TRI-COUNTY
REGIONAL ENERGY NETWORK
SAN LUIS OBISPO • SANTA BARBARA • VENTURA

Intro to Heat Pump Technology

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In Balance Green Consulting

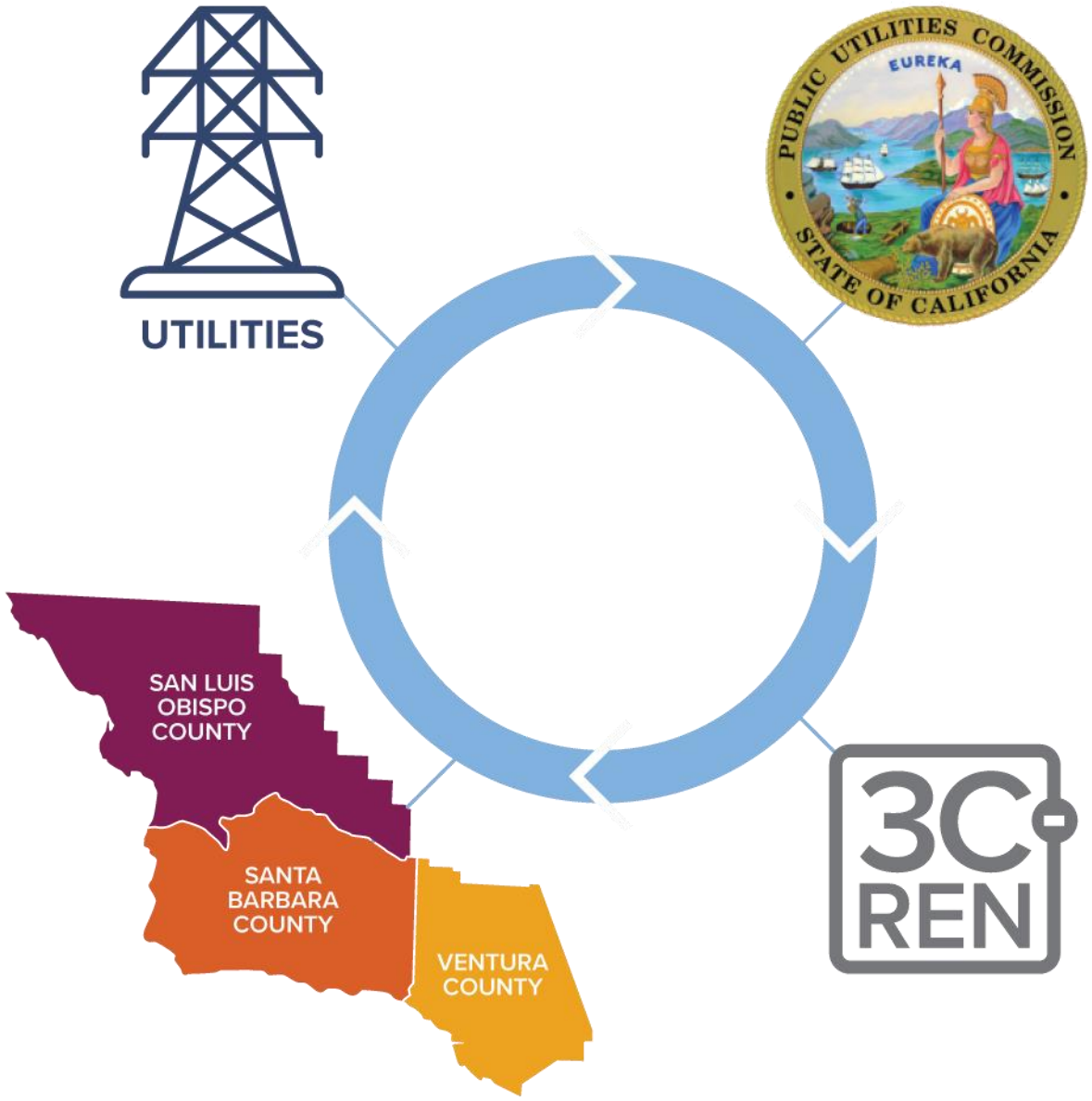
April 13, 2026

Before We Begin

Here are some quick reminders:

- Did you call in? Please **share** full name to confirm attendance
- To receive LUs and CEUs, you **must attend** at least 80% of the training. Attendance will be verified
- Use the "**Chat**“ to share questions or comments
- Slides/recording are **shared** after most events and can be found on 3C-REN’s on-demand page
- 3C-REN does **not** allow **AI notetakers**, unless used to accommodate a disability.

Heat pumps are a key part of California's clean, affordable energy future and are growing in popularity across the state. To help raise awareness and accelerate adoption, the California Heat Pump Partnership is hosting the first-ever **Heat Pump Week** from **April 11–19**



Tri-County Regional Energy Network

3C-REN is a collaboration between the tri-counties

Our programs reduce energy use for a more sustainable, equitable and economically vibrant Central Coast

Our free services are funded via the CPUC, bringing ratepayer dollars back to the region

Today's Learning Objectives

- Learn the basics of heat pump operation, pitfalls from years past and the benefits of current technology for HVAC and domestic hot water demand
- Understand options for ducted and ductless heat pumps for thermal comfort
- Discuss integrated and split-system Heat Pump Water Heaters, as well as combination systems
- Learn important considerations for design and installation such as dimensions, locations, venting and condensate line.

Learning Units:

- 1.0 AIA HSW LU approved for this course
- 1 ZNCD CEU approved for this course

Agenda

1. Heat Pump Basics
2. HP’s for Heating and Cooling
3. HP Water Heaters
4. Incentives and Resources

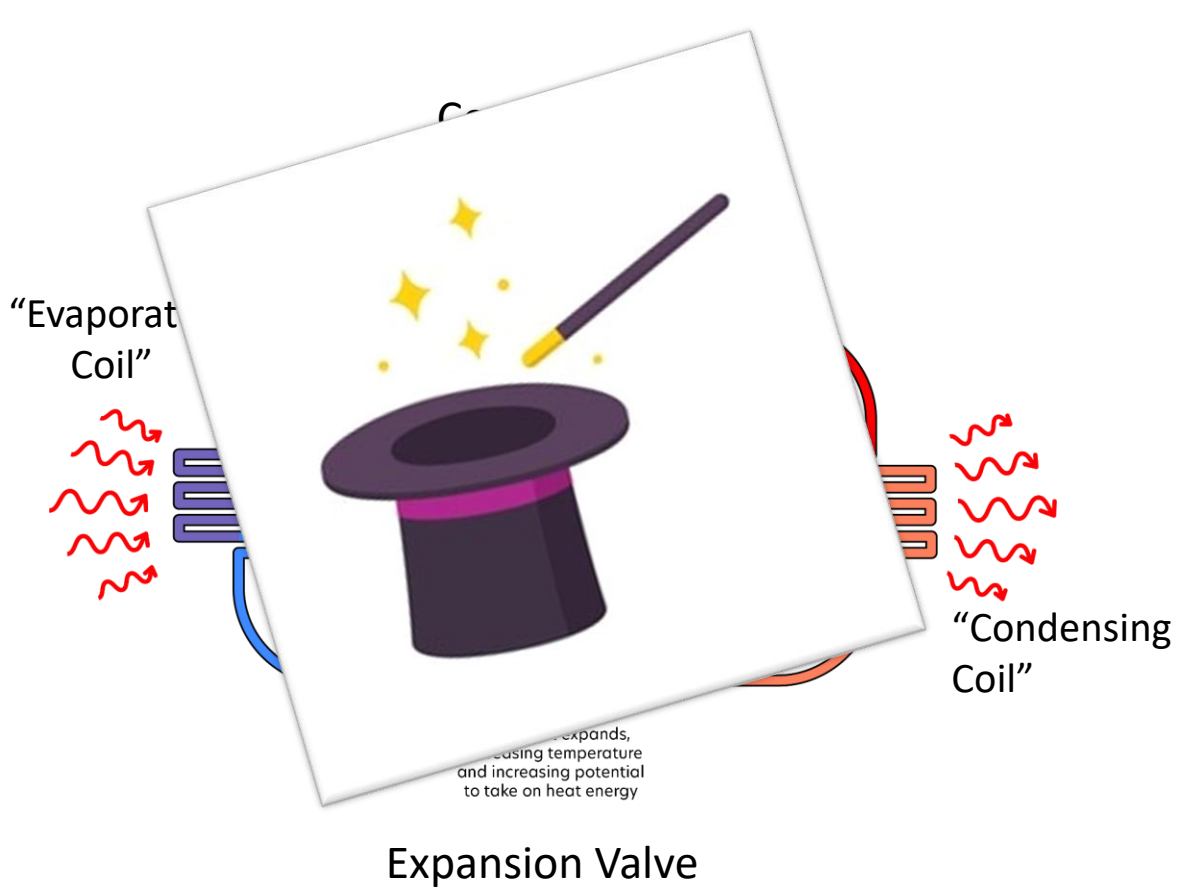
Heat Pump Basics

Reasons for moving toward heat pumps

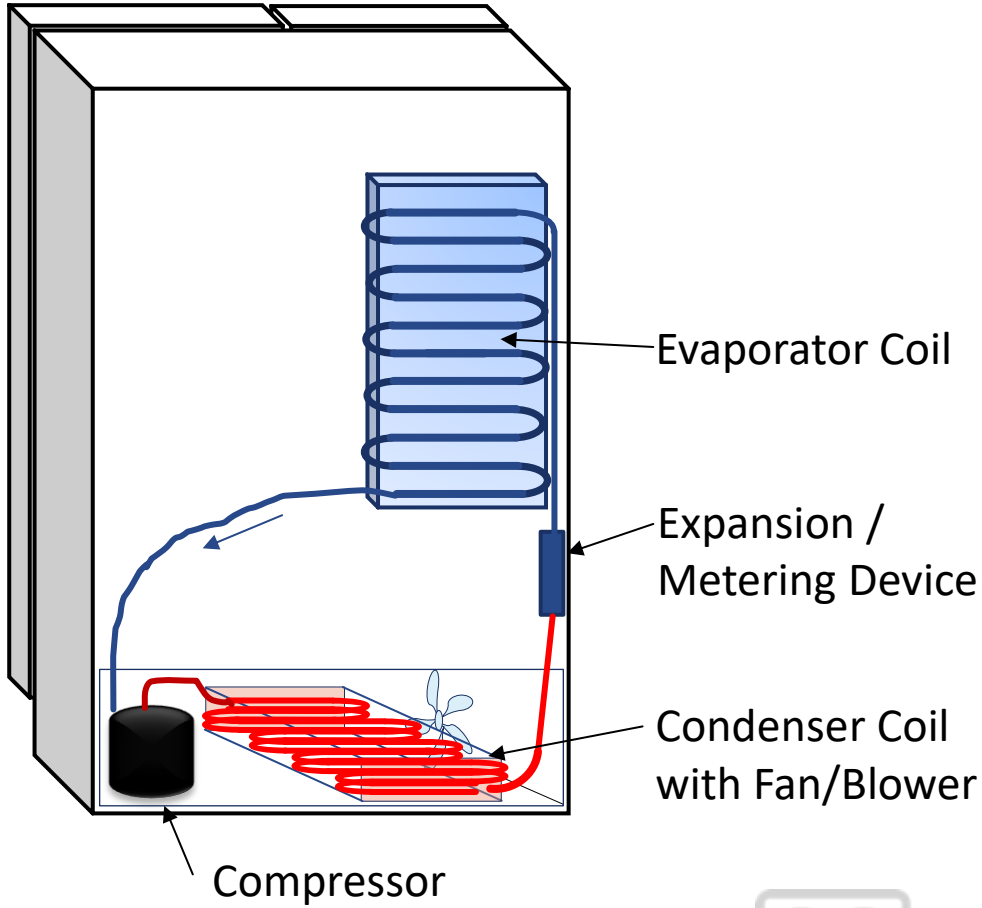
860 on the Wye – Multi-Family Low-Rise All-Electric Zero Net Energy

- Under Title 24 2025 Energy Code encourages all-electric
- Solar panels are required for New Construction, offsetting electric use
- Electric equipment is more efficient and performs much better
- All electric technology has been ‘field tested’ throughout the country and the world.
- All-electric removes health and safety concerns about methane

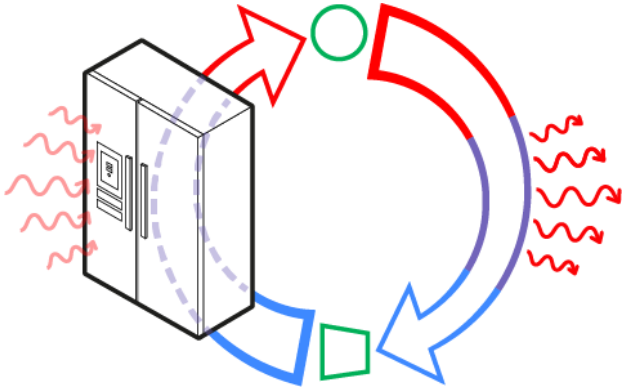
Refrigerator – Our favorite heat pump

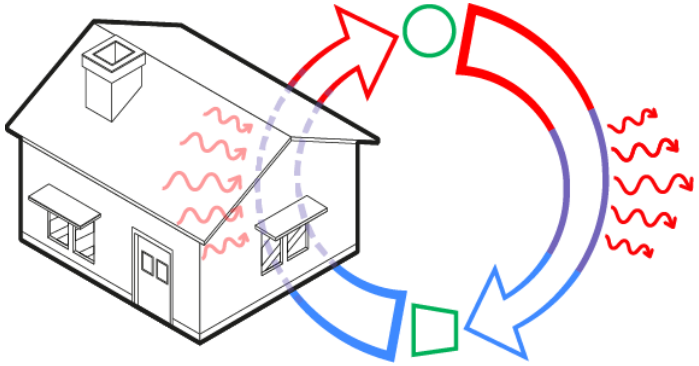


Expansion Valve

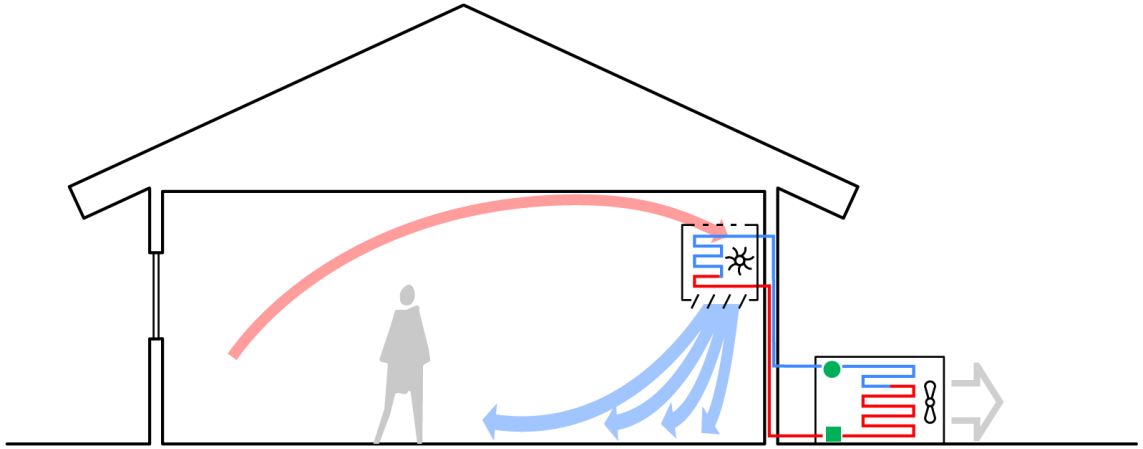


How Heat Pumps Work





Heat pumps don't *make* heat – like gas equipment. But rather, heat pumps capture and then *transfer* existing heat



Mini-split in Cooling Mode

Heat Pumps Can Heat, Too!

Heat Pump Technology

Removes heat from the air – even very cold air has heat that can be remove

Mitsubishi

Dispelling Myths

(often outdated information)

- Heat pumps DO heat well, even in cold weather
- Heat pumps are EASY to install
- Heat pumps are QUIET
- Heat pumps are COST EFFECTIVE

Why old heat pumps sucked (air and electricity), and today's are better

Old heat pumps = one speed

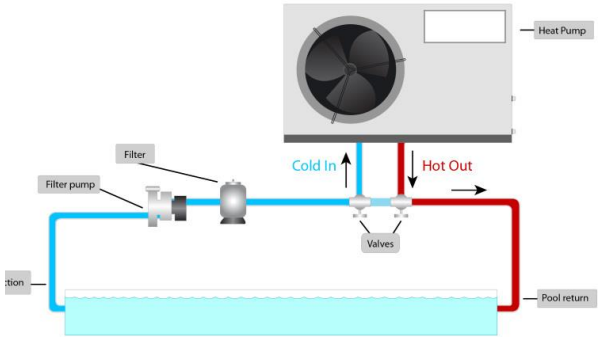
- Too fast, used lots of electricity, rapid cycles wore out motors quickly
- Less time to condition air
- Different temperatures in different areas
- Great idea, bad design

Today's heat pumps = variable speeds

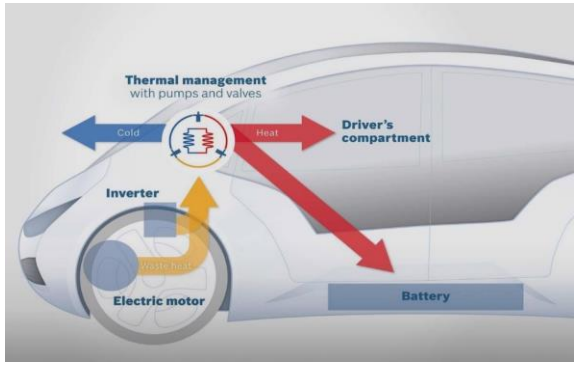
- Much slower
- Less cycling
- More efficient
- Even temperatures
- More comfortable buildings

Heat Pumps – Where We Use Them

Pools



Cars



Appliances

When to Install Heat Pumps

- **New Construction** All-Electric is relatively easy, with some exceptions for large scale buildings and industrial applications

- **Existing Buildings** – Incremental opportunities for
  - HVAC Replacement
  - Water Heater Replacement
  - Appliance Replacement
  - Integration with on-site Solar and Batteries

Morning Star Senior Living, San Jose, CA

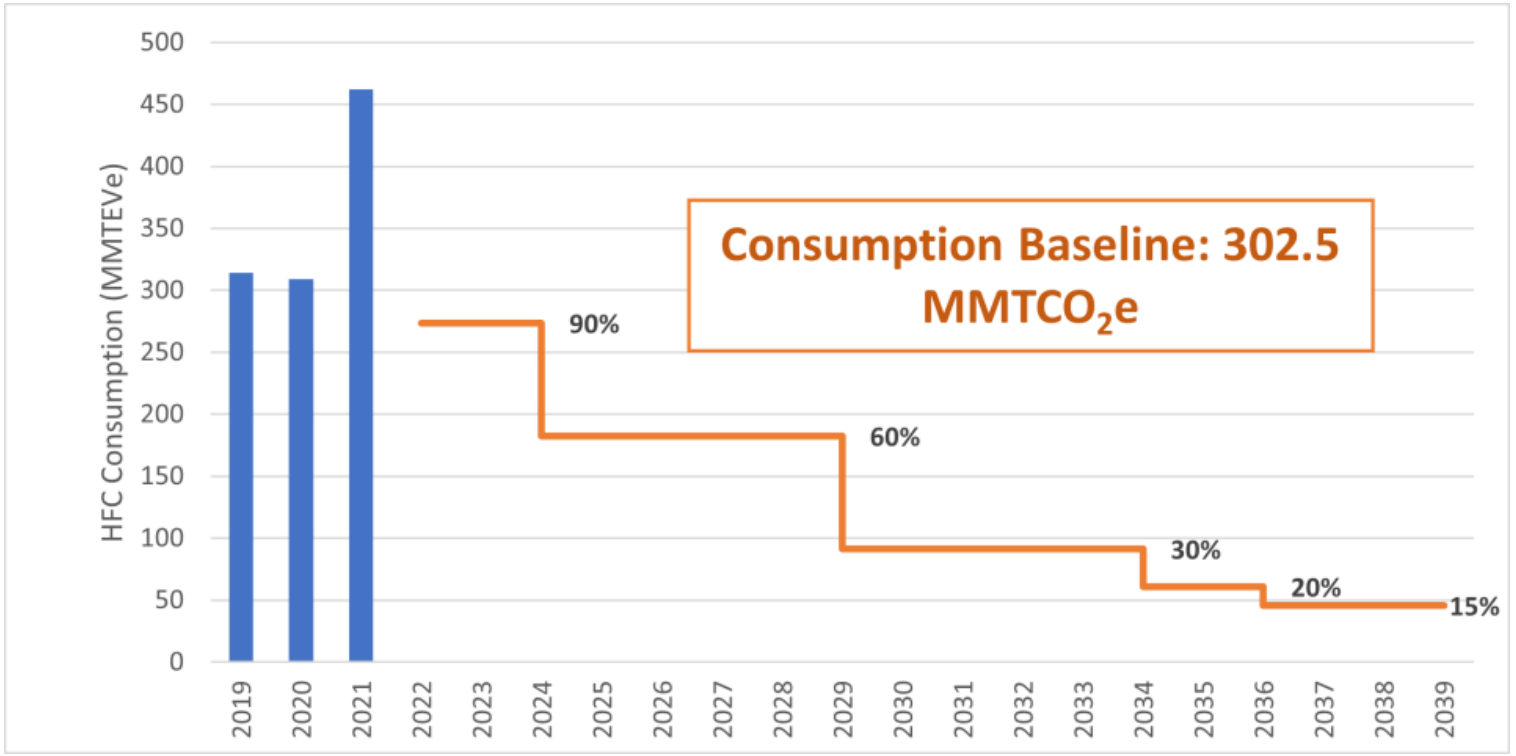
Refrigerants and GWP

- Heat pumps use refrigerant.
- Refrigerants typically have a high Global Warming Potential, **GWP**, MUCH higher than CO2.
- The American Innovation and Manufacturing (AIM) ACT calls for the phase out of refrigerants with a high GWP
- Under the AIM ACT, the EPA set a limit of 700 GWP for chillers, air conditioning, and heat pumps manufactured after Jan, 2025
- Different refrigerants are available, but some are flammable and/or not as effective, so manufacturers continue to develop new approaches.

An ultra low GWP Refrigerant: R-744 (CO2) has a GWP of 1

Refrigerants with Reduced GWP

California limit for Global Warming Potential (GWP) is 750.



Refrigerant	GWP
~~R-410A~~	~~2088~~
R-32	675
R-454B	466
R-290 (Propane)	3
R-744 (CO2)	1

Heat Pumps for Space Conditioning

Large Scale and Commercial Applications

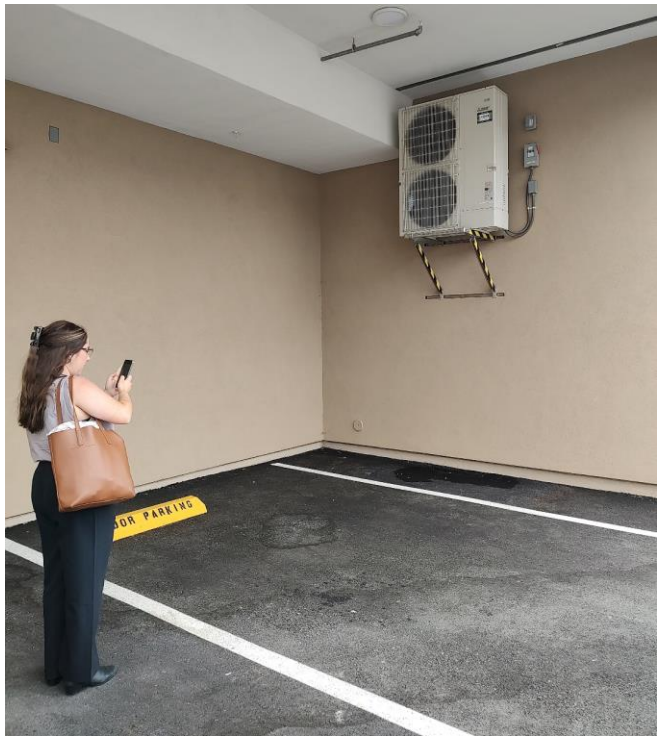
Source: www.mitsubishicomfort.com

Office / Retail

- Ducted and Ductless Systems
- Variable Capacity Systems
- Simultaneous Heating and Cooling

Small Scale Commercial and Residential

Senior Living / Hospitality



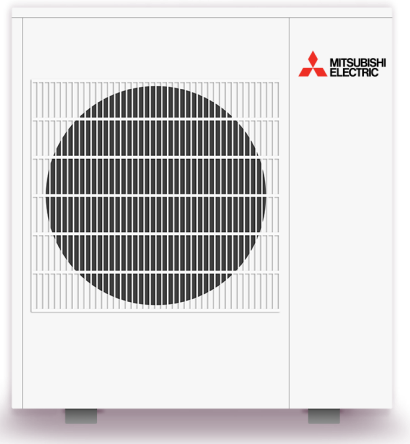
Small Commercial / Non-Res

Residential

Residential and Small-scale Commercial Systems

- Ducted Systems

- Ductless Systems



- Package System

Fully Ducted Heat Pump

Return Duct System

Supply Duct

Outdoor Unit
Compressor/Condenser

Electrical Connections (230v,
40 amp/15 amp Breaker)

Refrigerant Line

Indoor Air-Handler

Ducted System installed

- Locate indoor equipment in garage or equipment room
- Long duct runs: soffits, chases, pathways similar to gas FAU's
- Can theoretically utilize existing ducts in reno/remodel

Ductless “Mini-Split” Heat Pump

Indoor Unit –Head

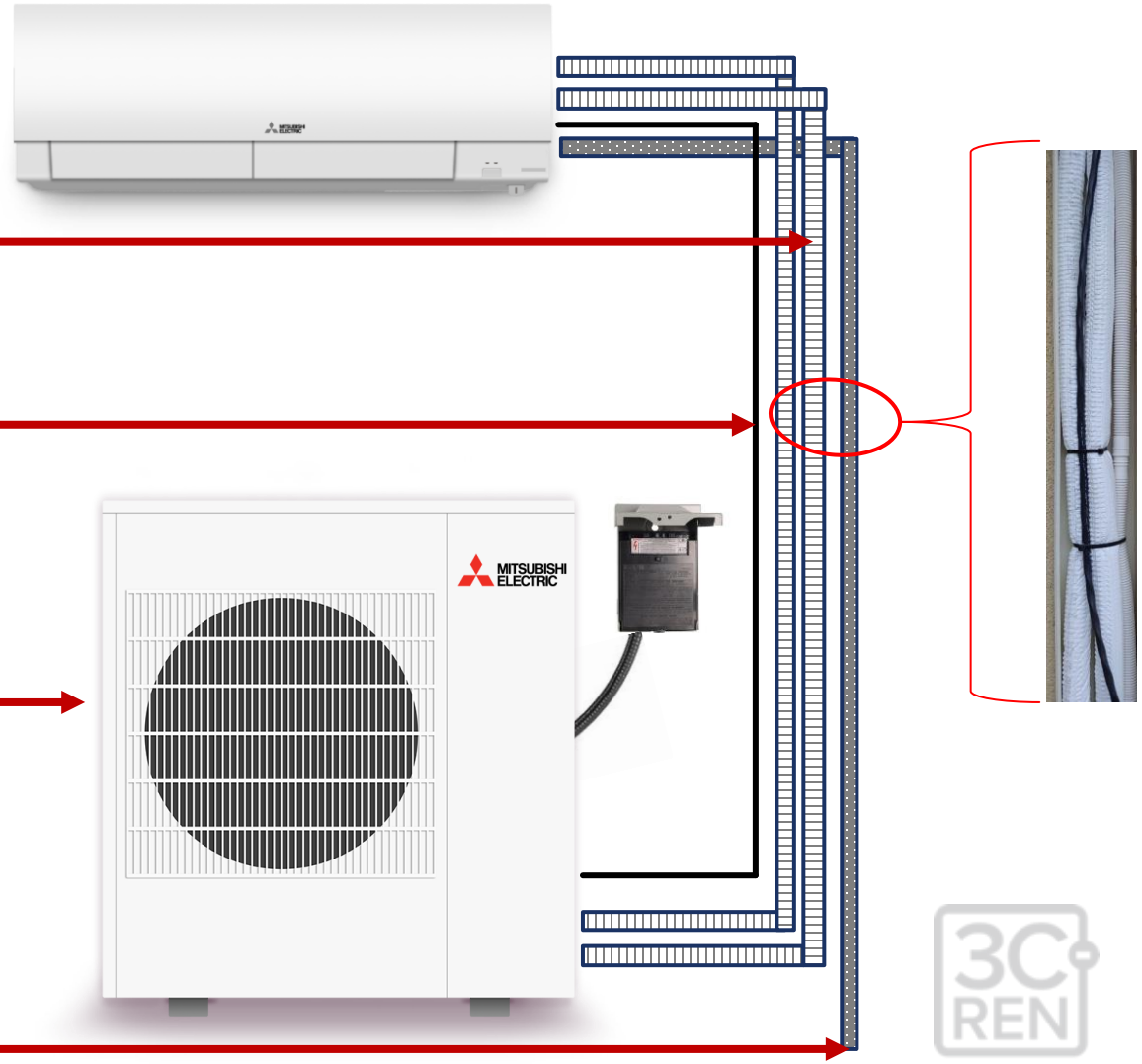
Line Set Pair/Piping –Insulated Copper Refrigerant Tubing

Power Cord – Connecting to the Indoor Unit (aka Communication Wire)

Outdoor Unit, i.e. Compressor/Condenser

Electrical Connection (110 or 230v, 20 amp to 40 amp Breaker)

Condensate Line –Drain Hose



Ductless System Installed

Image: Mitsubishi

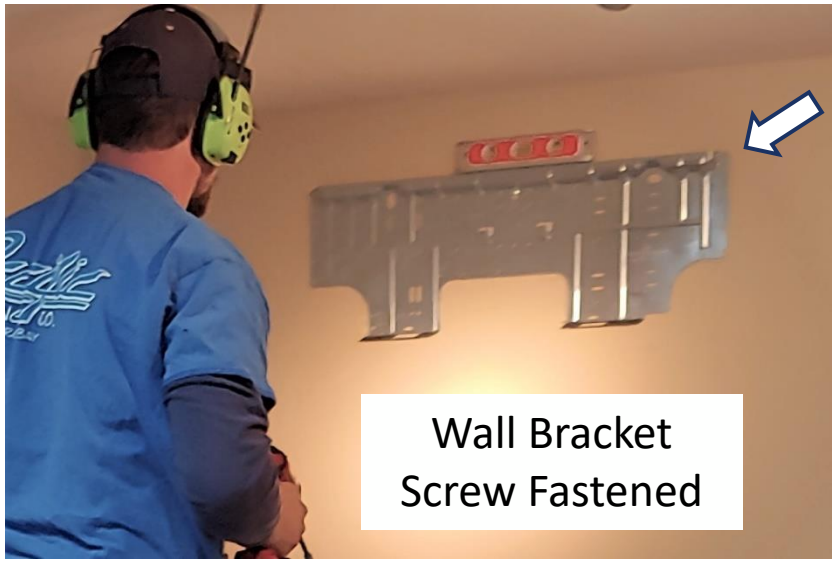
- Minimal space use
- Ceiling mount between joists
- Wall mount possible to conceal in furniture & built-ins
- +/- 20 SEER; +/- 15 EER

Popularity of Wall Mount – Ease of Installation

Protected Line Set

Out of the Box –Backside

Air Flow



Wall Bracket
Screw Fastened

From Indoor Unit

Concealed Duct Heat Pump

- Often located in attic or conditioned crawl space
- Multiple locations for larger homes
- Shorter duct runs from indoor unit
- Vents appear like typical HVAC grilles in walls or ceilings

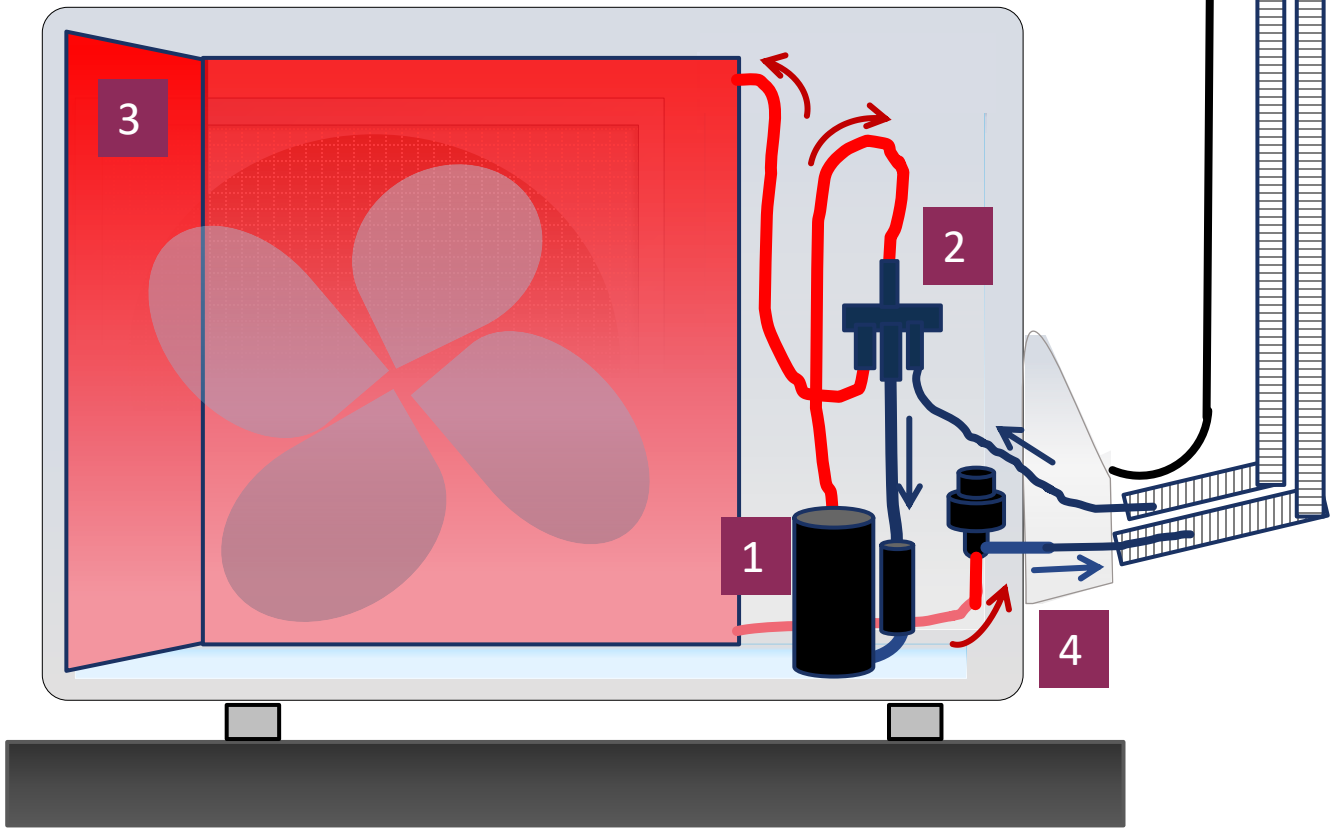
The Outdoor Unit for Ducted or Ductless

- Outdoor Unit Mounting Options: Ground Mount Pads, Racks, Hangers, etc.
- Electrical Work (power/breaker/junction box-shut off)
- Locate at least 5’ from a dryer vent

The Outdoor Unit

Outdoor Coil

4-Way or Reversing Valve



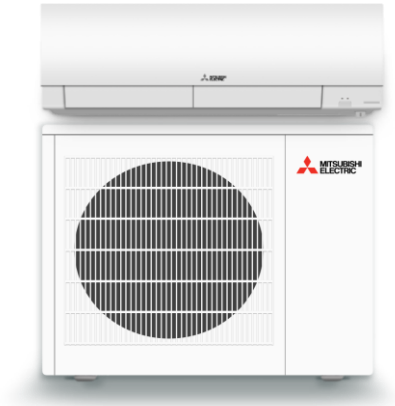
Metering Device – Electronic Expansion Valve (EEV)

Compressor

Accumulator

The Current Market for Heat Pumps

Many to Choose from... Full-service HVAC Installs to DIY Kits



Additional Items for a Complete Job

- Insulation on Refrigeration Lines
- Exterior Line Set Covers
- Hardwired thermostats, Smart Controls
- Set the thermostat and leave it – big set-backs are counterproductive
- Professional check-ups once per year

New Construction: Line Set Built-In to Wall

Remodel:
Exterior Line Set Cover

Owner Maintenance – Indoor Clean Filters Regularly

POOR PERFORMANCE

Under the Hood –with dirty Filters

Dirt and Dust Build-up

Excellent PERFORMANCE

Under the Hood –with clean Filters

Clean and Clear

- Wall Mount Units – Filters are easy to remove
- Filters can be cleaned with a light vacuuming and with a water rinse
- Some brands offer accessory allergy enzyme filters and/or PM2.5 microfilters

Heat Pump Water Heaters

Domestic Hot Water System Types

	Natural Gas	Electric Resistance	Electric Heat Pump
Storage Tank		 	 Split System  Integrated (Hybrid)
Tankless On-Demand		 	Not Applicable

Builder's Perspective on HPWH

1. Very easy to install – no flue, no gas piping, no combustion
2. No additional trades are needed on site – no gas; refrigerant is contained
3. Energy efficient – 2 to 4 times more efficient than standard electric
4. Less GHG emissions compared to standard gas and electric water heaters

- Mike Horgan, Cairn Collaborative Design-Build

Evolving Market for Residential HPWH

BRADFORD WHITE
WATER HEATERS

Rheem

RUUD

AO Smith

Lochinvar

state
WATER HEATERS

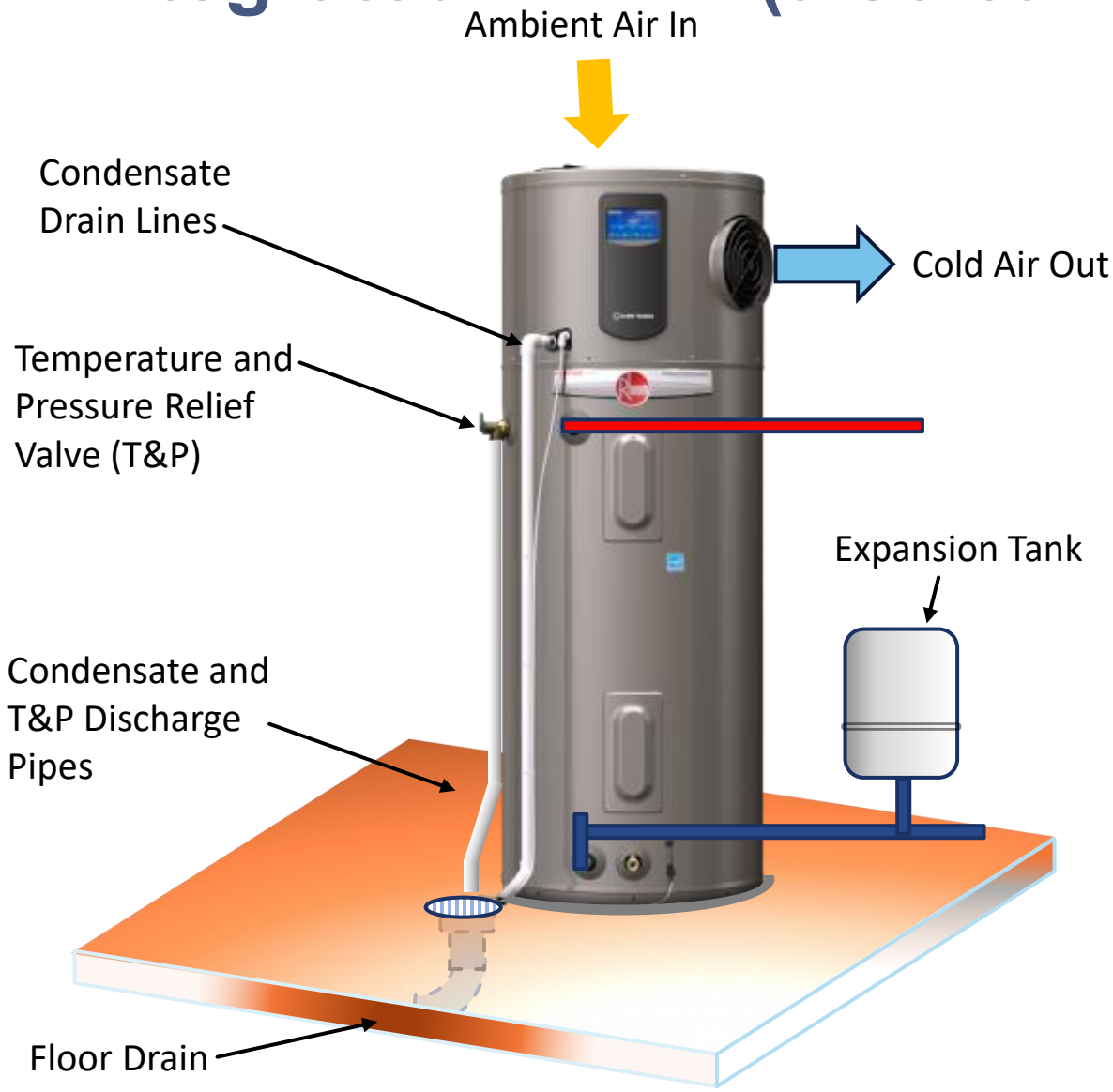
STIEBEL ELTRON

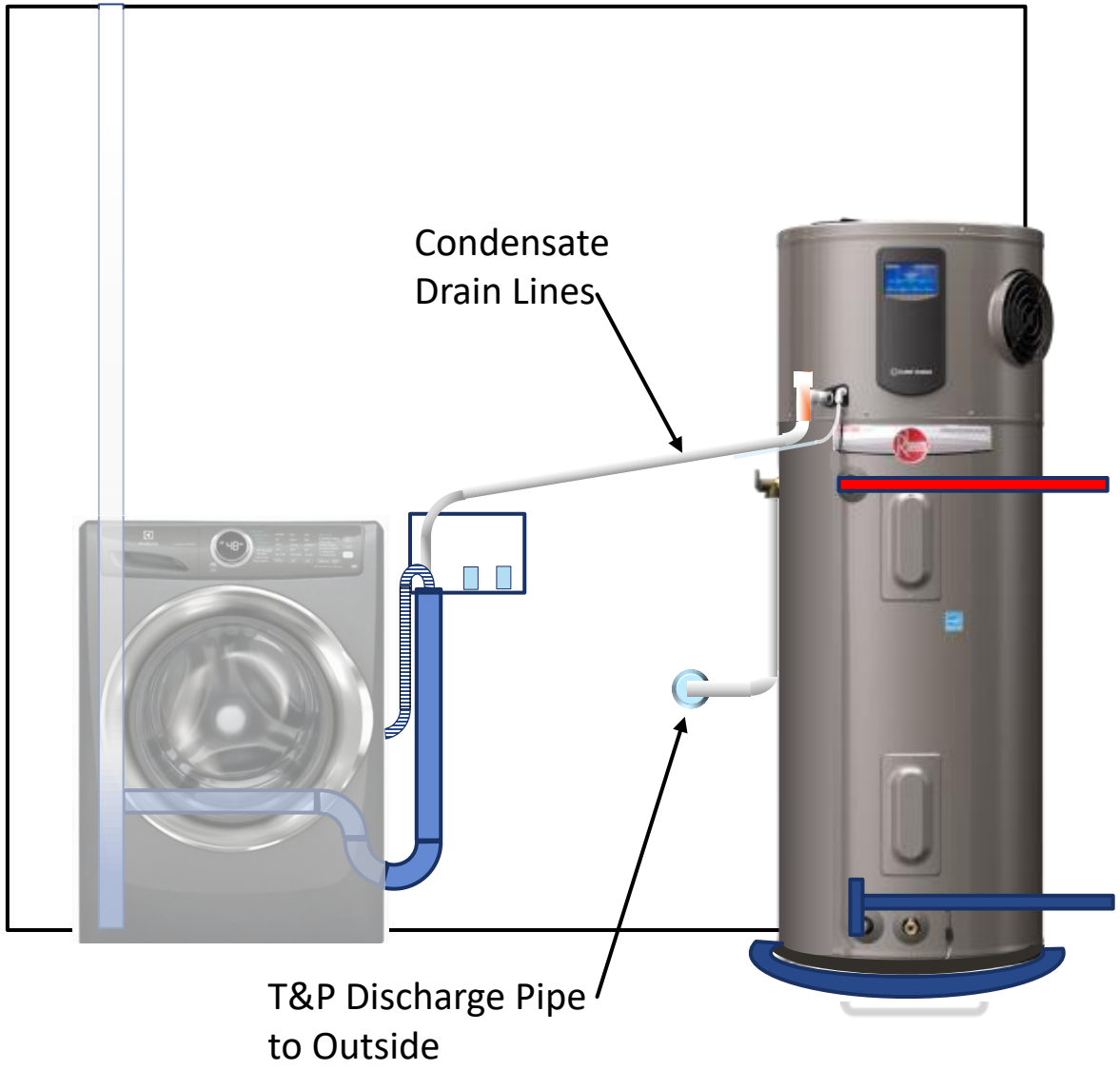
LG

SANDEN

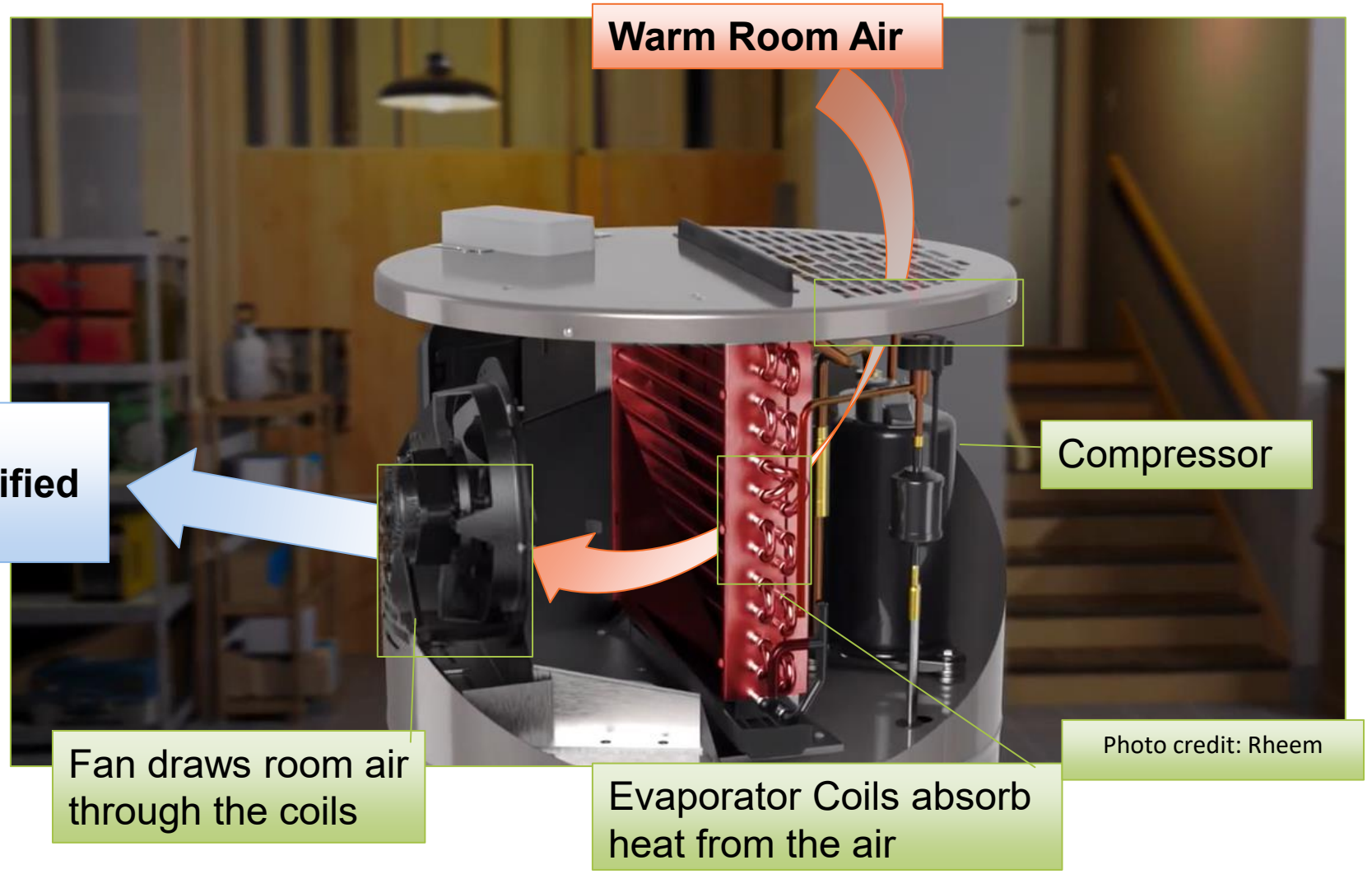
SANCO2
Hot water, naturally.

Integrated HPWH (also called “Hybrid” Water Heater)



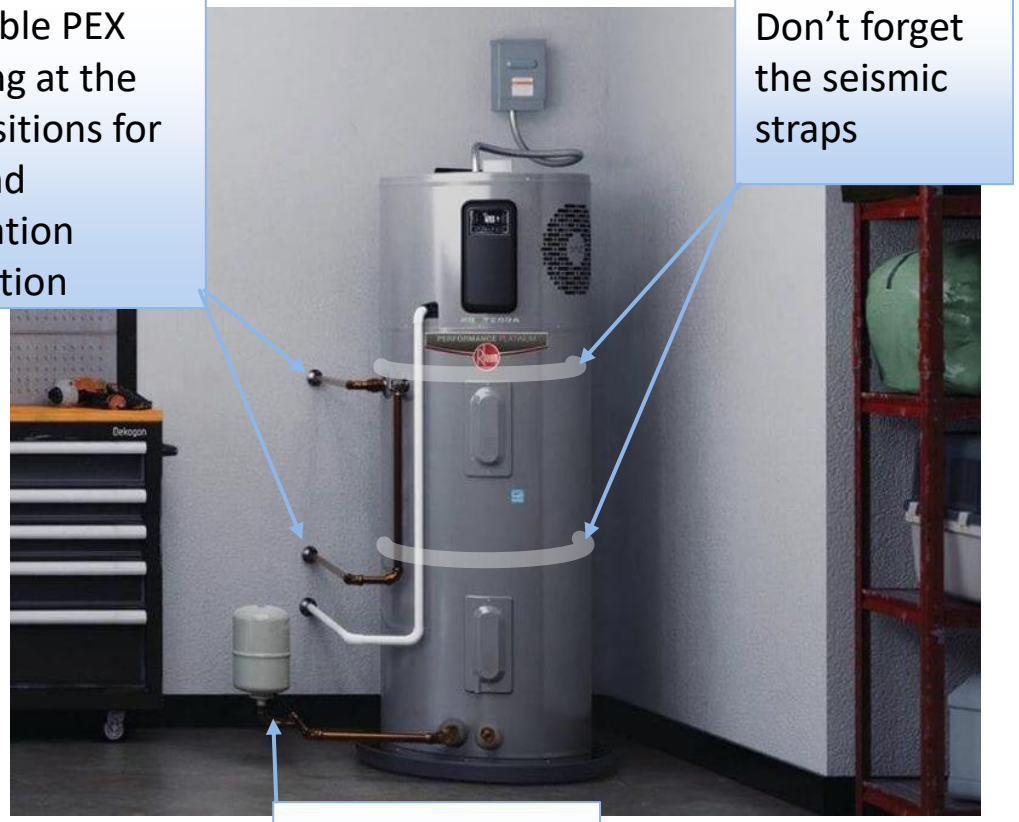


Integrated HPWH's Need Access to Air Volume



Integrated HPWH Design Considerations

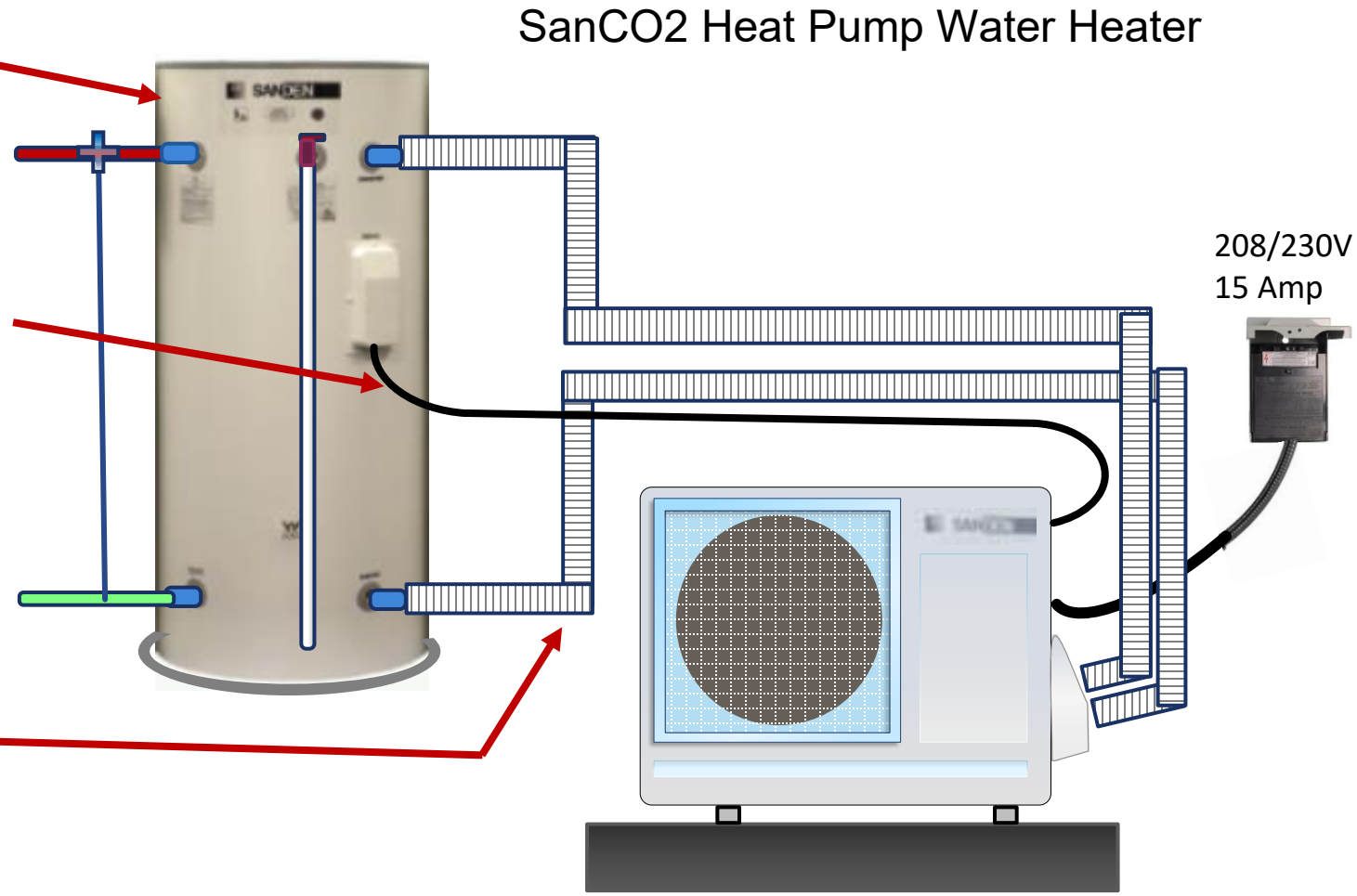
- Unit dimensions – larger diameter and taller
- Space at the air exhaust port – 6” min, 12”-24” recommended
- Condensate drainage needs to be addressed
- Electrical 240V 30amp typical, but 120v available
- Sound Level similar to a refrigerator
- Cold, dehumidified, air exhaust
- Needs 350 cubic feet volume, or ducted vent kit; older models may need more



Rheem marketing

Split System HPWH

Tank is located indoors and the condenser outdoors

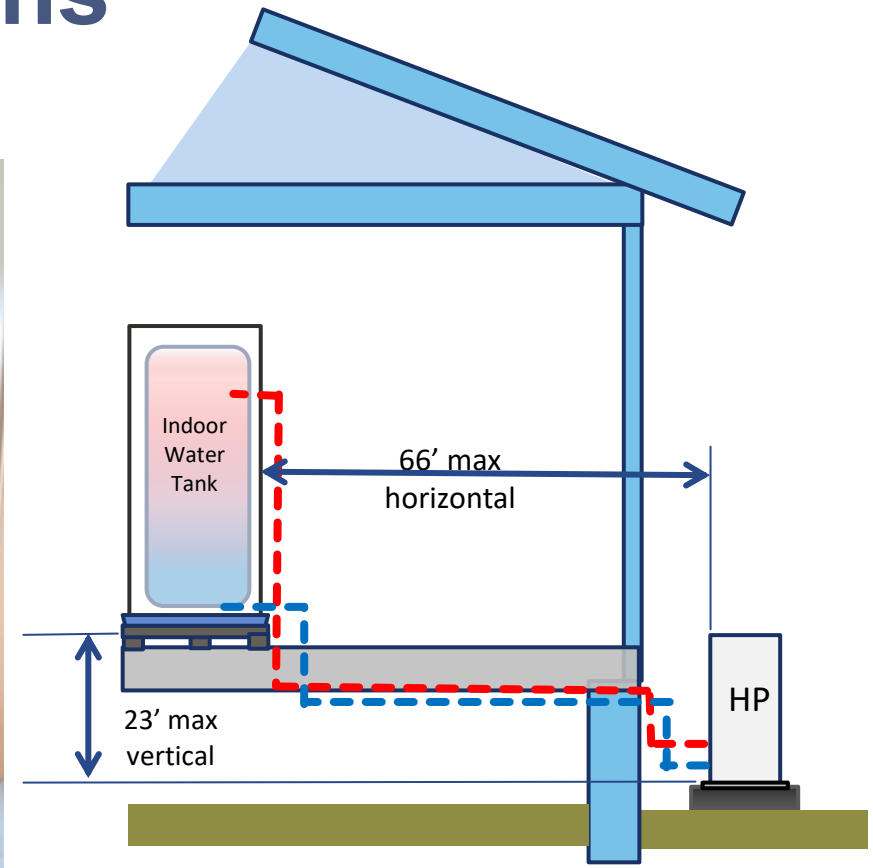


Interior Closet Location

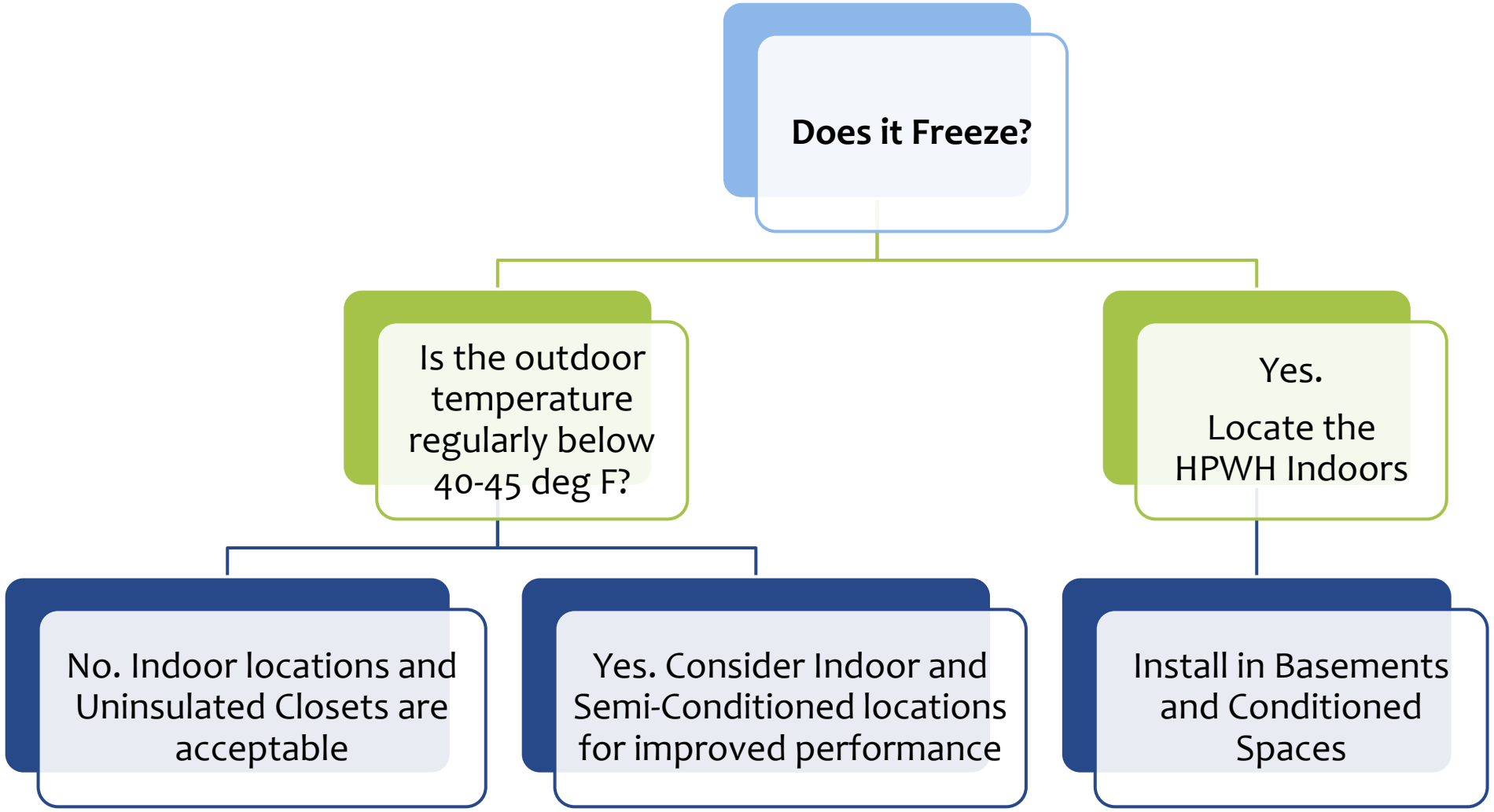
Image Source: eco2waterheater.com

Split System Design Considerations

- No moving parts, no noise
- Can locate tank in tight spaces
- Can locate tank close to hot water needs
- System works in negative -26 deg F
- System uses CO2 as refrigerant
- Higher upfront cost



Locating an Integrated HPWH



Why Climate Matters

Heat pumps have an operational temperature range – outside of the range means electric resistance mode – which means more energy and more money to operate

Integrated HPWH

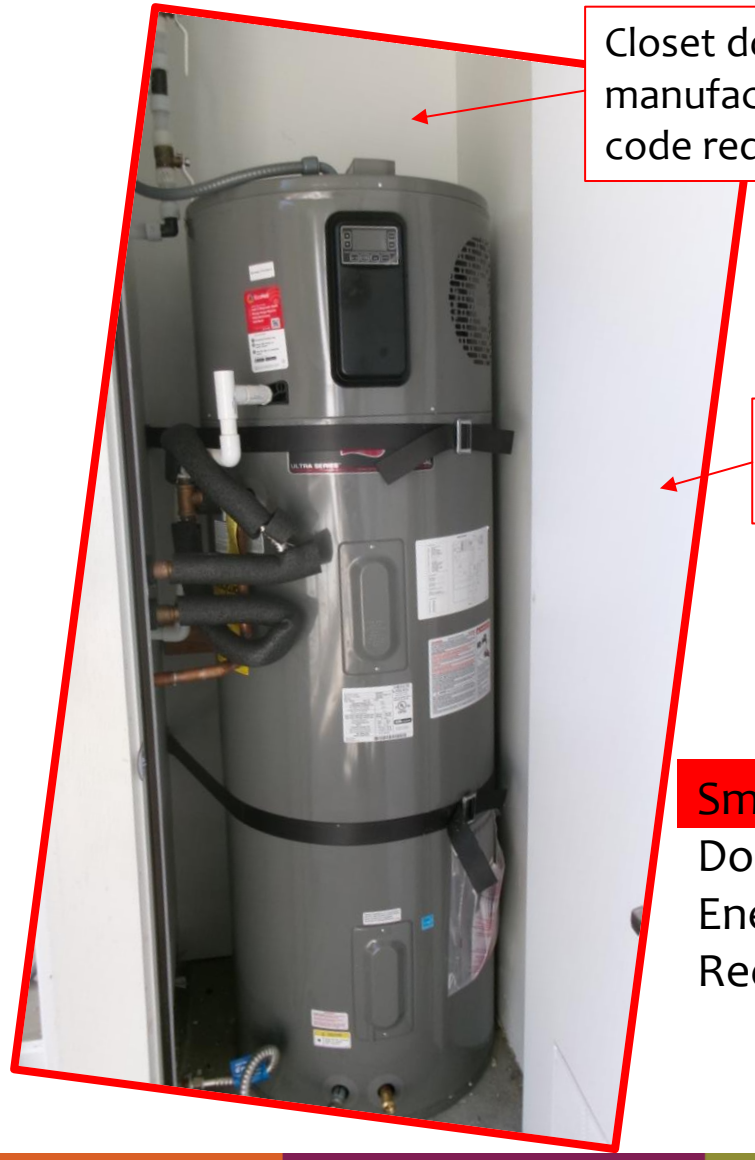
- Lower temp range:
  - Most brands 40-45 deg F
  - Some models 37 deg F
- Upper temp range:
  - Most brands 145 deg F

Hydronic Split System

- Lower temp range:
  - -26 deg F
- Upper temp range:
  - 114 deg F

HPWHs Need Surrounding Air

Garage Location –Pass
Lots of Air Volume



Closet does not meet the manufacture's requirements nor the code required minimum volume

Solid Door, i.e. no louvers or openings

Small Closet Location –Fail

Does not meet the 2025 Energy Code Mandatory Requirements

Air Intake and Exhaust Ports – Avoid Obstructions

- 6” minimum Clearances per Manufacture
- 12”- 24” Recommended Best Practices
- Also avoids potential condensate issues

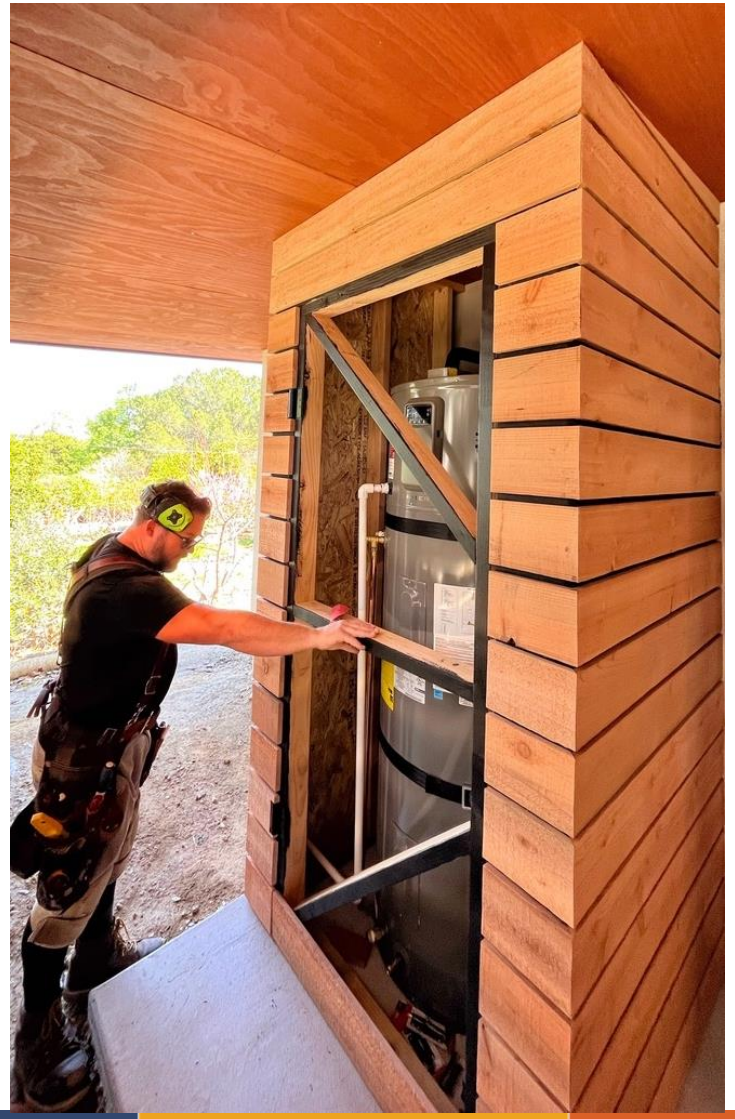
Interior Closets – Ducted and Louvered Door Options

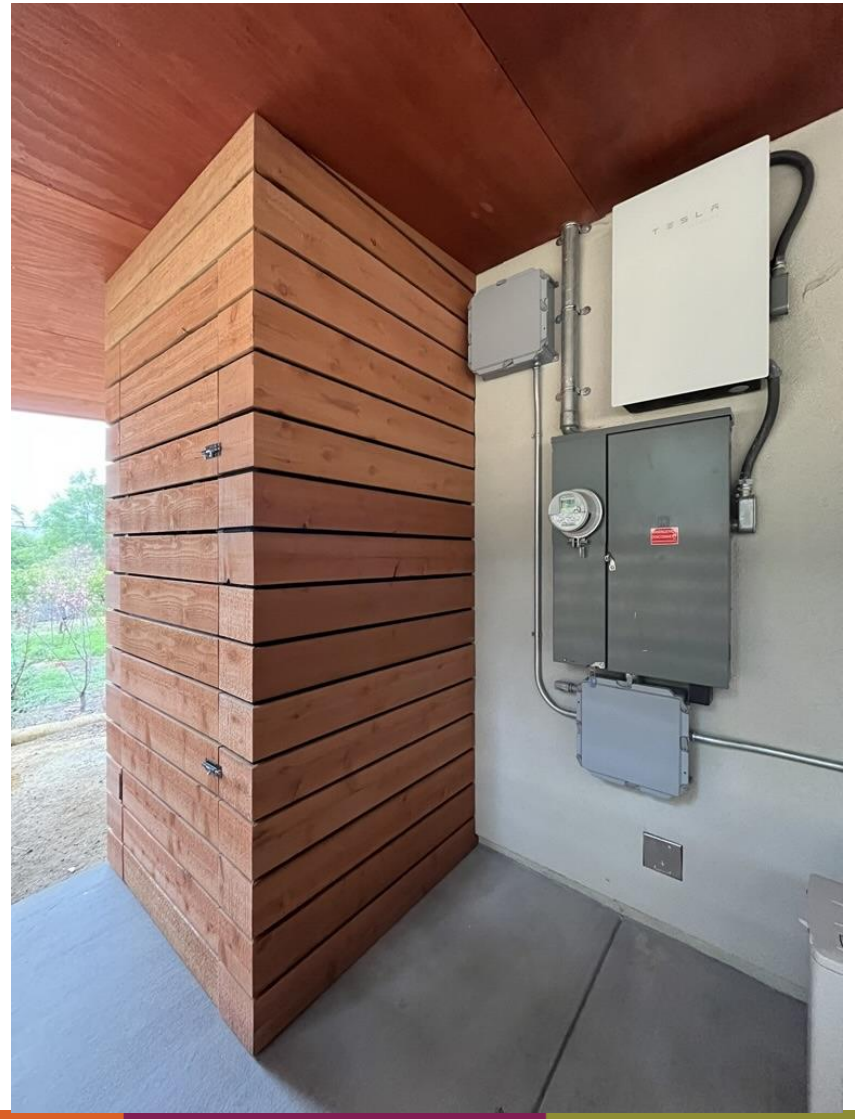
Ducts allow the HPWH to utilize the great outdoors

In progress construction photos!

Louvered door allows the HPWH to 'communicate' to the larger spaces of the house.

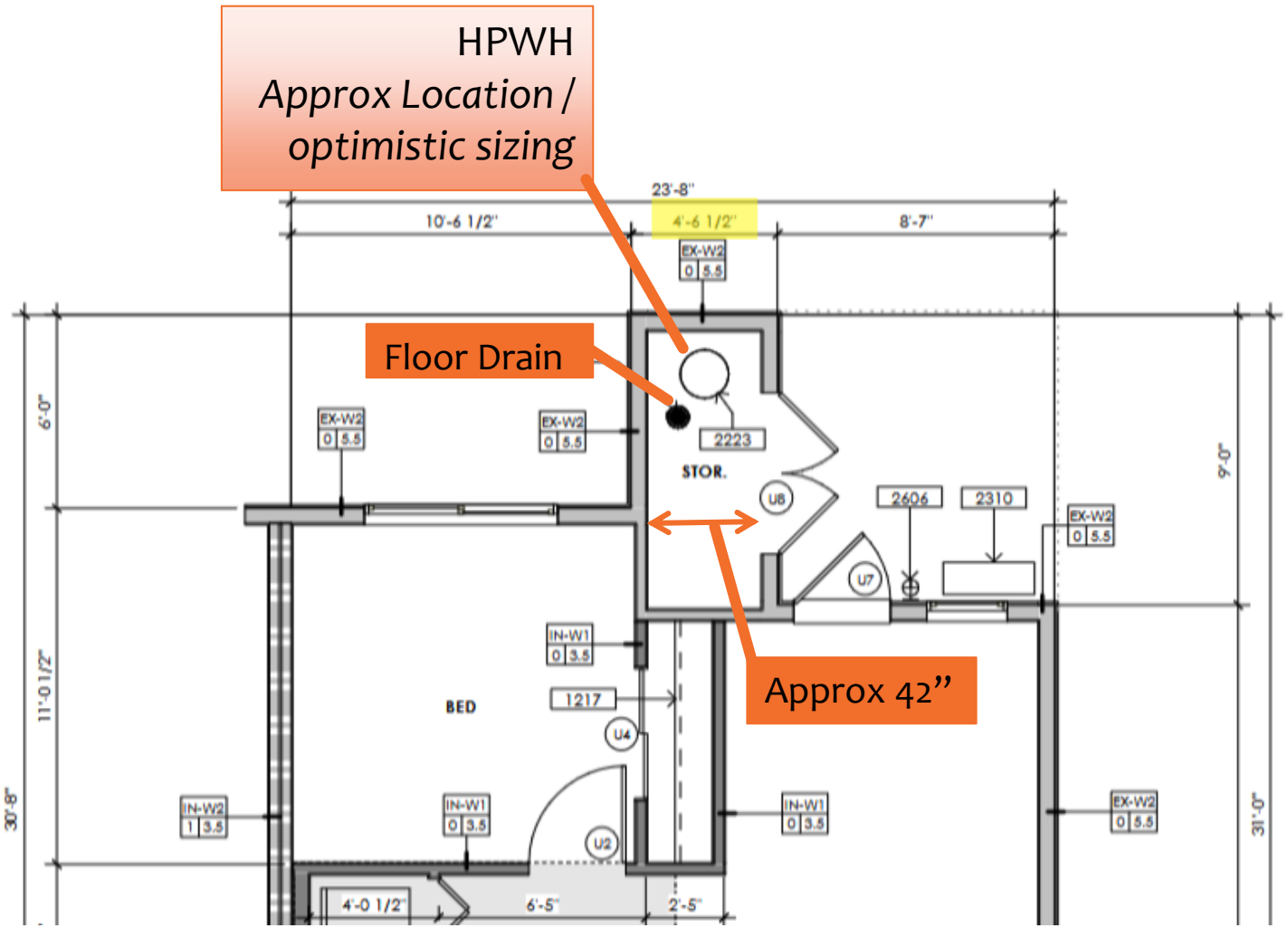
Outdoor Closet Installation

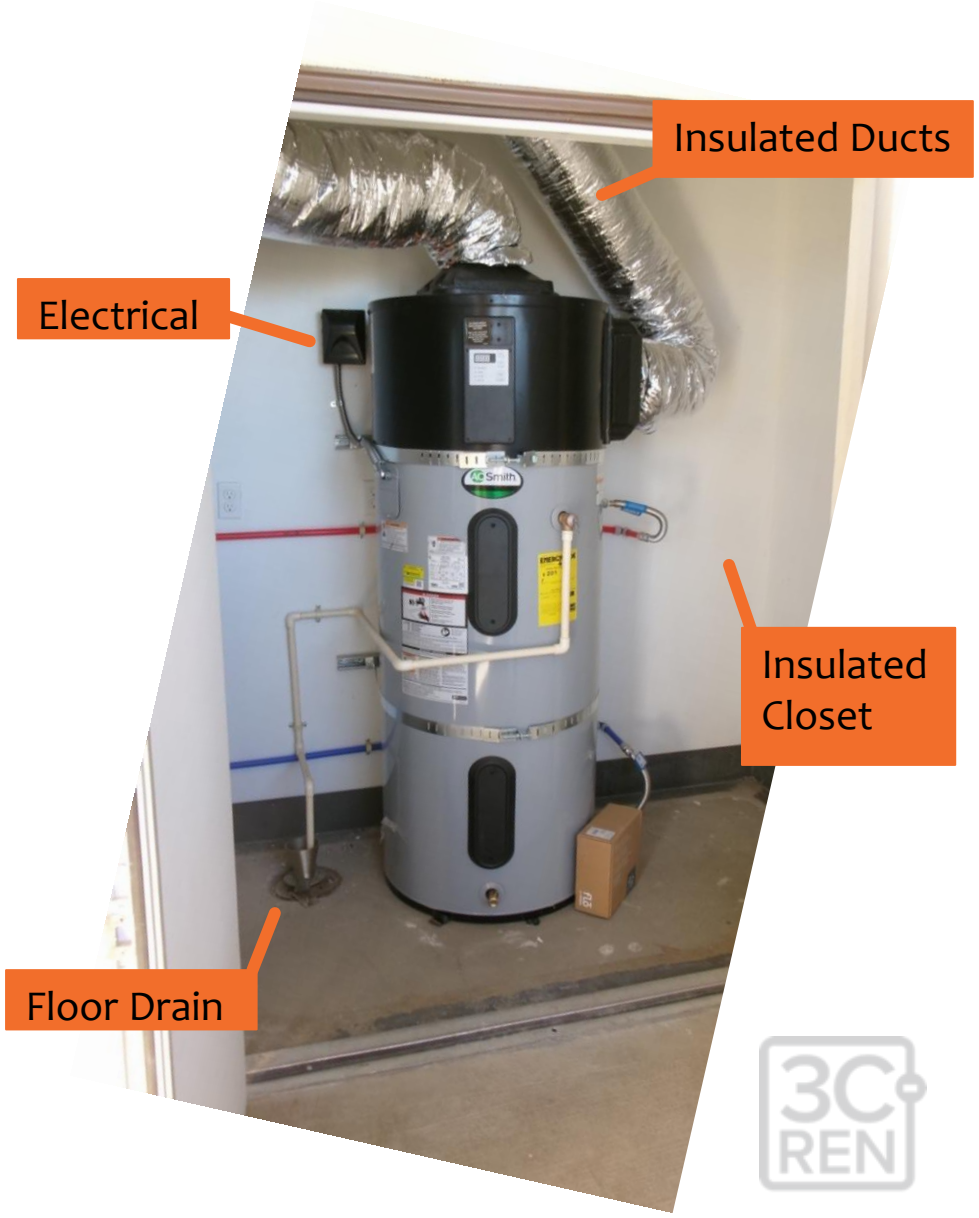




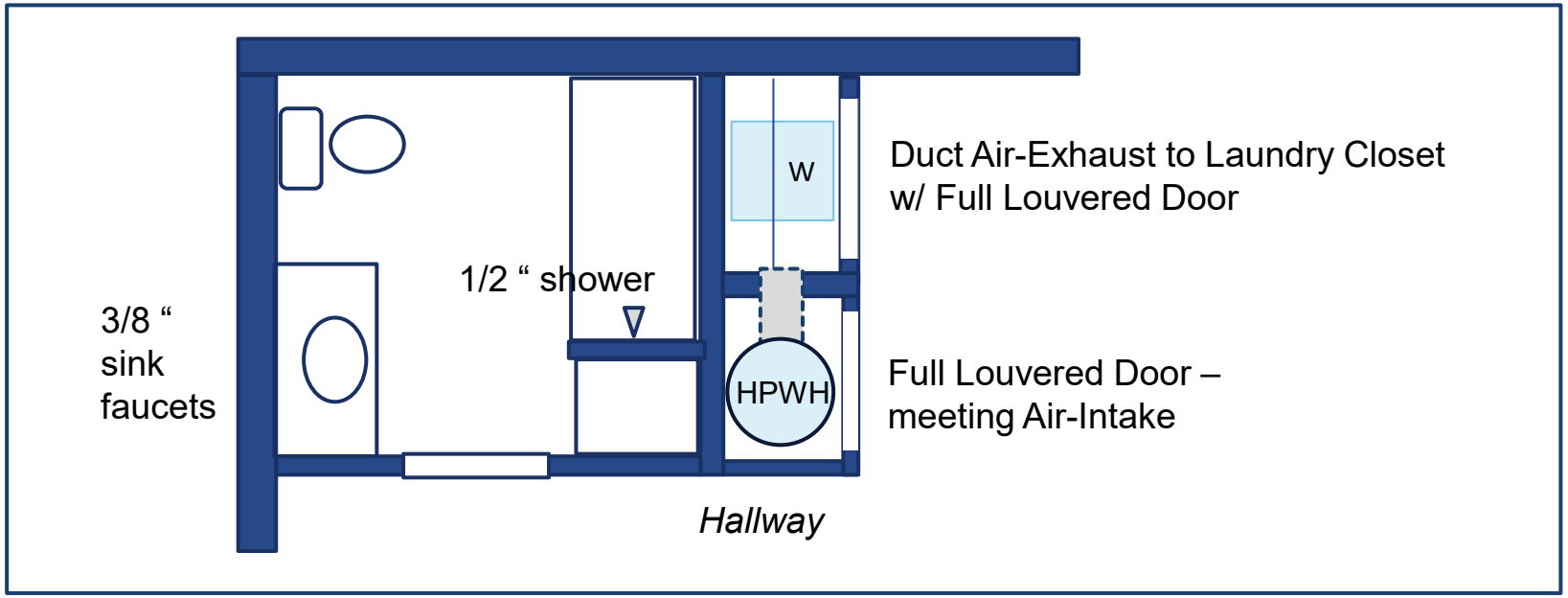
- Can work well in mild climates
- Protected from weather
- Louvered door for air volume

Insulated Outdoor Closet





Indoor Installations for Cold Climates and/or WUI



HPWH Located Indoors, and with Air-Inlet Indoors and Air-Outlet Indoors

Installation Tips:

- Look for HPWHs with lowest sound ratings
- Use app to schedule HPWH operation during the daytime
- Install with flexible piping at the water heater to isolate vibration
- Use flexible seismic straps or have sound/vibration isolation connectors
- Avoid locating along or behind a sleeping/bed wall

In Wildland-Urban Interface (WUI) areas, may need to locate the HPWH within the envelope, with non-combustible siding, solid exterior doors (or indoor), fire rated windows, and screen ventilation, etc.

Care and Maintenance

Changing the filter
Setting the temperature
Choosing the operation mode

Images: AO Smith https://www.hotwater.com/utility-programs/

Modes of Operation

- Efficiency: heat pump only
- Hybrid: both heat pump and electrical resistance heating elements
- Electric: electrical resistance heating only
- Vacation: puts the heater on hold at 60 deg F

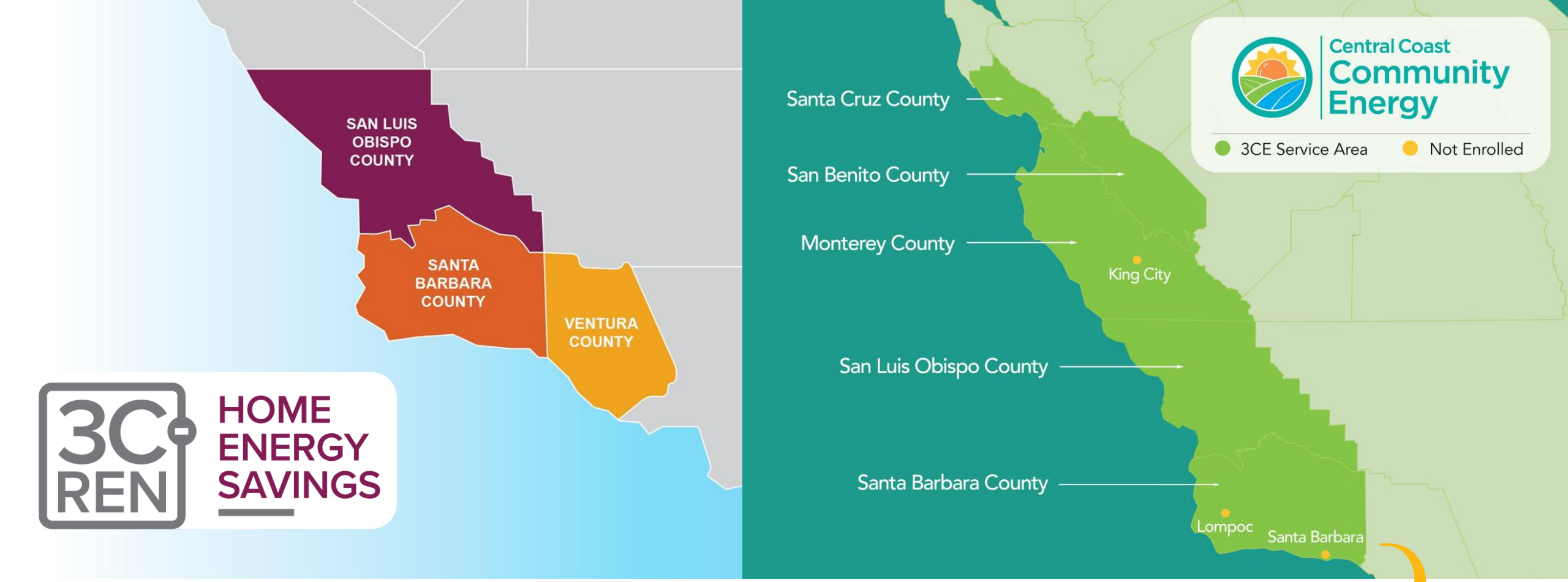
Images: AO Smith https://www.hotwater.com/utility-programs/

HPWHs Come with Washable Air Intake Filters

Filter is accessible and easily pulls out for maintenance

Issue: Elec conduit was installed over the top of the filter access zone

Incentives & Resources



3C-REN HOME ENERGY SAVINGS

Golden State REBATES

CALIFORNIA ENERGY-SMART HOMES ALL-ELECTRIC

Santa Barbara CLEAN ENERGY
CHOOSING RENEWABLE ELECTRICITY

Heat Pump HVAC Incentive Programs

Home Energy Savings
~ $750/$1,500
3c-ren.org
Available for Tri-County residents.

Air Pollution Control District
$5,000/$12,000
ourair.org and slocleanair.org
Available In SB & SLO counties.

3CE Electrify Your Home
$2,000-$4,000
3cenergy.org/rebates
Available for customers of Central Coast Community Energy (3CE).

Santa Barbara Clean Energy
$1,000-$7,500
santabarbaraca.gov/sbce
Available for SB Clean Energy customers, i.e. City of SB residents.

Cuyama Home Energy Retrofit Program (CHERP)
$2,500/$7,500
https://www.blueskycenter.org/cherp
Available for residents of the Cuyama Valley

All programs can be combined with each other except 3CE and SBCE.
Higher incentives reflect equity, hard-to-reach, and project-specific adders.
Incentive amounts current as of February 2026

Heat Pump Water Heater Incentive Programs

Home Energy Savings
~ $750/$1,500
3c-ren.org
Available for Tri-County residents.

Golden State Rebates
$400-$700
goldenstaterebates.com
Available throughout California.
Can't combine with 3C-REN.

3CE Electrify Your Home
$1,000-$2,500
3cenergy.org/rebates
Available for customers of Central Coast Community Energy (3CE).

Santa Barbara Clean Energy
$500-$7,500
santabarbaraca.gov/sbce
Available for SB Clean Energy customers, i.e. City of SB residents.

Cuyama Home Energy Retrofit Program (CHERP)
$2,500/$7,500
https://www.blueskycenter.org/cherp
Available for residents of the Cuyama Valley

All programs can be combined with each other except 3C-REN and Golden State Rebates.
Higher incentives reflect equity, hard-to-reach, and project-specific adders.
Incentive amounts current as of February 2026

Utilize 3C-REN's Incentive Concierge

3C REN HOME ENERGY SAVINGS

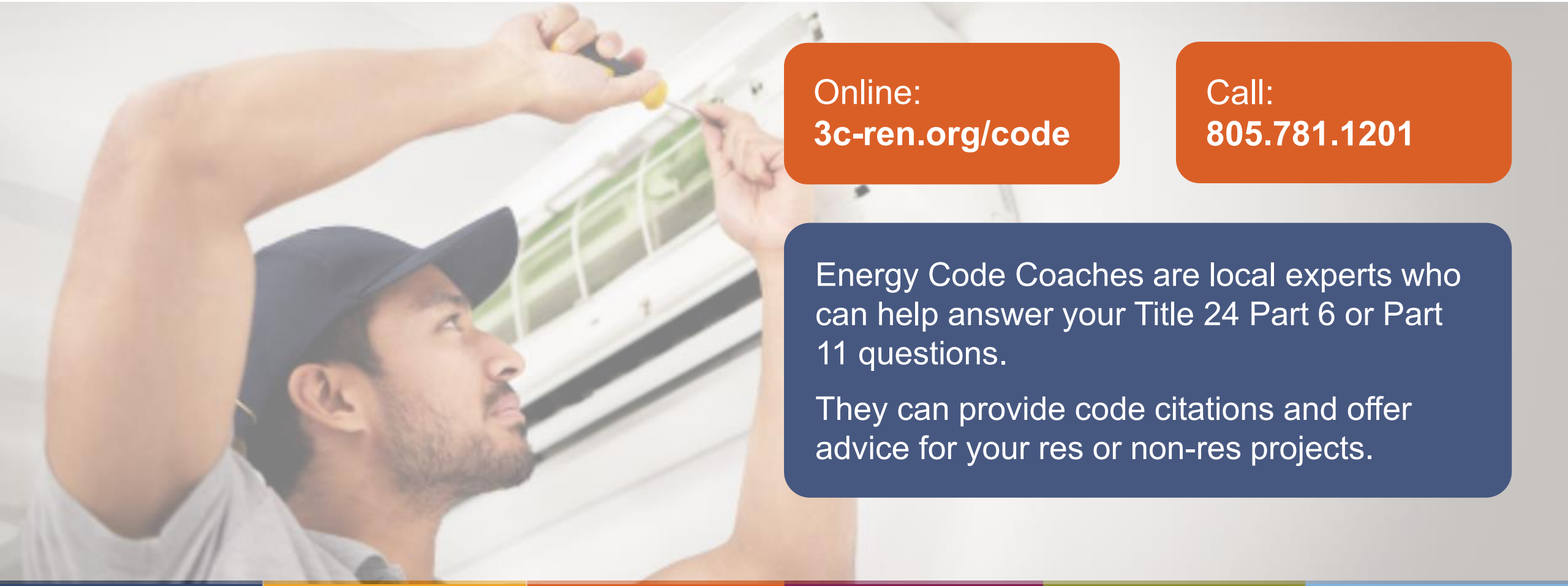
- For San Luis Obispo, Santa Barbara and Ventura counties
- Find an enrolled contractor
- Resident Resource Library

www.3c-ren.org/for-residents/

3C-REN Incentive Concierge
Available in English & Spanish
(805) 767-1204
info@3c-ren.org

Questions about Title 24?

3C-REN offers a *free* Code Coach Service



Online:
3c-ren.org/code

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 Part 6 or Part 11 questions.

They can provide code citations and offer advice for your res or non-res projects.

Thanks for coming!

Continuing Education Units Available

- Contact chloe.swick@venturacounty.gov with any questions

Today's Slides and Recording are Coming to Your Inbox Soon!

Upcoming Courses:

- ASK THE EXPERTS!: No More Heat Pump Headaches! (**Tomorrow!** 4/13)
- Energy Performance and Fire-Resistant Construction (4/16)
- Multi-Family Domestic Hot Water (4/28)
- **Regional Forum**: Retrofit Ready? Navigating the 2025 Energy Code for Aging Building (4/29)