Case Study:
Water Heating Electrification

County of Alameda

[1]

April 2023

Compiled by the Empower Procurement Program implemented by Prospect Silicon Valley, with funding from the California Energy Commission. Send questions or comments to e-buildings@prospectsv.org.

[1] https://www.visitoakland.com/listing/lake-merritt/122/

Executive Summary

The County of Alameda replaced eight gas water heaters with heat pump water heaters at no cost through PG&E's Government and K12 (GK12) Program, designed and implemented by Willdan. This case study documents the County's process and the environmental benefits achieved. It also reviews the barriers encountered and how the County overcame them, and presents key learnings for other public agencies seeking to electrify their existing buildings.

This case study is part of a series of four written by the Empower Procurement Program's E-Buildings team. The Empower Procurement Program was implemented by Prospect Silicon Valley, with funding from the California Energy Commission, to provide real-world examples of how municipal governments execute electrification projects. Prospect Silicon Valley will use these studies to highlight building-specific procurement barriers and make recommendations for reducing them to the California Energy Commission.

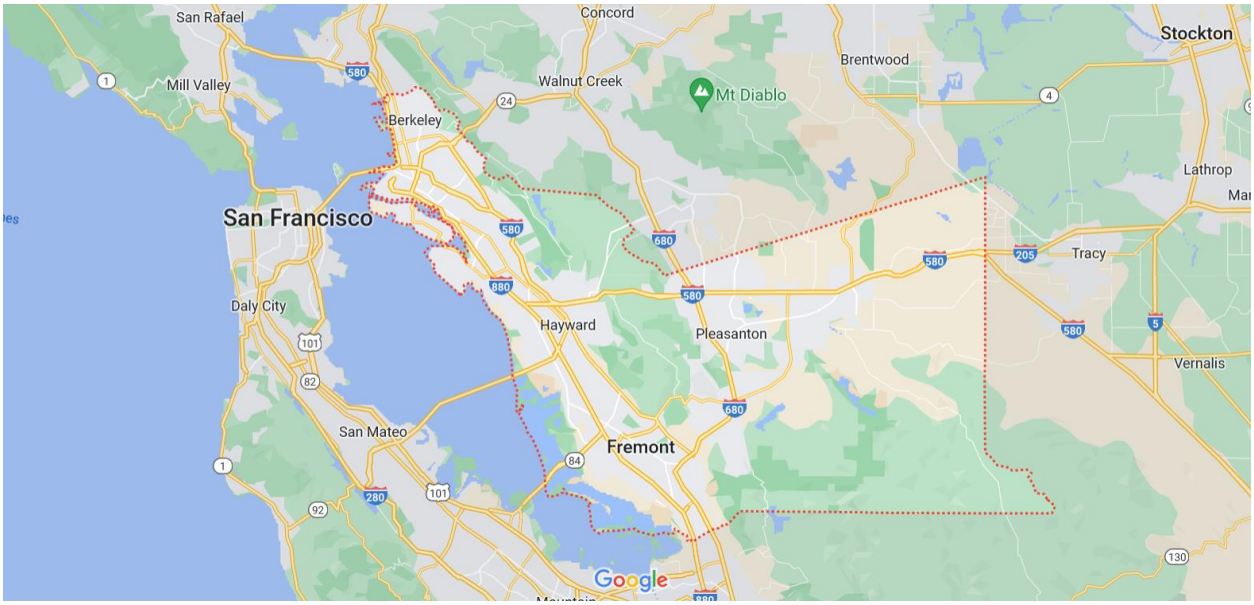
Background

Building electrification is one of the largest sources of potential GHG reductions in California. Local governments can help lead this market shift by setting an example with their own municipal buildings. Many of the challenges they face are not technical but procurement issues, such as getting approvals for less familiar technology and using total cost of ownership to weigh purchase options.

To study building-specific procurement challenges the Empower Procurement Program, implemented by Prospect Silicon Valley, formed an E-Buildings team. The E-Buildings team conducted outreach to municipal governments throughout California and created a series of four case studies. Prospect Silicon Valley shared these with municipal facilities and sustainability managers statewide to help start discussions about the challenges of zero-carbon procurement. It will also use these case studies to help make recommendations to the California Energy Commission on how to further promote public building electrification. The E-buildings team can be reached at E-Buildings@prospectsv.org.

Project Description

Alameda County is the seventh most populous county in California and has 14 incorporated cities as well as several unincorporated communities. Its population is about 1.5 million people. The Alameda County General Services Agency – Building Maintenance Department (GSA-BMD) provides maintenance, repair, and operation services for over 182 County owned and leased facilities, comprising approximately 8.1 million square feet of building space. The E-Buildings team contacted the County through its Sustainability Project Manager, Ms. Karen Cook, and Facilities Manager, Mr. Percy Irving, to learn if the County would be interested in receiving assistance to replace gas water heaters with high efficiency heat pumps.



Pre-visit Information Gathering

Alameda County did an initial inventory of gas water heaters under 120 gallons at a subset of their sites, focusing on the northwest part of the County. Seven gas water heaters were identified at six sites, with County staff providing information including capacity, input, build date, model, address, and location.

GK12 Program incentives were only available for 30, 50, 65, 80, and 120 gallons. One of the seven sites had a 100-gallon unit, so was omitted.

Site Visits

County and E-Buildings staff conducted initial site visits in April 2022 with Willdan and its installing contractor, Enovative Mechanical and Energy Services. Willdan and Enovative estimated the draw profiles for each water heater to determine the appropriate capacity of each replacement unit. They also determined whether there was enough electrical capacity available and at which panel, and if any sites had conditions affecting cost such as longer electrical runs, constrained spacing, or the need for new pipework.

After reviewing program requirements and incentives, the County requested visits to additional sites in May 2022.

Procurement

Equipment and services

The E-Buildings team reviewed the terms and specifications of the heat pump water heaters. All units provided by the GK12 Program meet the stringent requirements of CA Title 24, Joint Appendix 13. These include meeting ENERGY STAR standards, being demand-response enabled, and having a

10-year warranty. The County opted for the program's turnkey option, in which the installation and equipment are single-sourced to a program-qualified contactor and the workmanship has a one-year warranty.

Project cost

Willdan provided an initial project quote for the first six water heaters in April 2022. Table 1 below illustrates how the scope of work evolved. As the County learned about the program, it realized that some items such as training at each site and as-built drawings would not be necessary. Also, the claimable energy savings increased in 2023, which increased the incentive amount. In the end, the County's co-pay was zero.

Table 1: Installation Cost Changes During Project Development

Quote / modifications	Total Cost	PG&E Incentive	County Co-Pay	County Cost Per HPWH
Initial quote (six units)	$42,632	$33,927	$8,705	$1,450
Added to scope: • 6 additional water heaters • Prevailing wages • As-built drawings • Operations and maintenance (O&M) training	$133,252	$67,854	$65,398	$5,450
Streamlined scope: • O&M training – on one unit only • As-built drawings – electronic files OK	$123,924	$67,854	$56,070	$4,673
Removed four units from scope (During second site walk in January 2023, installer realized cost would be higher due to location constraints)	$78,989	$45,239	$33,750	$4,219
GK12 claimable energy savings for HPWHs increased for 2023	$78,989	$78,989	$0	$0

Permits and Approvals

Permits were not required, because the County of Alameda is exempt from local building and zoning ordinances according to Government Code Sections 53090 and 53091.

County staff did ask for as-built drawings, which were provided by Willdan. In addition, the County's Capital Programs- Environmental Team participated in certain job walks before installation.

GK12 Program Dedication to Service

After the installation of the two heat pump water heaters at the Magnolia Women's Recovery Center, occupants complained of running out of hot water. Occupancy had increased significantly since the initial site visit, causing hot water demand to exceed capacity. GK12 staff replaced both units with larger capacity units the same day, which completely addressed the issue. Percy Irving

and his staff were highly impressed, and stated the GK12 Program's responsiveness increased their confidence to continue working with the Program in other parts of the County.

Environmental Benefits

Table 2 presents the GHG reductions the County achieved by replacing eight water heaters. These calculations use the methods approved by the California Public Utilities Commission and are based on the efficiency of the existing gas water heater, the efficiency of the replacement unit, and typical hot water usage based on building type.[2] The GHG reductions were adjusted by the Empower Procurement team to account for the fact that Alameda County uses carbon-free electricity.

Table 2: Reduction in Energy Use and GHG Emissions from Eight HPWHs

Facility	HPWH capacity (gallons)	First year gas reduction (kBtu)	First year electric increase (kWh)	First year electric increase (kBtu)	Reduction in energy use (kBtu)	Annual GHG reduction (MTCO2e)	Lifetime GHG reduction (MTCO2e)
Albany Veterans Memorial Building	50	128,000	11,100	37,884	90,116	7	68
Magnolia Women's Recovery Center (2 80-gal units)	160	429,871	34,200	116,690	313,181	18.9	189.9
Alco Park	50	122,000	11,100	37,884	84,116	6	65
12th & OAK	50	86,500	7,130	24,335	62,165	5	46
Lakeside Building	50	86,500	7,130	24,335	62,165	5	46
Registrar of Voters	80	66,500	5,410	18,464	48,036	4	35
Registrar of Voters (Garage)	50	82,300	7,130	24,335	57,965	4	44
Total	**490**	**1,001,671**	**83,200**	**283,927**	**717,744**	**50**	**494**

The County managed to reduce its operational emissions by 31% between 2003 and 2019. Nearly half of that reduction (49%) in operational emissions was in buildings & facilities owned by the County. This significant reduction is attributed to the County's switch to carbon-free electricity in 2018, provided by East Bay Community Energy (EBCE).[3] In further reduce the emissions of County buildings and facilities, it is imperative to replace fossil gas equipment with zero-emission electric equipment.

[2] https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization/fuel-substitution-in-energy-efficiency

[3] https://www.acgov.org/sustain/documents/Exec_Summary_Emissions_Inventory_2019.pdf

Key Learnings

Invest in project planning

1. Plan adequate time for the organization to become familiar with new technologies and programs.
2. Early in the project, work with incentive program staff to create a detailed list of all steps required. Identify the roles and responsibilities of all stakeholders involved. These will include, among others, Building Maintenance, Sustainability, Legal Affairs, and Administration. Constantly ensure all stakeholders have a shared understanding of the electrification project's objectives, and encourage cross-department collaboration.
3. Document experience gained from the project to inform and accelerate future projects.
4. Be aware of all available procurement tools. Although it did not apply to this project, Government Code 4217 is particularly valuable to help municipal governments.

Aim to Make Heat Pump Water Heaters Standard Practice

Cities should stop purchasing gas units, and it should be standard practice to proactively replace gas water heaters with heat pump water heaters, regardless of their age.

1. Each purchase of a gas replacement unit removes a precious opportunity to make progress toward GHG emission reduction goals.
2. With the current incentives in PG&E territory, replacing gas heaters with heat pump units may cost less than buying more gas heaters. However, it is important to act quickly since these incentives are finite.
3. Heat pump units can have longer lead times, so end-of-life replacements should be done early, rather than upon failure of the existing equipment.
4. Future regulations from the Bay Area Air Quality Management District and the State are likely to eventually eliminate gas equipment in buildings. Proactively transitioning to electric equipment could decrease long term costs, including of future compliance.