

Case Study: Water Heating Electrification

City of Piedmont



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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.

Executive Summary

The City of Piedmont was able to replace all its remaining gas water heaters with heat pump water heaters at no cost. This was made possible by combined funding from the [PG&E Government and K-12 \(GK12\) Program](#) implemented by Willdan, and [East Bay Community Energy \(EBCE\)'s Municipal Electrification Assistance grant](#). Piedmont may well be one of the first cities in California to eliminate all the small gas water heaters from its municipal buildings. This illustrates the City's commitment to its Climate Action Plan and makes Piedmont a prime example of how smaller governments with simpler procurement processes can help lead market transformation.

The Empower Procurement Program's E-Buildings team has been creating case studies to provide real-world examples of how municipal governments execute electrification projects. Working under a grant from the California Energy Commission, it 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 the largest source of potential greenhouse gas (GHG) emissions reductions in California. The City of Piedmont, led by its Climate Action Task Force, began sourcing 100% clean electricity for its municipal buildings in 2018. Between 2018 and 2020, it replaced 3 gas water heaters with heat pump water heaters using its own funds. In May 2022, it replaced the remaining six at no cost thanks to combined funding from PG&E's GK12 Program and EBCE's Municipal Electrification Assistance grant.

When the electric supply is 100% renewable, transitioning from gas to electricity is especially effective for reducing GHG emissions. However, since this supply can be more expensive, it is critical to use efficient equipment. Heat pump water heaters are two to three times more efficient than conventional electric resistance water heaters. Instead of generating heat directly, they use electricity to take heat from the surrounding air and transfer it (at a higher temperature) to water in a tank. For more information, see [here](#) at energy.gov.

For California to meet its environmental goals, it must replace its gas-burning equipment as quickly as possible. Although they only operate a small fraction of their cities' buildings, local governments can help lead this market shift by setting an example. 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.

Project Description

The City of Piedmont is 13 miles east of San Francisco. Its population is about 11,000 people and its climate is temperate (Climate Zone 3). The city operates 14 buildings totaling approximately 60,000 sq feet.



The City learned of PG&E’s GK12 Program through an email from Sherry Bartolome, an Account Manager at Willdan, in February 2022. Piedmont’s local community choice aggregator, EBCE, also shared information about the program in February during a monthly meeting that convenes Alameda County municipal partners. Piedmont was familiar with EBCE’s program offerings to municipal agencies based on previous experience leveraging technical assistance to support the development of energy efficiency reach codes in 2020.

Pre-visit

The City set up a call with Willdan to discuss program opportunities, with a focus on identifying 30–80-gallon gas fired hot water heaters to replace with heat pumps. It was decided that Willdan should consider all the City’s remaining units, as summarized in Table 1:

Table 1: Water heaters considered for replacement

	Police	Veterans Hall	Firehouse Rooftop	Community Hall	Rec Center
Existing Gas HW	40-gallon	40-gallon	(2) tankless	48-gallon	40-gallon
Heat pump water heater replacement	50-gallon	50-gallon	(2) 50-gallon	50-gallon	50-gallon

Site visit

In early March, Tom Kouris, a Willdan Project Advisor, came to Piedmont for a site visit. In subsequent weeks, Tom again visited with an electrician to further investigate the sites. The visit validated that the potential sites had enough electrical capacity to handle the heat pumps.

- Distance to electrical panel
- Panel space for 220V/30amp breaker
- Drain for condensation line

Air exchange in the room meets specifications for proposed new unit

One of the most important tasks of the site visit was to confirm access to 220V power, required for all units offered by the GK12 program at the time.

Procurement

Because of its smaller size, the City of Piedmont has a relatively simple procurement process. Also, despite having limited staff, it is fortunate to have a Sustainability Program Manager who can learn about incentive programs and inform the City Council about opportunities to meet climate action plan goals.

Equipment and services to be provided

All units provided by the GK12 Program meet the stringent requirements of California Title 24, Joint Appendix 13. These include meeting ENERGY STAR standards, being demand-response enabled, and having a 10-year warranty. The City opted for the program's turnkey option, in which the installation and equipment are sole sourced, the installation is performed by program-qualified contactors, and the workmanship has a 1-year warranty.

Project cost

Willdan and the City concurrently reached out to EBCE to determine the feasibility of acquiring EBCE's Municipal Electrification Assistance grant funding (~\$10,000).

In April, the City received project cost estimates and found that all projects could be covered with a combination of PG&E incentives and the EBCE grant. All labor was quoted using prevailing wage. The City's Public Works Director and City Administrator notified the City Council which was thrilled to have the opportunity to progress on Piedmont's climate goals with no out-of-pocket expense.

Documents

Willdan provided all required forms and documentation. These include the incentive commitment letter, GK12 program participation agreement, contractor quotes, a memo to program participants, and the agreement to participate in PG&E's AutoGrid demand response program. Alyssa Dykman, Sustainability Program Manager, and Paki Muthig, the City's Facilities Official, notified all affected parties.

Installation

All installations were completed the week of May 9th, 2022, by Enovative Mechanical and Energy Services. The project manager at Enovative provided the City an installation timeline that was extremely helpful for coordinating schedules across departments.

Environmental Benefits

Table 2 presents the GHG reductions the City is projected to achieve from this project. These calculations use the methods approved by the California Public Utilities Commission and are based on the efficiency of the existing gas water heater and typical hot water usage based on building type. They also reflect the fact that Piedmont uses 100% renewable energy.

Table 2: Estimates of GHG reductions using the methods approved by the California Public Utilities Commission

Facility	Police	Veterans Hall	Firehouse Rooftop	Community Hall	Rec Center	Total
10-yr lifetime GHG Reduction (MTCO₂e (metric tons of CO₂ equivalent))	32.4	47.8	51.0	47.3	47.8	226.5

Although these reductions are minor compared to what is needed, they are a strong example of commitment to following the City's Climate Action Plan. Per the Plan, buildings accounted for more than half of all GHG emissions in 2005, and the City's goal by 2030 is to reduce this by 28%¹. Small steps like water heater replacement set the stage for bigger steps. For example, shortly after deciding to move forward with gas water heater replacement, the City Council voted to make Piedmont's new Aquatic Center an all-electric facility.

Projects to replace larger gas-burning equipment such as furnaces, rooftop units, and boilers are much more complex. They typically require custom engineering to size the equipment and obtain utility incentives and can also cause the building to expand its electrical system. However, a key step to lowering these costs is to make such projects more common. Local governments, in partnership with utility and grant programs can therefore have outsized impact to help transform the market.

¹From [Piedmont Climate Action Plan 2.0](#), p. 30

Key Learnings / Discussion Points

1. Programs such as Willdan's GK12 Program administered by PG&E and EBCE's Municipal Electrification Assistance Program are specifically designed to help cities implement their climate action plans.
2. Local governments should 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.
3. 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.
 - a. Each purchase of a gas replacement unit removes a precious opportunity to make progress toward GHG emission reduction goals.
 - b. With the current incentives in PG&E territory, replacing gas heaters with heat pump units may cost less than buying more gas heaters.
 - c. With current supply chain restraints, 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. Electrifying larger equipment such as furnaces, rooftop units, and boilers is much more complex. Cities should therefore replace their water heaters first to obtain GHG reductions as quickly as possible and get experience for larger projects. Small steps can lead to larger steps, such as the City of Piedmont's decision to make its new Aquatic Facility all-electric.
5. Electrification and efficiency upgrades should be considered together. For example, now that the City's municipal buildings use 100% renewable electricity, upgrading lighting to LEDs will increase GHG emissions because the lower heat output from LEDs will increase gas usage for heating. However, when the heating system is electrified, the two investments complement each other.
6. Heat pump units may also have health benefits related to improved indoor air quality.