We will be starting soon!

Thanks for joining us

Centralized versus Decentralized Ventilation Systems

Eric Fenno, Small Planet Supply

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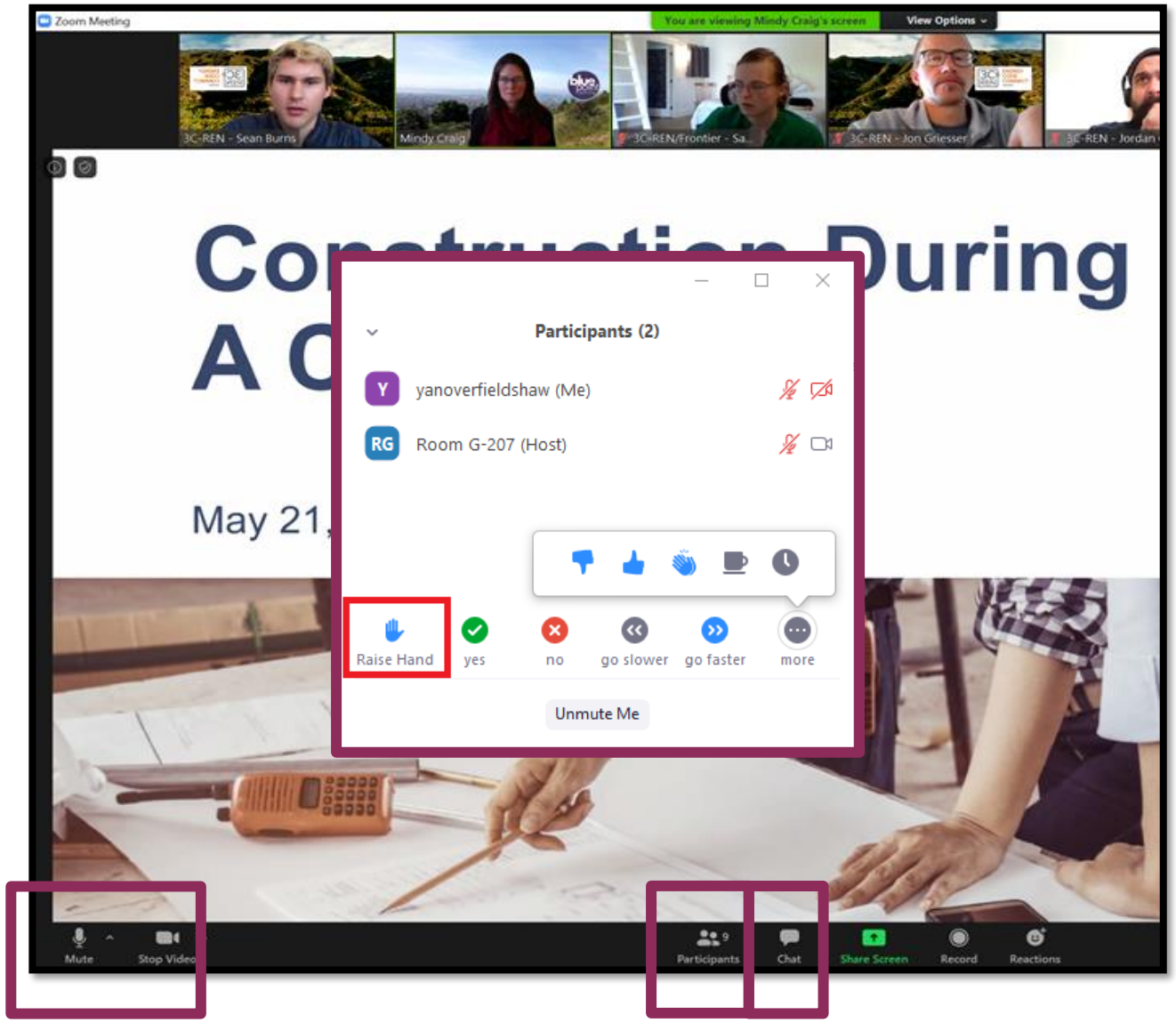
Zoom Orientation

- Please be sure your full name is displayed
- Please mute upon joining
- Use "Chat“ box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be recorded and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



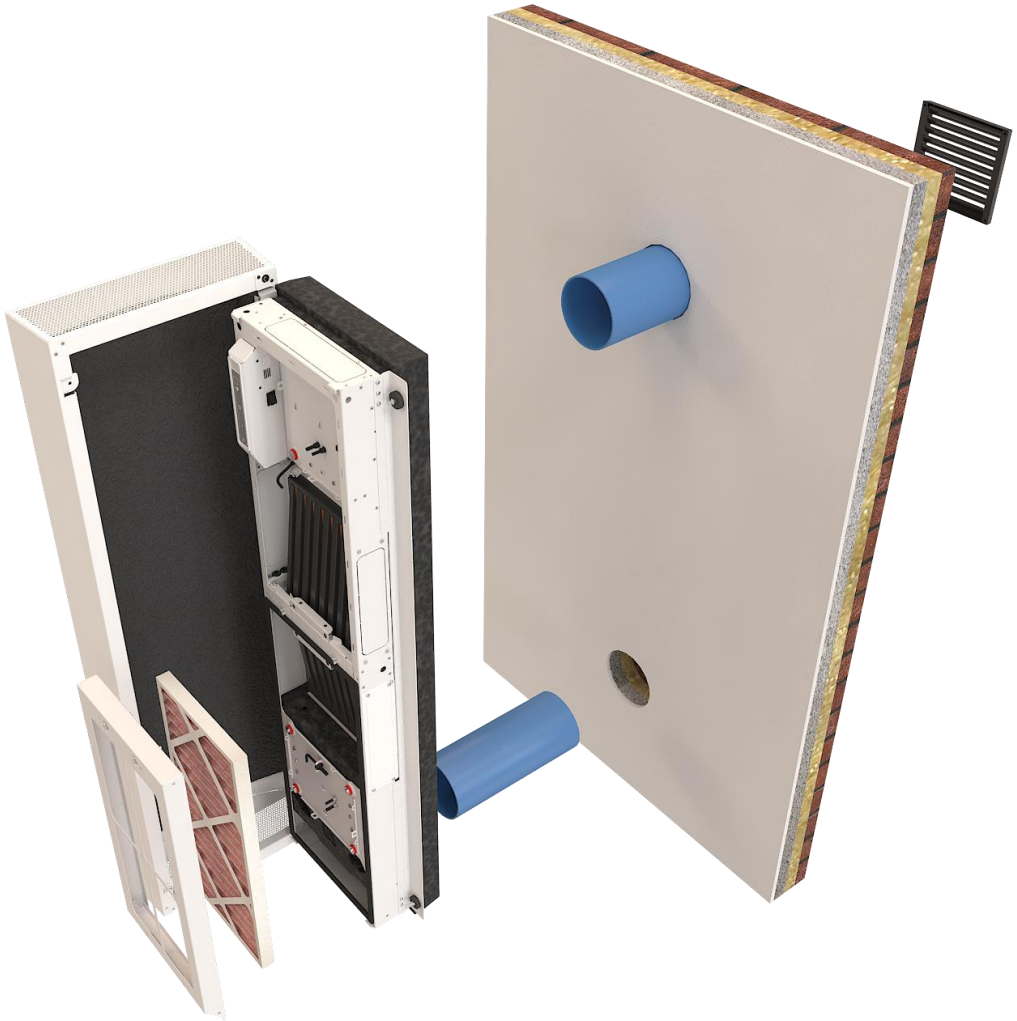
3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
  - **Building Professionals:** industry events, training, and energy code compliance support
  - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region

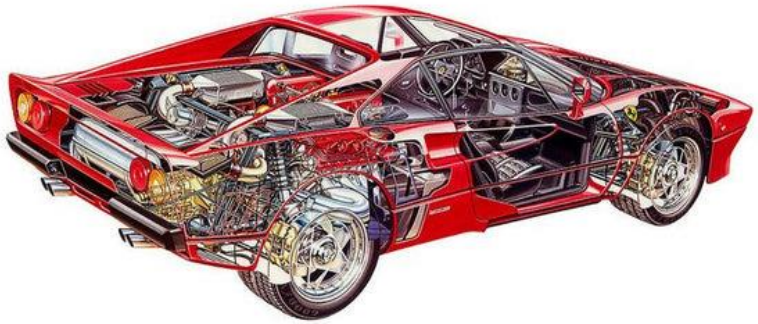
3C-REN Programs

- Energy Code Connect (ECC)
  - Industry Trainings and Regional Forums
  - Energy Code Coach: Title 24 Compliance Support Hotline (805) 220-9991
- Building Performance Training (BPT)
  - Industry Trainings & Certification for current and perspective building professionals
  - Helps workers thrive in an evolving industry
- Home Energy Savings (HES)
  - Flexible Home Energy Upgrades
  - Multifamily (5+ units) & Single Family (up to 4 units)

Central and Decentral



Ventilation is important (but not super exciting)



- If you do it right, nothing (visible) happens
- If you don’t, you have expensive problems
- It’s both kind of boring and extremely important
- Brush your teeth and ventilate your projects

Why is ventilation necessary?

Natural Ventilation

Marginally Insulated (if at all)

Not airtight (by design)

Durable, proven, simple.

Needs large continuous energy input to remain comfortable to live in, offers no protection against exterior humidity.

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PLAN IT WITH THE PLANET IN MIND

Modern Construction

Well Insulated

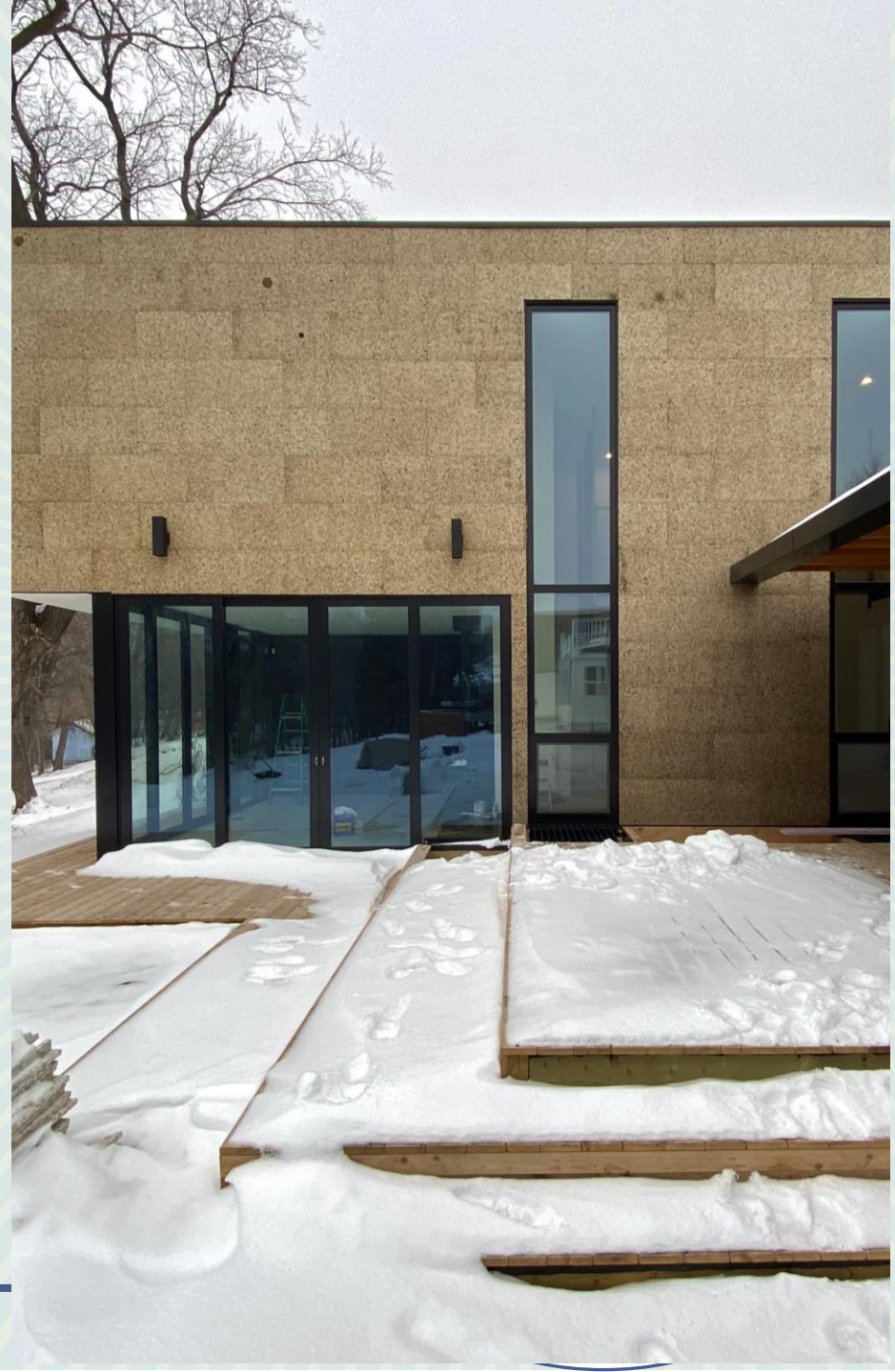
Airtight

Thermally efficient! Low energy input to condition.

Durable*, proven, not too complex but some new ideas.

Essentially a code-standard building in many states as of 2021 IECC. (Most states just copy and paste)

*if it's ventilated right
**namely, being ventilated right



Why do we build a thermos and not a colander?

1. Comfort!* No drafts, easy to condition, quieter, protect us from the elements better. *Driven by consumers*.
2. Energy efficiency – lower bills, lower demand on infrastructure, more rarely folks want to have zero demand on infrastructure (off-grid.) As energy production and consumption profiles change, homes are the most impactful target to address shortcomings in infrastructure. *Driven by policy*.
3. Value – It takes a lot of skill, knowledge, and craftsmanship to build a house that performs well, and if it performs well, it will be comfortable and durable.* *Driven by consumers and professionals*.
4. Climate concerns – Residential energy consumption is a leading contributor to greenhouse gas production. *Driven by some consumers, policy, and some professionals*.

*if you ventilate it right

IAQ Numbers

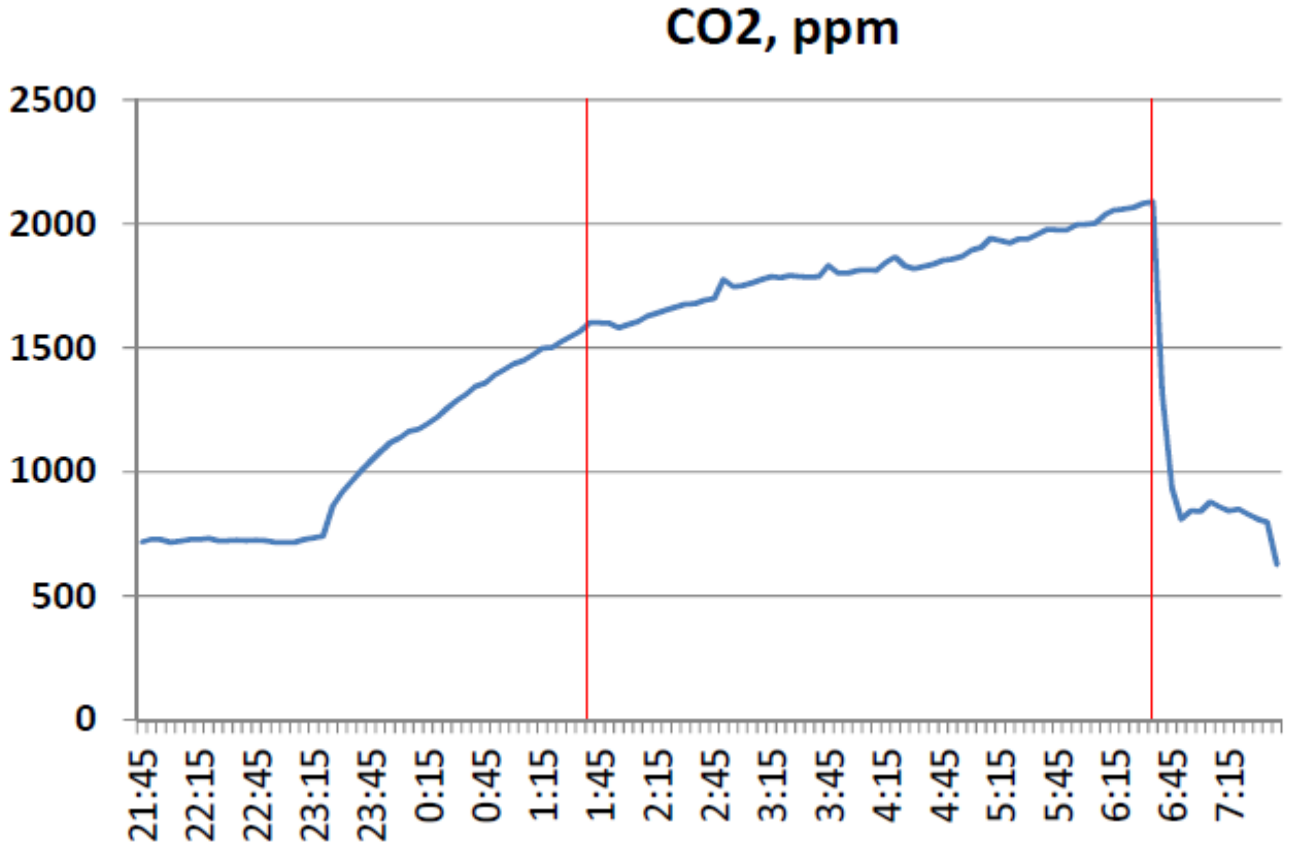
Parameters	Unit	Ideal Range	Effects
CO2 - Carbon Dioxide	ppm (partes por millón)	300 - 800 ppm	Drowsiness, headaches, loss of attention...
PM 10 - Particles < 10 µm in diameter	µg/m3	max 150 µg/m3 (exposure 24h)	Respiratory and cardiovascular diseases, asthma and respiratory infections.
PM 2.5 - Particles < 2.5 µm in diameter	µg/m3	max 35 µg/m3 (exposure 24h)	Because of their size, they pass through the lung barrier and enter the bloodstream, making them one of the most dangerous particles, as they are practically invisible and the body's defences are not effective in stopping them.
VOCs - Volatile Organic Compounds	mg/m3	Depends on the compound	Short term: headaches, coughing, eye inflammation. Long term: anxiety, asthma.
Temperature	°C	19 -21°C winter 24 - 26°C summer	Outside this range, people enter the discomfort zone. Loss of concentration, complaints, cold, etc.
Humidity	%	40 - 60%	Outside this range, humidity helps the survival of viruses, bacteria, fungi and dust mites.

- Just some reference levels for context in the next few slides.

CO2 – 800-1000ppm is the normally accepted guideline.

rH – 30-60% is normally accepted guideline.

What happens if you don't ventilate a normal house?

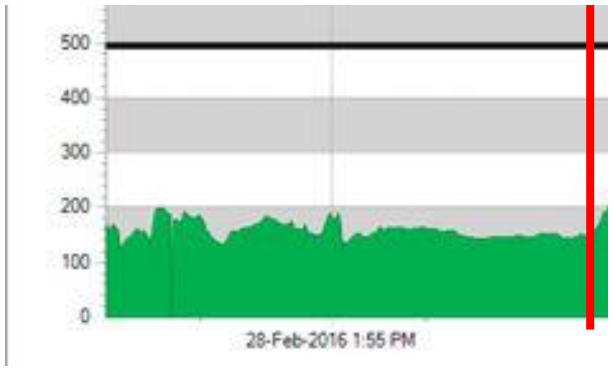


House is 5.0 ACH
At 50 PA

- Bedroom occupied at 11:15 pm with door closed
- Exhaust fan turned on at 1:30 am at 88 CFM (ASHRAE 62.2 Rate for house is 62 CFM
- Exhaust fan off at 6:00 am
- Door open at 6:30 am

What happens if you don't ventilate a tight home?

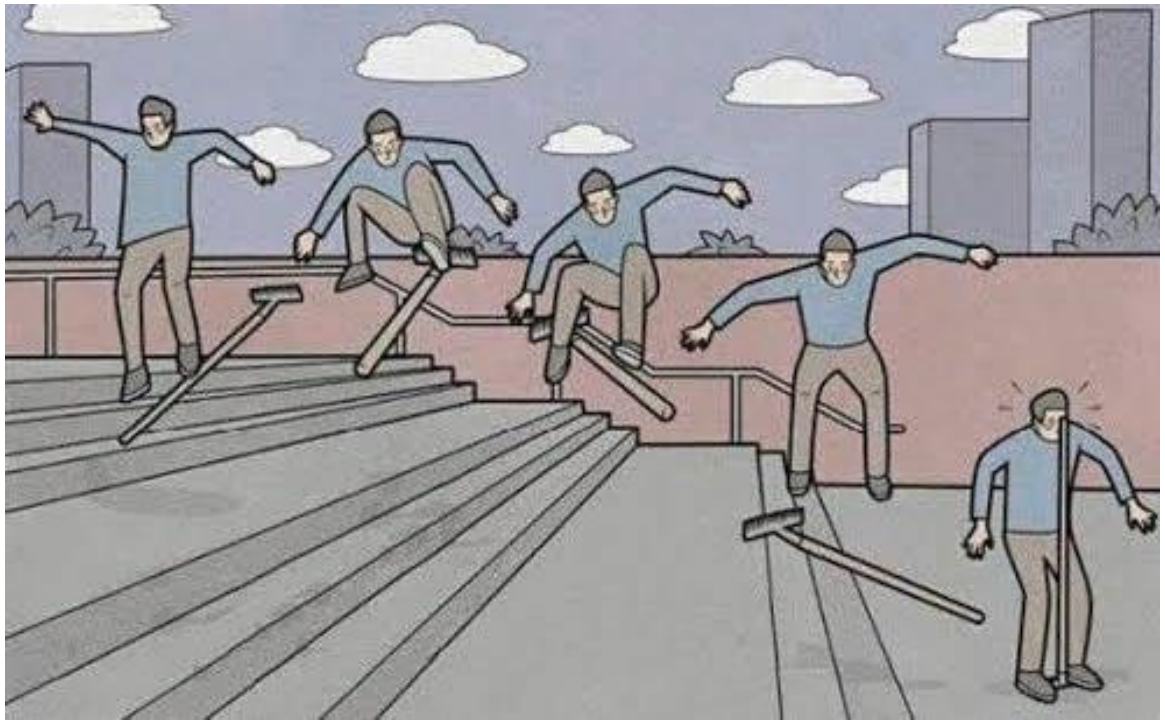
New home on Monterey Peninsula with ventilation system running shows VOC levels well below the WHO recommendation.



← WHO Recommendation

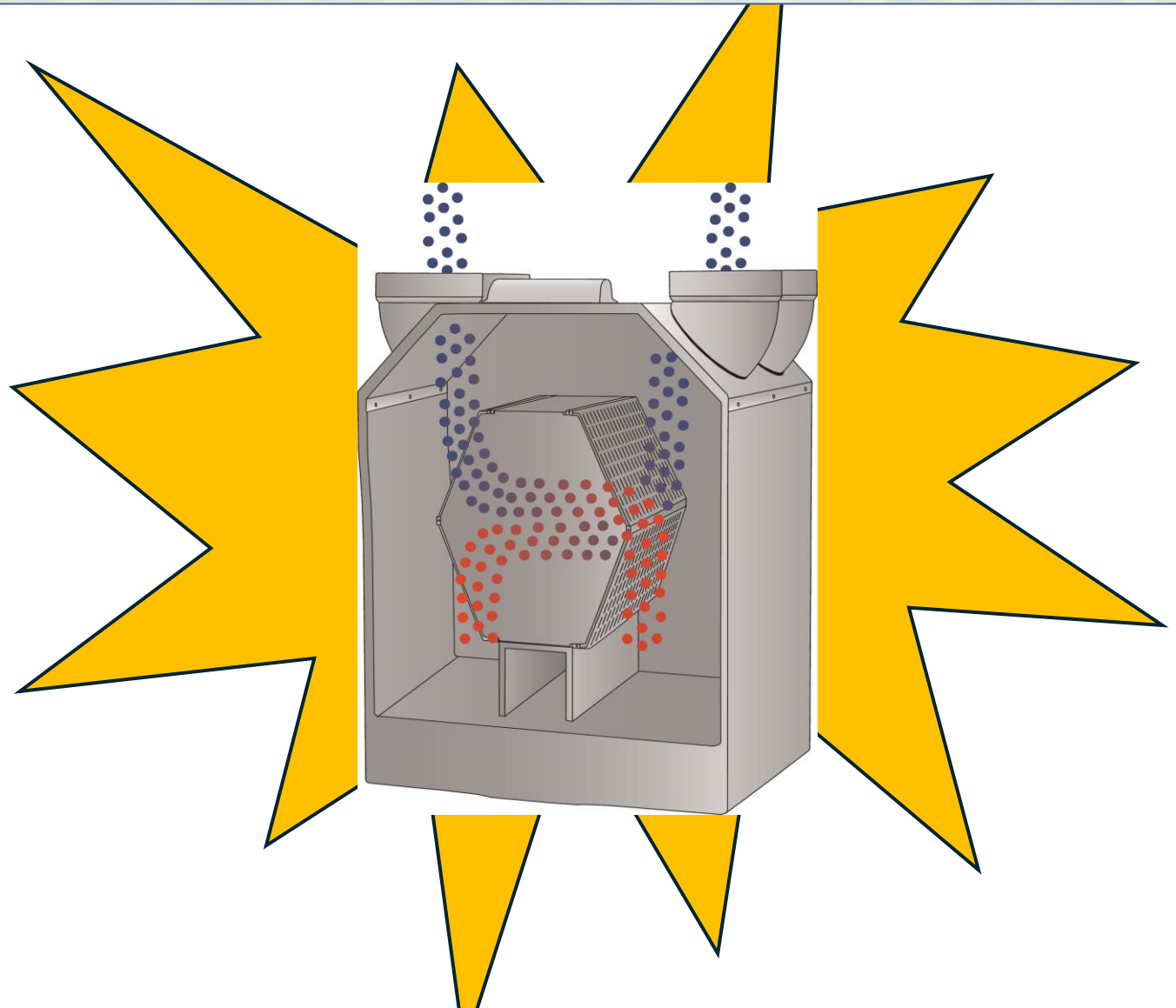
TVOC ppb

Could I just stab a hole in the thermos for air?



- Yes! People do! It's not great!
- 90% of the money, 90% of the effort, 90% of a thermos, just to turn it into a code-compliant colander that still doesn't solve those problems
- Not driven by spite (usually) but rather by not being aware that better options exist
- It is (technically) still ventilated, at least as far as your code guy is concerned.

Instead we use Recovery Ventilation

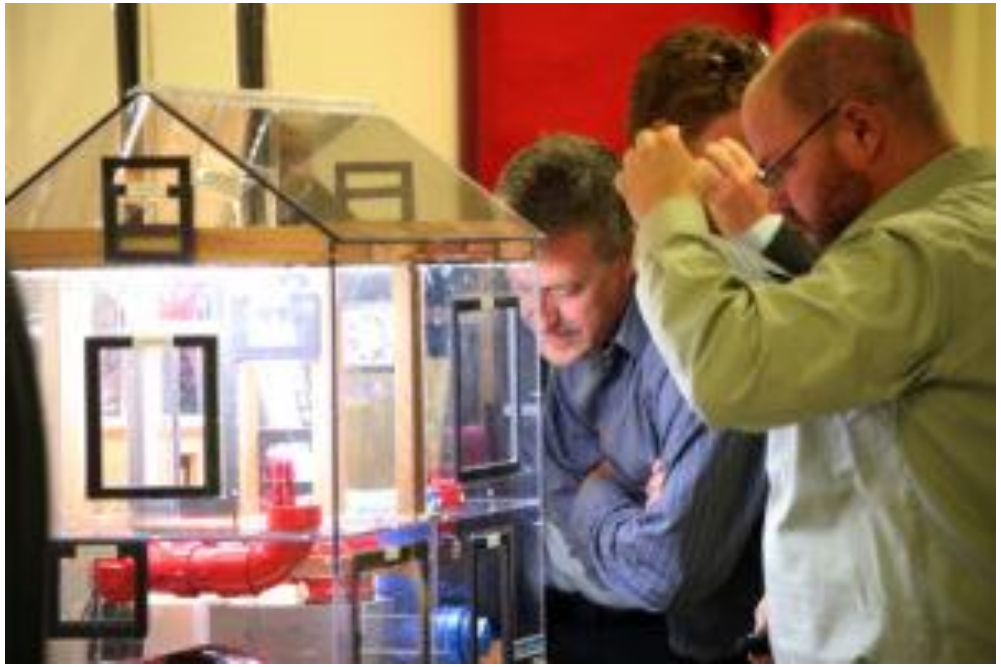


- Uncontrolled -> Controlled
- Central filtration
- Known volumes of air
- Purpose built, stand-alone systems.
- Can recover up to 95% of energy from exhausted air.
- Can be sole source of air movement in home
- Continuous management of IAQ

Balanced Ventilation

Continuous Flow Rate (CFM)	
Supply	Extract
	34
	22
	20
	22
	25
	13
32	
13	
13	
13	
13	
20	
32	
	27
	27
18	
18	
18	
190	**190**

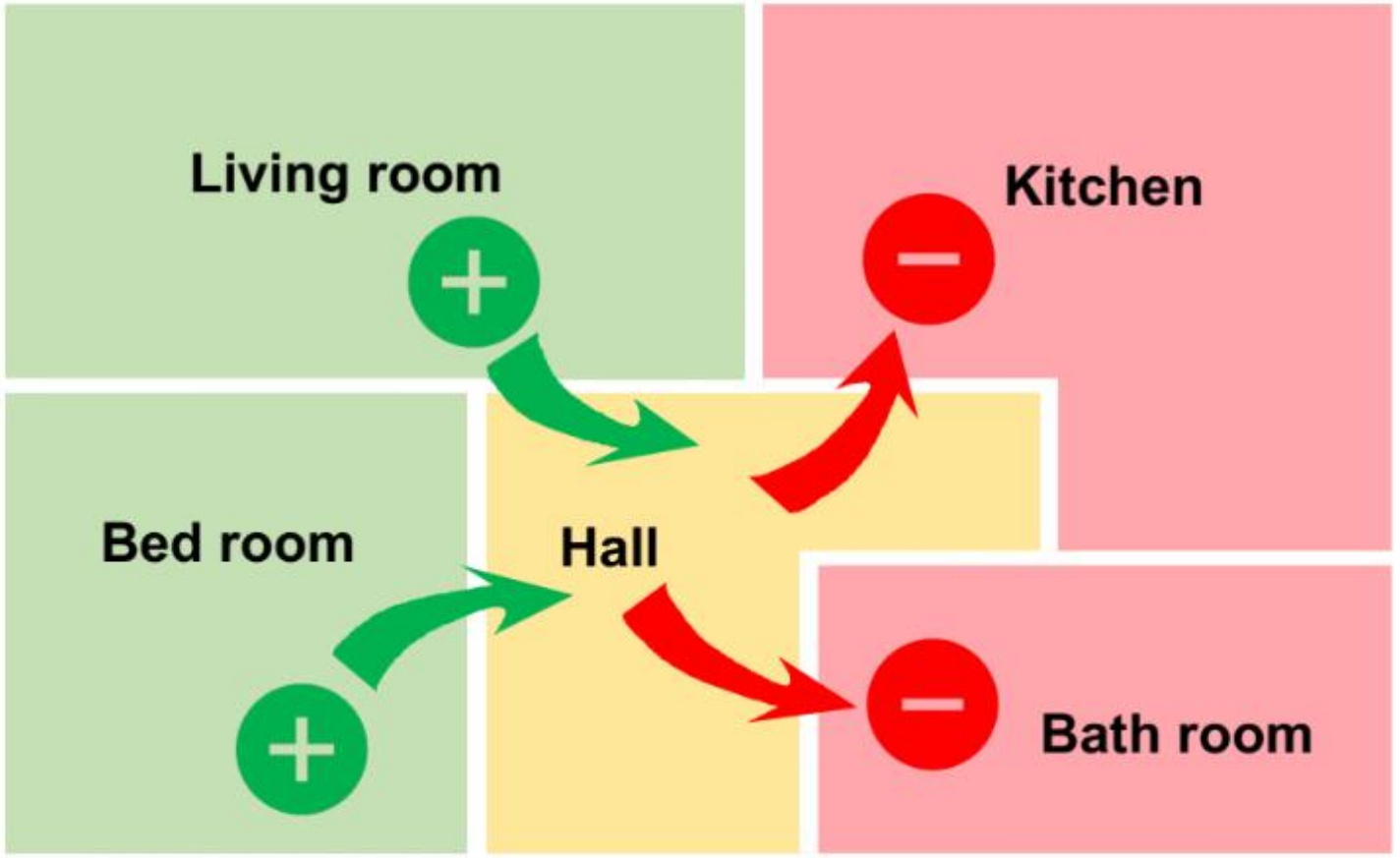
Central H/ERV Air Schedule



House of Pressure-Building Performance Institute
https://www.communityhousingpartners.org/energy-solutions/research-training-center/house-of-pressure/

Ventilation Goals

- Supply fresh air into living areas
- Remove stale air from areas of concern
- Use pressure to drive from + to -.
- Extract *controls*, supply dilutes.



Questions?

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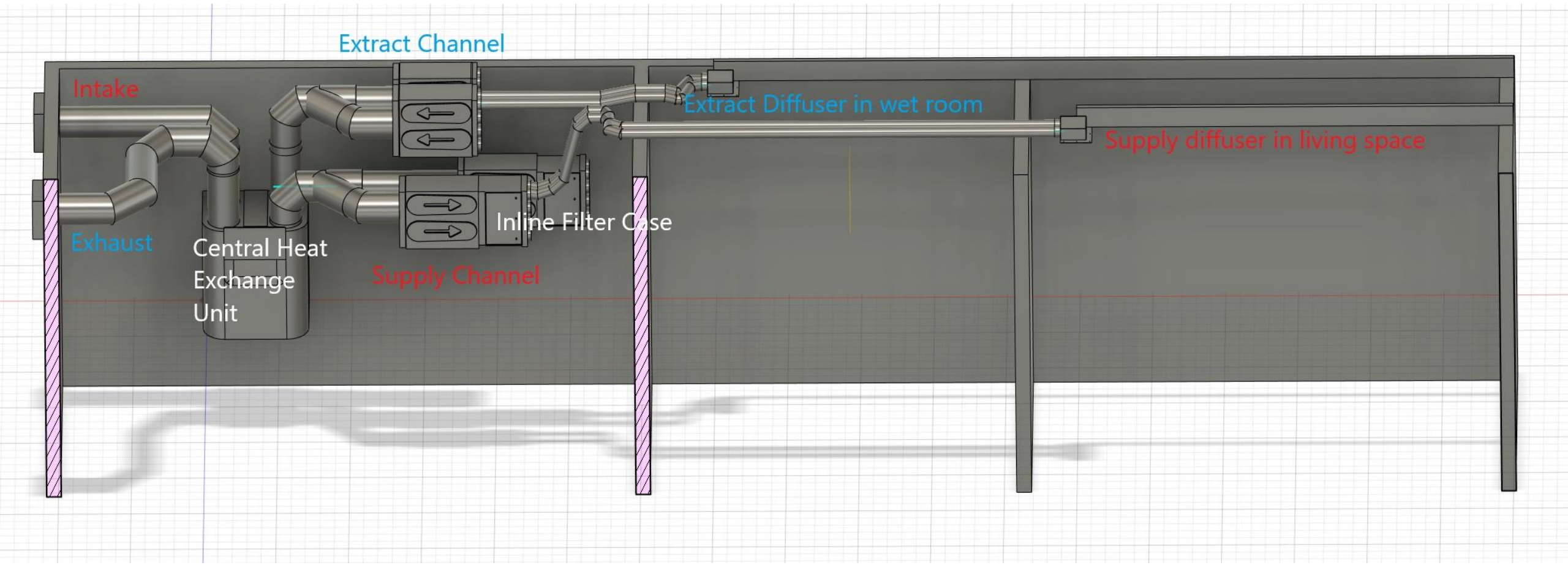
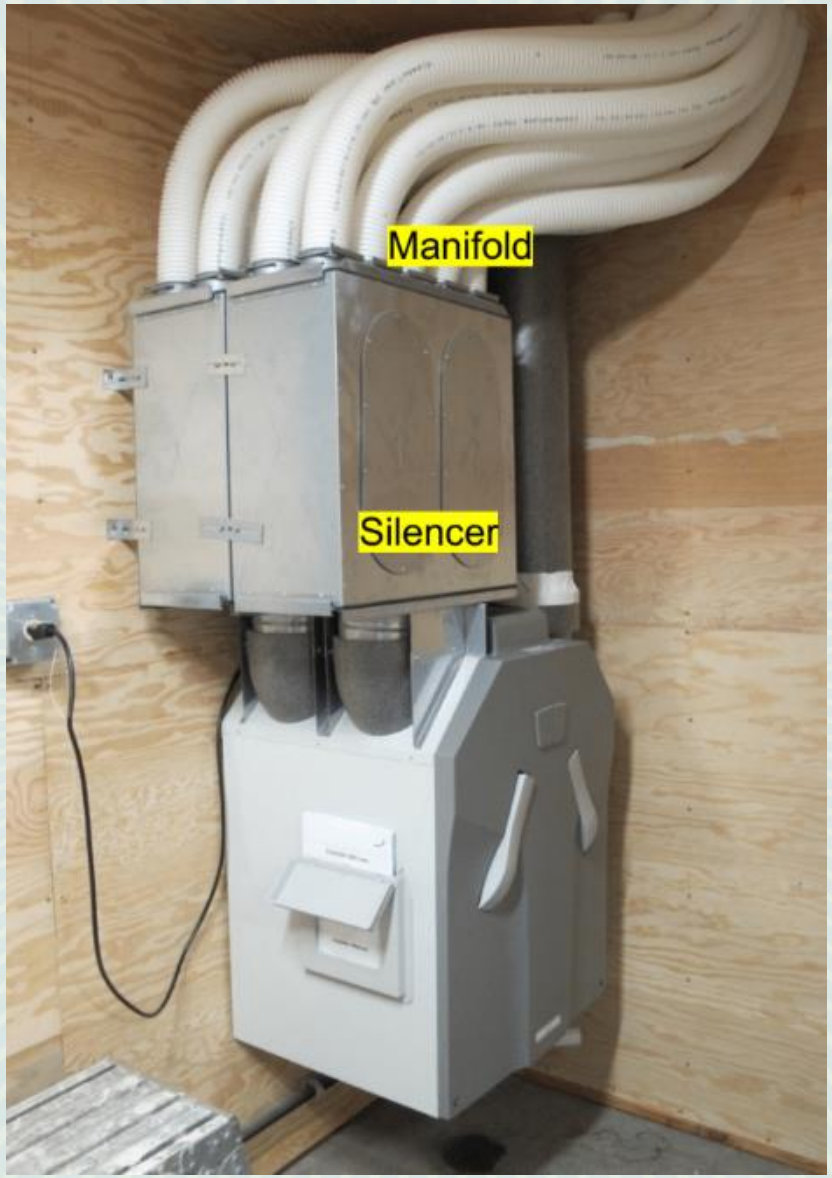
Balanced Central Ventilation





Central Ventilation

- Typically continuous and balanced
- Many brands and form factors
- Many installation options
- Pay special attention to duct sizing and installation
- Not just a box to check, we have a function to perform

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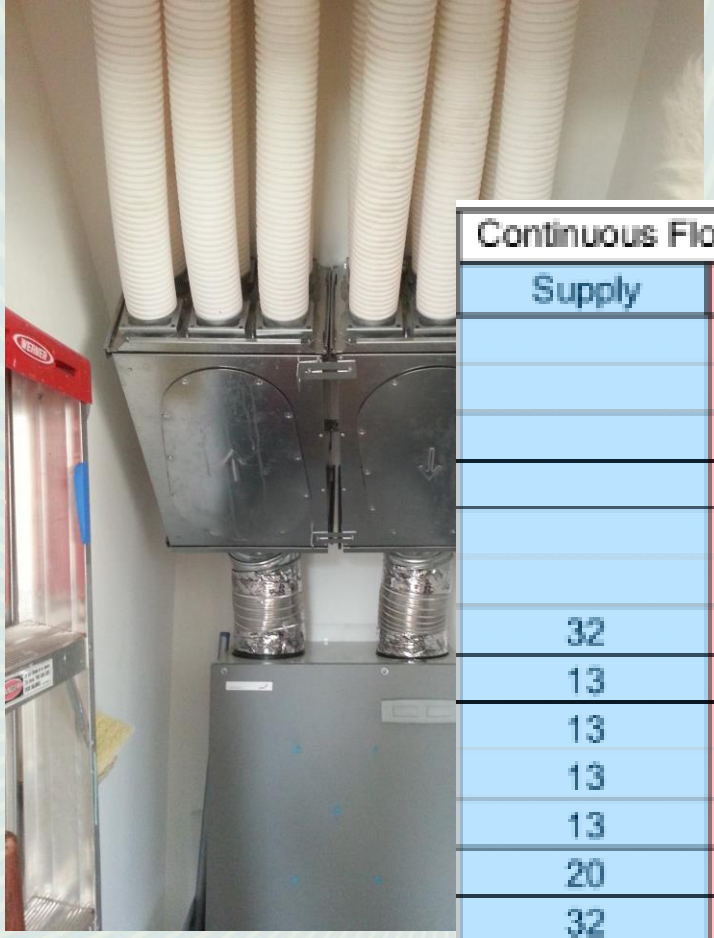
HRVs are bad at conditioning!

- Integrating with improperly-sized ductwork is to be avoided (Forced air systems)
- Many manufacturers approve this implementation, can and should are different
- HRVs don’t condition well, don’t move enough air
- Leave these separate if you have both

Central Ventilation Design

- Planning is key
- You will need space for ducting and equipment
- Systems need specific duct sizing, cannot simply use 5-8” duct everywhere. Manufacturer will specify.
- Exterior ducting must be insulated
- Must have a condensate-management solution
- Put unit somewhere accessible, filters need to be changed regularly
- Commissioning (testing) is important, encouraged, possible, and in some cases required
- Low static pressure, if not using home runs beware of trunk and branch systems.



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	34
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190	190

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Central Ventilation Use-Cases

- Pros: Powerful systems, efficient, stand-alone (ideally), provide excellent opportunity for filtration, can replace bath fans (requires commissioning) unobtrusive, controllable, predictable.
- Cons: Ductwork, space constraints. Harder to retrofit, sensitive to installation issues, total system cost can be high, engineering/design/planning recommended.
- Cases: New construction, single family, deep energy retrofits, large-scope renovations, energy-oriented certification, high sensitivity

Questions?

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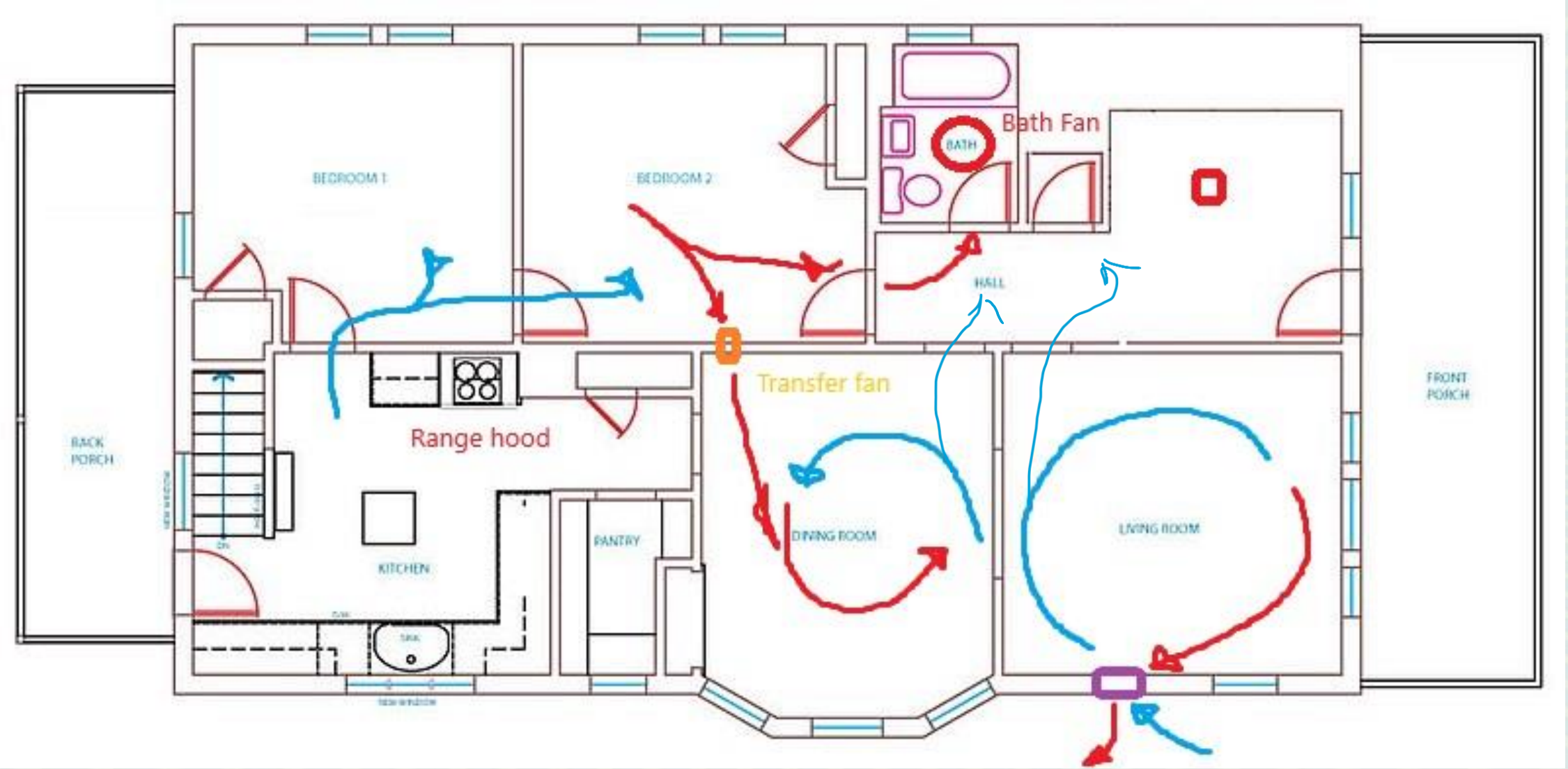
Decentral Ventilation



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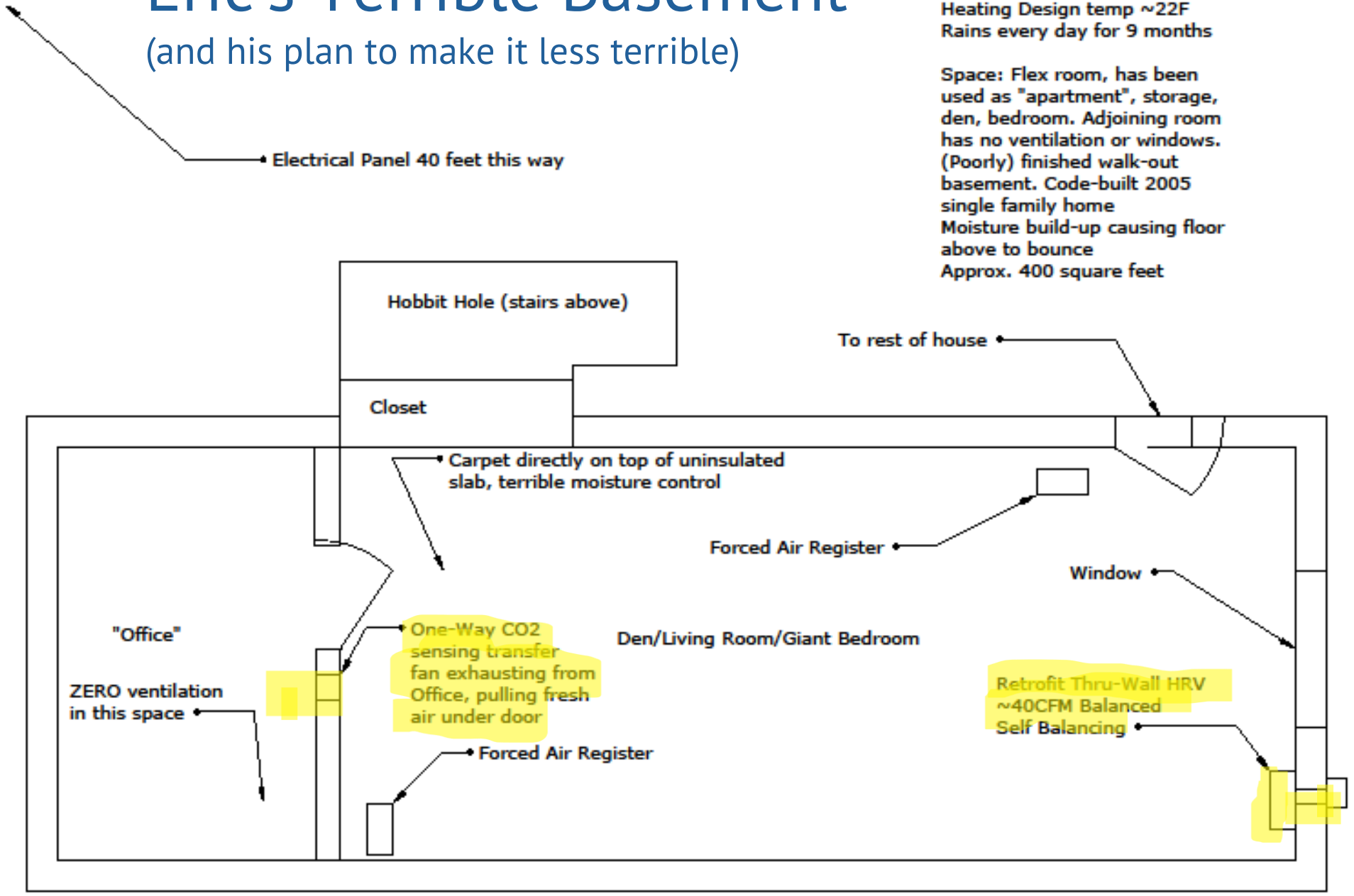
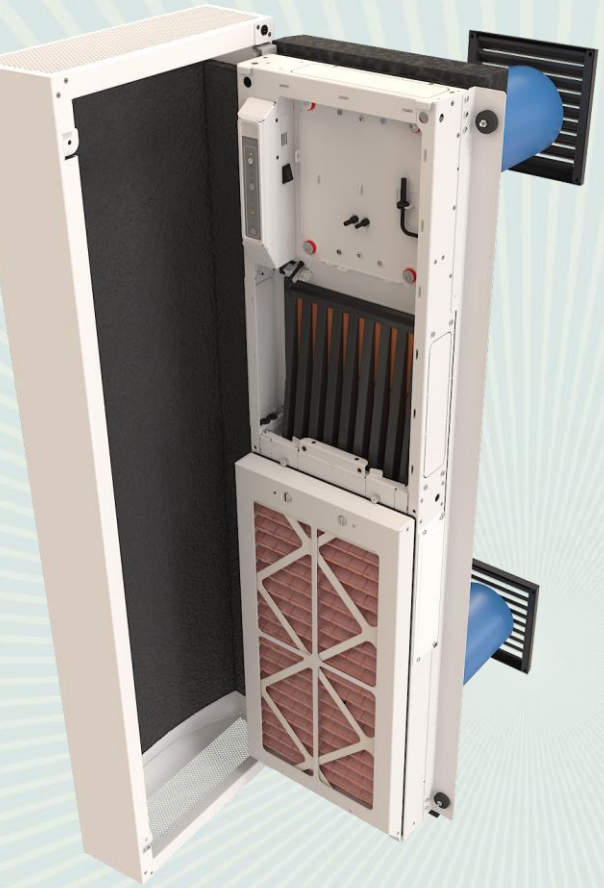
Eric's Terrible Basement

(and his plan to make it less terrible)

Western WA:
HRV Climate
High Humidity in winter
Temperate-Maritime climate
Heating Design temp ~22F
Rains every day for 9 months

Space: Flex room, has been used as "apartment", storage, den, bedroom. Adjoining room has no ventilation or windows. (Poorly) finished walk-out basement. Code-built 2005 single family home
Moisture build-up causing floor above to bounce
Approx. 400 square feet





Decentral Ventilation Cases

- Pros: Flexible, easy to install, low space requirements, perfect for ADUs, partial ventilation, retrofits, smaller projects. Can work in tandem with ceiling fans, transfer ducts etc to distribute, can still provide excellent filtration.

  Cons: Not quite as robust as a central system, not all are suitable for bath extraction, can be a little more intrusive to living areas, need to account for enclosed rooms. Typically not as feature-rich as central systems. Larger projects require multiple units.

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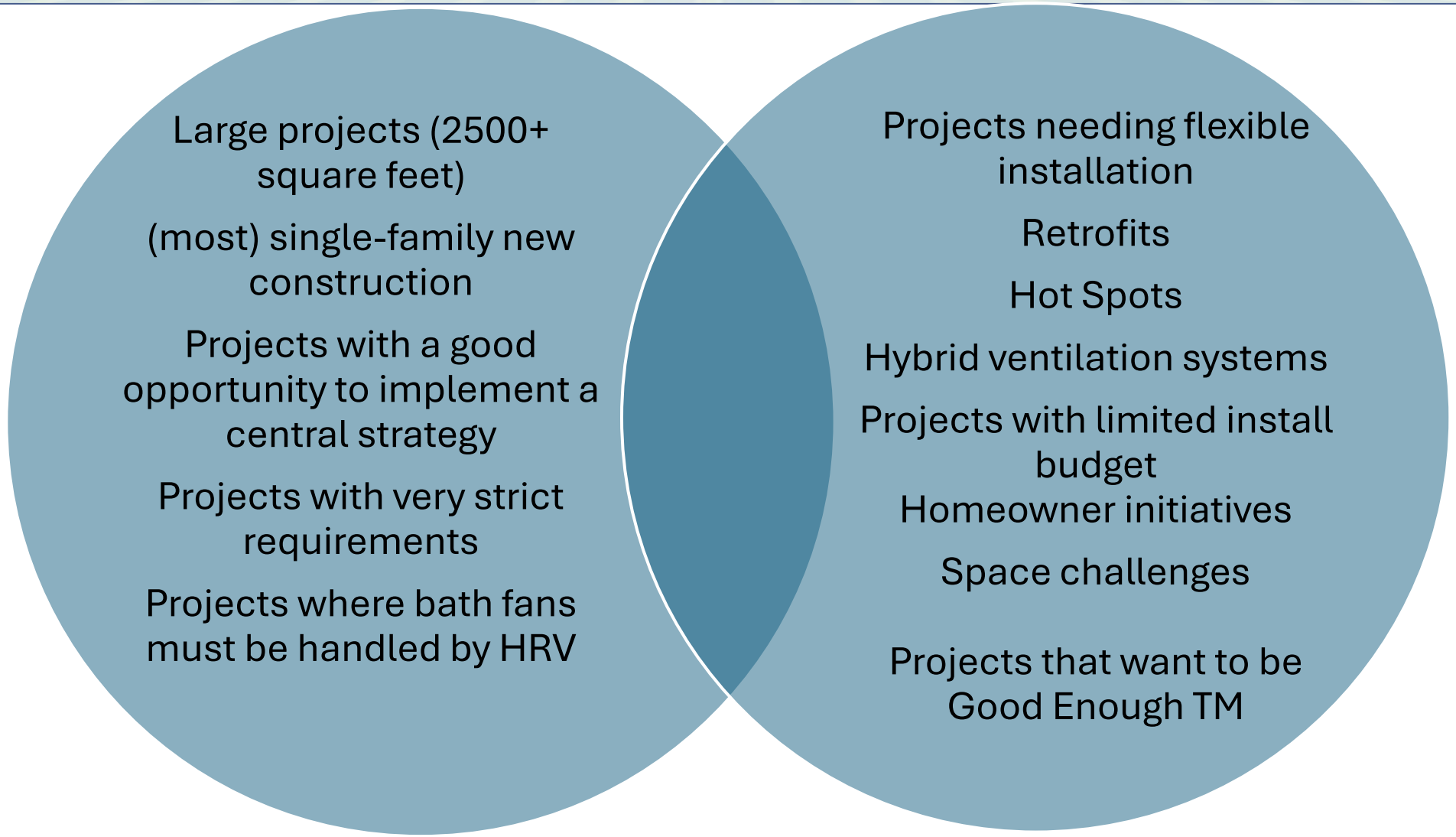
Central vs Decentral Recap



Questions?

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Closing

- Continuing Education Units Available
  - Contact itzel.ltorres@ventura.org for AIA
- Coming to Your Inbox Soon!
  - Slides, Recording, Survey – Please Take It and Help Us Out!
- Upcoming Courses
  - 12/19: Carbon Reduction through Building Electrification – Part 1: All-Electric Design & Construction
  - 1/9: Heat Pumps for Heating & Cooling – Part 2: All-Electric Design & Construction
  - 1/16: Certified Passive House Designer/Consultant (CPHD) Pacific Winter Hybrid Cohort
  - 1/16: Domestic Hot Water – Part 3: All-Electric Design & Construction
  - 1/22: Introduction to the Energy Code
  - 1/23: Ventilation & HRV – Part 4: All-Electric Design & Construction
  - 1/30: Appliances & Energy Storage – Part 5: All-Electric Design & Construction Series
  - 2/6: Home Electrification Contractor Boot Camp
- For more information about upcoming events please visit: https://www.3c-ren.org/events

Questions about Title 24

Energy Code Coaches are local experts who can help answer your Title 24 questions. Coaches have decades of experience in green building and energy efficiency improvements. They can provide citations and offer advice for your project to help your plans and forms earn approval the first time.

Online:
3c-ren.org/codes

Call:
805.781.1201

Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org

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SAN LUIS OBISPO • SANTA BARBARA • VENTURA