September 23, 2026

TRI-COUNTY REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA

Higher Performance Residential Remodels

Jennifer Rennick, AIA, CEA, ASES Fellow, In Balance Green Consulting

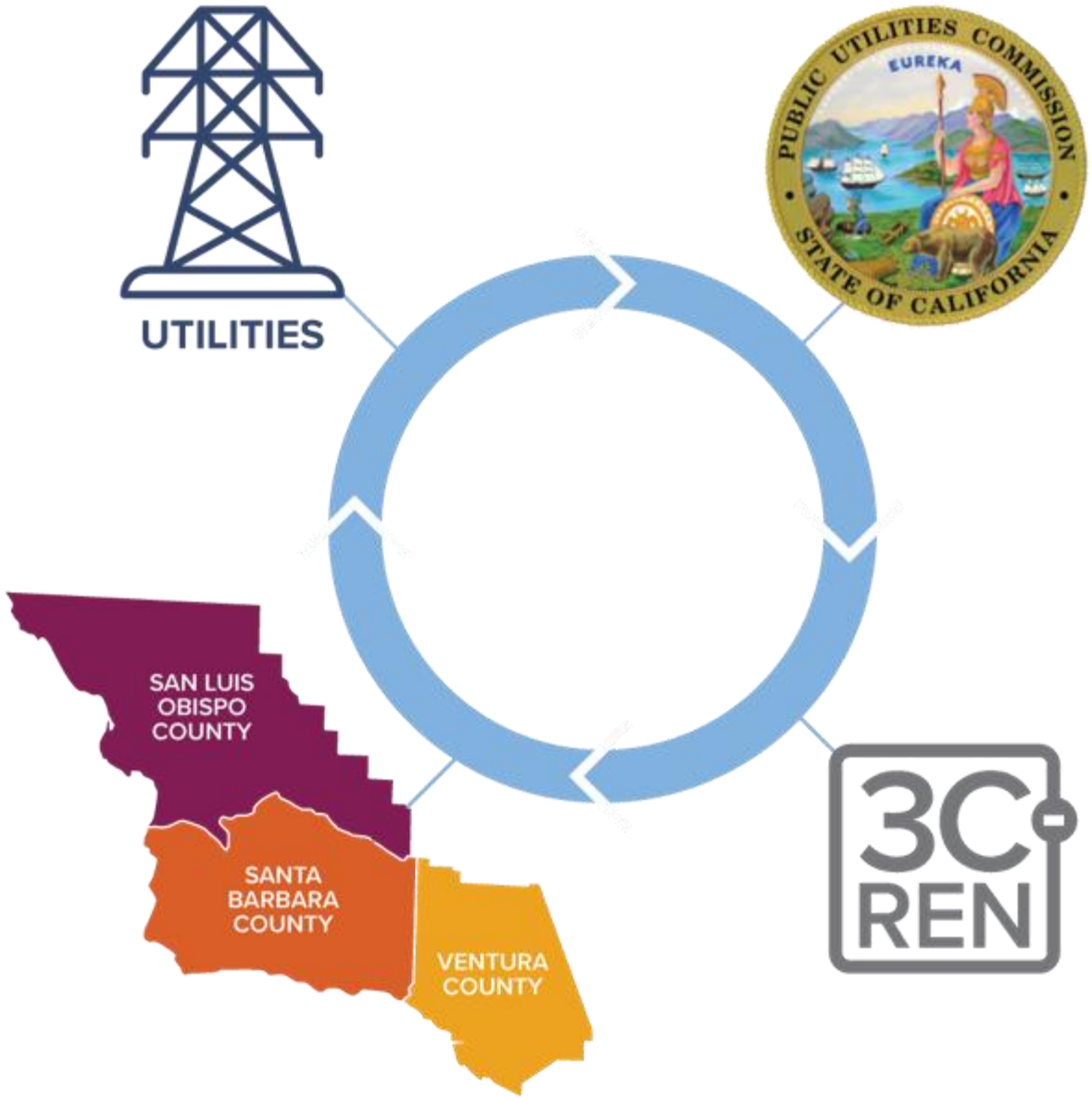
Andy Pease, AIA, LEED AP BD+C, In Balance Green Consulting



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

Agenda

1. Better Performance and Opportunities
2. Building Evaluations and Occupant Comfort
3. Heating/Cooling and Ventilation Equipment
4. Hot Water Heating and Appliances
5. Windows, Walls, Attics and Floors
6. Solar PV and Batteries





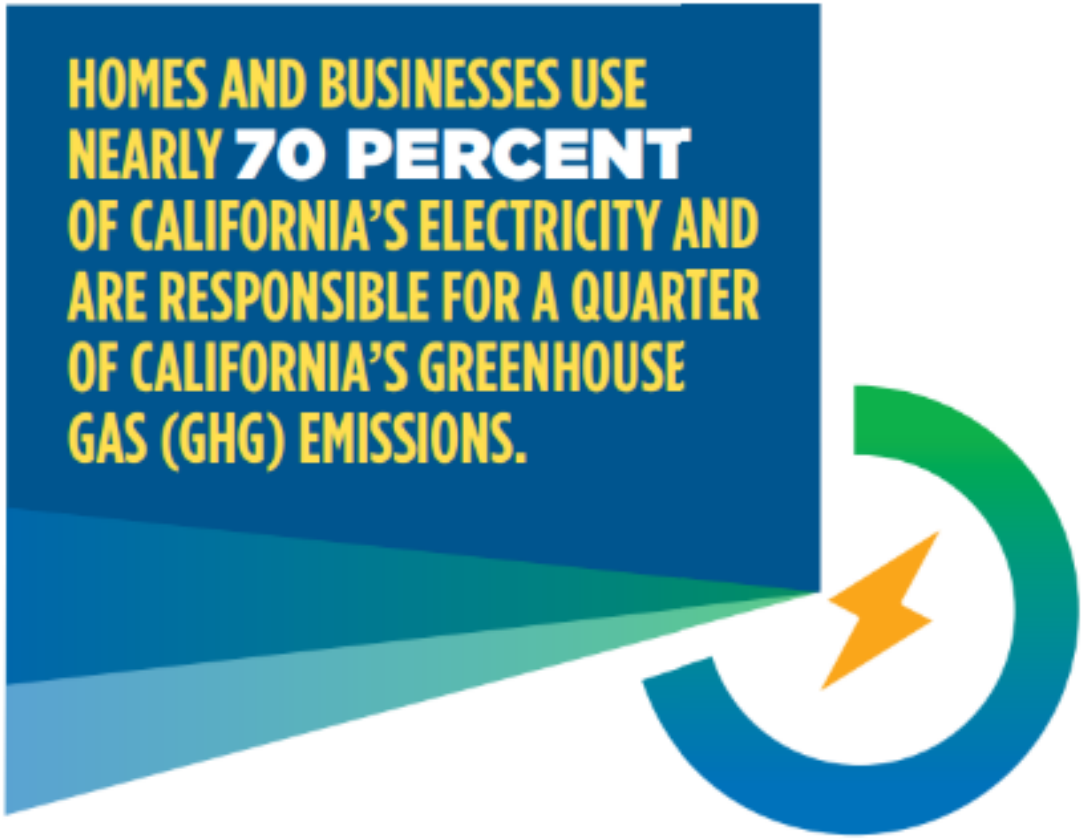
Today's Learning Objectives

- Learn how existing energy performance and indoor air quality is evaluated
- Review the benefits and challenges of moving toward all-electric equipment and appliances in a remodel
- Identify best practices and highest impact upgrades for retrofits
- Compare strategies for phasing-in improvements and where to start

Learning Units:

- 1.0 AIA HSW LU approved for this course
- Qualifies for 1.0 ZNCD for Architecture licensure

The Role of the California Energy Code and ZNCD



California Energy Commission

- Encourage heat pump technology for space and water heating
- Establish electric-ready requirements for single family homes
- Expand PV systems and battery storage standards
- Strengthen the ventilation standards
- Include cost effective strategies for alteration projects

Existing Buildings Will Play a Significant Role

The Challenge of Existing Buildings



At least 50 percent of single-family homes and nearly 60 percent of California's apartment complexes (about 14 million total residences) were built before the state's first energy standards.

Updating older buildings is critical to achieving the state's climate and clean energy goals.

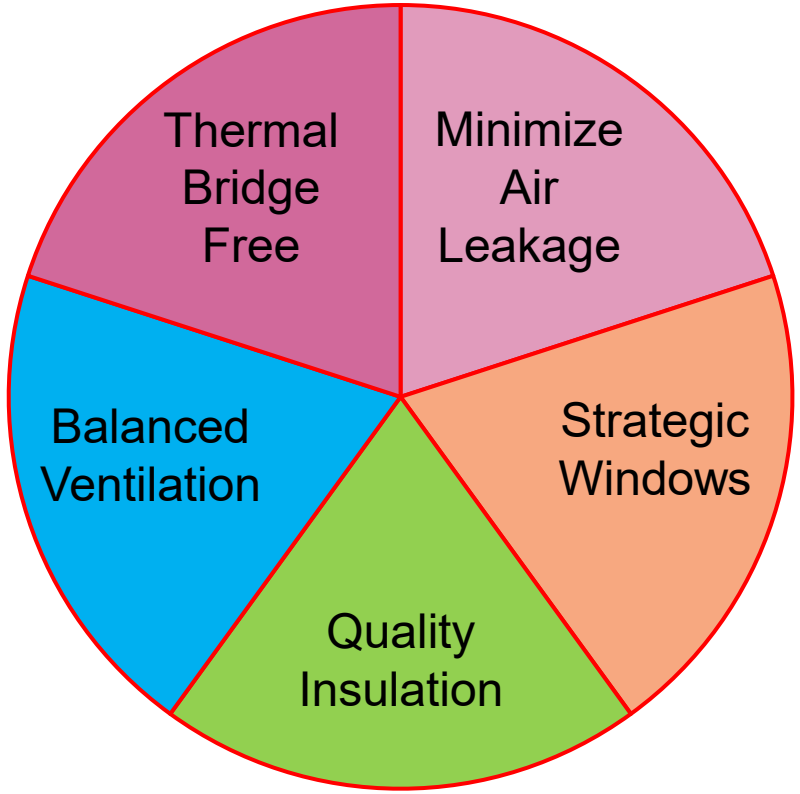
AIA National states that 75% of U.S. housing stock will need replacing within the next 30 years.

Building Performance and Opportunities



Ideal New Construction vs Reality of Remodels

1. Quality Envelope Assemblies:
   i. High Quality Insulation
   ii. Thermal Bridging Eliminated
   iii. Air Leakage Minimized
2. Strategically Placed Quality Windows
3. Balanced Ventilation (IAQ) System
4. Energy Efficient HVAC, DHW and Appliances
5. Solar PV and Battery Storage



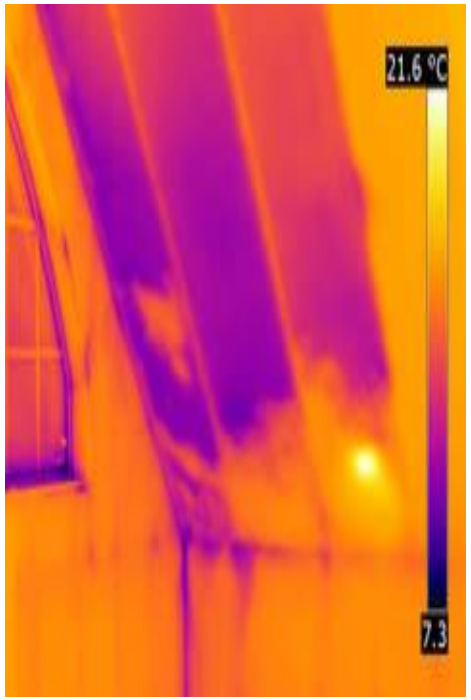
…but, what about remodels/alterations/additions?

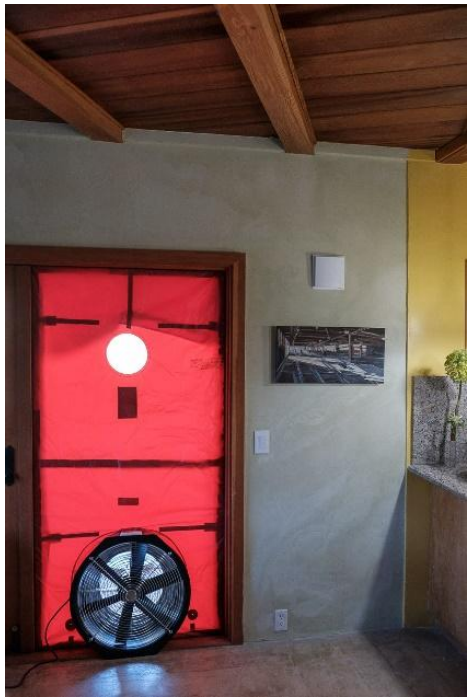
Evaluating for Highest Benefit and Opportunity

Understand needs & establish goals

CONSIDER:

- Owner Complaints or Concerns
- Visual Clues:
  - lack of insulation, infrared
  - Age of windows
  - mold growth/smell
- Blower Door /Duct Testing
- Existing Utility Bills
- Thermal Imaging
- Energy Audit







OPPORTUNITIES

- Fuel Switching – gas to electric
- Incentive programs

Helpful Tools



+











Tru Tech Tools®
Quality Tools. Essential Support.

"BPI Kit" approx $5,000



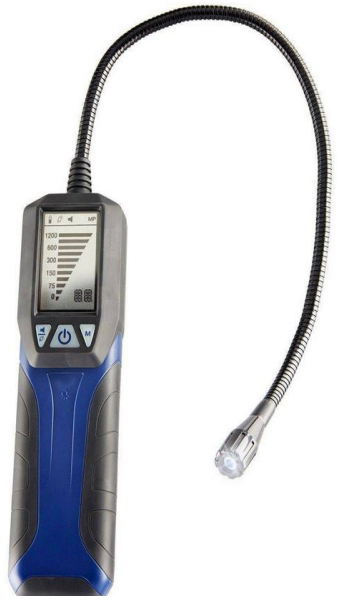
Varies: $15 -$120 Typical



$500



$3000 +

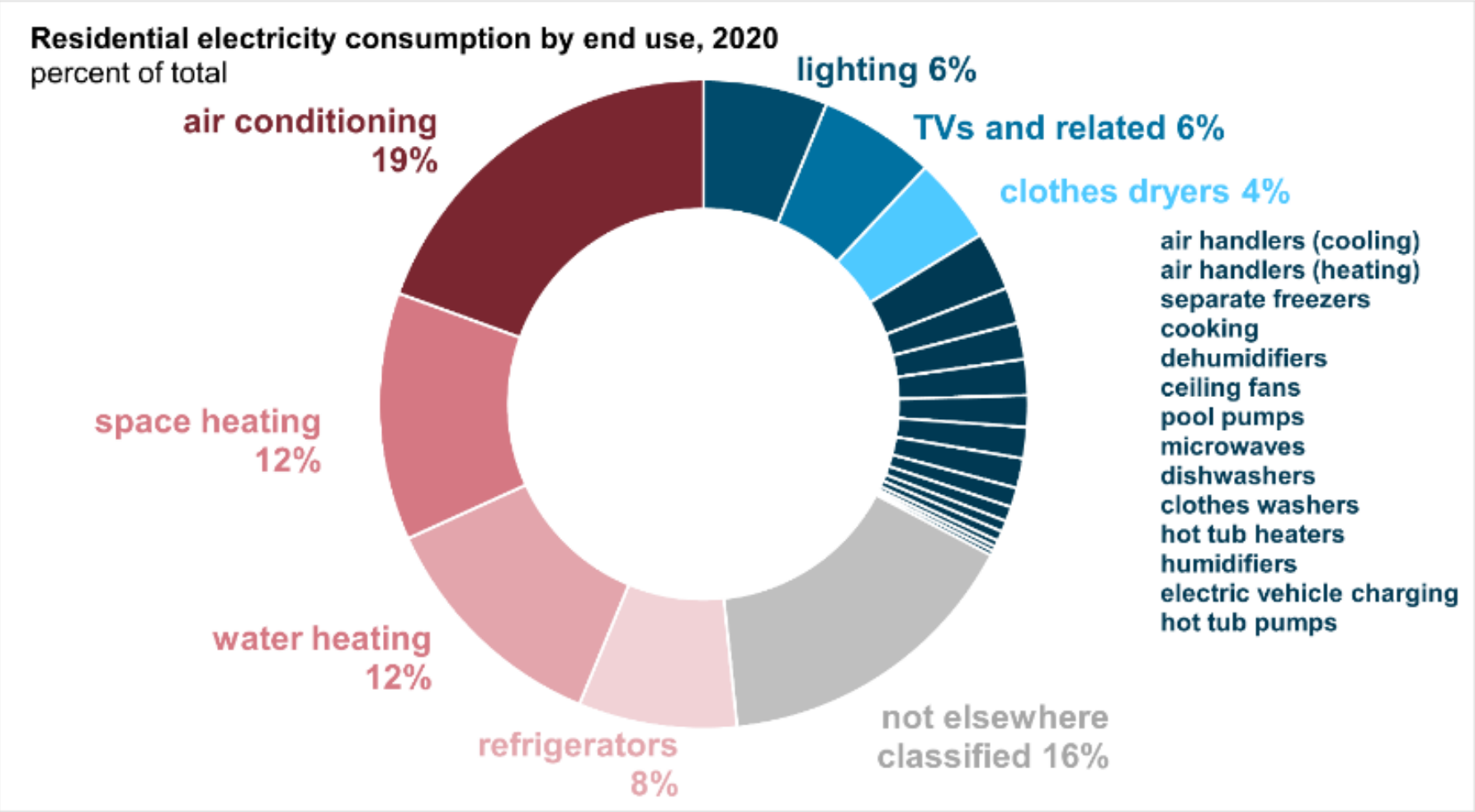


Wöhler GS 300 Gas Sniffer

$250 plus

3C REN

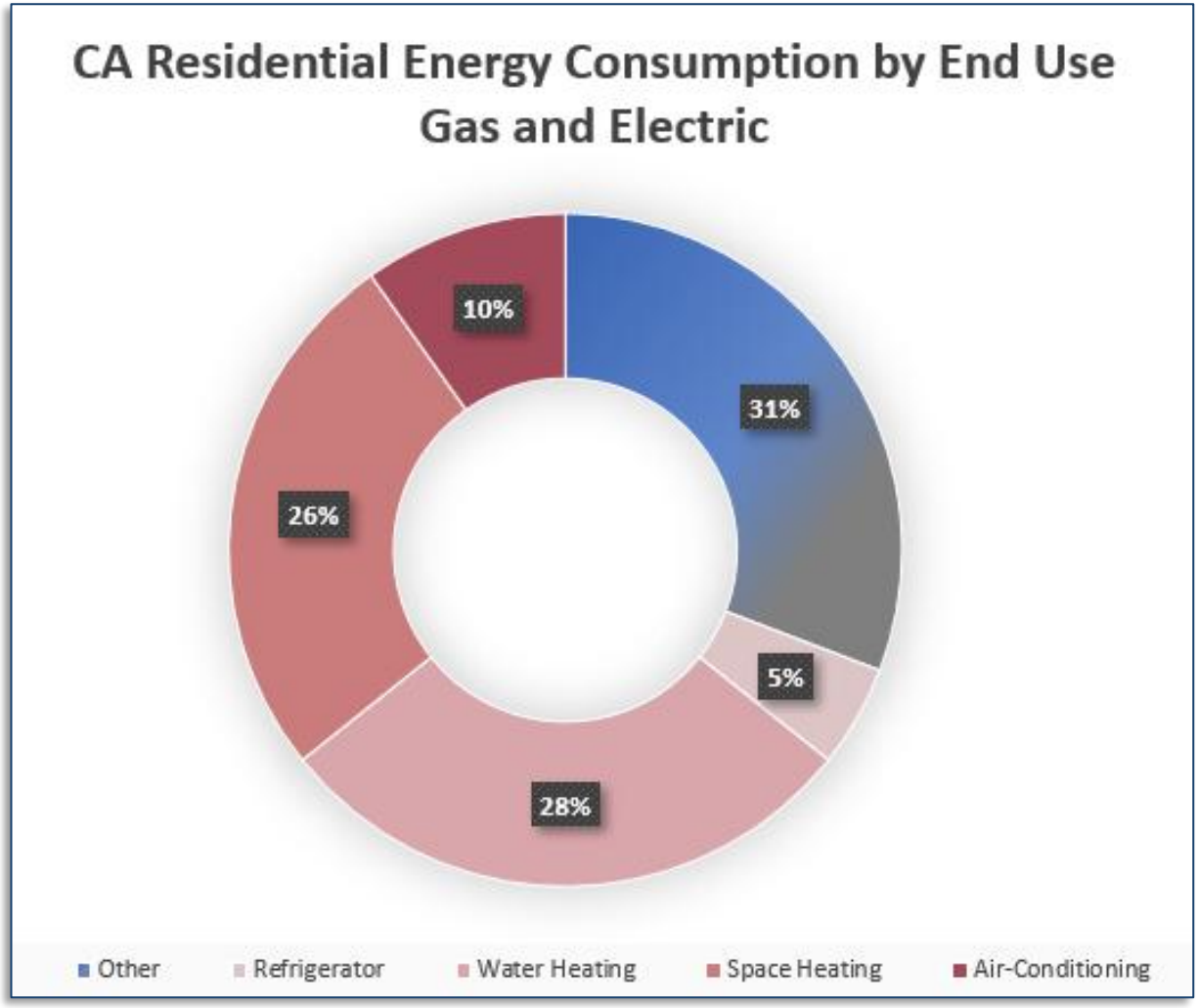
Energy Use in Homes



eia Data source: U.S. Energy Information Administration, 2020 *Residential Energy Consumption Survey* (RECS)

3C REN

Typical Household Characteristics – many gas appliances…



Household characteristics

53.7
Total site consumption per household (MMBtu)

64%
Natural gas as main space heating fuel

8%
All-electric households

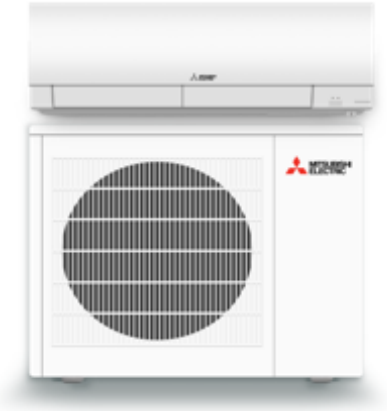
72%
Households that use air-conditioning equipment

eia Residential Energy Consumption Survey (RECS) Dashboard

Energy efficient electric options

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



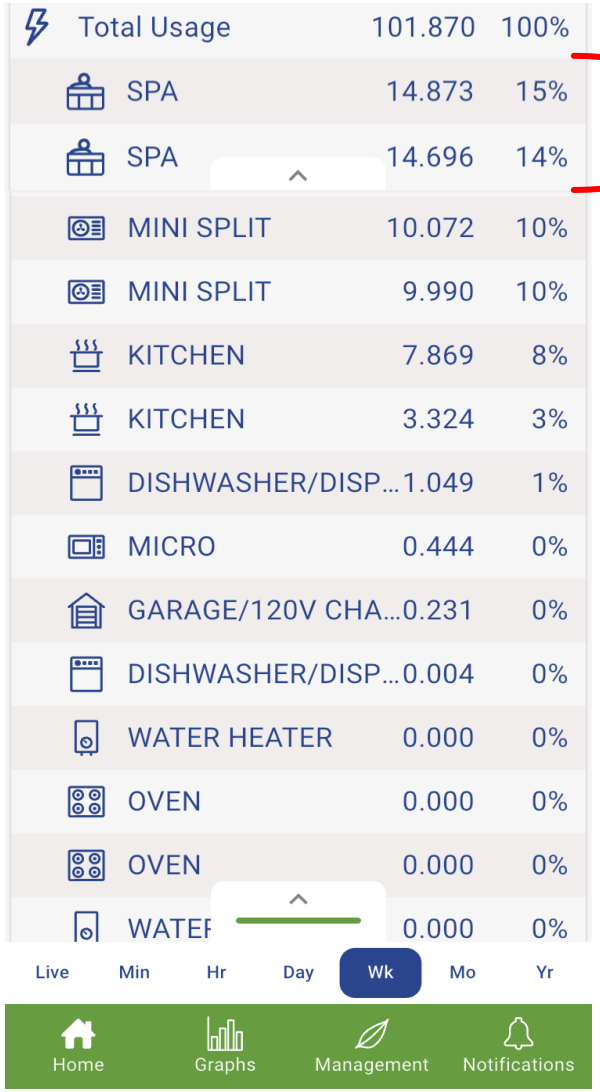






Each home has a unique mix of Energy Use

- Screenshot of Electrical Energy Use for the beginning of a week in April.
- All-electrical home, with grid tied solar and no battery storage…yet?



- Owner's beloved Spa was the largest energy use so far for this particular week
  - Approx half was grid electricity and half was solar electricity, for a total of 29%
- Mini-Split includes space heating and hot water
- Approx 39% of the electrical energy use is for other plug loads

Building Evaluations and Occupant Needs



Should we begin with an Energy Audit/Systems Evaluation?

YES!

- Energy Consultant
- ECC (formerly HERS)
  - *Energy Code Compliance*
- BPI
  - *Building Performance Institute*
- Test in/Test out?
- Find someone you trust and like working with!



HERS Rater prepping for a duct leakage test!

Top Strategies & Talking Points

Energy Savings Perspective:

- HVAC Upgrade *w/ fuel switching*
- DHW Upgrade *w/ pipe insulation*
- Insulation Upgrades *w/ air Sealing*

Comfort Perspective:

- Window Upgrades – *not* glazing replacements
- Insulation Upgrades + Air Sealing
- Filtered Fresh-Air Exchange System

Aesthetic/Design Perspective:

- Window Upgrades
- Daylighting Improvements
- Lighting and Controls Upgrade



Top Strategies & Talking Points

Health Perspective:

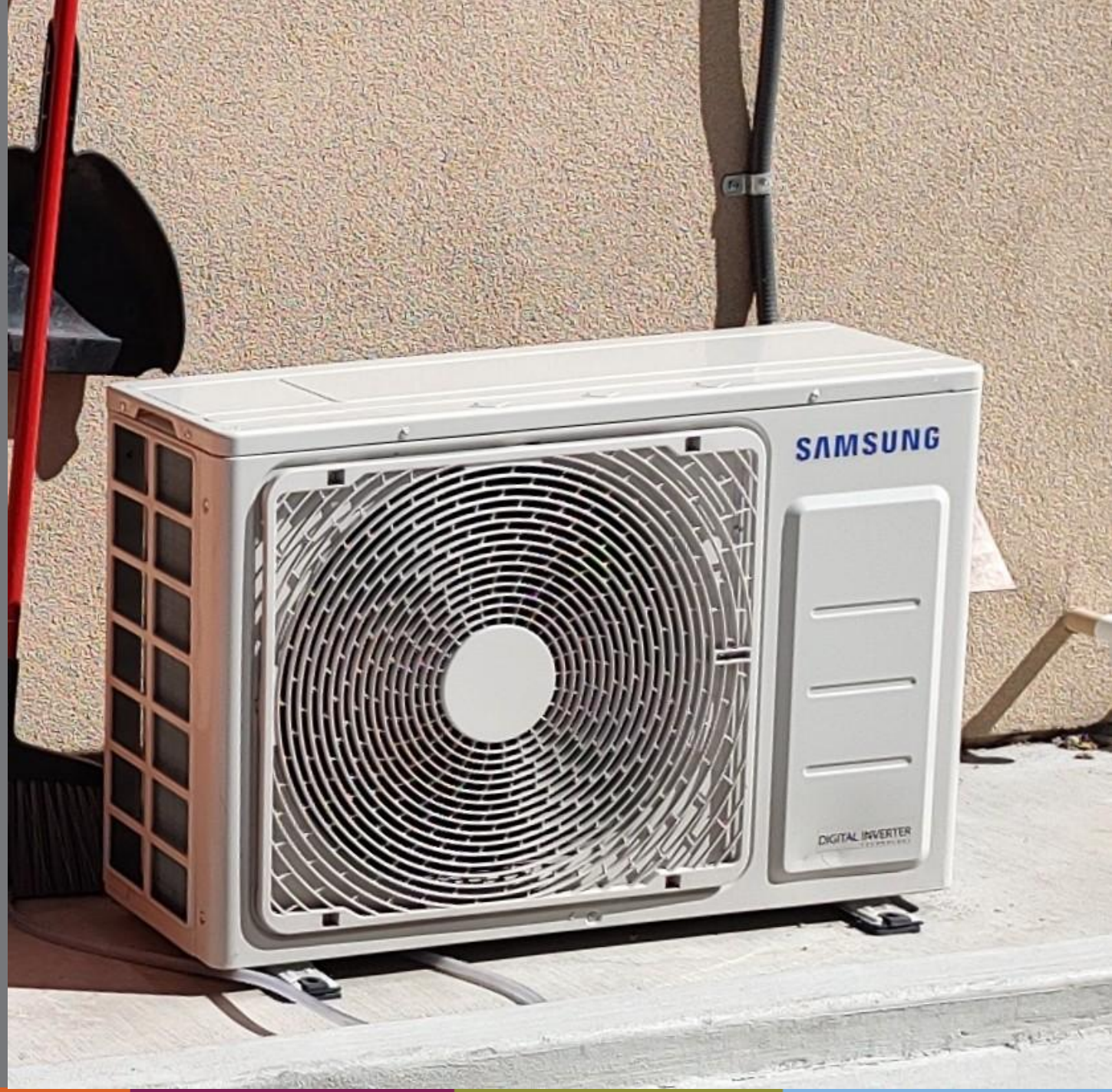
- IAQ Ventilation Upgrade
  - Controlled Outside Air
  - CO Management/Prevention/ Eliminate Combustion
- Moisture Mitigation
  - Mold Removal and Prevention
  - Bath Fans with Humidistat
  - Air-Seal Crawl Spaces

Resiliency and Durability Perspective:

- IAQ and Moisture Mitigation –above
- Battery Back-up
- Non-vented Attic
- Controlled Vented Crawl Spaces



Heating/Cooling and Ventilation Equipment



HVAC Gas Furnace or AC – Opportunity or leave as is?

Assessment:

- CO / combustion gas management
- Functionality
- Age and efficiency
- Location

Solution(s):

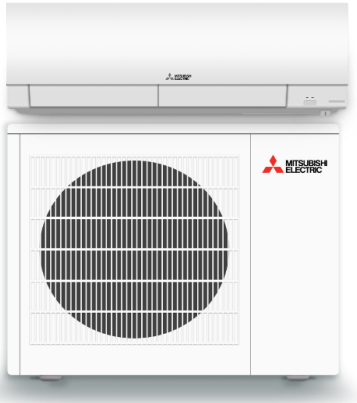
- Leave-in-place or Repair
- Remove and Replace:
  - Install ducted or ductless heat pump
  - Install “dual fuel” - new heating coil connected to heat pump





Mini-Split Heat Pumps

Full-Service HVAC Installs to DIY Available

















Outdoor Condenser Mounting Types/Locations







Example - “Dual Fuel” with Added Fan Coil to New Heat Pump

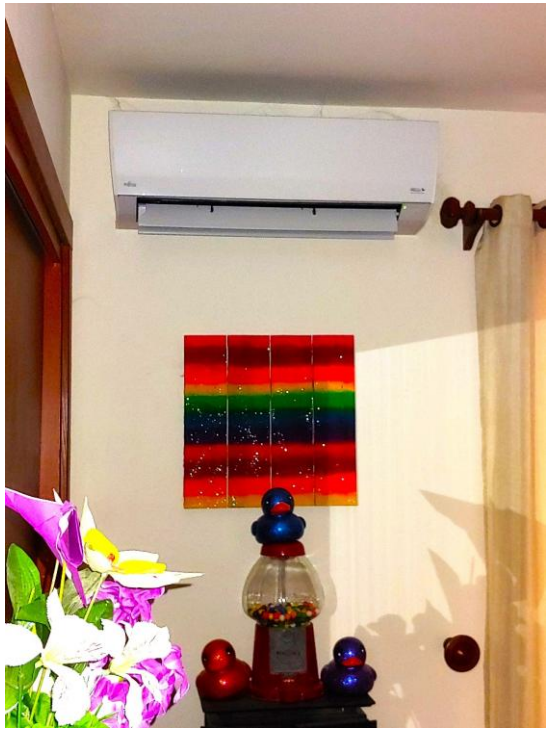
Assessment:

- Ownership wanted to reduce dependance on fossil fuels. Solar was a consideration.
- Large Home with Extensive Duct Layout
- Ducts in good condition
- Furnace needed replacing
- Cold Climate (Winter snow)
- Brand / Manufacture Offered Dual Fuel Replacement Options





Example – Existing Home, New Heat Pump System



Indoor Wall Mounted - Bedroom



Refrigerant and Communication Line Set – Raised Floor

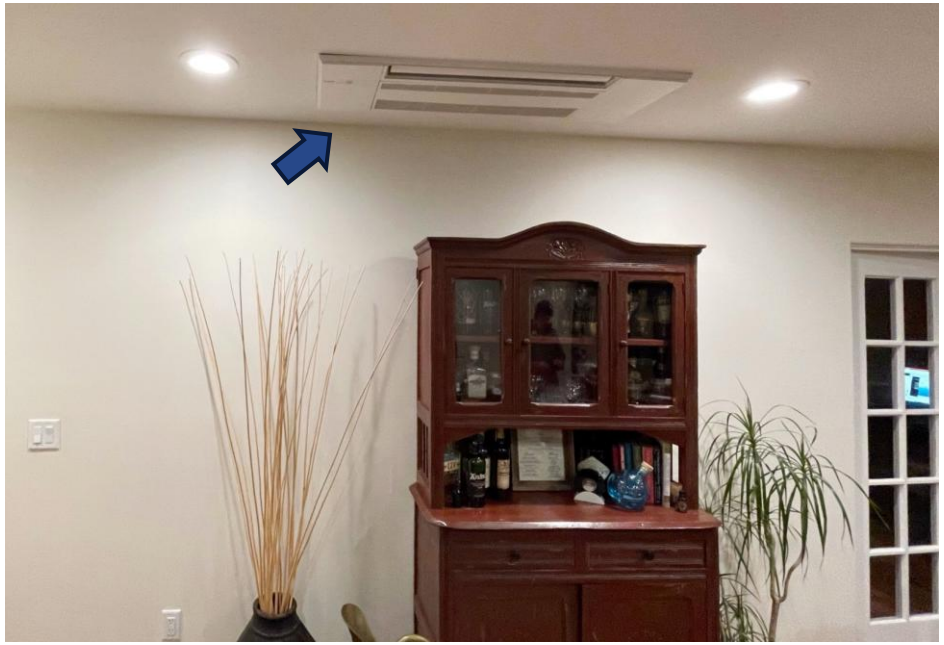


Outdoor Condenser

Assessment:

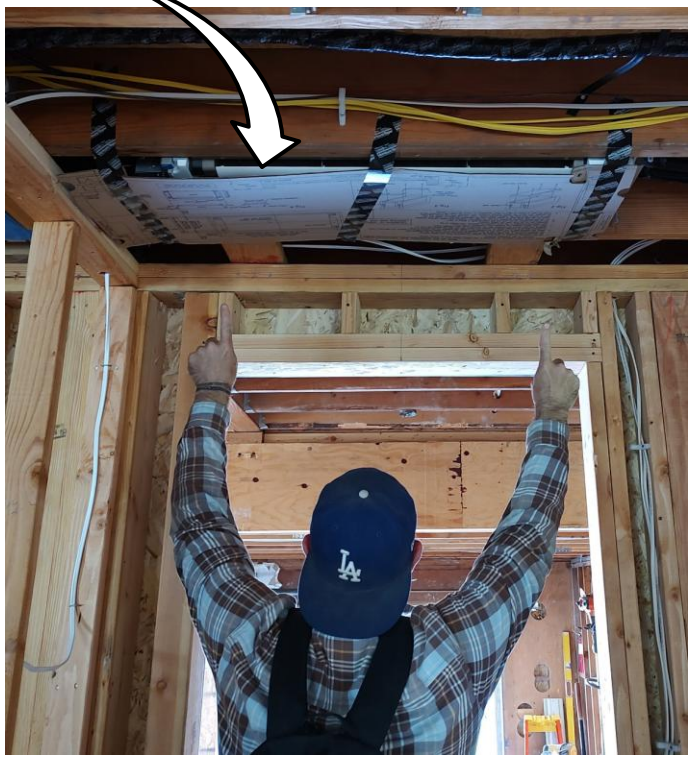
- Furnace Abandoned (Cracked Heat Exchanger)
- Ducts in Terrible Condition

Example – Ceiling Recessed Ductless Indoor Unit





Ductless Recessed-Ceiling



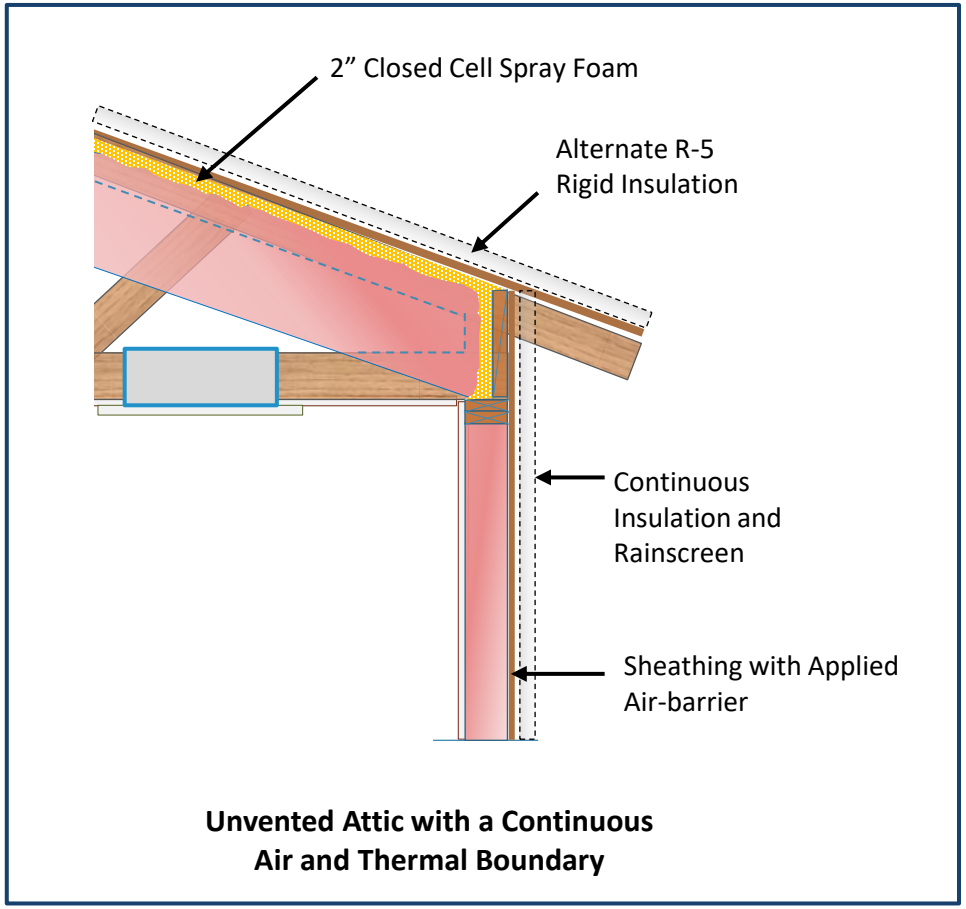
Ductless recessed-ceiling unit placed prior to insulation installation.

Assessment:

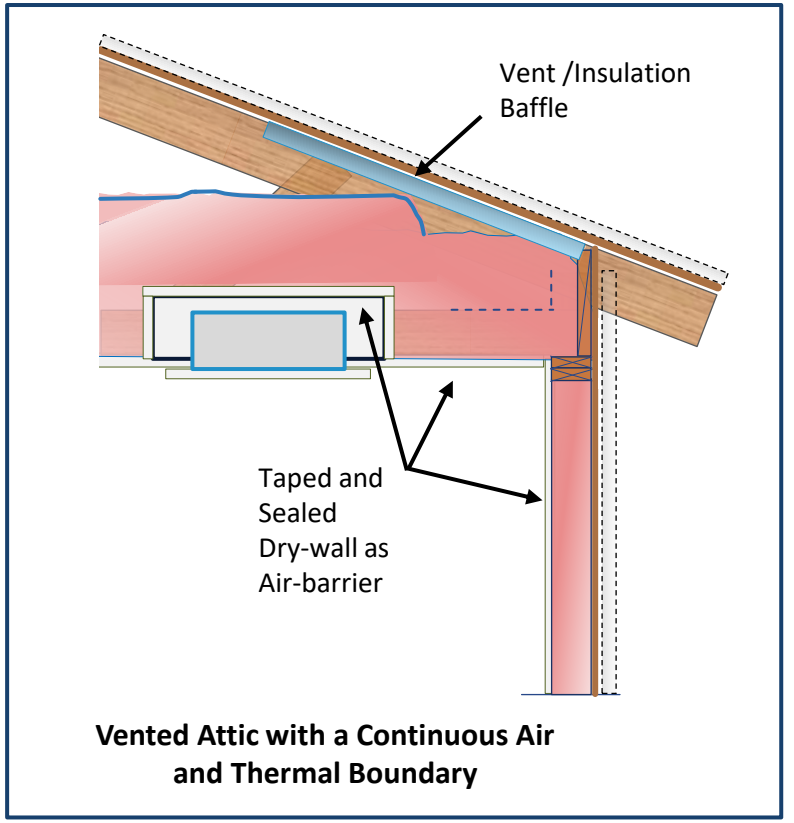
- Furnace at end of life
- Owner wanted heating and cooling, i.e. air-conditioning
- Owner did not want wall mounted units

Installing Heat Pump System with Recessed Ceiling Units

Indoor units shall be installed within the air and thermal boundaries



Unvented Attic with a Continuous Air and Thermal Boundary

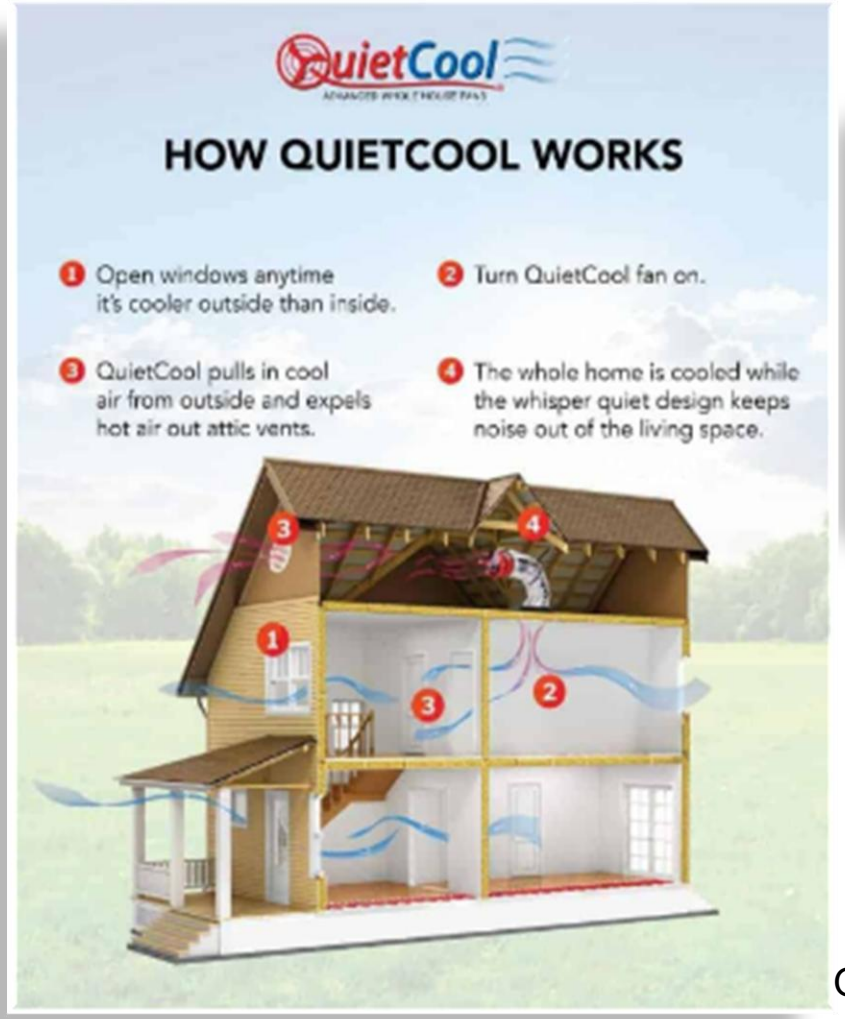


Vented Attic with a Continuous Air and Thermal Boundary

Ventilation Cooling

- Takes advantage of cooler night-time air temperatures
- Improves thermal comfort
- Combine with the other improvements:
  - air-sealing the attic
  - adding attic insulation
  - improving attic ventilation
- Safety Note:

May not work with older existing gas appliances due to potential backdrafting of combustion exhaust air.



Quiet Cool



Quiet Air Deluxe

The fan (and noise) are separated/isolated from the ceiling and structure.

Water Heating and Appliances



DHW Electric Tank – Opportunity or leave as is?

Assessment:

- Functionality
- Age and efficiency
- Location

Solution(s):

- Leave-in-place / Replace with Same
- Remove and Replace:
  - Install integrated heat pump
  - Install split system heat pump



Electric Tank – Leaking at base



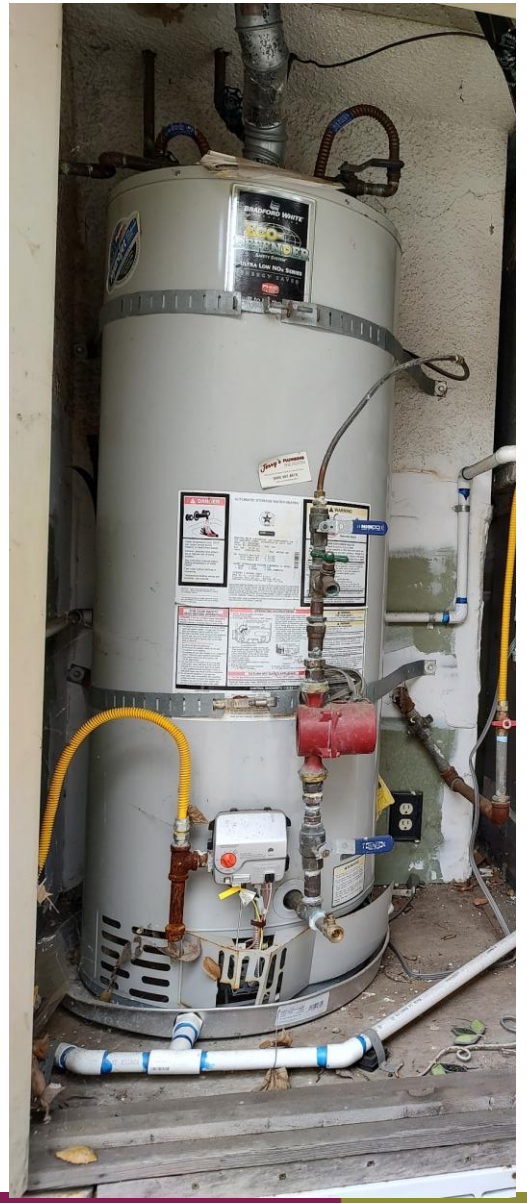
DHW Gas Tank / Tankless – Opportunity or leave as is?

Assessment:

- CO / combustion gas management
- Functionality
- Age and efficiency
- Location

Solution(s):

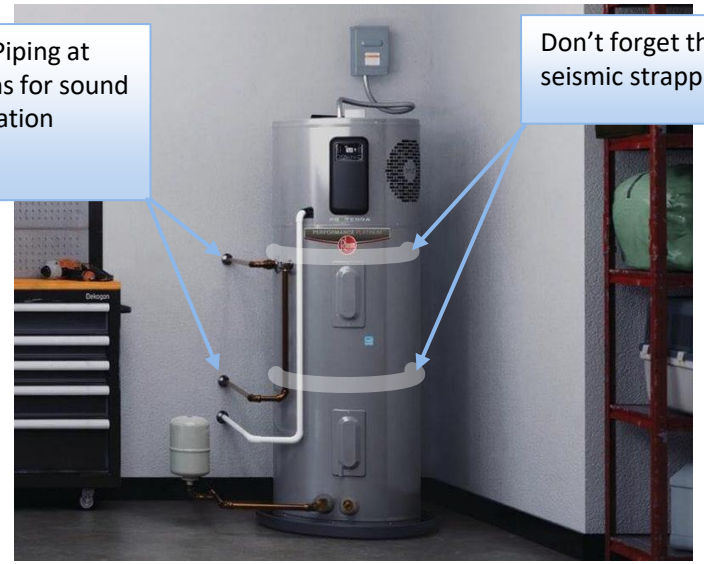
- Leave-in-place
- Replace with higher efficiency
- Remove and Replace:
  - Install integrated heat pump
  - Install split system heat pump



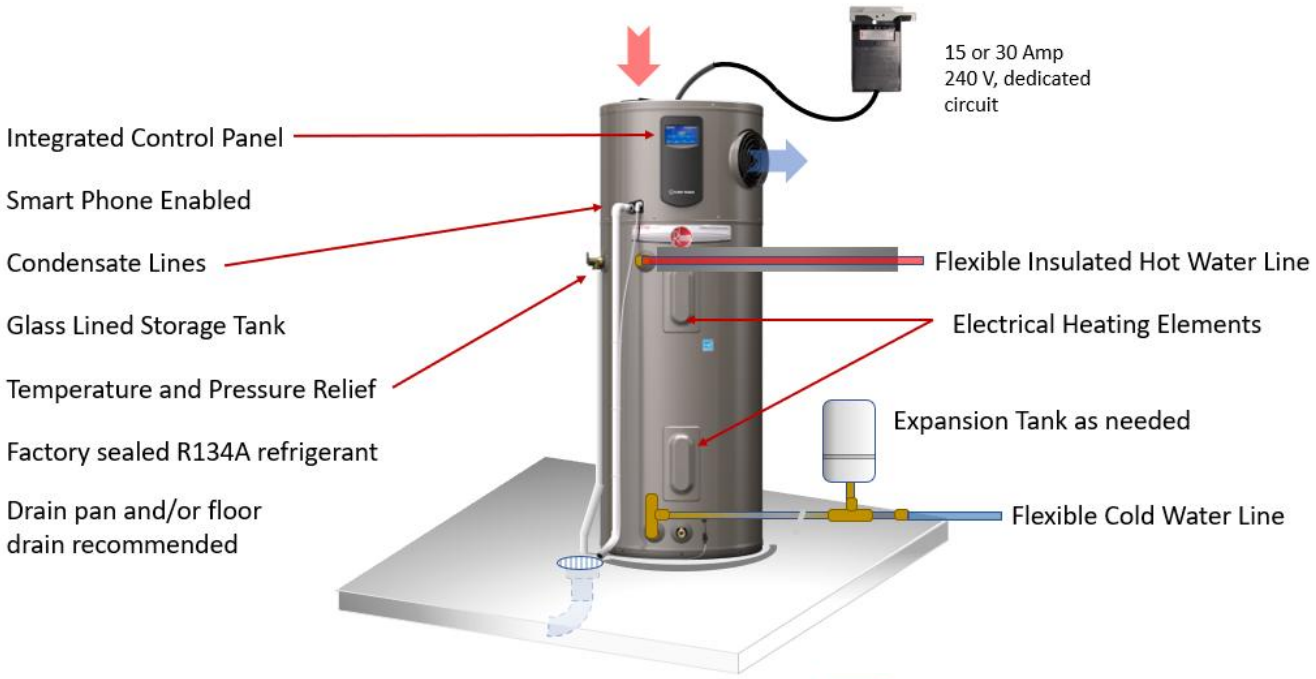


Integrated HPWH Considerations

- Integrated HPWH tanks taller than standard gas or electric units
- Sound Level is typically around 50 db
- Cold dehumidified air is expelled
- Condensate Drainage needs to be addressed
- Needs 450 - 750 cubic feet volume, or ducted vent kit, some newer models only need 350 cu ft
- Operating HP temp starts around 40-45 deg F, some models 37 deg F



Rheem marketing





Plug-in 120V HPWH Models Available

Units have slower recovery time than their 240V counterparts.

Recommendation is to up-size the units if consecutive showers are needed



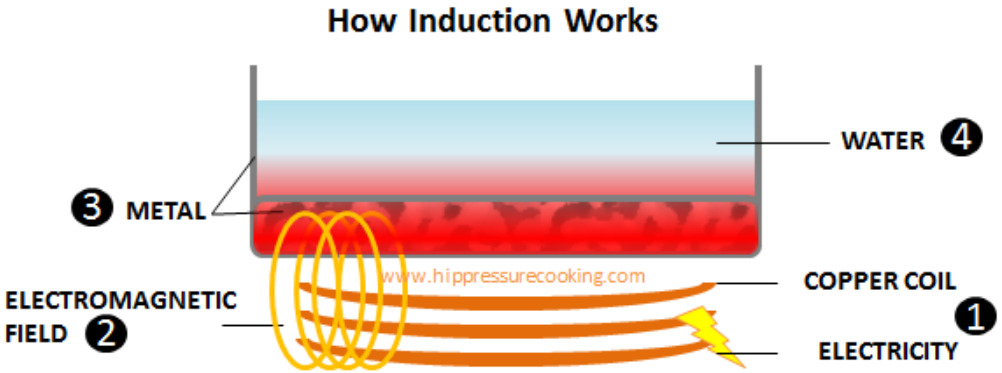
Ruud



A. O. Smith

These units can plug into an existing 120V electrical outlet, keeping installation costs down.

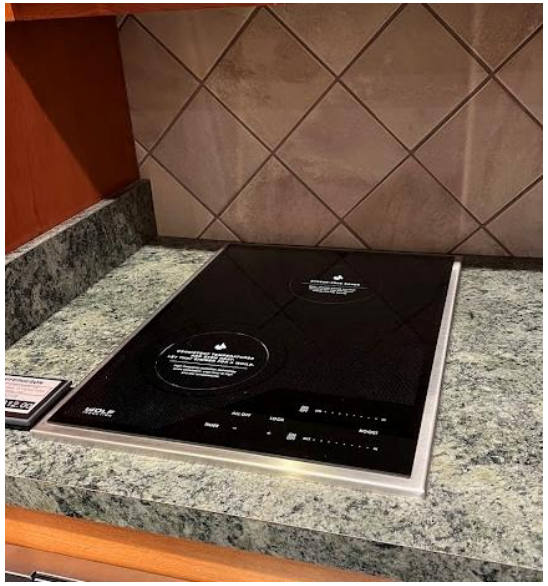
Induction Cooking











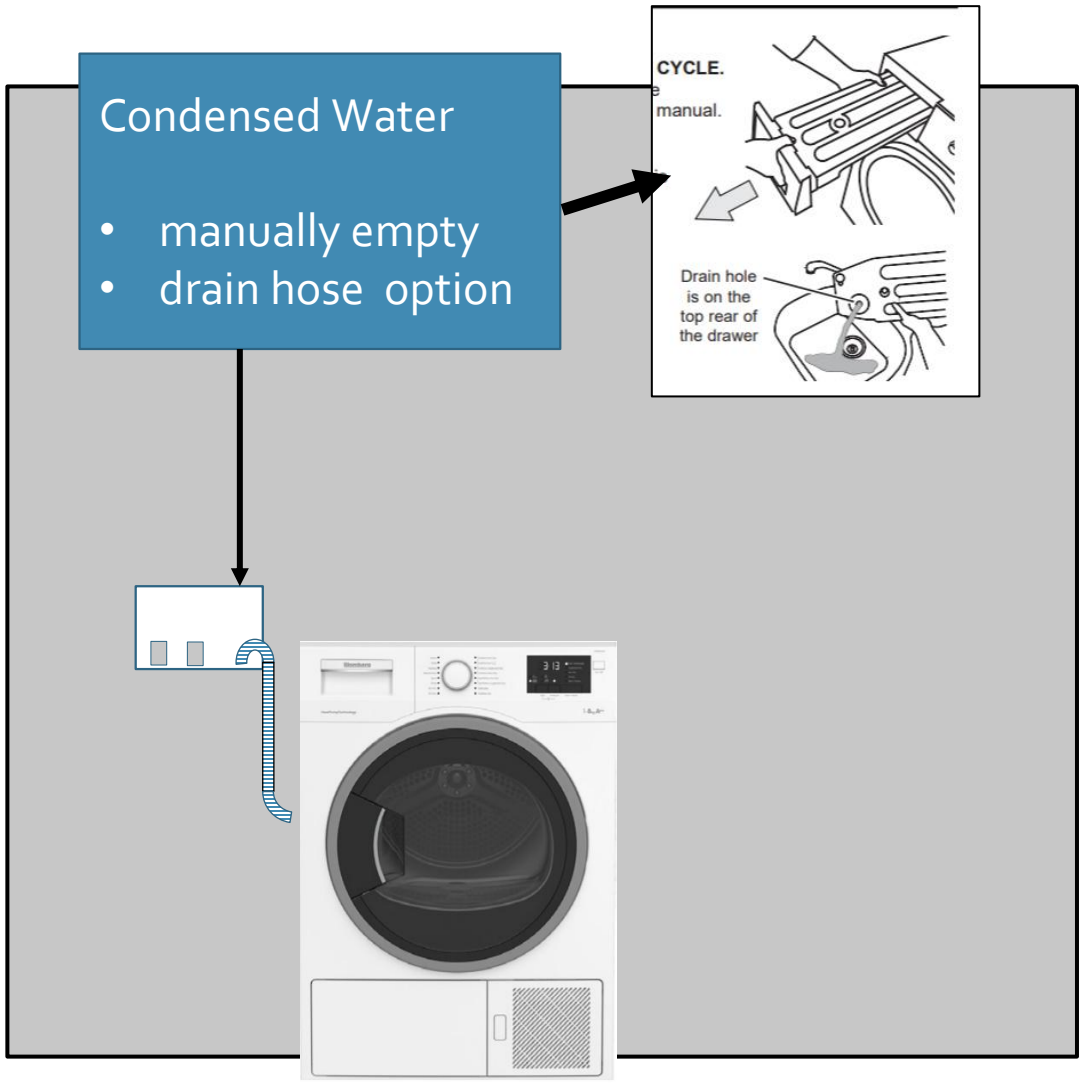
- Induction Ranges / Cooktops require steel or iron cookware.
- The ovens are not dependent on steel or iron cookware.

Examples – All-Electric Kitchens





Laundry Remodel – new appliances





Heat Pump and Condensing Dryers



Ventless Condensing Dryers / Washing Machines 2-in-1

Remodeled Bathroom with Laundry Alcove

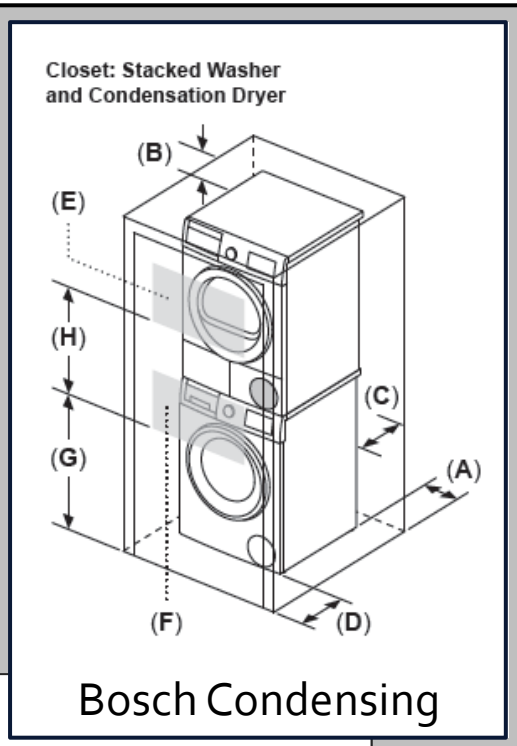
Background: *Apartment Remodel; ventless laundry added to new larger bathroom.*

Issue*: Laundry not drying with doors closed*

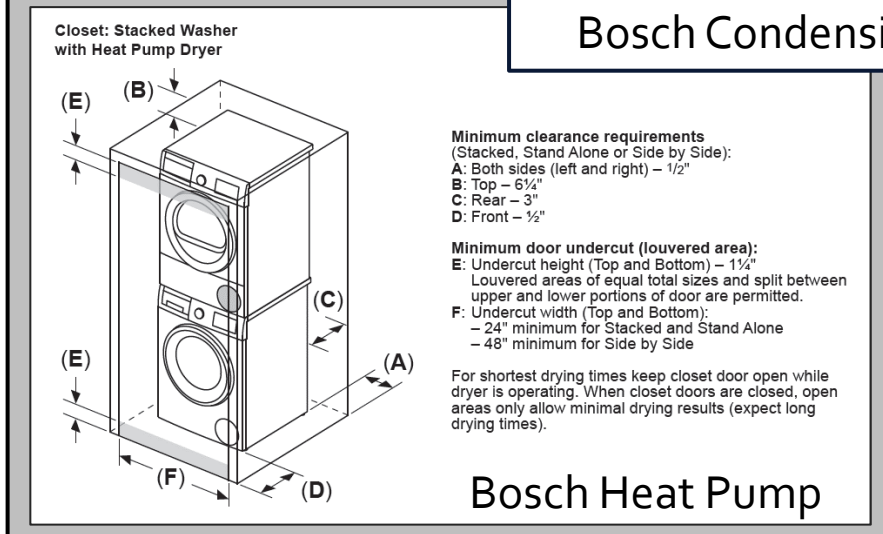
Response: *Keep doors open or replace w/ louvered doors and/or vent the space*



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



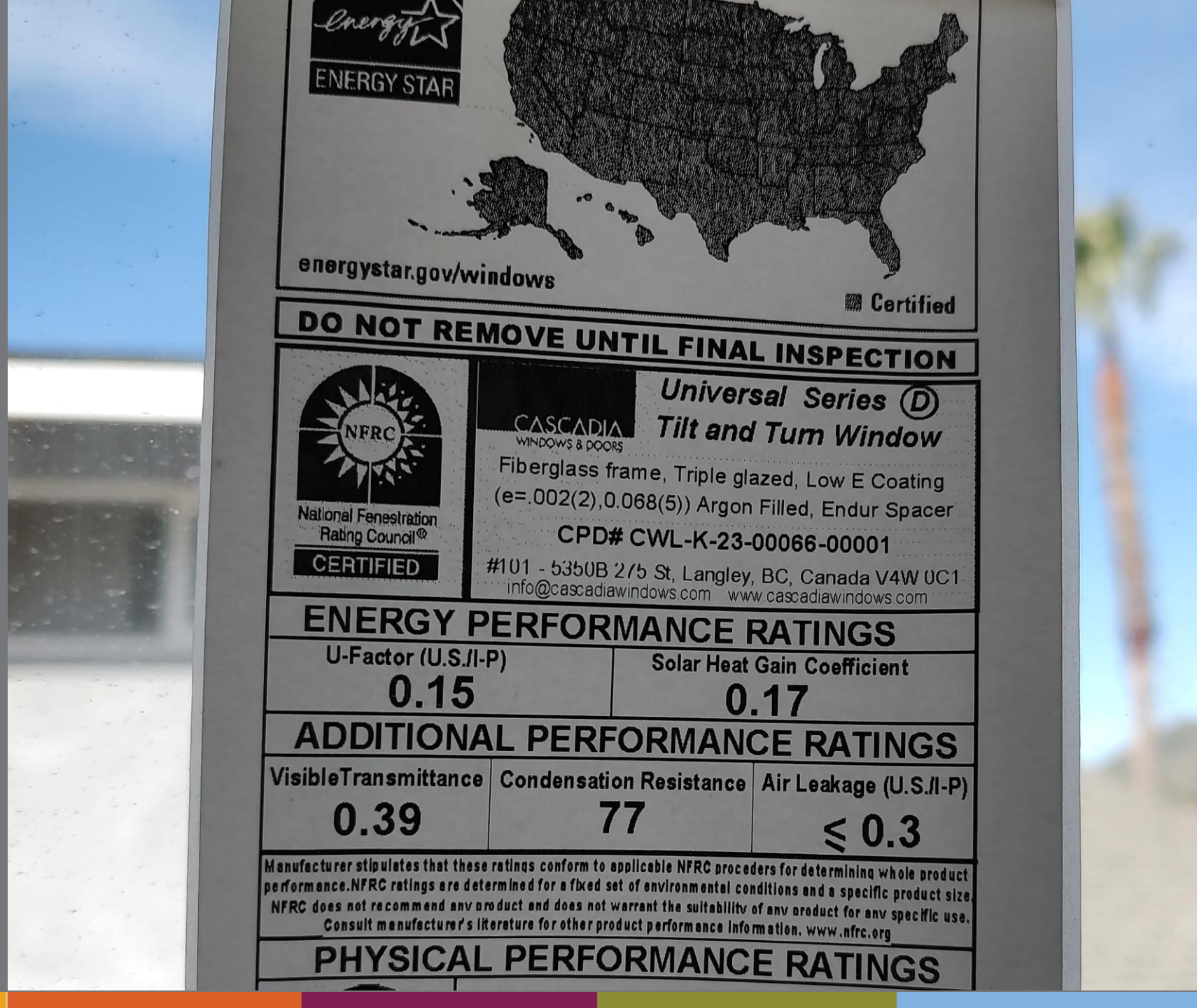
Bosch Condensing



Bosch Heat Pump

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

Windows, Walls, Attics and Floors



Existing Windows and Walls – Opportunity or leave as is?

Assessment:

- Wall Assembly: Insulation
- Glazing: Single / Double / Low-e2
- Frames: Metal / Thermal-Break / Wood / Other
- Location: Solar Gains / Daylight / Views

Solution(s):

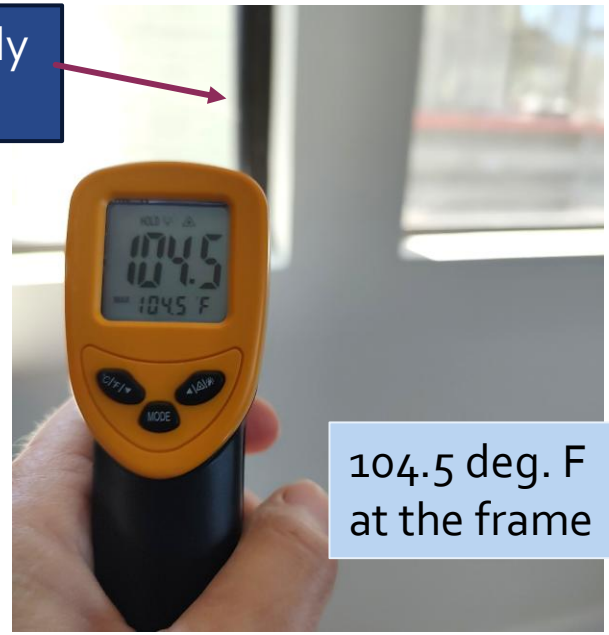
- Walls: Improve Insulation
- Windows: Leave-in-place
- Windows: Remove and/or Replace





Existing Windows –Metal Framed and/or High SHGC

(E) Windows – Non-thermally broken metal frames



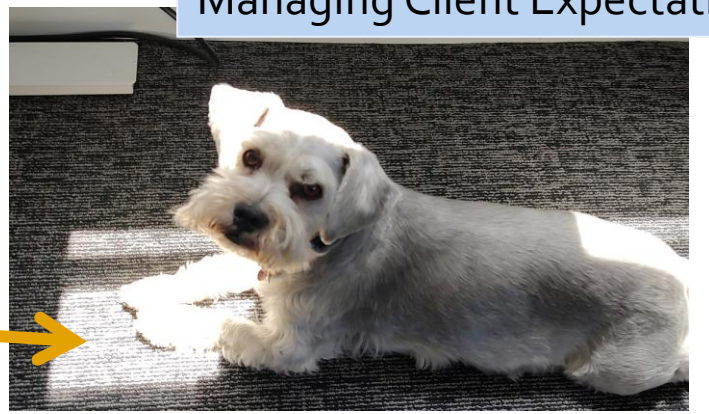
104.5 deg. F at the frame



66 deg. F at the wall

Note:
Interior frame temperature is an indication of exterior surface temperature.

Managing Client Expectations





107 deg F at the floor. Nice and Warm!?

Note:
Older (E) windows may have higher solar heat gain coefficient (SHGC) glass and 'accept' more solar heat/warmth as compared to (N) windows with low SHGC glazing.

Windows and Glass Doors

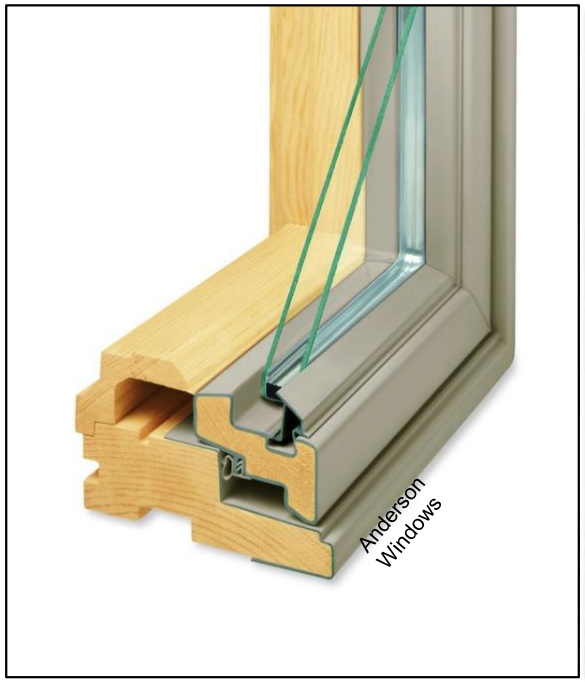
- Building Code (Part 2 and Part 2.5) Dictates when Tempered Glass is required, i.e. Glass in doors or windows next to doors, etc.
- Energy Code (Part 6) Dictates Thermal Performance – called U-factor

Note: The lower the U-factor the better insulating the window is against heat transfer.

2025 Energy Code Update
Mandatory:
- U-0.40 maximum

Prescriptive:
- U-0.27 for CZ 1-5, 11-14, 16
- U-0.30 for CZ 6-10, 15

Just about all brands of windows offer dual and triple paned options and all have tempered glass





Window Materials and WUI

Energy Code dictates thermal/energy performance but is agnostic on many factors that impact fire safety.

From the Cal Fire website

- Combustible framing material that, when ignited, glass breaks or falls out providing a path for embers or flames to enter your home.
- Radiant heat which can cause windows to break even before fire reaches the house. Single-pane and large windows are particularly vulnerable.
- Vinyl windows that do not have an internal reinforcement bar in the horizontal or vertical separator member as they are prone to failure from radiant exposure due to deformation of the frame.

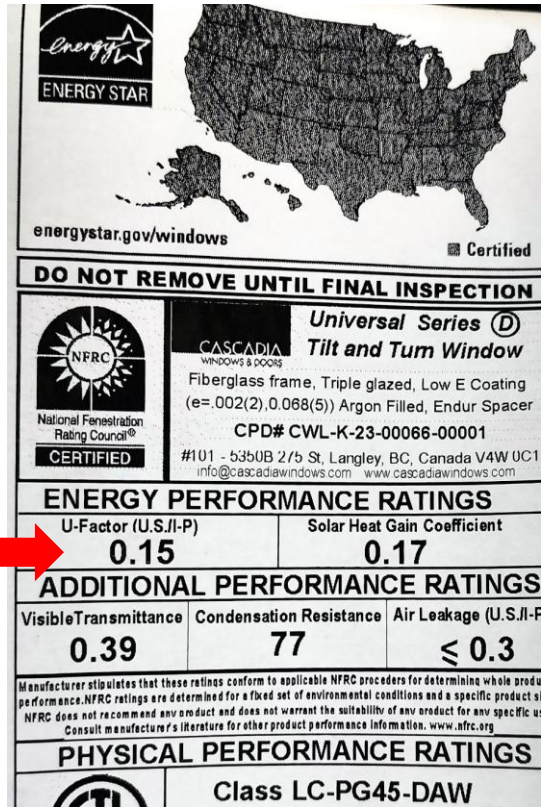
Source: https://www.fire.ca.gov/home-hardening

Example –High Performance Window with “Padded-out” Wall









Window Cost Comparison

	Panes	U-Factor	Delivered Cost
Alpen			
	Double	0.15	$75,878.51
	Double	0.16	$85,311.14
Andersen			
A-Series	Triple	0.23	$135,873.69
Loewen			
Alum Clad	Double	0.25	$152,826.18
Marvin			
Essential & Ultimate Drs	Double	0.29	$118,620.61
SeemRay			
	Double	0.21	$64,000.00
SmartWin			
	Double	?	$128,469.00
WeatherShield			
	Double	0.24	$99,873.00
Wythe			
	Triple	0.14	$91,702.00
Zola			
Classic-Clad	Double	0.25	$114,189.00
Cascadia			
	Triple	0.14	$70,557.00



Consider adding skylights

- Operable – promotes passive ventilation
- Introduces balanced daylight
- Sun tube option – domed or flat





Optional WUI-compliant

Attic and Roof – Opportunity or leave as is?

Assessment:

- Roof Assembly: Structural Integrity / Adequate Ventilation / Unvented Assembly
- Roofing: Replacement Time?
- Insulation: Quantity / Quality / Location
- Radiant Barrier: Condition / Location

Solution(s):

- Improve Insulation: Top of Roof Deck / Under Roof Deck / Ceiling
- Reroof with/without Rigid Insulation
- Consider WUI Gable/Dormer Vents



Attic Ceiling Insulation – Opportunity or leave as is?



Assessment:

- Vented Attic
- Existing R-19
- Not Reroofing - yet

Solution(s):

- Add blow-in over the top to bring up to Current Code or better





Blown-in Cellulose DYI Solutions at Lowes and Home Depot

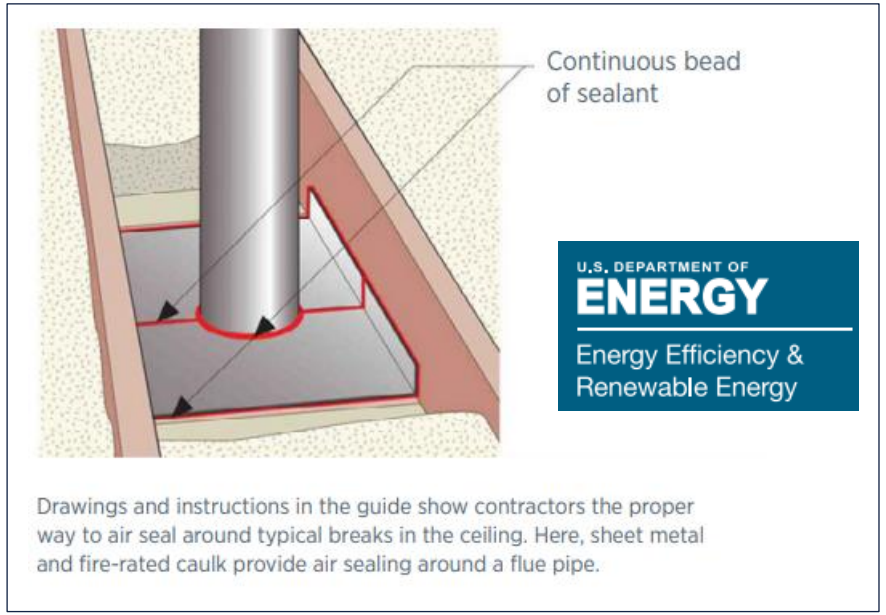
Note:
Caveat – confirm structural integrity of ceiling joist with older home construction –Cellulose may be too heavy.

Existing Attics, Ceilings –Opportunity and the Code

Solution(s):

- Air-Seal First!
- Upgrade light fixtures to air-tight insulation-contact (ATIC) rated or use fire-proof cover
- Reminder: Build drywall box, sealed and taped for ductless ceiling-recessed mini-split
- Use insulation that meets R-value and weight constraints

Altered Ceiling of Vented Attics

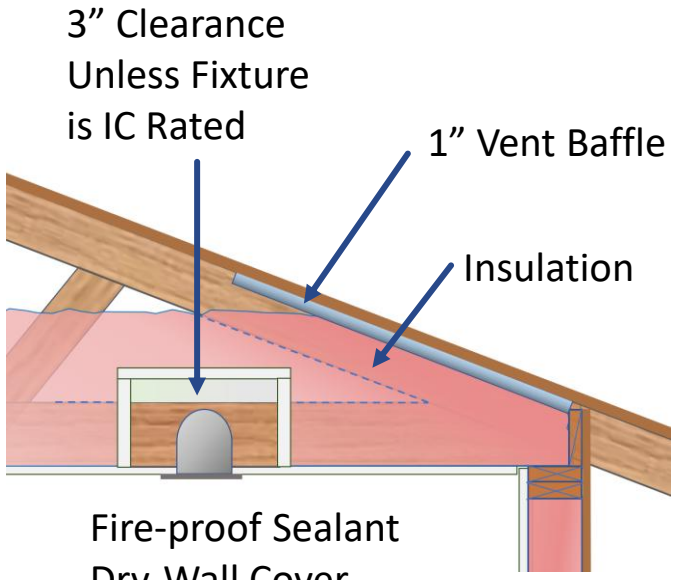


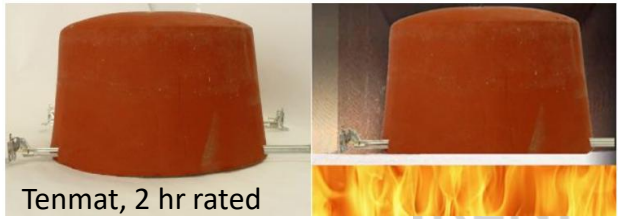
Drawings and instructions in the guide show contractors the proper way to air seal around typical breaks in the ceiling. Here, sheet metal and fire-rated caulk provide air sealing around a flue pipe.

NOTE:

Altered ceilings shall be insulated to R-49 in CZ 1-4, 6, 8-16 *[not CZ 5 and 7]*

- Except for CZ 1, 3, and 6 with existing R-19





Manufactured Cover

Raised Floor – Opportunity or leave as is?

Assessment:

- Insulation: Location / Condition / Quantity
- Adequate Ventilation
- Water or Moisture Present
- HVAC or DHW Appliances Present

Solutions:

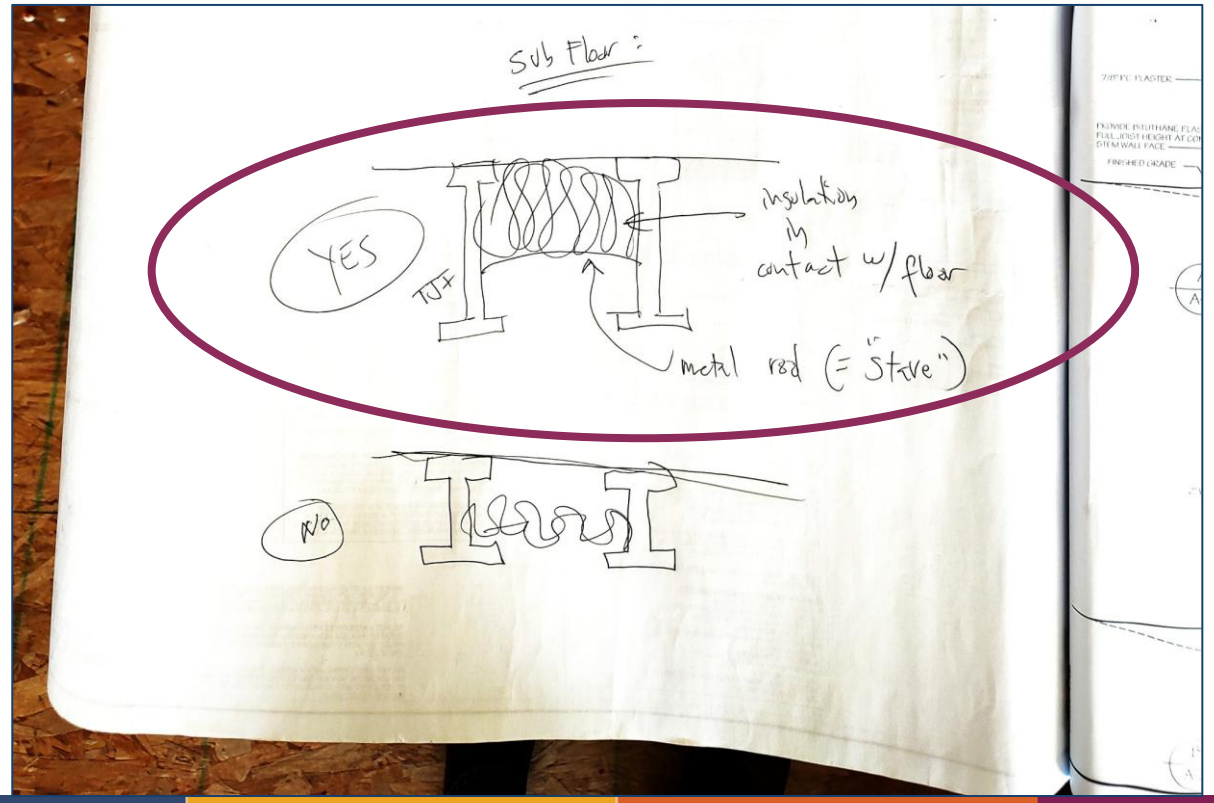
- Spray applied vapor retarders / air barriers
- Class I/II vapor retarder, taped and sealed
- Sump pumps
- Mechanical ventilation with humidistat
- Insulation at Floor Deck
- Unvented – Insulation at perimeter foundation wall and rim joist



Raised Floor Example – R19 Insulation

Assessment:

- Raised Floor Addition / ADU
- R-19 or Better, Code Compliant
- Improper Insulation Location, i.e. installed towards bottom of floor joist vs directly under floor deck with no air space





Friendly HERS Rater,
"Insulation Placement Matters"

Raised Floor – Vapor Barrier at the Ground/Floor

Assessment:

- Uninsulated Raised Floor
- Exposed Ground and moisture present



Membrane is securely attached to the foundation





Class I Vapor Barrier < 0.1 perms
Prevents Vapor Drive and Moisture Migration

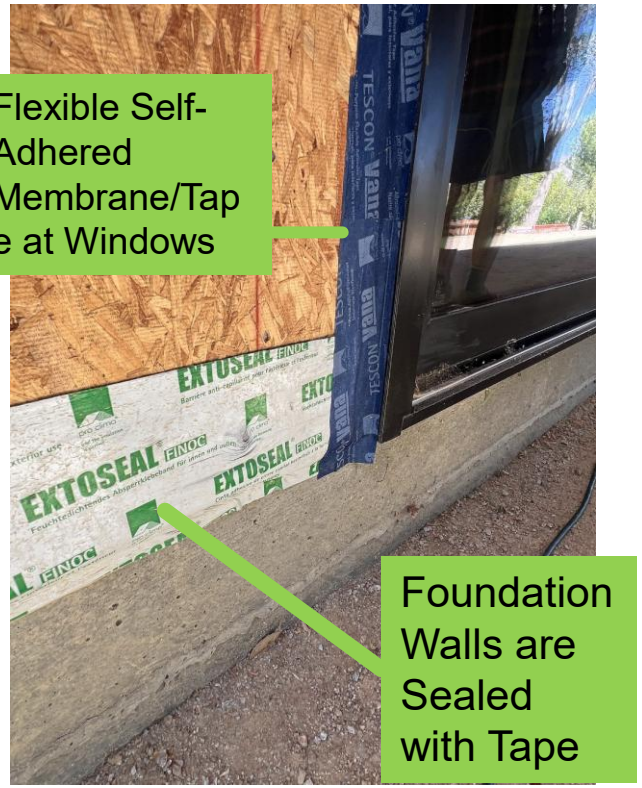
Reduce Air Leakage – Additional Opportunities

Assessment:

- HERS Existing Conditions
- Infrared Camera
- Blower Door Testing

Solutions:

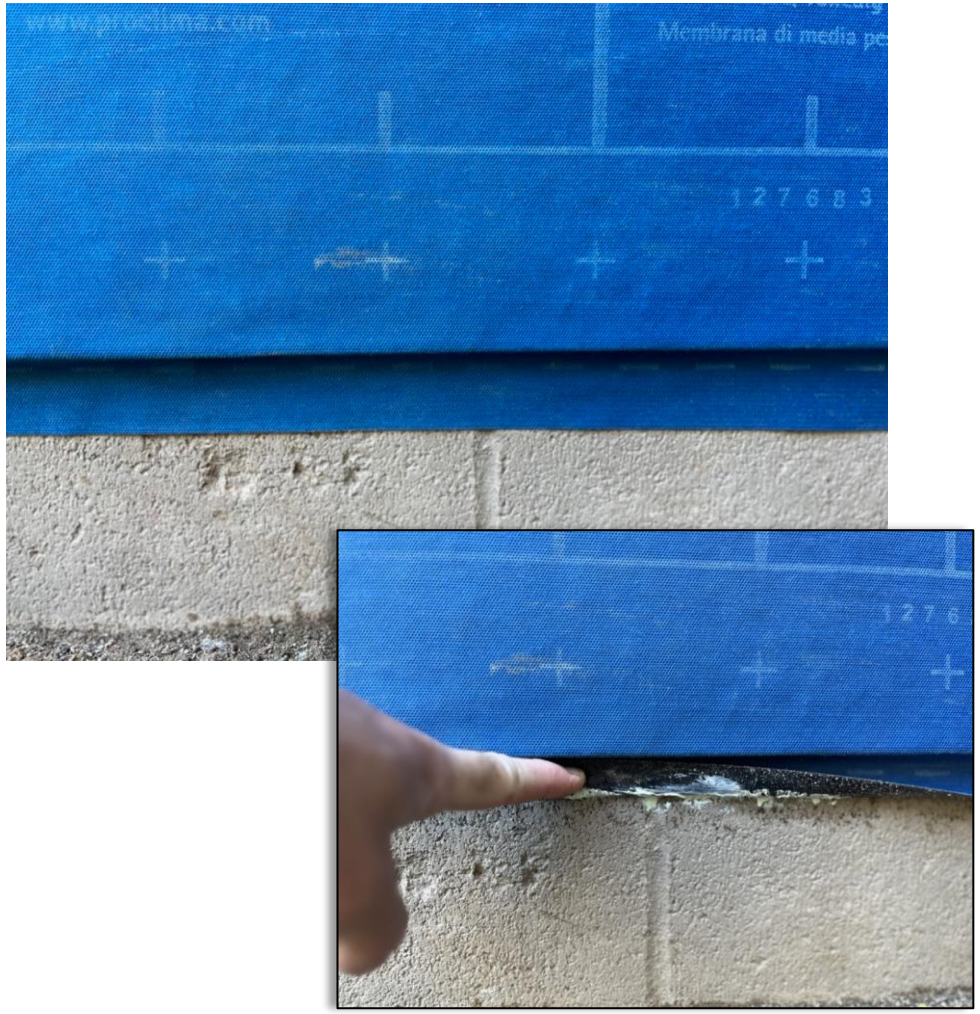
- Caulk Sill Plates
- Seal around windows while trim is off
- Attention at junctions







‘Ideal World’ – Air-Barrier from the Exterior







Remodel – Air Barrier from the Interior



1



2



3

Solar PVs and Battery Storage



Electric Panel Upgrade Needed?

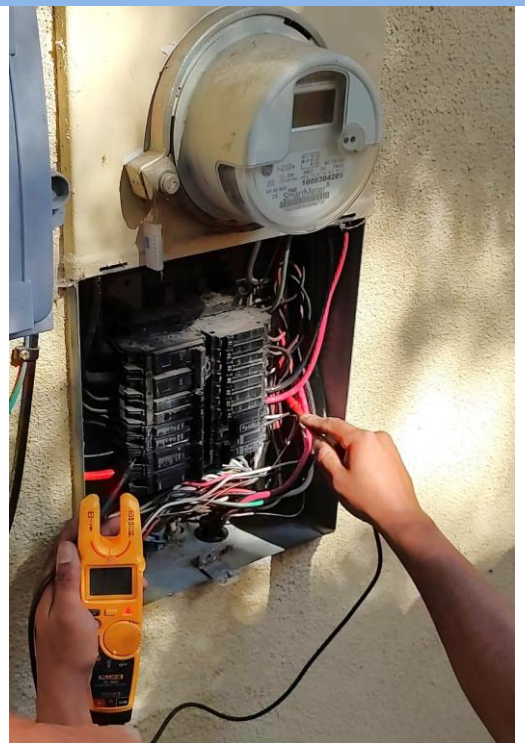
Assessment:

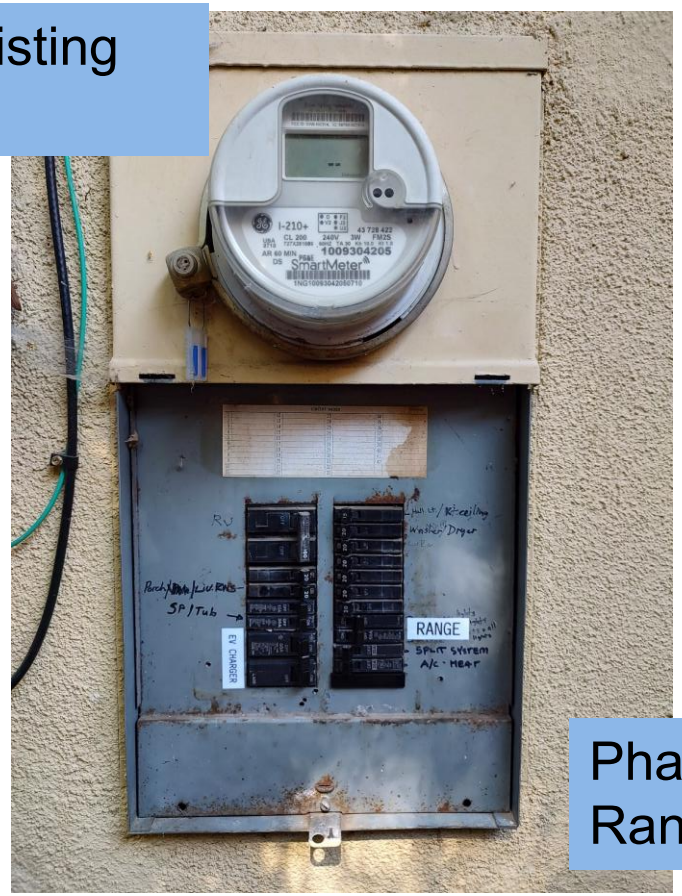
- Panel Size / Capacity
- Adding Electric Loads –all at once or in stages
- Adding Solar and/or Battery



Phase 2: New Elec Panel with Solar and Battery Storage

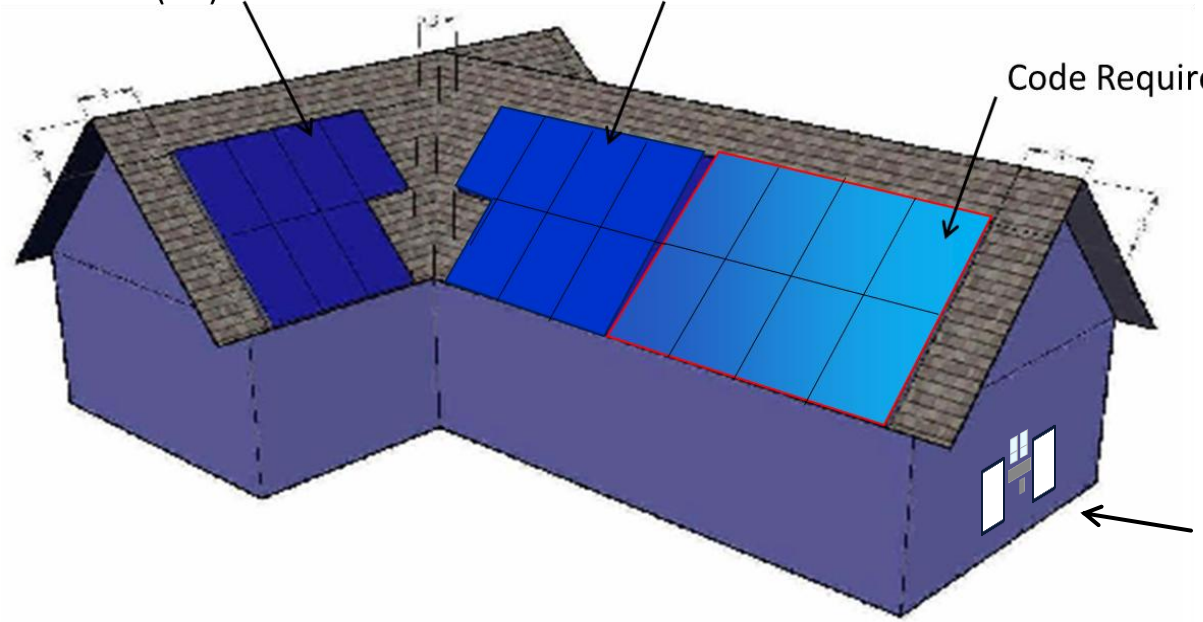
Phase 1: Reorganize Existing Panel





Phase 1: EV Charger, Induction Range, and HP Space Conditioning

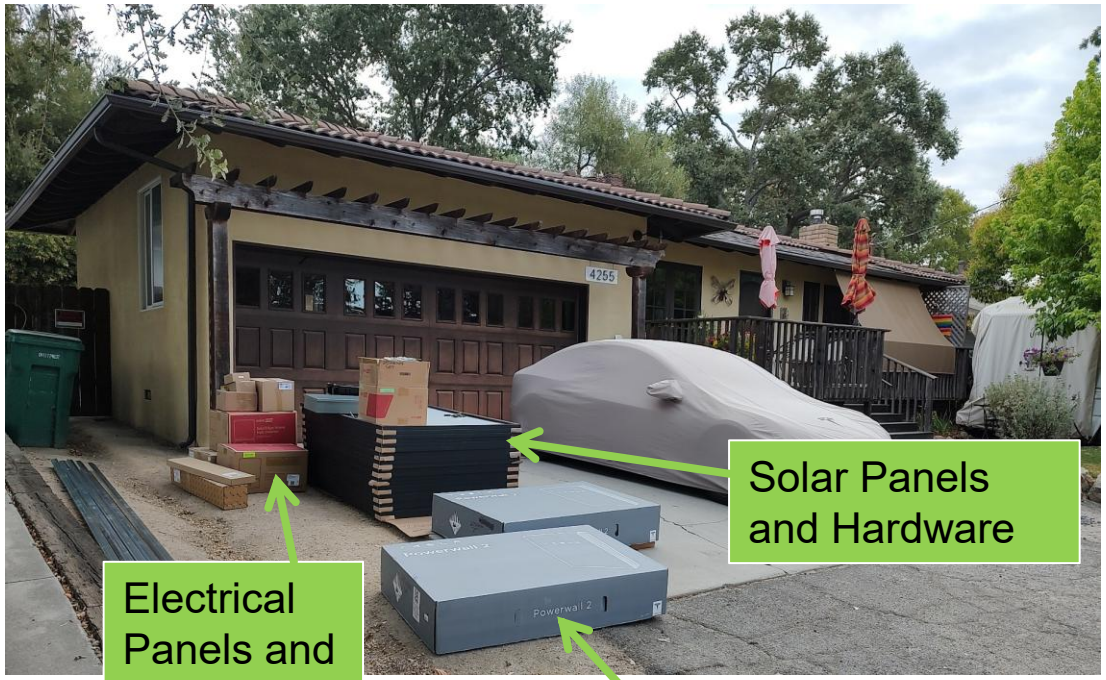
Zero Net Energy (ZNE) *–the energy a home uses in one year is equal to the energy produced on-site for that year*

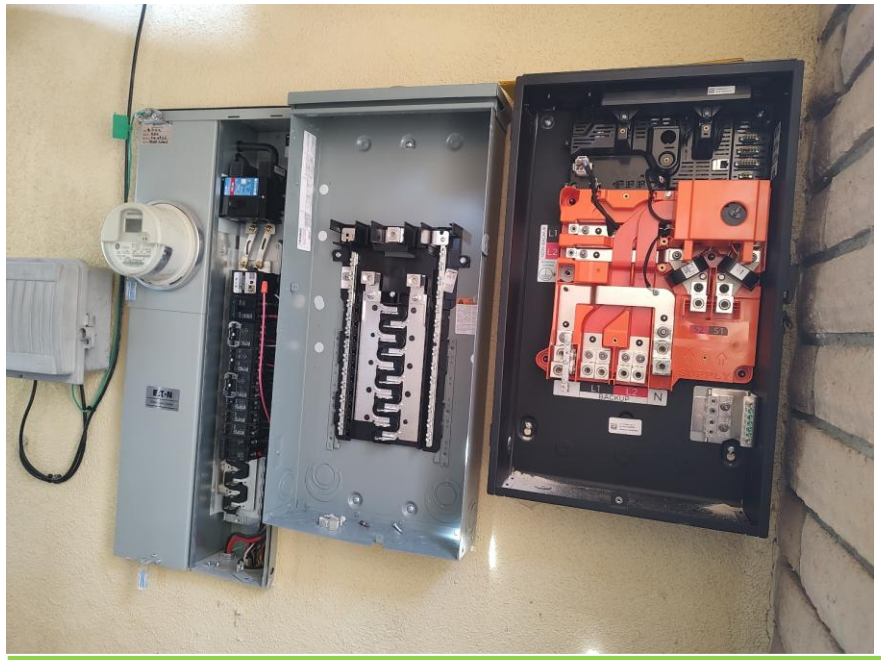


Under the new electric pricing system (NEM 3), a solar PV system with battery storage can be more cost effective than a PV System alone for a ZNE home.

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

Existing Homes: Solar PV and Battery Systems



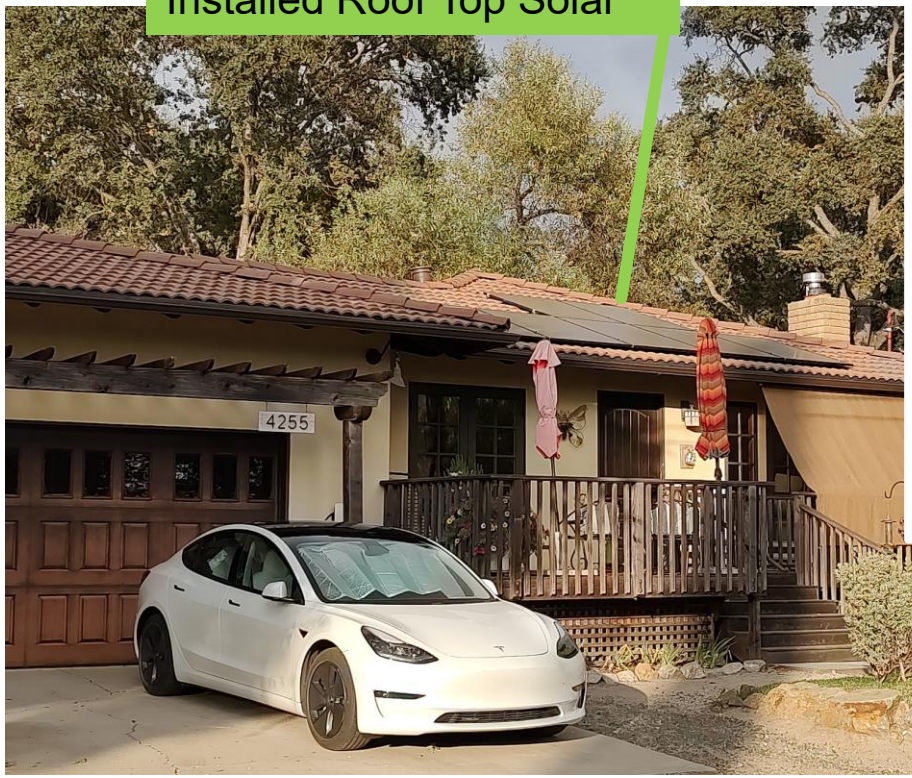


New electrical panel, sub-panel and controller.

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

Occupant Habits: Energy Usage, Solar PV and Battery Systems

Installed Roof Top Solar



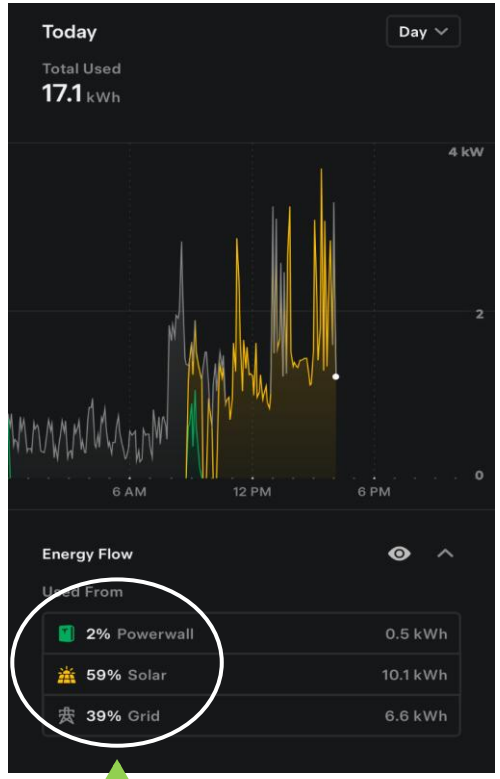
Depending on one's driving milage, electric cars can add significant loads.



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

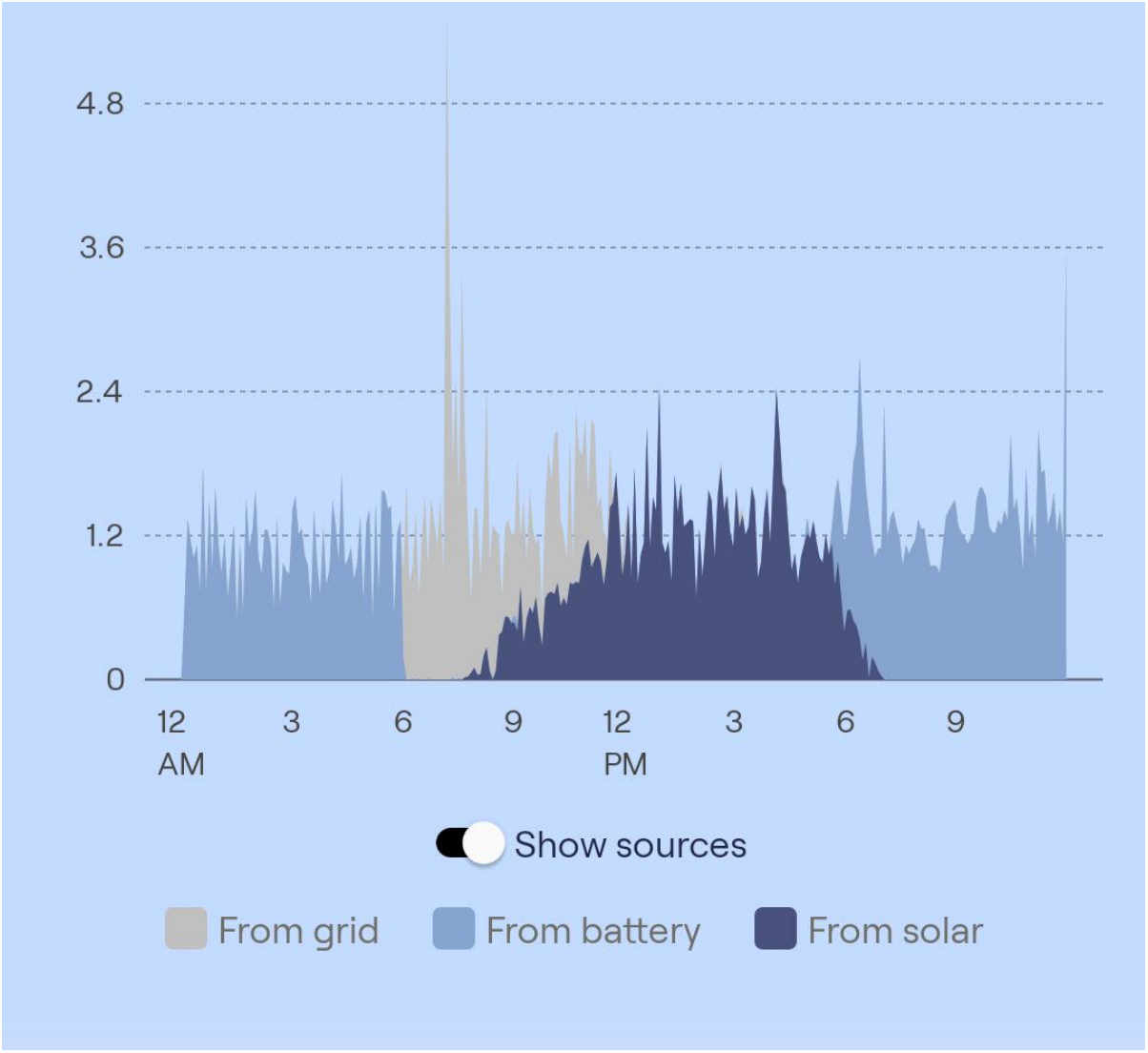


Electric dryer – Multiple consecutive use can add significant electric load, pulling energy from the grid.



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

Managing Client Expectations



Some Take-Aways:

- Some days, even with Solar and Battery Storage, the household will use ‘grid’ electricity.
- Will have an electric bill.
- Many days my car ‘charges’ on solar and that saves me over $100 /month.

Electrical Panel Upgrade, Car Charging and Remote Monitoring



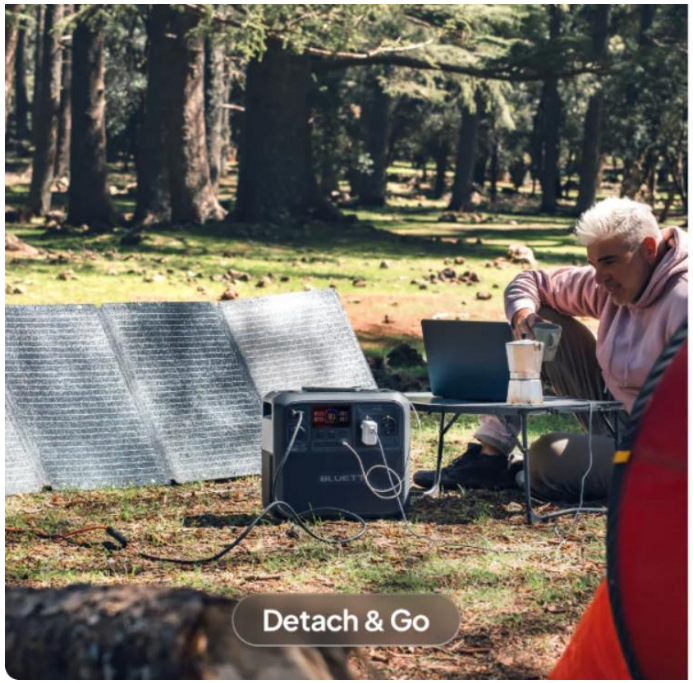




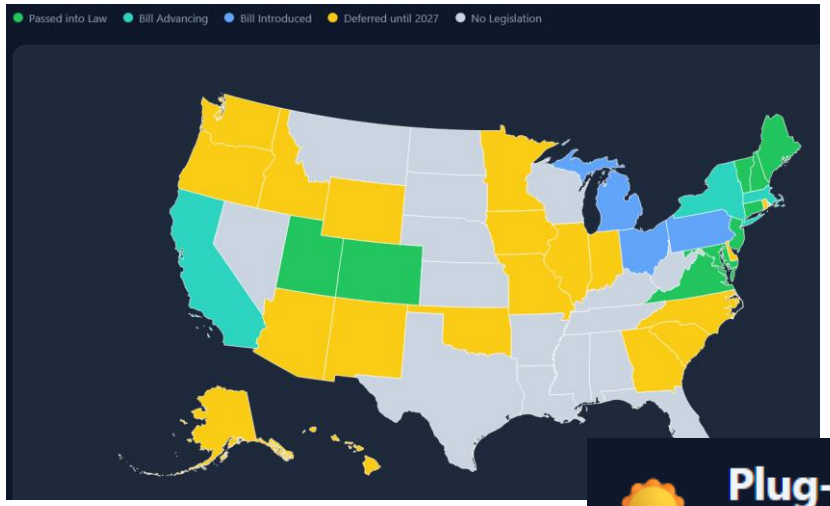
“Balcony Solar” – Plug-In Solar and Battery

- 9 States have legislation
- California SB 868 ‘Plug and Play Solar Act’ --waiting for Gov’s signature
- Allows occupants to use portable or non-hardwired solar and battery systems.

Example from Bluetti https://www.bluettipower.com







Plug-In Solar Guide
pluginsolarguide.com

Site includes information and a solar calculator

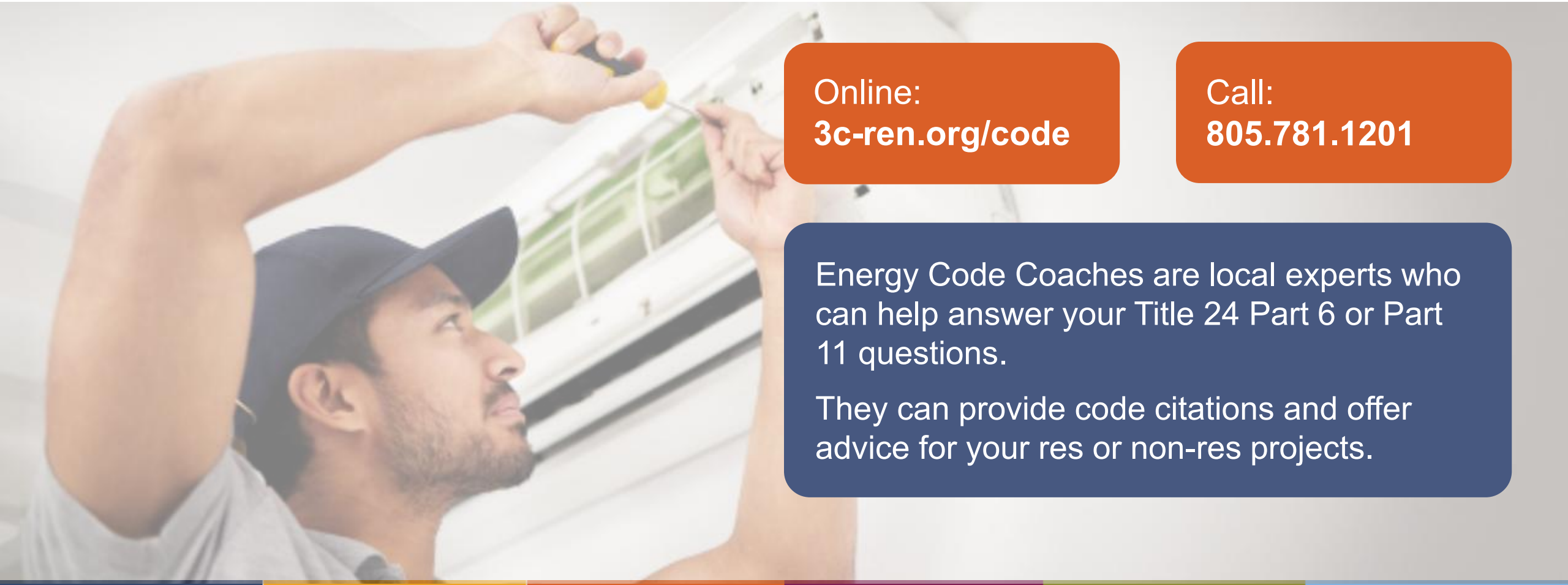
Wrap Up & Discussion

1. Assess big picture concerns and goals (e.g., comfort, IAQ, all-electric, cost savings)
2. Allow time to engage professionals and understand options
3. Develop an integrated approach to address the goals
4. Celebrate the wins!



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.

Do you or your clients have questions about energy upgrade incentives?

Our Energy Concierges can help!



Paul Whang
Commercial Concierge

Phone: 805-892-1066

Email: pwhang@3c-ren.org



Itzel Torres
Spanish Support
(commercial & single family)

Phone: 805-767-1204

Email: info@3c-ren.org



Naomi Newman
Single Family Concierge

Phone: 805-957-7843

Email: nnewman@3c-ren.org

Thanks for coming!

Continuing Education Units Available

- Contact chloe.swick@venturacounty.gov with any questions

Today's Slides and Recording are Coming to Your Inbox Soon!

Upcoming Courses:

- **Carbon Smart Construction Happy Hour** (all events in Santa Barbara)
  - Reducing Embodied Carbon (9/24)
  - Energy Water Nexus (10/20)
  - Green Building Construction Tour (10/28)
  - Renewable Energy, Storage, and Resilience (11/12)
- **Regional Forum** in San Luis Obispo-- Collaborative Solutions for Energy Code Compliance: Central Coast Conversation with the CEC (11/5)