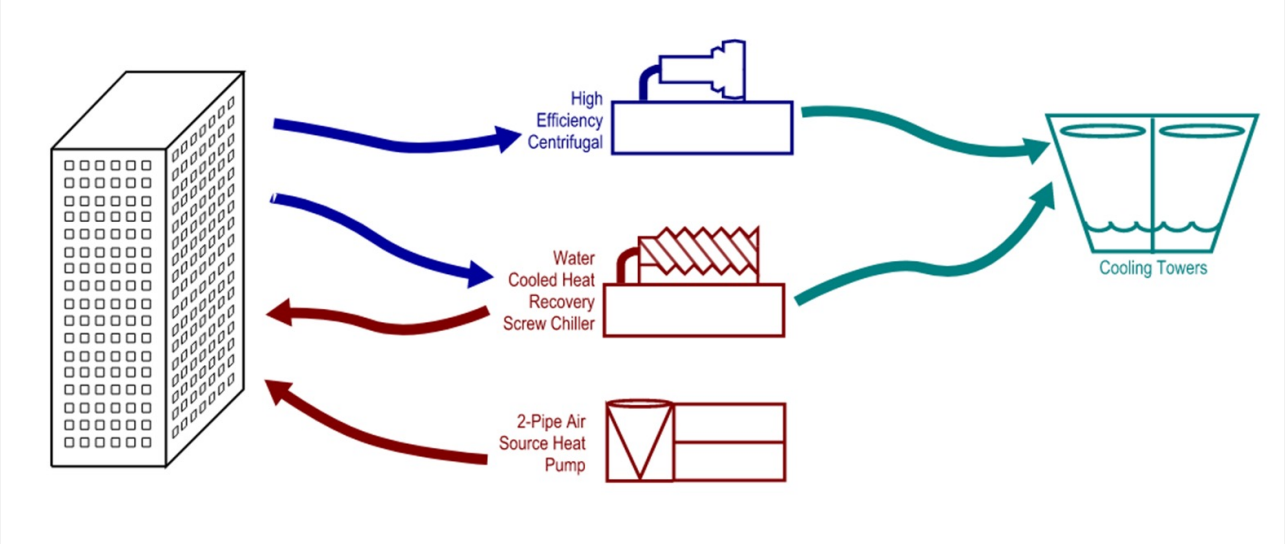
Technical Considerations – All-Electric Hydronics



Example of all electric plant without heat recovery
(our all-electric hydronic base case)

Source: B. Gill, Solving the Large Building All-Electric Heating Problem, ASHRAE Journal, October 2021 (link)

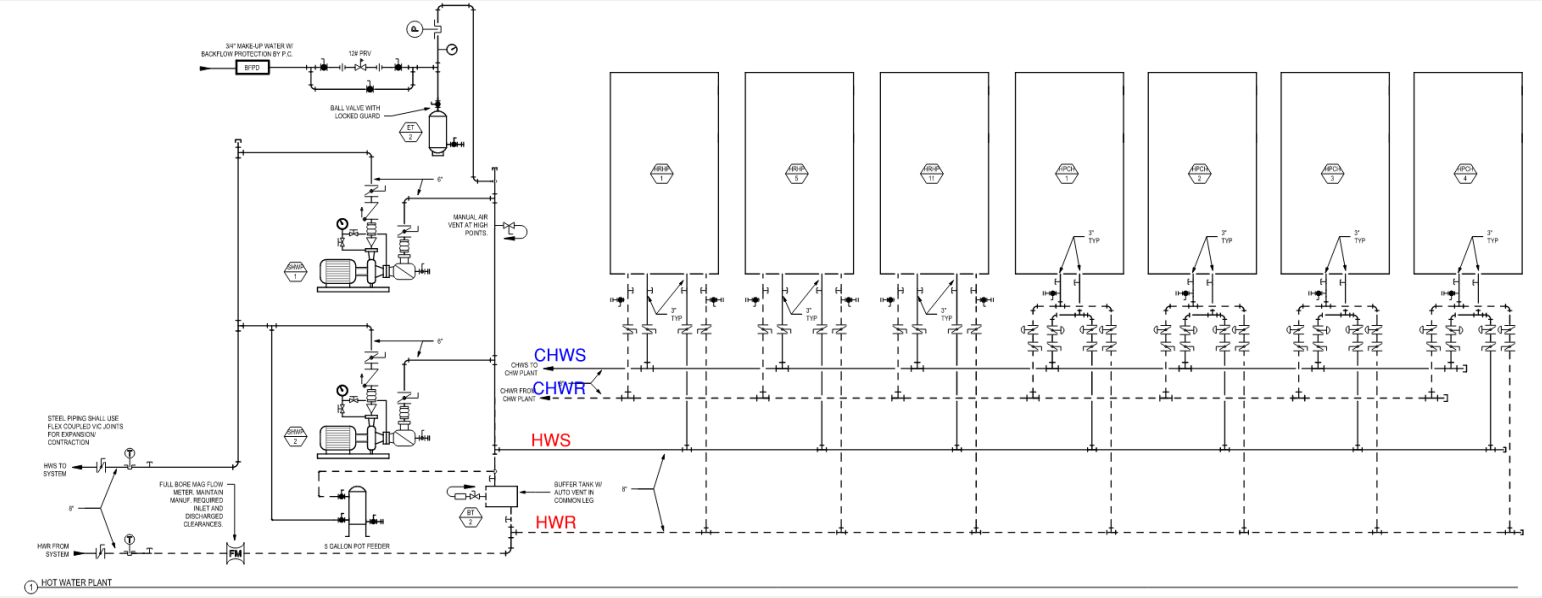
Technical Considerations – All-Electric Hydronics



Example of simultaneous heat recovery (140.4(k)9)

Source: B. Gill, Solving the Large Building All-Electric Heating Problem, ASHRAE Journal, October 2021 (link)

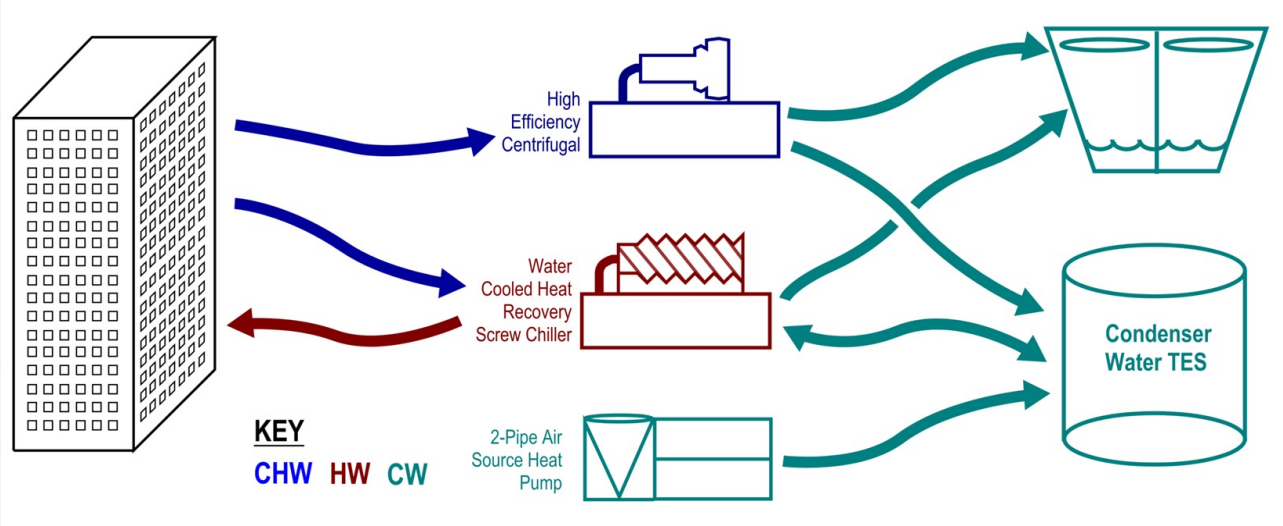
Technical Considerations – All-Electric Hydronics



Example of simultaneous heat recovery (140.4(k)9)

Source: Taylor Engineers, with permission

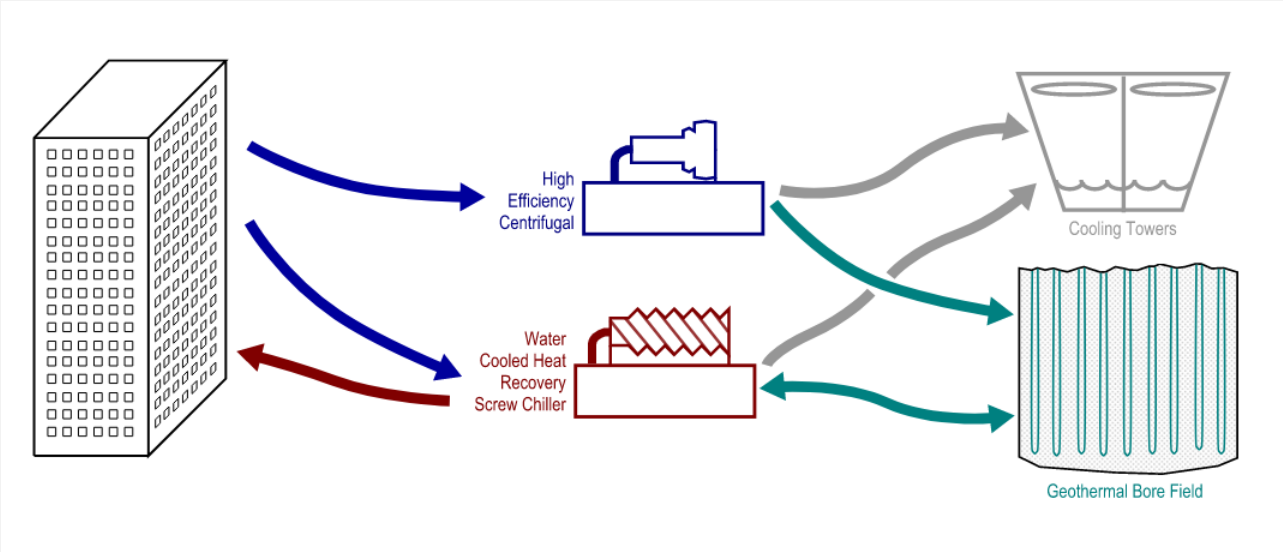
Technical Considerations – All-Electric Hydronics



Example of heat recovery with thermal energy storage (140.4(k)10)

Source: B. Gill, Solving the Large Building All-Electric Heating Problem, ASHRAE Journal, October 2021 (link)

Technical Considerations – All-Electric Hydronics



Example of heat recovery with thermal energy storage (140.4(k)10)

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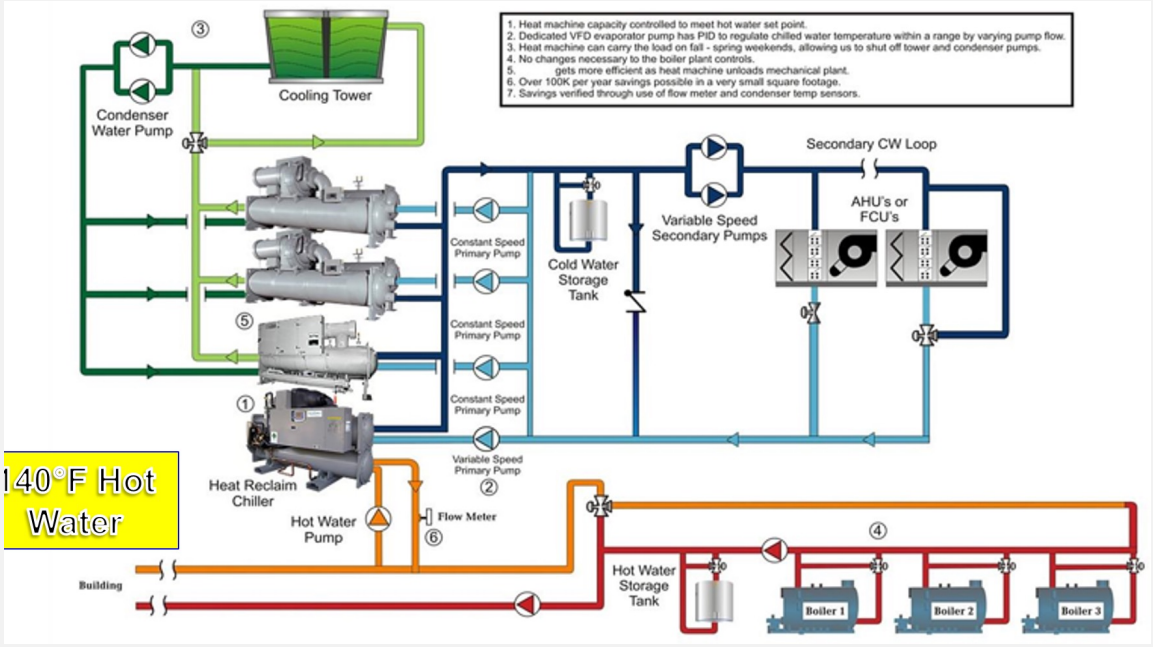
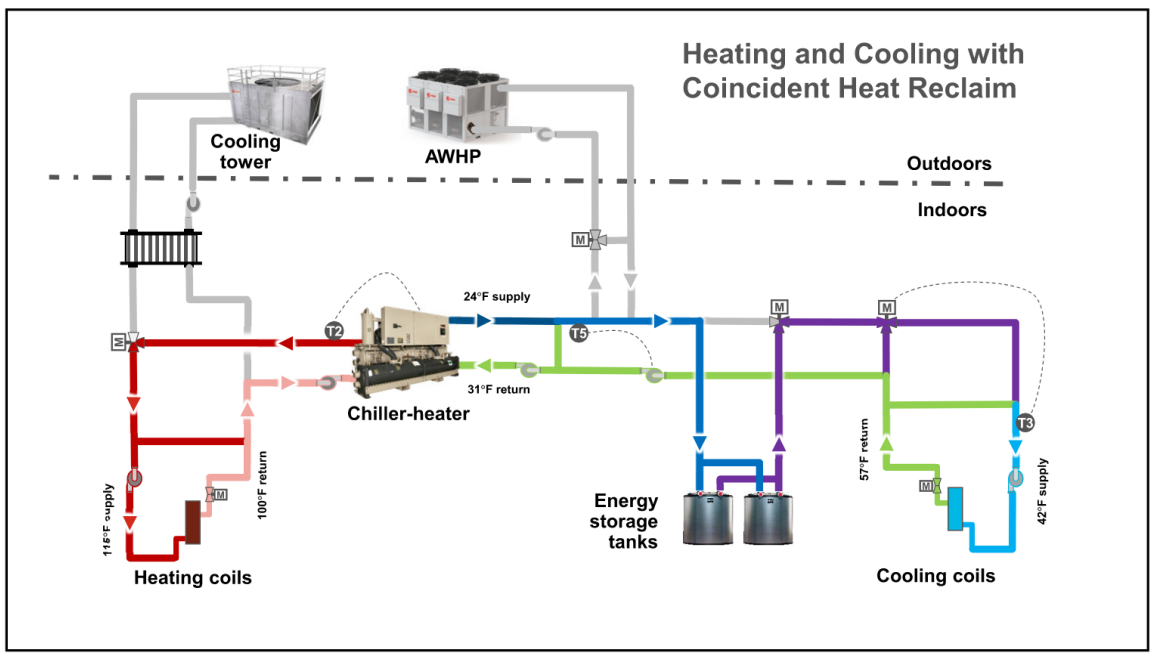
Technical Considerations – All-Electric Hydronics



Example of heat recovery with thermal energy storage (140.4(k)10)

Source: Carrier, with permission

Technical Considerations – All-Electric Hydronics



Example of heat recovery with thermal energy storage (140.4(k)10)

Source: Trane, with permission

Technical Considerations – Electric Resist. Heat

Technical Considerations

- Existing building hydronic reheat systems may have more significant downsides than previously assumed:
  - Poor part-load boiler efficiency
  - Rogue zones preventing HWST reset
  - Building operator concerns with distribution system leakage leading to 24/7/365 operation
  - HW distribution system losses when building is in economizer and cooling modes
- Buildings complying prescriptively (efficient envelope, efficient HVAC controls, solar PV) could be good candidates to allow ER reheat
  - First cost & maintenance savings expected with ER reheat

Technical Barriers and Potential Solutions

- Morning warm-up electric loads on winter CA grid
  - Adjustments to overnight setback on design days and an efficient envelope could mitigate

POLL QUESTION NEXT SLIDE

Technical Considerations

Existing building hydronic reheat systems may have more significant downsides than previously assumed:

Poor boiler thermal efficiency in low part-load conditions

Rogue zones preventing HWST reset & leading to higher boiler runtimes than assumed

Building operator concerns with distribution system leakage, leading to 24/7/365 operation

HW distribution system losses when building is in economizer and cooling modes

A building with a well-designed envelope and parallel fan-powered VAV boxes (and assuming T24-compliant HVAC controls) could be a good candidate for electric resistance reheat in place of a central hydronic heating system.

Technical Barriers and Potential Solutions

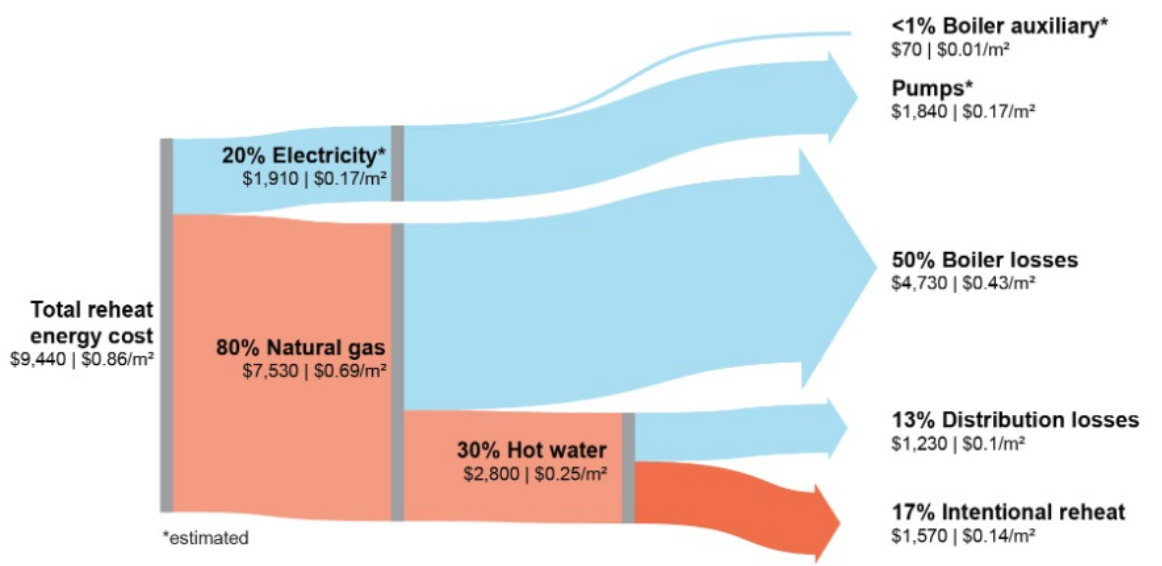
Morning warm-up electric loads on a CA grid that may become winter peaking in the future
(morning ventilation pre-purge)

- Adjustments to overnight setback on design winter days and an efficient building envelope could mitigate peak demand risks

Poll

Do you agree with the technical description given for Electric Resist. Heat?
What else should we know?

Technical Considerations – Electric Resist. Heat



A recent UCB CBE study of a Bay Area office building with HW reheat found that 17% of the reheat energy cost is converted to useful reheat energy.

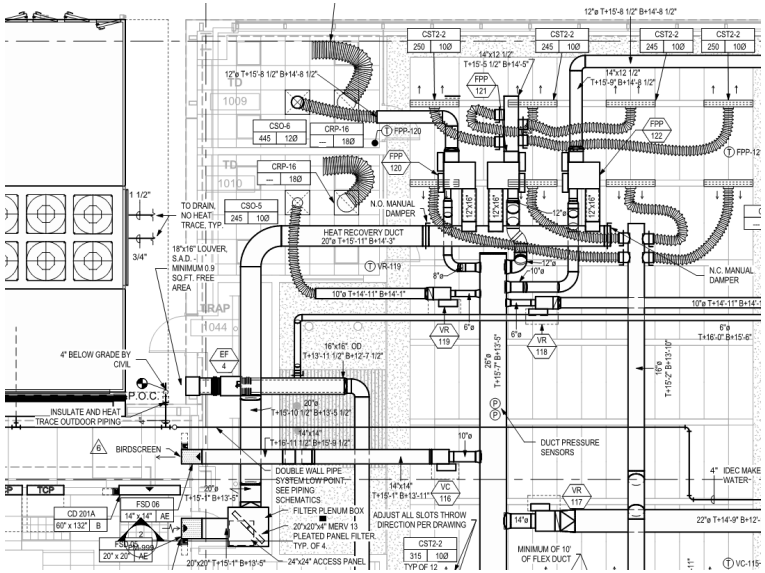
With electric resistance, 100% of the energy cost is converted to useful reheat energy.

Source: UC Berkeley Center for the Built Environment (link)

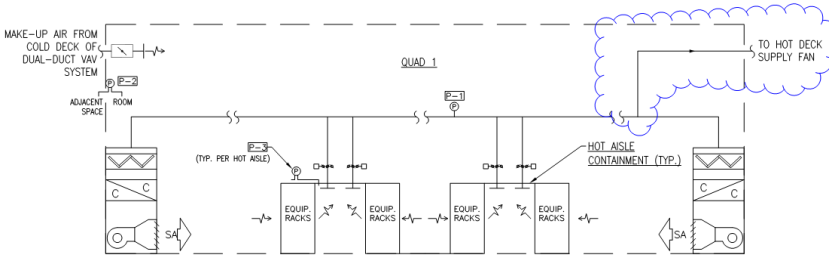
Include in discussion why this is a typical situation even though the information is being shown for a single building.

Technical Considerations – Electric Resist. Heat

Computer Room Heat Recovery with Parallel Fan Boxes



Computer Room Heat Recovery with Dual Fan Dual Duct



Energy and Cost Impacts Per Unit

Methodology and Assumptions

- Energy Savings Methodology
- Cost Impacts Methodology and Results
  - Incremental costs
  - Energy cost savings

Methodology for Energy Impacts Analysis (All Measures)

We mostly took the standard approach to modeling savings with some exceptions to capture aspects (thermal pipe losses, process loads) not in the prototypes.

- **Modeled prototypes that have gas boilers in the standard design:**
  - Large Office
  - Medium Office
  - Large School
  - Hospital
  - Modified NR prototype to include process loads
- **Modeled all 16 CA climate zones**

Due to modeling complexity around pipe losses and hydronic heat recovery, modeling results are initially presented using spreadsheet-based post-processing techniques

1) Limit HWST Assumptions for Standard and Proposed Designs

Standard Design

Minimally compliant with 2022 code, except pipe thermal losses added in accordance with CBE hydronics research

- Gas Boiler Baseline:
  - HWST at 160°F for non-condensing boilers (to align with 2022 ACM Reference Manual)
  - 40°F ΔT across HW coils
- Air-to-Water Heat Pump Baseline:
  - HWST at 140°F
  - 30°F ΔT across HW coils

Proposed Design

Minimally compliant with 2022 code, except pipe thermal losses added in accordance with CBE hydronics research

- Gas Boiler Proposed:
  - HWST at 130°F for condensing boilers
  - 25°F ΔT across HW coils
- Air-to-Water Heat Pump Proposed:
  - HWST at 130°F
  - 25°F ΔT across HW coils
- Pipes and pumps resized to account for new flow rate

2) All-electric Hydronics Assumptions for Standard and Proposed Designs

Standard Design

Minimally compliant with 2022 code

- Air-to-Water Heat Pump Baseline:
  - HWST at 130°F
  - 25°F ΔT across HW coils
- Pipe losses not added since there's no change between standard and proposed design

Proposed Design

Minimally compliant with 2022 code

- For prototypes with large overlapping cooling and heating loads:
  - Replaced 30% of 2-pipe ATWHPs with 4-pipe DHRCs and downsized WCCs
- For prototypes with small overlapping cooling and heating loads:
  - Configured ATWHP to deliver energy to CW loop
  - Added CW TES tank
  - Configured DHRC to operate from CW to HW

3) Electric Reheat Assumptions for Standard and Proposed Designs

Standard Design

Minimally compliant with 2022 code, except pipe thermal losses added in accordance with CBE hydronics research, and 130F Max HWST Proposal

- Condensing Gas Boiler Baseline:
  - 130F HWST
  - Standard VAV box with hydronic reheat coil
- Air-to-Water Heat Pump Baseline:
  - Hydronic space heating ATWHP and central heating coil
  - Standard VAV box with hydronic reheat coil

Proposed Design

Minimally compliant with 2022 code and no pipe losses

- Hydronic space heating boiler or ATWHP and distribution system removed
- Parallel fan powered VAV box with electric resistance reheat coil

Incremental Cost Framework (All Measures)

How we collected costs of base case technology and proposed technology:

- **Material:** Focus on hot water pipe distribution network, water pumps, analyzed potential VAV box cost impacts from HWST and electric reheat measures
- **Equipment:** Interviews and data requests from manufacturers and distributors. Focus is on **changes between baseline and proposed cases, impacting boilers, ATWHP, DHRC, TES, etc.**
- **Labor:** Interviews and data requests from contractors. Impact from new design strategies, new compliance approaches. Methodology in development

Prompts for discussion:

- What components of costs did we leave out?
- Do you find these costs to be reasonable?
  - Willing to discuss individually.

HWST Limit: Incremental Cost Per Square Foot

Over 30 Year Period of Analysis

Incremental First Cost	
Boiler*	$0.29 – $0.41 per sf
HW Pump	$0.03 – $0.05 per sf
Pipe	$0.19 per sf
Total	**$0.51 – $0.64 per sf**

*This is very conservative. It assumes upgrading from non-condensing boiler to condensing boiler even though condensing boilers are common and required in many cases.

Cost data came from:

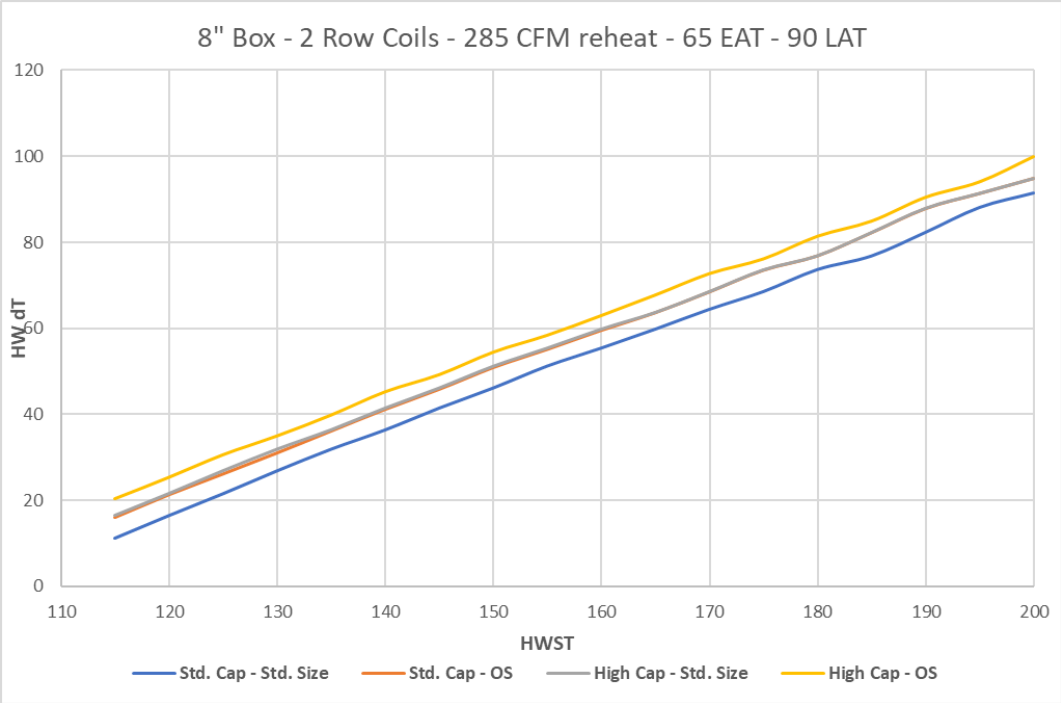
- Boiler and pump equipment reps
- Mechanical contractors

HWST Limit: Coil Impacts

Option 1: Use higher capacity or oversized reheat coils to keep the proposed design dT closer to the baseline dT

Option 2: Use standard reheat coils in both cases. Results in lower dT and larger hot water flowrates (and higher incr. pipe cost) than Option 1 but no incremental coil cost.

We used option 2.



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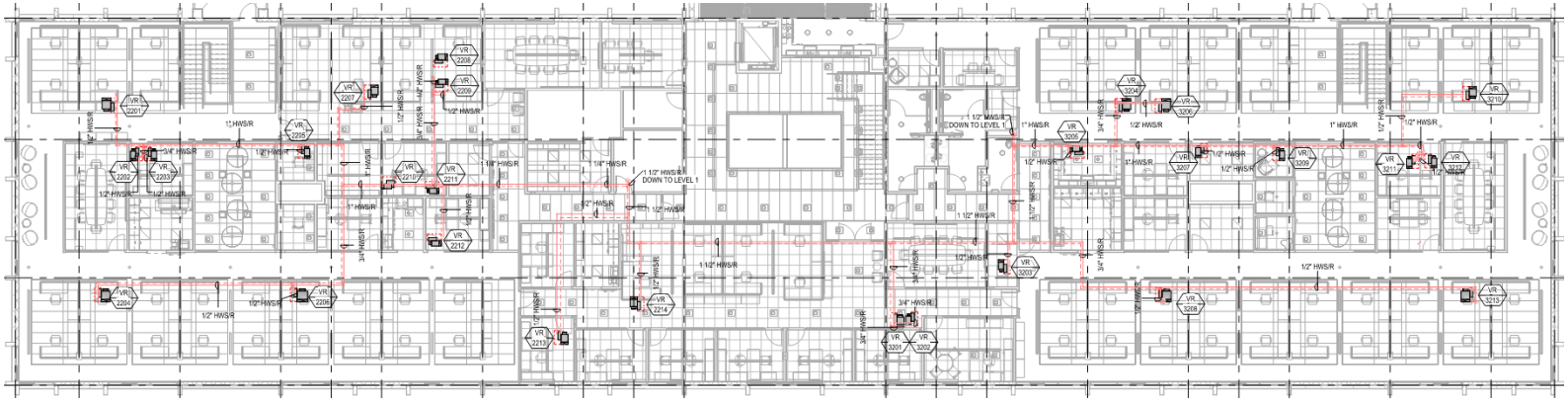
HWST Limit: Piping Costs

- Used piping costs from mechanical contractors and industry standard pipe sizing to develop a function for pipe cost as a function of flow rate (gpm)
- Baseline: Used design gpm and design dT for every segment of pipe in a couple real buildings to find pipe cost at baseline dT and gpm
- Proposed: Calculated new gpm and cost/lf for each segment based on design dT vs proposed dT

pipe size	Total installed cost ($/linear foot)	Max GPM
3/4”	$ 105.05	4.6
1"	$ 110.97	8.9
1-1/4”	$ 121.18	15
1-1/2”	$ 131.15	24
2"	$ 149.72	51
3"	$ 223.56	140
4"	$ 272.50	280



- What components of costs did we leave out?
- Do you find these costs to be reasonable?
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HWST Limit: Cost Effectiveness

Measure is cost-effective if B/C Ratio > 1.0

	CZ01	CZ03	CZ06	CZ07	CZ09	CZ12
Large Office - Gas Baseline						
total incremental cost ($/ft2)	$ 1.15	$ 1.06	$ 0.93	$ 0.89	$ 0.98	$ 1.11
energy savings ($/ft2)	$ 2.40	$ 1.85	$ 1.10	$ 1.00	$ 1.04	$ 1.57
Benefit-to-Cost Ratio	**2.1**	**1.7**	**1.2**	**1.1**	**1.1**	**1.4**
Large Office - AWHP Baseline						
total incremental cost ($/ft2)	$ 0.11	$ 0.11	$ 0.10	$ 0.10	$ 0.10	$ 0.11
energy savings ($/ft2)	$ 0.79	$ 0.62	$ 0.30	$ 0.25	$ 0.32	$ 0.54
Benefit-to-Cost Ratio	**7.2**	**5.9**	**2.9**	**2.4**	**3.1**	**5.0**
Medium Office - Gas Baseline						
total incremental cost ($/ft2)	$ 1.17	$ 1.07	$ 0.89	$ 0.80	$ 0.98	$ 1.21
energy savings ($/ft2)	$ 2.40	$ 1.71	$ 0.98	$ 0.89	$ 0.97	$ 1.58
Benefit-to-Cost Ratio	**2.1**	**1.6**	**1.1**	**1.1**	**1.0**	**1.3**
Medium Office - AWHP Baseline						
total incremental cost ($/ft2)	$ 0.12	$ 0.12	$ 0.11	$ 0.10	$ 0.11	$ 0.12
energy savings ($/ft2)	$ 0.89	$ 0.58	$ 0.27	$ 0.22	$ 0.30	$ 0.56
Benefit-to-Cost Ratio	**7.4**	**5.0**	**2.5**	**2.2**	**2.7**	**4.5**

Time Independent Energy Recovery: Incremental Costs

- CW TIER was bid as an add alternate versus AWHPs on these recent Bay Area new construction projects
- In all cases TIER cost less than the basecase all-electric design
- TIER also has fewer pieces of equipment and lower maintenance costs

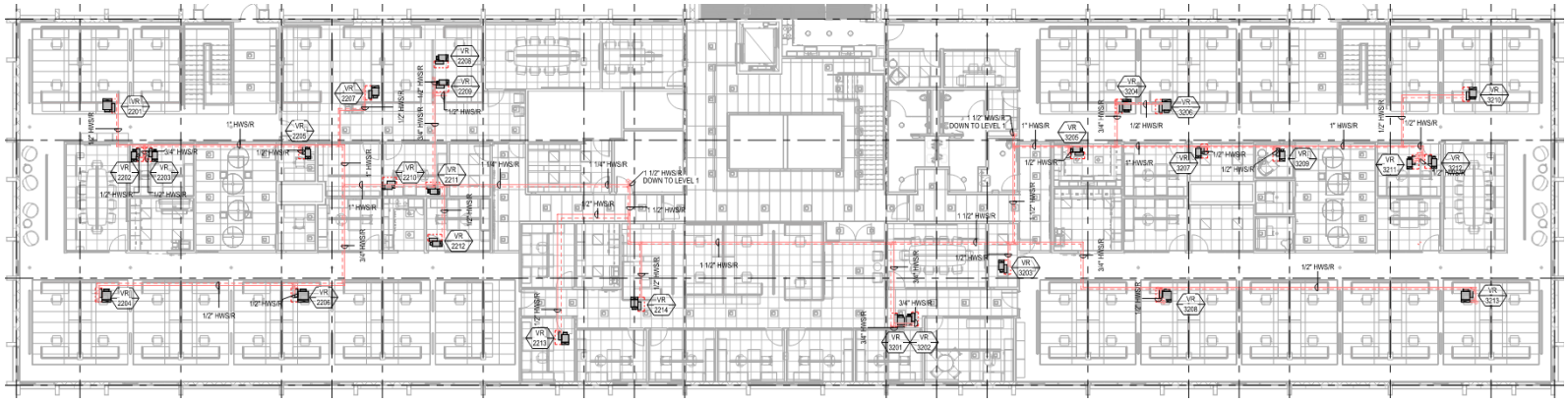
location	Santa Clara	Sunnyvale	San Jose	Oakland
stories	3	3	6	27
building area (ft2)	314,000	1,100,000	1,022,981	718,000
CHWcap (tons)	780	2,660	1,800	1,200
SHWcap (kBtuh)	307		553	
Hwcap (kBtuh)	5,000	18,986	11,896	10,215
tank capacity (kBtu)	12,125	45,807		34,436
First Cost Savings ($)		1,000,000	6,725,003	2,200,000
first cost savings ($/ft2)		0.91	6.57	3.06

- What components of costs did we leave out?
- Do you find these costs to be reasonable?
  - Willing to discuss individually.

Electric Resistance: Incremental Costs

- Redesigned same 40,000 ft2 real office building with gas boilers, AWHPs, and with electric resistance heating (FPBs)
- Solicited equipment costs from manufacturers, installation/maintenance costs from contractors

	Gas Baseline	AWHP Baseline	Elec. Resist.
Terminal Units (equip)	$18,282	$18,282	$82,721
Terminal Units (HVAC labor)	$265,000	$265,000	$180,000
Central HW Plant	$174,163	$283,763	
HW Piping	$227,200	$227,200	
Incr. Electrical		$10,000	$63,362
Total First Cost	$684,645	$804,245	$326,082
Annual Maint.	$1,000	$1,000	$5,550
NPV of Annual Maint.	$19,600	$19,600	$108,782
NPV of Future Replacement		$111,621	



- What components of costs did we leave out?
- Do you find these costs to be reasonable?
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Electric Resistance: Cost Effectiveness

		CZ03	CZ12
Gas Baseline	NPV first cost + maint. ($/ft2)	$ (6.73)	$ (6.73)
	NPV energy savings in LSC ($/ft2)	$ (3.40)	$ (3.66)
	Benefit-to-Cost Ratio*	2.0	1.8
AWHP Baseline	NPV first cost + maint. ($/ft2)	$ (12.52)	$ (12.52)
	NPV energy savings in LSC ($/ft2)	$ (3.12)	$ (3.61)
	Benefit-to-Cost Ratio*	4.0	3.5

*Measure is cost-effective if B/C Ratio > 1.0

Accounts for:

- Rated Boiler, AWHP Performance
- Fan Energy
- Piping Losses

Does NOT Account for:

- Actual Boiler, AWHP Performance
- Energy Savings from DCV, Occupied Standby, Computer Room Heat Recovery
- Prescriptive Benefits (window switches, good envelope, PV+storage, etc.)
- Refrigerant Leakage, Gas Leakage
- Embodied Carbon

Compliance and Enforcement

- Design
- Permit Application
- Construction
- Inspection
- Revisions to Compliance Software

Compliance and Verification Process

1. **Design Phase**
   - Small, incremental changes anticipated to comply with HWST Limit
   - Hydronic TES and HR equipment are newer concepts
     - Significant industry trend toward this equipment, major OEMs are focusing on TES and HR chiller offerings
     - Industry resources (including CA IOU trainings) exist to educate designers of new approaches

2. **Permit Application Phase**
   Code officials may need to be educated on new all-electric hydronic system layouts

3. **Construction Phase**
   - Equipment and hydronic distribution networks will be familiar to contractors
   - Controls will be different, workforce education will be needed

4. **Inspection Phase**
   Inspectors may need to be educated on new all-electric hydronic system layouts

Market Actors

Market actors involved in implementing this measure include:

- Building Owners
- Architects
- Mechanical Designers
- Plumbing Designers
- Electrical Designers
- Structural Designers
- Energy Consultants
- Builders
- Installers
- Plans Examiners
- Building Inspectors
- Manufacturers

POLL QUESTION
NEXT SLIDE

Poll

How will this proposal affect you?

Please reach out to our team if you feel that this measure impacts your work.

Software Updates

At a high level, the following aspects of the ACM Reference Manual would be impacted by our proposal:

- HWST = 130°F in the standard design. HWST ≤ 130°F in the proposed design
- Add CW, CHW, and HW TES to ACM Reference Manual
- Add 4-pipe dedicated HR chillers to ACM Reference Manual

Appendix C of the CASE Report will include a detailed discussion of proposed ACM Reference Manual changes

Proposed design has to be no greater than 130 deg because it is a mandatory requirement.

Review of Code Language Markup

- Draft Code Change Language

Draft Code Change Language: Limit HWST

SECTION 120.2 – REQUIRED CONTROLS FOR SPACE-CONDITIONING SYSTEMS

(k) HVAC Hot Water Temperature. Systems that use hot water for space heating shall be designed for a hot water supply temperature of no greater than 130°F.

Draft Code Change Language: All-Electric Hydronics

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(k) Hydronic System Measures

…

9. Simultaneous Hydronic Heat Recovery is required for hydronic systems meeting 1 or 2:

1. CHW_{HL} + 0.1*CHW_{LL} ≥ 500 tons and SHW_{cap} + HW_{cap} ≥ 300 kBtuh, or
2. CHW_{HL} + CHW_{LL} ≥ 100 tons and SHW_{cap} + 0.1*HW_{cap} ≥ 2,000 kBtuh
   - CHW_{cap} = design capacity of all chilled water (CHW) cooling systems
   - CHW_{HL} = CHW High Load = design capacity of all CHW cooling systems serving spaces with a design equipment power density > 5 watts/ft2
   - CHW_{LL} = CHW Low Load = CHW_{cap} - CHW_{HL}. If the CHW plant includes capacity for future systems, then assume 20% of future systems serve high load spaces.
   - SHW_{cap} = design capacity of all service hot water (SHW) systems
   - HW_{cap} = design capacity of all space heating hot water (HW) systems

The heat recovery system shall have a heating COP of at least 3.5 at design conditions and shall be capable of transferring the lesser of:

- 0.5*(CHW_{cap})
- 0.5*(SHW_{cap} + HW_{cap})

EXCEPTION to Section 140.4(k)9: Buildings that include Time Independent Energy Recovery meeting 140.4(k).10.1 and 140.4(k).10.2

10. Time Independent Energy Recovery (TIER) is required for hydronic systems meeting the following:

1. CHW_{cap} ≥ 800 tons
2. SHW_{cap} + HW_{cap} ≥ 4,000 kBtuh
3. The hot water heating system is electric (not gas boilers)

TIER systems shall include both:

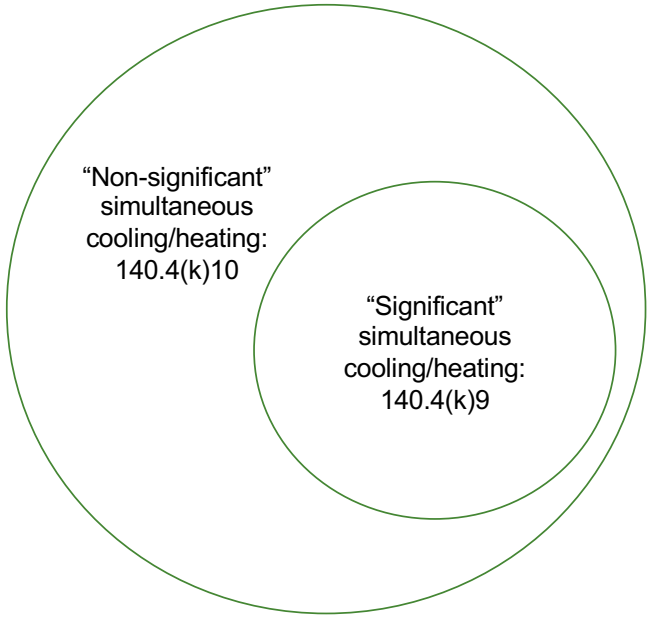
1. a condenser water storage tank, or other means, capable of storing 2 hours times (SHW_{cap} + HW_{cap}), and
2. water-to-water chillers or other means of heat recovery to extract heat from the storage system in heating and reject heat to the storage system in cooling

.

All-electric Hydronics Language Context

140.4(k)9: requires hydronic heat recovery. Triggers for sites with large simultaneous loads.

140.4(k)10: requires thermal energy storage (and heat recovery). Can apply to all sites but in practice will likely be the option for sites with low simultaneous loads.



Draft Code Change Language: ER Reheat (1 of 2)

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(g) Electric resistance heating. Electric resistance heating systems shall not be used for space heating.

Exception 1 to Section 140.4(g): Where an electric resistance heating system supplements a heating system in which at least 60 percent of the annual heating energy requirement is supplied by site-solar or recovered energy.

…

Exception 5 to Section 140.4(g): Where an electric resistance heating system serves an entire building that is not a hotel/motel building; and has a conditioned floor area no greater than 5,000 square feet; and has no mechanical cooling; ~~and is in an area where natural gas is not currently available~~.

Exception 6 to Section 140.4(g): Heating systems serving as emergency backup to gas or heat pump heating equipment.

Exception 7 to Section 140.4(g): in zones where all the following is true:

(a) the heating system is not hydronic

(b) all heating for each cooling zone is provided by equipment dedicated only to that cooling zone

(c) the primary airflow delivered to the zone at design heating conditions does not exceed the minimum required for ventilation

(d) the zone does not have continuous exhaust makeup air or pressurization requirements that require an outdoor air rate greater than 0.15 cfm/ft2.

(e) All spaces with Note F in Table 120.1-A have occupant sensor ventilation controls meeting 120.1(d)5.A to G

(f) All spaces with $R_t \geq 0.3$ in Table 120.1-A have demand control ventilation meeting 120.1(d)4

(g) "Available" computer room hot aisle air is transferred to the zone in heating. Computer room hot aisle air is "available" if there is a computer room with a design equipment load > 10 kW on the same floor and within 30 feet of the zone and > 50% of the heat from the computer room is not otherwise being recovered for space heating. The transfer system shall be sized for at least:

1. 50% of the design equipment load of the computer room, or
2. 50% of the design heating load of the zone

Draft Code Change Language: ER Reheat (2 of 2)

SECTION 141.0 – ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING NONRESIDENTIAL

~~**Exception 2 to Section 141.0(a):** Where an existing system with electric reheat is expanded by adding variable air volume (VAV) boxes to serve an addition, total electric reheat capacity may be expanded so that the total capacity does not exceed 150 percent of the existing installed electric heating capacity in any one permit, and the system need not comply with Section 140.4(g). Additional electric reheat capacity in excess of 150 percent of the existing installed electric heating capacity may be added subject to the requirements of Section 140.4(g).~~

Discussion and Next Steps

We want to hear from you!

- POLL QUESTION NEXT SLIDE:
  - Provide **any last comments or feedback** on this presentation now verbally or in GoTo Questions Pane

- More information on pre-rulemaking for the 2025 Energy Code at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency

Comments on this measure are due by March 13. Please send comments to info@title24stakeholders.com and copy CASE Authors (see contact info on following slide).

Poll

We want to hear from you!
Any final comments or questions?

Thank You

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