



A Guide to Electrification for Ventana Del Mar Owners



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Chapter 1: Executive Summary

Ventana Del Mar owners can electrify within the existing 90A panel by sequencing upgrades carefully, choosing low-power equipment, and using smart load management for EV charging in homes with connected garages.

Recommended path: decide on the full electrification sequence before replacing individual appliances, and prioritize low-power water heating, right-sized heat pumps, induction range options that fit the panel budget, and heat pump combination washer dryer laundry equipment.

What to avoid: the HOA will not allow a service upgrade so do not install high-power appliances one at a time without understanding their effect on the final all-electric load calculation.

When to call a professional: involve a licensed electrician before adding circuits or EV charging and involve an HVAC professional before selecting heat pump capacity or modifying ductwork.

Redwood Energy is available for consultation to guide homeowners on electrification strategy and perform load calculations for their individual home.

Introduction



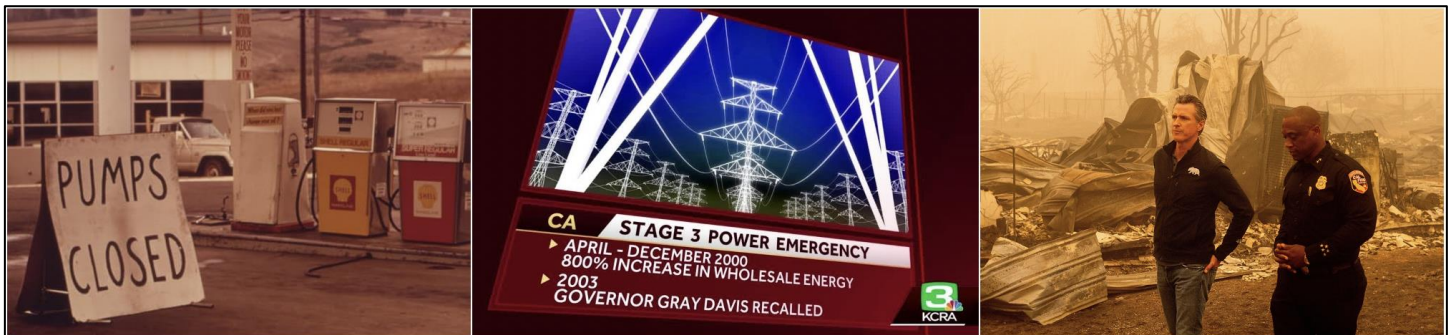
Following the deadly wildfires in nearby Santa Rosa and Paradise, in 2019 the East Bay Electrification Exposition audience considers a proposal to ban gas plumbing in new construction to address climate change. Berkeley's gas ban in August of 2019 was followed by another California city every 2 weeks for almost 2 years and was joined by other states, changing policies at California utilities, state agencies and the federal government. (Paradise fire photo credit: Josh Edelson AFP/Getty. Berkeley City Council photo credit: Emilie Raguso)

Did you know that San Francisco had the world's first power plant? It was built in 1879 to power 22 streetlamps, and just 15 years later San Francisco was showing off the spectacular 266-foot San Francisco Electric Tower, modeled after France's just-completed Eiffel Tower in what has become Golden Gate Park. The Electric Tower produced a beam so bright it was said a person could read a newspaper at night 10 miles distant. Electricity came first to San Francisco streetlights in 1879, then street trolleys in 1892, and finally houses in 1902.



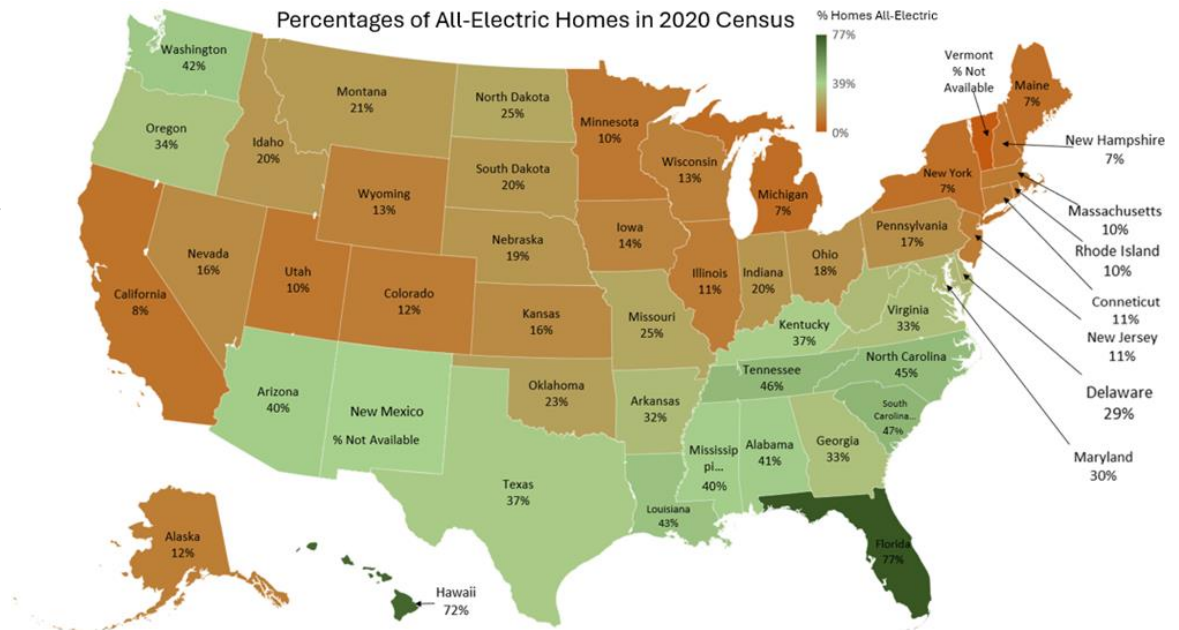
(L) The first electric trolley in San Francisco, triple overloaded for its inaugural ride in 1892. (Center) The spectacular "San Francisco Electric Tower" built in 1894 to celebrate San Francisco's electricity at California's Midwinter International Exposition. (R) After 30 years of debate, the Hetch Hetchy Valley in Yosemite Park was dammed and began providing power to San Francisco in 1925, with fresh water following in 1934. The dam still provides 20% of San Francisco's electricity.

California led the gas ban movement while joining a natural national electrification trend (Figure 1)—90% of laundry dryers purchased each year are electric, more than 50% homes built since 1970 have both electric space and water heaters¹, and 60% of Americans cook on an electric stove.² But until 2020 California's Energy Commission and Public Utilities Commission had strong anti-electrification policies for two historical reasons--the 1973 Oil Embargo and the 2000 California Energy Crisis, both of which raised electricity prices to crisis levels, and led regulators to discourage all-electric construction. But the 2022 Climate Emergency Declaration has set the state on a regulated path to 90% all-electric buildings by 2035.



(L) OPEC's 1973-74 oil embargo raised electricity costs 400%. (Center) Deregulation of California electricity markets led to an energy cost scam in 2000 with 800% more expensive electricity. (R) After 6 years of catastrophic fires, in 2022 Gov. Newsom declares a Climate Emergency, directs his state agencies to accomplish 90% electrification of all gas uses by

Figure 1: California is the #1 consumer of “natural” gas in the nation, and currently has only 8% all-electric construction, compared to leading states like Florida (77%). It is changing though: 80% of new construction state-wide was all-electric in California in 2023 (CPUC).



Benefits of Home Electrification

You likely want an all-electric home because:

- **You can sleep better** because heat pumps use a quiet, consistent blower fan, while gas furnaces turn on-and-off 3 to 8 times an hour to avoid overheating, and blow harder to compensate for less run time.
- **Comfort in the hot summer days** because you get cooling (air conditioning) as well as heating from heat pumps. Heat pumps are very similar to AC units but can be run in both directions to give both heating or cooling from one unit.
- You can watch a pot boil on an electric induction stove, because **induction is 3 times faster** than a gas stove, because it's 3 times as efficient!
- Studies show **gas stoves are responsible for 12% of childhood asthma** in the US³ and produce the same wheeze and heart stress in home cooks as second-hand cigarette smoke⁴.
- You can get your laundry clean with one machine, a combination electric washer/dryer.
- You can immediately **reduce your contribution to Climate Change**, and every year the grid is getting cleaner with new power plants that world-wide are 93% solar, battery and wind power!
- You can **lower your utility bills** with the most efficient electric appliances.



Figure 2: Gas stove smoke, seen at right in orange and pink polluting the purple air, is as bad for you as cigarette smoke and makes smog-like air pollution throughout your home.

Planning your Home Electrification with this guide

Avoiding Electrical Upgrades: A common misconception is that home electrification requires upgrading the electrical panel or service. These upgrades are expensive and likely prohibited by your HOA. **Chapter 2:** discusses simple strategies and technology choices that can help you avoid unnecessary electrical upgrades, potentially saving months of time and thousands of dollars. EV chargers and heat pumps are often blamed for triggering service upgrades, but this guide explains how to avoid that outcome.

Apply the Watt Diet: Chapter 4: applies Power Efficient Design to a Ventana Del Mar condominium. It illustrates a design journey where everything is electrified without too much forward planning resulting in the panel load calculations exceeding the 90-amp panel size. By making smart equipment choices, the power budget is brought back, well within the 90-amps.

Budget: Chapter 4 provides appliance examples, cost ranges, and installation factors so owners can compare options by electrical impact, fit, and likely project complexity rather than by equipment price alone.

Learn from examples: Chapter 5 provides case studies showing how other homeowners used sequencing, low-power equipment, incentives, and load management to electrify without making the project unnecessarily large.

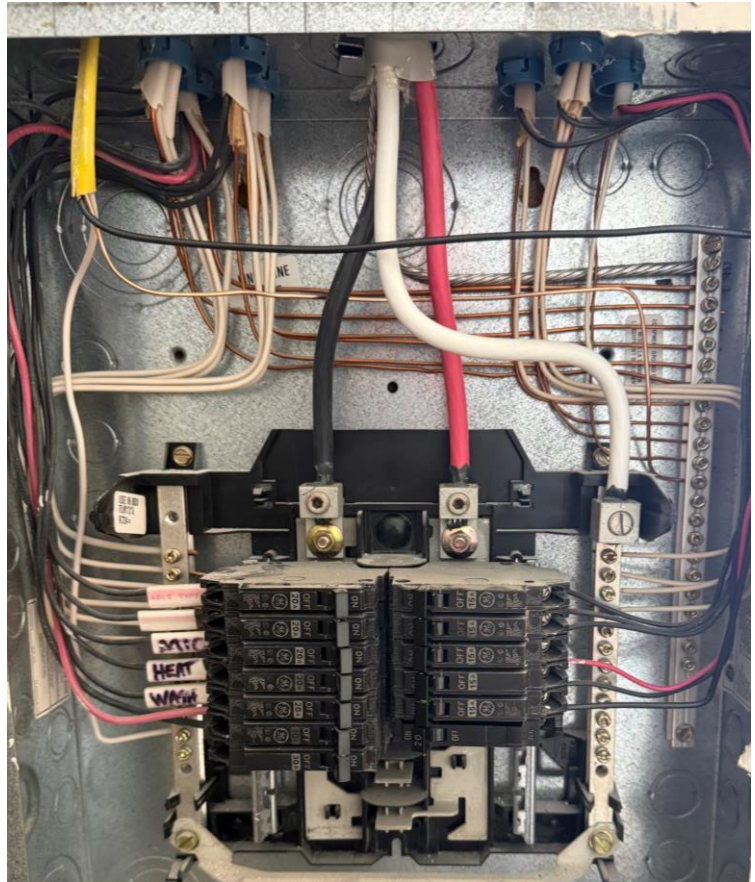


Figure 3: An example electrical panel from a Ventana Del Mar condo

Chapter 2: Minimizing Electric Panel Upgrade Needs

One of the first questions homeowners often ask is whether electrification will require an electrical panel upgrade, either because there is not enough space for more circuits or because there is insufficient power capacity for new loads. At Ventana Del Mar, the existing 90-amp in-unit panels generally have enough breaker space to support a carefully planned electrification pathway. With smart appliance selection and load management, full electrification is possible within the existing 90-amp panel. Staying within that limit matters because a larger panel can trigger costly follow-on work, including not only the new panel, but circuit rewiring, larger feeder wiring from the main electrical room, and a larger main breaker (in the electrical room), service upgrades from PG&E, and possibly even replacements of exterior transformers—all work that can cost thousands of dollars and may not be approved by either PG&E nor allowed by the HOA because of impacts on the building's overall electrical system. Some compromises are required, but they are reasonable and can save cost and time. This chapter explains practical ways to work within the existing 90-amp panel and avoid unnecessary upgrades.

The Watt Diet or Power Efficient Design

The **“Watt Diet”** (also known as “Power Efficient Design”) is a set of strategies for meeting these technical challenges. It's about spreading power usage over more time vs. using a high-power device for a short time. You can charge overnight for 3 hours at 40-amps or 6 hours at 20-amps, both get your car charged, the first might trip the power budget. In addition to this guide, there are many [online videos](#) explaining this approach to utilize your existing circuits without upgrading them and to keep your house on its current panel and service with the Watt Diet.

- **Use power-efficient equipment and appliances** that reduce the need for larger circuits and reduce your overall energy consumption.
- **Heat and cool the home with “inverter driven” heat pumps** —Heat pumps are reversible air conditioners and use a third as much electricity as electric resistance or gas equivalents to heat the home. Tax credits and rebate programs often require the heat pump to have an “inverter,” to allow the heat pump's compressor to run at variable speeds to modulate its output to precisely meet the heating or cooling needs. This eliminates the on/off cycling of traditional furnaces and the noise and air blasts that come with the switching. These heat pumps are also referred to as “variable-speed” and generally enhance thermal comfort. To meet Ventana del Mar's architectural constraints, we are recommending that only “all in one” heat pumps which do not require exterior compressors be used.
- **Use a heat pump water heater (HPWH)** — electric water heaters can be heat pump only (450W), electric resistance (4500W), or a hybrid of both (450W to 4500W). A shared circuit 120V HPWH (up to 900W) can be plugged into any standard wall outlet and let you avoid rewiring though noted that most floor plans at Ventana del Mar will need wiring to be brought to the water tank closet. These water heaters are currently slated to become mandatory in San Mateo County due to the “Zero-NOx” small appliance rules. While you are not required to replace your gas water heater, the regulatory framework will make electrification mandatory overtime. Because Ventana del Mar's builder-installed heating was a hydronic system that used the water heater, electrification of the water heater will require separate installation of heat pumps for heating and cooling.
- **Use a combined washer/dryer**, which come in “condensing” and “heat pump” options and are the most popular type of laundry machine in Europe and Asia. The heat pump models from Samsung, LG and GE are especially fast at drying and come in large washer drum sizes up to 5 cubic feet. These combined washer dryers allow the dryer circuit to be removed, which significantly frees up the power capacity of the electrical panel.
- **EV charging** - only those units that have attached garages (plan 6, plan 3A, and ground floor plan 8) have the garage electrical on the in-unit meter. For those floorplans, EV charging can be installed with HOA approval. The Association will be investigating solutions for charging in the other garages.
- **Smart power management EV chargers** (e.g. Emporia Charger Pro, Wallbox Pulsar Plus with Power Meter, Tesla Wall Connector with Dynamic Power Management) monitor your panel and either pause or reduce EV charging to ensure whole house power draw is below 80% (per code) of the panel's capacity. These techniques allow units with attached garages to add EV charging without increasing the panel load.

- **Use approaches that save breaker spaces.** Circuit sharing approaches and lower voltage equipment all save breaker spaces. In the unlikely event you lack the actual physical space to install another breaker and circuit, tandem breakers can safely create two circuits in the same breaker space that originally only had one circuit.
- **Insulate and air seal the home.** Most houses do not need more than three tons (36,000 BTUs/hr) of heating and cooling capacity if they are reasonably insulated, regardless of the climate. Insulating the home can be done through adding (or fixing gaps) to the insulation in attic, crawl spaces, and walls to reduce the heating and cooling power needed from the heat pump. Usually, insulation in the attic to is often one of the easiest and most effective way to improve a home's energy efficiency; caulking or taping cracks to "air seal" the home can reduce the heating and cooling loads by one third. Keeping the heat pump capacity smaller allows the reuse of existing ducts, which aren't typically designed for more than three tons of air flow. Ductless designs are an option that can save even more energy by not losing heat through ducting, nor requiring a powerful fan to push air through often convoluted and leaky ductwork.
- **Right size your heat pump.** It is important to request that your contractor also conduct a "heating load calculation" for your home so that your heat pump is right sized for your specific home, often resulting in a smaller heat pump being installed. Smaller heat pumps use less power and energy, resulting in a smaller circuit being installed and more efficient operation. This also improves homeowner comfort by minimizing temperature swings. Heat pump sizing in our mild climate can be around 800 to 1,500 square feet of home per ton of heat pump, but heat pump sizing calculations can show if your home is outside of that range. The Association is planning additional follow-up work with HVAC and heat pump specialists to provide additional guidance.
- **Reminder: All electrical modifications require HOA approval via an architectural request submission.**

Chapter 3: Electrifying Appliances

Electrifying your home is more practical than ever, even if you are working within the layout and electrical limits of an existing condo. New electric appliances and smart power-management options can often fit within your current panel and service, making upgrades more manageable and less disruptive. This chapter walks through common choices for heating and cooling, water heating, cooking, laundry, electric vehicle charging, and other home appliances. For each category, you'll find example products, key specifications, typical equipment costs, and installation factors that may affect the final price. To look for rebates and incentives that may apply to your project, visit The Switch Is On at switchison.org/ca.

How to use this chapter: treat the listed products **as examples, not endorsements**; compare each option by panel impact, installation complexity, fit within Ventana Del Mar constraints, and whether the listed price reflects equipment only or installed cost.

Source confidence note: there are often incentive programs from PG&E, BayREN, TECH Clean California, and WestLight Energy (formerly Peninsula Clean Energy) that should be investigated when making electrification decisions.





Figure 4: The appliances and equipment in a home that can be electrified. From the top left: air source heat pump, heat pump dryer, solar panels, induction stove, heat pump water heater, electric vehicle charging, home battery backup.⁵

Centrally Ducted Systems

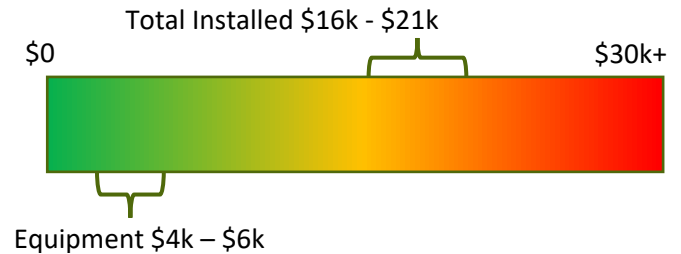
The current home heating at Ventana Del Mar uses a ducted system. Hot or cold air is blown through ducts to vents in different areas throughout the home. In the original design, the heat is provided by hot water from the gas water heater heating by what's called an air handler, a fan blowing air over hot or cold elements. When the gas water heater is replaced with a heat pump hot water heater there is no longer sufficient heat for the home which requires a replacement heating system.

A heat pump ducted system is one such replacement. It provides not only heating for the winter but also cooling for the summer. Ducted all-in-one heat pumps (technically Packaged Terminal Heat Pumps) are available. Innova manufactures such ducted all-in-one heat pumps with the heat pump compressor and air handler in a single compact package with two pipes to the outside, one for incoming air, the other for exhaust.

The original hydronic heating supplies 24-29kBtu/h of heat whereas these are rated maximum 14kBtu/h at 47F. It is likely more than one is required and recommended to seek analysis by a professional HVAC engineer.

Compressor units are not currently being approved due to the noise, lack of clearly available exclusive use common area for installation for most floorplans, and related concerns. The Association is planning to work with a specialist to provide additional recommendations.

Average Price Range



Factors that Influence Price

1. Whether one or two units are required
2. How much modification is required to the existing ducting
3. If the exiting wiring for the air handler cannot be reused, then a new circuit will be required. (the cost of running a new circuit averages \$1,000)
4. Modifications to fit a new air handler and provide ducting to the outside

REMINDER: Architectural approval from the HOA is required for the installation including the penetration of the stucco for venting.

Product Options

Manufacturer and Model	Innova - AIO Ceiling Ducted
Image	Direct external vent
Dimensions (in) WxDxH	41" x 46" x 11"
Ref. Type	R32
Volts/Amps	120V/21A with 25A breaker or 240V/9.5A with 15A breaker
Heating Capacity (BTU/h)	14,000 max, 9,200 recommended
Cooling Cap. (BTU/h)	15,000 max, 9,400 recommended
Heating (HSPF2)	9.2
Cooling (SEER2)	13.85
Price (\$)	\$3,095

Packaged Terminal Heat Pumps

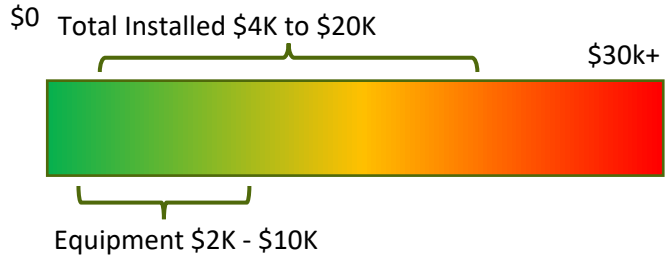
Packaged Terminal Heat Pumps (PTHP) are all-in-one HVAC units designed to heat and cool one to three rooms per unit. These ductless units can be wall-mounted (e.g., Innova) or placed in a wall cutout. The units listed offer dehumidifying capabilities and air filtration with washable filters.

Through-the-wall installation of the Innova requires some construction, including two louvered penetrations through a wall and options like perforated panels or custom louvers. The Friedrich wall master requires an additional wall sleeve and minor construction to install the sleeve into the wall.

Packaged units provide heating or cooling directly to the space, avoiding energy losses from ductwork but may have potential leaks if not properly sealed. R-32 refrigerants are the most environmentally friendly refrigerants in the market. Typically, to account for the heating and cooling of entire home, one unit will be installed in the common living area, then one for each bedroom.

The Innova products optionally allow adding an Energy Recovery Ventilator (ERV) which brings in fresh air from the outside, through a MERV 13 filter, while transferring heat to or from the air being exhausted.

Average Price Range



Factors that Influence Price

1. The quantity of PTHP requires; the estimate assumes four
2. Heating or cooling capacity of the heat pump
3. Wall or window modifications like adding a safety bar, caulking, etc. For models with "twin ducts" two louvered penetrations on the wall are necessary
4. Whether a new 240V circuit is needed (the cost of running a new circuit averages \$1,000)
5. Accessories: mounting kits, drain kits or assembly adapter are also offered at an additional cost
6. Labor costs to install the versions that have more construction work.

Product Options

Type	Through wall	Twin Ducts	Twin Ducts
Manufacturer and Product Name/Image	Friedrich: WallMaster WHT12A33A 	Innova: Wall Mounted Pro 	Merino Energy: 
Voltage (V)	240	120 and 240	
Dimensions (in) W x H x D	27 x 16 x 21	40 x 22 x 11	37 x 21 x 7.8
Ref. Type	R-32	R32	
Heating Capacity (BTU/h)	8,900	10,000 or 14,500	7,100
Cooling Cap. (BTU/h)	11,100	10,000 or 15,000	7,000
Heating (COP)	-	3.455	7.9 HSPF2
Cooling (COP)	9.4 EER	13.5 SEER	14.1 SEER2
Price	\$1,530	\$4,200	\$3,800 installed

Heat Pump Water Heaters

Heat pump water heaters (HPWH) come in different forms: *unitary*, meaning the heat pump and tank are combined into one unit, or *split* where the compressor is external. **Only unitary are covered here since external compressors are not suitable for Ventana Del Mar.**

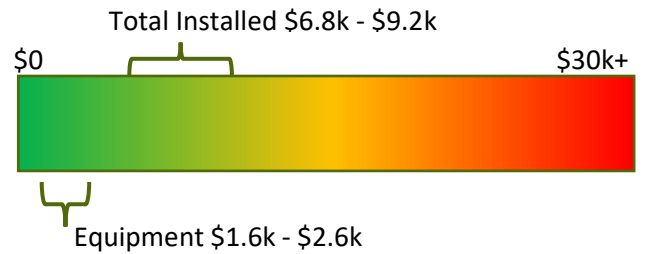
Ventilation for HPWHs is key to efficient operation. With the HOA prohibiting penetrations for ducting, the recommendation for the water heater closets with doors to the outside is to have the exhaust air blown towards a fully louvered door. This leaves Rheem as the best solution as other vendors place both the exhaust and air inlet at the top of the unit which requires ducting to direct the air towards the door.

Hybrid water heaters have both a heat pump and back up electric resistance elements with the heat pump typically operating down to 37°F before switching over to electric resistance heating. While Bay Area temperatures are almost never below 37°F during the day, winter mornings, combined with heavy hot water draw the night before may require

backup. For this reason, hybrid HPWHs are recommended for the closets where air is being drawn from the outside with a preference for Rheem's 2250W version over the 4500W to keep the electrical code load calculations low. For floor plans with indoor water heaters, the shared circuit 120V Rheem is a viable solution.

Heat pump water heater models typically increase hot water capacity by storing at a higher temperature (140°F) and using a mixing valve with cold water to deliver safe temperatures at the tap. All the products below are 50-gallon tanks, matching the size of the existing water heaters.

Average Price Range for the unitary type HPWHs.⁶



Factors that Influence Price

1. Tank capacity
2. Added features like leak guard
3. A new circuit averages \$1,000
4. The replacement of the existing door with a louvered door
5. Routing the condensate water line appropriately
6. Piping reconfiguration
7. Any drywall repair work needed

Product Options

HPWH Type	120V Shared circuit	240V Hybrid	120V Hybrid Shared circuit	240V Hybrid
Manufacturer and Product Image	<u>Rheem Plug-in</u> 	<u>Rheem ProTerra</u> 	<u>AO Smith Voltex</u> 	<u>Bradford White AeroTherm Series G2</u> 
Max Temp	140°F	140°F	140°F	140°F
Dimension (in) (HxD)	64 x 22.5	64 x 22.5	66 x 22	64 x 22
Hybrid (resistance in W)	0W	2250W or 4500W	900W	4000W
Ref. Type	R134a	R134a	R-513a	R134a
Breaker Size (Amps)	15	15A or 30A	25	25
First Hour Delivery (gal)	55	52 or 67	52	65
Uniform Energy Factor	3.0	3.75 or 3.88	3.0	3.89
Price (\$)	\$2,100	\$1600 - \$2600	\$2100	\$2,400

Electric Ranges

Induction ranges are safer, faster, more efficient, offer more precise temperature control, and are easier to clean than their gas counterparts.⁷

Safer as induction directly heats the metals in the pan, rather than the cooktop surface itself so surfaces are only hot where contact with the pan was made and cool down faster.

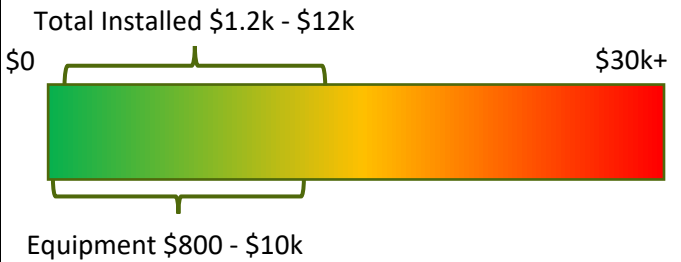
Gas cooking appliances are around 30% efficient so a lot of heat goes into the kitchen adding to the cooling load. Induction cooking averages 85% efficiency.⁸

Traditional ranges need a 240 V outlet, but new 120 V models use a built-in battery to deliver fast, powerful heating while sipping energy from a regular kitchen plug. Because the battery handles the heavy lifting, these ranges can run on an existing circuit without expensive electrical upgrades. They're smart, too: they can sense when other appliances on the same circuit turn on and automatically pause charging to avoid tripping the breaker. You can even schedule charging for off-peak hours, while cooking usually happens during peak times, helping you save on energy costs.

The Wattsipper requires a dedicated 20A circuit but is carefully engineered to take advantage of data showing that people rarely run all burners at the same time or together with the oven. The highest power is when boiling or pre-heating the oven in contrast, maintaining a given temperature uses less energy.

The products on this page are a small sample of the wide range of electric appliances available. They can vary by the number and size of burners, stove width, oven capacity, 120V or 240V, battery backup, freestanding or slide in.

Average Price Range



Factors that Influence Price

1. Aesthetics (e.g. unique style, luxury brands)
2. Self-installation vs. hiring a professional
3. Is a new circuit required? The cost of running a new circuit averages \$1,000
4. Is a battery required?
5. May also require purchasing induction compatible cookware
6. Stove width and oven size
7. Whether additional labor is needed to deal with space constraints (e.g. narrow doorways, tight cabinets)

Product Options

Description	240V Induction	120V Induction with Battery	120V Induction with Battery	120V Wattsipper
Manufacturer and Product Image	Many Manufacturers	Elektra	Channing Copper Charlie	Wattsipper
				
Width (inches)	30	30	30	30
Volts/Amps	240V/40A	120V/2-15A	120V/3-25A	120V/15A
Oven Size (ft ³)	6.3	5.9	4.6	4.0
Price (\$)	\$1,200-\$10,000	\$4,000	\$6,000	\$2000

Combination Washer/Dryers

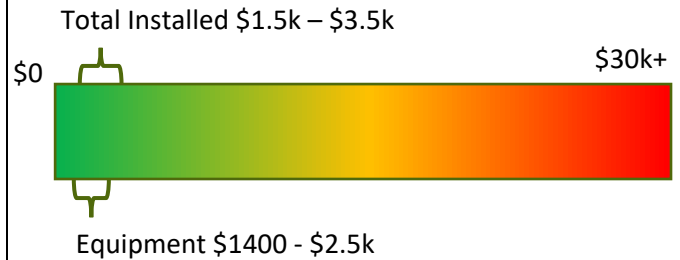
Combination washer-dryers have existed for many years, but major brands have recently brought them into the mainstream. They save space by replacing two laundry appliances with one and eliminate the need to remember to move wet clothes from the washer to the dryer.

Traditional vented models use electric resistance requiring 240V. While they may be more affordable upfront, they are more costly to operate than a heat pump dryer of similar size. Electric resistance dryers use a significant amount of electricity to boil water out of the clothes and send damp, hot air out through a vent.

With condensing and heat pump dryers, the moisture is condensed and exits through a drain line, while the air gets reheated and circulated through the clothes again to pick up more moisture. These are called ventless and run on 120V. All the product options described below are ventless 120V models.

Combination washer dryers exemplify the Watt Diet principles. Electrical code requires a 1500W allowance for a laundry circuit which historically is used by the washer, and a minimum of 5000W for an electric dryer. These heat-pump combo units eliminate that high power electric dryer load.

Average Price Range



Factors that Influence Price

1. Type of Dryer
 - a. Electric Resistance, Heat Pump
 - b. 120V or 240V
 - c. Laundry capacity (drum size)
2. Self-installation vs. hiring a professional

Product Options

Manufacturer and Product Image	GE Profile	Samsung WD53DBA900HBA1	Whirlpool WFC682CLW	LG WD53DBA900HZ
				
Energy Use (kWh/year)	136	103	139	108
Drum Size (ft ³)	4.8	5.3	4.5	5.0
Volts/Amps	120V/15A	120V/15A	120V/12A	120V/15A
Vent	Ventless	Ventless	Ventless	Ventless
Price (\$)	\$2,300	\$2,200	\$1,400	\$2,200

Electric Fireplaces

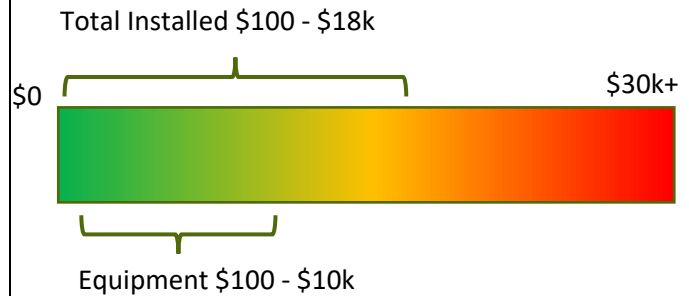
Electric fireplaces provide the ambience and aesthetic of a real fire, without the air pollution. Pregnant mothers and small children can enjoy these features without the health and safety risks of a real flame.

Electric fireplaces come in all sorts of configurations! Some styles imitate a wood pellet stove and plug into a regular wall outlet, while others are permanently hardwired or even connected to a water line. There are custom inserts to retrofit an existing fireplace, and the "flames" can range from realistic to multicolored works of art! These options, of course, come with a range of installation prices.⁹

Water vapor fireplaces create a fine mist that is lit with LED lights and agitated with an ultrasound vibrator. This creates a bouncing effect that makes for a realistic flame, especially when paired with optional crackling sounds. These fireplaces require a water source and usually have the option of either a direct connection or manually the adding water.

Most electric fireplaces offer supplemental heating, but some are purely decorative. Be sure to check the specifications of any products you intend to purchase. Also remember to consider the Watt Diet principles and whether you'll need a 240V outlet.

Average Price Range



Factors that Influence Price

- Style of fireplace
 - Freestanding, recessed, inserts, etc.
 - Plug in vs. hard wired
- Water vapor flames
 - Water manually added
 - Connected to a water line
- Heat Output/Area
 - Some models don't provide heating
- Self-installation vs. hiring a contractor
- Whether a 240V outlet needs to be installed - the cost of running a new circuit averages \$1,000

Product Options

Description	Freestanding	Freestanding	Freestanding Insert	Built-In	Built-In
	Water Vapor	Water Vapor	Water Vapor	Water Vapor	Water Vapor
Manufacturer and Product Image	ClassicFlame Electric Stove 	FESTIVO 36in Freestanding 	Aquafire Aquafire Lite 	Dimplex Optimyst GBF1000-PRO 	Dimplex Optimyst OLF86-AM 
Heating (BTUh)	5,200	3,400	No Heat	4,984	6,551
Heating Area	1,000 ft ²	1,000 ft ²	No Heat	400 ft ²	1000 ft ²
Max Power (W)	1500	1000	35	1460	1920
Volts/Amps	120V/12A	120V/12.5A	120V/2A	120V/15A	240V/10A
Price (\$)	\$100	\$450	\$1,400	\$5,250	\$10,000

Electric Vehicle Charging

Electric vehicle chargers can be installed **only in units with attached garages** (plan 6, plan 3A, and ground floor plan 8). There are three “levels” of charging:

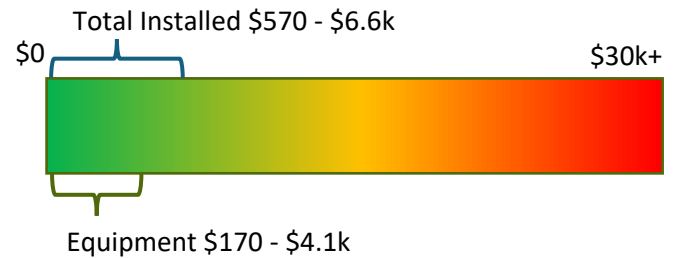
- Level 1: Uses a standard 120V outlet, is 1.4 to 1.9 kW, adding 3-5 miles of range per hour of charging.
- Level 2: Requires 240V, can use an outlet or be hardwired, runs at 3.3 to 11.5 kW adding 10-40 miles of range per hour of charging.
- Level 3 (DC Fast Charging): Adds significant cost and is not recommended.

For most households, the real-world consensus is that 3.5–7 kW (i.e., a 240 V / 15–30 A circuit) is the sweet spot for home EV charging. Bigger circuits (11–19 kW) rarely provide meaningful benefit because cars sit parked far longer than they need to charge.

Chargers supporting Dynamic Power Management are highly recommended for the 90A panels. These adjust the EV charge rate to ensure that the total current drawn from the panel, including other appliances drawing power in the home, is below 80% (per code) of the panel’s capacity. These do not add to the home’s panel sizing load calculation and with power management there will never be a main panel breaker trip due to EV charging.

Hardwiring for level 2 is highly recommended. Hardwiring removes the code requirement for a GFCI breaker (checks for ground fault currents) which are known to for nuisance trips especially when used with chargers that already implement GFCI. Outlets also require use of a higher quality EV ready NEMA 14-50 socket due to the high power and continuous nature of EV charging. A NEMA 14-50 plug and socket is restricted to 40A, hardwiring allows up to 48A.

Average Price Range



Factors that Influence Price

1. A new circuit averages \$1,000, little difference between a 120V or 240V circuit.
2. Level 2 chargers are more expensive than level 1.
3. Chargers with dynamic power management are \$150-\$250 more expensive but highly recommended.

Product Options

Manufacturer and Product Image	EVDANCE Level 1/Level 2	Tesla Wall Connector with Dynamic Power Management	Emporia Charger Pro	Wallbox Pulsar Plus with Power Meter
				
Portable or Hardwired	Various portable models	Hardwired	NEMA 14-50 Plug or Hardwired	NEMA 14-50 or Hardwired
Charger Type	J1772 or NACS	NACS	J1772 or NACS	J1772 or NACS
Voltage	120/240	240	240	240
Amperage	24-40A /11.5kW	Up to 48A /11.5kW	Up to 48A /11.5kW	Up to 48A / 11.5kW
Features	Level 1 or Level 2 charging, 23ft cord	24 ft cord	24 ft cord	25 ft cable1 EV
Dynamic Power?	No	Yes	Yes	Yes
Price (\$)	\$170-\$250	\$785	\$600	\$900-\$950

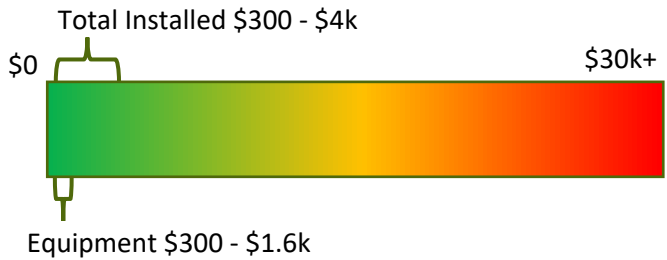
Circuit Splitters

When considering smart solutions for avoiding a panel upgrade, some of the most useful and cost-effective options are circuit splitters. Circuit splitters allow you to share 240V outlets between (typically) two devices. The primary side has priority with the secondary getting power when the primary is not used. A common use case is sharing an EV charger with a dryer. When the dryer is running the EV charger is paused, when drying finishes EV charging resumes.

Smart circuit splitters work with certain EV chargers to throttle down EV charging rather than pause it, monitoring the total current drawn on the circuit to keep it at safe levels. Other circuit splitters are designed to allow two EVs to be plugged in, switching from one to another when the first is charged. Some smart splitters have apps to control adjust how power is shared.

They are useful to understand. If a condo has power routed to an attached garage, sharing an EV charger with another 240V appliance—such as an electric dryer or 240V range—may be an option. The recommended EV solution is to use an EV charger that automatically reduces charging power to keep total panel load within the code-required limit of 80% of the 90A panel capacity.

Average Price Range



Factors that Influence Price

1. Hardwired vs external plug, hardwiring involves additional labor
2. More functionality, i.e. turning down power instead of just turning on/off
3. Voltage, 240V devices are typically more expensive than 120V devices

Product Options

Manufacturer and Product Image	Stepwise Tap	BSA Electronics Dryer Buddy Plus	NeoCharge Smart Splitter	SimpleSwitch 240
Smart?	Yes	No	Yes	Yes
App	Stepwise App	None	NeoCharge App	None
Electrician req'?	Yes	No	No	Yes
Features	2 modes; (1) Dynamically adjusts EV charging loads for Tesla, Wallbox, Grizzl-E). (2) sheds loads like water heaters, hot tubs, pool pumps etc.	Automatically switch off one load to prevent overcurrent, LED display with usage data, customizable plugs	Works with most all 240V devices, auto-switching on/off, power derating for EV chargers	Hardwired, auto-switching on/off, can monitor whole panel health with CTs (additional \$315)
Retail Price (\$)	\$780	\$340	\$400	\$750

Chapter 4: 55A Watt Diet Approach Applied to a Ventana Del Mar Condominium

As explained in Chapter 2, electrifying a home can increase the calculated load on the electrical panel. If too many high-power appliances run at the same time, the main breaker could trip. The Watt Diet approach avoids this by planning the panel carefully and using practical load-management tools to keep peak power use low.

This chapter applies the Watt Diet as a design method: reduce peak electrical demand by choosing efficient equipment, spreading large loads over time, and using controls where needed so annual electrification can rise without exceeding the panel budget.

Current Peak Power of Ventana Del Mar Condos

All Ventana Del Mar condos have 90A electrical panels. To better understand how much capacity is available, 12 months of hourly electricity-use data from 2024 was reviewed for 29 of the 244 condos. The table orders those 29 homes by their highest one-hour power use and shows the condo plan type, when the peak occurred, the peak amperage, and annual electricity use.

The lowest peak was only 6A, and the highest was 33A—well below the 90A panel capacity. This suggests that many condos have meaningful room for electrification when the panel usage is planned carefully.

The data also shows that annual electricity use and peak power use are not the same thing. A home with a low peak may still use a relatively large amount of electricity over the year, while a home with a higher peak may not use the most electricity overall. For example, the condo with the third-lowest peak used more electricity during the year than the condo with the third-highest peak.

This is the key idea behind the Watt Diet, also called Power Efficient Design: spread electricity use over time so peak demand stays low, even though annual electricity use may rise as gas appliances are replaced with electric ones.

Plan	Time of Peak	Peak Amps	Annual kWh
1	11/21 11:00	6A	1233
2	12/18 20:00	7A	1699
4	02/09 16:00	8A	2614
6	07/03 20:00	9A	3146
2	10/05 17:00	10A	3235
4	10/05 18:00	10A	3244
2	12/15 16:00	11A	2595
7	04/05 21:00	11A	1964
7	06/03 11:00	12A	3297
2	01/26 20:00	12A	1197
7	10/05 23:00	12A	4113
7	01/03 22:00	12A	3147
8	10/05 19:00	13A	3078
7	07/03 13:00	13A	3645
5	10/06 21:00	13A	1818
5	10/07 21:00	13A	2910
6	10/14 19:00	16A	4750
7	06/09 01:00	16A	3204
8	08/11 09:00	16A	1103
3	04/16 13:00	17A	1515
5	03/10 23:00	20A	3161
7	02/27 10:00	20A	4027
3	04/06 14:00	22A	2358
7	03/10 09:00	24A	3274
4	07/03 00:00	28A	1733
7	01/06 18:00	28A	3928
4	05/30 16:00	29A	2415
3	10/01 17:00	32A	5794
4	12/15 23:00	33A	3240

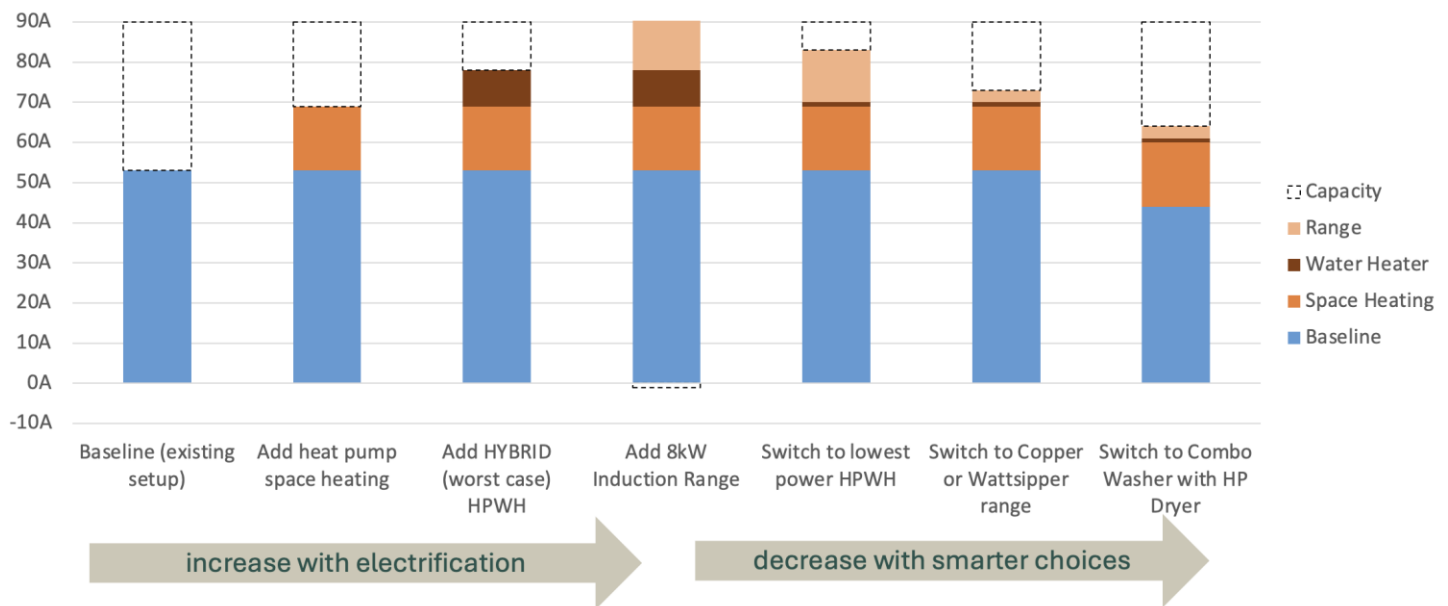
How the National Electrical Code determines panel sizes

This section is included for homeowners who want to understand how panel capacity is calculated. The National Electrical Code (NEC) provides rules for calculating the allowable load on an electrical panel. It starts with an allowance of 3 watts per square foot for lighting and general outlets, then adds 1,500 watts for each of two kitchen circuits and another 1,500 watts for laundry. It next includes major appliances such as the dryer, refrigerator, microwave, cooking range, heating and cooling equipment, and water heater. For some appliances, only 40% of the rated power is counted because not everything runs at full power at the same time. Even with these assumptions, the code is still conservative: the measured peak currents of 33-amps in the Ventana Del Mar sample were much lower than the calculated values of 53-amps.

However, at a building level the total static calculation was quite close to the building limits. The calculation showed 793 Amps vs. 800 Amps of capacity. This highlights why the Association has been cautious about electrification and concerned that no one owner's choices could negatively impact other owners. The data gathering that the Association did was key to validating the available headroom using NEC dynamic calculations.

A Watt Diet Electrification plan applied to Ventana Del Mar

The graph below shows a six-step process to electrifying a Ventana Del Mar condo while staying within the 90A panel limit. Each bar represents a step in the process where an appliance is electrified or changed. The bar shows how much panel capacity is used with the dotted line showing how much capacity remains. The first steps add electric appliances without much power-efficient design, so much so that by the third step the calculated load exceeds the panel limit. The later steps use Watt Diet choices to bring the load comfortably back within the 90A panel. All panel-load numbers are based on NEC 220.83.



In more detail, the first bar shows the baseline condition: the building's original design with gas water heating, gas space heating through the hydronic system and gas water heater, a gas range, and an electric dryer, even though many homes later installed gas dryers. This works out to about 53 amps, varying slightly on condo size. For comparison, the highest measured peak in the Ventana Del Mar sample was 33 amps.

Step 1 The first electrification step is space heating. In this example, four Innova in-wall heat pumps are selected to provide both heating and cooling. Most condos would likely need four units in different rooms; one condo type may need five, while smaller condos may be able to use three. Other approaches might use Innova's ducted system primarily and perhaps only one additional unit for the master bedroom. A professional heating-load

analysis is still recommended. This step **adds 16 amps** to the calculated load (note that a 40% demand factor applies to heating and cooling so it's not as simple as added 4x10 amps).

Step 2 Next, add a hybrid heat pump water heater. This example uses the higher-power case with a 4.5 kW backup electric resistance element, **adding 9 amps**.

Step 3 Then replace the gas range with an induction range. Many induction ranges are 8 kW or larger; this example uses 8 kW, which **adds 13 amps** and pushes the calculated load **over the 90A limit** (as shown by the dotted line available capacity part of the bar being negative)

Step 4 Now start to apply power efficient design to reduce the load. Choose a lower-power heat pump water heater with no backup resistance elements. This **saves 8 amps**.

Step 5 Instead of a 240V range, select one of the 120V range options. This **saves 10 amps**.

Step 6 Use a combination washer-dryer with heat pump drying that can run on the existing 120V laundry circuit. This allows the 240V 30A dryer circuit to be removed, **saving 8 amps**. In the diagram this saving is shown by reducing the blue baseline bar since this change is saving from the original baseline design.

In this example, the condo becomes fully electrified while the calculated load increases by just 11 amps, from about 53 amps to 64 amps.

This is only one possible sequence. Homeowners may choose a different order depending on their project goals, budget, and timing. However, because Ventana Del Mar's space heating is currently connected to the gas water heater, space heating should be electrified before, or at the same time as, switching to a heat pump water heater.

Removing the electric dryer circuit provides a substantial load-calculation reduction and should be considered early in the electrification project, especially if the home currently uses a gas dryer, and the intention is to replace it with a combo washer dryer in the future. If a circuit exists, it must generally be counted even if it is not used, so owners should have a view of their specific full electrification sequence even if the work is spread over several years.

Panel Outlines

Panel outlines help to illustrate the electrification process. These diagrams show the size of the breaker and an estimate of how many amps the circuit peaks at. The blue boxes signify 120 Volt circuits, the green boxes 240 Volt circuits.

The **Existing 90A Panel Home** shows the panel when Ventana Del Mar was first built. The largest breaker is a 240V 30A circuit for the electric dryer, even though many homes now have a gas dryer. There are many empty slots for additional circuits, though some may already have been used for remodels that added dedicated circuits for the refrigerator, range hood, and bathroom GFCIs, often required to meet updated code standards.

Homes with attached garages will have an additional slot used to provide power to the garage. Homes with builder installed AC will also have two (because these are 240V units) additional slots used.

A slot can be freed up by using a tandem breaker (shown right) that fits two circuits in one breaker space.



Existing 90 Amp Home

Electric dryer circuit, gas water heater, hydronic space heating, gas range

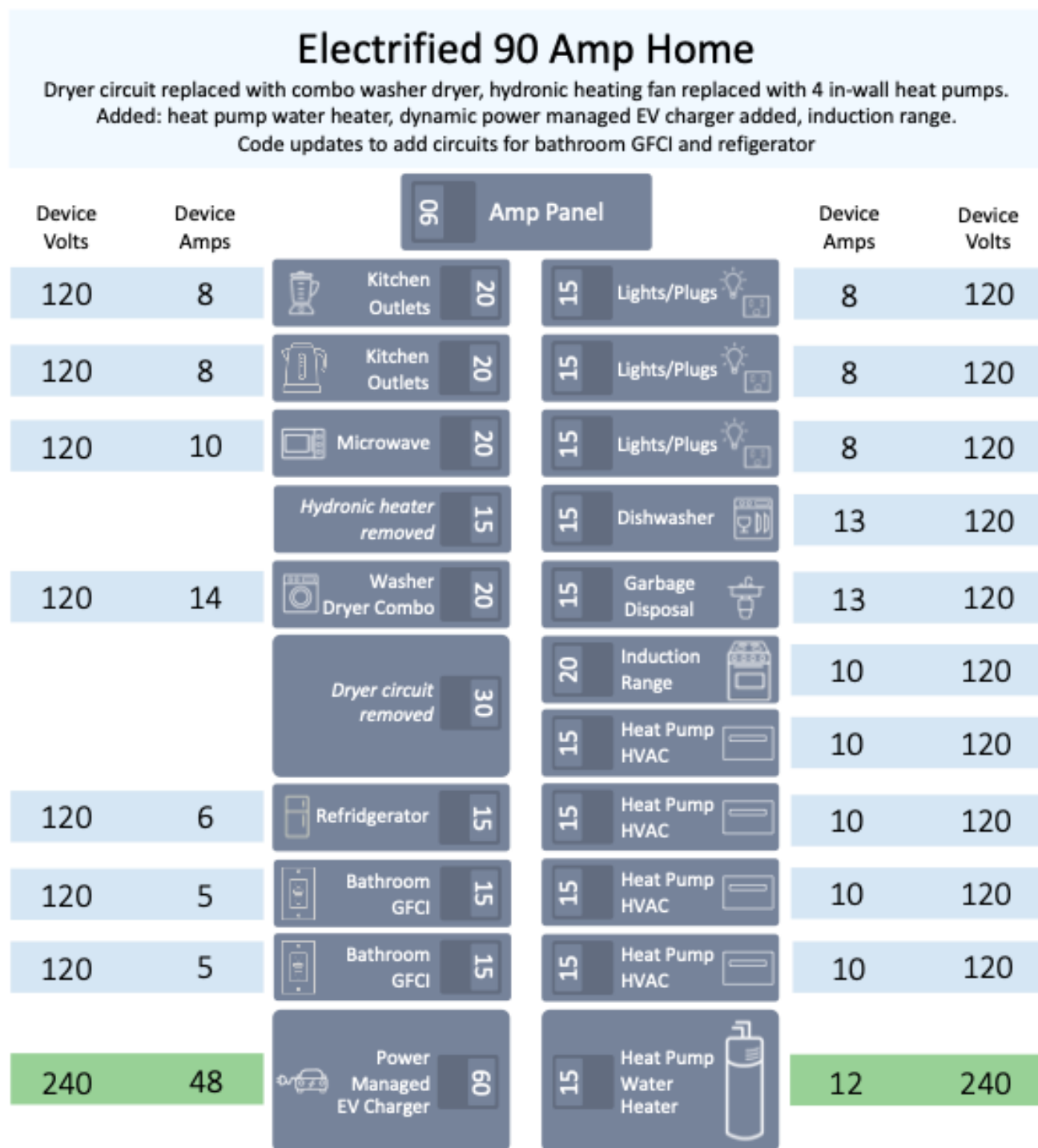
Device Volts	Device Amps	90 Amp Panel		Device Amps	Device Volts
120	8	 Kitchen Outlets	20	15 	8 120
120	8	 Kitchen Outlets	20	15 	8 120
120	10	 Microwave	20	15 	8 120
120	5	 Hydronic Heating	15	15 	13 120
120	7	 Clothes Washer	20	15 	13 120
240	25	 Dryer	30		

The **Electrified 90A Home** panel replaces the hydronic heating with four through wall heat pumps to provide winter heating and summer cooling. Some plan types may need fewer heat pumps and if a ducted system is used that may also reduce the number of panel slots required. Modern houses typically put plugs and lights on separate circuits with plugs on 20A circuits. Because the heat pumps are low amperage, they could be connected to such a 20A circuit, however the original wiring mixes the plugs and lights on a 15A circuit, so this is not an option. However, if remodeling has added a 20A circuit for plugs, and it is close to where the heat pump would be installed, then this would be an option.

The dryer circuit has been removed by installing a combination washer dryer that uses the same circuit as the old washer. Combination washer dryers are explained in Chapter **Error! Reference source not found.**

Remodels and updated electrical codes may require the refrigerator and bathroom GFCI receptacles be on their own circuits, so these have been added. A 240V hybrid heat pump water circuit has been added (the Rheem 2250W hybrid HPWH is recommended) as well as a 120V induction range though there are.

For homes with an electrical connection to an attached garage, an EV Charging circuit has been added. An EV charger has been selected that implements dynamic load management so that it throttles back when the panel is reaching 80% of its limit (as required by code). These chargers typically max out at 48A, requiring a 60A breaker though some can be programmed for lower max amperage allowing smaller lower cost wiring. In this example, there are still slots remaining in the panel for additional circuits.



Chapter 5: Case Studies

How a Dangerous Gas Leak Became a Catalyst for an All-Electric Retrofit: Williams Home

The Williams fully electrified their 1905, 1,350 square foot home in 2023. Initially, a solar PV system was installed with the help of a federal tax credit. Two years later, the Williams found out they had a gas leak in three different places in their home due to the aging gas pipes. This was the push for them to take the leap and retrofit their home to be fully electric, and the homeowner notes that she has “never looked back.”

The Williams have since expanded their solar system and qualified again for additional federal tax credits. The heat pump water heater also qualified for their local city’s rebate program. The homeowner states that “I am a single mom and the rebates really helped.”



Figure 6: The 1950s Williams home.



The new heat pump water heater cost \$6,500 to install and fit within the existing water heater closet adjacent to the carport. The new electric stove fit in the same place as the old gas stove and cost \$2,000 to install. All the gas lines were safely cut and capped.

Retrofitting your home to use a heat pump instead of a gas furnace offers the benefit of both heating and cooling. Before the retrofit, the Williams’ home did not have air conditioning, so by replacing their old furnace with a new, efficient heat pump, they also gained the benefit of air conditioning. Having a centralized system with ducting also allows the addition of an air filter to purify the air.

Figure 7: The new electric stove with freshly baked cookies, the heat pump water heater fitting within the existing water heater closet, and the homeowner enjoying their new all electric lifestyle!

The homeowner notes that after the retrofit, “the whole air system in the house feels noticeably cleaner.”

The cost to retrofit the HVAC system was \$24,000 for a 3-ton 2-zone system. Since the ducting of the old furnace was 30 years old, they also replaced the ducting as a part of their heat pump installation. The new heat pump was installed in the attic, with nontoxic insulation in the floor of the attic, metallic sheets lining the rafters were installed to provide a passive energy strategy that helps reduce the need for cooling in the hottest months and heating in the coldest months.



Figure 9: The solar array on all planes of the roof to maximize solar production to offset utility bill costs.

from their household. The benefit of financial incentives from both the federal government and the local city, and reduced utility bills make electrification financially within reach for an “ordinary single-mom teacher like me” says the homeowner; above all she is “proud to contribute to a better heritage of earth, sky and water for generations ahead.”

Leaving a Legacy of Clean Energy by Going All-Electric: Reuscher Home

In 2020, a Bay Area homeowner began their journey to retrofit their 1944, 2,700 square foot home with all-electric systems. Concerned about the future of the planet and wanting to leave a better world for their children and grandchildren, they decided to make their home part of the solution. Already equipped with solar panels installed in 2010 and an electric car (with Level 2 charging) since 2012, transitioning to an all-electric home was the next logical step.



Figure 10: The all-electric retrofitted home.

Before the home’s electrification retrofits, there was a major remodel of the home in 1995, that included a 200 amp panel upgrade, insulating the walls, and installing double pane windows. Fully electrifying their home happened in stages over the course of three years. The journey began in 2020 with installing a heat pump water heater and a new sub-panel to



Figure 8: The new HVAC system installed in the attic, with ample insulation around the heat pump itself, and on the lining of the rafters.

The solar PV system helps offset the costs of the new electric use and cost \$25,000 to install. The solar array was placed with maximal sun exposure, on the different planes of the roof, with enough panels to cover the electricity use for the entire home. For example, in June of 2024, the Williams home used 202 kWh of electricity, but their utility bill was negative \$38.

In total, the cost to electrify the Williams home was \$57,000, providing the family peace of mind by safely eliminating gas

deliver power to the water heater. This initial phase cost approximately \$8,000 and included additional electrical work of installing a 240V outlet for the future induction stove. In 2021, the homeowner upgraded to an induction stove, which cost \$10,000. The installation was straightforward, with the new stove fitting perfectly into the existing kitchen setup, and the homeowner notes it is much easier to clean compared to the previous gas stove.



Figure 11: The new electric induction stove, the heat pump air handler and heat pump water heater, and the electric car charger next to the subpanel for the water heater.

A major upgrade came in 2022 with the installation of a ducted heat pump HVAC system that cost \$17,000. This system replaced an older gas furnace, providing not only efficient heating but also the added benefit of air conditioning during hot months. The new system operates more quietly than the old gas furnace. In 2023, a second ducted heat pump HVAC system was installed for \$25,000. This additional system was necessary to ensure even heating and cooling throughout the entire house, given its size and layout, and it ended up being easier to install two separate systems rather than expanding the first one. Both systems are Mitsubishi MXZ-SM36NAM with 36,000 BTUs of heating, or 3 tons each.

By eliminating gas use, the homeowner significantly reduced their carbon footprint. The new heat pumps provided efficient heating and cooling, and the induction stove improved the cooking experience with faster, cleaner operation. With the transition to all-electric systems, the homeowner eliminated their gas bills. While electricity bills vary based on factors like electric vehicle usage and seasonal changes, the overall impact has been positive. The solar panels, installed in 2010 and expanded in 2021 with a rough total cost of \$35,000, help offset the electricity costs, making the transition more financially manageable. June through August the solar array produces more electricity than the home uses, even when the homeowner does most of their EV charging at home.



Figure 12: The heat pump air handler in the attic, and the heat pump compressor sitting on the outside of the house.

Electrifying Without Increasing Power Supply: Schmidt Home

Lisa and Steve Schmidt, two “early adopters” in Silicon Valley’s all-electric retrofit program and well-known energy consultants, run their large 4,000 square foot Los Altos Hills family home on a standard 200 Amp panel, even as they have retrofitted chargers for two electric cars, an electric motorcycle, an induction range, a washer-condensing dryer, two heat pump water heaters and three heat pumps for space heating and cooling. The trick to avoiding upsizing their power supply from 200 Amps to more (e.g. 400 Amps) was using NeoCharge plugs. These plugs are designed to share power between two 240V devices using one plug. The NeoCharge controls power use, so one electric car waits for the other to charge, or the water heater waits while the induction stove cooks, then resumes heating the water in the storage tank when the stove is done. This power sharing strategy avoided the need for an expensive panel and service line wire upsized.



Figure 14: The NeoCharge allows two electric vehicles to be plugged in at the same time at the Schmidt’s home, where one car is charged completely then it automatically switches over to the other car to charge (Images courtesy of Steve Schmidt).



Figure 15: At the Schmidt’s home, the Bosch electric induction stovetop is shared on the same circuit as the Rheem heat pump water heater using the NeoCharge (middle) (Images courtesy of Steve and Lisa Schmidt).

Their other strategy was selecting low power appliances. Rather than using a 7,000 Watt electric resistance laundry dryer and triggering a wiring upgrade, they bought 700 Watt condensing washer/dryer, so efficient with its power demand that it can plug into any existing 120V outlet. Lisa loves it-- “The condensing Washer/Dryer is just outstanding. It washes quickly and does a better job than my old washer and dryer—the clothes come out cleaner and very dry. I’m thoroughly impressed.” They also avoided extra power by not installing resistance strips in their new HVAC systems and opted for one of the new 120 volt heat pump water heaters. Steve and Lisa have now been using the strategy of power-sharing between their stove and water heater, and between their two EVs for four years now with no issues. Steve states that the power sharing “works great because we have NEVER noticed it.” That is just one of the many benefits of using this technology, the ability to set and forget, along with an easy installation, and avoiding any unnecessary wiring, electric panel or service upgrades.

References

- 1 Engelberg, Jeremy and Brassell, Evan. (2019). "Differences in Fuel Usage in the United States Housing Stock: American Housing Survey Report." U.S. Census Bureau. <https://www.census.gov/content/dam/Census/library/publications/2019/demo/h150-19.pdf>
- 2 Statista. (2023). "Electric or Gas? What the U.S. Is Cooking On." <https://www.statista.com/chart/29082/most-common-type-of-stove-in-the-us/>
- 3 Gruenwald, Talor, et al. "Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States." Nov. 2022. Int. J. Environ. Res. Public Health. <https://www.mdpi.com/1660-4601/20/1/75>
- 4 Jedrychowski, J. et al. "Effects of Domestic Gas Cooking and Passive Smoking on Chronic Respiratory Symptoms and Asthma in Elderly Women." International Journal of Occupational Health. Jan, 1995. <https://pubmed.ncbi.nlm.nih.gov/9990152/>
- 5 Photos acquired from the following sources:
Air Source Heat Pump: <https://hvacdirect.com/9-000-btu-19-seer-aciq-single-zone-wall-mounted-mini-split-system-w-wifi-115v.html>. Heat Pump Dryer: <https://www.weaverappliance.com/Whirlpool-WHD862CHC-7-4-cu-ft-Front-Load-Hybrid-Heat-Pump-Dryer>. Solar Panels: <https://www.bloomberg.com/news/articles/2016-04-06/7-things-to-know-before-installing-solar-panels-on-your-roof>. Induction Stove: <https://www.101cookbooks.com/induction-stove/>. Heat Pump Water Heater: <https://www.rheem.com/water-heating/articles/rheem-proterra-plug-in-heat-pump-water-heaters-designed-for-easy-gas-unit-replacement-2/>. Electric Vehicle Charging: <https://www.motortrend.com/features/home-ev-charging-installation-guide/photos/>. Home Battery: <https://nativesolar.com/home-battery-backup-in-2022/>
- 6 Cost analysis from utilizing the publicly available TECH Clean California program data. Cost range represents the 20th and 80th percentile total project costs for unitary type heat pump water heaters. <https://techcleanca.com/heat-pump-data/>
- 7 Humes, E. (2022, March 30). Chefs Turn Off the Gas and Light Up Induction Cooktops. Sierra. Retrieved from <https://www.sierraclub.org/sierra/2022-1-spring/notes-here-there/chefs-turn-gas-and-light-induction-cooktops>
- 8 Wharton, R. (2024, May 31). Buying a Gas Stove or Dryer? Read This First. The New York Times: Wirecutter. Retrieved from <https://www.nytimes.com/wirecutter/blog/buying-new-stove-oven-or-dryer/>
- 9 Costs estimated from: Alexander, C. (2024, January 2). How Much Does It Cost to Install an Electric Fireplace? Retrieved from <https://www.fixr.com/costs/electric-fireplace#:~:text=The%20average%20cost%20to%20install%20a%20built%2Din%20electric%20fireplace,mantel%2C%20surround%2C%20and%20hearth.> Freeman, A. (2024, June 26). How Much Does an Electric Fireplace Cost? Angi. Retrieved from <https://www.angi.com/articles/electric-fireplace-worth-money.htm>. How Much Does An Electric Fireplace Cost? (2022, November 3). HomeAdvisor. Retrieved from <https://www.homeadvisor.com/cost/heating-and-cooling/electric-fireplace/>