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

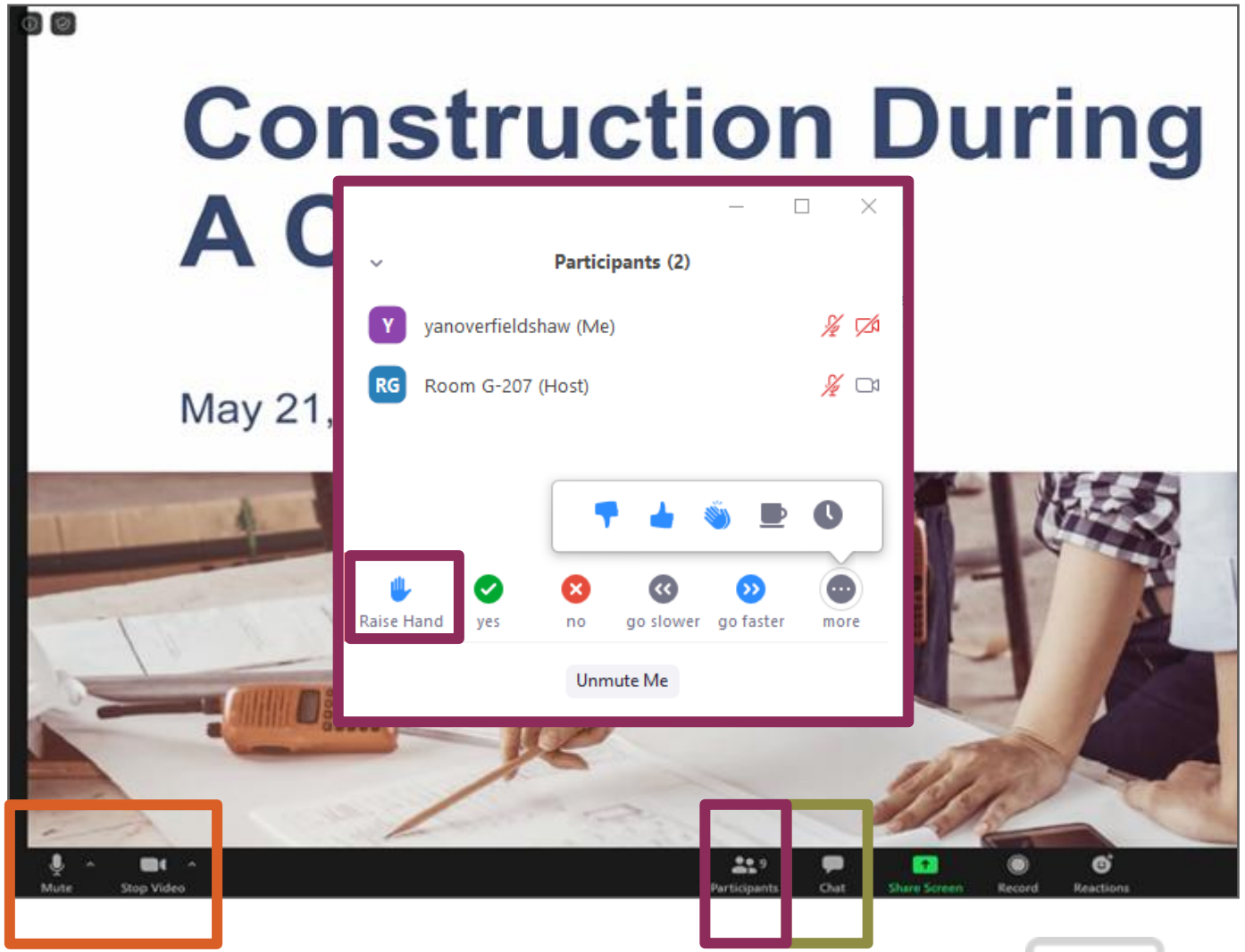
Panel Detectives:
Electrical Panel Assessments for Heat Pump Installers

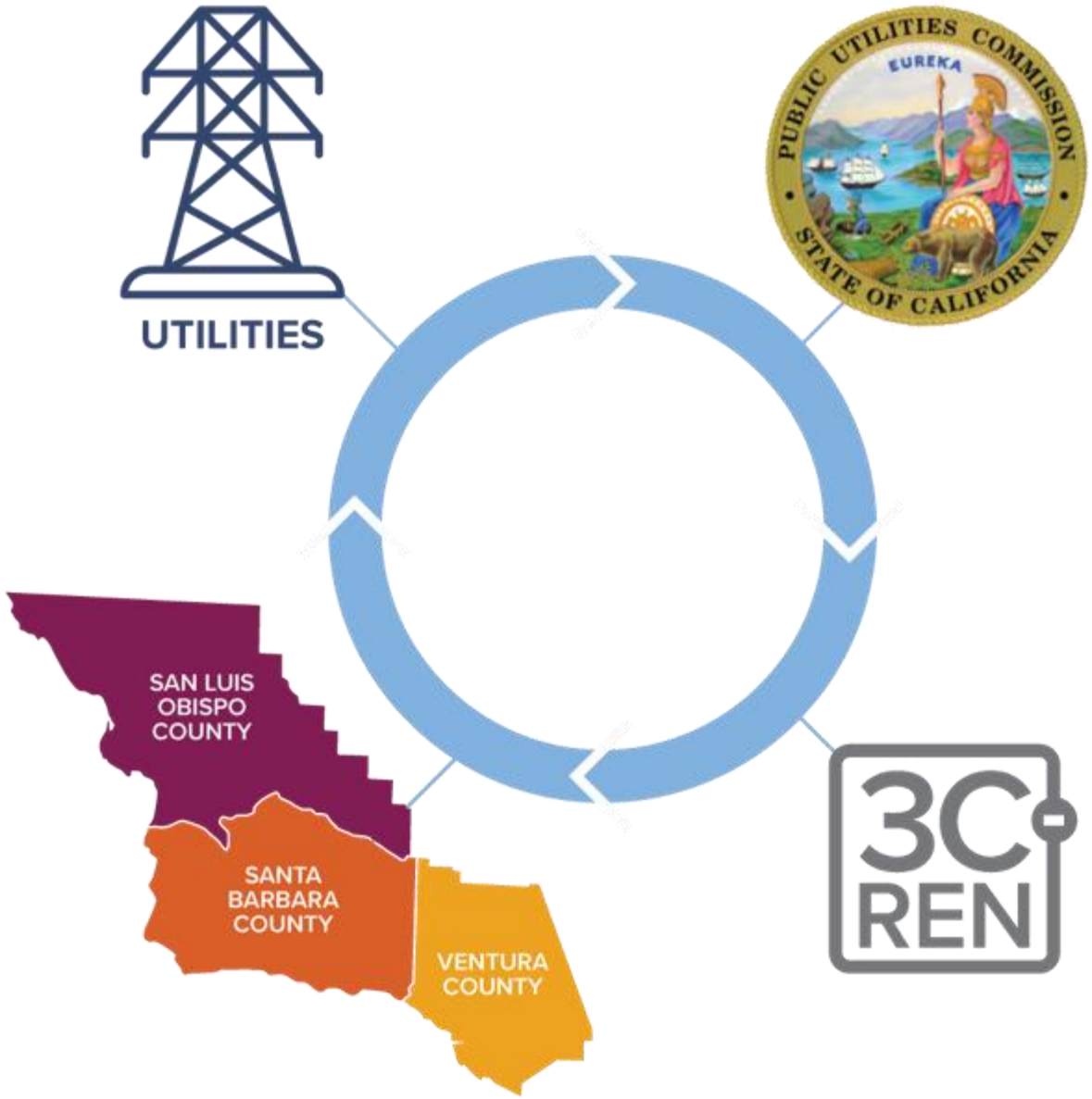
Larry Waters – Electrify My Home

April 8, 2025

Zoom Orientation

- Add an **introduction** in the chat.
  Be sure **full name** is displayed.
- Did you call in? Please **share** first and last name with us.
- Please **mute** upon joining
- Use the "**Chat**“ to share questions or comments
- Under "**Participant**" select "**Raise Hand**" to share a question or comment verbally
- Session may be **recorded** and posted to 3C-REN's on-demand page
- Slides/recording are **shared** after most events





Tri-County Regional Energy Network

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

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

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

Our Services

Incentives

HOME ENERGY SAVINGS

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

COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

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

Training

BUILDING PERFORMANCE TRAINING

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

ENERGY CODE CONNECT

3c-ren.org/code

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

Technical Assistance

AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture

ENERGY ASSURANCE SERVICES

3c-ren.org/assurance

3C REN

3C-REN Achievements

4,000+

Individuals Attended Training

1,374

Energy-Saving Projects Completed

334

Title 24/CalGreen Questions Answered

$155M

Secured for investment in the tri-county region through 2028

Data from 2019-2023 for three programs

Who's This Dude?

- 1982 (UTI), with these tools

- Certs along the way

- 2015 – only heat pumps

- 2020, founded Electrify My Home

Larry Waters
President, Electrify My Home

Electrify My Home – Electrification Pioneers

Our Mission:

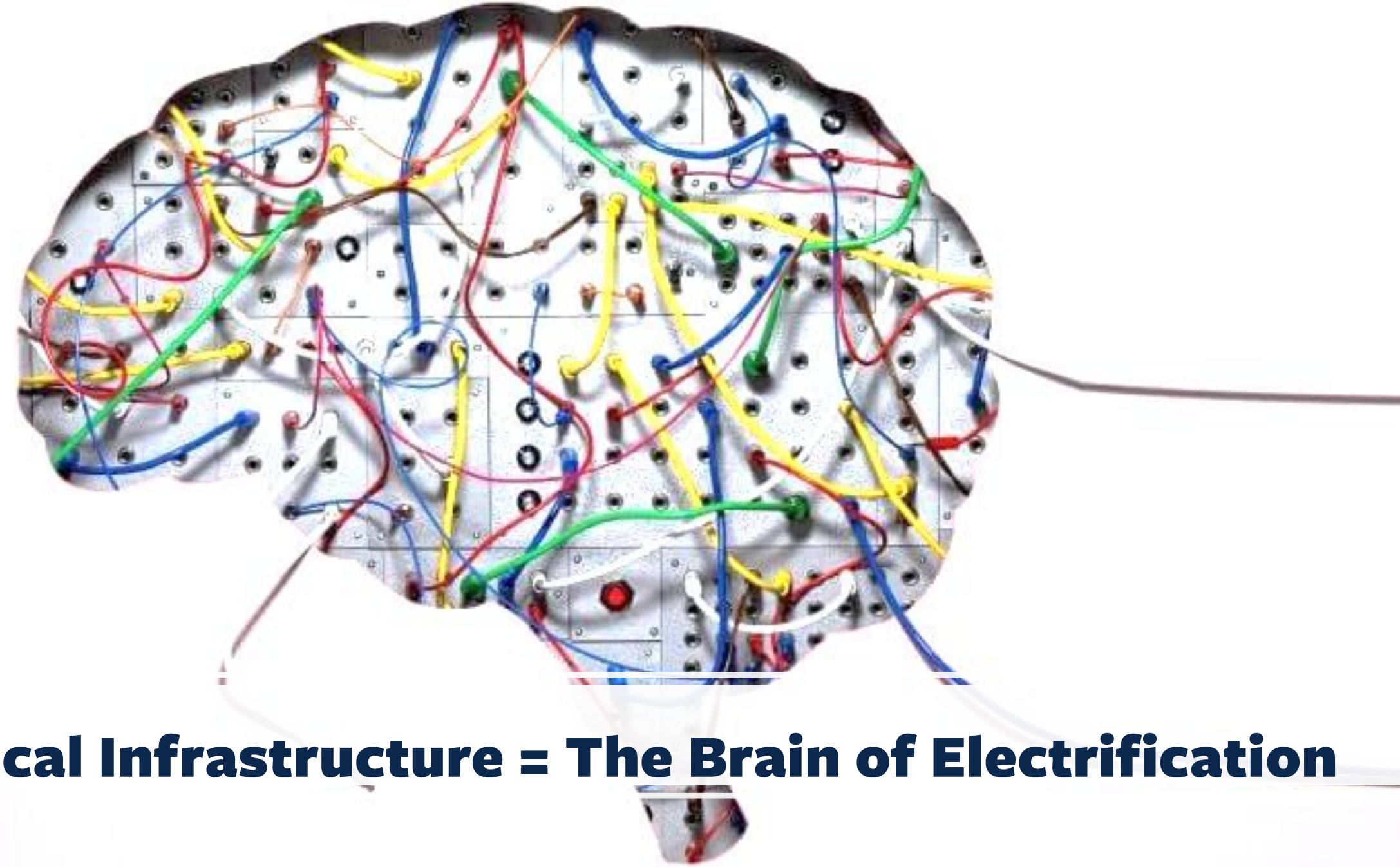
*To provide the **most efficient** cost-effective electrification solutions to California homeowners, to practice **good stewardship** of the electrical panel, and to **train and influence** other contractors to do the same.*

ELECTRIFY MY HOME

Agenda

- Introductions and Welcome
- Importance of the panel
- What's wrong with panel upgrades?
- Solutions to capacity challenges
- Real world examples

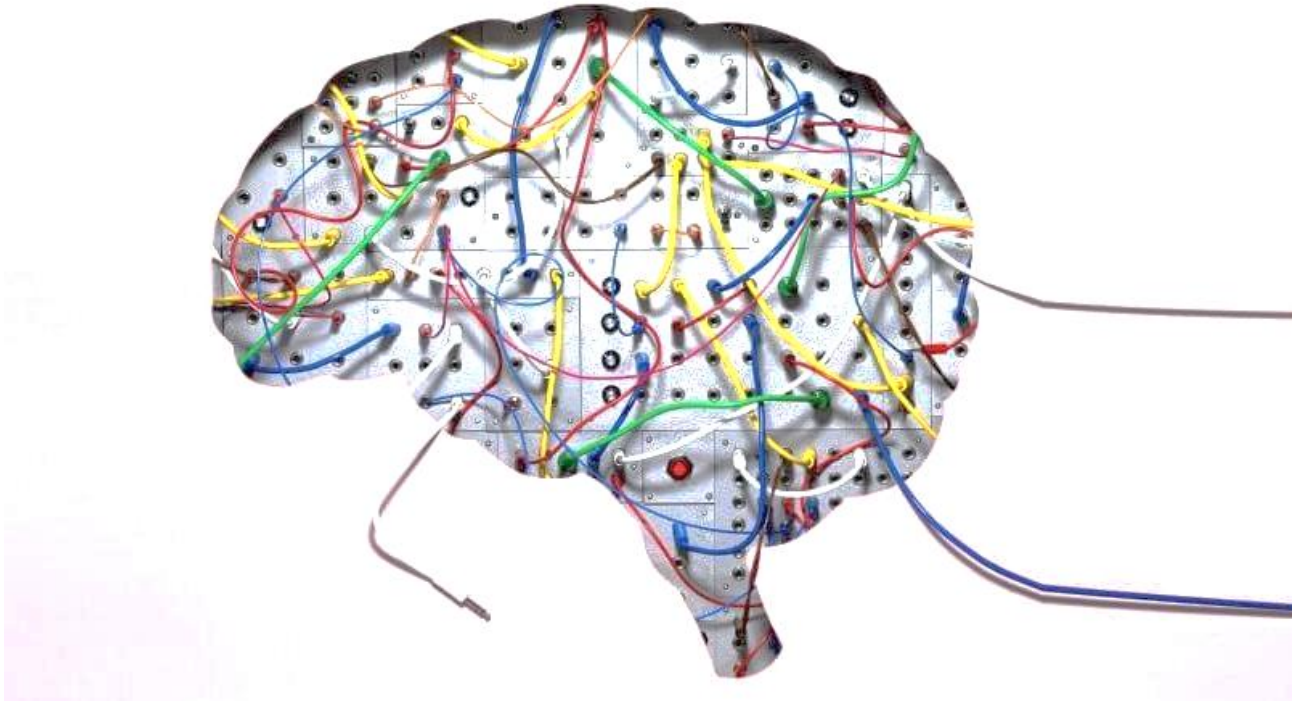
Importance of the Panel



Electrical Infrastructure = The Brain of Electrification

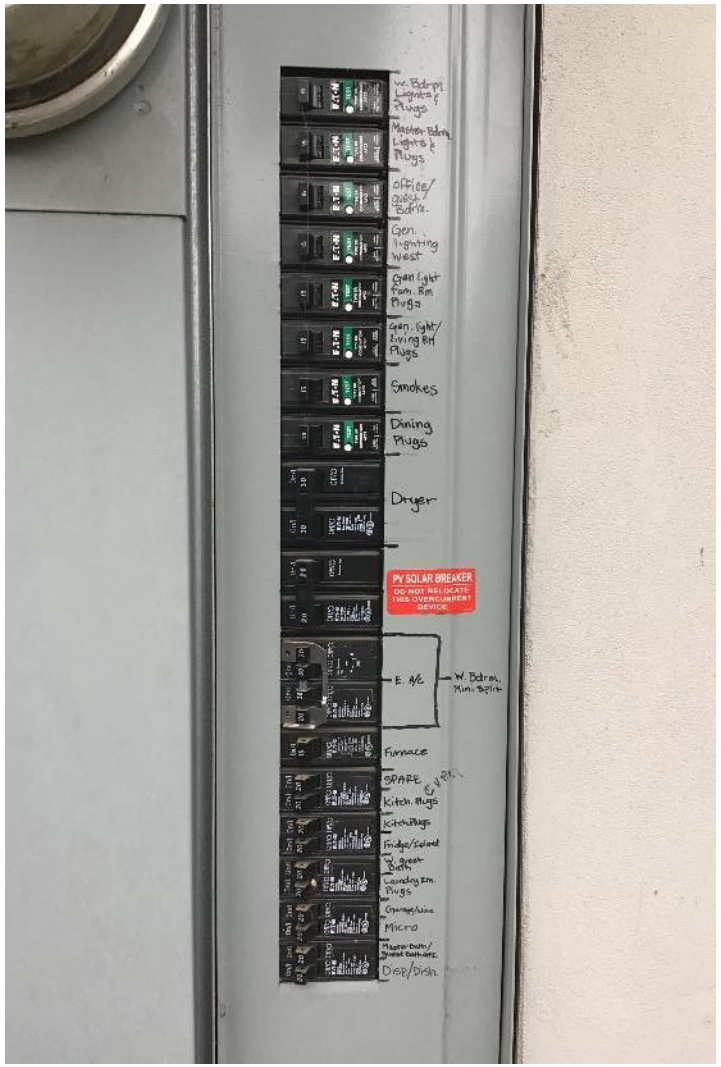
Heat Pumps are the Heart of Electrification

The Analogy, Tied Together



- Make sure you use the right heat pump for the right application
- Don’t fill your brain (panel) with garbage

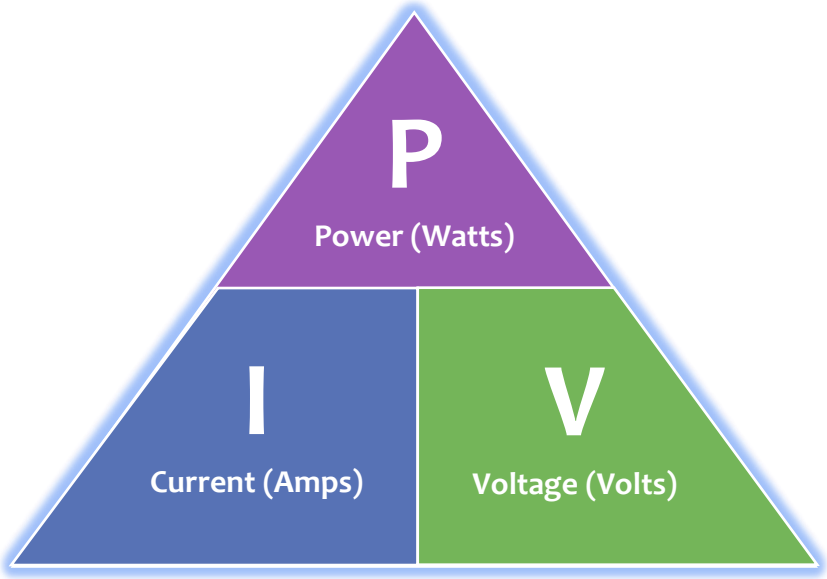
Are These Panels Full?



The Basics – Power Law

Important Concept #1: Power law is useful in calculating energy loads

- Watts = amps X volts [W = AV]
- Amps = watts/volts [A = W/V]
- Volts = watts/amps [V = W/A]



Important Concept # 2

- Electricity can kill you
- But don't fear the panel

Full Panel ≠ No Remaining Capacity

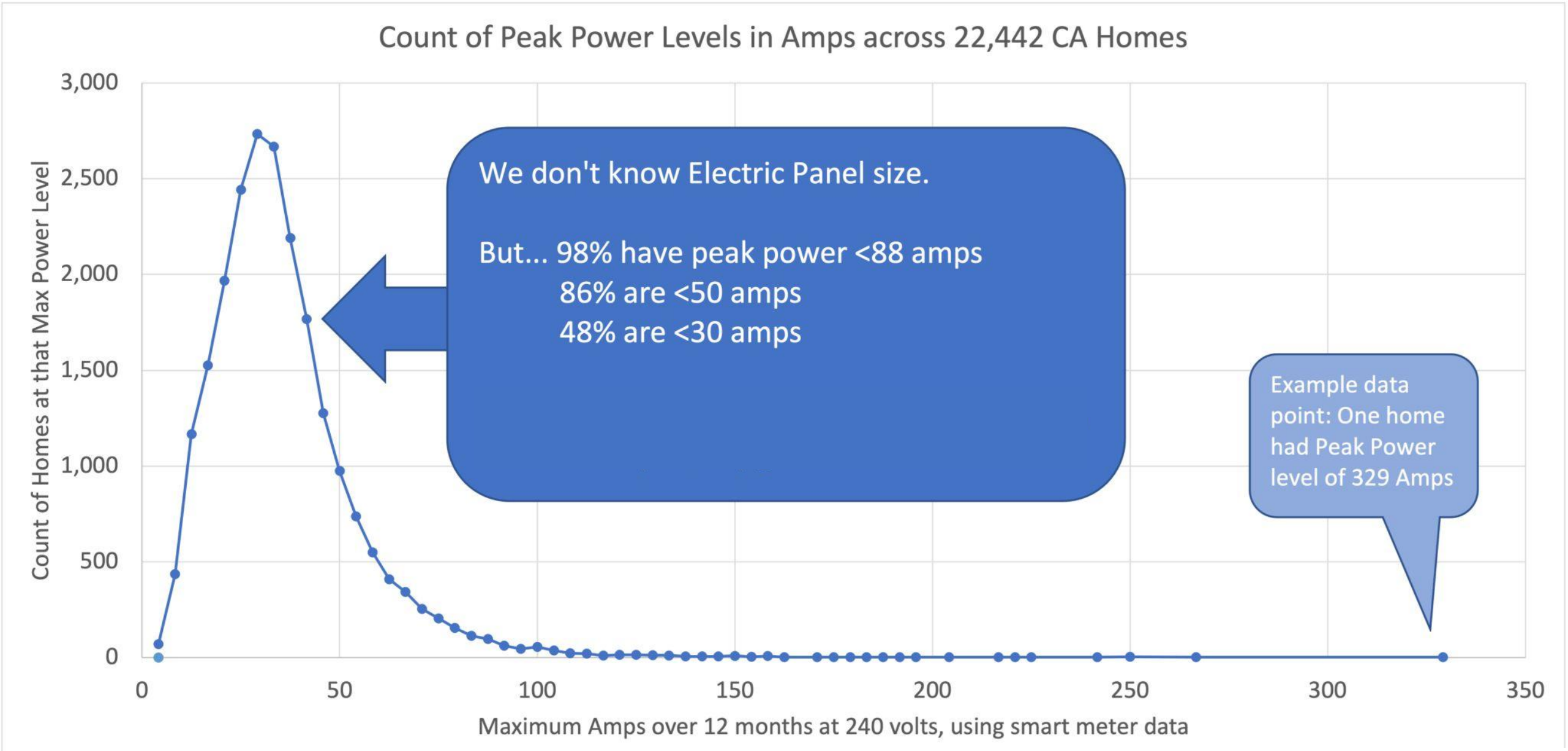
100A Panel:

100 Amps x 240 Volts = 24,000 Watts

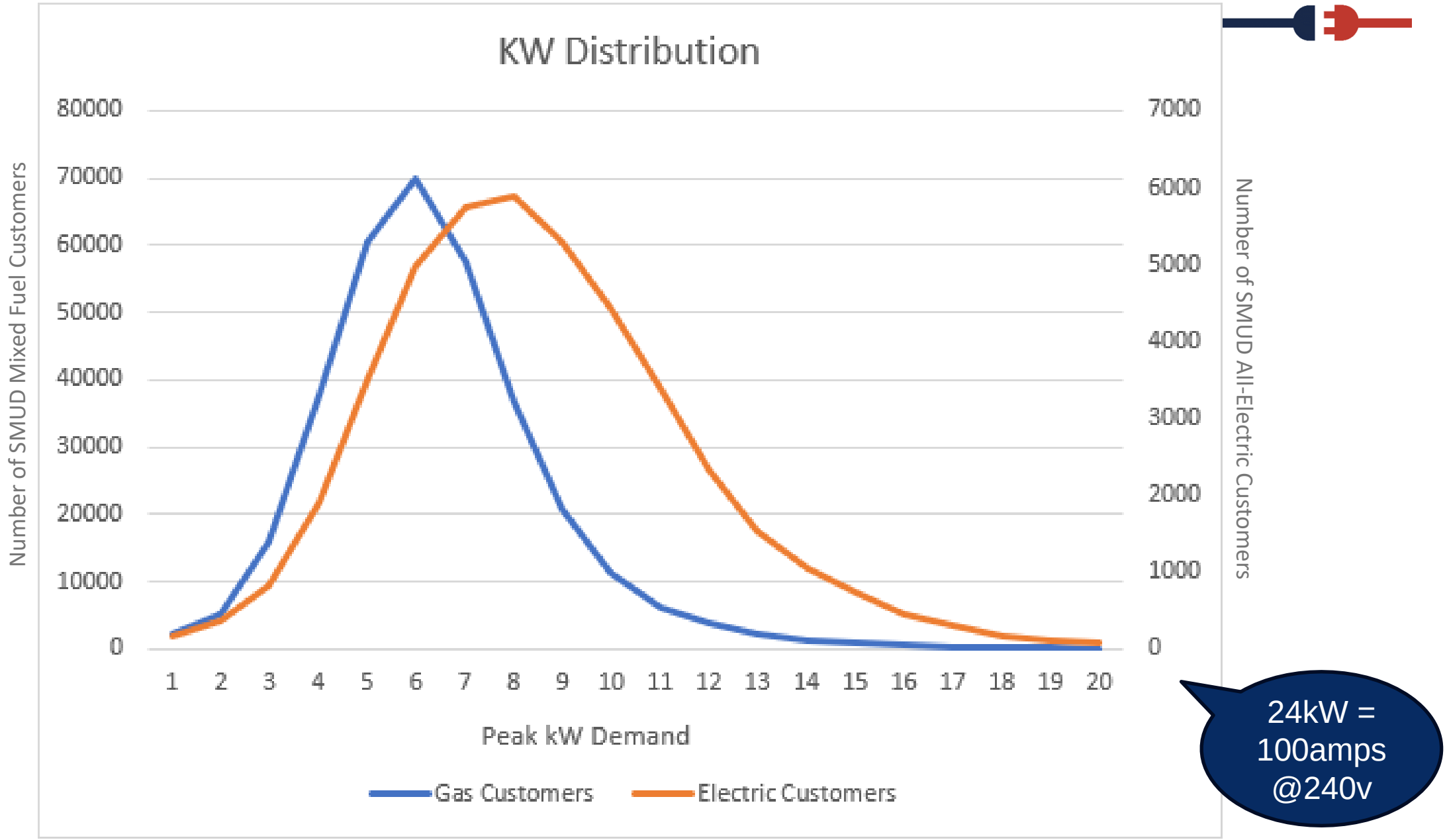
200A Panel:

200 Amps x 240 Volts = 48,000 Watts

That's a LOT of capacity!



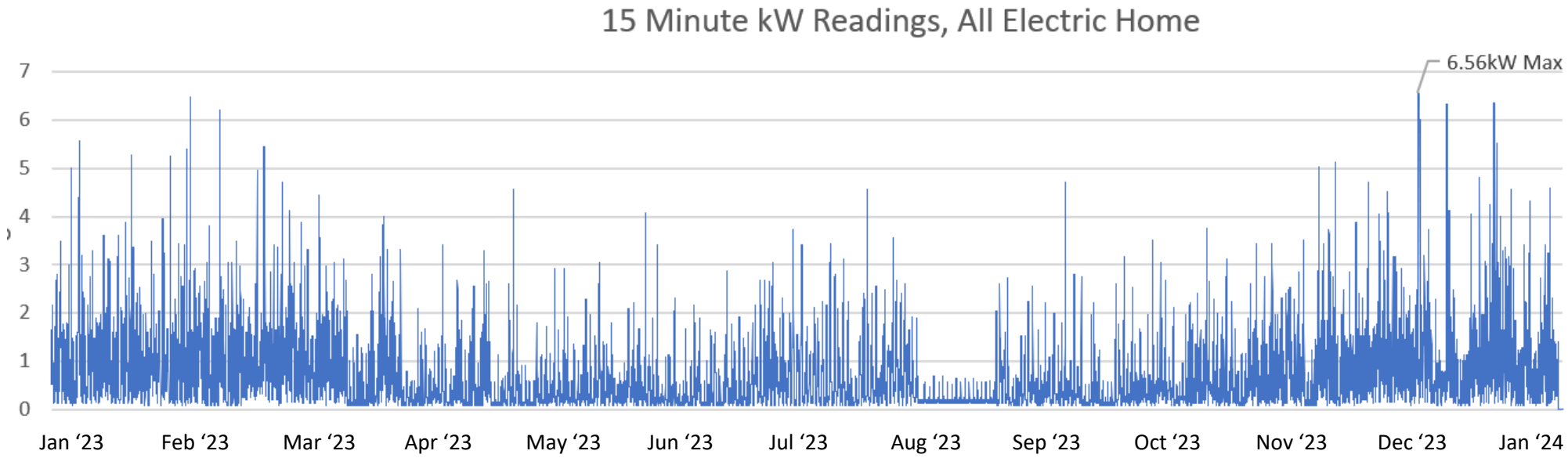
Source: Home Energy Analytics (HEA), PG&E HomeIntel service single family user data



24kW = 100amps @240v

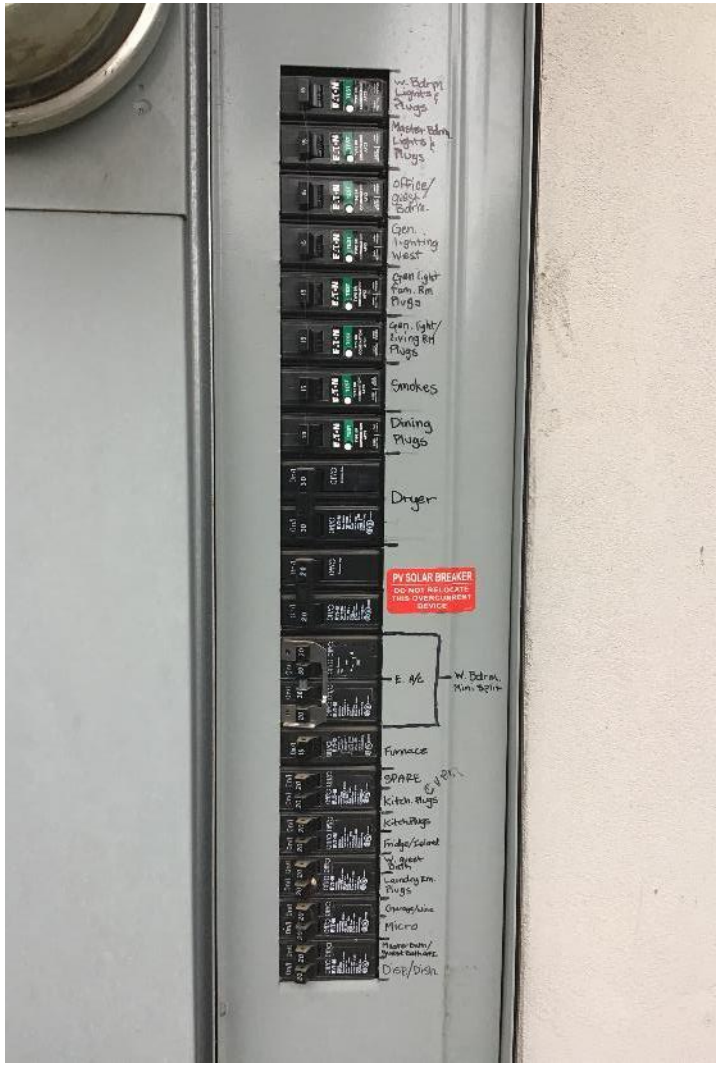
Source: Home Energy Analytics (HEA), Sacramento Municipal Utility District (SMUD) customer peak kW distribution

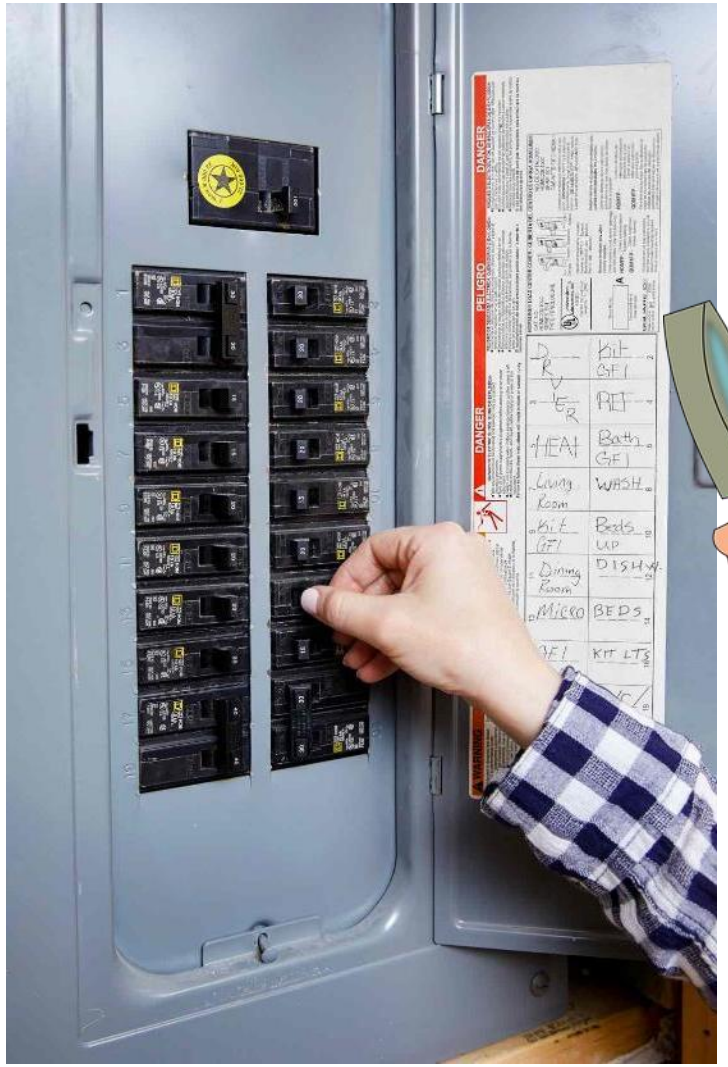
A Fully Electrified House Example – Max 6.56kW



- Built in 1959
- 1420 sqft
- 2-ton Mitsubishi inverter, 50-gal HPWH, elec range, elec resistance dryer

So…Are These Panels Full?





We Have Capacity…But Does It Meet Code?

- Practitioners must follow National Electric Code (NEC)
- Rules in place to prevent overheating of wires & bus bars
- For proper load calcs, you have 2 options:
  - NEC 220.87 Top-Down
    - Use metered or billing historic peak multiplied by 1.25
    - Add FULL nameplate rating of all new proposed appliances
  - NEC 220.83 (B) Bottom-Up
    - Nameplate loads x demand factors (aka coincident factors)
    - 40% coincidence for some devices/circuits, 100% for others

ELECTRIFY MY HOME

220.83(B) Electrical Load Calculations

General Light and Plug Loads					Volt-Amps
Dwelling	2,350 sq. ft.	×	3 VA/sf	=	7,050
Kitchen Small Appliance Circuits	2 (min. 2)	×	1,500 VA each	=	3,000
Laundry (Washing Machine) Circuit	1 (min. 1)	×	1,500 VA each	=	1,500
Appliance Loads (nameplate value)	**Volts**		**Amps**		**Volt-Amps**
Built-in Microwave (not countertop model)	120	×	10	=	1,200
Dishwasher	120	×	15	=	1,800
Garbage Disposal	120	×	9.5	=	1,140
Refrigerator (on dedicated circuit)	120	×	5	=	600
Stove hood	120	×	1	=	120
NEW: Frigidaire gallery 30" front control induction range with air fry	240	×	42	=	10,080
NEW: Whirlpool 7.4 cu ft hybrid heat pump dryer	240	×	14	=	3,360
NEW: Rheem 15-amp 65-gallon heat pump water heater	240	×	12	=	2,880
General Loads Subtotal					32,730
First 8,000 VA @ 100%					8,000
Remaining VA @ 40%					9,892
General Loads Total					17,892
Other Loads (nameplate value)	**Volts**		**Amps**		**Volt-Amps**
NEW: Electric Vehicle Charging Load @ 125% (with circuit pausing)	240	×	0	=	0
Bathroom Heater #1 @ 100%	120	×	11	=	1,320
NEW: Mitsubishi 3-ton centrally ducted heat pump HVAC system @ 100%	240	×	17	=	4,080
Other Loads Total					5,400
Total Load (General + Other)					23,292 VA
Divide Load by 240 Volts					97 A
Rating of Existing Electrical Service					100 A
Panel Upgrade Required?					No

What's Wrong With Panel Upgrades?

ELECTRIFY
MY HOME

Panel Upgrade Costs

$4,000 - $9,500

+much more if trenching or other infrastructure needed

Complicated If Near A Gas Meter

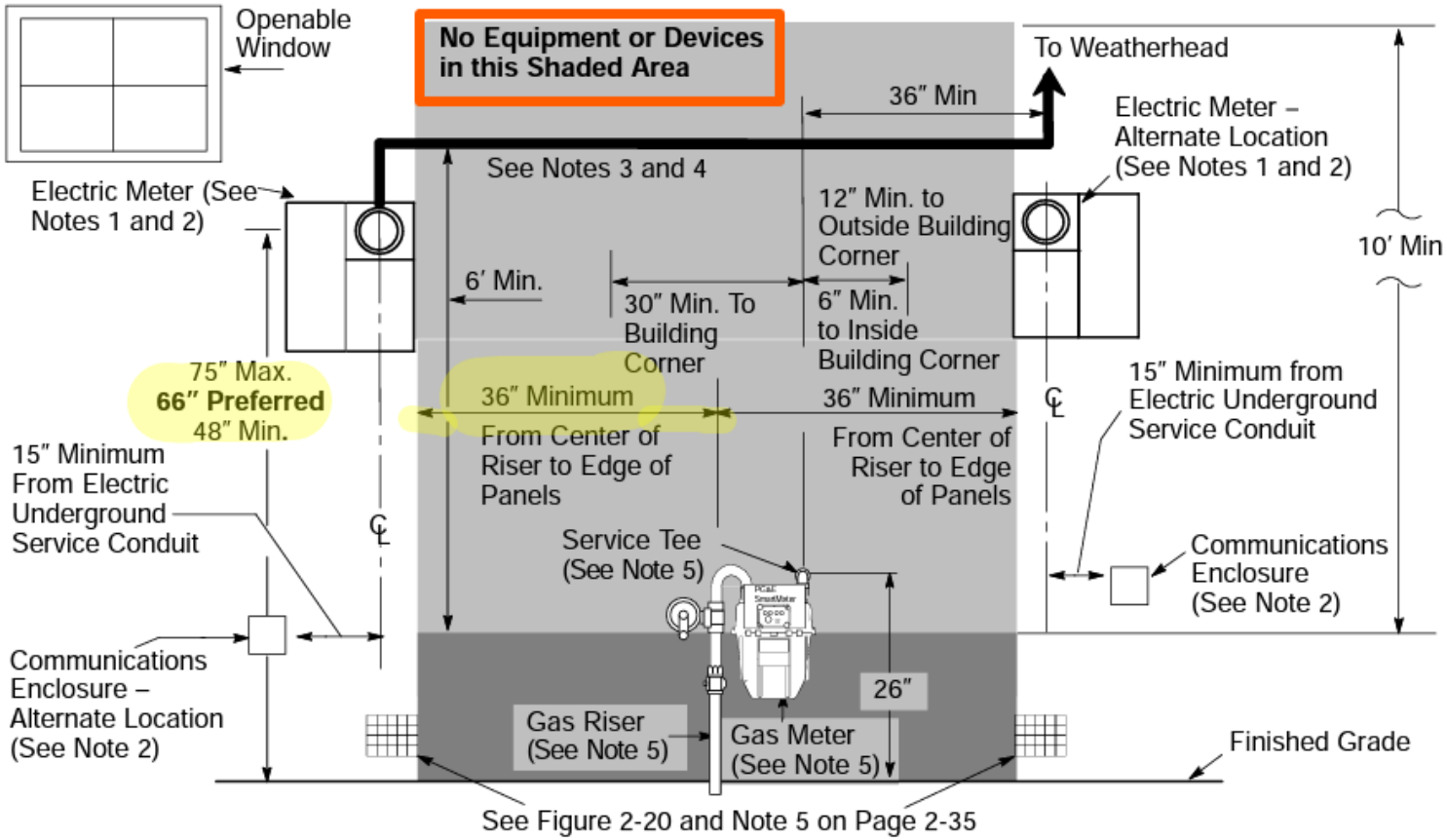
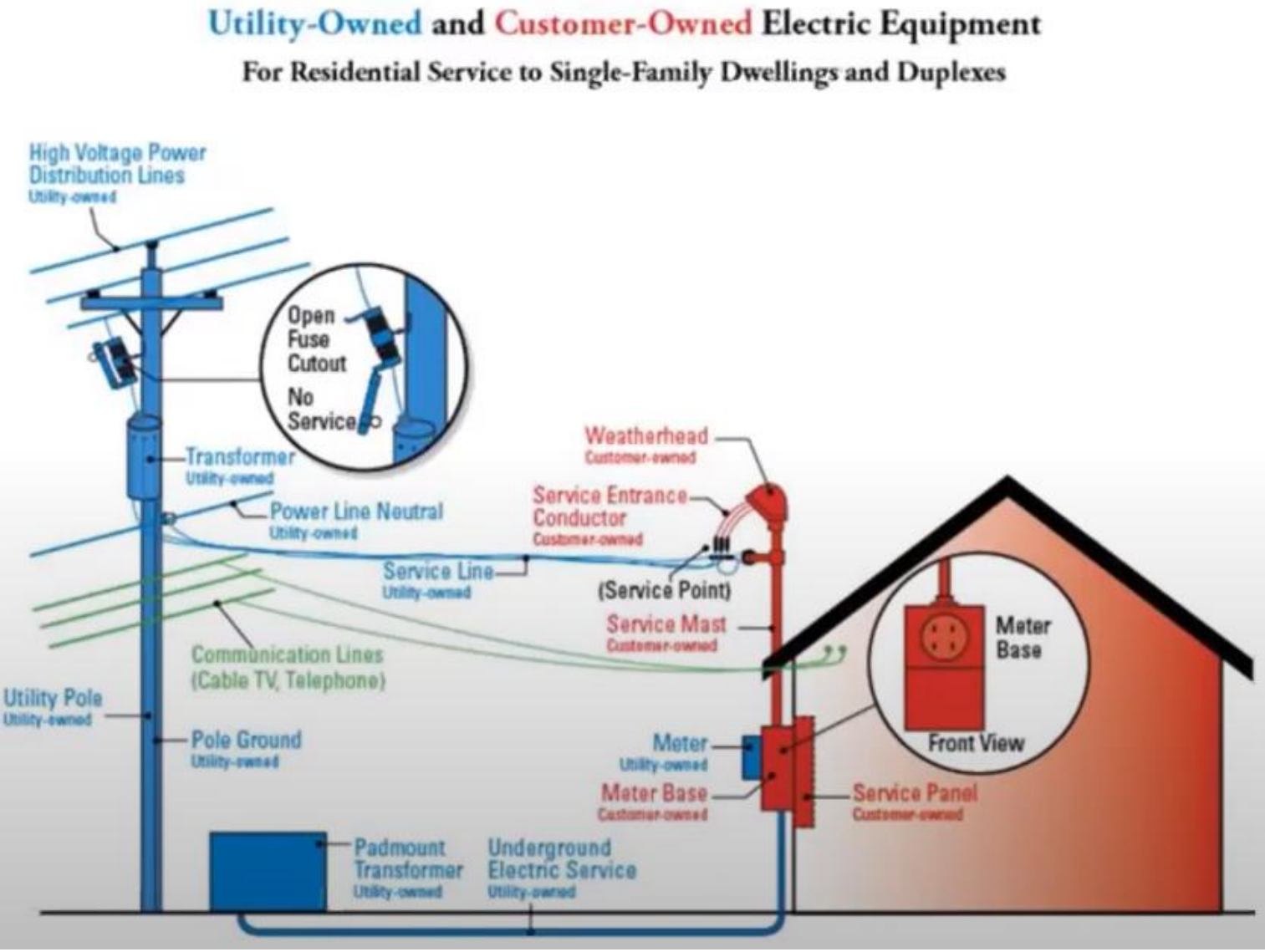


Figure 2-19
Electric and Gas Meter Set Separation Dimensions and Clearances

ELECTRIFY MY HOME

Utility Infrastructure Must Support Worst Case Scenarios



PG&E Infrastructure

Front-of-the-meter (FTM)

PG&E owns and is responsible for constructing, maintaining, and upgrading electrical infrastructure to the meter panel

Customer Infrastructure

Behind-the-meter (BTM)

Customer owns and is responsible for constructing, maintaining, and upgrading infrastructure from meter to the customer appliances

Electric Service Upgrade Steps

- Planning phase
- Application phase (3 days)
- Load assessment or service design (30 days)
- Contract & payment (70 days)
- Construction & energization (42- 84 days, $Varies)

Solutions – Subs & Slim Breakers

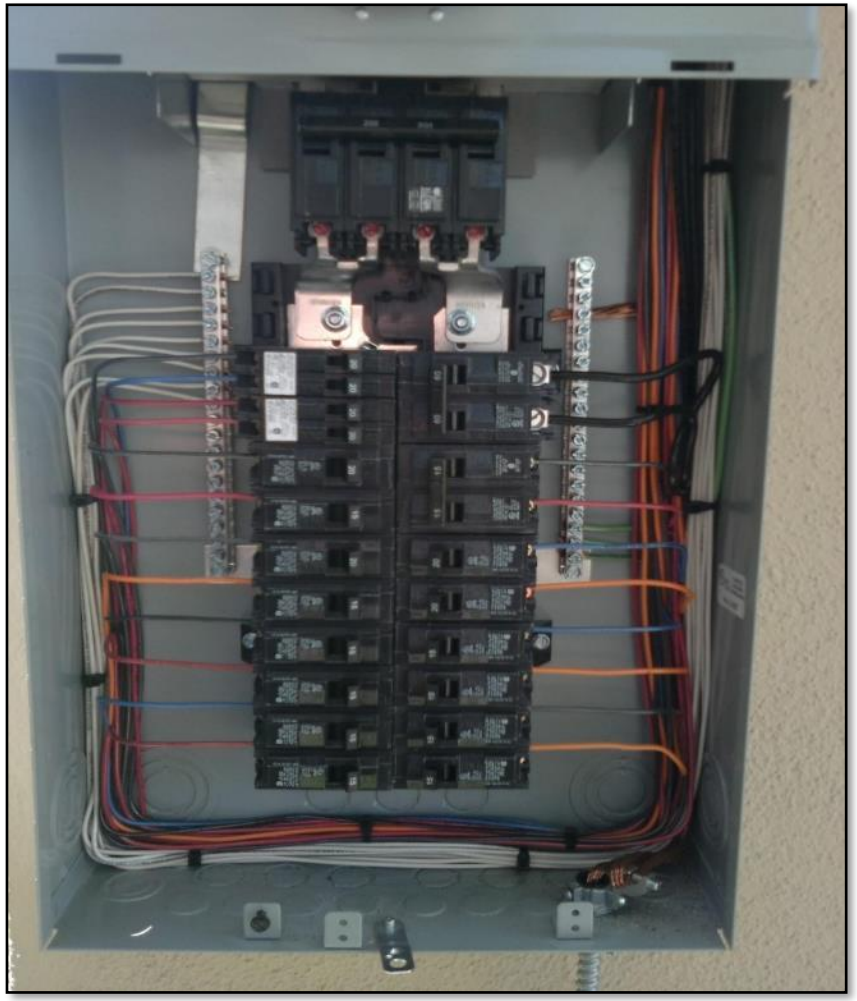
What Loads to Consider – Breaker Spaces

Most homes converting from gas, will need:

- Heat Pump 2-6 spaces (20a-50a)
- Dryer 2 spaces (30a)
- Hot water 2 spaces (15a or 30a)
- Range 2 spaces (50a)
- EV charger 2 spaces (30-50a)

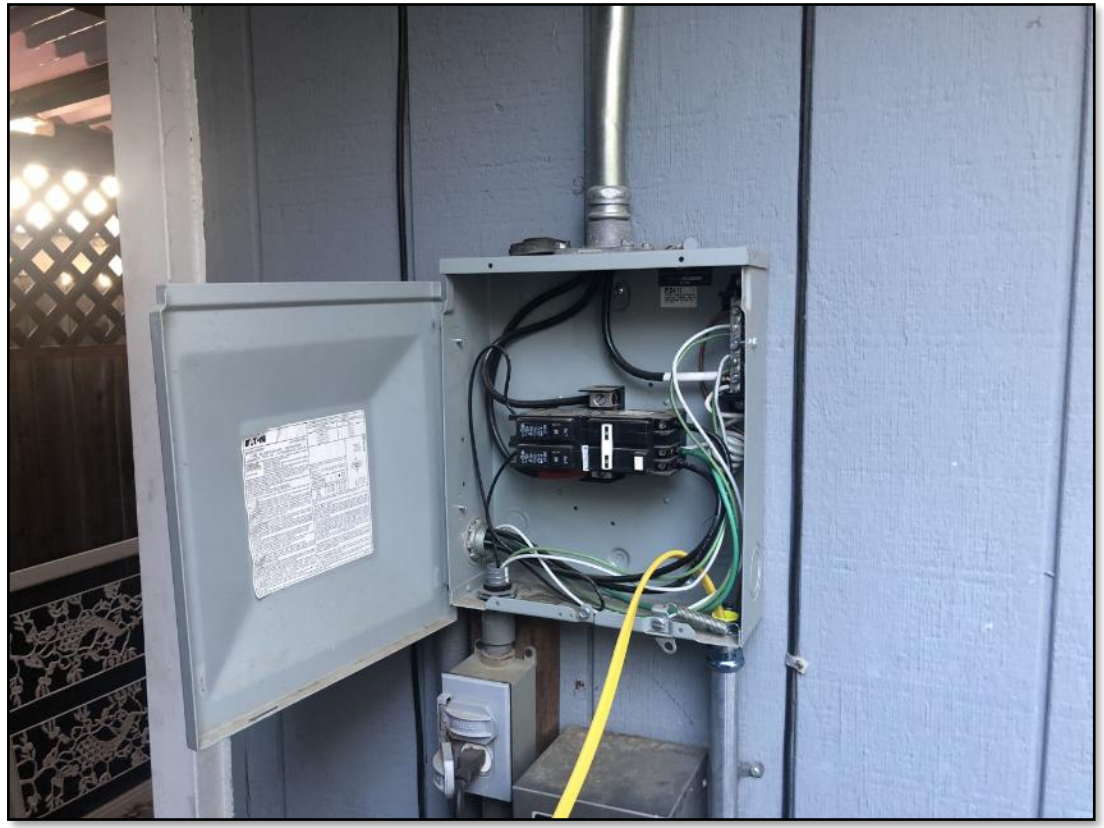
Panel is Full? "No Space" but *Not* at Capacity

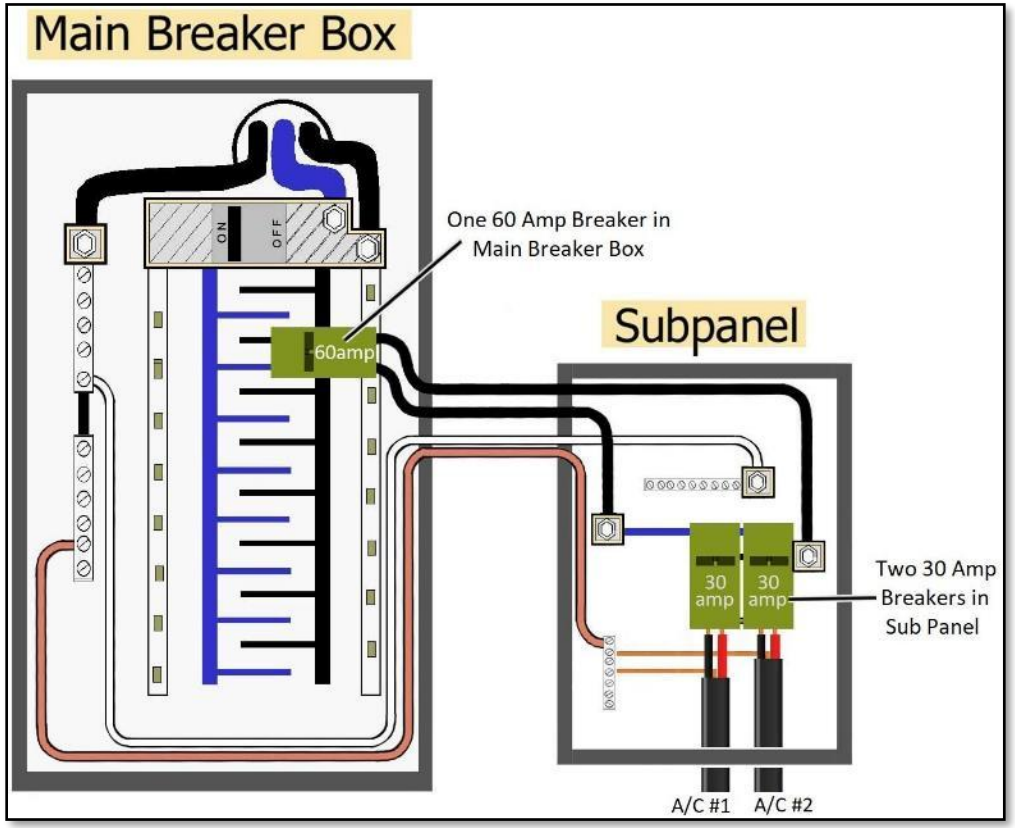
- Good example of panel that can be expanded by replacing wide 15 and 20's with 2 pole or quad



ELECTRIFY MY HOME

Utilize Subpanels to Gain Additional Space

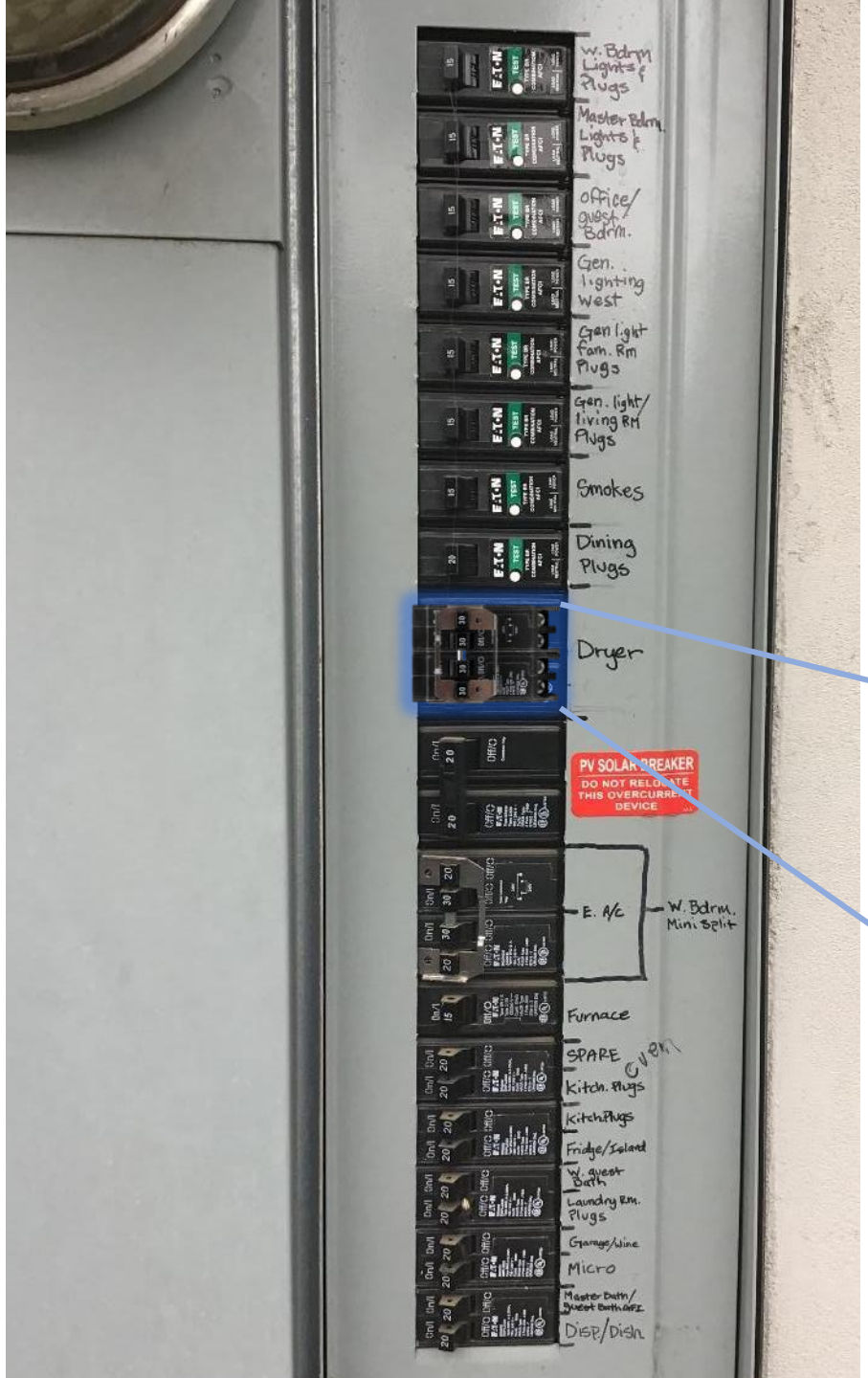




- If there is limited space on the main, but load is not exceeded, stretch with a quad to a subpanel
- Subpanels should not be fed with wire size less than #8

ELECTRIFY MY HOME

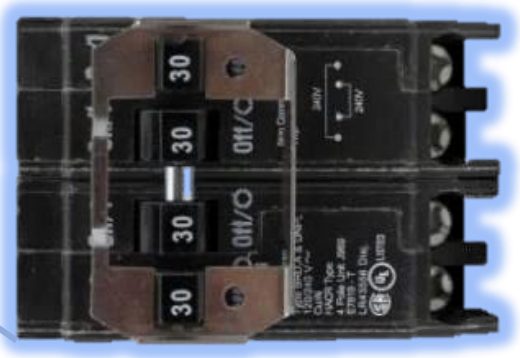
ELECTRIFY MY HOME



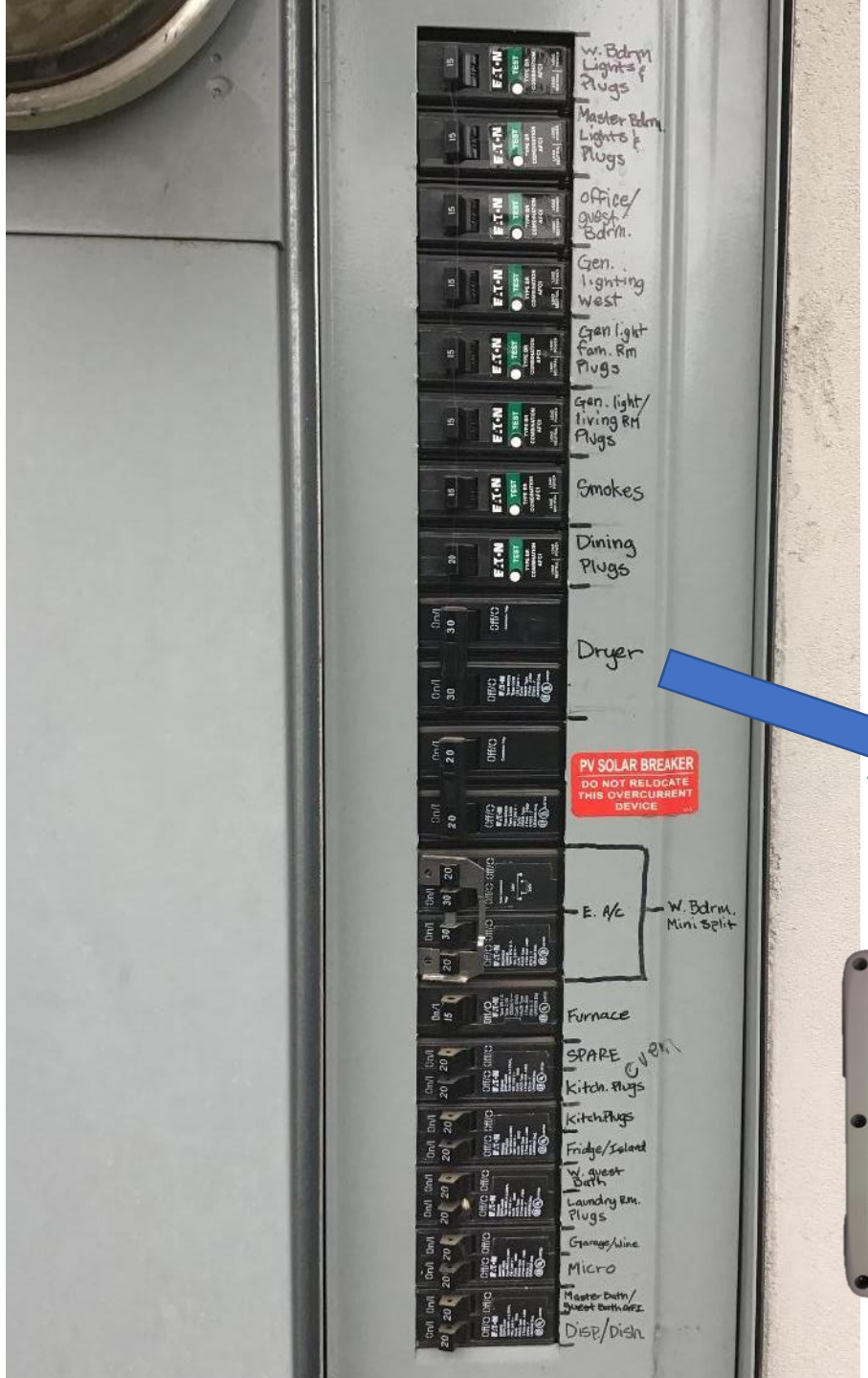
Solutions to "Full" Panels

Task: Add a HPWH Circuit

- Option 1: Quad it out!



ELECTRIFY MY HOME

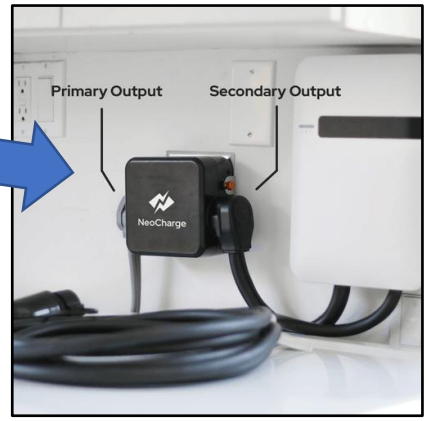


Solutions to "Full" Panels

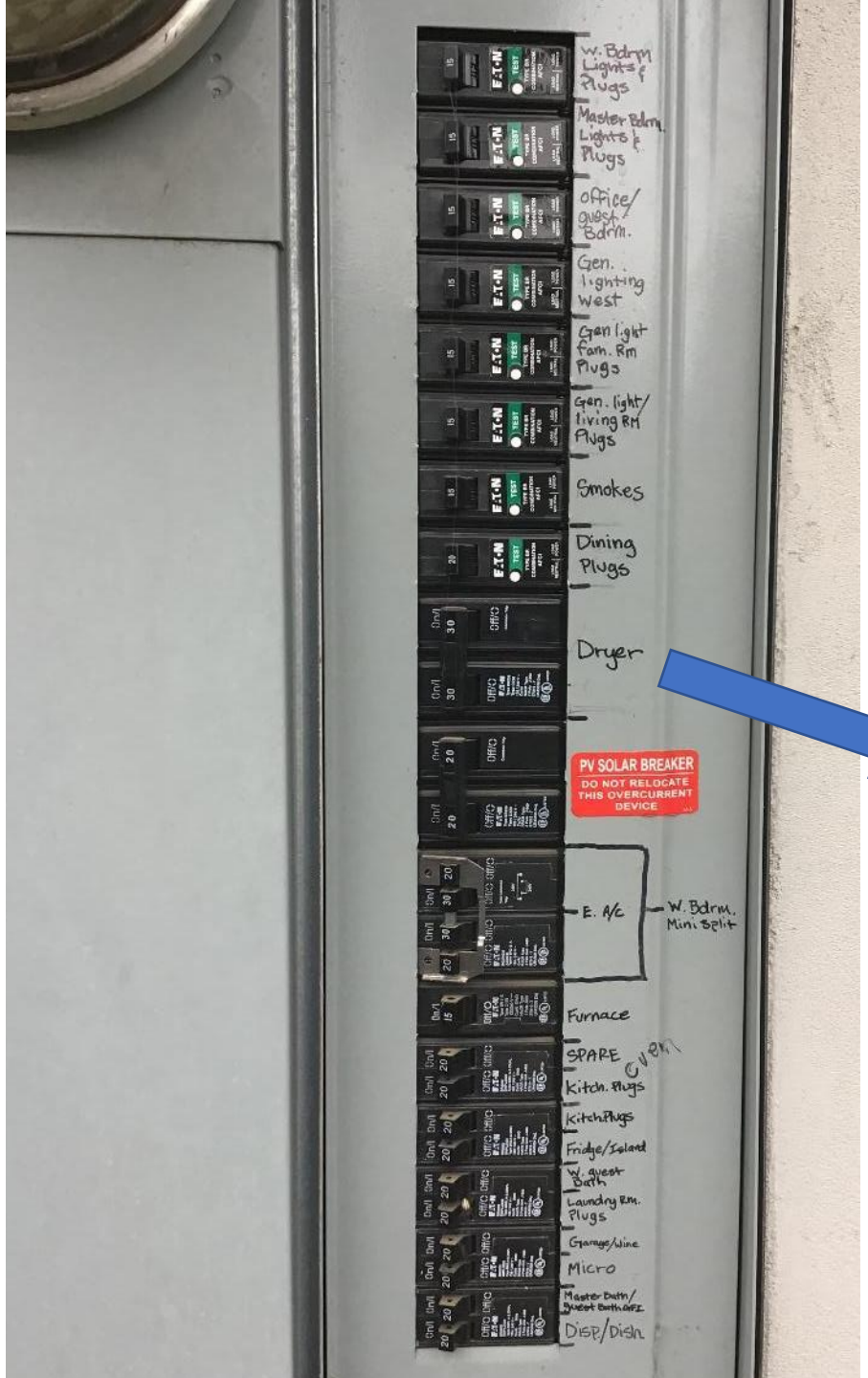
Task: Add a HPWH Circuit

- Option 2: Circuit Splitter!

+



ELECTRIFY MY HOME

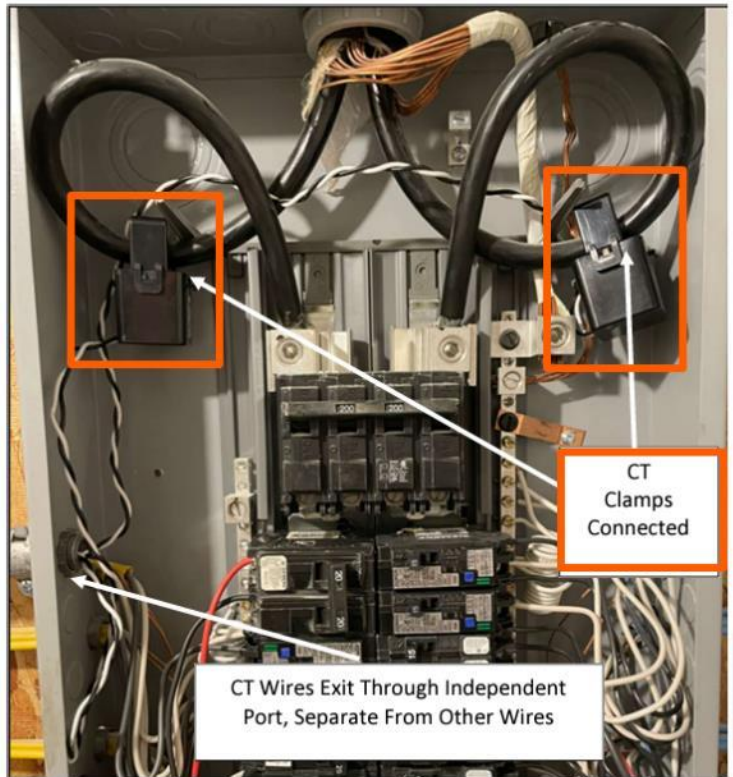


Solutions to "Full" Panels

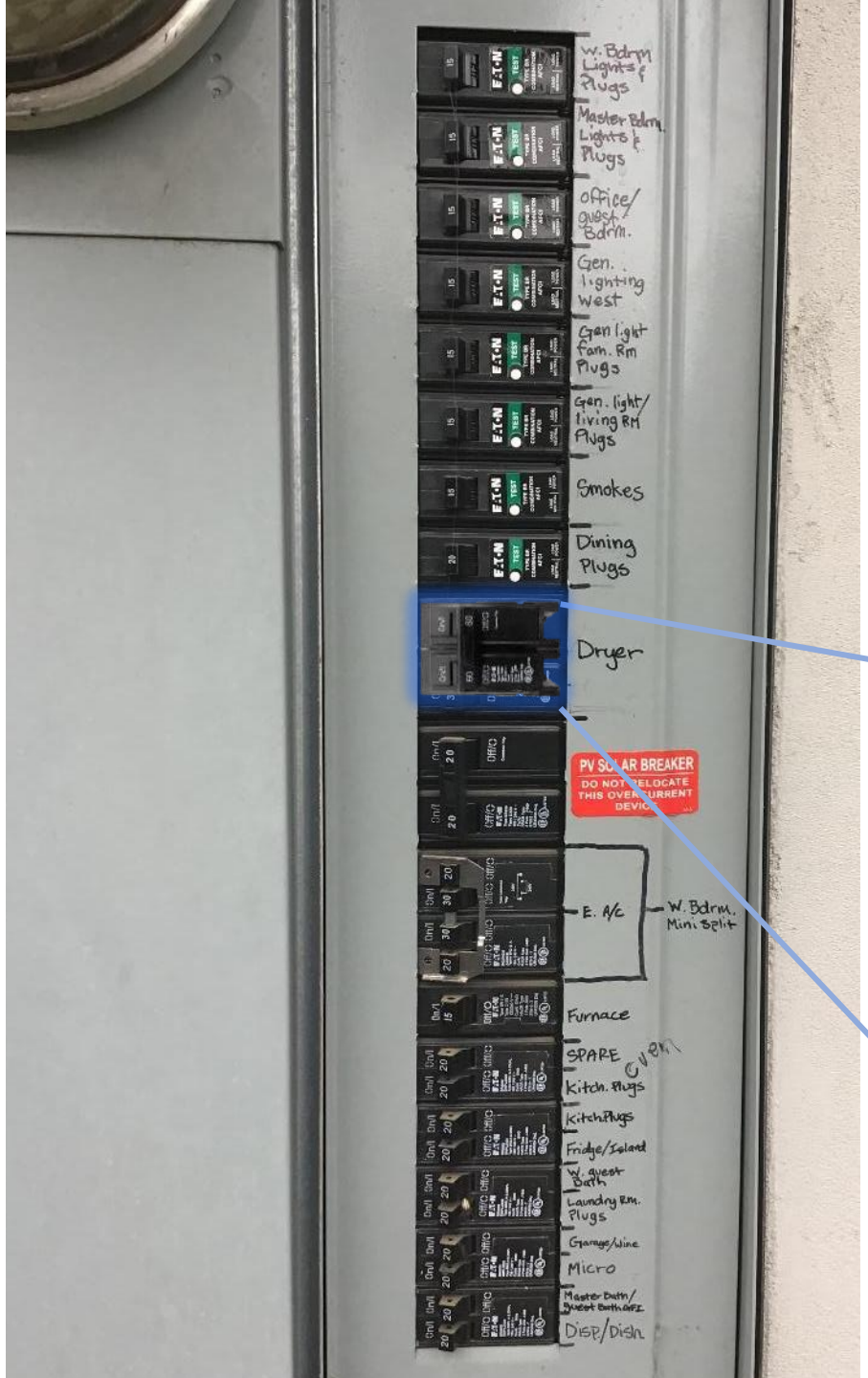
Task: Add a HPWH Circuit

- Option 3: Circuit Pausing!

+



ELECTRIFY MY HOME



Solutions to "Full" Panels

Task: Add a HPWH Circuit & a Couple More

- Option 4: Add a Subpanel

- Tip – add the neutral!

ELECTRIFY
MY HOME

Solutions to “Full” Panels

Task: Add a HPWH Circuit

(and much more)

- Option 5: Smart Panel

Solutions to “Full” Panels

Task: Add a HPWH Circuit

- Option 6: Use a 120v shared circuit unit!

FPE Stab-Lok

Zinsco

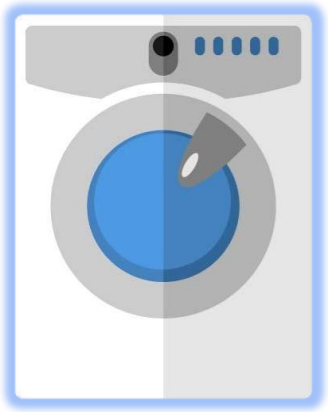
Pushmatic by ITE

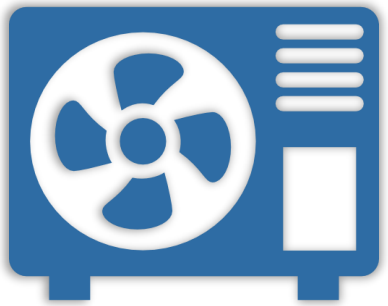
!! SAFETY !!

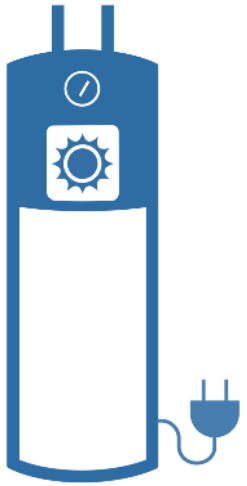
- We talk a lot about reusing infrastructure but **safety is always #1**
- It's better to **hold off** on certain electrification than to ignore a potential safety issue
- Replace or plan replacement for known panels with safety issues
- Any evidence of burning or damage in the panel is a red flag

Solutions – Watt Diet

Watt Dieting Examples



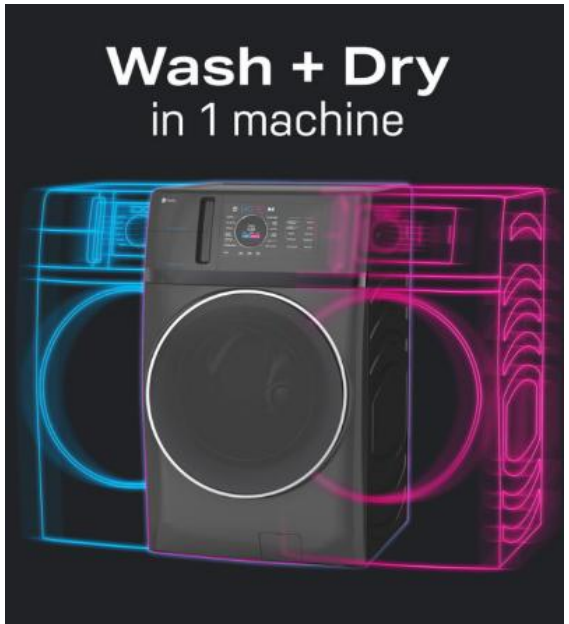




Category	Dryer	Dishwasher	Heat Pump	HP Water Heater	SUM
Standard	5,280 W	1,400 W	9,220 W (w/ heat strips)	4,500 W (30A)	20,400 W
Efficient	2,200 W	1,100 W	3,500 W	2,200 W (15A)	9,000 W

ELECTRIFY MY HOME

120 Volt Solutions



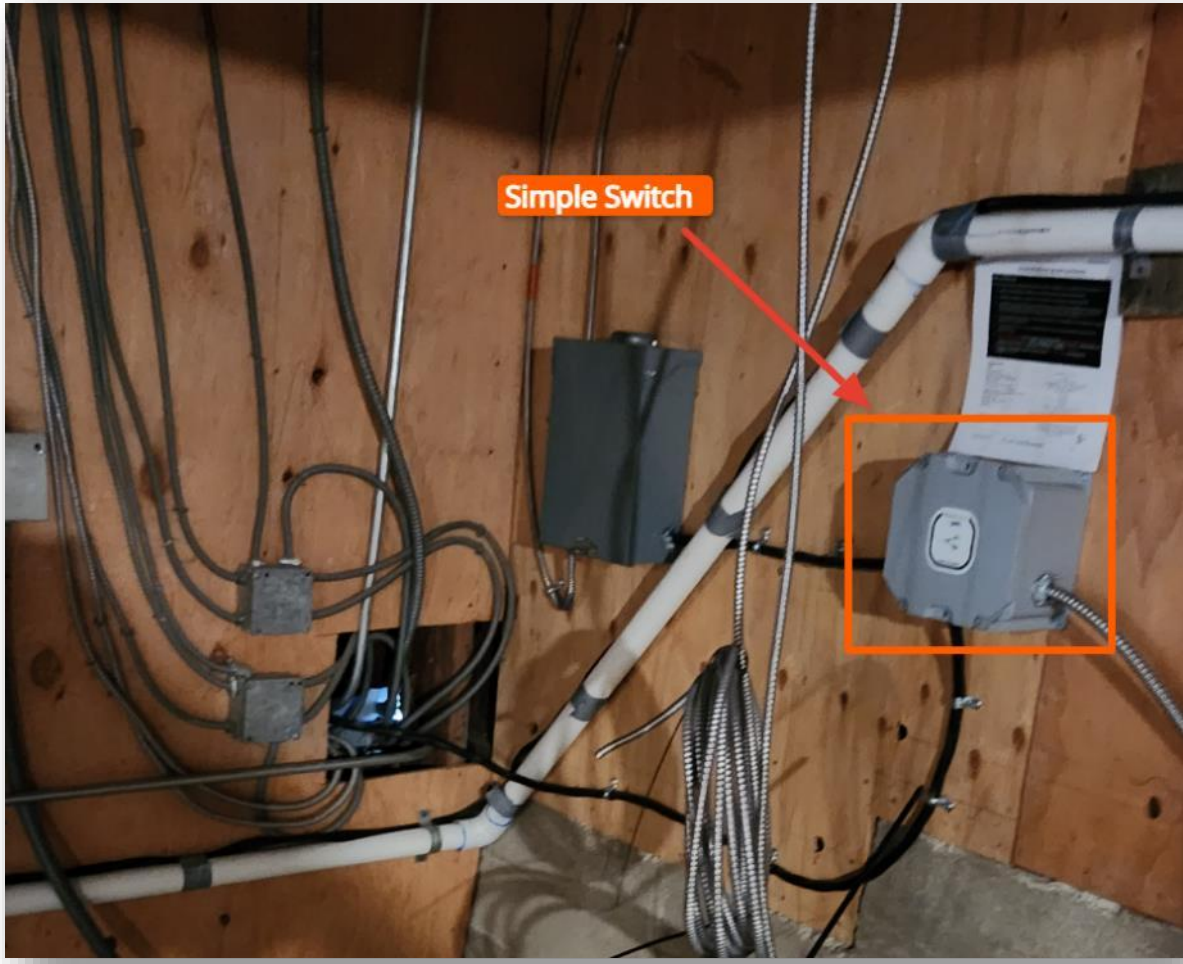
Examples From The Field

Example 1 (PRE) – Oakland, CA

- **Existing Panel:** 100 Amp
- **Staring Point:** All gas
- **Goals:** Remodel, full electrification
- The Challenge: 100A panel over gas meter, breakers mislabeled, multiple remodels resulted in unexpected loads

Example 1 (POST) – Oakland, CA

- **Post Panel:** No change! Customer may plan an upgrade when it's time for the EV.
- **Solution:** Simple Switch b/w Range & Heat Pump Subpanel
- **Scope:** 25A Heat Pump, 30A Heat Pump Water Heater, Induction Range



Example 2 (PRE) – Petaluma, CA

- **House:** 1870 Victorian
- **Existing Panel:** 125 Amp
- **Staring Point:** Gas Furnace, water heater
- **Goals:** Multizone heat pump, water heater, insulation & air sealing
- The Challenge: 125A capacity panel

Example 2 (POST) – Petaluma, CA

- **Post Panel:** No change, electrifying on 125A!
- **Solution:** Plug-in HPWH
- **Scope:** Multizone inverter heat pump, 120v heat pump water heater, induction range

120v HPWH during installation

Example 3 (PRE) – Vacaville, CA

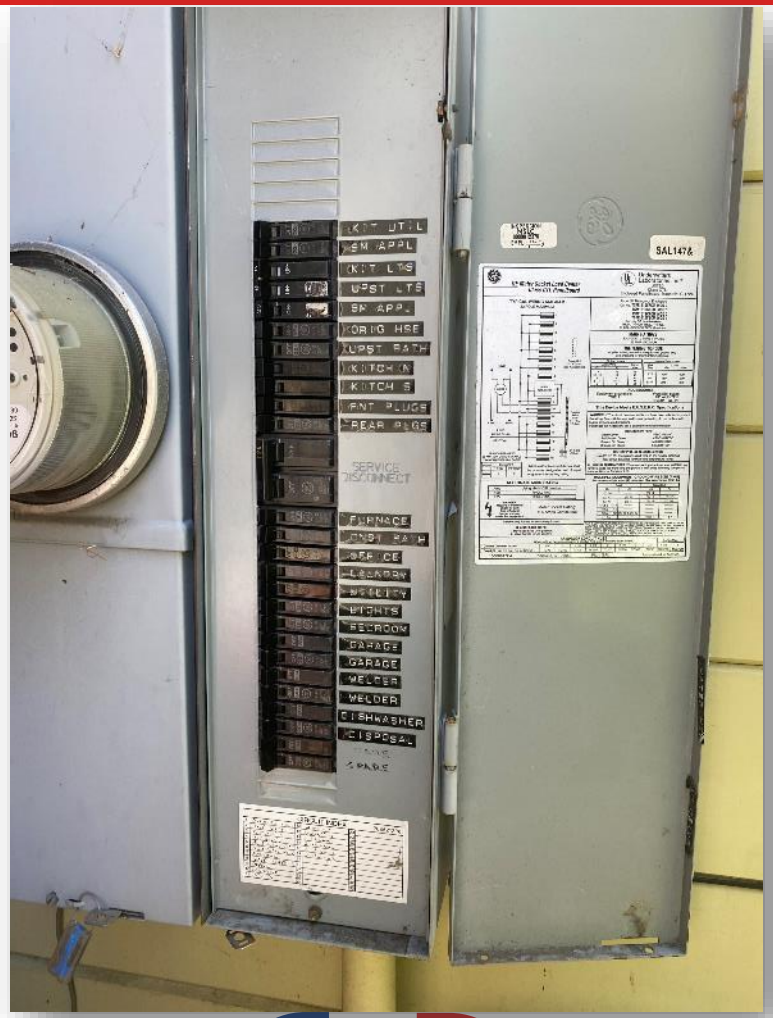
- **Existing Panel:** 100 Amp Zinsco
- **Starting Point:** Gas furnace, water heater, dryer, range
- **Goals:** Full electrification, envelope, solar+storage
- **The Challenge:** Gaining sufficient capacity for final electrification appliance and future EV. Older panel.

Example 3 (POST) – Vacaville, CA

- **Post Panel:** 125A with SPAN panel
- **Solution:** Low-amp appliances, span panel
- **Scope**: 20A Heat Pump, 120v HPWH

Example 4 (PRE) – Berkeley, CA

- **Existing Panel:** 125 Amp
- **Starting Point:** Gas furnace, water heater, dryer, range
- **Goals:** Lower bills, full electrification
- **The Challenge:** Costs, physical space, and capacity hit of running electrical to all new electric appliances.



Example 4 (POST) – Berkeley, CA

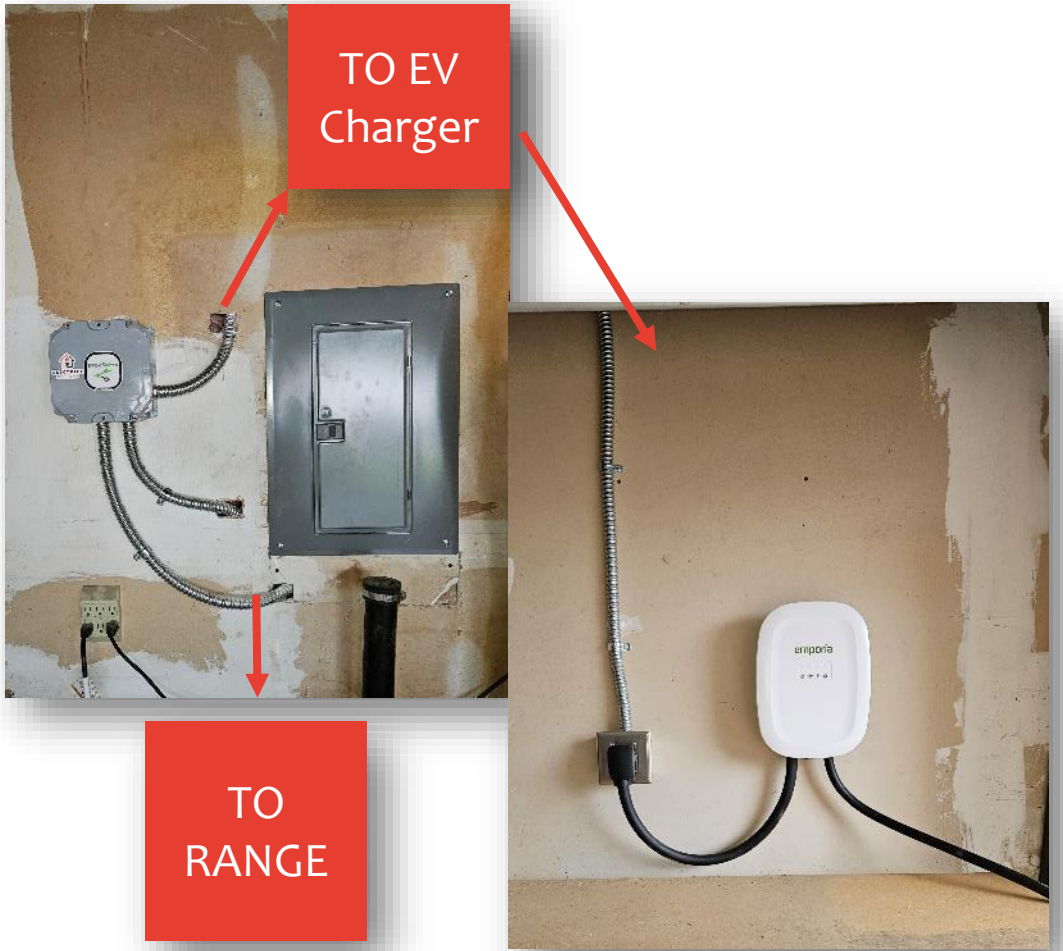
- **Post Panel:** Panel left in place
- **Solution:** Circuit splitter between dryer & water heater, low-amp heat pump
- **Scope**: 20A Heat Pump, 240v HPWH, attic air sealing and insulation

BONUS Example 5 (PRE) – Woodland, CA

- **Existing Panel:** 100 Amp
- **Starting Point:** Gas furnace, water heater, range, Zinsco panel
- **Goals:** Full electrification, EV Charger
- **The Challenge:** Costs, safety of panel, capacity limitations

BONUS Example 5 (POST) – Woodland, CA

- **Post Panel:** Panel upgraded but same capacity
- **Solution:** Circuit splitter between induction range & EV charger
- **Scope**: 20A Heat Pump, 240v HPWH, induction range, Emporia EV charger, attic air sealing and insulation



Example 6 (PRE) – Davis, CA

- **Existing Panel:** 100 Amps, Recessed, Feed Wire Capable of 125A
- **Staring Point:** All gas except dryer, small kiln
- **Goals:** Full electrification + insulation
- **The Challenge:** Near gas meter, limited physical breaker space, additional capacity needed to meet electrical load calc, customer wants fast charging for future EV

Example 6 (POST) – Davis, CA

- **New Panel:** 125 Amp SPAN Smart Panel, Feeding from Main
- **Scope:** 20A Mitsubishi, 120v RUUD HPWH, induction range
- **Thinking Ahead:** Customer wants fast charging for future EV

Case Study – Davis, CA


TECH Electrification Training
Next Up: 4/14-4/16, Bakersfield, CA

Questions? Stay in Touch!

ELECTRIFY
MY HOME

Larry Waters | 707-840-3411 | www.electrifymyhome.com | info@electrifymyhome.com

Closing

Continuing Education Units Available

- Contact julianna@3c-ren.org for AIA LUs and ICC CEUs

Coming to Your Inbox Soon!

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

Upcoming Electrify My Home Courses:

- Electrification Products for the Central Coast Climate (5/6)
- Optimizing Heat Pump Zoning for Maximum Comfort and Efficiency (6/17)

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

Any phone numbers who joined? Please share your name!

Thank you!

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

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

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

3C-REN

TRI-COUNTY REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA