Restaurant

Commercial water heating application for high-demand kitchens

THE CHALLENGE

- New Construction: Restaurant
- Pacific Northwest: Suburban
- Temperate Oceanic Climate (Cfb)
- Average Hot Water Usage: 10,000 gpd

The capital expenditure required to supply hot water at the specified usage level using only electric heat pumps (EHPs) exceeded both the original project estimates and benchmark costs from franchise locations.

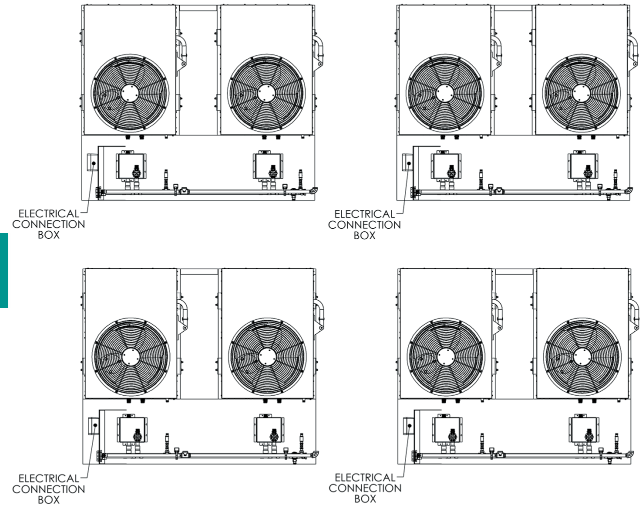
PACIFIC NORTHWEST ASSUMPTIONS

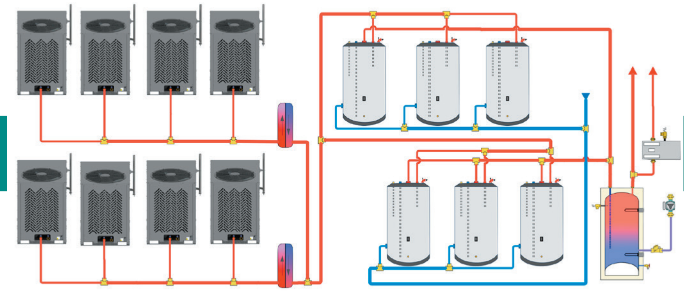
- Commercial electricity rates are slightly below the national average.
- Non-coincident peak (NCP) demand charges are common with commercial electricity providers.
- Commercial natural gas prices are higher than the U.S. national average.

THE SOLUTION

The baseline DHW design used multiple air-to-water electric heat pumps hydronically connected to large storage tanks with ample electric resistance backup, but the high upfront cost, operating expenses, and electrical infrastructure requirements were concerns. Our alternative employed eight (8) Anesi® gas-fired absorption air-to-water heat pumps (GHPs), hydronically connected to multiple storage tanks, with inhibited food-grade propylene glycol as the heat transfer fluid. The system was piped upstream of a peak-load finishing tank—preferably gas-fired storage or tankless. GHPs' strong cold-weather performance significantly reduced the required peaking capacity compared to the electric system.The design supported an average thermal load of 555,000 BTU/hr and a peak load of 644,000 BTU/hr, excluding the finishing tank. Flow metering for both the heat pump and domestic heat exchanger was integrated into the system and interfaced with the GHP control logic. The heat pump array was installed on the building's roof in coordination with roof penetrations, adjacent systems, and code compliance with attention to vibration isolation and adequate service access.

- To comply with regional code requirements, the gas heat pump system was engineered to meet 90–95% of the total heating load—significantly higher than the typical design recommendation of 50–80%.
- Note: The system design incorporated plate heat exchangers between the storage tanks for efficient thermal transfer, though indirect storage tanks remain a viable alternative.
- The peaker unit can be configured as a conventional gas storage water heater, a tankless water heater, or an electric resistance storage heater, providing multiple options to meet system design and performance requirements.





Mechanical one-line, double wall heat exchanger; 690g = 402,290 BTU in storage

THE DETAILS

This solution achieved substantial reductions in operational energy use compared to an equivalent installation using CO2 electric heat pumps (CEHPs), delivering a stronger lifecycle cost advantage and faster payback. Leveraging gas absorption technology, GHPs minimize electrical loads and optimize thermal performance, reducing OPEX through lower fuel consumption while maintaining reliability. They integrate seamlessly with condensing boilers, tankless water heaters, and hydronic systems, enabling flexible configurations for multi-load applications.

	Anesi 625K BTU GHP	700K BTU CEHP
Total Installed Price	$700,000	$1,100,000
Annual Fuel Use (therm)	18,700	--
Annual Fuel Use (kWh)	18,000	238,000
Annual Demand Chg.		$10,000
Annual Fuel Use Cost	$29,000	$40,000
CAPEX Savings	**$400,000**	
Annual Operating Savings	**$11,000**	
Annual CO2e (t)	140	175
CO2e Reduction/yr (t)	**35.2**	
CO2e Reduction/yr (cars equivalent)	8.5	
ASSUMPTIONS:	**NATURAL GAS**	**ELECTRICITY**
Fuel Cost ($/therm, $/kWh)	$1.43	$0.125
CO2e (therm)	14.9	--
CO2e (MWH) NWPP marginal grid	--	1,623
Annual Average COP	1.3	3.0

All figures based on 2025 values

THE CONVERSATION

The GHP system delivers exceptional efficiency and reliability with minimal electrical demand—only 840W per modular unit at high fire on a 120V circuit—reducing peak demand charges. With a gas utilization efficiency of 140% and seasonal COP of 1.3, it lowers fuel usage and simplifies gas service requirements. High return-water temperature capability enables direct heating of storage tanks, maximizing recovery and minimizing downtime. Modular design and off-the-shelf tanks ensure easy maintenance, while compact footprints save space. Operating costs rival or beat electric heat pumps, especially where demand charges apply.

The project economics are favorable, despite a low spark gap of 2.56, which benefits electric systems. Economics become even more advantageous for GHPs when the spark gap approaches the national average of 3.5.

ENERGY EFFICIENCY

Thermally driven absorption technology achieves up to 140% utilization efficiency with a seasonal COP near 1.3, reducing primary energy use.

EMISSIONS

Absorption technology lowers emissions by reducing fuel use and using natural ammonia refrigerant—a zero ODP, GWP solution—while supporting decarbonization goals.

OPERATING COSTS

By leveraging natural gas as the primary energy source, gas absorption heat pumps deliver COP values of 1.3 and cut operating costs by 20–40% over their lifespan.

ABOUT US

Stone Mountain Technologies (SMTI) is a leader in gas absorption heat pump technology, delivering high-efficiency solutions for residential and commercial heating. SMTI also provides custom application design services, including load analysis, system sizing, and integration with hybrid configurations. These tailored engineering services ensure maximum efficiency, reliability, and compliance with regional codes and decarbonization goals