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

Domestic Hot Water – Part 3: All-Electric Design & Construction Series

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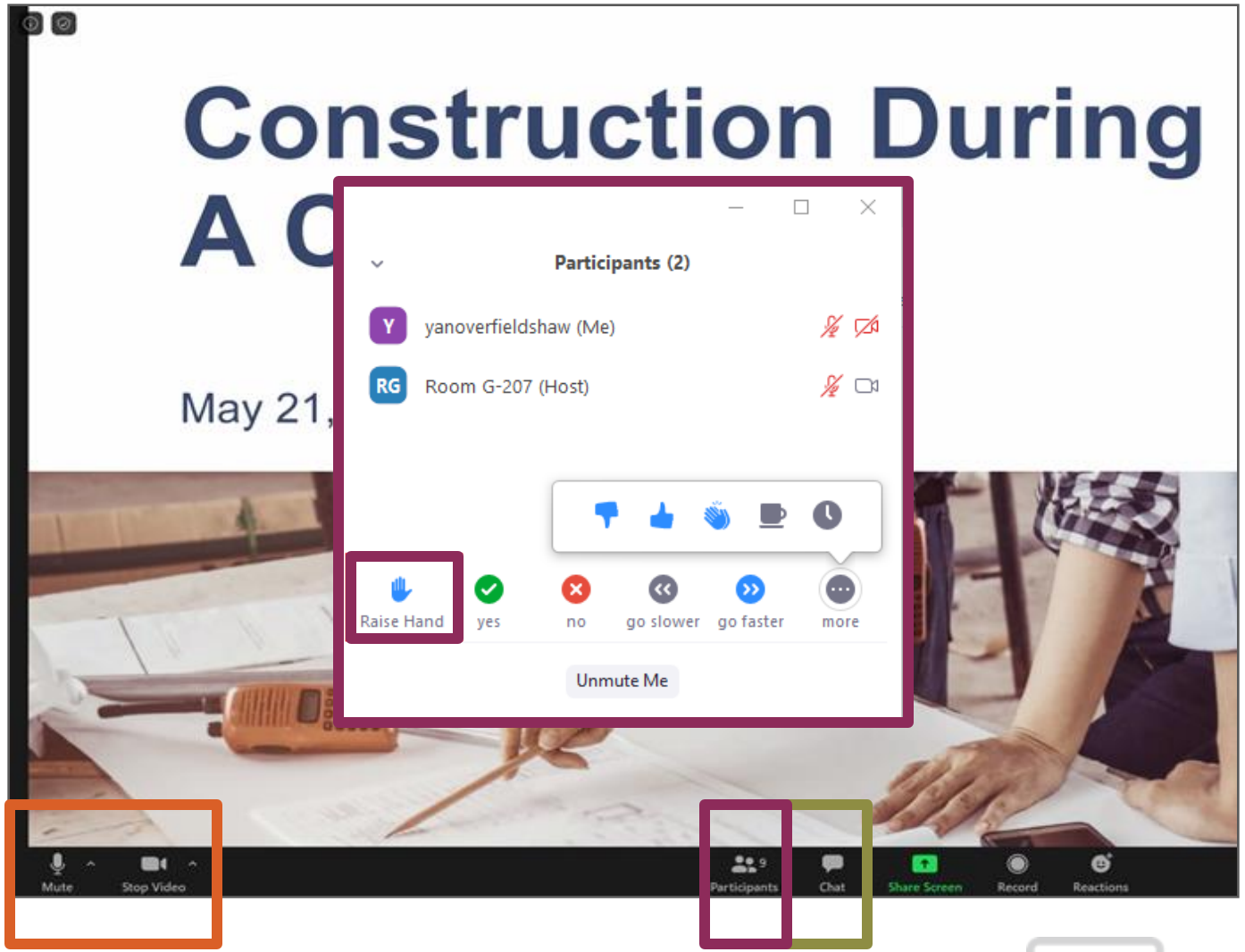
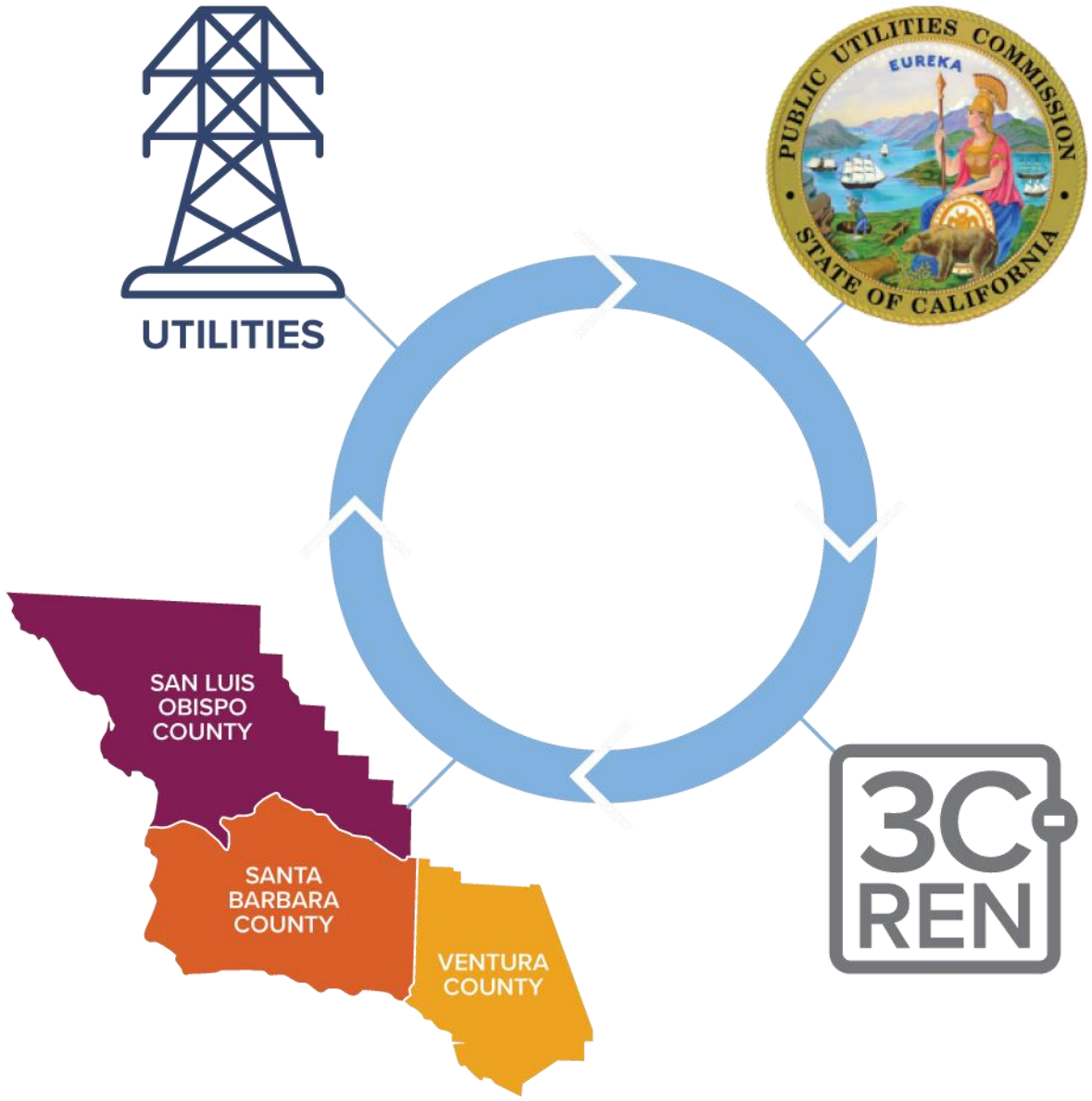
January 16, 2025

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

COMMERCIAL ENERGY SERVICES

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 Achievements

4,000+

Individuals Attended Training

1,374

Energy-Saving Projects Completed

334

Title 24/CalGreen Questions Answered

$155M

Secured for investment in the tri-county region through 2028

Data from 2019-2022 for three programs

California Licensure & AIA Learning Units

- Beginning in 2023 Licensed Architects are required by the State of California to take five (5) hours of Continuing Education (CE) coursework in Zero Net Carbon Design (ZNCD).
- This course is designed to count towards CA's ZNCD requirement **as well as** AIA's Health, Safety, Welfare (HSW) Learning Units.
- The whole series provides **5 AIA HSW / CA ZNCD** Learning Units
- For more information see https://www.cab.ca.gov/docs/misc/ab1010_zncdce_faq.pdf

CALIFORNIA ARCHITECTS BOARD

AIA

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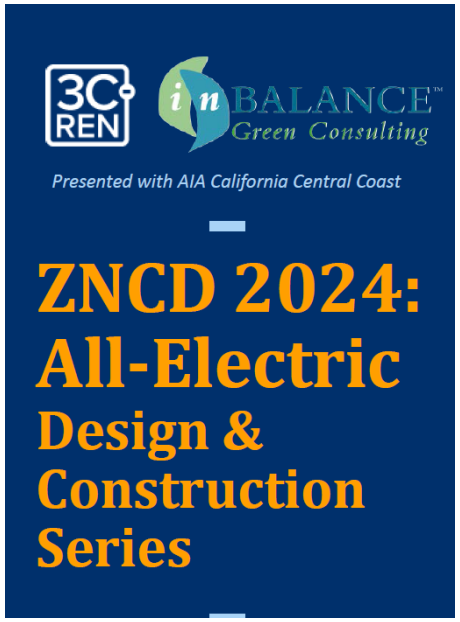
Series Outline



1. Overview: Carbon Reduction through Building Electrification
2. ZNCD for Heat Pumps for Heating and Cooling
3. ZNCD for Domestic Hot Water
4. ZNCD for Ventilation and HRV
5. ZNCD for Appliances & Energy Storage

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Today's Learning Objectives

- Learn the 'why' behind California's shift to building electrification and the link to Zero Net Carbon Design
- Learn the pros and cons of various products to help in selecting appropriate systems that meet electrification and carbon-reduction goals
- Learn critical installation details such as dimensions and venting to call out in plans and/or identify early in construction
- Understand the local market for specific all-electric/ZNCD equipment, including cost, availability and lead times.

Learning Units:

- 1.0 AIA HSW LU approved for this course

We'll send you the slides later!

Agenda

1. Context: CA Clean Energy Goals
2. Heat Pumps for Water Heating
3. Hot Water Heat Pumps for the Consumer
4. Tips for Managing Client Expectations

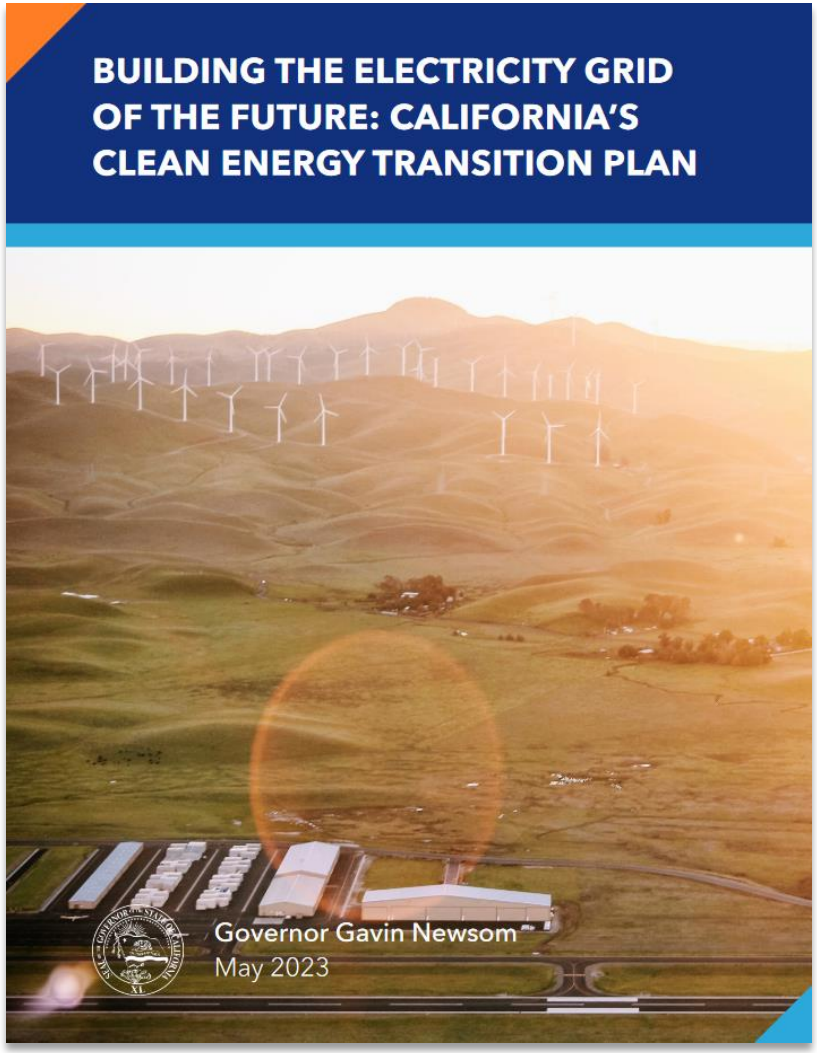
ZNCD and California's Clean Energy Goals

California Air Resources Board (CARB) - Mary D. Nichols Campus

California's Plan for Grid Stability and Expansion

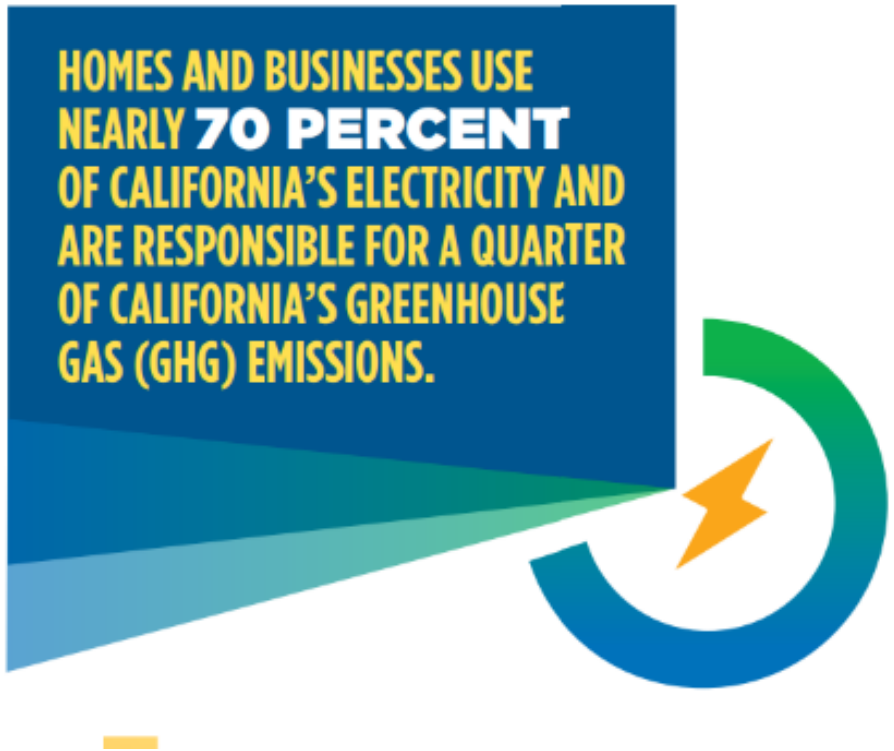
A carbon-free electric grid where:

- **Buildings** are increasingly decarbonized.
- **The Industrial Sector** is powered by clean electricity, and by clean fuels, such as green hydrogen.
- **Transportation** choices are zero-emission and able to plug into the electric grid at places of convenience for all customers



https://www.gov.ca.gov/wp-content/uploads/2023/05/CAEnergyTransitionPlan.pdf

Big Picture Goals for the 2022 Code and 2025 Updates



- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family homes
- Expand PV systems and battery storage standards
- Strengthen IAQ ventilation standards

Refrigerants and GWP

- Most heat pumps use R-410A with a GWP of 2088
- Many residential scale heat pump water heaters use R-134A with a GWP of 1430
- 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
- R-513A, GWP of 630, is being adopted for commercial and residential scale air to water heat pumps
- R-32, with a GWP of 675, is slightly flammable – therefore most units using R-32 will have leak detection and a mechanism to clear the refrigerant

A.O. Smith Emerge-x

Uses low GWP Refrigerant: R-513A with GWP of 630

SANCO2

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

Heat Pumps for Water Heating

Where can HPWH be used?

Single Family Dwellings

Commercial Applications

Industrial Applications or Large Central Systems

Multifamily, Grouped or Central Systems

A. O. Smith - Res

AO Smith –Small Commercial

Aegis A -- Lync by Watts Large-Scale Commercial

New Construction and

Alterations/Replacement – any existing water heater, electric or gas

Sanden –Multifamily – Grouped or Single Split System

Nyle –Industrial or Large Central Systems

Lochinvar Commercial Scale

Small Scale Commercial and Residential –Multifamily and Single

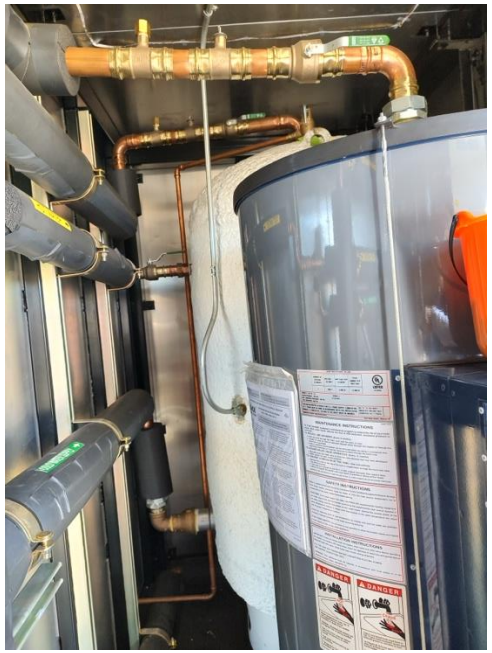
Single Family

Low-Rise Multifamily

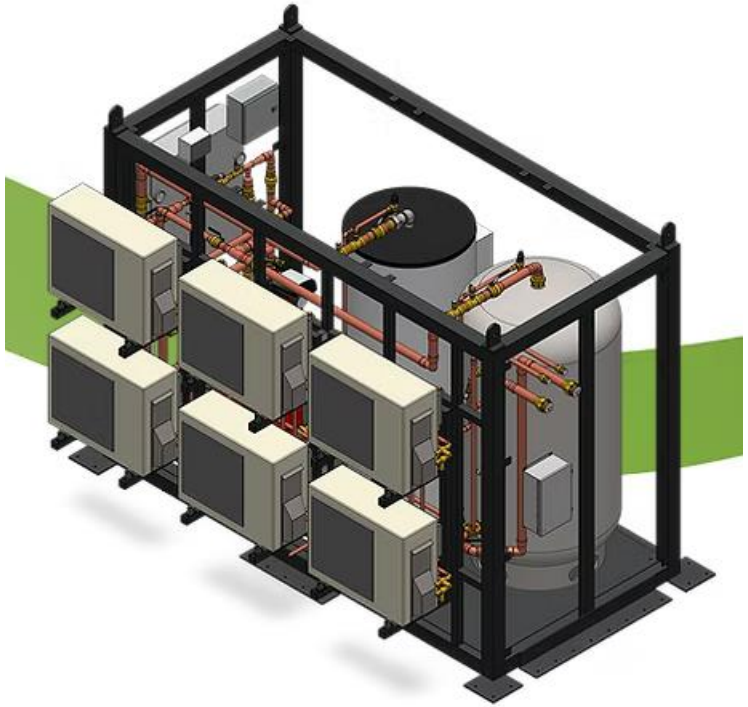
Senior Living / Hospitality / Central Multifamily

Central Systems –Pre-configured for a “drop-in” solution

https://www.waterdropsystems.com



Inside the Water Drop Unit…

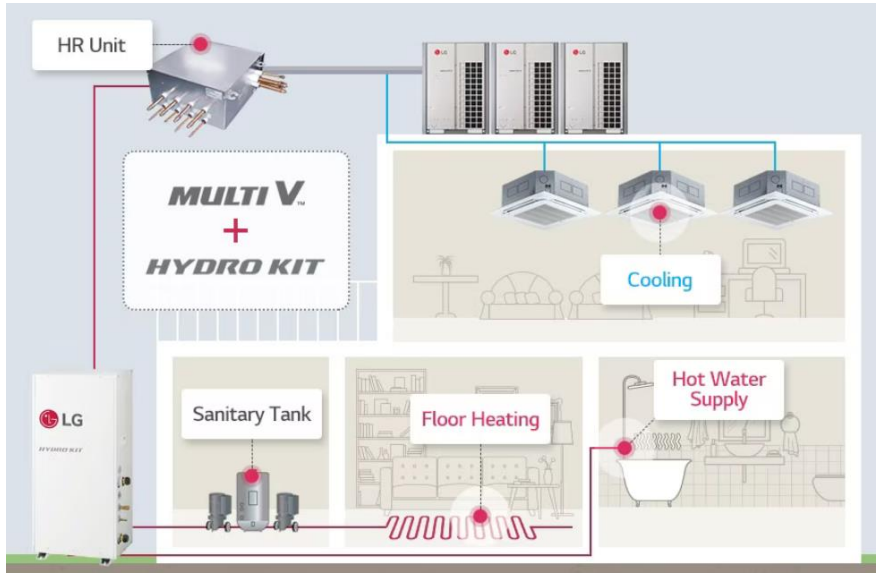


Large Scale and Commercial Split System Applications

Office / Multifamily / Hospitality

Source: www.rheem.com/commercialheatpumpwaterheater

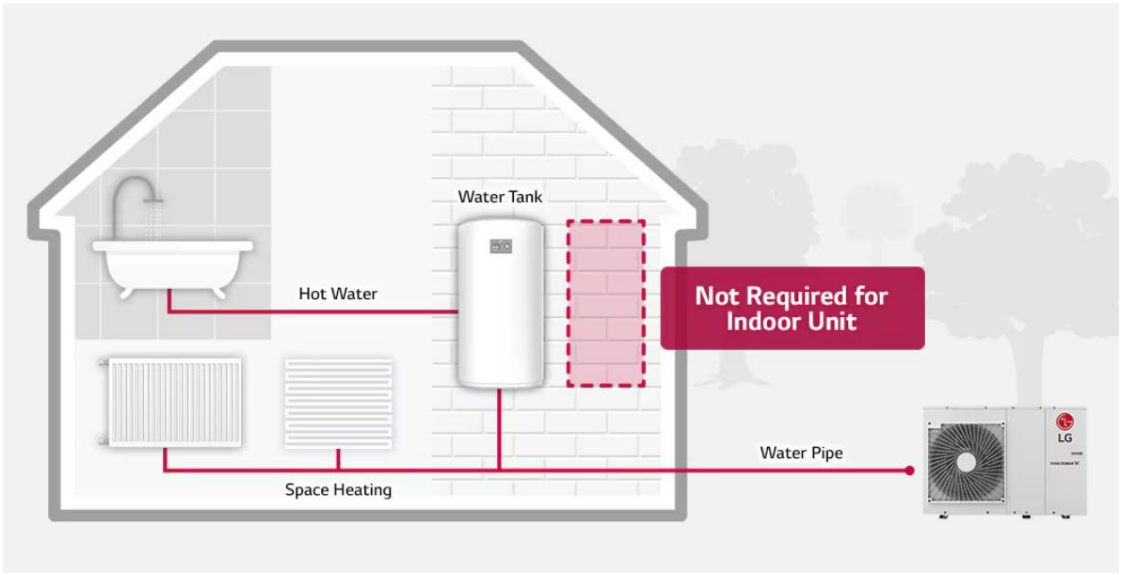
Combined Systems –Water Heating and Space Heating



Source: www.lg.com

Mixed Use / Multifamily / Hospitality

- Captures Heat from VRF Cooling
- Water Pipes can provide Space Heating and Domestic Hot Water



Source: www.lg.com Therma V R-32 Monobloc

Single Family

- Dedicated Air to Water system
- Water Pipes provide Space Heating and Hot Water
- Indoor Boiler/Gas Heater not needed in most climate zones

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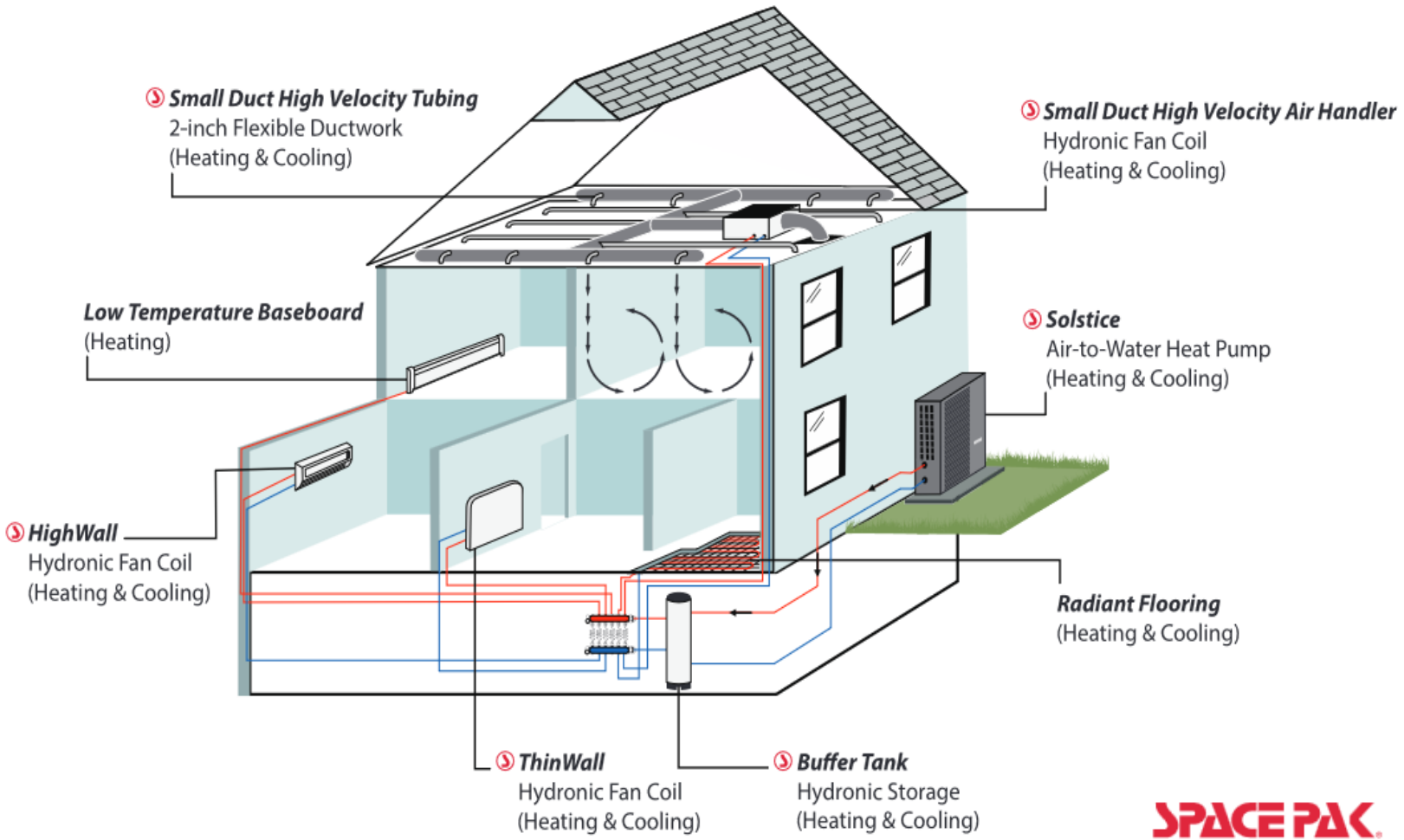
Combined Systems –Water Heating and Space Heating



Solstice® Inverter Monobloc

Air-to-Water Heat Pump

- Available with R-32 Refrigerant
- Hot or Cold water circulates within the house –not refrigerant
- Uses a ducted system to deliver cooling
- Uses Mitsubishi Inverter for high performance

https://www.spacepak.com/R32-heat-pumps

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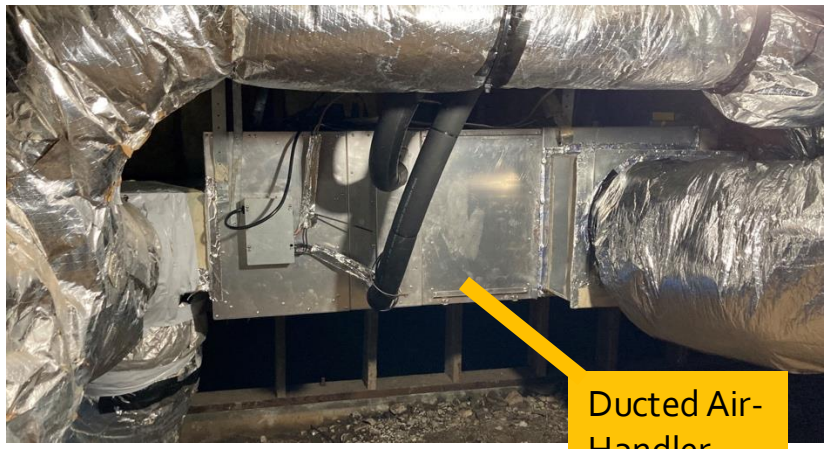
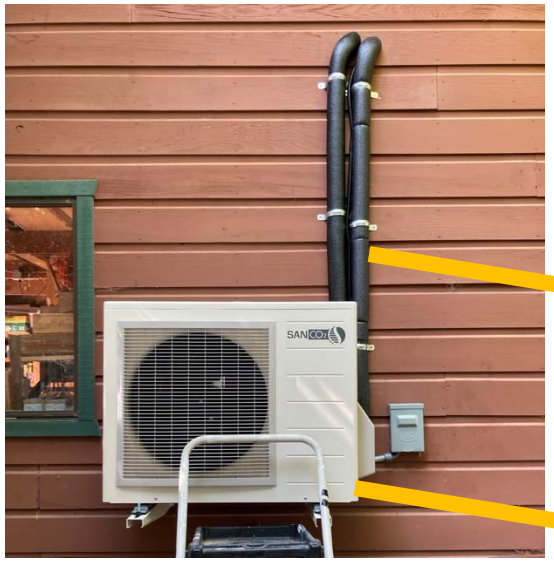
Combined Heating and DHW –Harvest Thermal System Example

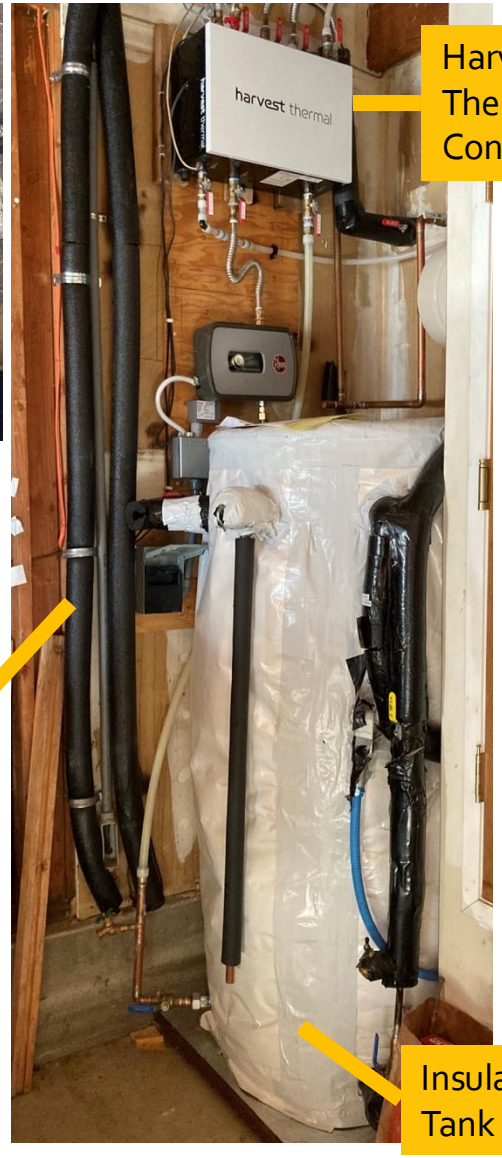


Ducted Air-Handler



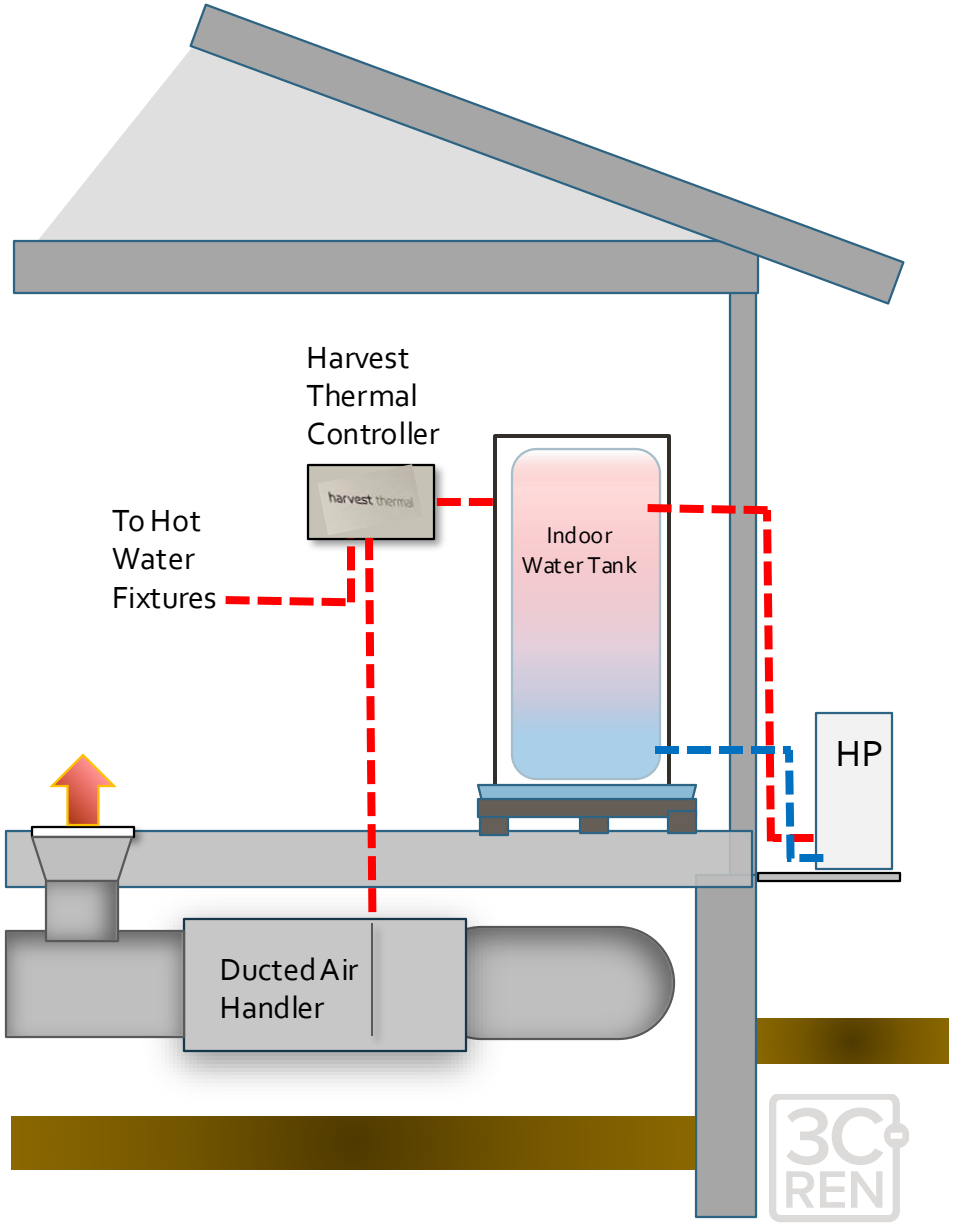
Insulated Piping

Heat Pump – Outdoor Installation



Harvest Thermal Controller

Insulated Tank



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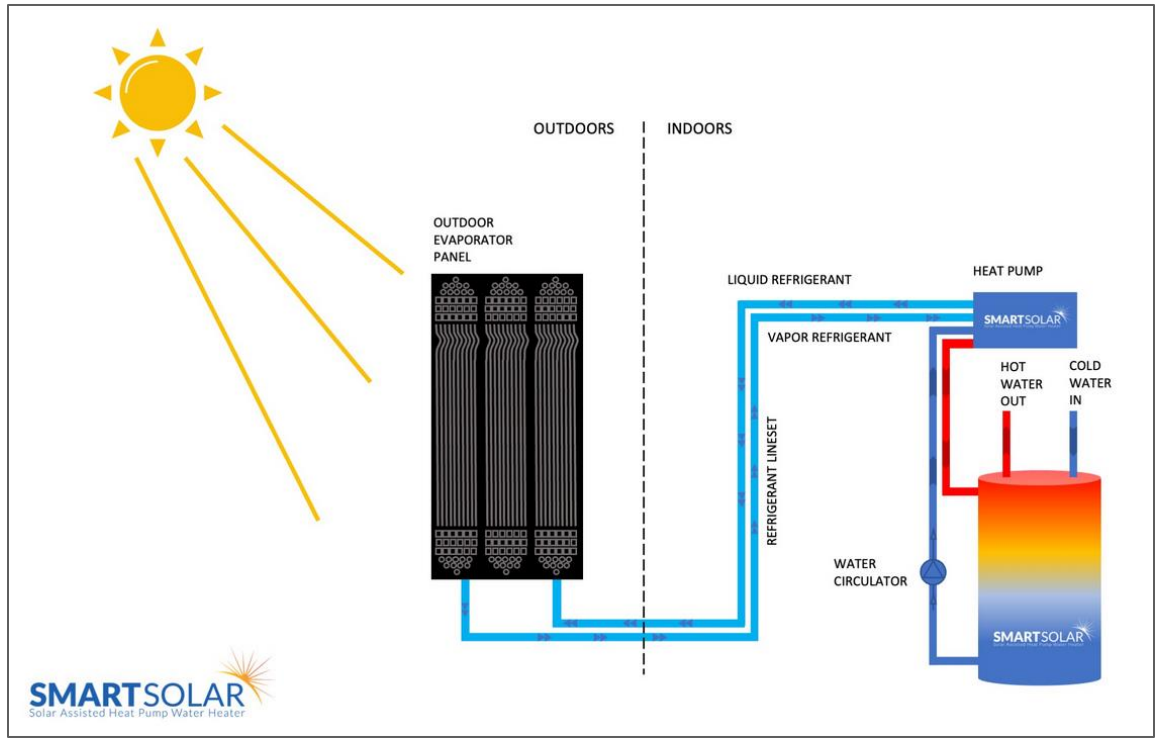
Innovative Split Systems

Smart Solar: "solar assisted" SA-HPWH



https://smartsolarwaterheater.com

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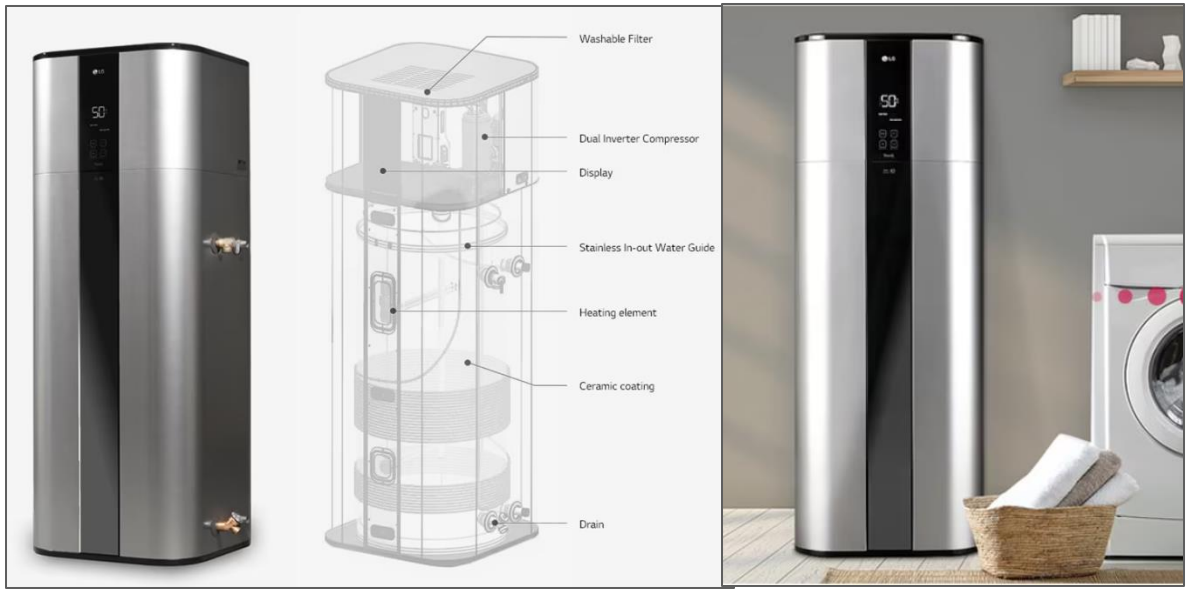
Solar PV and DHW/Thermal Batteries Innovations

CABEC Conf. Trade Show
Business marketing their DHW/Thermal Battery Kit –an LG Inverter HPWH, Smart Controls, and Solar PV



Source: LG Inverter Heat Pump Water Heater Marketing Material

A Closer Look at Heat Pump Water Heaters for the Consumer

EnergyStar Brands in the USA –Qualify for Tax Credits and Rebates

https://www.energystar.gov/productfinder/product/certified-heat-pump-water-heaters/

1

- ☐ 1HVAC (2)

A

- ☐ A. O. Smith (36)
- ☐ ACIQ (2)
- ☐ American (22)
- ☐ AMERICAN STANDARD WATER HEATERS (8)
- ☐ AquaThermAire (1)

B

- ☐ Bosch (6)
- ☐ Bradford White (3)

D

- ☐ DIYCOOL (2)

E

- ☐ Eco-Logical (2)

F

- ☐ Friedrich (34)

H

- ☐ Hubbell (4)

J

- ☐ JETGLAS (3)

K

- ☐ Kepler (3)

L

- ☐ LG (9)
- ☐ Lochinvar (13)

M

- ☐ Midea (14)

N

- ☐ Noritz (4)

P

- ☐ PolarWave (2)

R

- ☐ RELIANCE WATER HEATERS (19)
- ☐ Rheem (158)
- ☐ Richmond (38)
- ☐ Rinnai (9)
- ☐ Ruud (48)

S

- ☐ SANCO2 (6)
- ☐ Smart Solar (3)
- ☐ State (21)
- ☐ STEALTH (2)
- ☐ stream33 (2)

U

- ☐ U.S. Craftmaster (6)

V

- ☐ VAUGHN THERMAL (8)

- Approx 31 Brands Available under EnergyStar
- EnergyStar Products Qualify for Rebates and Tax Credits
- EnergyStar is an easy to use resource for comparing products and finding rebates

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The Current Market

In the US, we have seemingly many brands, but only a handful of manufactures:

BRADFORD WHITE
WATER HEATERS

Rheem

RUUD

STIEBEL ELTRON

LG

AO Smith

Lochinvar

state
WATER HEATERS

SANDEN

SANCO2
Hot water, naturally.

ECO2
SYSTEMS

Central Coast California Retailers Offer a Few Common Brands

...Some Companies have brands that are exclusive to their marketing region and retailer

Parent Company – Rheem:

- Friedrich
- Rheem
- Richmond
- Ruud

Parent Company -AO Smith:

- AO Smith
- American Water Heaters
- Lochinvar
- Reliance Water Heaters
- State Water Heaters

Most products can be ordered on-line and through plumbing distribution centers / whole-sellers / retailers.

Home Depot	Lowe's	Fergusons Supply House
Rheem	AO Smith	AO Smith State Bradford White Rheem

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Two Types of Heat Pumps for Domestic Water Heating

- Air-Source –**Integrated and/or Hybrid**

A. O. Smith

'Hybrid' often refers to electric heat pump and electric resistance back-up

'**Integrated'** refers to a unitary system where the heat pump and tank are one appliance

- Air-Source –**Split Systems**

SANCO2

'**Split System**' refers to a system where the heat pump and tank are separate components

Identifying Integrated HPWHs

Heat Pump

Large Storage Tank

Integrated Control Panel

Inlet ⬇ and Exhaust ➡Vents for Fan/Evaporator Coil

Electrical Connection

No Gas Connection and no Flue

A. O. Smith

A. O. Smith

Identifying Split HPWH's

Heat Pump Is Split

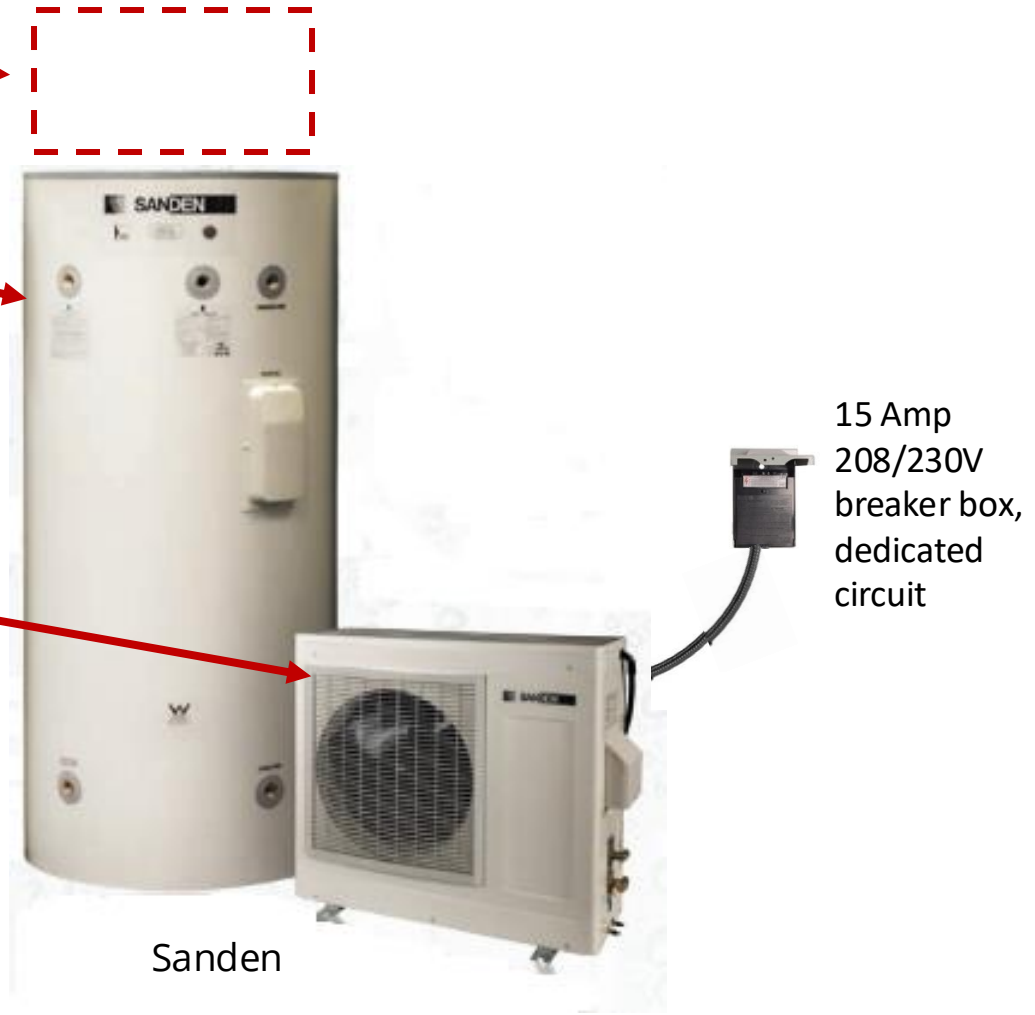
Storage Tank (inside)

Electrical Connection (at HPU)

Heat Pump Unit (HPU), i.e. Compressor/Condenser/ Evaporator and Fan (outside)

Insulated water lines connect the storage tank and heat pump unit

No Gas Connection

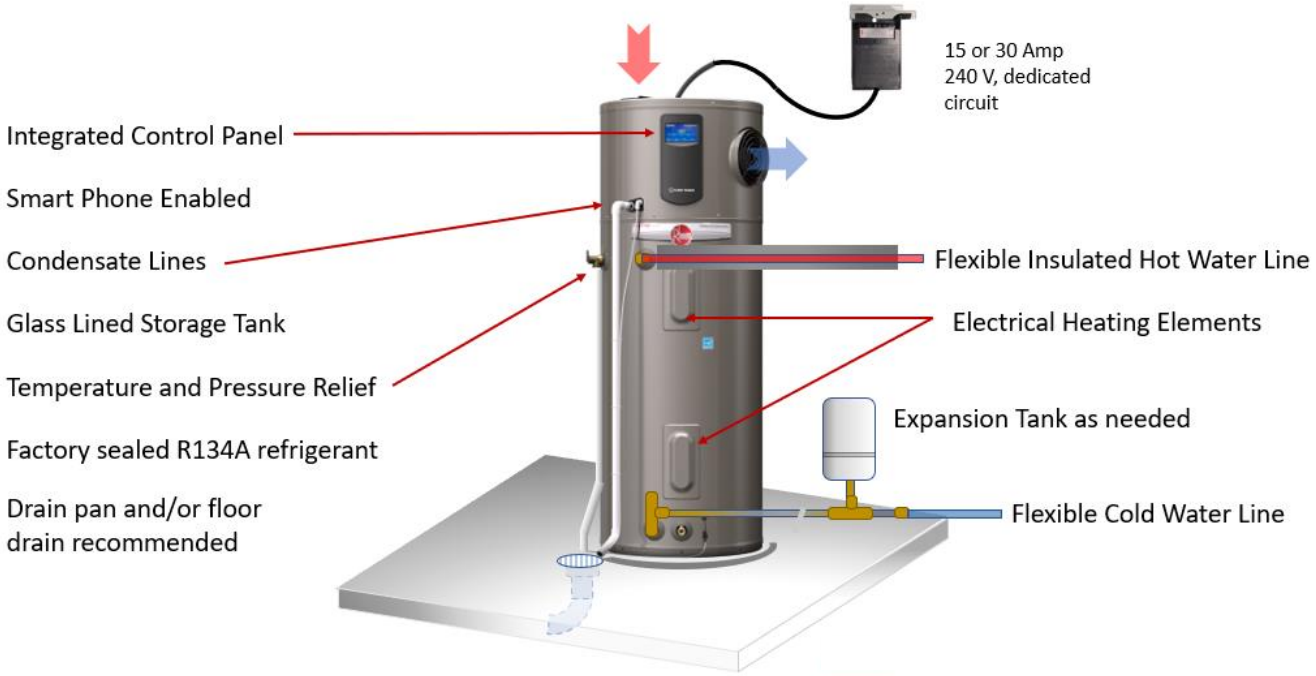


Sanden

Integrated HPWH

Integrated HPWH Considerations

- **Integrated HPWH tanks taller than standard gas or electric units**
- **Sound Level is typically around 50 db, newer models report 45 db**
- **Cold dehumidified air is expelled**
- **Condensate Drainage needs to be addressed**
- **Older models needed 1000 cubic feet volume, or ducted vent kit**
- **Current models need around 700 cu ft**
- **Some of the newest models need only 450 cu ft**
- **120-volt plug-in varieties now available for easy retrofit/replacement**



Rheem marketing

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/

Care and Maintenance

Changing the filter
Setting the temperature
Choosing the operation mode

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

Examples of High Efficiency HPWH Installations

Image source: IBGC – PSHH Office

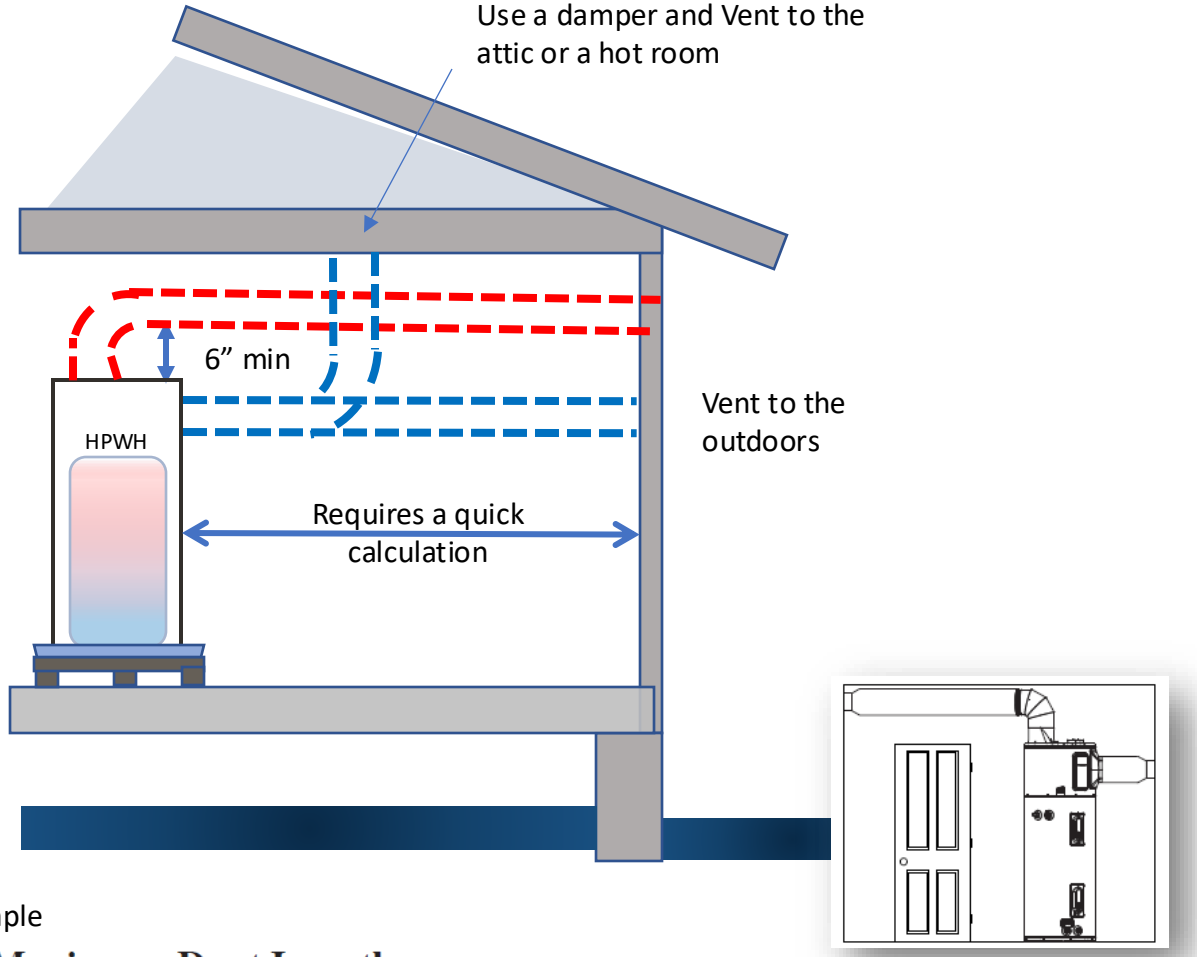
- **'Large' Utility Room with Floor Drain**
- **New Construction**
- **All Pipes Insulated**

- **Existing 2-car garage**
- **Retrofit/Replacement**
- **Plumbing and Electrical Trades Involved**

Image source: M. Zimney, IBGC – Private Residence

Ducted Options are Available

Photo Credit: IBGC – Multifamily Project in SLO



Rheem Example

Table 1.- Maximum Duct Length.

Duct Type / Diameter	8"	7"	6"	5"
Rigid	340'	160'	65'	17'
Flexible	125'	65'	25'	--

Split System HPWH

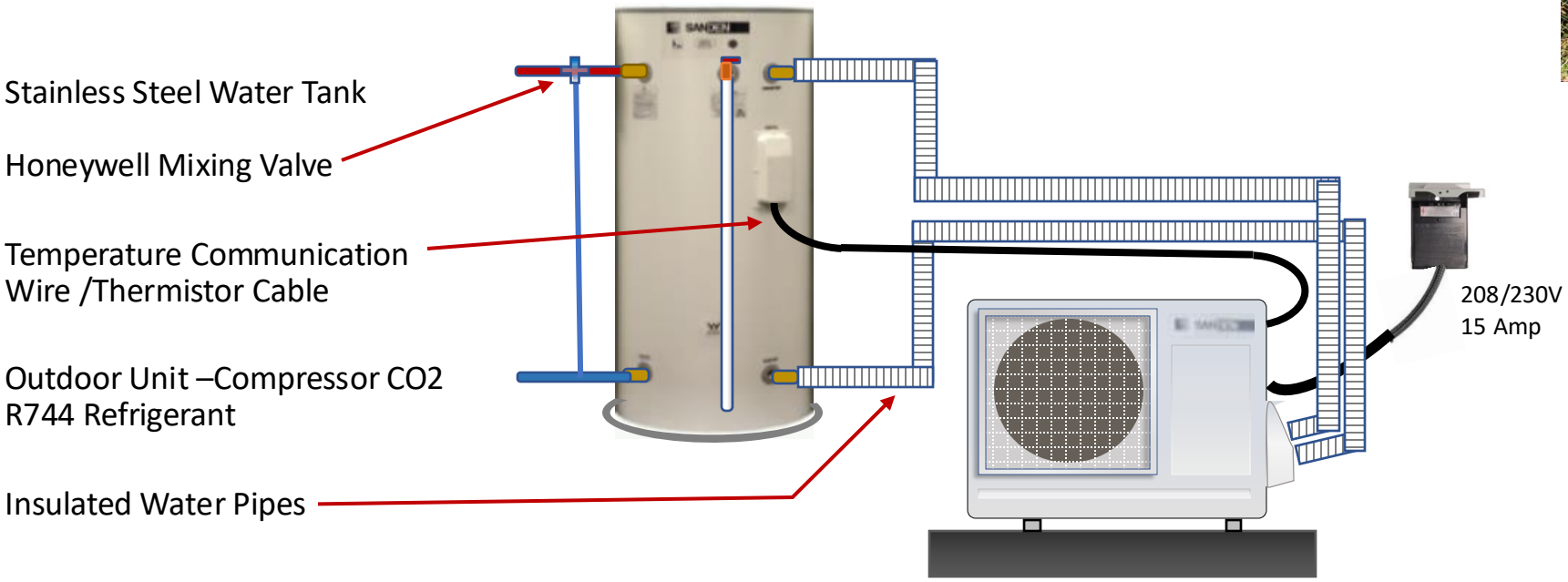
SanCO2 –readily available in the US

Many other brands are *available internationally* –and have been for years.

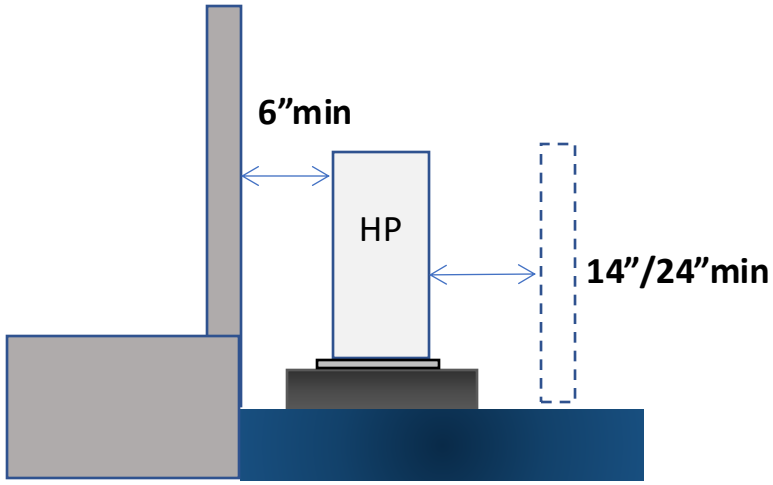
SanCO2 Split System HPWH Considerations

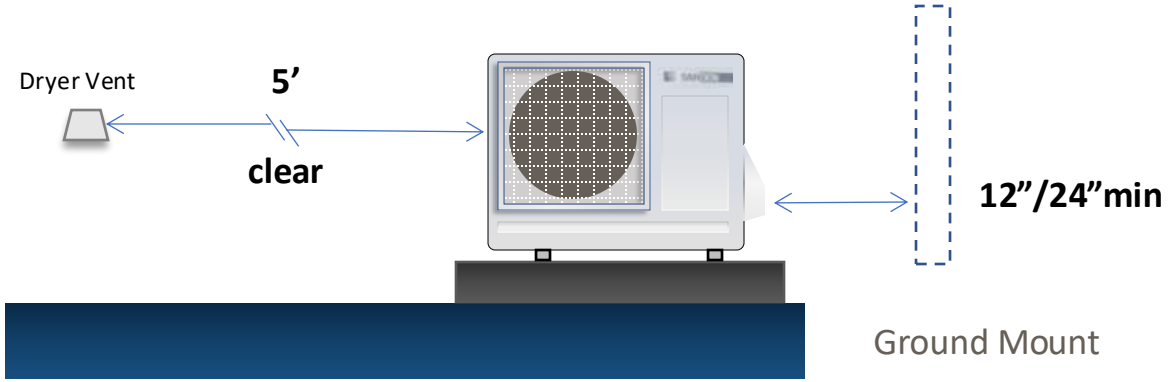
- **Outdoor unit operates at outdoor temps of 20 deg F *below zero***
- **Uses R-744 CO2 refrigerant – very low GWP of 1**
- **No noise from the indoor tank**
- **Tank does not need power –no filters, no anode rods, no electric resistance element –can be located in small closet, under stairs, cabinet**
- **Tank temp 130-176 deg F**
- **Rule of thumb: tank to plumbing fixture 65’ to 100’ (longer depending on application)**

Photo Credit: IBGC - Cox Cottages



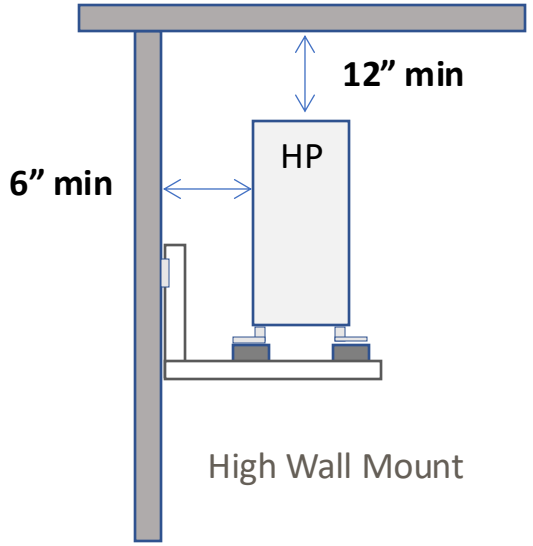
Clearances and Mounting





Ground Mount

Photo Images:
https://www.eco2waterheater.com/gallery



High Wall Mount

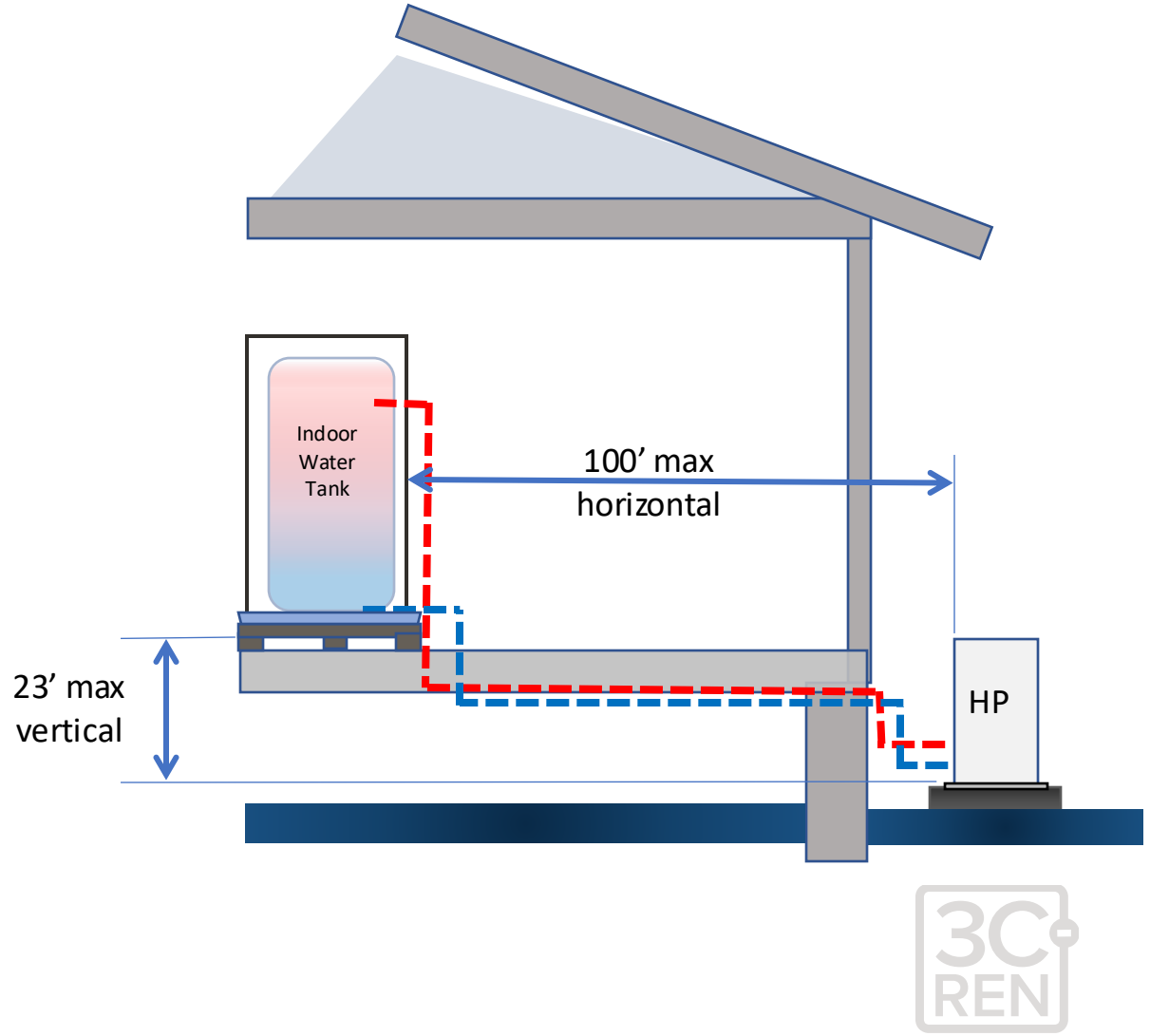
Indoor Tank Clearances and Piping Distances

In Closets

Photo Images:
https://www.eco2waterheater.com/gallery

- Only a few inches clearance needed
- No moving parts
- No noise
- No filters, etc

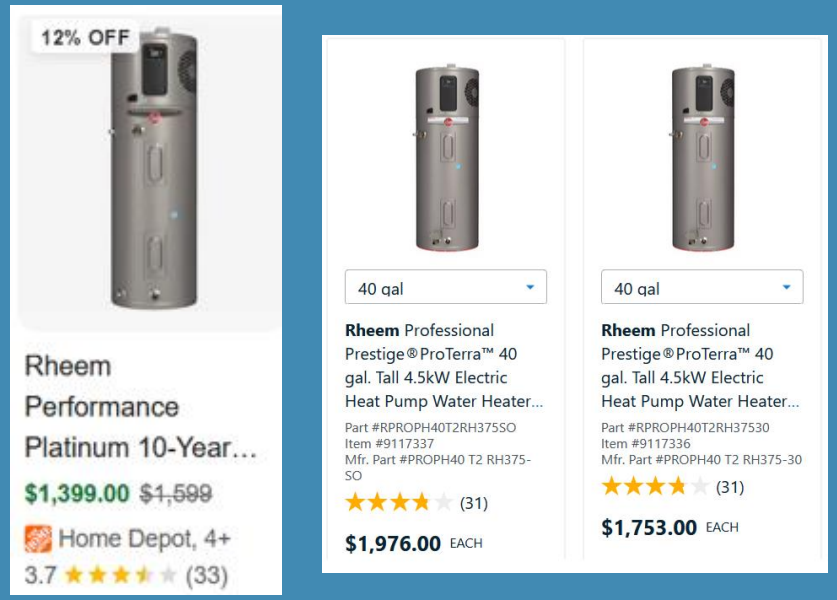
Under Stairs



Items and Features that Impact Purchase Price and Operation

- **Integrated or Split:** Split systems cost more than Integrated
- **Promotional Pricing:** Rebates and Tax Credits
- **Size / Capacity (gal):** nominal 40, 50, 60, 80, 119+ gals –brand and type dependent
- **Efficiency COP**: Higher efficiency can cost more, EnergyStar qualifies for Tax Credit
- **First Hour Rating (gal/min):** Important for right-sizing
- **Lower and Upper Temp Limit:** Some integrated units can only go to 45 F, some split system to -20 F
- **Sound and Vibration:** Location and plumbing details
- **Electrical Voltage**: 240V less expensive than 120V plug-in units
- **Refrigerant and/or Water Line**: Longer lengths can impact performance

Promotional Pricing
Look for Sales and Rebates…
Older vs Newer Models



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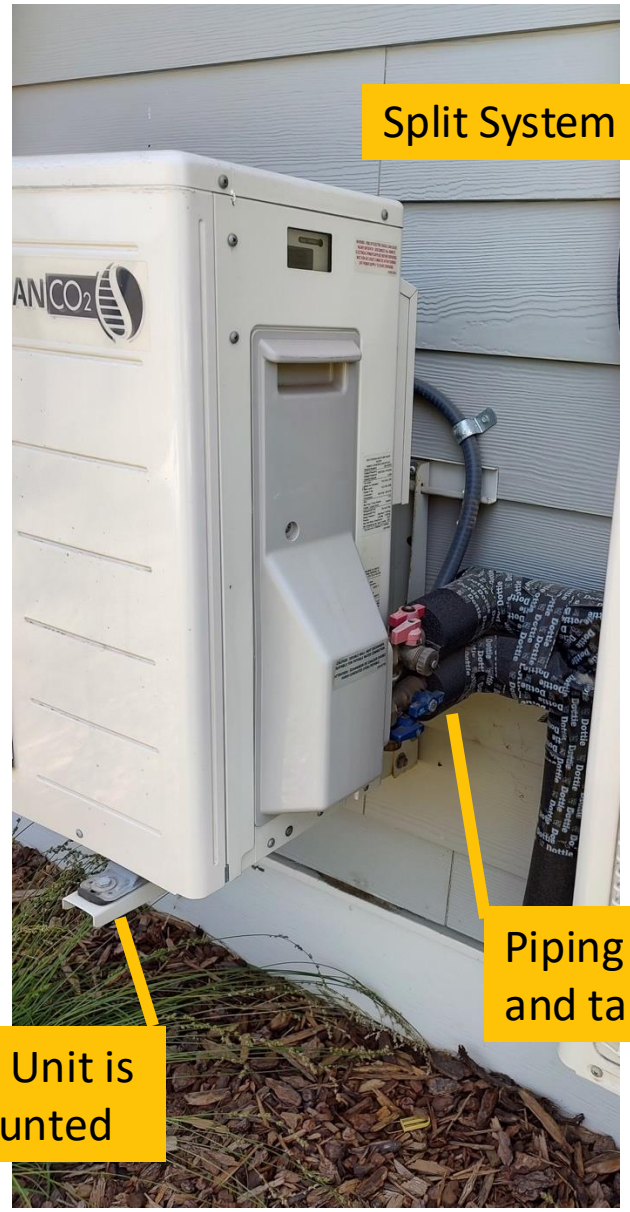
Additional Items for a Complete Job

Better Quality Install and Site Specific Items

- **Insulation** –Refrigeration Lines and/or Water Piping
- **Exterior Line Set Covers –**Remodels –Protects Piping
- **Outdoor Unit Mounting Options**: Ground Mount Pads, Racks, and Wall Hangers, etc.
- **Electrical Work –120V Plug-in or New Electrical –** i.e. 240V power/breaker/junction box-shut off, panel space or upgrade, etc



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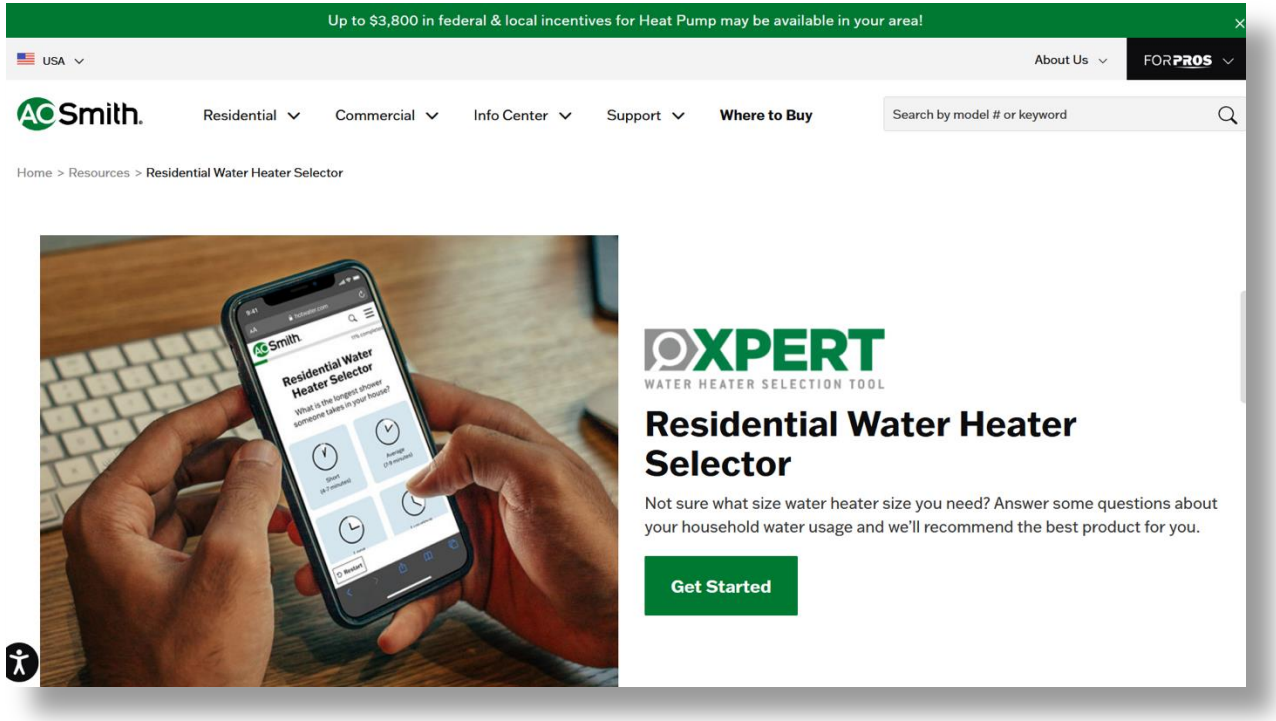
Before you shop: Learn what size (gal) HPWH you will need

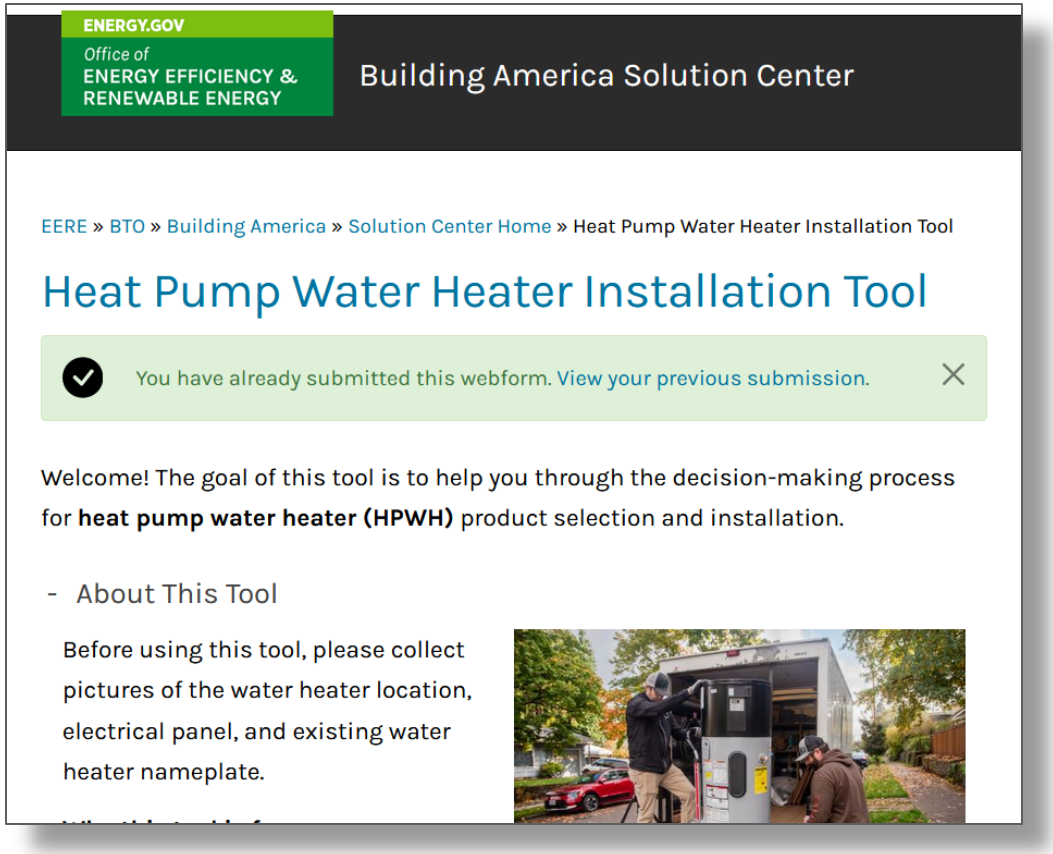
New or Existing Situation –Offers Brand 'Best Matches', including HPHW

https://www.hotwater.com/resources/water-heater-selector-tool



Designed for a Replacement –Links to List of EnergyStar Models

https://basc.pnnl.gov/hpwh_installation_tool



120V Plug-in HPWH – Gas Replacement Option

For optimal performance, Rheem recommends this model to be installed within the green US map zone. For other locations, consult a Professional Installer for more hybrid water heating options.

Average Ambient Air Temp in January

Below 37°F

Above 37°F

Central Coast is Covered

HOUSEHOLD SIZE		PLUG-IN TANK SIZE
BEDROOMS	BATHROOMS	MINIMUM GALLON CAPACITY
1	1–1.5	40
1–2	1–2.5	50
1–3	1–2.5	50
1–4	1–2.5	65
1–6	1–3.5	80

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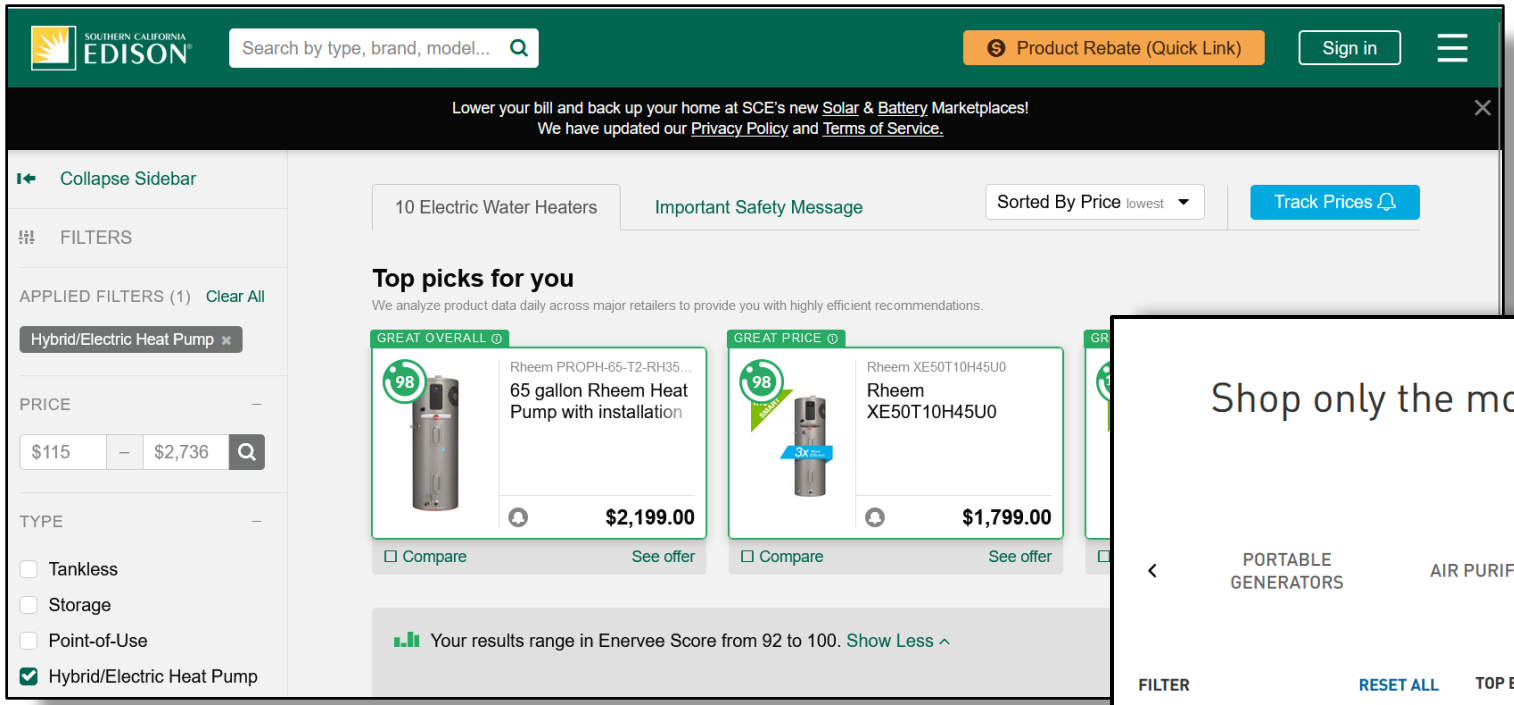
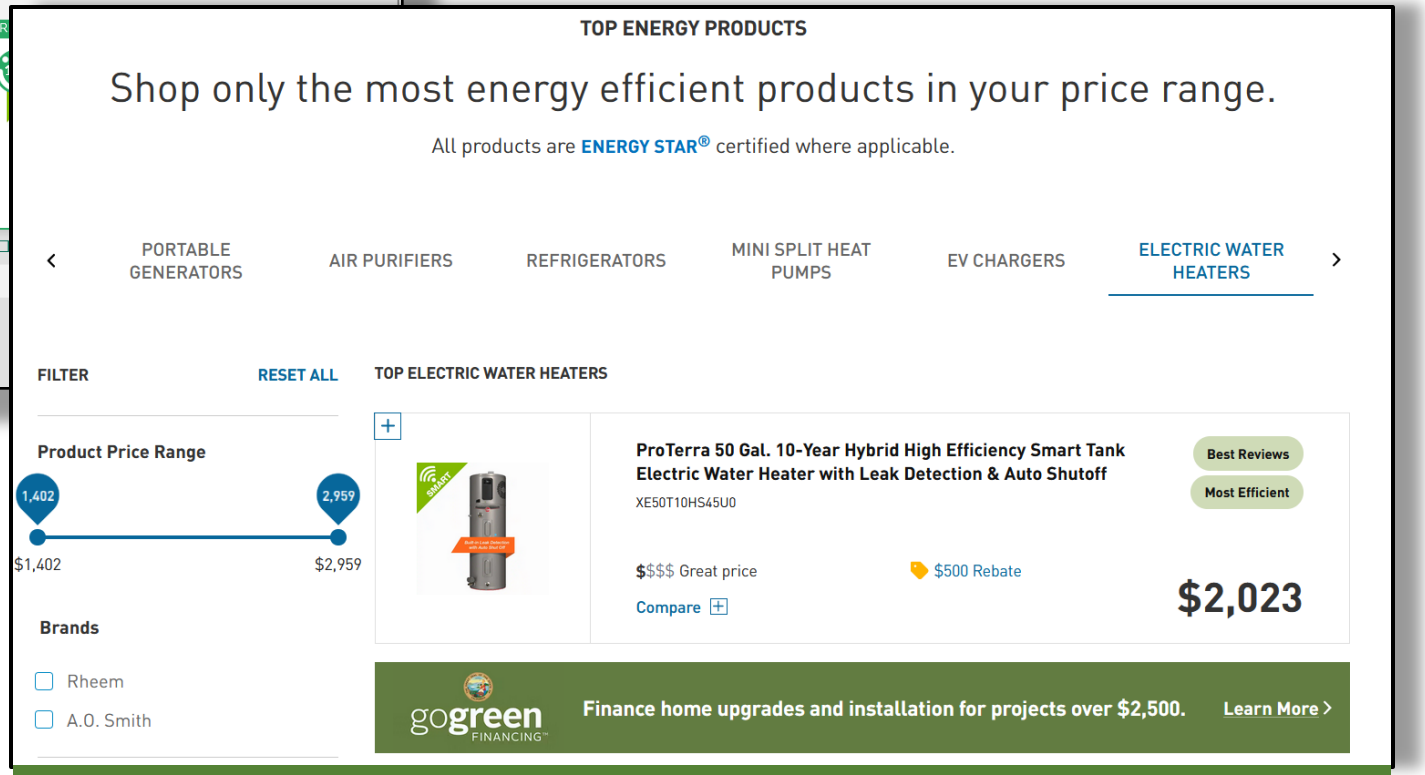
Consumer Shopping – Integrated HPWH



https://marketplace.sce.com/

- Price Range: $1,650 - $2,990
- Price varies by specialty features and tank capacity

- Product(s) link to Retail Seller
- Retail outlet links to Rebates and Incentives



https://guide.pge.com/browse/electric_water_heaters

Ferguson Plumbing Example of AO Smith Voltex Line

Older Models

700 cu ft

R-134A Refrigerant

Baseline
4.5 kW Elec
30 Amp,
3.45 UEF

50 gal

A.O. Smith Voltex® 50 gal. Tall 4.5kW Residential Hybrid Electric Heat Pump Water Heater with...

Part #AHPTU50CTA20217200
Item #9317972
Mfr. Part #100338904

(0)

$1,810.08 EACH

CTA-2045-A Utility Port for Demand Response

50 gal

A.O. Smith Voltex® 50 gal. Tall 4.5kW Residential Hybrid Electric Heat Pump Water Heater

Part #AHPTU50N202172000
Item #7113150
Mfr. Part #100313031

(0)

$1,637.00 EACH

Baseline

50 gal

A.O. Smith Voltex® 50 gal. Tall 9kW Residential Hybrid Electric Heat Pump Water Heater

Part #AFPTU50202172000
Item #7188326
Mfr. Part #100314534

(0)

$1,649.16 EACH

Two 4.5kW Elec Elements

Standard:

- 50 Gal Nominal –46 Gal Rated
- 10 yr Warranty
- Vacation Mode: Tank Temp Maintenance at 60 F
- Temp Range: 45 deg F

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Ferguson Plumbing Example of AO Smith Voltex Line

Slightly Newer Models

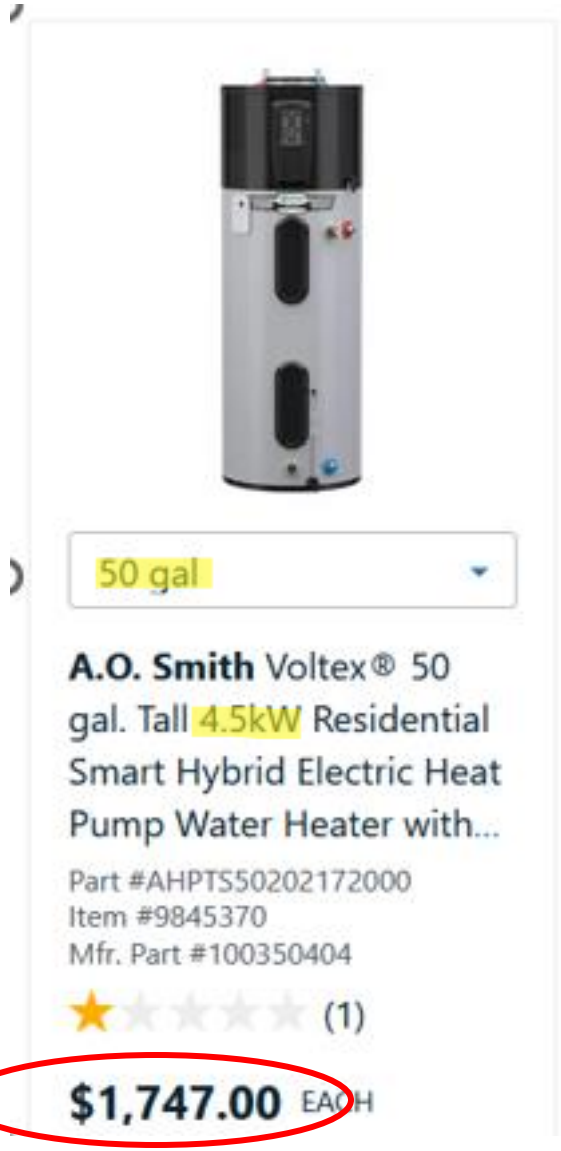
700 cu ft

R-134A Refrigerant

Leak Detection, Phone App and CTA-2045-A

23.6 Amp, 3.8 UEF

Next Step Up –Better Efficiency



Standard:

- 50 Gal Nominal –46 Gal Rated
- 10 yr Warranty
- Vacation Mode: Tank Temp Maintenance at 60 F
- Temp Range: 45 deg F

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Lowe's Example of AO Smith 'Signature 900' Example

Newest Model

450 cu ft

R-134A Refrigerant

Leak Detection, Phone App, and CTA-2045 23.6 Amp, **3.8 UEF**

A.O. Smith
Signature 900 Tall
10-year Warranty…

$1,950.00

Lowe's

Item #4065452 |
Model #HPS10-50H45DV

- **Top Air Inlet and Top Exhaust Vent**
- **Top or Side Cold and Hot Pipe Connections**
- **Temp Range: 37 F to 120 F**

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Example of AO Smith Voltex 120V Plug-In –Replacement for Gas Tank

Newest Model

450 cu ft

R-513A Refrigerant

Lower GWP Refrigerant

Leak Detection, Phone App, and CTA-2045-A, 120V, 15 amp, **3.2 UEF**

66 gal

A.O. Smith Voltex® 66 gal. Tall 120V Plug-In Residential Hybrid Electric Heat Pump Water Heater

Part #AHPTV66202172000
Item #10176592
Mfr. Part #100361937

(0)

$2,689.20 EACH

- **Top Air Inlet and Top Exhaust Vent**
- **Top or Side Cold and Hot Pipe Connections**
- **Temp Range: 37 F to 120 F**

SIZING RECOMMENDATION FOR EQUIVALENT FIRST HOUR RATING

Voltex 120V Plug-In Heat Pump		Gas Water Heater
Model	Nominal Capacity	Nominal Capacity
HPTV-66	66 gal (76 FHR)	30-40 gal (60-75 FHR)
HPTV-80	80 gal (93 FHR)	50 gal (80-100 FHR)

Voltex AL is recommended to replace a standard electric water heater or for use in new construction.

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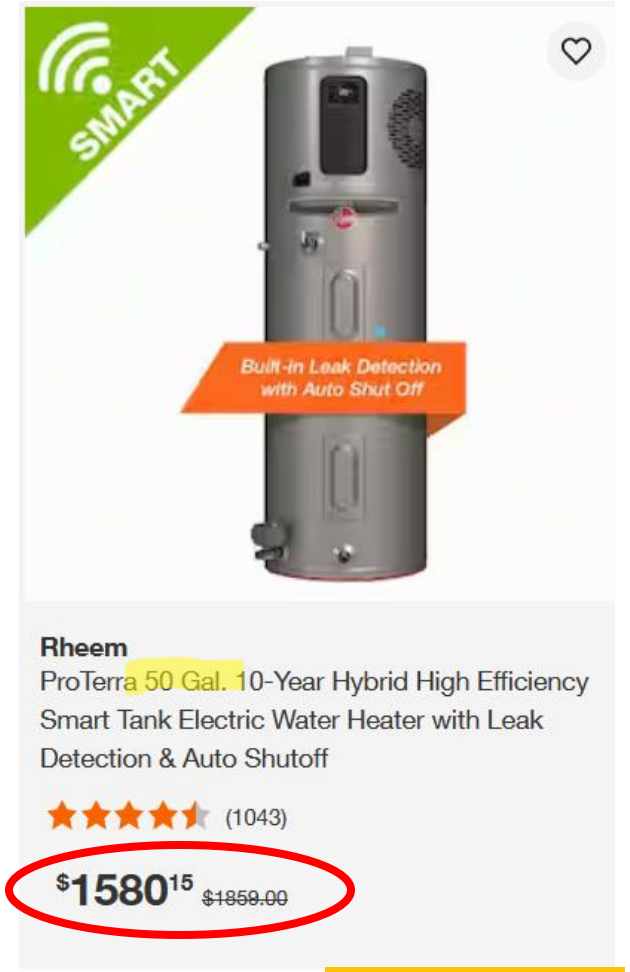
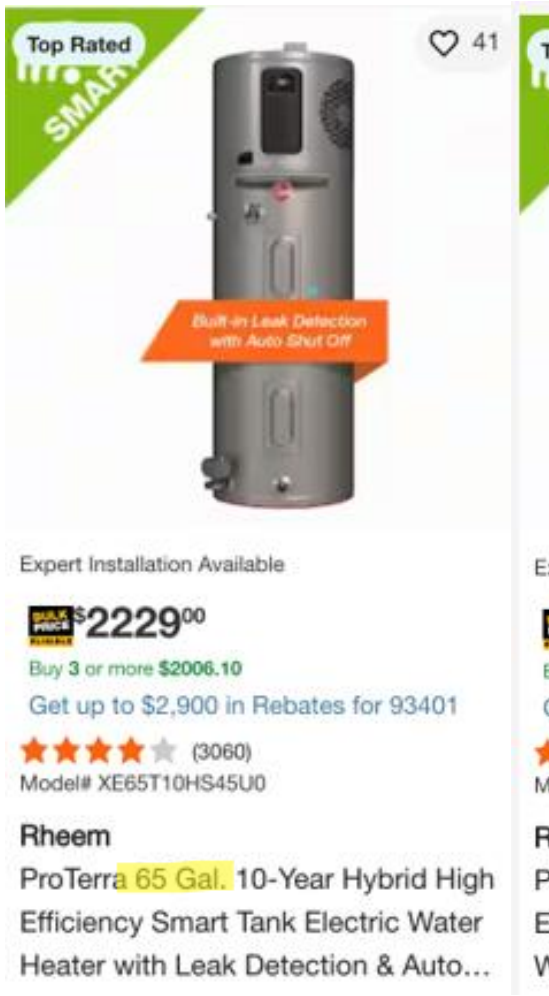
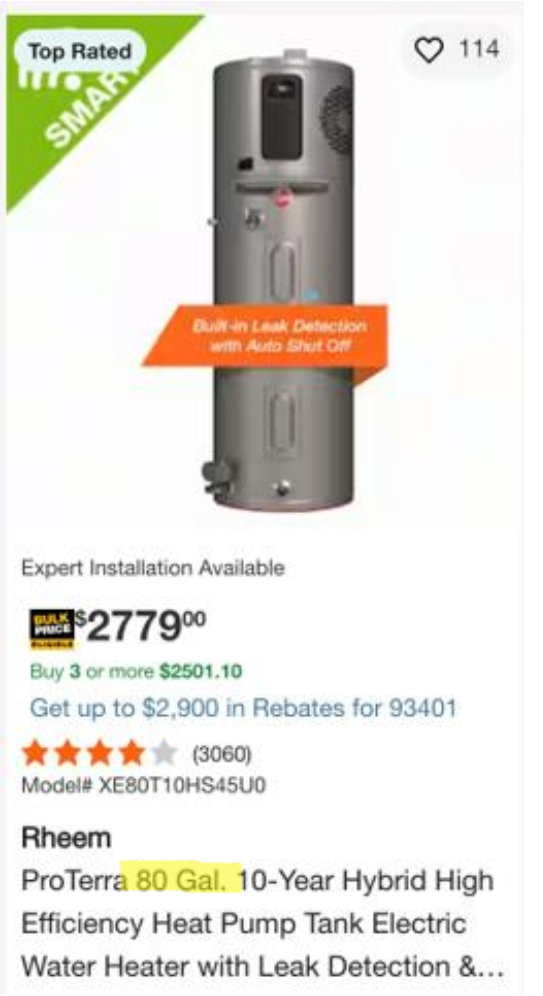
Price Typically Increases with Tank Size –Rheem Example

Local Home Depot Example –Rheem ProTerra, UEF 3.88







Sale Pricing…

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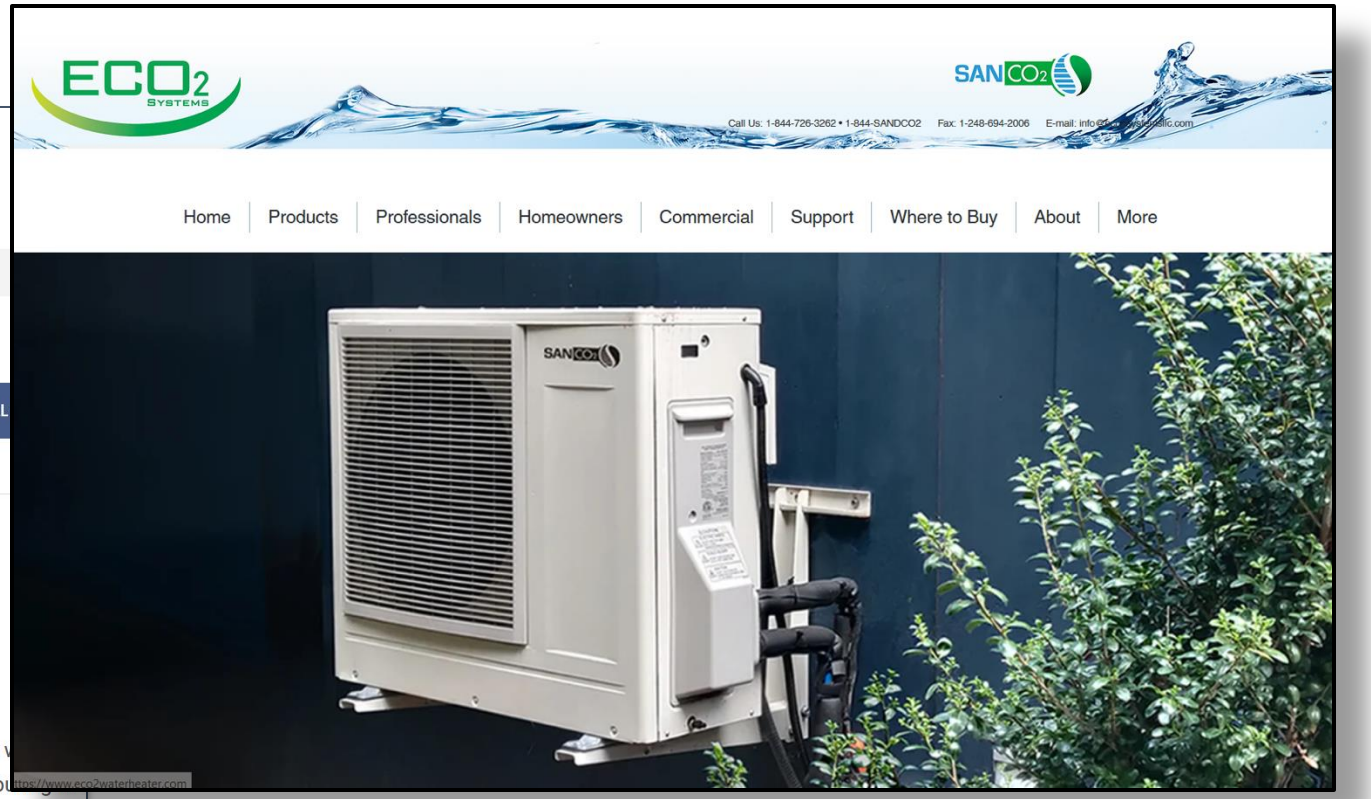
Consumer Shopping –Split System

Split System HPWH - ECO2 by SanCO2

https://smallplanetsupply.us/



https://www.eco2waterheater.com/

- Price Range: $5,400 - $7,200
- Price varies by tank capacity

Split Systems Cost More than Integrated HPWH –SanCO2 Example

but, may be worth it…

- **Outdoor unit operates at outdoor temps of 20 deg F *below zero***
- **Uses R-744 CO2 refrigerant – very low GWP of 1**
- **No noise from the indoor tank**
- **Tank does not need power –no filters, no anode rods, no electric resistance**

Price Increases with tank size.

Installations cost of the Whole System can vary…

- Add another $1000 for materials
- Add $1000 for electrician
- Add $3600-$5000 for Install depending on the complexity of the job

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Incentives and Rebates

Tax Credits
https://www.energystar.gov/about/federal-tax-credits/heat-pump-water-heaters

Rebates –Links to your State
https://www.energy.gov/save/rebates

The **Inflation Reduction Act of 2022** created two programs to encourage home energy retrofits:

- **Home Efficiency Rebates** (HOMES) to fund whole house energy efficiency retrofits, and
- **Home Electrification and Appliance Rebates** (HEEHRA) to help low-moderate income households "go electric" through qualified appliance rebates.

https://techcleanca.com/incentives

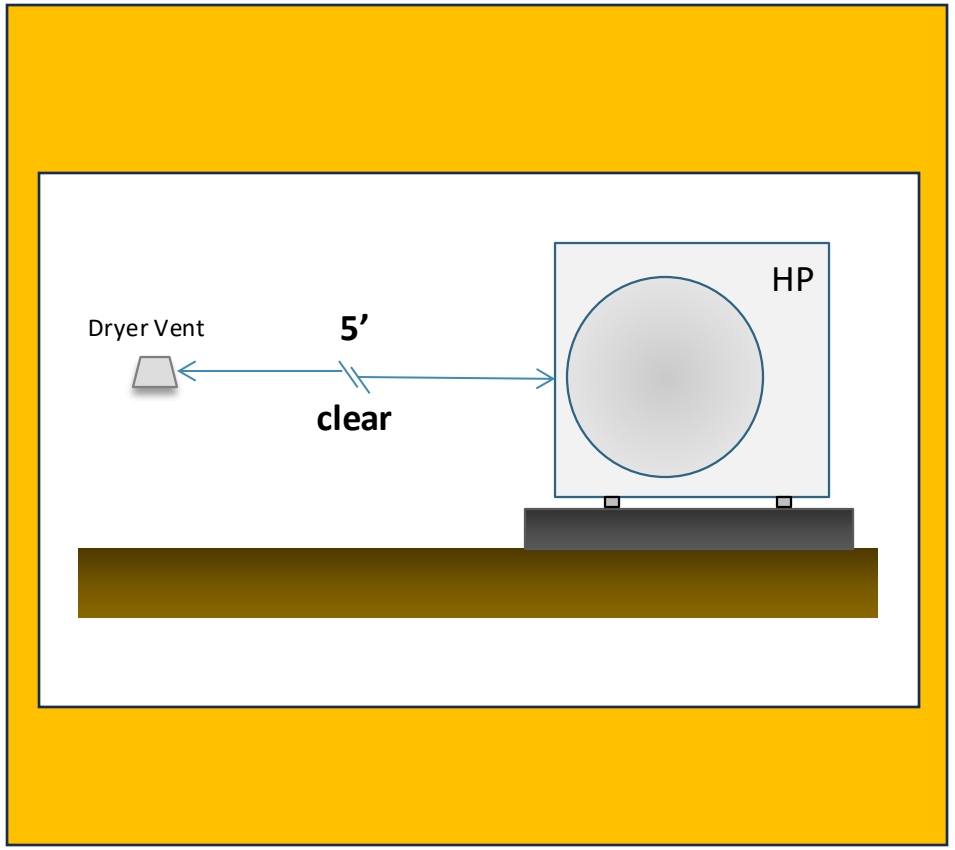
https://goldenstaterebates.com

NOTE: Access the programs via TECH Clean California. HOMES program will launch in 2025.

Tips for Managing Client Expectations and Title 24 for Residential Occupancies

Managing client expectations

- **Split System Outdoor Unit:** Locate at least 5 ft away from dryer vents
- **Owner Maintenance:** Integrated Units have filters that require periodic cleaning; the filter is designed to help keep the coil clean
- **Owner Operation**: ‘Heat Pump Only’ mode has best efficiency; ‘Hybrid’ mode increases capacity –useful when for guests or increased hot water need; ‘Vacation’ mode can save homeowner some money.
- **Integrated Units:** Reminder that noise and cold air can be problematic for some occupants



Specific Tier 2 Equipment Verification – HERS Required

HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION
CALIFORNIA ENERGY COMMISSION CEC-CF2R-PLB-22-H
SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF INSTALLATION
Note: This table completed by HERS Registry.

Project Name:	Enforcement Agency:
Dwelling Add	
City and Zip C	

A. Design HER
This table repo
registered CF1

01	0
Dwelling Unit Name	Wa Hea Syst ID Na

A2. Design HE
This table repo
document for

01	
Dwelling Unit Name	W He Syst or

B. Installed HE
This table repo

01	02
Dwelling Unit Name	Wat Heat Syste ID Nam

B2. Installed HERS Verified Dwelling Unit HPWH System Information
This table reports the water heating system(s) installed in this project

01	02	03	04	05	06	07	08
Dwelling Unit Name	Water Heating System ID or Name	Modeled Equipment Make and Model	# of Like (or Identical) Water Heaters in System	Tank Location	Exterior Tank Insulation R-value	Dwelling Unit DHW System Distribution Type	Compact Distribution

C. Design HERS Verified Dwelling Unit Water Heating Efficiency Information
This table reports the water heater(s) efficiency features specified on the registered CF1R compliance document for this project. (Not needed for central systems)

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank Location

D. Installed HERS Verified Dwelling Unit Water Heating Efficiency Information
This table reports the water heater(s) efficiency features installed in this project. (Not needed for central systems)

01	02	03	04	05	06	07
Water Heating System ID or Name	Heating Efficiency Type	Heating Efficiency Value	Standby Loss (%)	Exterior Insulation R-Value	Water Heater Storage Volume (gal)	Tank Location

E. Installed Water Heater Manufacturer Information

01	02	03
Water Heating System ID or Name	Manufacturer	Model Number

Registration Number: Registration Date/Time: HERS Provider:
CA Building Energy Efficiency Standards – 2022 Residential Compliance January 2022

Straight forward to verify; Important to alert installing contractor

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Hot Water Recirculation – Large Penalty, but less so with HERS Verified Demand Recirculation

HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION

CALIFORNIA ENERGY COMMISSION CEC-CF3R-PLB-22-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

P. Demand Recirculation Manual Control (R-DRmc) (RA4.4.9)/Sensor Control (RDRsc) (RA4.4.10) Requirements

Systems that utilize this distribution type shall comply with these requirements.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met.

01	The system operates "on-demand", meaning that the pump begins to operate shortly before or immediately after hot water draw begins, and stops when the return water temperature reaches a certain threshold value. For Demand Recirculation Manual Control, the pump shall be turned on using a manual switch system. For Demand Recirculation Sensor Control, the pump shall be turned on using a sensor system.
02	The controls shall be located in the kitchen, bathroom, and any hot water fixture location that is at least 20 feet from the water heater.
03	Manual controls may be active by wired or wireless mechanisms.
04	Sensor Controls may be activated by wired or wireless mechanisms, including buttons, motion sensors, door switches and flow switches. Each control shall have standby power of 1 Watt or less.
05	Pump and control placement shall meet one of the following criteria: 1. When a dedicated return line has been installed the pump, controls and thermo-sensor are installed at the end of the supply portion of the recirculation loop; or 2. The pump and controls are installed on the dedicated return line near the water heater and the thermo-sensor is installed in an accessible location as close to the end of the supply portion of the recirculation loop as possible; or 3. When the cold water line is used as the return, the pump, demand controls and thermo-sensor shall be installed in an accessible location at the end of supply portion of the hot water distribution line (typically under a sink).
06	After the pump has been activated, the controls shall allow the pump to operate until the water temperature at the thermo-sensor rises to one of the following values: 1. Not more than 10°F (5.6°C) above the initial temperature of the water in the pipe 2. Not more than 102°F (38.9°C).
07	Controls shall limit operation to no more than 5 minutes following activation.

Q. HERS-Verified Demand Recirculation (RA3.6.7) Requirements

Systems that utilize this distribution type

The responsible person's signature on t

this table have been met unless otherw

table.

01	HERS rater shall perform a visual inspection and operating properly consistent with the
02	Verification Status: 1. Pass - all applicable requirements are met; or 2. Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or 3. All N/A - This entire table is not applicable
03	Correction Notes:

N. Mandatory Requirements for all Recirculation Systems (RA4.4.7)

Systems that utilize this distribution type shall comply with these requirements.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met

01	A check valve located between the recirculation pump and the water heater to prevent unintentional recirculation.
02	Piping must take most direct path between water heater and fixtures.
03	Insulation is not required on the cold water line when it is used as the return.
04	If more than one loop installed each loop shall have its own pump and controls.

Potentially saves water, but uses more energy than a non-recirc system.

Manual Control and Mandatory Requirements

Manual Shut Off and Check Valve

Demand Controlled Recirculation Pump

Pipe Insulation –Mandatory Measure / HERS Credit Option
CF3R-PLB-22-H

HERS VERIFIED SINGLE DWELLING UNIT HOT WATER SYSTEM DISTRIBUTION

CALIFORNIA ENERGY COMMISSION

CEC-CF3R-PLB-22-H

SAMPLE FORM – NOT VALID FOR SUBMISSION TO BUILDING DEPARTMENTS

CERTIFICATE OF VERIFICATION

F. Mandatory Measures for all Domestic Hot Water Distribution Systems

01	Equipment shall meet the applicable requirements of the Appliance Efficiency Regulations (Section 110.3(b)1).
02	Unfired Storage Tanks are insulated with an external R-3.5 or combination of R-16 internal and external Insulation. (Section 110.3(c)4).
03	The following pipes are insulated, to the thicknesses required by Table 120.3A, except for those sections of pipe that are subject to one of the exceptions below: All domestic hot water piping shall be insulated as specified in Section 609.11 of the California Plumbing Code. Insulation buried below grade must be installed in a waterproof and non-crushable casing or sleeve. **1.1** Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing. Insulation shall butt securely against all framing members. **1.2** Piping installed in interior or exterior walls that is surrounded on all sides by at least 1 inch (2.5 cm) of insulation. **1.3** Piping installed in crawlspace with a minimum of 1 inch (2.5 cm) of crawlspace insulation above and below. **1.4** Piping installed in attics with a minimum of 4 inches (10 cm) of attic insulation on top **1.5** Pipe insulation shall fit tightly, and all elbows and tees shall be fully insulated.

J. HERS-Verified Pipe Insulation Credit Requirements (PIC-H) (RA3.6.3)

Systems that utilize this distribution type shall comply with these requirements.

The responsible person's signature on this compliance document affirms that all applicable requirements in this table have been met unless otherwise noted in the Verification Status and the Corrections Notes in this table

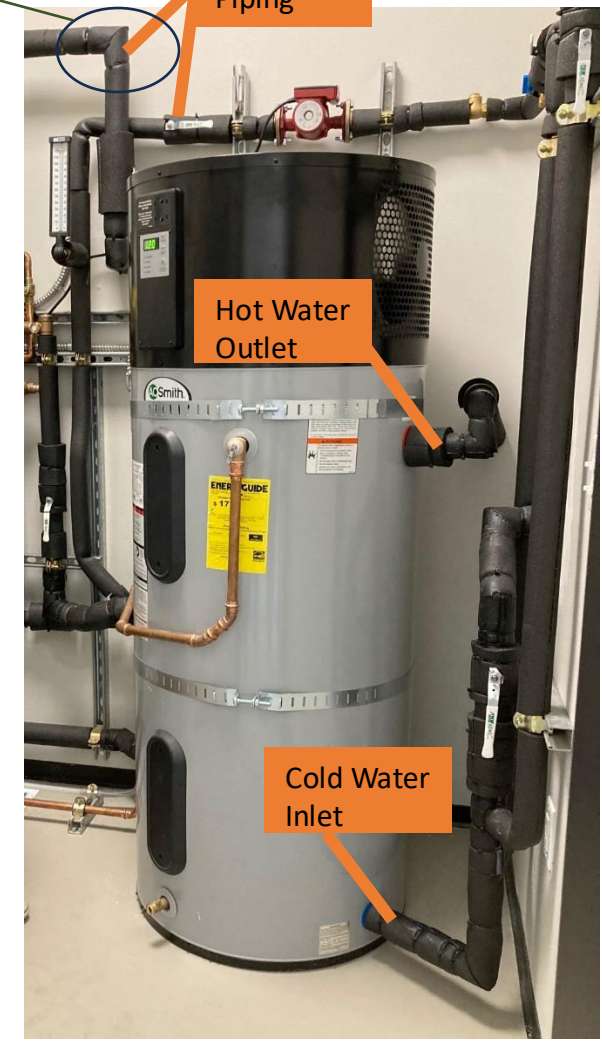
01	HERS rater shall perform a visual inspection that all hot water piping comply with the insulation requirements in 150.0(J).	
02	Verification Status:	1. Pass - all applicable requirements are met; or 2. Fail - one or more applicable requirements are not met. Enter reason for failure in corrections notes field below; or 3. All N/A - This entire table is not applicable
03	Correction Notes:	

…all elbows and tees shall be fully insulated

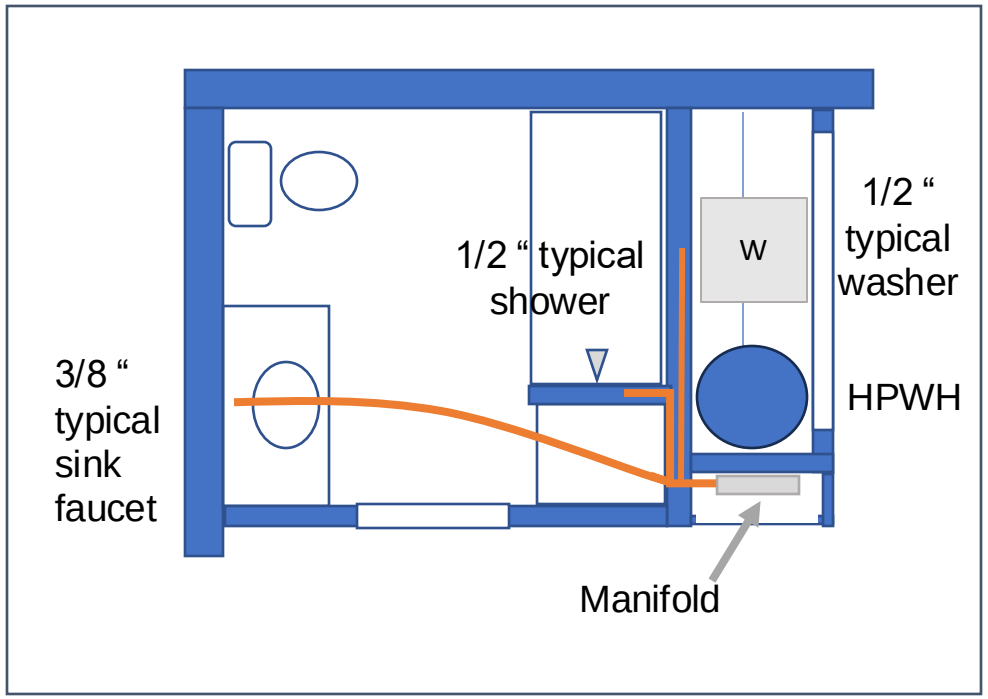
Table J HERS-Verified directs to the Energy Code Mandatory Measures 150.0(j)

Excerpt from 150.0(j):

(a) The first five feet of cold water piping from storage gas water heaters.
(b) All hot water piping with a nominal diameter between 3/4 inch (19 millimeter) and 1 inch.
(c) All hot water piping less than 3/4 inch in diameter that is associated with a domestic hot water recirculation system or leading to the kitchen fixtures.



Point of Use (POU)



POU - Point of Use Distribution

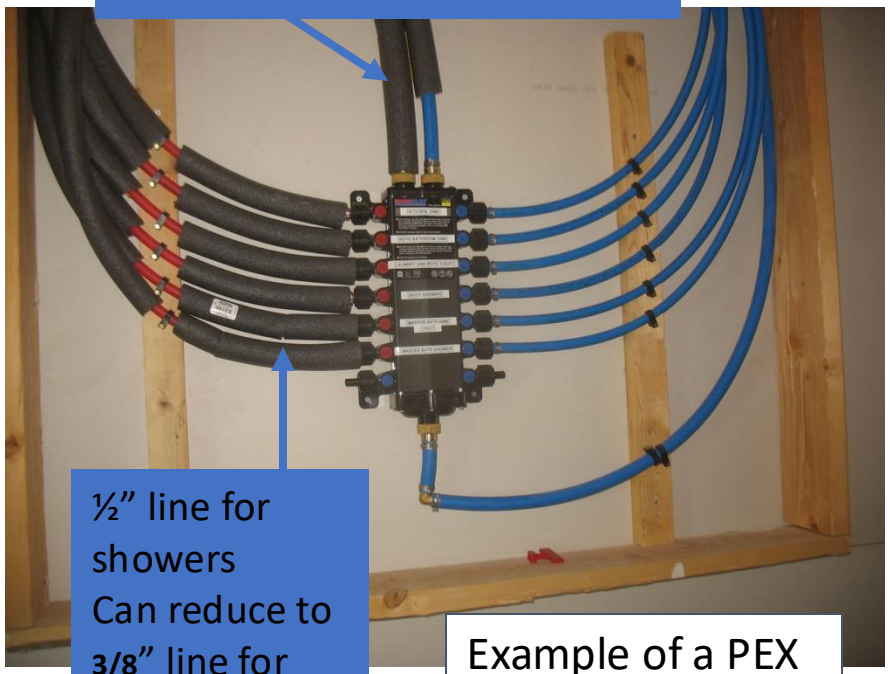
Table 4.4.5

Size Nominal (Inch)	Length of Pipe (feet)
3/8"	15
1/2"	10
3/4"	5

Line size vs Length for each run

Take most direct path with truck-branch line. If two pipe sizes are used in a single run, half the length of pipe shall be considered for each pipe size.

¾" Hot Water Line Directly from Water Heater



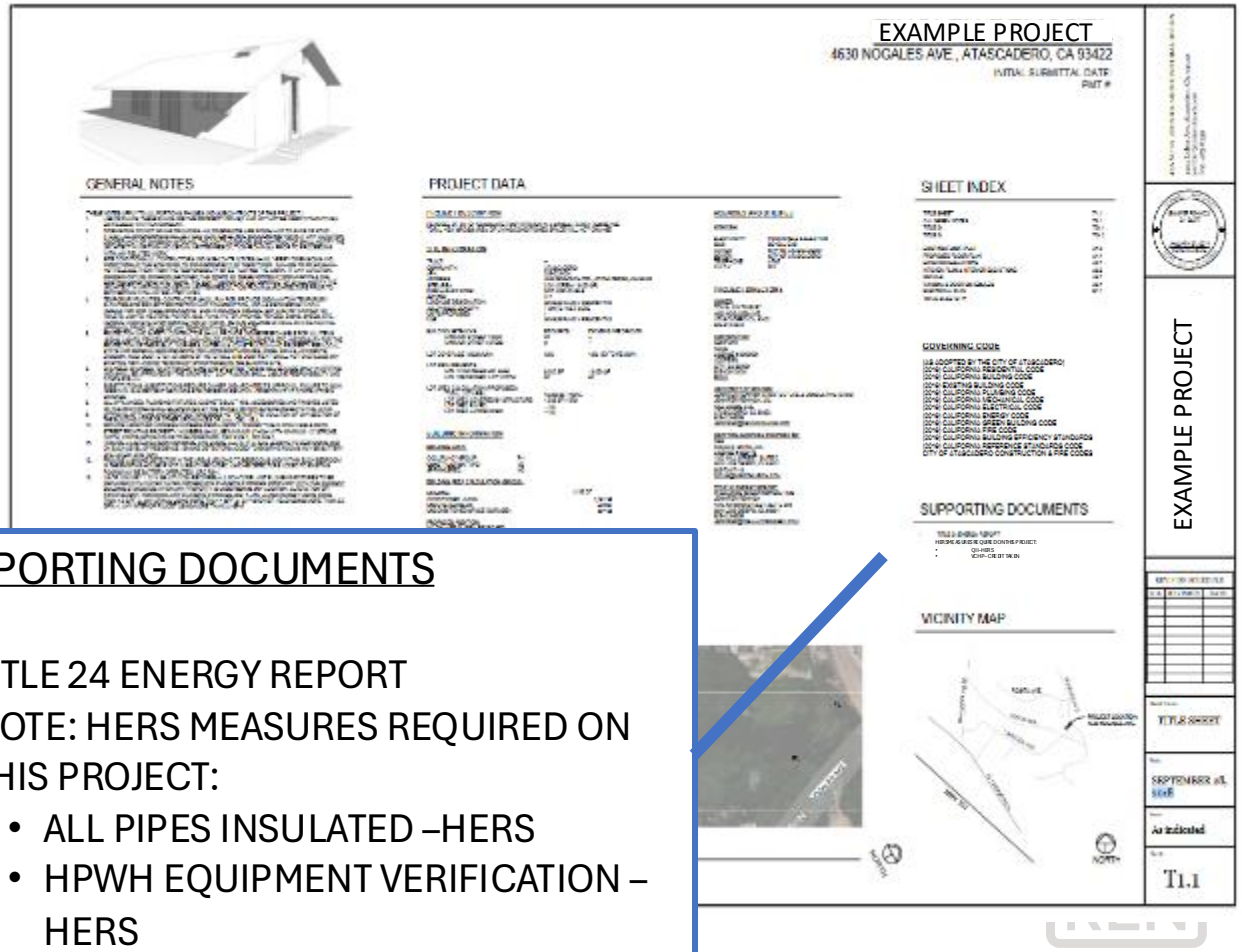
½" line for showers
Can reduce to 3/8" line for sinks

Example of a PEX Manifold System

Recommend Listing the Plumbing Credit on the Cover Sheet

Include the HERS measures (See CF1R or LMCC) on the Cover Sheet, suggested locations:

- ‘Code Summary’
- ‘Code Analysis’
- ‘Supporting Documents’
- ‘HERS Summary’

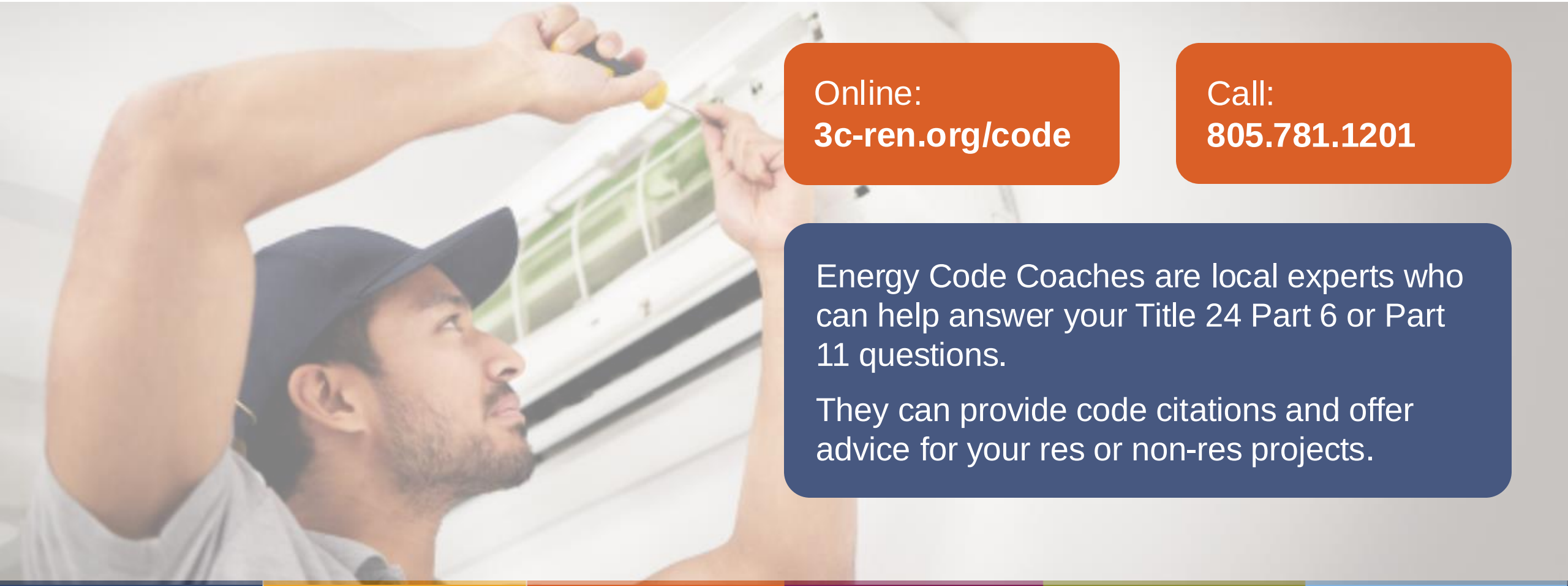


SUPPORTING DOCUMENTS

- TITLE 24 ENERGY REPORT
- NOTE: HERS MEASURES REQUIRED ON THIS PROJECT:
  - ALL PIPES INSULATED –HERS
  - HPWH EQUIPMENT VERIFICATION – HERS

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 chloe.swick@ventura.org for AIA LUs

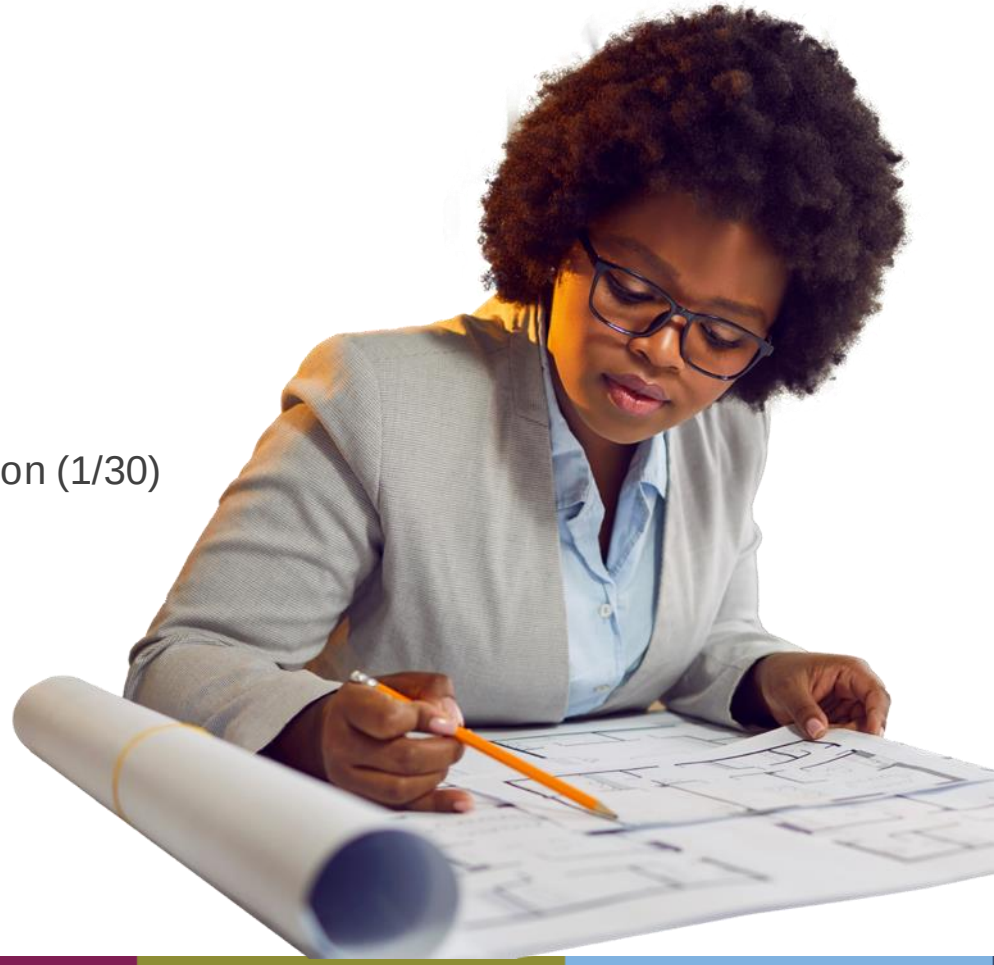
Coming to Your Inbox Soon!

- Slides, Recording, & Survey – Please Take It and Help Us Out!

Upcoming Courses:

- Introduction to the Energy Code (1/22)
- Ventilation and HRV – Part 4: All Electric Design and Construction (1/23)
- Appliances and Energy Storage – Part 5: All Electric Design and Construction (1/30)
- Green Building Construction Tour: San Luis Obispo (2/11)

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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TRI-COUNTY REGIONAL ENERGY NETWORK

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