

# Multi-Family Building Electrification

## Current examples

June 13, 2019

Scott Shell, FAIA

Principal, EHDD Architecture

The logo for EHDD Architecture, featuring the lowercase letters "ehdd" in white, followed by a small green square.



# **EHDD Housing**



**UC Berkeley**



**UC Davis Tercero**



**One Hawthorne, San Francisco**



**UC Merced**

## **EHDD all electric projects**



**Packard Foundation**



**Exploratorium**



**Boulder Commons**



**Mark Day School**



# Balboa Upper Yard Family Apts, San Francisco

120 units, in design development



Developer Mission Housing Development & Related California, Architect: Mithun  
Central Heat Pump Water Heating

# Casa Adelante, 2060 Folsom, San Francisco

127 Units, under construction



***Mithun: "We have found first costs to be neutral going all electric"***

**Developers: TNDC/CCDC, Architect: Mithun & YA Studio, Association for Energy Affordability  
Central Heat Pump Water Heating**



# Maceo May Veterans Apartments, Treasure Island

105 units, in permitting



Chinatown Community Development Center, Swords to Plowshares, Mithun, Association for Energy Affordability  
Central Heat Pump Water Heating

# Hunters Point Shipyard Block 52, San Francisco

136 units total, in Design Development



**Developer McCormack, Baron, Salazar, Architect: Mithun**  
**Central Heat Pump Water Heating**

# Hunters Point Shipyard Block 54, San Francisco

136 units total, in Design Development



**Developer McCormack, Baron, Salazar, Architect: Mithun**  
**Central Heat Pump Water Heating**



# 681 Florida, San Francisco

136 units total, In Design Development



**Developers: TNDC & MEDA, Architect: Mithun**  
**Central Heat Pump Water Heating**

## **Malcolm Harris, Mithun**

Mithun has a number of complete & in progress all electric multifamily housing projects

He is a huge, huge fan of this change to all electric multifamily housing.

It is better in every way, a great simplification of the system.

Less expensive, higher performance, less maintenance, more sustainable

We have found first costs to be cost neutral by eliminating gas connection & solar thermal system

It is a major cost saving move that pays for a lot of high performance upgrades.

At Maceo May big savings from eliminating gas fired hydronic heating, gas connection, and solar thermal that was required to meet T24.

The savings paid for continuous exterior insulation, energy recovery ventilators (eliminating Z-ducts), electric resistance heat, and PVs. With these upgrades they are beating Title 24 by 20%, get more Green Points, and lower GHGs on a grid that's getting cleaner.

The occupants get the air quality benefits from ERV.

Overall the system is just much simpler--just one energy system--electrical.

The gas fired boiler & hydronic systems are very problematic at every step from design to construction to maintenance. During construction there are often leaks. Commissioning is a constant challenge, lots of tenant complaints in first few months. Operations is challenging as maintenance staff are not equipped to operate the digital BMS system.



# Linda Vista, Mountain View

101 units, In bidding phase



Palo Alto Housing is Developer, architect is Van Meter Williams Pollack, Integral Group  
Central Heat Pump Water Heating

# Coliseum Place, 905 72nd Ave, Oakland

59 units, In Construction Documents



**DBA:**  
***"Construction cost  
is not an issue IF  
you can help  
subcontractors  
understand what  
you are asking  
them to price"***

**Developer Resources for Community Development, David Baker Architects, Energy  
Modeling by Redwood Energy, MEP by EDesignC**



## **Peter Waller, Pyatok**

In our experience it has been indispensable to have a knowledgeable energy/Title 24 consultant on the team to help guide both analysis and design.

It is critical to share information about best practices and lessons learned. By sharing best practices we can reduce mistakes.

We work with both non-profit and for-profit housing developers that own and operate lots of buildings. It is important to make sure everyone is aware of the potential challenges that come with new technology.

The life span of the current generation of heat pump water heaters may be less than the traditional gas fired boilers, depending on operating conditions. We expect the life span will increase as the market becomes deeper and more sophisticated, but we try to be open about this reality with our clients. With that in mind provide access for maintenance and future replacement down the road.

# St. Paul's Commons, Walnut Creek

Affordable – 45 Units, Under construction



RCD, Pyatok Architects, Fard Engineers, Association for Energy Affordability  
Central Heat Pump Water Heating

## ***Pyatok:***

“It is critical to share information about best practices and lessons learned”



# Altamira Family Apartments, Sonoma

Affordable, 48 units



Developer is SAHA, Pyatok Architects, Fard Engineers,  
Association for Energy Affordability

## **Nick Young, Association for Energy Affordability (AEA)**

Buildings with individual HVAC/DHW systems per unit are a no-brainer to go all-electric, from a technology, cost, modeling, and code compliance perspective. All-electric should be the standard design for those projects.

For buildings with central DHW, there are also excellent options for heat pump domestic hot water. For these we are seeing projects go with Sanden, Colmac, and Nyle systems. A significant challenge is that Title 24 doesn't have a modeling pathway for central HPWH, so we have had to do complex work-arounds, or add additional measures to make up for the incorrect values T24 forces them to use. The CEC is working on fixing this, targeting the 2019 code cycle.

Until the CEC fixes the software, AEA suggests that it might be possible to develop a rational and repeatable compliance demonstration workflow that cities could use to ease electrification.

### **All-Electric *New Construction* Projects:**

Edwina Benner Plaza, Sunnyvale, completed.  
2437 Eagle Ave, Alameda, completed.  
St Paul's Commons, Walnut Creek, under const.  
Stoddard Housing, Napa, under construction.  
Casa Adelante, San Francisco, under construction.  
Maceo May, San Francisco, under construction.

### **Partially or Fully-Electrified *Existing/Rehab* Projects**

*(through Low Income Weatherization Program)*

13 Projects, 1,043 Units Completed.  
10 Projects, 1,426 Units In Progress.



# Edwina Benner Plaza, Sunnyvale

Affordable – 66 Units, Occupied



MidPen Housing, David Baker Architects, Emerald City Engineers, Association for Energy Affordability  
Central Heat Pump Water Heating

# Stoddard Housing, Napa

Affordable – 50 Units, Under construction



Burbank Housing, Dahlin Group Architects, Emerald City Engineers, Association for Energy Affordability  
Central Heat Pump Water Heating



# 2437 Eagle Ave, Alameda

Affordable – 20 Units, Occupied



Housing Authority of the City of Alameda, Anne Philips Architecture, Fard Engineers,  
Association for Energy Affordability

# Cascade Apartments, 5<sup>th</sup> & Lenora

230 Units, 44 floors. At 95% Construction Docs.



Developer is Vulcan, Ankrom Mosian Architects,  
Engineering by Ecotope





# **4700 Brooklyn Ave NE**

**227 Units, 24 floors. Under Construction**

**Developer is FH Brooklyn, NBBJ Architects,  
Engineering by Ecotope**



## **Shawn Oram, Ecotope, Central Heat Pump Hot Water in Multifamily**

For case studies:

[https://www.phnw.org/assets/2019Conference/Presentations/PHnw2019\\_Central%20Heat%20Pump%20Water%20Heating%20for%20Passive%20Houses\\_Ecotope.pdf](https://www.phnw.org/assets/2019Conference/Presentations/PHnw2019_Central%20Heat%20Pump%20Water%20Heating%20for%20Passive%20Houses_Ecotope.pdf)

<https://www.youtube.com/watch?v=6MFmGz6H9PQ&t=11s>

<https://aceee.org/sites/default/files/pdf/conferences/hwf/2018/1c-oram.pdf>

<https://www.bpa.gov/EE/Technology/EE-emerging-technologies/Projects-Reports-Archives/Documents/Dec2015%20RCC%20Report%20with%20Appendix.pdf>

Ecotope has completed 26 central heat pump water heating projects since 2008, mostly 100-500 unit projects. The water heating load is ~3.5 eui for temperature maintenance of loop, and ~6.5 eui for heating the hot water. Temperature maintenance energy is purely a function of pipe insulation UA: (insulation x area). Heat pumps typically put in below grade garage where temps are never below 50 degrees in Seattle. Other locations include roof for outside air, solar greenhouse, ground source, and wastewater source. Heat pumps like 50 degree incoming water, very efficient. The most efficient design uses a separate heat pump for primary heat and for temperature maintenance heat. Stratification and insulation (R25) of storage tanks is key. (17) 500 gallon tanks installed in series. The hot water wants to rise up thru the building so we install 5' tall heat trap on each side of storage. Optimize the distribution design: a colder return water can increase COP by 0.7. Rightsizing piping is key. Inside units use 3/8" piping as home runs which yeilds very short wait times. Works great. Make sure you have back-up systems, redundancy is essential. Redundancy is essential. Post occupancy M&V: provide alarm systems to notify if something is going wrong.



# California Universities Are Transitioning to All-Electric Buildings

The University of California system and Stanford University are making all-electric buildings the default in new construction.

JUSTIN GERDES | SEPTEMBER 24, 2018



“No new UC buildings or major renovations after June 2019, except in special circumstances, will use on-site fossil fuel combustion, such as natural gas, for space and water heating”

[https://www.greentechmedia.com/articles/read/california-universities-are-transitioning-to-all-electric-buildings#gs.QUr5W\\_E](https://www.greentechmedia.com/articles/read/california-universities-are-transitioning-to-all-electric-buildings#gs.QUr5W_E)

# UC Santa Cruz Student Housing West

750,000 sf, 3,000 beds, under construction



P3, Capstone is Developer, Sundt is GC, HED Architects, Interface Engineering  
Central Heat Pump Water Heating



# UC Riverside Dundee Residence Hall

600,000 sf, under construction



***Interface:***  
***"We design almost all of our projects as electric only unless a client requires otherwise"***

**American Campus Communities is Developer, SCB Architects, Interface Engineering**

# UC Davis Student Housing, Webster Hall Replacement

371 beds,



**Design/Build, DPR GC, HKS Architects, Interface Engineering**  
**Central Heat Pump Water Heating**



# UC Irvine Student Housing West

1,441 beds



P3, Developer is American Campus Communities, KTG Y Architects

## **Hormoz Janssens, Interface Engineering**

Currently four large student housing projects underway in the UC System

The challenge with multifamily is T24 energy code compliance due to the gas baseline and lack of heat pumps in compliance software (this is being worked on now by the CEC)

There is not a technical problem to design all electric for multi-family.

Centralized domestic hot water systems are rewarded in T24 calculations. Developers protested when that rule was introduced because it makes it harder to bill to tenants for water.

Central systems are more expensive, require larger insulated hot water pipes running all around building, plus recirc pumps, etc.

## **Steve Gross, Interface Engineering, leads energy modeling**

Title 24 software lets you select a specific manufacturer for a residential HPWH, but larger heat pumps are not included in software so there is no compliant way to model them.

The majority of market rate buildings have individual HPWH per units which is not a technology challenge.

For centralized hot water on large buildings, the heat pumps have a big footprint and require space

Primary manufacturer is Nyle, largest heat pump is 250 mbh, not modular so lots of clearance requirements.

The manufacturers could make modular heat pumps to solve this problem.



# Station House, Oakland

171 Units, phase I completed



Developer City Venture, Baran Studio Architect

# Ice House, Oakland

Units



Developer City Ventures



# Resources

One in four homes is all electric: <https://www.eia.gov/todayinenergy/detail.php?id=39293>

Social Equity, affordable housing, and net zero energy: <https://rmi.org/social-equity-affordable-housing-and-the-net-zero-energy-opportunity/>

The economics of electrifying buildings: <https://rmi.org/insight/the-economics-of-electrifying-buildings/>

Are we ready for all electric buildings?: <https://tinyurl.com/y3unn3r4>

Decarbonization of heating energy: <https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf>

The smog in your kitchen: <https://www.fresnobee.com/opinion/readers-opinion/article222726175.html>

All electric commercial food service: <https://drive.google.com/open?id=1CjrN62JqgffTzri3zeE3hwDqW9Zu80ws>

All electric restaurant kitchens: <https://www.foodserviceandhospitality.com/why-induction-cooking-is-the-hottest-trend-to-hit-restaurant-kitchens/>

Zero carbon commercial construction: <http://sanjoseca.gov/DocumentCenter/View/82909>

# All Electric Kitchen

## Troisgros Grande Maison Roane, France

Michelin 3 stars

[https://troisgros.fr/page\\_3-maisons](https://troisgros.fr/page_3-maisons)





# All Electric Restaurants at LAX

## Bradley Terminal

**BUILT**  
[CUSTOM BURGERS]



**800°**  
DEGREES  
neapolitan pizzeria



*Border Grill*



**FRESH BROTHERS**  
PIZZA-SALAD-WINGS



**EARL OF SANDWICH**



**ciabatta bar**



Andre Salvador, So Cal Edison food service expert helped these tenants adapt to all electric, he's a great resource!

# All Electric Restaurants at LAX Bradley Terminal



<https://www.foodserviceandhospitality.com/why-induction-cooking-is-the-hottest-trend-to-hit-restaurant-kitchens/>





David Shell • 2nd

Energy Sales Supervisor at Gulf Power Company



- 60% of full service restaurants in our territory are all electric
- We've had success selling Wendy's and McDonald's on electric cooking
- The new combi ovens, steam cabinets, holding cabinets and induction cooktops work great!



- Also in our territory:
- 80% of single family homes are all electric
- 100% of multi-family buildings are all electric
- 70% of commercial buildings are all electric



# SUSTAINABILITY OFFICE SFUSD

NIK KAESTNER

DIRECTOR OF SUSTAINABILITY

- Has one electric kitchen under construction, Claire Lilienthal Elementary
- Currently designing kitchens at Clarendon, Hillcrest, and West Portal schools as all electric
- Worked with chef and staff to understand induction cooking
- Visiting Food Service Technology Center in San Ramon to give staff a hands-on look at the equipment
- Doing some training with staff to get them accustomed to induction
- Bids for electric equipment are coming in cheaper than gas
- Biggest energy hogs are the fryers and also make the least healthy food, so promoting other equipment is healthy!



# Sonoma Academy



From Interface Engineering