



# We will be starting soon!

*Thanks for joining us*



# Home Assessments for Decarbonization

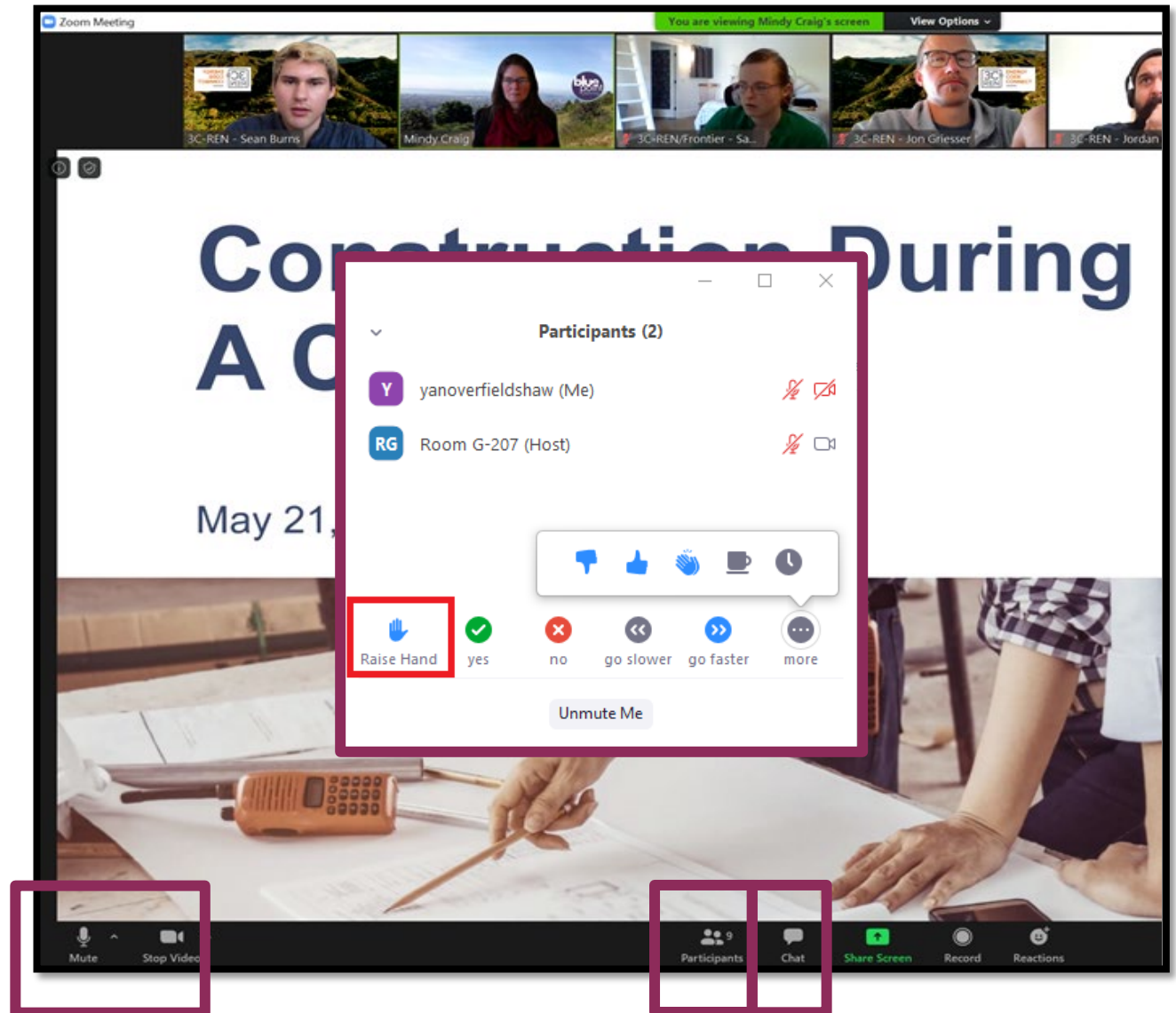
*Ann Edminster, Design AVEnues, LLC*

November 15, 2022



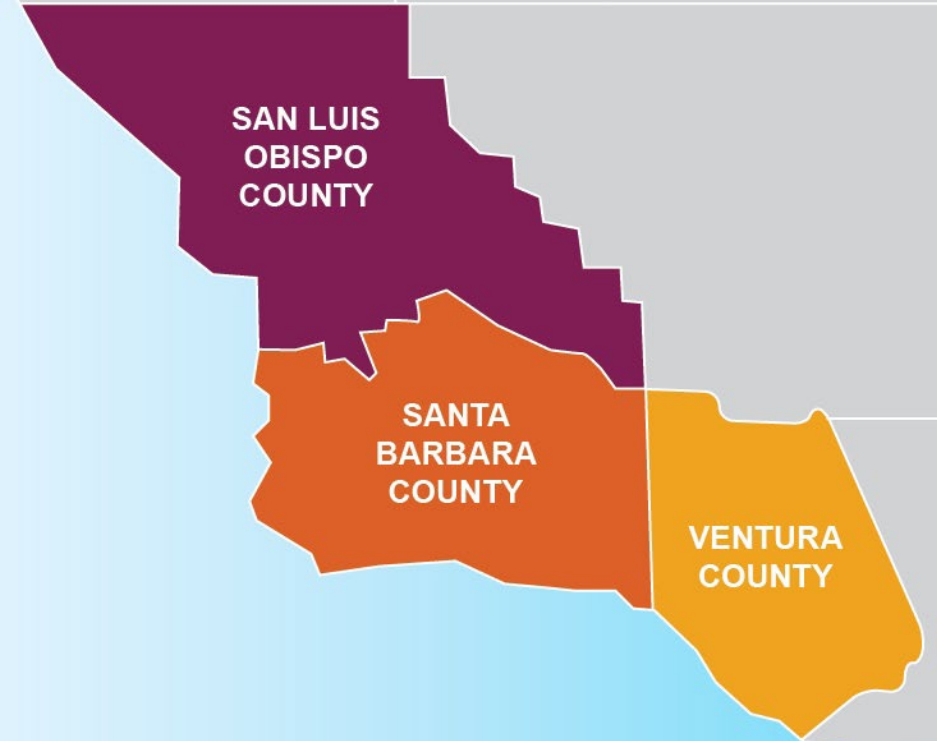
# Zoom Orientation

- 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 Staff Online





ENERGY  
CODE  
CONNECT

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HOME  
ENERGY  
SAVINGS

---



BUILDING  
PERFORMANCE  
TRAINING

---





ENERGY  
CODE  
CONNECT

- Serves all building professionals
- Three services –
  - **Energy Code Coach**
  - **Training and Support**
  - **Regional Forums**
- Makes the Energy Code easy to follow

Energy Code Coach:  
[3c-ren.org/codes](https://3c-ren.org/codes)  
805.220.9991

Event Registration:  
[3c-ren.org/events](https://3c-ren.org/events)





HOME  
ENERGY  
SAVINGS

### Multifamily (5+ units)

- No cost technical assistance
- Rebates up to \$750/apartment plus additional rebates for specialty measures like heat pumps

### Single Family (up to 4 units)

- Sign up to participate!
- Get paid for the metered energy savings of your customers

[3C-REN.org/home](https://3C-REN.org/home)







## BUILDING PERFORMANCE TRAINING

- Serves current and prospective building professionals
- Expert instruction:
  - **Technical skills**
  - **Soft skills**
- Helps workers to thrive in an evolving industry

Event Registration:  
[3c-ren.org/events](https://3c-ren.org/events)



# Home Assessments for Decarbonization

## High Performance Fundamentals (HPF)



# This class assumes you:

- Have **SOME** knowledge of and direct experience with buildings and their systems;
- Have completed 3C-REN's **High-Performance Fundamentals** classes 1 through 5;
- **MAY NOT** have a deep background in high-performance building work; *but*
- You can and will clearly identify for clients what **IS** and **WHAT IS NOT** within your potential scope; *and*
- What other professionals can *and should* do **that you can't**.

# Home Assessments for Decarbonization

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## High Performance Fundamentals

### Introduction: me, the HPF series, the class

- Establish homeowner goals & expectations
- Investigate and document
- Recommend & prioritize solutions
- Provide resources

#### You'll get some after class!

- Links in PDF
- Homeowner questionnaire
- Existing condition checklist
- Resource directory

# My pathway to high performance work



Nose image: Flaticon.com

# The High Performance Fundamentals series

**WHO:** *any* building practitioner who wants a solid grounding in building science

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**WHAT:** learn the fundamentals needed to holistically design and build better buildings

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**WHY:** to reduce greenhouse gas emissions and improve comfort, resiliency, & efficiency

## The HPF series:

- **Class 1:** Introduction to high performance buildings and careers
- **Class 2:** How buildings work—science *and* buildings and science *in* buildings
- **Class 3:** Enclosure best practices
- **Class 4:** Heat pump fundamentals—space conditioning and water heating
- **Class 5:** Water heating distribution best practices
- **Class 6:** Home assessments for decarbonization

# Other HPF Program Elements

## 3C-REN's plans for further program development include:

- Formal certificate of completion
- Field-based, hands-on classes to complement initial series of lecture classes
- Mentorship and/or peer learning activities to support participants' learning



# Why is this class part of the High Performance Fundamentals series?

A HIGH-PERFORMANCE building is one that exceeds the performance of conventional buildings in important areas, typically including:

- Energy conservation
- Durability
- Comfort
- Safety
- Indoor air quality

These BENEFITS  
have synergies with  
decarbonization



Some definitions include additional criteria such as **accessibility** and **enhanced occupant productivity**.



# Decarbonization + high-performance synergies

**SWITCHING** from **GAS** to **ELECTRICITY**  
*without addressing performance can mean:*



***and MISSED OPPORTUNITIES!***

# **This class: *Home Assessments for Decarbonization***

**IS a process framework; it WILL**

enable you to help homeowners map their electrification pathway

**IS NOT the get-it-all-done class; it WON'T**

make you an expert, able to meet all your clients'  
electrification needs

(if you already have that expertise, GREAT!)

**It WILL help you identify other resources (including people)**

to help homeowners complete their electrification projects

# WHEN decarbonization will matter to you

- **Now:** 60+ CA local jurisdictions have embraced all-electric new construction ... and considering retrofits next!

<https://www.sierraclub.org/articles/2021/07/californias-cities-lead-way-pollution-free-homes-and-buildings>

- **Tomorrow:** Your next client may ask for it
- **January 1, 2023:** Title 24-2022 goes into effect—
  - Encourages efficient **electric heat pumps**
  - Establishes **electric-ready requirements** for new homes
  - Expands **solar photovoltaic & battery storage** standards
- **The writing is on the wall – it's just a matter of time!**



August 8, 2022: Pasadena becomes CA's 60th city/county to require building electrification

# California's future is ELECTRIFYING!

By 2045 CA has committed to:

- **100% zero-carbon electricity** (SB100)
- **Economy-wide carbon neutrality** (Exec Order B-55-18)

This means natural gas (methane) will have to go\*

- Methane has **84x CO<sub>2</sub>**'s global warming potential\*\*

Outdoor air emissions aren't the only problem

- Line leaks make gas **as polluting as coal**
- Household gas appliances **cause or worsen:**
  - asthma and other respiratory problems
  - indoor air pollution
  - burn injuries

\* except where there's no practical alternative

\*\* measured over 20 years



Riding Zero | Shutterstock via Vox.com

# YOUR future is ELECTRIFYING!



## California's building industry is changing **FAST!**

- Specialize in decarbonization
- Help make your clients' homes healthier, safer, more climate-resilient
- Offer services unique in your market

**New business models are emerging!**

# WHY

your clients may be interested sooner than later:

# MISSION

and/or

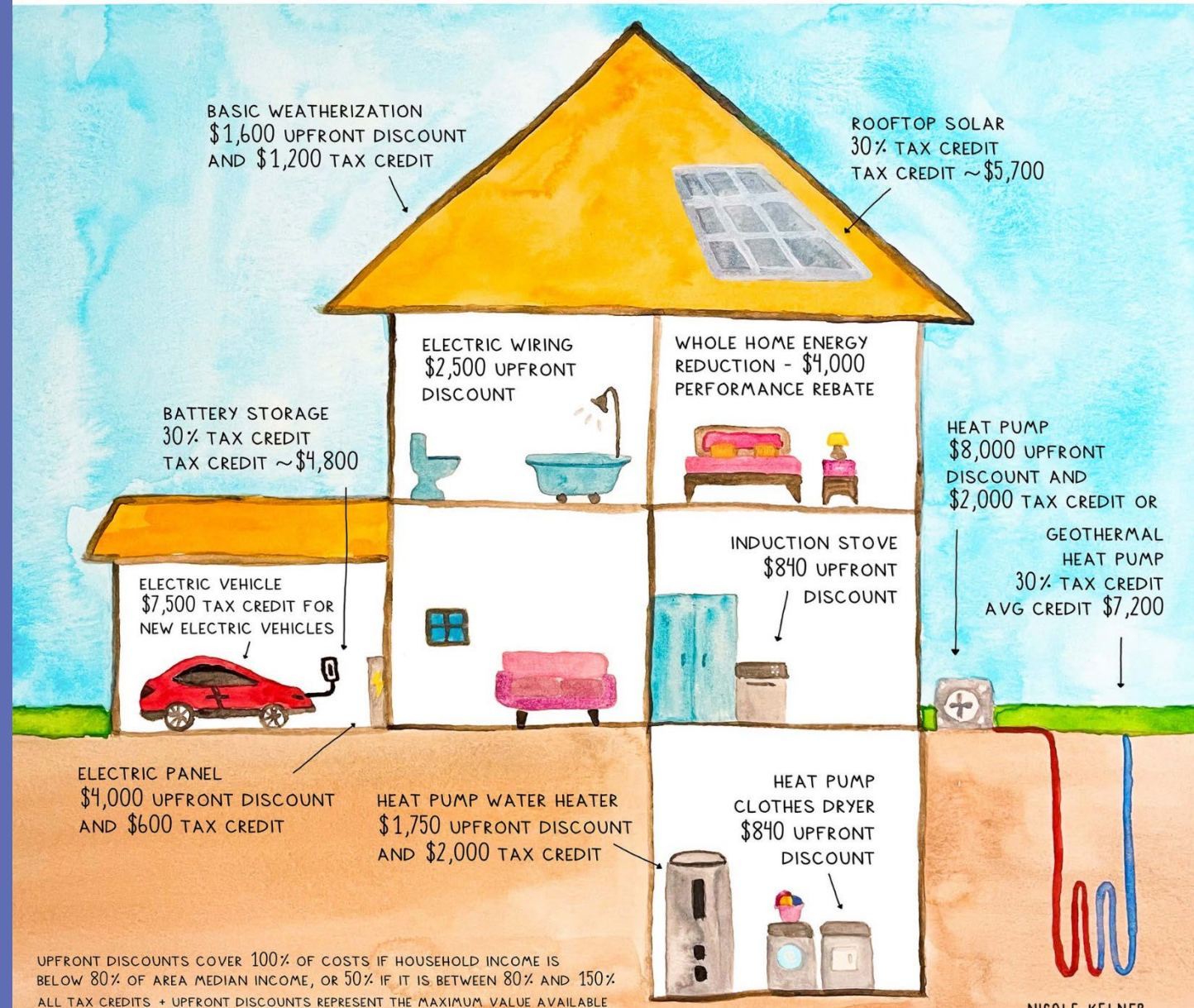
# MOOLA!

Wow! That's nearly \$55,000!

NOTE: Incentives listed are for income-qualified households and are expected to be available in 2024.

## POTENTIAL SAVINGS FROM THE IRA

BASED OFF A 2 PERSON HOME WITH A COMBINED INCOME OF \$150,000 IN NEW YORK CITY



# Home Assessments for Decarbonization

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## High Performance Fundamentals

- Introduction: me, the HPF series, the class

### **Establish homeowner goals & expectations**

- Investigate and document
- Recommend & prioritize solutions
- Provide resources

Find out:  
**WHAT**  
do your clients  
**WANT?**

No matter what  
they call you for,  
ask about ALL of  
these!

**RANK THESE:**

- **A nicer house** – more functional, spacious, contemporary, attractive...
- **Fixes** – comfort, air quality, repairs, updates, etc.
- **Lower utility bills**
- **ZERO** greenhouse gas emissions

Whether in the **decarb** scope or not, all may be relevant because **building systems interact!**



# Make sure to hear from *ALL* the decision-makers!



# Make sure to hear from **ALL** the decision-makers!

[SIX MONTHS LATER ...]

But did I  
mention ...  
???!?



# Ask about potential performance issues



- **Comfort?**
  - Too hot?
  - Too cold?
  - Too drafty?
- **Noise?**
- **Deterioration?**
- **Malfunction?**
- **Annoyances?**

# Identify gas items to swap for electric



## “The BIG Four”

- Space heating
- Water heating
- Clothes drying
- Cooking



# Explore other potential electric items—

Photovoltaics



present or future!

Electric vehicles



Energy storage



Fireplaces



Pools & spas



# Set client expectations

These all matter  
because  
**BUILDING SYSTEMS  
INTERACT!**



- **Clearly spell out** implications of electrification
  - Benefits
  - Potential challenges
  - How to address potential challenges
- **Establish** their budget & timeline
- **Identify *EVERYTHING*** they want done within that time & budget
  - Decarbonization
  - Other priorities
- **Explain your process**, what you can and *can't* help with, and your timeline

# Home Assessments for Decarbonization

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## High Performance Fundamentals

- Introduction: me, the HPF series, the class
- Establish homeowner goals & expectations

### **Investigate and document**

- Recommend & prioritize solutions
- Provide resources

**NOTE** which items are *within* and *outside* your level of skill

# Do a walk-through of the whole house

## DEFERRED MAINTENANCE? COMFORT ISSUES? LEAKS?

- Attic(s)
- Closets
- Every room
- Doors, windows, access hatches
- Crawlspace/basements/foundation
- Systems: HVAC, plumbing, electrical
- Equipment & appliances

Where might  
improvements  
be made?

Record your  
observations &  
ideas as you go

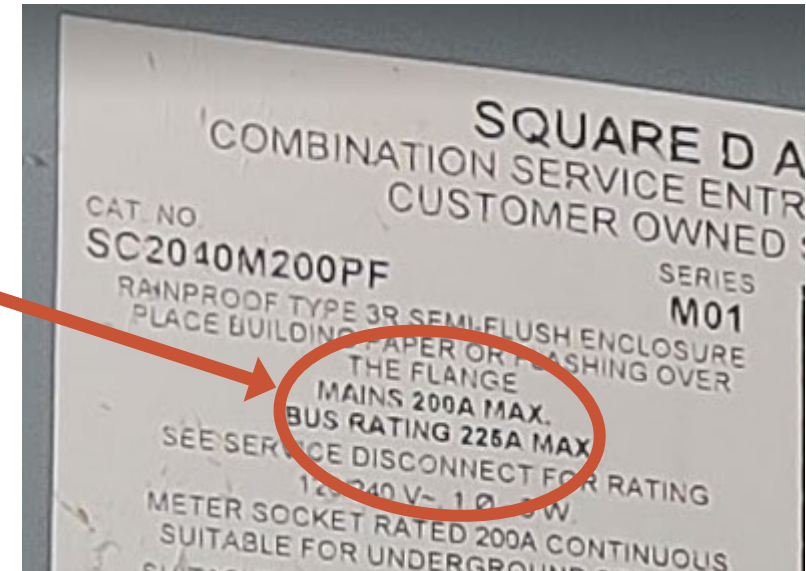
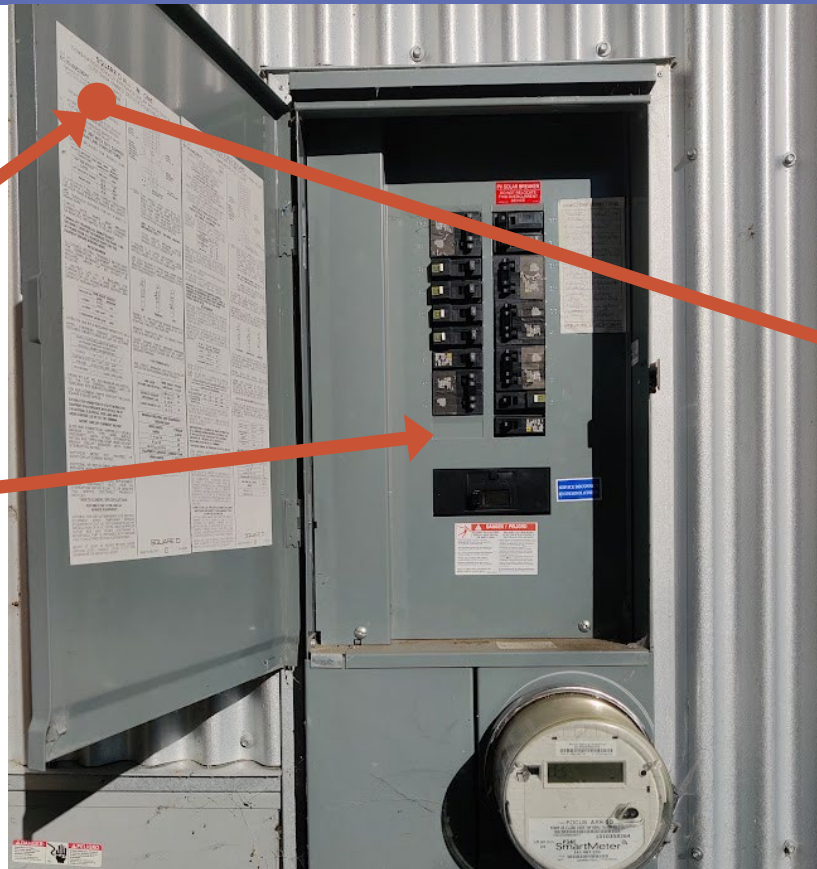




# Check electrical capacity

- **FIRST, find out what is there now—**

- Panel capacity? (Amperage)
- Available circuits?
- Amperage delivered to panel?



The amperage delivered to the panel may be less than its rated capacity. An electrician may be needed to determine this. **DOCUMENT** any questions or unknowns.

# Document critical electrical outlets

## KEY LOCATIONS – “The Big Four”

Where will 240V outlets be needed?

- Heat pump installation site(s)
- Heat pump water heater installation site
- Kitchen range/cooktop
- Laundry room
- + other locations?

120V  
options  
may be  
available

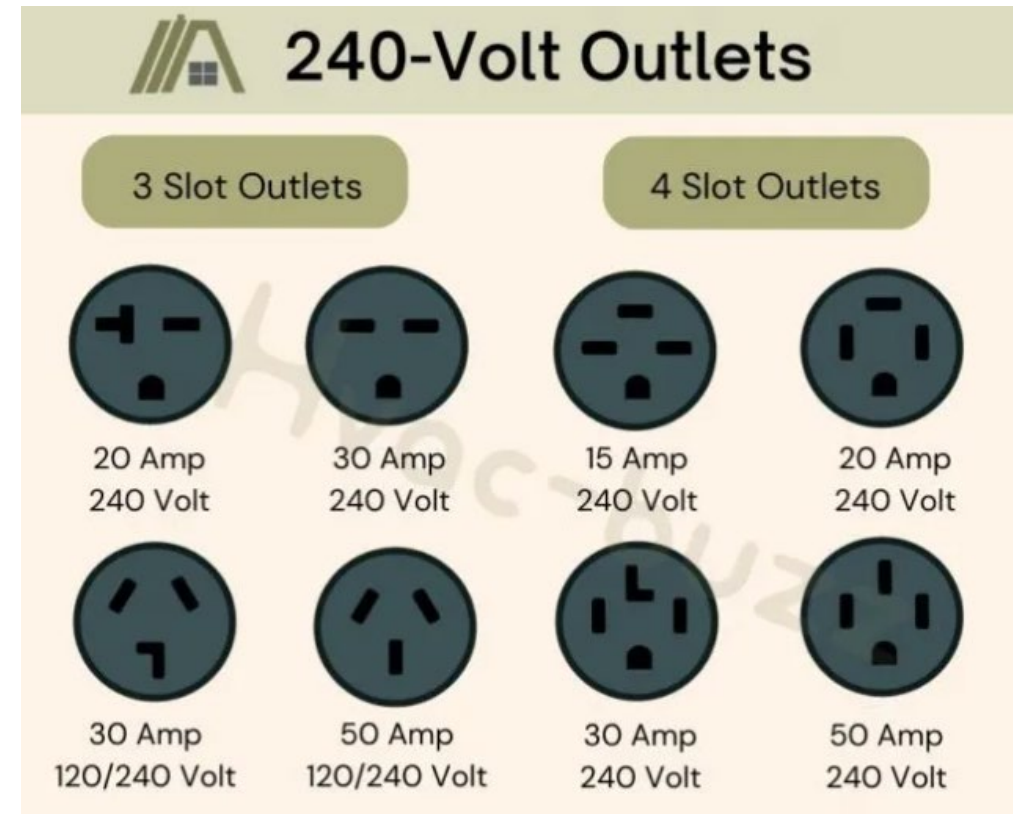


Image: HVAC-buzz.com

# Do the math

Add up the **NEW** capacity needed for planned items →

TYPICAL ELECTRIC LOADS (kW)	
Heat pump (without backup heat)	5
Heat pump water heater	5
Electric range	10
Electric dryer	5
EV charger	20-30
Lighting & plugs	6
Dishwasher, microwave, washing machine, etc.	1.5 each
Battery	32-50
<b>TOTAL</b>	Depends on items needed

# Gather other relevant information (if available)

## POTENTIAL INFORMATION SOURCES:

- The client
- The City or County building department
- The architect or developer

## WHAT MIGHT BE USEFUL?

- Blueprints
- Building permits
- Title 24 reports
- Diagnostic testing results



# Investigate potential issues for installing Space conditioning heat pump(s)

- **Would a ducted or unducted system make the most sense? (Can you tell?)**
- **Are there existing ducts?**
  - Are they in conditioned space? Insulated?
  - Are they in good/bad/so-so condition? Should they be tested?
- **Is there room to locate the air handler within conditioned space?**
- **Are there equipment space constraints?**
  - Indoors? Outdoors?



Image: Cowley's Pest Service

# Investigate potential issues for installing A heat pump water heater (HPWH)

## ■ Will it go where the existing water heater is?

- Is there enough space for it there?

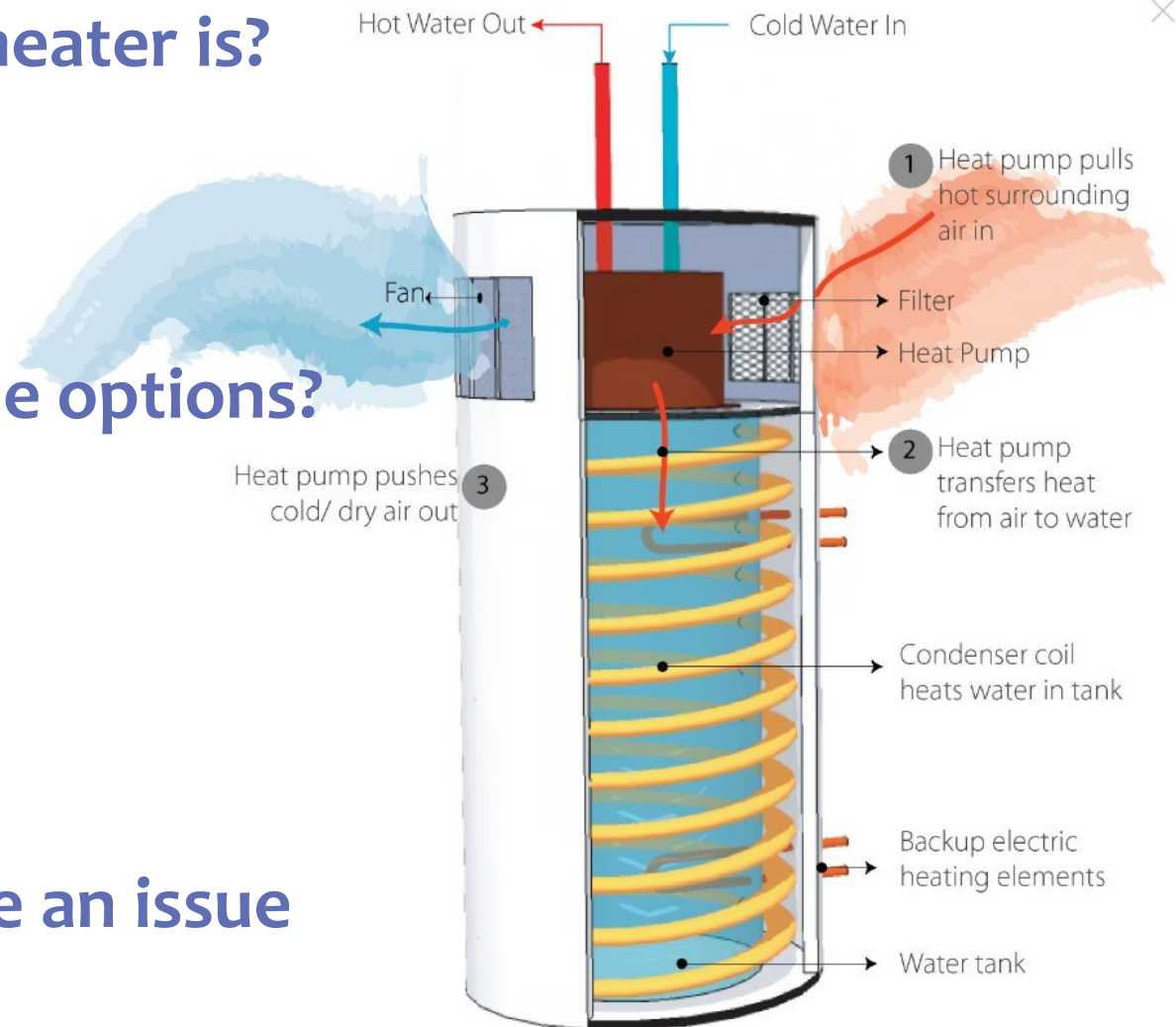
Most HPWHs need a space of at least 700-800 cubic feet for effective air flow

## ■ If more space is needed, what are the options?

- Consider different models?
- Enlarge the existing space?
- Find an alternative location?
- Explore venting strategies?

## ■ Depending on location, noise may be an issue

- Discuss with your clients



# Find opportunities to reduce demand: Replace dated lighting & appliances

## ■ Select “best in class”

- Lighting
- Appliances
- Electronics

100%  
LEDs



## RESOURCES:

California Lighting Technology Center, UC Davis

- [Residential Lighting](#)
- [Liberty Lighting Guidelines for Zero Net Energy Communities](#)

## Listings at:

- [energystar.gov/products/most\\_efficient](http://energystar.gov/products/most_efficient)
- [cee1.org](http://cee1.org)
- [marketplace.pge.com](http://marketplace.pge.com) ↓



Enervee Score shows energy efficiency 0-100

User reviews from all major retailers

Utility rebates

Email price alerts

Daily offers from hundreds of retailers

97

GE GTE18GTHWW  
GE - 17.5 Cu. Ft. Frost-Free Top-Freezer Refrigerator

★★★★☆ (2,096)

\$75 rebate

PRICE DROP!

\$578

See all 12 offers

# Find opportunities to reduce demand: **Improve enclosure efficiency**

## **EVALUATE:**

- **Insulation defects**
  - Visible in attics or crawlspaces?
  - Are there cold/hot spots?
- **Air sealing issues**
  - Do occupants notice drafts?
  - Are there obvious gaps?
- **Consider blower door testing & infrared camera diagnostics when appropriate**
  - (If you don't do this, recommend someone!)



**Poorly installed  
insulation is the  
NORM!**



# Find opportunities to reduce demand: Improve enclosure efficiency

## EVALUATE:

### ■ Window age, type, and condition

- Glazing – single, double?
- Frames – aluminum, wood, vinyl?
- Repair – good/bad/so-so?
- Architectural opportunities?

### ■ Shading opportunities to reduce cooling needs

- Exterior coverings/devices
- Interior coverings

RESOURCE: <https://efficientwindowcoverings.org/>



 National Fenestration Rating Council® CERTIFIED		<b>World's Best Window Co.</b> Millennium 2000+ Vinyl-Clad Wood Frame Double Glazing • Argon Fill • Low E Product Type: <b>Vertical Slider</b>	
<b>ENERGY PERFORMANCE RATINGS</b>			
U-Factor (U.S./I-P)	<b>0.30</b>	Solar Heat Gain Coefficient	<b>0.30</b>
<b>ADDITIONAL PERFORMANCE RATINGS</b>			
Visible Transmittance	<b>0.51</b>	Air Leakage (U.S./I-P)	<b>0.2</b>

For replacement windows, choose appropriate values for the climate!

# Assess other decarb opportunities: Pools, spas, water features?



## Heat Pumps + Photovoltaics

- **EXPERT** consulting needed to size and spec properly!

Pool heating is evolving – analysis suggests that PV + heat pump is the most cost-effective approach



## Solar Thermal

- Glazed or unglazed

### RESOURCES:

- ❑ [CleanTechnica article, 2013](#) (not 100% up-to-date, but some good info)
- ❑ [Webshop article, 2018](#) (more current, but EU-focused)

# Assess other decarb opportunities: Solar? Battery?

## ARE THERE ALREADY:

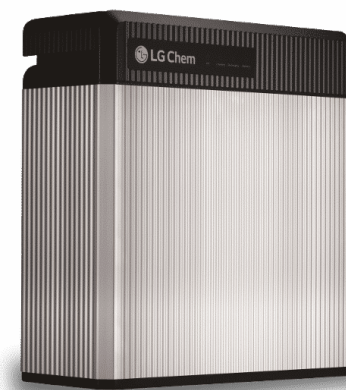
- Existing onsite distributed energy systems—

- Photovoltaics?
- Solar hot water?
- Wind turbine/other?

- Energy storage/backup energy—

- Batteries?
- Thermal storage?
- Generator?

**Pollution  
source!**



If these haven't already been considered, be sure to identify them as **DECARB OPPORTUNITIES!**

# Document your findings

- **Write a report**

- Keep it *concise*
- Use simple, non-technical language

**CLARIFY what you:**

- **DO** (and *don't* do)
- **Recommend** (and *don't*)
- **Suggest considering**

- **Include photos, diagrams, sketches** (as appropriate)

- **Include the good, the bad, the ugly—and most of all, the**

**OPPORTUNITIES!**


- **Provide a list of resources to help your clients with next steps**

- Information – where to learn more
- Incentives
- Service providers you know & trust
- Product sources
- ***What you can do for them!***

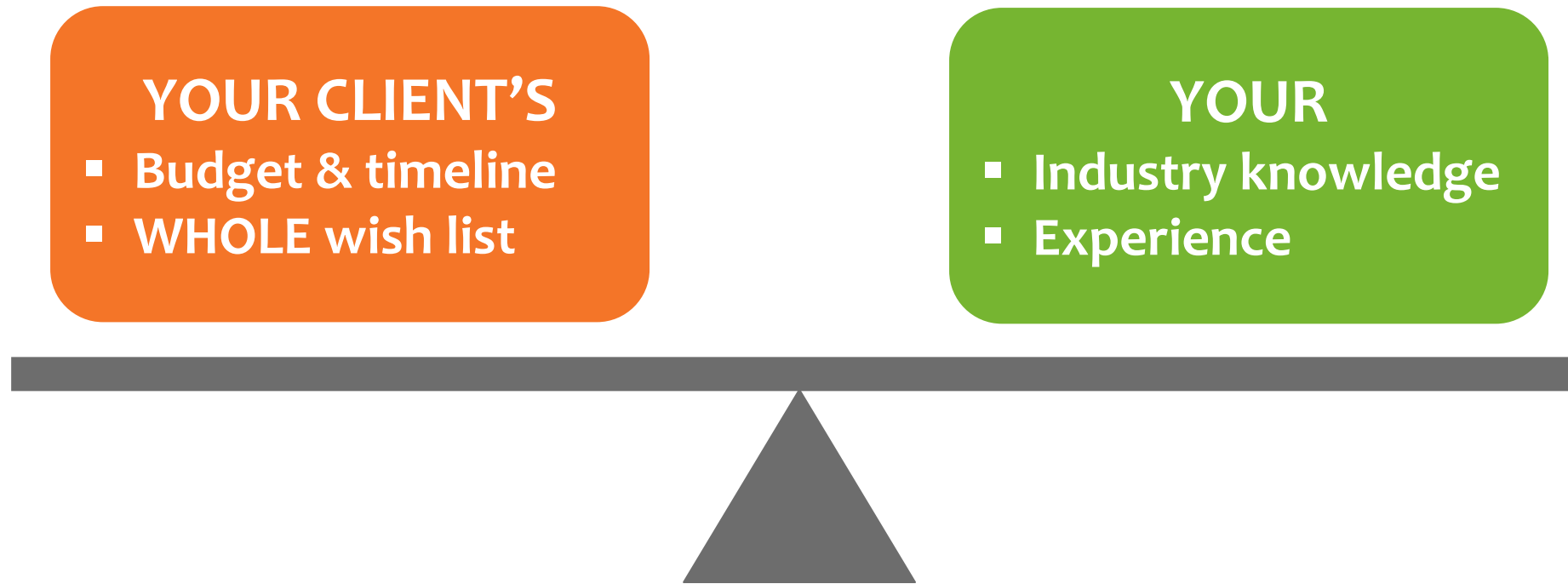
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- Investigate and document
-  **Recommend & prioritize solutions**
- Provide resources

# What do you recommend?



**RECOMMEND**, in priority order, the measures you believe will deliver the highest value and performance satisfaction—*factoring in available product and labor resources!*

# Timing: Consider the age of appliances

## REPLACE EQUIPMENT BEFORE FAILURE!

Appliance	Average Life Expectancy	Replace After Years
Gas water heater	13	10-12
Gas furnace	18	15-16
Air conditioner	10-15	8-10
Gas range	12	10
Clothes dryer	13	10-12

RESOURCES to find serial #s & appliance age:

- <https://www.building-center.org/>
- <http://www.appliance411.com/service/date-code.php>

Where to look for model/serial number



[www.maytagreplacementparts.com](http://www.maytagreplacementparts.com)

# Decarb/high-performance synergies: Load reduction strategies

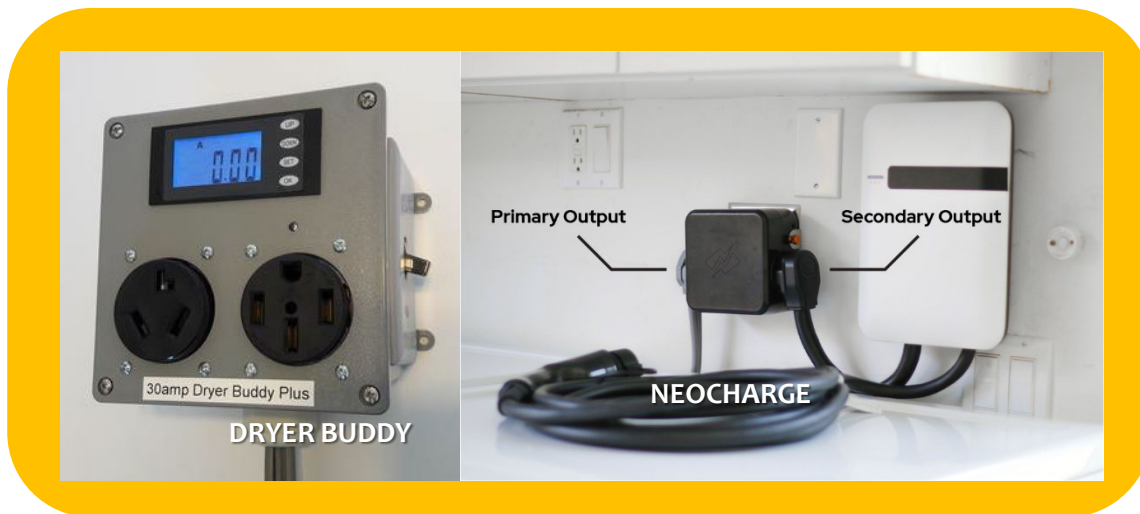
- **Enclosure improvements can**
  - **Enable smaller HVAC capacity (saving \$)**
  - Enhance survivability in power outages
  - Reduce utility bills
- **HVAC distribution system improvements can**
  - Double system performance
  - Cut demand in half
  - Improve comfort substantially





# Panel upgrade alternatives: Offer “DIET” or “SMART” options

- **Power-efficient equipment**
  - Combined condensing washer-dryer
  - 15A, 120V heat pump water heater
- **Smart technologies**
  - Smart panel (load management system)
  - Circuit sharing: dryer + EV or 2 EVs



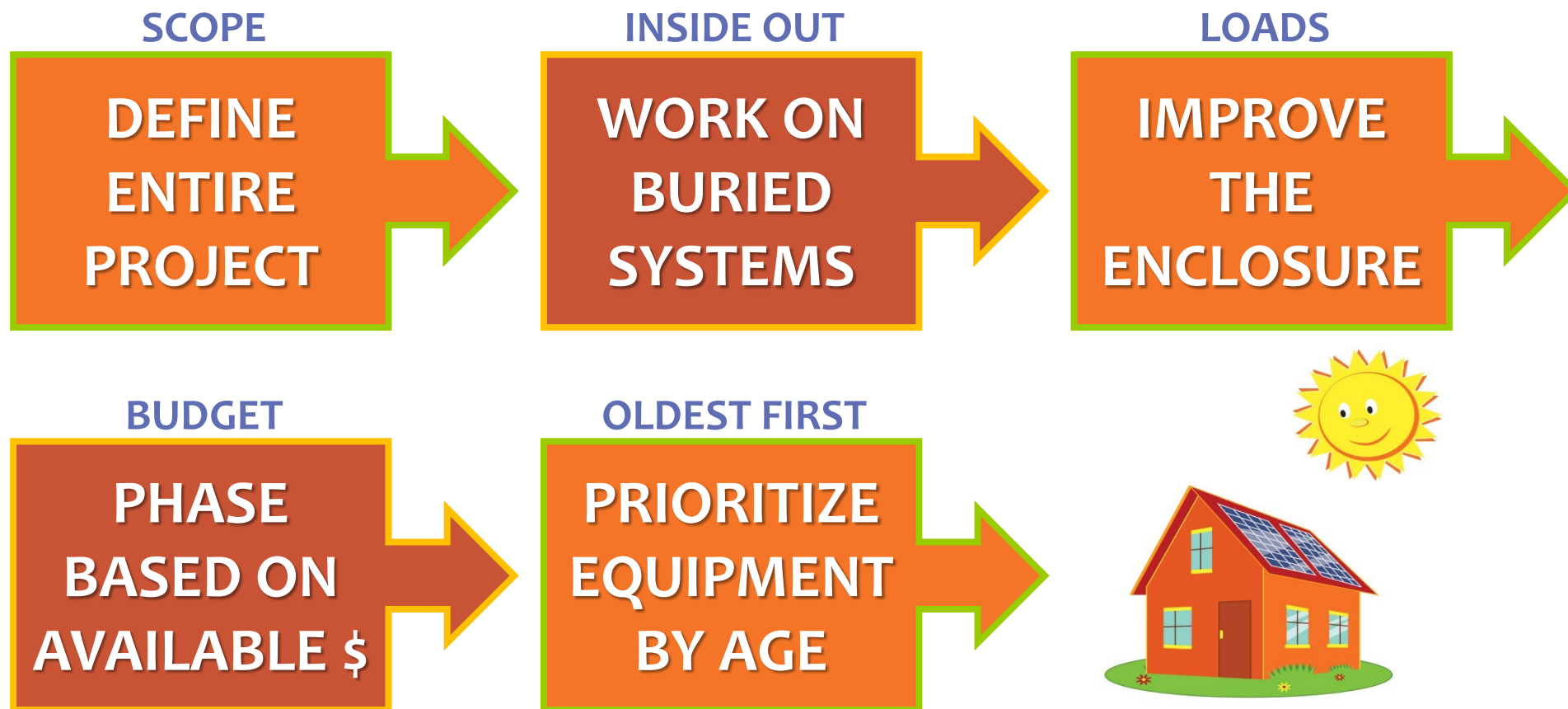
# Other potential synergies: Maintenance, wildfire risks, comfort, design ...

MULTI-BENEFIT EXAMPLES	
Attic & crawlspace vents?	Close, convert to conditioned/semi-conditioned space, install HVAC
Wildfire smoke issues?	Install heat recovery ventilation – less costly with other HVAC work
Deteriorated siding?	Remove, air seal, install continuous exterior insulation
Single-pane windows?	Replace for improved appearance, thermal performance, and – with tempered glass, greater wildfire safety

# Phasing: What if the project needs to be phased?

IDENTIFY THE OPTIMAL STEPS FOR IMPLEMENTATION—for example:

Steps  
will vary  
based on  
project  
specifics!



# Who can help?

## Offer people, not just ideas

- **HERS raters, BPI practitioners for diagnostic work**
- **Architects**
  - Design work, drawings, permit guidance
- **Engineers**
  - Properly sizing HVAC, pool & spa heating, etc.
- **Home performance or general contractors**
  - Enclosure & HVAC improvements
  - Electrification
- **Electricians, plumbers, HVAC installers**

Only  
**RECOMMEND**  
people you know  
and trust, and  
**ALWAYS**  
advise  
**CHECKING**  
**REFERENCES!**

# Home Assessments for Decarbonization

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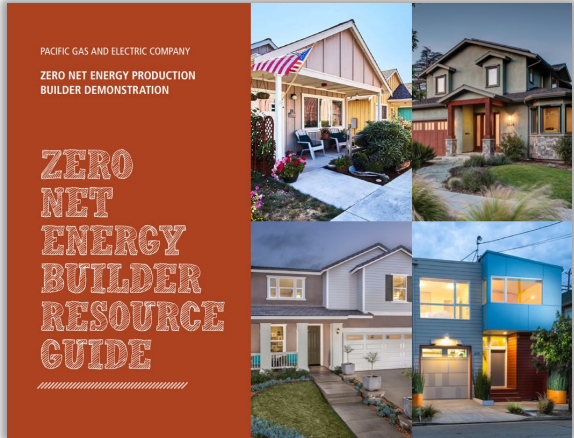
 **Provide resources**

# Resources

## 3C-REN incentive programs: single-family – for contractors multifamily – for building owners



ZNE Primer for Architects  
[Download here](#)



ZNE Builder Resource Guide  
[Download here](#)

All-Electric Home Retrofit Guide  
[Download here](#)

Watt Diet Calculator  
[here](#)

The Switch Is On Decarbonization  
Incentives & contractors [here](#)

Decarb Roadmap Tool  
[here](#) (beta version)

All-Electric New Home Guide  
[Download here](#)



All Electric 100 Amp Home (2,000 square feet)  
Ducted heat pumps, recirculating power fans, tank water heater, hybrid heat pump dryer

Device	Device	Device	Device	Device	Device
Watts	Amperes	Amperes	Amperes	Amperes	Watts
120	8	Lighting	Use Appliances	8	120
120	8	Lighting	Lighting	8	120
120	8	Lighting	Use Appliances	8	120
120	10	Garbage Disposal	Microwave	10	120
120	7	Refrigerator	Microwave	7	120
120	0	Stove	Dishwasher	7	120
120	0	Refrigerator	Dishwasher	10	120
240	90	Heat Pump Central Air	Hybrid Heat Pump Dryer	10	240
240	20	Heat Pump Water Heater	High-Speed Washer	10	240
240	16	Heat Pump Water Heater	Heat Pump Water Heater	10	210

House square footage = 2000 Total Circuit Breaker Amps = 96.7



**Zero Carbon Home**  
Electrify your Home

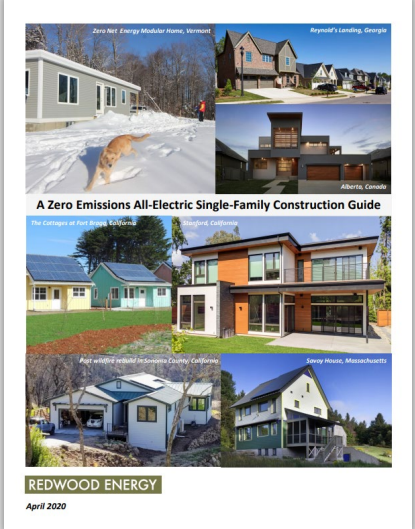
This website is under development.

For most Americans, vehicles and homes emit over half the climate-warming greenhouse gas. Let's get started! Note: this tool is under development.

Your name

Street address  City

1. Can my utility service support electrification?
2. What equipment do I need?
3. Choose your equipment
4. What wiring changes do I need?
5. What will this cost?
6. Generate a plan to share with contractors



*Thank  
you!*



**AnnEdminster.com**

- Zero energy consulting
- Design team facilitation
- Writing, research, advocacy

# Closing

- Continuing Education Units Available
  - Contact [shuskey@co.slo.ca.us](mailto:shuskey@co.slo.ca.us) for AIA HSW|LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - Communicating the Value of High Performance (Ongoing Invitation)
  - Become a HERS Rater (Ongoing Invitation)
  - Blower Door Basics and Beyond (11/16)
  - 2022 Energy Code Preview for Multifamily Projects (11/17)
  - 2022 Energy Code Preview for Nonresidential Projects (12/1)
- **Stay tuned for 3C-REN's 2023 course schedule - coming soon!**







**Thank you!**

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

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



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