



# We will be starting soon!

*Thanks for joining us*



# Panel Detectives – Electrical Panel Assessments for Heat Pump Installers



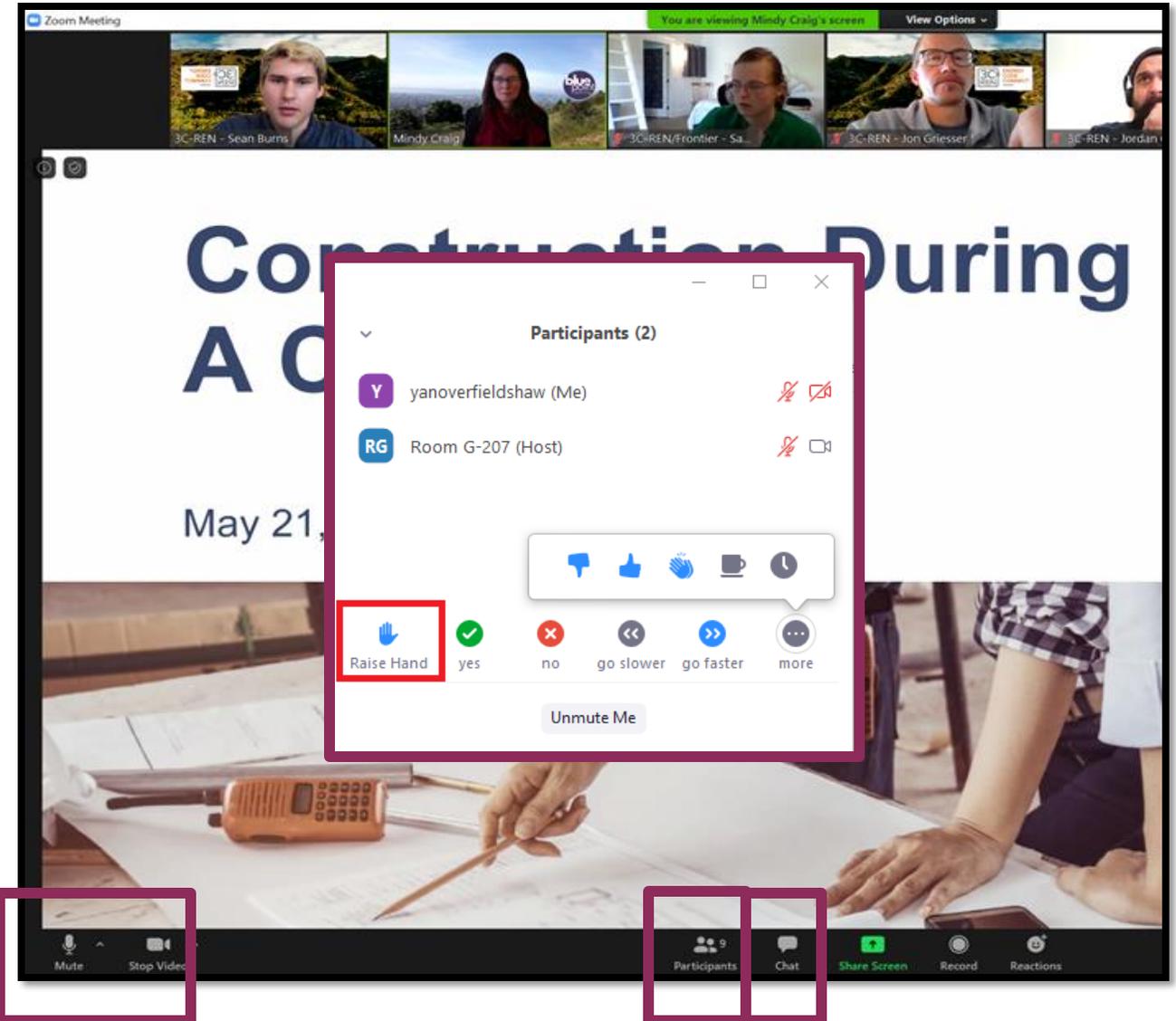
*Larry Waters – Electrify My Home*

June 5, 2024



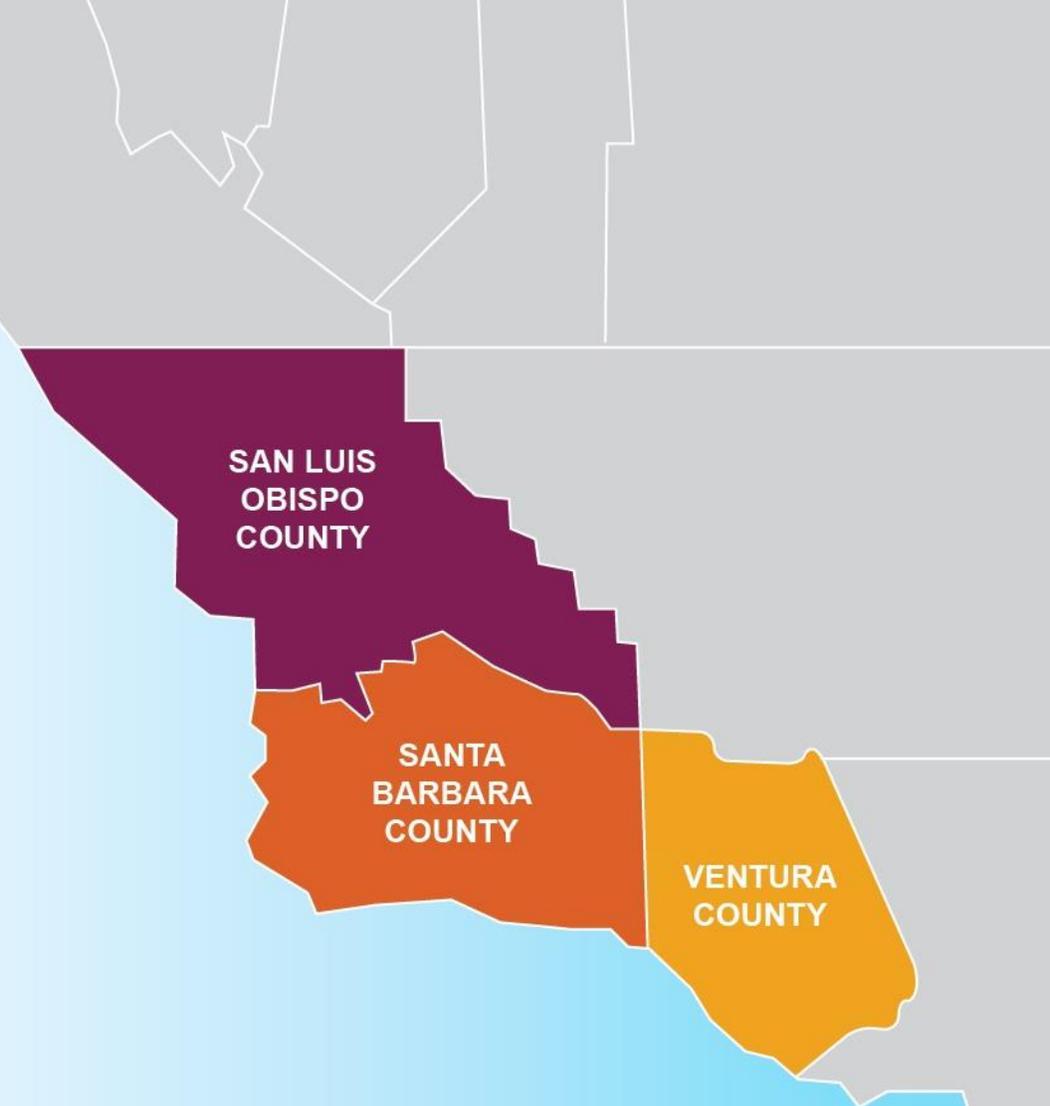
# Zoom Orientation

- 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)



# Who's This Dude?



⚡ 1982 (UTI), with these tools



⚡ Certs along the way



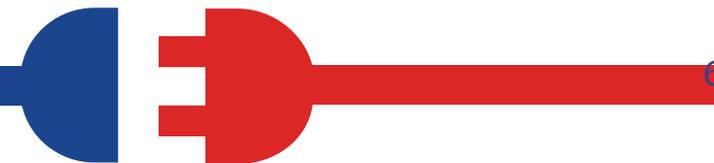
⚡ 2015 – only heat pumps



⚡ 2020, founded Electrify My Home



Larry Waters  
President, Electrify My Home



# Electrify My Home – Electrification Pioneers

## Our Mission:

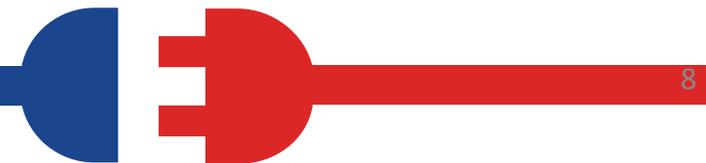
*To provide the **most efficient** cost-effective electrification solutions to California homeowners, to practice **good stewardship** of the electrical panel, and to **train and influence** other contractors to do the same.*



**ELECTRIFY**  
**MY HOME**

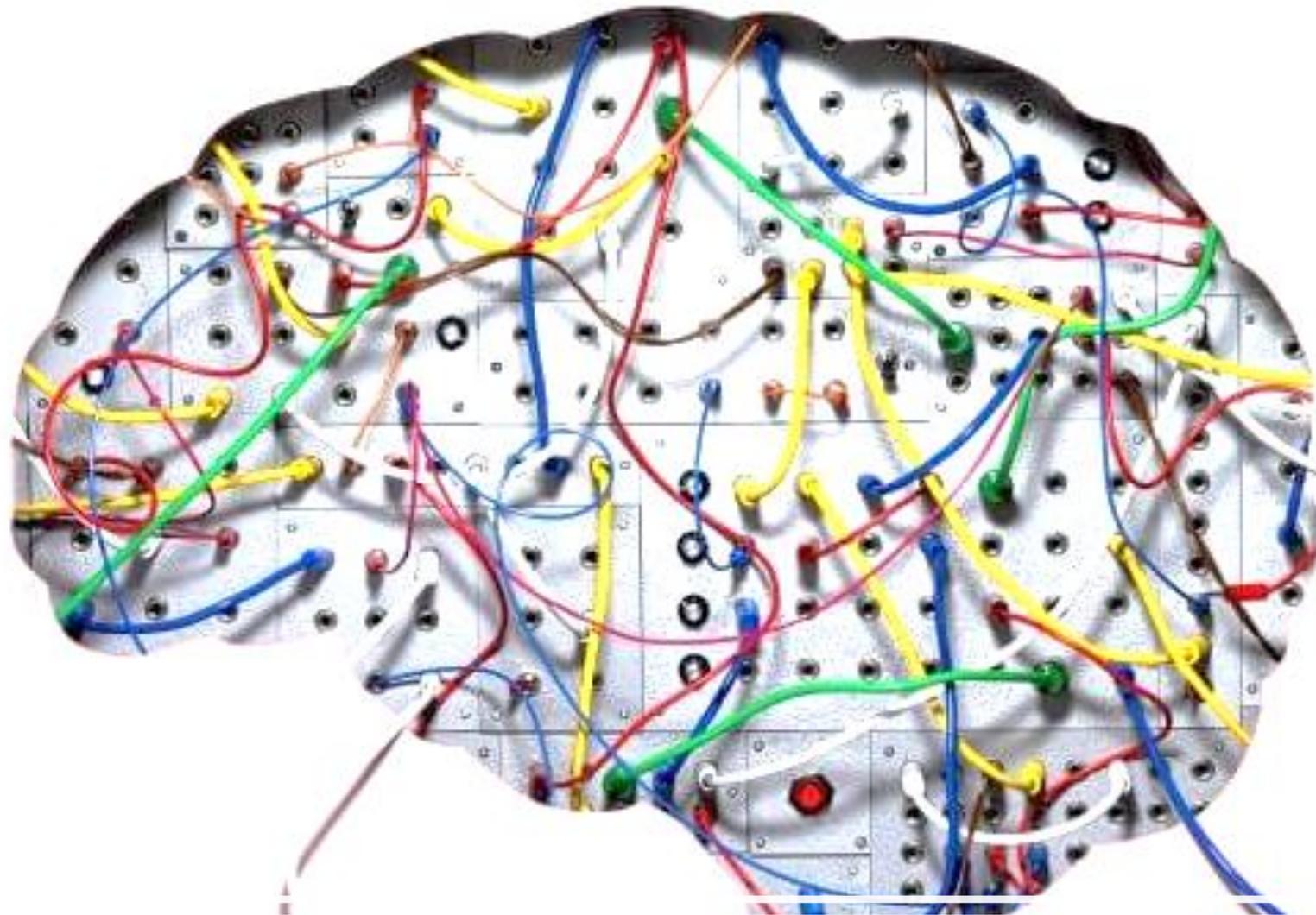
# Agenda

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



# Importance of the Panel





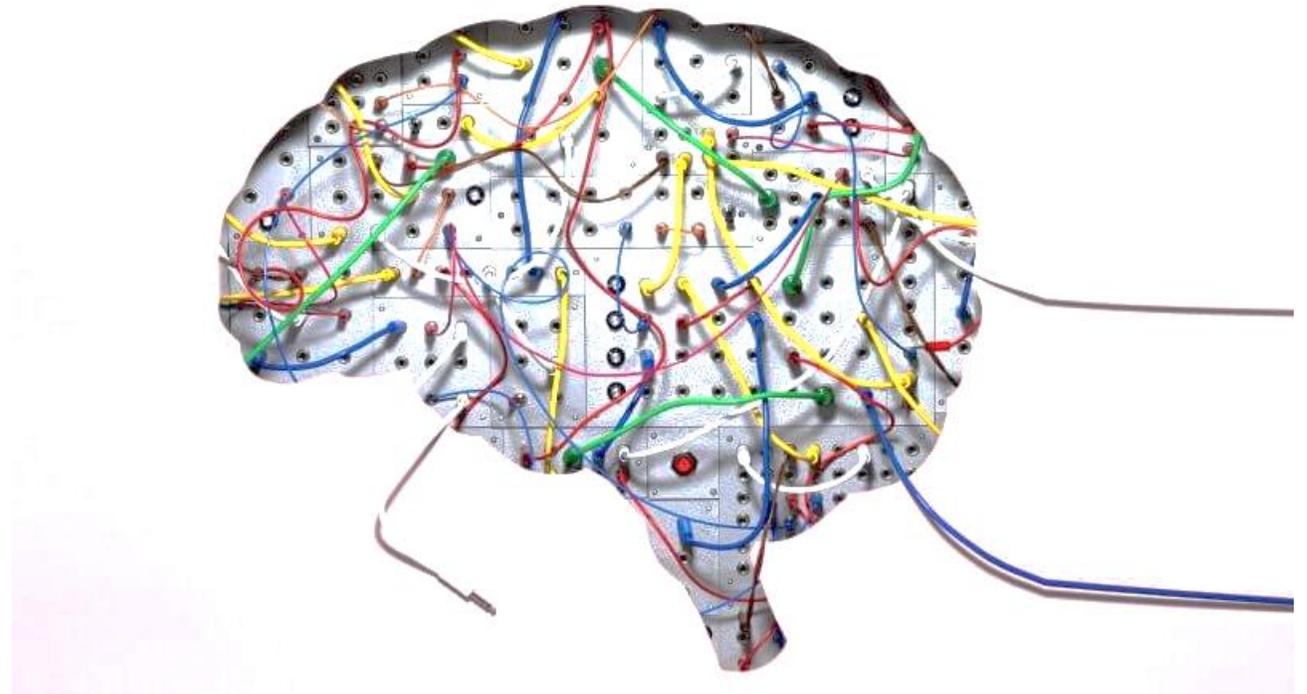
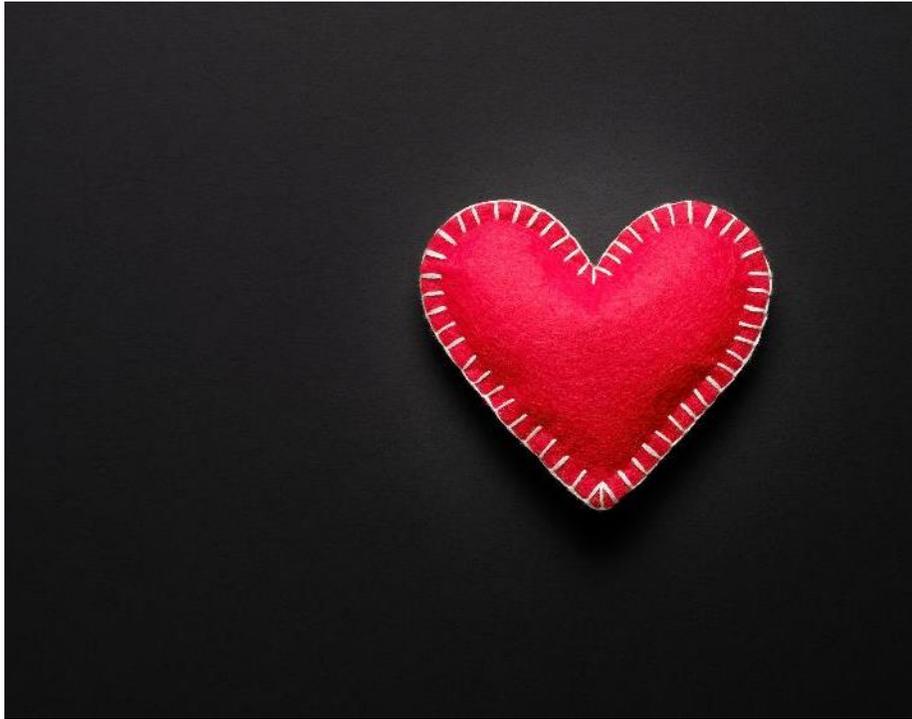
Electrical Infrastructure = The Brain of Electrification



# Heat Pumps are the Heart of Electrification

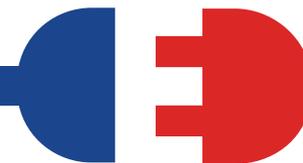


# The Analogy, Tied Together

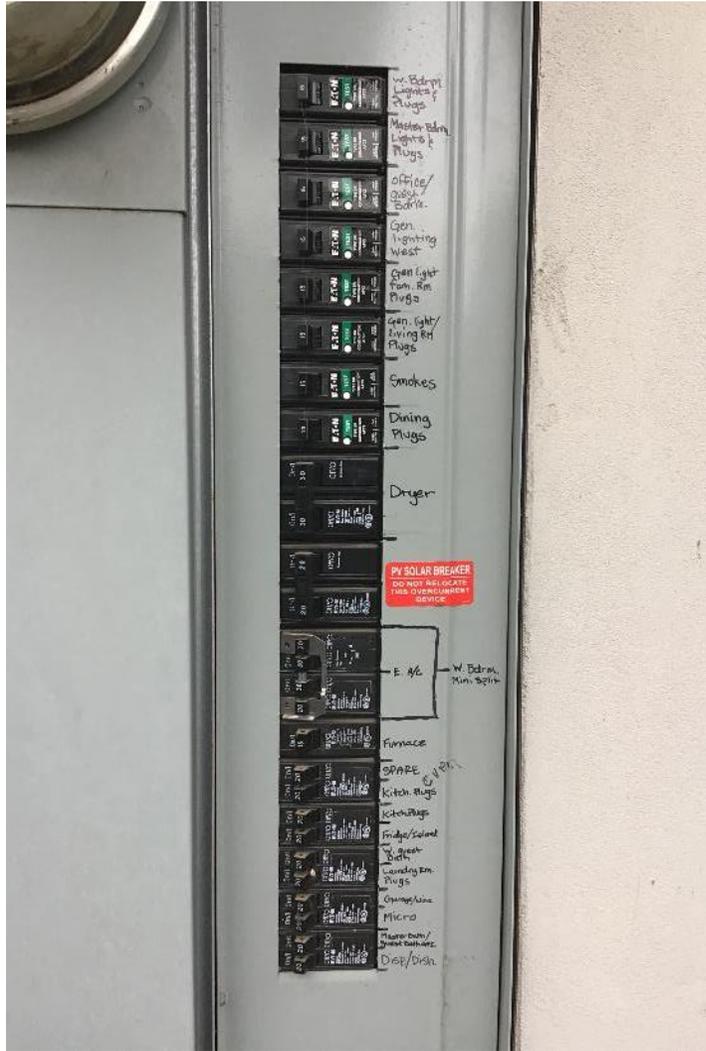


✦ Make sure you use the right heat pump for the right application

✦ 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]

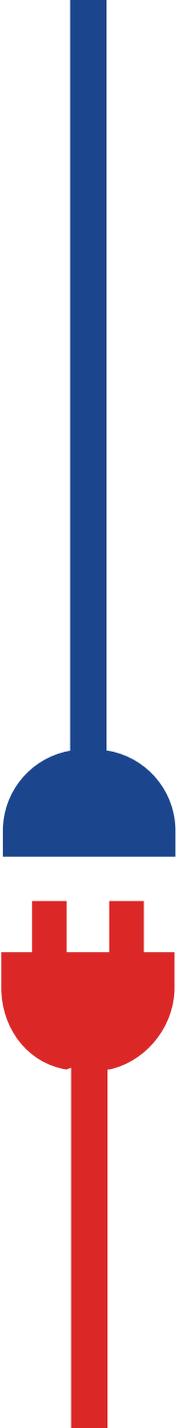
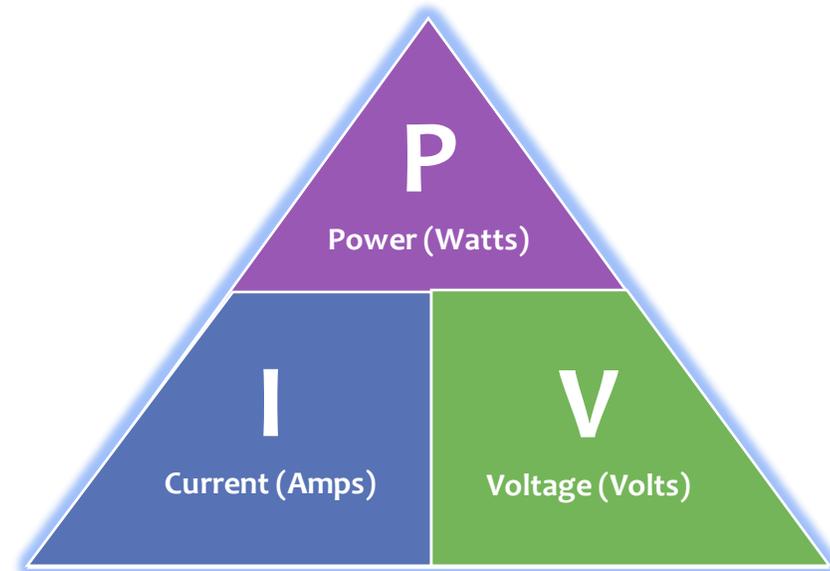
⚡ Amps = watts/volts [A = W/V]

⚡ 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:**

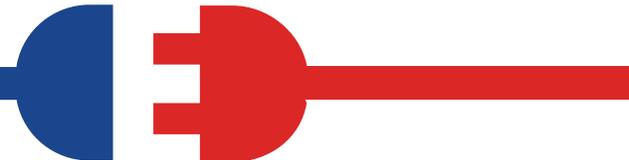
100 Amps x 240 Volts = 24,000 Watts

**200A Panel:**

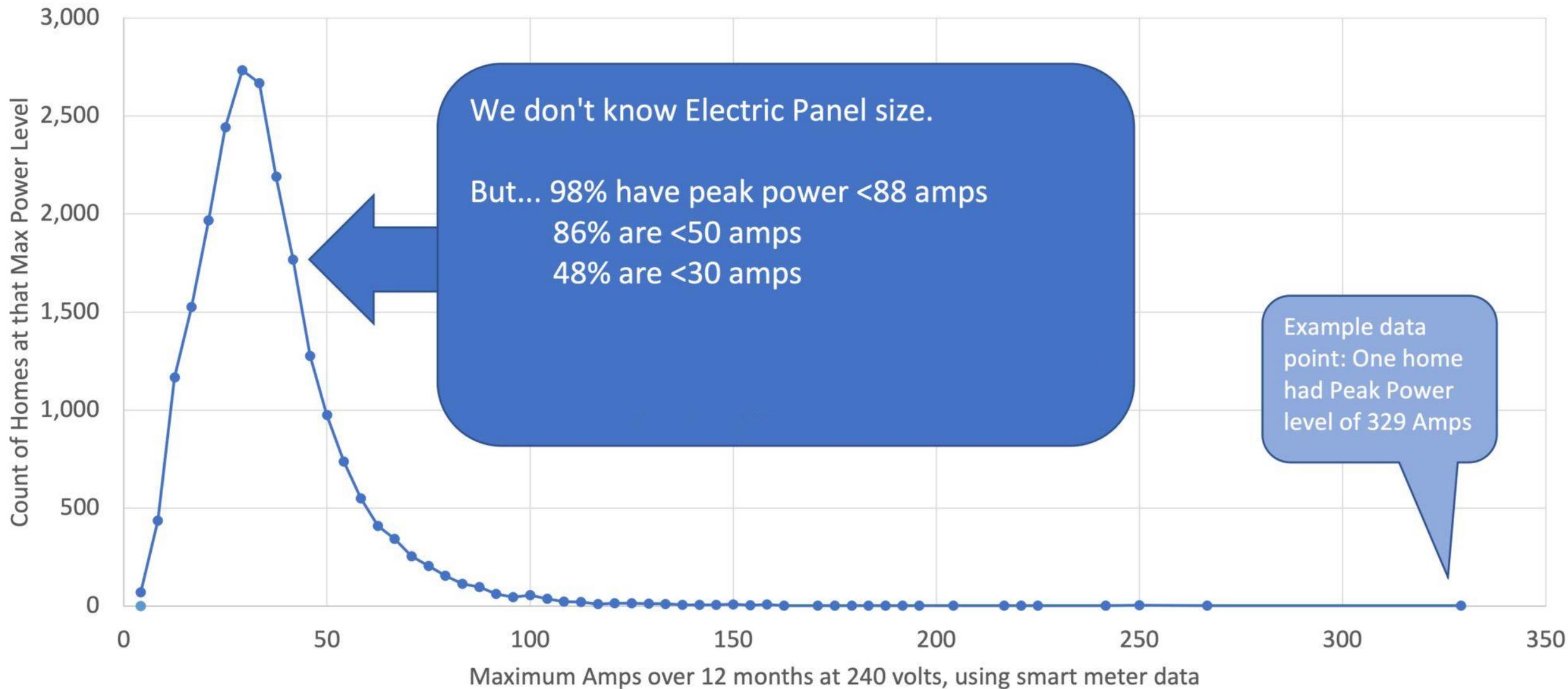
200 Amps x 240 Volts = 48,000 Watts

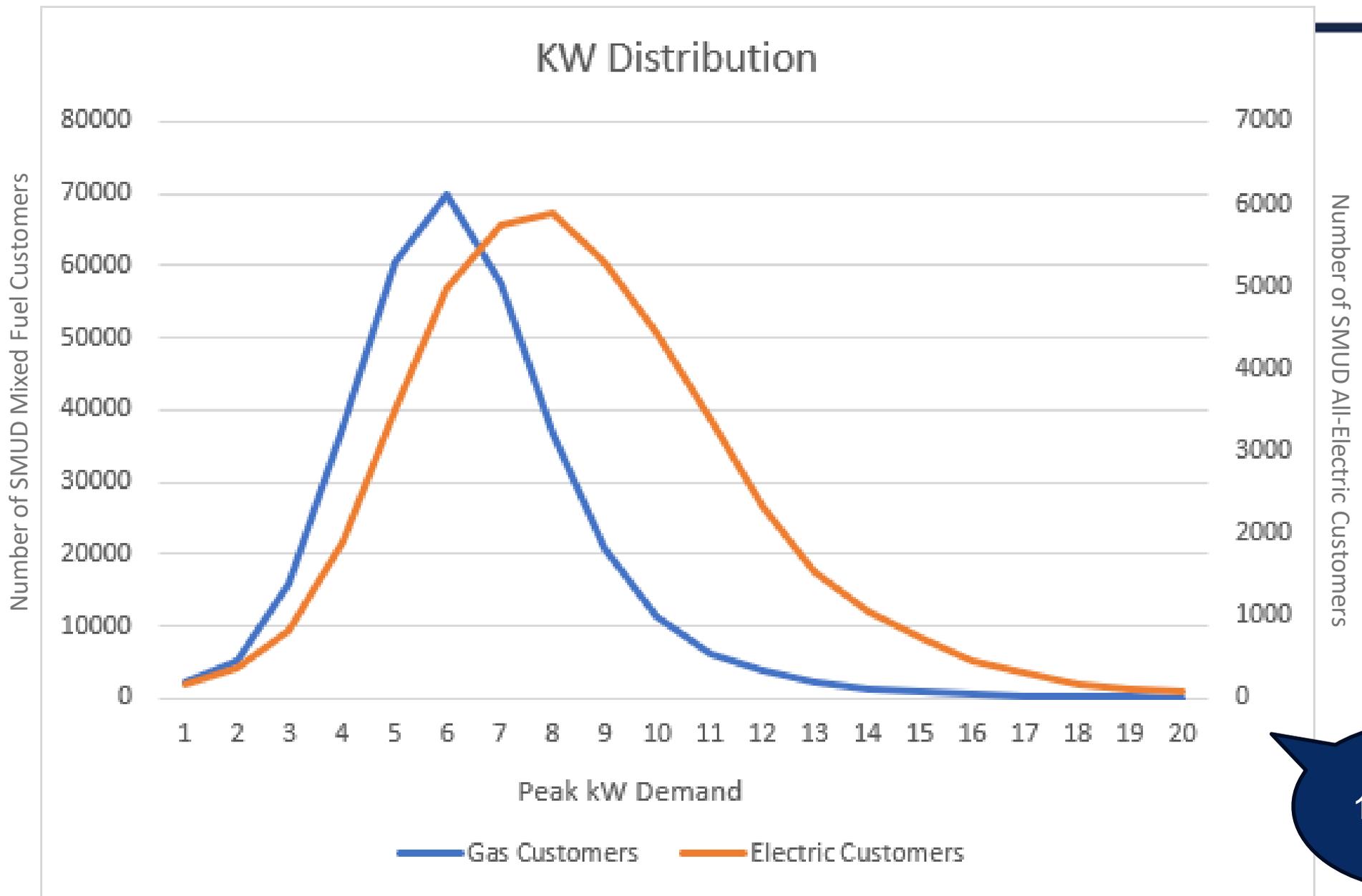


**That's a LOT of capacity!**



## Count of Peak Power Levels in Amps across 22,442 CA Homes

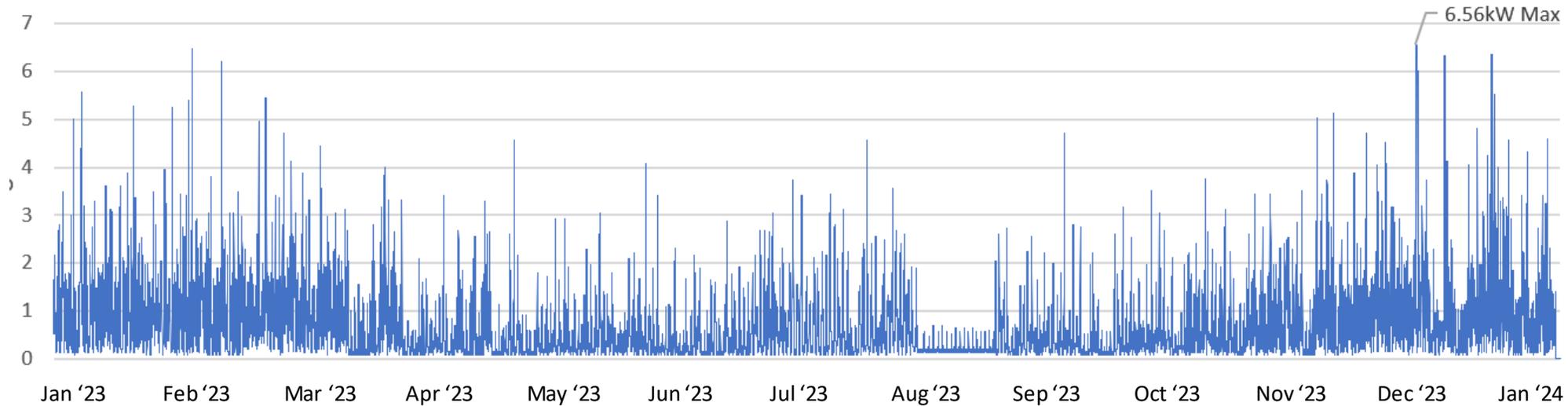




24kW =  
100amps  
@240v

# A Fully Electrified House Example – Max 6.56kW

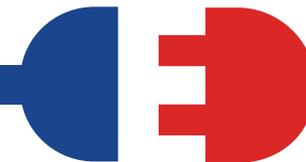
15 Minute kW Readings, All Electric Home



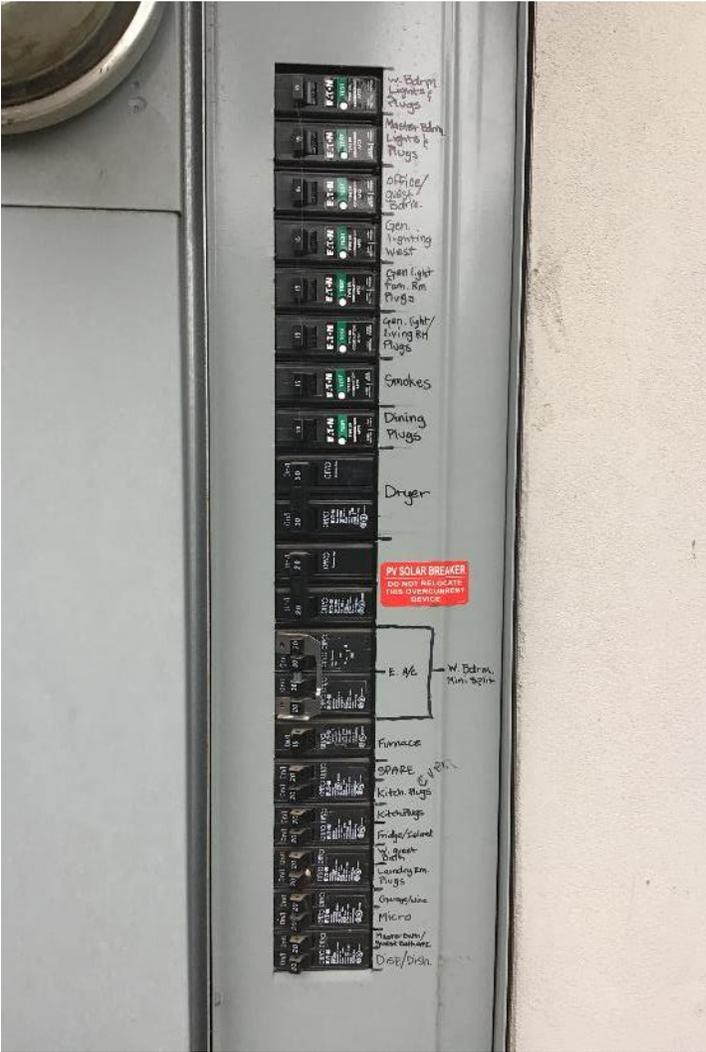
🔌 Built in 1959

🔌 1420 sqft

🔌 2-ton Mitsubishi inverter, 50-gal HPWH, elec range, elec resistance dryer

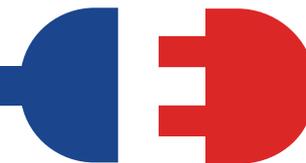


# So...Are These Panels Full?

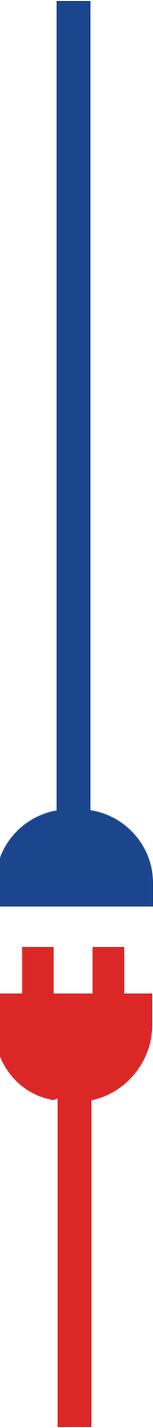


# We Have Capacity...But Does It Meet Code?

- ✦ 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 (spikey factor)
    - ✦ 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, 125% for EV chargers



# What's Wrong With Panel Upgrades?



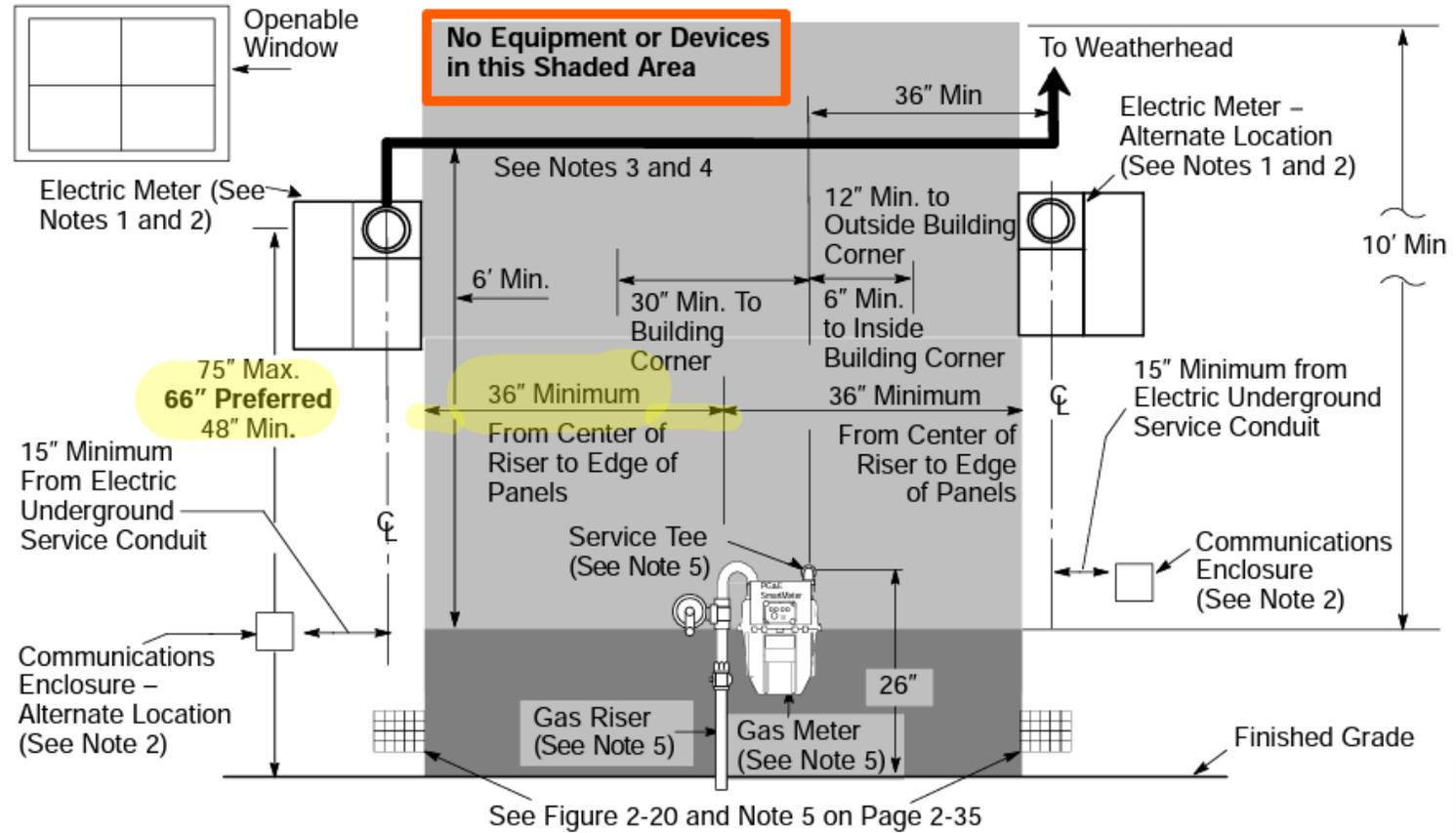
# Panel Upgrade Costs

**\$4,000 - \$9,500**

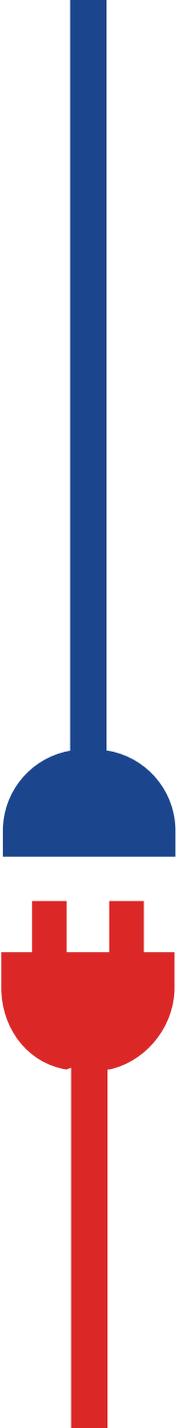
*+much more if trenching or  
other infrastructure needed*



# Complicated If Near A Gas Meter

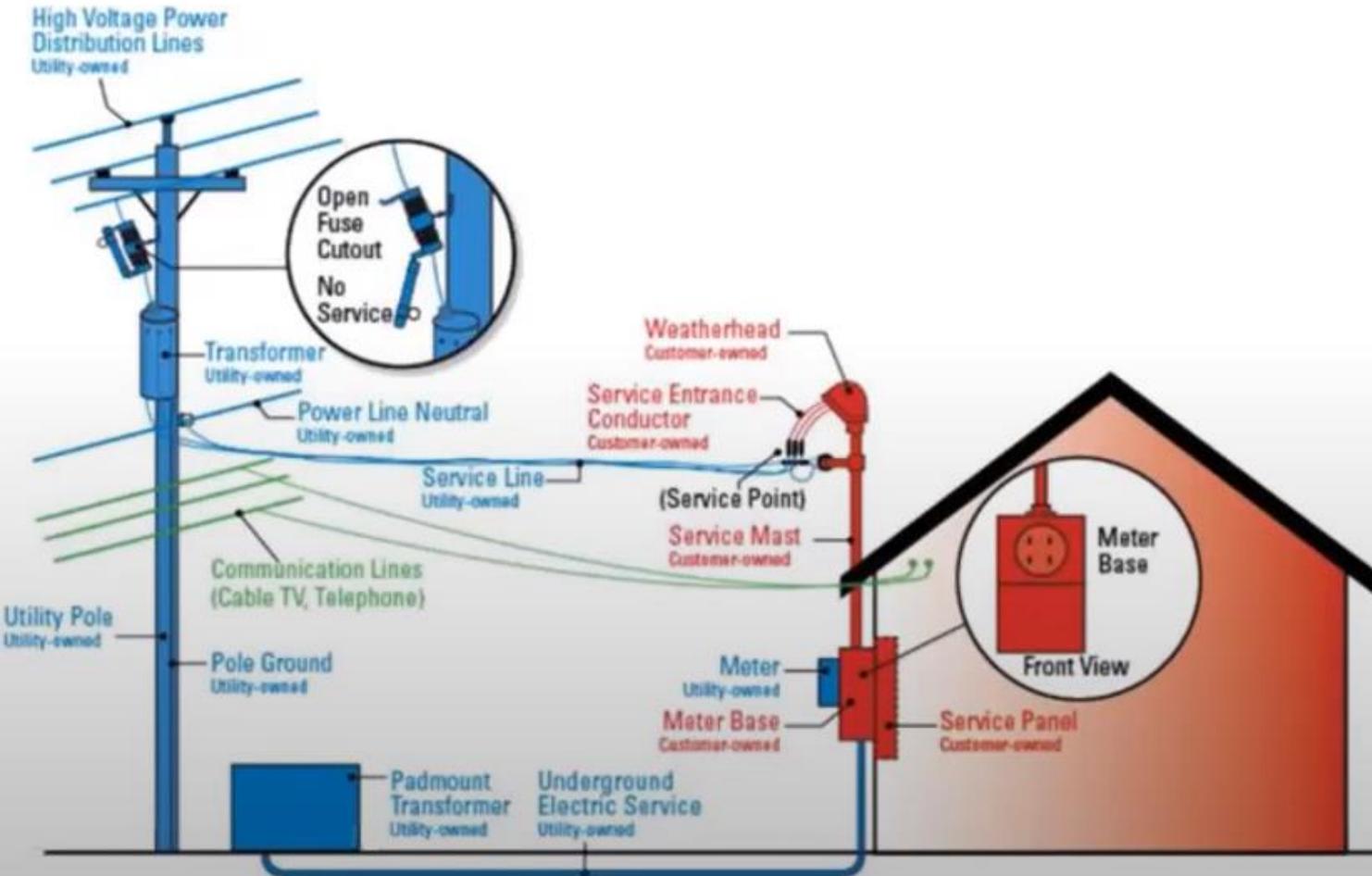


**Figure 2-19**  
Electric and Gas Meter Set Separation Dimensions and Clearances



# Utility Infrastructure Must Support Worst Case Scenarios

## Utility-Owned and Customer-Owned Electric Equipment For Residential Service to Single-Family Dwellings and Duplexes



### PG&E Infrastructure

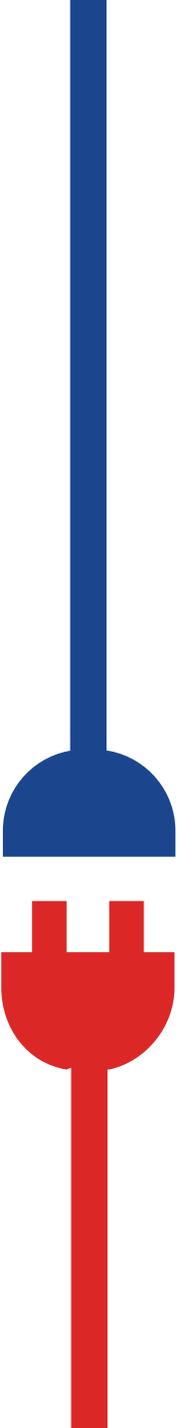
#### Front-of-the-meter (FTM)

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)



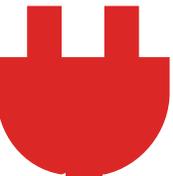
Load assessment or service design (30 days)



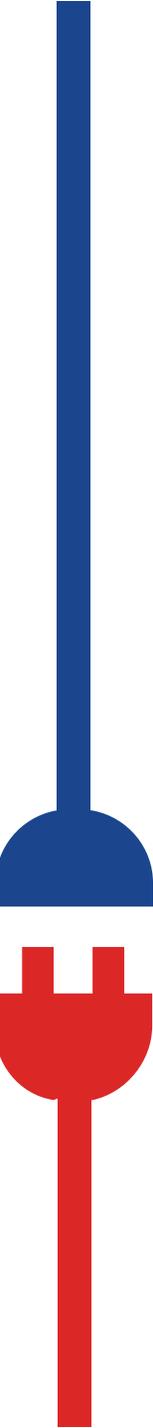
Contract & payment (70 days)



Construction & energization (42- 84 days, \$Varies)



# Solutions – Subs & Slim Breakers

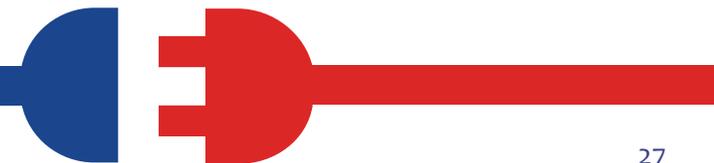


# What Loads to Consider – Breaker Spaces



**Most homes converting from gas, will need:**

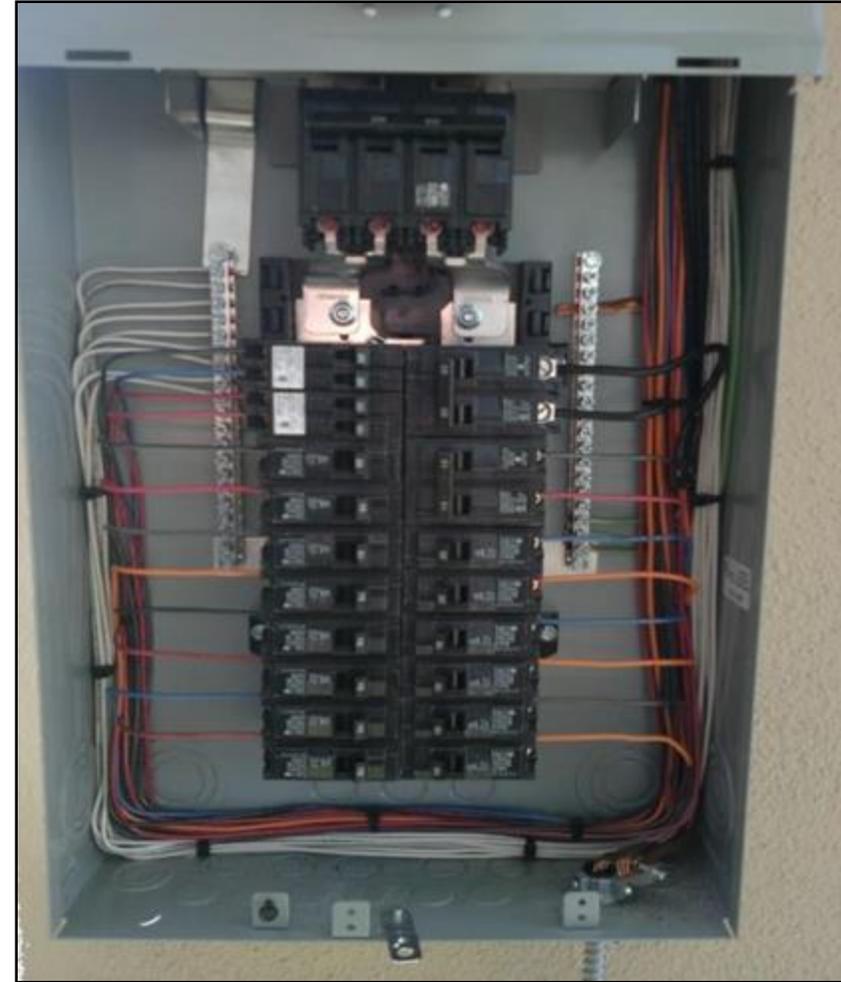
- ✦ Heat Pump 2-6 spaces (20a-50a)
- ✦ Dryer 2 spaces (30a)
- ✦ Hot water 2 spaces (15a or 30a)
- ✦ Range 2 spaces (50a)
- ✦ EV charger 2 spaces (30-50a)



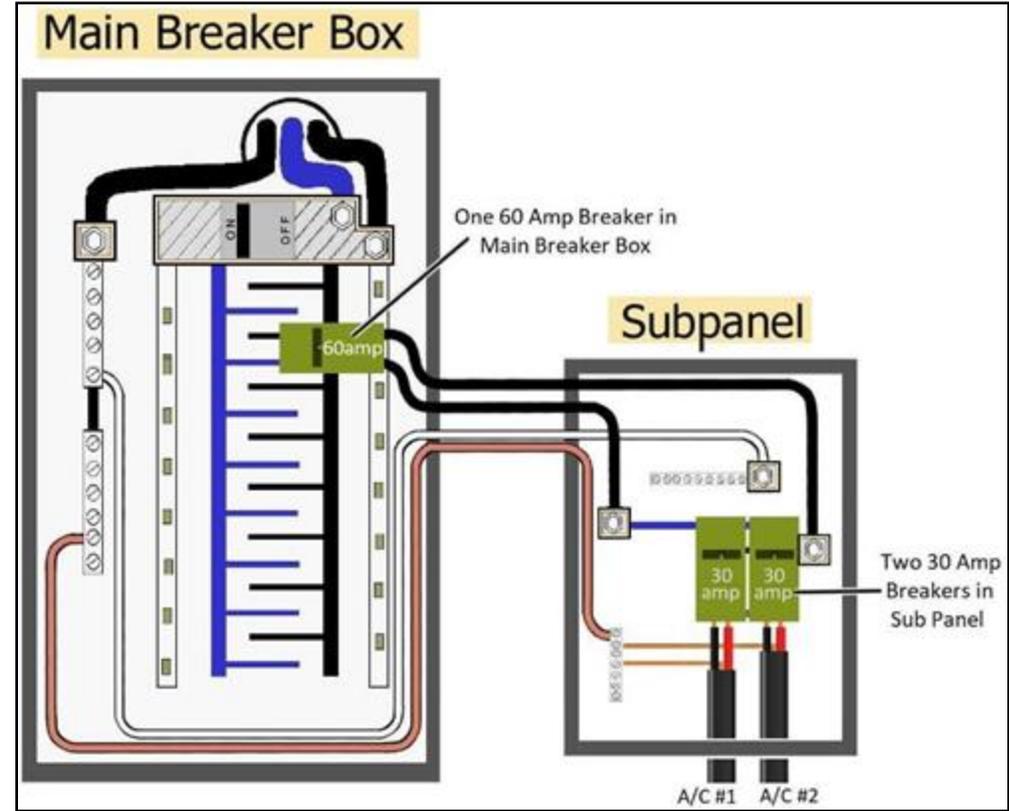
# Panel is Full? "No Space" but *Not* at Capacity



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

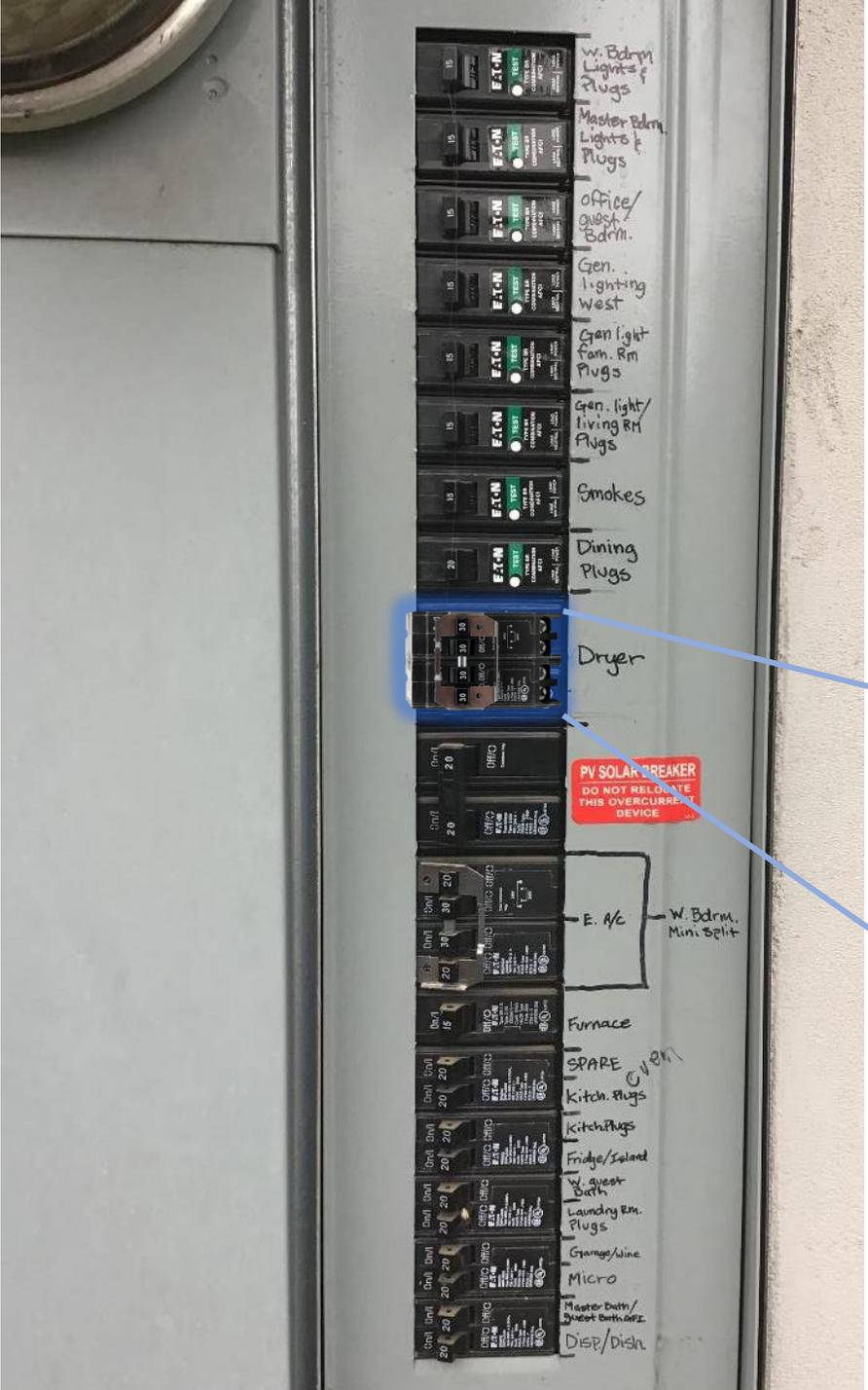


# Utilize Subpanels to Gain Additional Space



⚡ If there is limited space on the main, but load is not exceeded, stretch with a quad to a subpanel

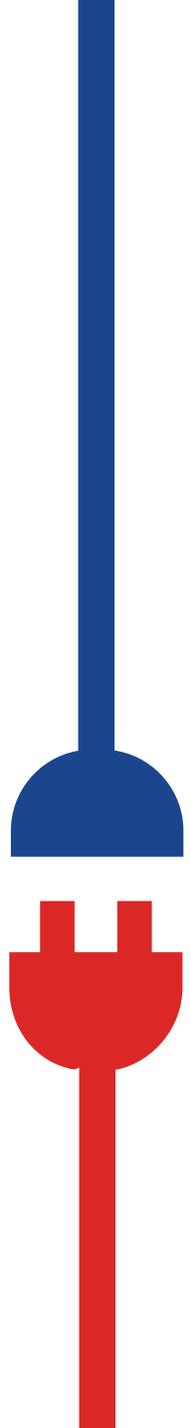
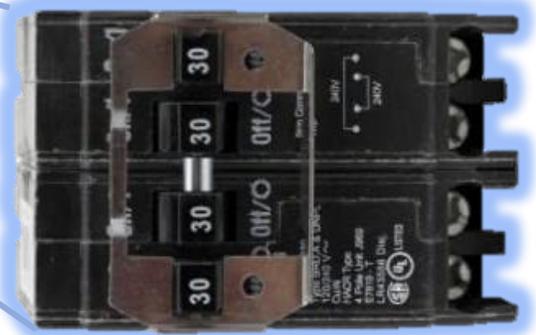
⚡ Subpanels should not be fed with wire size less than #8



# Solutions to “Full” Panels

Task: Add a HPWH Circuit

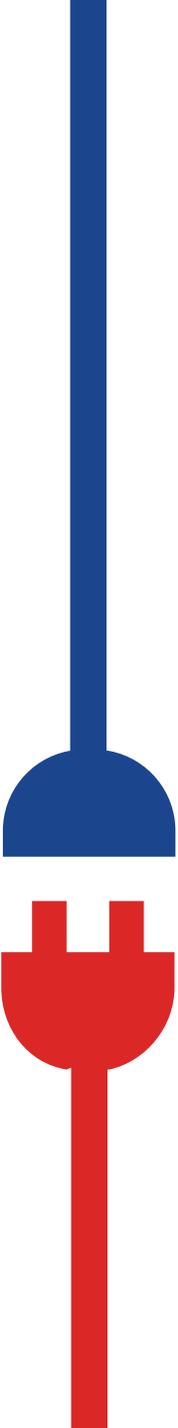
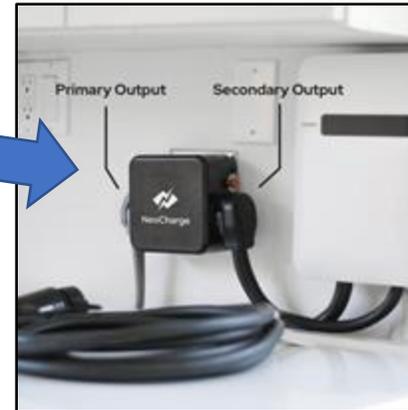
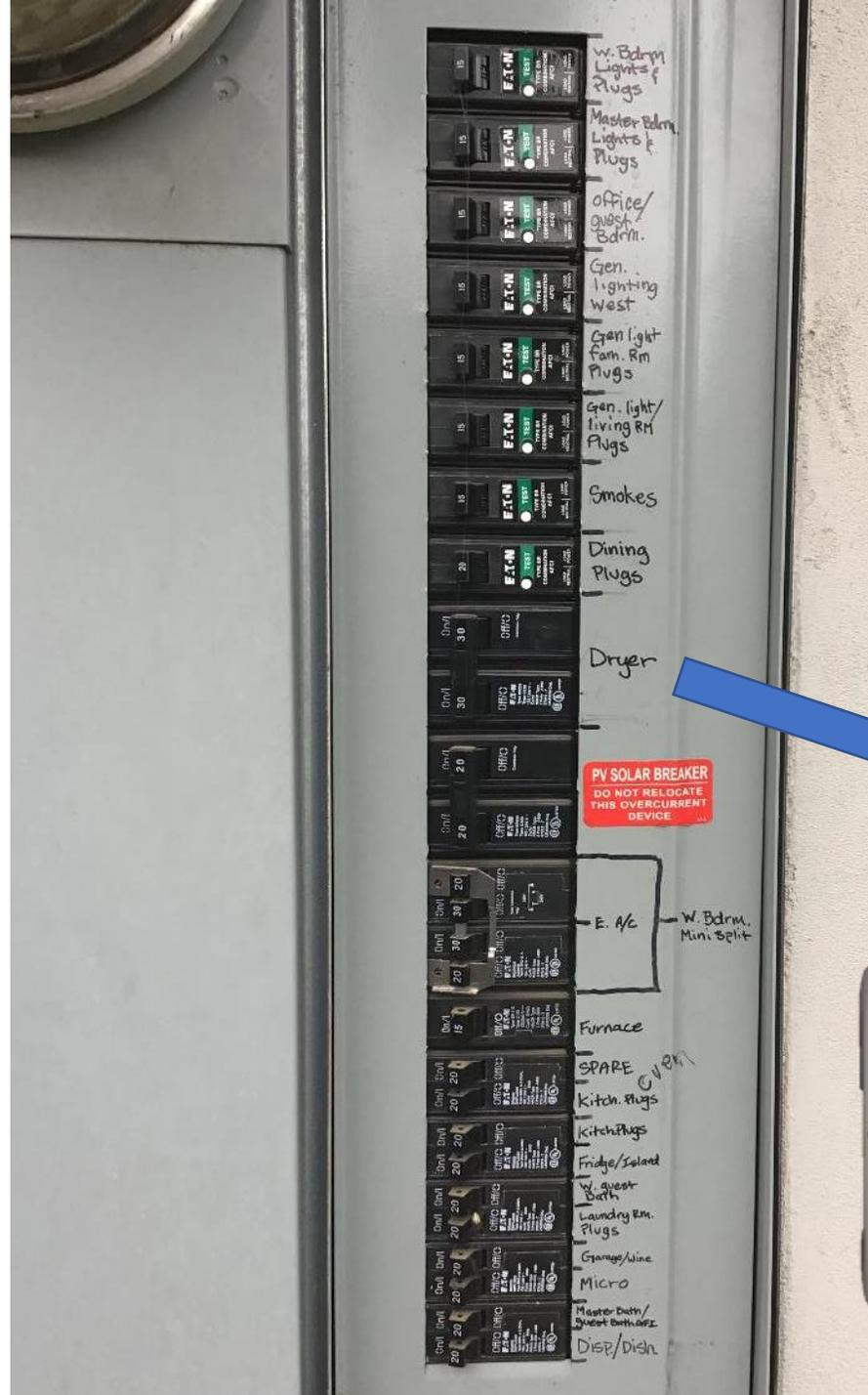
🔌 Option 1: Quad it out!

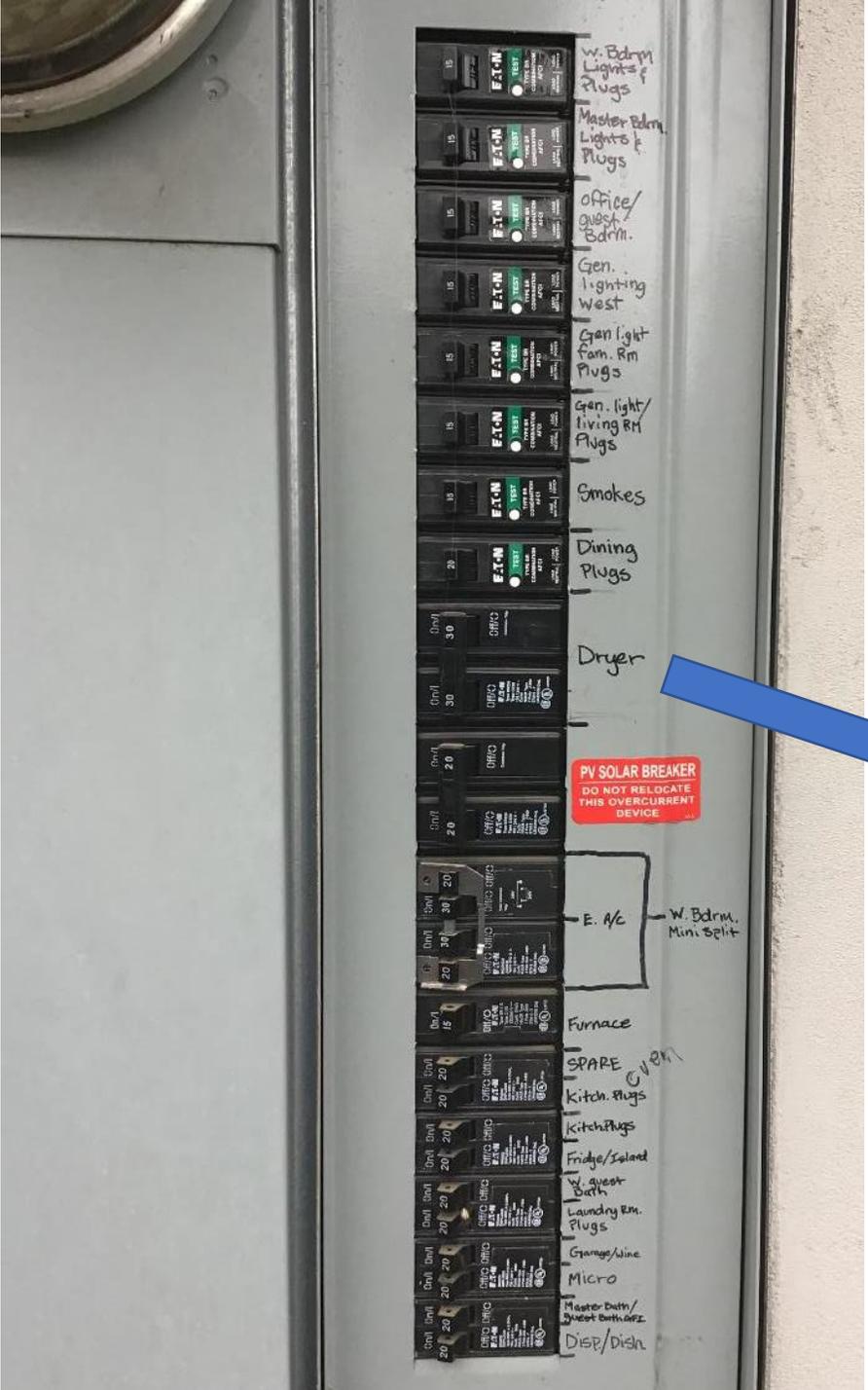


# Solutions to “Full” Panels

## Task: Add a HPWH Circuit

🔌 Option 2: Circuit Splitter!

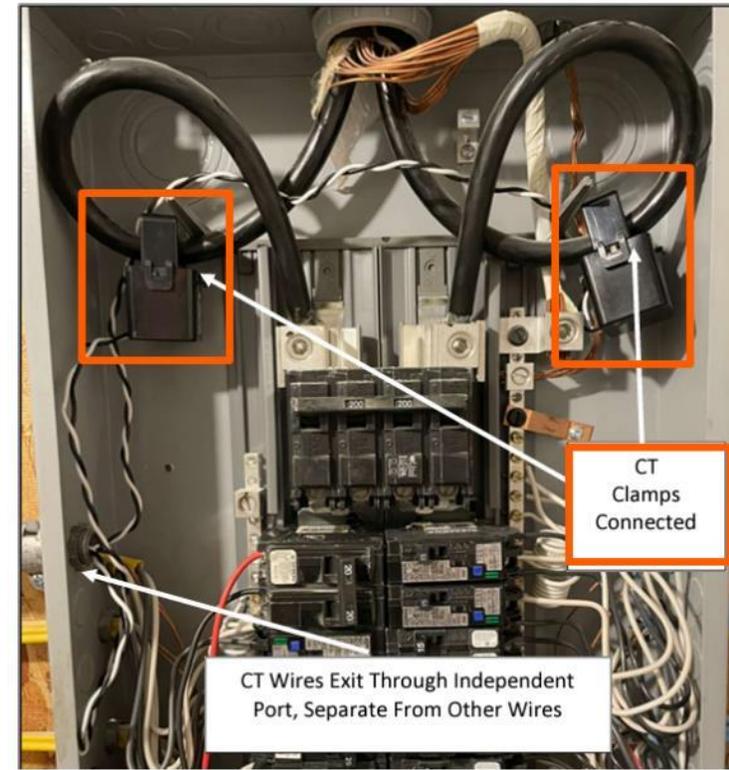


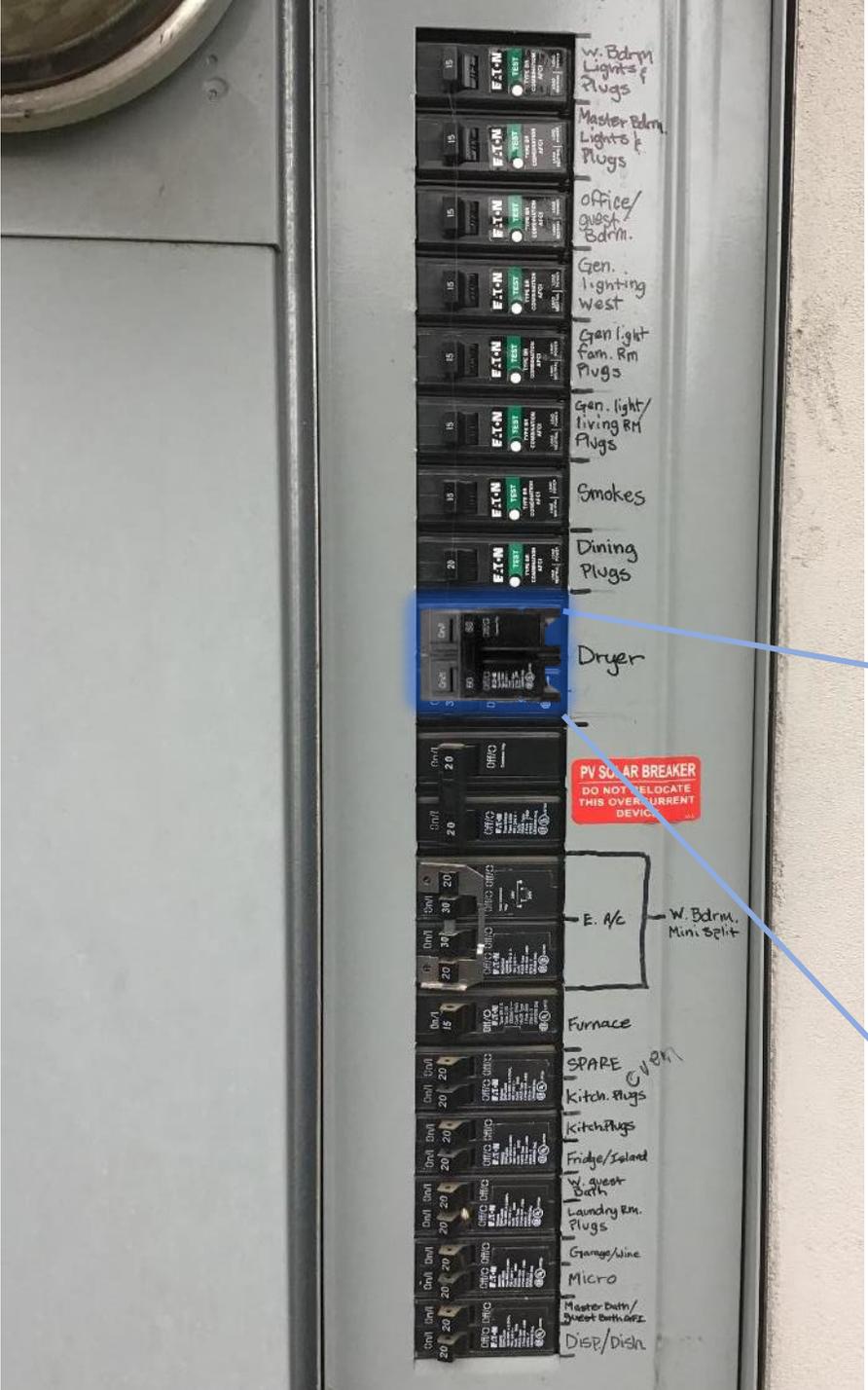


# Solutions to “Full” Panels

## Task: Add a HPWH Circuit

Option 3: Circuit Pausing!





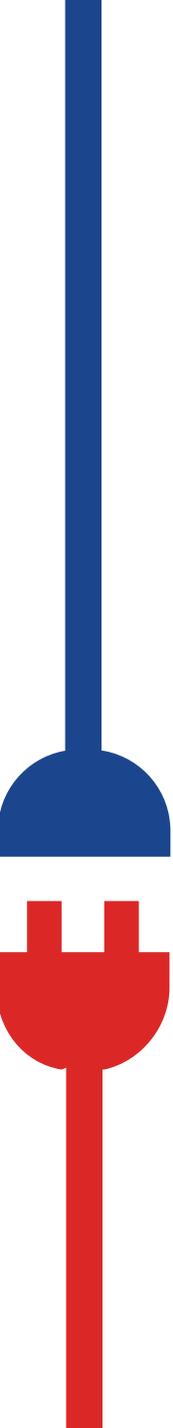
# Solutions to “Full” Panels

Task: Add a HPWH Circuit & a Couple More

🔌 Option 4: Add a Subpanel



🔌 Tip – add the neutral!

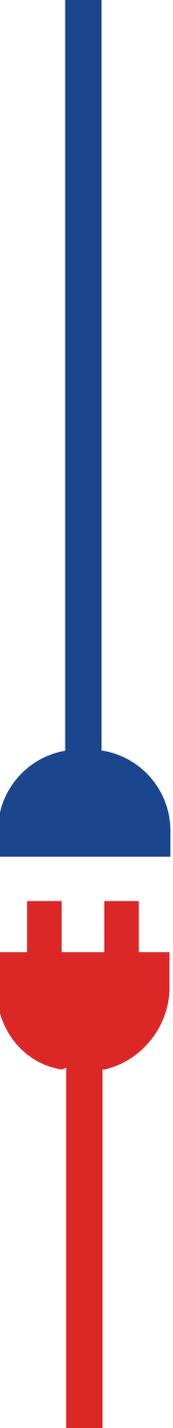




# Solutions to “Full” Panels

**Task: Add a HPWH Circuit  
(and much more)**

- 🔌 Option 5: Smart Panel

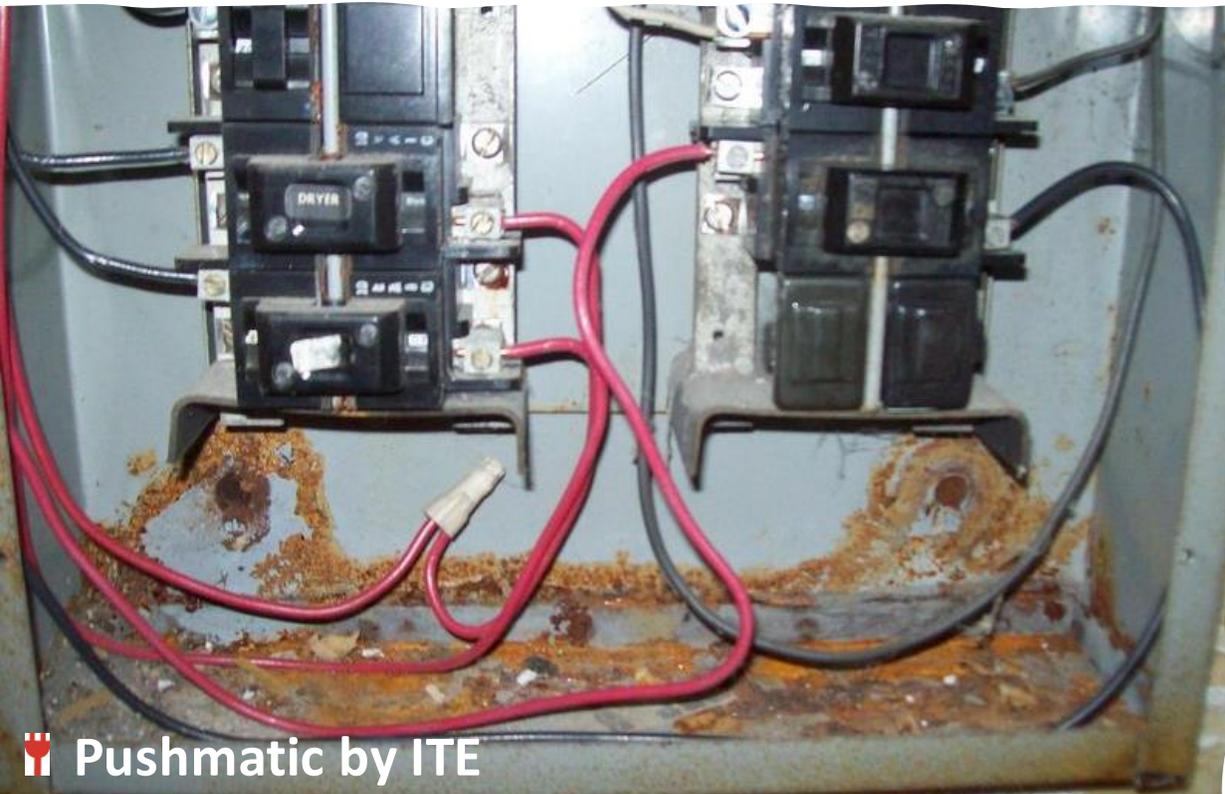




🔌 FPE Stab-Lok



🔌 Zinsco



🔌 Pushmatic by ITE

# !! SAFETY !!

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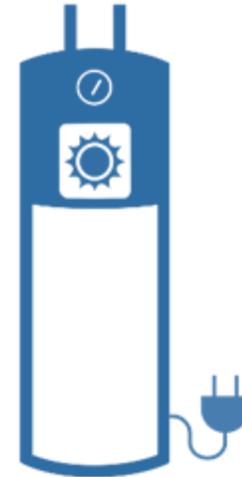
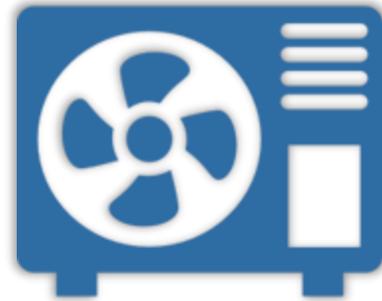
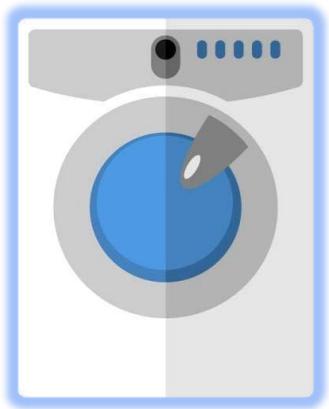
- 🔌 We talk a lot about reusing infrastructure but **safety is always #1**
- 🔌 It's better to **hold off** on certain electrification than to ignore a potential safety issue
- 🔌 Replace or plan replacement for known panels with safety issues
- 🔌 Any evidence of burning or damage in the panel is a red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

# Solutions – Watt Diet

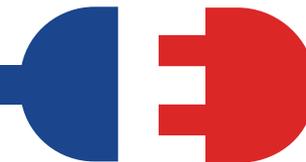


Tom Kabat

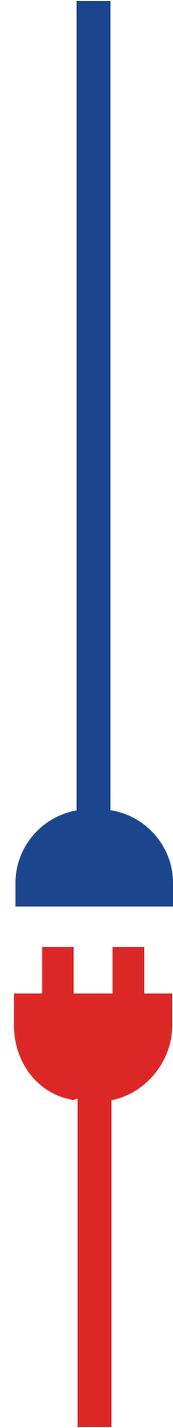
# Watt Dieting Examples



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



# Examples From The Field



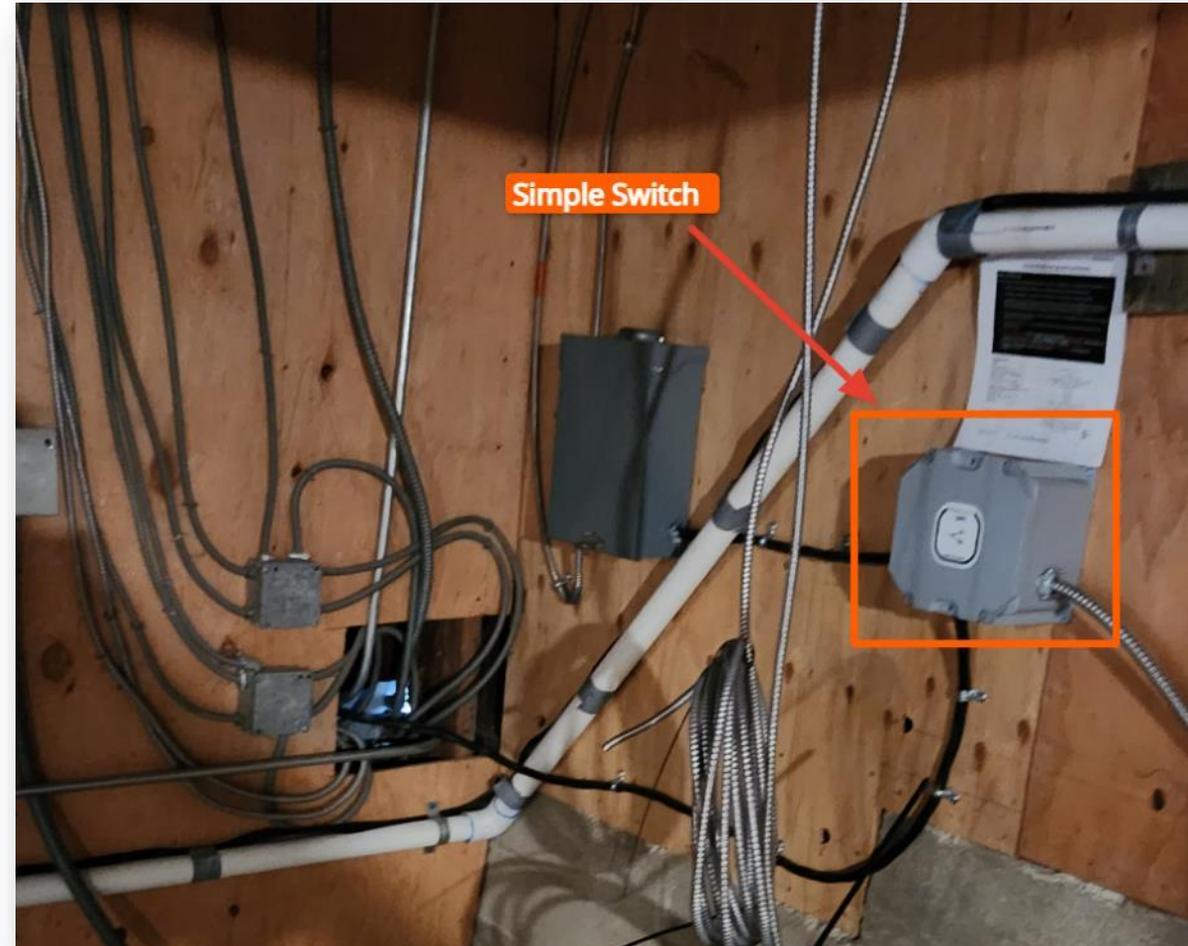
# Example 1 (PRE) – Oakland, CA

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



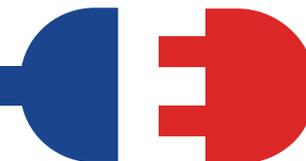
# Example 1 (POST) – Oakland, CA

- 🔌 **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
- 🔌 **Starting Point:** Gas Furnace, water heater
- 🔌 **Goals:** Multizone heat pump, water heater, insulation & air sealing
- 🔌 **The Challenge:** 125A capacity panel

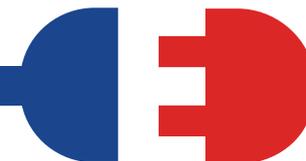


## Example 2 (POST) – Petaluma, CA

- 🔌 **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) – Davis, CA

- ⚡ **Existing Panel:** 100 Amps, Recessed, Feed Wire Capable of 125A
- ⚡ **Starting 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 3 (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



# Example 4 (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 4 (POST) – Vacaville, CA

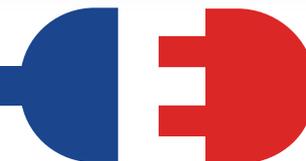
- 🔌 **Post Panel:** 125A with SPAN panel
- 🔌 **Solution:** Low-amp appliances, span panel
- 🔌 **Scope:** 20A Heat Pump, 120v HPWH





# Example 5 (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



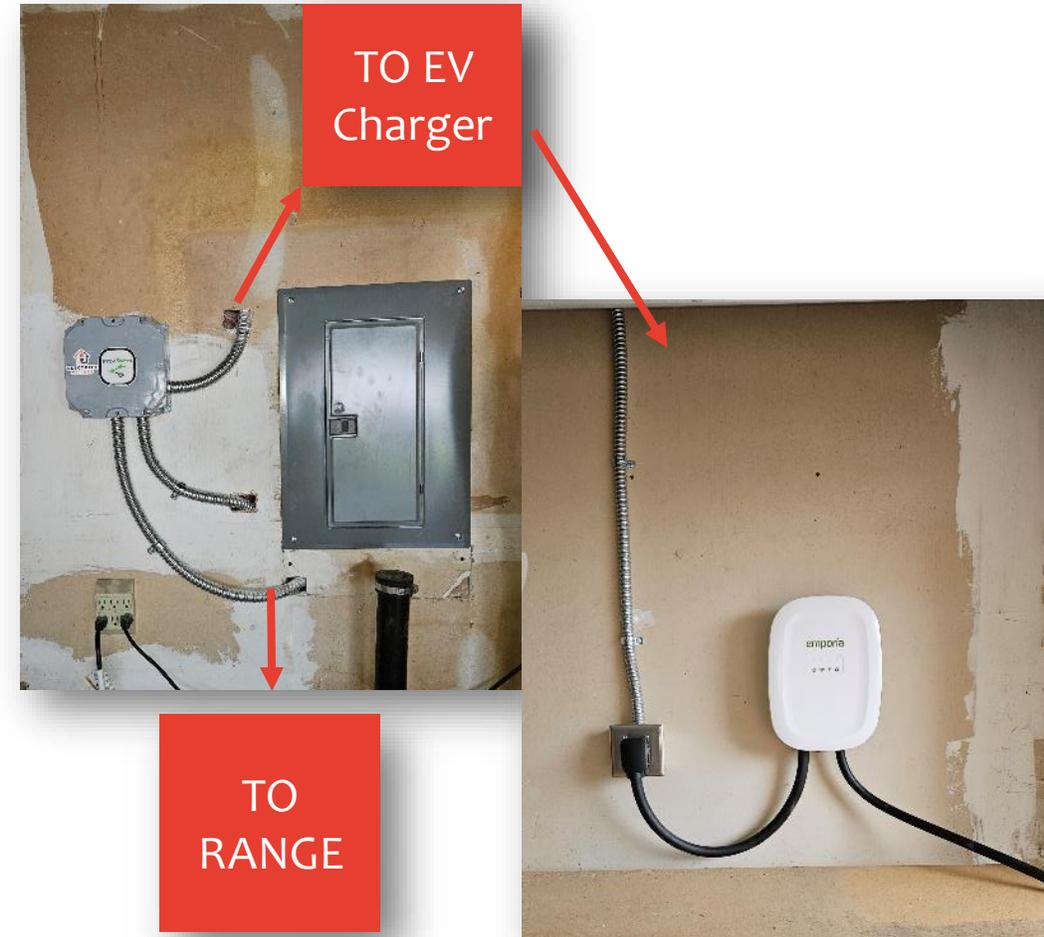
# BONUS Example 6 (PRE) – Woodland, CA

- ⚡ **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



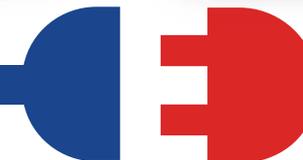
# BONUS Example 6 (POST) – Woodland, CA

- 🔌 **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



TO  
RANGE

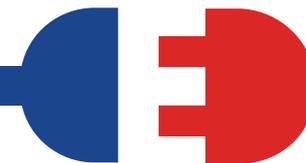
TO EV  
Charger



# Questions? Stay in Touch!



Larry Waters | 707-840-3411 | [www.electrifymyhome.com](http://www.electrifymyhome.com) | [info@electrifymyhome.com](mailto:info@electrifymyhome.com)



# Closing

- Continuing Education Units Available
  - Contact [ian.logan@ventura.org](mailto:ian.logan@ventura.org) for AIA & ICC LUs
- Coming to Your Inbox Soon!
  - Slides & Survey – Please Take It and Help Us Out!
- Upcoming Courses
  - [6/12 Energy Code Implementation: Multi-Family](#)
  - [7/8 2022 CalGreen Codes for Residential and Non-Residential](#)
  - [7/18-10/3 Certified Passive House Designer/Consultant \(CPHD\) Hybrid Cohort](#)
  - [7/18 Carbon Reduction through Building Electrification](#)
- 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](https://3c-ren.org/codes)

Call:  
805.781.1201





**Thank you!**

For more info:  
[3c-ren.org](https://3c-ren.org)

For questions:  
[info@3c-ren.org](mailto:info@3c-ren.org)



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