



We will be starting soon!

Thanks for joining us



Zoning for Heat Pumps – Strategies for Best Outcomes



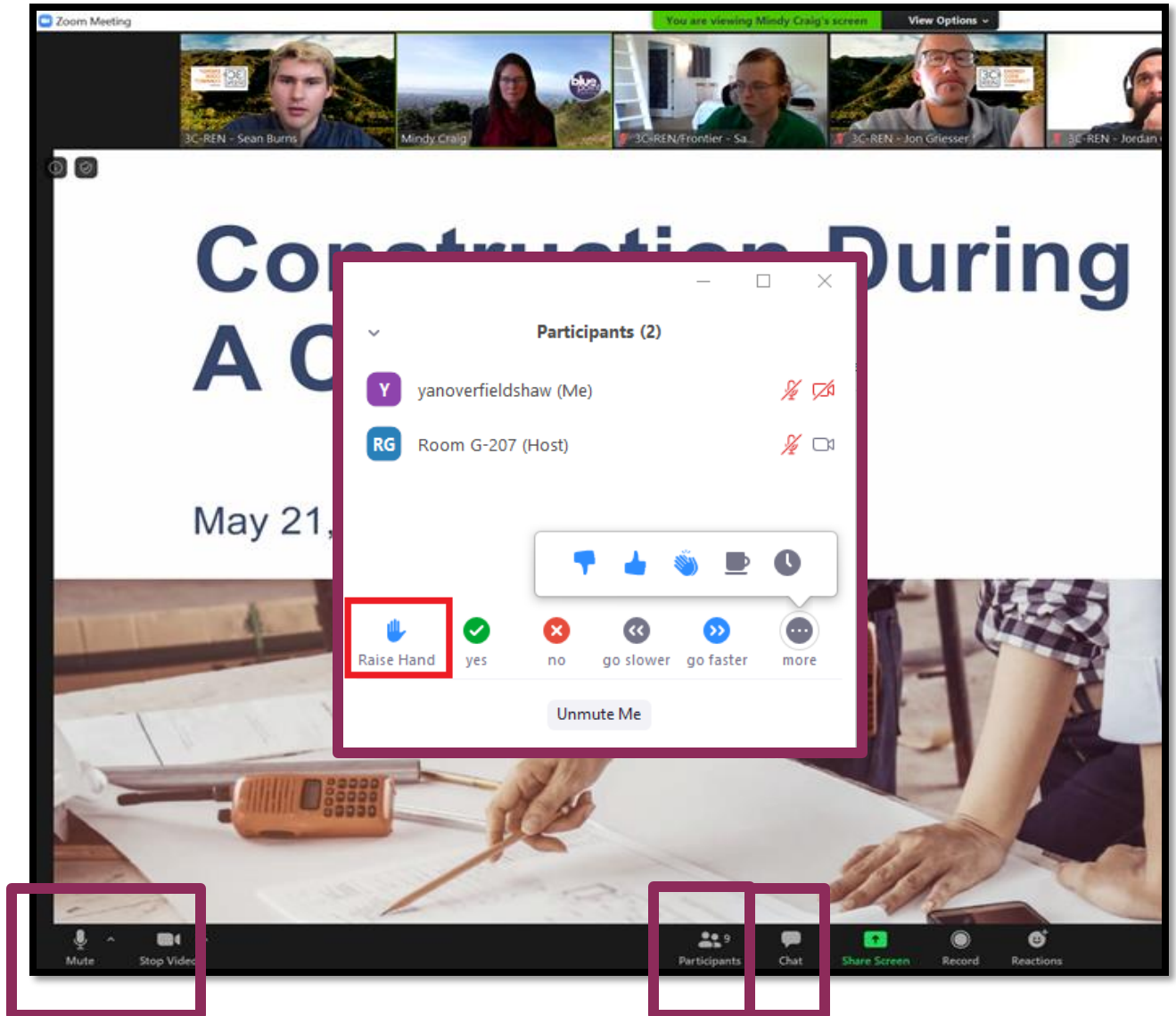
Larry Waters – Electrify My Home

July 18, 2024



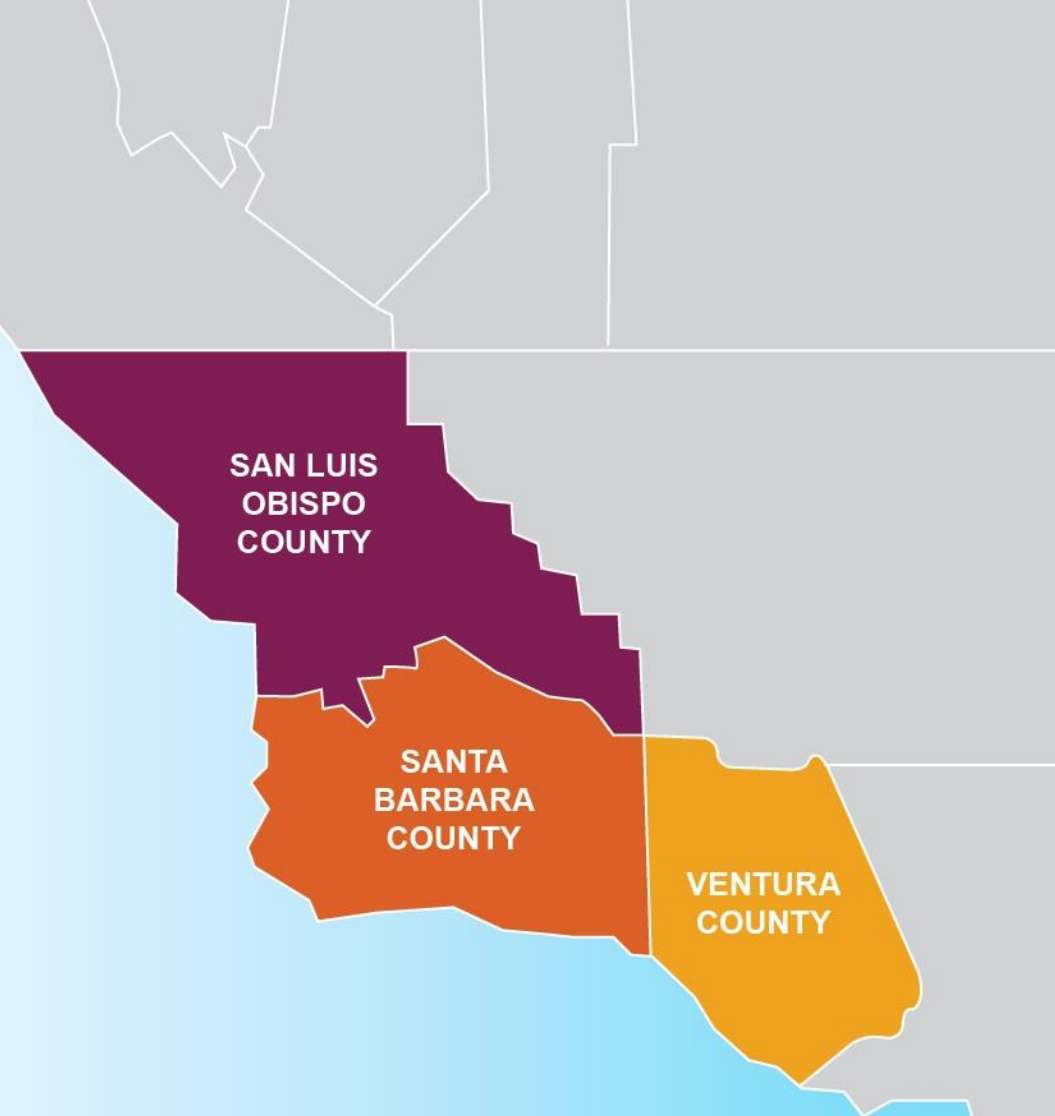
Zoom Orientation

- 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



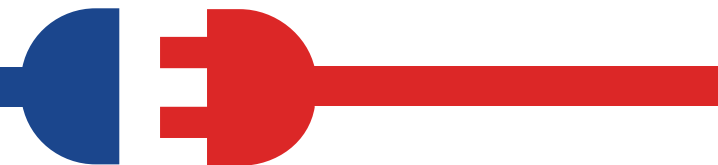
3C-REN Programs

- **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)



Agenda

- ✦ **Introductions and Welcome**
- ✦ **Introduction – Why Zoning?**
- ✦ **Ducted Zoning Tips**
- ✦ **Ductless Multizone Overview & Case Study**
- ✦ **Multizone Ducted Case Study**
- ✦ **Interview with Special Guest, Randy Jenkins!**



Electrify My Home – Electrification Pioneers

Our Mission:

*To provide the **most efficient** cost-effective electrification solutions to California homeowners, to practice **good stewardship** of the electrical panel, and to **train and influence** other contractors to do the same.*

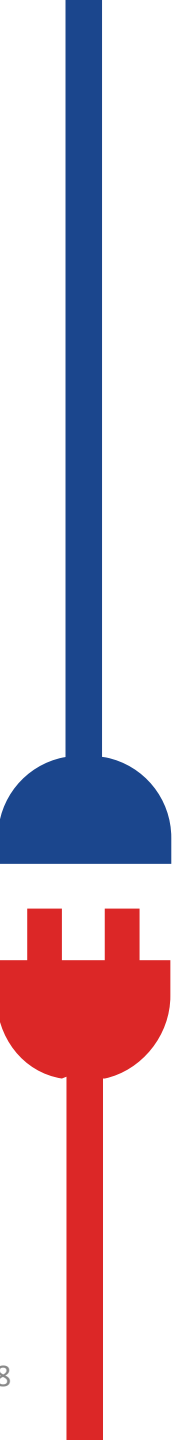




#ElectrifyEfficiently

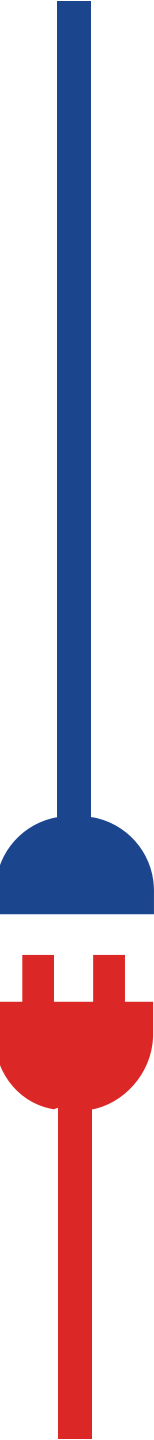
Areas of Focus

- 🔌 **Building electrification (single family residential)**
- 🔌 **HVAC & water heating (heat pumps)**
- 🔌 **Overcoming home electrification barriers**
- 🔌 **Approaches that optimize for comfort, efficiency, resilience, and low operational cost**
- 🔌 **All audiences will benefit, especially contractors and industry professionals**



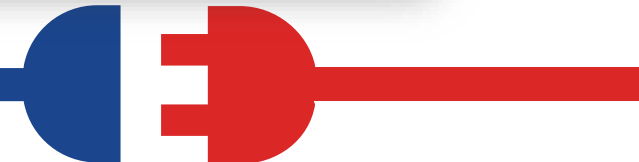
Introduction

Why Zoning?



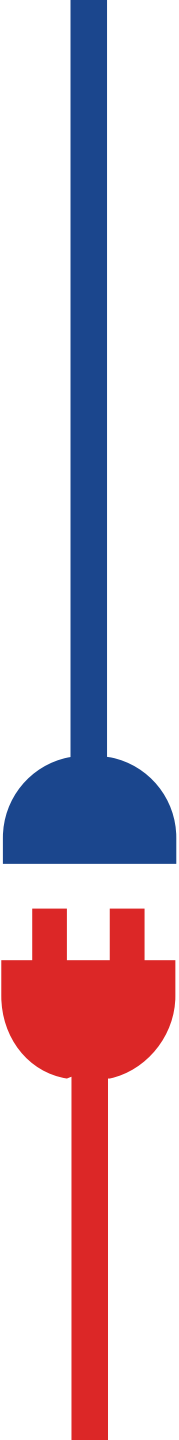
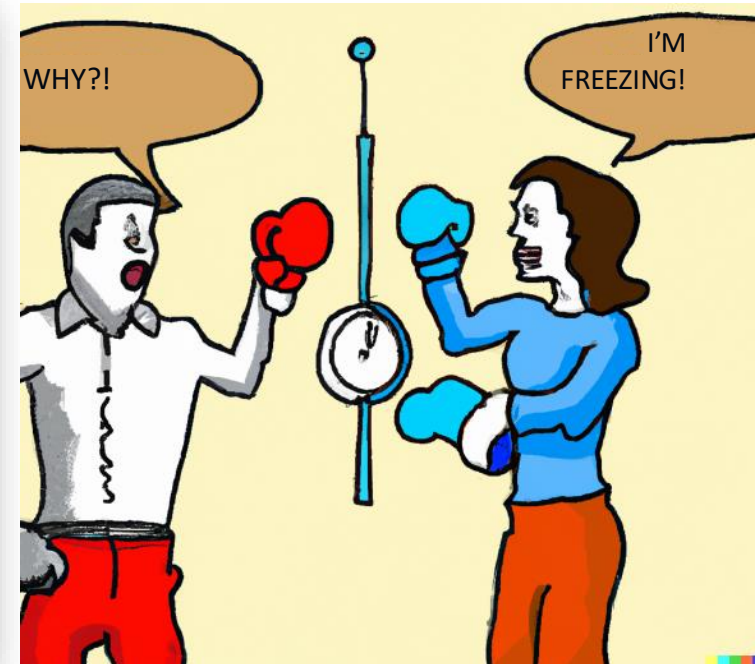
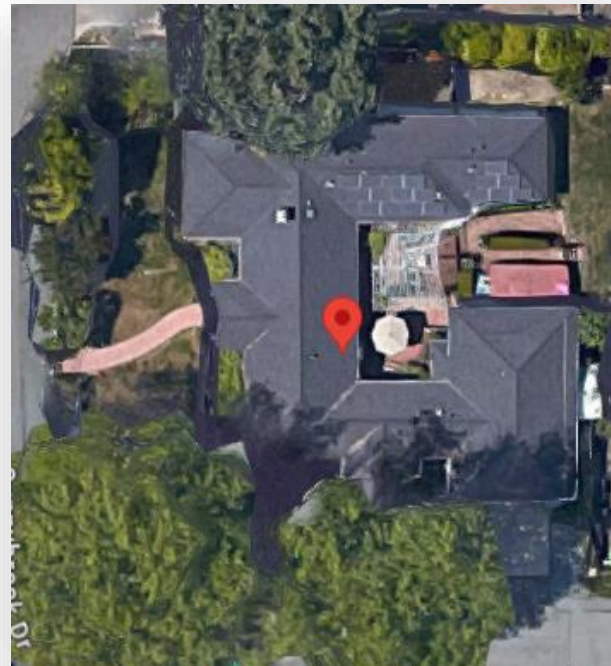
Why People Like The Idea of Zoning

- ⚡ Perceived improved comfort
- ⚡ Perceived energy efficiency
- ⚡ Perceived energy savings
- ⚡ Perceived solutions at reasonable price



Common Reasons for Zoning

- ⚡ Major climate differences in home
- ⚡ Unique architecture
- ⚡ Sections of home seldom used
- ⚡ Domestic temperature battles



Types of Zoning

- ❏ Traditional zoning with control board and automated dampers in ducts
- ❏ Multizone heat pumps
- ❏ Variable refrigerant heat pumps
- ❏ Multiple dedicated systems

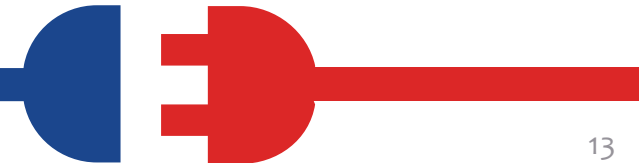


“Smart” Vents?

- ❌ Customers are finding these online
- ❌ They pair to sensors & damper down vents to restrict airflow to rooms
- ❌ Poor strategy for performance
- ❌ Can cause noise
- ❌ Increase static pressure, adding stress to the unit
- ❌ Rob system of necessary flow to maintain proper operation

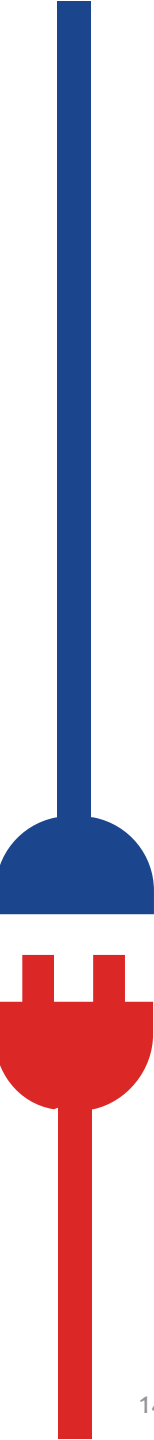


An AI-generated smart vent mockup



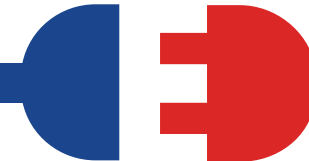
Ducted Zoning

A few things to be mindful of!



Zoning Doesn't Fix Poor Ducts

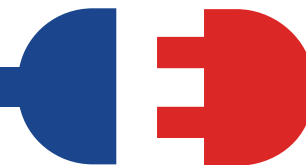
- ⚡ Particularly on single stage equipment, designing a duct system to work with zoning is challenging.
- ⚡ Dry climate requires more airflow
 - ⚡ Dampering = restricting airflow
 - ⚡ Restricting airflow = high static



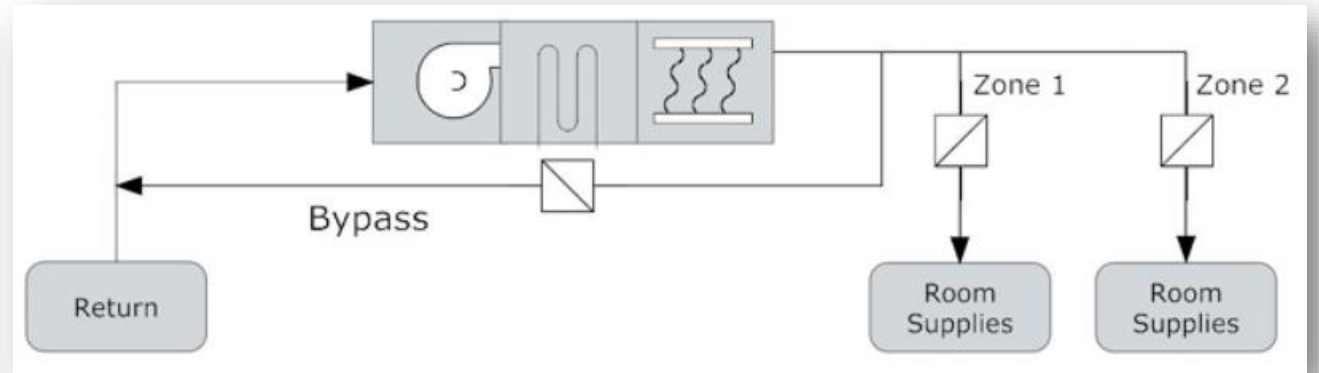
Examples of Poor Ductwork



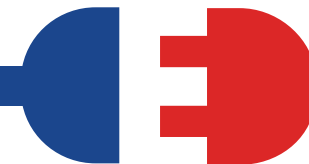
High static pressure, lower delivered airflow/capacity



Return Bypass – Not the Right Solution



- ⚡ The original thinking – install a bypass from supply to return to relieve static and lower noise
- ⚡ Result – lower coil temp (cooling), yielding lower capacity & efficiency



Does Traditional Zoning Save Energy?

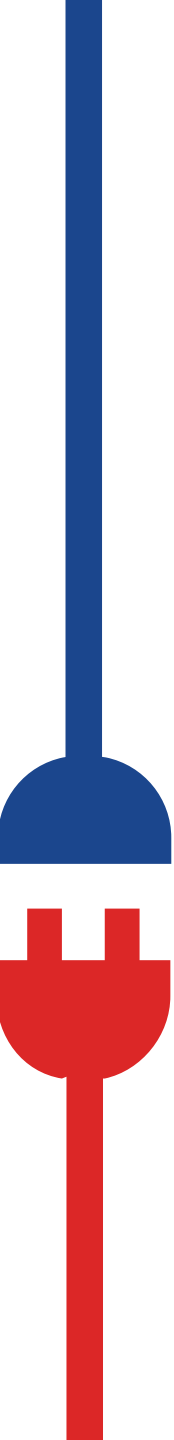
🔌 *Sometimes, but not always*

“ In four of seven heating cases in heating and four of six cooling cases, the energy consumption increased with the zoning configuration.”
Proctor Engineering, 2011

Study Author(s)	Energy Use Compared to Not Zoned		Notes
	Heating	Cooling	
Kenney & Barbour			
	148% ↑		5°F set up/down in each zone part of the day with basement
	76% ↓	71% ↓	5°F set up/down in each zone part of the day without basement
Oppenheim (from Kenney & Barbour)			
		135% ↑	No temperature set up
Oppenheim/Carrier			
		121% ↑	No temperature set up
		84% ↓	10°F temperature set up in every zone part of the day
Oppenheim/ASHRAE			
	107% ↑		Central with no modulation and 8-hour 12°F setback, zoned with modulating furnace and two additional setback periods on bedroom zones
	88% ↓		Central with no modulation and 8-hour 12°F setback, zoned with modulating furnace and 22 hours of setback on bedroom zones
Leslie & Kazmer			
	112% ↑		With basement conditioned
	99% ↔		No basement, zoning set back 12°F in the bedroom zone for 10 hours a day
Heflin & Keller			
	118% ↑	113% ↑	41% bypass
Temple			
		106% ↑	No bypass, no setback

Figure 1. Energy Consumption Zoned vs. Central System

↑ indicates increase in energy use; ↓ indicates decrease, ↔ indicates no change.



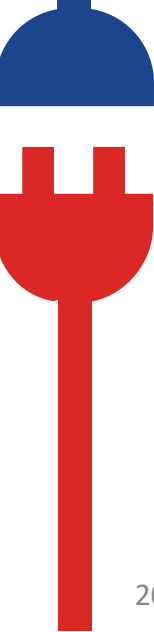
Traditional Zoning Challenges With Heat Pumps

- ⚡ Single/Dual stage HPs – similar challenges as ACs
- ⚡ Communicating inverters – 1,000s of points of communication; duct zoning not built into algorithms
- ⚡ Pressure/refrigerant sensing inverters – somewhat less problematic depending on air handler's ability to adapt
- ⚡ Use MFR specific components



Ductless Zoning

Must be done carefully



Ductless Solution – How Does It Work



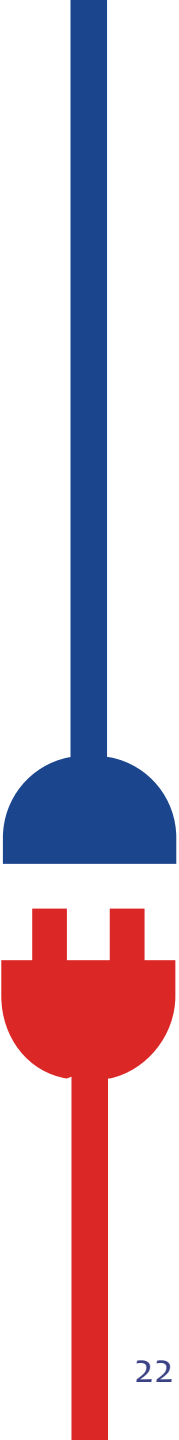
Multi-Zone Systems: Ductless

Advantages

- ✦ Flexibility for multi-room solutions
- ✦ Houses with a separate climate zones
- ✦ Branch boxes reduce line set lengths
- ✦ Less space needed

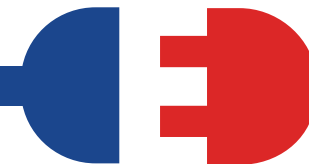
Disadvantages

- ✦ More refrigerant
- ✦ More chance for leaks
- ✦ Capacity penalty
- ✦ Less efficient
- ✦ No redundancy
- ✦ More difficult to repair
- ✦ More complicated installation

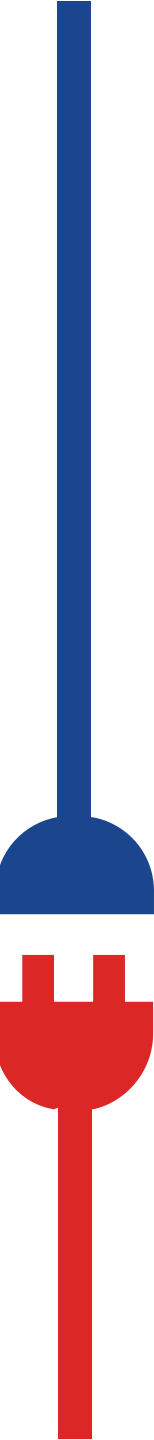


Case Study - Ductless Multizone Example

- 🔌 1200 sqft house
- 🔌 3 bedrooms
- 🔌 4 zone multizone setup...3 ton system (vs 1.5 ton ducted)
 - 🔌 2x 6kbtu wall-mounts (bedrooms)
 - 🔌 1x 9kbtu wall-mount (main bedroom)
 - 🔌 1x 15kbtu wall-mount (living room/kitchen)
- 🔌 Modulation: min 11,700 Btu/h (vs 5,400 on 1.5 ton ducted)
 - 🔌 What does this mean for smallest zone running at one time?
- 🔌 16 refrigerant connections, 4 condensate connections, possible condensate pumps & drywall work



Multizone Ducted Case Study



36 kBtu Multi-Zone Unit Serving 3 Ducted Air Handlers



- ⚡ Customer was not satisfied
- ⚡ Erratic temperatures
- ⚡ Part of house was less efficient and required more runtime
- ⚡ System can only modulate down so far
- ⚡ When a lower output than the minimum BTUs refrigerant will be sent to other zones
- ⚡ System waived all night



Monitoring Results (Pre)

Average Sensor Values from 2/16/2018 8:44:00 AM to 2/18/2018 8:44:00 AM using hourly averages



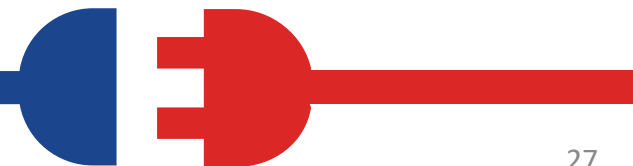
	T(°F) : Sensor #003 spare bedroom front	T(°F) : Sensor #005 spare bedroom back	T(°F) : Sensor #006 master bedroom	T(°F) : Sensor #008 kitchen counter	T(°F) : Sensor #009 dining room table	T(°F) : Sensor #010 spare bedroom return air
min	62.50	63.00	67.60	65.60	66.10	66.40
max	69.10	72.20	71.80	71.90	71.50	72.10
diff	6.60	9.20	4.20	6.30	5.40	5.70

No data found for sensor ID 22F0022C, Sensor #004 main unit return air

The Solution: Three Systems 1x 18k Unit + 2x 9k Units



- ⚡ A hard and expensive lesson
- ⚡ Downside modulation now 3100 kBtu/h instead of 11,000
- ⚡ Each zone gets exactly what it needs
- ⚡ True comfort finally achieved



Before (36K Multi-Zone)

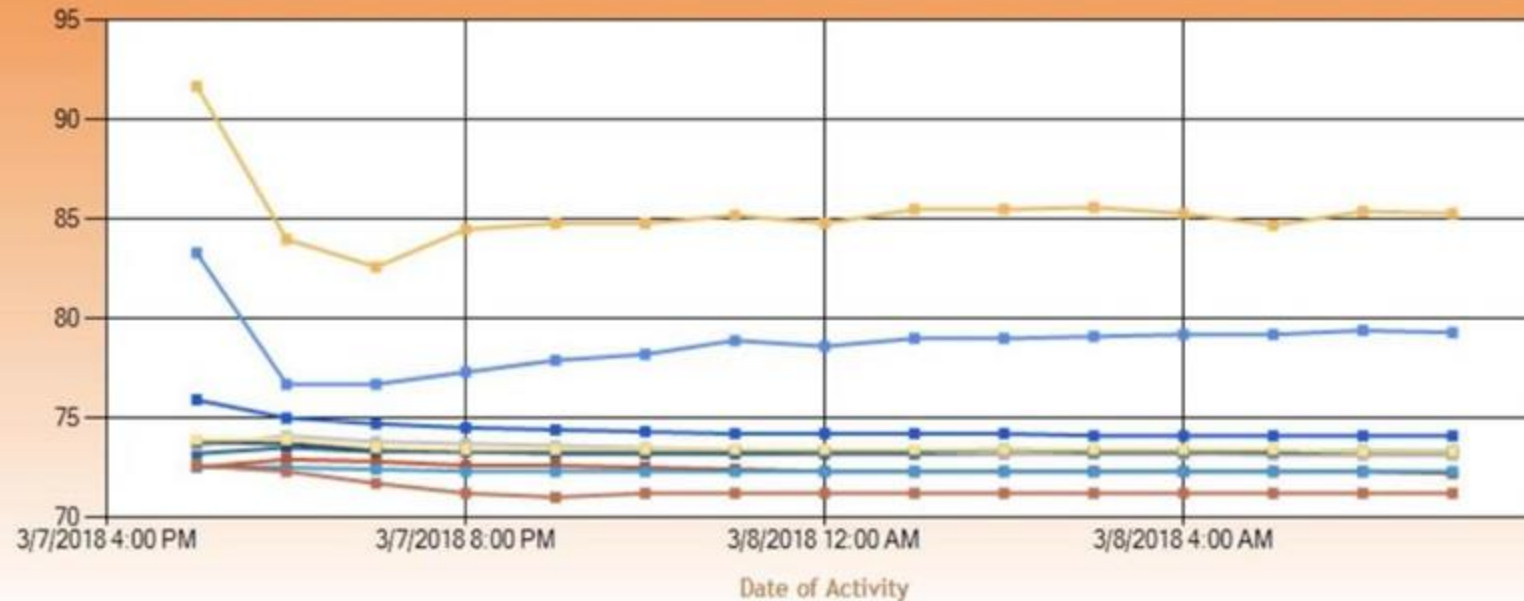
After (1x 18k Unit + 2x 9k Units)



Photos of work performed by A-1 Guaranteed Heating & Air Inc. Vallejo California

Monitoring Results (Post)

Average Sensor Values from 3/7/2018 5:00:00 PM to 3/8/2018 7:49:00 AM using hourly averages



	T(°F) : Sensor #001 Supply living grille	T(°F) : Sensor #002 supply bedrooms back grille	T(°F) : Sensor #003 spare bedroom front dresser	T(°F) : Sensor #004 main unit t stat	T(°F) : Sensor #005 spare bedroom back dresser	T(°F) : Sensor #006 above tstat in spare bedroom front	T(°F) : Sensor #007 Hanging in middle of spare bedroom front	T(°F) : Sensor #008 kitchen counter	T(°F) : Sensor #009 Master bed tstat	T(°F) : Sensor #010 spare bedroom return air
min	76.70	82.60	72.20	73.20	73.10	73.30	73.30	72.30	71.00	74.10
max	83.30	91.70	72.90	73.50	74.10	73.80	73.90	72.50	72.60	75.90
diff	6.60	9.10	0.70	0.30	1.00	0.50	0.60	0.20	1.60	1.80

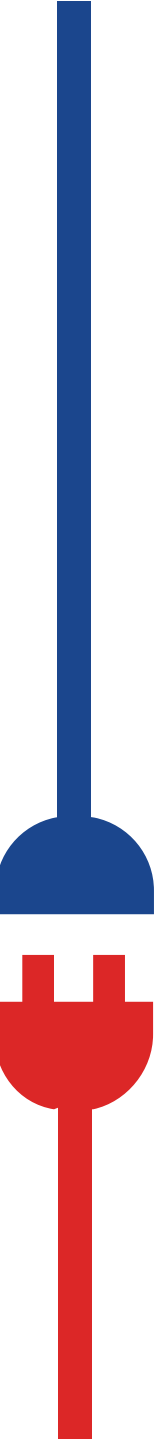
From Our Experience: Biggest Zoning Takeaways

- ❏ For most common residential applications, it's best to zone with dedicated units (1 outdoor, 1 indoor)
- ❏ We like 1 ducted system for majority of house and dedicated wall-mount for challenging room(s)
- ❏ Multizone results are better with limited air handlers or situations where multiple will be run at the same time
- ❏ Avoid multiple ducted air handlers on one multizone when possible (fans run continuously)



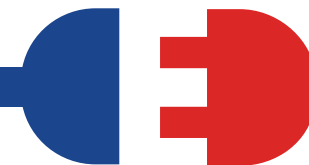
Zoning Q&A

With Special Guest, Randy Jenkins



Welcome, Randy

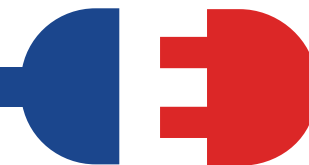
- ✦ Northern California native, raised in Central Valley
- ✦ 26 years in HVAC
- ✦ 17 years with mini split manufacturers
- ✦ Current role with Mitsubishi Trane
- ✦ Area Sales Manager, Sacramento to Bakersfield



Questions? Stay in Touch!



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Closing

- Continuing Education Units Available
 - Contact ian.logan@ventura.org for AIA & ICC LUs
- Coming to Your Inbox Soon!
 - Slides & Survey – Please Take It and Help Us Out!
- Upcoming Courses
 - [7/24 Intro to Passive House Retrofits](#)
 - [8/6 Beyond Energy: Using Passive House Standards to Boost Resilience of CA's Built Environment](#)
 - [8/8 Heat Pumps for Heating and Cooling – Part 2: All-Electric Design and Construction Series](#)
 - [8/14 Energy code Implementation: Non-Residential](#)
 - [8/23 Building the Future: Electrification Strategies for Contractors and Architects](#)
- 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:
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