

Electrification of Hot Water Systems for Community Organizations and Small and Medium Commercial Buildings

The primary objective of the Light-Duty Commercial Heat Pump Water Heater Focused Pilot was to identify and address barriers to greater adoption of light-duty heat pump water heaters in California’s small and medium commercial buildings occupied by community organizations. The pilot targeted five barriers to heat pump water heater adoption in these buildings:

- Lack of customer and contractor familiarity with heat pump water heaters.
- Existing water heating program eligibility limitations.
- Electrical capacity requirements associated with the installation of heat pump water heaters.
- Lack of participation in existing heat pump water heater programs.
- Limited understanding of the businesses and buildings best suited for commercial heat pump water heaters.

The project team hypothesized that improved contractor and customer familiarity with heat pump water heaters will increase small and medium commercial customers’ willingness to undertake a heat pump water heater conversion and overcome the barriers listed above.

Small and Medium Commercial Water Heating

The Challenge

- Large variance in water heating usage patterns and space constraints prevents a “one-size-fits-all” approach and necessitates a combination of residential and commercial technical solutions, reducing contractor confidence.
- Small commercial customers often face financial constraints, lack of bandwidth, and have low levels of awareness around opportunities and benefits.

The Opportunity

- Expand residential HPWH training to include larger capacity unitary and split HPWH product applications.
- Develop targeted program incentive and engagement strategies for small commercial segments.

Small and Medium Commercial Heat Pump Water Heater Study

The Methods

- Conduct an Engineering and Building Demographic Analysis that specifies and recommends appropriate HPWH models for various small commercial customer types, based on variables such as peak hot water usage and common space constraints.
- Test a model for community-based outreach and education to meet small businesses where they are, disseminate information, and recruit participation.
- Work alongside contractors and CBO’s to support HPWH installations that include both commercial “medium duty” and residential “light-duty” HPWH’s.
- Generate best practices and training materials for commercial customers and contractors.

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CalNEXT is California’s statewide electric emerging technologies program. CalNEXT identifies, tests, and grows electric energy technologies and delivery methods that have the potential to make major impacts on achieving California’s climate goals. The Light-Duty Commercial Heat Pump Water Heaters for Community Organizations Focused Pilot project was funded by CalNEXT.

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Focused Pilot Site Information

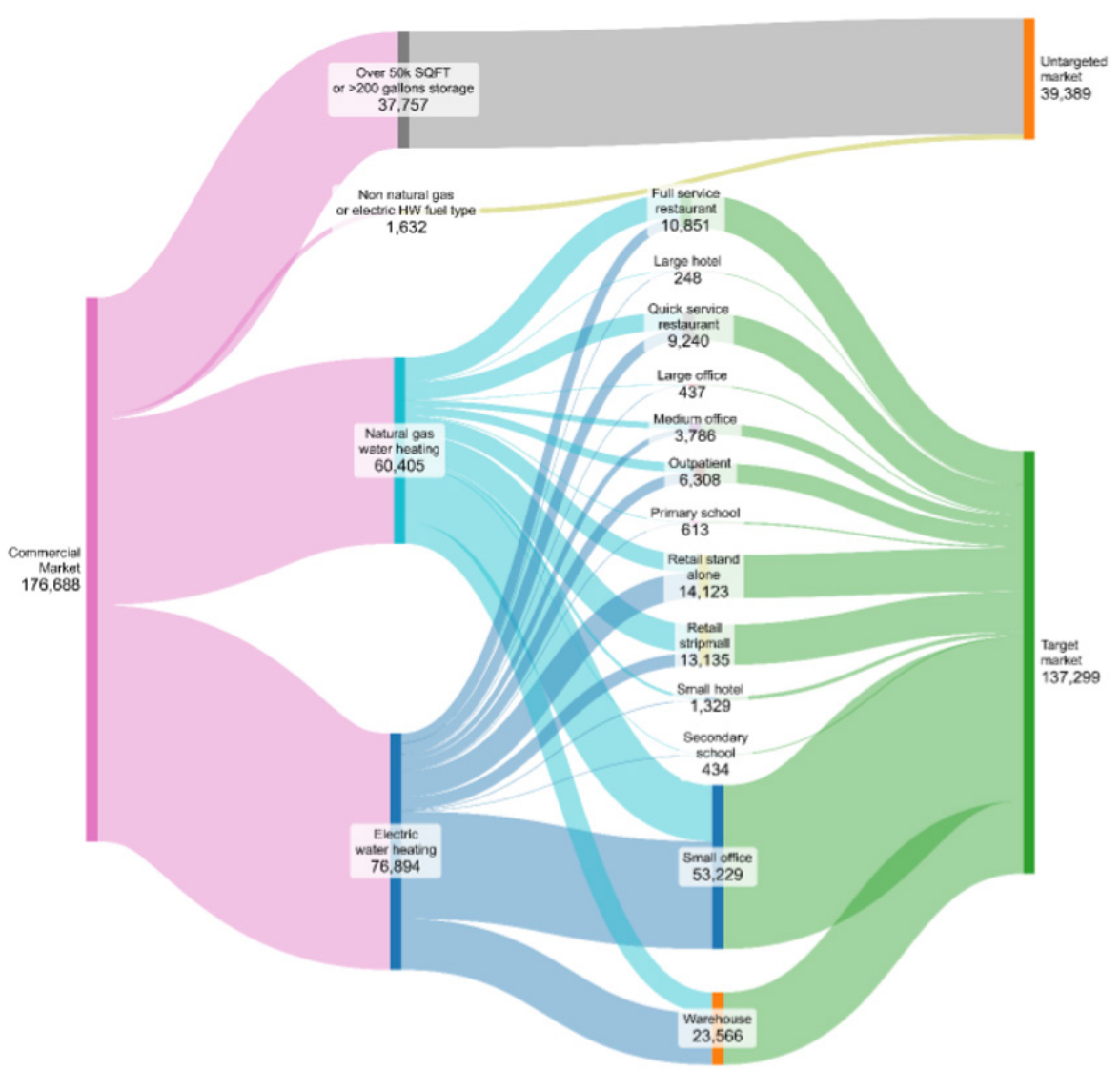
- All sites in CA Climate Zone 3 – mild/moderate coastal
- CBO Site #1, Equipment #1
 - Church parish house, basement
 - 50-gallon HPWH replacing 40-gallon gas WH
 - Required removing door jambs for access, electric panel capacity upgrade, new equipment location in basement
- CBO Site #1, Equipment #2
 - Church building, exterior installation
 - 83-gallon split HPWH replacing 199,900 BTU tankless gas WH
 - Required electric panel capacity upgrade
 - Excluded from current measure package, savings not calculated
- CBO Site #2, Equipment #1
 - Church kitchen, utility closet
 - 50-gallon HPWH replacing 40-gallon gas WH
 - Required a 30-amp 240V circuit run from utility closet sub-panel and relocating a gas furnace
- CBO Site #2, Equipment #2
 - Church bathrooms, utility closet
 - 40-gallon HPWH replacing 30-gallon non-functional gas WH
 - Required a 30-amp 240V circuit run to utility closet



Map source: <https://gis.data.ca.gov/documents/CAEnergy::building-climate-zones/about>

CA Small Commercial Market Segmentation

- 78% of the commercial building stock in CA is <58,000 square feet in size.
- Average annual hot water consumption varies significantly – ranging from fast food restaurants (average of 32.08 gals/sqft/yr) to storage and retail spaces (0.23 gals/sqft/year).
- Many commercial spaces will require larger commercial-scale unitary or split HPWH’s, but many will be adequately served by “Residential-style” HPWH and even plug-in 120V HPWH.



Summary of Findings

- Barriers to Adoption
 - Cost barriers to adoption:
 - Diversity of buildings
 - Relative installation complexity
 - Existing building and water heater conditions
 - Limited capital budgets
 - Spark spread
 - Technical barriers to adoption:
 - High-demand or recirculation applications
 - Existing distribution inefficiencies
 - Market barriers to adoption:
 - Lack of customer and contractor familiarity with applicable HPWHs
 - Commercial end user priority on operations vs. capital expenditure for electrification unless dedicated person is managing an over-time electrification plan
- Key building typologies with the most immediate opportunity for HPWH adoption:
 - Small offices (71,000 sites)
 - Warehouses (74,000 sites)

Summary of Savings

CBO Site #1	Equipment #1	Equipment #2
Electric Usage	12,900 kWh	N/A
Gas Usage	1,450 MBtu/h	N/A
TRC	\$11,629.61	N/A
TSB	\$16,541.49	N/A

CBO Site #2	Equipment #1	Equipment #2
Electric Usage	12,900 kWh	12,900 kWh
Gas Usage	1,450 MBtu/h	1,460 MBtu/h
TRC	\$11,629.61	\$11,708.38
TSB	\$16,541.49	\$16,726.54

Recommendations and Next Steps

Measure Package Update

- SSWH031-05: HPWH, Commercial
 - Lower minimum UEF rating to accommodate 120V HPWHs
- SSWH027-06: HPWH, Commercial, Fuel Substitution
 - Lower minimum UEF rating to accommodate 120V HPWHs
 - Expand allowed HPWH capacities to take performance characteristics into account, e.g. 40-gallon gas to 80-gallon HPWH
- SSWH028-07: Large HPWH, Commercial and MF, Fuel Substitution
 - Expand allowed capacities from 75-100 to 75-120 gallons, given equipment meets minimum efficiency requirements

Next Steps

- Contractor education and outreach, prioritizing small commercial office space and helping to identify CBOs with high electrification interest
- Establish Delphi panel to source inputs for naturally occurring market adoption curve (NOMAD) to further support market sizing and incentive strategy