



We will be starting soon!

Thanks for joining us



Appliances and Energy Storage – Part 5: All-Electric Design and Construction Series



Jennifer Rennick, AIA, CEA, In Balance Green Consulting

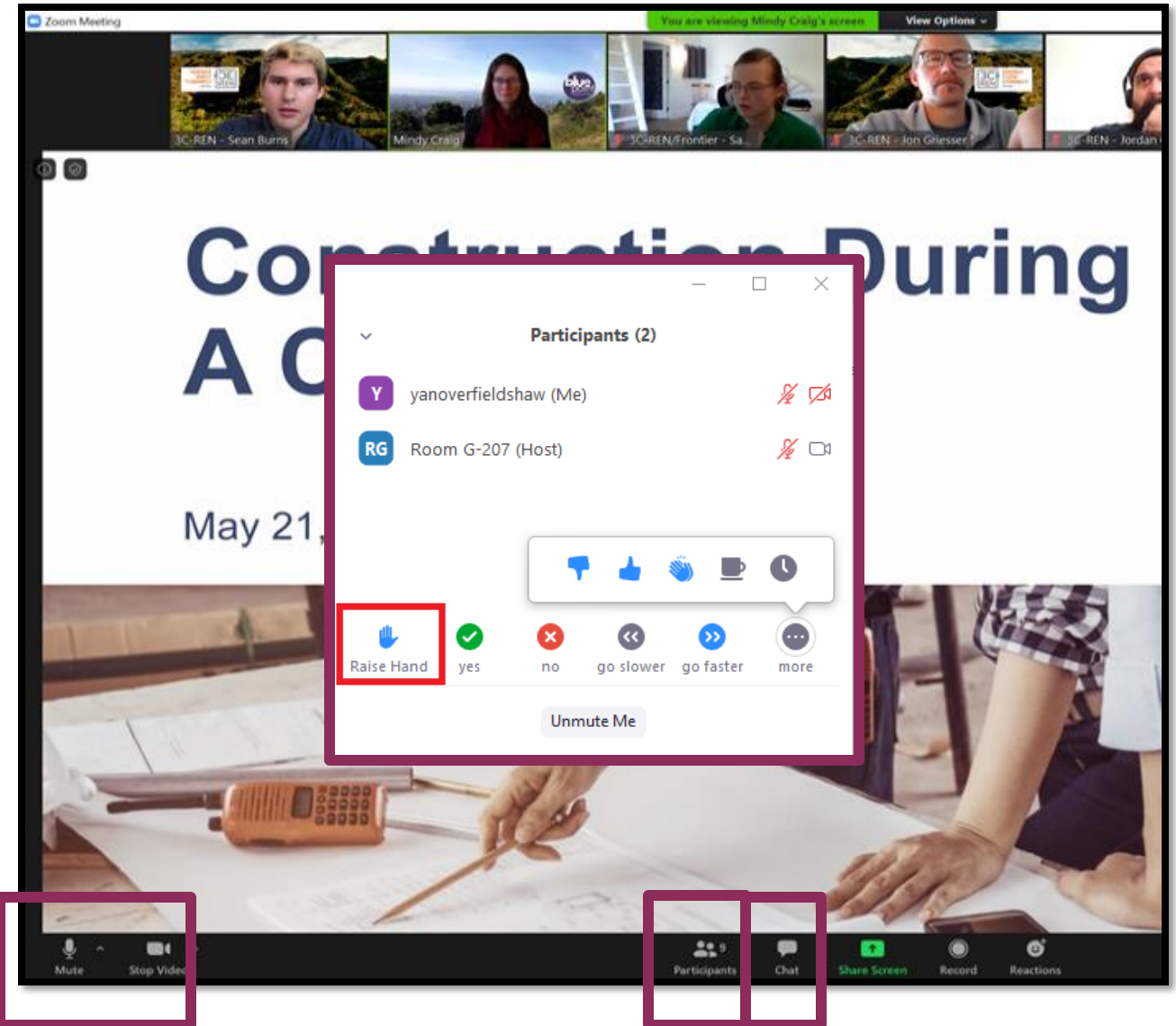
Tatiana Soglin, LEED AP BD+C, In Balance Green Consulting

October 24, 2024



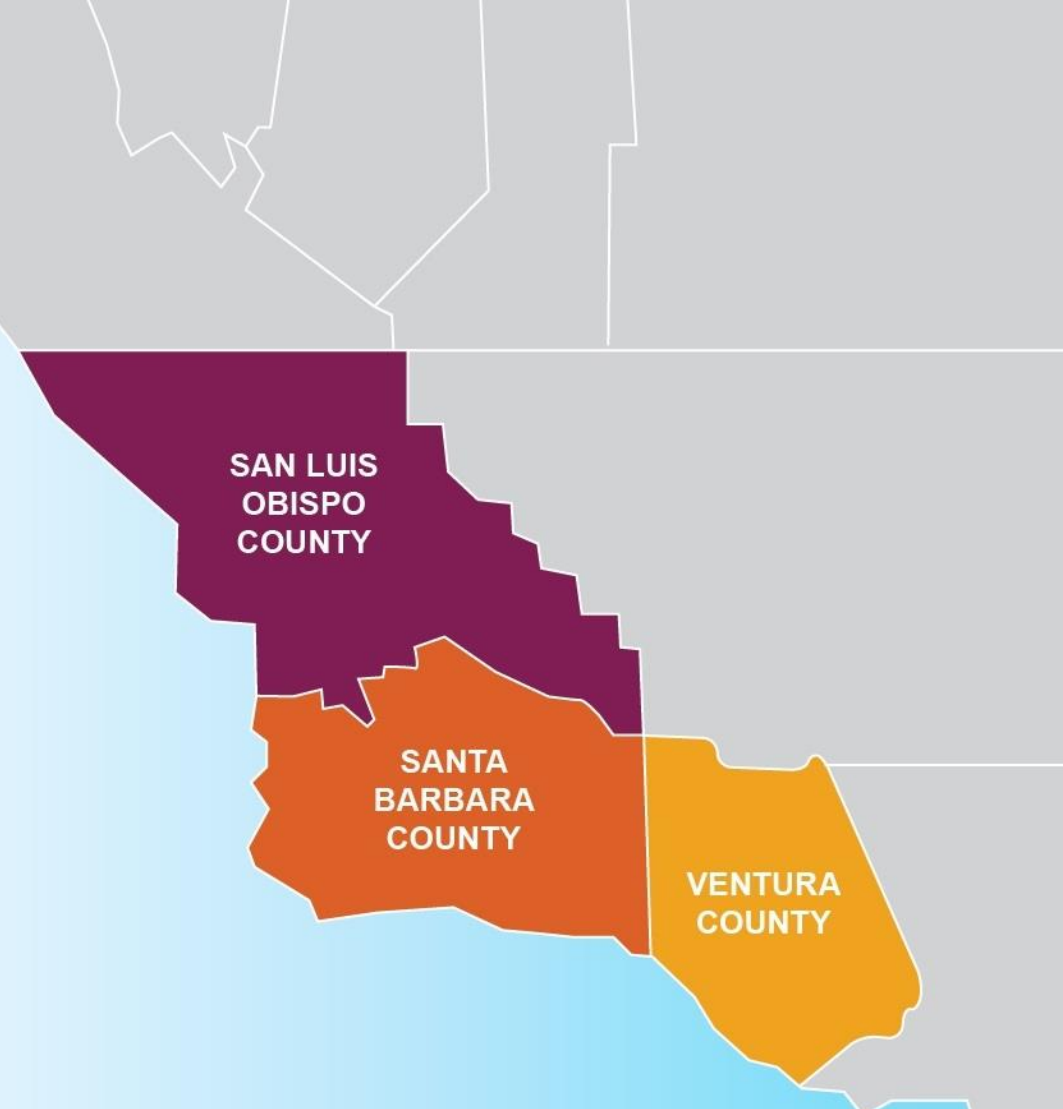
Zoom Orientation

- Please be sure your full name is displayed
- Please **mute** upon joining
- Use "Chat" box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be **recorded** and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
 - **Building Professionals:** industry events, training, and energy code compliance support
 - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region



3C-REN Programs

- **Energy Code Connect (ECC)**
 - Industry Trainings and Regional Forums
 - Energy Code Coach: Title 24 Compliance Support Hotline (805) 220-9991
- **Building Performance Training (BPT)**
 - Industry Trainings & Certification for current and perspective building professionals
 - Helps workers thrive in an evolving industry
- **Home Energy Savings (HES)**
 - Flexible Home Energy Upgrades
 - Multifamily (5+ units) & Single Family (up to 4 units)





BUILDING PERFORMANCE TRAINING

- Earn while you learn: Heat Pump Water Heater Installs
 - Hands on, in the field training
 - Earn \$300 when you participate



bitty

Learn More: <https://www.3c-ren.org/building-performance-training>

Earn While You Learn!

Curious about Heat Pump Water Heaters?

Earn up to \$599 while working alongside a skilled contractor to install a heat pump water heater.

Participants will:

- Receive hands-on training, installing a heat pump water heater
- Learn about the equipment, sizing, siting, and installation best practices
- Distinguish plumbing and electrical differences between HPWHs and traditional gas equipment.

How it works:

1. Fill out an interest form to get started
2. We'll let you know when opportunities are available
3. Get paid up to \$599 when you complete two HPWH installations

Note: to earn stipends, you MUST be a licensed contractor, or employee of a licensed contractor in the tri-county region

Get Started!

About SunWork

3C-REN has partnered with SunWork to bring this unique paid, hands-on installation training to the Central Coast.

SunWork is a nonprofit working in California's Central Coast that installs rooftop solar PV systems and heat pump water heaters with the help of trained volunteers. By making decarbonization more affordable for homeowners and supporting workforce development, SunWork puts climate action within reach for more people.

SunWork CA Contractor License 920732

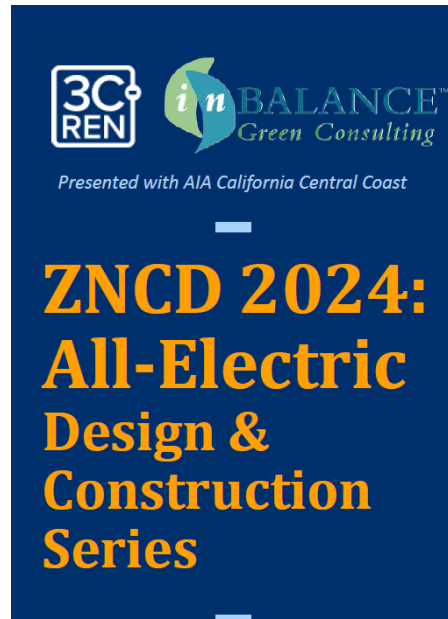
TRI-COUNTY REGIONAL ENERGY NETWORK | SAN LUIS OBISPO • SANTA BARBARA • VENTURA

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



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

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. ZNCD Buildings and California's Clean Energy Goals
2. Stove Tops and Ranges
3. Electric Clothes Dryers
4. Electric Car Charging
5. Battery Energy Storage (and Solar PV)





ZNCD and California's Clean Energy Goals

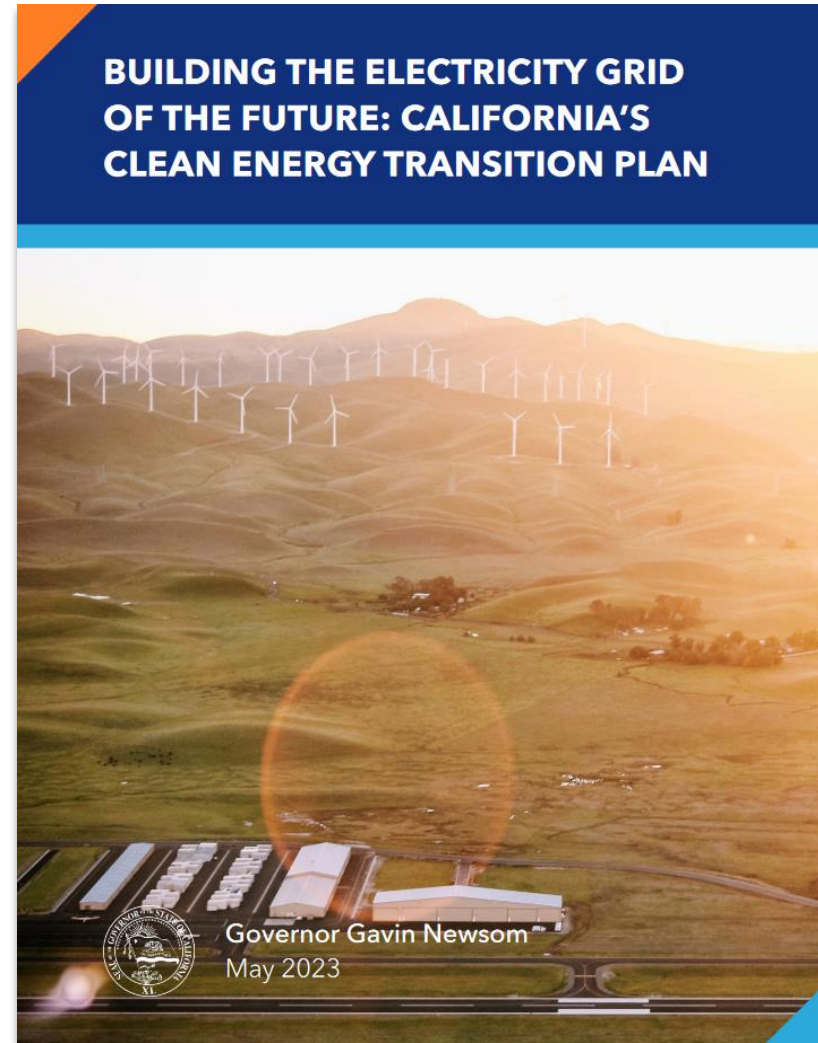


California Air Resources Board (CARB) - Mary D. Nichols Campus

California's Plan for Grid Stability and Expansion

“The vision for a clean electric grid of the future is one where:

- The electric grid is powered by low-cost, carbon-free electricity at all hours of the day and night, making clean electricity accessible to all Californians.
- Transportation choices are zero-emission and able to plug into the electric grid at places of convenience for all customers.
- Buildings are increasingly decarbonized.
- The industrial sector is powered by clean electricity and clean fuels, such as hydrogen.
- Advanced communication and digital technology enable seamless customer demand flexibility that supports electric grid reliability and helps keep electric service costs more affordable for all customers.”

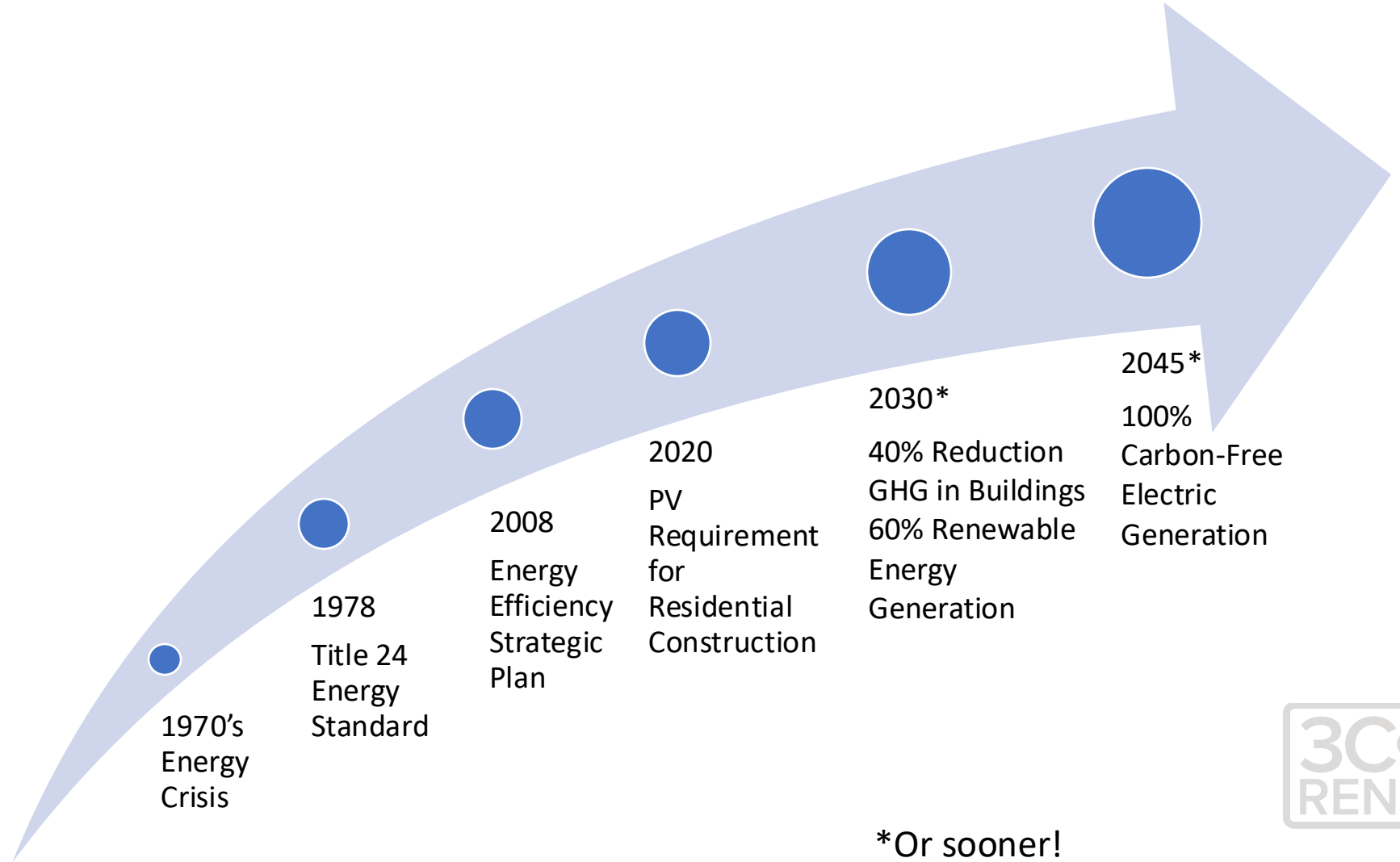


<https://www.gov.ca.gov/wp-content/uploads/2023/05/CAEnergyTransitionPlan.pdf>



California Buildings: Pathway to Carbon Neutrality

Reminder:
Every 3 yrs,
California Title 24
Building Codes
are updated,
furthering
California's Clean
Energy and Zero
Net Carbon
Goals.



Big Picture Goals for the 2022 Code Updates

HOMES AND BUSINESSES USE
NEARLY **70 PERCENT**
OF CALIFORNIA'S ELECTRICITY AND
ARE RESPONSIBLE FOR A QUARTER
OF CALIFORNIA'S GREENHOUSE
GAS (GHG) EMISSIONS.

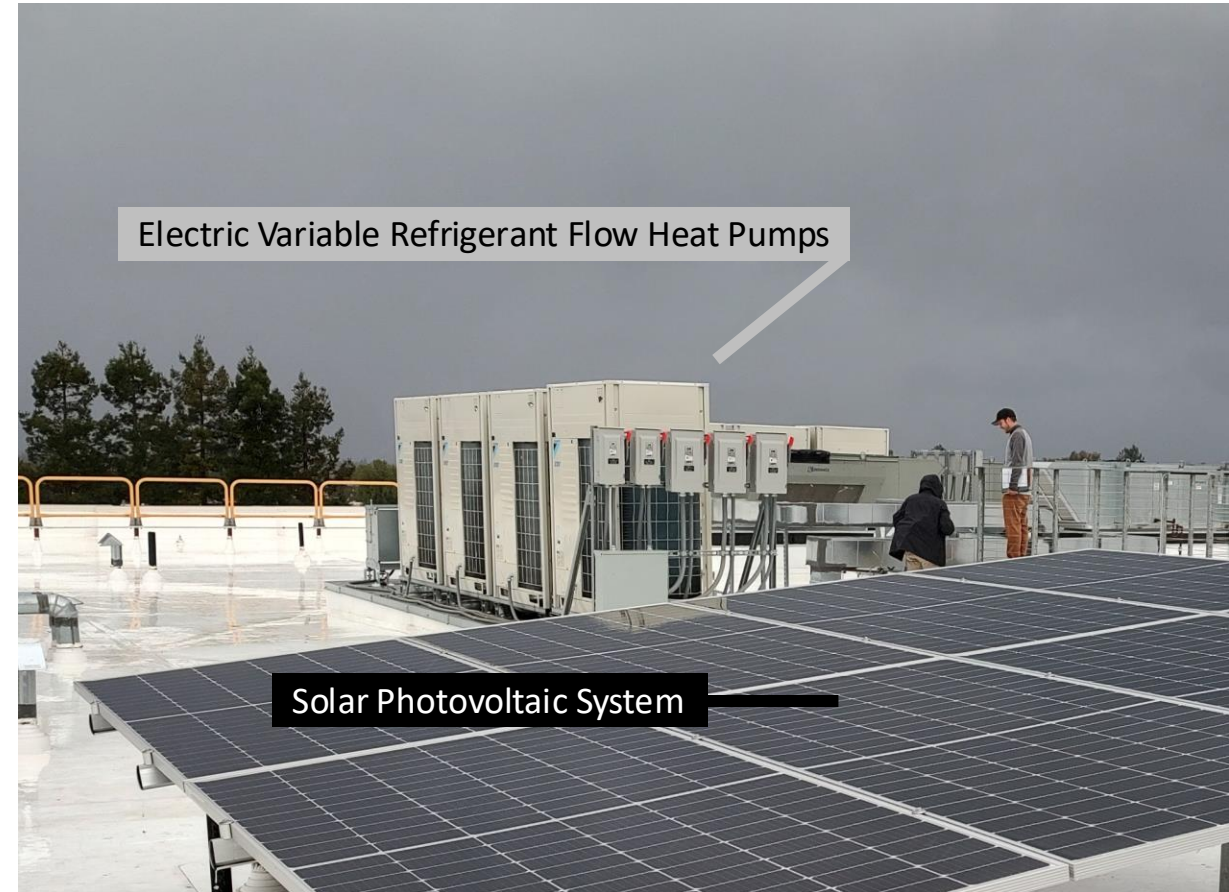


- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family homes
- Expand PV systems and battery storage standards
- Strengthen IAQ ventilation standards



All-Electric (and *Nearly All-Electric*) Buildings

- **New Construction** All-Electric is relatively easy, with some exceptions for large scale buildings and industrial applications
- **Existing Buildings** – Incremental opportunities for
 - HVAC Replacement
 - Appliance Replacement
 - On-site Solar and Batteries
 - Envelope Improvements
- **Existing Buildings** –Infrastructure Approach
 - Decarbonize the Grid
 - Reduce Natural Gas Carbon Footprint

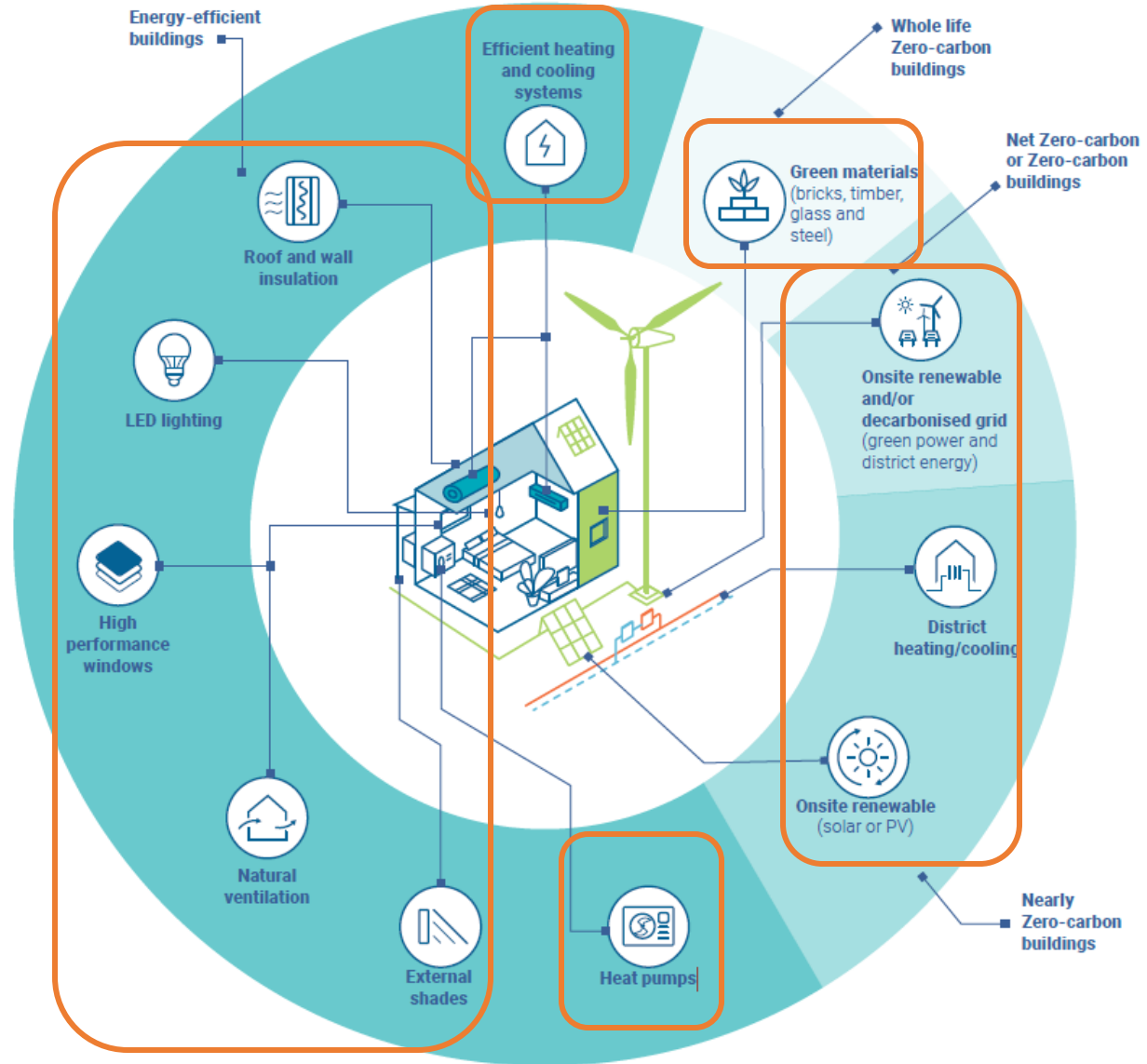


Morning Star Senior Living, San Jose, CA



ZNC Buildings

- Choose materials with low embodied carbon footprint
- Supply Buildings with clean electric energy
 - On-site solar, wind, micro-hydro, etc
 - Decarbonized Grid
- Design Energy Efficient Buildings
- Use heat pumps –with low GWP refrigerants
 - Space Conditioning and IAQ
 - Water Heating
- Appliances



Source: UN Environment Programme, "2022 Global Status Report for Buildings and Construction"

Energy Consuming Systems –*that use to be gas*

- HVAC - Ducted and Ductless (Ducted Air-Handler and Mini-Splits)
- Domestic Hot Water –Heat Pump Water Heaters
- Ranges, Cooktops and Ovens – Induction and Electric
- Laundry- Clothes Dryers –Electric, Condensing, Heat Pump
- Cars –Electric and Plug-in Hybrids



Appliances are part of the *all-electric* dwelling/building



Stove Tops and Ranges

- Electric Resistance
- Induction Cooktops and Convection Ovens

Dryers

- Electric Resistance
- Condensing
- Heat Pump

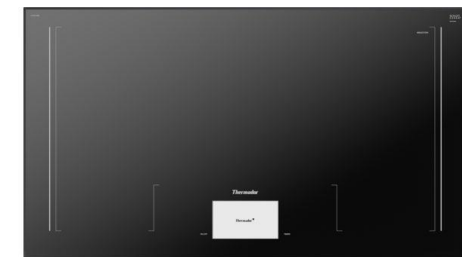
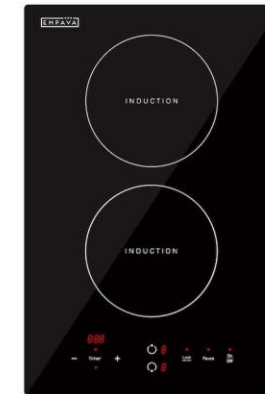
Car Charging

- Home Charging
- Level 2
- NEMA or Hardwired

Solar and Battery Energy Storage

- Energy Production
- Home Energy Storage

Stove Tops and Ranges



Induction Cooktops

Before:

- Gas and electric resistance were most common
- Old ideas of “electric cooking” is the old coil/electric resistance kind
- Clients seeking a specific “look” for their kitchen range:



Rangemaster



At San Luis Ranch

Now:

- There's a *range* of induction options – high end to affordable
- Reminder that induction needs stainless steel or cast iron cookware
- Induction is faster than electric resistance and gas – AND is more energy efficient!

Portable Induction Options...



NuWave PIC Double Portable, Powerful Independently Adjustable Dual Induction Cooktop with 52 Temperature Settings Between 100°F and 575°F & Advanced Stage Cooking & Program Functions

Brand: NuWave

★★★★★ 205 ratings

\$199⁹⁹

& FREE Returns

Pay \$19.50/month or less for 12 months with Affirm. [Learn more](#)

Brand	NuWave
Material	Ceramic
Color	Black/Gold
Item Dimensions LxWxH	12.25 x 12.5 x 2.75 inches
Item Weight	17 Pounds



- Add one burner or two burner cooktop
- Portable, affordable, popular
- Check one out from the library
 - San Luis Obispo
 - Santa Barbara
 - Ventura

Central Coast California Retailers Offer a Few Common Brands

Home Depot

Bosch
Empava
Frigidaire
GE
LG
Samsung
Trifecte

Costco

Bosch
GE
Nuwave
Samsung

Lowe's

Bosch*
Empava
Equator Advanced Appliances
GE
LG
SPT
Summit Appliance

Idler's

Bosch
Frigidaire
GE
KitchenAid*
Miele
Monogram
Samsung*

Ferguson Supply House

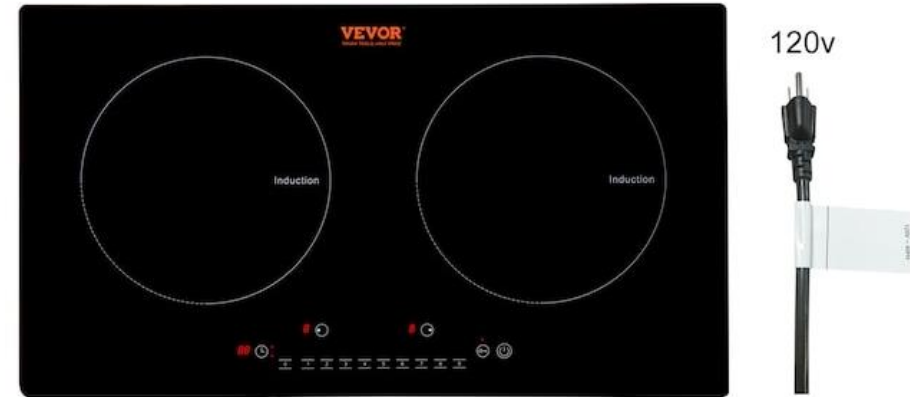
GE Café*
JennAir*
KitchenAid*
Miele*
Monogram*
Thermador*
Whirlpool
Wolf*

Note: These appliances run the full range of costs ("standard" to "ultra-high end") and features

* Brand has products on display in store

2 Burner Induction Cooktop Example – VEVOR \$

- **Cost Range:** \$95-\$140
- **Availability:** Home Depot, Lowe's, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 2 burners, plugs in to 120v outlet and doesn't require professional installation
- **Warranty:** 1 yr Standard

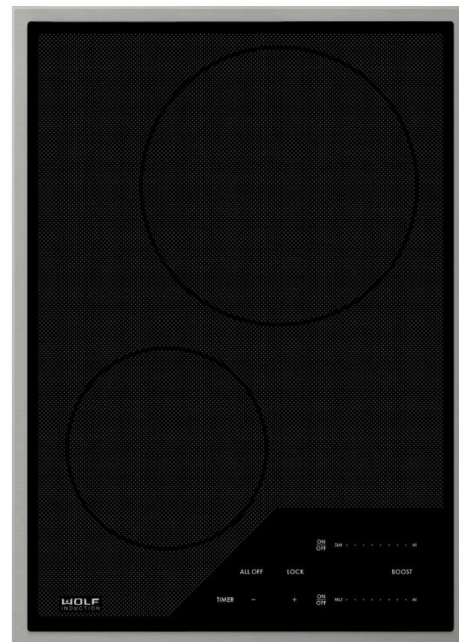


Note: This unit sit on counter top and can be plugged into a standard 120V outlet



2 Burner Induction Cooktop Example – Wolf \$\$\$

- **Cost Range:** \$1312-\$1620
- **Availability:** Ferguson, Idler's, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 15" 2-burner cooktop, illuminated touch controls
- **Warranty:** 2 yr Standard



Touch controls >

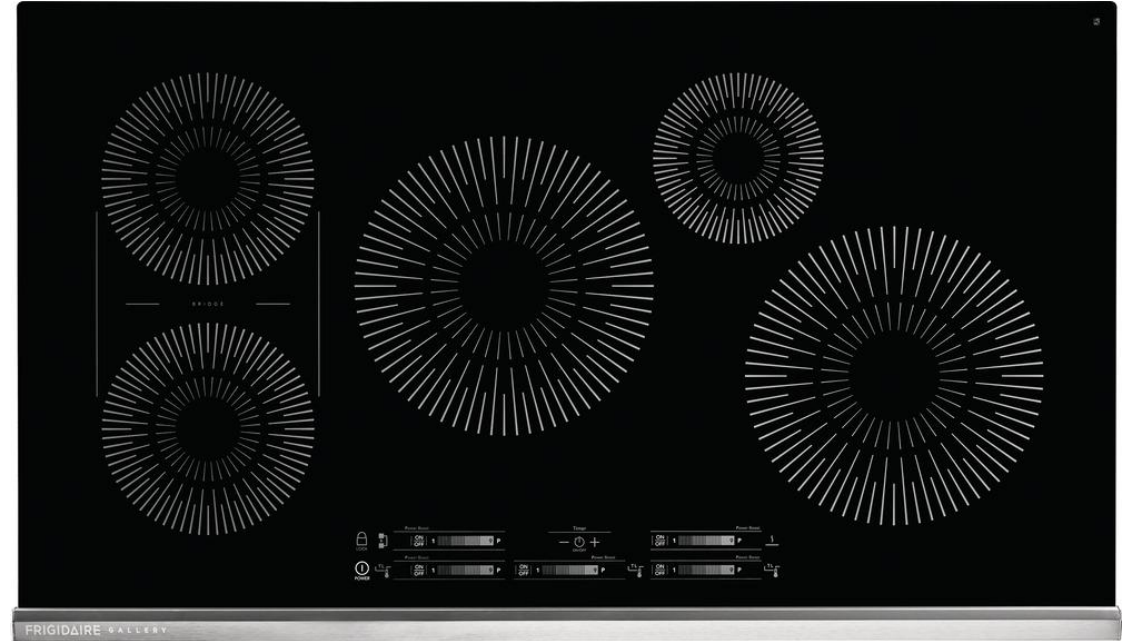


Note: This unit is hardwired



5 Burner Induction Cooktop Example – Frigidaire \$

- **Cost Range:** \$900-\$1100
- **Availability:** Idler's, Home Depot, Lowe's, direct manufacture's website, other on-line shops
- **EnergyStar:** Yes
- **Special Features:** 36" 5-burner cooktop, touch controls
- **Warranty:** 1 yr Standard



Touch controls ^

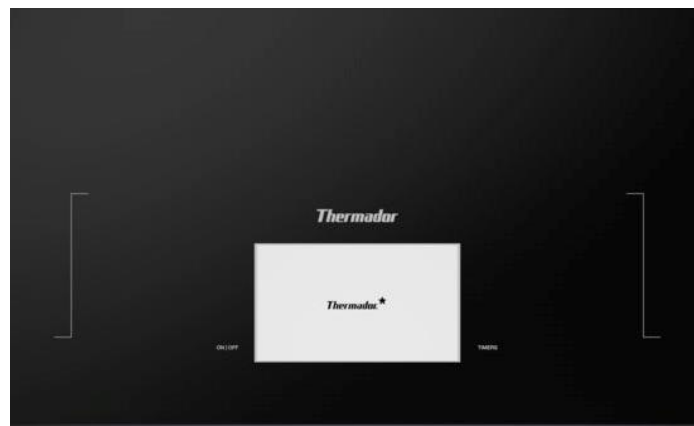


Full Surface Induction Cooktop Example – Thermador \$\$\$

- **Cost Range:** \$6099
- **Availability:** Ferguson, Idler's, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 36" of fully usable cooking surface with room for up to 7 pots and pans, WiFi enabled for remote monitoring
- **Warranty:** 2 yr Standard



Full color touch screen display >



Note: Cooktop shown here in combination with 36" downdraft ventilation



Induction Range Example – Frigidaire \$

- **Cost Range:** \$680-\$1000
- **Availability:** Home Depot, Ferguson, Best Buy, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 30” induction cooking surface, rear panel control
- **Warranty:** 1 yr Standard



Rear panel control



Induction dial control

Note: Look for sale prices, often priced to be competitive with gas models



Induction Range Example – Samsung \$\$

- **Cost Range:** \$1300-\$1600
- **Availability:** Home Depot, Lowe's, Idler's, direct manufacture's website, other on-line shops
- **EnergyStar:** Yes
- **Special Features:** 30" induction cooking surface, touch controls, WiFi connectivity
- **Warranty:** 1 yr Standard



Touch controls



Induction Range Example – GE Café \$\$\$

- **Cost Range:** \$4050-\$4500
- **Availability:** Ferguson, Home Depot, Lowe's, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 30" wide front-control convection range with dial control induction cooktop
- **Warranty:** 1 yr Standard



2 Burner Induction Duel Fuel Range Example – Thermador \$\$\$\$

- **Cost Range:** \$19,150
- **Availability:** Ferguson, Idler's, direct manufacture's website, other on-line shops
- **EnergyStar:** No
- **Special Features:** 48" dual fuel range with steam oven, 6 burners and 12" induction zone, WiFi enabled with Home Connect
- **Warranty:** 2 yr Standard



Note: Commercial depth dual-fuel range



Electric Clothes Dryers



Electric clothes dryers

Ventless Dryers can use significantly less energy than a traditional electric vented dryer... important for ZNE and battery storage capacity

Electric Dryers

Vented

Vents moisture laden air to the outdoors

Standard Electric

Ventless

Uses condenser to remove moisture from the air

Condensing

Heat Pump

Resources: <https://guide.pge.com/> and https://www.energystar.gov/products/products_list

Ventless Dryers

Utilize very dry air and low heat to dry clothes

Ventless

Uses condenser to remove moisture from the air

Condensing

Non-refrigerant condenser; typically requires more air volume

Heat Pump

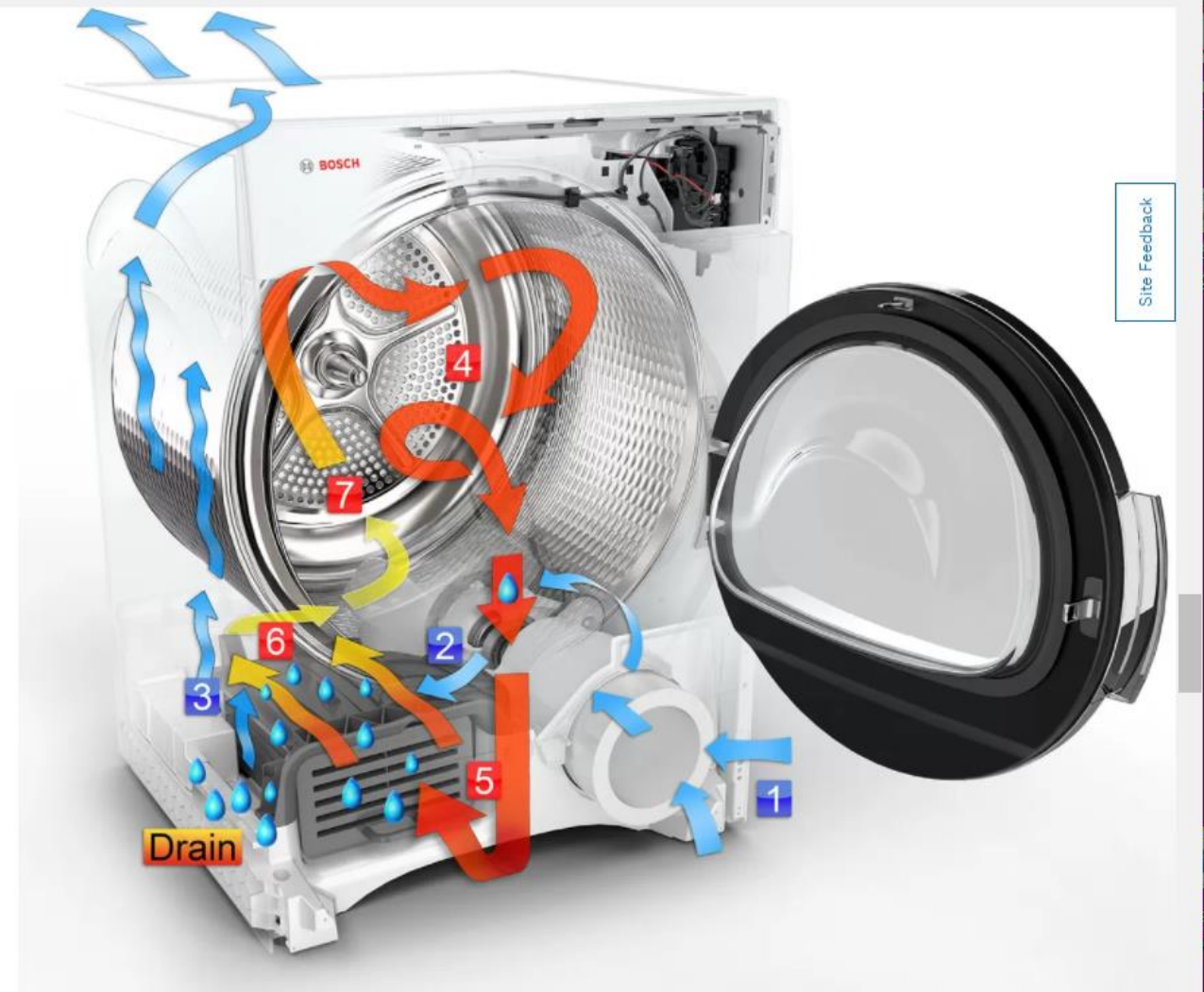
Hermetically sealed refrigerant cycle and usually a secondary heat exchange

Price range \$800-\$1600
Search dryers and filter for ventless

Condensation, the new way to dry.

The Bosch Condensation Dryer uses an eco-friendly solution to gently dry clothes at an optimal temperature without the need of external ducting.

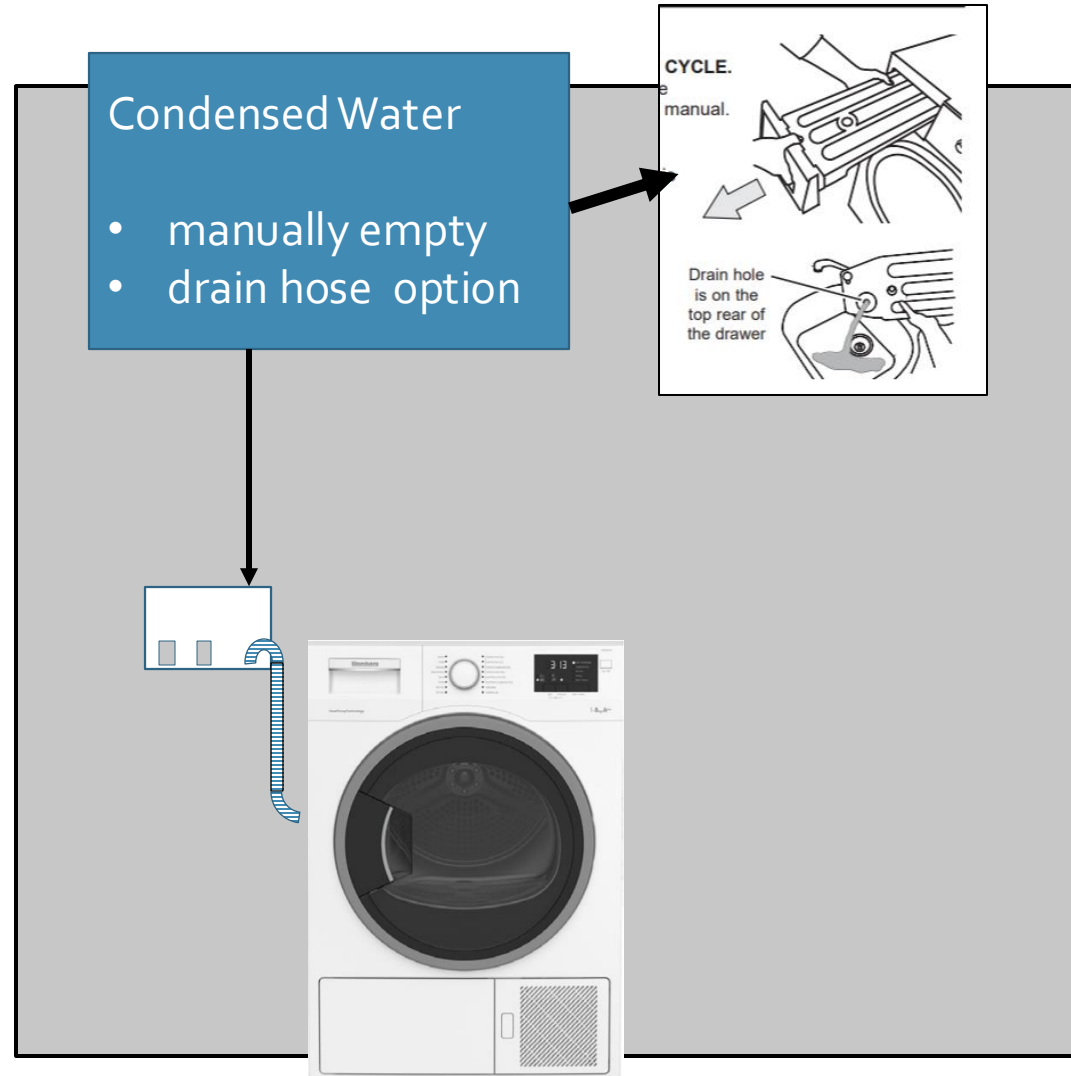
1. Cool ambient air goes inside the dryer from the living area.
2. Cool ambient air is heated by the heating element at the back of the dryer.
3. Hot air circulates in the drum, evaporating moisture from the load.
4. The combination of the hot air and moisture circulates through the condenser unit.
5. The hot air and moisture condenses into water as it passed through the cool condenser unit.
6. The water is collected under the condenser unit and is pumped out by the drain pump.
7. Warm dry air is reheated and circulated back into the dryer drum.



Dryers with Condensers

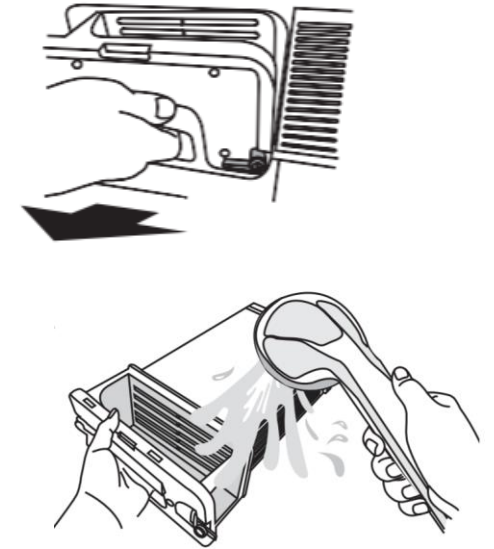
Ask:

- Manual or 'self-draining' condenser reservoir?
- Manual or self cleaning condenser coil?
- Net free ventilation area needed?



Condenser Coil

- self cleaning option
- manual clean monthly



Venting and Clearances

Issue: Laundry not dry with doors closed

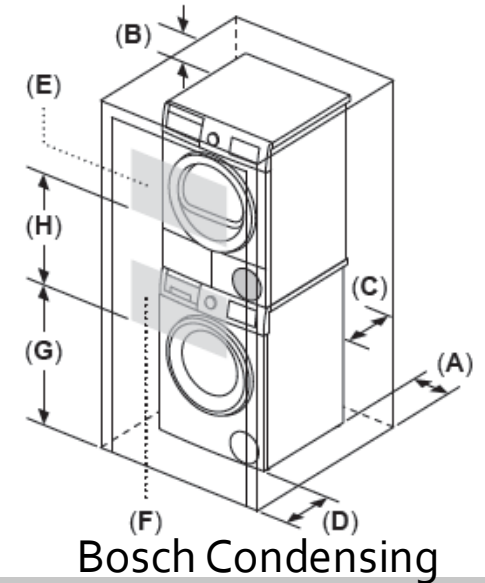
Response: Keep doors open or replace w/ louvered doors and/or vent the space



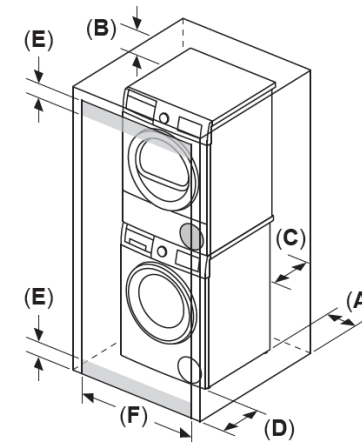
Bosch condensing dryer
Installed. Dwelling designed
for Bosch heat pump dryer

Bonus: Bosch heat pump dryer only \$300 more and comes with self cleaning condenser coil.

Closet: Stacked Washer and Condensation Dryer



Closet: Stacked Washer with Heat Pump Dryer



Minimum clearance requirements
(Stacked, Stand Alone or Side by Side):

- A: Both sides (left and right) – 1/2"
- B: Top – 6 1/4"
- C: Rear – 3"
- D: Front – 1/2"

Minimum door undercut (louvered area):

- E: Undercut height (Top and Bottom) – 1 1/4"
- Louvered areas of equal total sizes and split between upper and lower portions of door are permitted.
- F: Undercut width (Top and Bottom):
 - 24" minimum for Stacked and Stand Alone
 - 48" minimum for Side by Side

For shortest drying times keep closet door open while dryer is operating. When closet doors are closed, open areas only allow minimal drying results (expect long drying times).

Bosch Heat Pump

Central Coast California Retailers Offer a Few Common Brands

Home Depot

Black+Decker
GE*
Koolmore
LG*
Midea
Samsung*
Summit Appliance
Whirlpool

Costco

LG*
Samsung

Lowe's

Bosch
Electrolux
GE*
LG
Midea
Miele
Samsung
Whirlpool

Idler's

Bosch
LG
Maytag*
Samsung
Speed Queen*
Whirlpool

Ferguson Supply House

LG
Samsung
Summit Appliance

Note: These appliances run the full range of costs ("standard" to "ultra-high end") and features

* Brand has products on display in store

Two-In-One Washer/Dryers

- One machine – no load transfer
- 120V standard outlet
- No dryer vent exhaust system needed

- Samsung
 - 5.3 cu. ft.
 - \$2000 (on sale for \$1300 on Home Depot)
 - Energy Star
 - Warranty: 1 year Parts and Labor; 3 year stainless steel tub; 20 year motor part
 - Special Features
 - Wifi Connectivity with SmartThings (cycle alerts, remote start/stop/delay, etc.)
 - 7" LCD Display



- GE
 - 4.8 cu. ft.
 - \$2900
 - Energy Star
 - Warranty: 1 year entire appliance; 5 year sealed drying system; 10 year motor part
 - Special Features
 - Pet hair removal
 - Antimicrobial technology
 - Smart features powered by SmartHQ (specialty cycles, status notifications, etc.)
 - Dewrinkle



Standard Capacity Ventless Options

Look for heat pumps with rebates for best pricing



SPECIAL BUY \$898⁰⁰ Was \$1299.00
Save \$401.00 (31%)

Get up to \$185 in Rebates for 93405

★★★★★ (282)

Model# DLHC1455W

LG

24 in. W 4.2 Cu. Ft. Ventless Stackable Compact SMART Electric Dryer in White with Dual Inverter HeatPump Technology

Capacity (cu. ft.) — 4.2

Vent Type — **Ventless**

Matching Washer... — **Front Load Mat...**



SPECIAL BUY \$898⁰⁰ Was \$1299.00
Save \$401.00 (31%)

★★★★★ (31)

Model# DV25B6900HW

Samsung

4.0 cu. ft. Smart Dial Heat Pump Dryer with Sensor Dry in White color

Capacity (cu. ft.) — 4.0

Vent Type — **Ventless**

Matching Washer... — **Front Load Mat...**

Appliance Type — **Electric Dryer**



SPECIAL BUY \$798⁰⁰ Was \$1099.00
Save \$301.00 (27%)

★★★★★ (46)

Model# DV25B6900EW

Samsung

4.0 cu. ft. Smart Dial Electric Dryer with Sensor Dry

Capacity (cu. ft.) — 4.0

Vent Type — **Vented**

Matching Washer... — **Front Load Mat...**

Appliance Type — **Electric Dryer**

Large Capacity Ventless Options

Look for heat pumps with rebates for best pricing



\$1098⁰⁰ Was \$1699.00
Save \$601.00 (35%)

Get up to \$285 in Rebates for 93405

★★★★★ (77)
Model# DLHC5502W

LG

7.8 cu. ft. Dual Inverter Heat Pump ventless Electric Dryer with DirectDrive Motor, 6 Motion and AI Sensor Dry in White

Capacity (cu. ft.) — **7.8**

Vent Type — **Ventless**



\$1898⁰⁰ Was \$2899.00
Save \$1001.00 (35%)

Get up to \$185 in Rebates for 93405

★★★★★ (37)
Model# WKHC252HWA

LG

5.0 cu. ft. Washer 7.8 cu. ft. Dual Inverter Heat Pump Ventless Dryer Electric Washtower in White

Dryer Fuel Type — **Electric**

Capacity (cu. ft.) — **5.0**



SPECIAL BUY **\$898⁰⁰** Was \$1299.00
Save \$401.00 (31%)

★★★★★ (31)
Model# DV25B6900HW

Samsung

4.0 cu. ft. Smart Dial Heat Pump Dryer with Sensor Dry in White color

Capacity (cu. ft.) — **4.0**

Vent Type — **Ventless**

Matching Washer... — **Front Load Mat...**

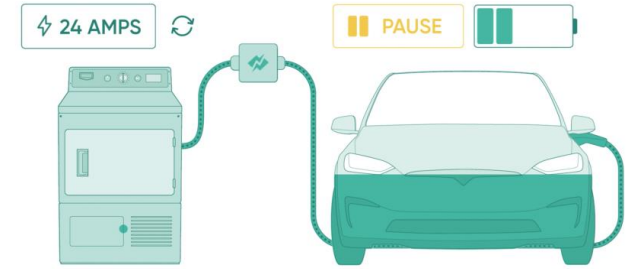
Electric Car Charging



Charging Our Cars



*^ Bank of Tesla Super Chargers (AG, Calif)
NACS Plugs on 2025 EVs will allow for
multi-brand charging*



<https://getneocharge.com>

Bonus: SLO, Calif based company



^ Plug-in (240V) Smart Circuit Splitter



*< Level 2 Home
Charger (240V) >*



*Plug-in
110/120V >*

Level 2 Chargers

Some Brands
are Specific to
Car Brands

ABB

AMPROAD

Atecs

Blink

ChargePoint

Cyber Switching

Delta

EV Gear

Eaton

Emporia

Emporia Energy

Enphase

EvoCharge

FLO

Ford

Gateway International 36

InCharge

Injet

LITEON

Leviton

Loop

MUSTART

Mid-Cour

Morec

Phihong

Piwin

PowerPump

Rivian

SARIN Energy

Siemens

Smartenit

Sunrun/Ford

Tesla

TurnOnGreen

Vestel

Vevor

Wallbox

Webasto

YEAHCO

ZEF Energy

Zencar

Zerova

Relative Costs

If Installing a permanent charger or need a new NEMA 14-50 (240V) outlet add \$750-\$2000 for Lic Electrician's work.

- Level 2 **240V Hardwired and NEMA 14-50 Plug-in**
- Typical Cost Range \$500-\$700

-
- Least expensive: Some **Plug-in 240V** but most are only **110V/120V** and 15-20 amp
 - Costs start under \$100
 - Available on-line and at Home Depot and Lowe's

-
- NeoCharge Smart Splitter
 - Plug into your home's existing **240V** outlet
 - All outlet configurations available
 - Typical Cost Range \$350-400



Enphase IQ 40
Level 2 32A ...
\$644.00
Enphase Store



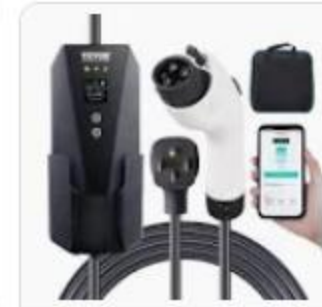
15% OFF
GM Genuine
Parts Power...
\$599.00
GM Genuine ...



ChargePoint
Level 2 EV...
\$549.00
Amazon.com



10% OFF
EVDANCE
Level 1&2...
\$186.99
Evdance



EV Charger
Level 2...
\$180.49
Home Depot



NEMA 10-30
Smart Splitte...
\$299.00
NeoCharge

Select a Home Charger

Browse home chargers with costs after incentives or learn more with our [FAQs](#).

ZIP CODE

93401

ESTIMATED INSTALLATION COSTS

\$0 \$500 \$1000 \$2000
None Low Avg. High

WIFI CONNECTIVITY

YES NO

VIEW YOUR AVAILABLE INCENTIVES →

Filter

CHARGER PRICE

 < \$1,000

BRAND
 All

CORD LENGTH

 < 25 ft

TYPE
WALL MOUNTED PORTABLE

SOCKET
 6-20 6-30
 10-30 14-30
 6-50 14-50
 14-60 HARDWIRED

Piwin PEVC2107 Wall Mounted 16 ft. Cable Hardwired 7.68 kW \$308 Charger Price \$1000 Estimated Installation -\$1092 Total Incentives \$216 Total Cost SELECT	Piwin PEVC2107 Wall Mounted 16 ft. Cable Hardwired 3.84 kW \$311 Charger Price \$1000 Estimated Installation -\$1093 Total Incentives \$218 Total Cost SELECT	MUSTART MUSTART - Level 2 Smart EV Charger Wall Mounted 25 ft. Cable 14-50 Socket 7.68 kW \$349 Charger Price \$1000 Estimated Installation -\$1105 Total Incentives \$244 Total Cost SELECT
Piwin PEVC2107 Wall Mounted 16 ft. Cable Hardwired 7.68 kW \$353 Charger Price \$1000 Estimated Installation -\$1106 Total Incentives \$247 Total Cost SELECT	MUSTART MUSTART - Level 2 Smart EV Charger Wall Mounted 25 ft. Cable 14-50 Socket 9.6 kW \$379 Charger Price \$1000 Estimated Installation -\$1114 Total Incentives \$265 Total Cost SELECT	Emporia Smart Home EV Charger Wall Mounted 24 ft. Cable 14-50 Socket 11.52 kW \$399 Charger Price \$1000 Estimated Installation -\$2519 Total Incentives \$-1120 Total Cost SELECT

<https://homecharging.electricforall.org/home-chargers-incentives-catalog/>

Resource:
This Catalogue Site Links to Potential Incentives

Rebates and Incentives – San Luis Obispo Example



**REBATES &
INCENTIVES**

RATES

**ABOUT
3CE**

**BOARD
MEETINGS**

**NEWS &
EVENTS**



Electrify Your Ride

Electrify Your Ride

Electrify Your Ride provides 3CE customers with a “one-stop-shop” for post-purchase rebates for electric vehicles (EVs), EV Chargers, and EV Readiness (electrical upgrades).

[LEARN MORE](#)

www.3cenergy.org

Level 2 Charger Rebates

Base	Tier 1 400-201% Federal Poverty Level for the 48 Contiguous States, 2021 (gross annual income)	Tier 2 <200% Federal Poverty Level for the 48 Contiguous States, 2021 (gross annual income)
\$400	Up to \$700	Up to \$700

California and Bi-Directional Vehicle-to-Grid Charging (V2G)

NUVVE

Nuvve V2G Hubs

Turning EVs into Flexible Storage

Nuvve (NASDAQ:NVVE) is a global leader in vehicle-to-grid (V2G) and commercial V2G deployments with an intelligent energy platform that combines the world's most advanced V2G technology with an ecosystem of electrification partners.



Electrifying Fresno EOC Transit Systems' 50-Shuttle Fleet

In January 2024, Nuvve won a \$16M contract with the Fresno Economic Opportunities Commission to support Fresno's vision of a greener future and enhance the overall reliability and effectiveness of its transportation services.



Gov. Newsom signed SB 59 (Skinner) into law (Sept 2024) allowing the California Energy Commission (CEC) to require electric vehicle (EV) manufacturers selling in California to include bi-directional charging/discharging capabilities. V2G strategies have been identified as a potential grid resiliency and grid capacity solution for meeting California's peak demand and reducing energy costs to consumers.

200 buses connected with V2G capability at 125kW would equate to **25MW of capacity**

25MW would be capable of reducing peak consumption of **10k homes by 50%**

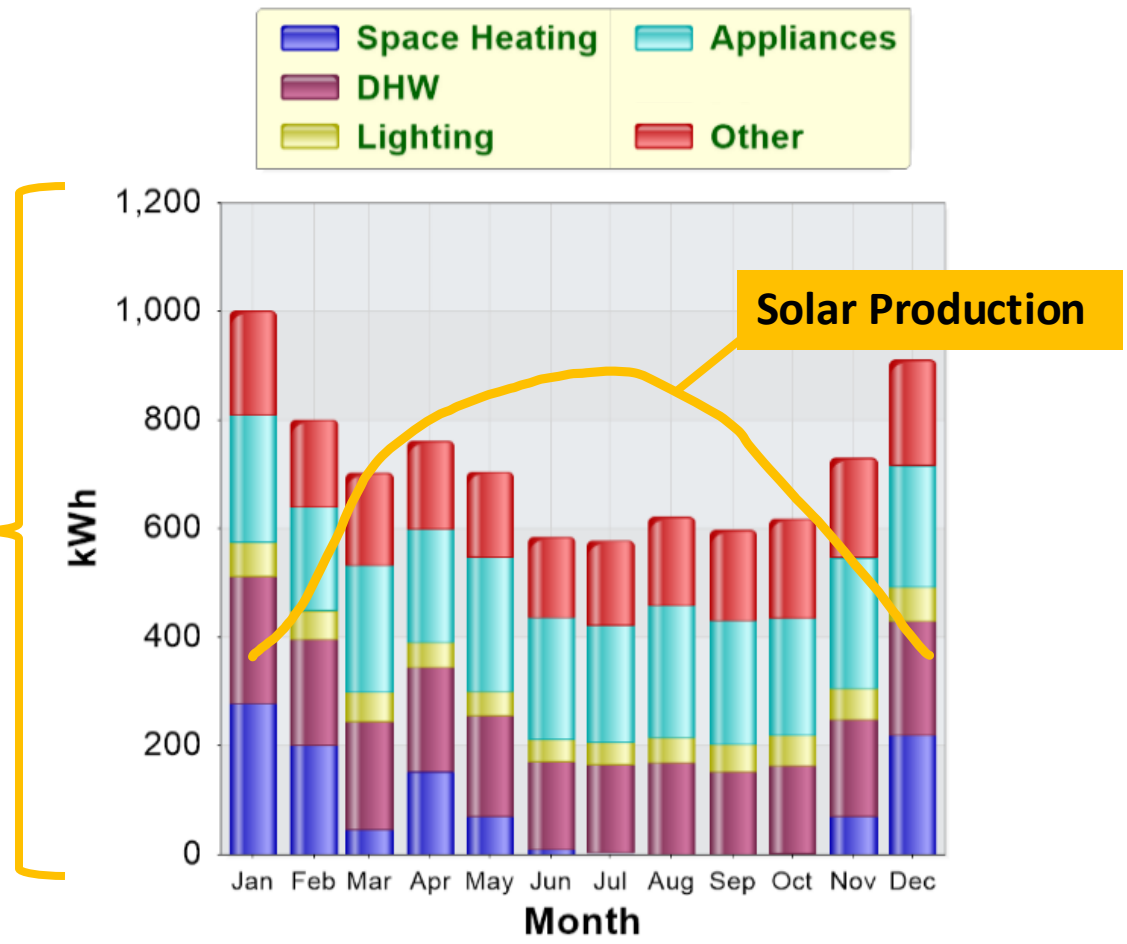


Battery Energy Storage (and Solar PV)



The Electric Grid was the Seasonal 'Battery' for Solar PV...

Predicted Electricity Energy-Use in Kilo-Watt Hours (kWh) per Month



Grid-Tied solar systems were designed to use the 'Grid' as a seasonal battery.

During a given year the building's solar production would deliver as many kWh as the household used.



Peak Loads –Daily Load Shifting and Grid Relief

Resiliency and Load Shifting (Single Fam and all Occupancies)

- Load Shifting –Use battery when electric rates are highest cost
- Resiliency –Use battery when electric power goes out
- Grid Stability –Distributed Resources and Virtual Power Plant (VPP) Battery Programs through the Electric Utility or Battery Provider/Brand Partner
- Self Utilization –Store excess on-site Solar Energy for later use

Code Requirement (High-Rise Multifamily and Non-Res)

- Multifamily 4 Stories or Greater
- Commercial Occupancies
- Only Required if a PV System is Triggered
 - Grid Tied
 - Minimum Size Threshold – Exemptions

Battery – Energy Storage Systems (BESS) (ESS)



SunGrow Power Titan



<https://primuspower.com/en/energy-storage/>

Batteries for Grid Scale Applications Must Last Decades and Deliver Long Duration Energy Discharge On-Demand

Utility Scale –Grid Stabilization and In Front of the Meter Micro-grids



Commercial and Industrial



Multifamily and Non-Res and Behind the Meter Micro-grids



Private Homes



Energy Code – Highrise and Non-Res

2022 Code Applicable Occupancy Types:

High-Rise Residential

Grocery

Retail

Restaurant

School

Warehouse

Auditorium, Convention Center, Theater

Hotel-Motel

Office, Financial, or Unleased

Clinic/Medical Office Building

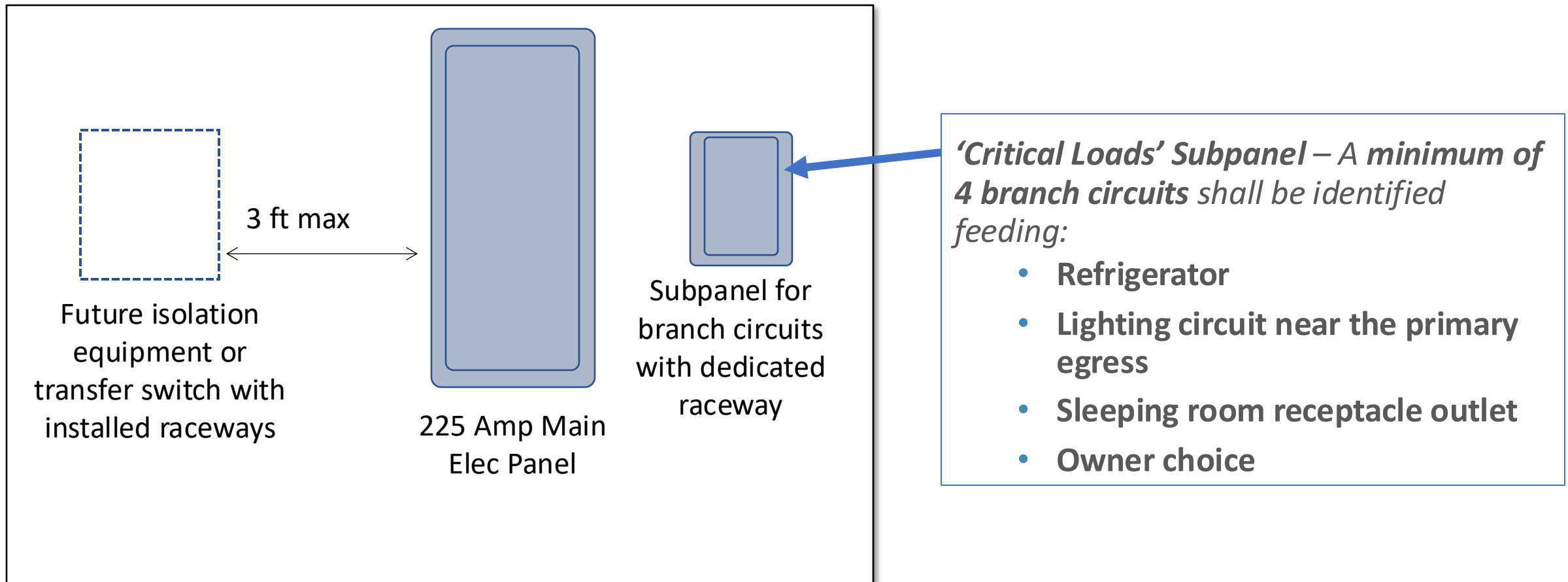


Solar System size will depend on Occupancy Type, Conditioned Floor Area, etc. The Battery System size will depend on PV System Size.

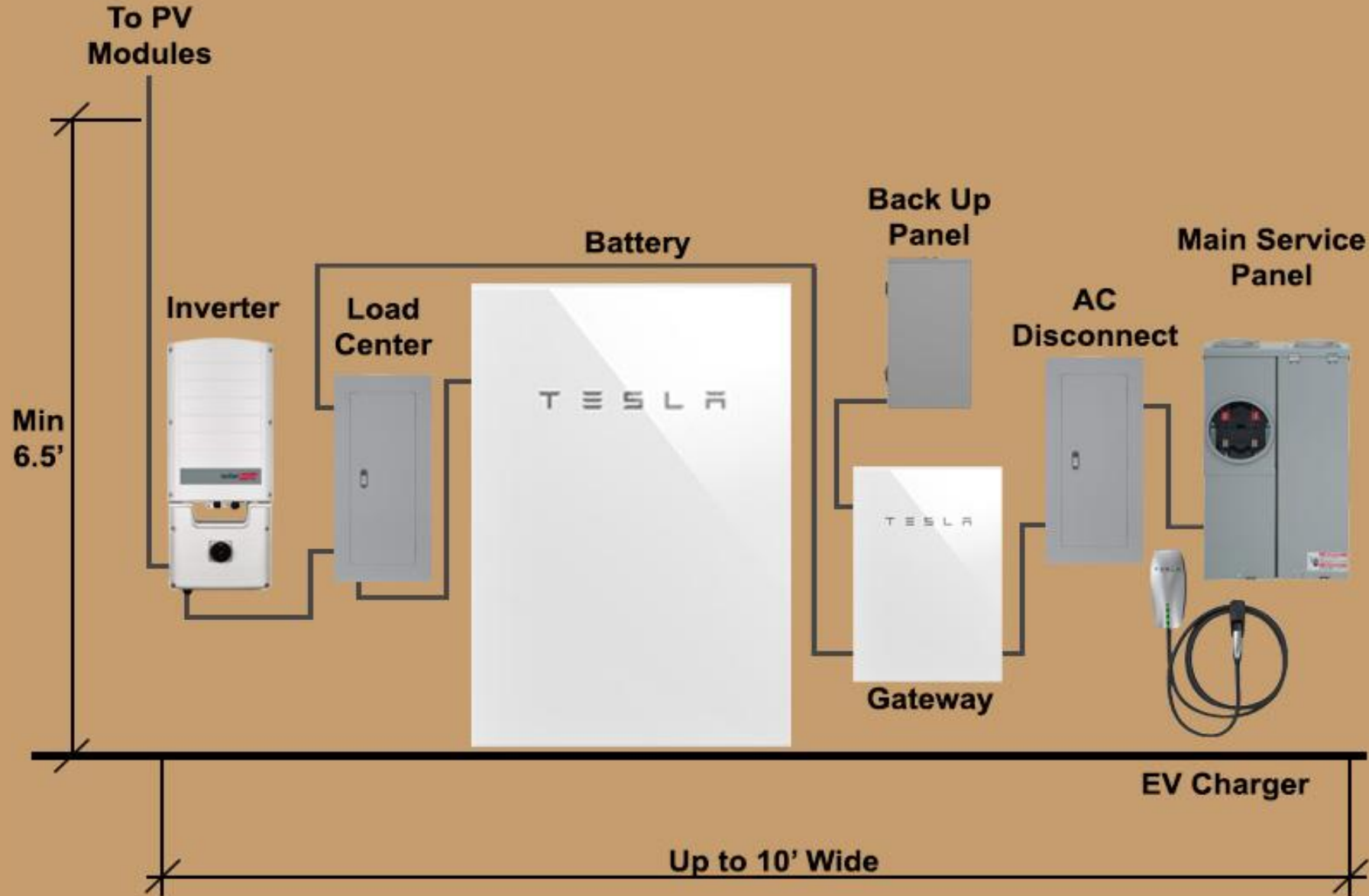
Under the 2025 Code occupancies are expanded and some will have increased PV and Battery requirements. Restaurants for example have a dramatic increase.

2022 Energy Code – Single Family

- Battery is Optional
- **Mandatory Measure:** “Battery Ready” for New Construction



Common Equipment for a Solar + Battery System



General Design Considerations

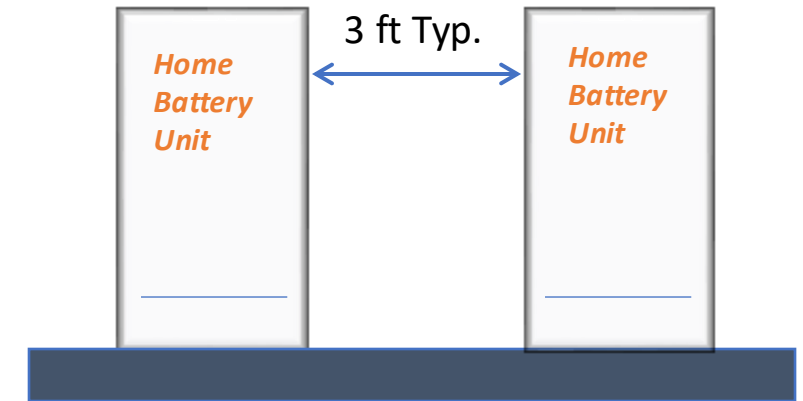
- Outdoor and indoor installations are possible
- Protect from impact damage
- Protect from temperature extremes
- Protect from adverse weather
- Maintain 3 ft distance from paths of travel, doors and windows
- Follow manufacture's installation requirements



Fire Safety – NFPA 855

Highlights from Chapter 15 – One and Two Family Units and Townhouses:

- Individual ESS units max 20 kWh stored energy
- Separate individual units by 3 ft
- Aggregate capacity shall not exceed:
 - 40 kWh within utility closets or storage spaces
 - 80 kWh in garages and/or detached accessory structures
 - 80 kWh on exterior walls or in outdoor installations
- Utility closets/spaces and/or garage shall have 5/8" Type X gypsum board ceilings and walls
- Interconnected smoke alarms shall be installed through out the dwelling and attached garage (or when appropriate an interconnected heat alarm)
- Maintain 3 ft clearance from all windows and doors



Batteries maybe installed closer if it can be shown to the AHJ that the battery manufacture has complied with proper fire testing and has specified the minimum distance.



Home Battery Systems – Large Market

Some popular examples, but there are many others coming to market every day:



gm energy



LG Energy Solution
ESS Battery Division



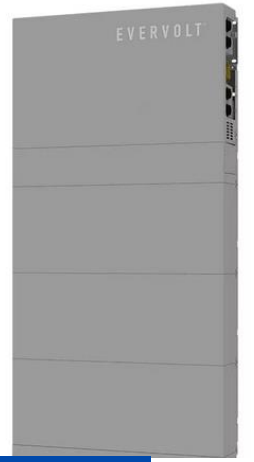
FRANKLINWH



solaredge



ENPHASE



Panasonic EVERVOLT®



electriq
power



sonnen



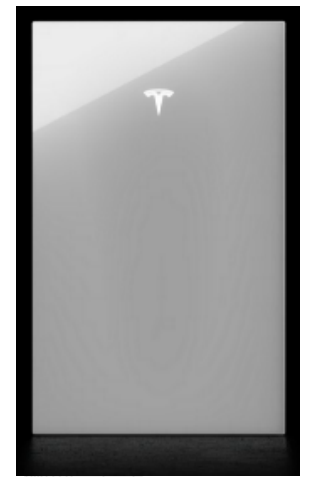
GOALZERO



GENERAC



LITHION

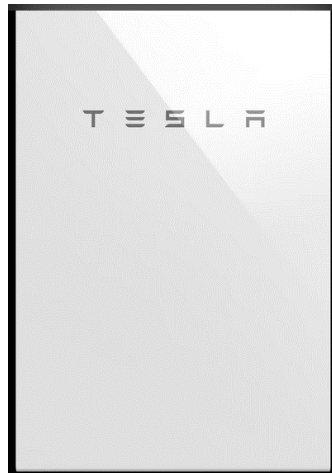


TESLA

Common Battery Chemistry

Lithium-Ion

Typically: LNMC –
Li, Ni, Mg, & Co
Thermal Runaway
Possible
High-Power Density

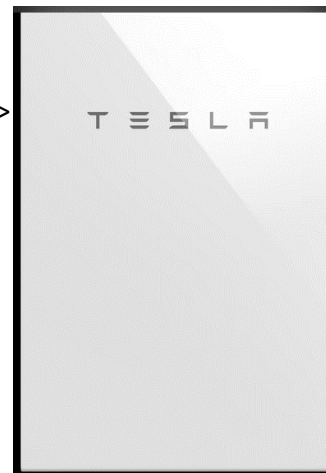


< PowerWall 2

Lithium Ferro (Iron) Phosphate

LFP – Li, Fe, PO4
Non-combustible
High-Power Density
Cobalt (Co) Free

PowerWall 3 >



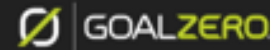
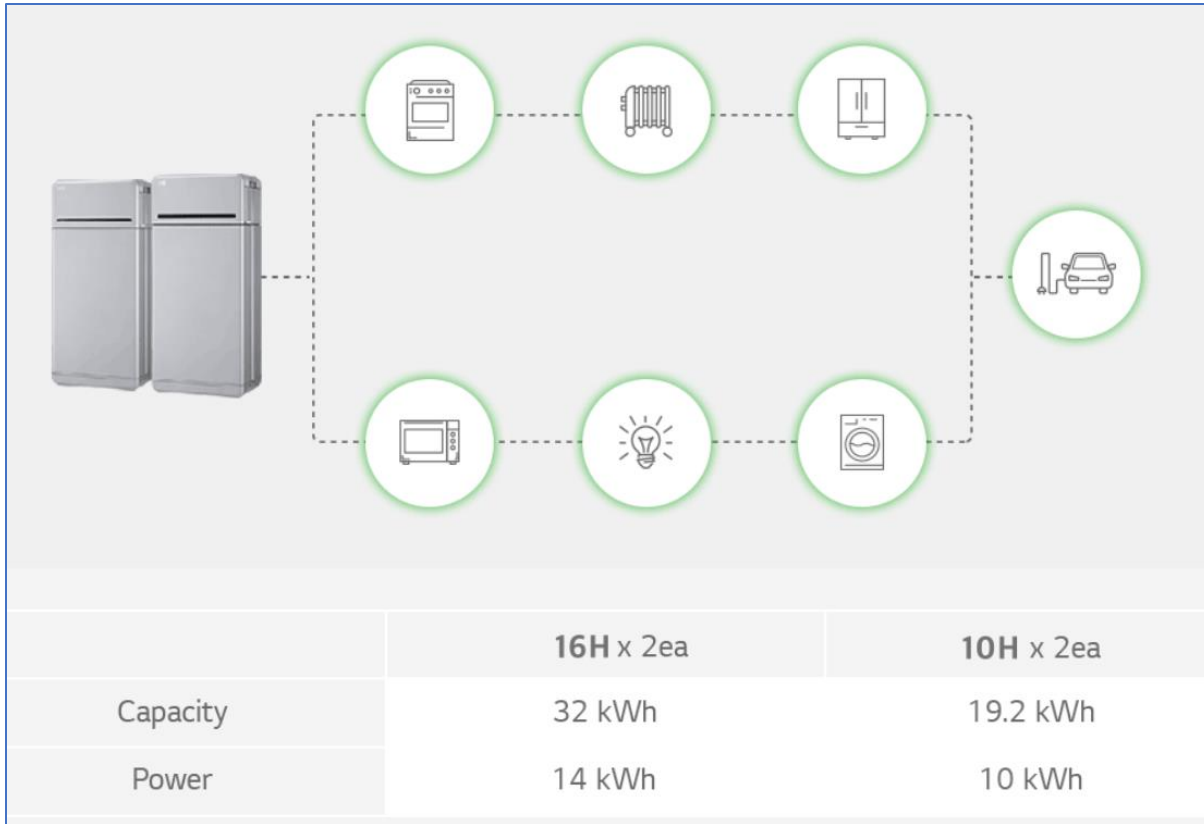
Lithium Titanate Oxide

LTO – Li & Ti
Non-combustible
Lower-Power Density
Cobalt (Co) Free



Manufacturers often show estimates for their products' use:

This is useful information for a basic understanding of the capacity and duration of use for a battery system.



One Yeti PRO 4000 gives you 4,000 watt hours of backup power! That's enough to keep the essentials running for a whole day.

Power these devices simultaneously for a day with one Yeti PRO 4000.



Full Size Refrigerator

Run time: 24 Hours

(Uses about 67 W/hr):



WiFi Router

Run time: 24 Hours

(Uses about 25 W/hr):



60" TV

Run time: 4 Hours

(Uses About 80 W/hr):



Microwave

Run time: 15 Mins

(Uses 1000 W/hr):



4 LightBulbs

Run Time: 4 Hours

(Uses about 44 W/hr):



Phone

Charges 2

(Uses about 12 Wh per):



Laptop

Charges 2

(Uses about 51 Wh per):



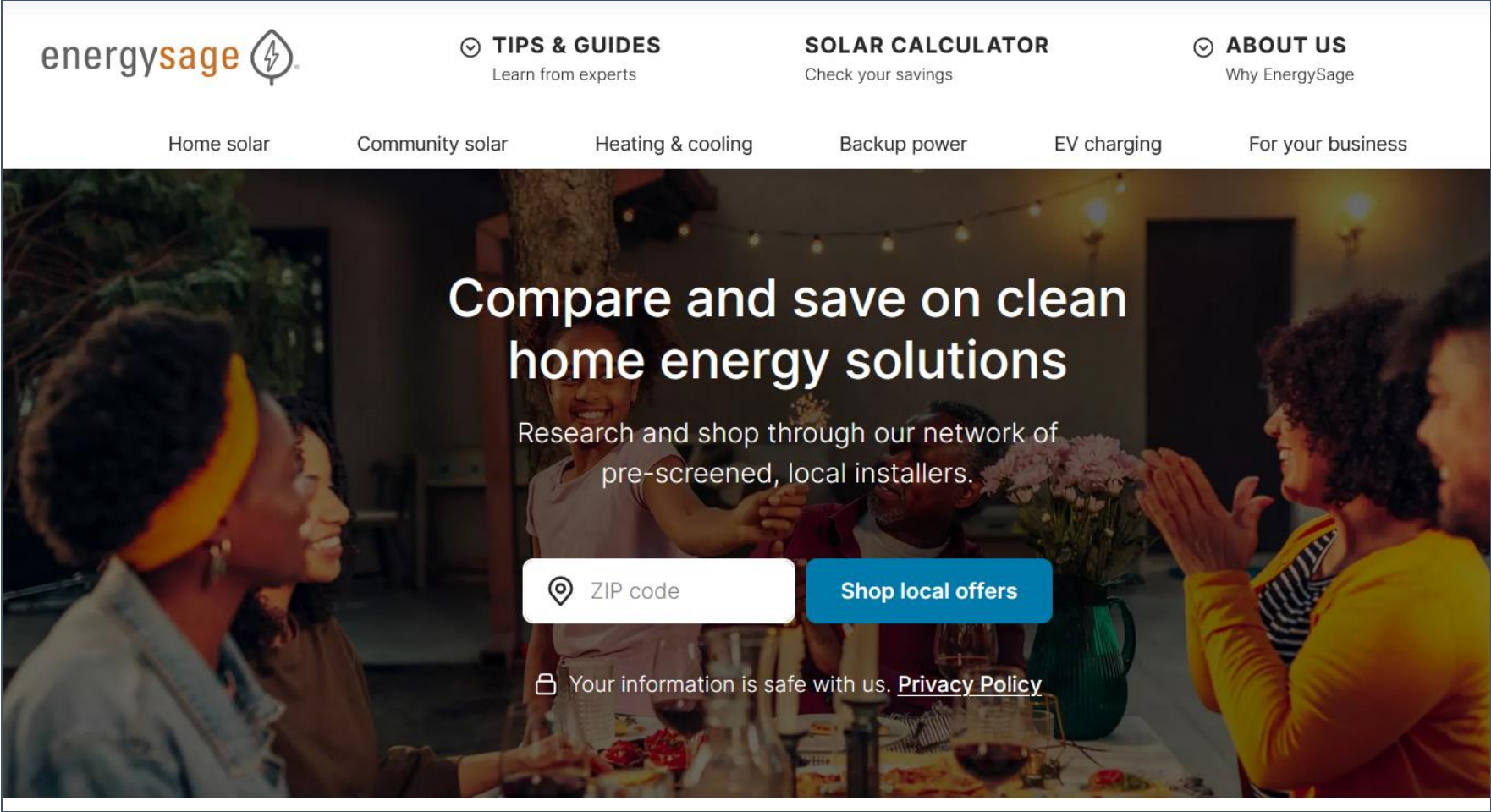
Coffee Maker

1 Pot

(250 w/hr per):

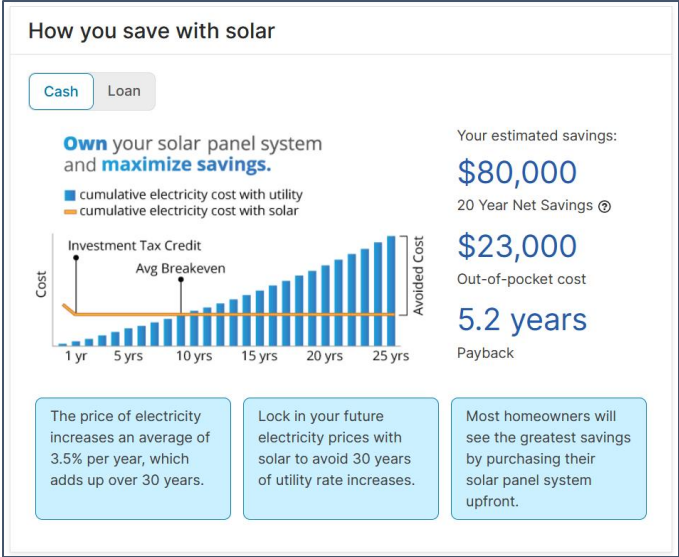
EnergySage: Information Hub, Pre-screen Installers

https://www.energysage.com/



The image shows the EnergySage website homepage. At the top left is the EnergySage logo. To its right are four main navigation categories: 'TIPS & GUIDES' (Learn from experts), 'SOLAR CALCULATOR' (Check your savings), and 'ABOUT US' (Why EnergySage). Below these are six sub-categories: 'Home solar', 'Community solar', 'Heating & cooling', 'Backup power', 'EV charging', and 'For your business'. The main content area features a large background image of a diverse group of people dining at an outdoor restaurant at night. Overlaid on this image is the text: 'Compare and save on clean home energy solutions', 'Research and shop through our network of pre-screened, local installers.', a search bar for 'ZIP code', a blue 'Shop local offers' button, and a privacy notice: 'Your information is safe with us. Privacy Policy'.

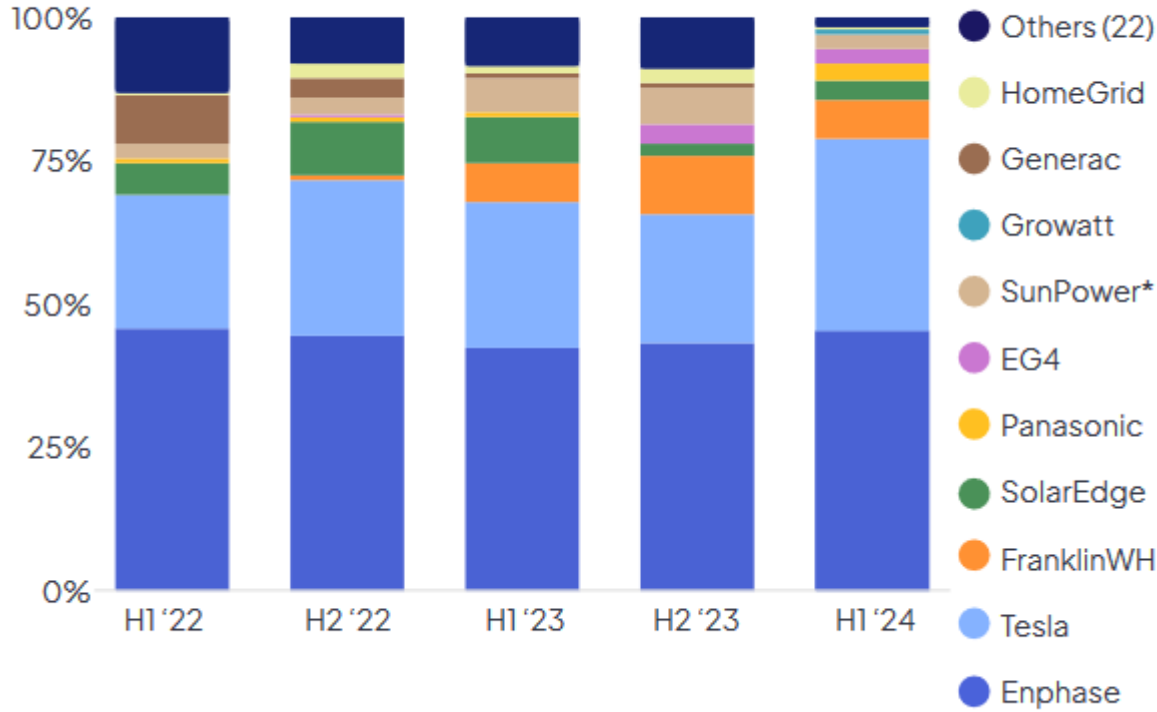
Sample Results from the 'Solar Calculator'



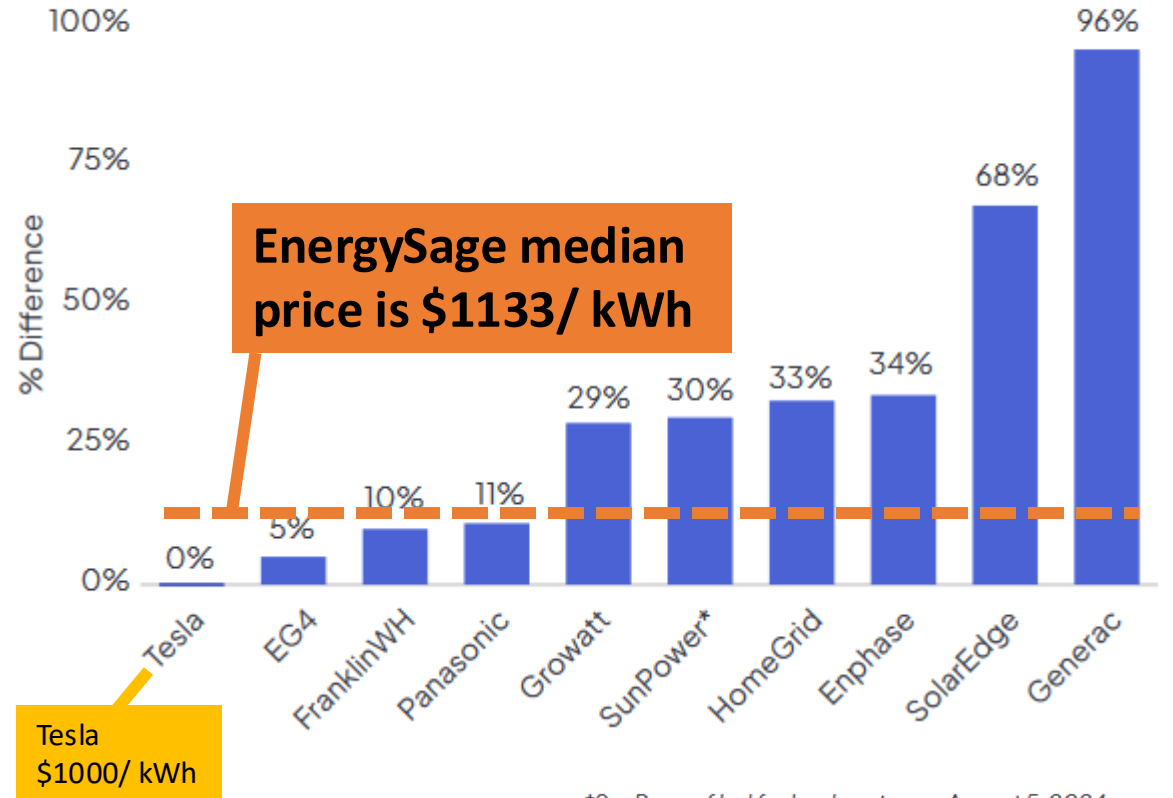
Market Share – Excerpt from EnergySage Data Set

www.energysage.com

STORAGE MARKETPLACE SHARE BY HALF YEAR



PERCENT DIFFERENCE FROM LEAST EXPENSIVE OPTION



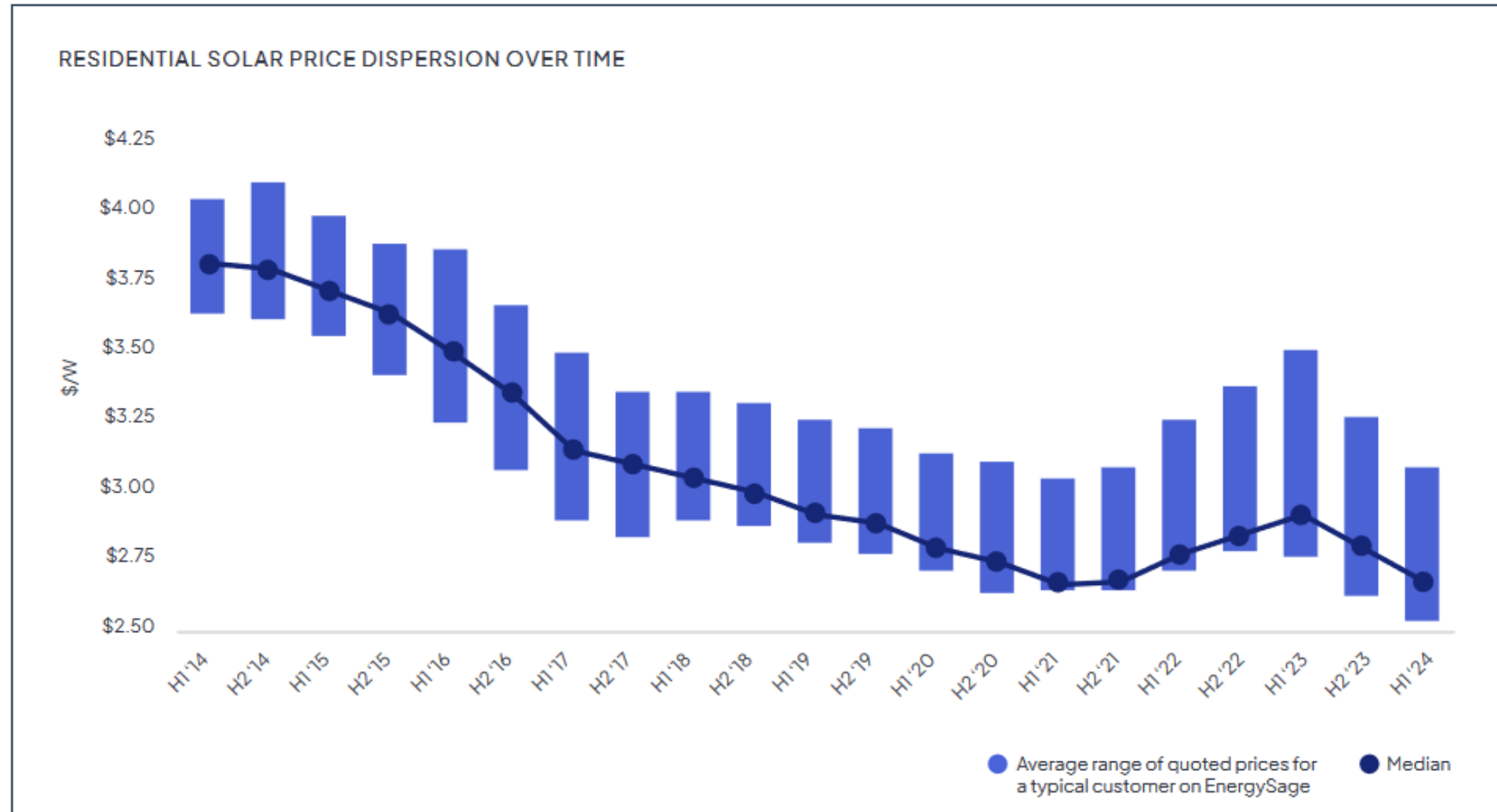
Solar & Storage Marketplace Report

intel@energysage.com

*SunPower filed for bankruptcy on August 5, 2024, so we expect this to be the last report including its products.

Market Share – Excerpt from EnergySage Data Set

www.energysage.com



Solar & Storage Marketplace Report

intel@energysage.com

Sizing and Cost Savings – Solar Calculator ‘WattPlan’

<https://guide.pge.com>

PG&E RESOURCES

Explore resources for PG&E Customers

Everything you need to reduce costs and maximize savings

[RESET ALL](#)



Solar Calculator

Make an informed decision about rooftop solar for your home. Calculate your solar savings potential with a personalized assessment with PG&E's Solar Calculator.

[GENERATE SOLAR POWER](#) | [TOOLS AND CALCULATORS](#)

[Start Estimate >](#)



Disadvantaged Communities – Single-Family Solar Homes (DAC-SASH) program

Learn more about available programs for income qualified customers in disadvantage communities

[GENERATE SOLAR POWER](#) | [PROGRAMS, REBATES](#)

[Get Started >](#)



Solar and Battery Details

My new plan

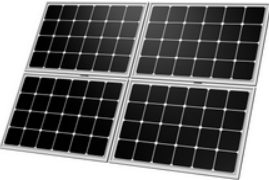
Electricity comes from utility & solar

5.3 kW

System size (DC)

14

Number of panels



5.320 kW

System size (DC)

4.549 kW

System size (AC)

9,099 kWh

System annual electricity production

My new plan

Solar is stored for use in the evening when energy costs are highest

13.5 kWh

Battery capacity

5.0 kW

Power, max continuous



Select an option ↔

User can fine tune the battery parameters and costs

Storage

Storage can increase the amount of usage you can cover with generation from your solar system.

Include storage?

Energy capacity: 13.5 kWh [?]

0.5  27

Power, Max Continuous: 5.0 kW [?]

1  10

Unit Price: \$1,000 per kWh [?]

100  2000

System Price: \$13,500 [?]

Benefit of Battery Storage

If you can afford the upfront costs of the battery (assumed \$13,500 installed):

- Save additional \$9,307 over 20 yrs
- Additional year to 'Breakeven'
- Very low utility bill (est. \$82/mo)
- Power some critical loads during a power outage

Solar only

No Backup power	41% Solar energy used on site, not exported
---------------------------	--

Key financials

System cost	\$15,960
Total incentives	\$4,788
Net savings or (costs) over the next 20 years	\$33,184
Breakeven	Year 6
Current average monthly bill	\$349
Average monthly bill after solar	\$178

Key features

- Solar system will export excess power to receive bill credits
- Solar generation shuts down during power outages unless special inverter is used

Solar and storage

Yes Backup power	78% Solar energy used on site, not exported
----------------------------	--

Key financials

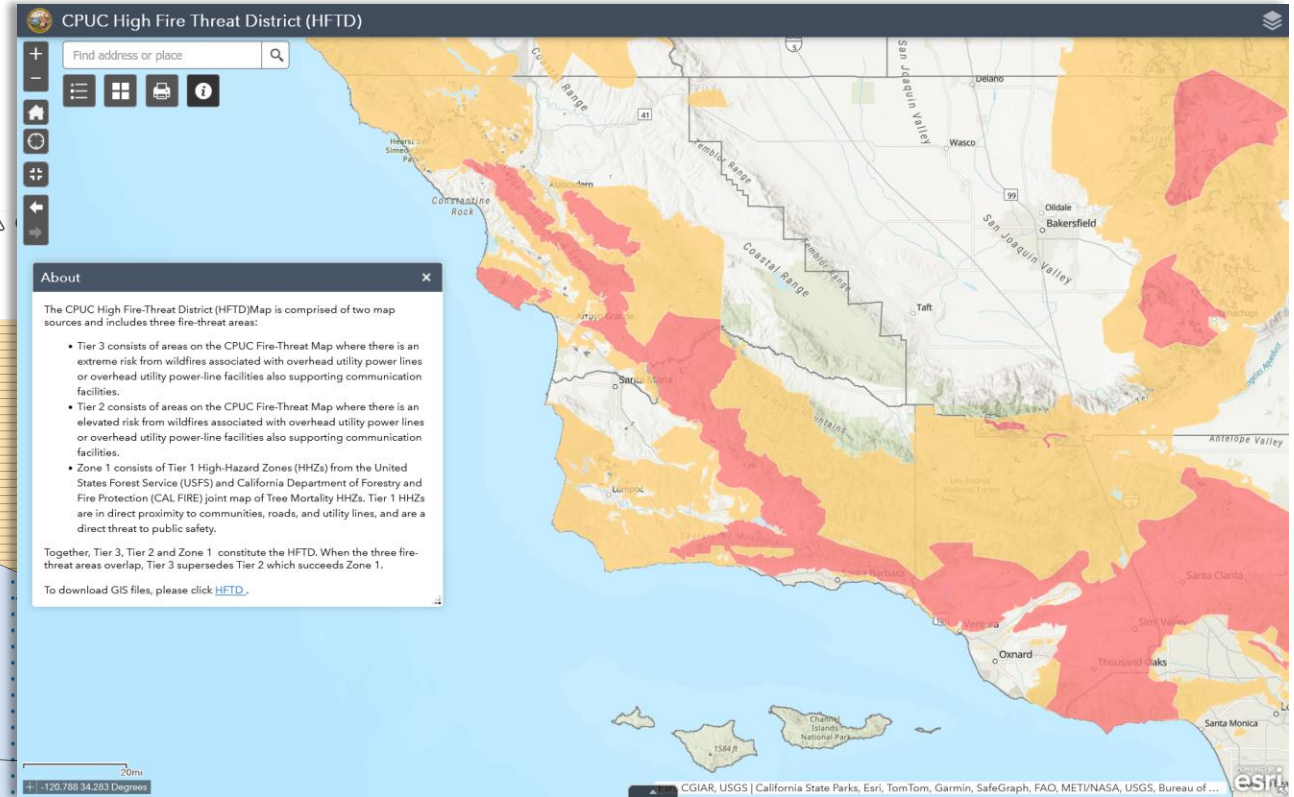
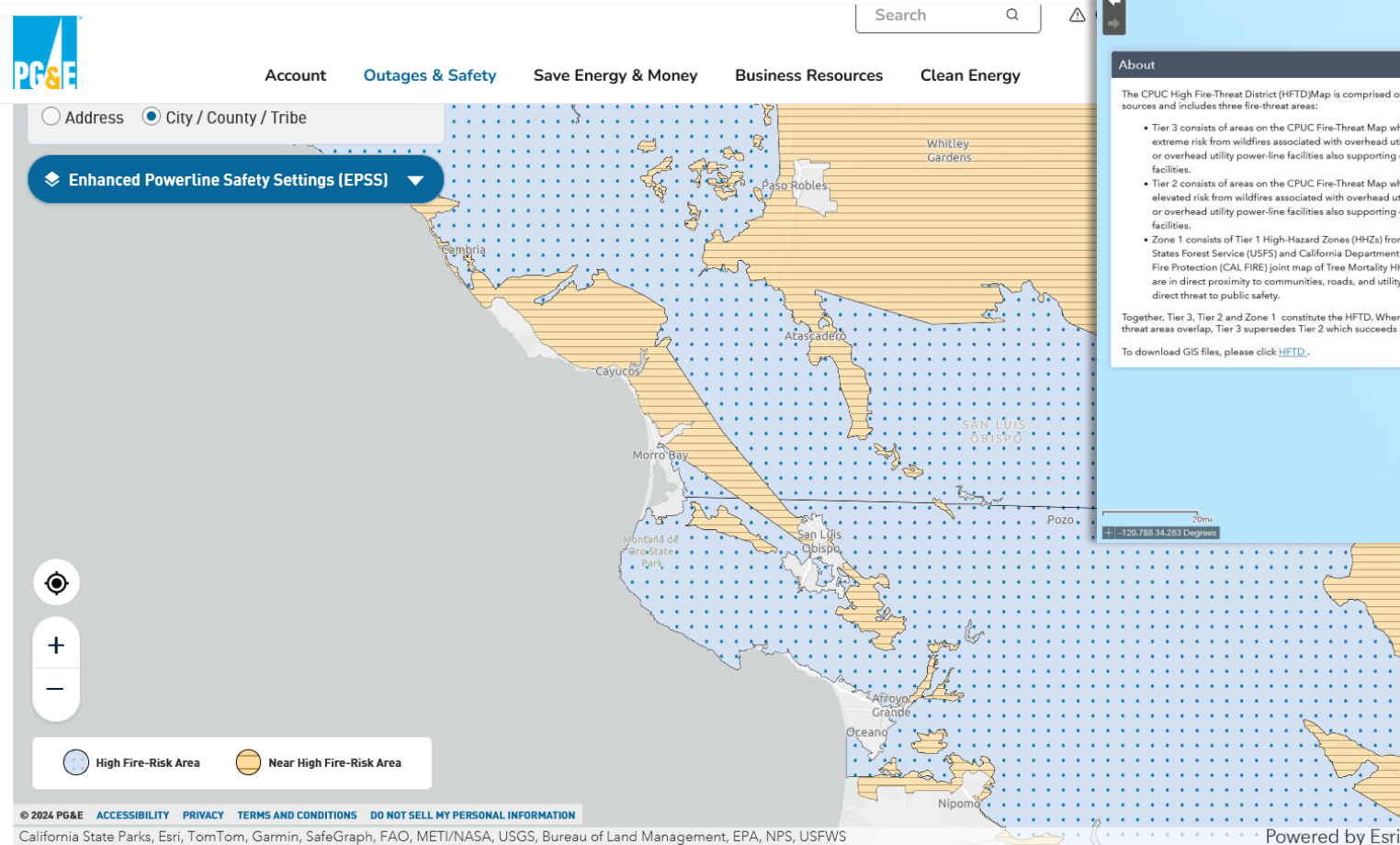
System cost	\$29,460
Total incentives	\$8,838
Net savings or (costs) over the next 20 years	\$42,491
Breakeven	Year 7
Current average monthly bill	\$349
Average monthly bill after solar + storage	\$82

Key features

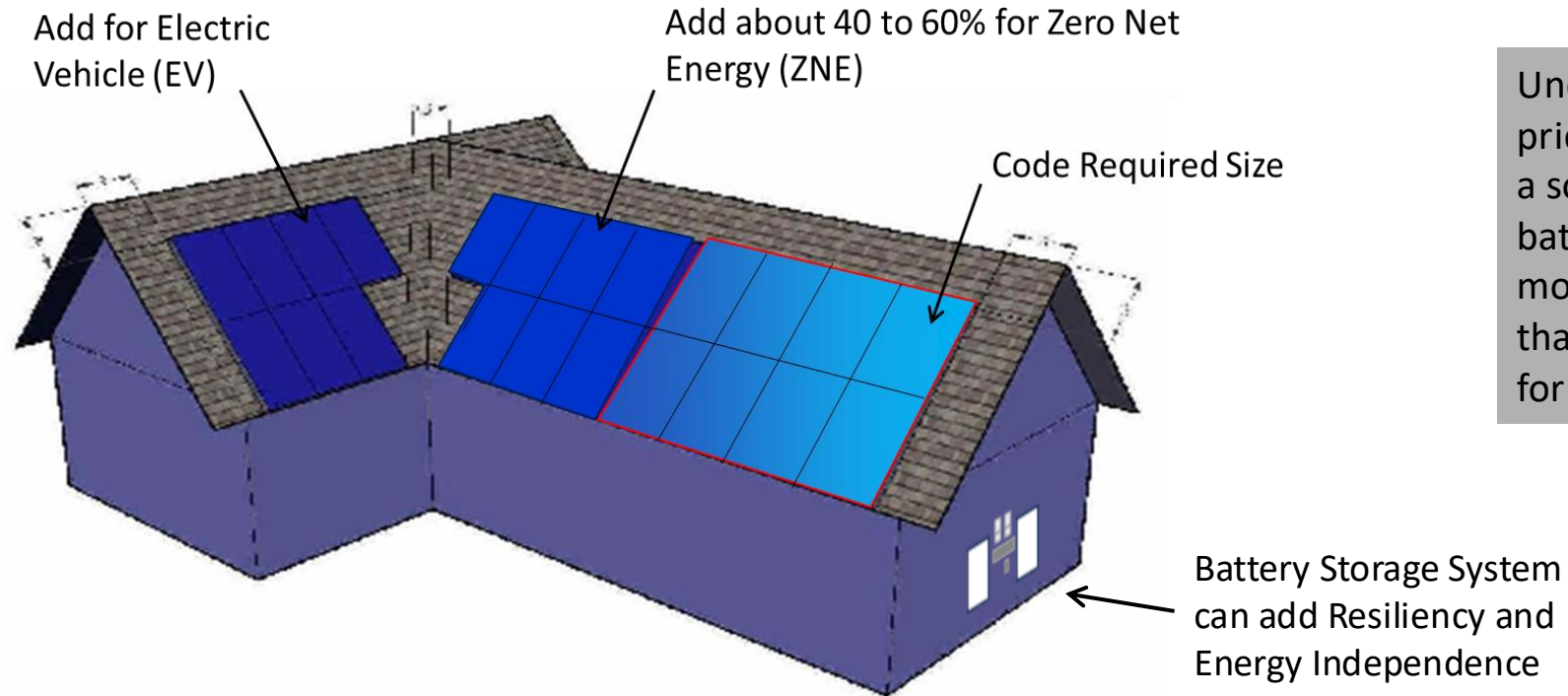
- Power critical appliances - or even your whole home - for a limited duration during power outages
- Use solar energy when the sun is shining, store excess solar power for use during evening peak hours, when electricity is most expensive

Battery Storage Rebates for Qualifying Utility Customers

Need to be in a Tier 2 or Tier 3 Fire Zones, and Enhanced Powerline Safety Settings districts – follow links to appropriate maps from PG&E website.



Zero Net Energy (ZNE) –the energy a home uses in one year is equal to the energy produced on-site for that year



Under the new electric pricing system (NEM 3), a solar PV system with battery storage can be more cost effective than a PV System alone for a ZNE home.

For Example: New Construction 2000 SF home in Atascadero (climate zone 4) a 2.38 kW system would be required.
Santa Barbara and Ventura coastal areas would be slightly less.



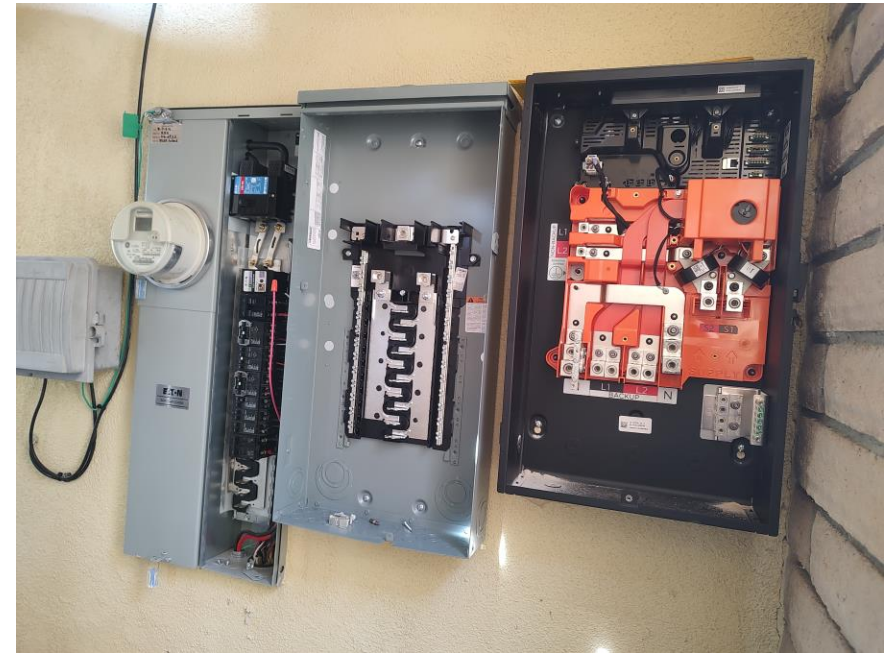
Existing Homes: Solar PV and Battery Systems



Electrical Panels and Inverters

Solar Panels and Hardware

Batteries



New electrical panel, sub-panel and controller.

Considerations:

- New roof or re-roofing / repairs needed?
- Panel upgrade needed –additional costs?
- Solar access / shading on roof?



Occupant Habits: Energy Usage, Solar PV and Battery Systems



Installed Roof Top Solar

Depending on one's driving mileage, electric cars can add significant loads.

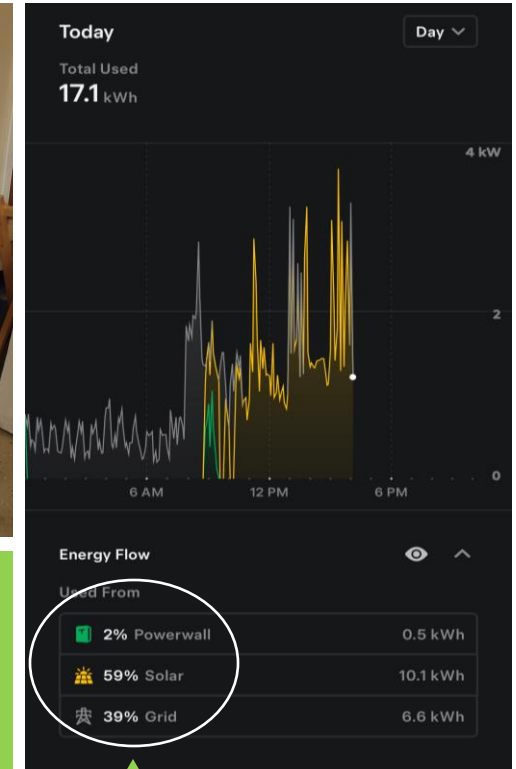


Battery Storage: Two batteries are providing whole home back-up – for the most part...



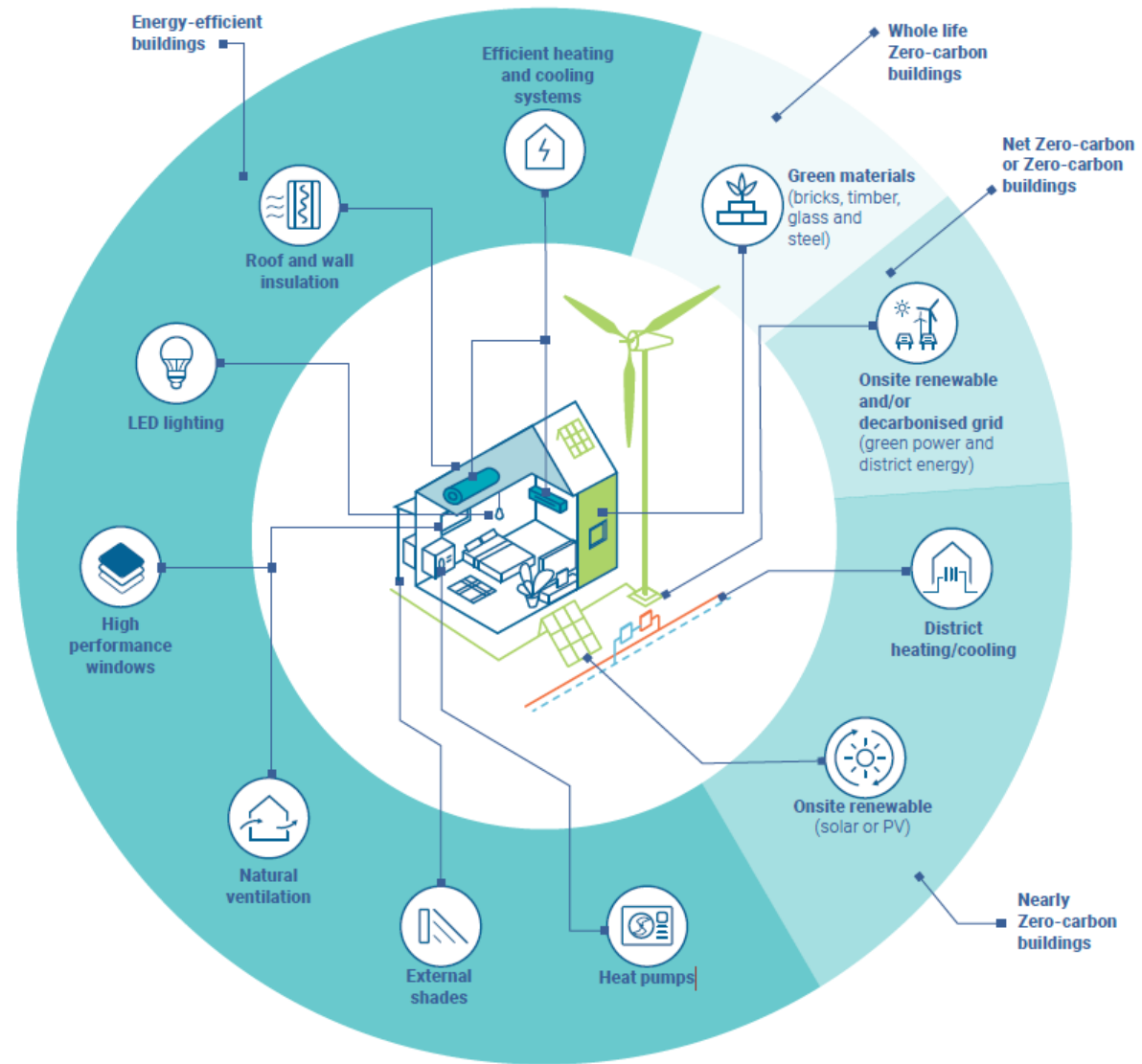
Electric dryer – Multiple consecutive use can add significant electric load, pulling energy from the grid.

“Laundry Day” – Solar only met 59% of the need that day – battery recharge has “priority” on solar energy.



ZNCD Buildings –Strategy for our Future

- Choose materials with low embodied carbon footprint
- Design Energy Efficient Buildings
- Use heat pumps –with low GWP refrigerants
 - Space Conditioning and IAQ
 - Water Heating
 - Appliances
- Supply Buildings with clean electric energy
 - On-site solar, wind, micro-hydro, etc
 - Decarbonized Grid



Closing

- Continuing Education Units Available
 - Contact ian.logan@ventura.org for AIA & ICC LUs
- Coming to Your Inbox Soon!
 - Slides & Survey – Please Take It and Help Us Out!
- Upcoming Courses
 - [10/25: Regional Forum SMVCA's Inaugural Cornhole Tournament](#)
 - [11/7: ZNCD: All-Electric Design & Construction Series – Day 2 \(SLO\)](#)
 - [11/13: Health and Resilience of Clean Energy Homes](#)
 - [11/14: Modeling All-Electric Homes in the 2022 Energy Code](#)
 - [11/19: Residential Compliance Forms for Permitting](#)
 - [11/21: HRV and ERV Basics](#)
 - [12/3-12/5: Installing HPWH's \(SLO, SMV, SB, VTA\)](#)
- For more information about upcoming events please visit: <https://www.3c-ren.org/events>



Questions about Title 24?

Energy Code Coaches are local experts who can help answer your Title 24 questions. Coaches have decades of experience in green building and energy efficiency improvements. They can provide citations and offer advice for your project to help your plans and forms earn approval the first time.

Online:
3c-ren.org/codes

Call:
805.781.1201

3C-REN ENERGY CODE CONNECT

Who We Are
Our team of local experts are Certified Green professionals with years of experience in the construction industry working as contractors, planning consultants, HERS raters, GreenPoint Ratings, architects, and Certified Energy Analysts. We understand your needs.

Energy Code Coach will answer your questions and provide technical modeling and compliance reporting, with the references and resources to support you and your department or firm.

How it Works—It's FREE!
Energy Code Coach offers free, professional and friendly consultation online, over the phone, or in the field. Call or submit your question online and we will respond within one business day.

How can Energy Code Coach help you?

- **Personalized Support:** Energy Code Coach answers your specific questions.
- **Plan Review:** Energy Code Coach can review plans and building department comments.
- **Field Visits:** Energy Code Coach can meet with you for on-site inspections and questions.
- **Department Trainings:** Energy Code Coach can provide customized code trainings for your team, online or in person.

Questions about the California Energy Code?

Get a 3C-REN Energy Code Coach. Our local experts are here to help. We'll respond within one business day so that your project meets Title 24 Part 6 requirements without slowing you down.

- Help with compliance, installation and verification forms
- All electric pathway compliance support
- Modeling support for PV, heat pump technology, and beyond

3C-REN ENERGY CODE COACH

Call: 805-781-1201
Online: www.3c-ren.org/ecc
Free support within one business day

TRICOUNTY REGIONAL ENERGY NETWORK
SAN LUIS OBISPO • SANTA BARBARA • MENDOCINO



Thank you!

For more info:
3c-ren.org

For questions:
info@3c-ren.org



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