



TRI-COUNTY
REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA

All Electric Retrofit with Electric Panel Constraints

Nick Brown, Build Smart Group

Robert Fortunato, ForStrategy Consulting

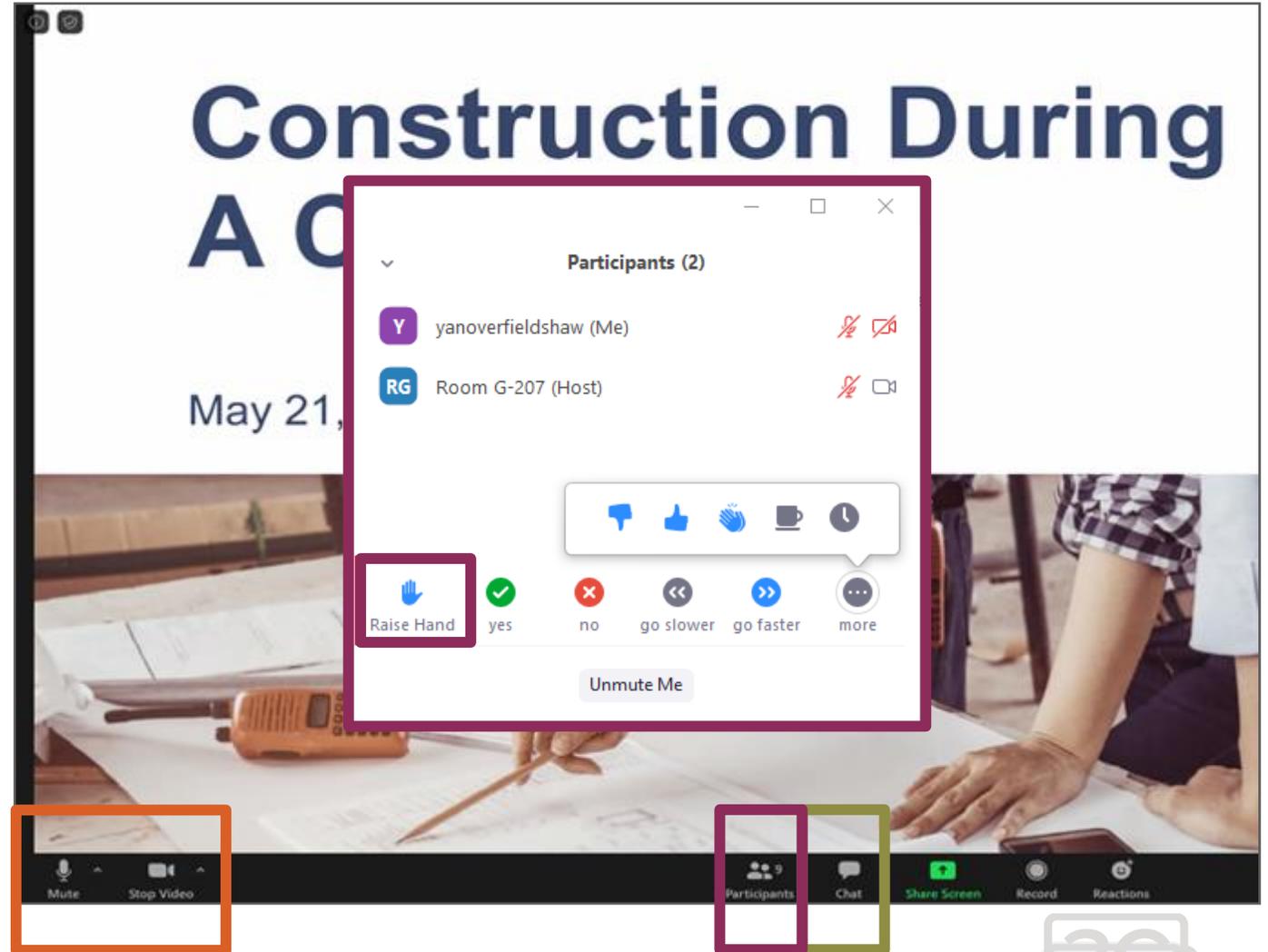
October 23, 2025

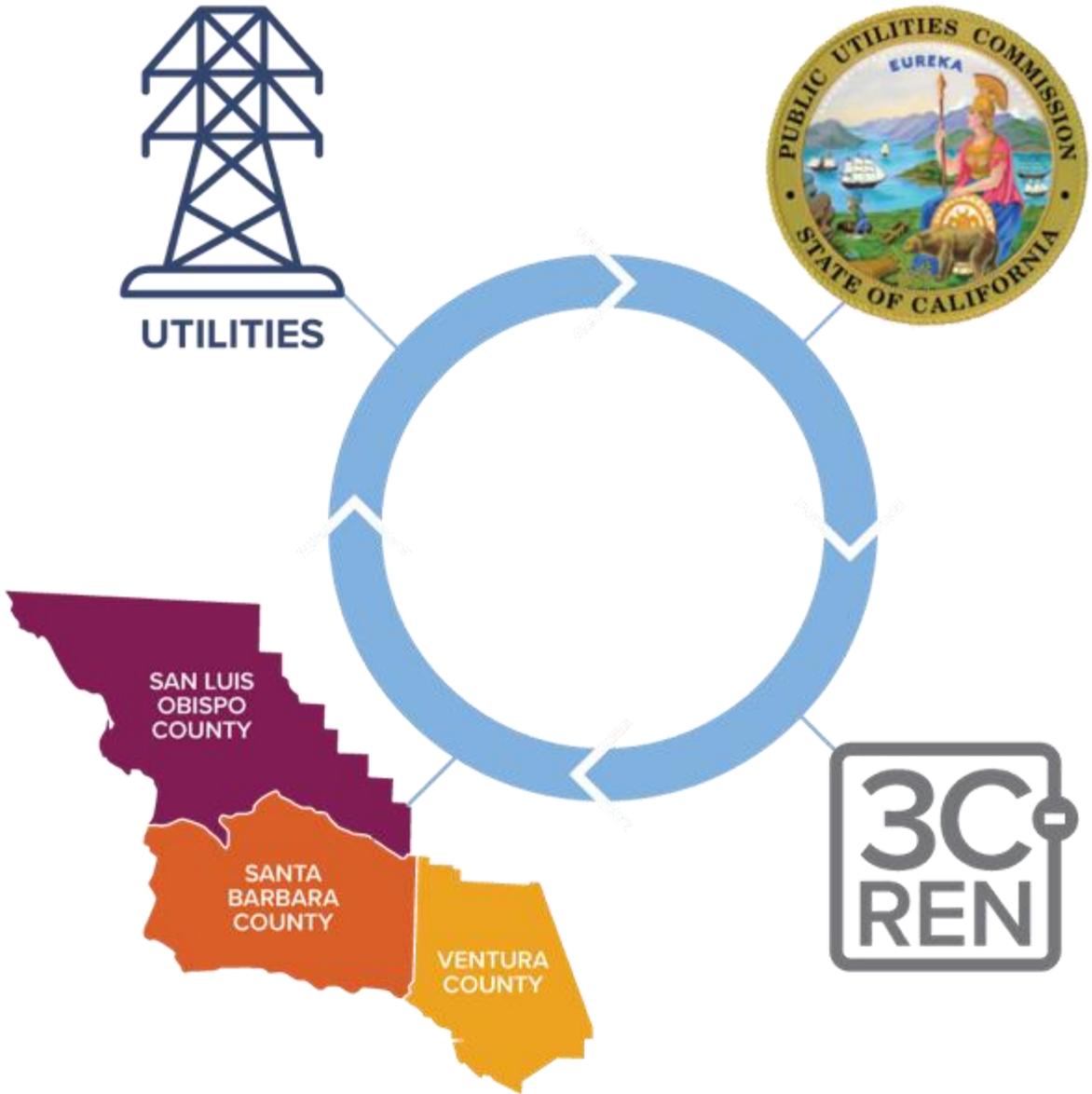


Before We Begin

Here are some quick reminders:

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





Tri-County Regional Energy Network

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

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

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



Our Services

Incentives



HOME ENERGY SAVINGS

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



COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

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

Training



BUILDING PERFORMANCE TRAINING

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



ENERGY CODE CONNECT

3c-ren.org/code

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

Technical Assistance



AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture



ENERGY ASSURANCE SERVICES

3c-ren.org/assurance



Electrification With Panel Constraints

3C-REN

October 23, 2025

OUR TIME TOGETHER



Introductions

Our Backgrounds -
Economics & Living All-Electric



Why All-Electric?

Health, Emissions, Utility Costs, etc



Calculating Panel Size

What the code requires



Tools to Evaluate Size

Historical usage, Watt Diet, etc



Making a Small Panel Work



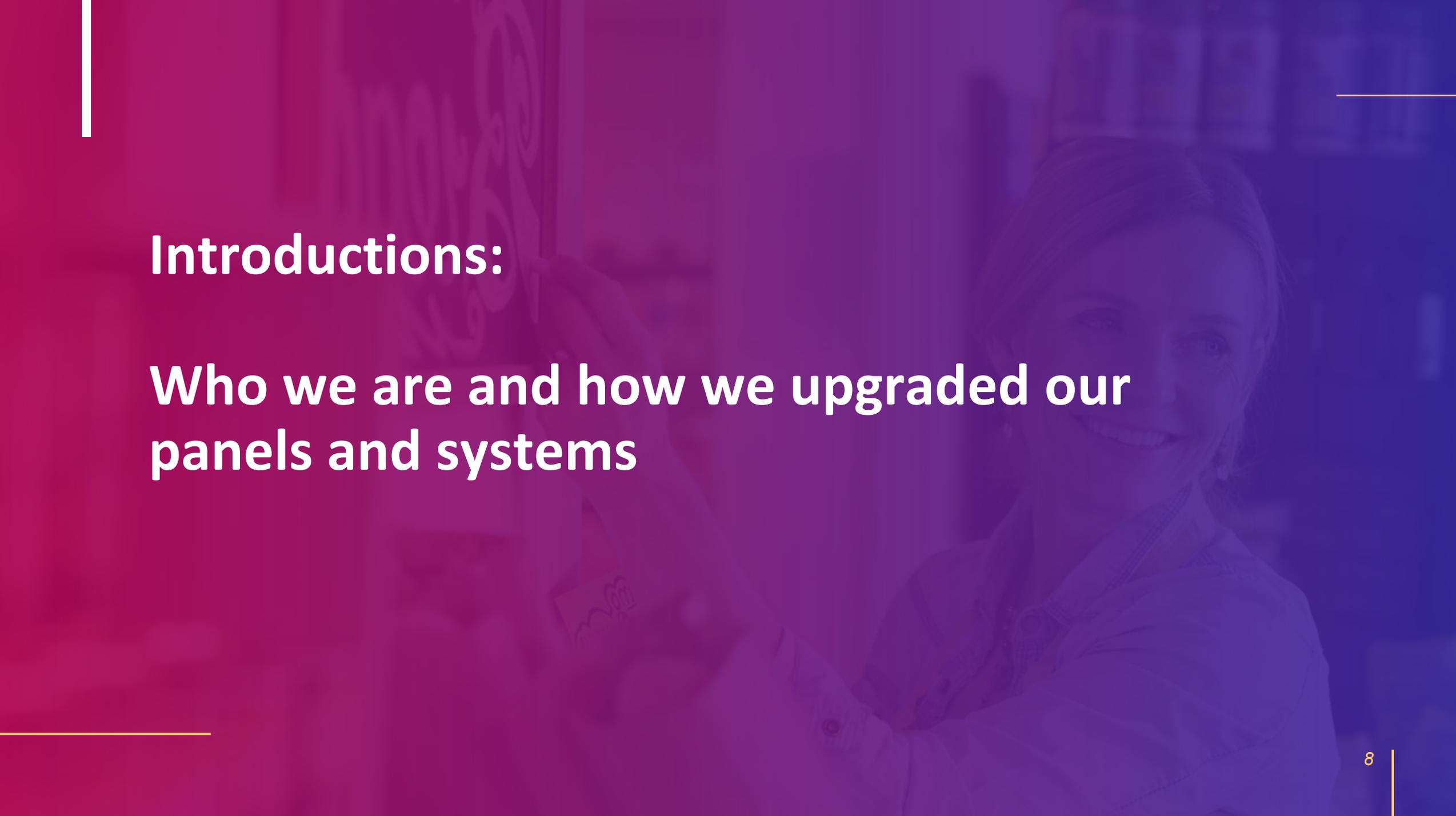
Case Studies

IMPORTANT NOTICE!

Products/Procedures Not Approved or
Endorsed

DISCLAIMER:

- Any products used in this presentation are just used as examples of options to convert a building to all-electric. This presentation does not recommend any specific products.
- Any estimates of costs, utility costs, incentives, and savings are rough estimates, not to be relied upon solely to justify a project. Experienced architects and engineers should be hired to do their own evaluation of all projects.
- Electrical projects should be done with licensed electrical professionals for your safety.

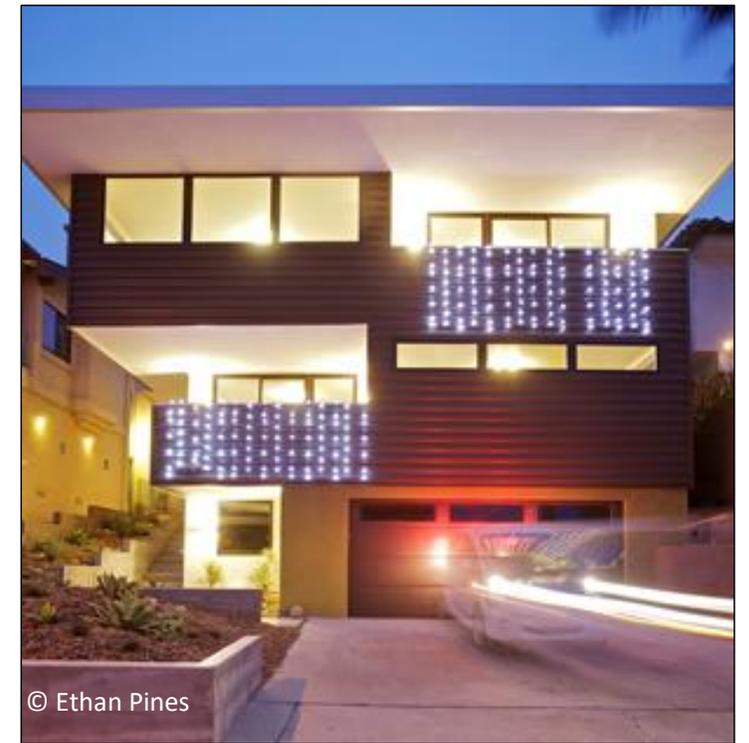
A woman with blonde hair, wearing a light-colored button-down shirt, is pointing with her right hand towards a whiteboard. The whiteboard has some faint, illegible markings. The background is a blurred office setting with bookshelves. The entire image is overlaid with a semi-transparent blue and purple gradient.

Introductions:

Who we are and how we upgraded our panels and systems

Robert Fortunato

Owner/Builder, Green Idea House
President, ForStrategy Consulting, Inc.



© Ethan Pines

Green Idea House:

- Completed in 2012
- 2,150 sf, 2 BR & 2 Bath + 2 office/studies
- 6.5 kW PV array (26 panels)
- Green Point Rated, Living Building Challenge NZE Petal
- Living Lab still today!



© Izumi Tanaka Photography

Your past and current electricity usage

	Electricity (kWh)
08/08/25 to 09/08/25	
Consumption	330
Net Generation	-834
Total electricity usage this month in kWh	-504

Your next billing cycle for meter [REDACTED] will end on or about 10/07/25.

Consumption is the total amount of electricity imported from SCE.

Net generation is the amount of excess electricity exported to the grid by your generating system.

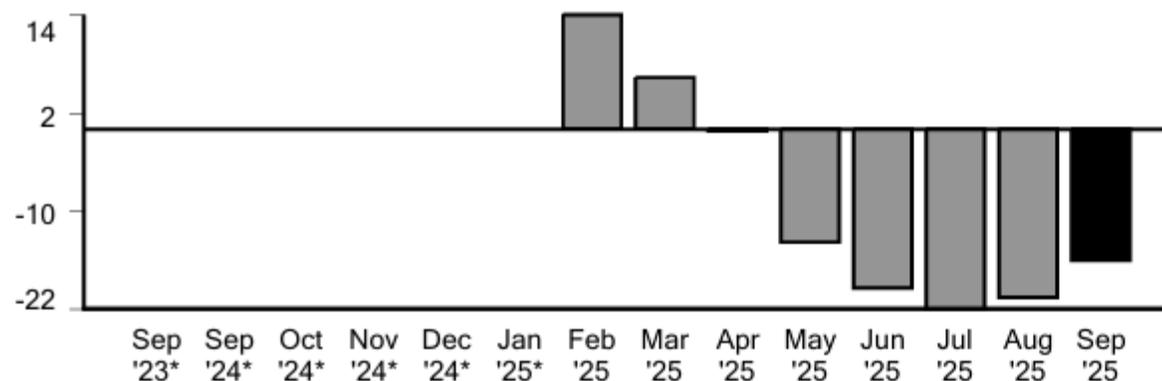
Total electricity usage is your system's total net generation minus your total consumption.

Your daily average electricity usage (kWh)

2 Years ago: N/A

Last year: N/A

This year: -15.75



* No data available

Additional information regarding your Net Consumption/Generation:

- Your year-to-date delivery and CRS energy charge total as of previous month: **-\$407.61**
- Your current month delivery and CRS energy charge total: **-\$115.69**
- Your year-to-date delivery and CRS energy charges: **-\$523.30**
- Your year-to-date kWh: **-2,189 kWh**

- TEDx Talk 2014.
- Initiated one of the first NZE Schools in Hermosa Beach.
- Work with affordable housing developers on portfolio audits, retrofits and new building pipeline.
- Completed year long commercial and multifamily commissioning class.
- Built a team that won CEC's EPIC \$1mm Grant to design most sustainable affordable housing development.
- Won additional \$9mm in funding based on report to CEC.
- Accredited Passive House Consultant.
- High Performance buildings instructor for USGBC-CA, SCE and 3C-REN.
- [Recently featured on NPR !](#)



CLIMATE

5 lessons from a house that generates more energy than it uses

SEPTEMBER 20, 2025 · 6:30 AM ET

HEARD ON WEEKEND EDITION SATURDAY



Jeff Brady

Green Idea House



Before



After

Heating and Hot Water Before and After

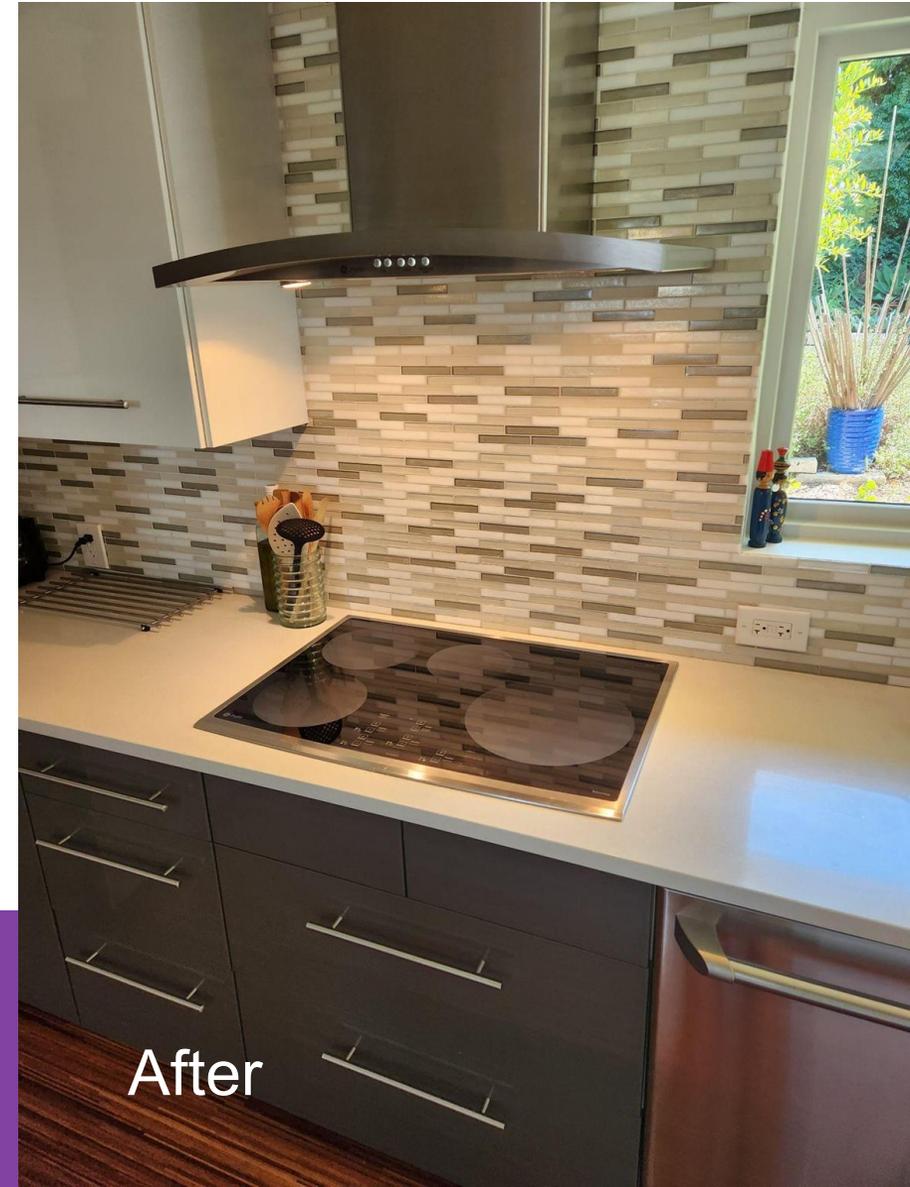


Induction Cooking



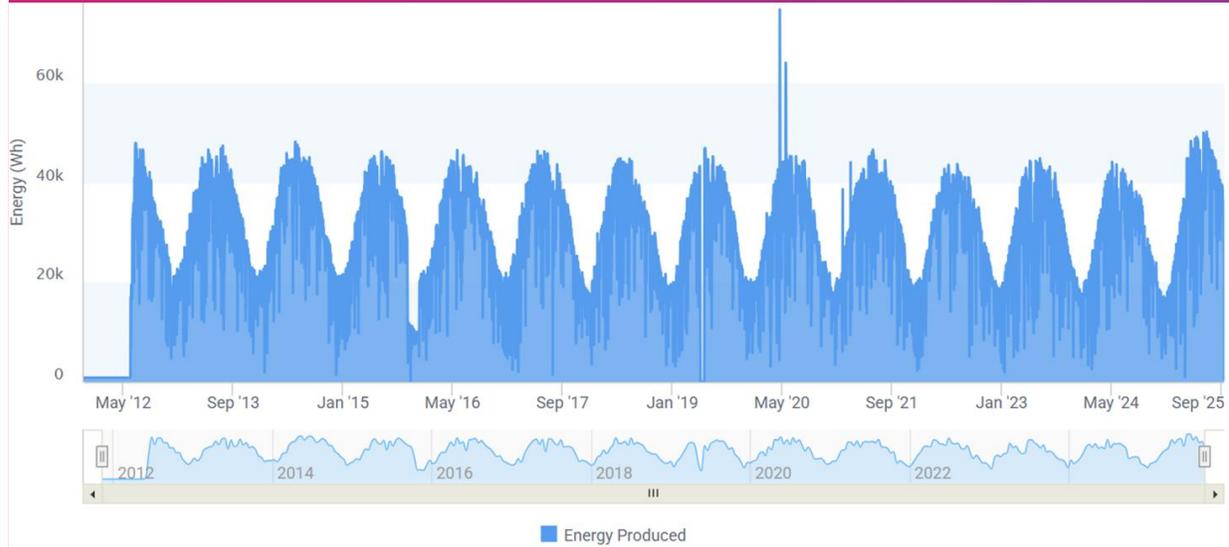
Before

- More efficient by heating cookware – not the room
- Boil water in half the time
- No gas combustion byproducts
- A snap to clean!
- Safer for kids to touch
- Auto-off
- Digital controls



After

Talkin' Bout My Generation



Maximum
Produced
74.5 kWh

Total
Produced
139 MWh

Full System

Energy Status

Today
558.00 Wh

Peak: 653.00 W at 8:40 AM
Latest: 9.00 W at 8:55 AM

Past 7 Days
192.31 kWh

Month To Date
495.40 kWh

Lifetime
139.41 MWh

Microinverter AC Voltage
245.0 V

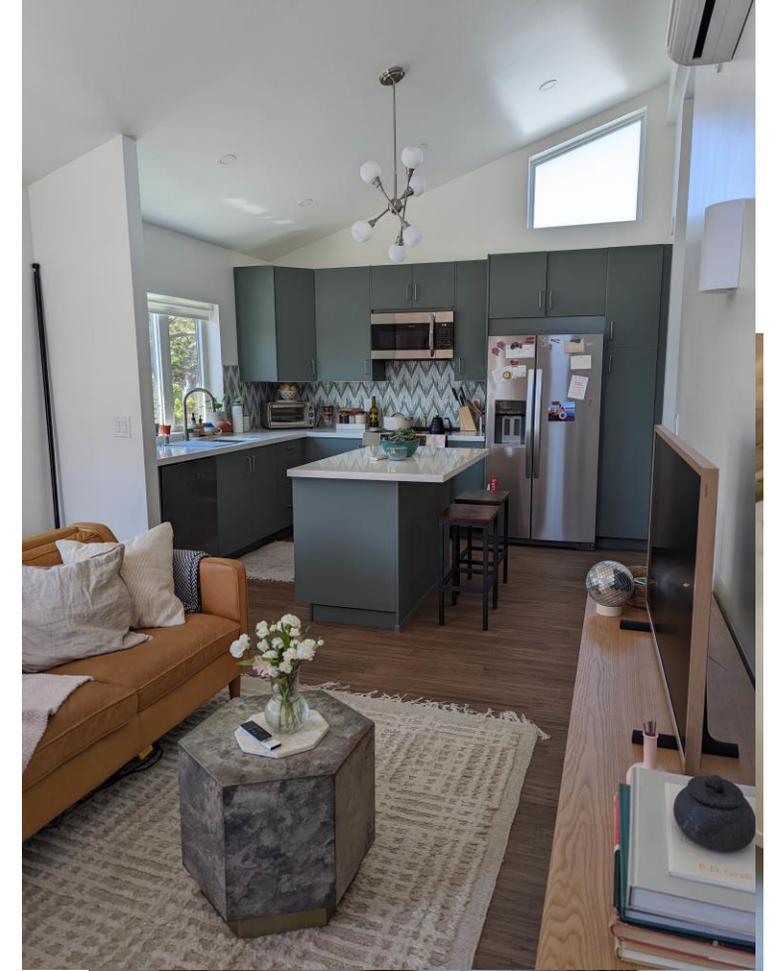
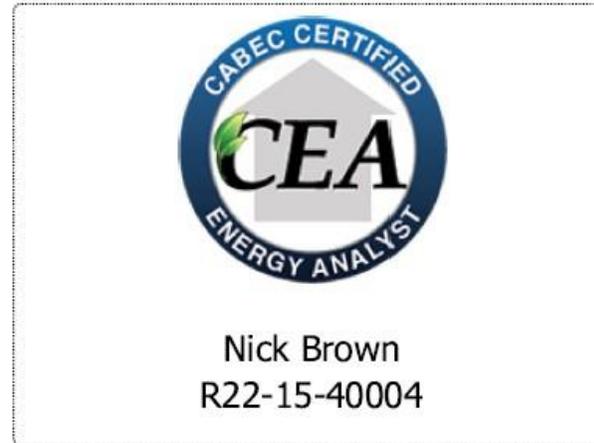


Talkin' Bout My Generation

- Saved over \$62,400 over the past 13 years in fossil fuels charges - \$400/mo. x 13years (\$200/mo for house and \$100/mo for each car)
- Payback period 3.75 years @ \$18k for 6.5kw system
- \$.06/kWh over the 25 year warranty period
- System payback of carbon = 6 years, system could last 40+ years
- Additional savings because EVs and all-electric appliances need less maintenance

NICK BROWN

President, Build Smart Group



Net Zero Nest:

Completed in 2016
1,950 sf, 3 BR & 3 Bath
4.4 kW PV array (16 panels)
Now All Electric

All-Electric ADU:

Completed in 2022
576 sf, 1 BR & 1 Bath
4.1 kW PV array (12 panels)
Net Zero Carbon

Instructor for various classes:

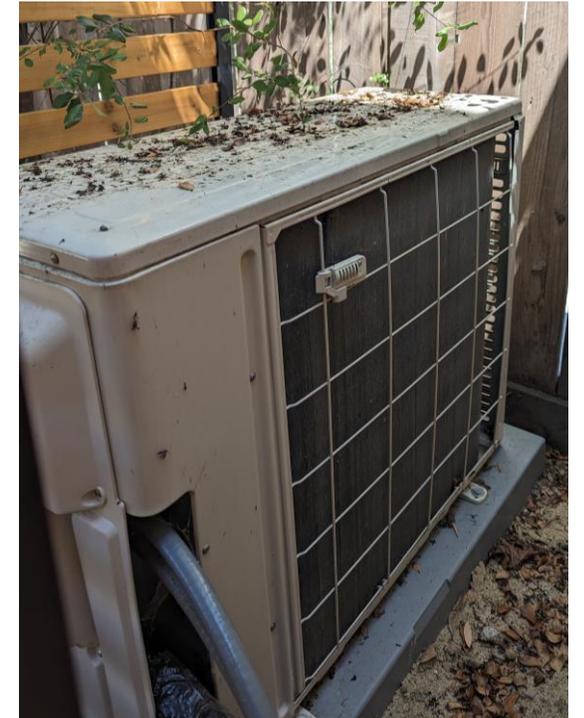
All-Electric Homes
Demyth-defying Heat Pumps
Installing Heat Pump Water Heaters
Energy Standards for Residential Architects

ADU Heat Pump

HVAC

Ductless variable capacity heat pump

- Slimline outdoor unit is quiet
- 2 indoor units: one in great room and one in bedroom
- Using 2.0 kWh per day



ADU Heat Pump Water Heater

Hot Water

50 gallon unit in garage

- 240V, 30 amp
- Heat pump only mode
- Using ~1 kWh per day
- Trouble-free



Water Heater



ADU Laundry & Cooking

Induction Range

- 240V 40 amps

Washer & Heat Pump Dryer

- 120V 15 amps each



Main House Electrification

Replacing Tankless Gas Water Heater with Heat Pump Water Heater

- 50 gallon, 120 volt 15 amp plug-in
- Outdoor closet location
- Allows for the end of gas
- Also available in shared circuit models with mixing valves for added capacity and load shifting





Main House Electrification



Replacing Gas furnace & A/C with Heat Pump

- Slimline 3-ton outdoor unit uses same power as 3-ton A/C unit
- Ducted 36kbtu indoor unit will take place of 80k btu furnace & get power from outdoor unit
- Efficiency gains from variable capacity controller
- One less gas system

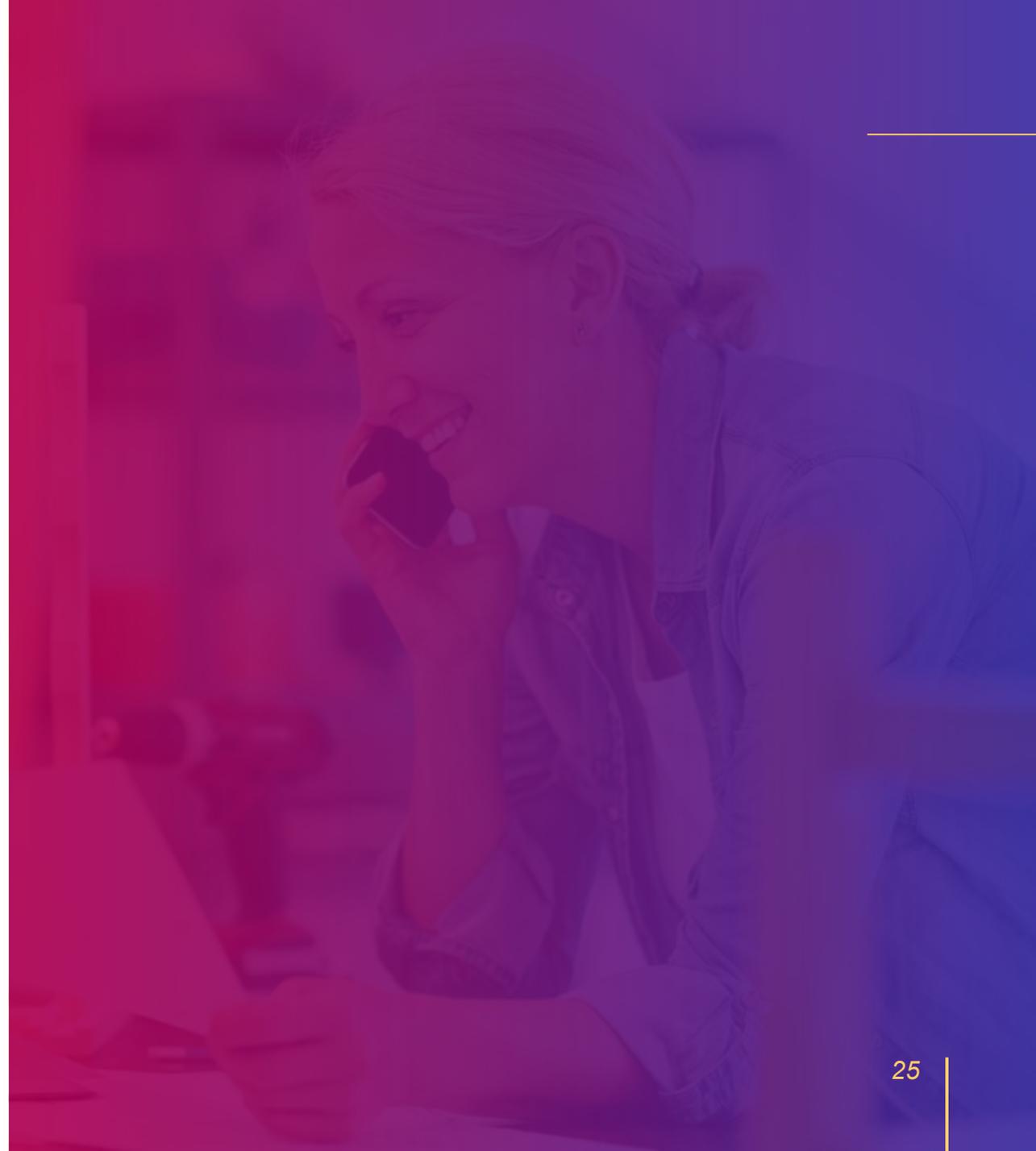


Main House Electrification

Induction Cooktop & Electric Oven
Heat Pump Dryer and Washer

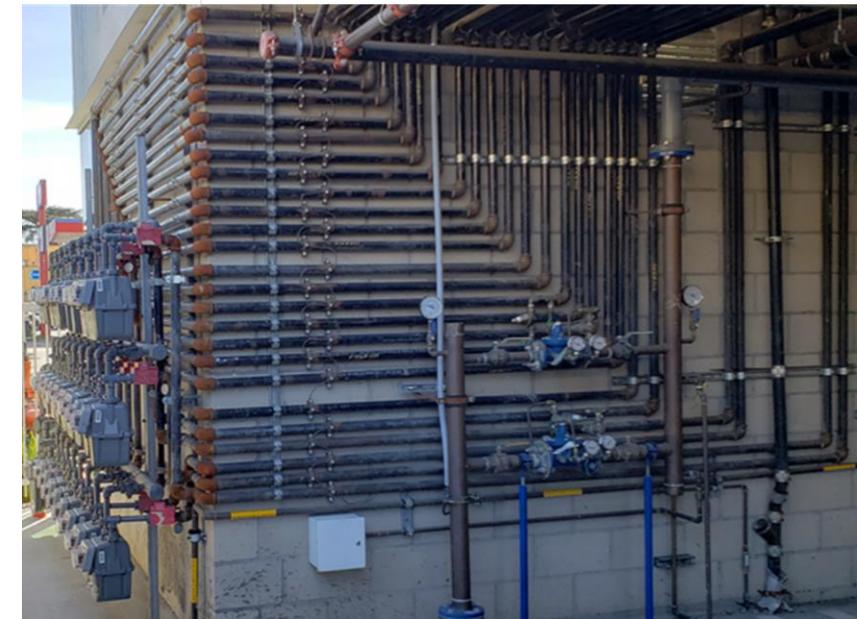
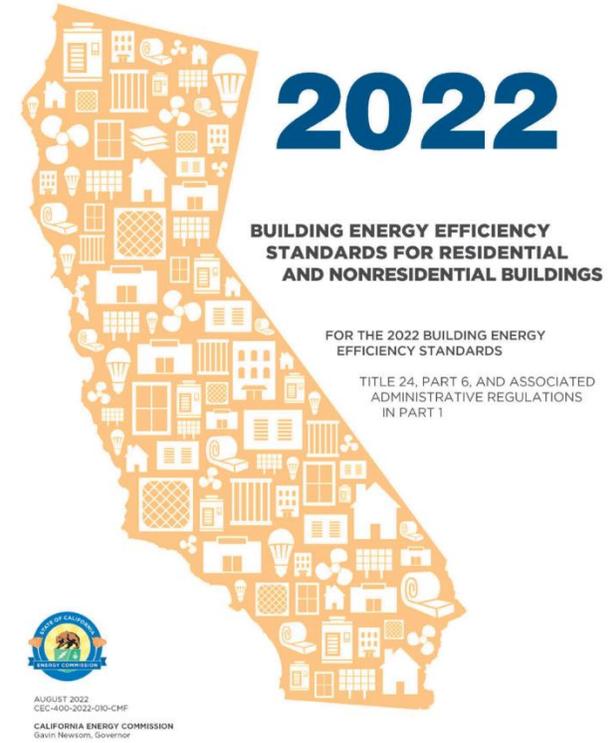


Why Electrify?
What's in it for you?



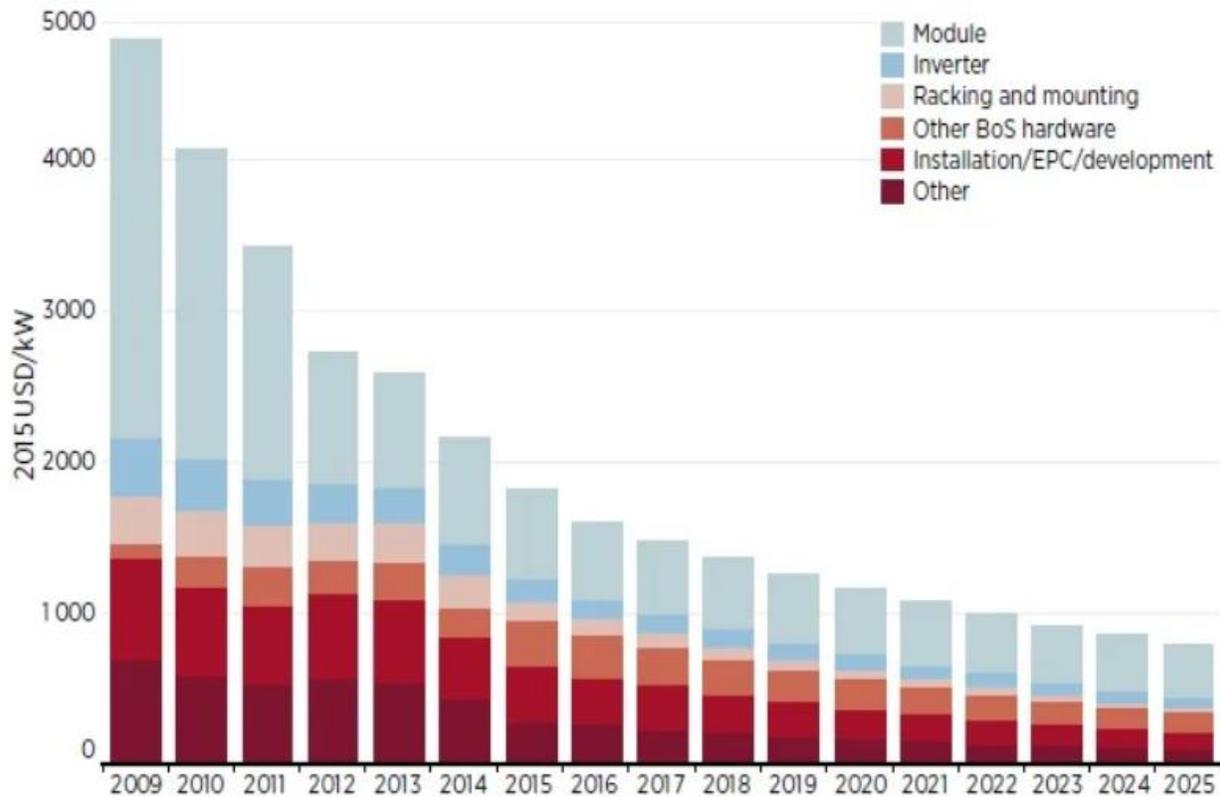
Reasons to Electrify Homes

- Simpler: only one utility in the building
- Easier energy code compliance
- Efficient: 300+% efficiency with heat pumps
- Safer: less risk of gas leakage, fire
- Health: Improve indoor environmental quality (IEQ) contributes to occupant health and productivity and the risk of childhood asthma
- Utility costs: all-electric buildings with PV can generate significant utility cost savings
- Self-sufficiency: Electric+PV+battery can run off-grid much of the time and in case of disaster
- Lower Carbon footprint: All-electric buildings have ½ the Greenhouse gas emissions (pollution) of mixed fuel buildings
- Better technologies: all-electric systems such as induction ranges and heat pump clothes dryers offer superior features
- Futureproof: gas systems are expected to be phased out in California in near future
- Reduced dependence on foreign energy



Cost of Solar PV and Batteries

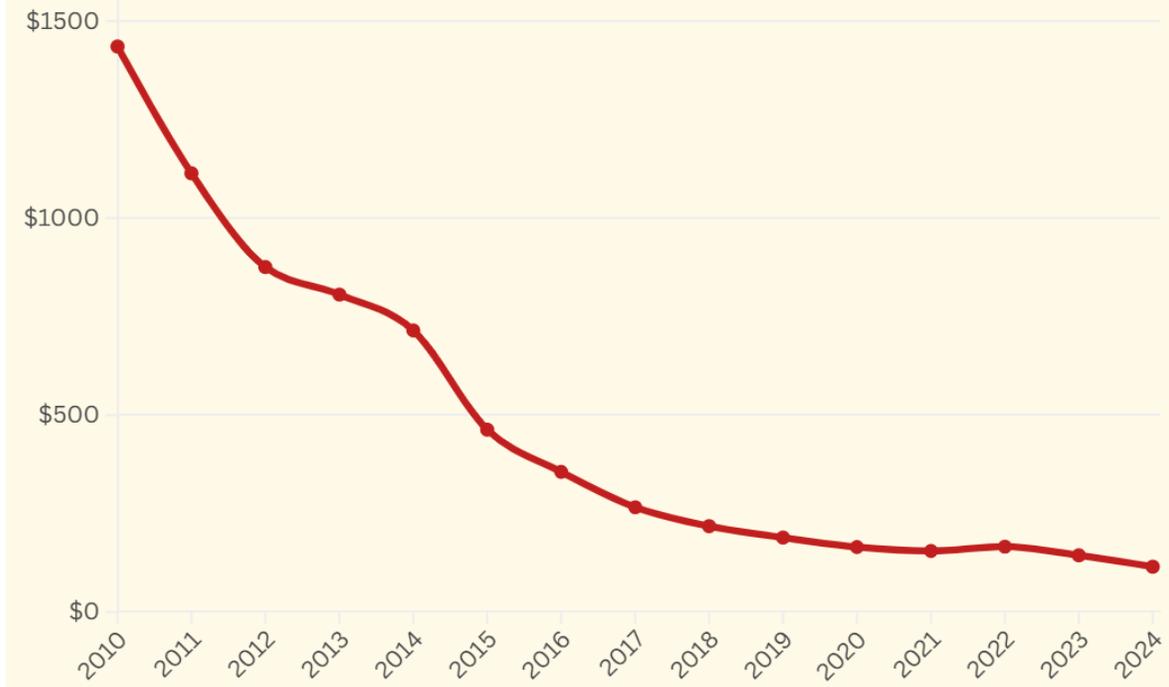
FIGURE ES 1: GLOBAL WEIGHTED AVERAGE UTILITY-SCALE SOLAR PV TOTAL INSTALLED COSTS, 2009-2025



<https://www.pv-tech.org/balance-of-system-costs-key-to-further-solar-system-cost-reductions-says-ir/>

Battery prices dropped yet again in 2024

Average lithium-ion battery pack price, in dollars per kilowatt-hour



Source: [BloombergNEF, 2024](#)

CANARY MEDIA

<https://www.canarymedia.com/articles/batteries/chart-lithium-ion-battery-prices-fall-yet-again>

State Incentives Available Now

- New Home incentives through [Energy-Smart Homes](#)
 - All-Electric: start at \$3,500
- [TECH](#) Retrofit Heat Pump incentives:
 - \$1,500 for HVAC heat pumps
 - \$1,100-\$2,100 & up for Heat pump water heaters
 - Multifamily \$3,100 for Heat pump water heaters
- [Energy-Smart Homes](#) Retrofit incentives:
 - \$4,250 whole home electric retrofit incentive
 - Additions & ADUs start at \$1,750
 - \$250 Heat pump clothes dryer
 - \$1,000 Electrical upgrades
 - \$600 for Advanced heat pumps



TECH

CLEAN CALIFORNIA



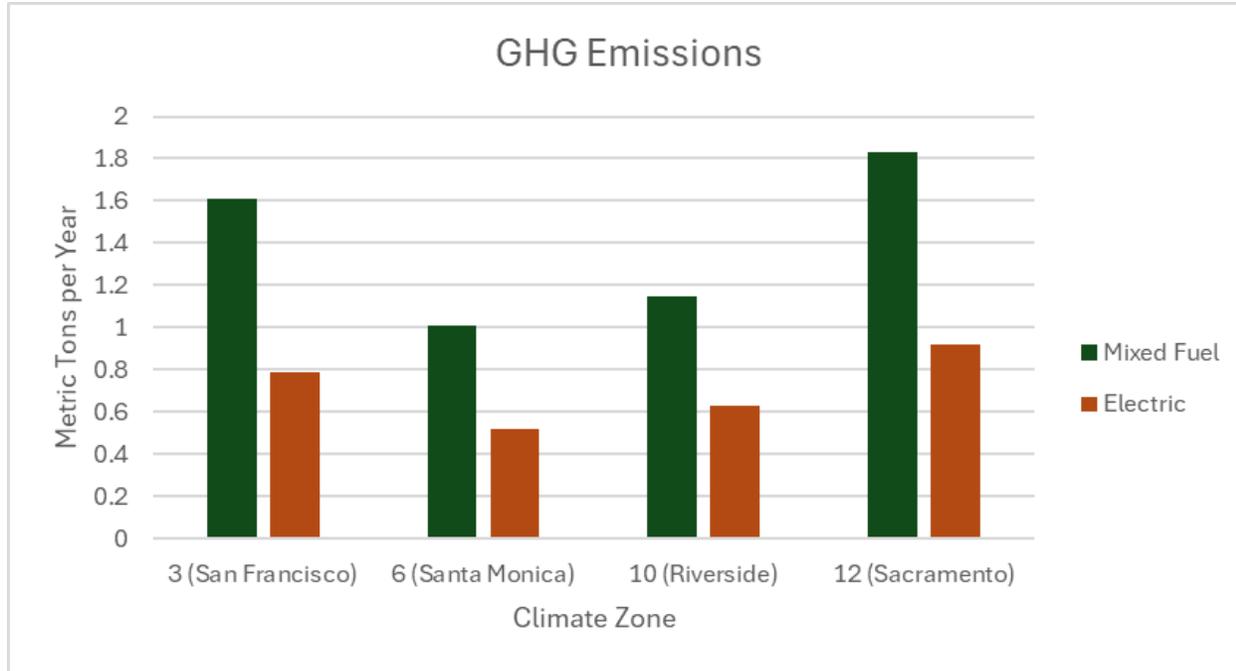
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BUILD

Building Initiative for Low-Emissions Development Program

All-Electric Designs Reduce GHG Emissions ~50%

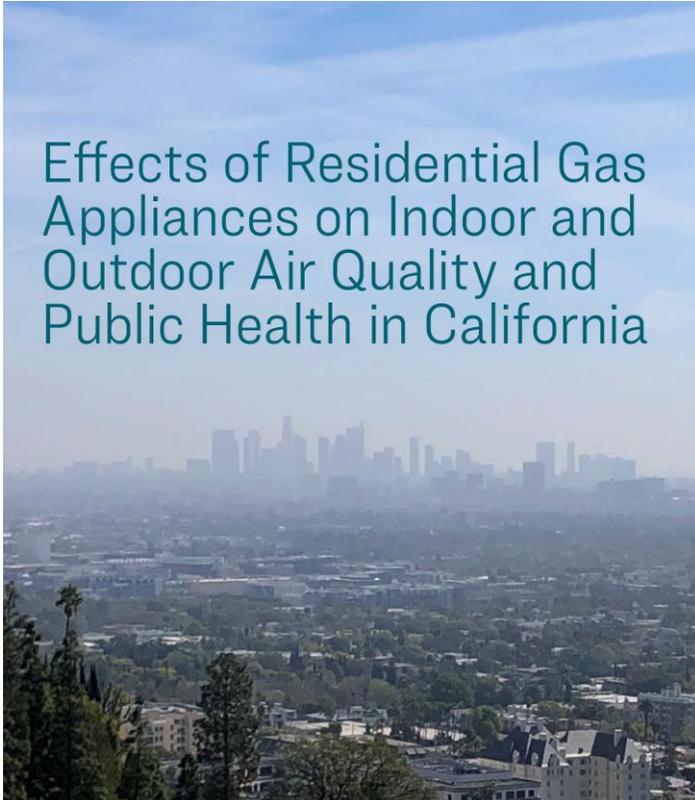


TIP: Use your compliance models to design for lower GHG emissions and Zero Net Carbon

Source: CBECC-RES 2025 modeling of new 2,700 sqft home with code compliant features. Note that mixed fuel designs require multiple upgrades not required for all-electric designs

Indoor Air Better Without Gas in the Home

Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California



UCLA Fielding School of Public Health
Department of Environmental Health Sciences
April 2020

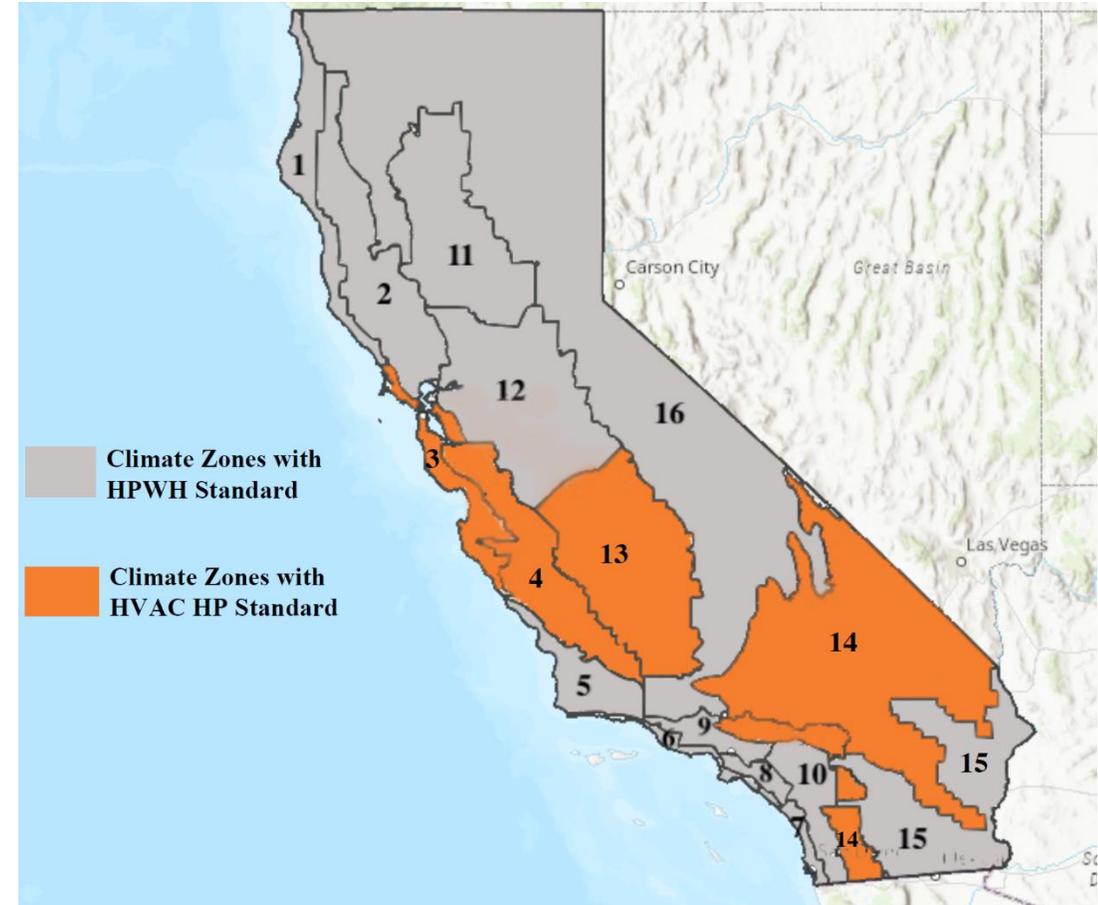


- AMA Study – Gas appliances increase risk of childhood Asthma.
- UCLA study found that 90% of homes exceed NOx limits after one hour of cooking
- 4 out of 9 natural gas cooktops exceeded NOx concentrations of 100 ppb
- RMI Study - 20% of childhood asthma in CA due to gas cooking
 - Children living in homes with gas cooking are 34% more likely to have Asthma



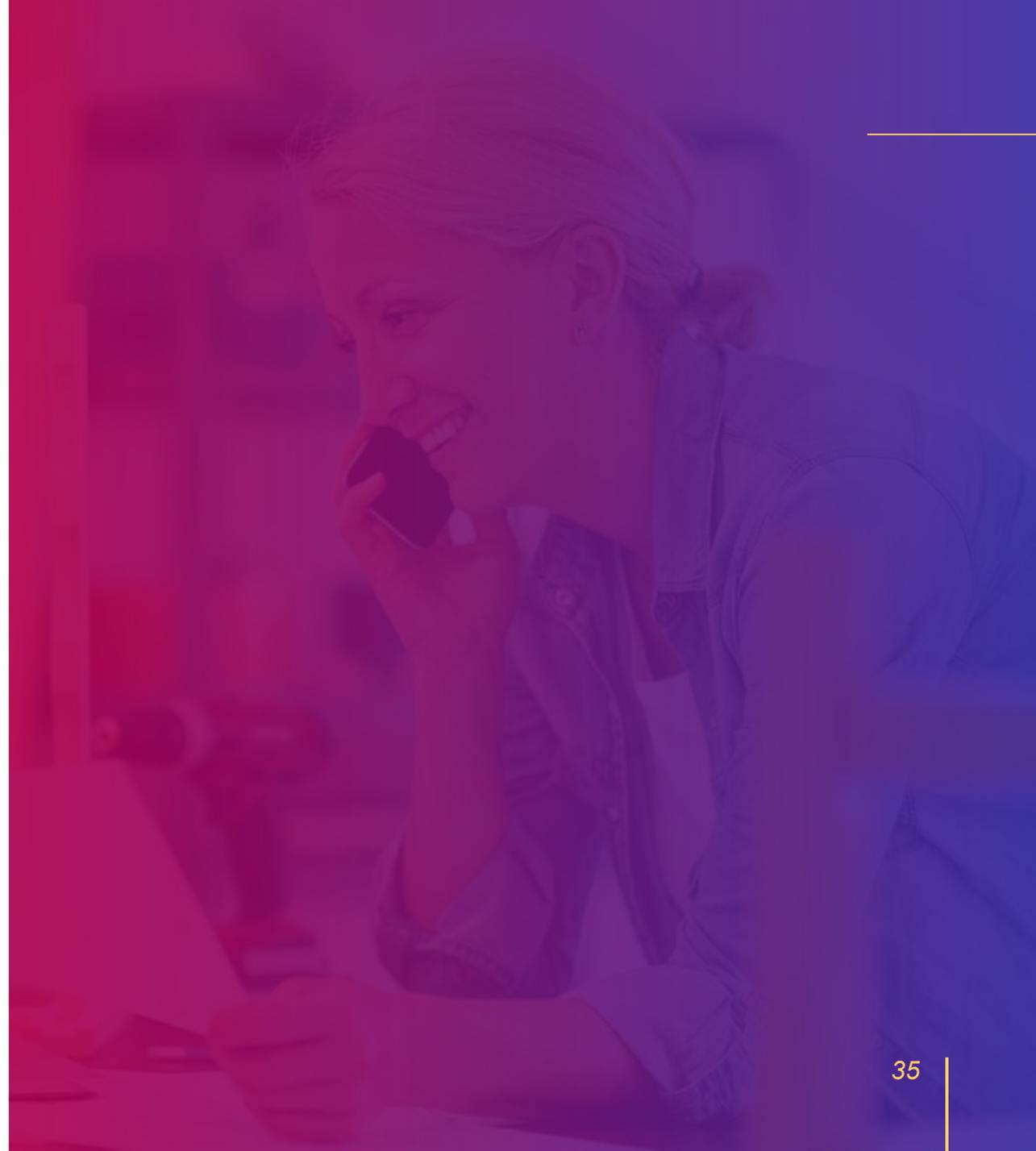
The 2022 & 2025 California Energy Code: Compliance Easier with All-Electric Systems

- Dedicated electrical circuits, plumbing etc. are required to backup every gas appliance installed
 - Except central HW in multifamily.
- New compliance metric measures GHG emissions
- Heat pumps prescriptive standard statewide for 2025
- Gas cooktops require additional mechanical ventilation than electric



Panel Sizing Matters

What's in it for you?



Why Panel Size Matters

What's in it for you?

- **Save on average \$3,000 maybe lots more!**
- **Save on service line upgrade to transformer**
- **Solar and batteries can go longer/better in outage**
- **Avoid upsizing of transformer**
- **Avoid upsizing of grid and related costs**
- **Makes decarbonization easier for all**

Why Panel Size Matters

— Bigger is not better:

Goal is to futureproof electrical/uses below and still have 20amps for EV charging @ 19miles/hour

- Knob & Tube wiring/Romex
- Solar & Battery
- EV Charging
- HP Washer/Dryer
- Furnace to HP
- HP Water Heater
- Induction cooking

Summary

Property Insurance and General Liability Insurance Policy Non-Renewals Due to Recalled Panels and Old Wiring

We are seeing a surge of non-renewals of property insurance and general liability insurance due to recalled panels and old wiring. Insurers are notifying property owners 1 month ahead of renewal date that the property will be dropped from coverage due to not meeting electrical requirements.

The timeline for replacing panels are long and often delayed by utility and building department processes, exacerbated by a global supply chain shortage of certified UL listed panels, meter stacks, and distribution centers.

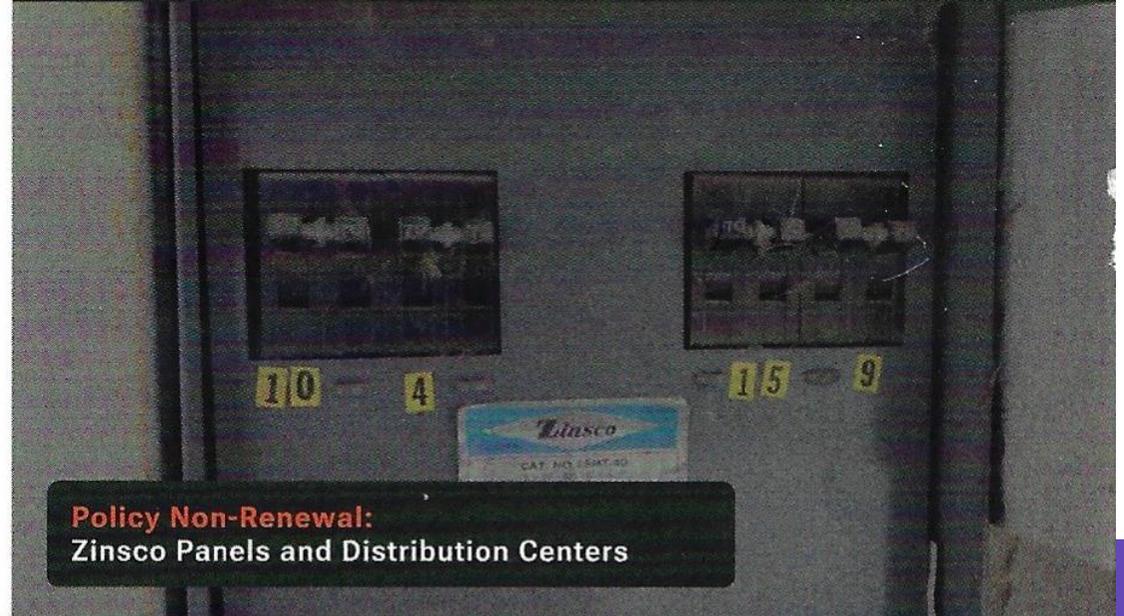
We strongly recommend property owners to start the upgrade or replacement process as soon as possible to avoid lapse in coverage. It takes 6 months to 12 months for a complete process.

Insurance Red Flags

- ✗ Federal Pacific ("Stab Lok") Panels, Meter Stacks, or Distribution Centers
- ✗ Zinsco Panels, Meter Stacks, or Distribution Centers
- ✗ Fuse Panels
- ✗ Knob-and-Tube Wiring
- ✗ Electrical Violations (e.g. wrong panel placement)



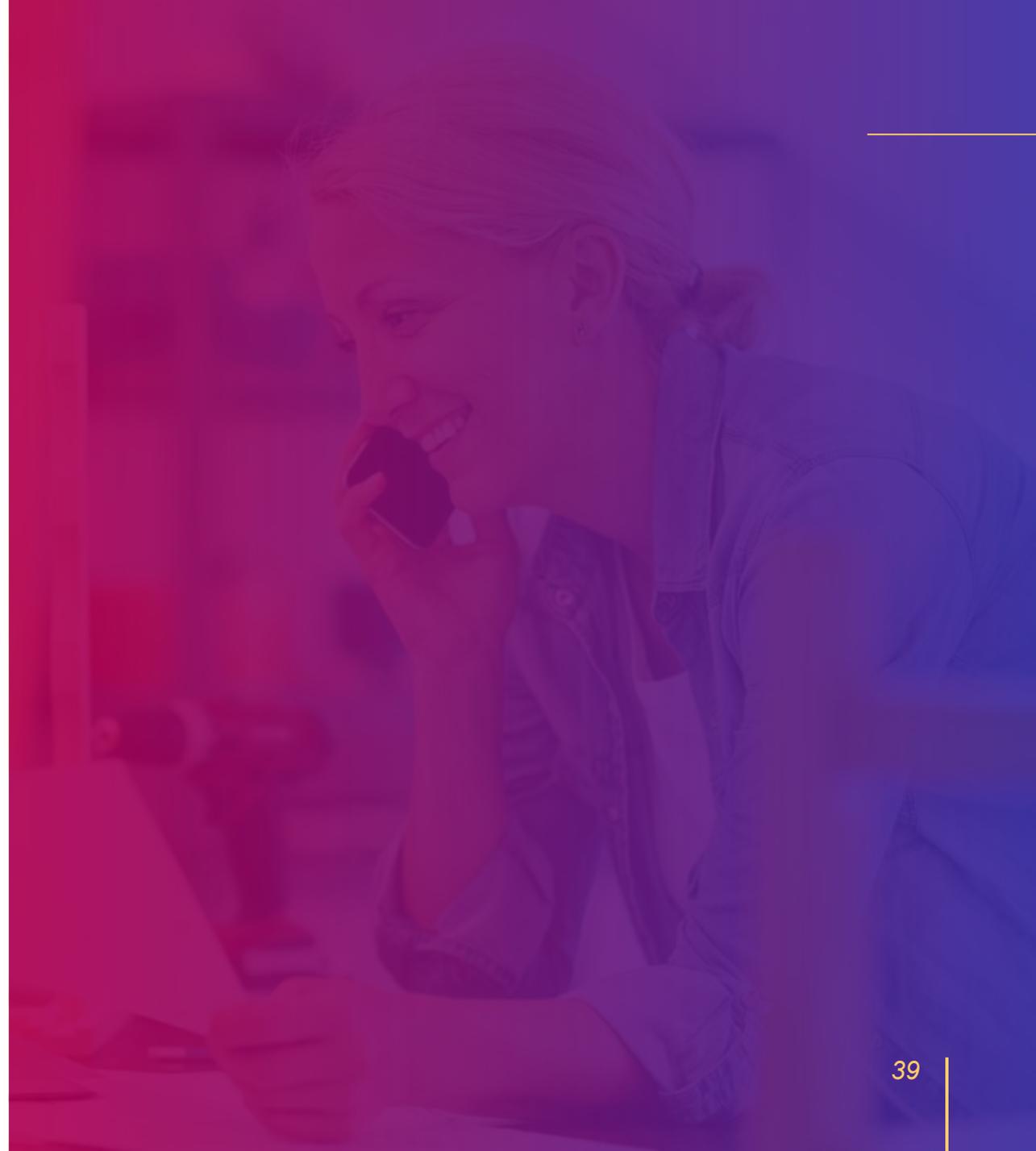
Policy Non-Renewal:
Federal Pacific Panels & Distribution Centers



Policy Non-Renewal:
Zinsco Panels and Distribution Centers

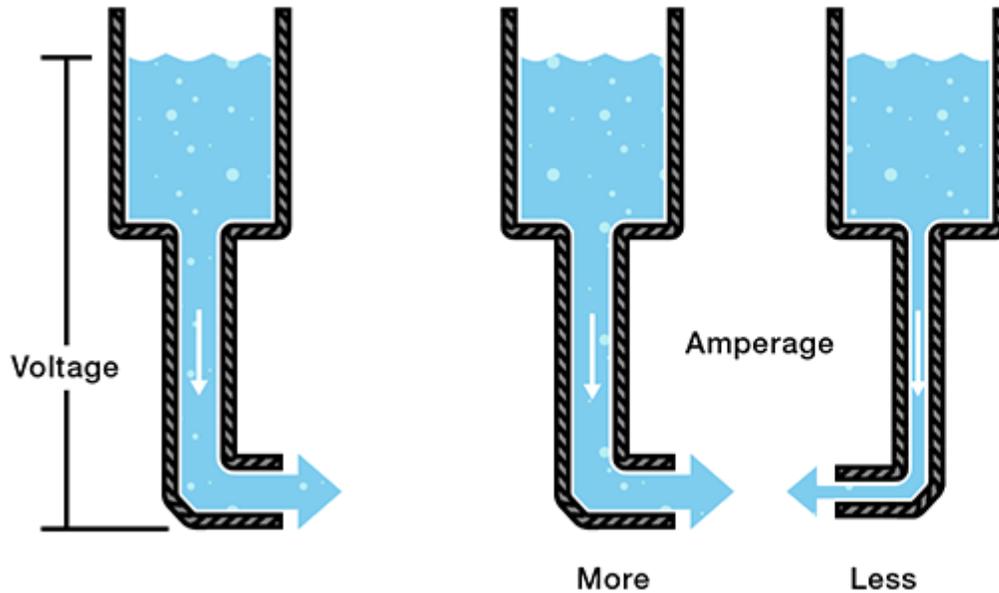
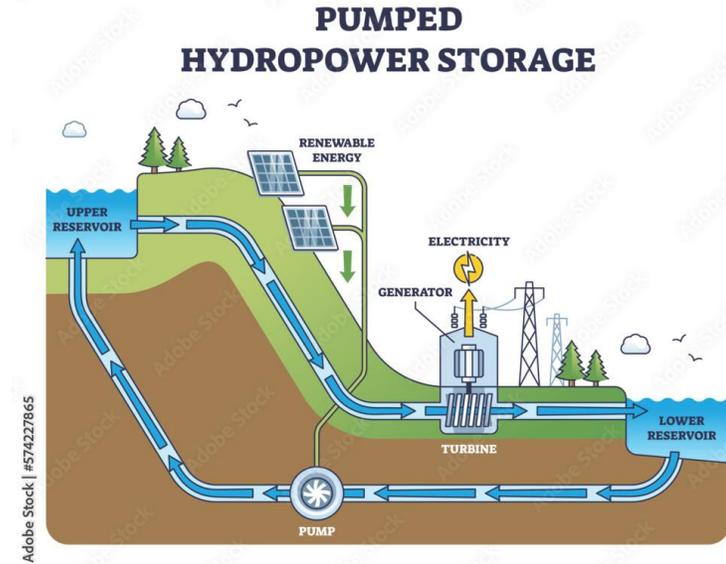


Panel Basics

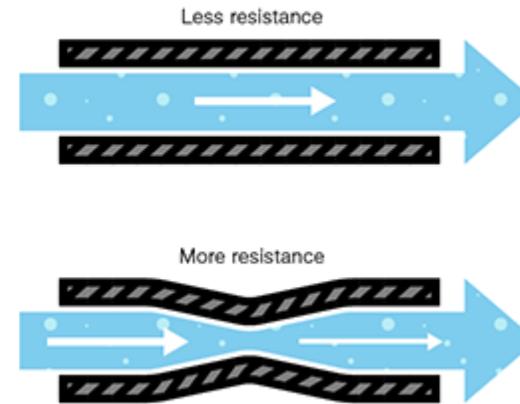


Electricity is like Plumbing

Pressure x Flow = Power
Volts x Amps = Watts

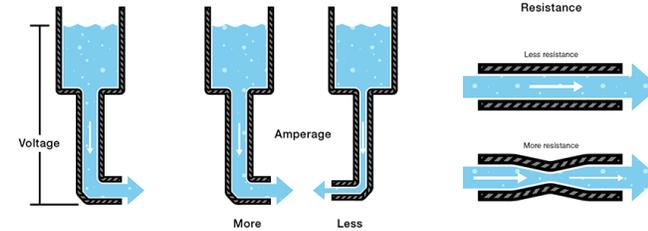


Resistance



Electricity is like Plumbing

Pressure x Flow = Power
Volts x Amps = Watts

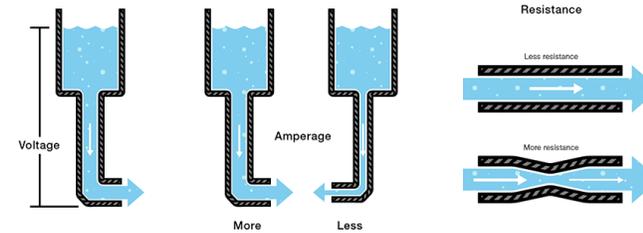


Kilowatt = kW = 1000 watts = measure of power

kWh = Kilowatt Hour = amount of energy used by a 1,000-watt appliance running for one hour

Electricity is like Plumbing

Pressure x Flow = Power
Volts x Amps = Watts

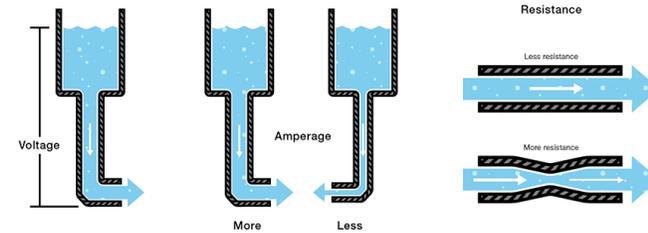


Peak Panel Capacities

- 80 amp panel = 240v x 80a = 19,200 watts or 19.2 kW
- 100 amp panel = 240v x 100a = 24,000 watts or 24 kW
- 200 amp panel = 240v x 200a = 48,000 watts or 48 kW

Electricity is like Plumbing

Pressure x Flow = Power
Volts x Amps = Watts



Average all-electric house in CA uses 12,128 kWh/year

Average 1,000 kWh/month @ .32/kWh = \$320

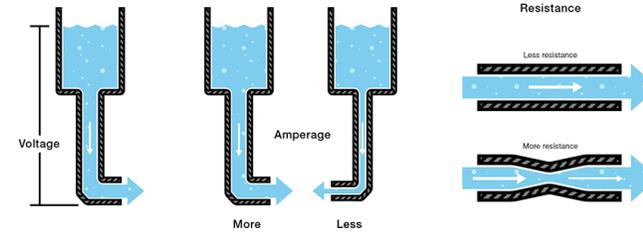
Average peak load is 10 kW

A 6.5 kW solar system generates 6.5 kW @ peak

Electricity is like Plumbing

Pressure x Flow = Power

Volts x Amps = Watts



- If 20 amps will do the job, it's better than 30 or 40 amps
- Common Mistakes
 - EV chargers
 - 120V 15 amp = 1.8 kW per hour = 6 miles per hour
 - 240V 20 amp = 4.8 kW per hour = 19 miles per hour
 - 240V 50 amp = 12 kW per hour = 48 miles per hour

		EV Battery Capacity			
		40kWh	60kWh	80kWh	100kWh
Charger Power Output	1.4kW	1.5 days	2.2 days	3 days	3.7 days
	1.9kW	1.1 days	1.6 days	2.2 days	2.7 days
	7.7kW	5.8 hours	8.7 hours	11.5 hours	14.4 hours
	9.6kW	4.6 hours	6.9 hours	9.3 hours	11.6 hours
	11.5kW	3.9 hours	5.8 hours	7.7 hours	9.7 hours
	150kW	16 minutes	24 minutes	32 minutes	40 minutes
	250kW	10 minutes	14 minutes	19 minutes	24 minutes

Calculating Panel Size: The National Electric Code



Sizing an Electrical Panel: National Electric Code 220 or NFPA 70

Method 1: Load Calculations

- Each system's electricity usage calculated
- Base load is derived from house square footage
- Heating/cooling system factored in at 100% full load
- EV chargers at 125% full load
- Other circuits at 40% coincident multiplier
- Size panel to sum of these calculated loads

Method 2: Historical Usage

- Use actual usage data for 1 year
Or 30 days with power meter
- Calculate maximum power usage in kW
- Size panel to maximum historical kW
- NOTE: this method not permitted if historical usage includes a renewable energy/PV system

Panel Upgrades

How Your Electrician Thinks

- Electrical Code governs panel sizing based on all the loads in your home
- Exceed the rated capacity and you'll need an upgrade
- Better to have too much power

How to Manage Your Electrician

- Show them your monthly electric usage for the past 12 months
- Give them the power requirements of your new electric systems
- Ask them to show you their calculations
- Think of the future: EV charging, PV panels, batteries, pool equipment and consider upgrading your panel

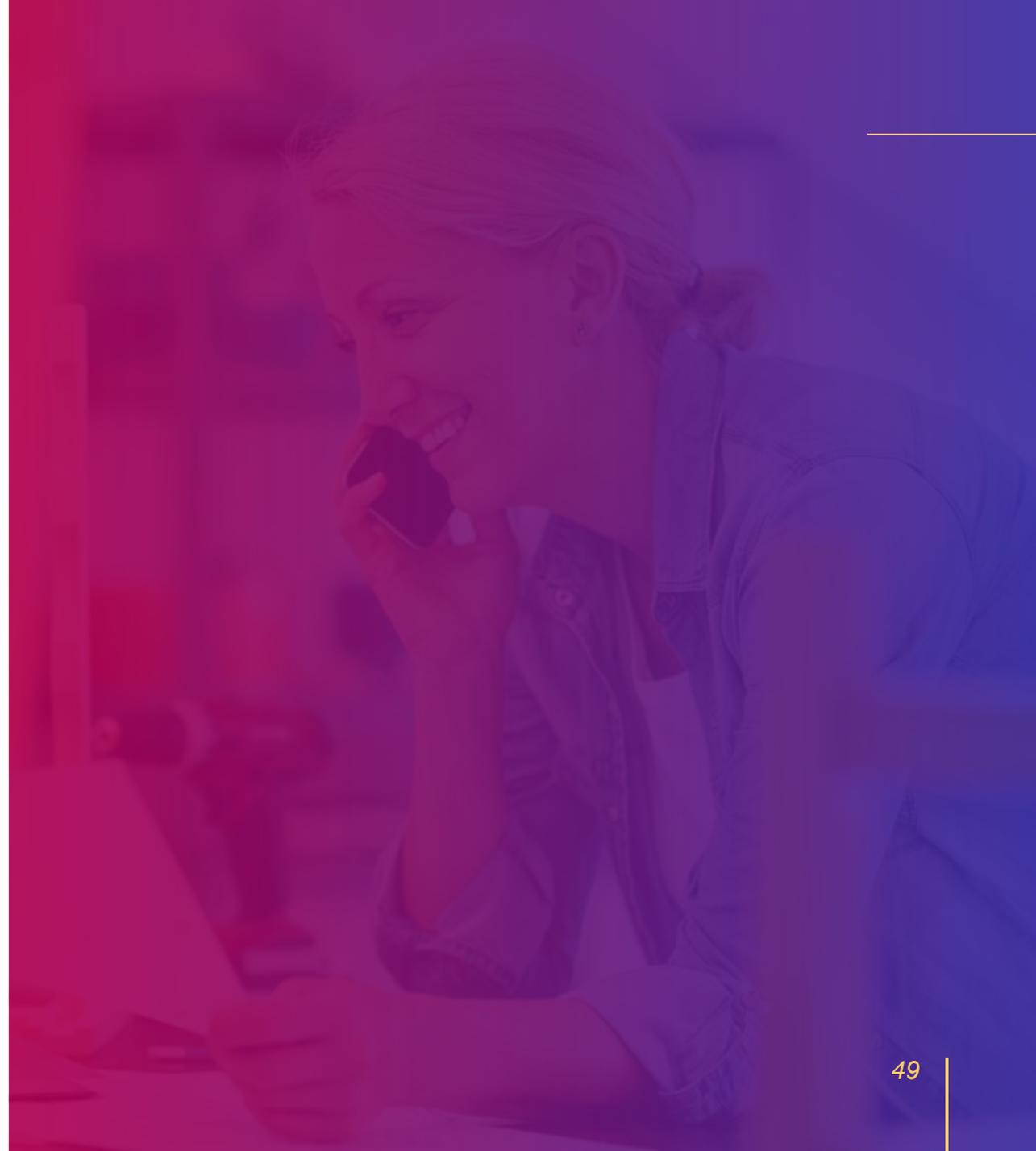
The Electrician's Pitfall That Leads to Big Panels

Gas (therms) x 29.3 = Equivalent kWh

- **Don't use gas bills and appliance nameplate information to make approximations**
- **Model the systems you plan to use with an energy consultant**
- **Find the circuit size needed**

Source: [EIA 2020 RECS Survey](#)

Tools to Evaluate Panel Size



Watt Diet

Helps You Fit into Your Panel

- Establish your base load (e.g., lighting and plugs often on)
- Enter your other loads and power requirements from tech sheets
- Watt Diet calculates the panel you need
- Allows for circuit sharing
- **Watt Diet Calculator**
- <https://www.redwoodenergy.net/watt-diet-calculator>

3. Determine "Watt Diet" and Panel Size						
Use the drop down menu for the type of products and volts, amps and the circuit size will autofill. Many product will use less than their rated circuit amperage, refer to the "Product Data" tab to see specification sheets for products show in the drop down menu. If you do not want to select a device, choose the ""Select Device"" option in the dropdown.						
Panel Baseline Assumptions						
Utility Service Volts (120, 240, 240 is most common)						240
Base Energy Use (defined by electrical code) (Watts)						5,573
3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps and circuit size will autofill with your selection. If you want to remove the selection, choose ""Select Device""						
	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square					5,850
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (note: laundry circuit must be 1500)					1,500
Laundry (note: if specified power is under the baseline, the baseline value is used.)	Washer (or combined)	Washing Machine: LG	120	-	10	1,200
	Dryer	Heat Pump Dryer: Miele (120V)	120	-	15	1,800
Kitchen	Fridge	Fridge: Frigidaire 20.4 cuft	120	6	-	720
	Optional: Garbage Disposal	Garbage Disposal: GE	120	4	-	480
	Optional: Dishwasher	Dishwasher: Frigidaire	120	-	10	1,200
	Optional: Kitchen Hood	Kitchen Hood: Broan	120	1.4	-	168
	Optional: Microwave	Microwave: Frigidaire (built-in)	120	9.2	-	1,104
	Range (oven and cooktop)	Range: Frigidaire Induction	240	41.6	-	9,984
	Oven	No Device	-	-	-	-
Water Heating	Water Heater	Heat Pump Water Heater: Rheem 30 Amp	240	21	-	5,040
		User Defined Heat Pump (Selected On Tab 2)	-	-	-	1,810
Heating, Cooling and Ventilation	Air Handler Fan (for central ducted system)	Air Handler Fan: General	120	4.6	-	552
		EV Charger	EVSE Level 2 (high)	240	32	40
3b. Power Management Selection: use the drop down menu to choose what strategy of power management you would like to use. The selections are representative of real products. An example of how it works: when selecting "car to dryer" the EV charging will pause when the dryer runs, therefore the lesser power draw of the two will be subtracted from the Watt Diet.						
Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-
			"Device" Watts:		Total Watts (before coincidence calculation)	
			"Panel" Watts:			
				Coincidence Factor	Watts	
				1	5,573	
				1	1,810	
				1.25	7,680	
				0.4	25,526	
					27,193	
					113	
					125	
					66,641	

Watt Diet Example: 125 amps

3. Determine "Watt Diet" and Panel Size

Use the drop down menu for the type of products and volts, amps and the circuit size will autofill. Many product will use less than their rated circuit amperage, refer to the "Product Data" tab to see specification sheets for products show in the drop down menu. If you do not want to select a device, choose the "Select Device" option in the dropdown.

Panel Baseline Assumptions	
Utility Service Volts (120, 240, 240 is most common)	240
Base Energy Use (defined by electrical code) (Watts)	5,573

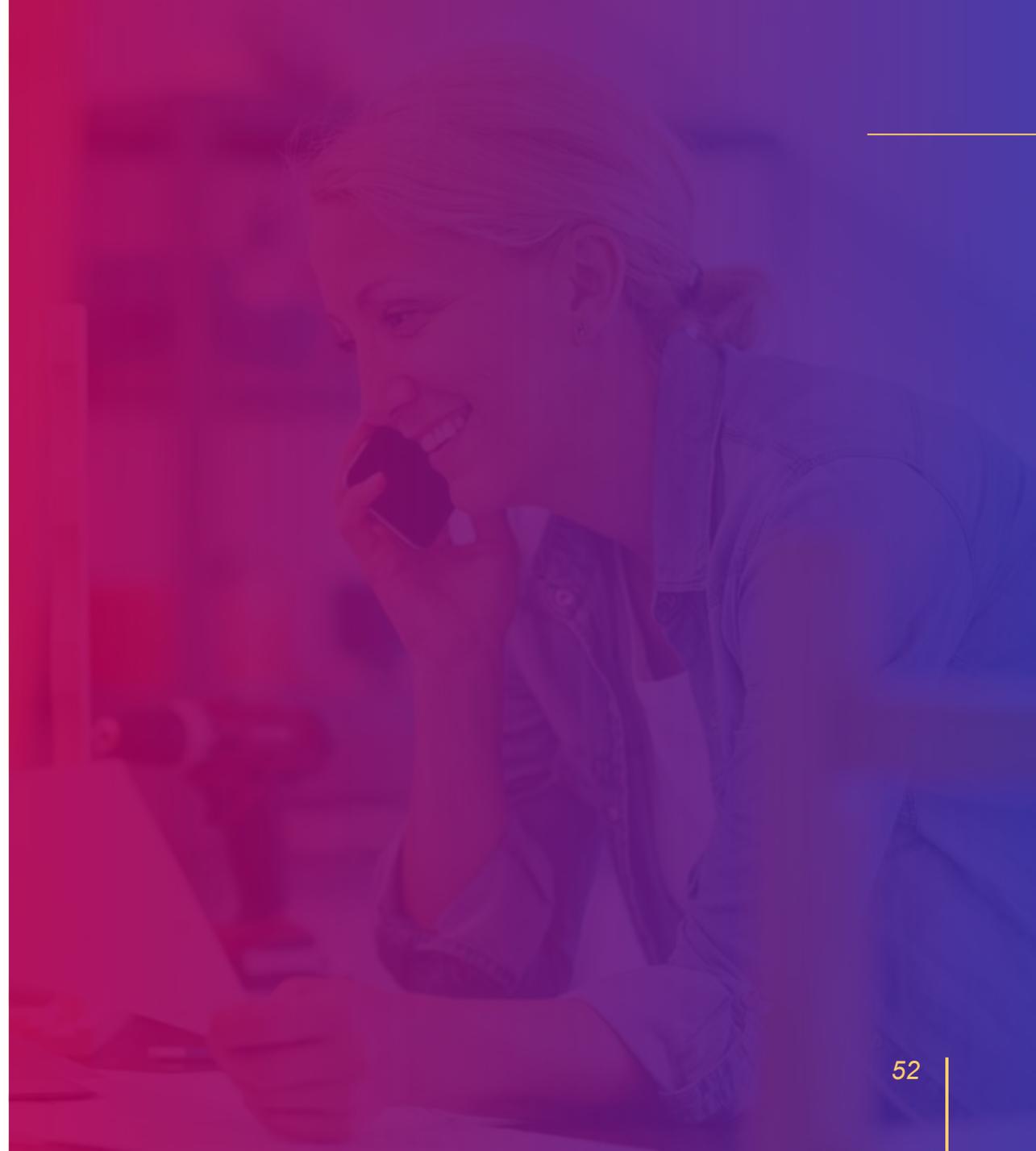
3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps and circuit size will autofill with your selection. If you want to remove the selection, choose "Select Device"

	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square					5,850
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (note: laundry circuit must be 1500)					1,500
Laundry (note: if specified power is under the baseline, the baseline value is used.)	Washer (or combined)	Washing Machine: LG	120	-	10	1,200
	Dryer	Heat Pump Dryer: Miele (120V)	120	-	15	1,800
Kitchen	Fridge	Fridge: Frigidaire 20.4 cuft	120	6	-	720
	Optional: Garbage Disposal	Garbage Disposal: GE	120	4	-	480
	Optional: Dishwasher	Dishwasher: Frigidaire	120	-	10	1,200
	Optional: Kitchen Hood	Kitchen Hood: Broan	120	1.4	-	168
	Optional: Microwave	Microwave: Frigidaire (built-in)	120	9.2	-	1,104
	Range (oven and cooktop)	Range: Frigidaire Induction	240	41.6	-	9,984
	Oven	No Device	-	-	-	-
Water Heating	Water Heater	Heat Pump Water Heater: Rheem 30 Amp	240	21	-	5,040
	User Defined Heat Pump (Selected On Tab 2)		-	-	-	1,810
Heating, Cooling and Ventilation	Air Handler Fan (for central ducted system)	Air Handler Fan: General	120	4.6	-	552
	Electric Vehicle Charging	EV Charger	EVSE Level 2 (high)	240	32	40

3b. Power Management Selection: use the drop down menu to choose what strategy of power management you would like to use. The selections are representative of real products. An example of how it works: when selecting "car to dryer" the EV charging will pause when the dryer runs, therefore the lesser power draw of the two will be subtracted from the Watt Diet.

Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-	
"Device" Watts:			Total Watts (before coincidence calculation)				40,588
"Panel" Watts:				Coincidence Factor	Watts		
			Baseload Watts	1	5,573		
			Heat Pump Watts	1	1,810		
			EV Charging Watts	1.25	7,680		
			Remaining Watts	0.4	25,526		
			Total Panel Watts		27,193		
			Total Panel Amps		113		
			Minimum Panel Size		125		
			Allowed Watts		66,641		

Making a Small Panel Work



Making a Small Panel Work

- 1) Choose power-efficient appliances (e.g., 120V)
- 2) Use high efficiency appliances
(e.g., 20+ SEER2 heat pumps)
- 3) Use circuit sharing and circuit pausing devices
- 4) Right-size HVAC systems
- 5) Decrease your loads (especially on HVAC)



Power-efficient Appliances

- If 120V will do the job, it's better than 240V
- If 20 amps will do the job, it's better than 30 or 40 amps
 - *HVAC systems*
 - *Run load calcs to see if 20 amp HVAC system will work instead of 30 amp*
 - *Water heaters*
 - *NEVER choose electric; use Heat Pump Water Heaters*

TAX CREDIT ELIGIBLE

Hybrid Heat Pump Water Heater
(15 AMP plugin model)



Visit energystar.gov for details

*Effective January 1, 2023. Tax Credit limited to 30% of the cost of equipment & installation up to \$2,000. Consult a tax advisor for qualifications and visit energystar.gov for additional details



High Efficiency Appliances

- The more efficient the appliance, the less electricity it needs to do the same work

Examples

- HVAC: 21 SEER2 heat pump does 50% more work than 14 SEER2 air conditioner
- Refrigerators: choose one that uses 700 kWh per year, not 1,000 kWh per year
- Water heaters: Heat pump water heaters have COP of ~3.5
 - *3.5 COP = 350% efficient*
 - *Electric tankless are maximum 96% efficient, so they use ~4X more electricity*
- Ranges: induction is ~80% efficient; electric is ~60% efficient; gas is ~40% efficient



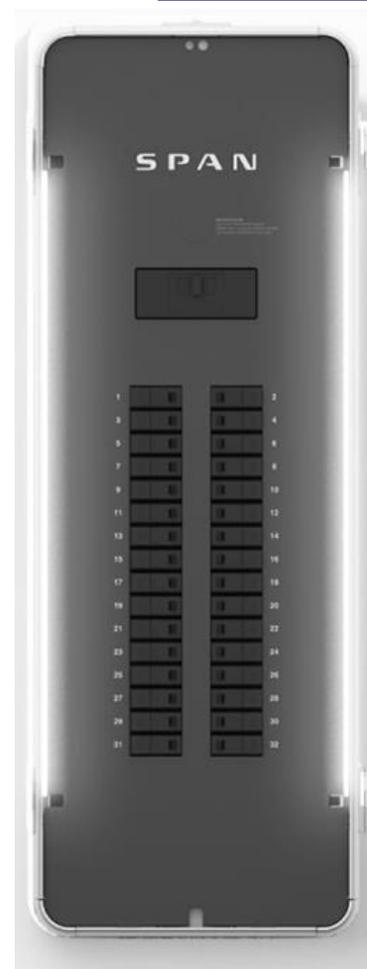
Load Management Devices

When you have more load than your panel/service can deliver:

- Install 2 appliances on one circuit with a circuit sharing device
- Install 2 appliances on one circuit with a circuit pausing device
- Or use smart breakers to manage loads through the app

When you need more physical space for breakers:

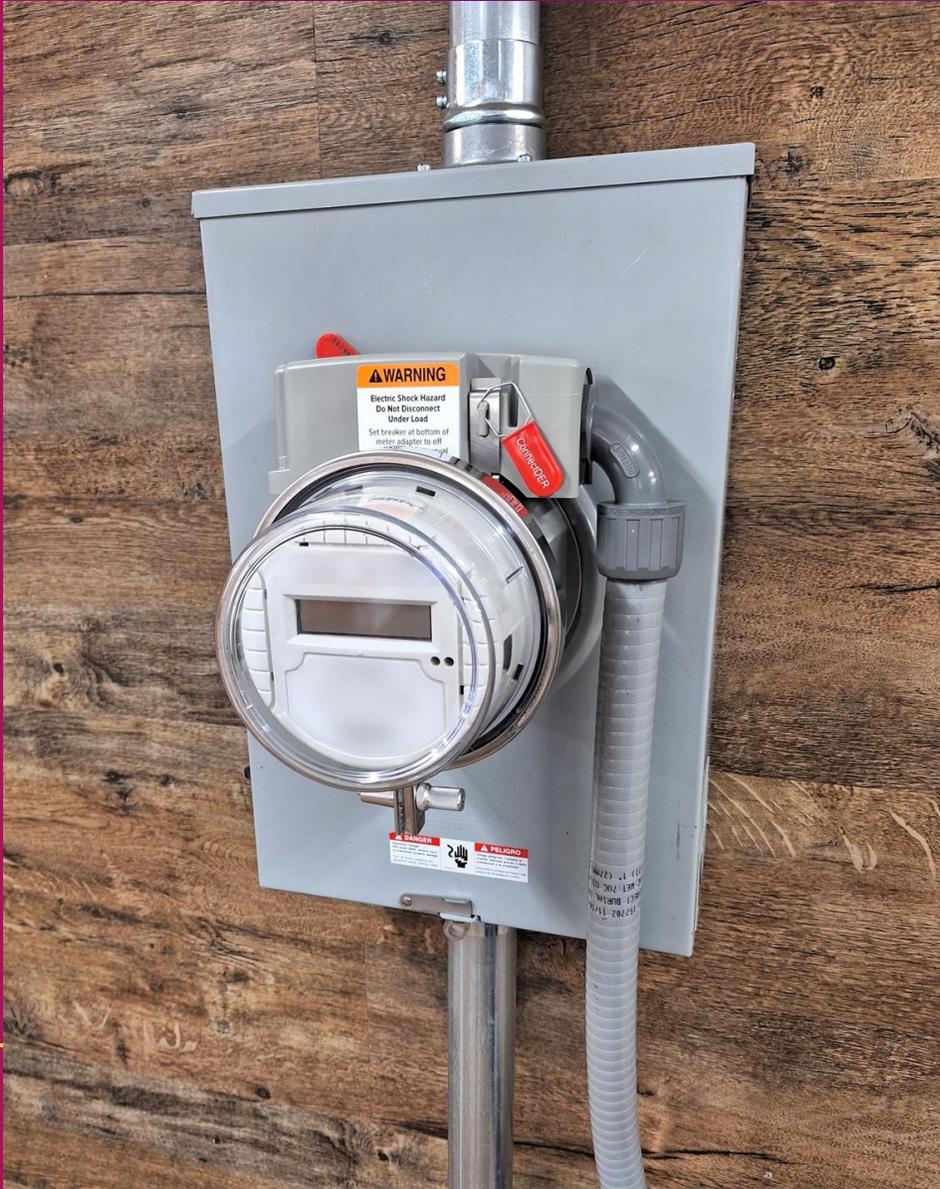
- Use tandem breakers
- Join two low-load circuits together (e.g., lighting)
- Install solar system using meter collar



Load Management Devices



Meter Collars for PV



- For space-constrained electric panels
- Connect PV system to meter, instead of using a breaker in the electric panel

Right-sizing

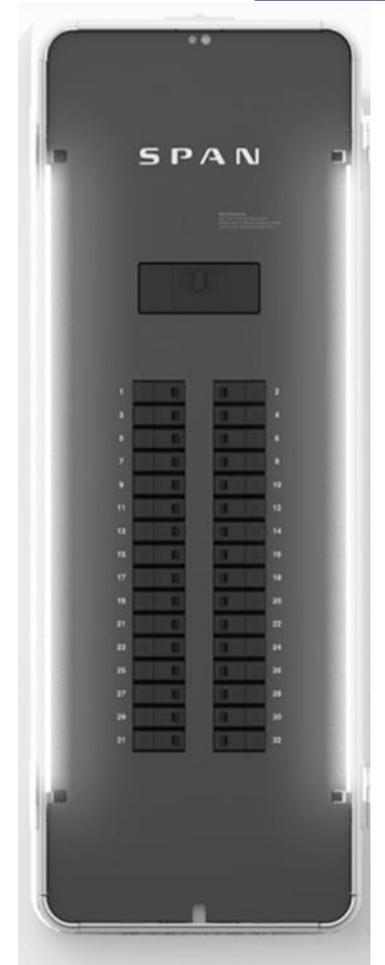
- HVAC systems are commonly sized 2X maximum load
- Pay for ACCA Manual J load calculations to minimize panel problems
- Go ductless
- Upgrade your building envelope if possible to reduce loads
- Choose reasonable size cooking, laundry, water heaters, pools, etc.



NEC Code Changes

Section 220.70

Allows the use of digital energy management systems to limit the maximum current used by the electrical system.



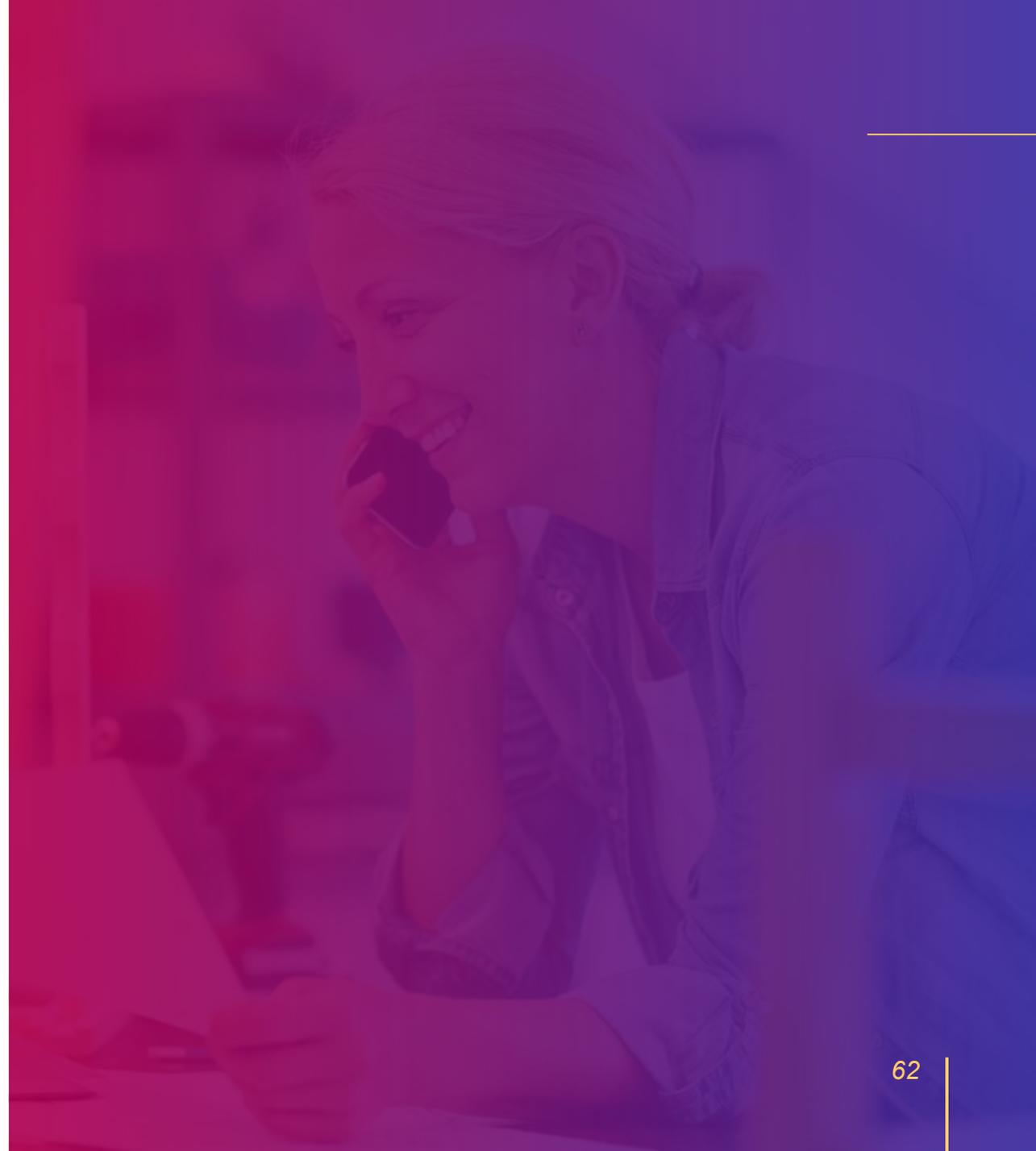
NEC Code Changes

Section 625.42

Recognizes modern electric vehicle supply equipment (EVSE) with adjustable settings and energy management systems (EMS), which allows for more flexible and cost-effective installations.



Case Studies



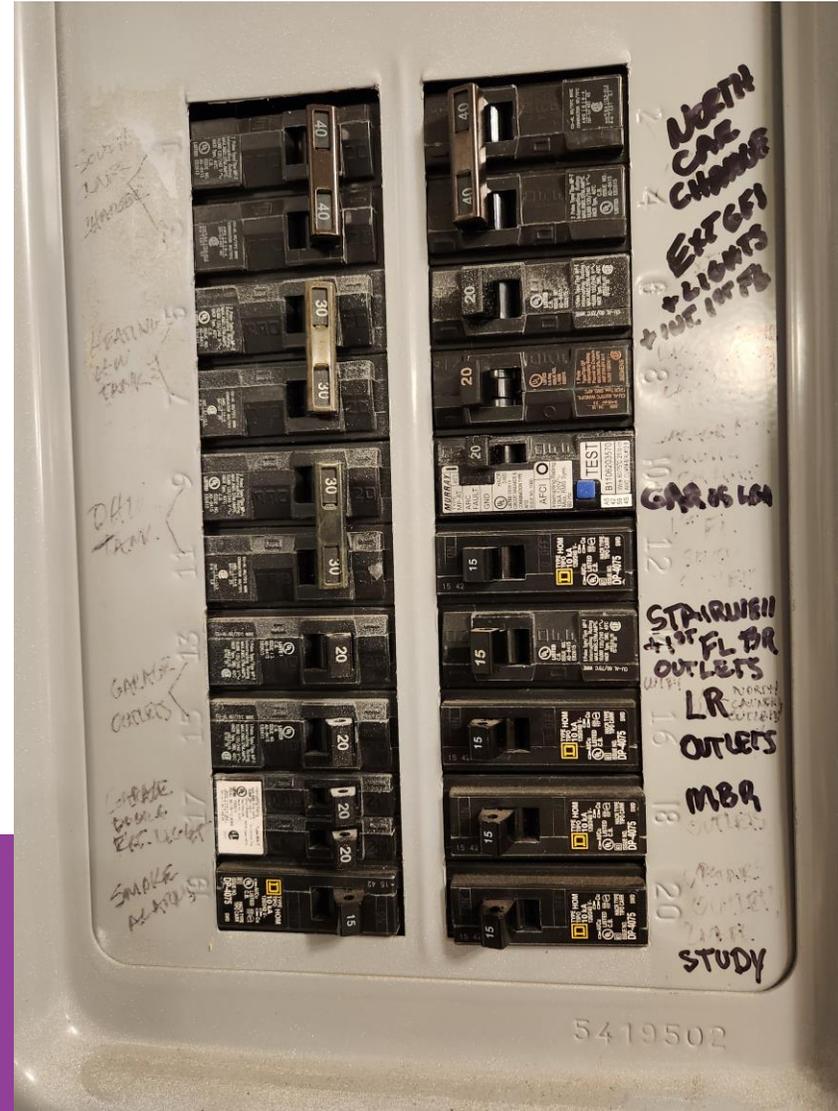
Green Idea House: All-electric on 200 amps



SHOP
TAX
FREE

Panel and Sub-panel

Early Sizing Experiment

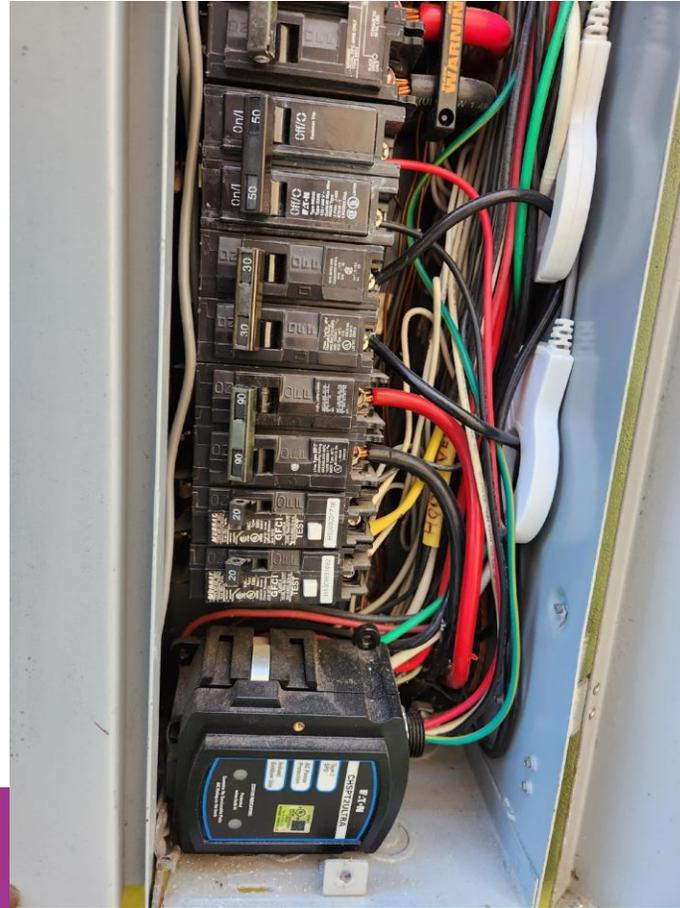


Have One Trench – Not Two

With Gas – Additional Trenching, Hookup and Meter Charges



Install and Check Your Whole house Surge Protector



Typical Difficulty

1930's Bungalow with 80 Amp Service



SHOP
TAX
FREE

Power- and Energy-efficient Equipment: Packaged Terminal Heat Pumps



Ephoca

SHOP
TAX
FREE

120v HP Washer Dryer Combo



SHOP
TAX
FREE

120v Induction Cooking

TRUE INDUCTION TI-2B Built-In Double Burner Induction Glass Cook-Top 120V Black

★★★★★ 197

\$380⁰⁰



- German made Schott-Ceran smooth ceramic glass that is scratch, chip/shatter, high heat resistant and has no crevices for controls making it simple to clean. The unit has a one piece ceramic glass surface made for easy cleaning. All that is needed is a damp cloth to wipe down the top.
- There are multiple safety features within the unit, it has a built-in safety turn-off feature that registers when the cookware is removed from the burner and placed back on, allowing for a safe cooking experience. Once the cooktop reaches its maximum temperature of 450 degrees, it will stay at that temperature and will not exceed it .
- 1800 watts of cooking power and can run off a standard 110 outlet.
- This unit can also be portable and placed wherever you would like, which is beneficial for dorm rooms, camping, or needing extra burners for a special occasion. True Induction is the choice cooktop of Winnebago and many other RV manufacturers.
- Includes True Induction's trademark EZ touch controls and child safety controls.
- Glass Top Measurement: 24 3/8" Width x 15" Depth
- Base Measurement: 23 5/8" Width x 14 1/8" Depth x 2 1/4" Height

[Show less](#)

SHOP
TAX
FREE

120v Induction Cooking: with Onboard Batteries



Impulse

Channing Street Copper



Watt Diet: 80 amp panel

Panel Baseline Assumptions						
Utility Service Volts (120, 240, 240 is most common)					240	
Base Energy Use (defined by electrical code) (Watts)					4,838	
3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps and circuit size will autofill with your selection. If you want to remove the selection, choose **Select Device**						
	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square					3,750
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (note: laundry circuit must be 1500 Watts)					1,500
Laundry (note: if specified power is under the baseline, the baseline value is used.)	Washer (or combined)	Washing Machine: LG	120	-	10	1,200
	Dryer	Heat Pump Dryer: Miele (120V)	120	-	15	1,800
Kitchen	Fridge	Fridge: Frigidaire 20.4 cuft	120	6	-	720
	Optional: Garbage Disposal	Garbage Disposal: GE	120	4	-	480
	Optional: Dishwasher	Dishwasher: Frigidaire	120	-	10	1,200
	Optional: Kitchen Hood	Kitchen Hood: Broan	120	1.4	-	168
	Optional: Microwave	Microwave: Frigidaire (built-in)	120	9.2	-	1,104
	Range (oven and cooktop)	Range: Frigidaire Induction	240	41.6	-	9,984
	Oven	No Device	-	-	-	-
Water Heating	Water Heater	Heat Pump Water Heater: Rheem 120V / 15A	120	7.5	-	900
Heating, Cooling and Ventilation	User Defined Heat Pump (Selected On Tab 2)		120	20	20	1,000
	Second Heat Pump	PTHP: Innova DK92 (second largest)	120	15	20	1,800
Electric Vehicle Charging	EV Charger	EVSE Level 2 (low)	240	16	20	3,840
3b. Power Management Selection: use the drop down menu to choose what strategy of power management you would like to use. The selections are representative of real products. An example of how it works: when selecting "car to dryer" the EV charging will pause when the dryer runs, therefore the lesser power draw of the two will be subtracted from the Watt Diet.						
Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-
"Device" Watts:			Total Watts (before coincidence calculation)		30,946	
"Panel" Watts:				Coincidence Factor	Watts	
				1	4,838	
				1	1,000	
				1.25	3,840	
				0.4	21,269	
					19,145	
					80	
					80	
					40,744	

SHOP TAX FREE

Two Houses on 225 amps



Main house:

- 200 amp panel
- Mixed fuel, planning to electrify
- 4 kW PV system

ADU being added:

- All-electric
- 4 kW PV system

Will they fit in 200 amps???

Two Houses on 225 amps

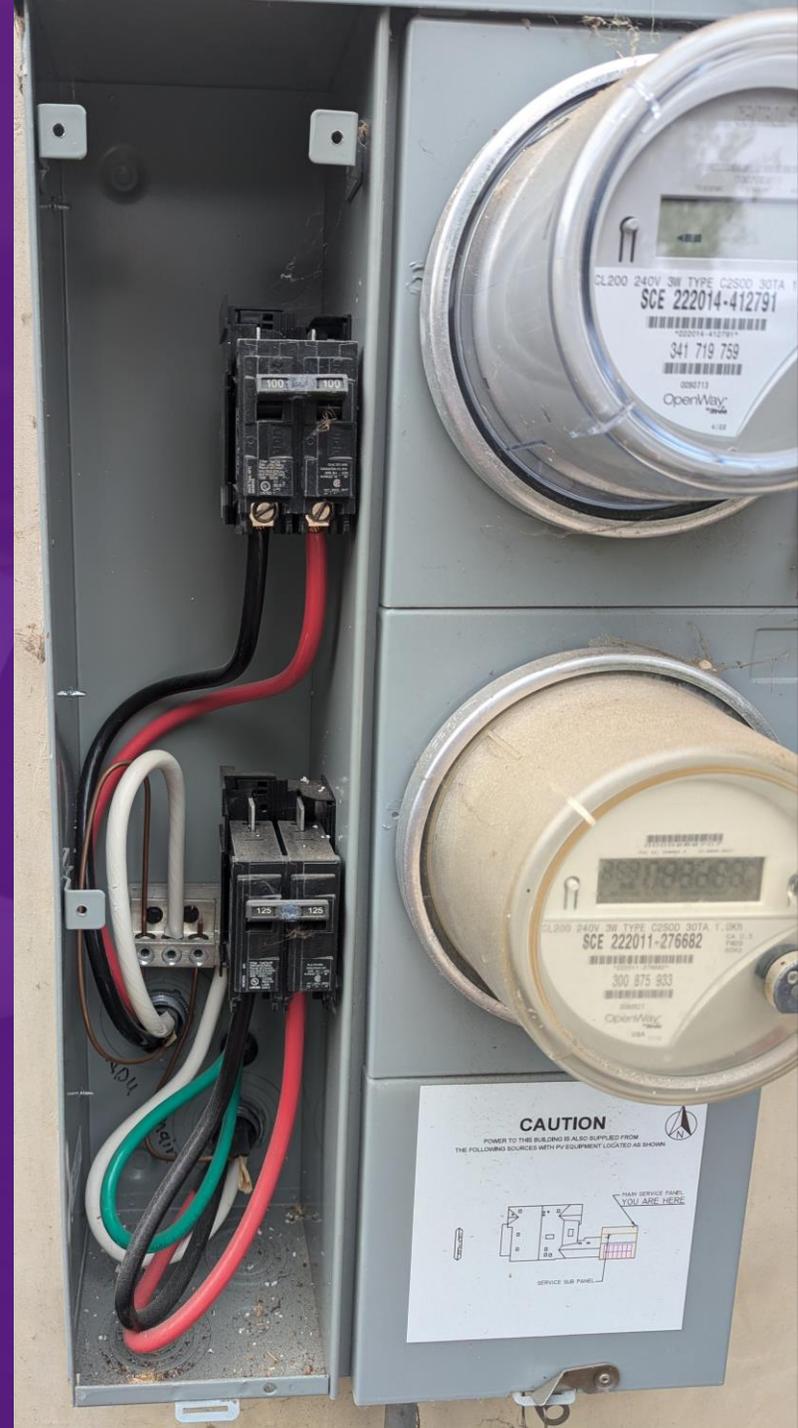


Main house:

- 125 amp service
- 200 amp panel becomes subpanel
- All electric
- 4 kW PV system

ADU:

- New 100 amp service and subpanel
- All electric
- 4 kW PV system



GARAGE
 GARAGE
 OFFICE
 OVEN
 MSTR BED
 BATH OUTLETS
 LIVING RM
 LIGHTS
 ISLAND
 BACK PORCH
 COOK TOP
 HV
 AC
 KITCHEN
 DISH WASH
 FRT LIGHT
 X MAS
 OFFICE
 KITCHEN WASHER
 DISPOSAL
 FAU

5419501

Washer
 Oven
 oven
 Dryer
 Bath
 A/C
 A/C
 water
 Heater
 Water
 Water
 Heater
 HRV
 solar
 solar

Light
 Kitchen counter
 Kitchen counter
 Livingroom
 Bedroom
 Dish
 Garbage
 micro
 Fridge

5419501

3. Determine "Watt Diet" and Panel Size

Use the drop down menu for the type of products and volts, amps and the circuit size will autofill. Many product will use less than their rated circuit amperage, refer to the "Product Data" tab to see specification sheets for products show in the drop down menu. If you do not want to select a device, choose the "***Select Device***" option in the dropdown.

Panel Baseline Assumptions	
Utility Service Volts (120, 240, 240 is most common)	240
Base Energy Use (defined by electrical code) (Watts)	5,573

3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps and circuit size will autofill with your selection. If you want to remove the selection, choose ***Select Device***

	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square foot					5,850
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (note: laundry circuit must be 1500 Watts)					1,500
Laundry (note: if specified power is under the baseline, the baseline value is used.)	Washer (or combined)	Washing Machine: Samsung	120	-	15	1,800
	Dryer	Heat Pump Dryer: Miele (120V)	120	-	15	1,800
Kitchen	Fridge	Fridge: Frigidaire 27.6 cuft	120	8.5	-	1,020
	Optional: Garbage Disposal	Garbage Disposal: GE	120	4	-	480
	Optional: Dishwasher	Dishwasher: Frigidaire	120	-	10	1,200
	Optional: Kitchen Hood	Kitchen Hood: Broan	120	1.4	-	168
	Optional: Microwave	Microwave: Frigidaire (built-in)	120	9.2	-	1,104
	Range (oven and cooktop)	No Device	-	-	-	-
	Oven	Oven: Built in GE	240	11.9	20	2,856
Cooktop	Cooktop: Frigidaire 4 Element 30in	240	35	40	8,400	
Water Heating	Water Heater	Heat Pump Water Heater: Rheem 120V / 15A	120	15	-	1,800
Heating, Cooling and Ventilation	User Defined Heat Pump (Selected On Tab 2)		240	30	40	1,570
	Second Heat Pump	No Device	120	15	20	-
Solar Panels	4.4 kW PV system		240	20	20	4,800
Electric Vehicle Charging	EV Charger	EVSE Level 2 (high)	240	32	40	7,680

3b. Power Management Selection: use the drop down menu to choose what strategy of power management you would like to use. The selections are representative of real products. An example of how it works: when selecting "car to dryer" the EV charging will pause when the dryer runs, therefore the lesser power draw of the two will be subtracted from the Watt Diet.

Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-
	"Device" Watts:		Total Watts (before coincidence calculation)			43,528
	"Panel" Watts:			Coincidence Factor	Watts	
			Baseload Watts	1	5,573	
			Heat Pump Watts	1	1,570	
			EV Charging Watts	1.25	7,680	
			Remaining Watts	0.4	28,706	
			Total Panel Watts		28,225	
			Total Panel Amps		118	
			Minimum Panel Size		125	
			Allowed Watts		66,641	

3. Determine "Watt Diet" and Panel Size

of products and volts, amps and the circuit size will autofill. Many product will use less than their rated circuit

Panel Baseline Assumptions	
Utility Service Volts (120, 240, 240 is	240
Base Energy Use (defined by electrical	4,130

3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps and circuit size

	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square foot					1,728
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (note: laundry circuit must be 1500 Watts)					1,500
Laundry (note: if specified power is under the baseline, the baseline value is used.)	Washer (or combined)	Washing Machine: Samsung	120	-	15	1,800
	Dryer	Heat Pump Dryer: Miele (120V)	120	-	15	1,800
Kitchen	Fridge	Fridge: Frigidaire 20.4 cuft	120	6	-	720
	Optional: Garbage Disposal	Garbage Disposal: GE	120	4	-	480
	Optional: Dishwasher	Dishwasher: Frigidaire	120	-	10	1,200
	Optional: Kitchen Hood	No Device	-	-	-	-
	Optional: Microwave	Microwave: Samsung (with exhaust fan)	120	13.5	15	1,620
	Range (oven and cooktop)	Range: Frigidaire Induction	240	41.6	40	9,984
	Oven	No Device	-	-	-	-
Cooktop	No Device	-	-	40	-	
Water Heating	Water Heater	Heat Pump Water Heater: Rheem 30 Amp	240	15	-	3,600
Heating, Cooling and Ventilation	User Defined Heat Pump (Selected On Tab 2)		240	20	20	1,570
	Second Heat Pump	No Device	120	15	20	-
Electric Vehicle Charging	EV Charger	No Device	-	-	-	-

3b. Power Management Selection: use the drop down menu to choose what strategy of power management you

Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-
	"Device" Watts:		Total Watts (before coincidence calculation)			27,502
	"Panel" Watts:			Coincidence Factor	Watts	
			Baseload Watts	1	4,130	
			Heat Pump Watts	1	1,570	
			EV Charging Watts	1.25	-	
			Remaining Watts	0.4	21,802	
			Total Panel Watts		14,421	
			Total Panel Amps		60	
			Minimum Panel Size		80	
			Allowed Watts		41,805	

10-unit All-electric Apartment Building on 600 amps



Current Systems:

- Gas furnaces in each unit, No cooling
- Gas central hot water system
- Gas ranges
- Gas central clothes dryer
- 200 amp main panel, 40 amp subpanels
- Insurance requiring 400 amp main panel upgrade & replacing subpanels

Envisioned Systems:

- Heat pumps in each unit, heating & cooling
- Heat pump central water heating system
- Induction ranges
- Electric/heat pump central clothes dryer
- 600 amp main panel, 60 amp subpanels



3. Determine "Watt Diet" and Panel Size

of products and volts, amps and the circuit size will autofill. Many product will use less than their rated circuit

Panel Baseline Assumptions		
Utility Service Volts (120, 240, 240 is		240
Base Energy Use (defined by electrical		4,575

3a. Device Selection: Use the drop down menu to determine each device, the voltage, rated amps, and circuit size

	Device	Select with Dropdown Menu	Volts	Rated Amps	Circuit Size (Amps)	Calculated Power (Watts)
Baseline Loads (specified by NEC)	Lighting+Plugs 3W/square foot					3,000
	Kitchen Countertop Circuits					3,000
	Laundry Circuit (<i>note: laundry circuit must be 1500 Watts</i>)					1,500
Laundry (<i>note: if specified power is used the baseline the baseline must be</i>)	Washer (or combined)	No Device	-	-	-	-
	Dryer	No Device	-	-	-	-
Kitchen	Fridge	Fridge: Frigidaire 20.4 cuft	120	6	-	720
	<i>Optional: Garbage Disposal</i>	Garbage Disposal: GE	120	4	-	480
	<i>Optional: Dishwasher</i>	Dishwasher: Frigidaire	120	-	10	1,200
	<i>Optional: Kitchen Hood</i>	Kitchen Hood: Broan	120	1.4	-	168
	<i>Optional: Microwave</i>	Microwave: Frigidaire (built-in)	120	9.2	-	1,104
	Range (oven and cooktop)	Range: Frigidaire Induction	240	41.6	-	9,984
	Oven	No Device	-	-	-	-
Water Heating	Water Heater	No Device	-	-	-	-
	Cooktop	No Device	-	-	-	-
Heating, Cooling and Ventilation	User Defined Heat Pump (Selected On Tab 2)		120	20	20	1,000
	Second Heat Pump	No Device	120	15	20	-
Electric Vehicle Charging	EV Charger	No Device	-	-	-	-

3b. Power Management Selection: use the drop down menu to choose what strategy of power management you would like to use. The selections are

Power Sharing	Circuit Sharing Device	No Device	-	-	Watts Saved	-
----------------------	------------------------	-----------	---	---	-------------	---

"Device" Watts:		Total Watts (before coincidence calculation)	20,656
------------------------	--	--	--------

"Panel" Watts:		Coincidence Factor	Watts
Baseload Watts		1	4,575
Heat Pump Watts		1	1,000
EV Charging Watts		1.25	-
Remaining Watts		0.4	15,081
Total Panel Watts			11,607
Total Panel Amps			48
Minimum Panel Size			50
Allowed Watts			23,138

Each unit: 50 amps & Central HW & Laundry 100 amps

The Homeowner Electrification Worksheet & Scavenger Hunt

Homeowner Electrification Worksheet & Scavenger Hunt

Attention, homeowners! Your mission is to get clear on your goals and then embark on a scavenger hunt within the walls of your very own home.

What are your project goals? Check all that apply:

- Save on first costs through incentives/tax credits
- Save on operating expenses/fuel charges
- Make the house more comfortable
- Reduce health and safety risks
- Reduced localized pollution
- Other _____

List the age, condition, and life expectancy for each:

Items	Age	Condition	Life Expectancy

WORKING WITH CONTRACTORS

How to Find and Qualify the Best Ones and Manage Them Effectively

Finding Contractors

- Be clear and specific from the outset
 - *Have a written Project Requirements document that you share*
 - *Detail the work you would like performed/ products specified*
- Referrals are helpful
- Platforms/reviews can give you leverage
 - *HomeAdvisor or the National Association of the Remodeling Industry (NARI), Thumbtack, Yelp*

Qualifying Contractors

Licensed, experienced and references on what you need to have done?

Check State Contractor's License Board, BBB and places they advertise (Thumbtack..)

Interview each of them – you will learn about them and the project

Who is already down the learning curve - or won't charge you 50% extra for them to learn?

Ask: How many times have you done something similar? Where? When? What is the size of your crew? What are you working on now? How busy? How are change orders handled? What is the warranty on the work? Get references.

Checking References and Contracting

- Check real references in similar location or jurisdiction:
 - *What went well, what did not go well? Would you recommend again?*
- Workers compensation and liability Insurance certificates in your name?
- Have an umbrella policy yourself
- Get detailed estimates
- Have exact schedule of payments and start with no more than 10 - 20 % deposit
- The name on the permit is responsible for the work
- Be leery of low bid

Resources

Watt Diet calculator - <https://www.redwoodenergy.net/watt-diet-calculator>

California Energy Smart Homes - <https://caenergysmarthomes.com/>

TECH Rebate Program - <https://switchison.org/>

Building Decarbonization Coalition - <https://buildingdecarb.org/>

Questions??

Nick



nick@buildsmartgroup.com



Robert



fortunato@forstrategy.com



Energy for What's AheadSM

Questions about Title 24?

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



Online:
3c-ren.org/code

Call:
805.781.1201

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

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



Closing



Continuing Education Units Available

- Contact dresurreccion@co.slo.ca.us for AIA & ICC CEUs

Coming to Your Inbox Soon!

- Slides & Recording

In-Person Regional Forum and Tour in Santa Barbara

- [Nov 4 - Preparing Buildings for Wildfire Resiliency in 2025 and Beyond](#)

Upcoming Courses:

- [Nov 12 - 2025 Energy Code Update for the Building Industry](#)
- Dec 9 – 11 – Heat Pump Water Heater Installation Training IN-PERSON
 - [12/9: Westlake Village](#)
 - [12/10: Santa Maria](#)
 - [12/11: San Luis Obispo](#)



Thank you!

More info: 3c-ren.org

Questions: info@3c-ren.org

Email updates: 3c-ren.org/newsletter



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