Building Electrification

Lessons from Affordable Multifamily Housing

Meghan Duff, Energy Analyst II
mduff@aea.us.org | (510) 431-1795

What is Building Electrification?

Electrification - replacing direct fossil fuel use (e.g., propane, heating oil, gasoline) with electricity [use] in a way that reduces overall emissions and potentially energy costs while lowering other air pollutants.
(Source: New Buildings Institute via Environmental and Energy Study Institute)

Left Image: Sanden, Rheem heat pump water heater
Right Image: Mitsubishi ductless mini split heat pump (https://www.acwholesalers.com/Mitsubishi)

- All common gas appliances have an electric counterpart that is safer and more efficient than the gas option.
- Electric heat pumps can be used in space heating and cooling, domestic hot water heating, clothes drying, and pool heating.
- Heat pumps are 3-5 times more efficient than comparable gas equipment.
- Instead of using combustion to *create* heat, a heat pump *moves* heat from one place to another by compressing and expanding refrigerant.

Why Electrify?

Building electrification is important because:

- Create Safer and healthier buildings
- Reduces greenhouse gas emissions and air quality degradation
- Results in potential cost stabilization and savings

More broadly, building stock electrification is a critical pathway to achieve statewide climate goals to help avoid the worst-case scenario impacts of Climate Change.

- The electricity grid in CA is getting cleaner—100% carbon-free electricity by 2045 (SB 100, 2019)
- The cost of maintaining gas infrastructure will fall on fewer and fewer customers and therefore become a greater and greater cost burden

How to Electrify Your Building?

1. Design: How to Do It

What are the design considerations pre-construction or -retrofit that lead to successful building electrification?

- It is not that different!
  1. Early in design
  2. Confirm enough electrical capacity
  3. Reduce load
  4. Analyze electricity rates
  5. Optimize with renewables

2. Value Proposition: Getting to Yes!

What is the value proposition to building owners?

- Cost-effective
  1. Electricity can be offset by renewables
  2. Eliminate gas infrastructure, infrastructure and service costs, and upkeep
  3. Buildings are always going to have electricity
- Health and Safety
- Long-term maintenance

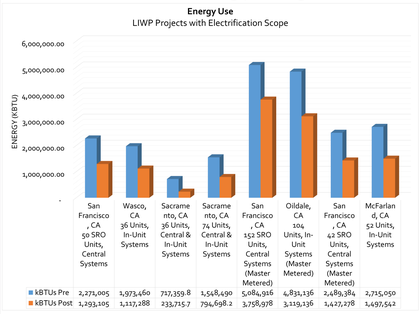
3. Installation Considerations: How to Achieve Success

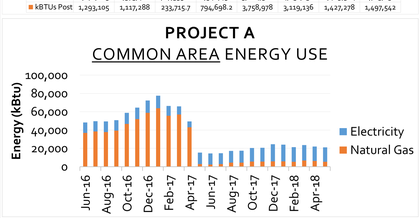
What is needed to ensure contractor engagement and successful installation?

- Correct sizing and settings
- Familiarity with equipment
- Sizing for thermal storage and load shifting/demand response
- Re-piping or wiring, and need for more electrical capacity
- Changes to familiar O&M and training delivery
- Engagement is key!

Results: Show Me the Data

Reduce Energy Usage

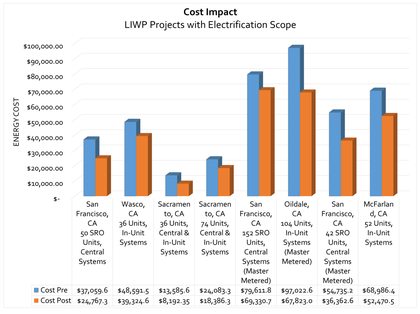


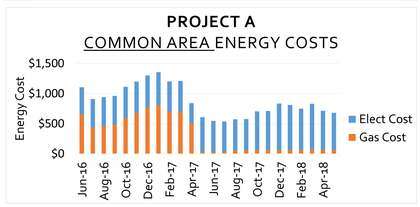


Property Information

- Located in Sacramento, CA; built in 1960
- 36 units, 36,944 sq. ft.
- Central DHW (switched from gas to heat pumps)
- Unitary HVAC (gas furnace & AC) - energy use not included in graph (graph is common area data only)
- Energy savings of 64% (89% gas, -33% electric)

Stabilize (and offset) Costs



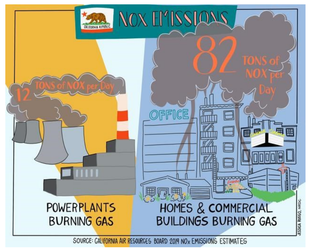


- Cost savings follow similar curve as energy savings (see left) — property is on small commercial electric rate (SMUD - GNS_T) and had pre-existing solar PV
- Energy savings of 64% (89% gas, -33% electric)
- Cost Savings of 36% (90% gas, -25% electric)

Promote Health and Safety

- Fossil fuel-powered appliances use combustion to run and emit Carbon Monoxide (CO) and Nitrous Oxide (NOx).
- Heating, water heating, laundry, and cooking are all large in-home end uses that can endanger users when fueled with gas.

⇒ Incomplete combustion can give off Carbon Monoxide and become life-threatening.
⇒ Release gases and particulates that degrade air quality
⇒ Threat of leaking gas lines, unsafe for the homeowner and the environment

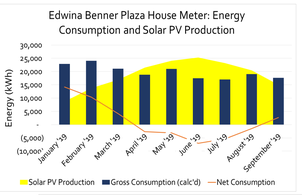


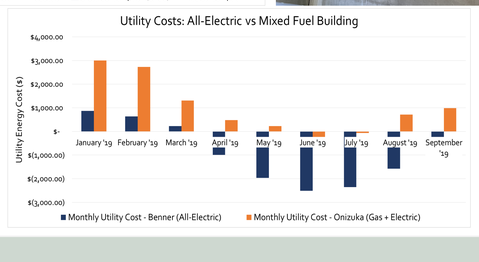
Created By: Jessica Russo, NRDC

Case Study: Edwina Benner Plaza

- Sunnyvale, CA
- 66 Affordable Units
- All-electric
- Central Heat Pump Water Heating System
- Site lighting, central laundry (with electric dryers)


Credit: Keith Baker Photography

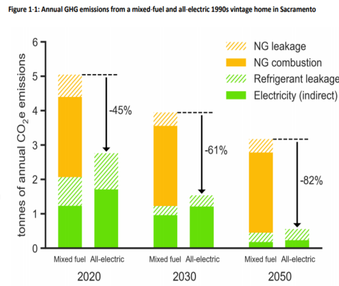




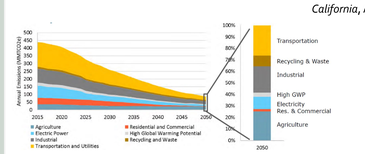
Conclusion: It Works

Electrification is already being done in Affordable Multifamily, both new construction and retrofit. It is tangible and achievable!

It is **imperative** that we electrify our building stock—both new construction and retrofit—to achieve our climate goals.



Source: E3, *Residential Building Electrification in California*, April 2019.



Source: E3, *Pathways to 2050: Decarbonization in a High Renewables Future* (presentation), April 2019.