DHW Electrification in Multifamily Buildings

On-the-Ground Perspective

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Topics We Will Cover

- Programmatic context for electrification in CA
- Real world challenges, concerns, of deploying central HPWH in MF
- Walk through some recent project examples
  1. Sanden central system projects (existing building fuel substitution)
  2. Aermec central systems project (new construction)

LIWP Program DHW Electrification

- AEA: Statewide implementer Multifamily Low Income Weatherization Program (LIWP) administered by the Department of Community Services and Development and funded through California's Cap-and-Trade Program
- EE and PV GHG Reduction Program
- Savings based on MTCO2 reductions = gas savings measures have big bang for the $.

Sanden System Mid-install

Lessons Learned - Advantages

- Pairing with PV attractive to owners
  - Solar thermal can have building limitations
  - Owners had been installing PV systems that offset owner meter electric load (mostly lighting) with roof or carport space to spare and DHW gas load not offset
- No venting or gas line limitations, installation can be relatively straightforward (electrical and piping)

Lessons Learned - Advantages

- Potential for load shifting can work well with Time-of-Use electric tariffs
- Modular set up configurations
  - Various tank and heat pump combinations to meet hot water demand of building
  - Future for additional tank sizes and heat pump capacities

Lessons Learned - Challenges

- Need to add 220 V outlet (when fuel switching), meaning distance from closest panel is important
- Space constraints because of larger storage needs and locations for split heat pumps
- Contractor and owner knowledge and hesitancy

Lessons Learned - Challenges

- Energy Code/Permitting Challenges
  - California Energy Code limitations, no prescriptive pathway for central HPWH, and does not model well or at all using performance approach
- Inconsistent material and labor costs
- Potential for a usage profile that can increase energy costs without education and/or controls (demand charges and TOU)

Sizing Challenges

•Engineers' original sizing proposal is 50% of first hour load covered by storage, rest by recovery. This results in lots of heat pumps!

- Proposed 75% of first hour load covered by storage, rest by recovery. Results in less heat pumps and vulnerability to kW demand charges
- Other sizing factors as well (Temperature Rise, Usage Type)

Flow Monitoring to Verify Sizing

Central Heat Pump Chillers

- Simultaneous heating, cooling, DHW production
- Circulates hot and chilled water to building
- Designed to take the place of boiler (heating & DHW) + chiller
- Internal Heat Recovery

Efficiency

EER: 9.2
COP: 3.05
TER (Total Efficiency Ratio): 6.4
Heat recovery on condenser loop yields highly efficient operation while in simultaneous modes:

CEC Research Project

Meter and logging:

- Heating energy production & consumption (kW, kWh, Btu)
- Cooling energy production & consumption (kW, kWh, Btu)
- DHW energy production & consumption (kW, kWh, Btu)
- Indoor Temperature Set-points (from visual inspection)
- Indoor Temperatures (°F)
- Pumping energy (kW, kWh)
- Distribution losses (Btu)
- Tank losses (standby) (Btu)
- Domestic hot water usage (gal, gal/person/day)
- Total (cold + hot) water usage (gal)

How does DHW production efficiency compare to the GeoSpring and Sanden projects?

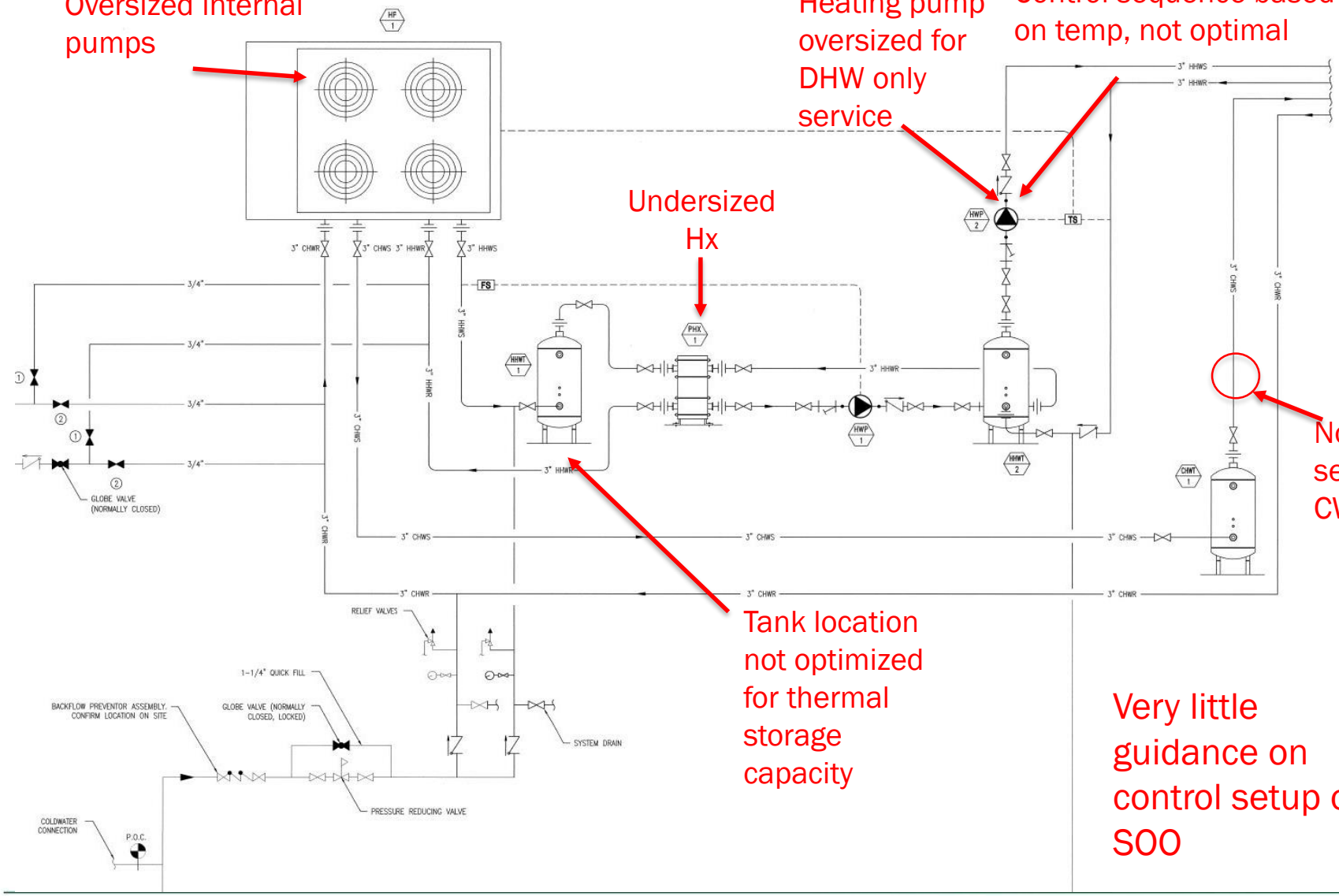
How much benefit are we getting from the heat recovery process?

Can system be used effectively for thermal storage

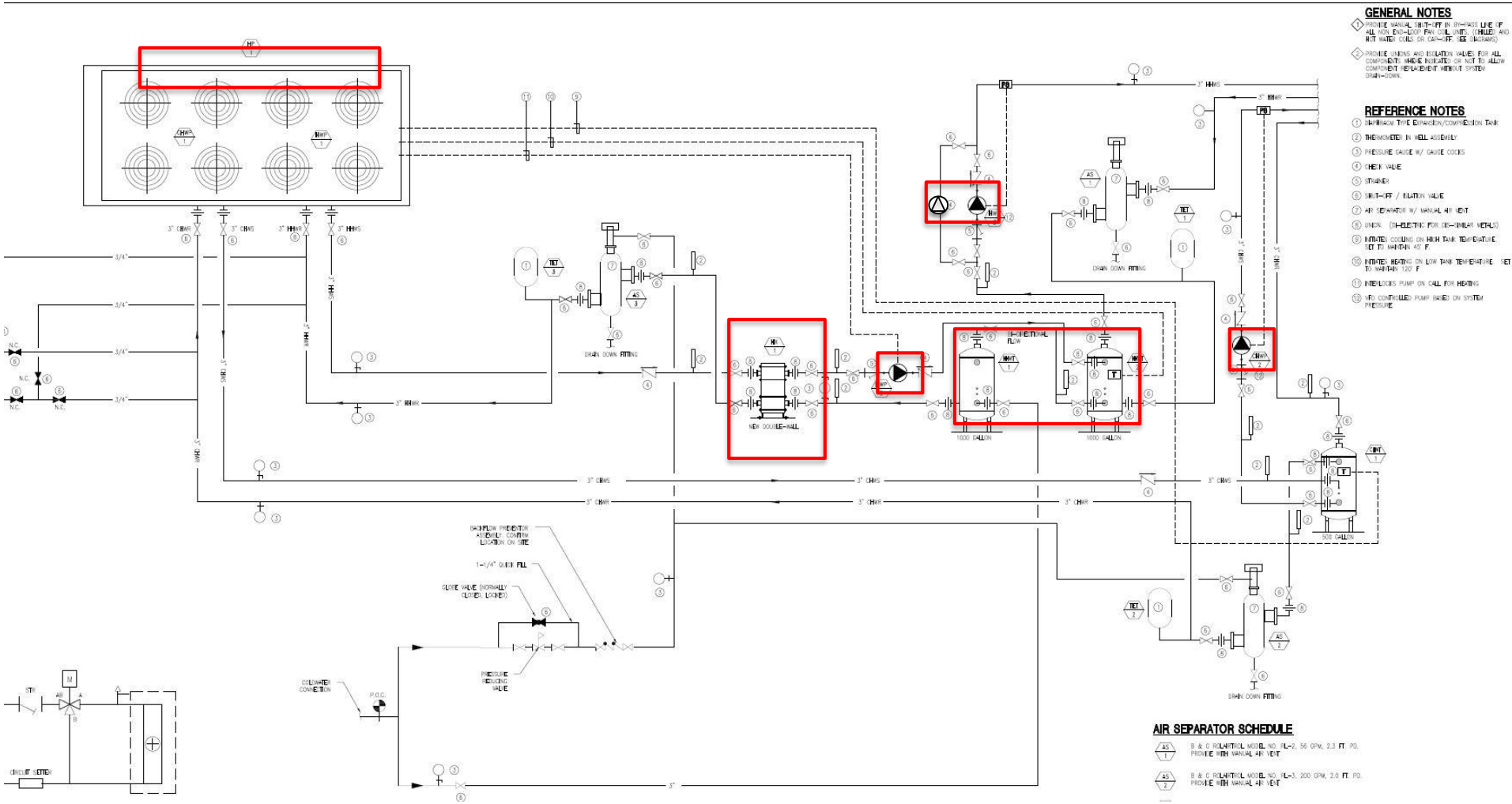
What Have We Discovered *So Far*

- Many technical challenges (design & install)
- Still relatively new technology in US
- Not plug-and-play out of the box
- Problems with first 2 installs, unhappy residents, owners, management

Original Schematic: Project #1

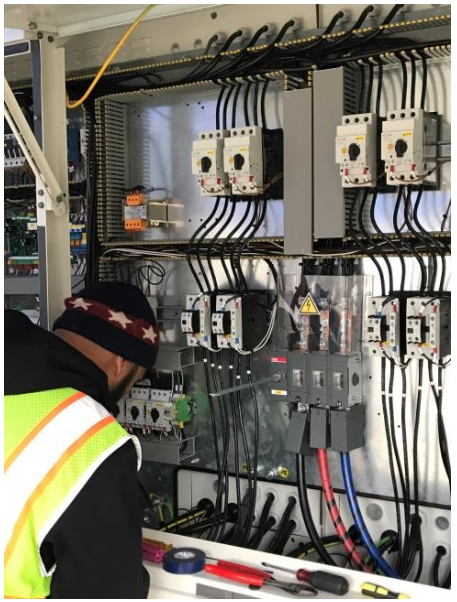


Change Order Schematic: Project #1



Installation Challenges

- Complexity
- Noise levels
- Troubleshooting
- 2 compressors failed in a first year
- 1 year warranty!
- Parts availability
- Start-up
- Service



Thank You!

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