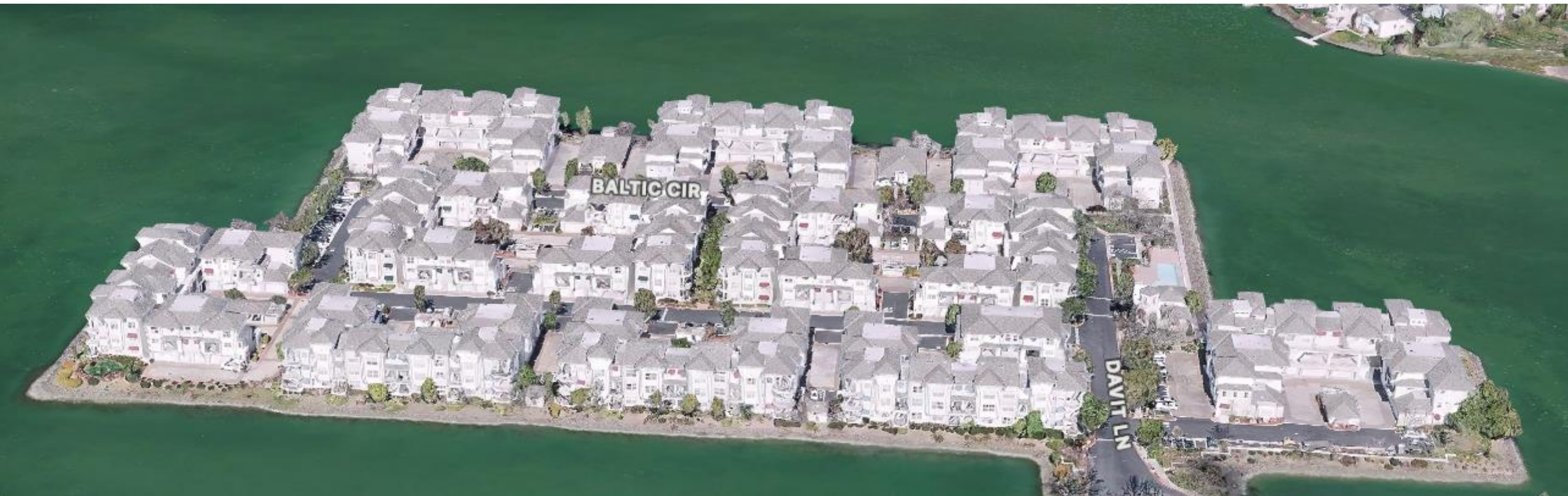




Ventana Del Mar – Electrification Pathways





Executive Summary

- Why electrify?
 1. Zero-NOx rules (BAAQMD, Jan 2027 effective – but delayed)
 2. CA Air Resource Board (2030 effective)
 3. Owner desires to eliminate natural gas
- Community can make electrification work, requires
 - Smart and
 - Reasonable choices
- However: tradeoffs will be required





Heating and Cooling (HVAC)

- Currently our hot water heaters provide heat
 - Apollo Hydronic heating system
 - Handful of units also have builder-installed air conditioning
- Recommendation:
 - Install “all in one” heat pump units, several brands available (Innova; Merino Energy; more)
 - External compressors are not recommended for our complex
 - We expect that owners may desire different mixes of all-in-ones
 - Some can reuse existing ducting
 - Modeled between 3-5 all-in-one heat pumps per unit
- Cautions:
 - Homeowners must get HOA approval for installation and to penetrate the building exterior for venting
 - Open questions, HOA conducting follow up:
 - HVAC specialist on air flow/distribution questions to better understand ability to reuse ducting
 - And more...
- Note: You can swap out your Apollo unit without replacing your water heater; only have to disconnect the extra circulation loop

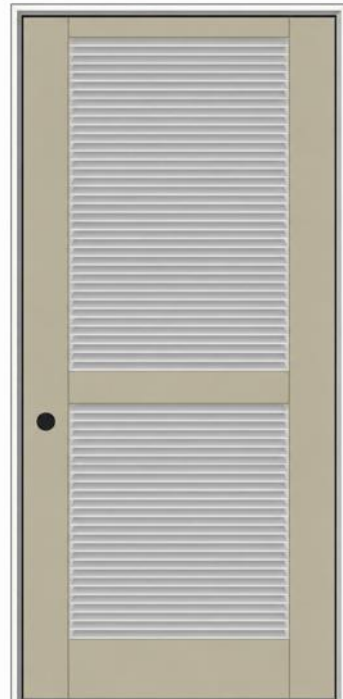


Example Innova all-in-one ducted unit, requires external venting but no compressor



Heat Pump Water Heaters (HPWH)

- Recommendation:
 - Possible, but cannot be used for hydronic heating
 - Most floorplans have limited clearance, get a unit <23" width
 - Get a front/side venting unit only
 - Need a fully louvered water heater closet door for adequate ventilation
- Cautions:
 - Homeowners must get HOA approval to install
 - Additional stucco penetrations/ducting for venting will not be approved
- Note: Must replace home heating system before replacing the hot water heater. The HPWH will not provide enough hot water for the Apollo system





EV Charging in Garages

- A few potential solutions. Significant costs for wiring and system installation
 - RVE (Montreal company) has two solutions.
 - 1st unlikely to fit – limited space in electrical room
 - 2nd could provide each garage EV charging with billing for electrical usage
- **The Board will be conducting additional discussions and evaluating options**
 - Fairness remains a concern as currently everyone is paying the bill for garage charging and usage is rising
- Floorplans with attached garages (Plan 3A, Plan 6, Plan 8 [ground floor])
 - You can with HOA approval install 240V charging to your circuit breaker
 - This has been modeled in the electrical calculations



Topics

1

Home Electrification



Space heating
and cooling



Water Heating
(BAAQMD)



Range
(Oven / Cooktop)



Dryer

2

EV Charging



Board Questions



Is there sufficient building capacity for everyone to electrify?



Is 90A enough to electrify a unit?



Guidance for appliances



How to equitably provide EV charging to everyone



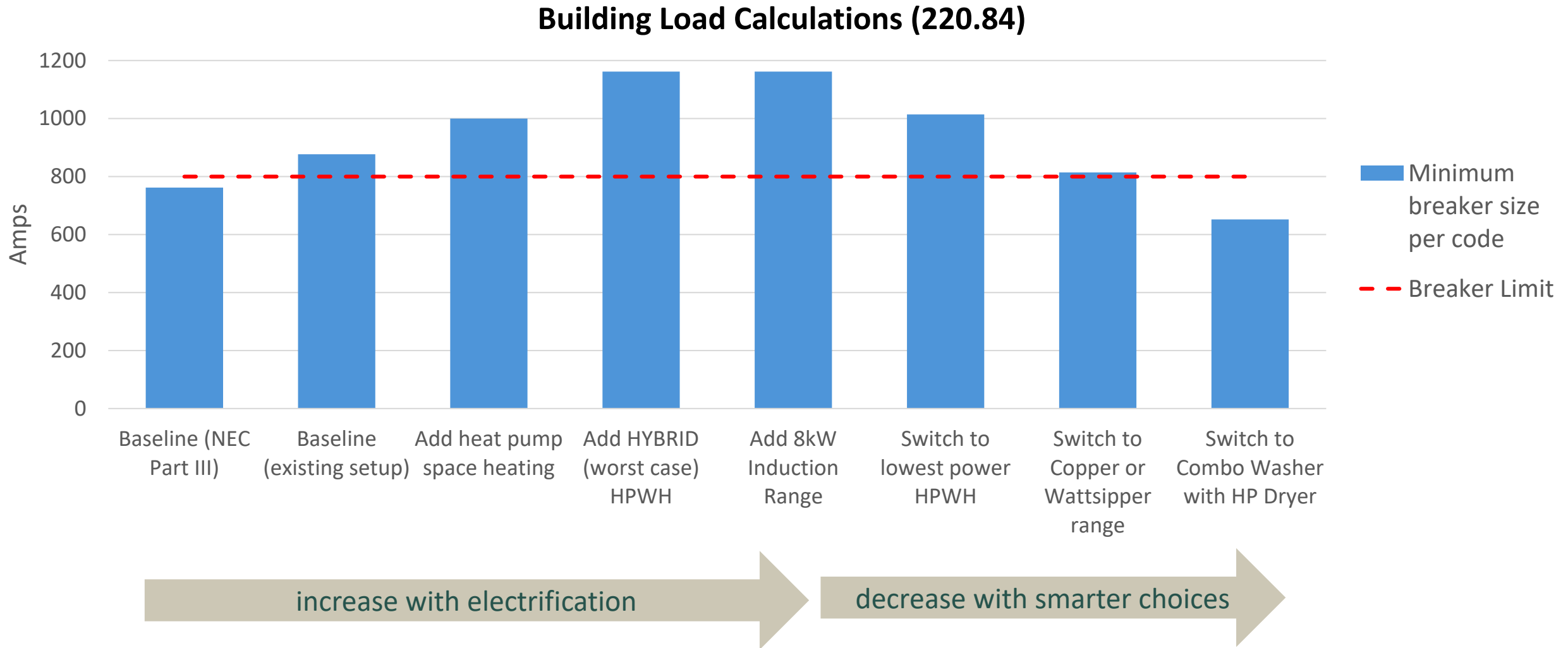
Is there sufficient capacity and is 90A enough for full electrification?

Watt Diet Analysis performed for units and whole building for different stages of electrification.

Answer is "YES"



Building Load Calculations – Over the limit





Solution: Alternative Load Calculation

Alternative electrical code path (220.87)

- Uses historical measurements
- 800A service, only around 150A* used
- Collecting data is the challenge

Additional potential data gathering support:

- EV charger solutions can collect additional data if/as needed

* Estimated from the data collected from 29 units across the complex that were collected as a virtual building with a hour peak in the year of 148A. This estimate is likely high since the max units per building is 21. On the other hand, house loads (coming lighting and garages) have not been accounted for but they are likely to be less than the 8 excess condos.



Existing Usage – well under 90A

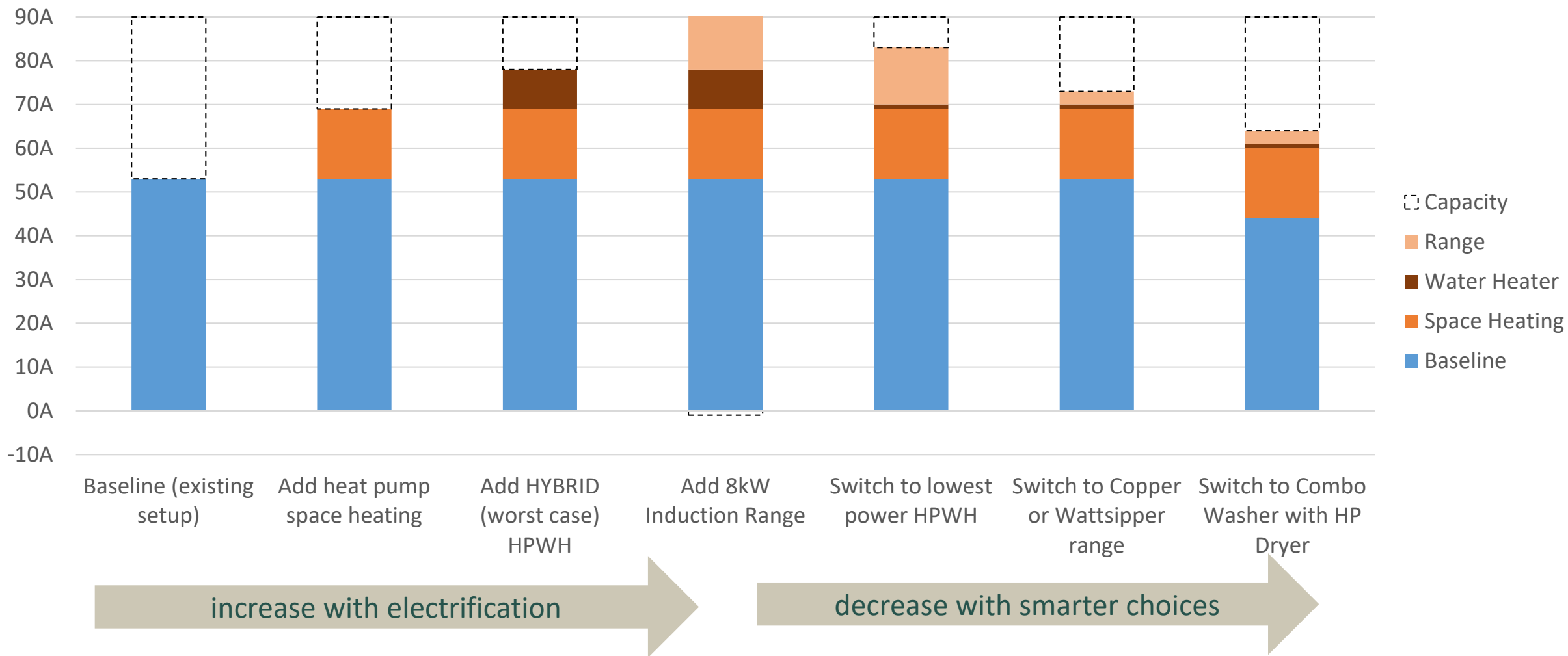
- A year of hourly data for 29 of 244 Units
- Data shows lots of spare capacity
- Sum hourly data across all 29 samples: **148A Peak**
- Well under the 800A building supply
- Lots of capacity at the **unit and building level**

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



NEC 220.83 Load Calculation

Plan 3/3A (2 bed, 1290 sqft)





Heat Pump Water Heater (HPWH)

Small space is the challenge

Existing gas water heater is 22" diameter, 56" tall





Heat Pump Water Heater

48 Gallon
44,000* Btu/h



50 Gallon
4,200 Btu/h



Gas 10x Btu/h vs HPWH

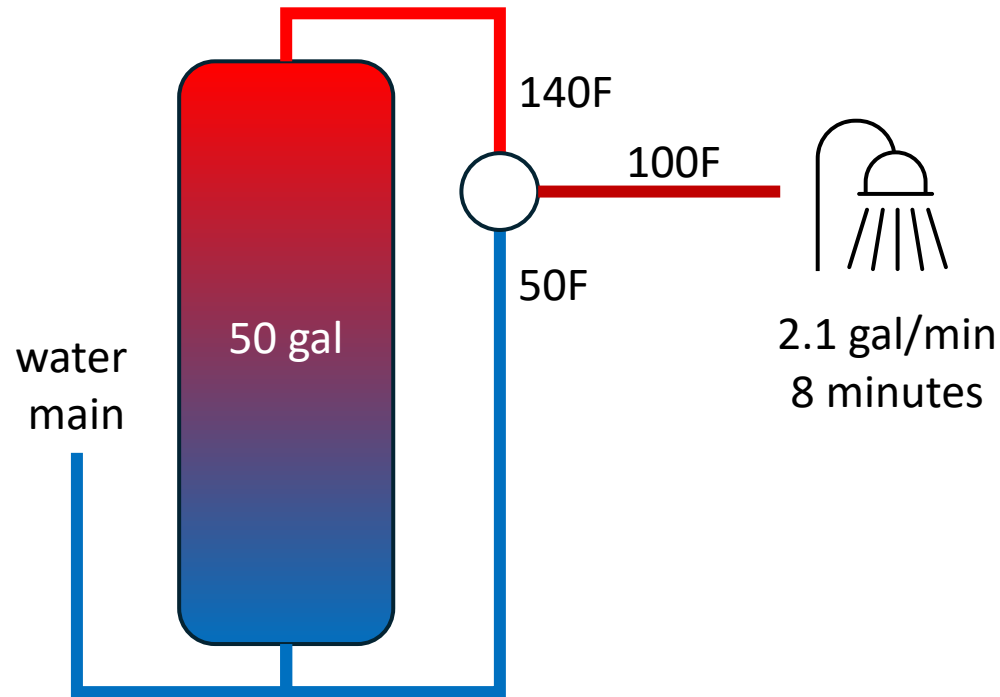
Cannot be used for hydronic heating

*Rated 55kBtu/h input but 80% combustion efficiency



Won't I run out of hot water?

- Five 8-minute showers from 1 tank



- Hot water fraction
$$= (T_{\text{desired}} - T_{\text{cold}}) / (T_{\text{hot}} - T_{\text{cold}})$$
$$= (100 - 50) / (140 - 50) = 0.556$$
- 16.8-gallon shower requires
 - 16.8 gal * 0.556 = **9.33 gal** from the tank.
- **Five 8-minute back-to-back showers** achievable
- A bath is about 2-3 showers
- 50F is worst-case cold-water temp



50 Gallon (Hybrid) Heat Pump Water Heaters

 Voltex	 BRADFORD WHITE WATER HEATERS AeroTherm Series G2	 Plug-in Heat Pump Water Heater	 Rheem - ProTerra Hybrid Electric Heat Pump
22" diameter	22" diameter	22.25" diameter	22.25" diameter
"zero side or rear clearance"	"zero side or rear clearance"	Protusions raise fit questions	"zero side clearance requirement"
450W 4300Btu/h Compressor	365W Compressor	440W 4200Btu/hr Compressor	440W 4200Btu/hr Compressor
120V 15A Breaker	240V 25A Breaker	120V 15A Breaker	240V 30/15A Breaker
2 x 900W resistive heat	2 x 4000W resistive heat	No resistive heat backup	4500W or 2250W resistive heat options





Ventilation Required

- Existing gas flue too long and too narrow....
- Cold exhaust air directed at louvered door – no need for additional penetrations
- Recommending a fully louvered door

[Report: The Incredible Shrinking Room](#)

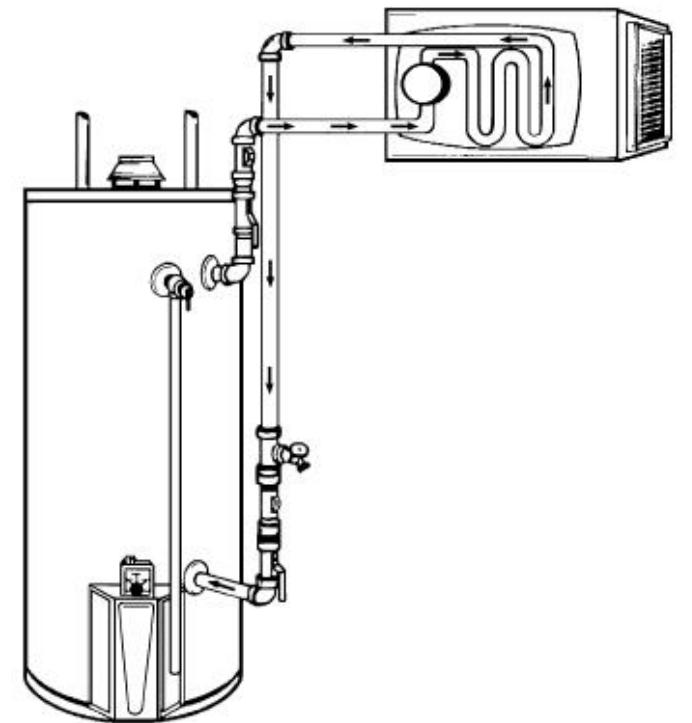
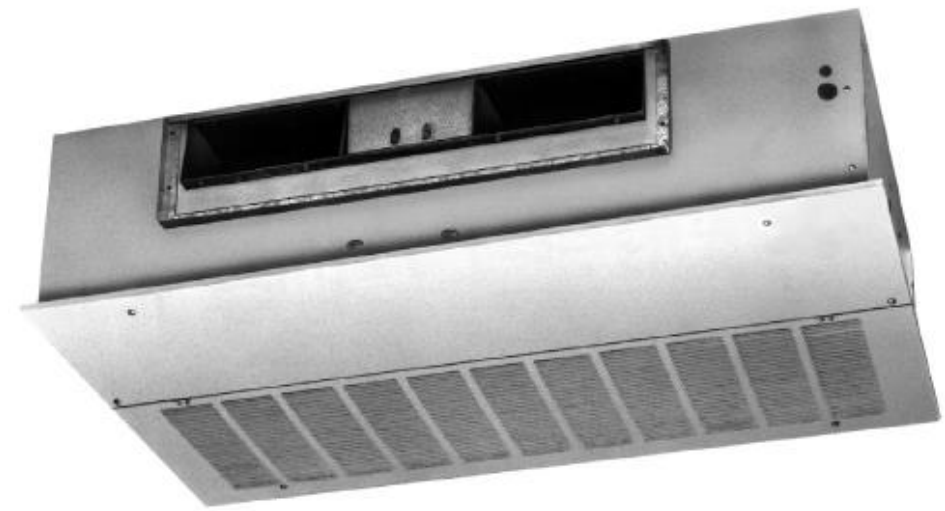




Heat & Cooling Solutions (HVAC)

Electrify HVAC before electrifying water heater

Existing system can put out up to 30,000 Btu/h





All in One Heat Pumps

Multiple brands and options

Works with energy envelope of the buildings/units

HOA has hired an HVAC consultant to make more detailed recommendations



[Website](#) | [PDF Catalog](#)



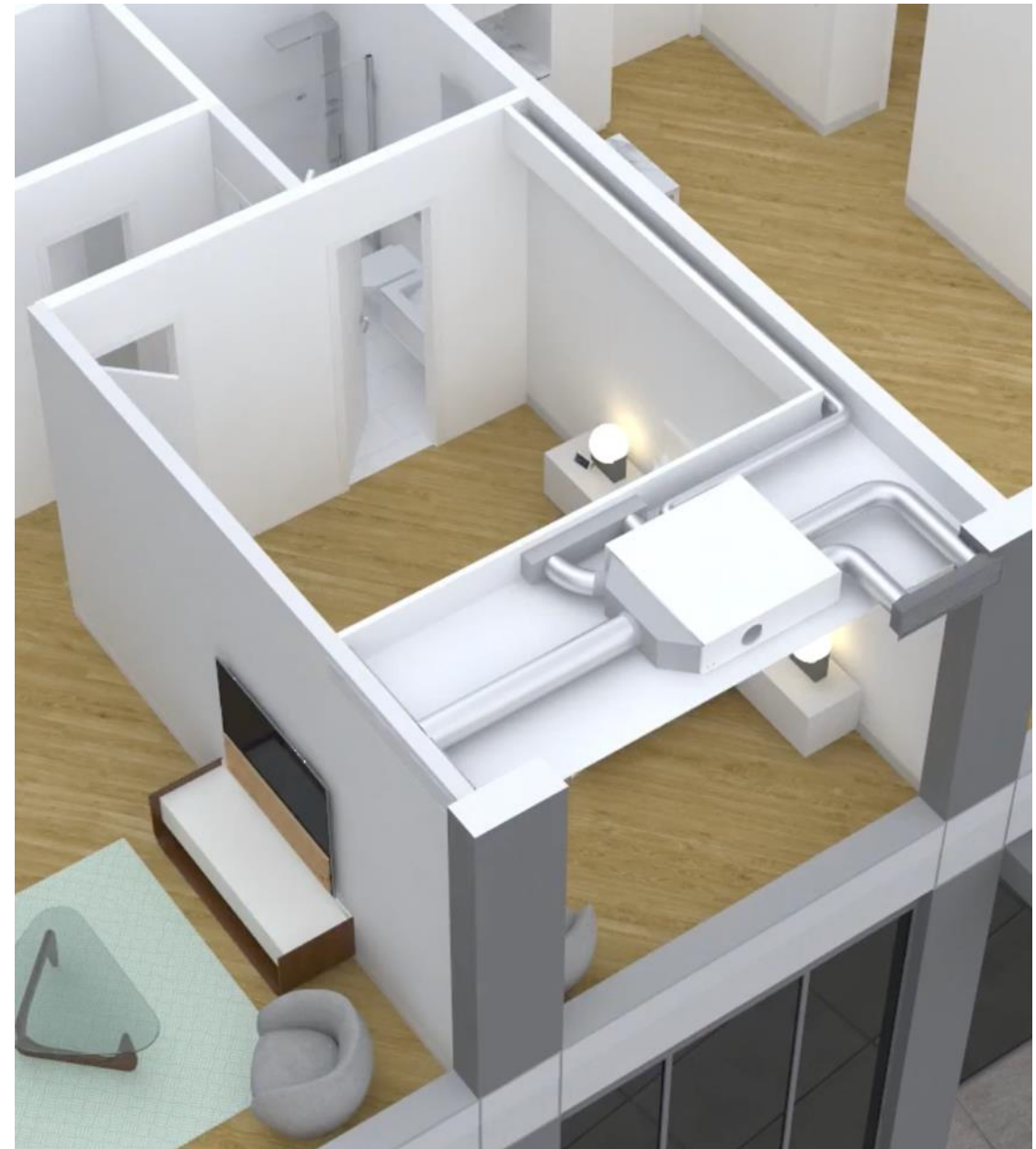
Merino Energy [Website](#)



Innova Ducted Example

- May be able to reuse existing ducting
 - But will need to penetrate stucco to duct – requires HOA approval
- ~\$12-20K to install
- 14kBtu/h heating/cooling
 - May be adequate for some floorplans and not for others.

More investigation forthcoming





Wall Mounting Options

- Wall mounted units are an option for spot heating/cooling
 - Variable output => Better comfort
 - 120V, 10A Units
 - 10kBtu/hr heating/cooling
 - Roughly 1/3rd existing Apollo air handlers
- ~\$4-6K per unit installed
 - Requires penetration of stucco to vent and HOA approval
- More investigation about number of units per floorplan forthcoming



Innova wall mounted unit shown



Externally visually unobtrusive – multiple venting options

<https://innova.co/brochures/#page104>

Flange Louver Assembly

Designed for use with the AIO series heat pumps, the standard flange linear louver assembly offers clean architectural lines, excellent airflow performance. LLA/F is serious about keeping water out with unique features that provide failsafe protections for water intrusion, ensuring that no matter the circumstance, no water will enter the wall assembly or inside the room. The two-part assembly consisting of a plenum box and separate louver enables flexible and easy installation. Concealed screws on the side of the louver fasten to the plenum box, so no screws mar the front. LLA/F can be finished in baked enamel or Kynar in any custom color. LLA/F is available in four configurations; horizontal, elongated, vertical, and single. The LLA/F series louvers are tested to meet ASHRAE 62.2 -2016 section 6.8.4 as a combination louver. To view the brochure with all pricing and details, please scan or click the QR code.



Vertical configuration



Horizontal configuration



Installed

Concealed Louver Assembly

Designed for the Innova AIO series heat pumps and designed for the highest aesthetic appeal with only a 1/4" (6.35 mm) visible frame, the concealed flange linear louver assembly offers clean architectural lines and excellent airflow performance. LLA/C is serious about keeping water out with unique features that provide failsafe protections for water intrusion, ensuring that no matter the circumstance, no water will enter the wall assembly or inside the room. The concealed flange is available in any setback depth to accommodate any wall assembly, from stucco to brick, from siding to glass or aluminum panels. LLA/C can be finished in baked enamel or Kynar in any custom color. LLA/C is available in four configurations; horizontal, elongated, vertical, and single. The LLA/C series louvers are tested to meet ASHRAE 62.2 -2016 section 6.8.4 as a combination louver. To view the brochure with all pricing and details, please scan or click the QR code.



Vertical configuration



Horizontal configuration



Installation cutaway

Surface-Mounted Louver Assembly

Approved for the Innova AIO series heat pumps are designed for retrofit installations where core drilling the holes without making a larger opening is desirable and can also set in wood or vinyl siding with minimal depth visible. The surface-mounted linear louver assembly offers clean architectural lines and excellent airflow performance. The two-part assembly consisting of a plenum box and separate louver enables flexible and easy installation. LLA/S is serious about keeping water out with unique features that provide failsafe protections for water intrusion, ensuring that no matter the circumstance, no water will enter the wall assembly or inside the room. LLA/S is available in two configurations; horizontal and single. LLA/S can be finished in baked enamel or Kynar in any custom color. The LLA/S series louvers are tested to meet ASHRAE 62.2 -2016 section 6.8.4 as a combination louver. To view the brochure with all pricing and details, please scan or click the QR code.



Louver and plenum box separated



Louver and plenum box combined



Installation in vinyl siding

Round Vents

Designed for use with the AIO series heat pumps, the RLA series assembly offers easy installation, clean architectural lines, and excellent airflow performance.

RLA is serious about keeping water out with unique features that provide failsafe protections for water intrusion, ensuring that no matter the circumstance, no water will enter the wall assembly or inside the room.

The three-part assembly consists of an outer sleeve, an inner sleeve, and a cast louver.



Front



Rear with gasket



Installed



Air Flow Consideration Required

- E.g., Plan 4 – The Dory 1266 sq ft
 - 2 bed, 2 bath
- Options:
 - 1 ducted unit where Apollo air handler + 1 vent?
 - 1 ducted + 1 wall for master?
 - 3 wall units?
- Concerns to study:
 - Does heat get to whole home?
 - How does existing ducting get used to circulate and mix air if at all?





Kitchen Induction Ranges

Heat faster

Finer control

More energy efficient (40% vs 90%)

Safer

Easier to clean

Healthier



Induction Ranges – lots of innovation



Many model to choose
from: 240V, 40A
\$1200-\$10,000



Copper's *Charlie* with
battery – 120V, 15A
\$6000



Elektra with battery -
120V, 15A
\$4000



Wattsipper
120V, 20A
\$1500-\$2500



Combo Washer Dryers

Uses Laundry (washer) circuit, drops the Dryer circuit (240V 30A). About \$2000 appliance.



GE Profile



Samsung



LG



Yes, there is enough breaker capacity

6-12 slots free in each unit's panel

+1 or +2	+1 for 120V HPWH or +2 for 240V HPWH
+4 or +5	PTHP depending on how many required in unit plan
-1	Hydronic Heater blower and pump removed
+1 or + 2	+0 for 120V range with battery +1 for 120V stove on dedicated circuit +2 for 240V stove
-2	Switching to combo washer dryer
-1	<u>Switch to single pole twin breaker</u>





Before and After Panels

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	Lights/Plugs	8	120	
120	8	Kitchen Outlets	20	15	Lights/Plugs	8	120	
120	8	Microwave	20	15	Lights/Plugs	8	120	
120	5	Hydronic Heating	15	15	Dishwasher	13	120	
120	7	Clothes Washer	20	15	Garbage Disposal	13	120	
240	25	Dryer	30					

Electrified 90 Amp Home

Dryer circuit replaced with combo washer dryer, hydronic heating fan replaced with 4 in-wall heat pumps.
Added: heat pump water heater, dynamic power managed EV charger added, induction range.
Code updates to add circuits for bathroom GFCI and refrigerator

Device	Volts	Device	Amps	90 Amp Panel	Device	Amps	Device	Volts
120	8	Kitchen Outlets	20	15	Lights/Plugs	8	120	
120	8	Kitchen Outlets	20	15	Lights/Plugs	8	120	
120	8	Microwave	20	15	Lights/Plugs	8	120	
		Hydronic heater removed	15	15	Dishwasher	13	120	
120	7	Washer Dryer Combo	20	15	Garbage Disposal	13	120	
		Dryer circuit removed	30	15	Heat Pump Water Heater	4	120	
				15	Heat Pump HVAC	10	120	
120	6	Refridgerator	15	15	Heat Pump HVAC	10	120	
120	5	Bathroom GFCI	15	15	Heat Pump HVAC	10	120	
120	5	Bathroom GFCI	15	15	Heat Pump HVAC	10	120	
240	40	Power Managed EV Charger	50	50	Induction Range	240	40	



EV Charging

Currently:

- 20 out of 24 garages on the House Panel
 - About 3-4 garages per shared 20A circuit
 - Nuisance tripping issues
- Everyone is paying $1/244^{\text{th}}$ of the usage



Each garage 2-pairs of receptacles (sockets) ...on different circuits, 3-4 garages per circuit

Garage
door and
lights from
socket in
ceiling

15A circuit



General
use

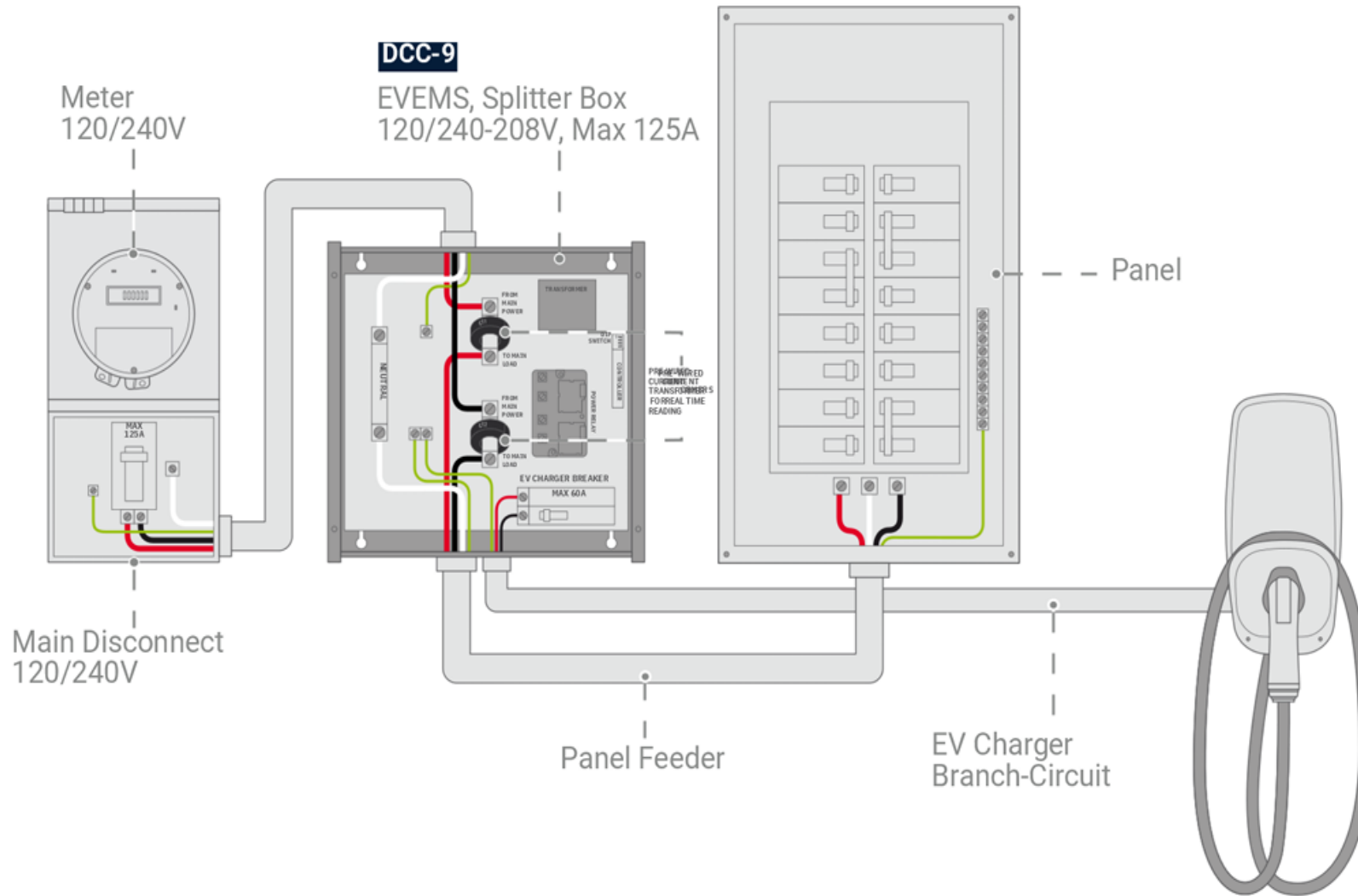
20A circuit

Some use
for EV
charging



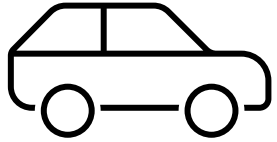


Potential Solution: DCC But Will it Fit?





EV Charging – What might power draw look like



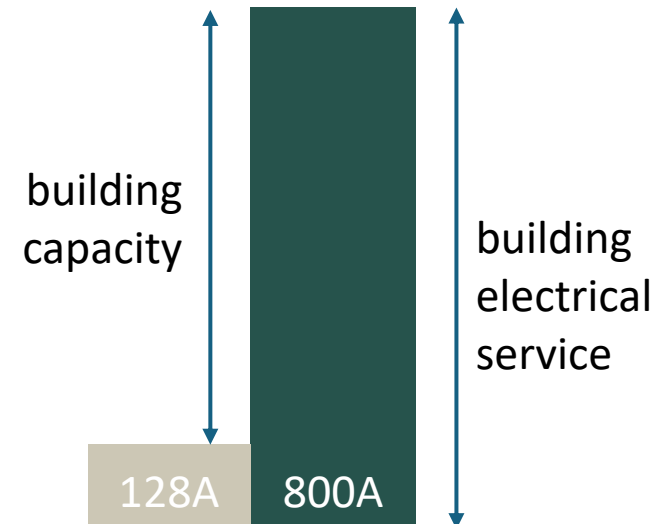
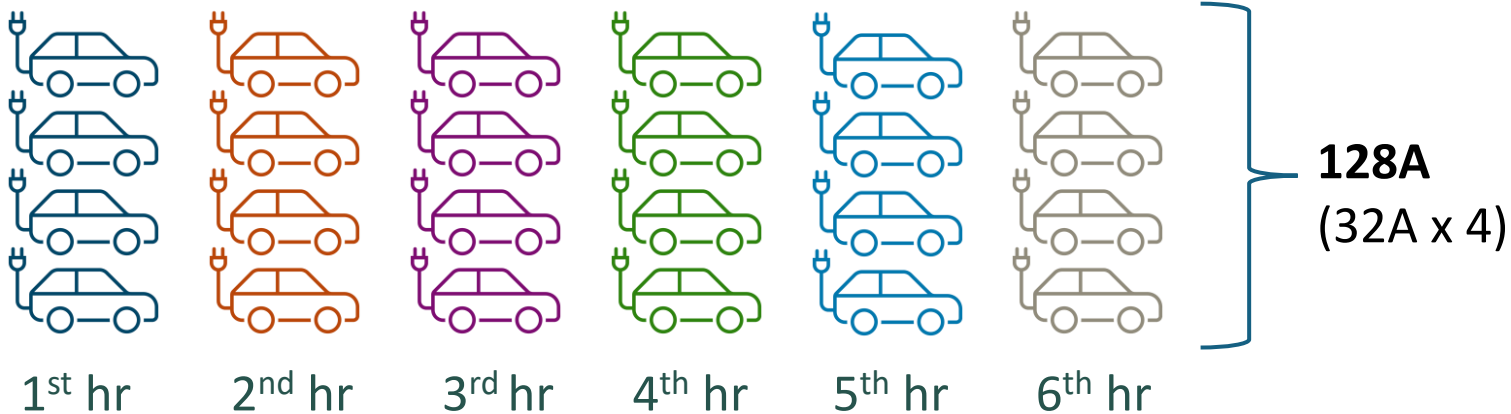
27 miles a day (Bay Area Average - 10,000 miles/year)



**240V
@ 32A**

1 hour to recharge (7.7 kWh vs 8.1 kWh if 300Wh/mile)

If all 24 garages had an EV.... charge 4 at a time





Recommendations for garages directly wiring to the condo's panel

- Run large wires from the panel for the EV charger
 - 240V requires two #6 wires, a #10 ground and 60A breaker
 - Hardwire rather than plugging in. Eliminates need for GFCI breaker and EV grade NEMA 14-50 receptacle
- Use a charger with Dynamic Power Management
 - It monitors the panel current draw and throttles charging if the rest of the home is using a lot of power. This will avoid breaker trips.
 - Products:
 - Emporia Charger Pro (\$600)
 - Wallbox Pulsar Plus with Power Meter (\$1000)
 - Tesla Wall Connector with Dynamic Power Management (\$800)
 - Adds \$150-\$250 compared to chargers without dynamic power management,





Thank you & Questions

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Sean Armstrong seanarmstrongpm@gmail.com



Appendix

Slides mostly documenting the Ventana Del Mar complex.



Site Overview

Ventana Del Mar is a multi-family residential property that was constructed between 1995 to 1998. It is managed by Ventana Del Mar HOA. The property is comprised of 12 buildings, each is a multistory building with 20 units. The addresses are 1000 Davit Ln; 100, 200, 300, 400, 401, 500, 501, 600, 601, 700, 701 Baltic Cir.

Each building has 12 single-car garages and 6-two car garages on the first level. Most are not attached to units. All are considered reserved common areas. Each garage has a 15 amp outlet for garage door opener and 20 amp GFCI outlet. All garages are fed from a single House Panel that feeds garages, building and street lights as well as fire alarm for the building. There are 130 reserved outdoor parking spaces, plus guest and handicapped spaces. Each unit is deeded two parking spaces. Some owners have a 2-car garage, others have two 1-car garages, others have a 1 car garage and a reserved outdoor parking space, others have 1 car garage and a permanent guest parking permit.



Two Key Problems to solve

Gas Water Heaters effectively not allowed to be sold after Jan 1, 2027 in the Bay Area

- Water Heater also supplies home heat.
- Existing WH closets small (2ft wide), not all are close to power.
- Most WH are externally accessible (landings, balconies), others internal to home.
- Harvest came in but \$20K deemed high and doesn't provide AC.
- Existing heating insufficient for 2 story condos.

EV Charging infrastructure is ad-hoc.

- Residents are Level 1 charging in their personal garage.
- Most garages are on HOA community power – equity problem.
- Up to 4 garages on one 20A circuit.
- Circuits do trip, residents know how to fix this.



Kitchen Setup

- 36" Stove
- Microwave above, original with suction fan with filter
- No exhaust for fan, just recirculates back to the room.
- Some have moved microwave and replaced with hood but still not exhausting to outside.
- There is 120V circuit by the stove, reportedly 10A, but not sure which circuit it is on. Perhaps the kitchen appliance?





Bay Area District Regulation 9, Rule 6: Nitrogen Oxides from Natural Gas-Fired Boilers

- Regulation 9: Inorganic Gaseous Pollutants, Rule 6: Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters (Rule 9-6) sets nitrogen oxides (NOx) emissions standards for newly sold and installed water heaters and boilers in the San Francisco Bay Area. Rule 9-6 amendments adopted in March of 2023 currently **require newly installed natural gas-fired water heaters under 75,000 BTU/hr to meet zero NOx emissions standards if they are manufactured after January 1, 2027.** Water heaters and boilers between 75,000 and 2 million BTU/hr must meet the same requirement for a 2031 or later manufacture date. The Rule applies at the point of sale and installation and does not require retrofitting or pre-emptive replacement of existing equipment. **Rule 9-6 does not apply to any other residential appliances other than water heaters.**

[rule-09_06-concepts-paper_final-v1-pdf.pdf](#)



Exemptions to Regulation 9, Rule 6

Hydronic Systems. Standard HPWHs are generally not a suitable direct replacement for a dedicated hydronic heating system. HPWHs lack the additional heat rating provided by natural gas fired units to operate as part of a recirculating, closed-loop hydronic system. **Thus, staff recommends that projects in homes with existing hydronic water/space heating systems be eligible for an exemption with some documentation of eligibility.**

(p12 of [REGULATORY OVERVIEW: RULE 9-6 FLEXIBILITY AMENDMENTS](#))

Anticipated vote on exemptions: Oct 2026.



Unit Electrical Panels



Plan 7 Breaker

- Main breaker not in panel (see next slide)
- 30A Dryer circuit
- Measured cable diameter 0.377" matches to 2 AWG aluminum rated at 100A at 90°C.
- [PRIORITY WIRE 2 AWG THHN Aluminum THHN Building Wire - 876EE2|2-01AL-THHN-BK-100 - Grainger](#)

GE PowerMark Gold™ Load Center
Type 1 Indoor Enclosure
Front Cat. No.: TLM12BC
Use with GE Load Center Enclosure Cat. No.: TLM1212CCU
MAIN RATING: 120/240VAC, 1-Phase, 3-Wire, 125 Amp Maximum

Use only GE type breakers:
THQP, THQP, THQL, THQL, or TXQL

WARNING: Use only with GE type breakers, use of other circuit breakers voids the warranty, may void the UL Listing and could result in property loss or personal injury. The circuit breakers in this box have been selected to protect the wiring. To avoid damage and loss of protection, do not replace with higher ampere rated breakers. If changes are necessary call a qualified electrical contractor.

DANGER
Hazard of electrical shock or burn.
Turn off power before working inside this equipment.

Equipment ground kits:
TGM12, TGM24, TLK20

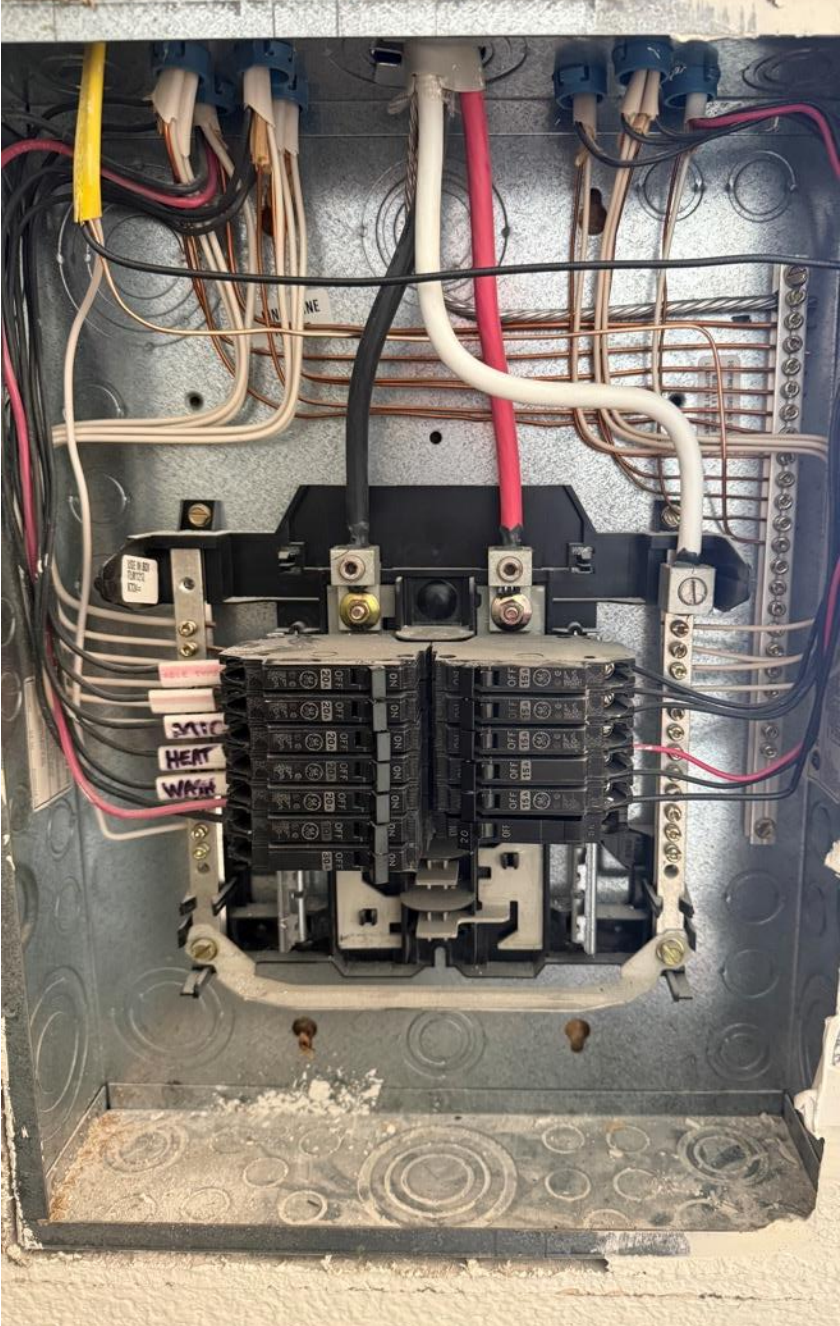
Subfeed Lugs

Accessories:
Circuit directory:
T042

Front filler plates:
1/2" width - TF
1" width - TQLFPI

Made in the U.S.A.
Plainville, CT 06062

California Electric			
Kitchen Receptacles	1	2	Lights and Receptacles
Kitchen Receptacles	3	4	Lights and Receptacles
Microwave	5	6	Lights and Receptacles
Heater	7	8	Dishwasher
Washing Machine	9	10	Disposal
Dryer	11	12	UP stair Bath Hallway
Dryer	13	14	
	15	16	





Units' Meters and main breaker

- 90A Breaker
- Located next to the meter in the main electrical room





Plan 8H Breaker Labels

- Remodels have added circuits to this panel:
 - Range Hood
 - Hallway / Bathroom
 - Refrigerator
 - Bathroom GFCI
- Other units will have different additions

7/16/26

10055274P1
Made in the U.S.A.
Plainville, CT 06062

GE PowerMark Gold™ Load Center

Type 1 Indoor Enclosure
Front Cat. No.: TLM12BC
Use with GE Load Center Enclosure Cat. No.: TLM1212CCU
MAIN RATING: 120/240VAC, 1 Phase, 3-Wire, 125 Amp Maximum

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DANGER
Hazard of electrical shock or burn.
Turn off power before working inside this equipment.

ACCESSORIES
Equipment ground kit: TGM12, TGM2, TLM2, TLM2, TLM2
Subfeed Lugs: TLM2, TLM2, TLM2
Front filler plates: 1/2" width - TF 1" width - TQLTPH
Door lock kit: TLM2

For additional Series Rating information refer to DET-008

California Electric			
Kitchen Receptacles	1	2	LIVING RM
Kitchen Receptacles	3	4	BED RM
Microwave	5	6	BATH RM
Heater	7	8	Dishwasher
Washing Machine	9	10	Disposal
Dryer	11	12	New Hallway Bath
Dryer	13	14	
HOOD	15	16	
STOVE			
REFRI			

11 bathroom
Ventana Del Mar





House Panels

House panels power building common areas, typically lighting but also individual garages.



House Panels

- 125A panels
- Minor differences from building to building
- 24 Garages per building
 - 4 garages supplied by unit -> 20 units on common house power
- 3 x 20A circuits for garage lights and door openers
 - Split to 2 + 9 + 9 garages
- Garage Plug Circuits – 20A
 - 7 circuits on one
 - 6 circuits on the other
 - 5 circuits suggested by building drawings
 - (Drawings don't necessarily reflect what was built!)

100552/10P1
Made in the U.S.A.
Phonix, CT 06061

GE PowerMark Gold™ Load Center

Type 1 Indoor Enclosure
Front Cat. No.: TLM12BC
Use with GE Load Center Enclosure Cat. No.: TLM1212CCU
MAIN RATING: 120/240VAC, 1-Phase, 3-Wire, 125 Amp Maximum

Use only GE type breakers:
THQP, THQP, THQL, THHQ, or TXQL

WARNING: Use only with GE type breakers; use of other circuit breakers voids the warranty, may void the UL Listing and could result in property loss or personal injury. The circuit breakers in this box have been selected to protect the wiring. To avoid damage and loss of protection, do not replace with higher ampere rated breakers. If changes are necessary call a qualified electrical contractor.

DANGER
Hazard of electrical shock or burn.
Turn off power before working inside this equipment.

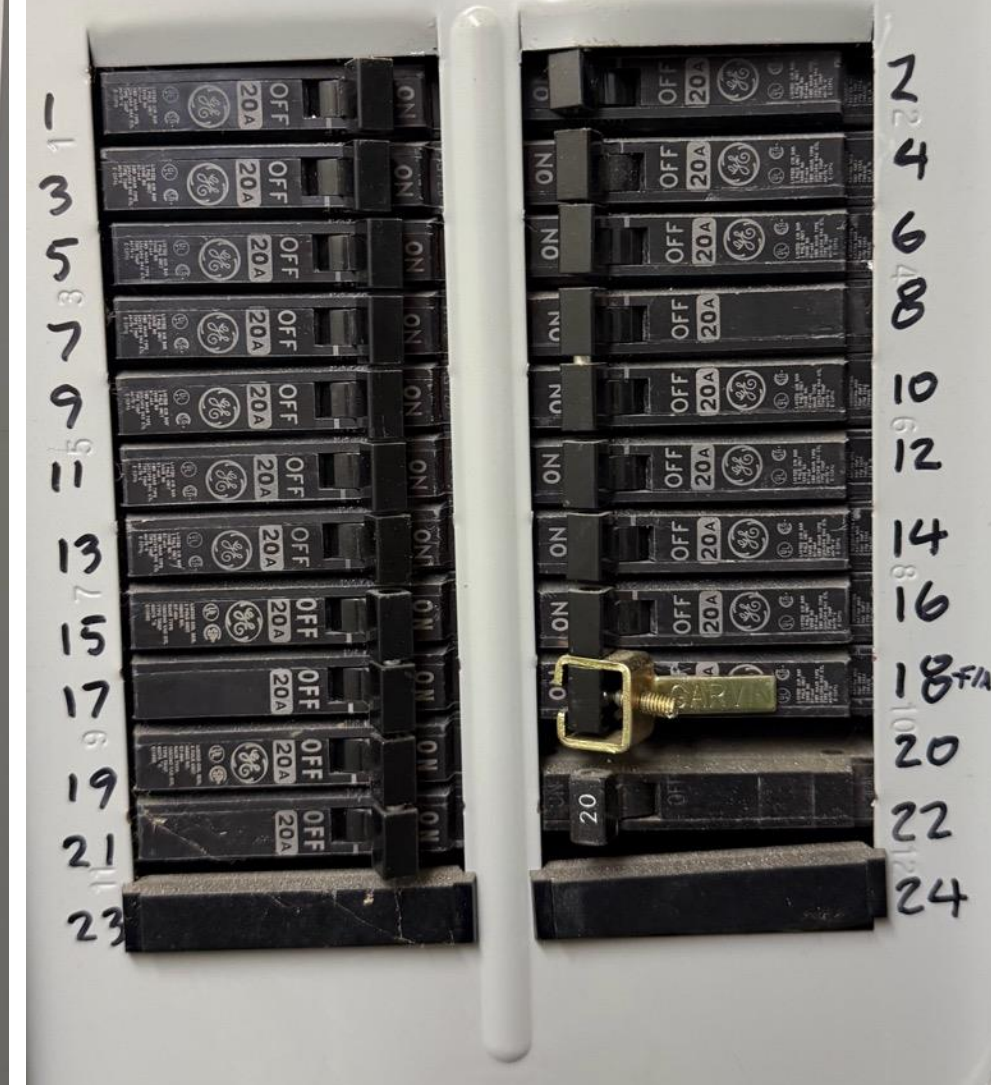
Accessories:
Equipment ground bus: TQNL, TQCL, TLQD
Terminal block: TMB
Subfeed Lug: TMLK
Front filter plate: 100" with TQLP
Front seal: TFS1
Door lock kit: TDL100

For additional wiring rating information refer to SET-500

If a breaker trips:
1. Move handle to OFF position.
2. Move handle to ON position.

1 A	HOUSE LIGHTS	GARAGE PLUGS	2
3 B	"	"	4
5 A	"	"	6
7 B	GARAGE LIGHTS & DOOR OPENERS	"	8
9 A	"	"	10
11 B	"	"	12
13 A	CARPORT LIGHTS	ELECTRIC ROOM PLUG & LIGHT	14
15 B	STREET LITES	PHONE BOARD PLUGS	16
17 A	"	FIRE ALARM	18
19 B	STREET LIGHTS	"	20
21 A	"	"	22
23 B	"	"	24

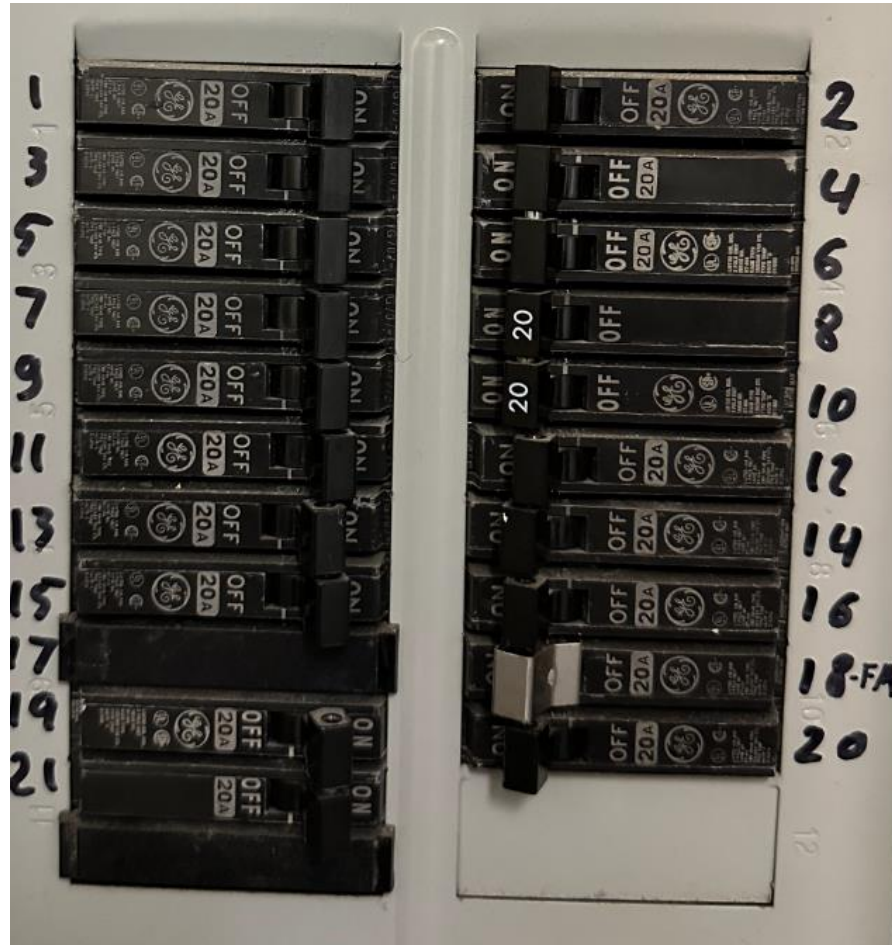
1117





Building 300 House Panel

- 6 x Garage receptacle circuits
- 4x Garage lights



18052/4P1
GE PowerMark Gold™ Load Center
Made in the U.S.A.
Pittsfield, CT 06892

Type 1 Indoor Enclosure
Front Cat. No.: TLM12BC
Use with GE Load Center Enclosure Cat. No.: TLM1212CCU
MAIN RATING: 120/240VAC, 1 Phase, 3 Wire, 125 Amp Maximum
Use only GE type breakers:
THQP, THQP, THQL, THQL, or THQL

WARNING: Use only with GE type breakers, use of other circuit breakers voids the warranty, may void the UL Listing and could result in property loss or personal injury. The circuit breakers in this box have been selected to protect the wiring. To avoid damage and loss of protection, do not replace with higher ampere rated breakers. If changes are necessary call a qualified electrical contractor.

DANGER
Hazard of electrical shock or burn.
Turn off power before working inside this equipment.

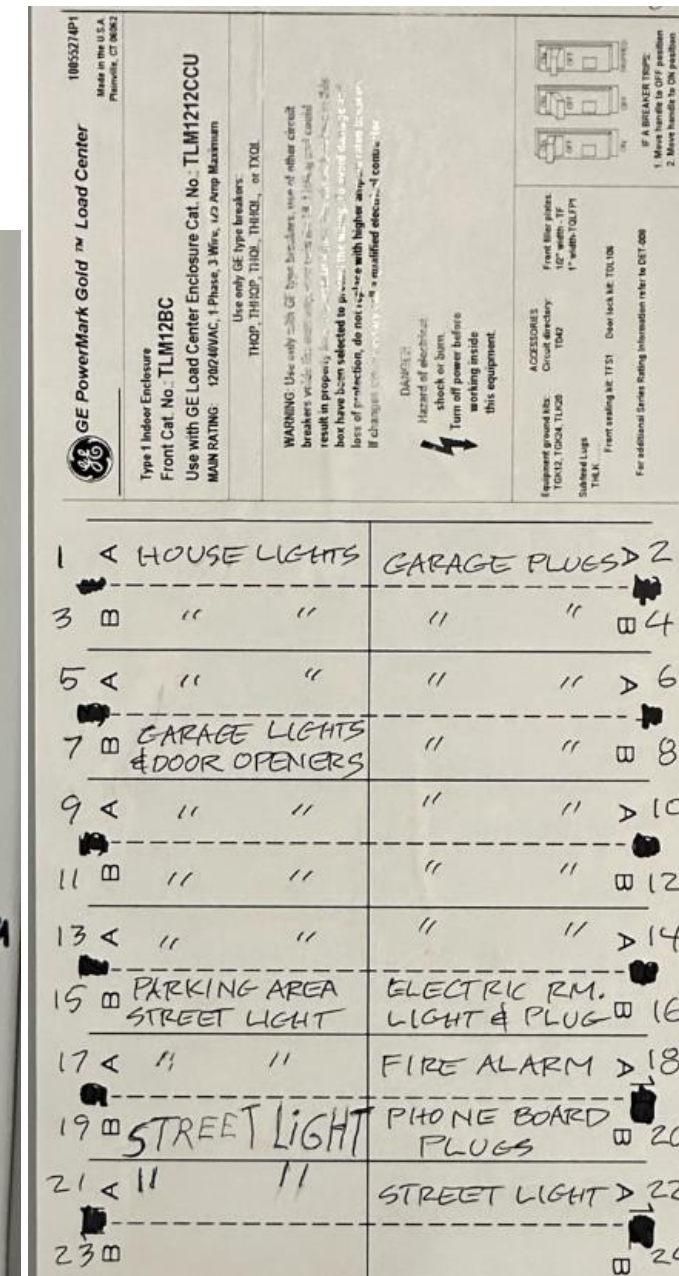
ACCESSORIES
Equipment ground bar: TDM12, TDM12, TDM12
Subpanel Lug: TMLK
Front Bar Joints: 12" width, 17" TMLK
Front Bar Joints: 17" width, 17" TMLK
Front Bar Joints: 17" width, 17" TMLK

For additional Series Rating Information refer to SET 008

1	A HOUSE LIGHTS	GARAGE PLUGS	2
3	B " "	" "	4
5	A " "	" "	6
7	B GARAGE LIGHTS	" "	8
9	A " "	" "	10
11	B " "	" "	12
13	A " "	ELECTRIC RM. LIGHT & PLUG	14
15	B LANDSCAPE LIGHTS	TELEPHONE BOARD PLUGS	16
17	A " "	FIRE ALARM	18
19	B PARKING AREA STREET LIGHT	CARPORT LIGHTS	20
21	A " "	" "	22



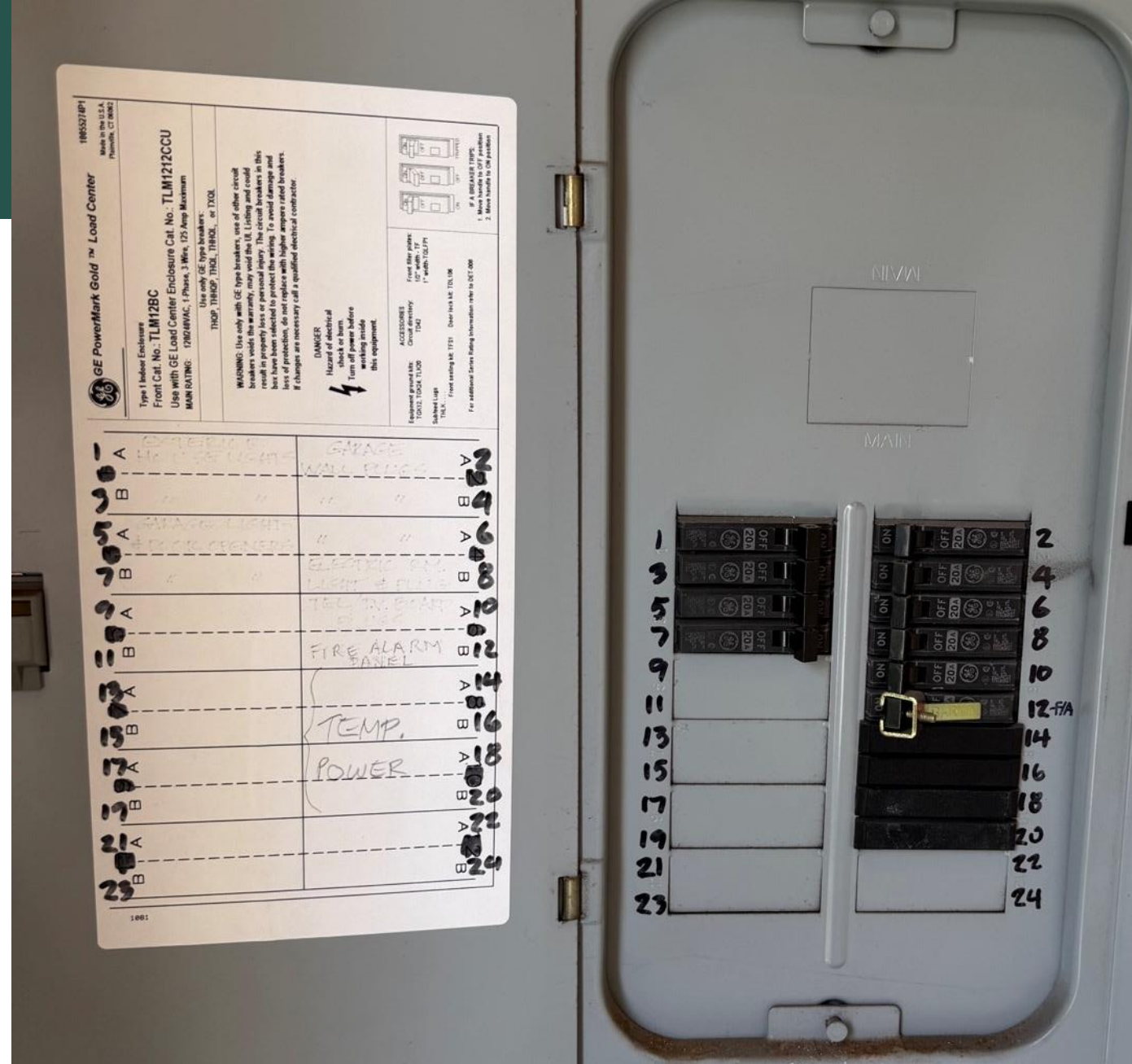
- 7 x Garage receptacle circuits
- 4 x Garage Light & door opener circuits





700D House Panel

- 700D is a building with 4 Type 3 units.
- The adjacent unit is 700C
- The 'C' and 'D' are assumed to refer to the Building Type mentioned in the drawing BLDG-CD.pdf, page 8.
- 700D has a 600A feeder where all other buildings are 800A.





700D Main Breaker

- Labeled 600A





700C Main Breaker

- Labeled 800A





Dryers

Each unit has a 240V 30A receptacle outlet for electrical dryers

Some units use electric, others (majority?) gas



Site Pictures



Compressor Noise Concern in alley

- Buildings face one another; potential compressor noise is a concern





- Multi-level condos with garages. Some are double garages.





Example Balcony – not a lot of space for a compressor





Utility Transformer markings

(CoPilot answers to best guess of transformer size)

- “1600” is most commonly a kVA rating for pad-mount or pole-mount distribution transformers. Utilities routinely use 500, 750, 1000, 1500, 2000 kVA, etc. A 1600 kVA unit is a standard size for three-phase pad-mount distribution transformers. (This is consistent with typical utility transformer nameplate conventions.
- “AB 97J304342” looks like a manufacturer serial number. Serial formats vary by manufacturer (ABB, Cooper, GE, etc.).
- “027288” is likely an internal utility asset tag, not a model number.
- PCE EV Ready Report for Ventana Del Mar reports there are **four** of these on-site providing a total of 6400 kVA.





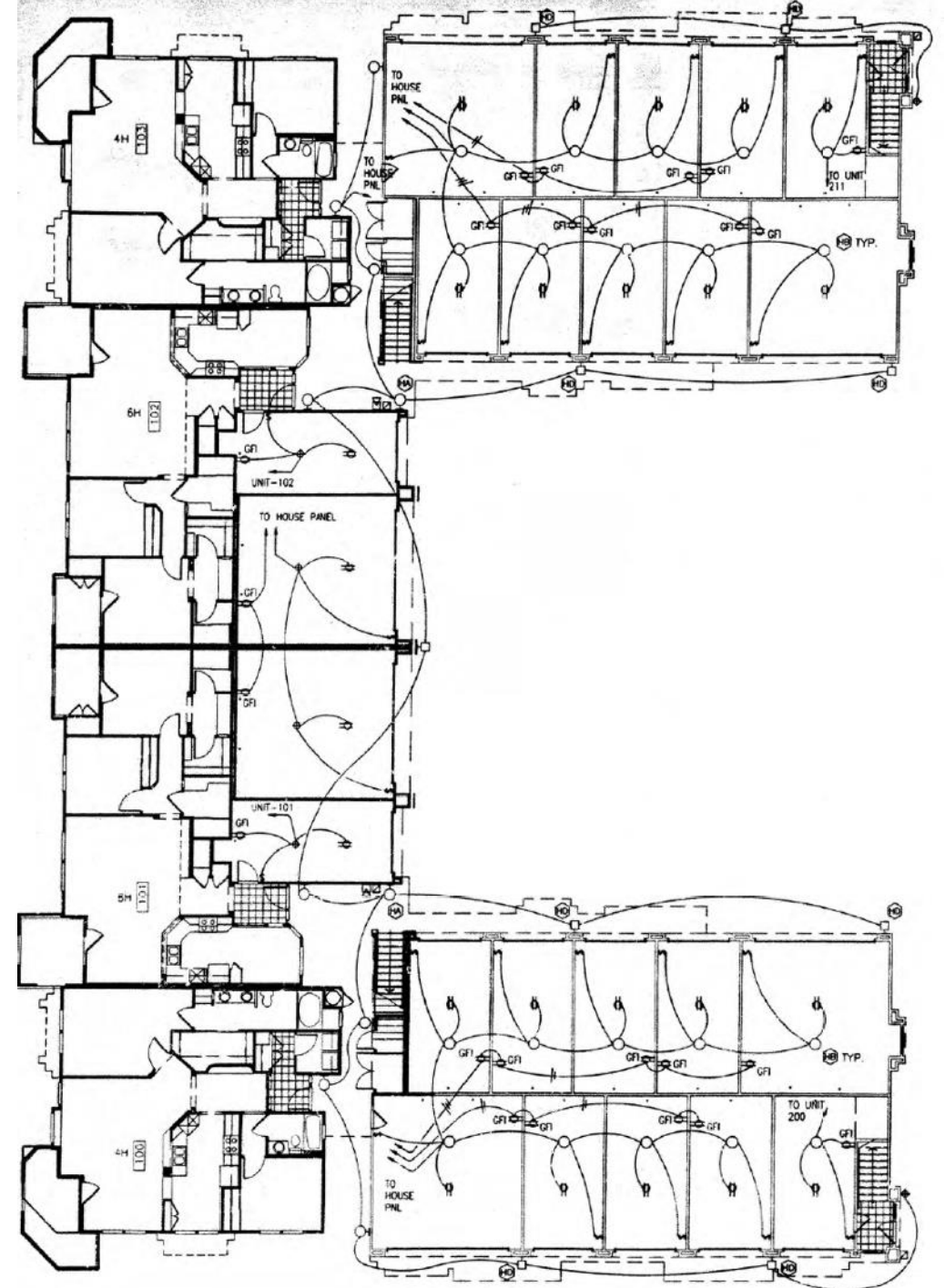
EV Charging

Suggestions for EV Charging solutions
and
Documenting the existing garage wiring.



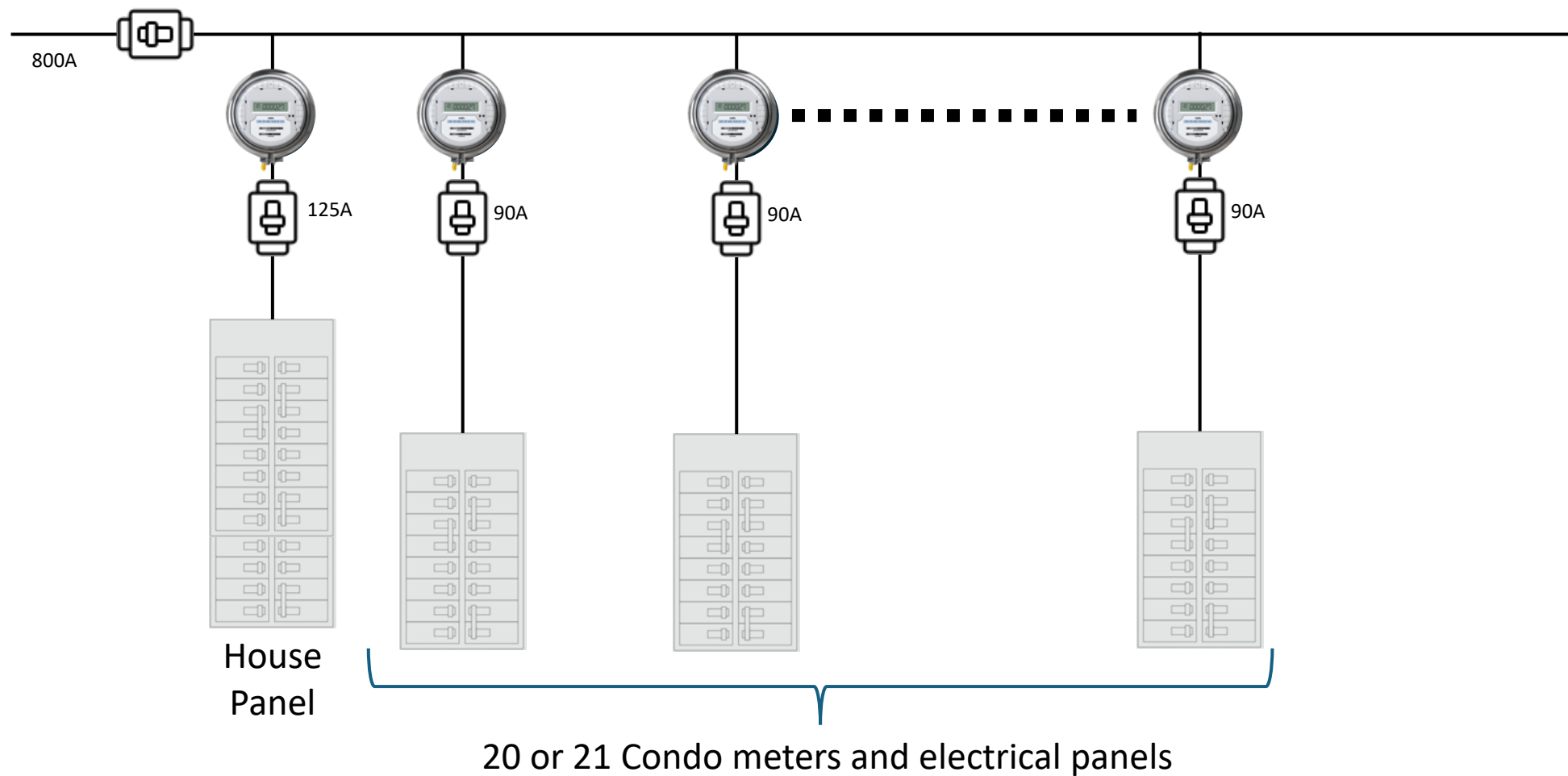
Building A & B Ground Floor

- 2 blocks of 10 garages
- 4 between
- 24 garages total
- 3-4 Extra garages per building
 - Building A: 20 Units
 - Building B: 21 Units
- 4 powered from condo
- 20 powered from house panel



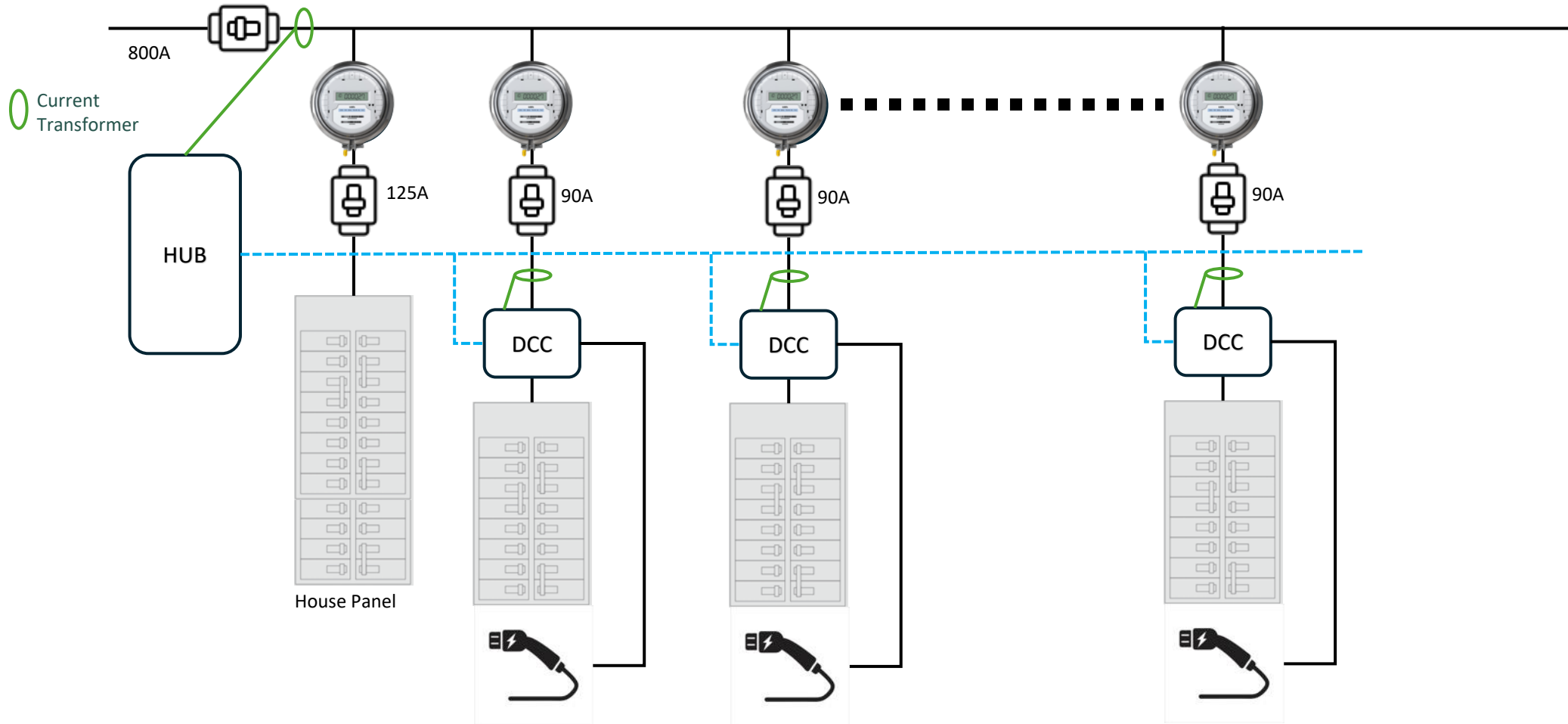


Existing Electrical - Simplified Diagram



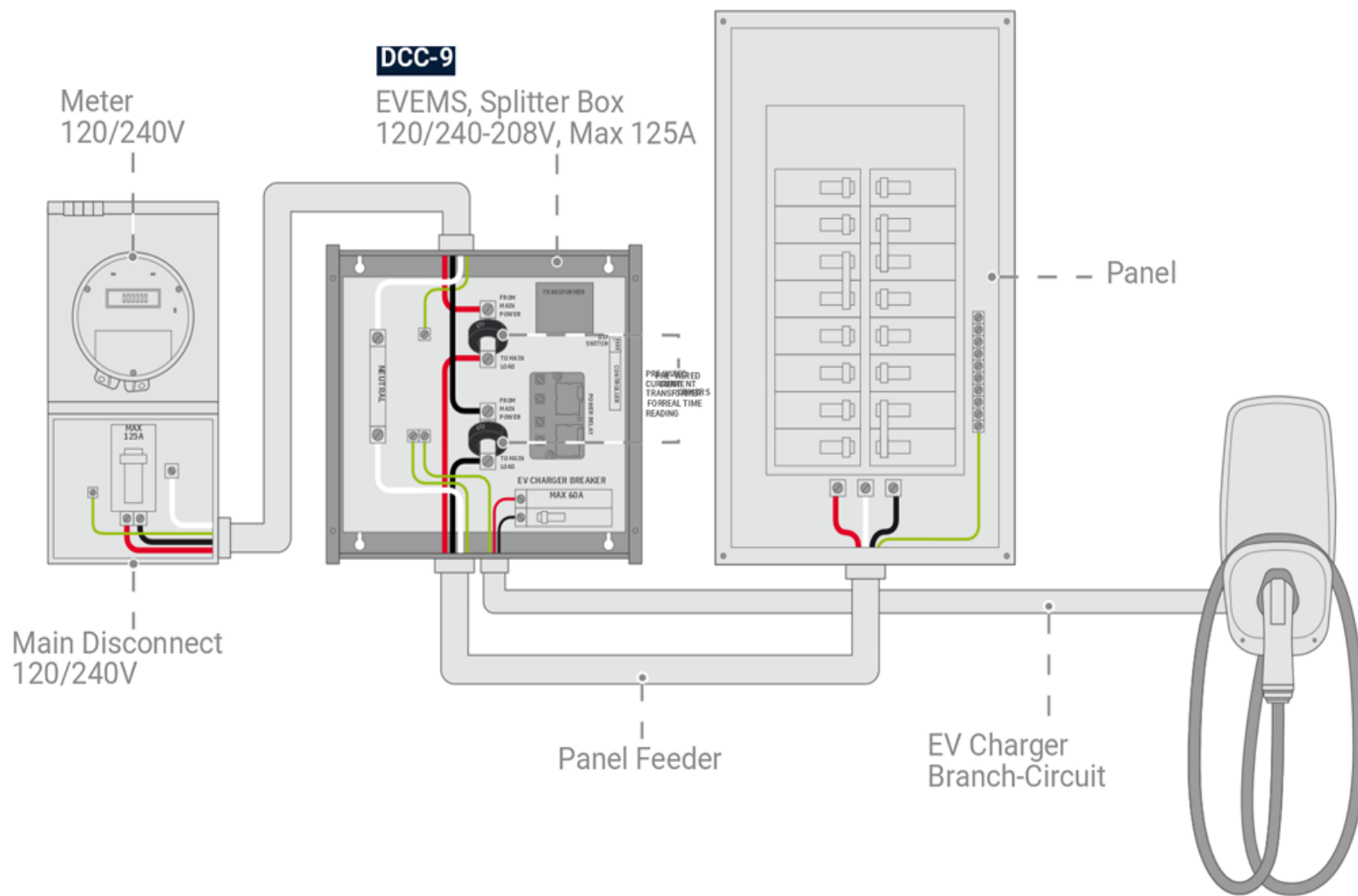


With EV Tied to each Unit's Panel



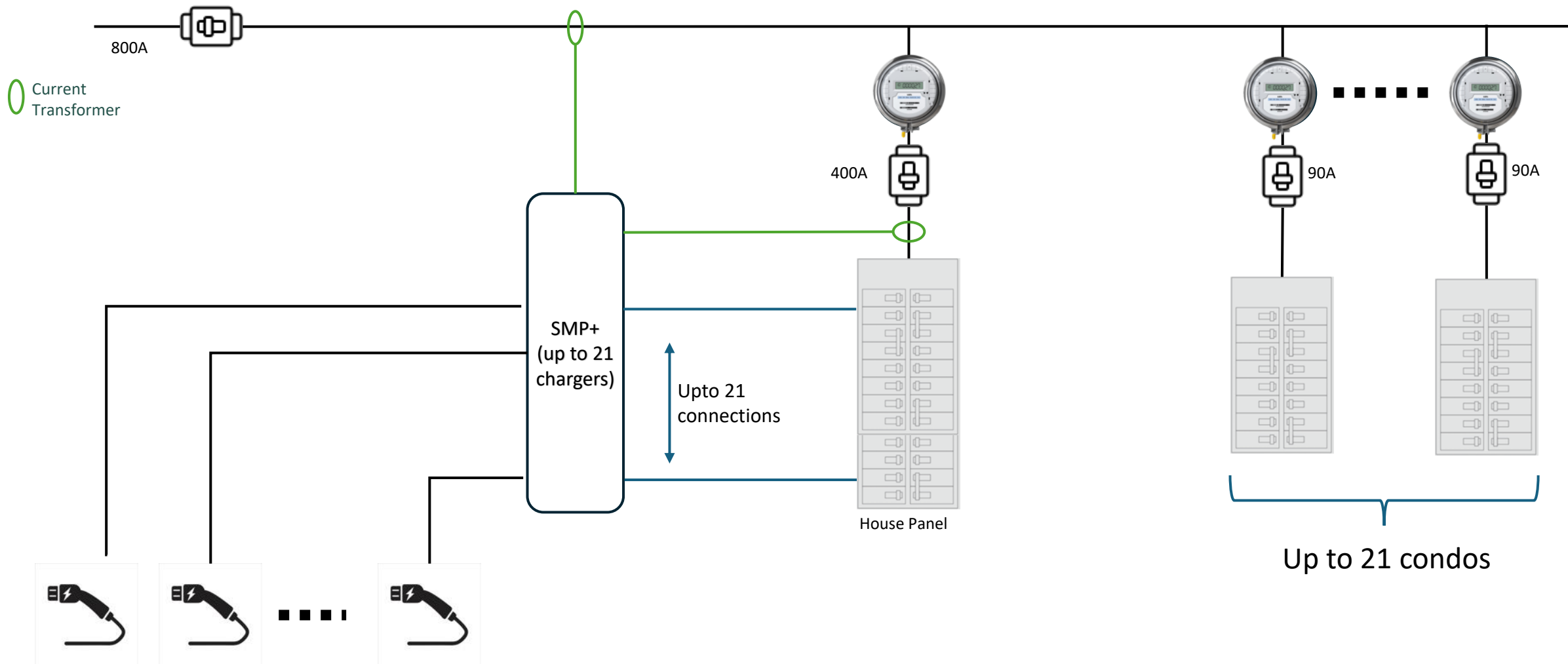


DCC Installation – Will they fit?





With One Box Tied to House Panel





Options for Garages currently wired to Condo's Panel

1

On their own

- Run larger wire from their panel for EV charger
- Recommend a Power Managaged Charger to avoid breaker trips
 - Emporia Charger Pro (\$600)
 - Wallbox Pulsar Plus with Power Meter (\$1000)
 - Tesla Wall Connector with Dynamic Power Management (\$800)



2

Include in program

- Include with the garage EV upgrade program



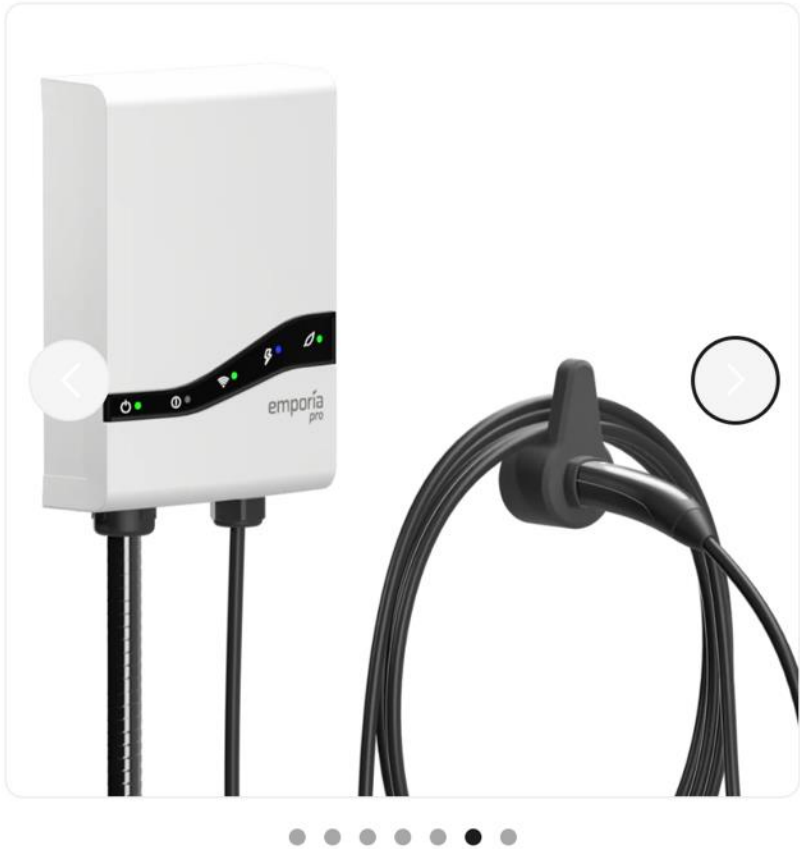
Requires Wifi for the charger

emporia

Login

\$0.00⁰

[EV Chargers](#) [Energy Monitors](#) [Smart Plugs](#) [Accessories and CT Sensors](#) [Bundle and Save](#) [Back to Emporia.com](#)



Emporia Pro Level 2 EV Charger

\$599.00

Benefits

Best For

Bonuses

Fast Charging Without Upgrades: Overcome limited electrical capacity and charge at the maximum speed possible, **without upgrading your panel**, thanks to Emporia's PowerSmart technology that works with your existing electrical panel to automatically balance load.

Fully Automated Charging: Schedule and automate charging times to avoid high utility prices.

Award-Winning Performance: Named a "Top Home EV Charger of 2025" for unmatched design, power, reliability, and price.

Fast, Reliable, and Safe Charging: Up to 48 amps of power for swift, consistent Level 2 charging across all EV models. UL certified and GFCI-protected.

NACS/Tesla and J1772 Options: Compatible with all EVs - just choose your car's connector style



Garage Receptacles (sockets) on house panel

How to prevent being used for EV Charging

- Label as not for EV charging
- Switch to 15A breaker to cause more nuisance trips
- Remove altogether





Alternative EV Solutions

- AmpWay Multifamily

- No upfront cost - They handle all the installation.
- Connects to the House Panel
- They **add 10c/kWh as a fee**. Also have profit sharing options.
- Dynamic load management – zero on load calcs
- Designed to scale over time as more residents move to EVs

- Ampway handles operations, software, support, billing
- EVSEs designed for shared garages. Up to 11.5kW, QR and remote activation with mobile app. [Spec Sheet](#).



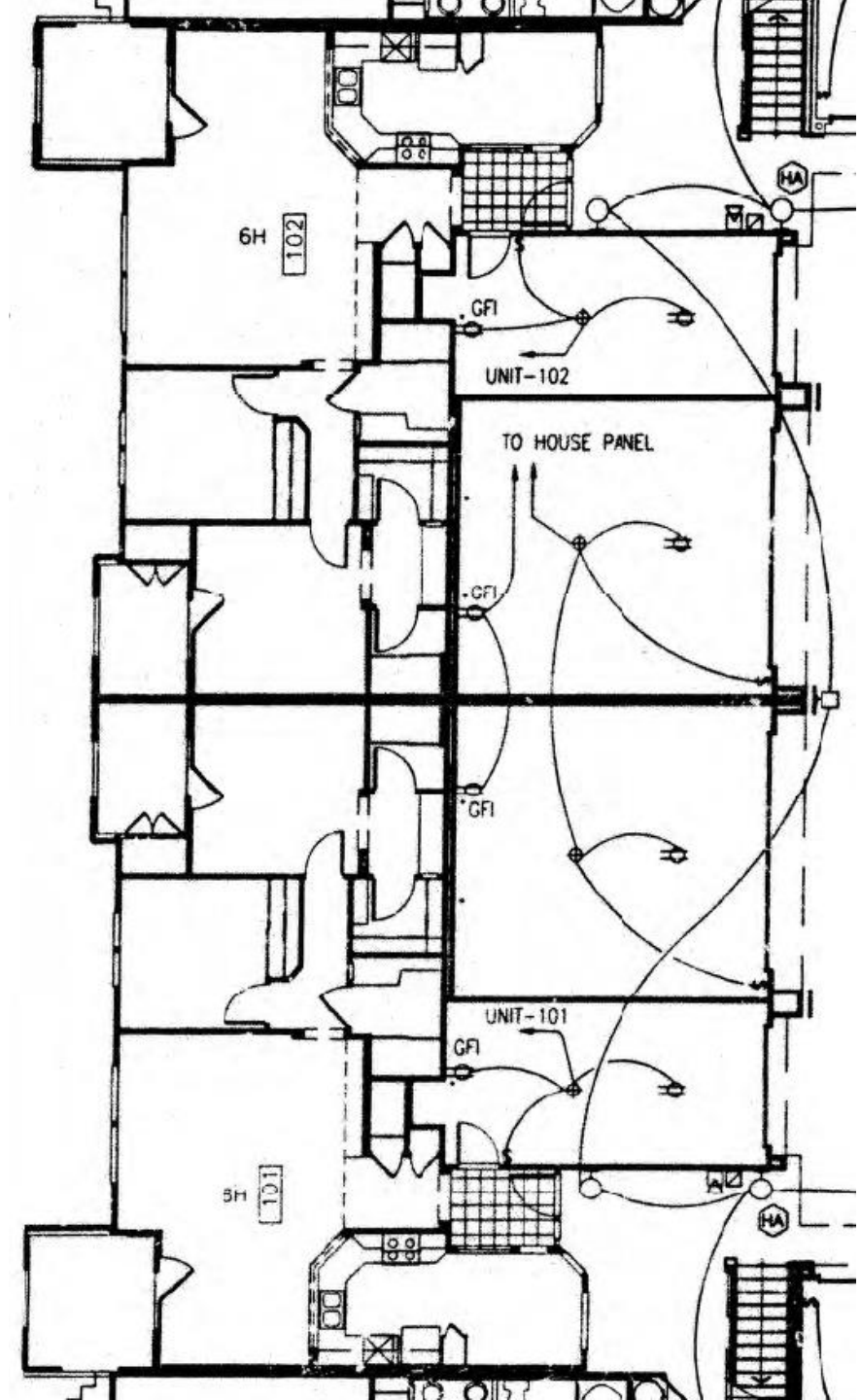
Alternative EV Solutions

- [EVMatch Multifamily](#) - **managed, shared EV charging** for apartments, condos, and townhomes.
 - Networked Level 2 charging
 - Mobile app provides reservation-based access to avoid conflicts
 - Tools for property managers to monitor usage and offset utility costs
 - Ability to open chargers to the public to improve utilization and revenue
- [ampUp Multifamily](#)
 - Shared EV charger infrastructure
 - Install the EV charging infrastructure including trenching.
 - Includes load management to avoid service upgrade
 - Reservation system, idling fees.
- [Pando Electric](#)
 - San Jose company
 - Install box with NEMA socket. Scan QR code, plug in personal charging cable, start charging.
 - They track energy used by each driver, bill driver, **take 10% of the revenue**
 - **Subscription \$20/month/charger or 9c/kWh**
 - No mention of load management but do mention doing load calcs.
- [EverCharge](#)
 - Smart power allocation to cars
 - “fully-managed, turnkey solution that will maximize the number of cars that can charge at once on your existing electrical infrastructure”



4 Garage Block

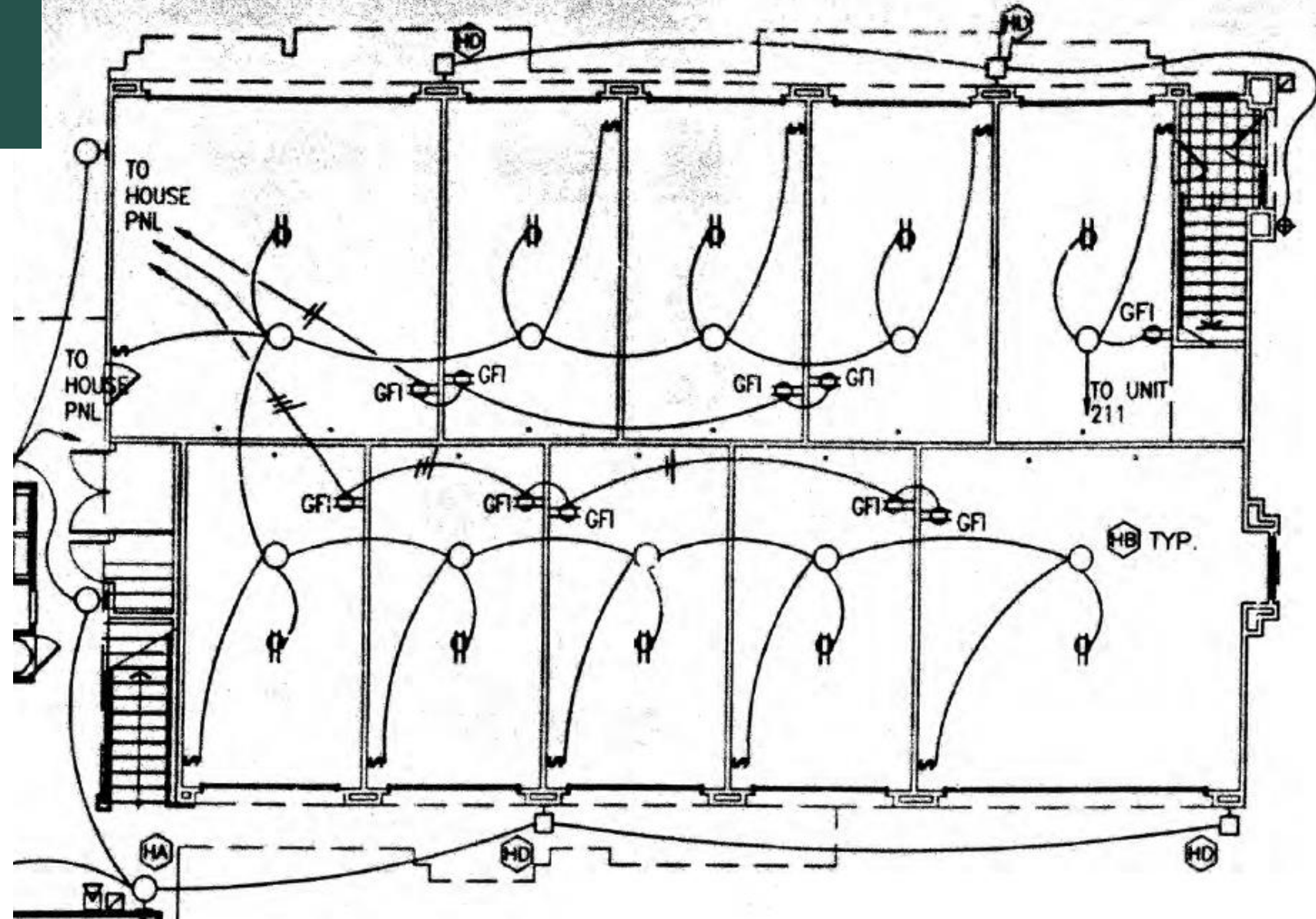
- End garages powered from a Plan 6H's panel
- Remaining 2 from House Panel.





Garage block power routing

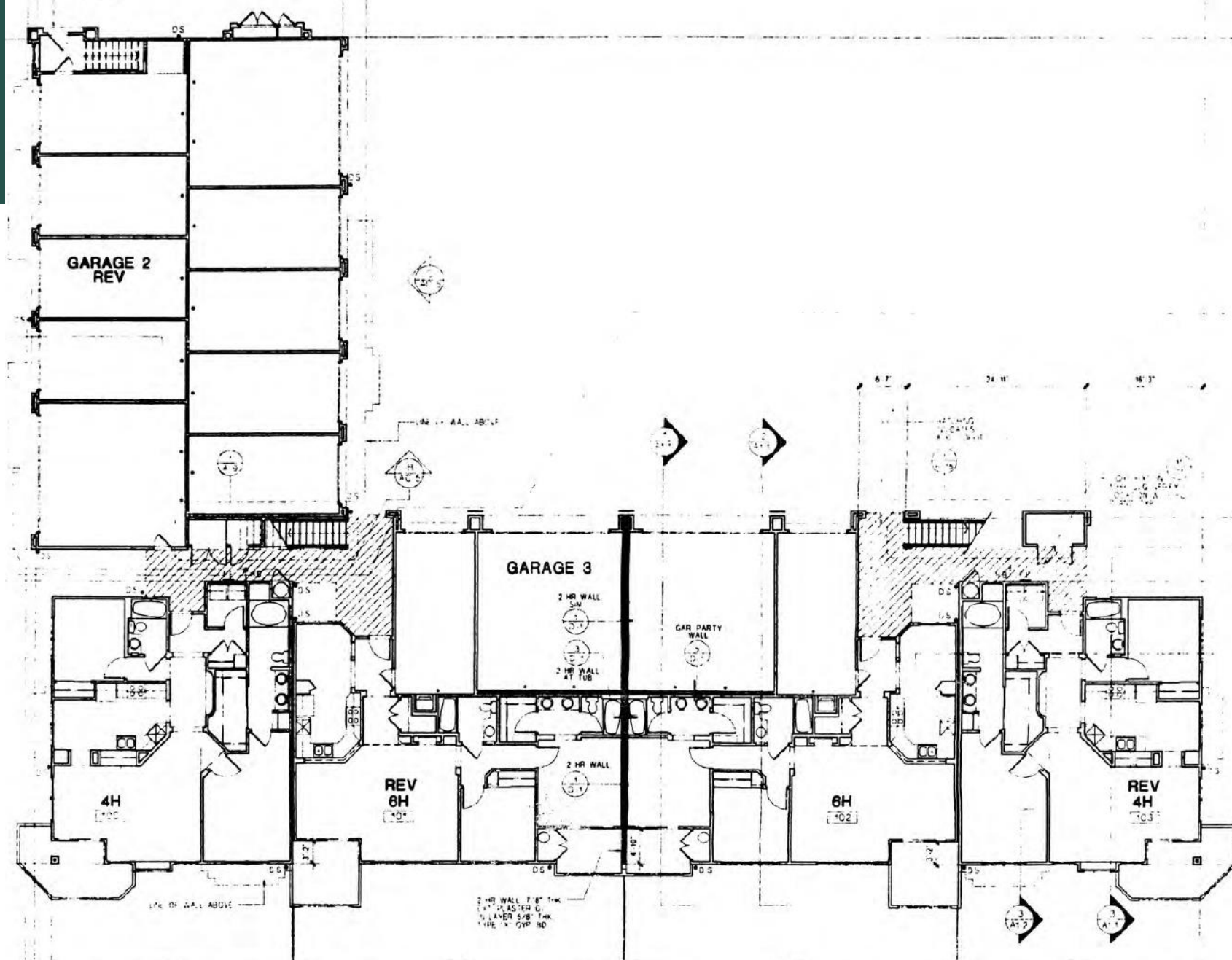
- Block of 10 garages
- 2 powered from Plan 3A's panel, rest from house panel.





Building C

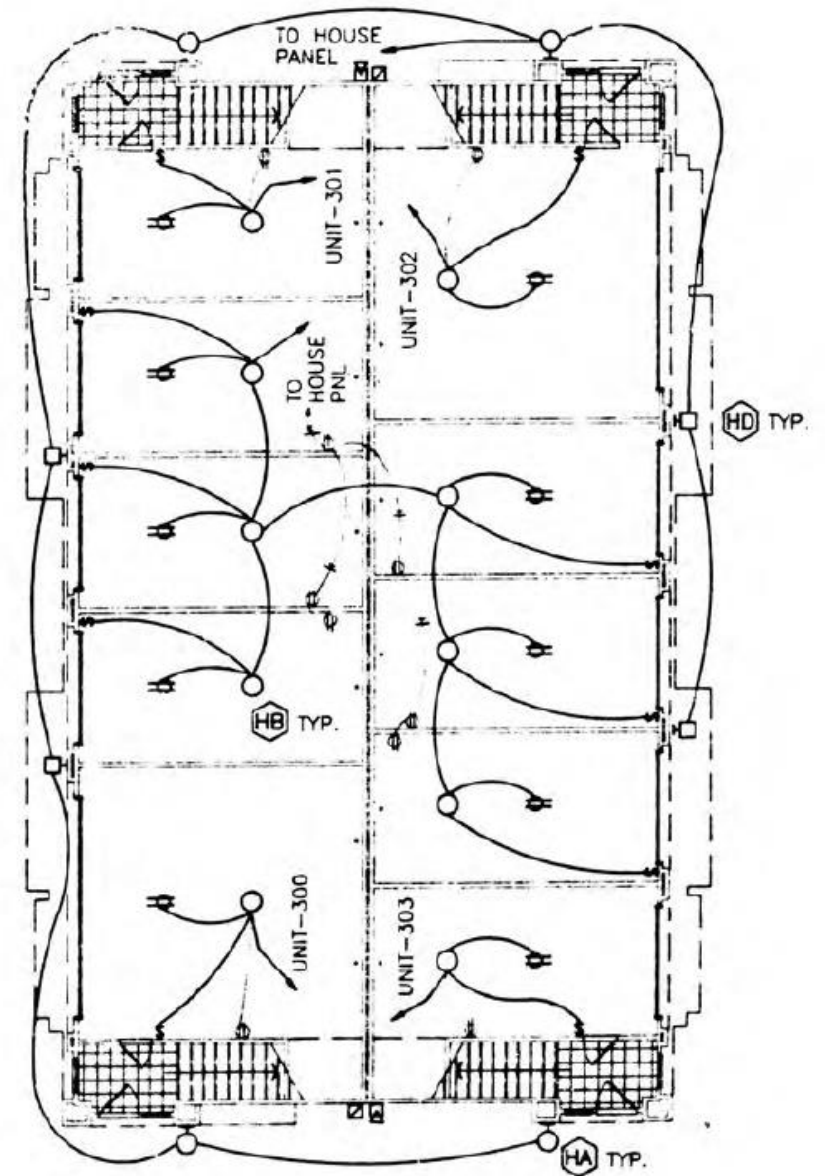
- Like Buildings A & B but missing a block
- 14 Garages total
- “Missing” block is in Building D (next slide)





Building D garage

- Below 4 Plan 3A units.
- 2 of the 3A units have double garages.
- All 4 plan 3A units power their own garage.
- Remaining 6 garages powered from House Panel
- Ref: P98 of MISC-MECH-PLUMB-ELECT-COMPONENTS-FOR-A-B-C-D.pdf



BUILDING "D" FIRST FLOOR PLAN

TYPICAL SCALE: 1/8" =



Notes

- Units that connect directly to the garage can have their own EV charger.
- If it is a dedicated circuit, then can convert to 240V but still limited to 16A draw. This does mean there is no 120V in the garage other than in the ceiling for the garage opener.
- NEC 220.57 "The EVSE load shall be calculated at either 7200 watts (volt-amperes) or the nameplate rating of the equipment, whichever is larger." This minimum was removed in the 2026 code version but that may not be adopted in CA for 3 years.
- Use Dynamic Load Management. 2023 NEC 750.30. For example Emporia EV Charger Pro that monitors the load on the panel and scales back if close to the limit. Tesla and Wallbox have similar products



NEMA 6-20

- 240V 16A continuous on a 20A breaker
- No Neutral so no 120V option
- Suitable charger (\$120)
[Amazon.com: EVDANCE Level 1&2 EV Charger, Electric Vehicle Portable Charger with 25FT Cable, Home EV Charging Station for J1772 Electric Cars, 12A 120V/16A 240V, NEMA 5-15 & NEMA 6-20 Plug : Automotive](#)





Orange Charger - Reliable & Affordable EV Charging Solution

- “Smart Socket”
- No power management
- Requires dedicated 20A circuit & Cell connection for billing
- \$12,500 for 20 chargers -> \$625 each
- No Maintenance contracts
- Usage based fee
- Users download app, enter credit card information, billed monthly, property gets cut.



Level 1 Outlet

Most scalable



Level 2 Outlet

Best power to cost



RVE's DCC Load Handling

- Per Code, cannot allow more than 80% of the panel breaker
 - That's 80% of 90A = 72A
 - (80% rules not in 2023 NEC but is in 2026 NEC)
- DCC configured for 90A panels allows either 30A or 40A EV charger breakers
 - Code's 80% rules makes that 24A or 32A actual charging
- Cannot charge if the unit is pulling much. How much?
 - 72A is the cut off
 - With 32A charging, leaves 40A for the unit to pull
 - The maximum of any of the 33 units is 33A
 - This is peak, average much less, thus not a problem



RVE's DCC vs SMP Option Comparisons

Item	DCC	SMP
Each garage needs rewiring to support EV charging	✓	✓
Every Garage can get a charger (0-2 garages/unit) vs only one charger per unit	✗	✓
Energy use included in unit's PG&E bill, no need to bill owners for electrical use	✓	✗
No House Panel upgrade	✓	✗
Will fit in the electrical room	✗	✓



Hot Water

This section documents the existing hot water (complementing existing documentation from the HOA which is in some aspects more comprehensive).

The second half of the section identifies candidate HPWHs that fit in the tight closet space.



Water Heater Closet Configuration

Three Configurations

1. Approx 24" square closet on public walkway or balcony (many face entry to unit or very public walkways).
2. Approx ~2' x ~4 on private balcony
3. Internal to unit, on upper floor with laundry, ~3'x2' area within a laundry closet that is about ~9' long***



Config #1

- Plans 1, 3, 3A, 4, 5, 8
- Really tightly packed
- Some have electrical close by. Many don't.
- 48 gal, 55,000Btu/hr for units shown





Config #2

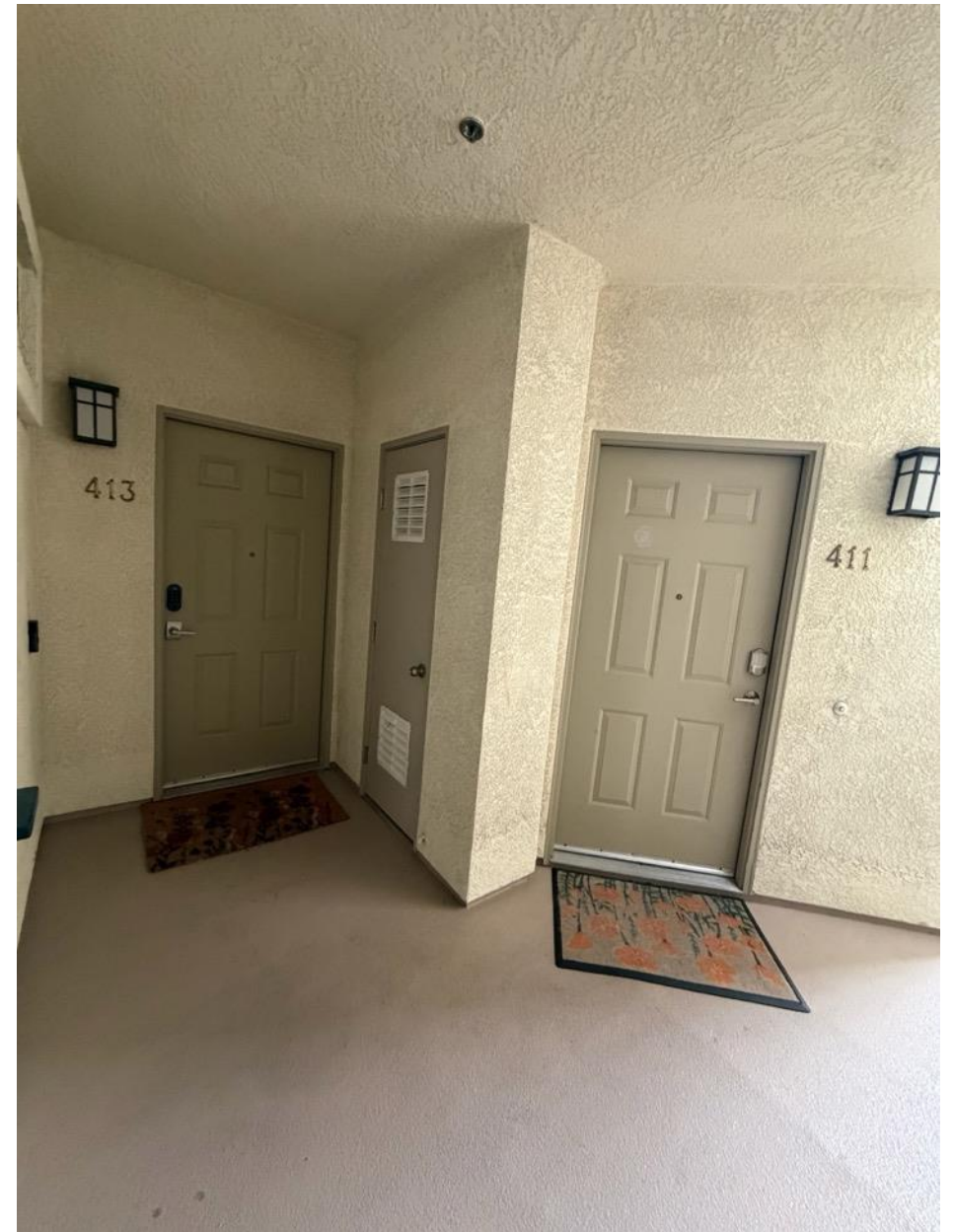
- Plan 8
- On balcony
- ~30" wide x ~36" deep
- Door is ~23-24"
- Flues for other gas heaters in back





Water Heater Closet

- Plan 2
- One example
- Water Heater closet for 413 which is a plan 2 next to a plan 3 unit.





Config #3

- Plan 7
- Internal to unit, on upper floor with laundry, ~3'x2' area within a laundry closet that is about ~9' long. 6' high.





Existing Water Heating Venting



- 4" diameter gas water heater vent. Surrounded by 5" rigid aluminum shield.
- Heater vent goes straight up to roof. The other 4" flexible pipe going at an angle to the roof is the vent for the master bath
- Dryer vent is like the water heater vent. It is shielded and goes vertically up to roof.
- Both too small to be used for Heat Pump Water Heater venting



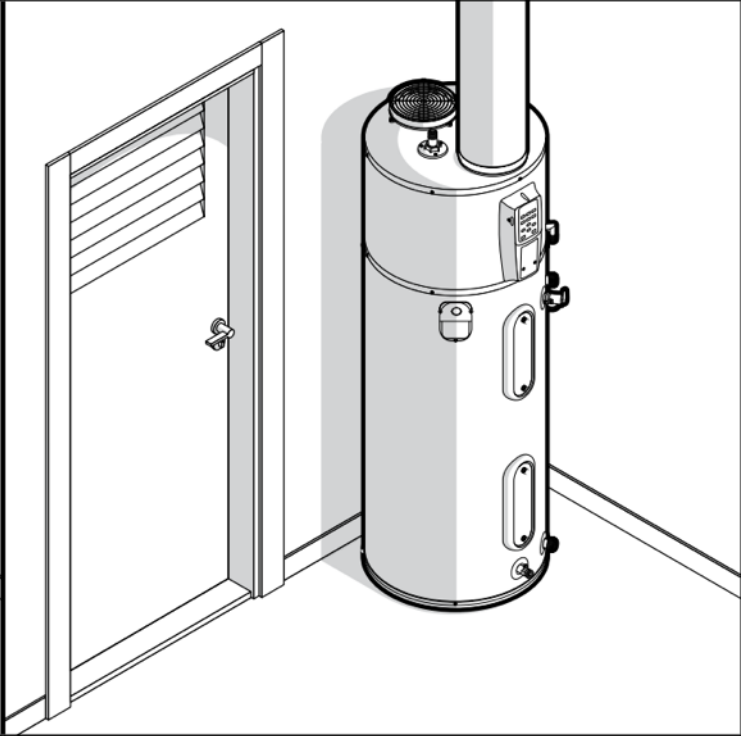
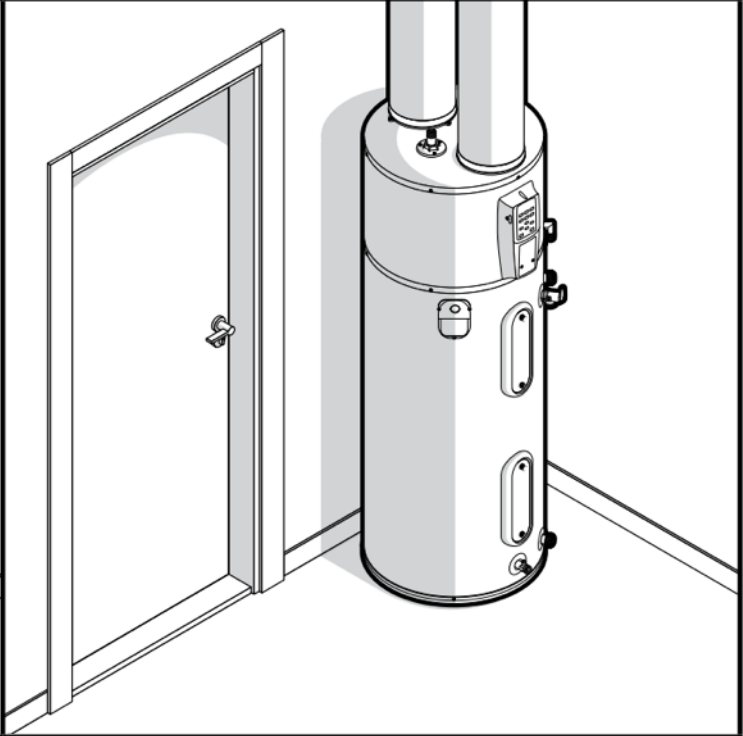
Rheem Ventilation Recommendations

1. Install a fully louvered door or a door with upper and lower louver panels. No dimensions for louvered area or net free area (NFA) are given.
2. Undercut the door to provide an 18 in² air gap, install a louver panel in the upper portion of the door at the same height as HPWH exhaust, place HPWH within one foot of louver panel, and direct the exhaust (at a 45° angle or less) at the panel.
3. Undercut the door to have a minimum 18 in² air gap, and duct the intake or exhaust from or to another space.
4. Duct both the intake and exhaust from and to another space.



AO Smith Ventilation Guidance

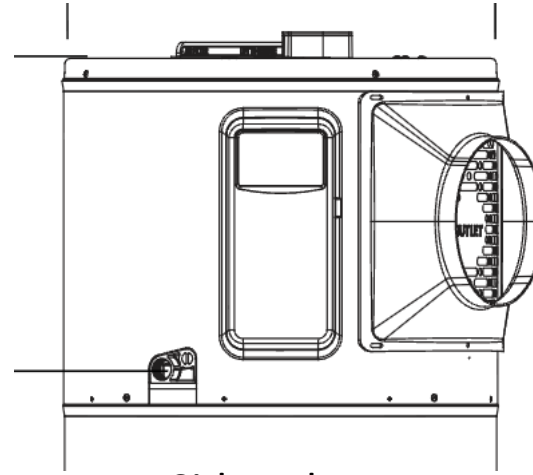
- For no minimum space requirement...
 - (in other words, very small closets)
- Either of the two options shown
- 18 in² (3/4") required for undercut door
- Or 130 in² louver

	
Inlet OR Outlet Ducting and a Single Louver OR Undercut Door ^{1,3,4,5}	Inlet AND Outlet Ducting ⁵
No minimum space requirement	No minimum space requirement

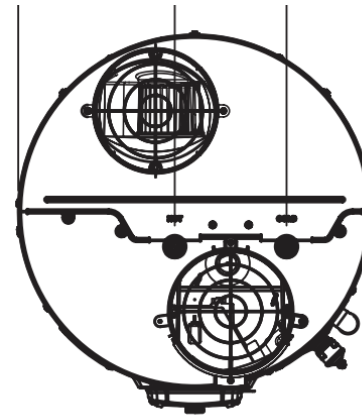


Ventilation

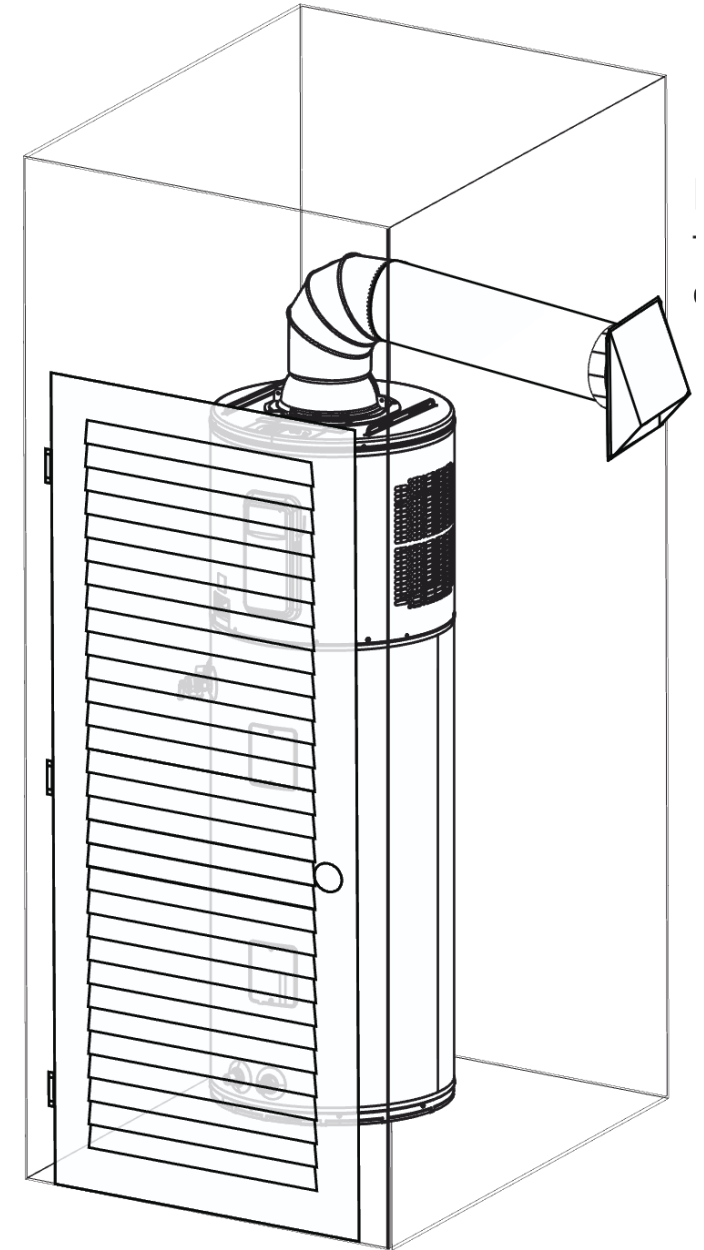
- **Caveate:** Side exhaust required to do exhaust through door
- Only Rheem has this
- Ecological also has side exhaust
- AO Smith, Bradford White: both air vents on top – would require ducting



Side exhaust,
top intake



top exhaust,
top intake





AO Smith Vortex

- 22" diameter
- 50 Gallon Hybrid
- 120V Shared circuit
- Two 900W resistive elements
- 450W 4300Btu/hr compressor
- "Zero clearance required on sides and back to fit in tighter spaces"
- <https://assets.hotwater.com/damroot/Original/10008/ARXSS00123.pdf>





Bradford White AeroTherm Series G2

- **240V, 25A** breaker
- 365W compressor
- 4000W upper and lower backup resistive heating
- **22"** diameter
- Zero side or rear clearance
- https://fortheupro.bradfordwhite.com/our-products/usa-residential-heat-pump/aerotherm-series-g2/?_gl=1*1wo7wmg*_gcl_au*NjUzOTU1OTE5LjE3ODAwMTk5NzE.*_ga*MTQ4NDU0NTU5My4xNzgwMDE5OTcx*_ga_T9DHK449DL*cZ_E3ODAzNzY4ODEkbzlkZzAkDE3ODAzNzY4ODQkajU3JGwwJGg

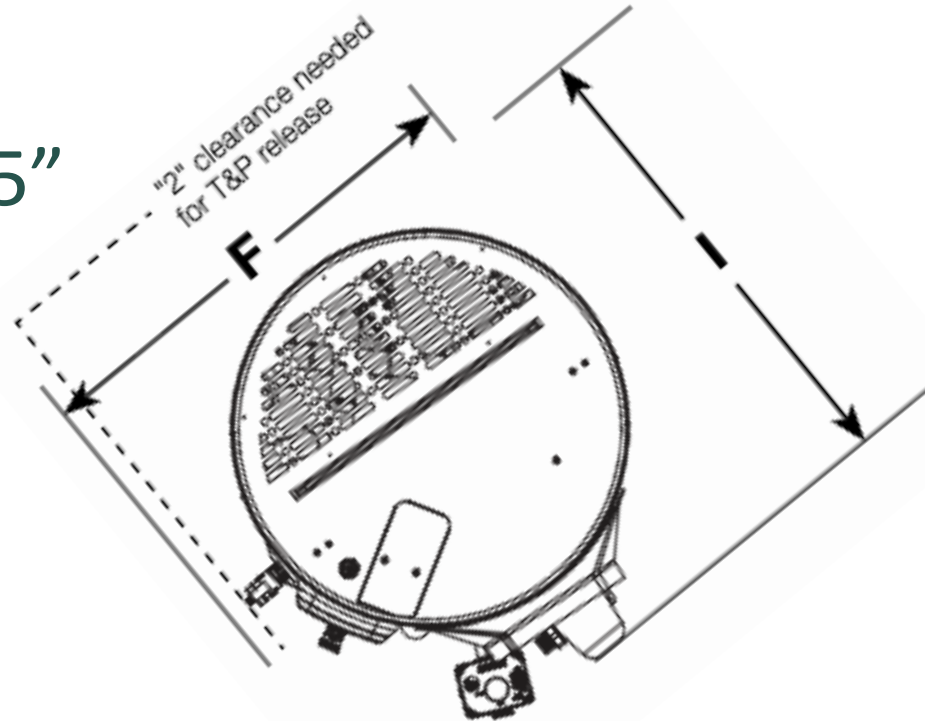




Rheem - Professional Prestige Plug-in Heat Pump Water Heater with HydroBoost and LeakGuard

- <https://www.rheem.com/product/rheem-professional-prestige-plug-in-heat-pump-water-heater-with-hydroboost-and-leakguard-proph65-t0-rh120-mso/>

- 50 Gallon HPWP
- **22.5" wide** but F,I are 25"
- May fit if rotated?
- 440W, 4200Btu
- Built in mixing valve

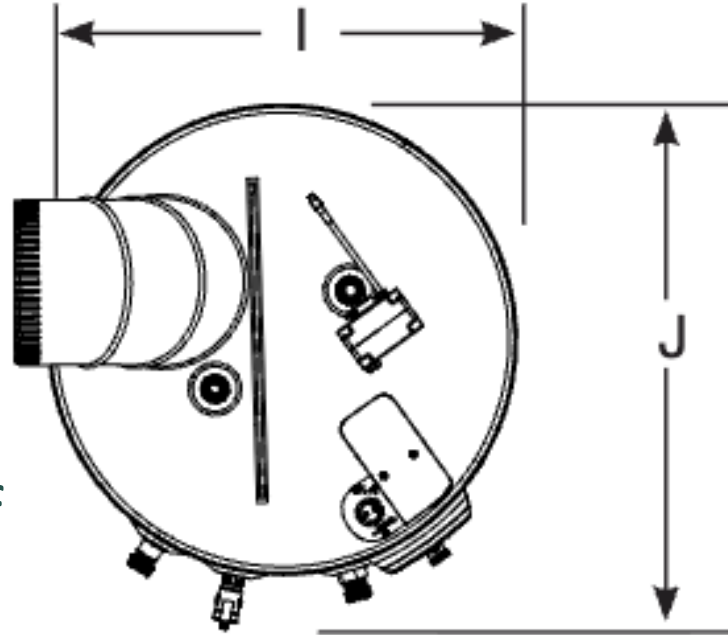




Rheem - Professional Prestige ProTerra Hybrid Electric Heat Pump with LeakGuard and Top Water Connections

- **240V, 30A/15A** breaker
- 440W, 4200Btu/h HP
- 4500W or 2250W backup resistive heating
- Dimensions
 - **I = 22.25"**
 - **J = 25.6" +2"** for pressure relief valve

• <https://www.rheem.com/product/rheem-professional-prestige-proterra-hybrid-electric-heat-pump-with-leakguard-and-top-water-connections-proph50-t2-rh400-so/>





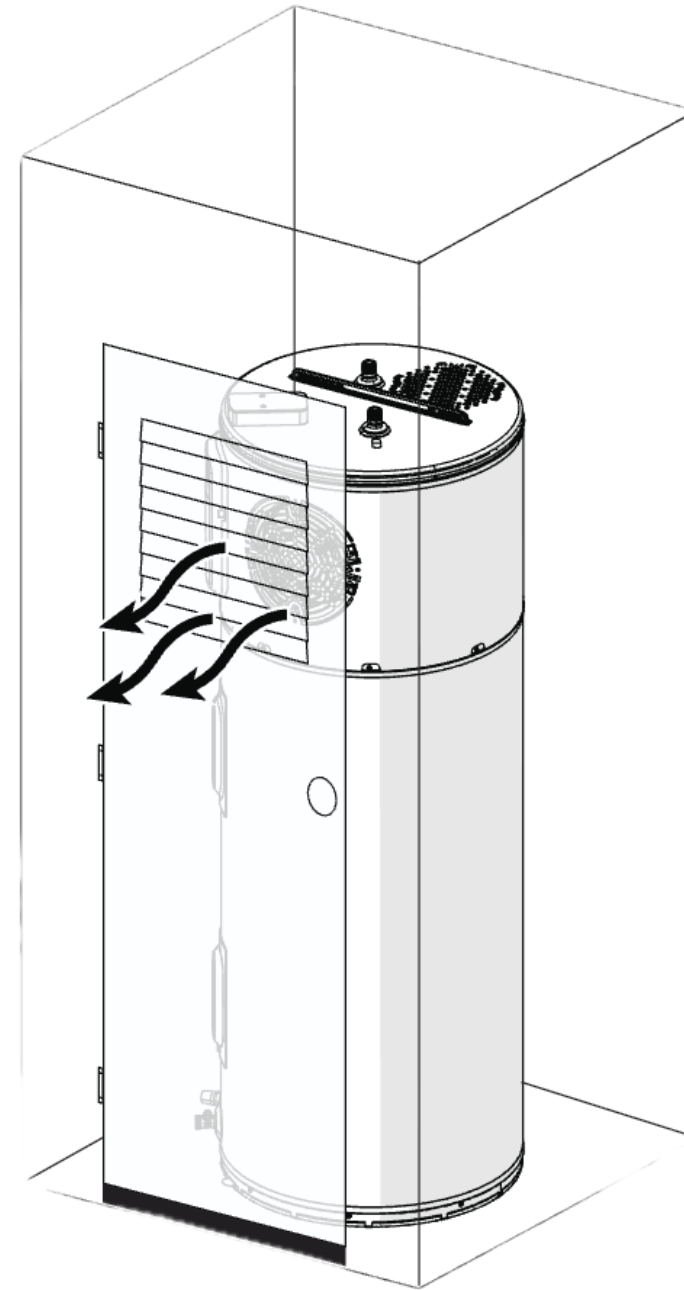
Ventilation Required

Existing gas flue too long and too narrow....



Ventilation

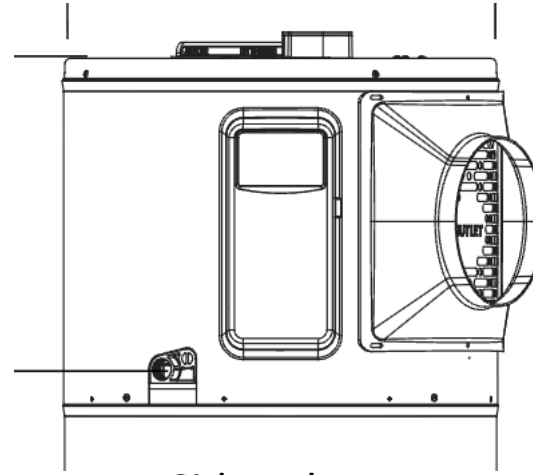
- Cold air exhausted through louvered door
- Diagram shows $\frac{3}{4}$ " gap at bottom of door – vermin risk
- Instead use full louvered door
- [Report: The Incredible Shrinking Room](#)
- HOA disallows penetrations for ducting



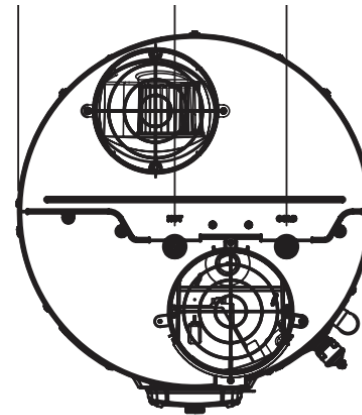


Ventilation

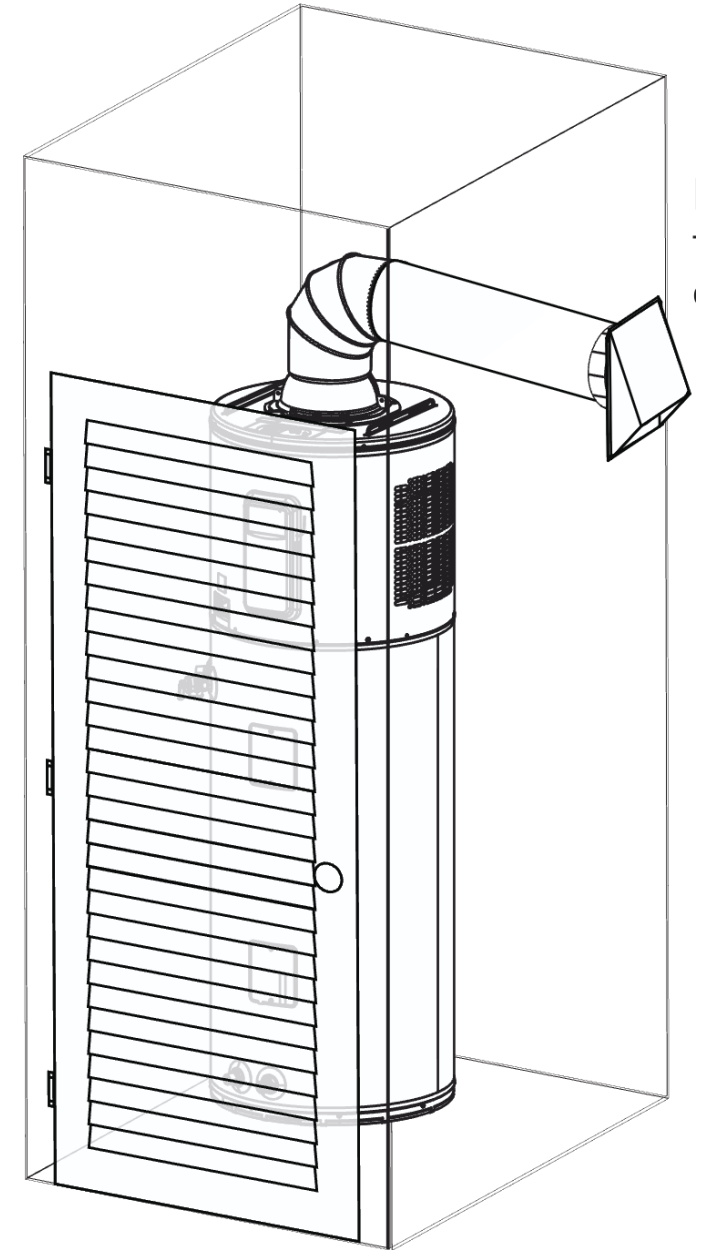
- **Caveate:** Side exhaust required to do exhaust through door
- Only Rheem has this
- Ecological also has side exhaust
- AO Smith, Bradford White: both air vents on top – would require ducting



Side exhaust,
top intake



top exhaust,
top intake





Heat Pump Water Heaters in Small Spaces Lab Testing

<https://neea.org/wp-content/uploads/2025/03/Heat-Pump-Water-Heaters-in-Small-Spaces-Lab-Testing.pdf>

	COP	Draw Pattern	Room Volume ft3	Ventilation Regime	NFA in2	Total min	Runtime		Average Air Temperature			
							ER min	HP min	Intake °F	Exhaust °F	Room °F	Exterior °F
Duct-LgMakeup-Full	3.30	Medium	83.5	Forced	180	454	0	442	68.0	38.2	69.1	68.1
Duct-SmMakeup-Full	3.26	Medium	83.5	Forced	68	462	0	442	67.4	37.7	69.4	68.2
Grilles-Both	3.17	Medium	83.5	Free	259	472	0	460	57.2	41.1	57.8	66.5
Shelf	3.12	Medium	83.5	Forced	33	480	0	468	56.6	37.9	57.6	68.7
Louvers-Full	3.06	Medium	83.5	Free	286	487	0	473	53.7	39.3	55.2	65.5
DirectedExhaust	2.98	Medium	83.5	Forced	188	497	0	484	49.5	37.0	54.9	67.7
Louvers-Half	2.62	Medium	83.5	Free	143	488	13	453	51.9	38.3	56.8	67.7
Doorstop	2.47	Medium	83.5	Free	115	497	15	476	49.0	37.0	55.4	67.0
VentCaps-HighNFA	2.18	Medium	83.5	Free	33	507	23	476	46.3	33.7	52.9	67.9
Duct-LgMakeup-Half	2.11	Medium	83.5	Forced	180	434	37	376	67.5	37.6	68.8	67.7
Closed-Med-84	1.53	Medium	83.5	Closed	0	547	67	372	43.0	37.4	52.5	67.1
Grille-Upper	1.48	Medium	83.5	Free	130	415	80	309	45.1	36.3	56.9	67.8
Grille-Lower	1.48	Medium	83.5	Free	130	411	77	306	44.6	37.5	58.1	68.4
VentCaps-LowNFA	1.38	Medium	83.5	Free	22	410	89	357	43.1	36.0	56.6	67.8
Closed-High-84	1.24	High	83.5	Closed	0	530	172	348	43.8	37.6	53.3	66.7
DownElbow	1.12	Medium	83.5	Closed	0	336	128	250	56.7	44.5	64.0	67.8



Observations from the table

- Highlighted rows are ones deemed to have acceptable efficiency
- NFA: Net Free Area, size of all the openings
- ER: Time the electric resistance was on during the test. This should be avoided and the half louvers do not give enough ventilation
- HP: Time the heat pump was on during the test
- Best COP was 3.69 in an open room with unlimited supply of air at room temperature (filtered from this table view but in main report)
- These room sizes are almost 2x the volume of the closet but provide a good guidance.



Venting Efficiencies

	COP	Ventilation Regime	Runtime			
			NFA in ₂	Total min	ER min	HP min
Duct-LgMakeup-Full	3.30	Forced	180	454	0	442
Duct-SmMakeup-Full	3.26	Forced	68	462	0	442
Grilles-Both	3.17	Free	259	472	0	460
Shelf	3.12	Forced	33	480	0	468
Louvers-Full	3.06	Free	286	487	0	473
DirectedExhaust	2.98	Forced	188	497	0	484
Louvers-Half	2.62	Free	143	488	13	453

Summary.

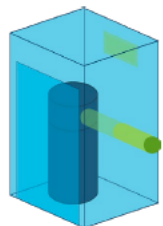
Ducting is the best. A lot of makeup air helps but not significantly.

After ducting, which isn't permitted, two grills is the next best performer.

"Shelf" separates intake and exhaust air, remarkably good results in small air exchange.

RECOMMEND:
Combination of directed and full louvered.
Alternatively, convert existing louvers into grills.
Should achieve COP of "Grilles-Both".

Duct-LgMakeup-Full



Forced Convection

Makeup Intake:

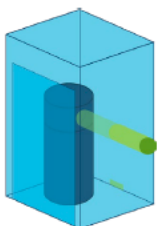
Upper wall grille (130 in² NFA)

Exhaust Path:

Unrestricted duct

Simulates a best-case exhaust ducting scenario: duct run is short, straight, and smooth; large opening for makeup air

Duct-SmMakeup-Full



Forced Convection

Makeup Intake:

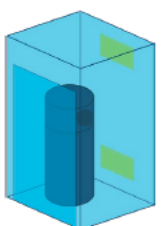
Floor slot (18 in² NFA)

Exhaust Path:

Unrestricted duct

Simulates a favorable exhaust ducting scenario: duct run is short, straight, and smooth, though opening for makeup air is small

Grilles-Both

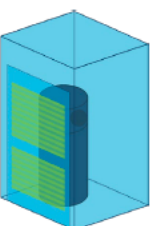


Free Convection

Openings: Two wall grilles, one high and one low (260 in² NFA)

Fairly low-effort, low-cost intervention that adds significant area for air exchange,

Louvers-Full

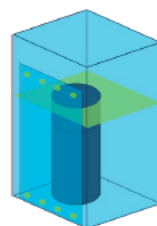


Free Convection

Opening: All door louvers (218 in² NFA)

A simple approach to increasing air exchange, one that is often recommended for small-space installs.

Shelf



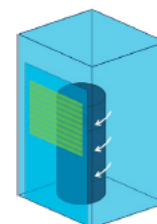
Forced Convection

Makeup Intake: Upper door holes, fitted with wire-mesh vent caps (25 in² NFA)

Exhaust Path: Lower door holes, fitted with wire-mesh vent caps (25 in² NFA)

"Shelf" of rigid foam divides room into two compartments, with the HPWH intake drawing from the upper compartment and the exhaust discharging into the lower. Forces convection without ducting.

DirectedExhaust



Forced Convection*

Openings:

Upper louver panel of door (129 in² NFA)

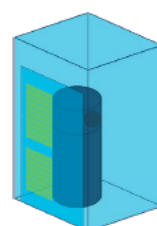
Floor slot (18 in² NFA)

Other: HPWH rotated to blow exhaust more toward door

A method recommended by some HPWH manufacturers. Uses the fan to more intentionally direct the exhaust airflow.

*While the airflow paths in this configuration are intentionally directed, exhaust and intake were not fully isolated. Even though some part of the makeup air was drawn in through the door louvers, the approach is better understood as a forced convection intervention.

Louvers-Half



Free Convection

Opening: Half the width of all door louvers, side opposite exhaust (109 in² NFA)

Designed to test the importance of total free area on intervention effectiveness—to provide information useful when considering different door designs/dimensions which may have less free area.



Grills

- 24-in x 8-in wall grilles were installed, approximately 8 in from the ceiling and approximately 8 in from the floor in the moveable bulkhead wall.





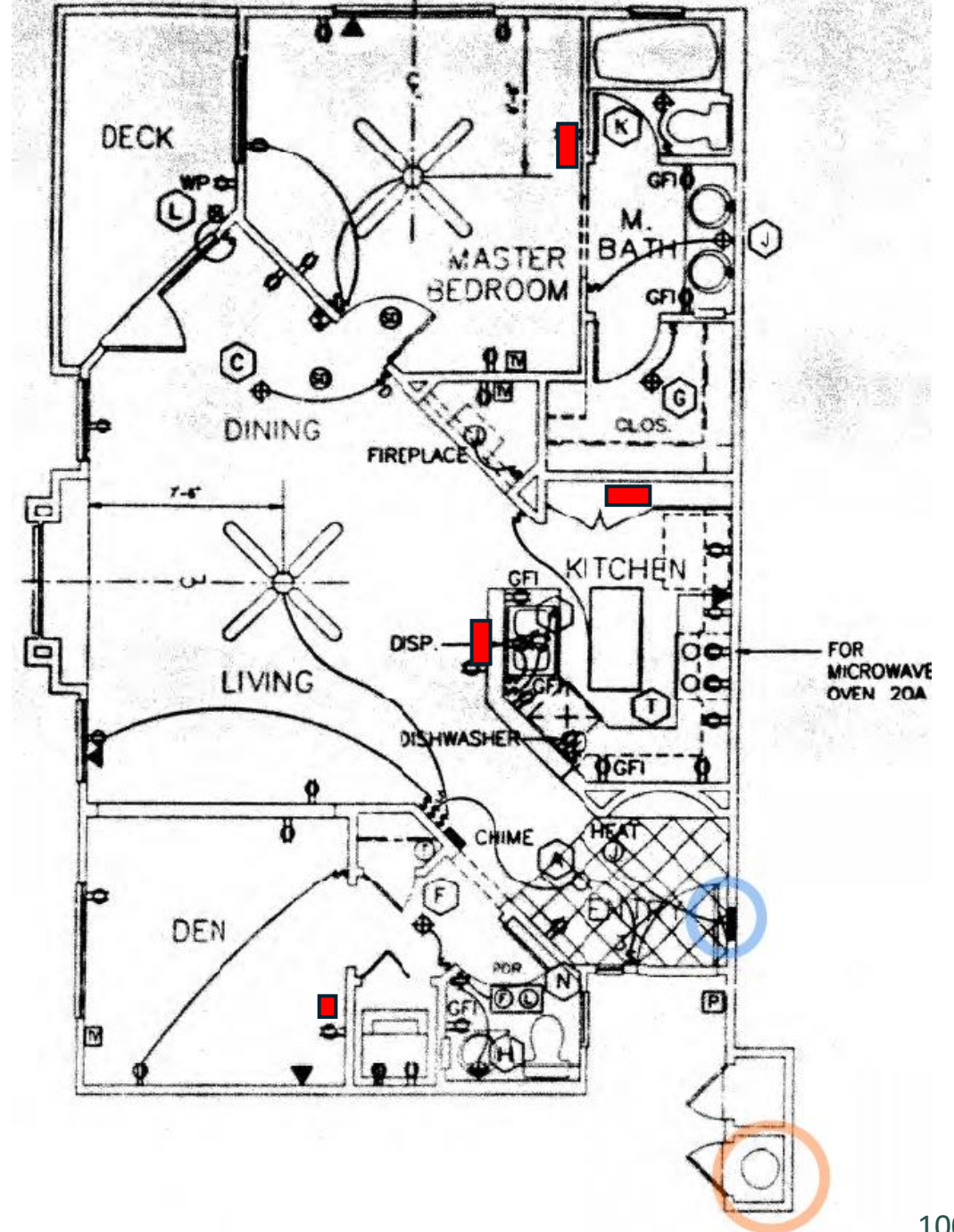
Condo Plan Types

- Screen shots from the building drawings showing electrical layouts
- **Blue circle** highlights electrical panel location
- **Orange circle** highlights water heater location
- **Red rectangles** are best effort location of existing hot air heating vents based on building drawings.



Plan 1 – The Launch

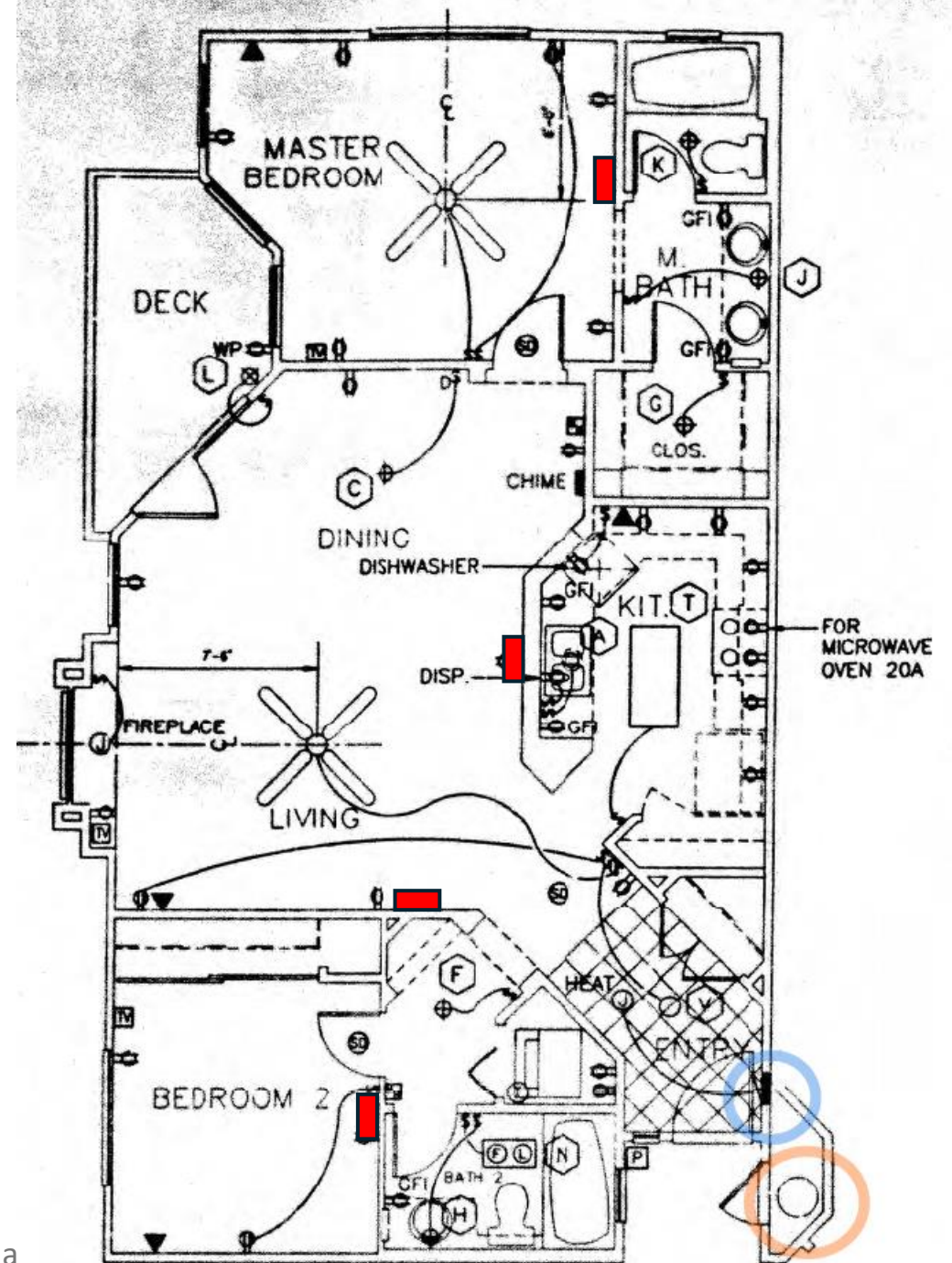
- 926 sq ft
- 1 bed, den, 1.5 bath
- 3 Innova's





Plan 2 – The Gondola

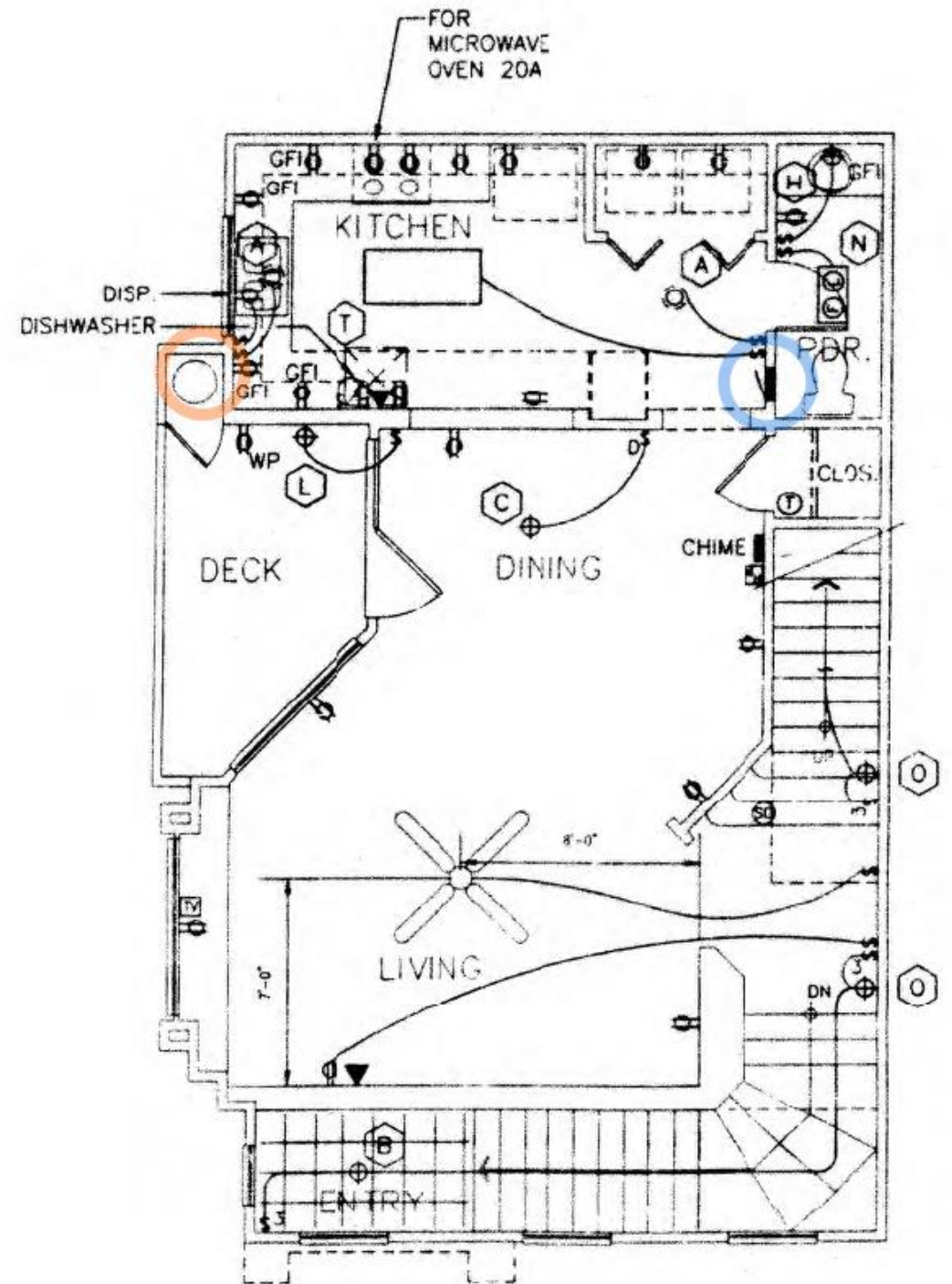
- 1049 sq ft
- 2 bed, 2 bath
- 2nd floor next to unit of type 3 or 5.
- 3 Innova Wall Mount





Plan 3A – The Craft

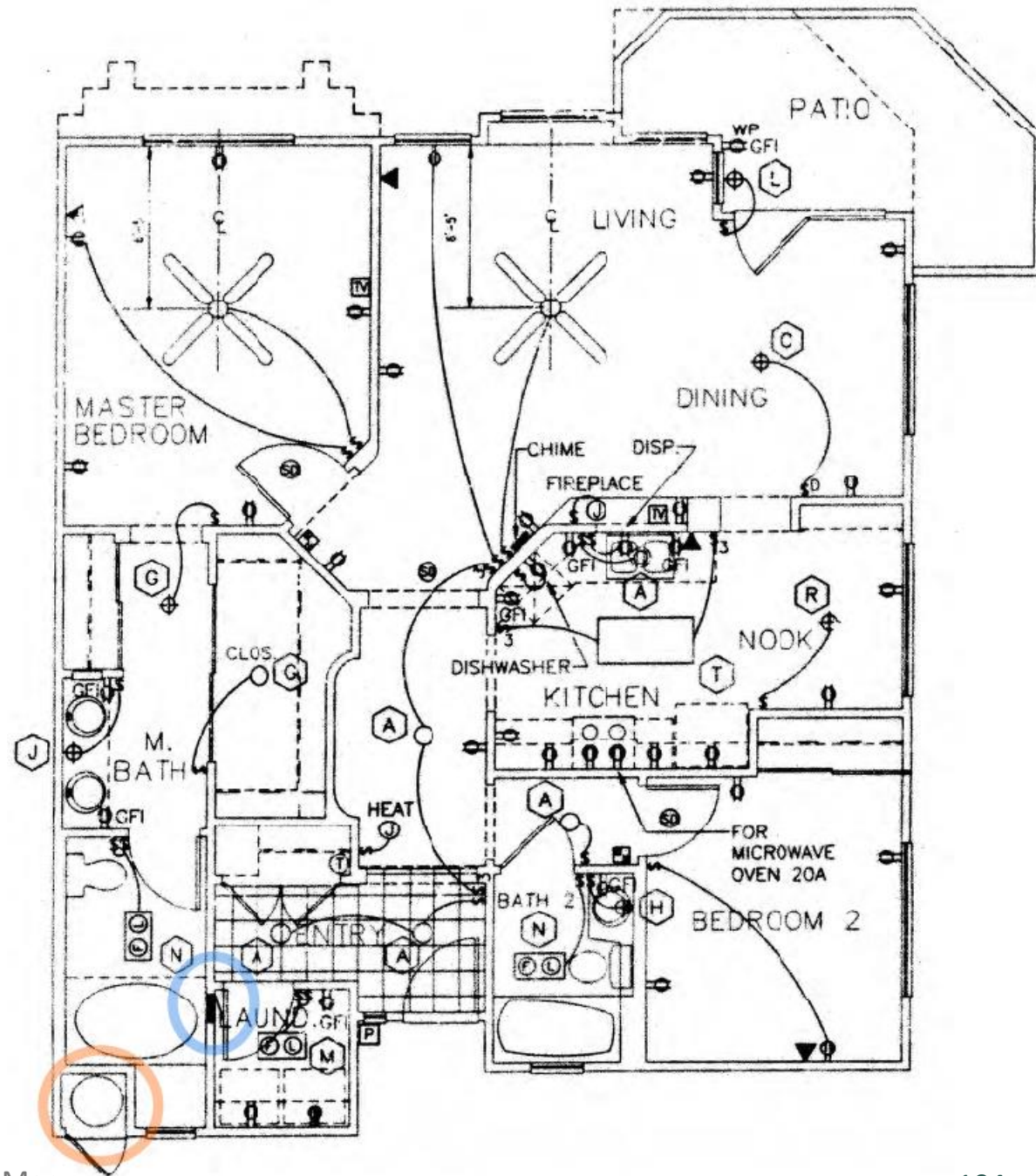
- Very similar to Plan 3
- 1424 sq ft
- 2 bed, 2.5 bath
- Unit's panel powers garage
- HPWH could be vented to the outside in this plan (to confirm)
- 4 Innovas





Plan 4 – The Dory

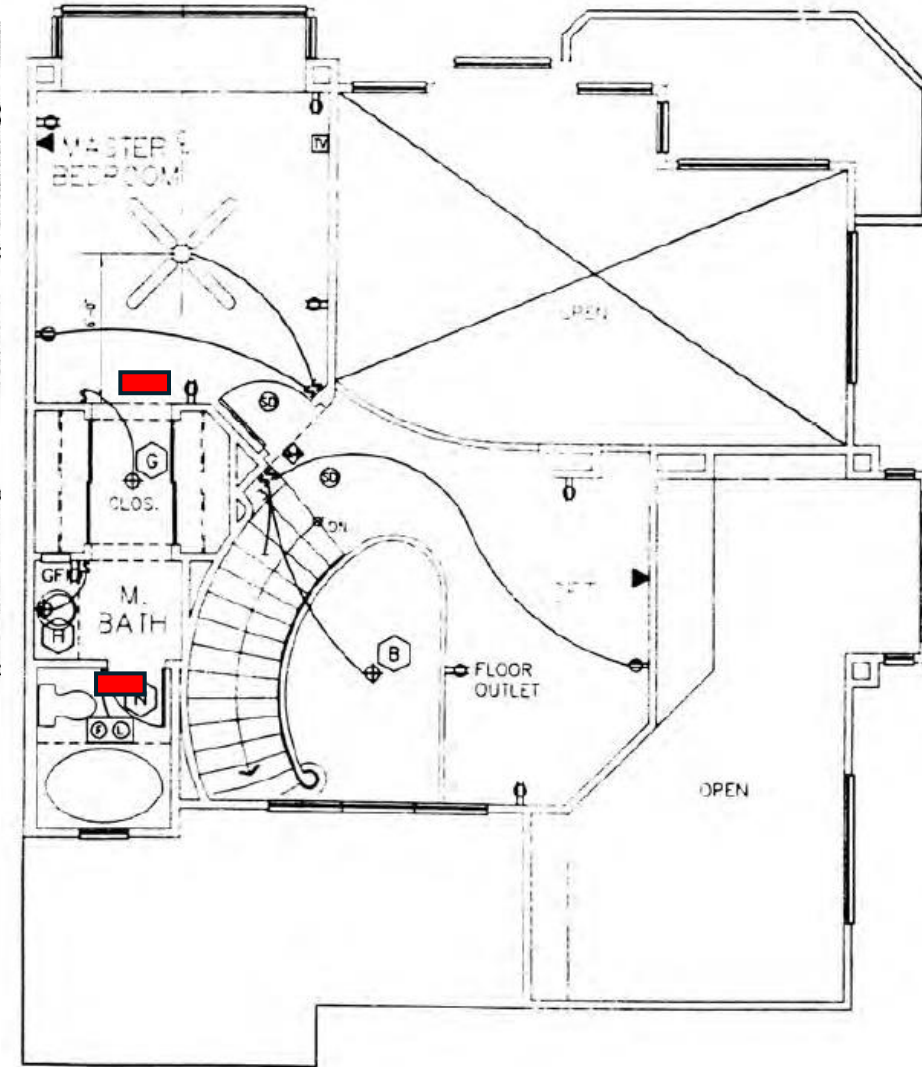
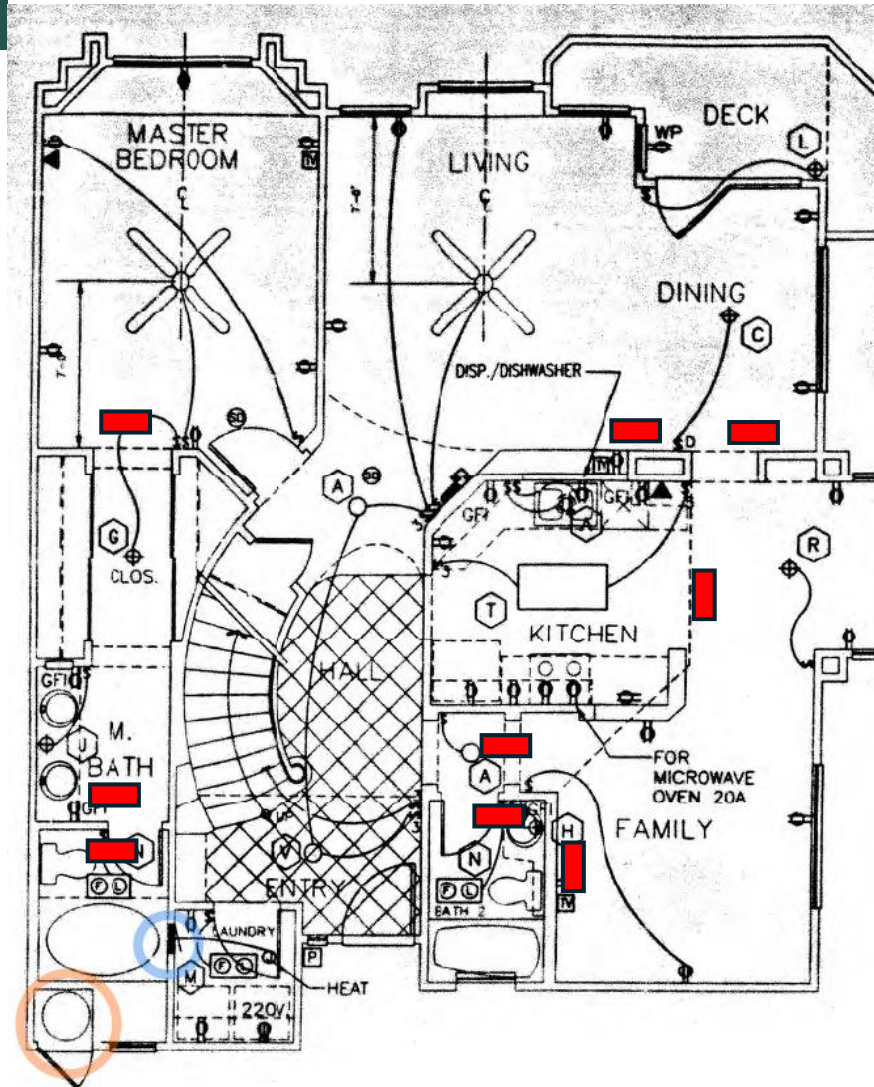
- 1235 – 1266 sq ft
- 2 bed, 2 bath
- On 2nd floor corners
- Plan type 5 typically right above this unit.
- 3 or 4 Innovas





Plan 5 - The Galleon

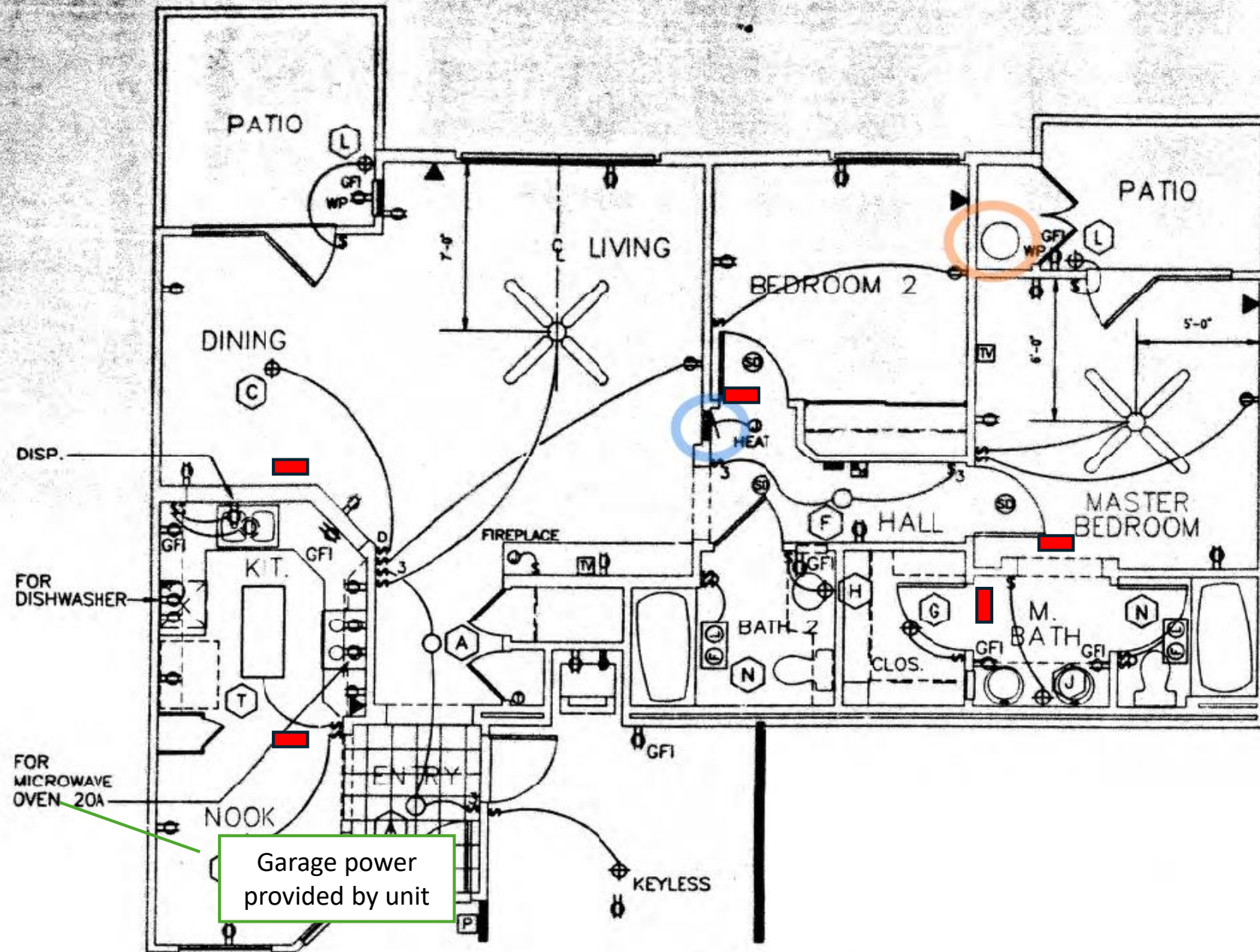
- 1729 sq ft
- 2 bed, loft, family room, 3 bath
- On 3rd floor corners
- Plan 4 typically right below this unit.
- 5 Innovas





Plan 6 – The Shallop

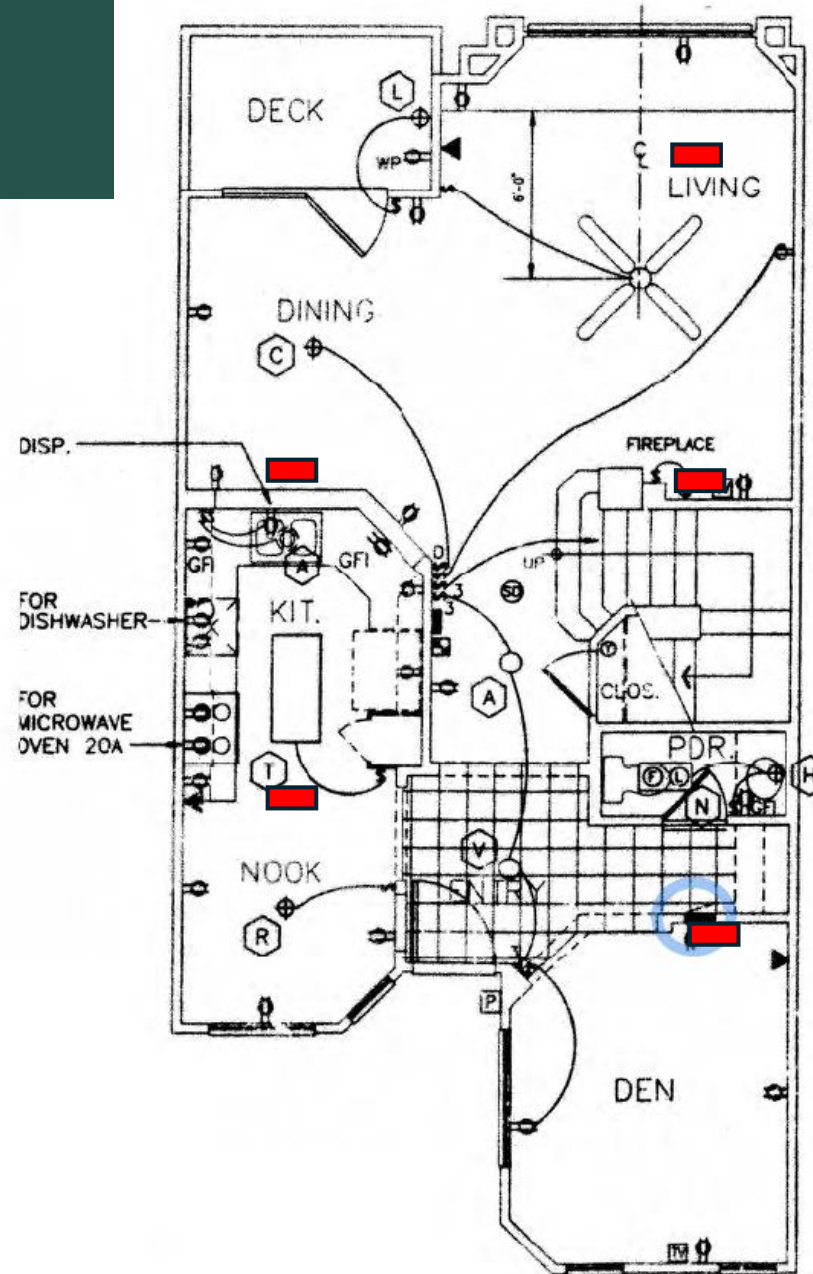
- 1117 sq ft
- 2 bed, 2 bath
- Unit's panel powers garage
- 1st floor
- Looks like large water tank closet space with potential venting to the outside.
- 3 or 4 Innova's



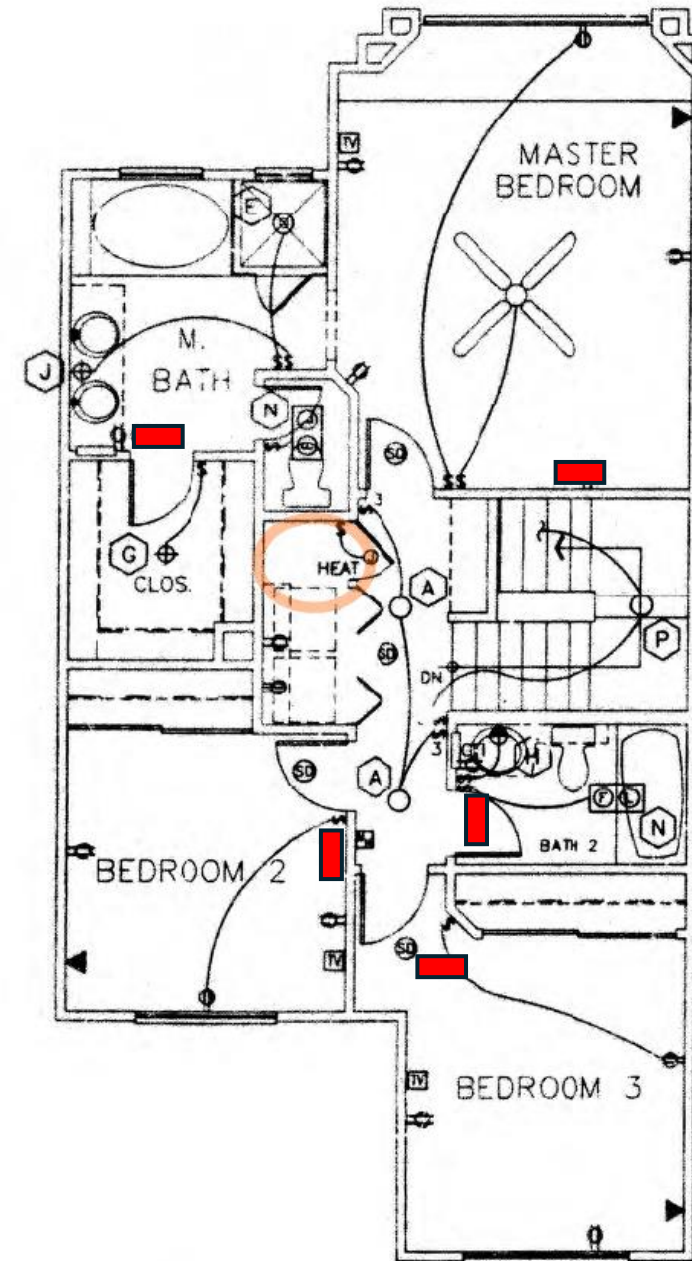


Plan 7 – The Clipper

- 1567 – 1625 sq ft
- 3 bed, den, 2.5 bath
- 2nd Floor
- The only unit plan with the water heater inside the unit.
- 5 Innovas



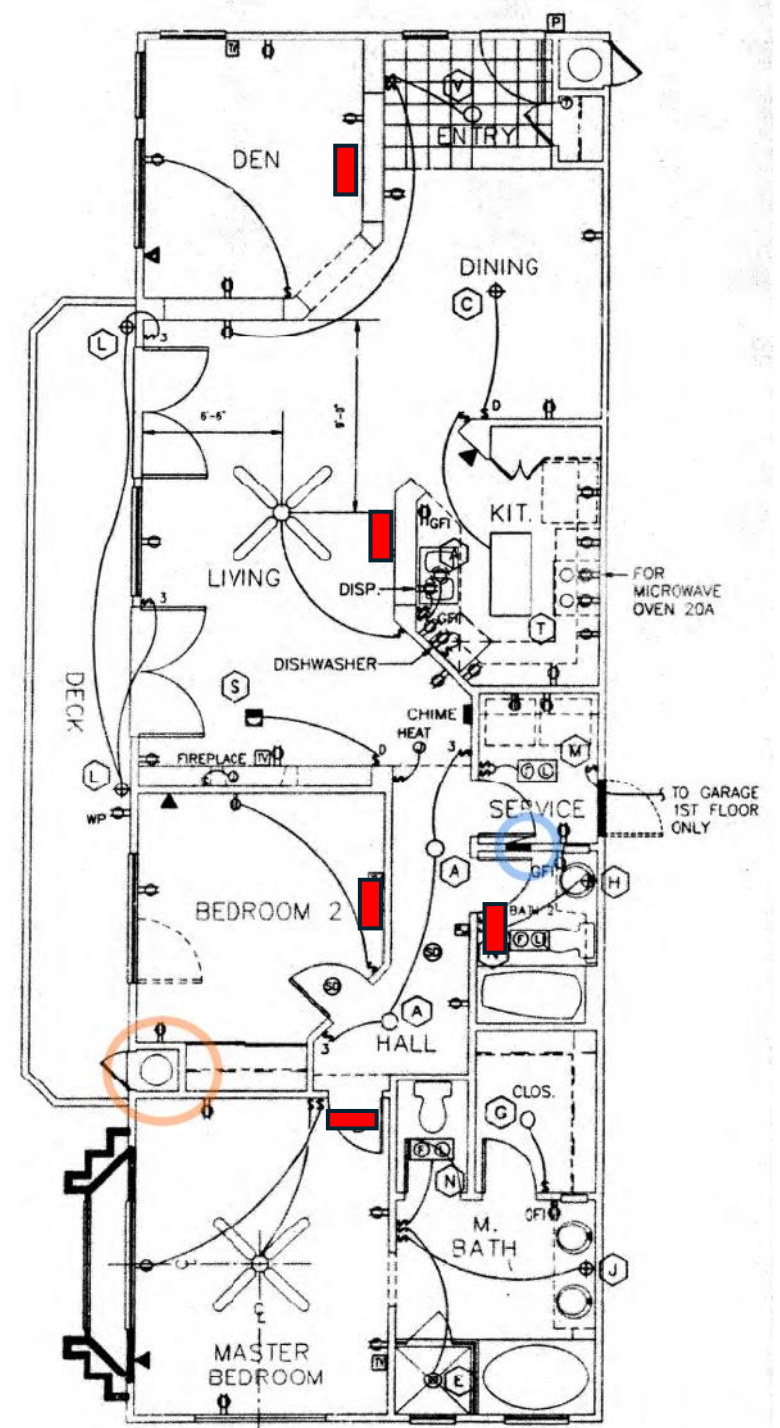
Ventana Del Mar





Plan 8 - Barque

- 1398 sq ft
- 2 bed, den, 2 bath
- Units on all floors
- 4 Innovas





Space Heating

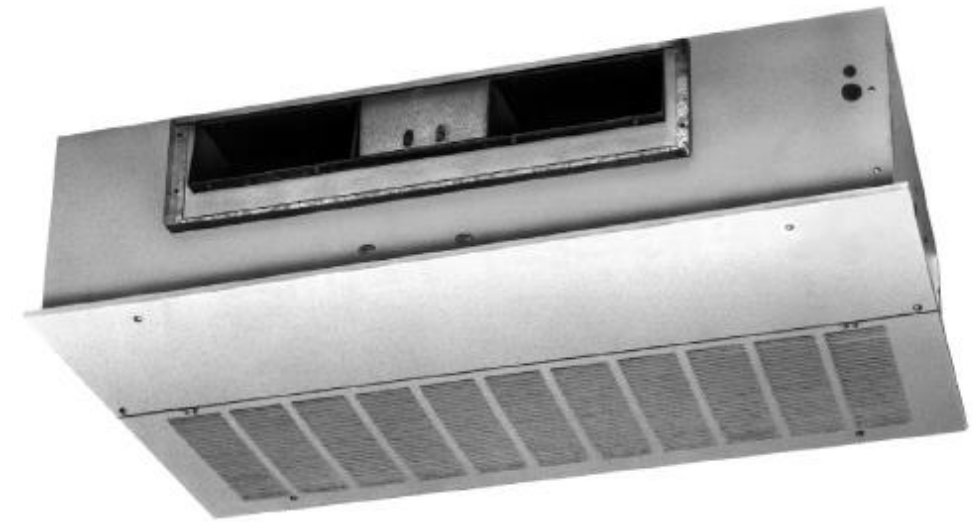
This section documents the existing space heating appliances.

Space heating provided by the hot water heaters. A hot water circulation pump passed through an air handler where a blower blows air past fins, picking up heat.



Typical Air Handler

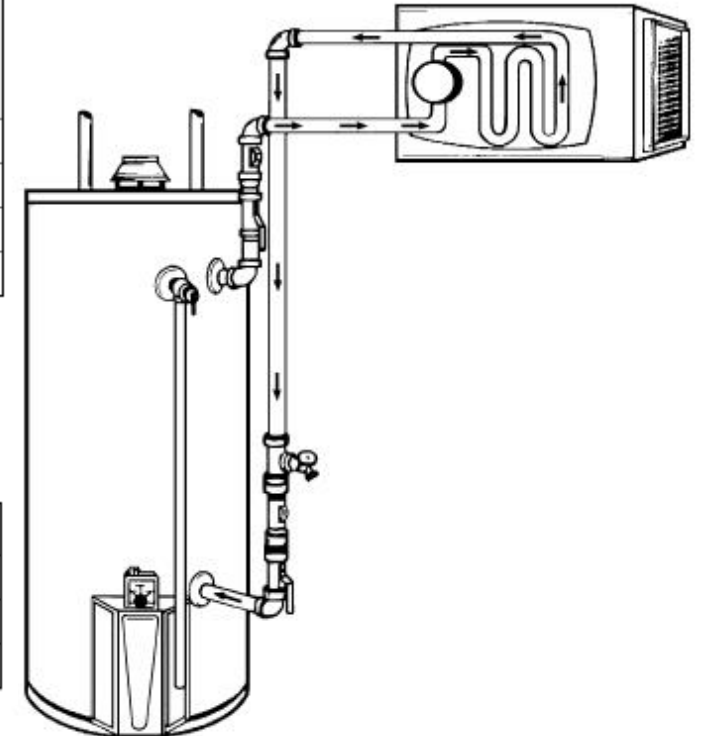
- Hot water taken from gas hot water heater to air handler
- Web archive: [Apollo Specification Sheets](#)
- HydroHeat H Sheet PDF: [Wayback Machine](#)
- Likely the H-32H variant based on one sample.
 - 32KBtu/h at 140F
 - 41kBtu/h at 160F.
 - Insufficient for the larger 2-story layouts
- Possibly H-24H for the smaller Plan 1/2s
 - 24KBtu/h at 140F
 - 29kBtu/h at 160F
- No mixer valves on domestic hot water supply
 - 120F recommended and in plumbing building code
 - 140F can results in burns withing 5 seconds
- 610W blower fan



H 2824 / H 3230

CAPACITY VS AIR FLOW			
ENTERING WATER TEMP. (°F)	1000 CFM	800 CFM	600 CFM
130°	28,500	25,600	23,000
140°	32,500	29,500	26,200
150°	36,650	33,000	29,500
160°	40,800	36,800	32,900

ELECTRICAL CHARACTERISTICS
115V-60H-1PH
Rated Amps 5.3
Minimum Circuit Amps 15





Air Handlers

- Sufficient for single level homes
- Struggles in two level homes – increasing water temperature in winter helps

Air handler intake
with a filter



Air handler &
heating vent



Close up of
heating vent.

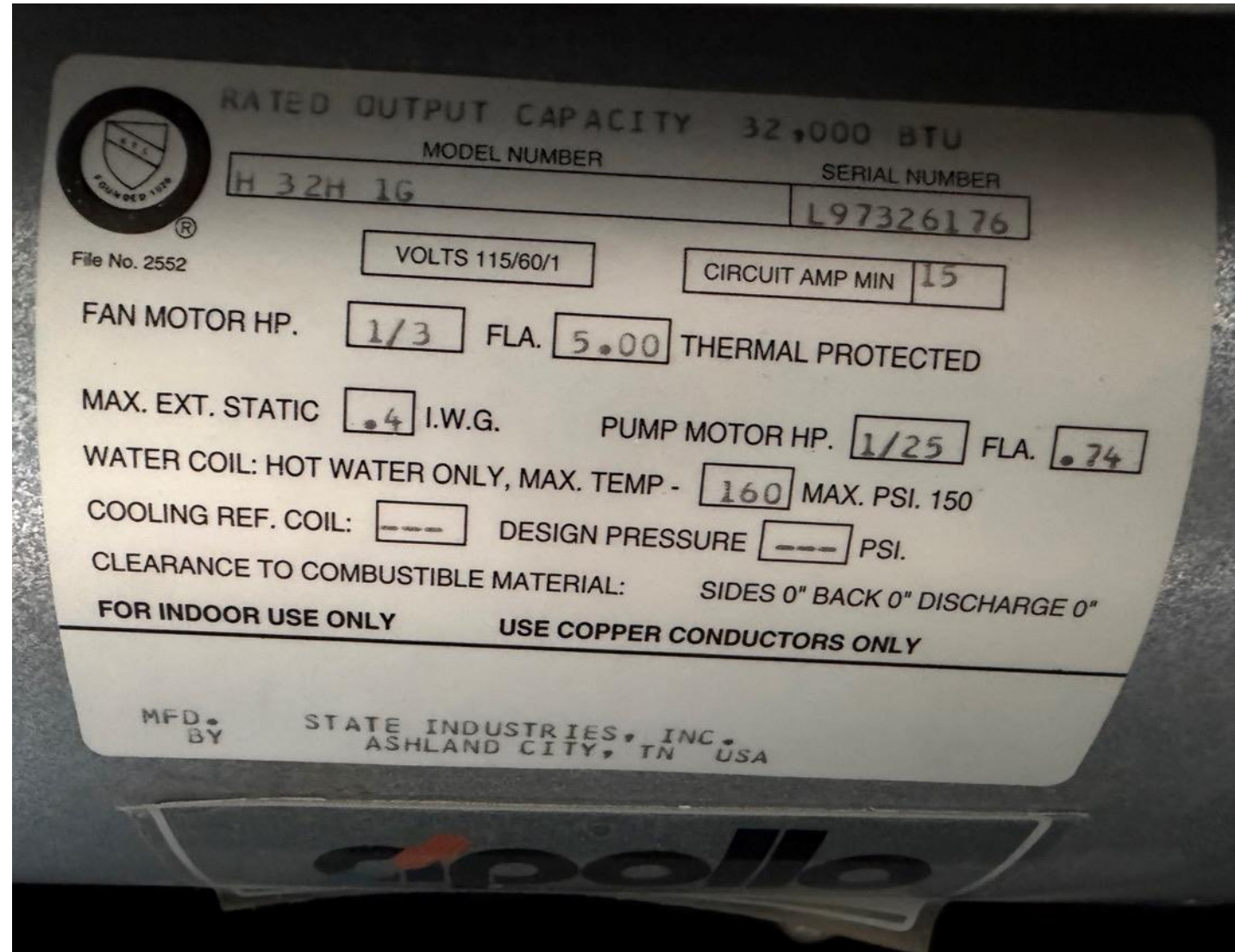
Several around
the house





Apollo Air Handler Hot Water Circulation Pump

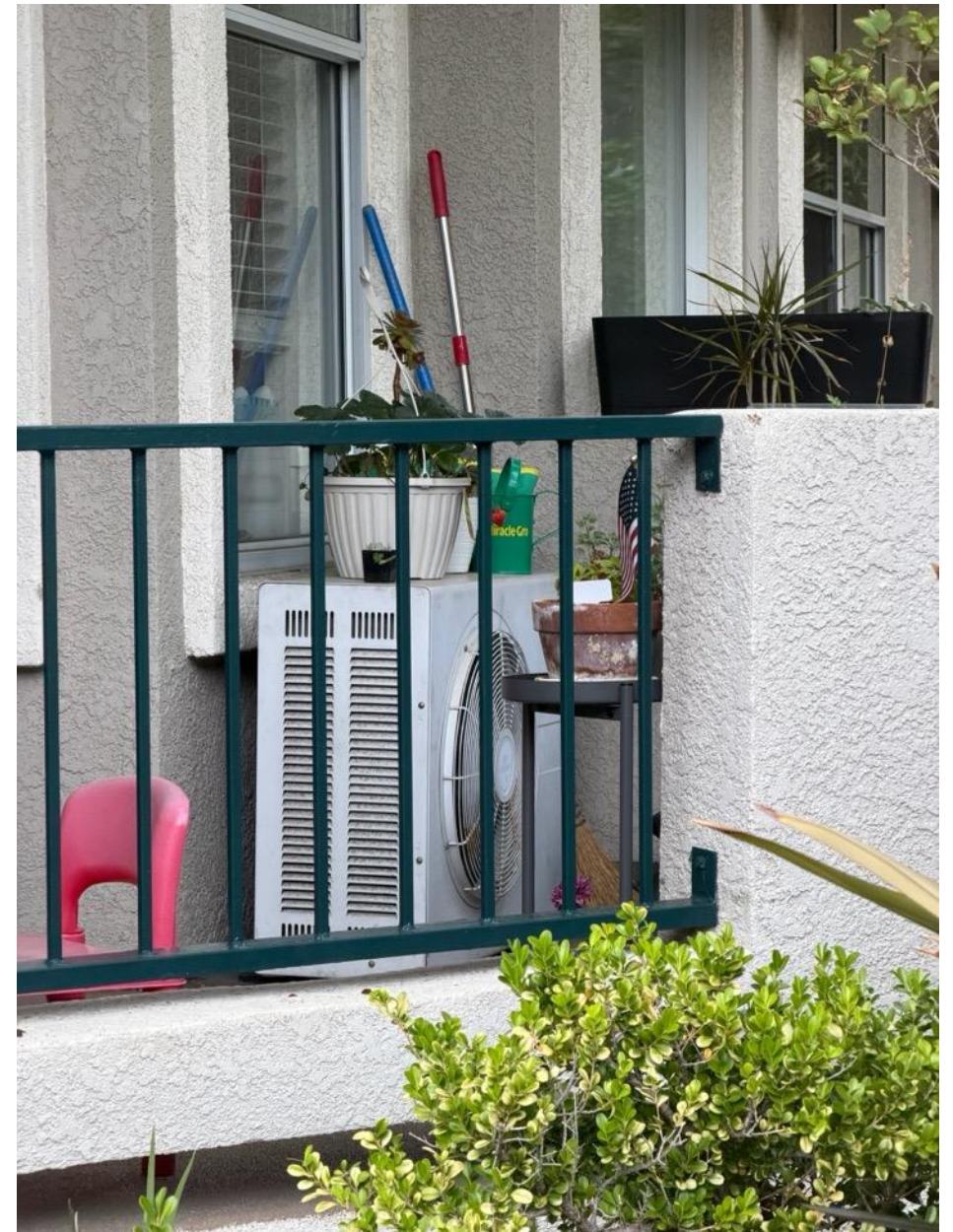
- Rated 32KBtu/h
- Pump electrical:
 - Full Load Amps 0.74
 - Max power draw 89W
- Total power draw for heating is the 89W above plus the 610W for the blower = 700W





A small number of units have AC

- Approximately 20 units
- AC supplies coolant to separate fins in the air handler
- Unlikely all air handlers have dual fins – sentiment is that the builder kept costs low and cooling was an additional cost





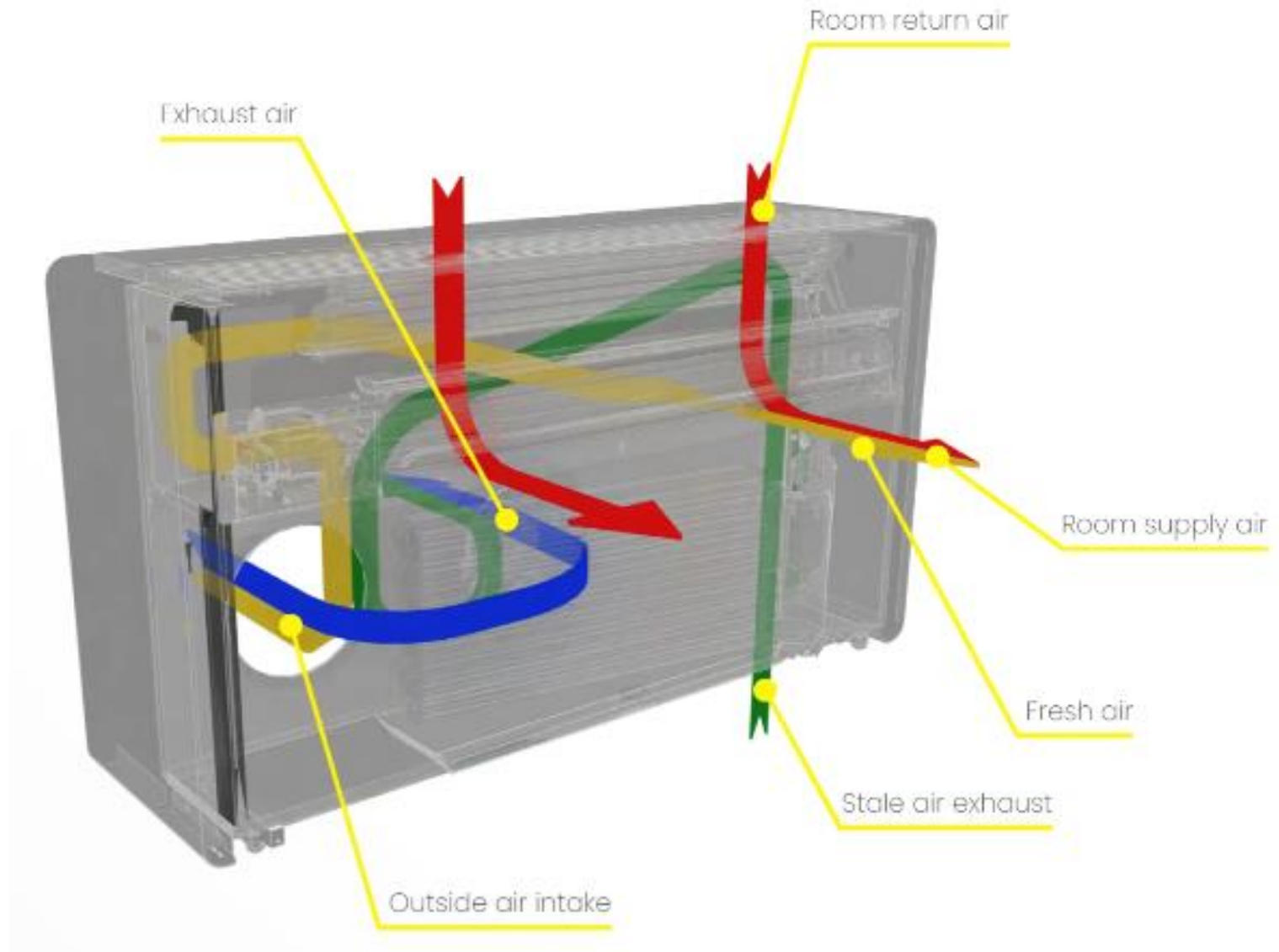
Externally visually unobtrusive – multiple options





Optional EVR (Energy Recovery Ventilator)

- Bring fresh air in
- Outgoing air's heat transferred to incoming air
- MERV 13 filter
- 30 CFM fresh air
- Plugs behind HVAC units – no additional holes





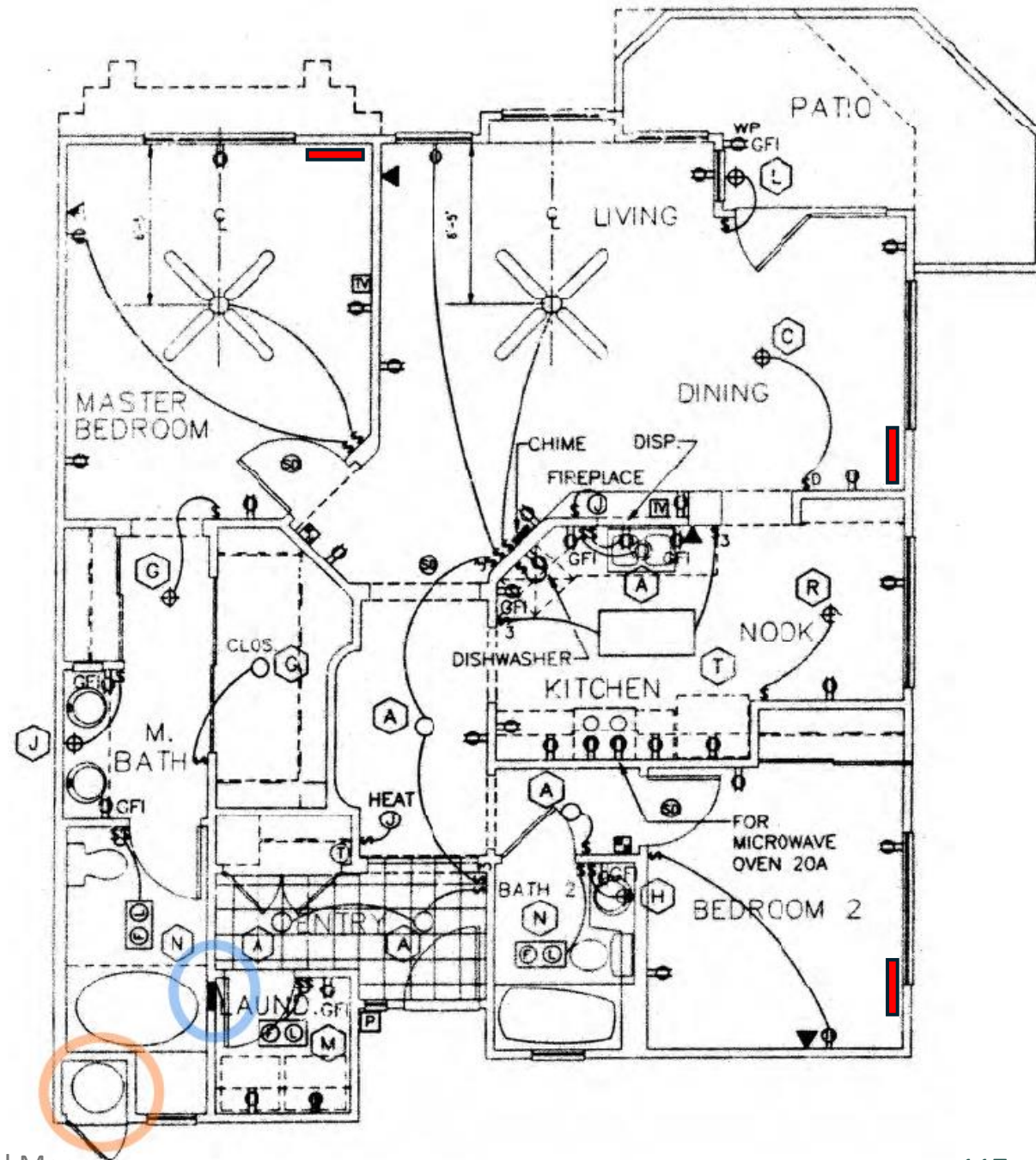
Merino Energy

- San Francisco Based Startup
- Flat rate \$3800 including installation
- 1 hour install
- 120V, 7.5kBtu/h
- Plugs into nearby socket



Air Flow Consideration Required

- E.g., Plan 4 – The Dory 1266 sq ft
 - 2 bed, 2 bath
- 3 or 4 Innovas (see red rectangles for ideas but needs professional)
- Does heat get to whole home?
- Use existing ducting and fan to circulate and mix air?
- HVAC consultant
- Bathroom – radiant heat lamps and/or electric floor pads





Documenting the appliances used for the electrification journey

These are screenshots from the Common Appliance sheet of the WattDiet calculator.



Baseline Load Calc

- Sample products are used since units vary by household
- Used 720W Fridge
- 540W Garbage Disposal
- No Range hood (associated with microwave in original design)
- No Water heater or range (gas in original design)
- Electric dryer at code's minimum wattage (5000W)
- 700W for air handler fan and hot water circulation pump



Baseline Load Calc

- Sample products are used since units vary by household
- Range hood associated with microwave (original design)
- Gas water heater and range
- Electric dryer uses code's minimum wattage
- Heat Pump for heating is actually the blower and circulation pump for the hydronic system.

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	No Device			
Range (oven and cooktop)	No Device			
Clothes Dryer	Manual Entry	5000W	240V	20.8A
Heat Pump	Manual Entry	700W	120V	5.8A
EV Charger	No Device			



1. Add Heat Pump HVAC

- 10kBtu/h Wall Mount Units
- Below is a quick estimate of number of PTHP units in table below – more rigorous HVAC sizing required

Unit Type	Sq ft	Bed-rooms	Bath-rooms	floors	Suggested PTHP
1 / Launch	949	1	1.5	1	3
2 / Gondola	1,066	2	2	1	3
3 & 3A / Craft	1,290	2	2.5	2	4
4 / Dory	1,248	2	2	1	4
5 / Galleon	1,718	2	3	2	5
6 / Shallop	1,117	2	2	1	4
7 / Clipper	1,597	3	2.5	2	4
8 / Barque	1,400	2	2	1	4

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	No Device			
Range (oven and cooktop)	No Device			
Clothes Dryer	Manual Entry	5000W	240V	20.8A
Heat Pump	Innova AIO Wall Mount	1152W	120V	9.6A
EV Charger	No Device			



2. Add Heat Pump Water Heater

- Rheem 240V Hybrid (worst case) Heat Pump Water Heater

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	Rheem Hybrid HPWH 30A 240V	5000W	240V	20.8A
Range (oven and cooktop)	No Device			
Clothes Dryer	Manual Entry	5000W	240V	20.8A
Heat Pump	Innova AIO Wall Mount	1152W	120V	9.6A
EV Charger	No Device			



3. Add 8kW Range

- This is a typical size for an electric range

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	Rheem Hybrid HPWH 30A 240V	5000W	240V	20.8A
Range (oven and cooktop)	Standard 8kW 240V	8000W	240V	33.3A
Clothes Dryer	Manual Entry	5000W	240V	20.8A
Heat Pump	Innova AIO Wall Mount	1152W	120V	9.6A
EV Charger	No Device			



5. Switch to Copper Stove

- Change from an 8000W Induction stove to a 120V stove.
- Two options
 - Copper Charlie stove with Battery
 - Wattsipper

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	Rheem Hybrid HPWH 30A 240V	5000W	240V	20.8A
Range (oven and cooktop)	Copper Charlie (120V)	1800W	120V	15.0A
Clothes Dryer	Manual Entry	5000W	240V	20.8A
Heat Pump	Innova AIO Wall Mount	1152W	120V	9.6A
EV Charger	No Device			



6. Switch to Combo washer dryer

- Select version with Heat Pump dryer
 - Most modern dryers use a heat pump
- Typical 2hr wash and dry cycle
- Removes the need for a 30A 240V Dryer Circuit.
 - Frees up 2 breaker panel slots
- Combo Washer Dryer is on the existing “Laundry Circuit”

Fridge	Frigidaire 20.4 cu ft	720W	120V	6.0A
Garbage Disposal	Waste King	540W	120V	4.5A
Dishwasher	Frigidaire 24in	1200W	120V	10.0A
Range Hood	No Device			
Microwave	Samsung (with exhaust fan)	1620W	120V	13.5A
Water Heater	Rheem 120V Shared Circuit	436W	120V	3.6A
Range (oven and cooktop)	Wattsipper (all 120V models)	1800W	120V	15.0A
Clothes Dryer	No Device			
Heat Pump	Innova AIO Wall Mount	1152W	120V	9.6A
EV Charger	No Device			

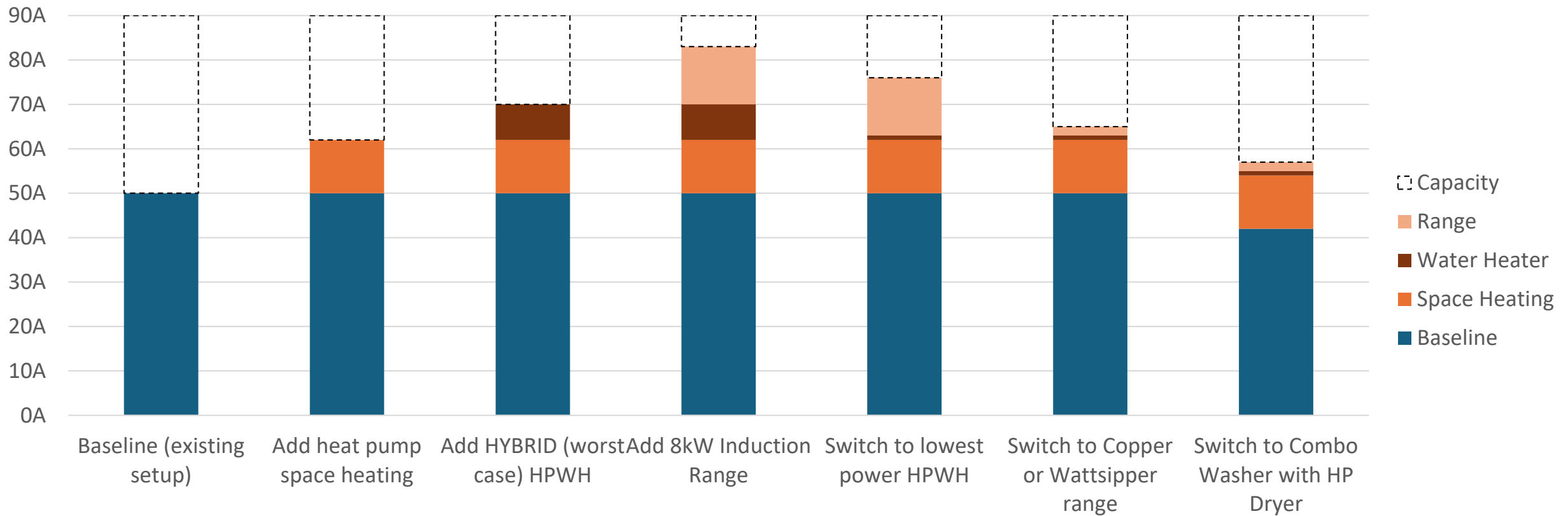


Load Calculation Pathway for each Condo Layout Plan

This illustrates the journey of electrification and how judicious choices can enable full electrification without exceeding the panel limit. With the choices in this sample journey, the panel is exceeded in some cases but then is brought back into line.

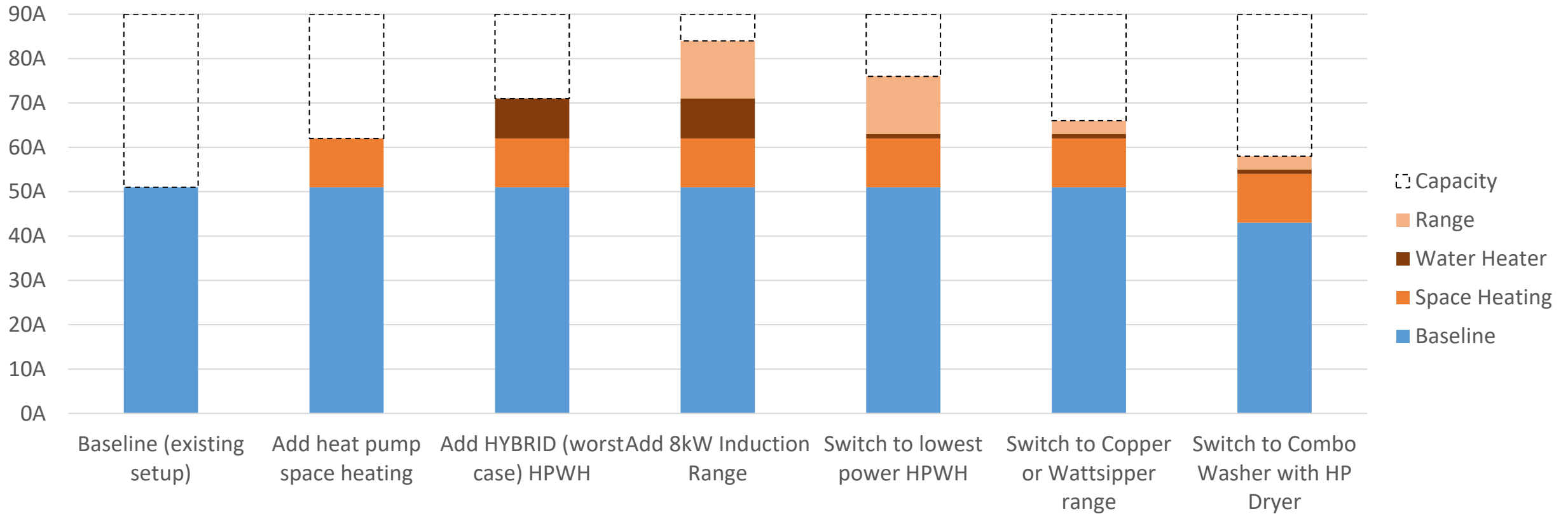


Plan 1 (1 bed, 949 sqft) NEC 220.83 Load Calculation



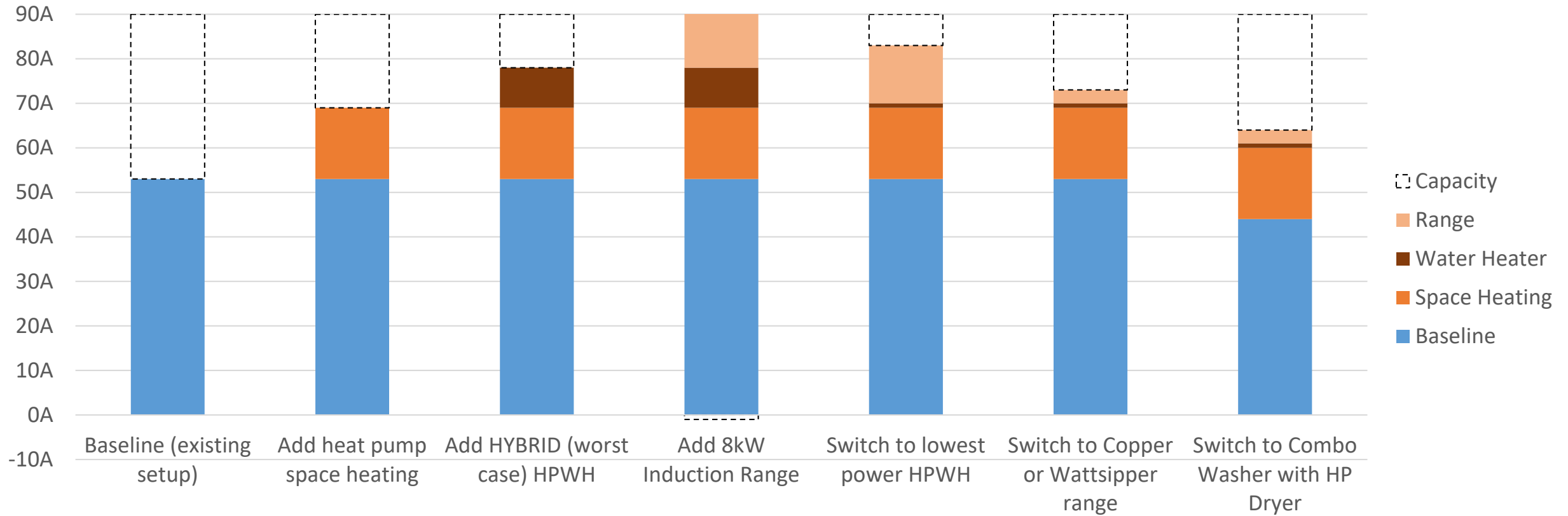


Plan 2 (2 bed, 1066 sqft) NEC 220.83 Load Calculation



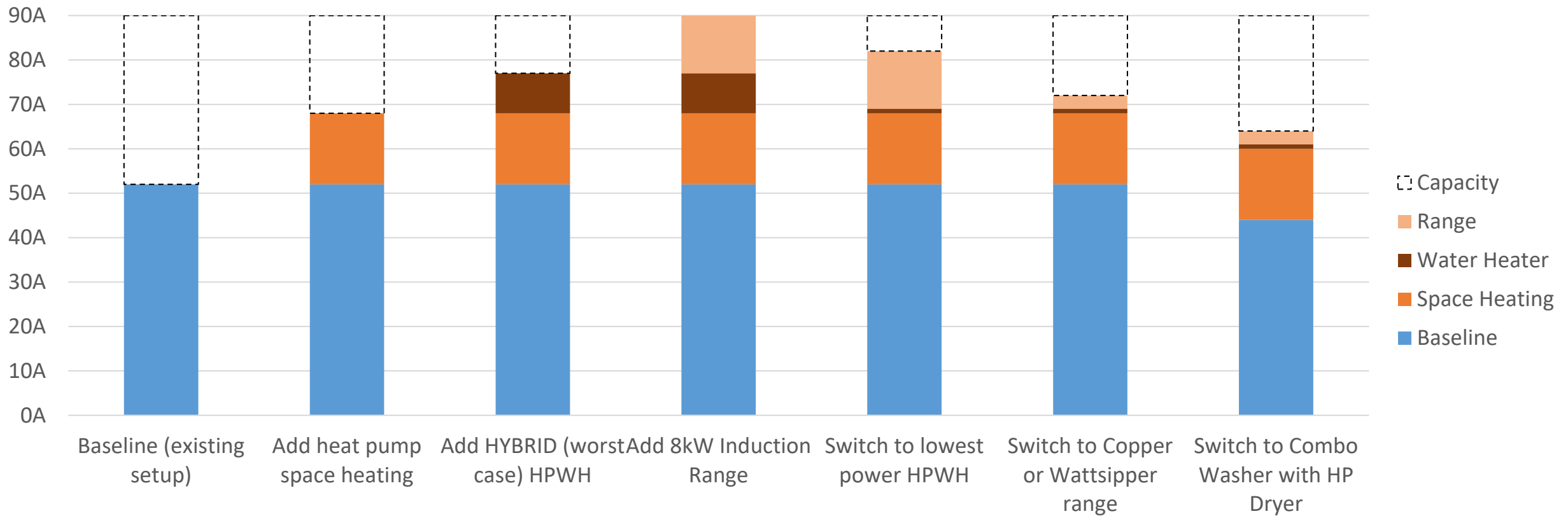


Plan 3/3A (2 bed, 1290 sqft) NEC 220.83 Load Calculation



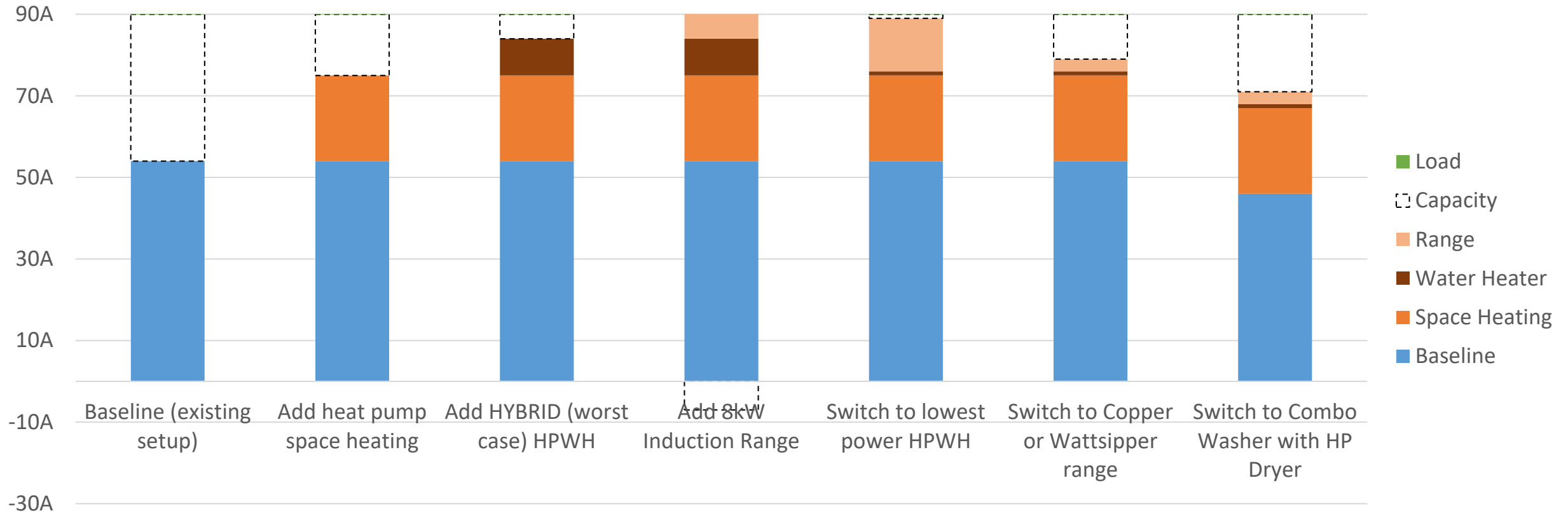


Plan 4 (2 bed, 1248 sqft) NEC 220.83 Load Calculation



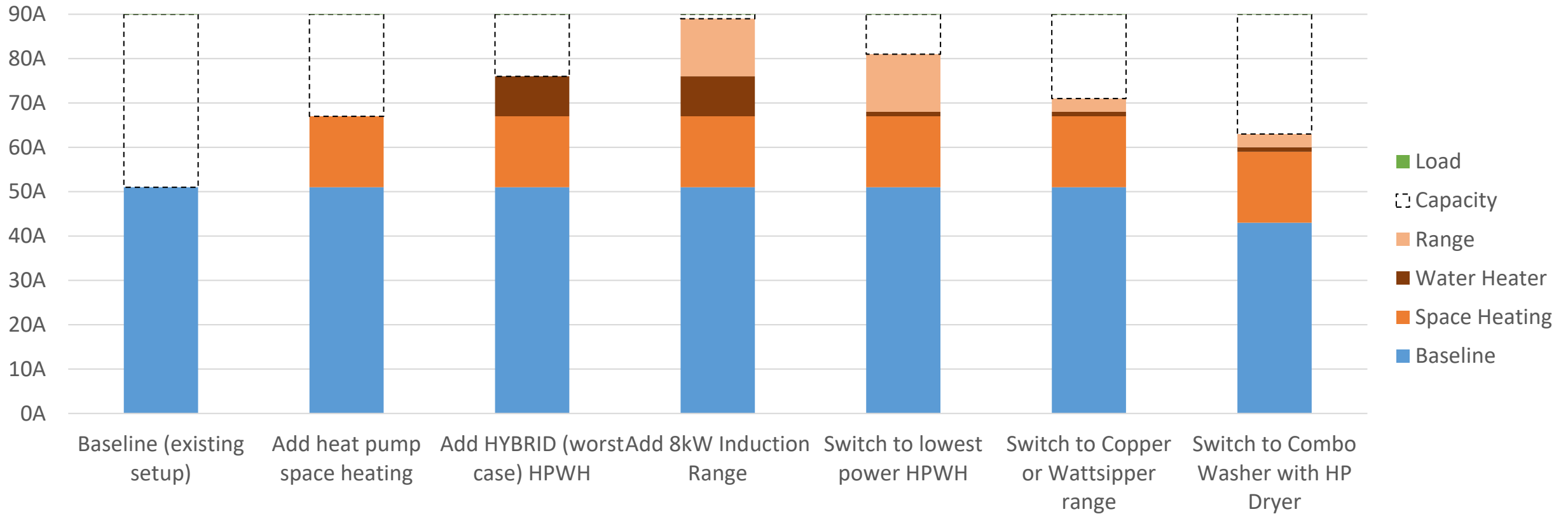


Plan 5 (2 bed, 1719 sqft) NEC 220.83 Load Calculation



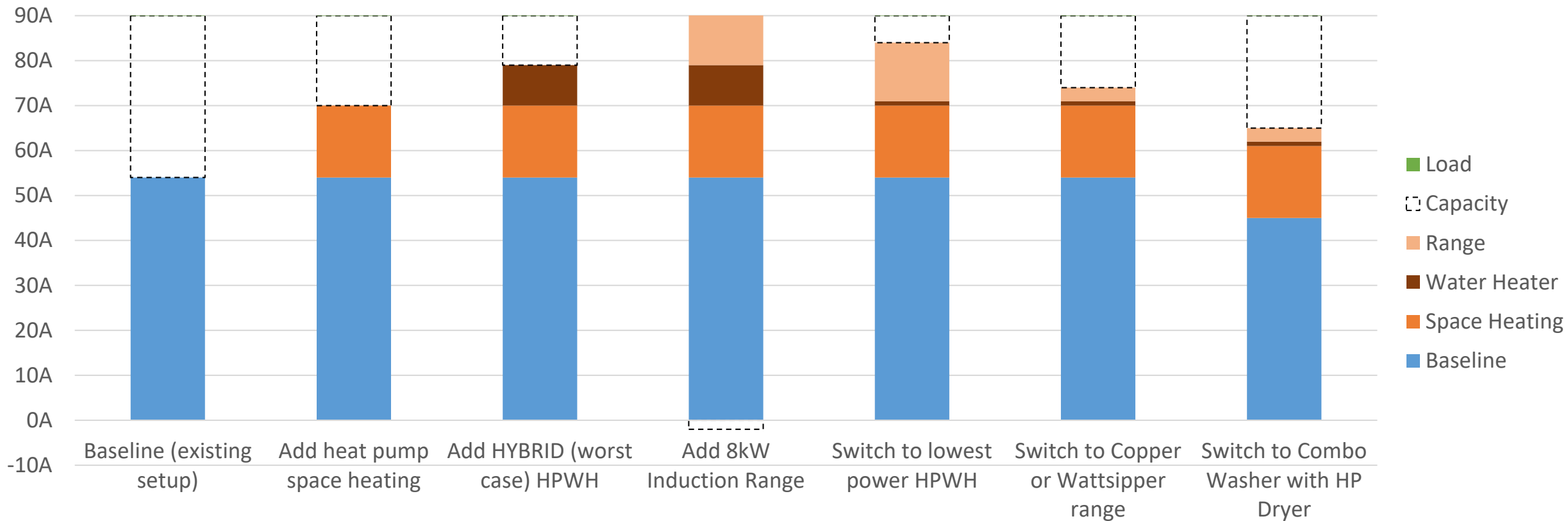


Plan 6 (2 bed, 117 sqft) NEC 220.83 Load Calculation



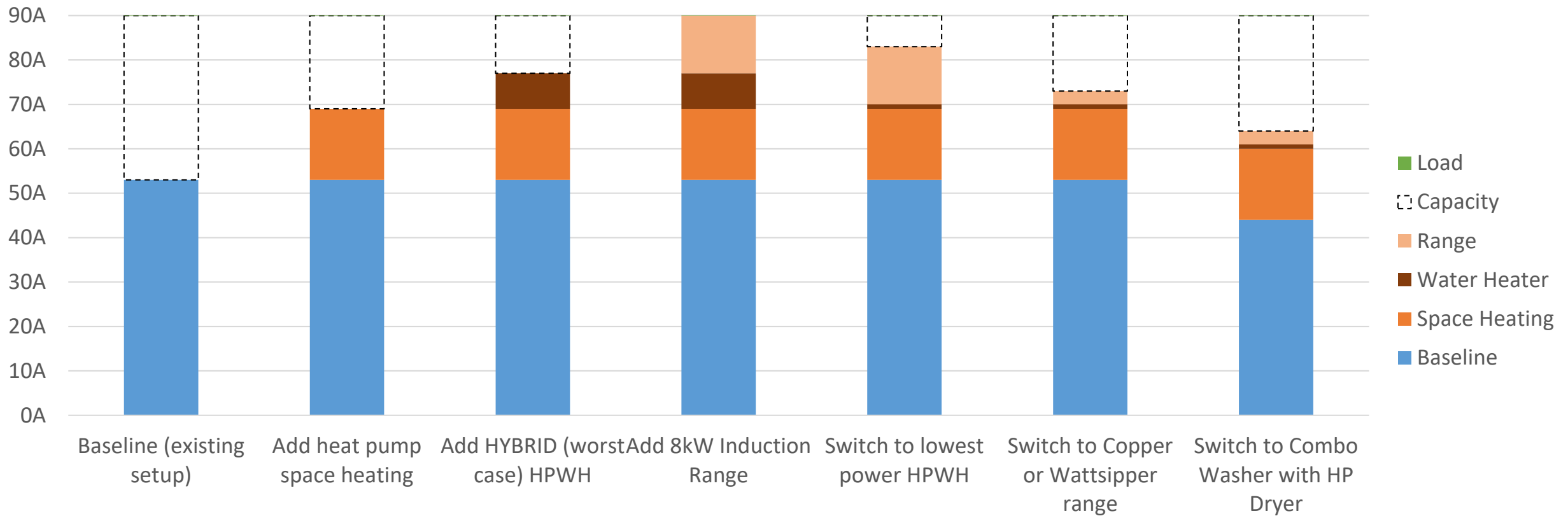


Plan 7 (3 bed, 1597 sqft) NEC 220.83 Load Calculation





Plan 8 (2 bed, 1400 sqft) NEC 220.83 Load Calculation





Building Load Calculations



Discussion of Building Load Calculations

The buildings have 800A services. Building B, with 21 condos, has the largest load calculation, just under the 800A threshold. The National Electrical Code load calculations are notoriously conservative, born out by combining the measurements of the 29 condos into one building that peaks at a mere 148A, less than 1/5th of the available capacity.

If everyone in a building electrifies their heating, then another less conservative path through the code is allowed (called 220.84). This is illustrated in the graph in a following slide and when an electric dryer is eliminated, the load calculation comes back within limits. Elimination of the dryer circuit can be achieved by running a gas dryer or switching to a combo washer dryer.

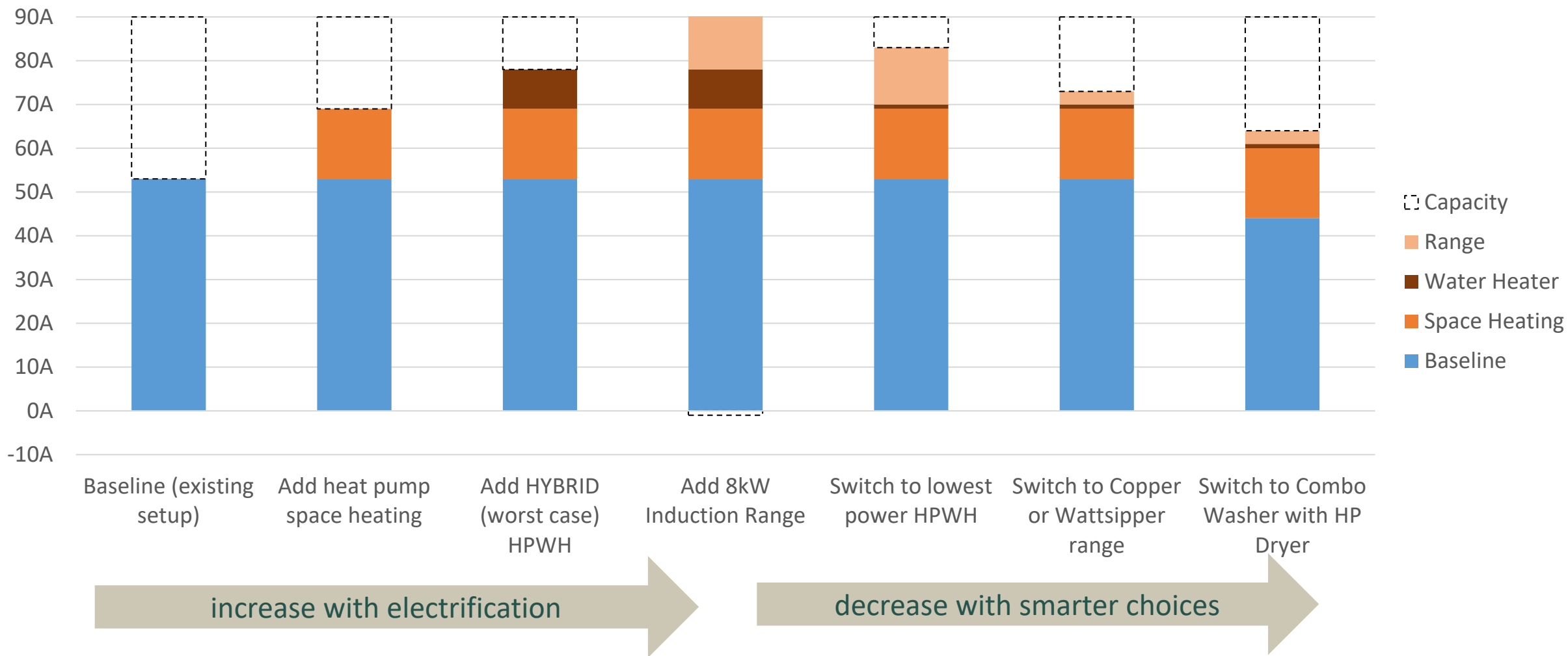
Contractors working in the space of upgrading existing multifamily building say they never get asked for building level load calculations. They do say that having backup historical data is a good idea to prove that there is no overload potential, and an overload is only dangerous in that it will trip the breaker for a whole building. It won't burn down the building but nothing that should happen either.

Current loggers can be installed, looking at \$500-\$1000 per building plus someone to collect the data. The RVE EV charging solution does monitor the service current draw so provides this data as a side effect. This should be considered; there is considerable value to having this data on an ongoing basis to monitor the electrical draw as residents electrify.



NEC 220.83 Load Calculation

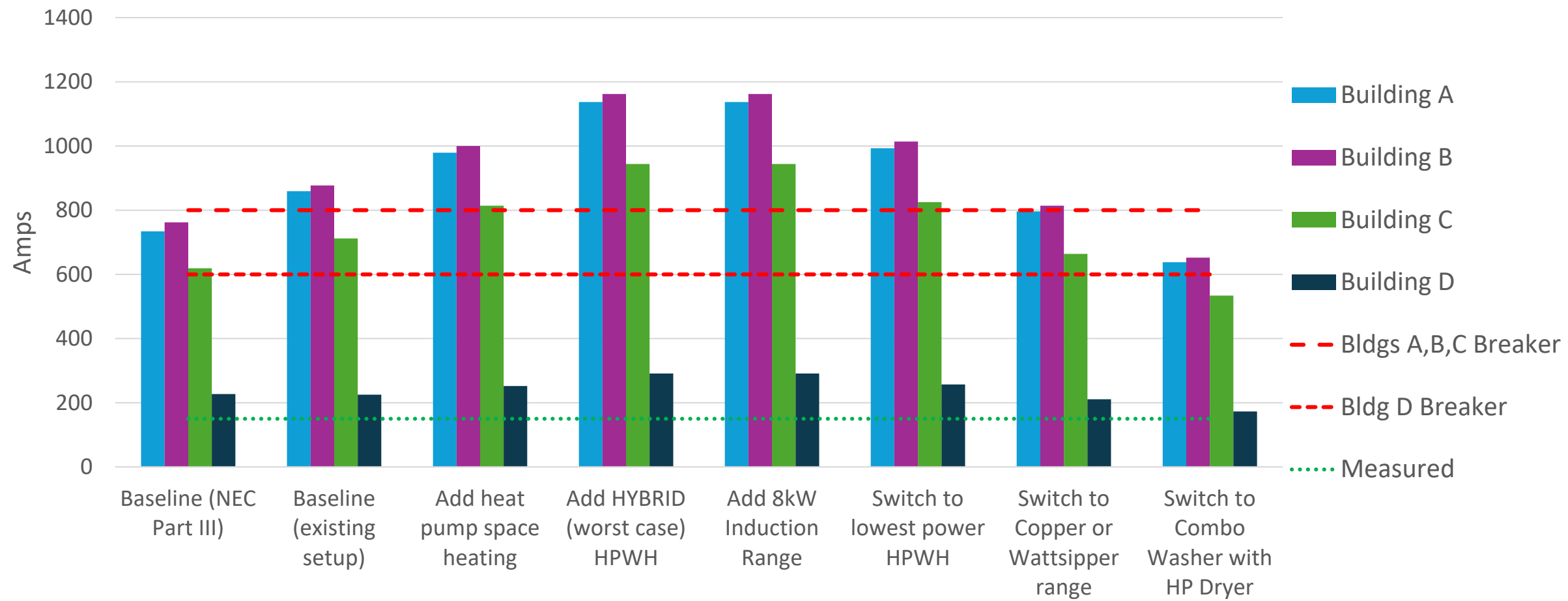
Plan 3/3A (2 bed, 1290 sqft)





Building Load Calculations – Over the limit

Building Load Calculations (220.84)





Building Load Calcs – explanation

- 1995 – Original Load calcs
 - Building B: **793A** vs WattDiet **762A**
 - Right on the **800A** limit
 - Minor difference because:
 - NEC Code has changed slightly
 - Minor variations in appliance values (e.g. disposal 840W vs 540W)
- 2 ways to calculate bldg. load
 - Part III – Usually comes out higher
 - Part IV - 220.84
 - Almost always **lower**
 - **But requires** electric space heating/cooling, electric cooking
 - **Allowed** if 8kW range in lieu of no electric range
 - **All units must comply** to use 220.84 and this is very unlikely to happen for a condo complex as each homeowner will have their own plans and timeline.
 - Recommendation to use 220.87



Load Calcs with low power hybrid HPWH

A hybrid HPWH is recommended over a non-hybrid due to pulling air from the outside together with overnight winter temperatures' potential to prevent the heat pump operating.

The HPWH compressor only works when inlet air temperature is above 37F. Typically HPWHs are operated in a “conditioned” space, in other words, one that isn’t open to the outside and which gets some additional heat from the home. Sometimes this is in a garage, sometimes they are in the home itself. In these situations a hybrid HPWH is not needed.

For most of the Ventana floor plans the water heater closet has a louvered door to the outside; it is pulling heat from of the outside air. In the Bay Area this will work most of the time, especially if it is possible to take advantage of the large temperature swings between night and day. However, for days when it is really cold at

night and into the early morning, when evening showers may exhaust the hot water stored in the tank and early morning hot water is desired, a backup resistive heating element may be required. A HPWH with both a heat pump compressor and a resistive heating element is called a hybrid HPWH.

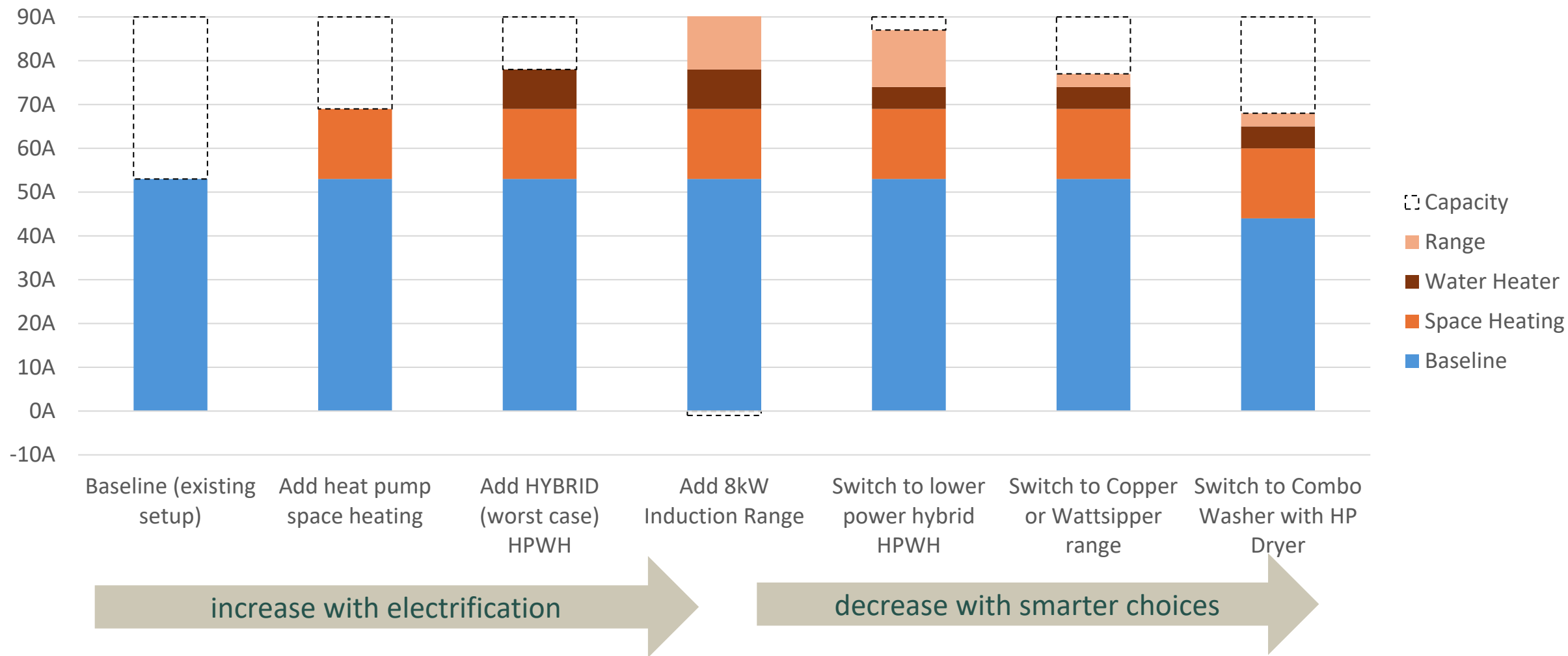
While resistance heating is an expensive way to heat water, it adds little to the cost of the HPWH. It would normally only be used a few times a year. To keep the load calculations down, the Rheem 2250W element is preferred over the 4500W element.

[Weather Spark](#) provides records of Redwood City temperatures, showing that even on nights when the temperature drops below 37F, the day temperature reaches 50F. The following slides show the relatively small impact of this on the load calculations at both the unit and building level.



Plan 3/3A switching to 2250W Rheem Hybrid HPWH

(instead of the shared circuit version used for all other plots)





Building loads using the 2250W Rheem Hybrid HPWH

(instead of the shared circuit version used for all other plots)

