

California PIER Hot Water Distribution Systems Research

ACEEE Water Heating Forum
Getting Hot Water—Multifamily Technologies
Sacramento
June 2nd, 2008

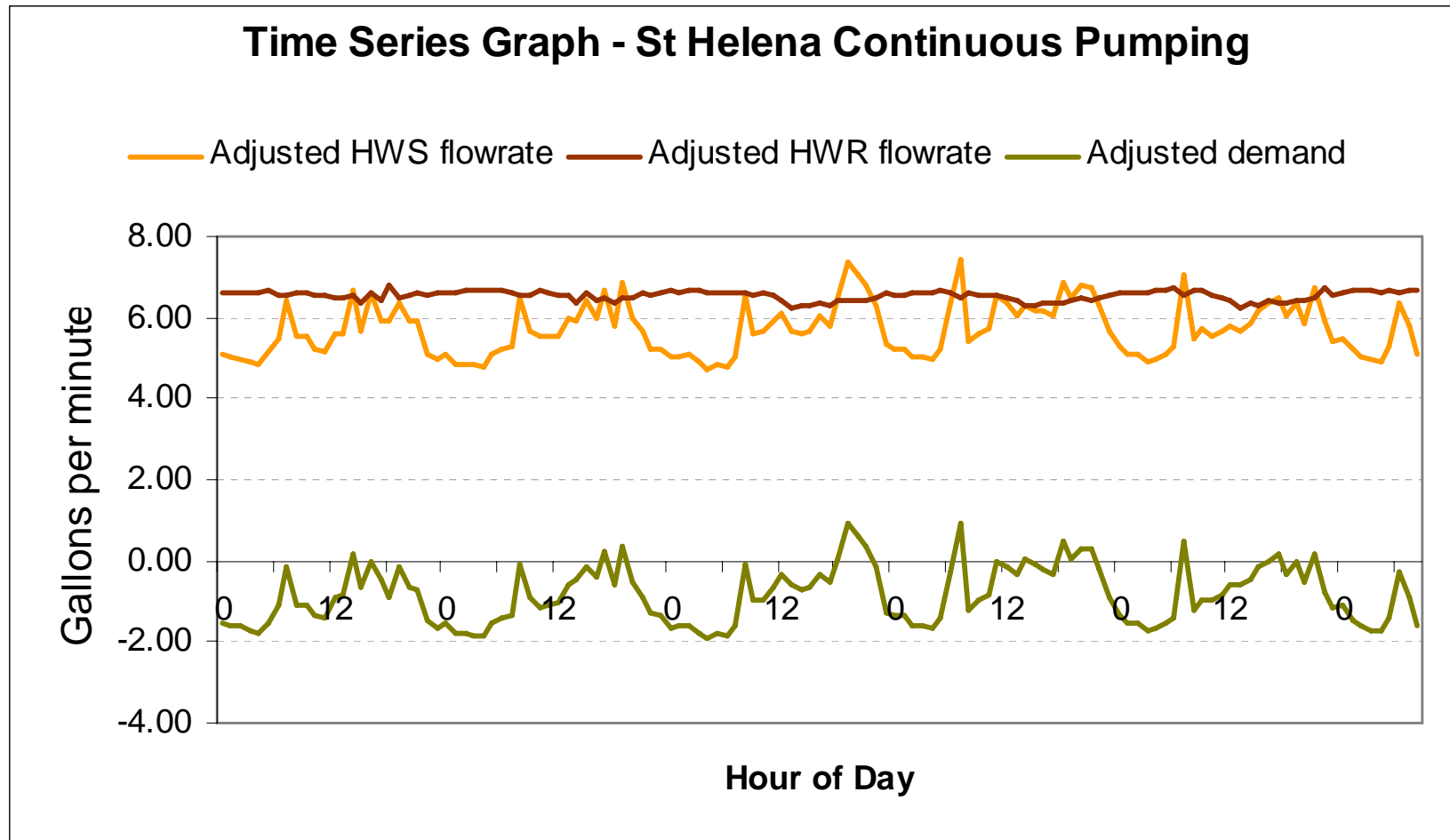
First and Second PIER Studies

- First PIER Study
 - Study complete
 - Data from 3 sites
 - Non-significant, indicative results
 - Direct short-term comparison of controls only
 - Second PIER Study
 - Study in progress
 - Data from 12 sites, possibly 20 more
 - Expect statistically significant results
 - Direct short-term comparison of controls
 - AND long-term study of persistence
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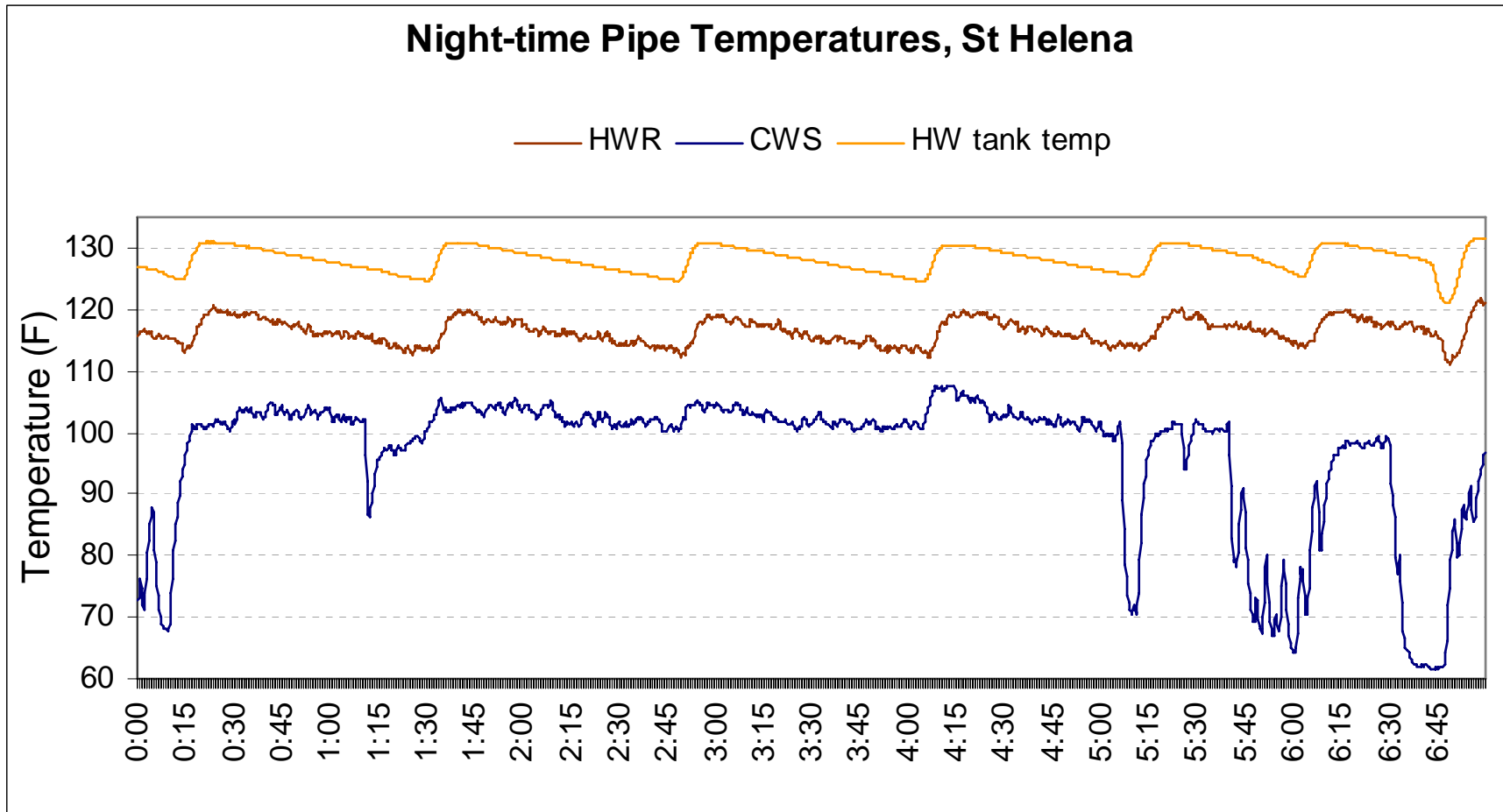
Findings of First PIER Study

- Average 27% savings from controls
 - But most of this probably just from reduction in supply temperature
 - High variation in controls savings between sites
 - Large errors in measurement due to flow meter error
- Evidence of energy waste from crossover flows
 - 2-7% at one site, <1% at another, 0 at a third
 - At the 2 sites, flow was 15-34gpd per dwelling unit
- Timeclock control made no difference to gas consumption
- Limited analysis of EDC historical data found pump failure at 5% of sites at any given time
- Timeclocks at two of three sites were not working

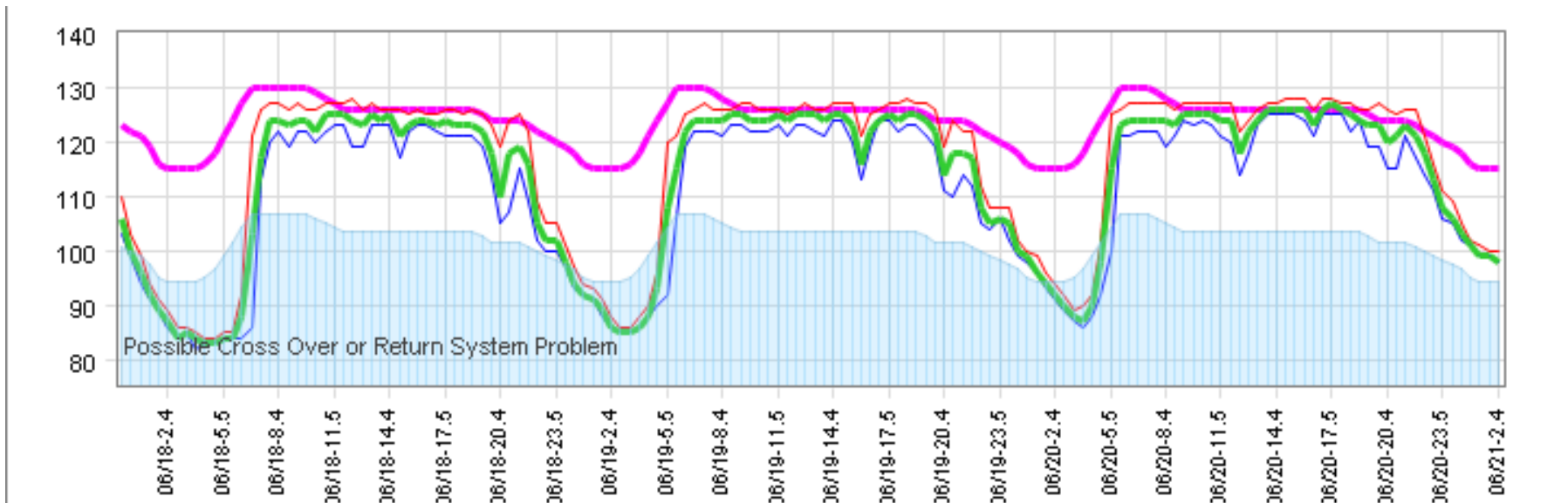
Evidence of Crossover from Water Flow Measurements



Evidence of Crossover from Water Temperature Measurements



Evidence of Pump Failure from Temperature Measurements

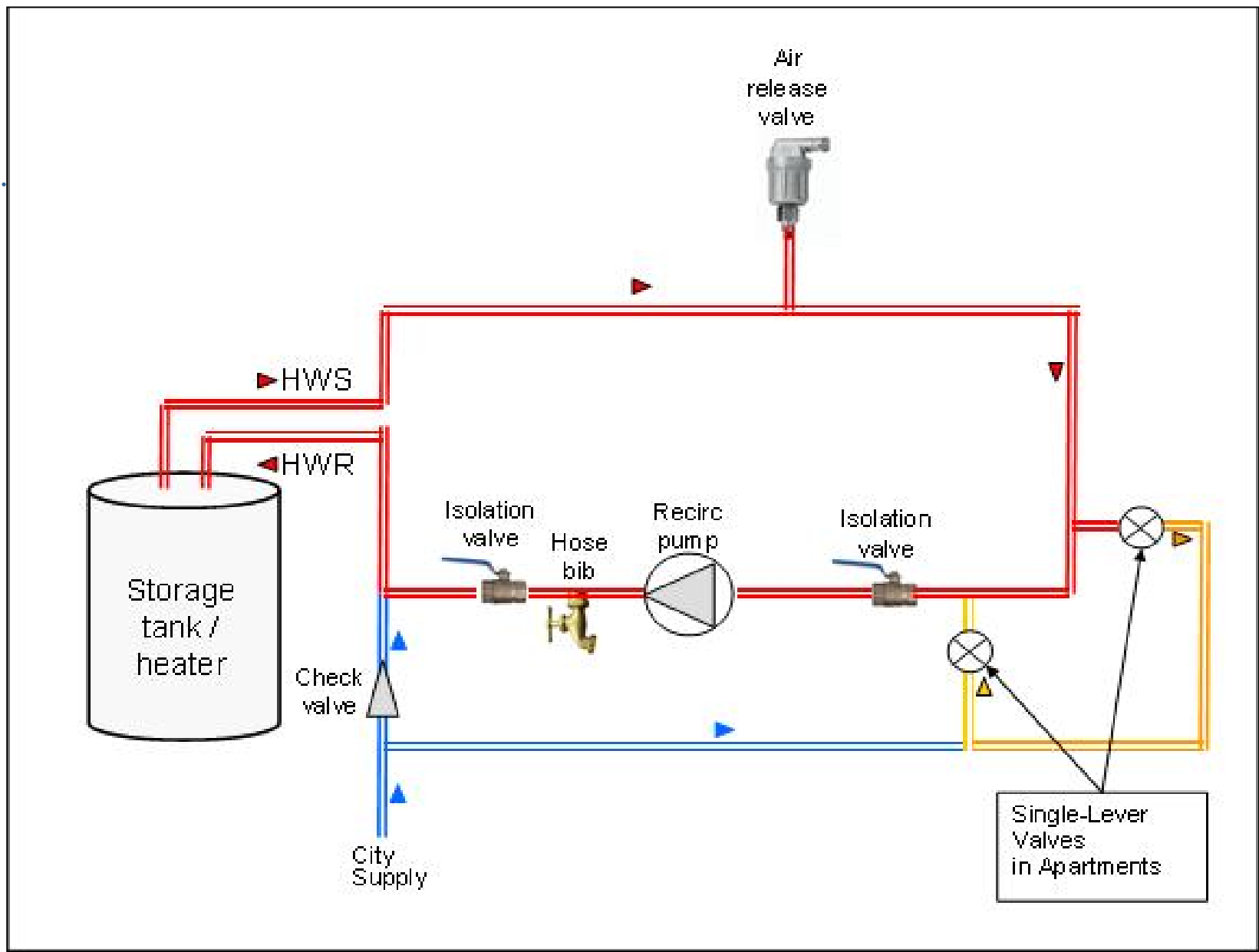


Source: EDC Controls

According to EDC the symptoms of pump failure are rapid temperature fluctuations at the supply and return ends of the recirculation loop, and very large drops in loop temperature at times of low usage, such as overnight

Changes to Title 24 2008

- Hose bibb at pump to release air from system before starting pump
- Automatic air release valve immediately upstream of pump to prevent cavitation
- Isolation valves either side of the pump, for maintenance
- Require check valve on return pipe
- Require check valve on cold water supply
- No connection of pipes to tank drain port
- For 2008 Code we did not feel ready to revise allowances for control systems



PIER Phase 2: Next Big Sources of Savings

- recirculation pump reliability

- Hypothesis (based on EDC Controls) that recirc pump failure causes maintenance staff to increase supply temperature, wasting energy.
- HMG is looking at years of historical data from hundreds of EDC sites to find evidence of pump failure and any changes to supply temp.

PIER Phase 2: Next Big Sources of Savings

- recirc loops vs. individual heaters

- For Title 24, we would like to know whether recirculation loop systems are more or less efficient than individual water heaters in MF.
 - However, at present, there seem to be no studies of the real energy consumption of individual water heaters, either in SF or MF.
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PIER Phase 2: Next Big Sources of Savings

- WaterCalc

- A detailed analytical model of DHW energy consumption
 - Will calculate savings in individual buildings
 - Will be calibrated using results from on-site surveys
 - Can be used to generate estimates of savings from programs and code
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PIER Phase 2: Next Big Sources of Savings

- Crossover flow

- Phase 2 on-site survey results should provide evidence of whether crossover flow exists and how much energy it wastes.
 - Will validate T24 2008 crossover measures.
 - May identify further opportunities for savings.
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