Bill Impacts of Home Electrification Across the Bay Area

Building simulations that forecast real-world scenarios and inform customer choice

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Outline

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2. Purpose
3. Methodology
4. Results
5. Conclusions
6. Appendix

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Executive Summary

Throughout the Bay Area, installing heat pumps can lower customer bills TODAY.

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Purpose

1. To better understand the **bill impacts** of electrifying existing homes across the Bay Area.
2. To **enhance upon on previous studies** by testing high efficiency appliances, presence of air-conditioning, and individual measures versus whole-home packages.
3. To develop estimates using **real-world and calibrated** assumptions using PCE/SVCE meter data and market-ready equipment

Approach - Homes

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CPUC prototypes

- Existing cooling vs. no existing cooling
- Early Replacement (older, inefficient gas equipment) vs. End of Life Substitution (newer gas equipment)

Energy Calibration

- Whole-building consumption based on utility bill data
- Cooking and clothes drying (“white goods”) consumption based federal data.

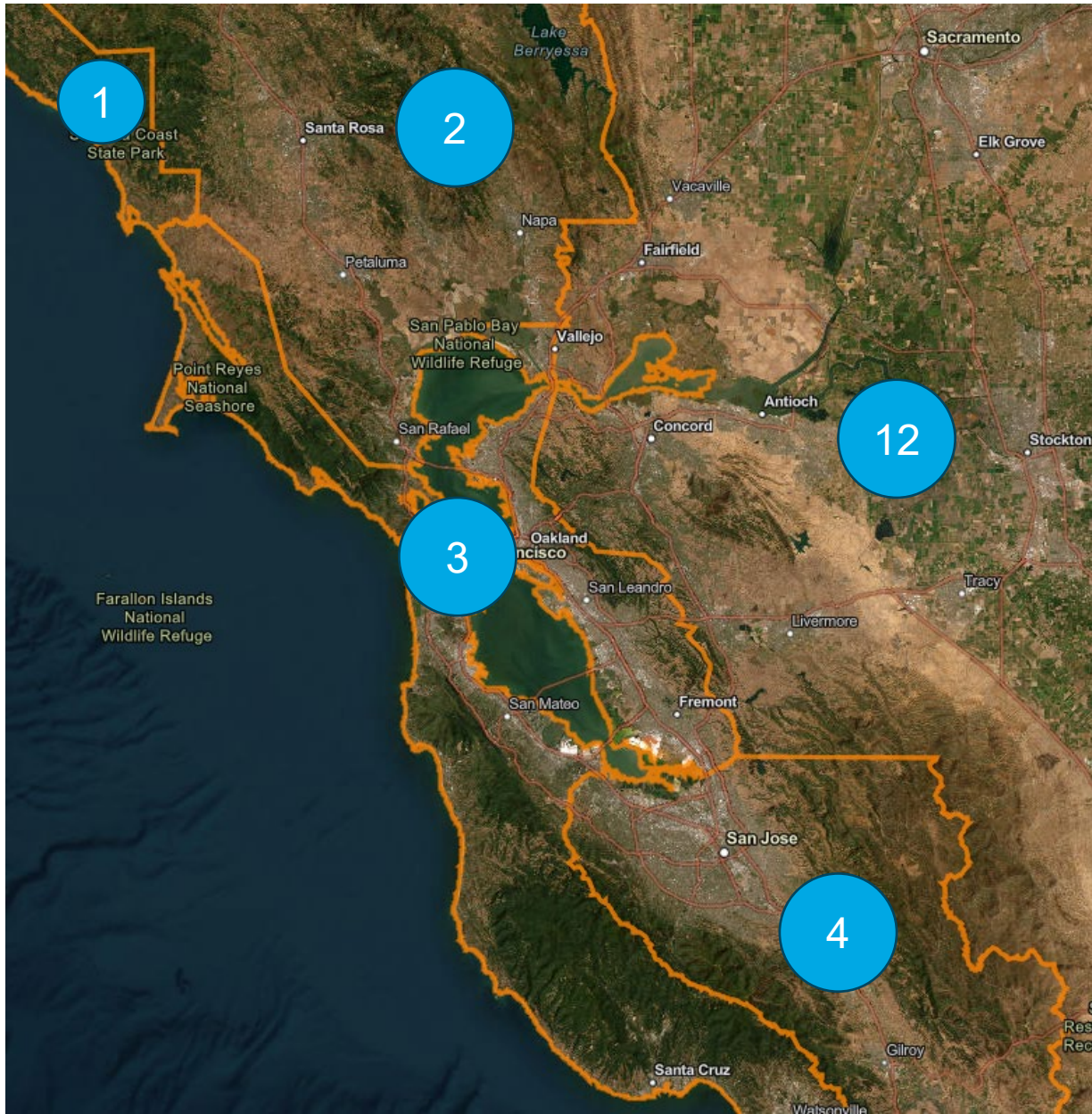
Electrification Measures

- Electric cooking and clothes drying, HP water heating and HP space heating

Climates

- 1: Sonoma Coast
- 2: North Bay (e.g., Santa Rosa)
- 3: Central Bay (e.g., San Mateo, Oakland)
- 4: South Bay (e.g., San Jose)
- 12: Valley (e.g., Stockton)

Vintages: 1975 and 1985 (CZ12)



Approach - Rates

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Electric (Dec 2024)

- E-TOU-C for gas homes
- E-ELEC for electrified homes

Period	E-TOU-C Electricity Rates ($/kWh)	
	Peak	Off-Peak
Summer	$0.61	$0.50
Winter	$0.50	$0.46

Period	E-ELEC Electricity Rates ($/kWh)		
	Peak	Partial- Peak	Off-Peak
Summer	$0.61	$0.45	$0.39
Winter	$0.38	$0.35	$0.34

Gas (Jan-Dec 2024)

- G-1 for gas homes
- Average summer and winter months

Period	Gas Rates ($/therms)	
	First 4000 Therms	Excess
Summer	$2.208	$2.663
Winter	$2.242	$2.701

Both First-year and Net Present Value (NPV) bill impacts over 15 years are estimated

Results

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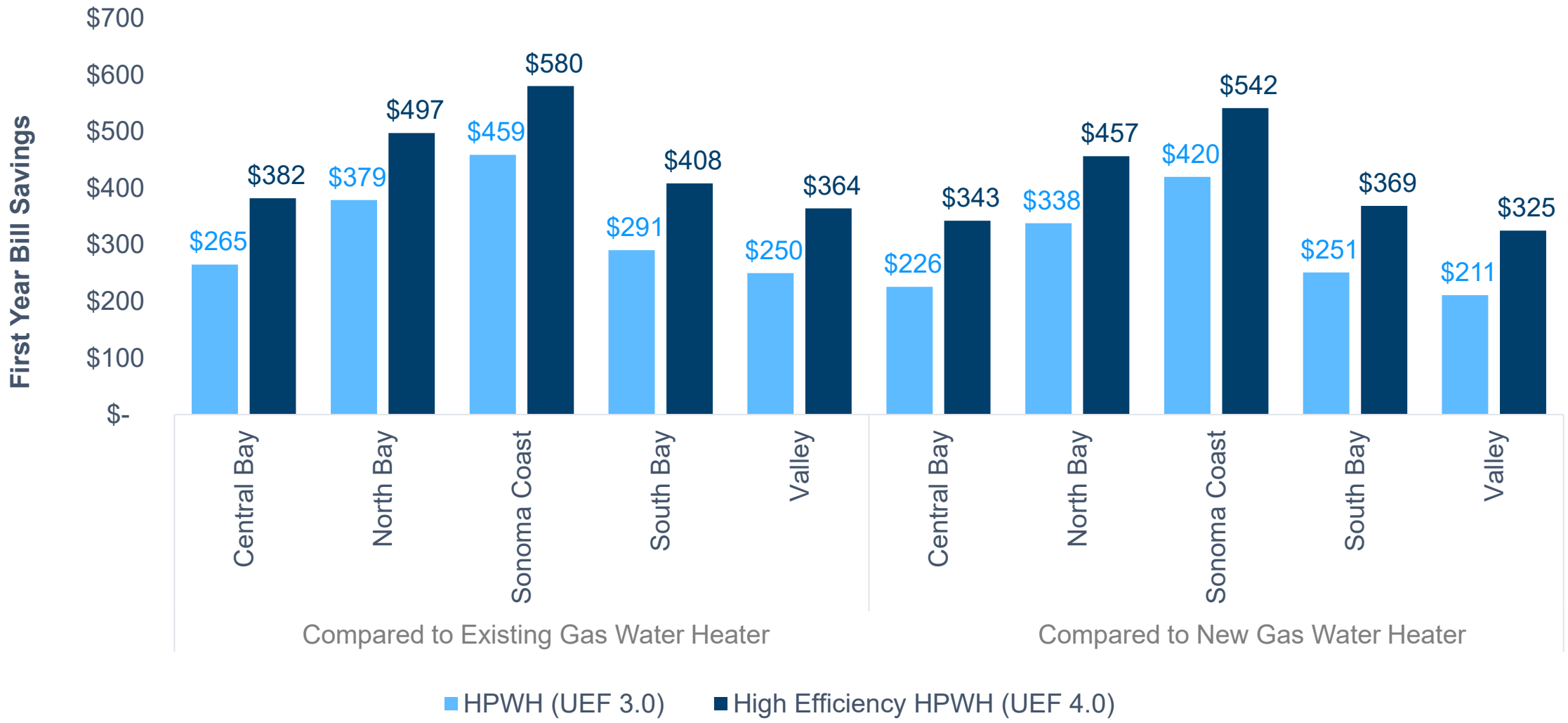
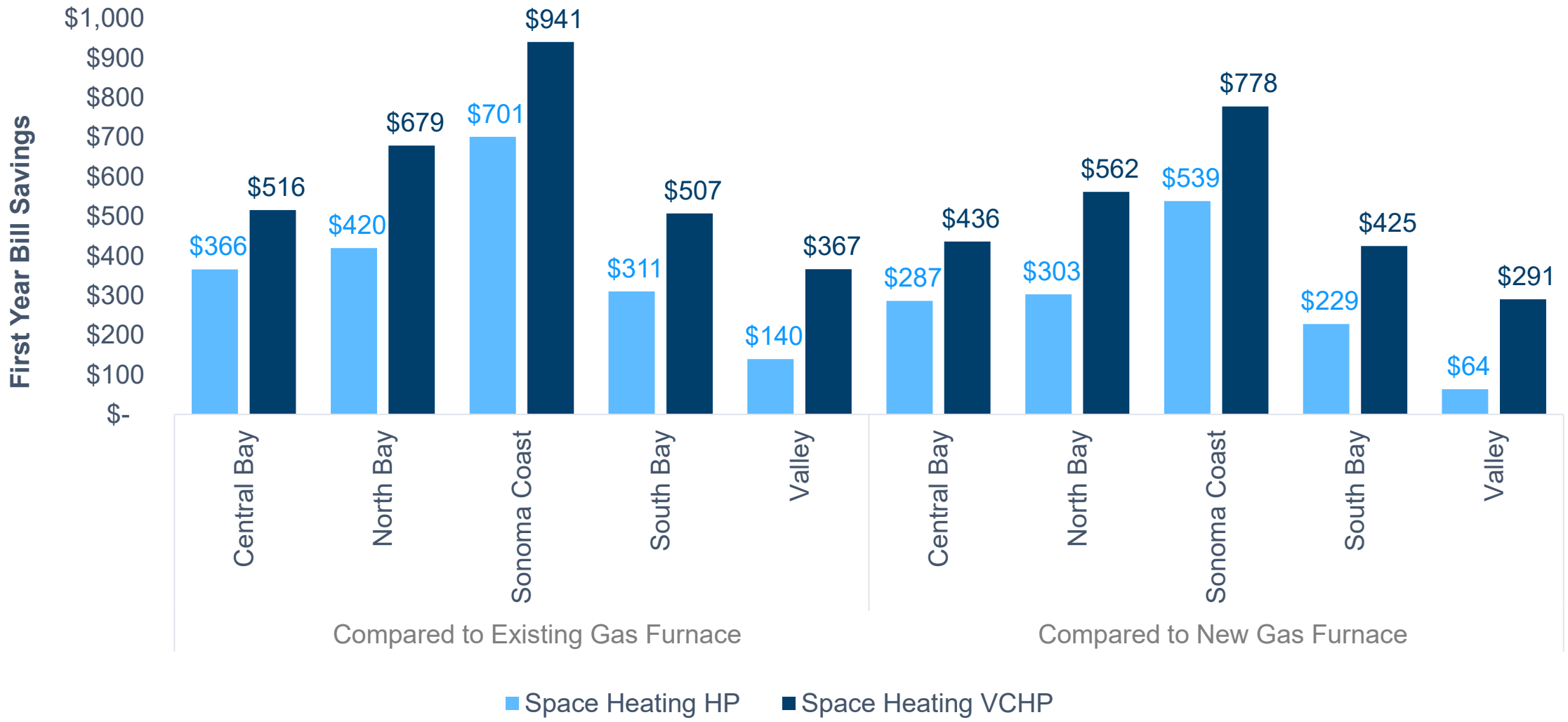
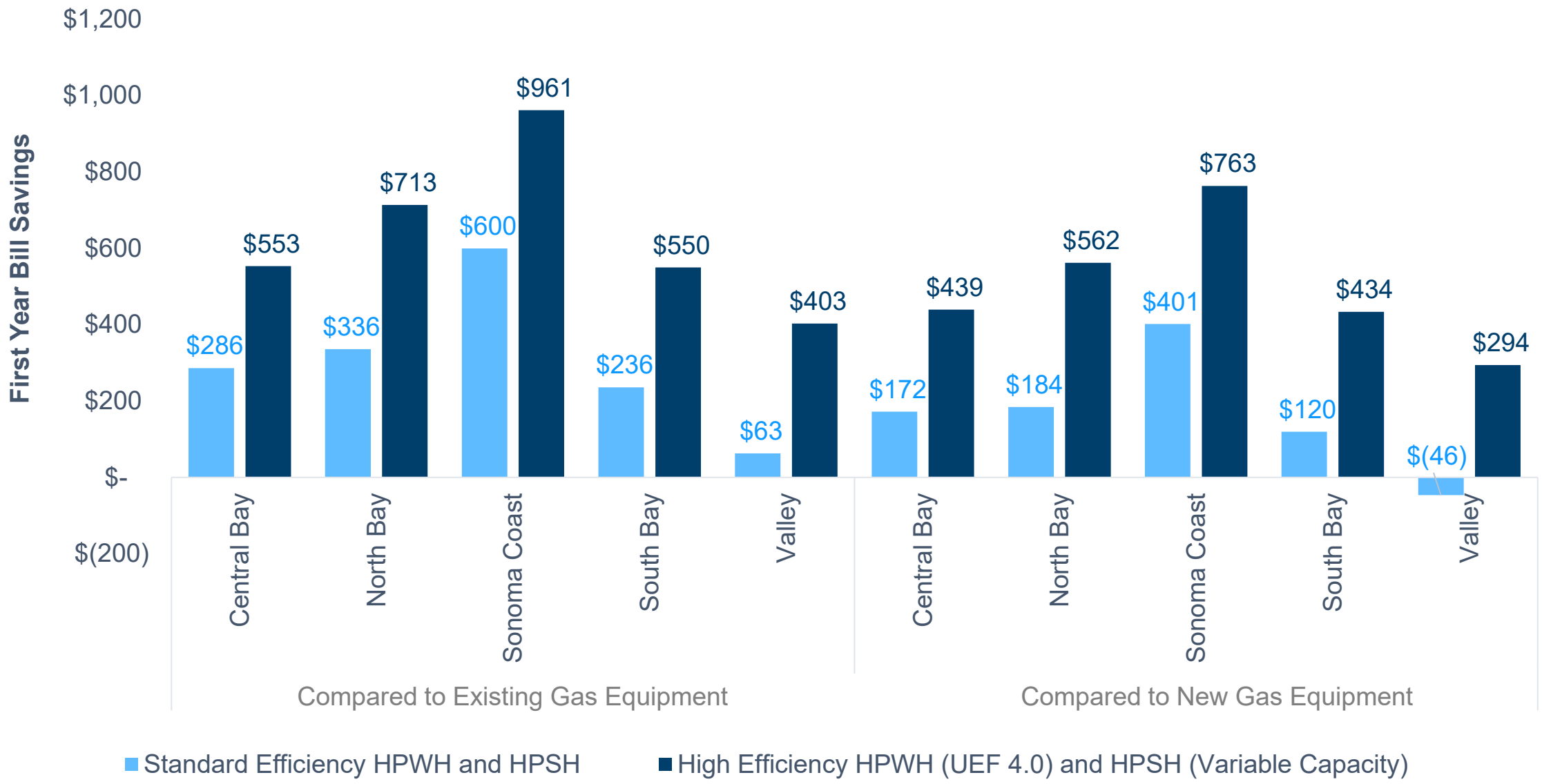
HPWHs Save $ Today



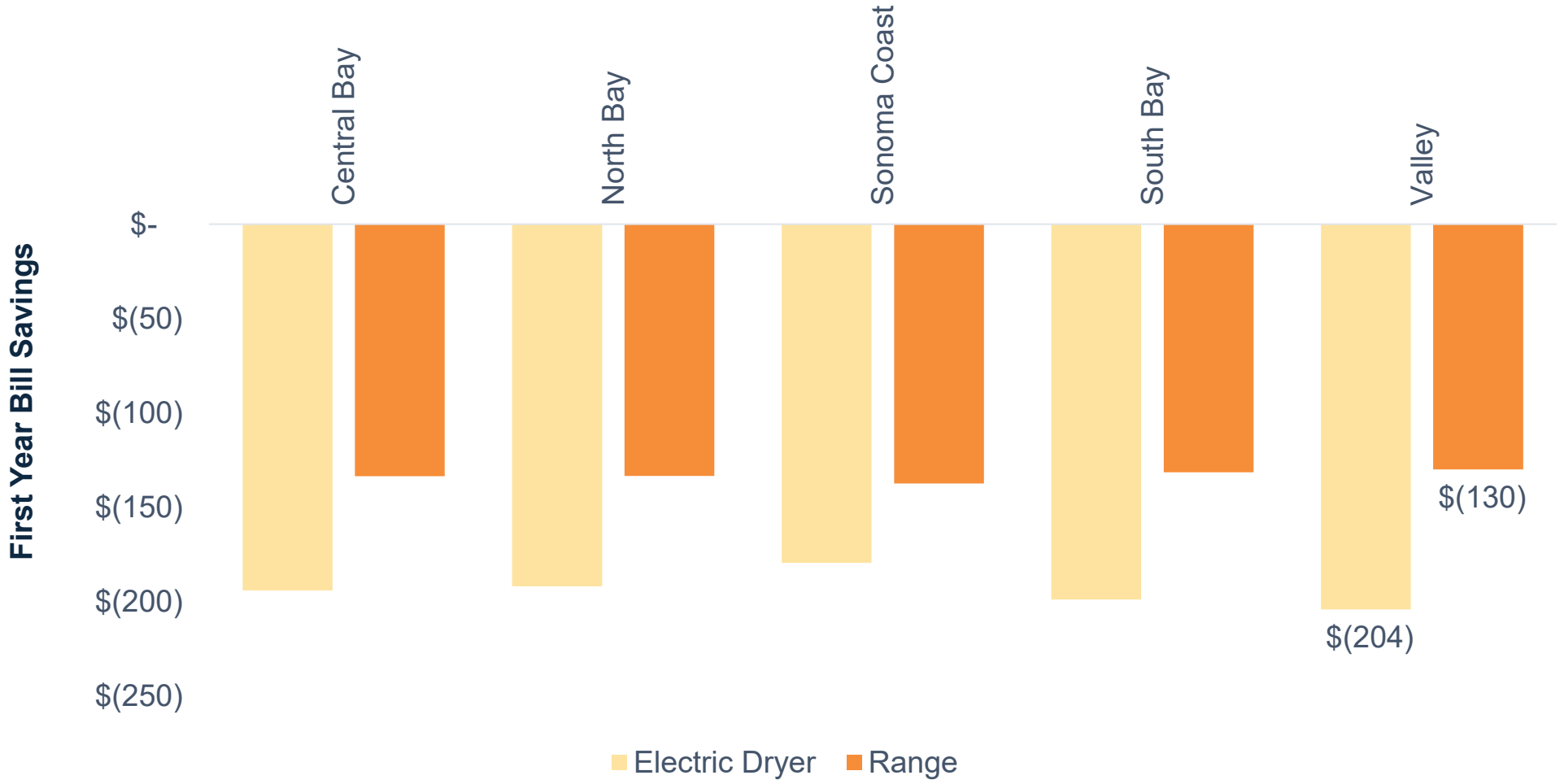
HPSHs Save $ Today



Two HPs Save $ Today

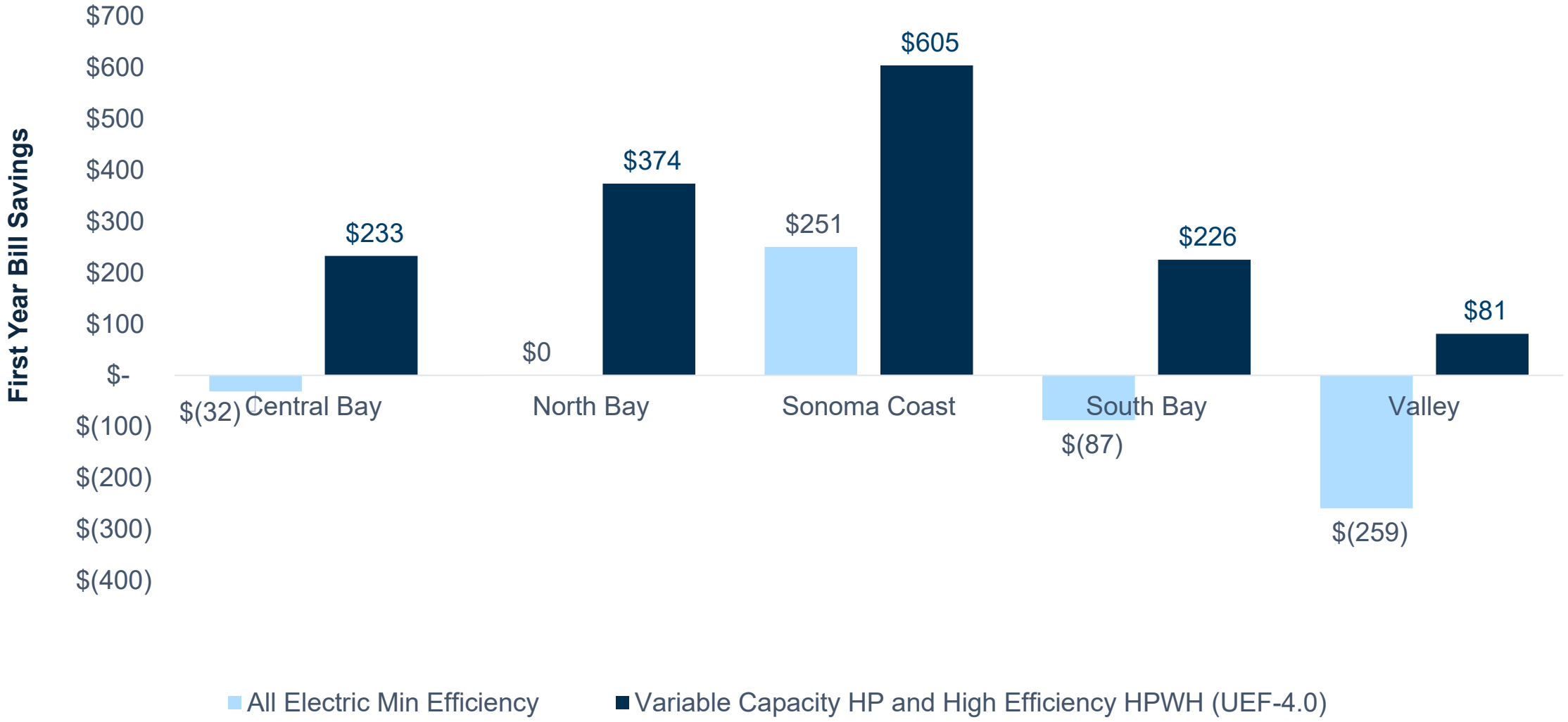


White Goods increase costs



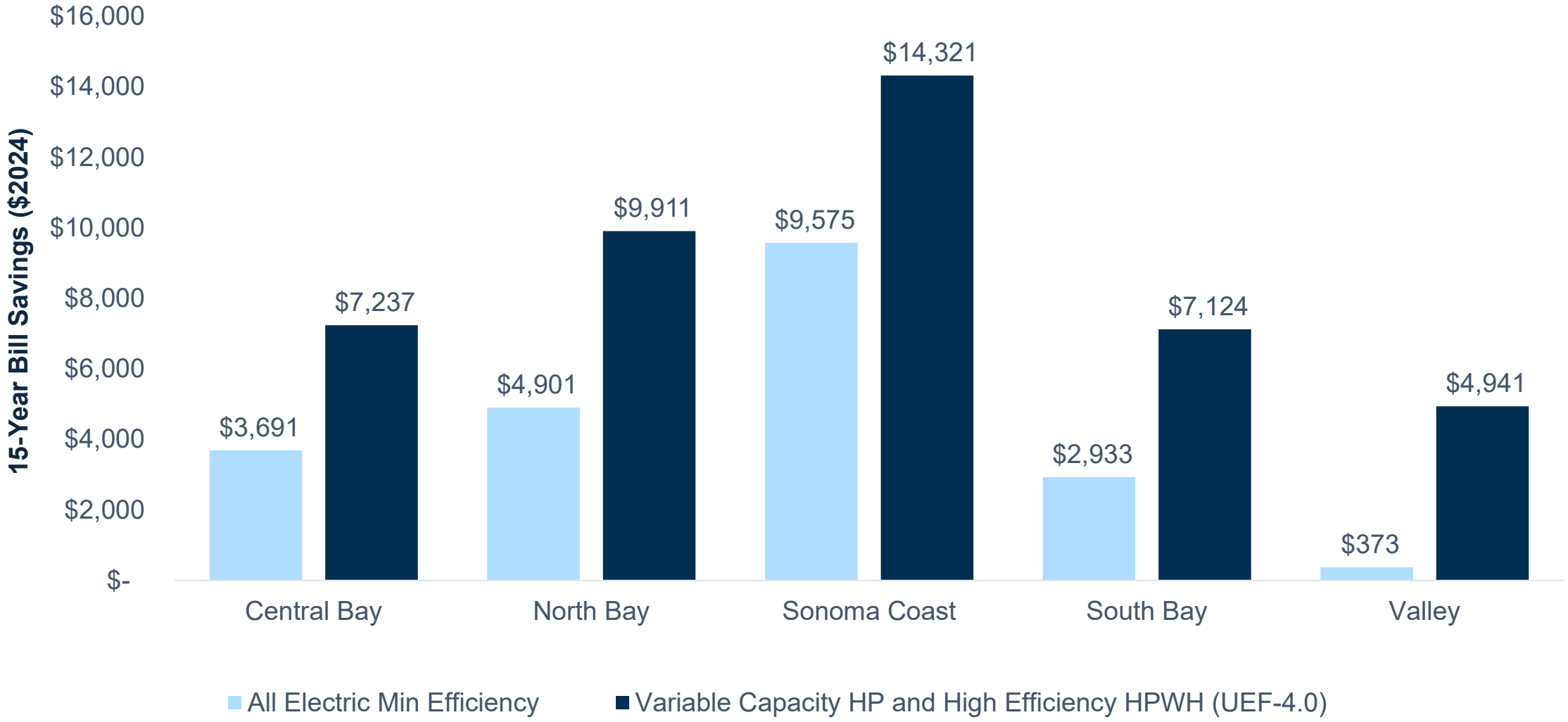
Whole-Home Electrification

Overall (whether a home previously had A/C or not, whether comparing to existing gas equipment or new) choosing efficient appliances can lower customer bills.



Electrification Saves $

Whole-home electrification saves customers money over time, even with minimum efficiency equipment. Installing high-efficiency equipment helps significantly boost long term savings.



Conclusion

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Avoiding Bill Increases

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Every project is unique, and simply installing a heat pump does not guarantee bill savings. Here are some common installation pitfalls to avoid to help ensure bills decrease and other factors that may increase bills.

- Customer remains on E-1 or TOU-C electricity rate after heat pumps are installed (rather than switching to EV-2 or E-ELEC).
- Heat pump is not properly programmed for efficient and/or cost-effective operation.
- Heat pump water heater is not upsized correctly and spends more time operating in electric resistance mode to meet demand.
- Variable-speed heat pump HVAC is installed with an incompatible ("non-communicating") thermostat and loses high-efficiency performance capability.
- Bill increases may be experienced when heat pumps are added as part of a larger home remodel project that increases overall electricity usage (e.g., adding new appliances, increasing square footage, purchasing an electric vehicle, etc.).
- Hotter- or colder-than-usual weather increases utility bills.

Conclusions

- Despite rising electricity rates, heat pumps can help **save money today** for customers throughout the entire Bay Area.
- In many circumstances, whole-home electrification can **lower customer bills**, provided:
  - Customers install **variable-speed HVAC systems**
  - Electrification retrofits are **paired with energy efficiency** opportunities
  - Customers are enrolled in the **optimum electric rate**
- Homes **adding AC for the first time** may see slight bill increases, but this can be avoided with variable-speed HVAC and high efficiency HPWHs.
- Bill increases due to cooking and clothes drying can be **off-set by also electrifying space and water heating**.

Appendix

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Methodology Comparison

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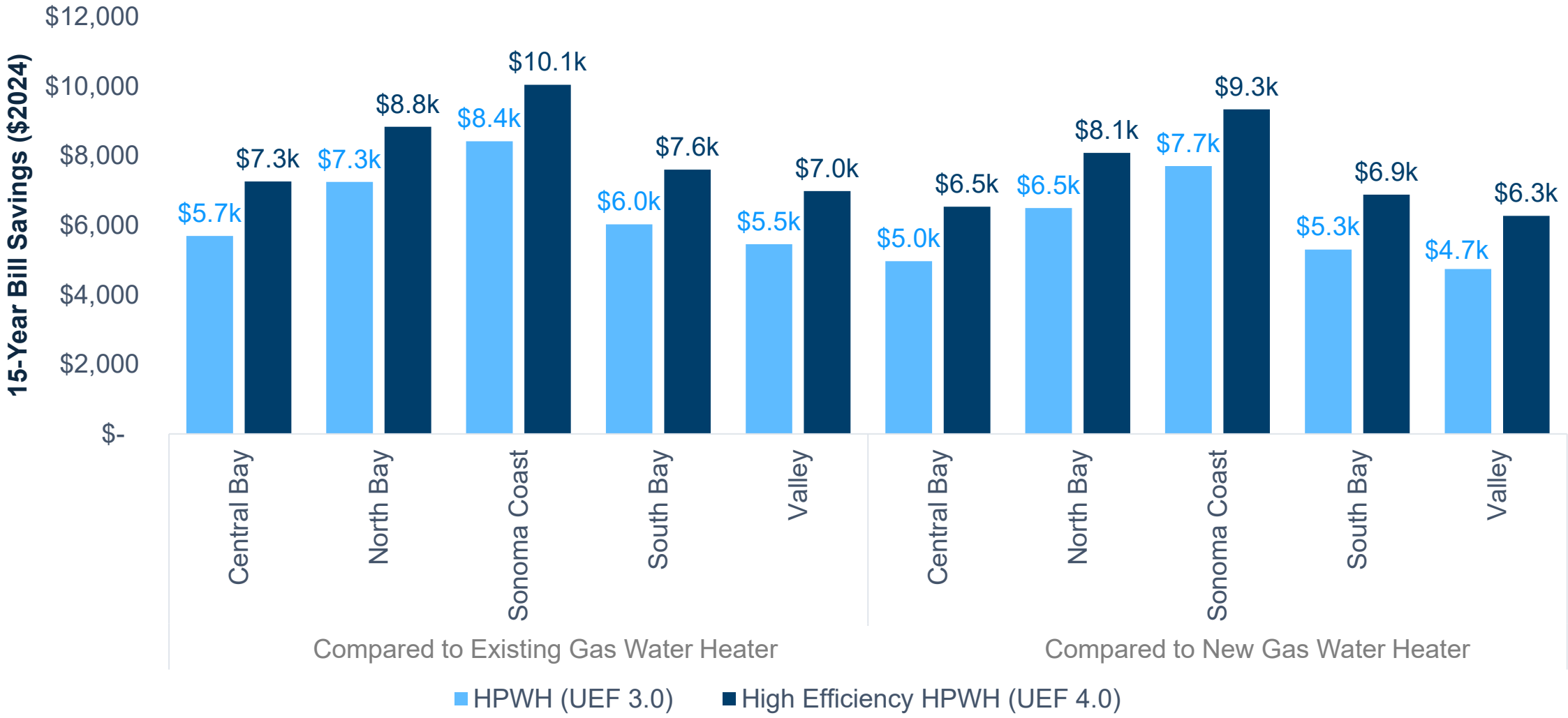
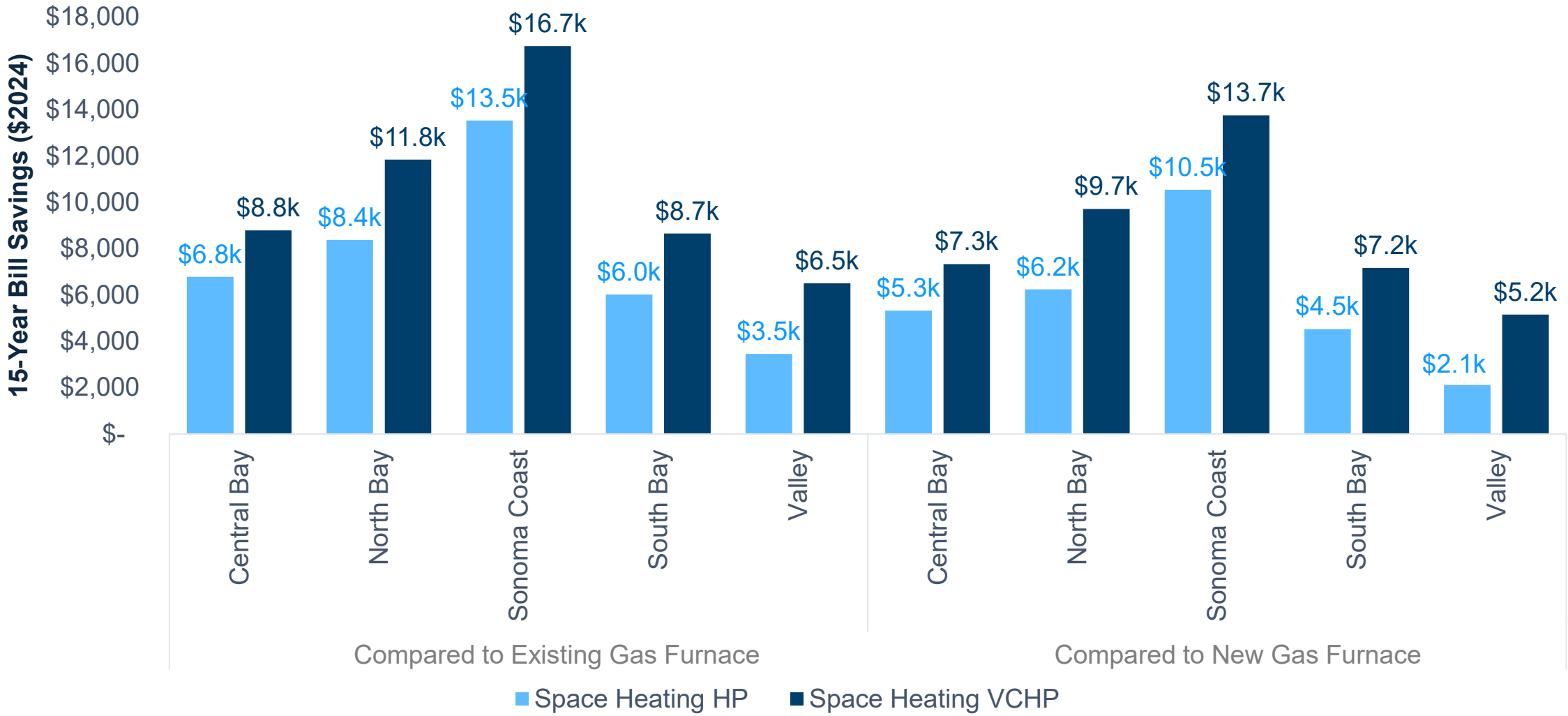
Study Design	Current On-Bill Analysis	Reach Codes Cost-Effectiveness Studies
Intent	Estimate on-bill impacts of various electrification measures	Support policy adoption of efficiency and electrification measures by passing Energy Commission cost-effectiveness criteria and avoiding federal pre-emption
Software	EnergyPlus - Federally developed. Full flexibility over measure settings	CBECC-Res - State developed. Limited flexibility to prevent misuse during permitting
Prototypes	Based on CPUC-approved size and vintage	Based on CEC-approved size and vintage
Energy Consumption	Calibrated to local meter data and custom thermostat settings	Primarily based on state or federal minimum efficiency standards; generally fixed settings

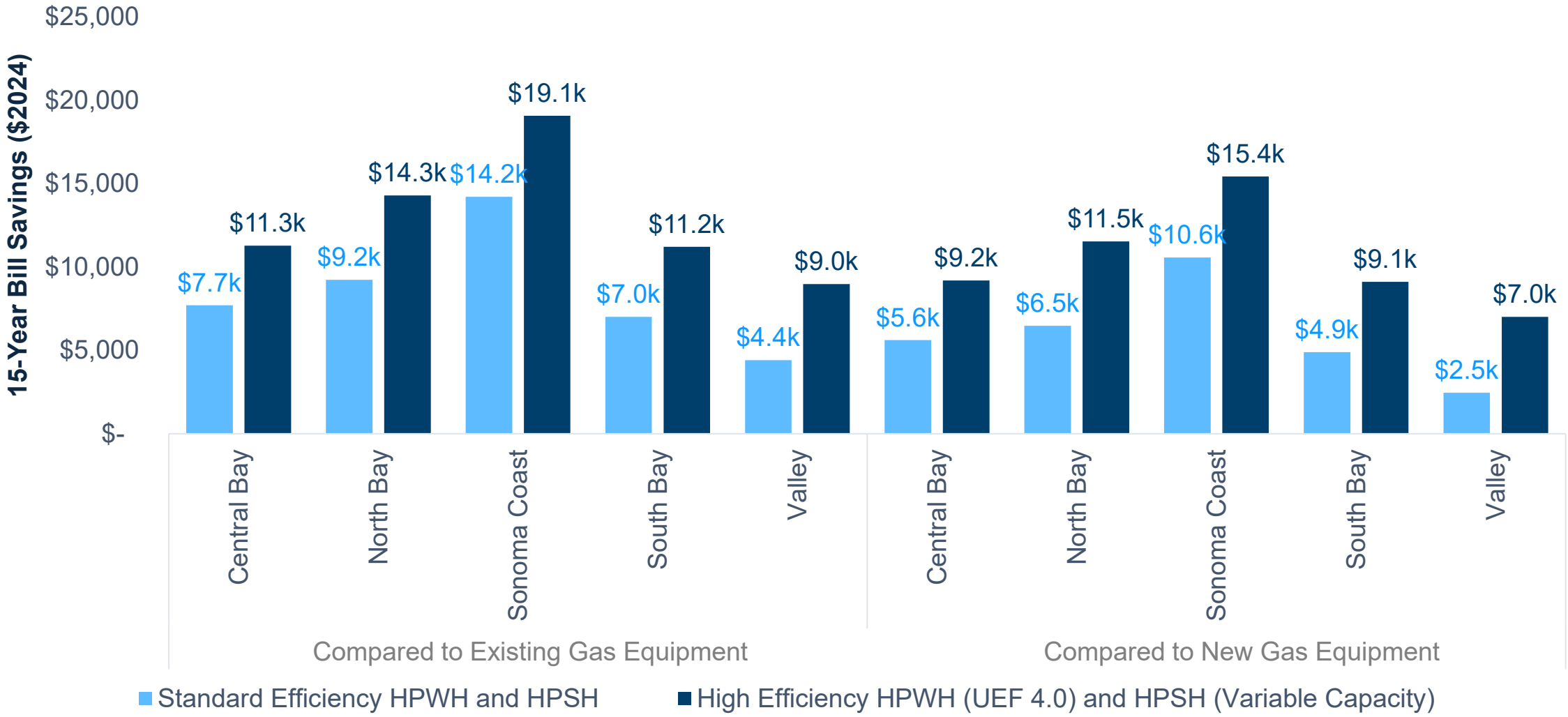
HPWH Lifetime Savings



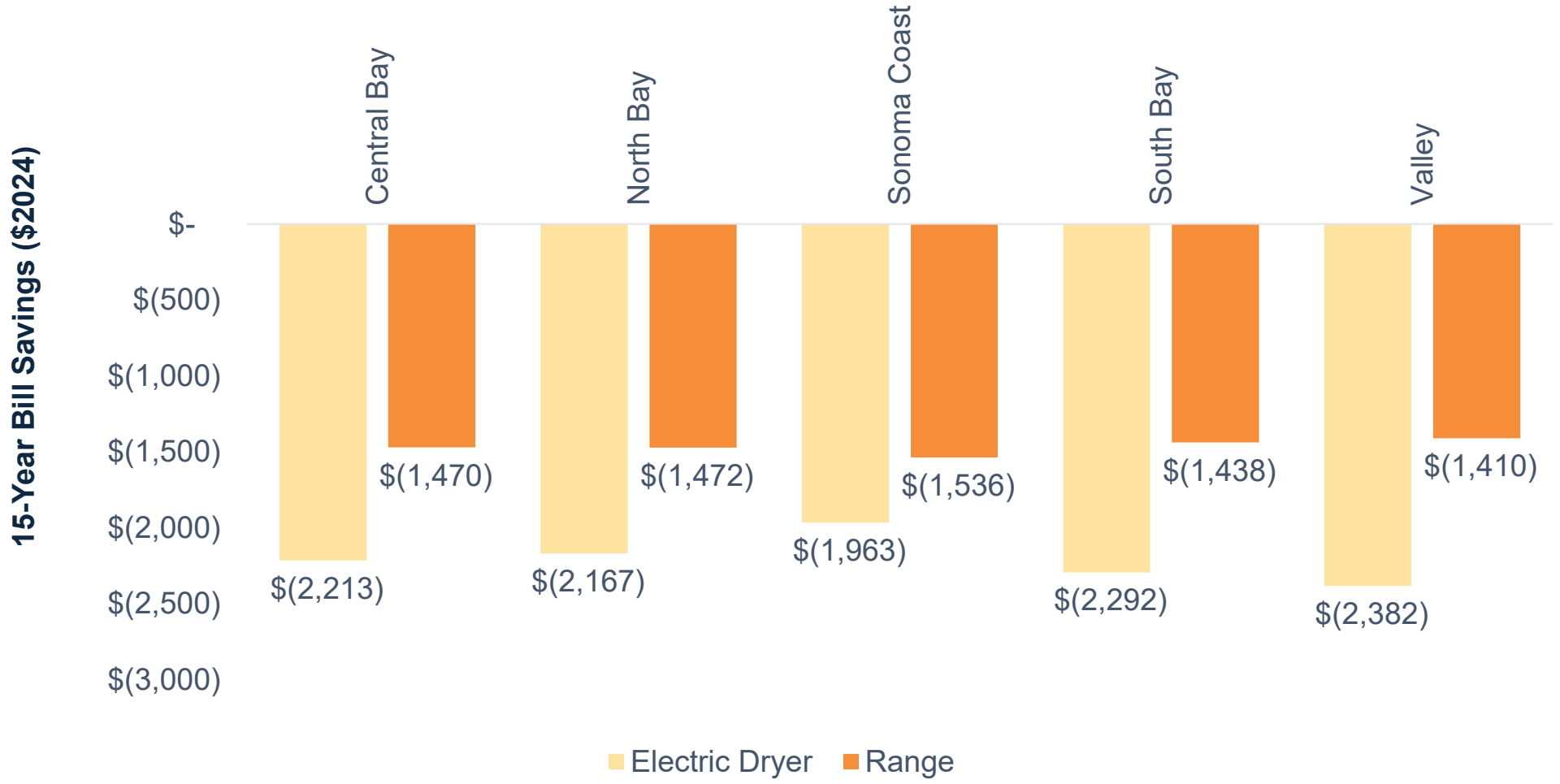
HPSH Lifetime Savings



Two HPs Lifetime Savings



White Goods Nominally Increase Costs over 15-years



Modeling Approach and Assumptions

Prototype Characteristics:

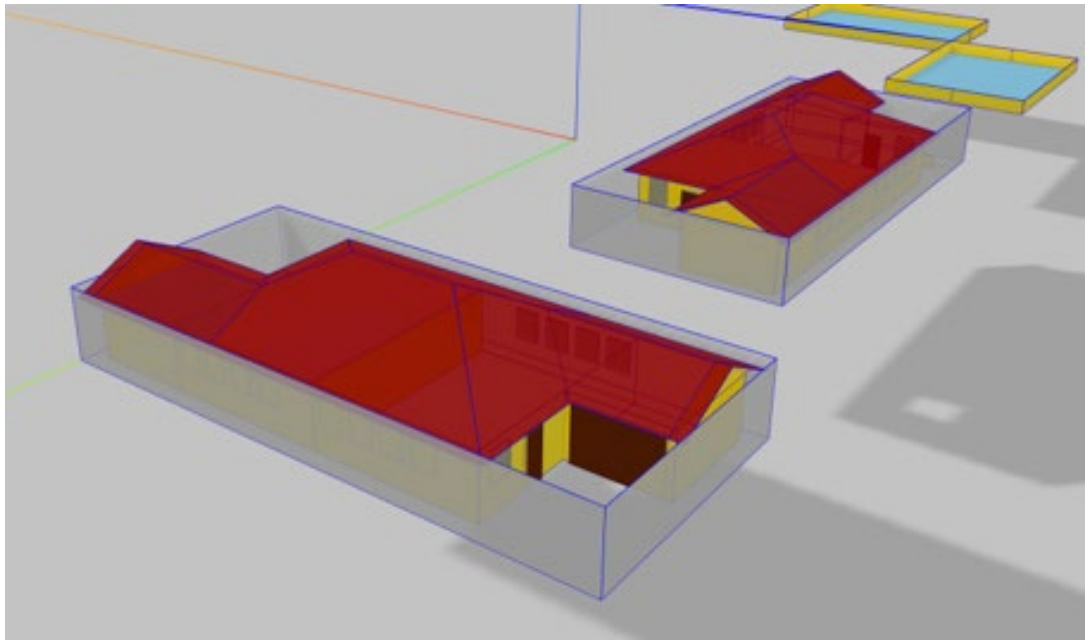
DEER Prototype including two single story building

a) Building Characteristics

- Net Conditioned floor area per building: 1,453 sf
- Total floor area per building: 1,889 sf
- People per building: 3
- Bedroom per building: 2 (assumed)

b) HVAC system

- DXGF – AC (DX) with gas furnace
- NCGF – No cooling with gas furnace



White Goods Data Assumptions

Category	Gas Baseline (kWh/yr)	Electric Measure Case (kWh/yr)
Oven	259	186
Cooktop	519	207
Clothes Dryers	615	547

- The baseline gas and electric consumption are based on the federal rated energy consumption data.

Modeling Approach and Assumptions

Whole Building Gas Data Comparison to Baseline

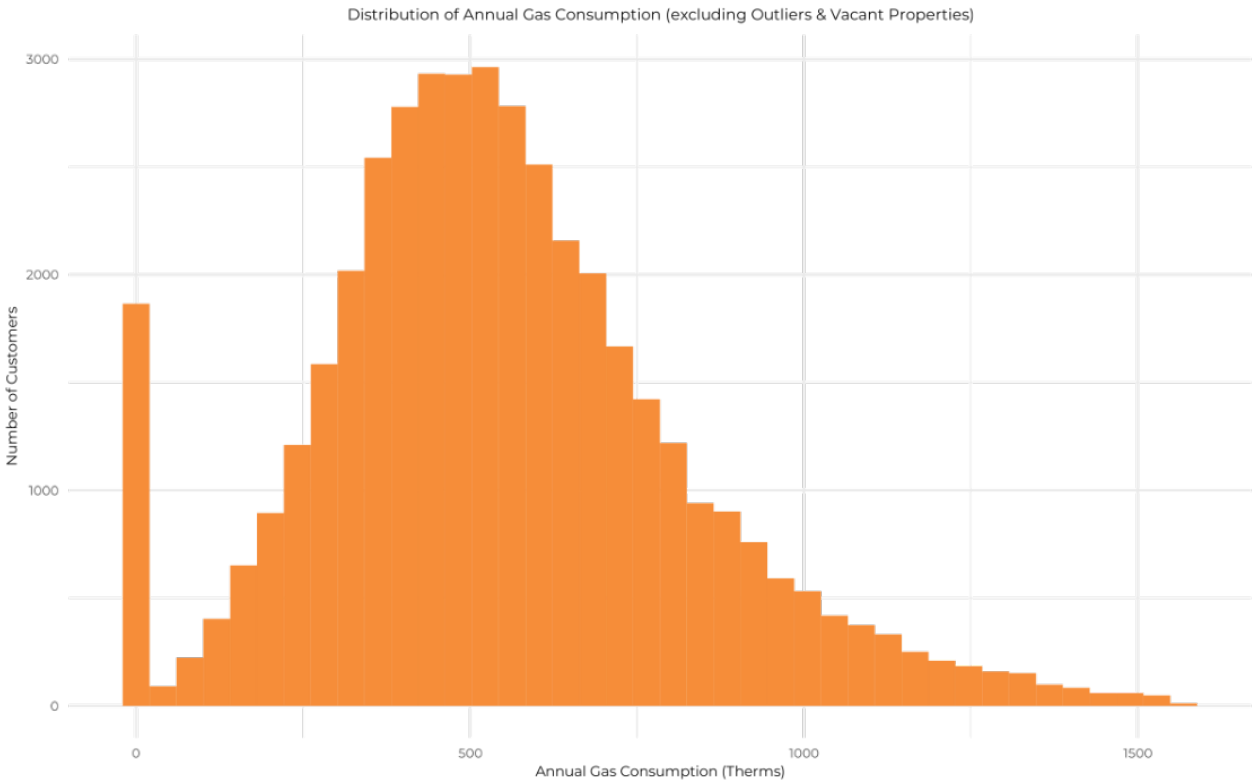
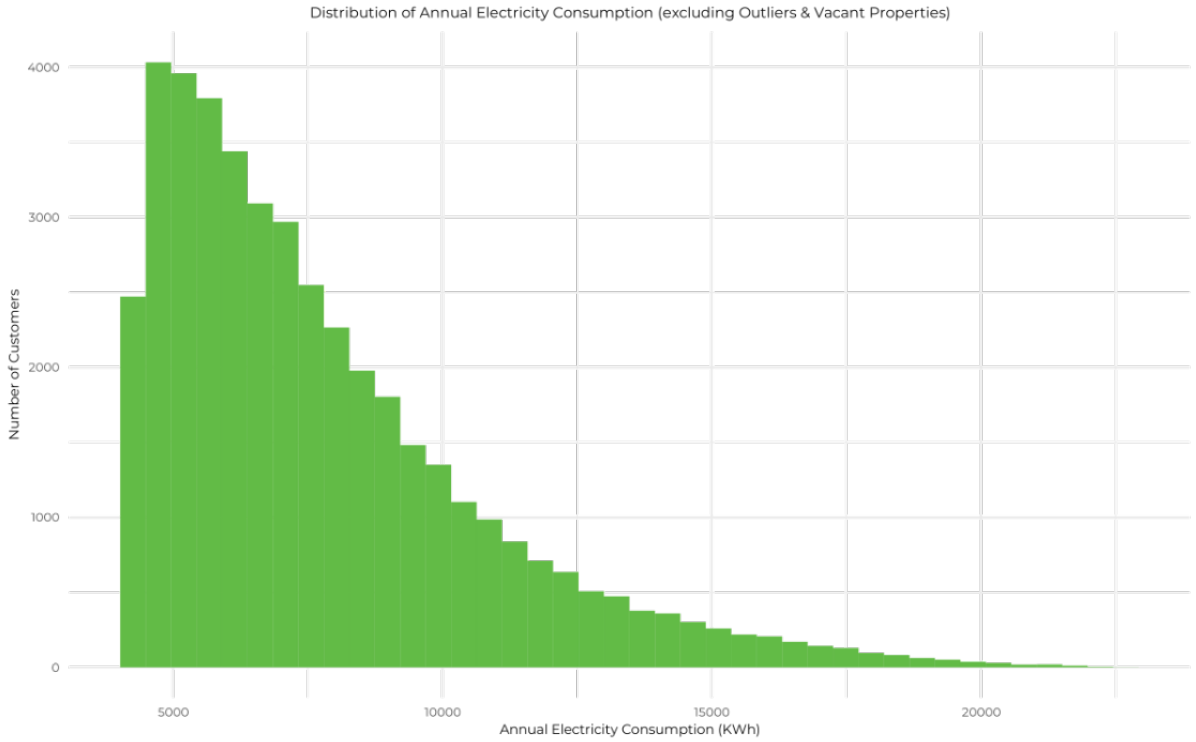


Chart Source: Single-Family Home EUI Analysis, Silicon Valley Clean Energy, December 2024

Climate Zone	Total Baseline Gas Consumption (Therms)
CZ01	531
CZ02	431
CZ03	362
CZ04	359
CZ12	334

Modeling Approach and Assumptions

Whole Building Electric Data Comparison to Baseline



Climate Zone	Total Baseline Electricity Consumption (kWh)
CZ01	5,209
CZ02	5,396
CZ03	5,243
CZ04	5,411
CZ12	5,643

Chart Source: Single-Family Home EUI Analysis, Silicon Valley Clean Energy, December 2024

Modeling Approach and Assumptions

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Heat Pump (HP)

Space Heating Assumptions

Base Case

- Type: end of life HVAC: Gas Furnace Only (AFUE 0.8)
- Type: end of life HVAC: Gas Furnace With AC (SEER 14)
- Type: early replacement HVAC: Gas Furnace Only (AFUE 0.78)
- Type: early replacement HVAC: Gas Furnace With AC (SEER 13.0)

Measure

- Heat pump (HSPF 8.8, SEER 14)
- Variable Capacity Heat pump (HSPF 8.8, SEER 14)

Modeling Approach and Assumptions

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Heat Pump Water Heater(HPWH)

Water Heating Assumptions

Base Case

- Type: end of life DHW: gas storage water heater (0.66 UEF) — HVAC: Gas Furnace Only (AFUE 0.8)
- Type: early replacement DHW: Gas storage Water heater(0.53 UEF) — HVAC: Gas Furnace With AC (SEER 14)
- Type: end of life DHW: gas storage water heater (0.66 UEF) — HVAC: Gas Furnace Only (AFUE 0.78)
- Type: early replacement DHW: Gas storage Water heater(0.53 UEF) — HVAC: Gas Furnace With AC (SEER 14)

Measure

- Electric storage heat pump water heater (3.0 UEF)
- Electric storage heat pump water heater (4.0 UEF)

Modeling Approach

- **Baseline :**
  - Heating : Ducted gas furnace.
  - Cooling : DX cooling/No Cooling
  - DHW :Gas Storage Water Heater

- **Measures**
  - Heating : Heat Pump
  - Cooling : Heat Pump
  - DHW : Heat Pump

Parameters related to each baseline and measure case are defined in the cases and cohort files.

skip	cohort	root	:cool_setp	:cooling_coil	:cool_coil	:heat_coil_type	:heat_coil	:burner_ef	:hvac_type	:coil_type	:dx_comp	:vav_fan	:water_he	:water_he	:heat_elen	:thermal_(	:uef	:tank_size	:draw_pat	:parasitic	:parasitic	:tank_h
	SFm&1&rNCGF&Ex	SFm-1 St	25.6	NONE		COMBUSTION		0.78				NO	gas	41000['BTUH']		0.71	0.53	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rNCGF&New	SFm-1 St	25.6	NONE		COMBUSTION		0.79				NO	gas	41000['BTUH']		0.79	0.66	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXGF&Ex	SFm-1 St	25.6		4.55	COMBUSTION		0.78				NO	gas	41000['BTUH']		0.71	0.53	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXGF&New	SFm-1 St	25.6		4.96	COMBUSTION		0.79				NO	gas	41000['BTUH']		0.79	0.66	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXHP&Ex	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	NO	gas	41000['BTUH']		0.71	0.53	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXHP&New	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	NO	gas	41000['BTUH']		0.79	0.66	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXHP&VAV&Ex	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	YES	gas	41000['BTUH']		0.71	0.53	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rDXHP&VAV&New	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	YES	gas	41000['BTUH']		0.79	0.66	58	HI	350	['BTUH	NaturalGa	57['in']
	SFm&1&rNCGF&HPWH&Ex	SFm-1 St	25.6	NONE		COMBUSTION		0.78				NO	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
	SFm&1&rNCGF&HPWH&New	SFm-1 St	25.6	NONE		COMBUSTION		0.79				NO	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
	SFm&1&rDXGF&HPWH&Ex	SFm-1 St	25.6		4.55	COMBUSTION		0.78				NO	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
	SFm&1&rDXGF&HPWH&New	SFm-1 St	25.6		4.96	COMBUSTION		0.79				NO	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
	SFm&1&rDXHP&HPWH	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	NO	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
	SFm&1&rDXHP&VAV&HPWH	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	YES	hpwh	4500['W']		0.98	3	66	MD-HI				50['in']
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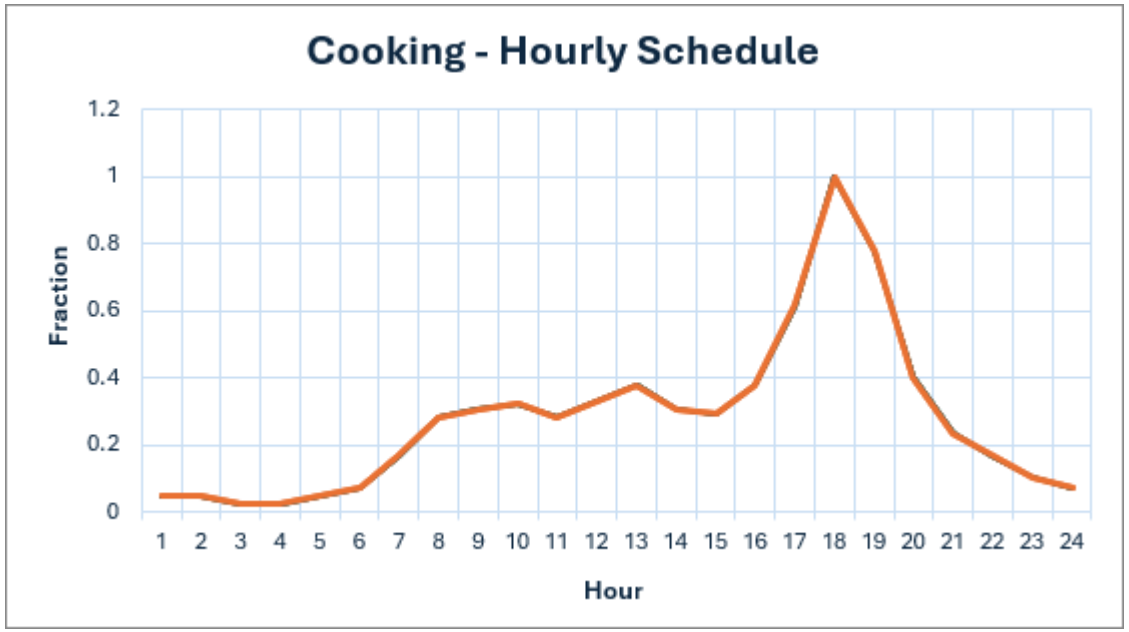
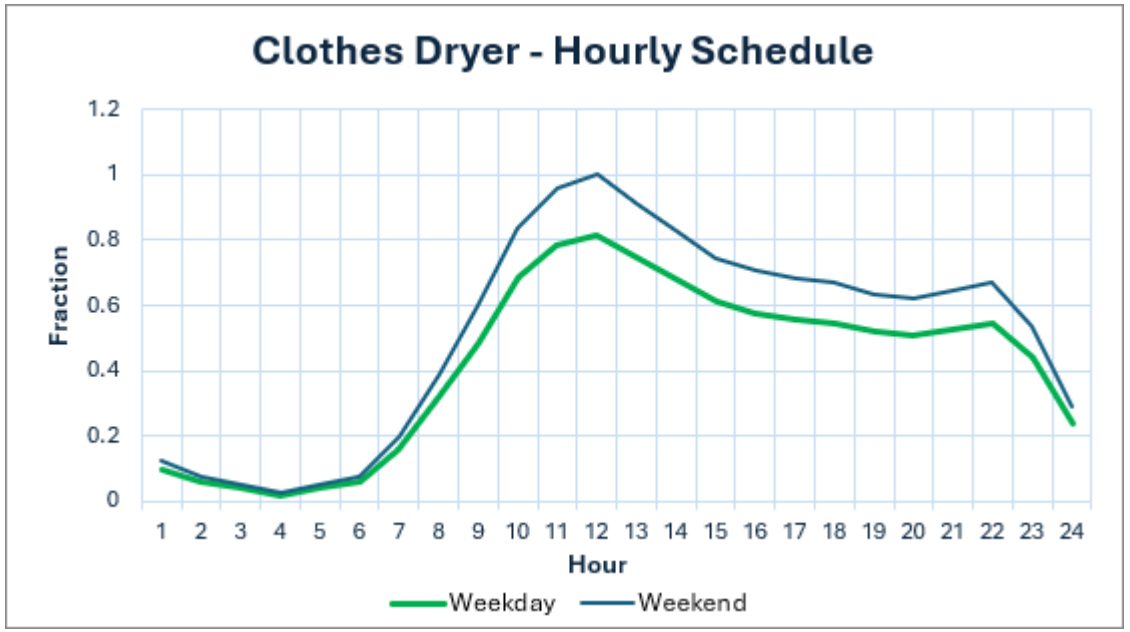
#	SFm&1&rDXHP&Ex-fan-test2	SFm-1 St	25.6		3.53	DX-AIR	4.11		unitary_system	multispeed	4	NO	gas	41000['BTUH']		0.8	0.53	58	HI	350	['BTUH	NaturalGa	57['in']

White Goods Schedules





- The Equivalent Full Load Hours of Operation Per Year (EFLH) for *Oven and Cooktop* is **2,434** and for *Clothes Dryers* is **3,909**. These EFLH assumptions are taken directly from the DEER prototypes.

Utility Cost Modeling – Cost Escalation

$$NPV\ factor = \sum_{i=1}^{n} \frac{(1 + escalation\ rate_i) * \cdots * (1 + escalation\ rate_1)}{(1 + real\ discount\ rate)^i}$$

$$n = 15\ (years -\ from\ 2025\ to\ 2039)$$
$$real\ discount\ rate = 3\%$$

Real Utility Rate Escalation Rate Assumptions, 2025 LSC Basis

Year	Statewide Natural Gas Residential Average Rate (%/year, real)	Statewide Electricity Residential Average Rate (%/year, real)
2024	4.6%	2.1%
2025	4.6%	2.1%
2026	4.6%	2.1%
2027	4.2%	0.6%
2028	3.2%	1.9%
2029	3.6%	1.6%
2030	6.6%	1.3%
2031	6.7%	1.0%
2032	7.7%	1.2%
2033	8.2%	1.1%
2034	8.2%	1.1%
2035	8.2%	0.9%
2036	8.2%	1.1%
2037	8.2%	1.1%
2038	8.2%	1.0%
2039	8.2%	1.1%
2040	8.2%	1.1%
2041	8.2%	1.1%
2042	8.2%	1.1%
2043	8.2%	1.1%
2044	8.2%	1.1%
2045	8.2%	1.1%
2046	8.2%	1.1%
2047	3.1%	1.1%
2048	-0.5%	1.1%
2049	-0.6%	1.1%
2050	-0.5%	1.1%
2051	-0.6%	1.1%
2052	-0.6%	1.1%
2053	-0.6%	1.1%

Shen, A., German, A., Evans, R., Hoeschele, M., & Bruceri, M. (2024). *2022 Cost-Effectiveness Study: Existing Single Family Building Upgrades*. Frontier Energy, Inc. & Misti Bruceri & Associates, LLC. Prepared for Pacific Gas and Electric.

Gas to Electric Dryer

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Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$1,702	-$3,603	-$1,901
		CZ02	$1,551	-$3,719	-$2,168
		CZ03	$1,489	-$3,677	-$2,188
		CZ04	$1,431	-$3,745	-$2,314
		CZ12	$1,344	-$3,764	-$2,420
	End of Life	CZ01	$1,576	-$3,602	-$2,027
		CZ02	$1,454	-$3,712	-$2,258
		CZ03	$1,384	-$3,673	-$2,290
		CZ04	$1,349	-$3,736	-$2,387
		CZ12	$1,283	-$3,754	-$2,471
No Cooling	Early Replacement	CZ01	$1,701	-$3,601	-$1,899
		CZ02	$1,544	-$3,616	-$2,073
		CZ03	$1,487	-$3,622	-$2,135
		CZ04	$1,424	-$3,618	-$2,193
		CZ12	$1,343	-$3,631	-$2,288
	End of Life	CZ01	$1,575	-$3,601	-$2,025
		CZ02	$1,448	-$3,616	-$2,169
		CZ03	$1,382	-$3,622	-$2,240
		CZ04	$1,342	-$3,618	-$2,275
		CZ12	$1,282	-$3,631	-$2,349

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$93	-$269	-$176
		CZ02	$84	-$277	-$193
		CZ03	$81	-$274	-$193
		CZ04	$78	-$279	-$201
		CZ12	$73	-$281	-$208
	End of Life	CZ01	$86	-$269	-$183
		CZ02	$79	-$277	-$198
		CZ03	$75	-$274	-$199
		CZ04	$73	-$279	-$205
		CZ12	$70	-$280	-$210
No Cooling	Early Replacement	CZ01	$92	-$269	-$176
		CZ02	$84	-$270	-$186
		CZ03	$81	-$270	-$189
		CZ04	$77	-$270	-$192
		CZ12	$73	-$271	-$198
	End of Life	CZ01	$86	-$269	-$183
		CZ02	$79	-$270	-$191
		CZ03	$75	-$270	-$195
		CZ04	$73	-$270	-$197
		CZ12	$70	-$271	-$201

Electric Range

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$1,117	-$2,671	-$1,554
		CZ02	$1,159	-$2,624	-$1,464
		CZ03	$1,180	-$2,643	-$1,463
		CZ04	$1,194	-$2,614	-$1,420
		CZ12	$1,217	-$2,606	-$1,389
	End of Life	CZ01	$1,154	-$2,671	-$1,516
		CZ02	$1,188	-$2,627	-$1,438
		CZ03	$1,188	-$2,645	-$1,457
		CZ04	$1,211	-$2,618	-$1,406
		CZ12	$1,234	-$2,611	-$1,377
No Cooling	Early Replacement	CZ01	$1,116	-$2,671	-$1,555
		CZ02	$1,161	-$2,667	-$1,506
		CZ03	$1,182	-$2,666	-$1,484
		CZ04	$1,197	-$2,667	-$1,470
		CZ12	$1,218	-$2,663	-$1,445
	End of Life	CZ01	$1,153	-$2,671	-$1,518
		CZ02	$1,189	-$2,667	-$1,478
		CZ03	$1,189	-$2,666	-$1,477
		CZ04	$1,212	-$2,667	-$1,455
		CZ12	$1,234	-$2,663	-$1,429

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$61	-$199	-$138
		CZ02	$63	-$196	-$133
		CZ03	$64	-$197	-$133
		CZ04	$65	-$195	-$130
		CZ12	$66	-$194	-$128
	End of Life	CZ01	$63	-$199	-$136
		CZ02	$65	-$196	-$131
		CZ03	$65	-$197	-$133
		CZ04	$66	-$195	-$129
		CZ12	$67	-$195	-$128
No Cooling	Early Replacement	CZ01	$61	-$199	-$139
		CZ02	$63	-$199	-$136
		CZ03	$64	-$199	-$135
		CZ04	$65	-$199	-$134
		CZ12	$66	-$199	-$132
	End of Life	CZ01	$63	-$199	-$137
		CZ02	$65	-$199	-$134
		CZ03	$65	-$199	-$134
		CZ04	$66	-$199	-$133
		CZ12	$67	-$199	-$132

HPSH Min Efficiency

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$15,234	-$1,695	$13,540
		CZ02	$10,159	-$1,050	$9,109
		CZ03	$6,926	$179	$7,105
		CZ04	$6,887	$40	$6,927
		CZ12	$5,888	-$555	$5,333
	End of Life	CZ01	$12,245	-$1,696	$10,550
		CZ02	$8,075	-$1,164	$6,911
		CZ03	$5,491	$128	$5,619
		CZ04	$5,457	-$96	$5,361
		CZ12	$4,666	-$816	$3,851
No Cooling	Early Replacement	CZ01	$15,234	-$1,710	$13,524
		CZ02	$10,050	-$2,413	$7,637
		CZ03	$6,868	-$408	$6,460
		CZ04	$6,775	-$1,667	$5,108
		CZ12	$5,835	-$4,247	$1,587
	End of Life	CZ01	$12,245	-$1,710	$10,535
		CZ02	$7,987	-$2,413	$5,574
		CZ03	$5,445	-$408	$5,037
		CZ04	$5,367	-$1,667	$3,700
		CZ12	$4,623	-$4,247	$375

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$828	-$126	$702
		CZ02	$552	-$78	$474
		CZ03	$377	$13	$390
		CZ04	$374	$3	$377
		CZ12	$320	-$41	$279
	End of Life	CZ01	$666	-$126	$539
		CZ02	$439	-$87	$352
		CZ03	$299	$10	$308
		CZ04	$297	-$7	$290
		CZ12	$254	-$61	$193
No Cooling	Early Replacement	CZ01	$828	-$128	$701
		CZ02	$546	-$180	$366
		CZ03	$373	-$30	$343
		CZ04	$368	-$124	$244
		CZ12	$317	-$317	$0
	End of Life	CZ01	$666	-$128	$538
		CZ02	$434	-$180	$254
		CZ03	$296	-$30	$266
		CZ04	$292	-$124	$167
		CZ12	$251	-$317	-$65

HPSH Variable Capacity

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$15,234	$1,513	$16,747
		CZ02	$10,159	$2,423	$12,582
		CZ03	$6,925	$2,185	$9,111
		CZ04	$6,886	$2,677	$9,563
		CZ12	$5,888	$2,489	$8,377
	End of Life	CZ01	$12,245	$1,512	$13,757
		CZ02	$8,075	$2,309	$10,384
		CZ03	$5,491	$2,133	$7,624
		CZ04	$5,457	$2,540	$7,997
		CZ12	$4,666	$2,229	$6,895
No Cooling	Early Replacement	CZ01	$15,234	$1,497	$16,731
		CZ02	$10,050	$1,060	$11,110
		CZ03	$6,868	$1,597	$8,466
		CZ04	$6,774	$970	$7,744
		CZ12	$5,834	-$1,203	$4,631
	End of Life	CZ01	$12,245	$1,497	$13,742
		CZ02	$7,987	$1,060	$9,047
		CZ03	$5,445	$1,597	$7,042
		CZ04	$5,366	$970	$6,336
		CZ12	$4,622	-$1,203	$3,419

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$828	$113	$941
		CZ02	$552	$181	$733
		CZ03	$377	$163	$540
		CZ04	$374	$200	$574
		CZ12	$320	$186	$506
	End of Life	CZ01	$666	$113	$779
		CZ02	$439	$172	$611
		CZ03	$299	$159	$458
		CZ04	$297	$189	$486
		CZ12	$254	$166	$420
No Cooling	Early Replacement	CZ01	$828	$112	$940
		CZ02	$546	$79	$625
		CZ03	$373	$119	$493
		CZ04	$368	$72	$441
		CZ12	$317	-$90	$228
	End of Life	CZ01	$666	$112	$777
		CZ02	$434	$79	$513
		CZ03	$296	$119	$415
		CZ04	$292	$72	$364
		CZ12	$251	-$90	$162

HPWH Min Efficiency

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$8,379	$44	$8,424
		CZ02	$8,004	-$714	$7,290
		CZ03	$7,907	-$2,182	$5,726
		CZ04	$7,884	-$1,790	$6,094
		CZ12	$7,783	-$2,153	$5,630
	End of Life	CZ01	$7,668	$44	$7,712
		CZ02	$7,259	-$724	$6,535
		CZ03	$7,182	-$2,189	$4,993
		CZ04	$7,169	-$1,804	$5,365
		CZ12	$7,082	-$2,178	$4,904
No Cooling	Early Replacement	CZ01	$8,379	$43	$8,422
		CZ02	$7,999	-$785	$7,214
		CZ03	$7,904	-$2,232	$5,673
		CZ04	$7,879	-$1,909	$5,971
		CZ12	$7,778	-$2,485	$5,293
	End of Life	CZ01	$7,668	$43	$7,711
		CZ02	$7,253	-$785	$6,469
		CZ03	$7,180	-$2,232	$4,948
		CZ04	$7,162	-$1,909	$5,253
		CZ12	$7,076	-$2,485	$4,591

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$456	$3	$459
		CZ02	$435	-$53	$382
		CZ03	$430	-$163	$267
		CZ04	$429	-$133	$295
		CZ12	$423	-$161	$263
	End of Life	CZ01	$417	$3	$420
		CZ02	$395	-$54	$341
		CZ03	$390	-$163	$227
		CZ04	$390	-$135	$255
		CZ12	$385	-$162	$223
No Cooling	Early Replacement	CZ01	$456	$3	$459
		CZ02	$435	-$59	$376
		CZ03	$430	-$166	$263
		CZ04	$428	-$142	$286
		CZ12	$423	-$185	$238
	End of Life	CZ01	$417	$3	$420
		CZ02	$394	-$59	$336
		CZ03	$390	-$166	$224
		CZ04	$389	-$142	$247
		CZ12	$385	-$185	$199

HPWH High Efficiency

PENINSULA CLEAN ENERGY | SILICON VALLEY CLEAN ENERGY

High Efficiency UEF 4.0

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$8,374	$1,678	$10,052
		CZ02	$8,001	$874	$8,875
		CZ03	$7,902	-$605	$7,297
		CZ04	$7,880	-$210	$7,671
		CZ12	$7,782	-$629	$7,153
	End of Life	CZ01	$7,664	$1,678	$9,342
		CZ02	$7,257	$863	$8,120
		CZ03	$7,178	-$612	$6,565
		CZ04	$7,166	-$224	$6,943
		CZ12	$7,082	-$654	$6,428
No Cooling	Early Replacement	CZ01	$8,374	$1,677	$10,051
		CZ02	$7,996	$805	$8,801
		CZ03	$7,900	-$661	$7,239
		CZ04	$7,875	-$326	$7,549
		CZ12	$7,778	-$944	$6,833
	End of Life	CZ01	$7,663	$1,677	$9,341
		CZ02	$7,250	$805	$8,056
		CZ03	$7,176	-$661	$6,515
		CZ04	$7,159	-$326	$6,833
		CZ12	$7,075	-$944	$6,131

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$455	$125	$580
		CZ02	$435	$65	$500
		CZ03	$430	-$45	$385
		CZ04	$428	-$16	$413
		CZ12	$423	-$47	$376
	End of Life	CZ01	$417	$125	$542
		CZ02	$395	$64	$459
		CZ03	$390	-$46	$345
		CZ04	$390	-$17	$373
		CZ12	$385	-$49	$336
No Cooling	Early Replacement	CZ01	$455	$125	$580
		CZ02	$435	$60	$495
		CZ03	$430	-$49	$380
		CZ04	$428	-$24	$404
		CZ12	$423	-$70	$352
	End of Life	CZ01	$417	$125	$542
		CZ02	$394	$60	$454
		CZ03	$390	-$49	$341
		CZ04	$389	-$24	$365
		CZ12	$385	-$70	$314

HPWH and HPSH

Minimum Efficiency

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$22,809	-$8,581	$14,228
		CZ02	$17,533	-$7,560	$9,973
		CZ03	$14,298	-$6,274	$8,023
		CZ04	$14,259	-$6,340	$7,919
		CZ12	$13,208	-$6,924	$6,284
	End of Life	CZ01	$19,164	-$8,582	$10,582
		CZ02	$14,816	-$7,675	$7,141
		CZ03	$12,229	-$6,326	$5,903
		CZ04	$12,205	-$6,476	$5,729
		CZ12	$11,376	-$7,184	$4,192
No Cooling	Early Replacement	CZ01	$22,809	-$8,596	$14,212
		CZ02	$17,424	-$8,923	$8,500
		CZ03	$14,240	-$6,862	$7,378
		CZ04	$14,147	-$8,047	$6,100
		CZ12	$13,155	-$10,616	$2,539
	End of Life	CZ01	$19,164	-$8,596	$10,568
		CZ02	$14,727	-$8,923	$5,804
		CZ03	$12,184	-$6,862	$5,322
		CZ04	$12,115	-$8,047	$4,067
		CZ12	$11,332	-$10,616	$716

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,240	-$640	$600
		CZ02	$953	-$564	$389
		CZ03	$777	-$468	$309
		CZ04	$775	-$473	$302
		CZ12	$718	-$516	$202
	End of Life	CZ01	$1,042	-$640	$402
		CZ02	$806	-$572	$233
		CZ03	$665	-$472	$193
		CZ04	$664	-$483	$181
		CZ12	$619	-$536	$83
No Cooling	Early Replacement	CZ01	$1,240	-$641	$599
		CZ02	$947	-$665	$282
		CZ03	$774	-$512	$263
		CZ04	$769	-$600	$169
		CZ12	$715	-$792	-$76
	End of Life	CZ01	$1,042	-$641	$401
		CZ02	$801	-$665	$135
		CZ03	$662	-$512	$151
		CZ04	$659	-$600	$59
		CZ12	$616	-$792	-$176

HPWH and HPSH High Efficiency

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

UEF 4.0 and Variable Capacity

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$22,809	-$3,729	$19,079
		CZ02	$17,533	-$2,496	$15,036
		CZ03	$14,298	-$2,690	$11,607
		CZ04	$14,259	-$2,130	$12,129
		CZ12	$13,208	-$2,361	$10,847
	End of Life	CZ01	$19,164	-$3,730	$15,434
		CZ02	$14,816	-$2,611	$12,205
		CZ03	$12,229	-$2,742	$9,487
		CZ04	$12,205	-$2,266	$9,939
		CZ12	$11,376	-$2,621	$8,755
No Cooling	Early Replacement	CZ01	$22,809	-$3,745	$19,064
		CZ02	$17,424	-$3,859	$13,564
		CZ03	$14,240	-$3,278	$10,962
		CZ04	$14,147	-$3,837	$10,310
		CZ12	$13,155	-$6,053	$7,102
	End of Life	CZ01	$19,164	-$3,745	$15,419
		CZ02	$14,727	-$3,859	$10,868
		CZ03	$12,184	-$3,278	$8,906
		CZ04	$12,115	-$3,837	$8,277
		CZ12	$11,332	-$6,053	$5,279

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,240	-$278	$962
		CZ02	$953	-$186	$767
		CZ03	$777	-$201	$577
		CZ04	$775	-$159	$616
		CZ12	$718	-$176	$542
	End of Life	CZ01	$1,042	-$278	$764
		CZ02	$806	-$195	$611
		CZ03	$665	-$204	$460
		CZ04	$664	-$169	$495
		CZ12	$619	-$195	$423
No Cooling	Early Replacement	CZ01	$1,240	-$279	$961
		CZ02	$947	-$288	$660
		CZ03	$774	-$244	$530
		CZ04	$769	-$286	$483
		CZ12	$715	-$451	$264
	End of Life	CZ01	$1,042	-$279	$763
		CZ02	$801	-$288	$513
		CZ03	$662	-$244	$418
		CZ04	$659	-$286	$373
		CZ12	$616	-$451	$165

All-Electric – Min Efficiency

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$24,759	-$13,353	$11,406
		CZ02	$19,483	-$12,464	$7,019
		CZ03	$16,248	-$11,190	$5,058
		CZ04	$16,210	-$11,311	$4,899
		CZ12	$15,159	-$11,934	$3,225
	End of Life	CZ01	$21,114	-$13,354	$7,760
		CZ02	$16,766	-$12,578	$4,188
		CZ03	$14,180	-$11,241	$2,938
		CZ04	$14,156	-$11,447	$2,708
		CZ12	$13,326	-$12,194	$1,132
No Cooling	Early Replacement	CZ01	$24,759	-$13,369	$11,390
		CZ02	$19,374	-$13,827	$5,547
		CZ03	$16,191	-$11,777	$4,413
		CZ04	$16,098	-$13,018	$3,079
		CZ12	$15,105	-$15,626	-$521
	End of Life	CZ01	$21,114	-$13,369	$7,745
		CZ02	$16,677	-$13,827	$2,851
		CZ03	$14,134	-$11,777	$2,356
		CZ04	$14,065	-$13,018	$1,047
		CZ12	$13,283	-$15,626	-$2,343

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,346	-$996	$350
		CZ02	$1,059	-$929	$130
		CZ03	$883	-$834	$49
		CZ04	$881	-$844	$38
		CZ12	$824	-$890	-$66
	End of Life	CZ01	$1,148	-$996	$152
		CZ02	$912	-$938	-$26
		CZ03	$771	-$838	-$67
		CZ04	$770	-$854	-$84
		CZ12	$725	-$909	-$185
No Cooling	Early Replacement	CZ01	$1,346	-$997	$349
		CZ02	$1,053	-$1,031	$22
		CZ03	$880	-$878	$2
		CZ04	$875	-$971	-$96
		CZ12	$821	-$1,165	-$344
	End of Life	CZ01	$1,148	-$997	$151
		CZ02	$907	-$1,031	-$124
		CZ03	$768	-$878	-$110
		CZ04	$765	-$971	-$206
		CZ12	$722	-$1,165	-$443

All Electric - VCHP

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

3.0 UEF HPWH and Variable Capacity Heat Pump Space Heating

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$24,759	-$10,233	$14,526
		CZ02	$19,483	-$9,039	$10,444
		CZ03	$16,248	-$9,229	$7,018
		CZ04	$16,210	-$8,704	$7,506
		CZ12	$15,159	-$8,891	$6,267
	End of Life	CZ01	$21,114	-$10,234	$10,880
		CZ02	$16,766	-$9,153	$7,612
		CZ03	$14,180	-$9,281	$4,898
		CZ04	$14,156	-$8,840	$5,315
		CZ12	$13,326	-$9,151	$4,175
No Cooling	Early Replacement	CZ01	$24,759	-$10,249	$14,510
		CZ02	$19,374	-$10,402	$8,972
		CZ03	$16,191	-$9,817	$6,373
		CZ04	$16,098	-$10,411	$5,686
		CZ12	$15,105	-$12,583	$2,522
	End of Life	CZ01	$21,114	-$10,249	$10,866
		CZ02	$16,677	-$10,402	$6,275
		CZ03	$14,134	-$9,817	$4,317
		CZ04	$14,065	-$10,411	$3,654
		CZ12	$13,283	-$12,583	$700

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,346	-$763	$583
		CZ02	$1,059	-$674	$385
		CZ03	$883	-$688	$195
		CZ04	$881	-$649	$232
		CZ12	$824	-$663	$161
	End of Life	CZ01	$1,148	-$763	$385
		CZ02	$912	-$683	$229
		CZ03	$771	-$692	$79
		CZ04	$770	-$659	$110
		CZ12	$725	-$682	$42
No Cooling	Early Replacement	CZ01	$1,346	-$764	$582
		CZ02	$1,053	-$776	$278
		CZ03	$880	-$732	$148
		CZ04	$875	-$776	$99
		CZ12	$821	-$938	-$117
	End of Life	CZ01	$1,148	-$764	$384
		CZ02	$907	-$776	$131
		CZ03	$768	-$732	$36
		CZ04	$765	-$776	-$12
		CZ12	$722	-$938	-$216

All Electric – UEF 4.0

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

4.0 UEF HWPH and Minimum Efficiency Heat Pump Space Heating

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$24,759	-$11,730	$13,029
		CZ02	$19,483	-$10,886	$8,597
		CZ03	$16,248	-$9,605	$6,642
		CZ04	$16,210	-$9,732	$6,477
		CZ12	$15,159	-$10,414	$4,744
	End of Life	CZ01	$21,114	-$11,731	$9,383
		CZ02	$16,766	-$11,001	$5,765
		CZ03	$14,180	-$9,657	$4,522
		CZ04	$14,156	-$9,869	$4,287
		CZ12	$13,326	-$10,674	$2,652
No Cooling	Early Replacement	CZ01	$24,759	-$11,746	$13,013
		CZ02	$19,374	-$12,249	$7,125
		CZ03	$16,191	-$10,193	$5,997
		CZ04	$16,098	-$11,439	$4,658
		CZ12	$15,105	-$14,106	$999
	End of Life	CZ01	$21,114	-$11,746	$9,368
		CZ02	$16,677	-$12,249	$4,428
		CZ03	$14,134	-$10,193	$3,941
		CZ04	$14,065	-$11,439	$2,625
		CZ12	$13,283	-$14,106	-$823

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,346	-$875	$471
		CZ02	$1,059	-$812	$247
		CZ03	$883	-$716	$167
		CZ04	$881	-$726	$156
		CZ12	$824	-$777	$48
	End of Life	CZ01	$1,148	-$875	$273
		CZ02	$912	-$820	$91
		CZ03	$771	-$720	$51
		CZ04	$770	-$736	$34
		CZ12	$725	-$796	-$71
No Cooling	Early Replacement	CZ01	$1,346	-$876	$470
		CZ02	$1,053	-$914	$140
		CZ03	$880	-$760	$120
		CZ04	$875	-$853	$22
		CZ12	$821	-$1,052	-$231
	End of Life	CZ01	$1,148	-$876	$272
		CZ02	$907	-$914	-$7
		CZ03	$768	-$760	$8
		CZ04	$765	-$853	-$88
		CZ12	$722	-$1,052	-$330

All Electric – High Efficiency

PENINSULA CLEAN ENERGY

SILICON VALLEY CLEAN ENERGY

High Efficiency Heat Pumps; UEF 4.0 and Variable Capacity

Baseline Cooling	Replacement Scenario	Climate Zone	15-Year NPV Electricity Savings (Nominal $)	15-Year NPV Natural Gas Savings (Nominal $)	Total 15-Year NPV Savings (Nominal $)
Cooling	Early Replacement	CZ01	$24,759	-$8,608	$16,151
		CZ02	$19,483	-$7,454	$12,029
		CZ03	$16,248	-$7,644	$8,603
		CZ04	$16,210	-$7,120	$9,090
		CZ12	$15,159	-$7,366	$7,793
	End of Life	CZ01	$21,114	-$8,609	$12,506
		CZ02	$16,766	-$7,568	$9,197
		CZ03	$14,180	-$7,696	$6,483
		CZ04	$14,156	-$7,256	$6,899
		CZ12	$13,326	-$7,626	$5,700
No Cooling	Early Replacement	CZ01	$24,759	-$8,623	$16,136
		CZ02	$19,374	-$8,817	$10,557
		CZ03	$16,191	-$8,232	$7,958
		CZ04	$16,098	-$8,827	$7,271
		CZ12	$15,105	-$11,058	$4,047
	End of Life	CZ01	$21,114	-$8,623	$12,491
		CZ02	$16,677	-$8,817	$7,860
		CZ03	$14,134	-$8,232	$5,902
		CZ04	$14,065	-$8,827	$5,238
		CZ12	$13,283	-$11,058	$2,225

Baseline Cooling	Replacement Scenario	Climate Zone	First Year Gas Savings ($)	First Year Electricity Savings ($)	First Year Total Savings ($)
Cooling	Early Replacement	CZ01	$1,346	-$642	$704
		CZ02	$1,059	-$556	$503
		CZ03	$883	-$570	$313
		CZ04	$881	-$531	$350
		CZ12	$824	-$549	$275
	End of Life	CZ01	$1,148	-$642	$506
		CZ02	$912	-$564	$347
		CZ03	$771	-$574	$197
		CZ04	$770	-$541	$229
		CZ12	$725	-$569	$156
No Cooling	Early Replacement	CZ01	$1,346	-$643	$703
		CZ02	$1,053	-$658	$396
		CZ03	$880	-$614	$266
		CZ04	$875	-$658	$217
		CZ12	$821	-$825	-$3
	End of Life	CZ01	$1,148	-$643	$505
		CZ02	$907	-$658	$249
		CZ03	$768	-$614	$155
		CZ04	$765	-$658	$106
		CZ12	$722	-$825	-$102

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