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

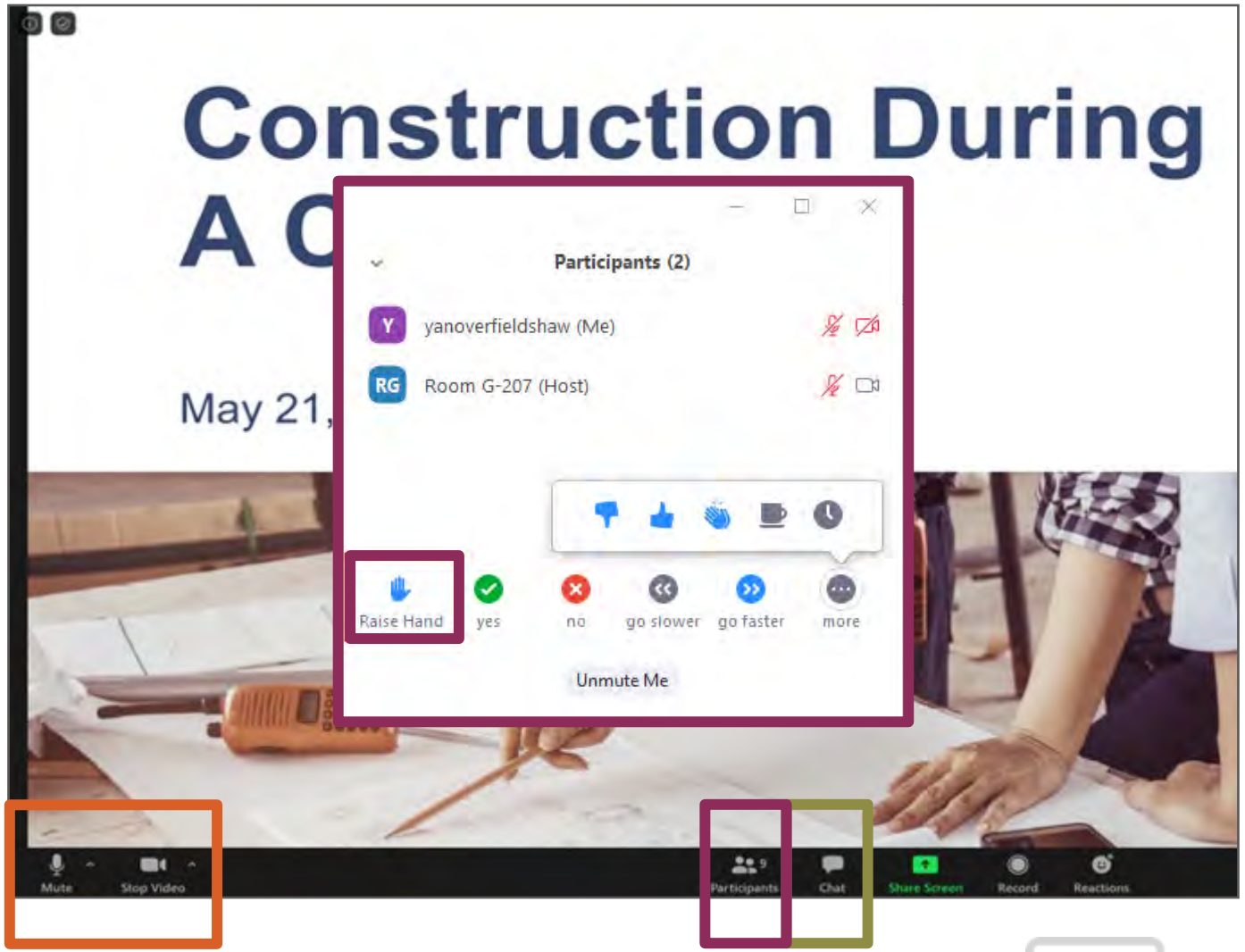
Ask the Experts: Heat Pump Water Heater Installations

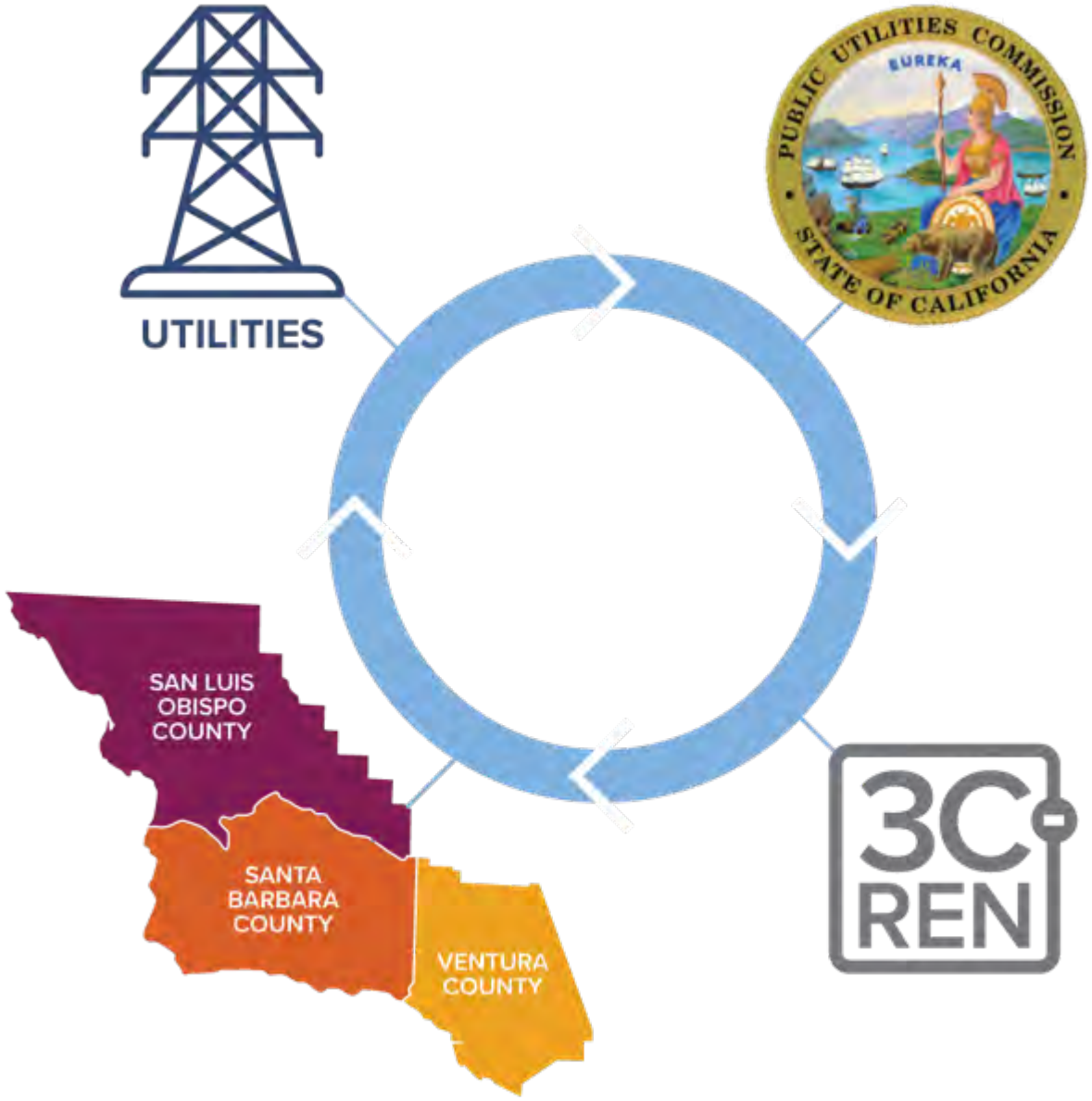
Nick Brown – Build Smart Group
Gary Klein – Gary Klein & Associates

June 27, 2025

Zoom Orientation

- Add an **introduction** in the chat.
  Be sure **full name** is displayed.
- Did you call in? Please **share** first and last name with us.
- Please **mute** upon joining
- Use the "**Chat**" to share questions or comments
- Under "**Participant**" select "**Raise Hand**" to share a question or comment verbally
- Session may be **recorded** and posted to 3C-REN's on-demand page
- Slides/recording are **shared** after most events
- 3C-REN does **not** allow **AI notetakers**, unless used to accommodate a disability.





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

Our Services

Incentives

HOME ENERGY SAVINGS

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

COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

Contractors can enroll at
3c-ren.org/contractors

Training

BUILDING PERFORMANCE TRAINING

3c-ren.org/events
3c-ren.org/building

ENERGY CODE CONNECT

3c-ren.org/code

View past trainings at
3c-ren.org/on-demand

Technical Assistance

AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture

ENERGY ASSURANCE SERVICES

3c-ren.org/assurance

3C REN

Add Heat Pump Water Heaters to Your Toolbox

Training Sponsored by Tri-County Regional Energy Network

From Tank to Tankless and Now Back Again?

Agenda

Why we need HPWHs

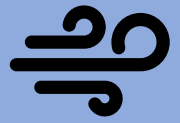
How to Install HPWHs

The Good, The Bad, and The Ugly

From Around California

How HPWHs are Different

Compared to Typical Water Heaters



Air Flow is the #1 Key

The Amazing Shrinking Room Research

Reasons to Electrify Homes

- One less utility - Less expensive to build and operate
- Billions of dollars in incentives, training….
- Easier energy code compliance
- American Medical Association (AMA) Study - Gas Stoves Increase Household Air Pollution (NOx) and the Risk of Childhood Asthma
- Utility cost savings
- Reduced pollution & 50% Lower Greenhouse Gas emissions than homes with gas

Heat Pump Water Heaters: Why We Need Them

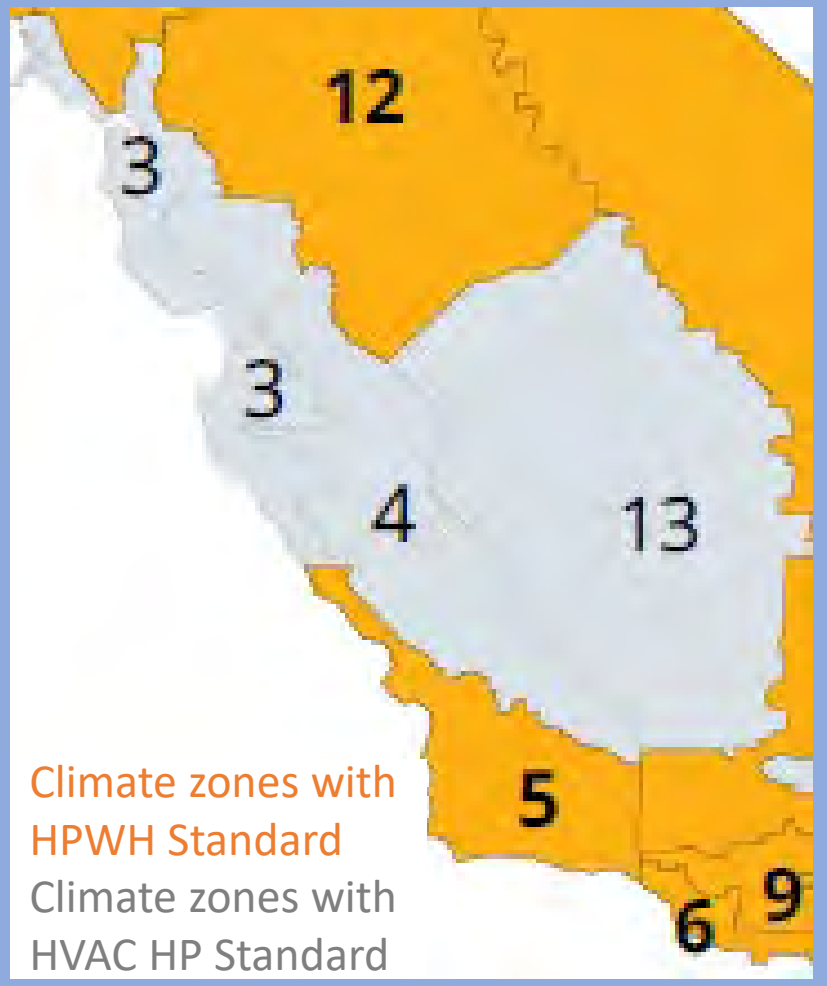
What's In It for You?

"You Can't Stop the Waves but you can Learn to Surf"

- **$3,500 rebates to the contractor through TECH program and Switch is On [program suspended for now]**
- **Get comfortable with the new style water heater so your business can grow with the changes**
- **CA may soon require all water heaters sold to be HPWHs**
  - **Bay Area AQMD already has passed a rule doing this by 2027**

Title 24 Makes Heat Pump Water Heaters Prescriptive Standard in Most of 3C-REN for New Construction

- HPWHs prescriptive standard in LA, Ventura, Santa Barbara, SLO
- Dedicated electrical circuits, plumbing etc. are required to backup every gas appliance installed
- Big compliance credit for HPWHs
- Big compliance penalty for gas WHs
- 2025 code will make HPWHs prescriptive standard statewide

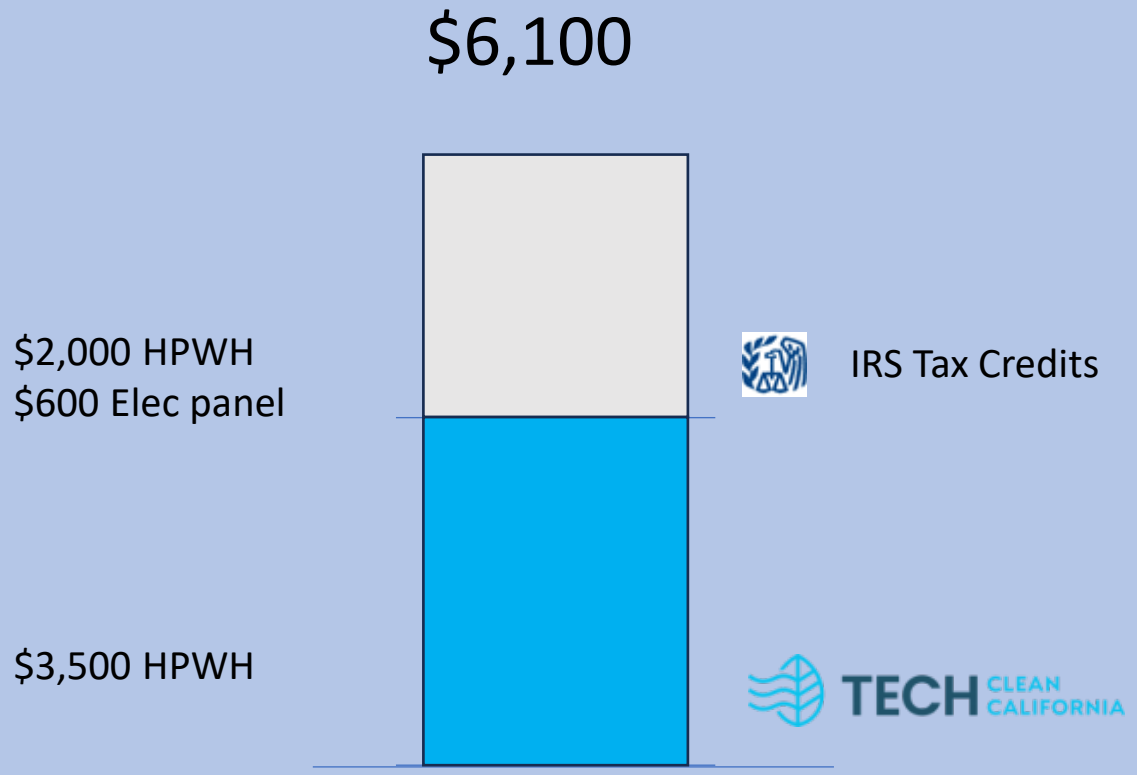


Incentives Add Up

HPWH $6,100

Available to All Income Levels

Whole House All-electric Incentives can add up to $21,000 !



Project Spotlight: Jefferson 17-unit in Los Angeles

"**It just doesn't make any sense to me to run all those gas lines through my building… just from a financial perspective.** We hope to save money and permitting by having one less trade."

- Steve Kraemer, Rock Development

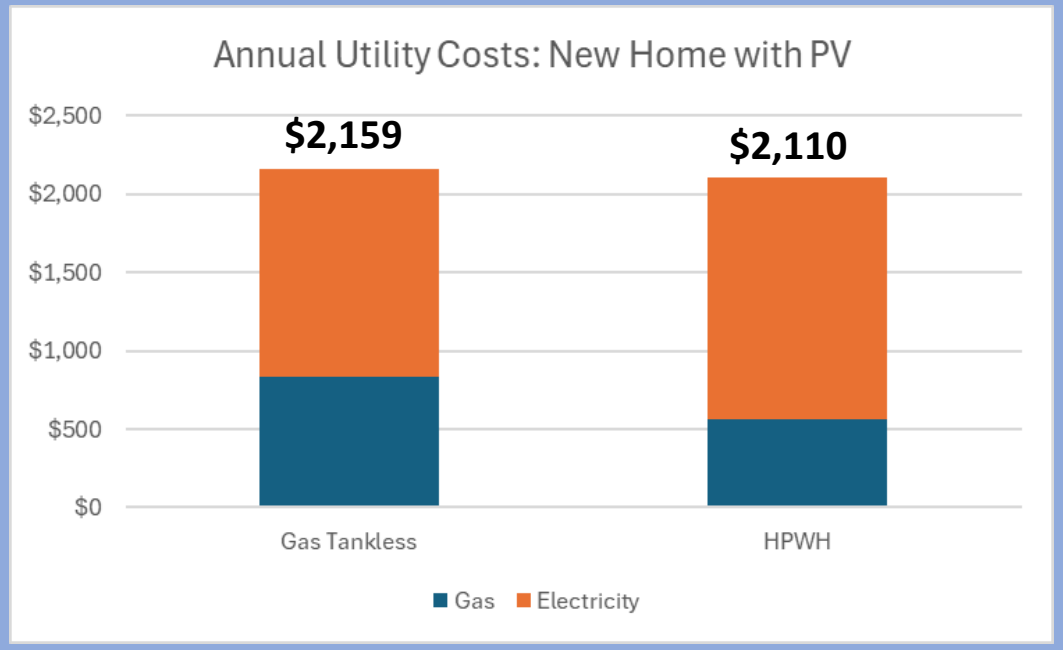
- All-Electric
- HPWH in each unit/hallway
- Ductless minisplit HVAC in each unit; condensers on the roof
- Required electrical upgrades through LADWP
- Complied with Non-residential energy code

Gas is Not Cheaper!

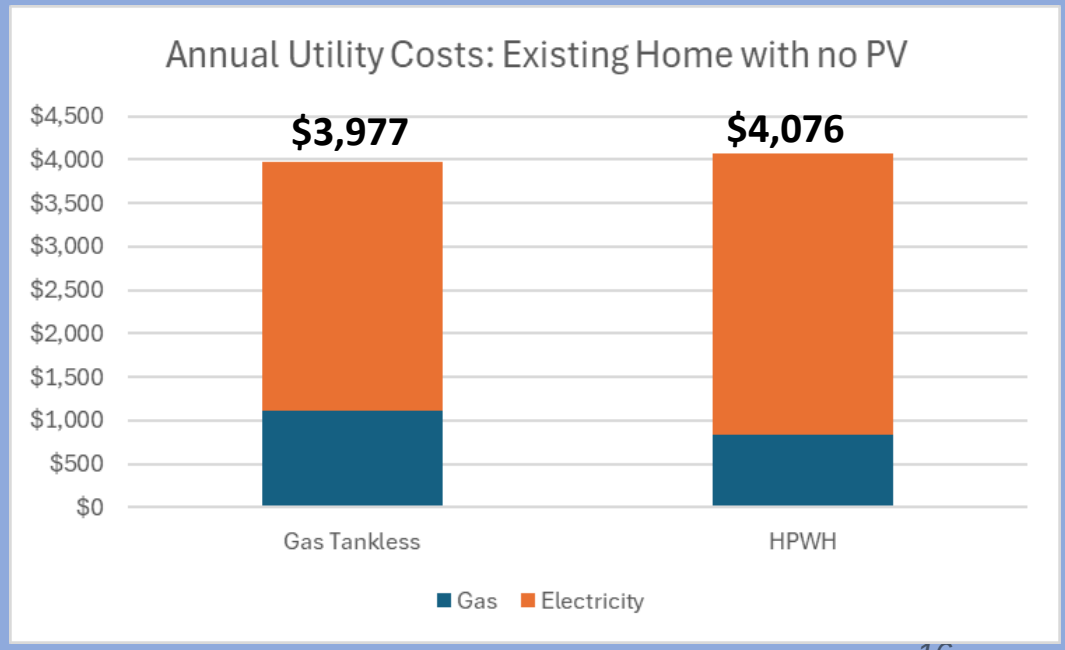
Set HPWH to run in Heat Pump Only mode & not run in peak periods.

Then cost would be less than gas

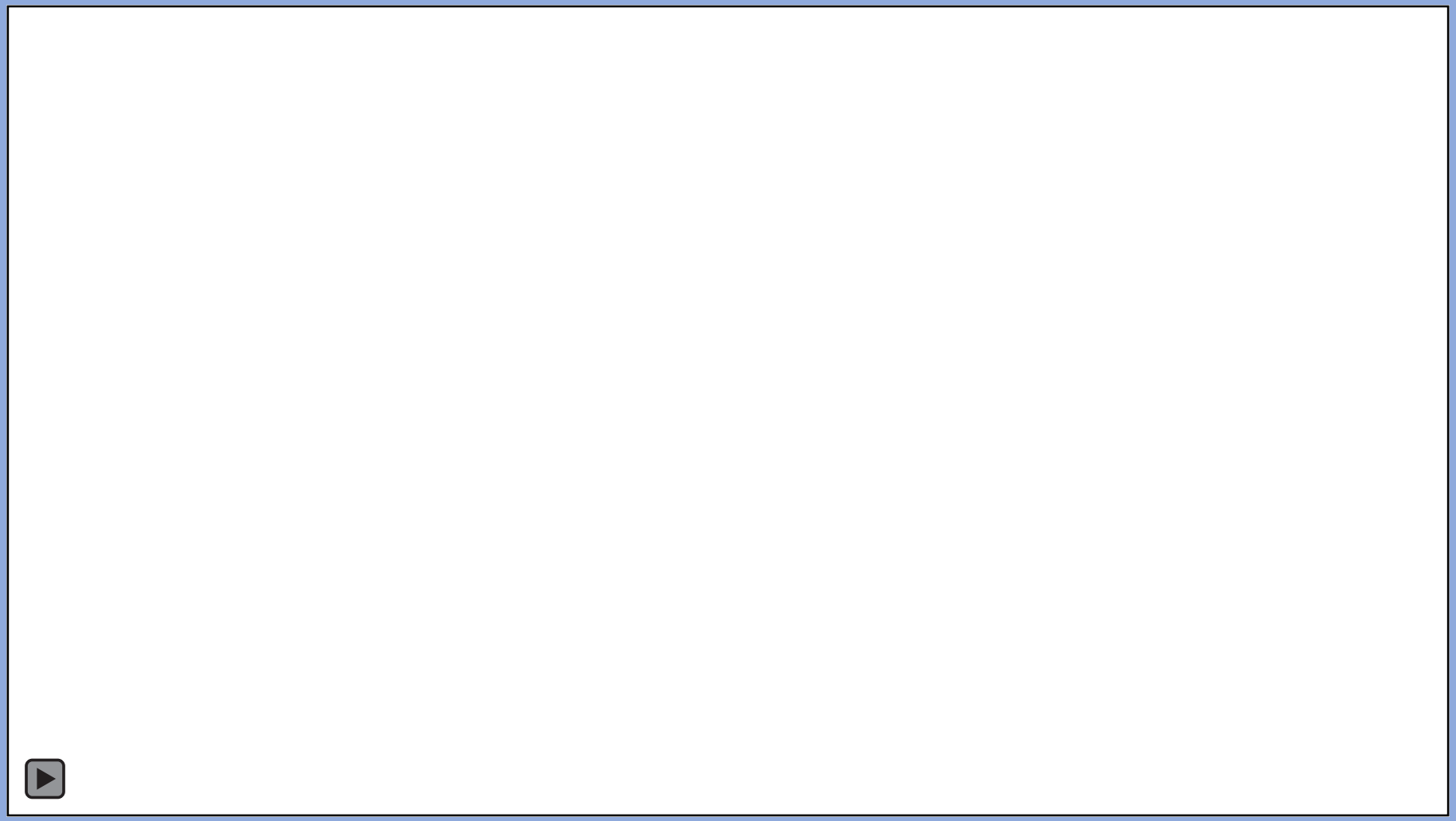
CZ 12, Annual Utility costs: New 4 BR Home with PV



CZ 12, Annual Utility costs: Existing 4 BR Homes with no PV



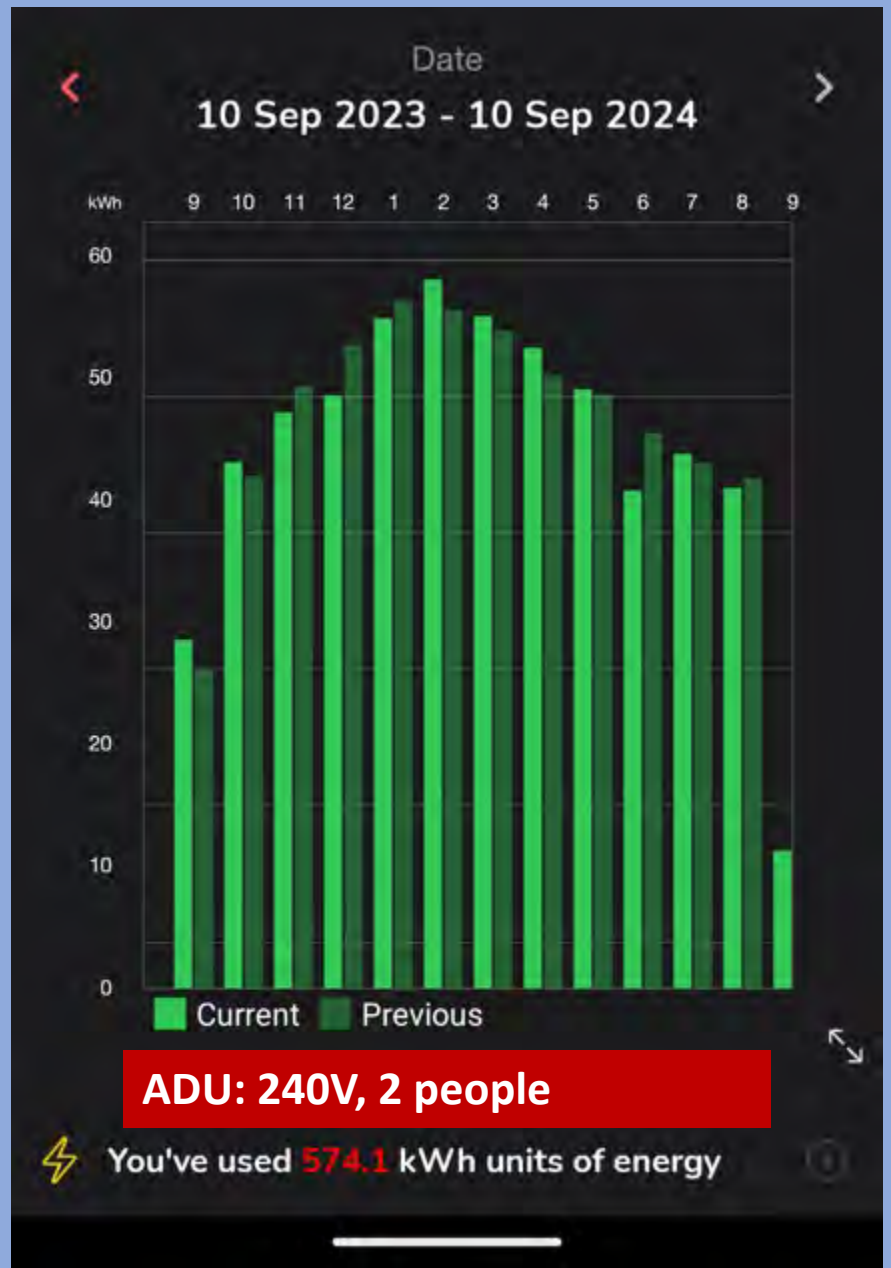
Are HPWHs Really That Loud?

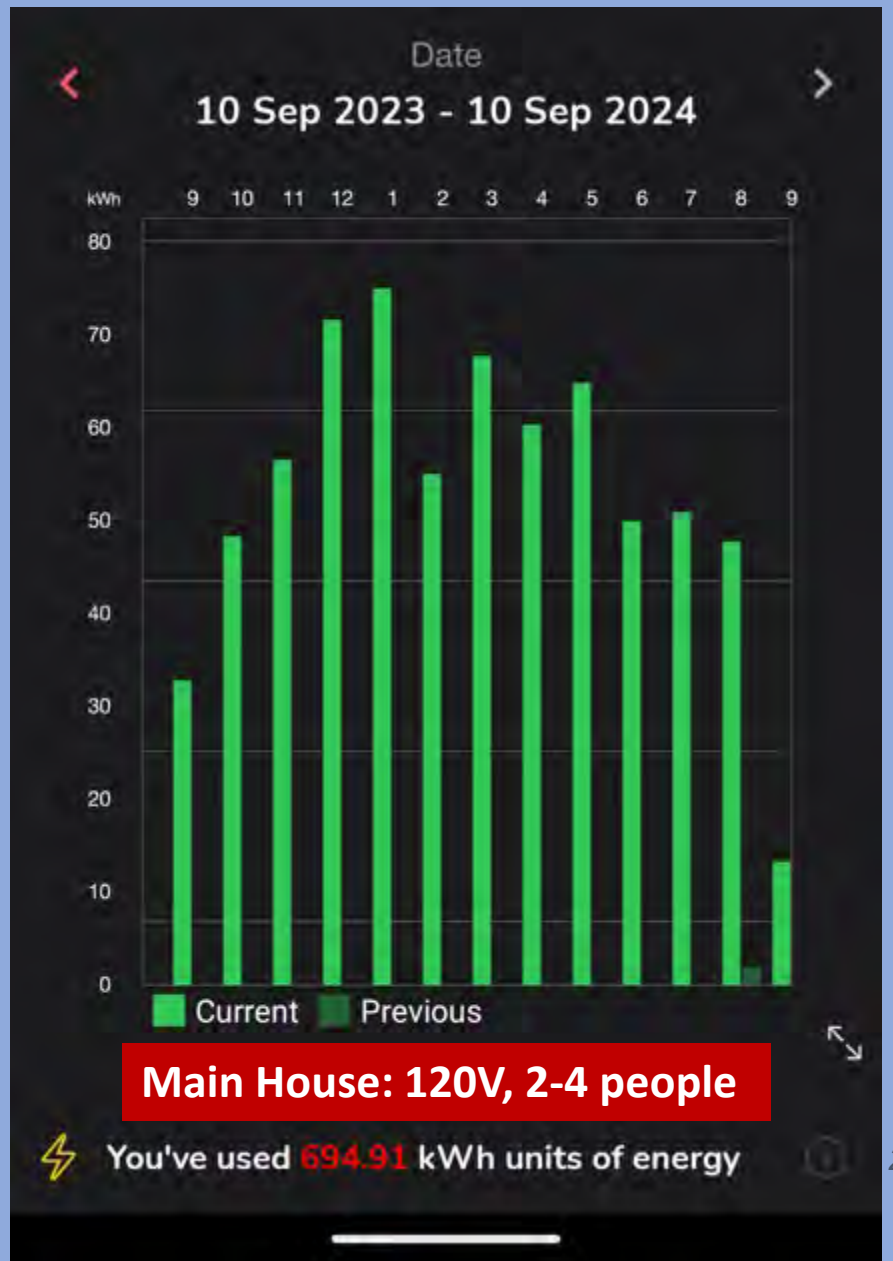


Project Spotlight: Long Beach Installs Working Well

Heat Pump Water Heaters: Very Small Loads

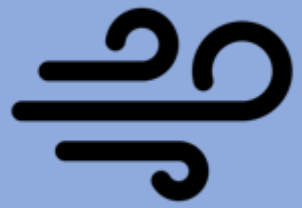
Units run on ~50 kWh per month= $18 per month





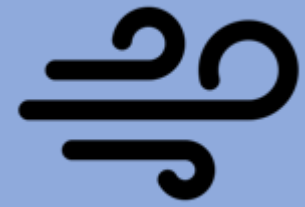
Heat Pump Water Heaters: What's Different

What's Different about HPWH?



Air-source HPWH get the energy to heat water from the air

This makes them different from traditional water heaters that get energy from fossil fuel or electricity directly

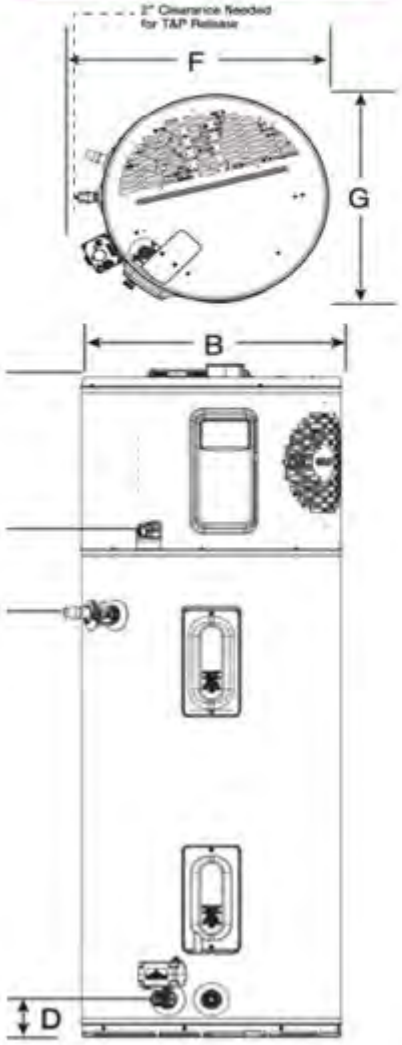


We need to pay special attention to the air around our installs

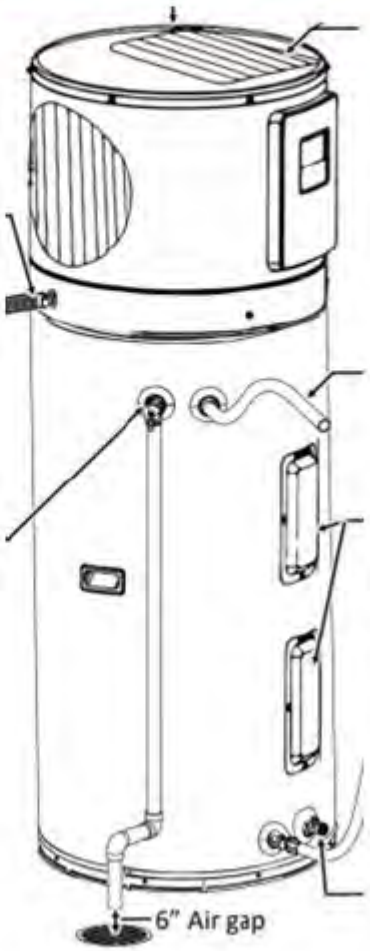
Makes & Models Available Today

Configurations, Clearances, and Air Flow

Top Intake Side Exhaust

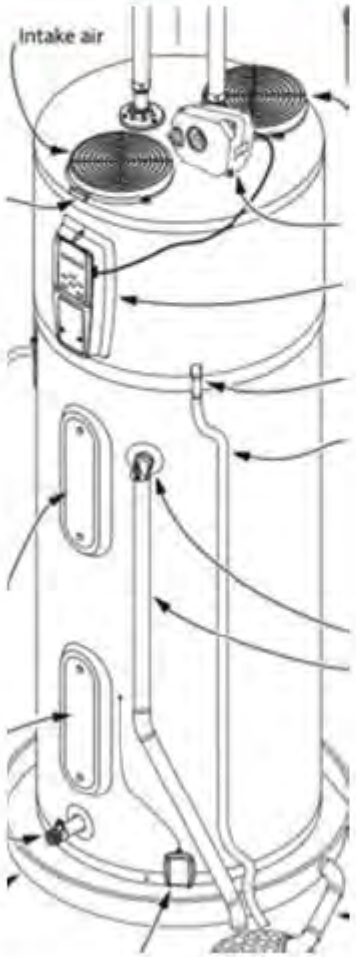


Top Intake Side Exhaust

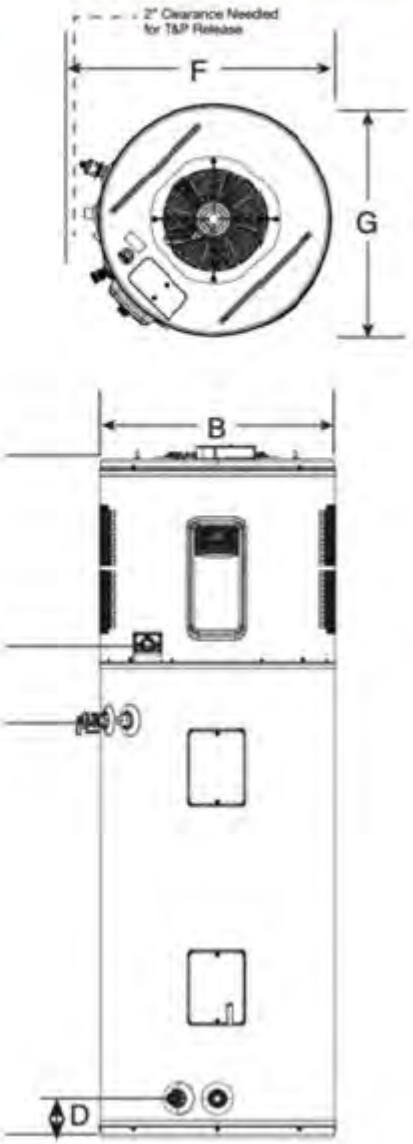


Top Intake Rear Exhaust

Top Intake Top Exhaust

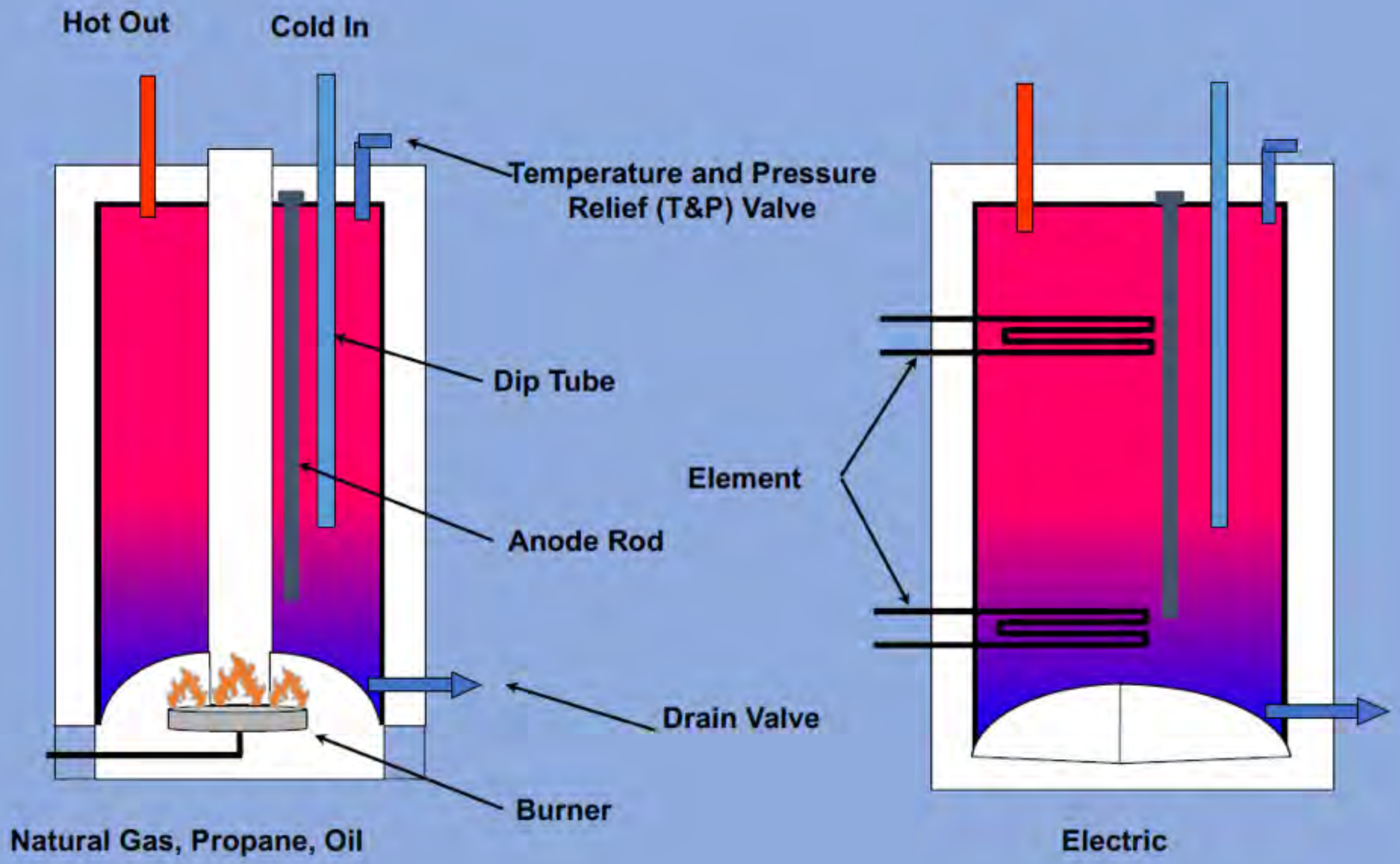


Side Intakes Top Exhaust

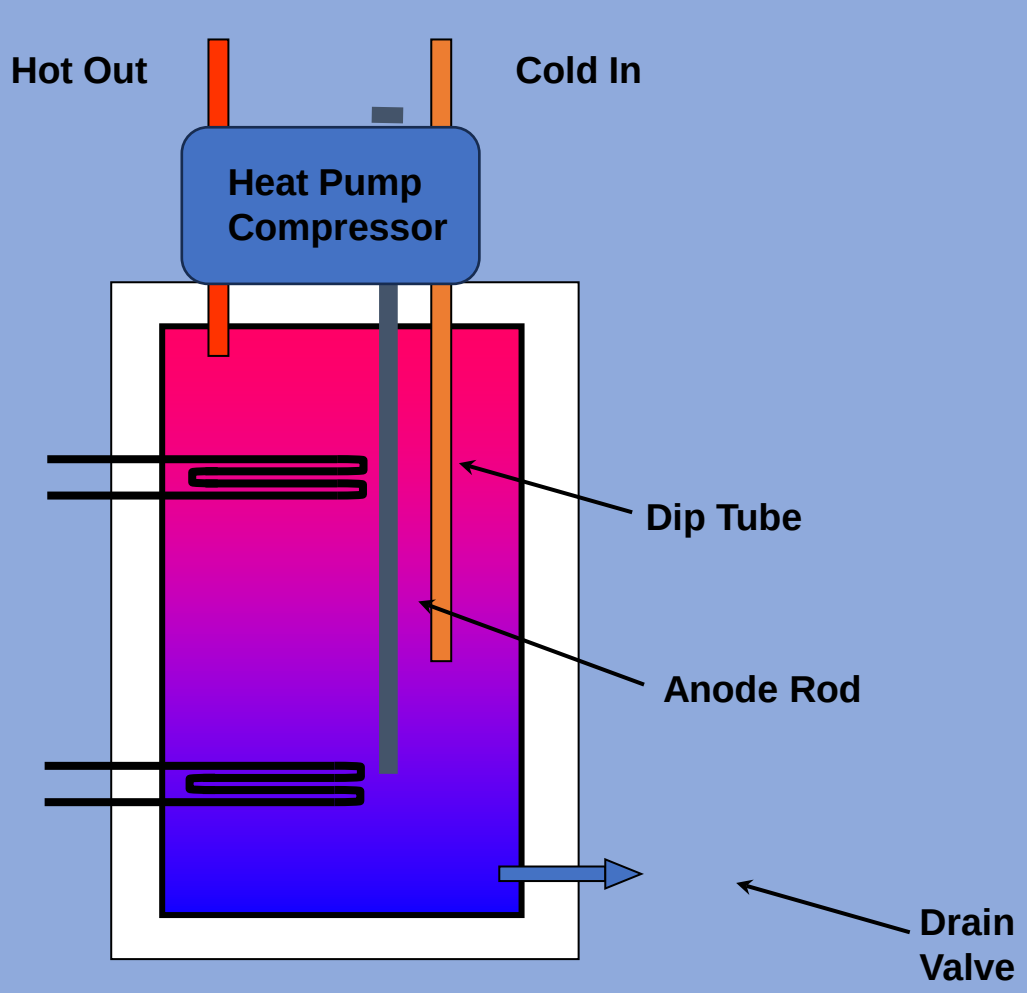


SANCO2 in Multifamily

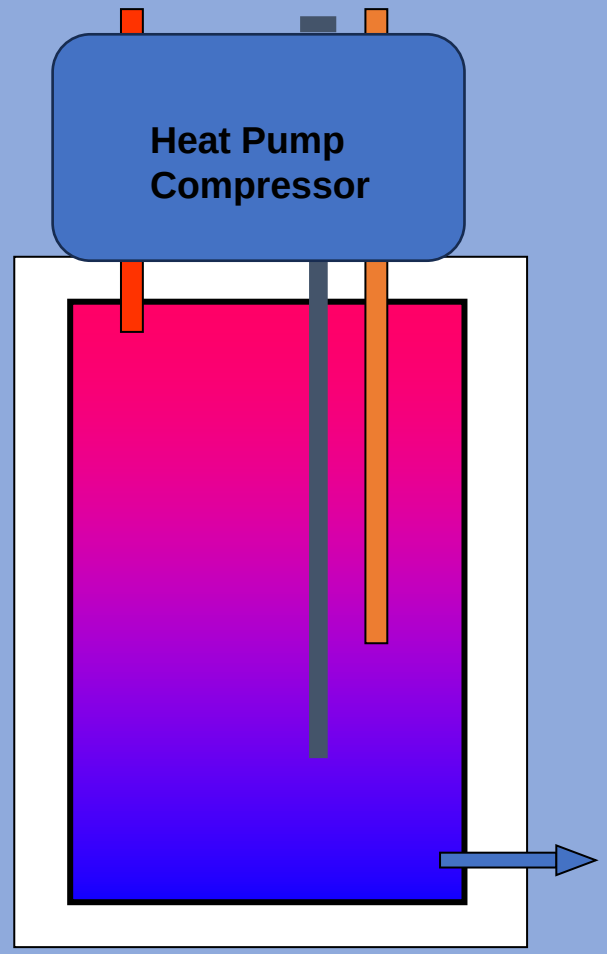
Tank Water Heaters Have Different Heat Sources



Tank Water Heaters Have Different Heat Sources



“Hybrid” 240V Heat Pump:
Air + Electricity Back-up

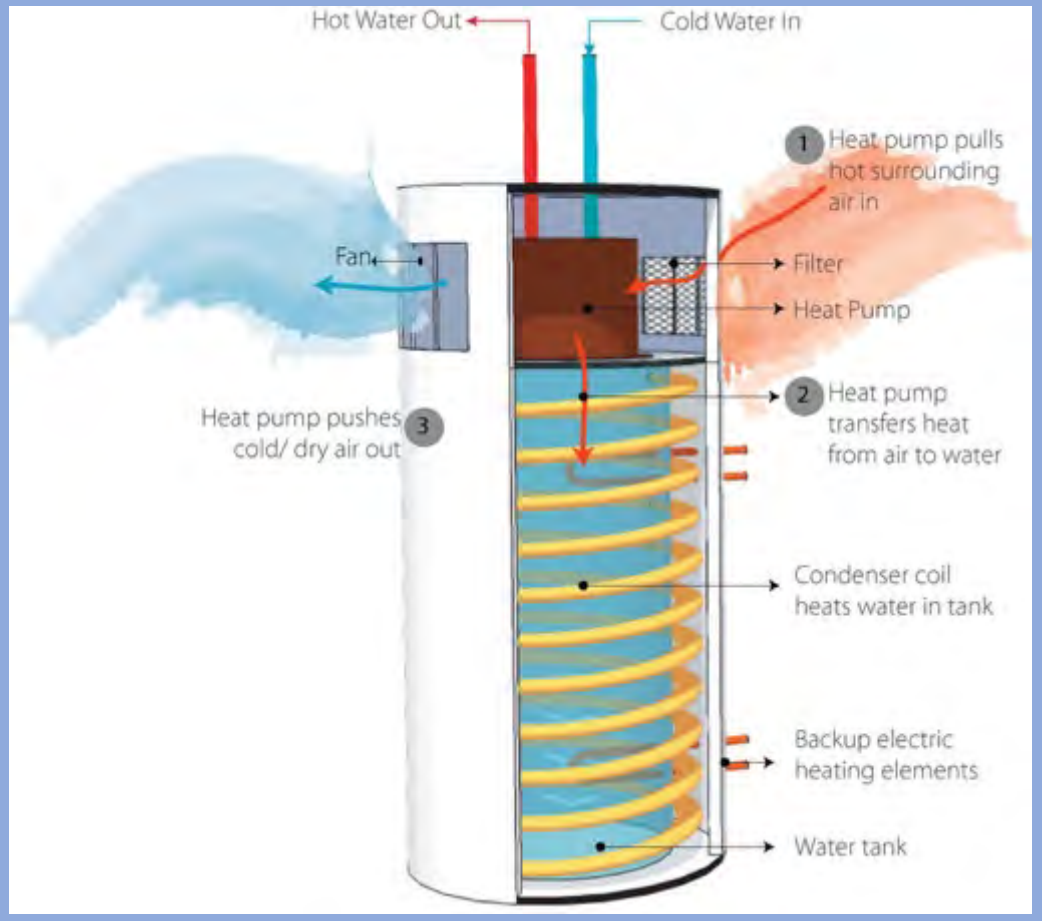


“Plug-in” 120V Heat Pump:
Air*

***NOTE: some 120V have electricity back-up**

Heat Pump Water Heaters

Unitary: The HP is attached to the tank

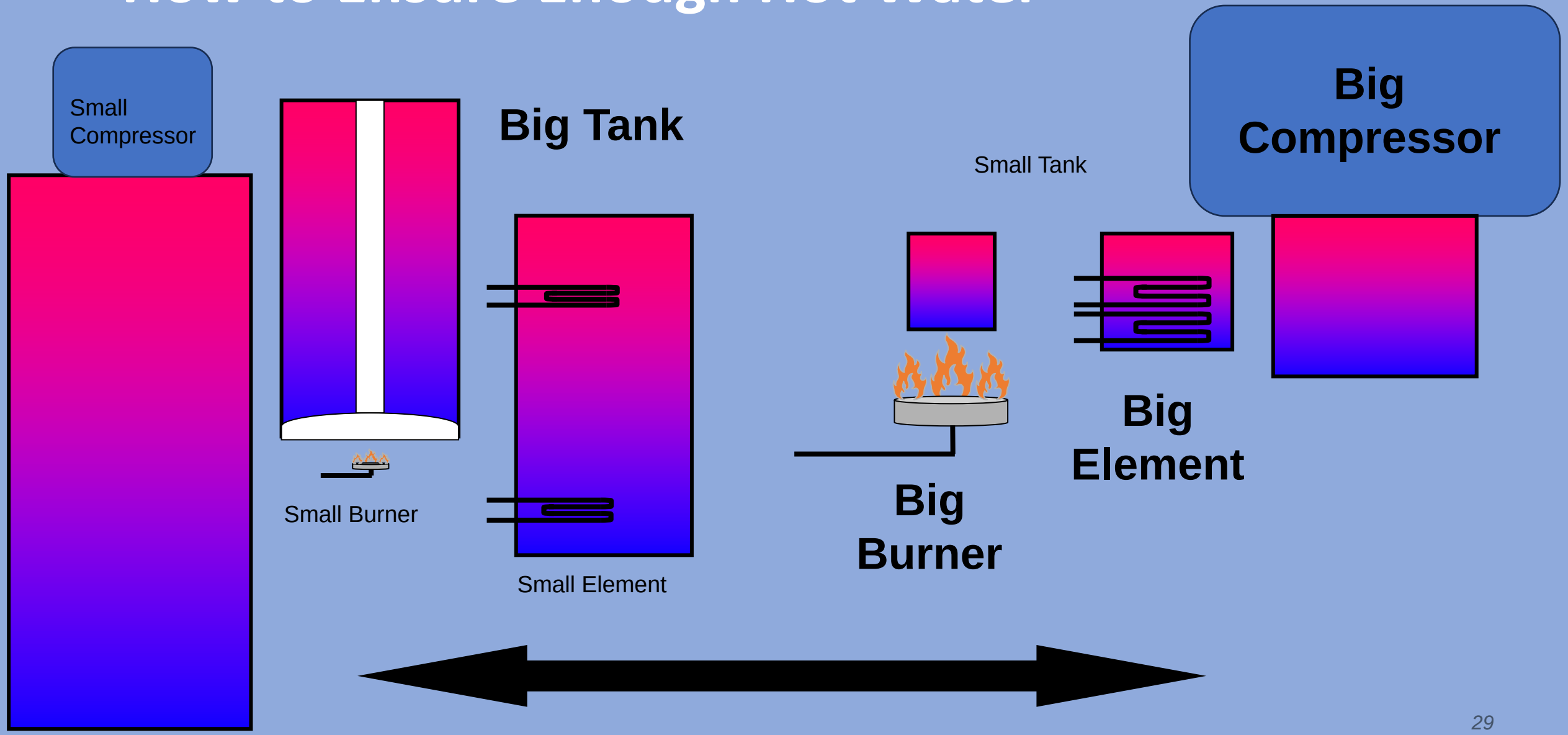


Source: PNNL.gov

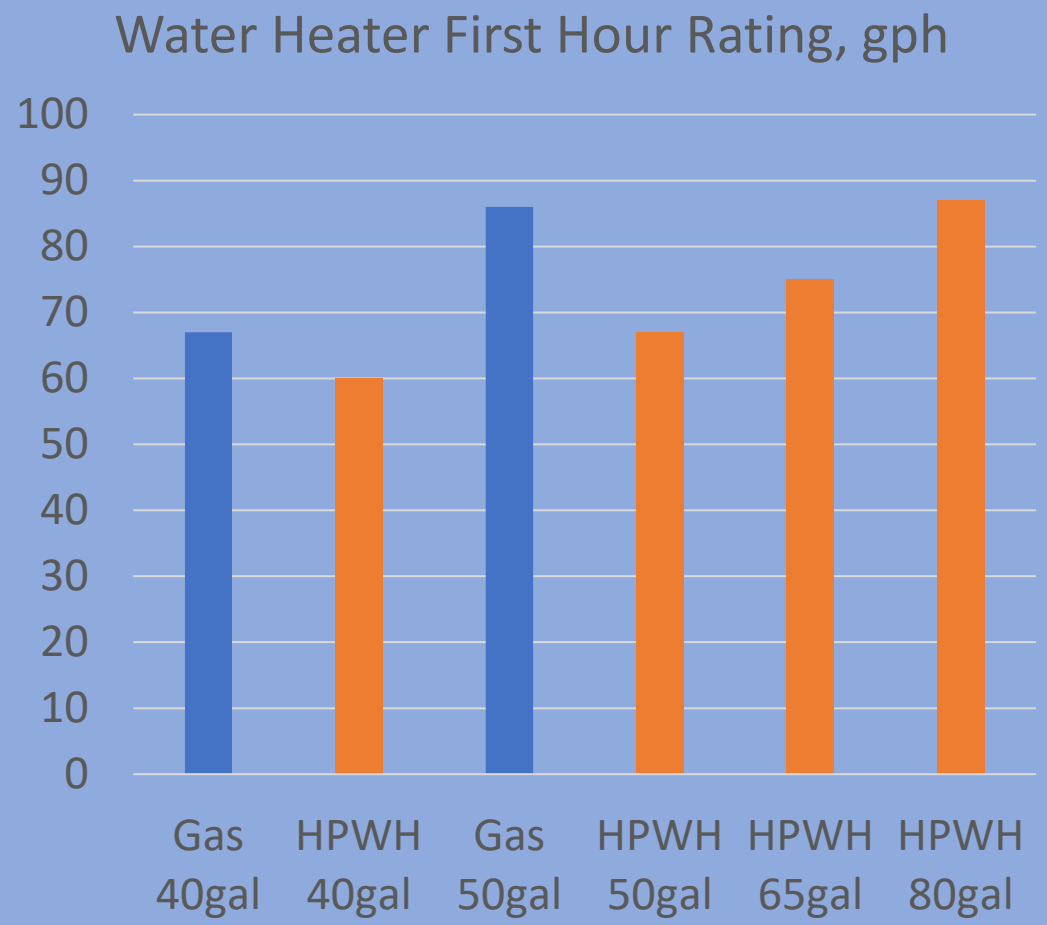
Split: The HP is separate from the tank

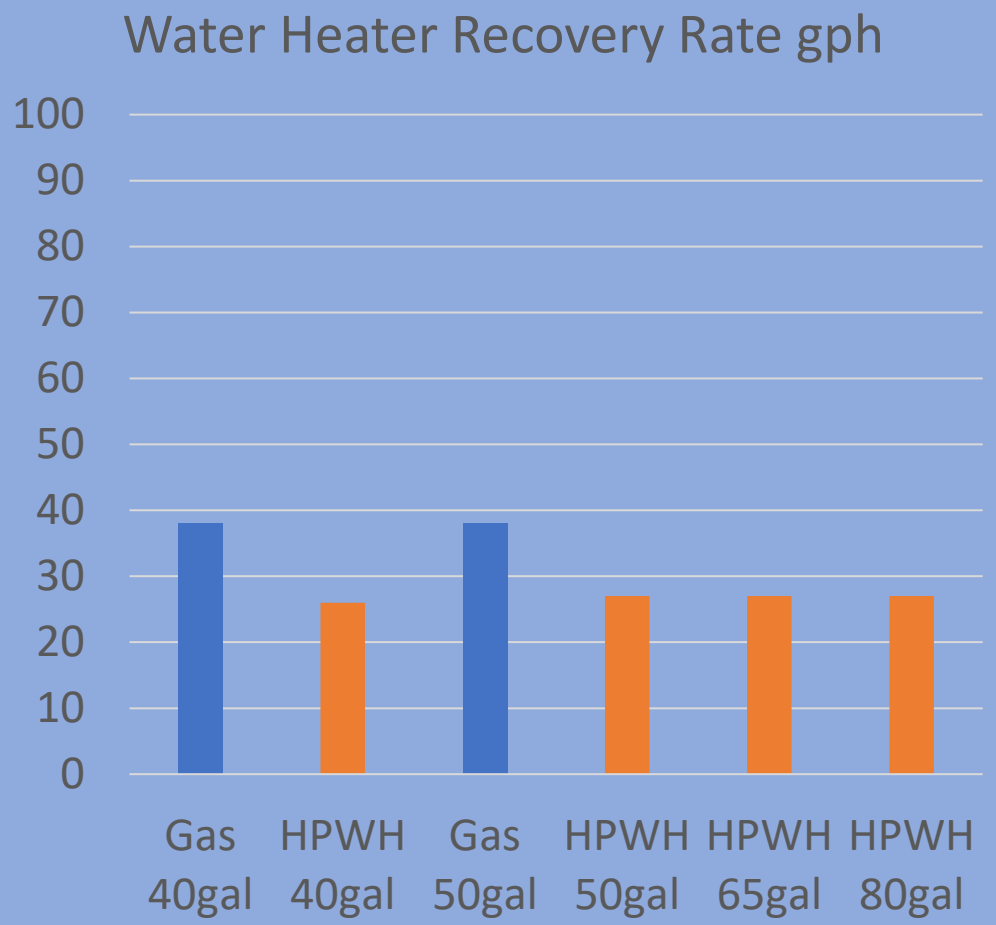
Source: coowor.com

How to Ensure Enough Hot Water



HPWHs are Energy Sippers



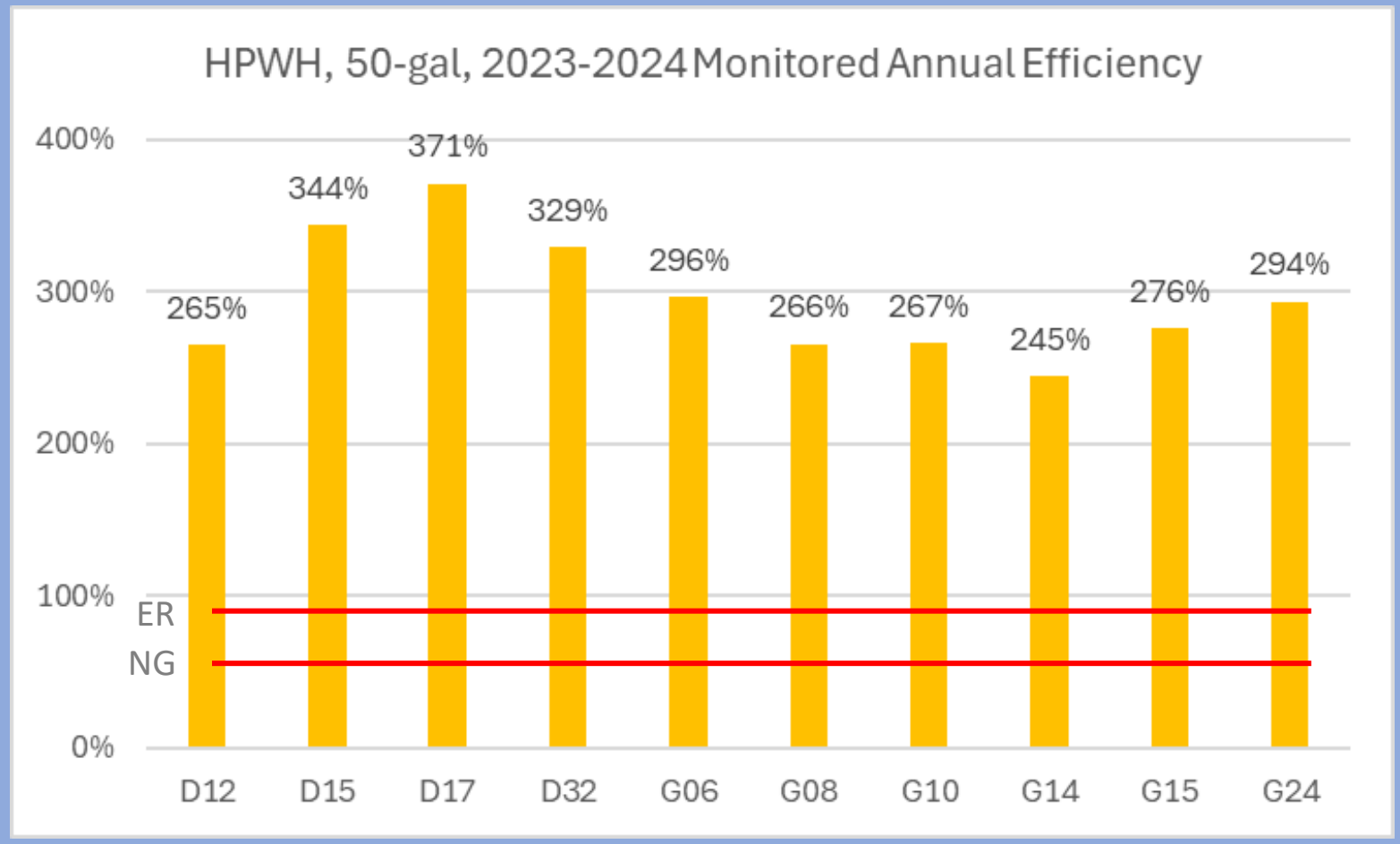


b. **Thermal storage**: comply with the first hour rating requirements in the following table (Chapter 5, Table 501.1(2) in 2022 California Plumbing Code):

Number of bathrooms	1 to 1.5	1 to 1.5	1 to 1.5	2 to 2.5	2 to 2.5	2 to 2.5	2 to 2.5	3 to 3.5	3 to 3.5	3 to 3.5	3 to 3.5
Number of bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating (gallons)	38	49	49	49	62	62	74	62	74	74	74

HPWHs are Working Efficiently & Reliably

- Average 270% efficiency
- Hot water use:
  - 37-144 gal per day
- Slightly lower efficiency in high usage homes
  - 37-75 gal/day: 302%
  - >100 gal/day: 279%
- No major complaints in 2 full years



Effective Capacity of Storage Water Heaters

Nominal Tank Volume (Gallons)	40	50	65	80
Percent Available	70%	70%	70%	70%
Usable Volume (Gallons)	28	35	46	56
Assume Hot Water Flow Rate is:	**Shower Time (min)**			
1 GPM	28	35	46	56
2 GPM	14	18	23	28
5 GPM	6	7	9	11
10 GPM	3	4	5	6

1.75 gpm shower head

Raising the tank temperature reduces the amount of hot water in the mix, increasing the time.

How Fast Can They Heat the Water?

Make/Model	Heat Pump Capacity	Resistance Element Capacity
Standard 240V Rheem Bradford White AO Smith Rinnai	4,000 btu/hr	15,000 btu/hr
LG 240V variable capacity	10,000 btu/hr	17,000 btu/hr
AO Smith 120V	4,000 btu/hr	3,000 btu/hr
Rheem 120V dedicated circuit	12,000 btu/hr	None
Rheem 120V shared circuit	4,000 btu/hr	None

Understand the differences in the time to reheat the tank

Why Tankless Aren't Better than Tank

- Yes, there's no standby loss
- Yes, they don't take up floor space
- Yes, they're inexpensive to buy
- Yes, Title 24 allows them (only in new homes < 500 sqft)

BUT…

- Electric **resistance** is NOT same as Electric **Heat pump**
- Electric resistance is Less Efficient & Means Higher Utility Bills than Heat pump
- Most electric panels cannot fit 240 Volt 60+ amp circuit
- Flushing required annually for maintenance
- In Title 24 compliance, Electric Tankless perform poorly

The ONLY good choice in electric water heaters is HPWH

Installing Heat Pump Water Heaters

Our Project in San Joaquin Valley shows the units work for all types of homes.

BUT, they are often installed incorrectly

Installing HPWHs

1. They need an electrical connection.
   - *Most are 240 VAC; 120 VAC units are now available*
2. There needs to be an adequate supply source of “warm” air
3. There needs to be an equally adequate space to absorb the cold air that comes out of the heat pump or the unit needs to be ducted
4. Filters need to be accessible for cleaning
5. They produce condensate that must be disposed of properly
6. The compressor noise may be a concern.
7. If the storage temperature will be set above 140F, a master mixing valve (ASSE-1017 only) needs to be installed
8. They do not work efficiently with warm inlet water
   - *Recirc pumps and Solar Thermal systems require extra design consideration*
9. Anything else?

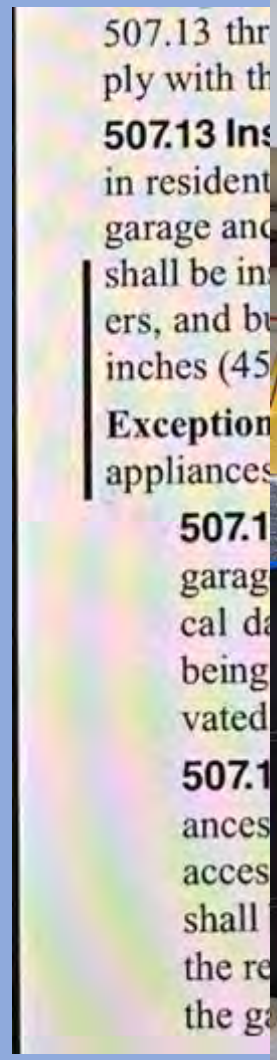
Install Pictures from Around California

Let’s Learn from What Other Installers Have Done

What the Code Says About Installing in Garages

There needs to be a platform so that:

- Heating elements 18 inches above the floor
- If HPWH has elements, they should comply with this
- If element is 10” above the base, then need an 8” platform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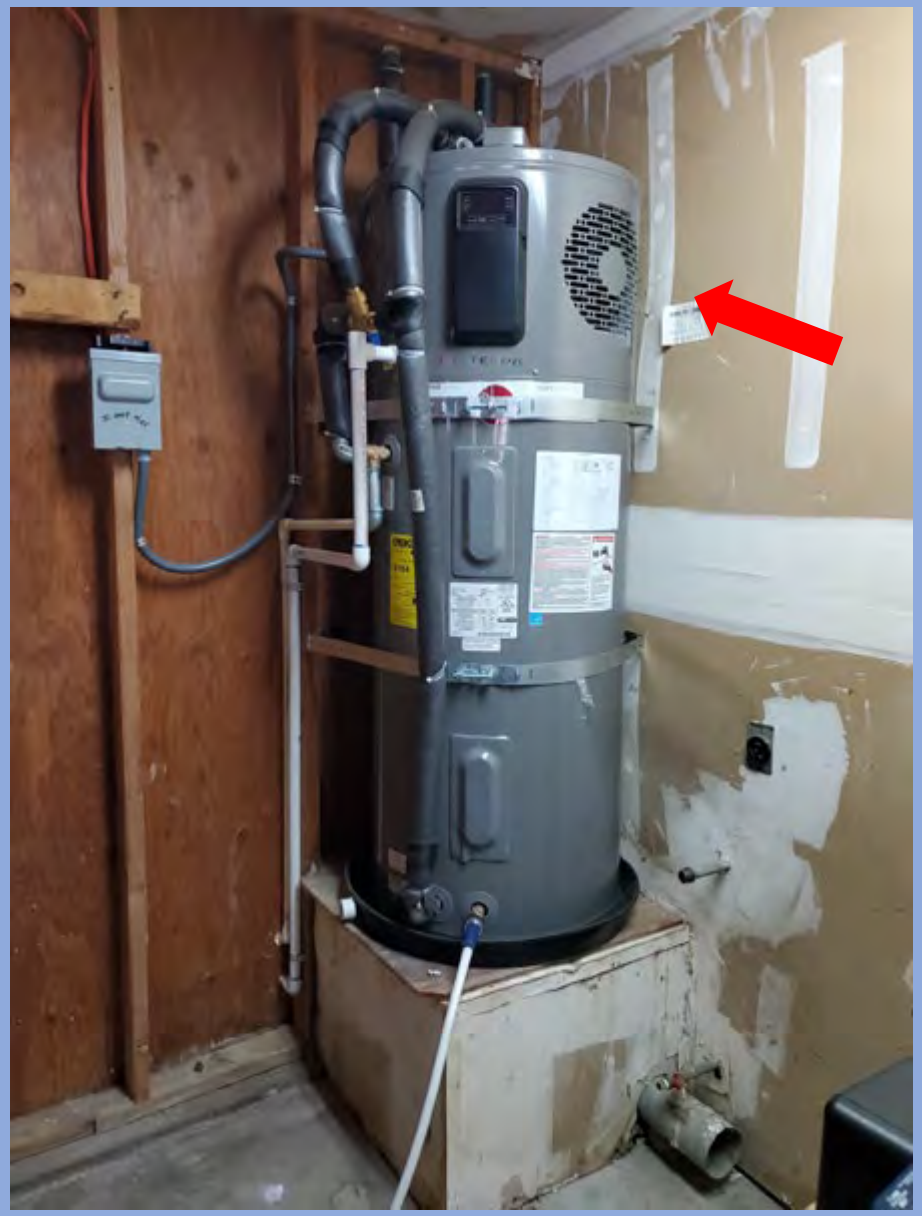

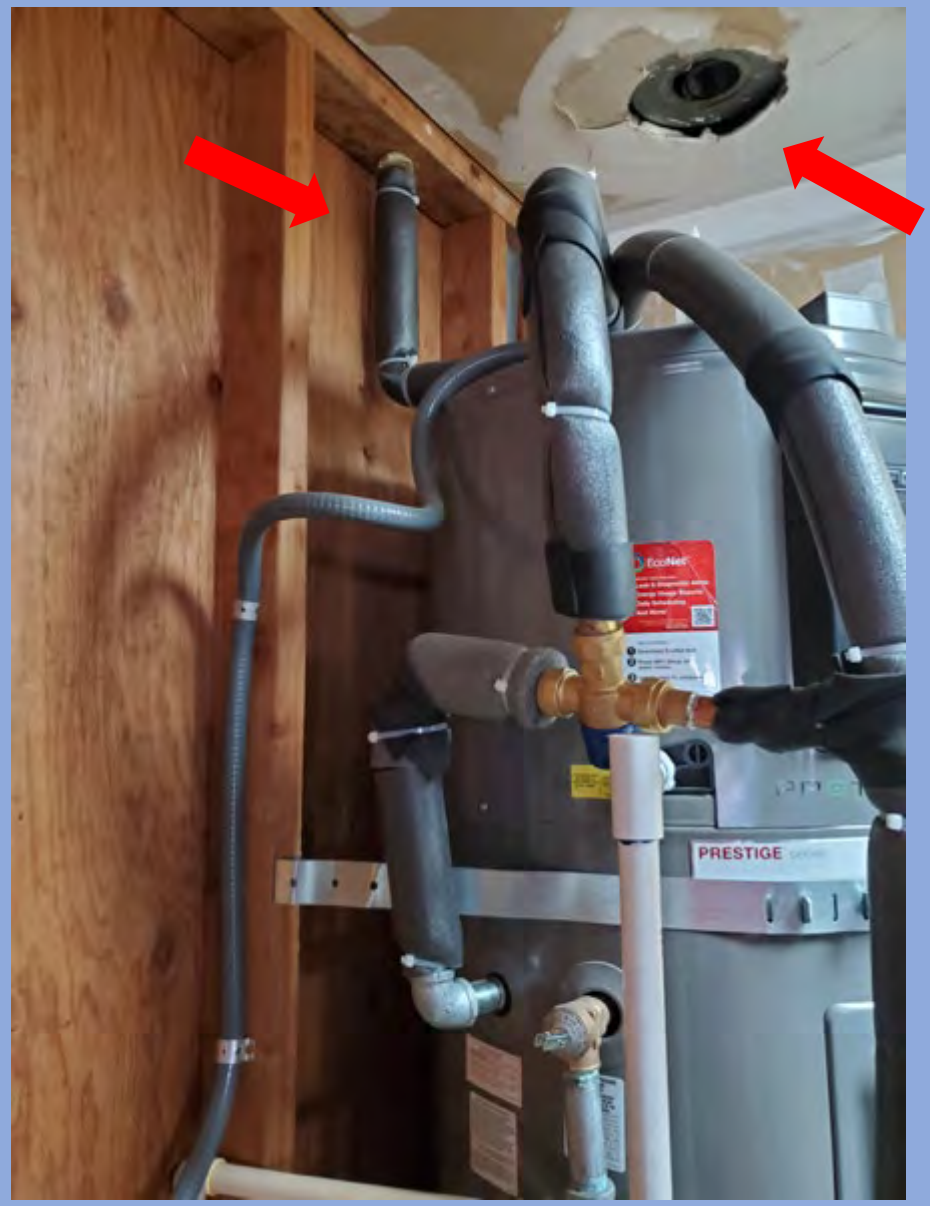
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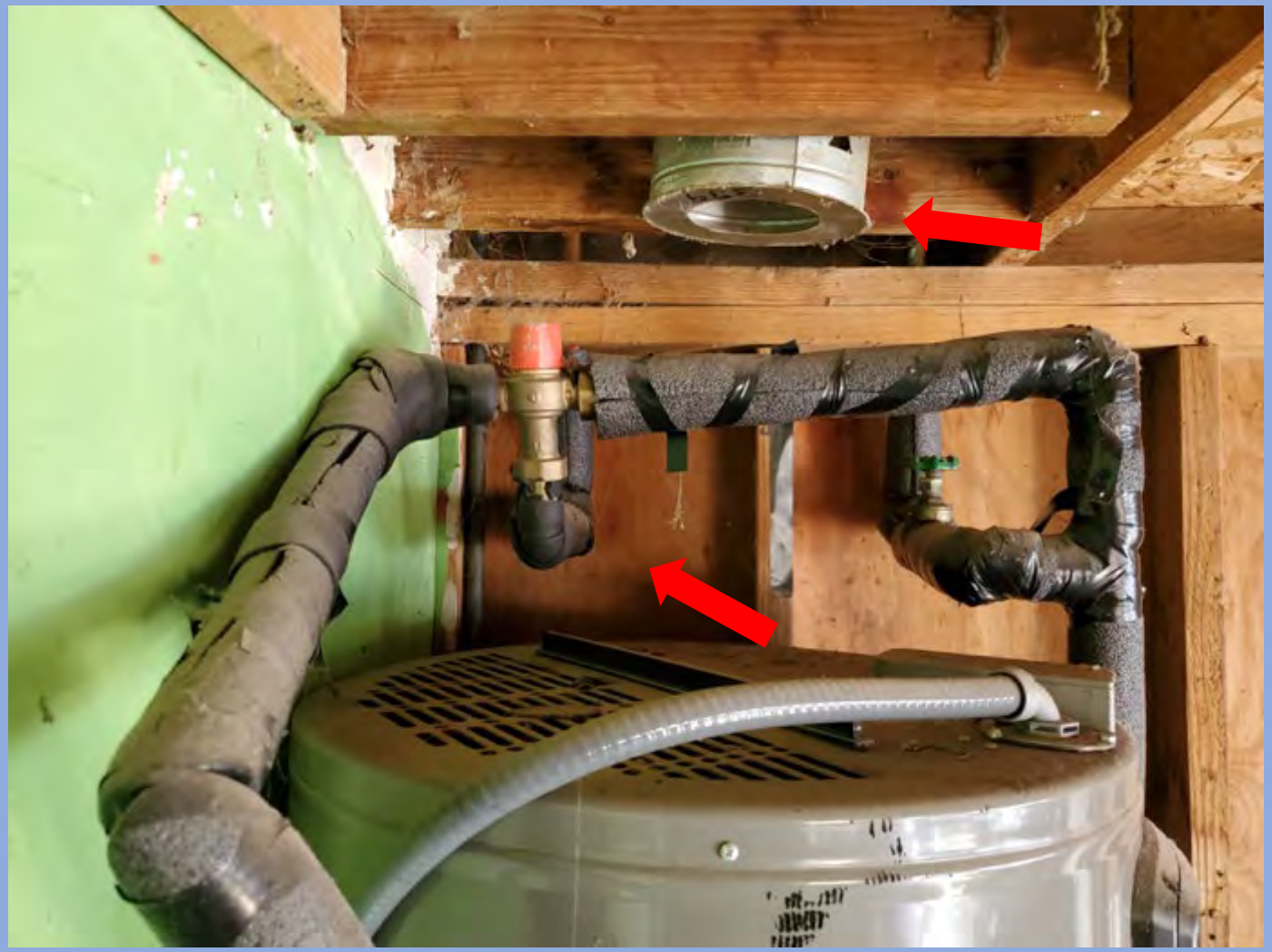
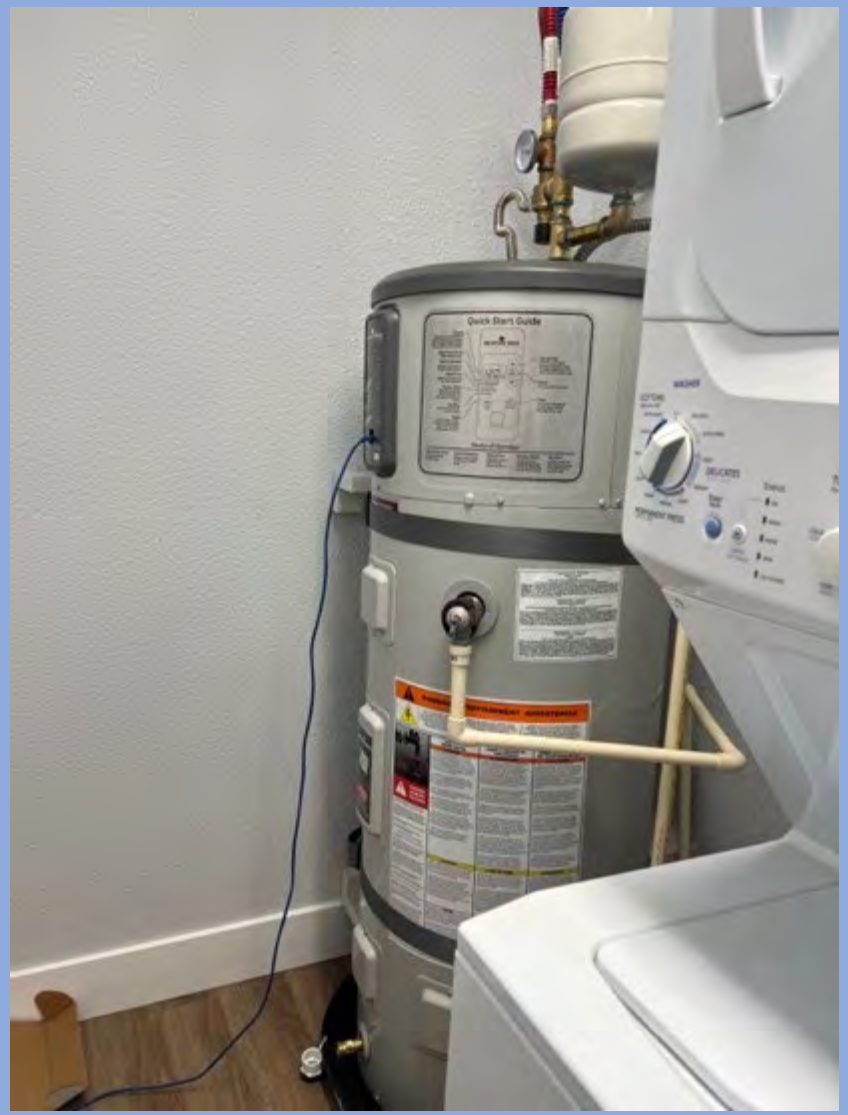





BRADFORD WHITE


BRADFORD WHITE

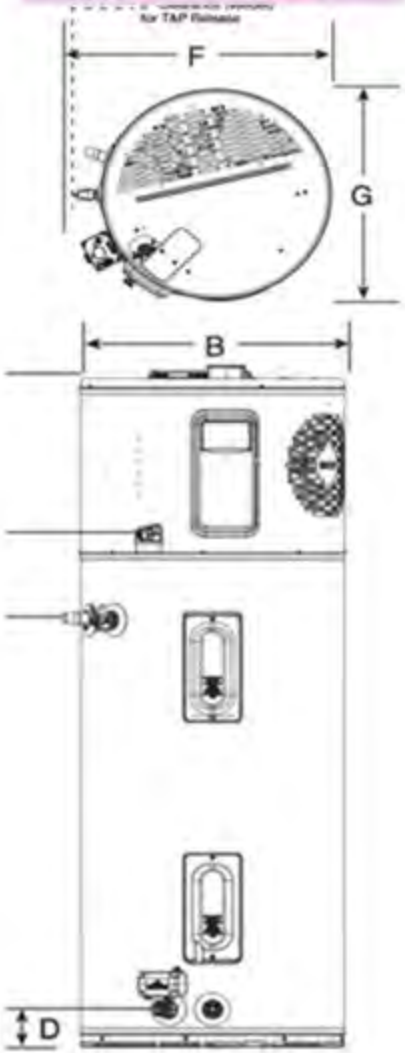

Rheem

Controls generally allow for 2-way communication

Air Flow is the #1 Key

Unitary HPWH Intake and Exhaust Locations

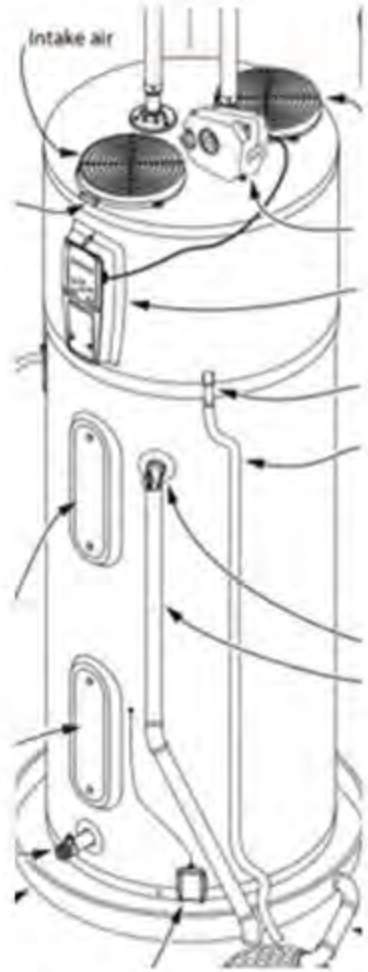
Top Intake Side Exhaust



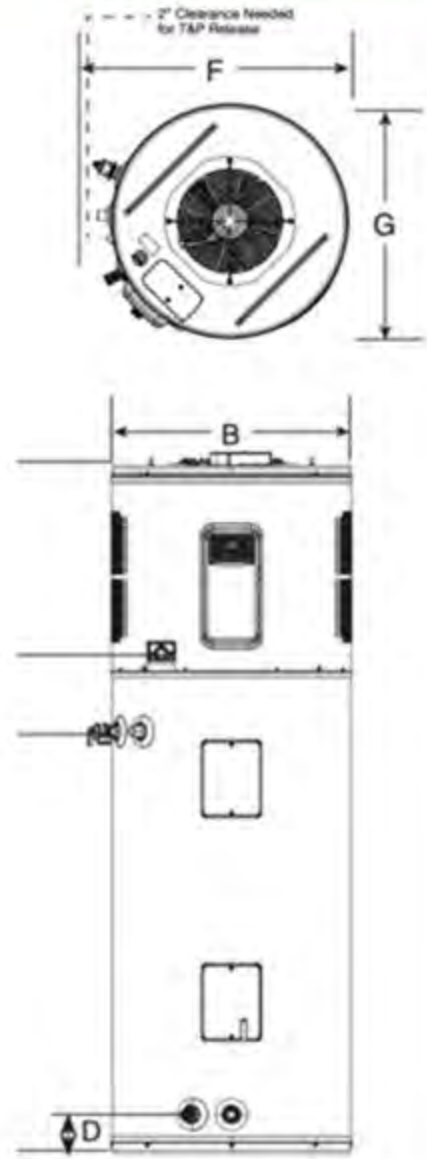
Top Intake Side Exhaust

Top Intake Rear Exhaust

Top Intake Top Exhaust



Side Intakes Top Exhaust



2025 Title 24 Addressing Air Flow for HPWHs

Without ducts:

- ~~Space must be 100 cubic feet per kBtu/hr of compressor (or follow manufacturer); OR~~ ***Need access to more energy.***
- Space must vent to another space that meets above goal
  - Net Free Area of vents must be 125 sq in + 25 sq in per kBtu/hr of compressor (or follow manufacturer)
  - Must be fully louvered door or two openings, one high and one low
  - For a typical 4kBtu/hr HPWH compressor, NFA = min 225 sq in

With ducts:

- Space connected to with ducts must meet 100 cubic feet per kBtu/hr goal
- Other requirements also apply

Source: 2025 Express Terms, Section 110.3 Mandatory Requirements for Service Water-Heating Systems and Equipment

3. the cold
be ducted

Air Source HPWH

Where Does the Warm Intake Air Come From?
Where Does the Cold Exhaust Air Go?

ACEEE Hot Water Forum
March 4-5, 2025

Gary Klein
gary@garykleinassociates.com
916-549-7080

Link to video: https://heatinghelp.com/systems-help-center/air-source-heat-pump-water-heaters/

The Big Problem:
Poor Installations Have Consequences

📌 **Unintended issues from poor HPWH installation**

❌ Cold air impacts surface → condensation & mold on surface

❌ Cold air trapped → condensation & mold inside building cavities

❌ Limited airflow → reduced efficiency & higher costs

Real-World Case Studies…

Garage Install Failure

Richmond, VA
Resulted in Mold Growth

✅ Plenty of air exchange

❌ Cold discharge air impacts air handler and ductwork

❌ Humid garage air condensed on air handler and supply ductwork, causing mold

❌ Equipment was removed

🚨 **Lesson Learned: Plan exhaust direction & airflow carefully!**

***Issue**: Installation instructions say that the space volume is large enough.*

However, instructions do not address where the exhaust air is directed, or the potential to create condensation on exposed surfaces.

Indoor Closet Install Failure

Richmond, VA
Resulted in Mold Growth

✅ Plenty of air exchange through louvered door

❌ Cold discharge air impacts back wall

❌ Humid air condenses on back wall

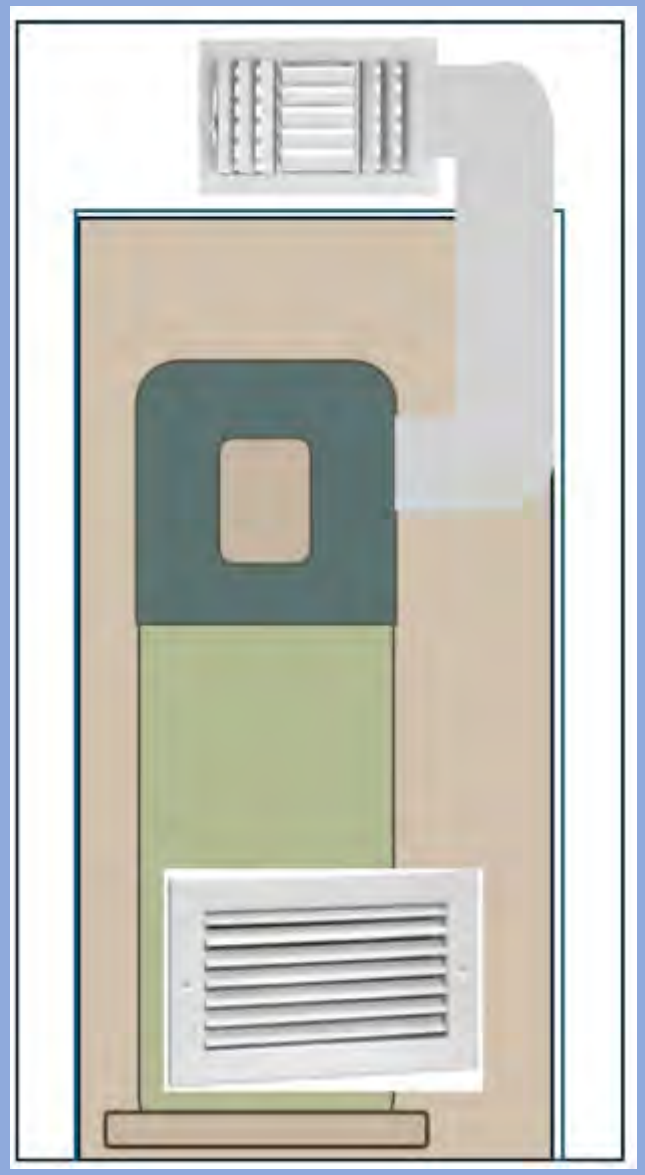
❌ Dehumidifier was added as part of the mold mitigation effort

🚨 **Lesson Learned: Don't cool surfaces below the dew point!**

***Issue**: Installation instructions say that the full louvered door provides enough airflow and require minimum spacing to the back wall, which appears to have been met.*

However, the instructions do not address the high humidity/dewpoint of the incoming air.

Closet Installs: Duct Exhaust Out to Mix with Indoor Air



<-Front View

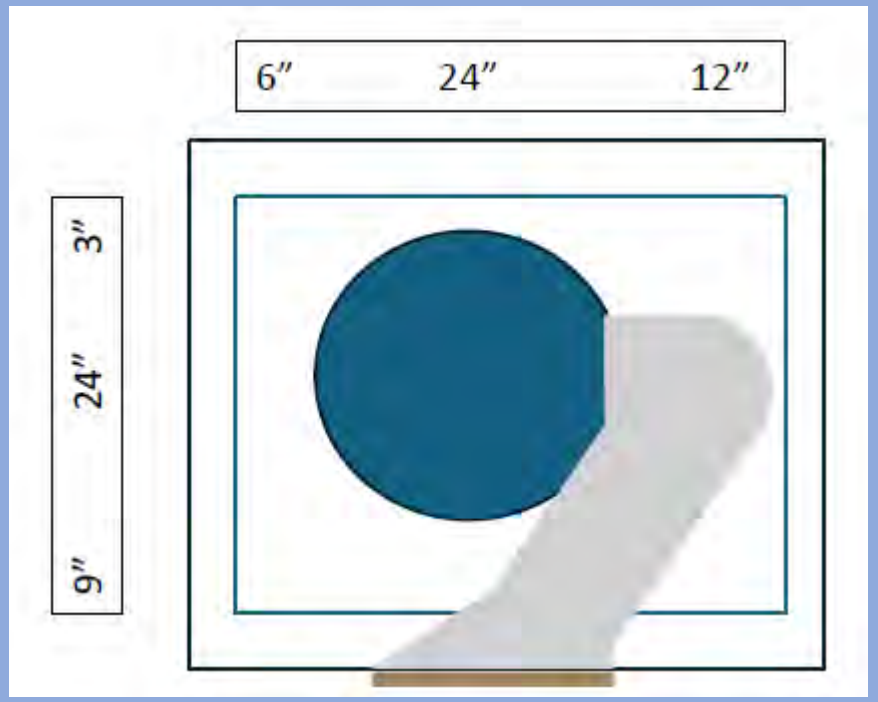
Exhaust

- Duct exhaust to register above door

Intake

- Install intake grille(s) in door(s)

Top View->



Existing Buildings:

- Dimensions of the closet determine which HPWH can be installed

New Construction:

- The clearances for access and airflow determine the minimum dimensions.
- Recommend 4’ x 4’ x 8’ minimum to accommodate all types

Talking About Heat Pump Water Heaters

May Require Some Small Changes

- Explain efficiency with “they take heat from the surrounding air rather than burning a fuel to make heat”
- Explain need for air flow with “they need air flow to get the free heat from the air”
- Learn the electrical options (240V, 120V shared/dedicated) and work with an electrician
- Learn how to upsize them compared to the old tank water heaters
- Use the venting options we showed you: louvered doors, ducting, top and bottom grilles

Common Considerations with Installing HPWHS

- Locating unit: 4’ square x 8’ tall
- Air flow
- Capacity to serve usage loads
- Electrical: 240V or 120V
- Draining Condensate
- Noise
- Maintenance of air filters, anode rod, and flushing

Do NOT Locate Your HPWH…

- In a small, crowded closet with limited air flow

Do Locate Your HPWH…

- In the corner of a garage
- In a closet, pantry, laundry room, or exterior closet with
  - Exhaust ducting out of the enclosure
  - Intake air through a louvered door or filter grille
- In a large basement with a source of ”warm” air

Summary

Skate to Where the Puck is Going

Add HPWHs to Your Business

- Increased revenue and cost per job
- Good state and federal incentives right now
- HPWHs are where the state is going
- They work, they are affordable to run, and they are zero emissions

Contact Us

Gary Klein, gary@garykleinassociates.com

Nick Brown, nick@buildsmartgroup.com

Resources

	AO Smith	Bradford White	Rheem
Website	www.hotwater.com	www.bradfordwhite.com	www.rheem.com
240 VAC spec	https://assets.hotwater.com/damroot/Original/10004/AOSXE50009.pdf	https://s3.amazonaws.com/bradfordwhitecorp/wp-content/uploads/residential_heat_pump_aerotherm_re_series_con_specsheet_1901.pdf	http://s3.amazonaws.com/WebPartners/ProductDocuments/44399EA7-D027-49B0-AD09-7AC40D39C8ED.pdf
120 VAC spec			
Shared Circuit	https://assets.hotwater.com/damroot/Original/10008/ARXSS00123.pdf	Not Yet	https://files.myrheem.com/webpartnerspublic/ProductDocuments/1DC43590-F660-4E37-978A-B789F2B4E192.pdf
Dedicated Circuit	Not Yet	Not Yet	https://s3.amazonaws.com/WebPartners/ProductDocuments/2145F003-E68C-4769-84D1-624AE7968E4C.pdf

https://switchison.org/contractors/training-hub/

Resources

	LG	Rinnai	Noritz
Website	https://www.lg.com/global/business/hvac/residential-solutions/water-heater	https://www.rinnai.us/rehp-electric-heat-pump-water-heater	www.noritz.com
240 VAC spec	https://www.lg.com/gr/business/download/airsolution/Therma_V_Water%20Heater_Leaflet[20220621_230553735].pdf	https://rinnai.widen.net/s/sqtprd5njs/rinnai-electric-heat-pump.rehp.brochure	https://help.noritz.com/wp-content/uploads/2024/08/Noritz-Heat-Pump-Operation-Installation-Manual_Web.pdf
120 VAC spec			
Shared Circuit	Not yet	Not Yet	Not Yet
Dedicated Circuit	Not Yet	Not Yet	Not Yet

https://switchison.org/contractors/training-hub/

What Type of HPWH to Use

	Retrofits with Standard Outlet Nearby	New Construction	Noise concerns & Height Limits
240 Volt 30 amp		✓	
120 Volt 15 amp (Dedicated circuit)	✓		
120 Volt 7.5 amp (Shared circuit)	✓		
Split system			✓

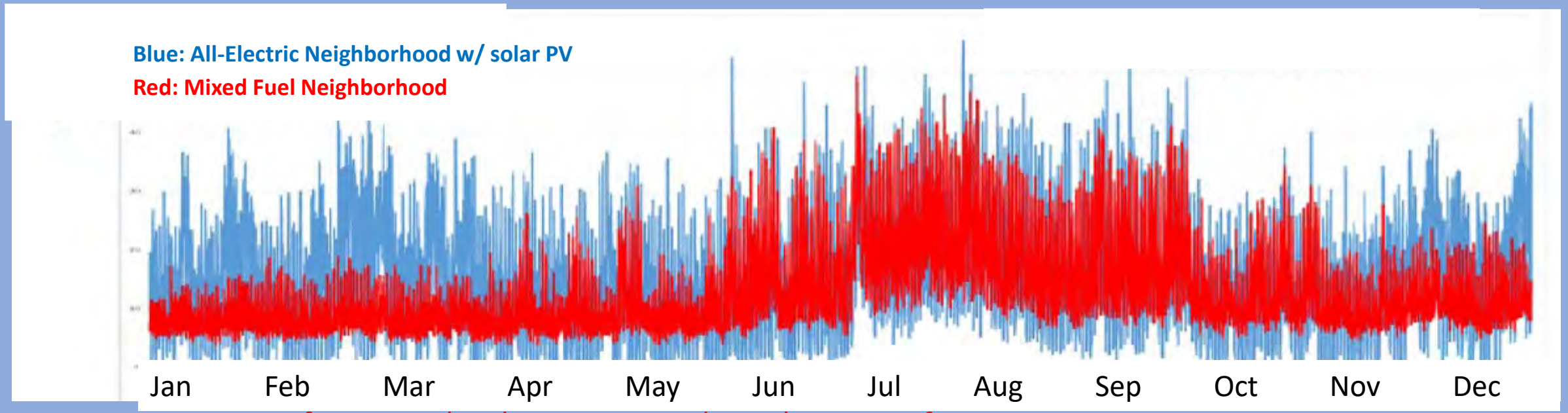
How Fast Can They Heat the Water?

	Heat Rate into the Water	Notes
Natural Gas	30,000 (BTU/Hour)	40,000 BTU/hr into the heater. 75% efficient
Electric Resistance	4,500 Watt Element 15,000 BTU/Hour @240 VAC	98% efficient. 2-Elements, usually only 1 fires at a time
HPWH Small Compressor	HP Mode: 4,000-4,500 BTU/Hour	HP and Resistance may run at the same time.
	Resistance Mode: 15,000 BTU/Hour @240 VAC	Similar to electric resistance.
HPWH Large Compressor	HP Mode: 12,000-15,000 BTU/Hour	Can be done on 120 - 240 VAC
	No Resistance	NA

Can the Grid Handle it?

The electric grid is designed to accommodate “peak demand,” plus a margin

- All-electric neighborhoods do not have a significantly higher peak compared to mixed-fuel
- Peak is in summer, based largely on air conditioner operation
- All-electric homes do consume more electricity, but this additional consumption mostly occurs during off-peak hours when there is abundant capacity on the grid

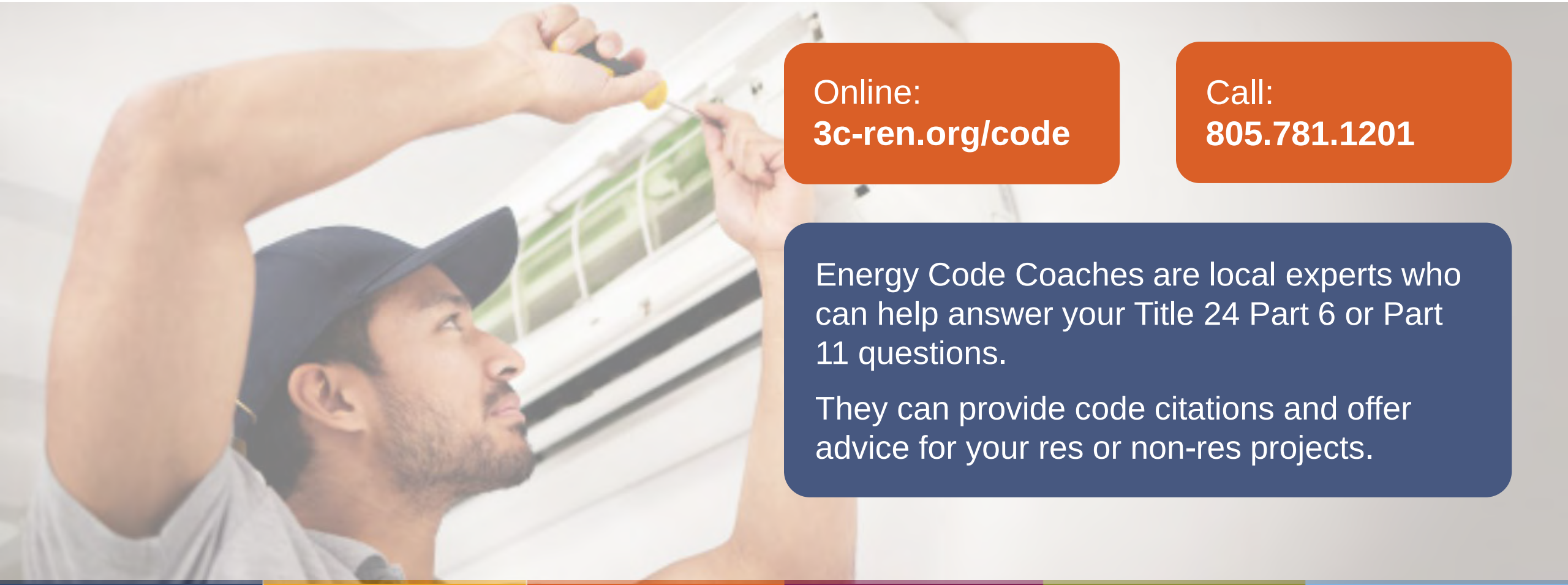


Transformer-Level Peak Energy Demand over the Course of a Year

Source: Southern California Edison, Fontana ZNE Homes Case Study

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.

Closing

Continuing Education Units Available

- Contact dresurreccion@co.slo.ca.us for AIA and ICC LUs

Coming to Your Inbox Soon!

- Slides & Recording

Upcoming Water Heating Courses:

- 7/14 Unitary versus Split Heat Pump Water Heating Systems
- 7/31 More Than One Brand In The Hand: Application Specific HPWH Design
- 8/20 Best Practices for Hot Water Distribution
- 8/28 Retaining Profit – Minimizing Call Backs on Heat Pump Projects
- 9/11 Multi-Family Domestic Hot Water

Any phone numbers who joined? Please share your name!

Thank you!

More info: **3c-ren.org**

Questions: **info@3c-ren.org**

Email updates: **3c-ren.org/newsletter**

3C REN

TRI-COUNTY REGIONAL ENERGY NETWORK

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