

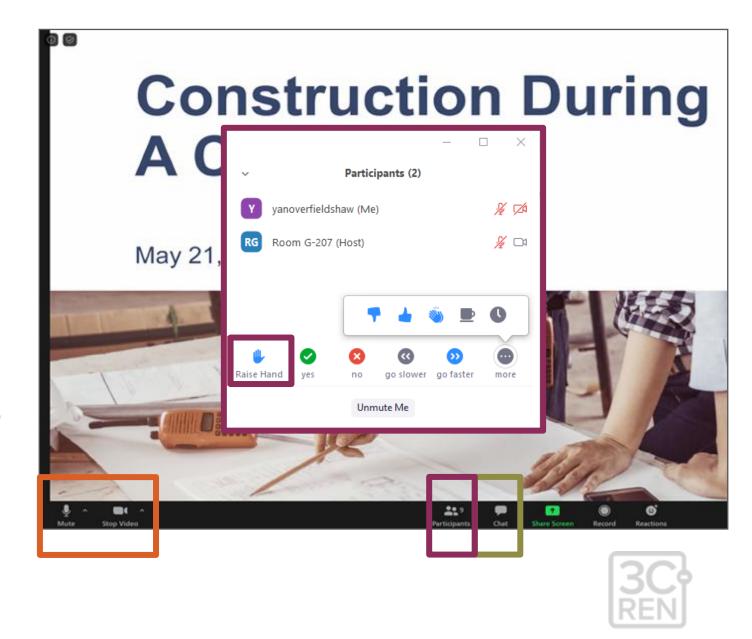
More Than One Brand In The Hand: Application Specific HPWH Design

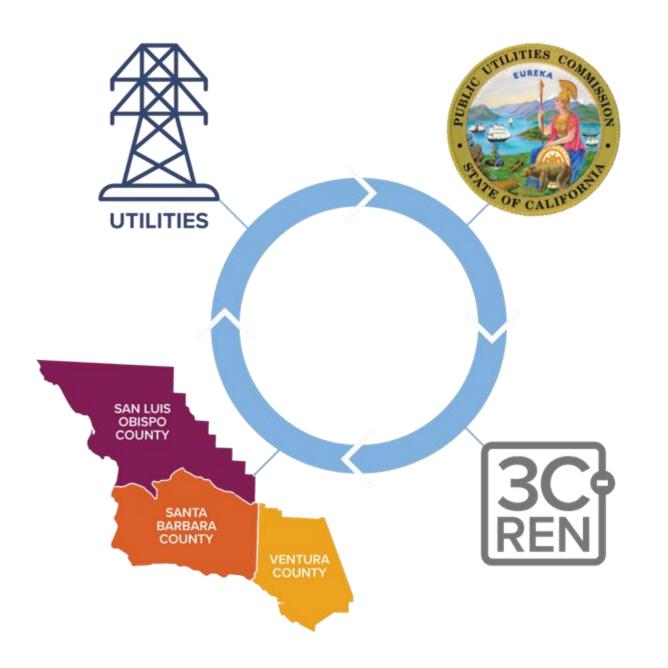
Larry Waters – Electrify My Home July 31, 2025



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





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



3c-ren.org/commercial

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

Training



BUILDING PERFORMANCE TRAINING

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



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 Achievements









4,000+ 1,374

Individuals Attended Training

Energy-Saving Projects Completed 334

Title 24/CalGreen **Questions Answered** \$155M

Secured for investment in the tri-county region through 2028

Data from 2019-2023 for three programs



Who's This Dude?











† 1982 (UTI), with these tools †

Certs along the way



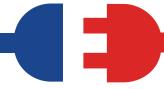
2015 – onlyheat pumps



2020, foundedElectrify My Home



Larry Waters
President, Electrify My Home



Electrify My Home's 3C-REN Webinars

- **3/11/25:** Nail the Sale: Getting Past Heat Pump Objections
- **4/8/25:** Panel Detectives Electrical Panel Assessments for Heat Pump Installers
- **5/6/25:** Electrification Products for the Central Coast Climate
- **6/17/25: Optimizing Heat Pump Zoning for Maximum Comfort and Efficiency**
- 7/31/25: More Than One Brand In The Hand: Application Specific HPWH Design
- 8/28/25: Retaining Profit Minimizing Call Backs on Heat Pump Projects



Electrify My Home – Electrification Pioneers

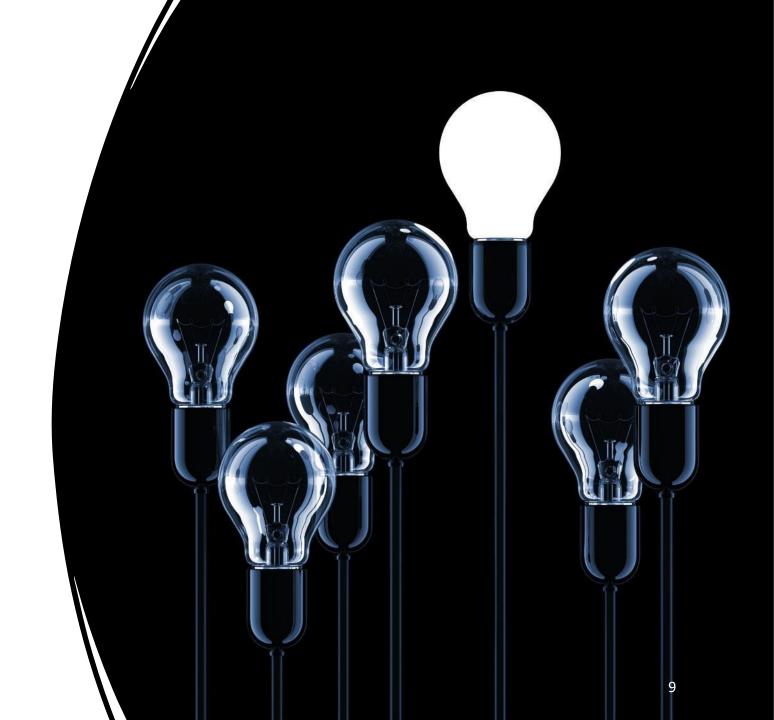
Our Mission:

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



Agenda

- **†** Emergence of HPWHs
- Considerations To InformSystem Selection
- Scenarios & Real-World
 Case Studies



A Note Before We Get Started

The heat pump water heater (HPWH) brands and models featured in this presentation are provided solely for educational and illustrative purposes.

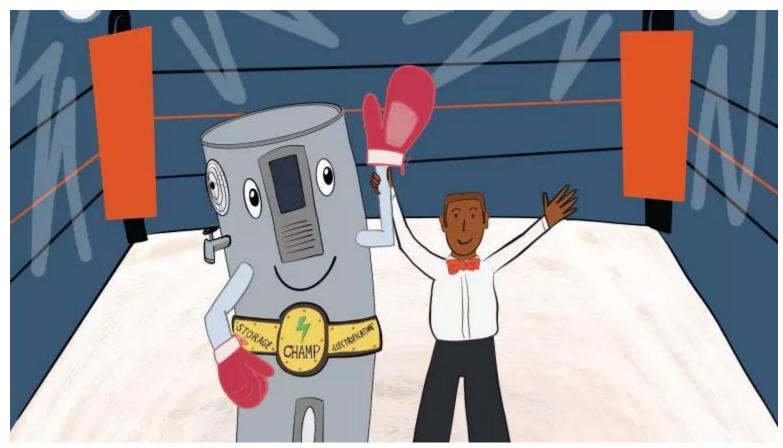
We **do not endorse or recommend any specific manufacturer** over another. Every product has strengths and ideal applications, and **successful performance depends on proper matching to the home's unique conditions**.

Additionally, all design and installation guidance provided here is general in nature. Always consult the latest manufacturer **installation manuals** and **technical documentation** to ensure compliance with code, safety standards, and warranty requirements.

Section 1: Heat Pump Water Heater Backdrop



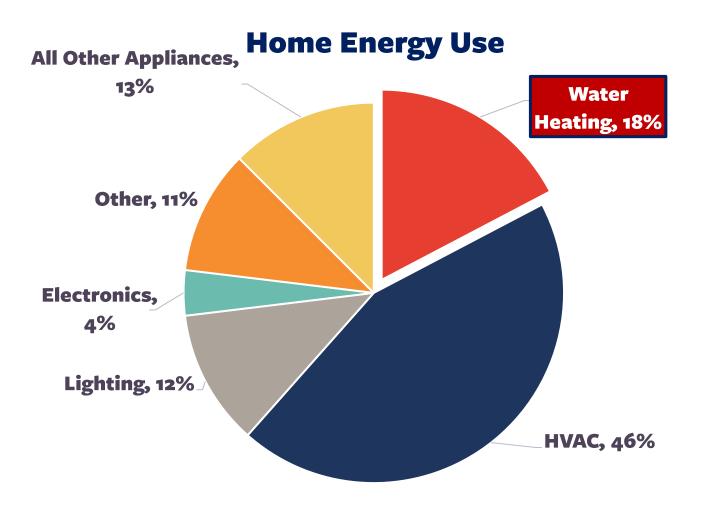
Before We Start...Why All The HPWH Hype?



Source: NRDC



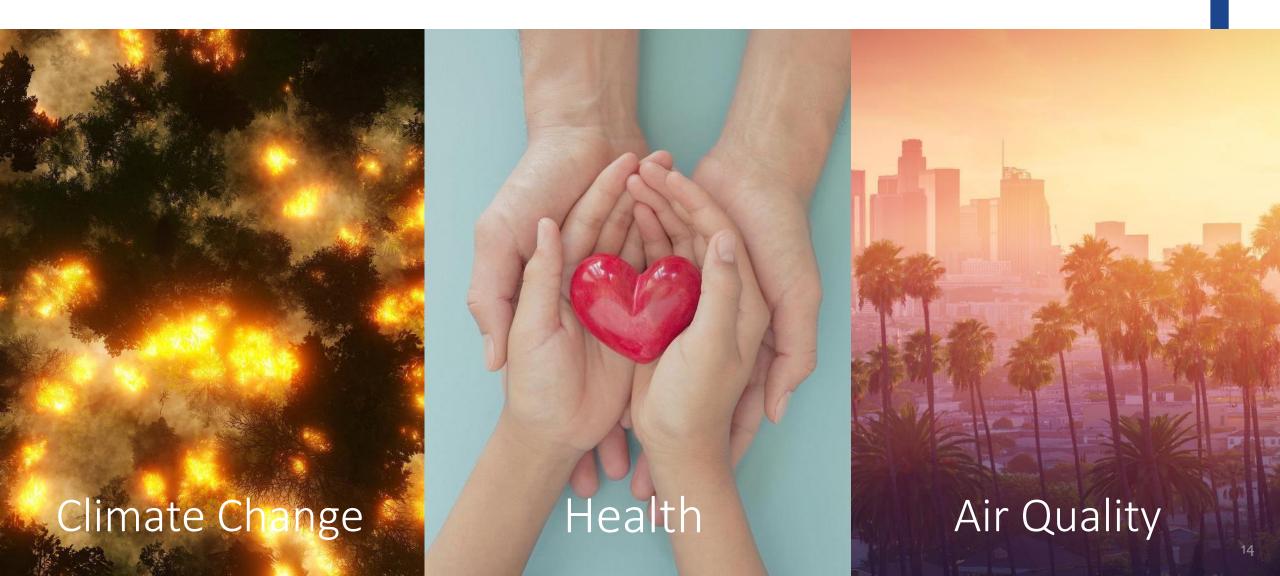
Water Heaters – #2 Energy User



Source: EnergyStar.gov



Why Heat Pump Water Heaters?



Most Polluted US Cities

| By Short-Term Particle Pollution | By Year Round Particle Pollution | By Ozone | | | |
|---------------------------------------|----------------------------------|---------------------------------------|-------------------------------|---|--|
| 1. Bakersfield, CA | A | 1. Bakersfield, CA | Δ | 1. Los Angeles-Long Beach, CA | |
| 2. Fresno-Madera-Hanford, CA | | 2. Visalia, CA | <u> </u> | 2. Visalia, CA | |
| 3. Fairbanks, AK | | 3. Fresno-Madera-Hanford, CA | <u> </u> | 3. Bakersfield, CA | |
| 4. Eugene-Springfield, OR | | 4. Eugene-Springfield, OR | | 4. Fresno-Madera-Hanford, CA | |
| 5. Visalia, CA | A | 5. San Jose-San Francisco-Oakland, CA | <u> </u> | 5. Phoenix-Mesa, AZ | |
| 6. Reno-Carson City-Fernley, NV | | 6. Los Angeles-Long Beach, CA | <u> </u> | 6. Denver-Aurora, CO | |
| 7. San Jose-San Francisco-Oakland, CA | | 7. Sacramento-Roseville, CA | <u> </u> | 7. Sacramento-Roseville, CA | |
| 8. Redding-Red Bluff, CA | | 8. Medford-Grants Pass, OR | | 8. San Diego-Chula Vista-Carlsbad, CA | |
| 9. Sacramento-Roseville, CA | A | 9. Phoenix-Mesa, AZ | | 9. Salt Lake City-Provo-Orem, UT | |
| 10. Chico, CA | | 10. Fairbanks, AK | 10. Houston-The Woodlands, TX | | |
| 11. Los Angeles-Long Beach, CA | A | 11. Indianapolis-Carmel-Muncie, IN | 11. Las Vegas-Henderson, NV | | |
| 12. Yakima, WA | | 12. Yakima, WA | | 12.San Jose-San Francisco-Oakland, CA 🥼 | |

American Lung Association, 2024

Policies & Decisions Leading to This Point Primary Drivers = Health & Air Quality



| US clean |
|--------------------|
| Air Act Amended |
| 1965/67 |
| 1970/77 |

1963

CARB Board Forms

1968

1970

Clean Air Act shifts Fed's role allowing states to

limit

1976

A.Q.M.D formed across state

1988

CA Clean Act Air Act & admin becomes by US Law

1990

Clean Air amended **EPA**

2018

SB 1477 Technology & Equipment for Clean Heating (TECH) **Initiative**

2020

Exec. Order N-79-20 mandates zero emission vehicles by 2035/2045

2022

Governor directs CARB to adopt 6 million heat pump goal by 2030

2022

CARB implementation plan measure to phase out gas-fired WH and furnaces by 2030

2023

Bay Area **AQMD** regulation to prohibit gas WH sales by 2027 & **furnaces** by 2029

So...What Can We Do About It? 1 Very Popular Pathway:



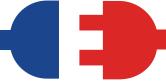
Electrify our power – reduces pollution from powerplants & GHGs



Electrify our homes – improves air quality, safety



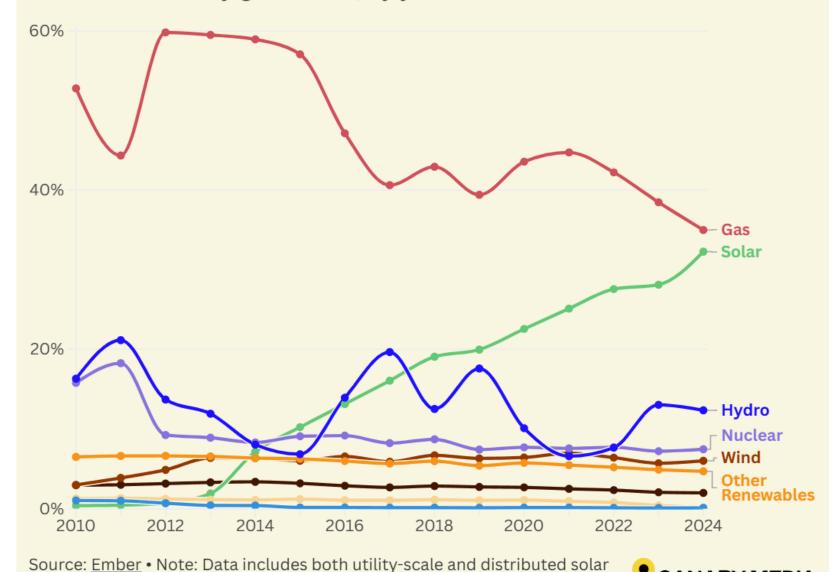
#ElectrifyEfficiently – focus on energy efficiency



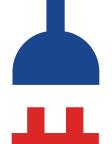
Solar is closing in on gas in California

Share of electricity generation, by year

generation.

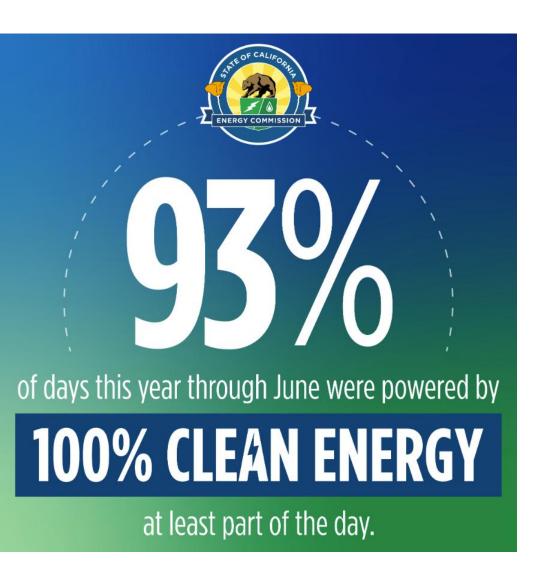


California's Electricity Generation



CANARY MEDIA

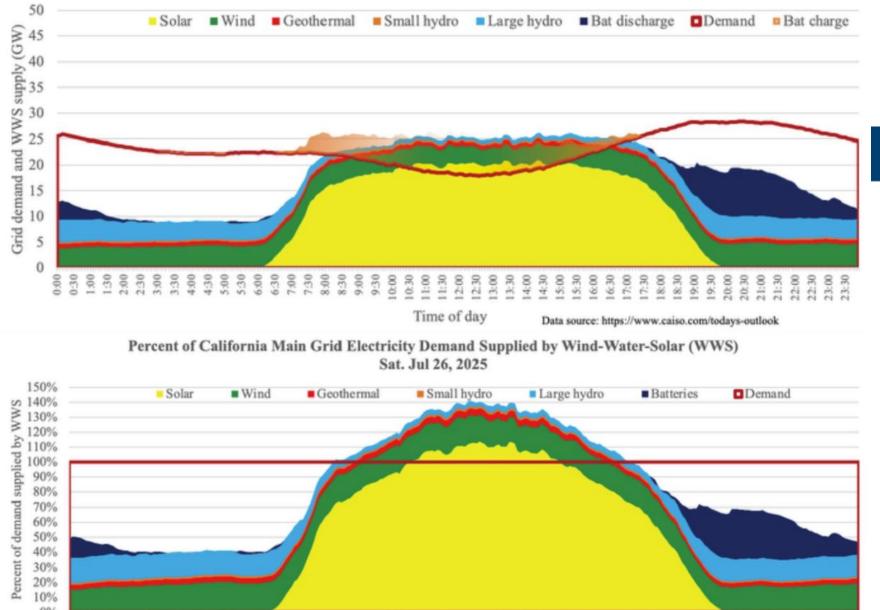








California Main Grid Electricity Demand and Wind-Water-Solar (WWS) Supply (GW) Sat. Jul 26, 2025



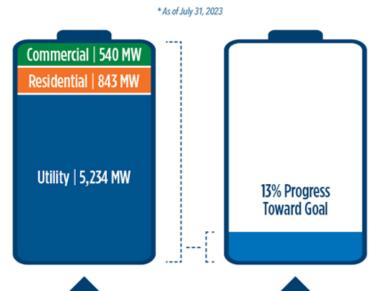
QB CD CB CD CC CB CD CC

Data source: https://www.caiso.com/todays-outlook

Time of day

Batteries Are Working!

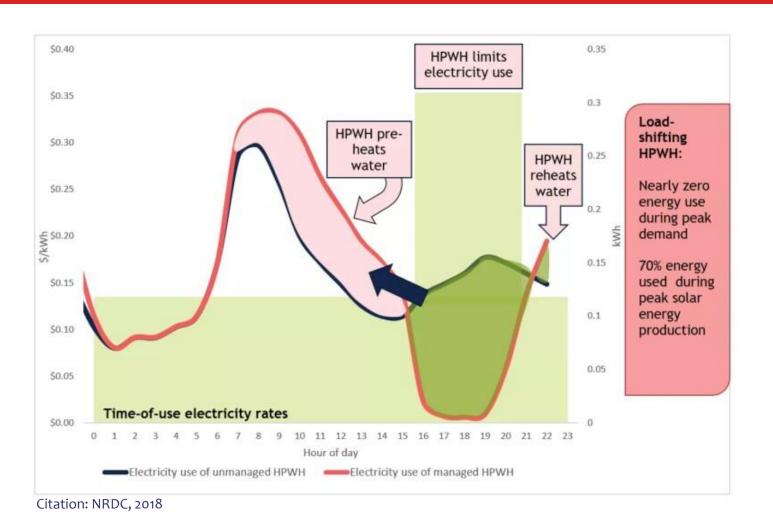
Energy Storage in California by Type



2023 | 6,617 Total MW

2045 | 52,000 Total MW

HPWHs = Excellent For Time-Based Utilization





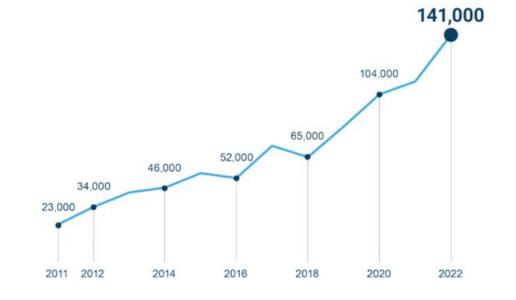


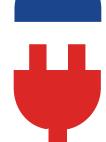
HPWH Penetration Is Increasing



Growth of Heat Pump Water Heaters





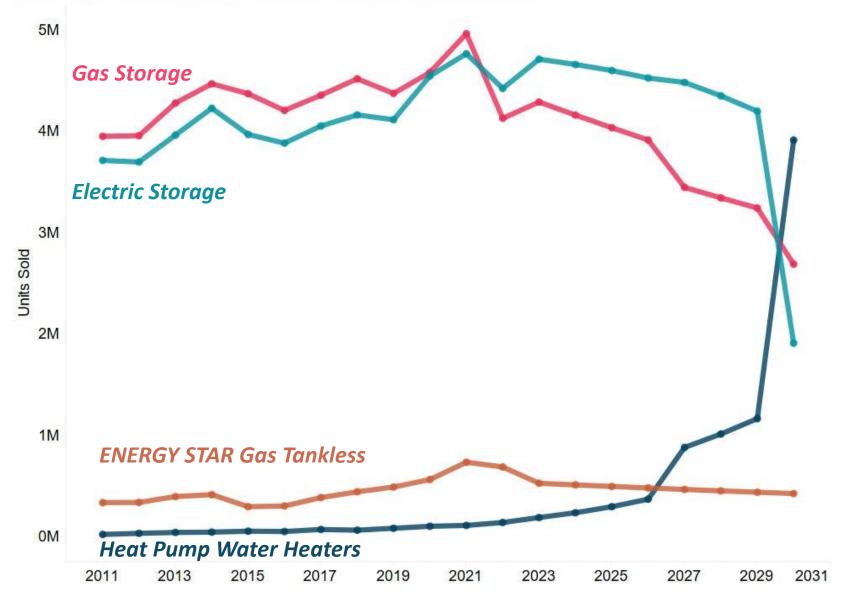






Actual and Projected Water Heater Sales 2011-2030

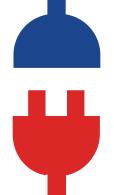
Gas Storage vs Electric Storage vs HPWHs vs ENERGY STAR Gas Tankless





HPWHs Are No Longer Unicorns

They're becoming the <u>default</u>, not the exception.

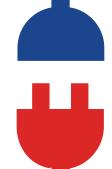




There Are Many Design Considerations

- Fitment/size
- First hour rating
- # # of occupants
- Electrical
- Sound
- Efficiency nameplate
- Efficiency application
- Exhaust location
- Protection from elements

- Existing or new recirculation pump
- Distribution vintage, sizing, inlet distance
- Strength of base
- Distance to router
- Climate zone
- Delivery logistics
- Condensate Route
- Rebate eligibility
- JA13 compliance





Luckily, We Now Have More Options!

























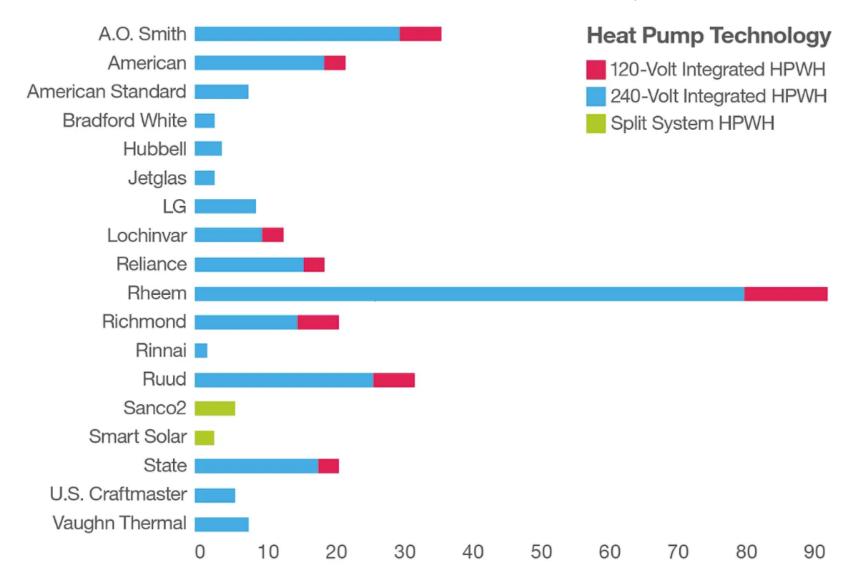








US Brand Breakdown (As of 2024)



Heat Pump Water Heater Review – 3 Styles

•Self-contained, heat pump on top



•Split System SanCO₂



Combined Split System





120V Heat Pump Water Heaters

Pros

- Avoids electrical expense (except for dedicated circuit models)
- Limited panel capacity hit good for electrifying on small panels

Cons

- Longer run times
- More noise (from longer run times)
- Do not work well in weather below 40F
- Longer recovery/first hour rating



Split Configuration Helps with Application Challenges

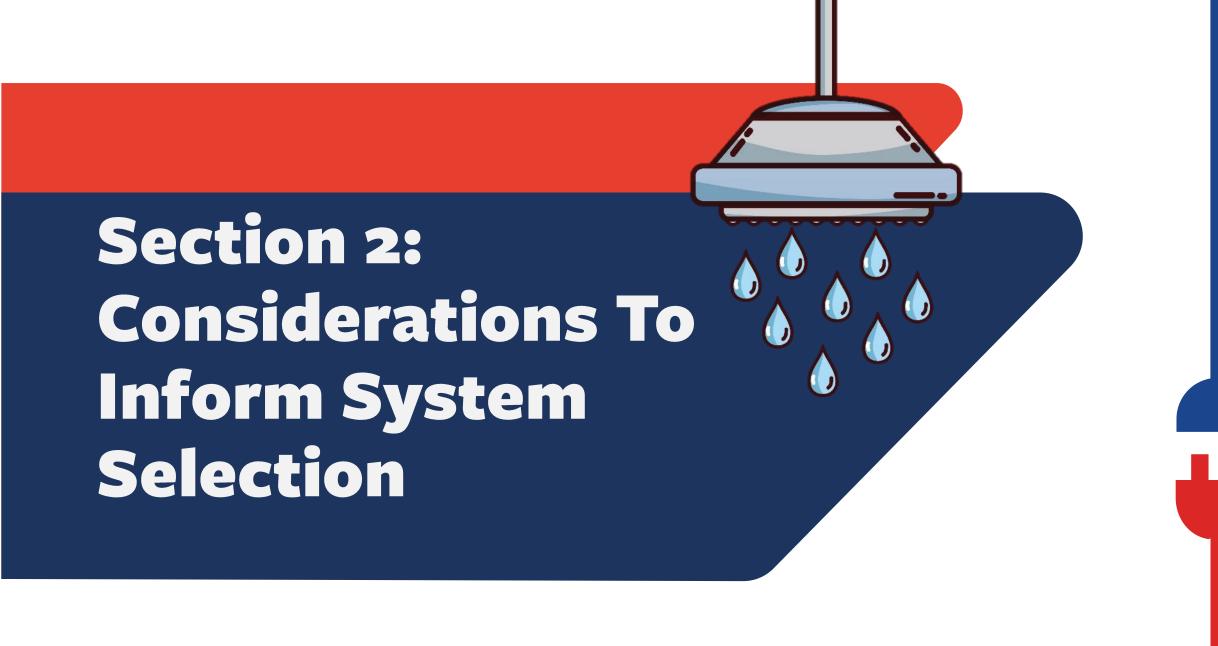
Split system HPWH solves several problems

- Location
- Sound 37 DbA
- Faster Heat 115 gal (83-gal system) 145°F temp
- Best for environment CO2 = GWP of 1
- † 15A breaker
- Works well at low temperatures
- Inverter-based

Disadvantages

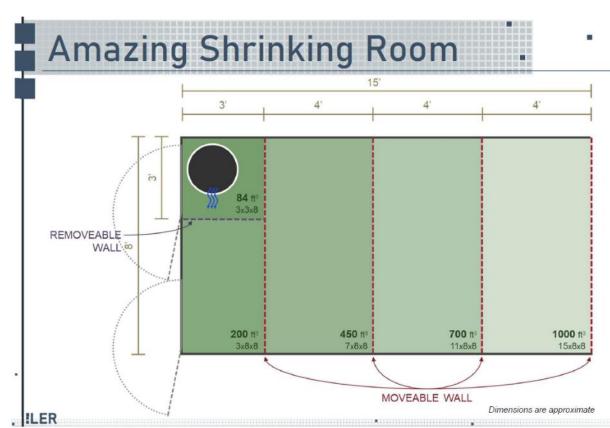
- Higher cost [But higher margin!]
- Additional time required
- Outdoor unit must be kept upright and level



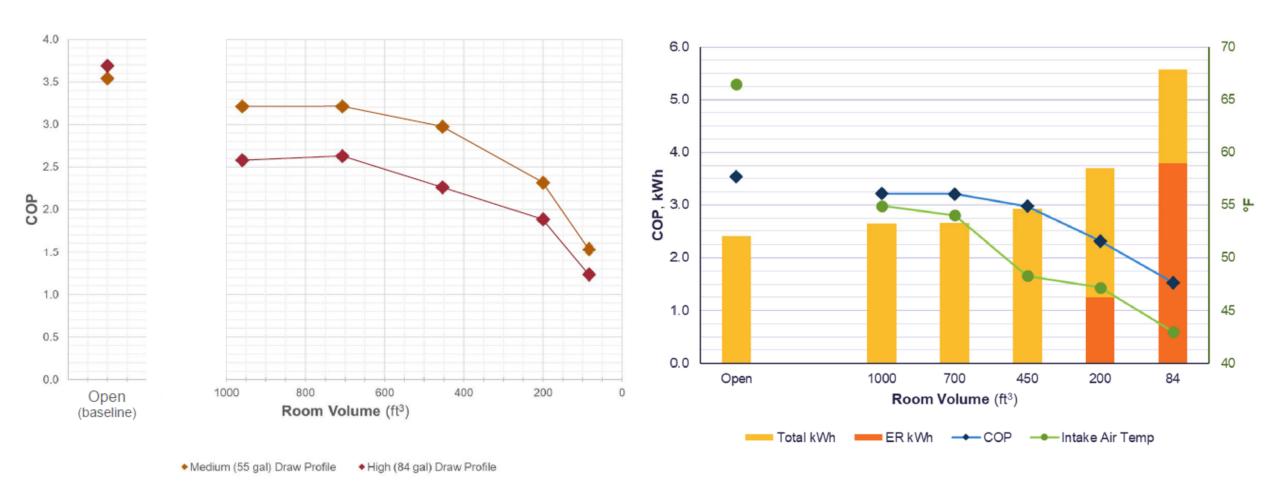


#1 - Room Size

- ♥ Ideal = ventilated space with 1000+ cubic ft
- Manage cold exhaust to prevent moisture issues
 - Never trap exhaust in small enclosed areas
 - Raise exhaust air above dewpoint by mixing air or ducting to safe location
- Beware of closets
- Follow manufacturer specs at a minimum but keep an eye out for unique instances and dewpoint of incoming air
- Position exhaust away from surfaces
- Ensure sufficient airflow min 40 CFM per 100W of Citation: Larson Energy Research, Amazing Shrinking Room compressor power



#1 – Room Size Lower Room Volume = Lower Efficiency



Some Options For Air Exchange Goal Is Always More Warm Air, Less Cool Air



Heat Pump Space Requirements

| <u>HPTS</u> | | | | | | |
|----------------------------------|---------------|---------------------|---|--|--|---|
| Configuration | Enclosed Room | Fully Louvered Door | Upper and Lower Louvers in Door (Note 1,2) | Upper Louver and Undercut Door (Note 1,3,4) | Inlet <u>or</u> Outlet Ducting and a Single Louver or Undercut Door (Note 1,3,4,5) | Inlet <u>and</u> Outlet Ducting (Note 5) |
| Minimum Space (FT ³) | 450 | 84 | 84 | 84 | | No minimum space requirement |
| Space Example L x W x H (FT) | 6 x 7.5 x 10 | 3 x 2.8 x 10 | 3 x 2.8 x 10 | 3 x 2.8 x 10 | No minimum space requirement | |

Note 1: Minimum louver size is 130 in 2 free area

Note 2: When two louvers are installed, install one louver at the top of the heater and the other close to the floor.

Note 3: Undercut door should have a minimum of 0.75" clearance (minimum 18 in 2 air gap)

Note 4: When one louver is installed, install the louver in a location close to the top of the heater.

Note 5: This heater supports multiple duct diameters as well as rigid and flex ducting options. See manual for more information.

Tip: Add filter grilles to minimize dust and other buildup



#2 Ducting

Why Duct?

- Space constraints
- Minor noise improvement
- Efficiency boost in some cases
- Relocating exhaust if cool air in room is an issue

Tips

- Clearance can be tough, especially with certain brands
- Do not restrict diameter. If you must, follow manufacturer requirements.
- Keep straight, use rigid mechanical transitions
- Use Panduit strap
- Terminations must not let water in
- Be mindful of pulling super hot or dusty intake air

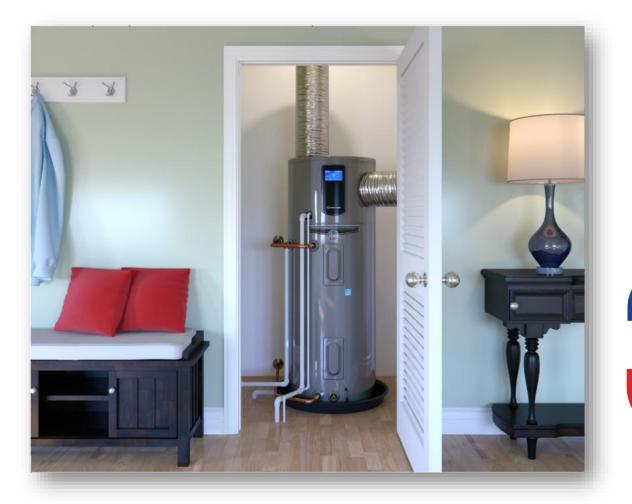




#2 Ducting, Continued

- Metal ducts must be insulated to prevent condensation
- Use quality materials
- Some manufacturers require adapters that must be used. ORDER AHEAD OF TIME!
- Rodent-proof terminations







#3 Fitment Measure Twice, Then Once Again

- Note all space dimensions
 - THPWH usually bigger than existing gas unit
 - Need space for mixing valve & plumbing
- Note path of electrical
 - ♥ Most units 240v 30A.
 - If existing 120v outlet is nearby, document as a 120v unit might be possible.



#3 Fitment, Continued

- HPWH sizes are very different from gas tanks they're replacing
- Wider & taller
- Check T&P and condensate heights, especially in basements
- Top or side plumbing based on height & width restrictions

Sampling of 50-gal models, for example:

| BRAND | MODEL | Height | Width | Floor to T&P | Floor to Condensate |
|-----------------------|------------------------|------------|-----------|--------------|---------------------|
| Bradford White | RE2H50S10 | 59 - 3/16" | 21 - 3/4" | 38 - 7/8" | 46 - 13/16" |
| Rheem | PROPH50 T2 RH400-30 | 64 - 3/8" | 22 - 1/4" | 39 - 5/8" | 47" |
| State | HPSX-50-DHPT | 63" | 22" | 40 - 1/2" | 48" |
| GE | PF50S10FPY (120v/240v) | 68-1/4" | 24" | 42-3/4" | 51-7/8" |

#4 - Noise Prevention

- **# #1** Be mindful of nearby bedrooms or quiet rooms.
 - ▼ Talk to your customers, "sound" not "noise."
- #2 Use these install tips:
 - Flexible pipe connectors, rubber grommets behind earthquake straps, rubber mat or rated foam pad
 - Acoustic panels & ducting can help a bit
- #3 Pick a quiet unit:
 - Published decibel levels may not be consistent
 - Two units may have same decibel but different frequency. Customer hearing very subjective.
- #4 For super sensitivity, use a split unit





#5 Weight

- ₱ Some 8o Gallons = >300 lbs
- ₱ Invest in a good lift
- **Y** Watch out for:
 - Y Strength of Existing Structure/Platform.
 We're upsizing both dimension & weight of the unit as well as volume (water weight)
 - **†** Attics
 - Hauling up/down stairs
 - Proper Earthquake strapping











#6 – LEAVE ROOM FOR THE FILTER!



#7 – Be Mindful of Space Heat Interaction

Space Heat Interaction [1]

Fully-Conditioned Space

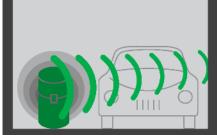
Mainfloor Utility Closet, Laundry Room

Cooling effect is largely limited to rooms where HPWH installed, and typically sufficiently isolated from thermostat to have minimal effect on space heating system.

Effect further limited by HPWH's ability to capture excess heat (heating shoulder season, solar gains, latent heat).



Heat pumps installed outside a house have no measurable impact on space conditioning.



Non-Conditioned Space

Garage, Attic, Exterior Storage Closet

No noticeable impact on space-heating system. Heat is replaced from outside.



Semi-Conditioned Space

Basement

In spaces within insulated building envelope but not actively heated, feedback to space heating system is limited even further than in fully conditioned spaces.





#7 – Space Heating Interaction

- Mainly a concern for indoor installs.
 Garage, basement, outdoor closets ok.
- You can expect 2-5°F drop in space temperature following a cycle.
- Biggest issues come when unit blows cold air on thermostat
- Avoid crossing the pressure boundary with venting.

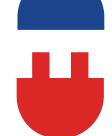
Study from Central Florida:

Table 16. Cooling Season Summary

| | Cooling | Cooling |
|--------------------------|----------------|----------------|
| | Savings | Savings |
| | (kWh/d) | % |
| Indoor to Indoor | 0.86 | 3.8% |
| Outdoor to Indoor | -0.26 | -1.2% |

Table 17. Heating Season Summary

| | Heating Savings | Heating Savings |
|--------------------------|--------------------|--------------------|
| | (kWh/d) | % |
| Indoor to Indoor | -0.42 | -5.9% |
| Outdoor to Indoor | -1.38 | -17.5% |

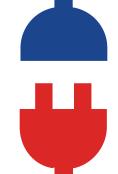


Citation: Effect of Ducted HPWH on Space-Conditioning and Water Heating Energy Use— Central Florida Lab Home Carlos Colon, Eric Martin, and Danny Parker Building America Partnership for Improved Residential Construction



#8 – Uniform Energy Factor (UEF)

- **Y U.S. Department of Energy (DOE)** has lab testing procedures to determine UEF.
 - **Lab testing** controlled temperature (67.5°F), humidity (50% RH), and water temp (58°F (±2°F)) conditions
 - Modes tests in different modes to reflect typical patterns
 - **Tenergy Input/Output** Measured energy input vs hot water production. Aka Energy Factor (EF)



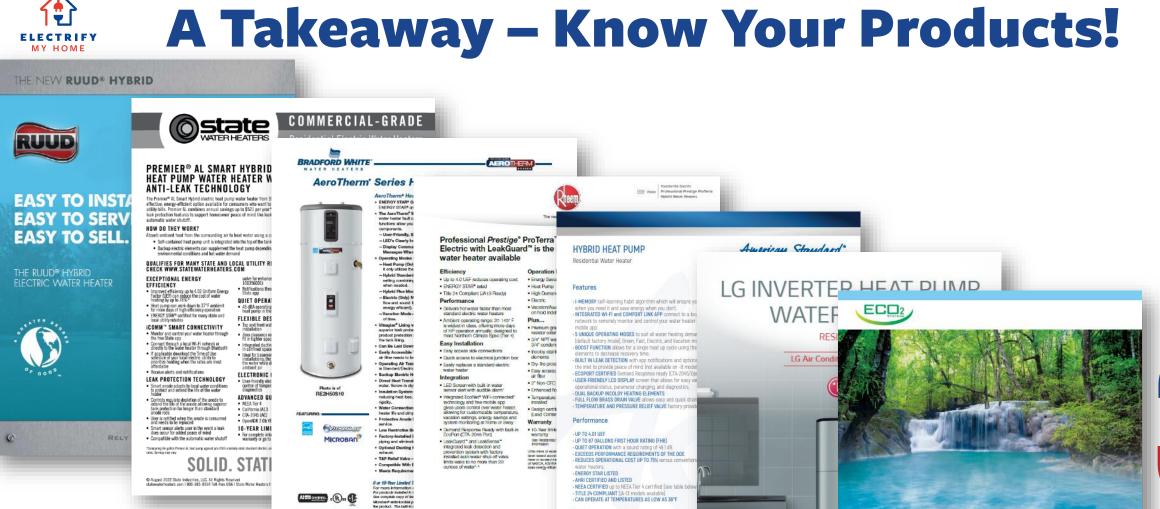
#9 - First Hour Rating

- Changes per unit
- Always meet plumbing code requirements
- Sometimes you can only fit a 50-gal (for example). Not all 50-gal units have a high enough FHR to meet code or your customer's needs!

| Number of | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
|-----------------------------------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| bathrooms | to to | to | to | to | to | to | to | to | to | to | to |
| | 1.5 | 1.5 | 1.5 | 2.5 | 2.5 | 2.5 | 2.5 | 3.5 | 3.5 | 3.5 | 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 |

Chapter 5, Table 501.1(2) in 2022 California Plumbing Code





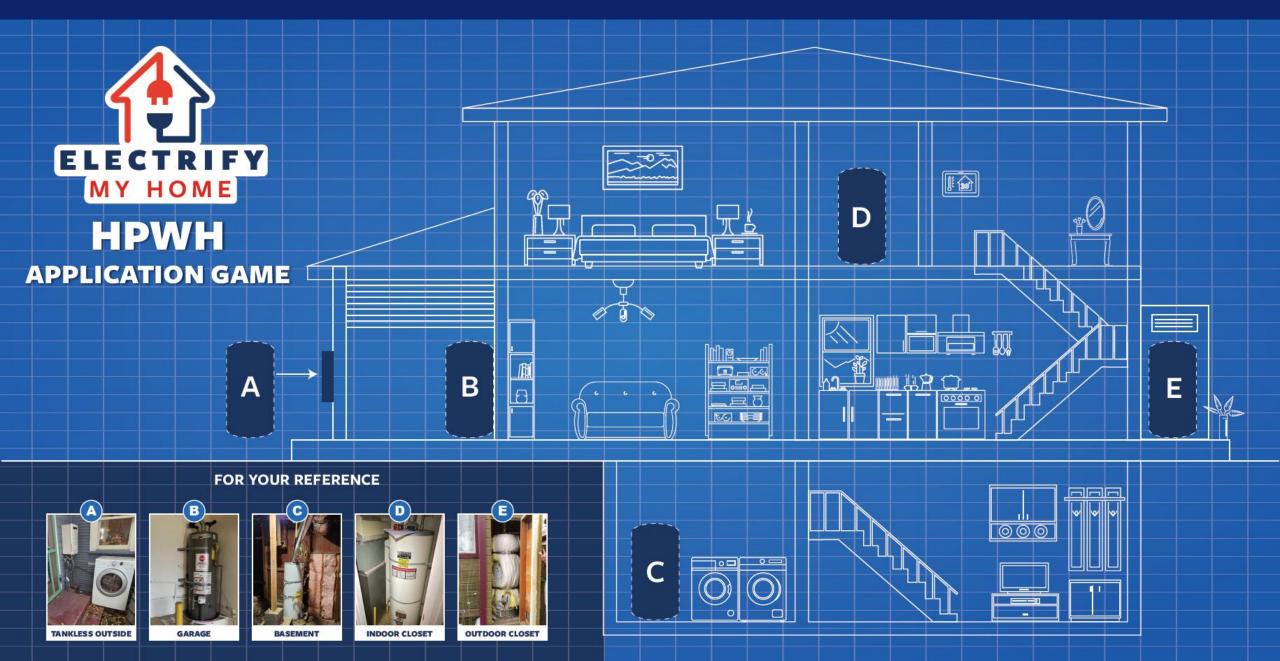
HEAVY GAUGE STEEL TANK for extra years of trouble-free - GLASS-LINED TANK with DuraGlas" and fired at 1600°F for DUAL CATHODIC PROTECTION featuring a powered and a r for enhanced protection and extended tank life. 10-YEAR LIMITED WARRANTY Includes 10-year limited wa

Heat Pump Water Heater

Section 3: Application Scenarios

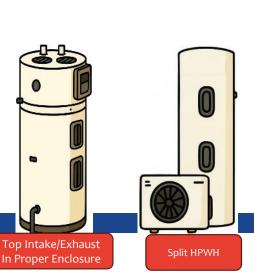


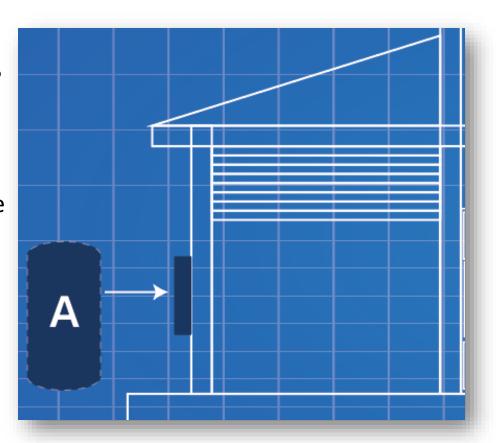
Water Heaters Are Found All Over Homes!



Standalone Outdoor

- Common with gas tankless
- Most HPWHs require protection from the elements
- Solutions:
 - Build an insulated and ventilated enclosure
 - Duct out cool air and filter incoming air when possible
 - ♥ Install a weather-rated heat pump and tank
 - Don't forget UV-rated pipe insulation & fittings





Standalone Outdoor

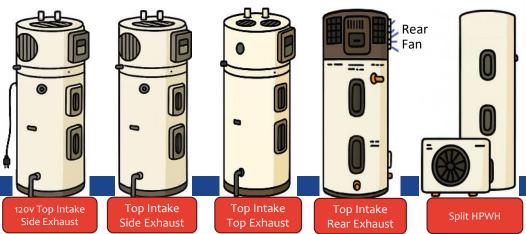


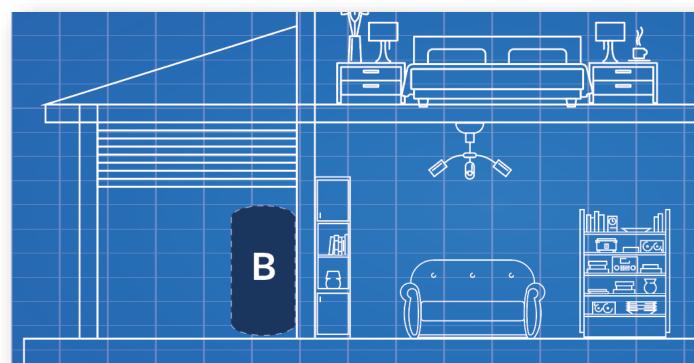




Garages

- Usually, the most forgiving
- Almost any HPWH will work
- Double check cubic ft of space
- Avoid back- or side-exhaust against a wall
- Never exhaust-only duct into house





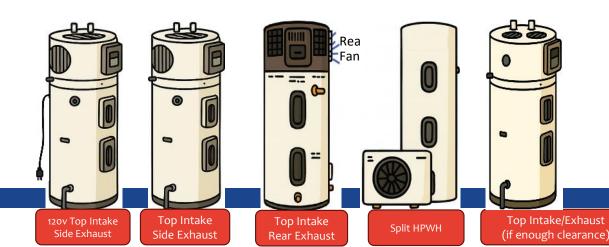


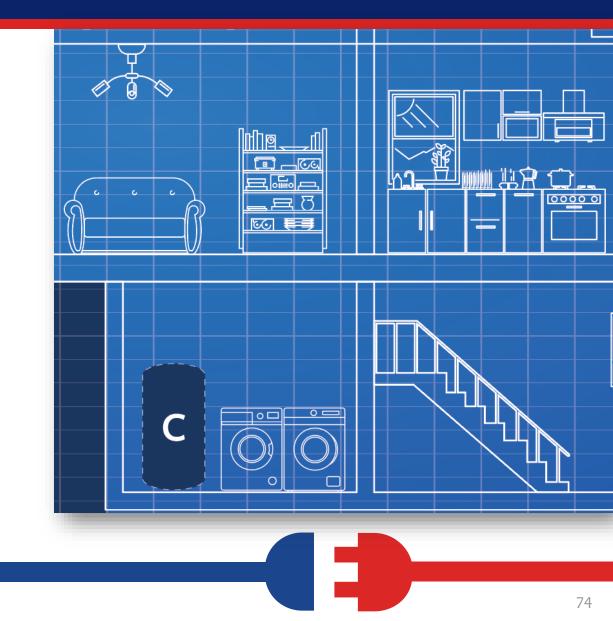




Basements/Crawlspaces

- Ensure unit will fit through doors, downstairs, and can be tipped upright
- Double check cubic feet of space
- If height-restricted:
 - Side- or back- exhaust are good choices
 - Side-plumbing (vs top plumbing)
 - Consider split HPWH w/ lowboy if it meets FHR

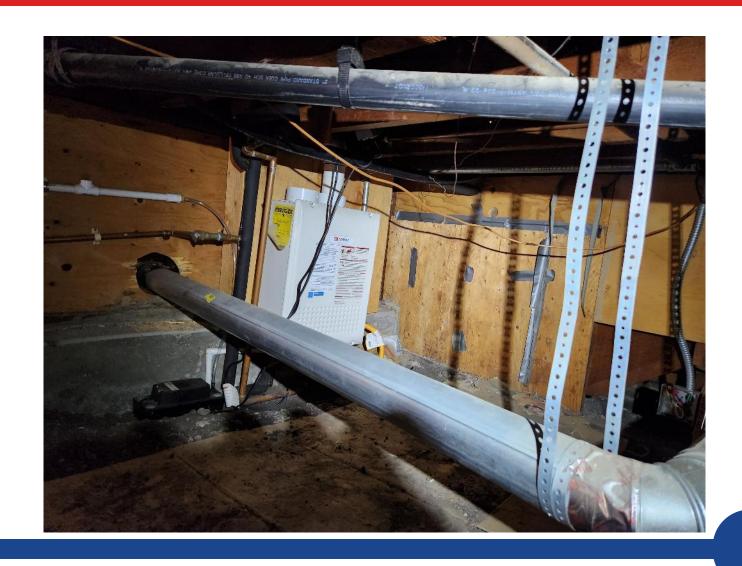








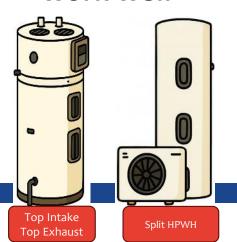
Not Always Easy!



Indoor Closets

Often Trickiest

- Be VERY mindful of sound
- Avoid cool exhaust air escaping to nearby HVAC thermostat
- Avoid crossing a pressure barrier with ductwork
 - Make the closet fully "outdoor" or fully "indoor"
- Top-venting & top-plumbing tend to work well





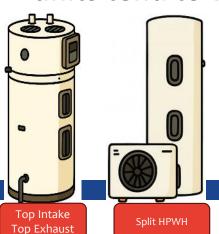


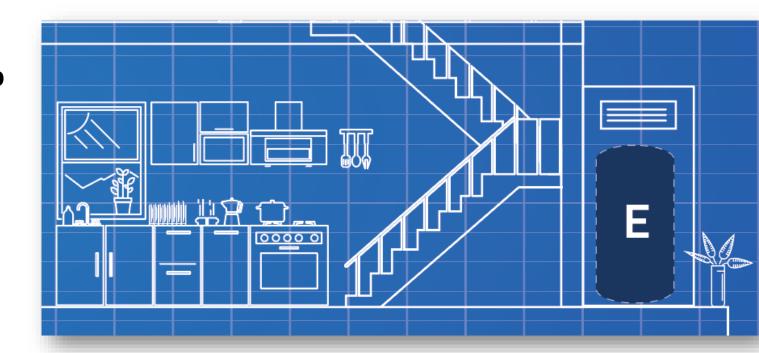




Outdoor Closets

- Foam board recommended
- Ducting strategy recommended
- Be mindful of sound if adjacent to sensitive area
- Triple check closet dimensions
- Avoid 120v units as it can get cold
- Top-plumbing and top-venting units tend to work well



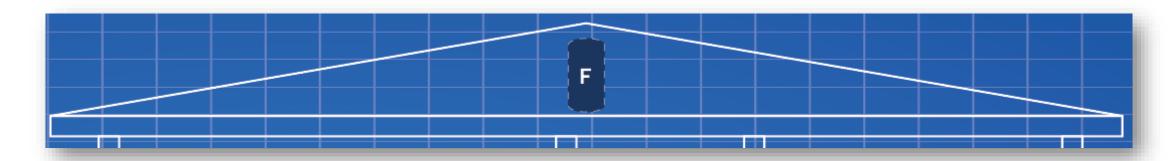




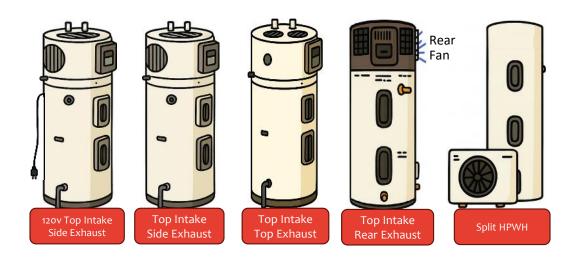




Attics



- Avoid if you can
- Unit may switch to electric resistance if it gets too hot
- Be careful with 120v units as attics get cold
- If adding weight from existing condition, be extremely careful





Questions? Stay in Touch!

Join us 8/28/25: Retaining Profit – Minimizing Call Backs on Heat Pump Projects





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Closing



Continuing Education Units Available

Contact <u>julianna@3c-ren.org</u> for AIA LUs and ICC CEUs

Coming to Your Inbox Soon!

Slides & Recording

Upcoming Electrify My Home Courses:

Retaining Profit – Minimizing Call Backs on Heat Pump Projects (8/28)

Other Opportunities

<u>Passive Design/Build Boot Camp with Emu Passive – Hands On Training and Exam (FREE!)</u> – Monday, September 29th to Friday, October 3rd

https://www.3c-ren.org/calendar-of-events-and-trainings/

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



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