I wish they all could be California codes

Seriously CA, please take the lead

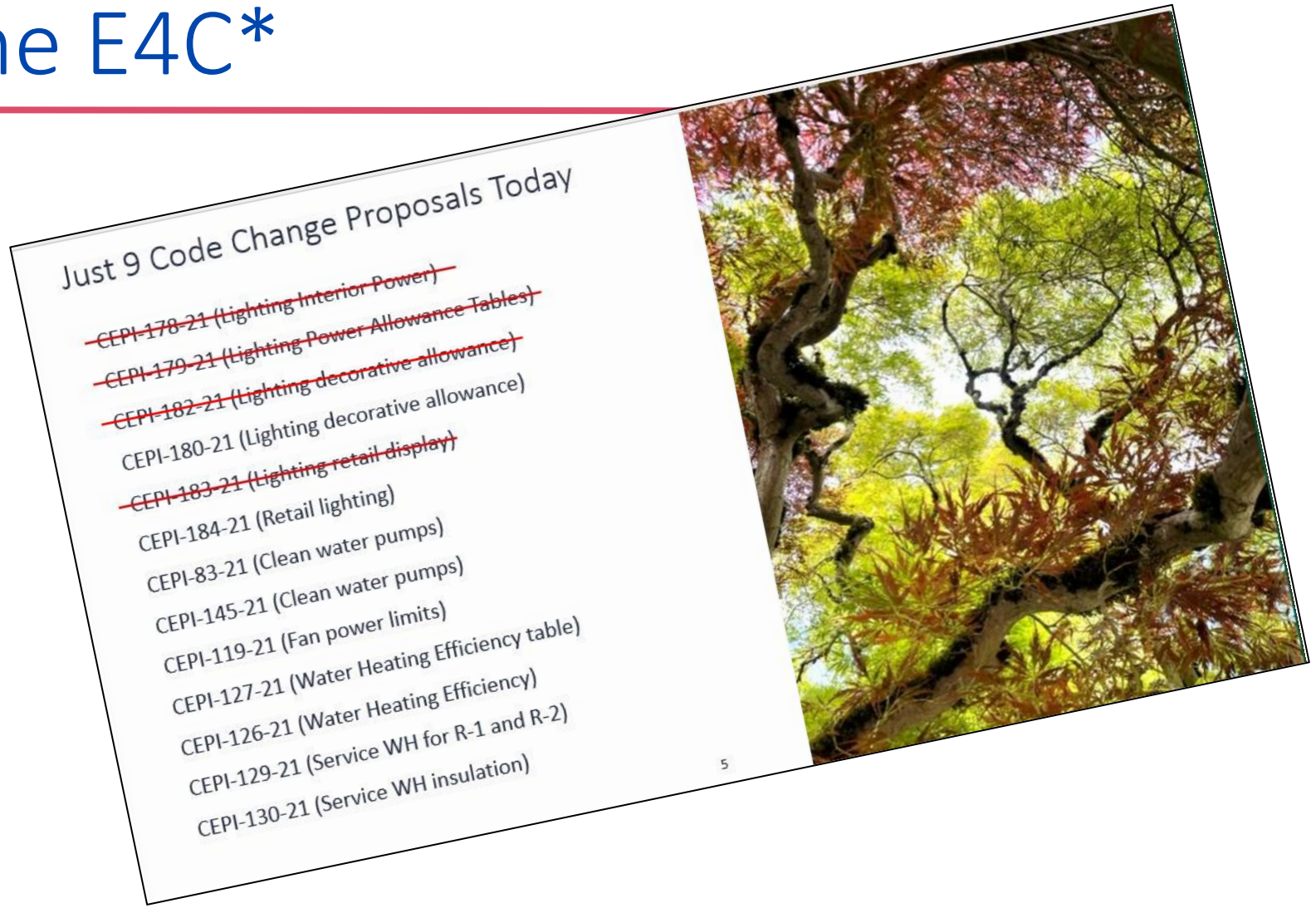
Duane Jonlin, FAIA
Seattle Department of Construction and Inspections
December 2022

Old IECC routine

- 2 week-long meetings
- 12-hour days
- 2 min each at microphone
  - …and then months later…
- National vote of building officials

New routine – the E4C*

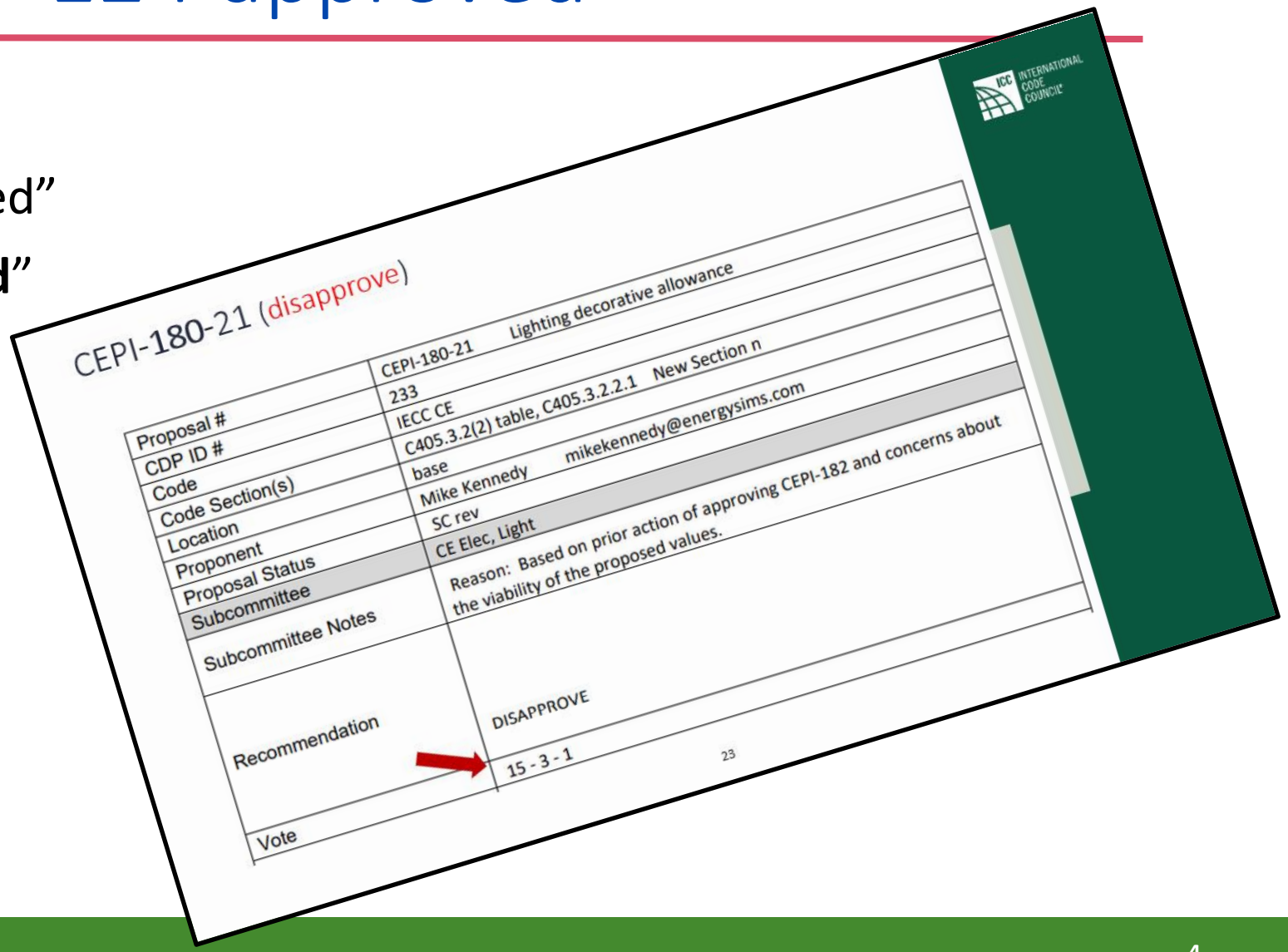
- 45 members
  - Selected by ICC Board
- Plus 11 more on each tech subcommittee
  - 96 total



***Commercial Energy Code Consensus Committee**

256 proposals ⇨ 124 approved

- Lots “disapproved”
- Some “approved as submitted”
- Most “**approved as modified**”
- **7 “committee consensus”**
  - EV charging
  - Renewable energy
  - Air leakage
  - Thermal bridging
  - Zero Code mods
  - Parking garage ventilation
  - Lighting power



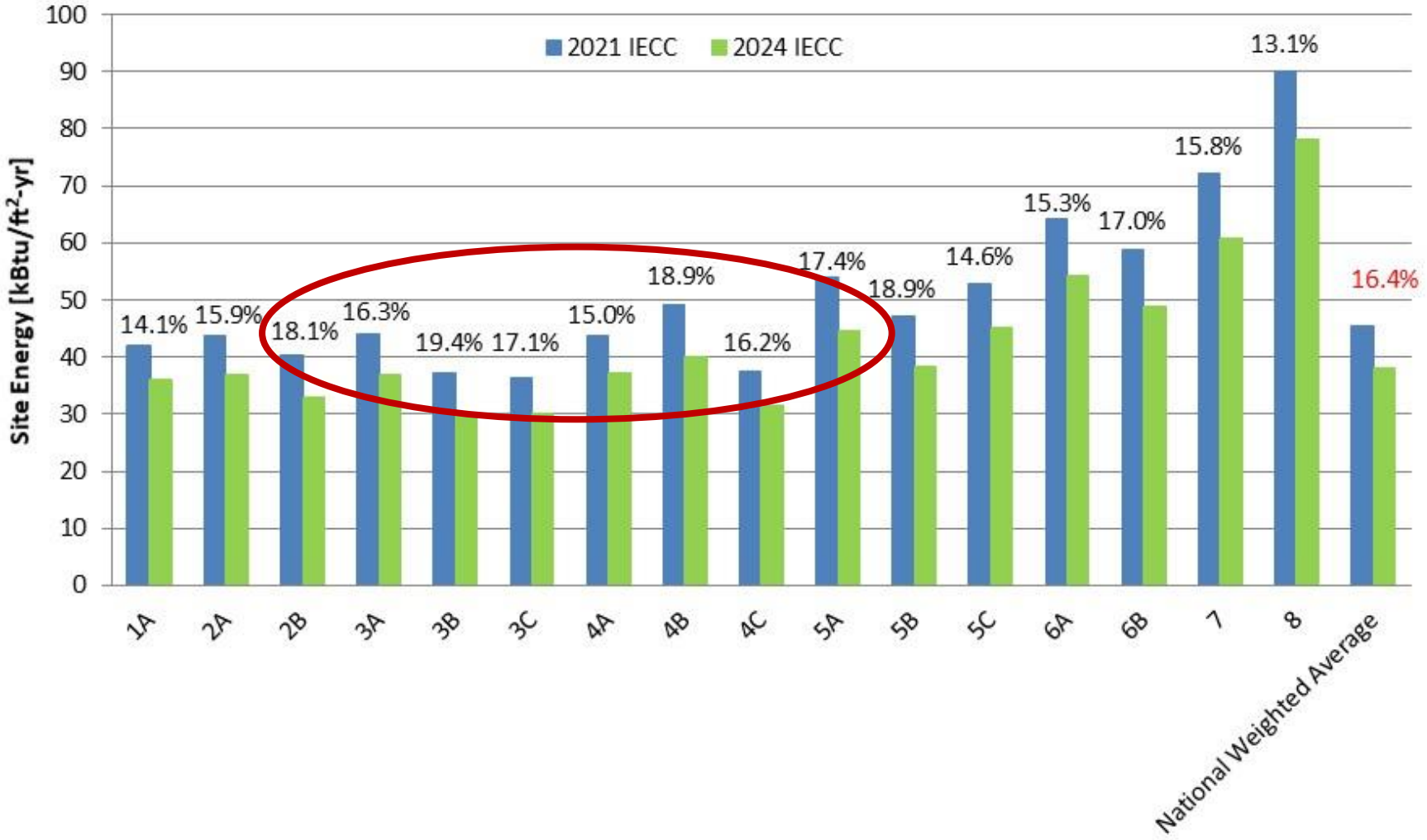
Pacific Northwest NATIONAL LABORATORY

Summary of Results

National Weighted Average		Site Energy [kBtu/ft²-yr] Energy Cost [$/ft²-yr] Emissions [tons/kft²-yr]		% Savings
		IECC 2021	IECC 2024 [Gross] / [Net]	[Gross] / [Net]
Whole Building	Site Energy	45.6	40.8 / 38.1	10.6% / 16.4%
	Energy Cost	$1.22	$1.09 / $1.01	10.2% / 17.2%
	Emissions	7.5	6.7 / 6.2	10.0% / 17.5%

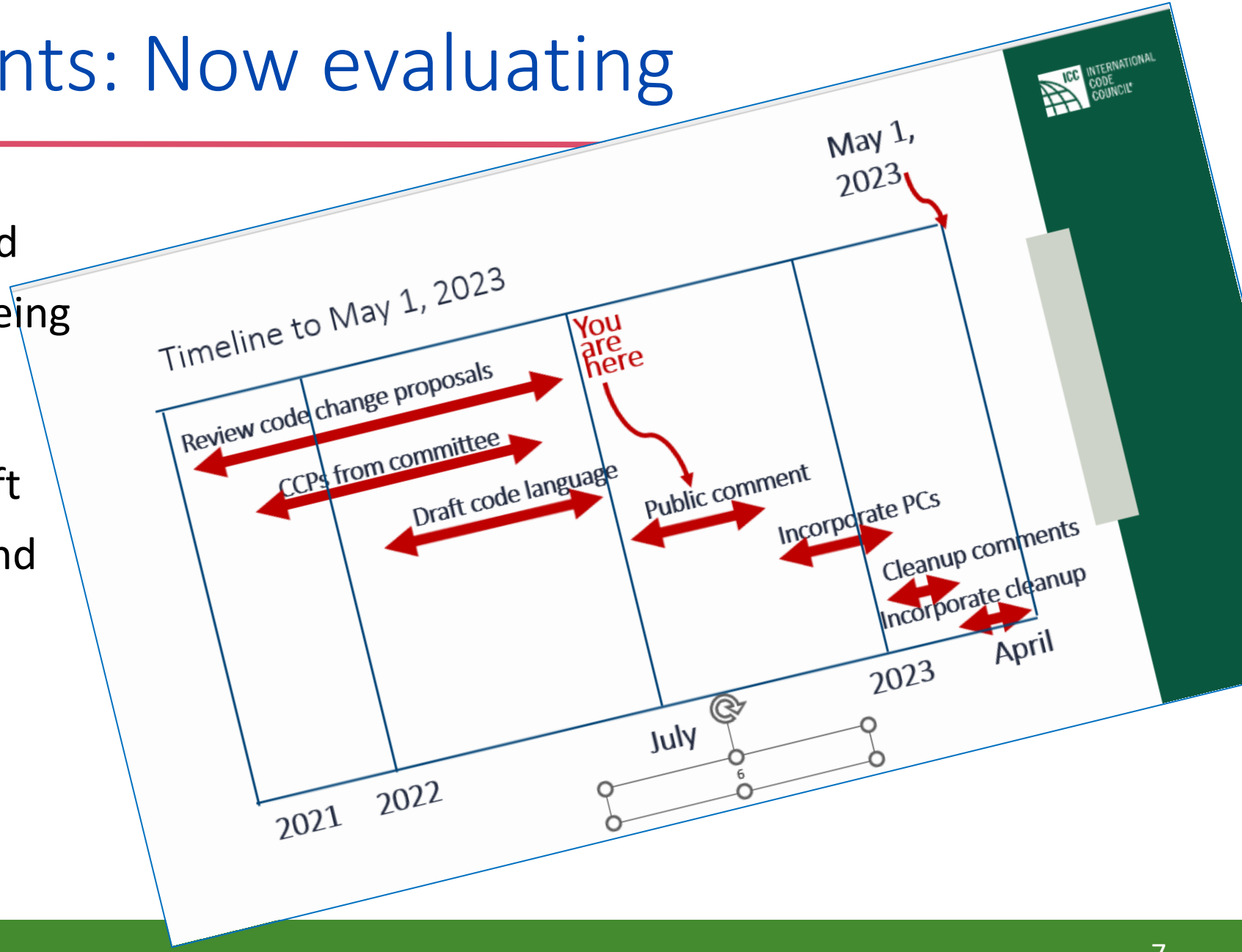
Gross = total before accounting for renewable energy
Net = site energy after accounting for onsite renewable generation

Net Energy Savings by Climate Zone (Commercial)



Public comments: Now evaluating

- 225 comments received
- Additional proposals being developed within committees
- 2/3 vote to modify draft
- Cleanup comment round this winter
- Complete by May 1



But wait, there's more! (and more, and more…)

- "Continuous maintenance"
- Submit new proposals whenever
- Subcommittees and E4C will meet "periodically" to process & vote
  - We're not saying *how* periodically
- When published, they're available for adoption
  - Maybe your state could get a custom code that includes a few of the new amendments?
- Publish new edition every 3 years

Choose your own adventure?

Original idea:

- Solid base code
- Plus alternate paths
  - Zero Code
  - 2030 Glide Path
- Plus optional appendices:
  - ~~EV charging~~
  - ~~Renewable energy~~
  - ~~Battery storage~~
  - Decarbonization?
  - ~~Embodied energy~~
  - …

The problem:

Everything's either:

- Too important to go in the appendix
  - or
- Nobody submitted an appendix proposal

The virtual life

Advantages

- No jet fuel burned
- No need to cram huge agenda into one insane week (ICC) or weekend (ASHRAE)
  - Regular scheduled meetings with time in between for other work
- No travel budget
- Toddlers hang onto mom & dad
- No super-spreader events
- Don’t miss band practice!

Disadvantages

- No late-night debates in the hotel bar
- No chit-chat in line for lunch
- No snide remarks or raised eyebrows after some outrageous statement
- No chance that you’ll be sitting next to your adversary at dinner

Cost Effectiveness: Efficiency & decarbonization are critical for human survival….but we still require them to be "cost-effective"

"…life cycle cost effective, considering economic feasibility, including potential costs and savings for consumers and building owners, and return on investment."

- NPV *and* ASHRAE-style scalar ratio
- 3% *and* 7% discount rates
- Committee sees all 4 numbers
- Plus SCC, if provided ($51/ton)

But, not many customers!

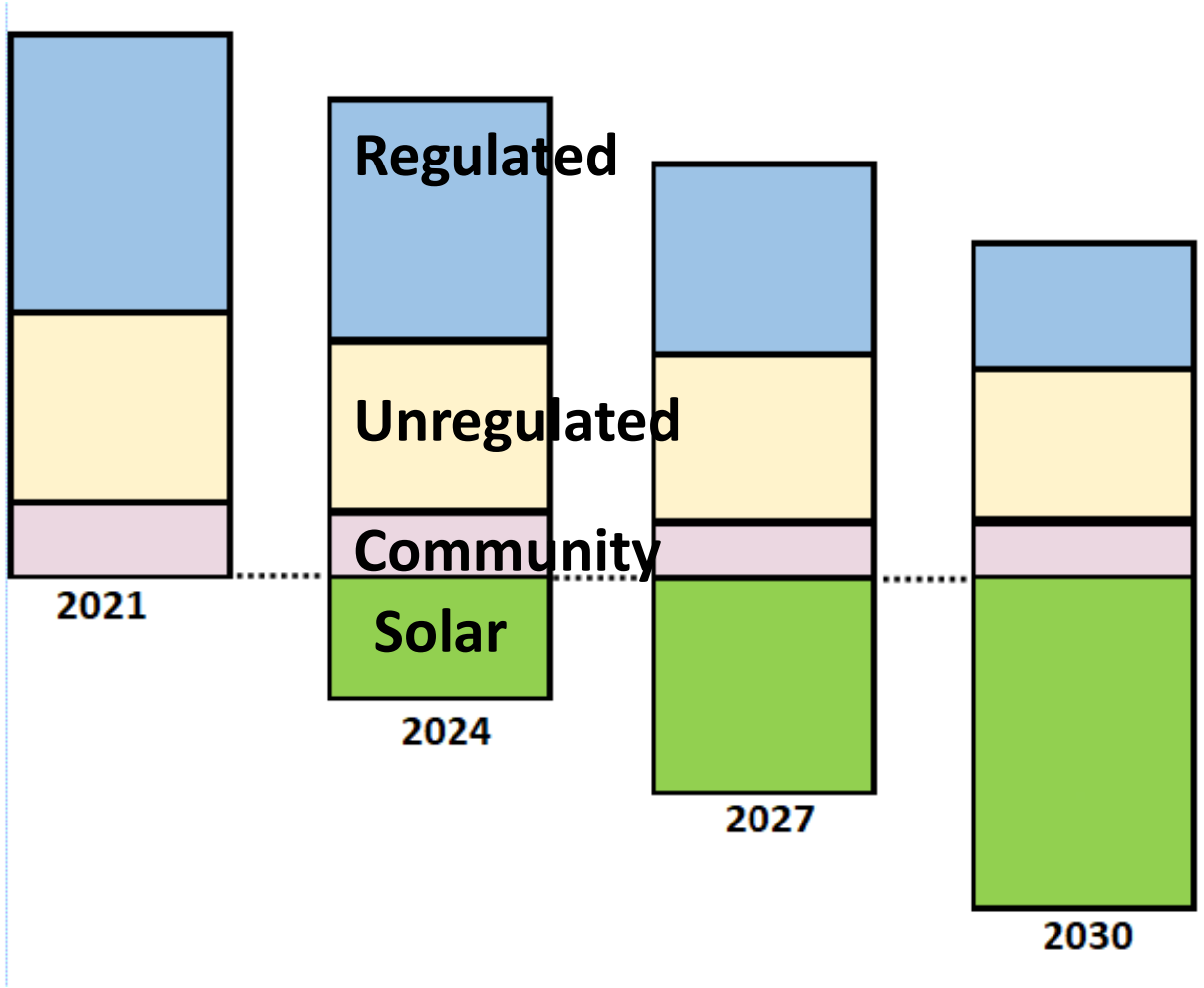
Alternate paths – any takers?

The 2030 Glide Path

- Three steps: 2024, 2027, 2030
- Reduce energy use 13% per step
  - By adding efficiency credits
- Increase renewables each step
  - Same W/ft2 rate for all buildings
- Spread community process loads across all building types
- Approx net zero in 2030

Appendix CC "Zero Code"

- Meet code minimum.
- Obtain enough RE to equal entire estimated energy use



2024 IECC Top Ten

- **4.0 Additional efficiency credits**
- **2.0 Occupied standby controls**
- 0.5 Interior LPA reductions
- 0.5 Dimming everyplace
- 0.5 Egress lighting off when unoccupied
- 0.5 Fan energy reduction – 10%
- 0.2 VAV turndown
- 0.2 Parking garage ventilation
- 1.0 All other combined

~~+5.0~~ 6.0 Renewables:
0.75 W per sf, largest 3 floors

(Presuming these survive the public comment process)

- **~~9.4%~~** Irresponsible guess at overall energy savings (Actually **10.6%)**

Meanwhile, in the upper left corner

Carbon-neutral Seattle by 2050 (or sooner)

1. Build great envelope
   - Dependable energy savings for decades
2. Eliminate combustion
   - Carbon neutral today, won't need change later
3. Use electricity wisely
   - Don't waste on electric resistance heat
4. Generate power
   - Plus "solar readiness" for bigger future system

Build so that no "major surgery" for buildings is required for 2050

Whole-building code requirements

- **"Additional efficiency credits" required**: above-code measures selected from a list of options
- **Energy modeling** 10% UxA backstop to protect envelope U-values
- **Commissioning**, medium & large buildings
  - Cx plan submittal and Cx report
- **Metering & submetering**
  - Submetering: HVAC, water heating, lighting, plug loads, process loads, full-floor tenants
  - (not just separation of circuits)

The "additional efficiency credits" system provides huge savings:

- Highly flexible
- Doesn't burden any one trade
- Credits high-performance mech without violating federal preemption

Seattle building performance rules

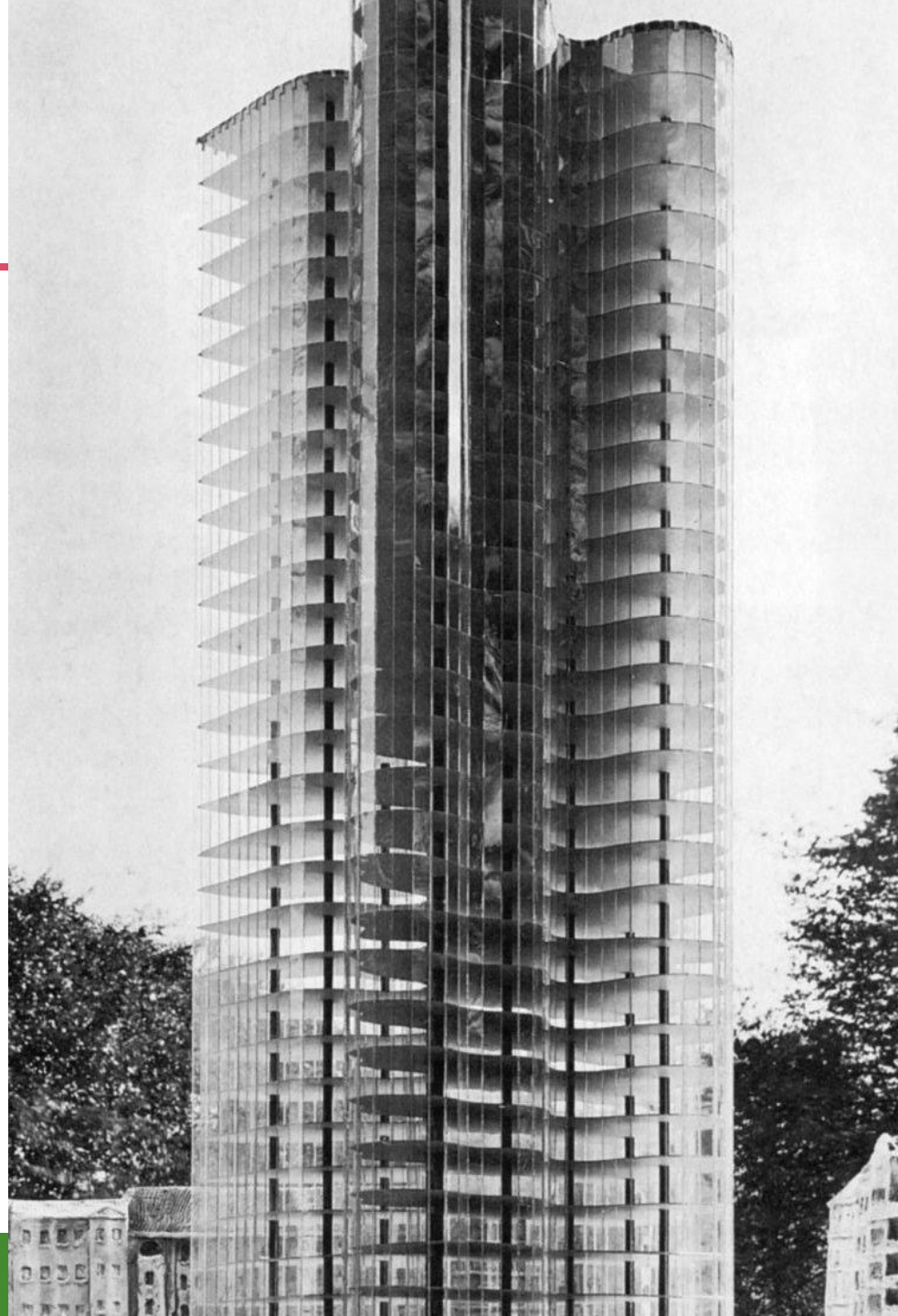
- **Benchmarking/Reporting** required every year
  - 20,000 sf threshold
  - This is how Seattle realized that we were going the wrong way with carbon emissions
- **"Building tune-up"** required every 5 years
  - Will be replaced with BPS in a few years
- **Building Performance Standards** require sub-par buildings to reduce **energy use**
  - Seattle will overlay **carbon emissions** requirement on this

Enforced by Seattle's Office of Sustainability & Environment, not the building department

- BPS will be major influence over time

Building envelope highlights

- **Air leakage testing mandatory all buildings – 0.25 cfm/sf**
  - But maybe not for Carmel-by-the-Sea
- **Envelope U-values as good as Minneapolis**
  - even in mild Seattle climate
  - CA zones 1 & 16 similar to WA zones
- **Maximum fenestration area specific to each building type**
  - Not just straight 30% or 40%
- **Thermal bridging limitations**
  - For concrete balconies & fenestration frames



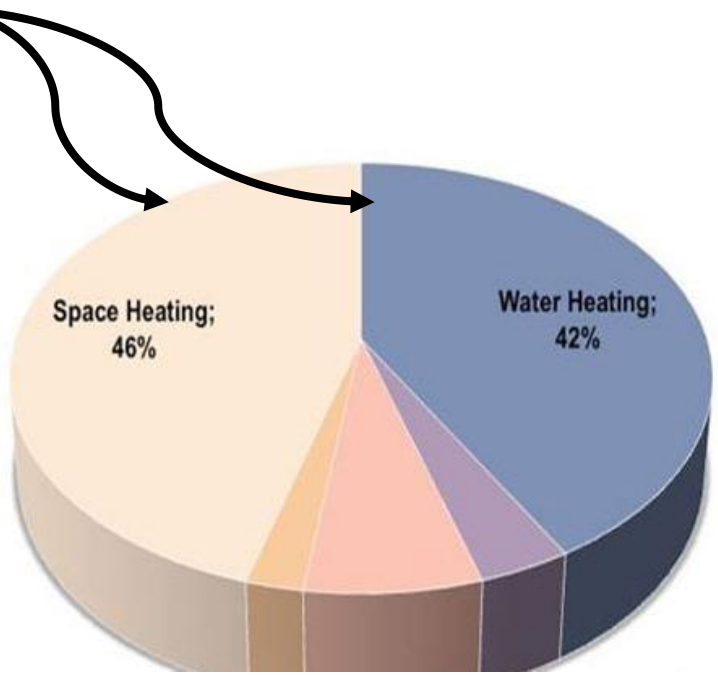
Decarbonization focus

Big gas uses:
(Eliminate now)

- Space heating
- Water heating

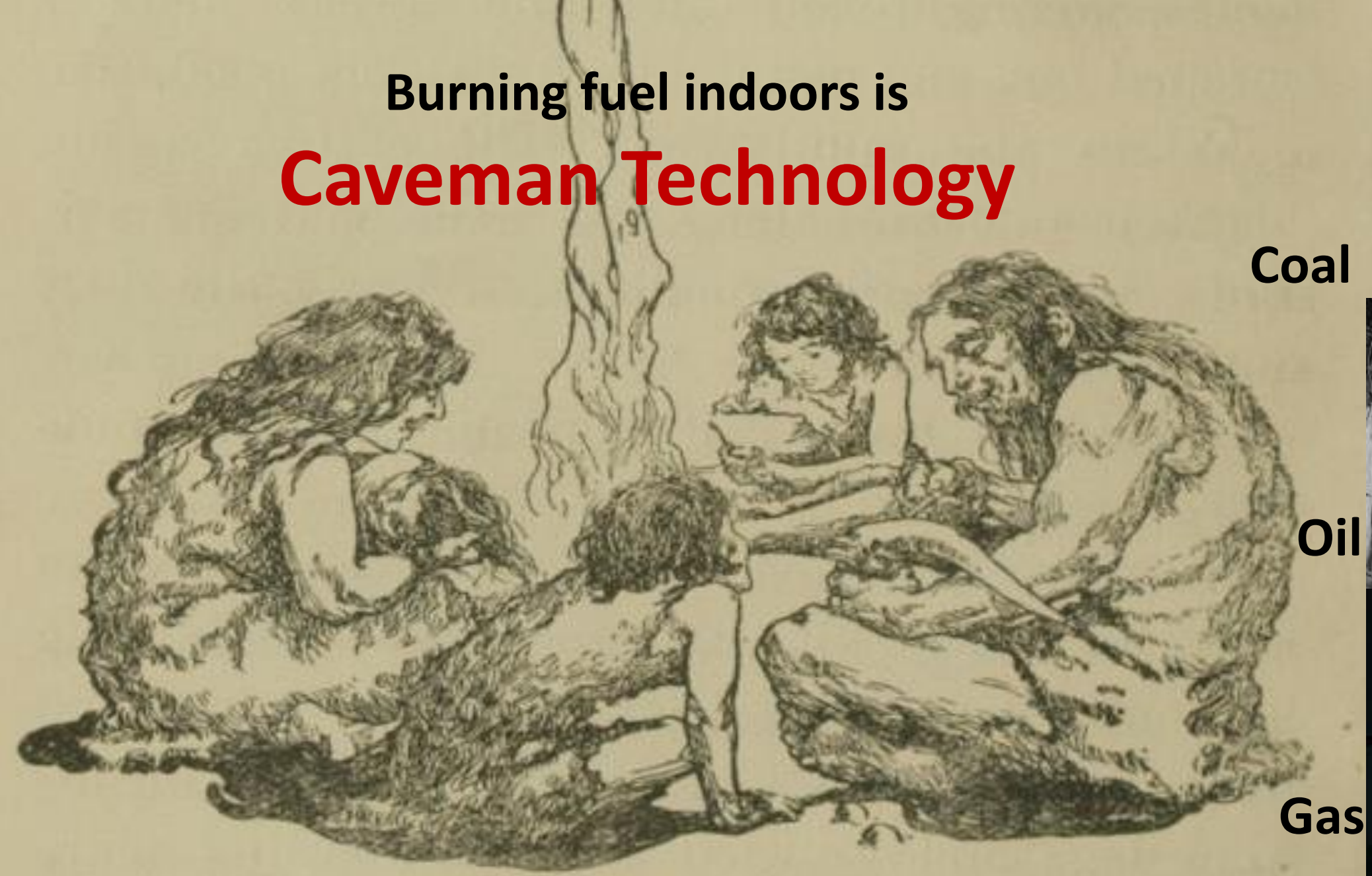
Little uses:

- Cooking
- Fireplaces



Burning fuel indoors is

Caveman Technology



Coal

Oil

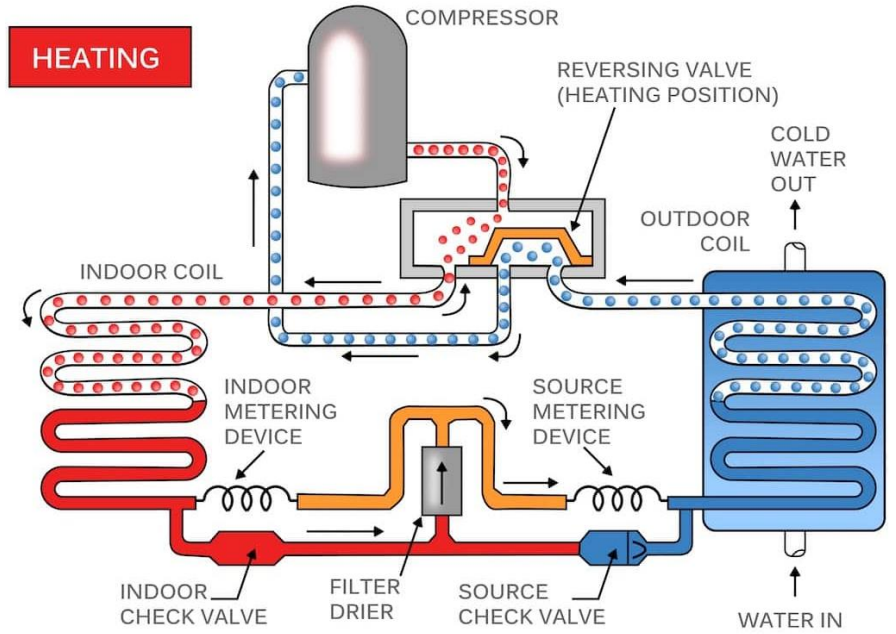
Gas

No electric resistance or fossil fuel space heating

All buildings, single & multi-zone.

Exceptions allow electric resistance heating for very small loads & supplementary heat:

1. **Dwelling units: Max 750 W** per habitable room (1000 W for corner room)
2. Other space types: Max 2.5 W/sf total installed heating (The “Passive House” rule)
3. Heat pump auxiliary heat in cold weather
4. …etc



Heat pumps squeeze warmth out of cold air

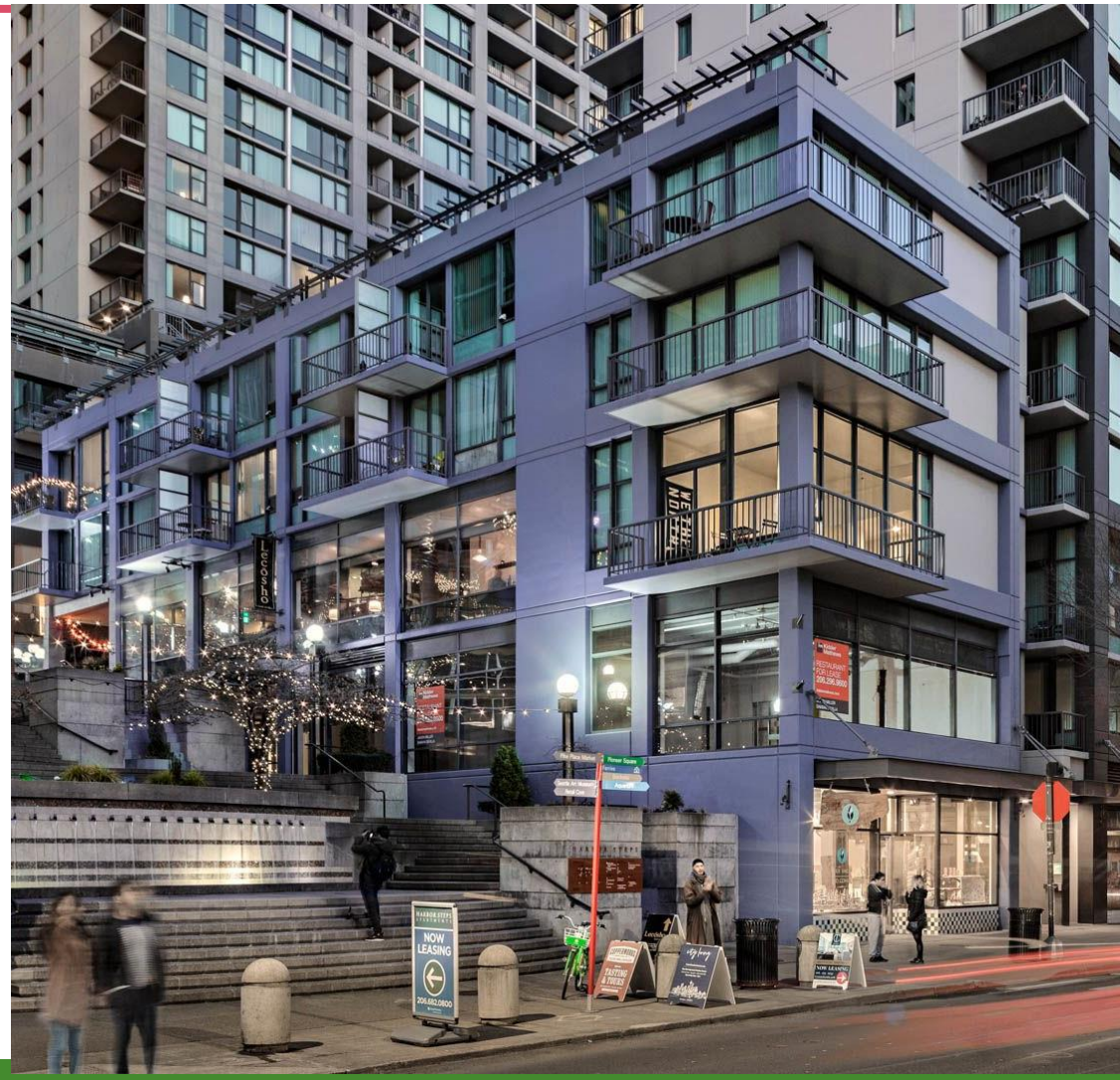
No Electric Resistance or Fossil Fuel Water Heating

For hotel & multifamily buildings with central domestic water heating:

- Use heat pump
- Not required for residential in-unit water heaters

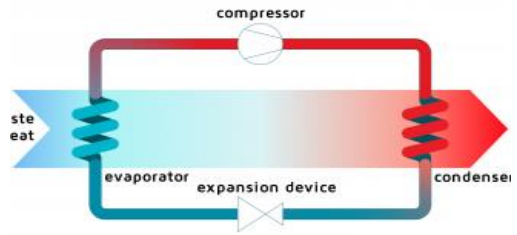
For other commercial buildings:

- Use heat pump
- Not required (yet) for alterations to commercial buildings



Heat pumps run on

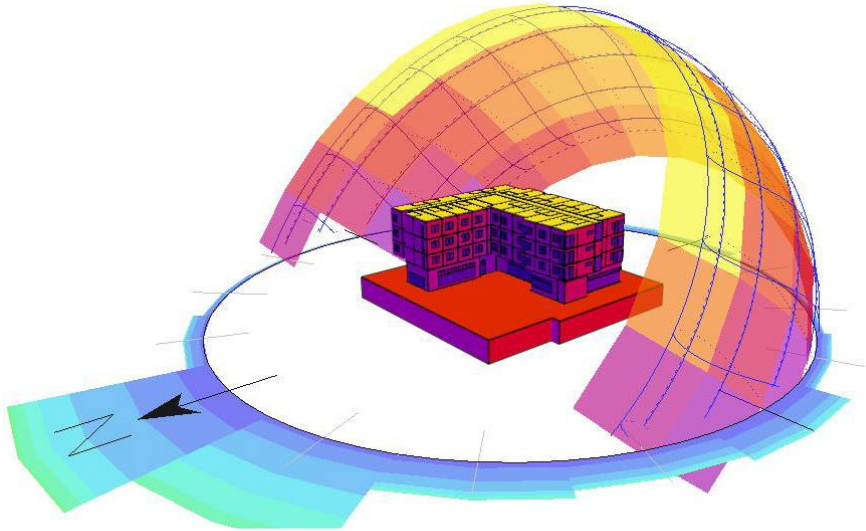
Renewable Energy



Heat pump separates out heat

Energy Modeling – CO_2 emissions based …and now including an EUI cap as well

- **Carbon emissions** compared with 2004 ASHRAE 90.1 standard
- Seattle BPF 10% below WA code
  - To align models with more stringent Seattle Energy Code requirements



SEATTLE 10% lower									
Building Area Type	Multi family	Health care	Hotel	Office	Rest.	Retail	School	Ware house	Others
Building Performance Factor	~~0.56~~ 0.50	~~0.54~~ 0.49	~~0.64~~ 0.58	~~0.54~~ 0.49	~~0.73~~ 0.66	~~0.47~~ 0.42	~~0.36~~ 0.32	~~0.48~~ 0.43	~~0.54~~ 0.49

More HVAC

- **From IECC: Occupied Standby** (modified for DOAS)
- **ERV (Energy recovery ventilation)** – everywhere
  - 60% effective
  - and “balanced ventilation” with ERV in multifamily
- **DOAS (Dedicated Outdoor Air System)** – major spaces
  - traditional VAV/reheat not permitted
- **TSPR (Total System Performance Ratio)**
  - = Heating & cooling at coils/total HVAC energy use
  - ensures overall annual efficiency of HVAC system
- **DCV (demand control ventilation)**
  - Assembly, restaurant, gym, conference, now **retail**

“Occupied standby” ventilation & temp control is huge.

- Shuts down ventilation & tweaks temp when space is unoccupied

Lighting & Solar

- **Renewable energy ~~0.25~~ 0.50, 0.75? W/sf of conditioned floor area**
  - Less complicated than CA rules
  - And 40% of net roof “solar ready”
  - But no storage requirement
- **Interior LPA (Lighting Power Allowance) 10% below ASHRAE**
- **50% of electric receptacles controlled**
  - by time clock or occupancy sensor
  - Office, classroom, break room…

Renewable energy

- ~~**0.25**~~ **0.75? W/sf** of conditioned floor area
- Option: More efficiency credits
- Affordable housing exempted
- Option: Gift to affordable housing

Building Stories	Roof Area Required
1	1.8%
2	3.6%
4	~~7.2%~~ 14.5%
6	10.9%
8	14.5%
10	~~18.1~~ 54.3%
12	21.7%
14	25.4%
16	29.0%
18	~~32.6~~ 98.0%
20	36.2%

This is how change happens

- **Code creates change at massive scale**
- More political than technical
- “2024” code will take effect in **2026**, then:
  - First “2024” buildings occupied in **2028**
  - Final 2024 buildings occupied in **2033**
- **…so this will really be our “2030” code**
- Not the time for timid measures

Duane Jonlin, FAIA
duane.jonlin@seattle.gov
206-233-2781

Leaders make it happen

followers can catch up later