

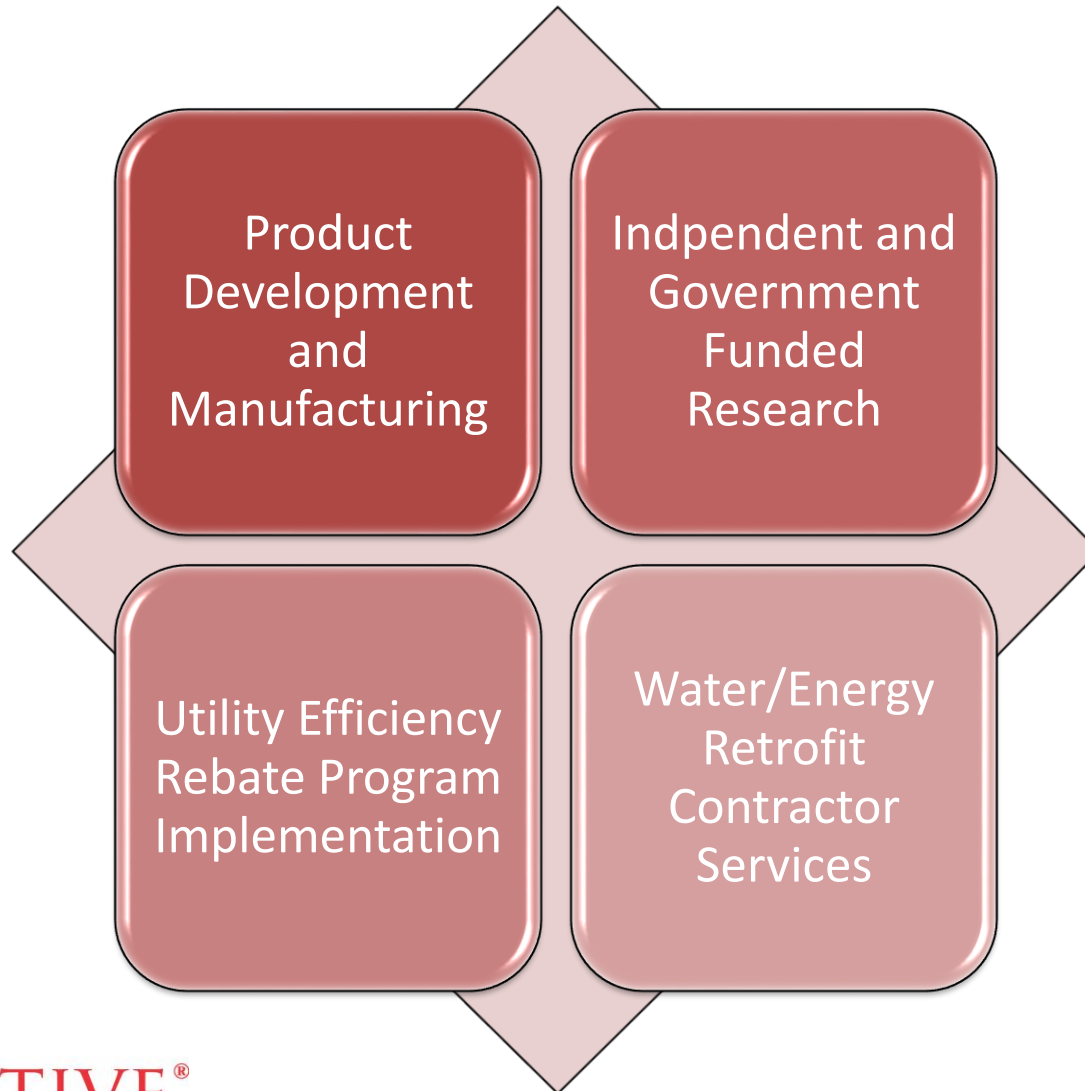
Developments in Multifamily CDHW Distribution Controls and Crossover Research

2017 ACEEE Hot Water Forum

February 28, 2017

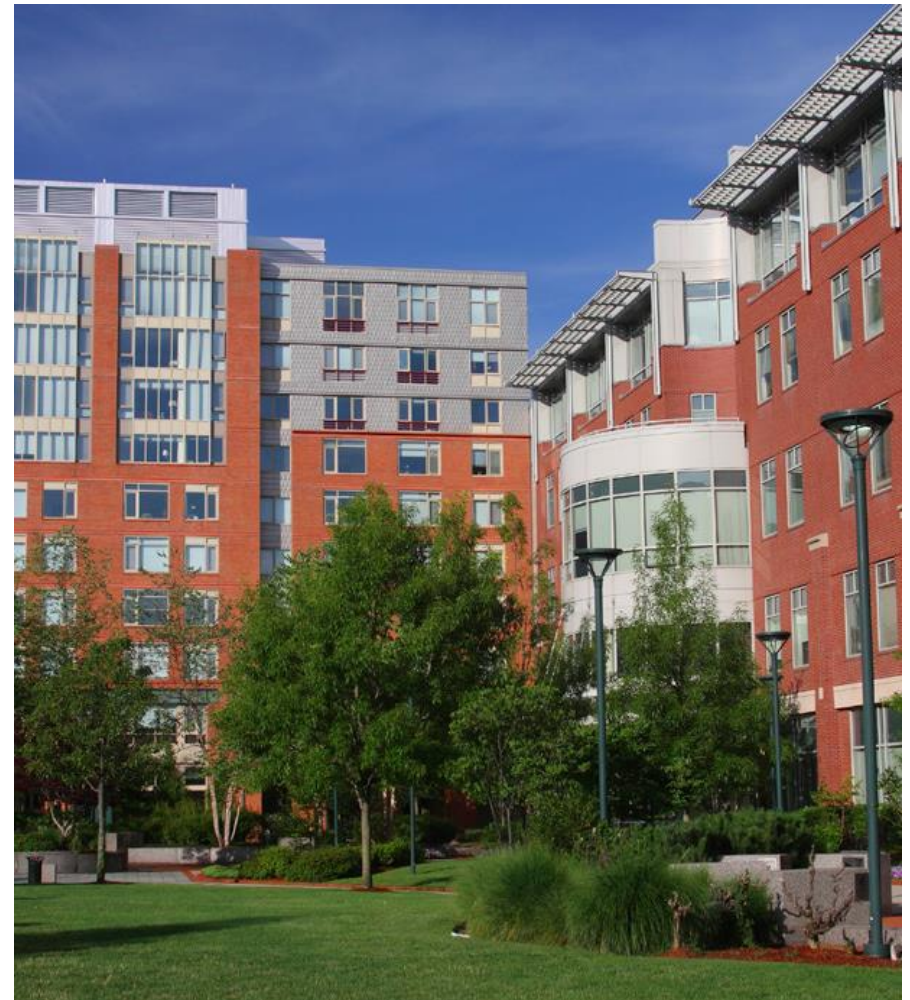
Portland, OR

About Enovative



So Cal Gas “On-Demand Efficiency” Program- Campus Housing (ODECH)

- Provides demand recirculation pump controls for student housing with CDHW
- Saves gas by reducing recirculation loop loss
- Save electricity by reducing pump run time
- Aids in reducing the occurrence of pinhole leaks



How will savings differ?

- More people per 'door'
- Many have shared fixtures
- Different usage patterns
- Long break periods between semesters
- Similar water heating equipment and temperatures
- Similar distribution runs
- Similar pump 'as found' conditions (i.e., constant operation)

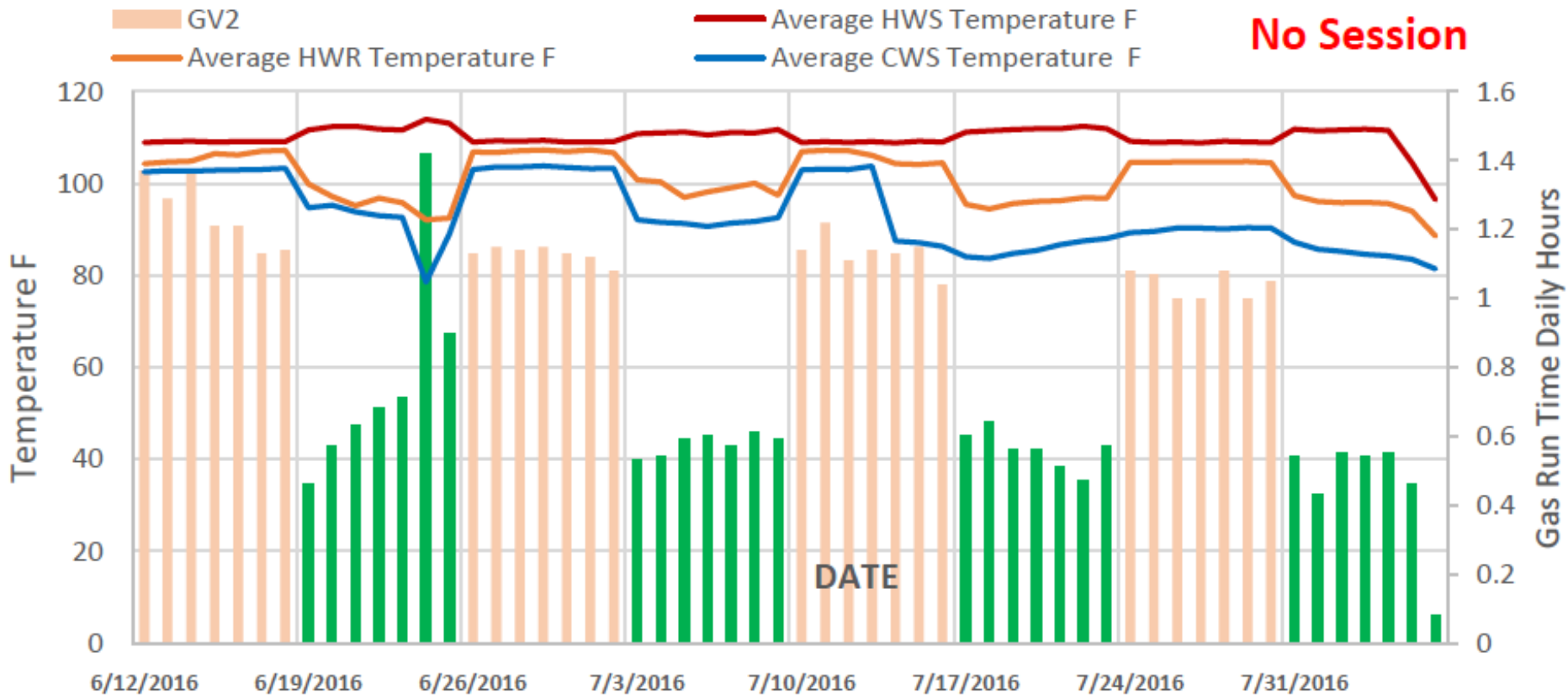
Testing Methodology

- Data logging and control rig alternates pump run time every week
- CT loggers on gas valve measures boiler run times
- CT loggers on pump measures circulation run times
- Temperature sensors on HWS, HWR, CWM

ODECH Monitored Data

| Site Name | Session | | No Session | | Weighted Average | |
|----------------------------------|-----------|--------------|------------|--------------|------------------|--------------|
| | % Savings | Therms Saved | % Savings | Therms Saved | Per Unit | Therms Saved |
| California Poly Technic, Pomona | 14.00% | 443.52 | 37.00% | 527 | 19.82 | 475.6 |
| UC Riverside, Falkirk Bldg. 3(1) | 24.28% | 461.13 | 48.80% | 707.02 | 34.73 | 555.7 |
| UC Riverside, Falkirk Bldg. 2(2) | 34.18% | 1141.41 | 38.10% | 1090.97 | 70.47 | 1127.52 |
| UC Irvine, Mesa Court 4021 | 27.67% | 509.61 | 32.54% | 244.04 | 14.552 | 407.47 |
| UC Irvine, Middle Earth | 23.62% | 781.61 | 42.40% | 549.32 | 24.72 | 692.27 |
| Azusa University, Court B* | 25.06% | 567.44 | n/a | n/a | 31.52 | 567.44 |
| Average | 24.80% | 650.79 | 39.77% | 623.67 | 32.64 | 637.67 |

UC-Riverside Falkirk Bldg. 3- No Session (Unoccupied)

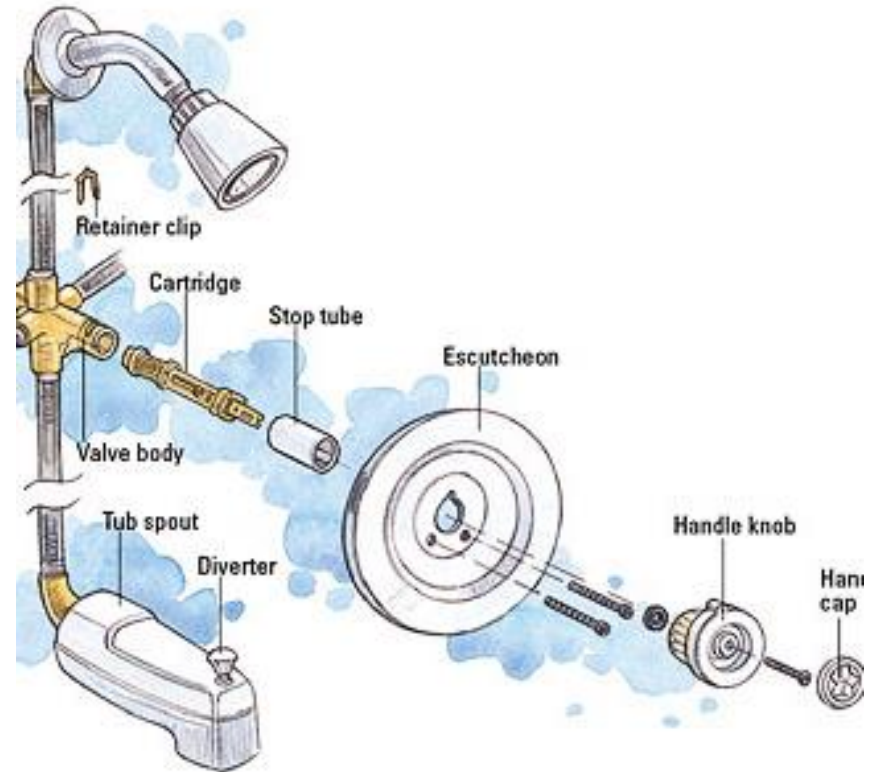


CEC Crossover Research Update

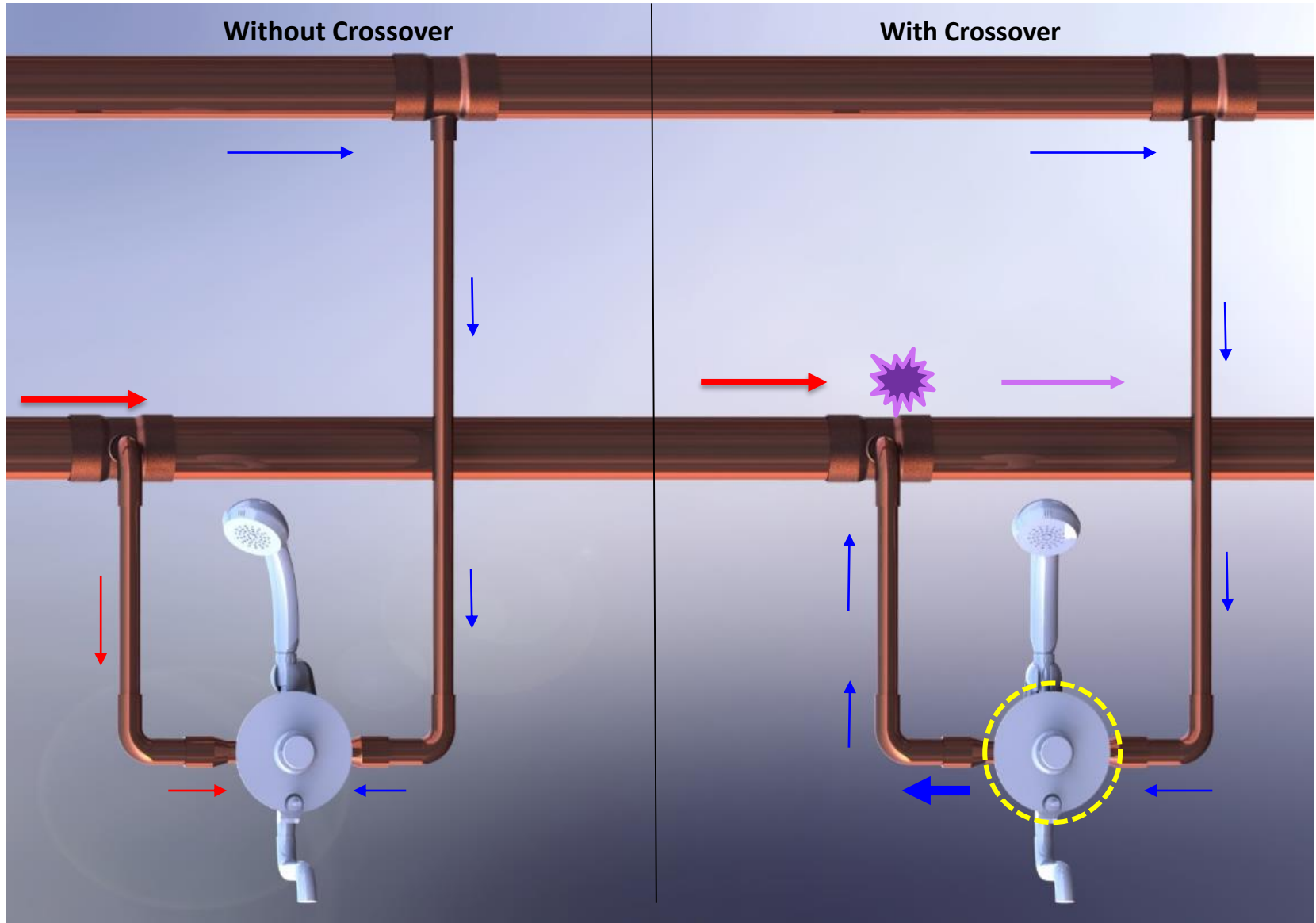
Measuring impact of repairing
crossover flows in multifamily CDHW

What is Crossover?

- Uncontrolled mixing between the hot and cold water pipes
- Can potentially happen at any point where hot and cold water pipes meet
- May be asymptomatic



What is Crossover?

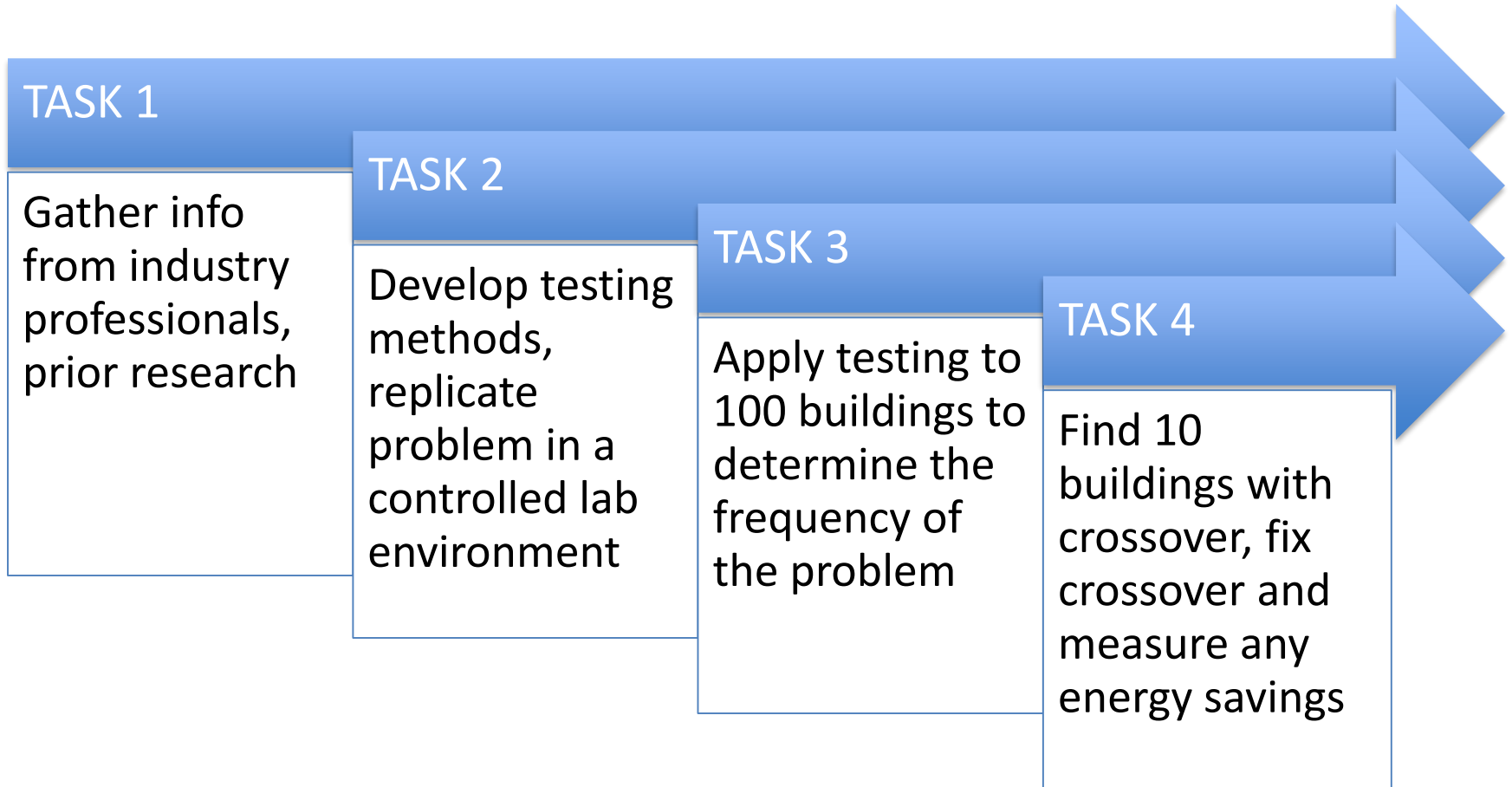


Impact of Crossover on Hot Water Distribution

- May cause inconsistent and fluctuating water temperature from the fixture
- May cause long hot water wait times
- May cause excessive workload on the water heater
- May prohibit effective use of recirculation pump and water heater controls

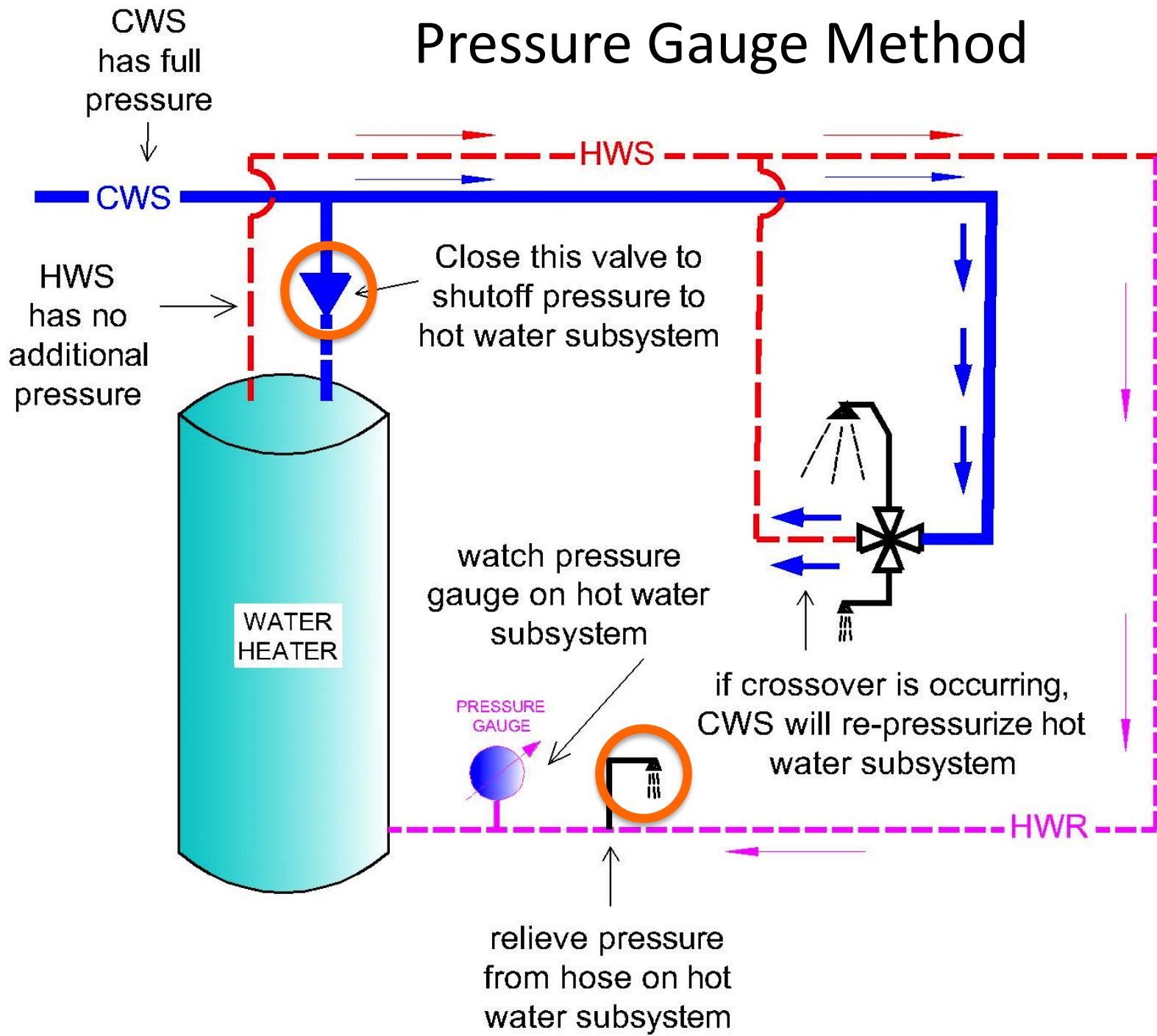


Project Tasks





Pressure Gauge Method



Final Test Sites

| | | | | | | | | | | |
|-----------------|------------------------|---------------------------------------|--------------------------|------------------------------|------------------------------|---------------------------|---------------------------------|------------------------|-----------------------------------------------|--------------|
| Sites | 119 Driftwood | 10 th Street, Santa Monica | State College A, Anaheim | State College B, Anaheim | City Gardens A, Santa Ana | City Gardens B, Santa Ana | Falkirk, UC Riverside | Culver City | Lakeside Drive, Oakland | Park La Brea |
| Number of Units | 16 | 24 | 9 | 9 | 20 | 20 | 16 | 12 | 195 | 28 |
| Before Fix | Data collected | Data Collected | Data Collected | Data Collected | Data Collected | Data Collected | Data Collected | Data Collected | Pending | Pending |
| Fix | Shower Valves Replaced | Check Valves on Risers | Shower Valves Replaced | Check Valves at supply lines | Check Valves at Supply Lines | Shower Valves replaced | Shower Valves Replaced | Shower valves replaced | Adding check valve, replaced shower cartridge | TBD |
| After Fix | Data Processed | Data Processed | Data Processed | Data Processed | Data Processed | Data Processed | Processing and Analysis Pending | Pending | N/A | N/A |

Fix #1: Replacing Shower Valves



Fix #2: Adding Check Valves



Before

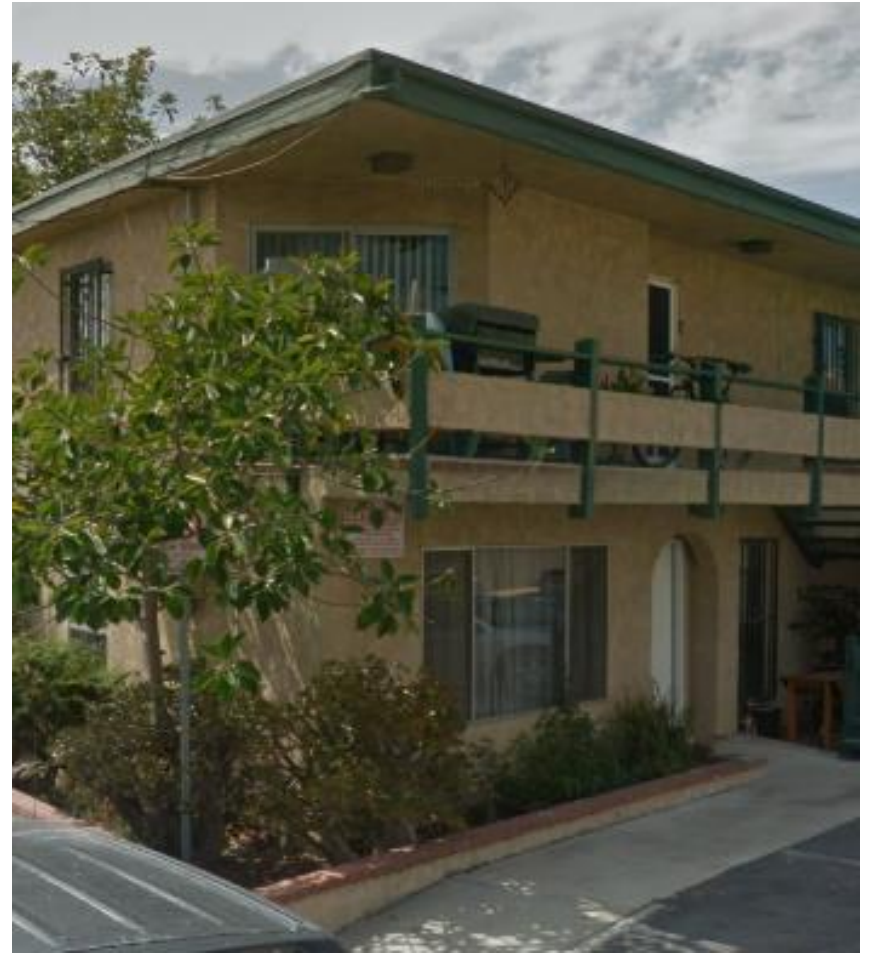


After

Fix #3: Replacing Valve Cartridges



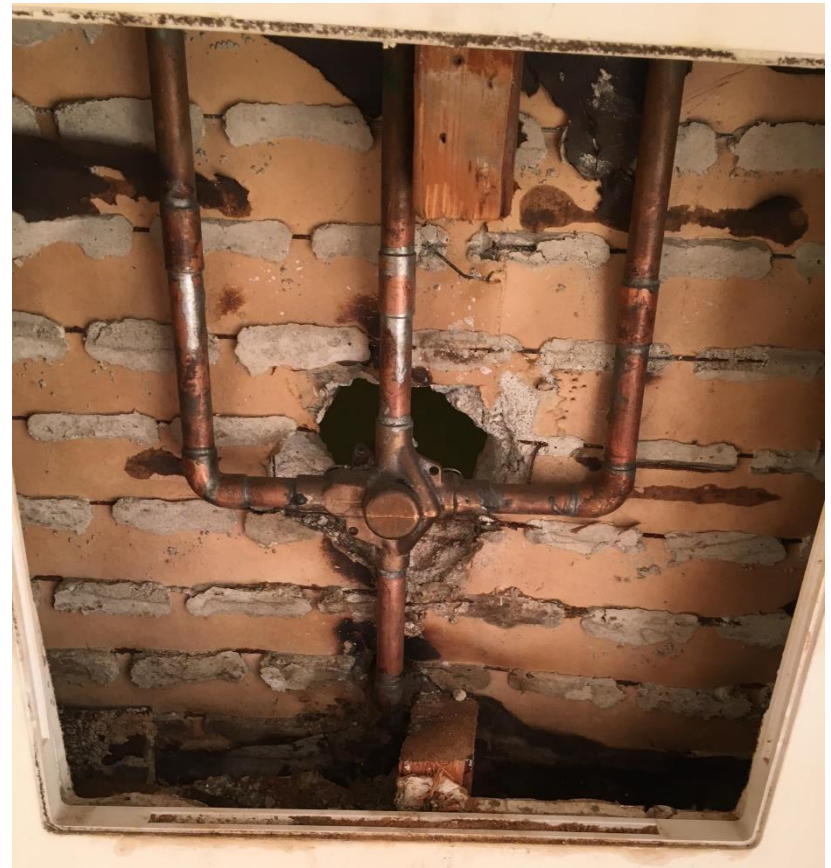
16-unit building, Marina Del Rey, CA



Marina Del Rey fix- Replace Shower Valves



Before



After

| | |
|---------------------------------------|-----------------|
| Before Fix (Gas usage in Hrs) | 2.327794 |
| After Fix (Gas usage in Hrs) | 2.066786 |
| Difference (Gas usage in Hrs) | 0.261008 |
| Saving % | 11.21% |
| Total Saving Therms (Annually) | 238.3333 |

Notes Post Fix:

- Tenants described having more consistent hot water
- Water 'felt hotter' than before the fix
- Pump controls that had previously been bypassed, now reactivated without issues

Gas Usage Data Completed Sites

| Site / Location | Before Fix (Gas Valve – Daily Hrs) | After Fix (Gas Valve – Daily Hrs) | Difference (Gas Valve – Daily Hrs) | % Savings |
|-----------------------------|------------------------------------|-----------------------------------|------------------------------------|------------|
| 119 Driftwood, MDR | 2.32 | 2.06 | 0.26 | 11.2% |
| 10 th Street, SM | 3.01 | 2.57 | 0.43 | 14% |
| State College Blvd A | 4.06 | 4.16 | -0.10 | -2.49 |
| State College Blvd B | 2.94 | 2.44 | 0.50 | 17% |
| City Gardens 17 | 9.03 | 8.42 | 0.60 | 6.69% |
| City Gardens 54 | 4.56 | 3.88 | 0.69 | 15% |
| AVERAGE | 4.32 | 3.92 | 0.4 | 10% |

Notes on T4 Challenges

- Finding source of crossover- Not always a mixing valve
- Accessibility to shower valves- Tiled walls
- Replacing shower valves- Isolation valves, sweating connections in the walls



Crossover Case Study, Oakland CA

| Apt unit | Cold Water Lav Temp |
|----------|---------------------|
| 1506 | 95 |
| 1406 | 95 |
| 1306 | 85 |
| 1206 | 90 |
| 1106 | 80 |
| 1006 | 81 |
| 906 | 95 |
| 806 | 83 |
| 706 | 73 |
| 606 | 68 |
| 506 | 64 |
| 406 | 68 |



Thank You

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