Going from Gas to Electric at Home

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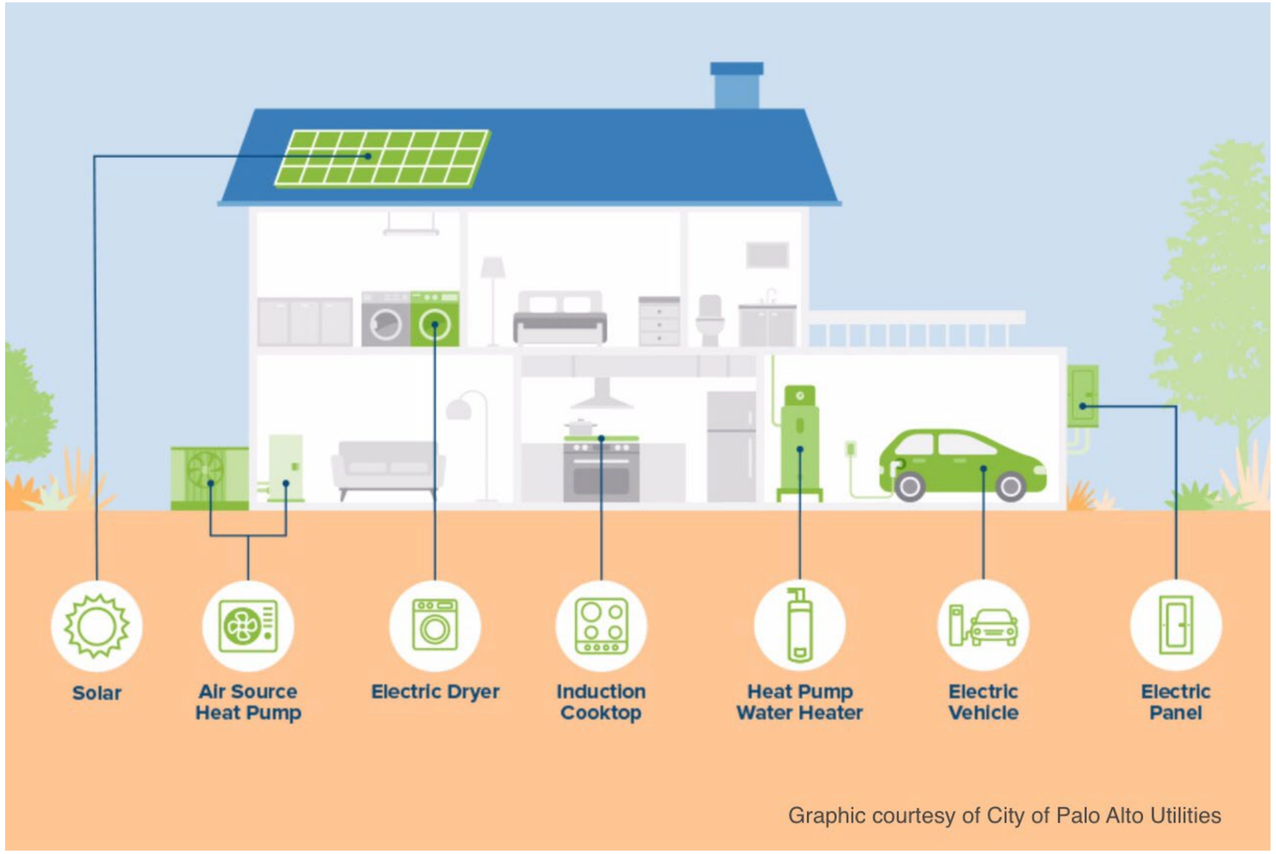
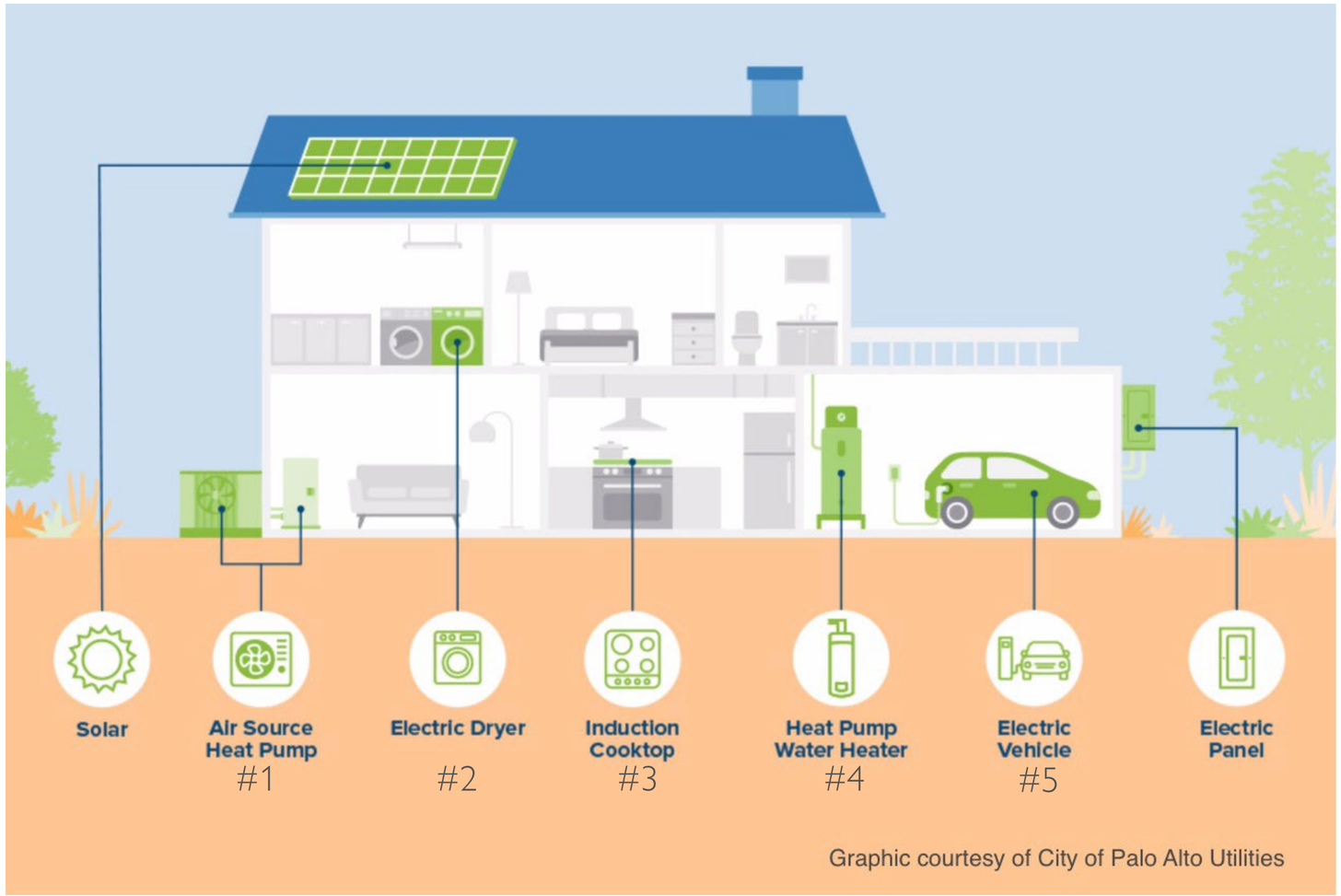
AGENDA

- Electrification basics
- Why electrify?
- Home example
- Ample panel space
- Barriers to electrification
- Pitfalls to avoid
- Benefits of electrification



WHAT IS BUILDING ELECTRIFICATION?



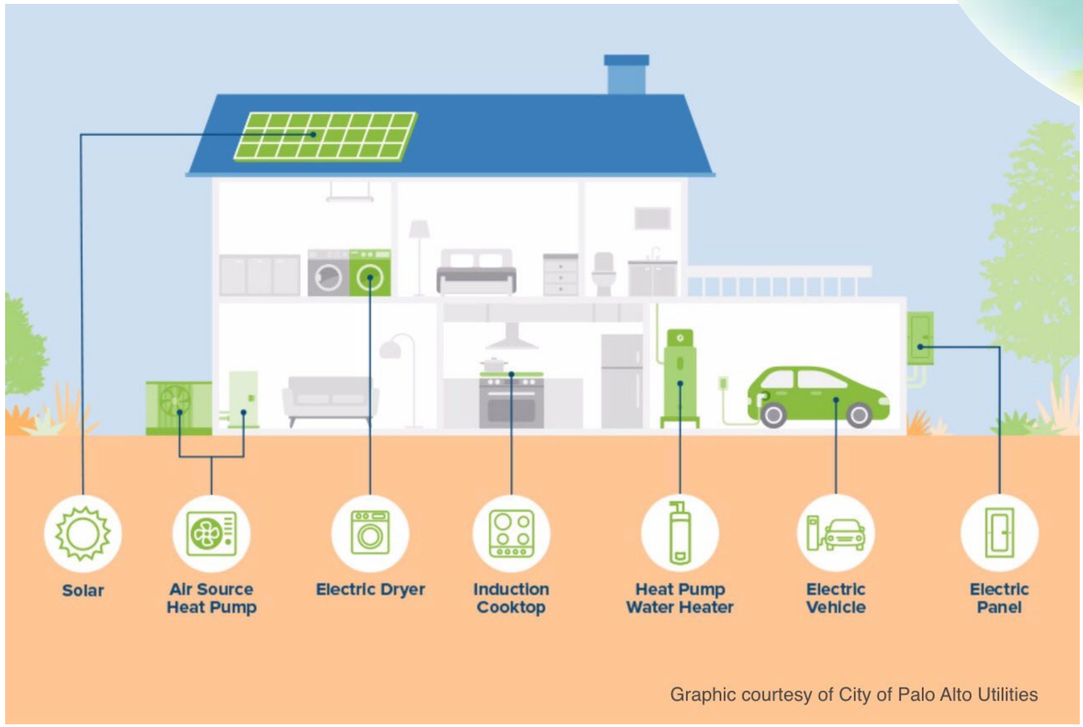
Replacing all fossil fuel appliances in the building:

#1 gas furnace
#2 gas dryer
#3 gas range
#4 gas water heater
#5 gasoline for car

...with high efficiency electric alternatives

- Rooftop solar (at $0.05–0.10 per kWh) makes all-electric home conversions affordable
- Battery backup systems make all-electric homes reliable during grid outages

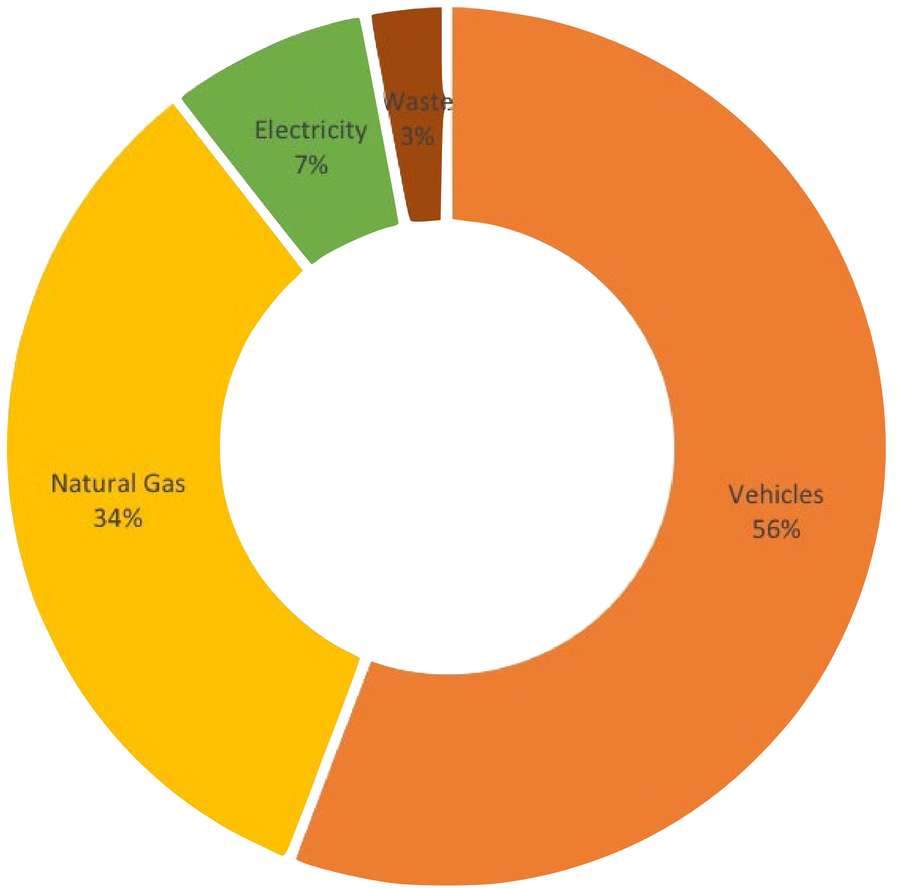
WHY ELECTRIFY?



- PCE provides 100% carbon-free electricity - today!
- Enables quick transition away from fossil fuels
- Necessary to meet all energy needs with clean renewables
- Cleaner air, indoors and out
- Saves energy
- Saves $$ and hardship from climate damage

TYPICAL GHG EMISSIONS

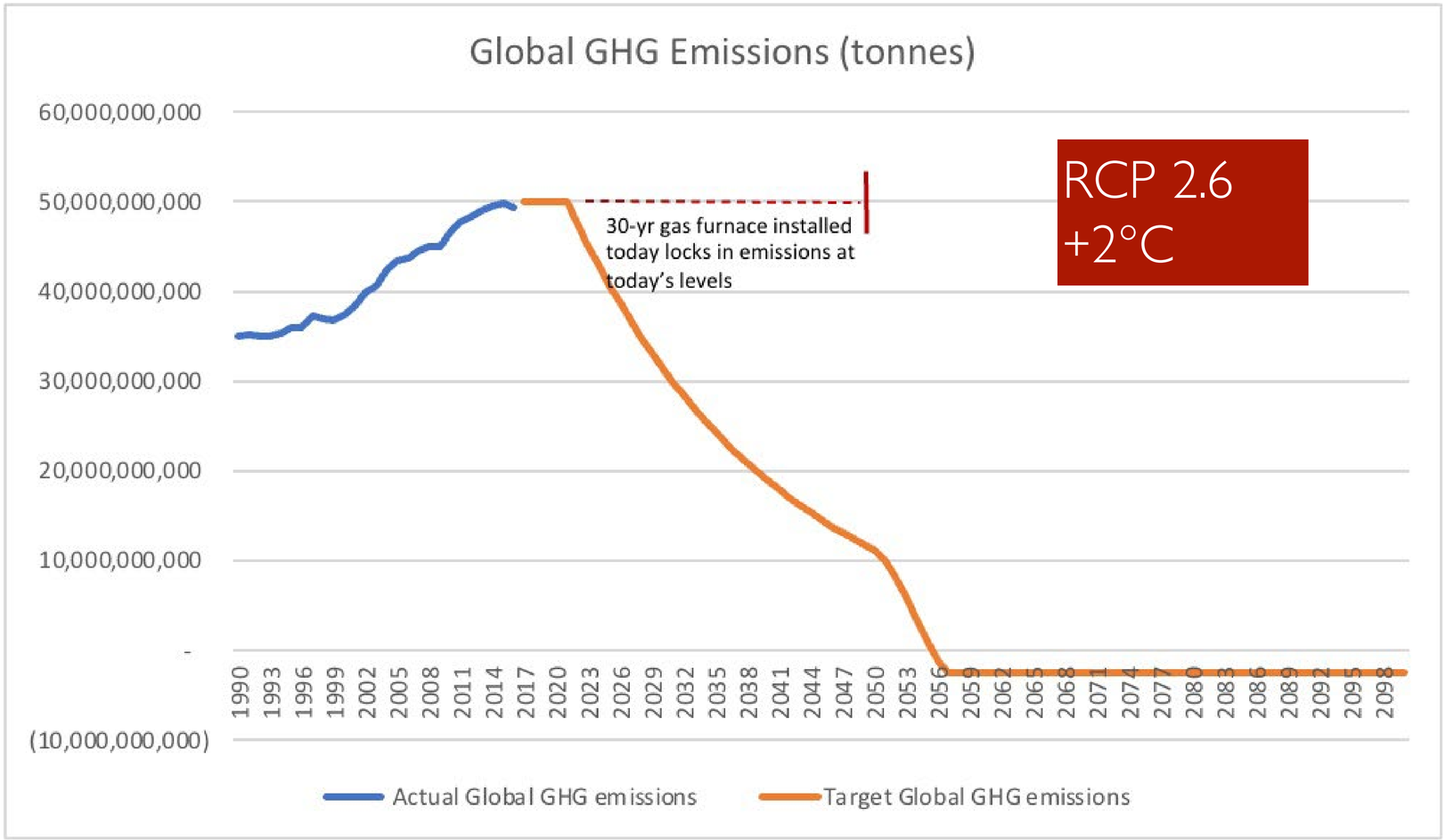
for cities on the Peninsula



In 2020: 12% of cars registered in Portola Valley were EVs, adoption rate is increasing (source: CEC ZEV dashboard)

Source: City of Menlo Park December 2019 Staff CAP report

OUR ONLY PATH REMAINING TO 2°C

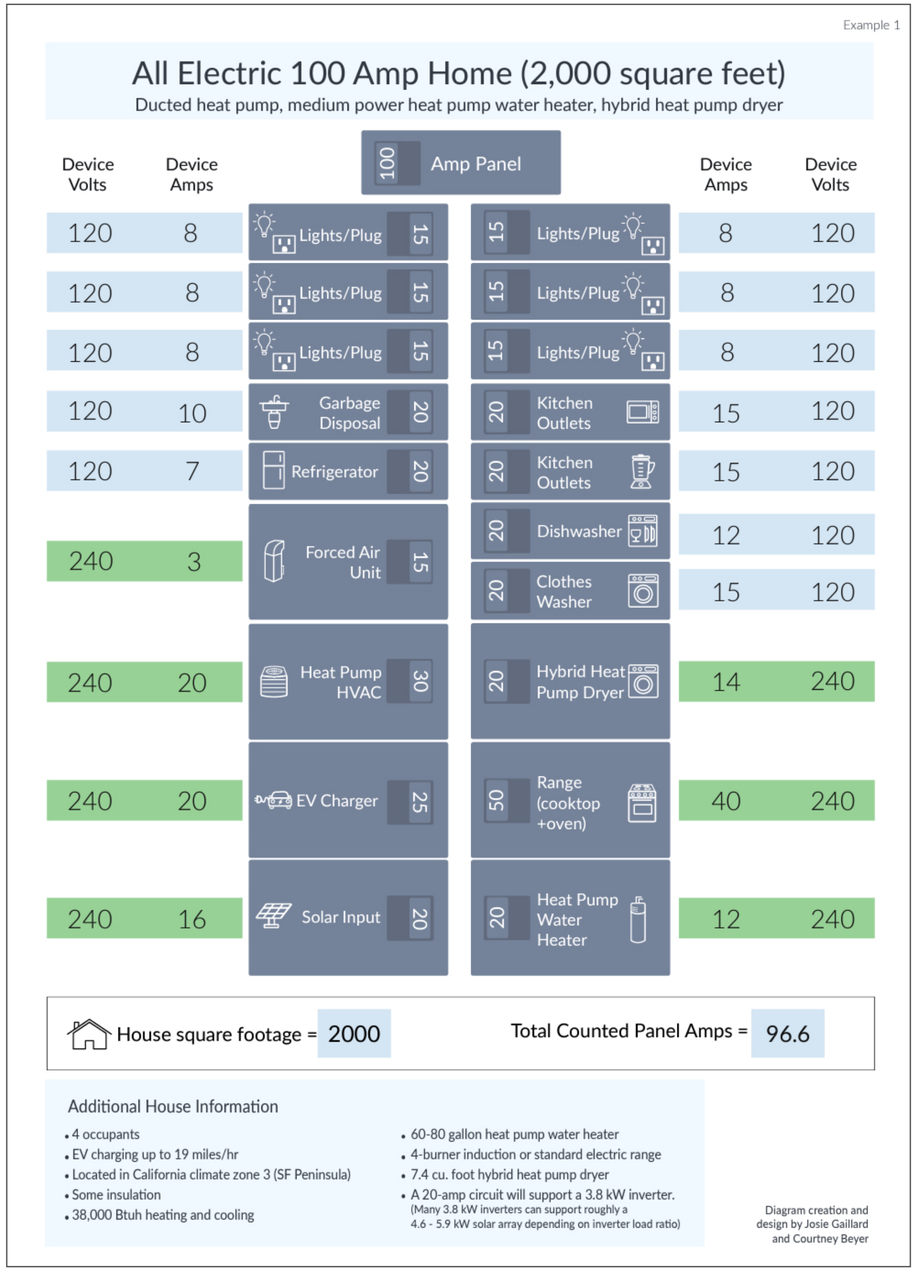


EXAMPLE HOME

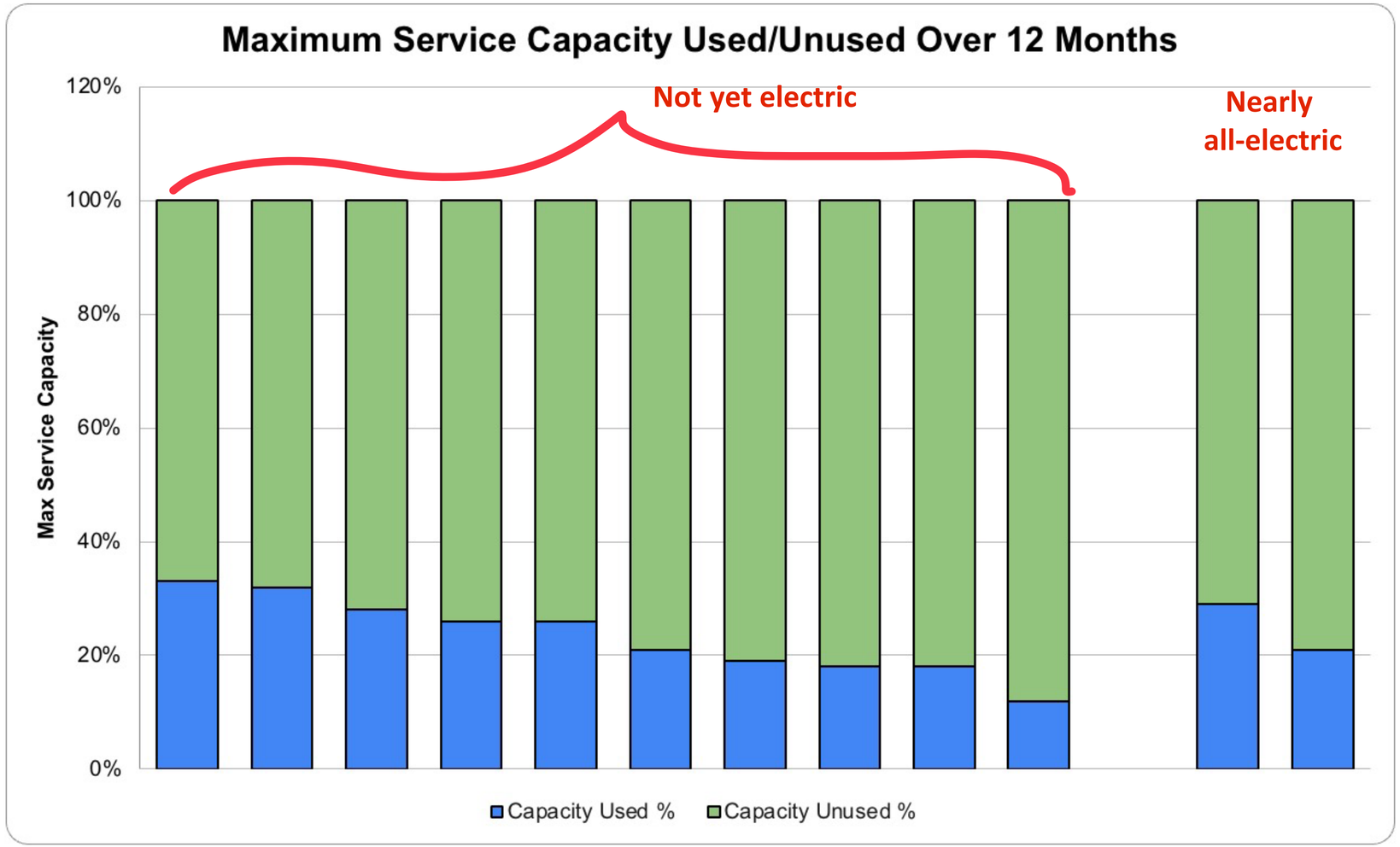
Location: Redwood City, CA
Square footage: 1,900
Occupants: 4
Main panel size: 100 amps
Vintage: 1960's

“PANEL OPTIMIZATION”
for
2,000 sq ft home

- For homes with 100 amp electrical panels
- Helps avoid ~$5,000 electric panel upgrade
- Favors efficient devices w/ low rated amps
- Provides roadmap for building owner
- Helps guide tradespeople



AMPLE SPACE TO ELECTRIFY



WATER HEATER

Uses 1/3 the energy of a gas water heater

Today: 50-gallon gas tank WH in garage

Recommended: 80-gallon, 15-amp heat pump tank WH in garage

SPACE HEATING/COOLING

Uses 1/3 the energy of a gas furnace

Today: A/C + Bryant gas furnace

Recommended: Mitsubishi 3-ton inverter-driven heat pump HVAC system w/ ducted air handler

COOKING

Today: 48" gas Jenn-Air range

Recommended: 48" AGA induction range

CLOTHES DRYING

Today: Samsung 7.5 cu ft resistance electric dryer 22.5-amps / 240 volts

Recommended: Whirlpool 7.4 cu ft hybrid heat pump dryer 14 amps / 240 volts

EV CHARGING

Recommended: Wallbox Pulsar with adjustable current from 6 to 32 amps (rated 13 amps/240 volts)

Budget Option: NEMA 6-15 outlet with 12-amp/240-volt circuit for outside of garage

CIRCUIT SHARING & AUTOMATIC LOAD SHEDDING

SimpleSwitch Allows 2 appliances to share one circuit

DCC9
Sheds load for one circuit

Span.io
Sheds load for 0-32 circuits in the panel

SOLAR + BATTERY

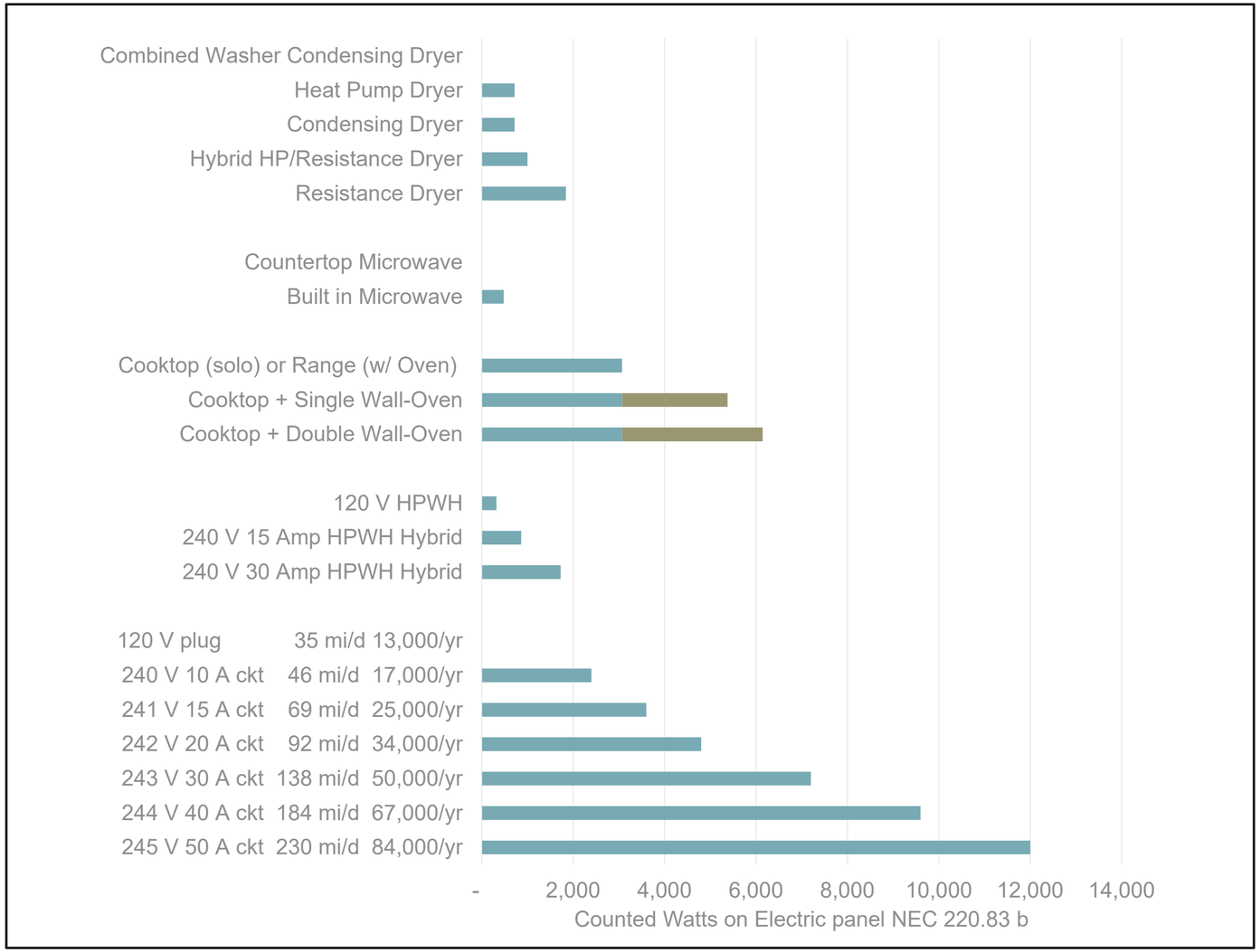
Recommended: 5.8 kW rooftop solar system + 20 kWh battery system

BUILDING SHELL IMPROVEMENTS

Today: Attic, R-19 insulation
Recommend: R-38

Today: Crawlspace, no insulation, poorly insulated ducts
Recommend: R-19 or R-30 for floors, repair ducts

APPLIANCE OPTIONS



WHAT IS STOPPING US?

THE CASE FOR ELECTRIFICATION

- Technically feasible…no new technology needed
- All needed products available today…heat pumps $13 billion market in US
- Good for the climate
- Good for air quality and health
- Good for US energy security and independence
- Good for future generations

BARRIERS

- Habit and inertia…California is addicted to gas
- Contractor resistance
- Low public awareness that electrification is a solution to climate change
  - People stuck on rooftop solar as a solution…no!
- Public misperceptions
  - Electrification = utility service (or panel) increase
  - All-electric home is more vulnerable to grid outages
- Slow permitting processes in local jurisdictions
- Misguided first electrification "moves" by building owners
- Fear, uncertainty, doubt and disinformation spread by fossil fuel industry and real estate industry

EQUIPMENT GUIDES

- Released by Redwood Energy and Menlo Spark
- Electrification solutions for existing buildings
- Product lists
- Case studies from across the country
- Panel optimization ("watt diet") info
- Cost examples
- Download guide here: https://redwoodenergy.net/wp-content/uploads/2021/02/Pocket-Guide-to-All-Electric-Retrofits-of-Single-Family-Homes.pdf
- Great panel calculator tool here: https://redwoodenergy.net/watt-diet-calculator/

ELECTRIFICATION PLANS (PILOT)

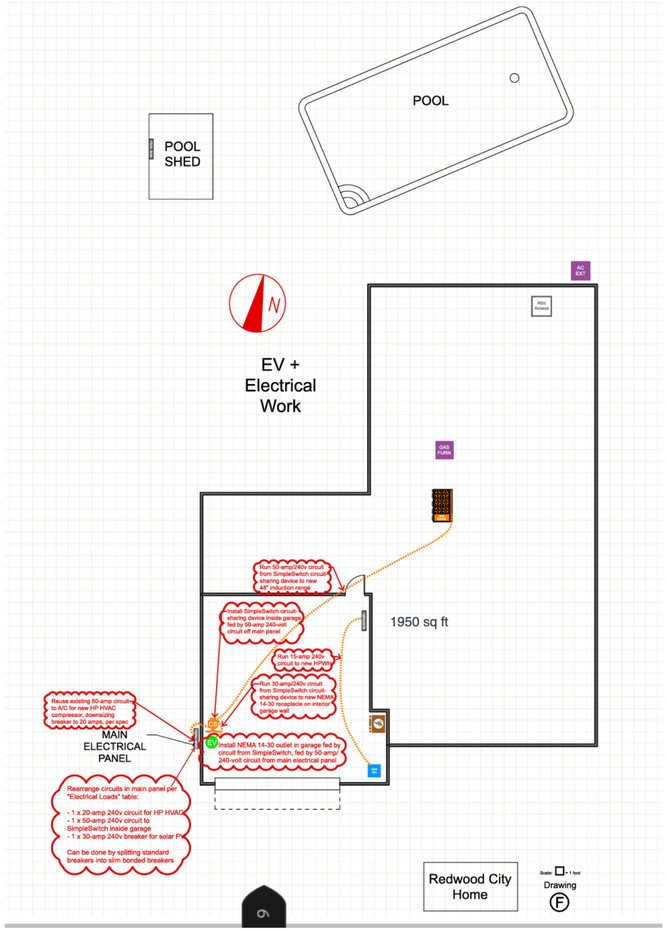
Quote Request

Please provide notional quotes (±10% of expected cost) for the following work.

Home Background Info
Single-family, detached
1,900 sq ft
1-story
Built 1966
Redwood City Emerald Hills

Please provide separate estimates for each project and a discount estimate if the electrification projects were all combined together. Please separate the $ quotes into separate cost categories of equipment, labor, permit labor

Work Type	Work Description	Price
1) HPWH	Replace existing gas-fired 50-gallon tank water heater with new 15-amp electric HPWH in same location about 25 feet from sub panel in unconditioned garage workspace. (WH location is protected from car driving area.) Code minimum sizing for 4 BR 2 BA home is 62 gallons of first hour rating. To preserve Amps for future pool equipment, JT suggest 15-amp water heater similar to Rheem or Ruud 65-gallon or 80-gallon models or Stiebel Eltron tank models. Also please quote an alternative 80-gallon 120-volt retrofit ready HPWH if information can be found for it. Price an option for adding a mixing valve (for enhancing the ability to deliver more gallons of 120°F water from any storage tank operated at a higher temperature). Please price labor, permits and materials separately. Also please price a discount if electrification projects are combined. See **Drawing B** for details Contractor reply including prices:	



Wolf Home

Redwood City Emerald Hills, 94062
Main panel size: 100 amps
Square footage: 1900

Electrical Panel Information

Circuits

Main Panel, rated amps: 100

Circuit Number	Voltage	Breaker Amps	Type	Splittable?	Notes
1 + 2	240	100	Subpanel	yes	Subpanel in garage serving most indoor loads
3 + 4	240	50	Air Conditioner	yes	Breaker can be reduced to 20 amps and circuit repurposed for heat pump
5	120	15	Unknown	yes	Assuming no load on this circuit, other than lights and plugs
6	120	20	Unknown	yes	Assuming no load on this circuit, other than lights and plugs
7 + 8	240	30	Subpanel	yes	Subpanel serving pool equipment

Subpanel 1, rated amps: 100

Circuit Number	Voltage	Breaker Amps	Type	Splittable?	Notes
1	120	20	Clothes Washer	no	Washer
3	120	20	Lights and Plugs	no	Lites + Plugs
5	120	20	Lights and Plugs	no	Lites + Plugs
7	120	20	Lights and Plugs	no	Lites + Plugs
9	120	20	Dishwasher	no	Disposal and Dishwasher
11	120	20	Lights and Plugs	no	Lites + Plugs
13	120	20	Lights and Plugs	no	Lites + Plugs
15	120	20	Lights and Plugs	no	Whole House Fan
17	120	20	Lights and Plugs	no	Dining Room Plugs
19	120	20	Kitchen Outlets	no	Kitchen Plugs
21	120	20	Microwave	no	Microwave Oven, microwave is built-in model, 1550 watts/120v
23	120	20	Unknown	no	
2 + 8	240	30	Clothes Dryer	no	Dryer
4 + 6	240	30	Oven	no	Oven 1, part of range
10 + 16	240	20	Oven	no	Oven 2, part of range
12 + 14	240	20	Griddle	no	BBQ but we think it now serves a griddle on the range
18	120	20	Lights and Plugs	no	Plug under pool, side yard light, house fan
20	120	20	Lights and Plugs	no	?
22	120	20	Garage Outlets	no	Garage refrigerator + freezer

PITFALLS TO AVOID

- Installing power hogs, like 50-amp EV chargers
- Painting yourself into an expensive corner (requiring a panel upsize) by picking sloppy equipment and not planning your electrification
- Waiting until your water heater, furnace, dryer or cooktop fails to install circuits... be proactive, **pre-wire for electrification**!
- Oversizing your HVAC equipment “just to be safe”
- Undersizing your heat pump water heater

BENEFITS OF ELECTRIFYING

For owner/user

- Better controlled advanced modern devices perform more functions
- Cleaner air in home and neighborhood. Reduced asthma risk
- Safer home without gas risks
- Ability to add solar and batteries for long duration resilience
- Being part of a solution our kids can be proud of

For Society

- Quicker demonstration of climate progress from a fortunate community
  - Helps show how to speed climate progress elsewhere.
  - If Portola Valley does not act, why should any community act?
- Fewer stranded assets when gas equipment and pipes need to be shut down early
- It's needed to meet climate safety targets, since home and driving are >70%
- Can you imagine solving climate change without electrifying buildings?

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APPENDIX

EQUIPMENT SILVER BULLETS

1. 15-amp heat pump water heaters
2. 17-amp inverter-driven heat pump HVAC systems that are not just power efficient and energy efficient but also extremely quiet
3. Centrally ducted heat pumps w/ air handlers on same circuit
4. Upsizing the hot heater and adding a mixing valve to compensate for slower recovery time
5. Split heat pump water heaters for tight spaces
6. Heat pump dryers
7. Wallbox Pulsar EV charger with adjustable current (6 to 32 amps)
8. Circuit-sharing devices like Neocharge and SimpleSwitch
9. Circuit-pausers like DCC9 and EV Duty
10. Smart electric panels like Span.io

TIPS: MAKE A PLAN, DEFEND THE PANEL

- Most single trade contractors will want to get their device in first while you still have panel space
- May be in their interest to sell you a big power using version
- But that paints you into a corner after they are gone.
    - Have your electrification plan so you know how much panel Amperage you are saving for each future need (heating, water heating, 240 V charging, cooking, drying).
    - Install circuits and space for controls if needed
    - Shop for contractors by telling them the maximum nameplate Amps or Watts you are allocating for the device, and that you have the circuit installed
    - Work with them to accept not just selecting overpowered devices
    - Think of the EV as the "shock absorber" in the plan. 120V charging is common.

We can’t afford to not fight climate change. But yes, it takes effort.

- Gas has a much bigger carbon footprint than we thought (leakage doubles to quadruples the total emissions). California cannot meet its climate goals without electrifying existing buildings. ‘RNG’ & ‘green H2’ cost more than electricity.
- There are manageable capital costs to converting on burnout by planning ahead. E.g. $4k to $30k per home or more if you want. You can team up to lower costs.
- The energy use of advanced electric devices is lower, affordable and cleaner.
- Gas prices will rise as emissions get priced, and as flow slows in pipes.
- The existing panel size is usually big enough for good choices e.g. 100A = 24 kW
- You can keep old knob and tube wiring working in place and just add 0-5 new circuits for Heat Pump, Heat Pump Water Heater, Cooking, EV, 220V drying
- Modern Electric Efficiency Advantage: 2 to 4 times better than gas combustion. EVs already cheaper to own for same class and features.
- We have to electrify, even while the grid is improving. Waiting = losing.
- Even gas customers need a $40 propane camp stove in their quake kit.