

High Efficiency Hot Water Systems

Franklin Elementary Santa Barbara, CA

Delivering hot water efficiently...

Franklin Elementary School, located in downtown Santa Barbara, serves 600 students from kindergarten through sixth grade. It is one of the oldest and largest elementary schools in the Santa Barbara Unified School District. The maintenance supervisor at SBUSD was looking for ways to reduce the school's water and energy footprint as well as its utility costs.

As a result, Franklin Elementary School was an excellent candidate for the *Demonstration of High-Efficiency Hot Water Systems in Commercial Foodservice* research project, which examined the water and energy use of existing systems and demonstrated significant savings through strategic equipment replacement and the utilization of more efficient design. Frontier Energy performed the study for the California Energy Commission's Natural Gas Research and Development Program with co-funding and support from SoCalGas.

After an initial field survey, Frontier Energy determined that the school would benefit from a retrofit project. They identified four pieces of equipment for replacement and utility savings: the dishmachine, pre-rinse spray valve, domestic water heater and the recirculation pump and controls. These equipment updates resulted in 43% water savings, 43% electricity savings, and 53% gas savings.



Replacement 44" rack conveyor dishmachine with gas tank heat



ORIGINAL SYSTEM:

The original domestic water heater was a tank-type storage unit, which supplied hot water to the kitchen, gym, and administrative rooms at an outlet temperature of 115°F to prevent scalding.

The hot water distribution system used a continuously operating recirculation pump to maintain hot water throughout the building piping and return unused hot water to the water heater.

The original dishmachine was old, out of specification, and breaking down often. Also, the booster heater was located remotely in the mechanical room, connected in series with the domestic water heater. The booster heater delivered 165°F rinse water. The pre-rinse spray valve was rated at 1.5 gpm but measured at 2.2 gpm.

The research results showed that the equipment consumed an estimated 4446 therms/year and 194,500 gallons per year.

Annual Operating Costs¹

Original Equipment² \$6,841

Replacement Equipment \$3,507

¹This site operated 251 days/year (180 school days, 51 summer days) with a gas utility rate of \$0.85/therm, electric utility rate of \$0.17 kWh, and water/sewer rate of \$10.20/hcf.

²Represents the combined operating costs of the dishmachine, pre-rinse spray valve, and recirculation pump

Operating Savings

Annual Energy Savings \$2,113

Annual Water Savings \$1,126

Applicable Custom Incentives^{3,4} \$3,000

³ View applicable incentives for your local utility at: fishnick.com/saveenergy/rebates.

⁴ Incentives based on 1st year savings at \$4/HCF, \$1/therm, \$0.8/kWh, 6 year payback based on total project purchase cost.





ECM Circulator and recirculation pump controller

REPLACEMENT SYSTEM:

- The replacement heater was a condensing storage heater rated at 96% thermal efficiency that incorporated remote monitoring and digital interface and was set at 120°F.
- The recirculation system was outfitted with a smart controller to optimize recirculation pump operating time without any programming. The smart control device learns the site’s patterns of hot water use and turns off the pump when the site is not in use.
- The replacement dishmachine is an updated version of the original unit. It had new features including insulated doors, thermal layer curtains, door actuated drain closure, digital interface, and an energy saver mode. This machine is ENERGY STAR listed.
- The inefficient pre-rinse spray valve was replaced with a high-performance low-flow model for manually rinsing wares that go into the dishmachine.

Quick Guide to Franklin Elementary Savings

EQUIPMENT UPDATE	WATER SAVINGS (gal/y)	GAS SAVINGS (therms/y)	ELECTRICITY SAVINGS (kWh/y)	BENEFITS
Replaced standard efficiency water heater with a best-in-class water heater	N/A	300	0	New unit had a dedicated return port and modulating burner to achieve higher efficiency operation over similar condensing heaters
Replaced 88-watt pump with 14-watt high-efficiency pump and added smart controller	0	225	683	Saved gas at heater by lowering recirculation flow rate from 2.2 gpm to 1.0 gpm and run time from 24 hrs/day to 8 hrs/day
Replaced conveyor dishmachine with an ENERGY STAR conveyor dishmachine	68,070	1,697	285	Improved performance, reduced water and energy use
Replaced 2.5 gpm pre-rinse spray valve with 1.05 gpm unit	11,220	112	0	Reduced water consumption



Replacement Condensing Water Heater

The most significant utility savings were achieved through the reduction in water use at the dishmachine as it reduced the heating load on both the main water heater and booster heater. Several refinements with the new dishmachine accounted for a reduction in idle losses, which reduced the wash tank heater run time.

The most cost-effective elements of this project were the installation of the low flow pre-rinse spray valve (\$70), smart controller (\$120) and pump and flanges (\$340). The collective payback period would be one year without incentives. Replacing a working old dishmachine with a newer version had a theoretical payback period of 6 years with incentives. In fact, the projected overall payback period for this project was 6 years based on the purchase price of the new equipment (\$27,400) and potential custom incentive (\$3,000) with the assumption that utility costs would increase at 5% per year.

Equipment Savings

Heater Gas Energy Savings	\$255
Distribution Gas Energy Savings	\$191
Distribution Electric Energy Savings	\$116
Dishmachine Water Savings	\$927
Dishmachine Gas Energy Savings	\$1,443
Dishmachine Electric Energy Savings	\$48
Pre-Rinse Spray Valve Water Savings	\$153
Pre-Rinse Spray Valve Gas Energy Savings	\$95



Replacement 1.05 gpm pre-rinse spray valve