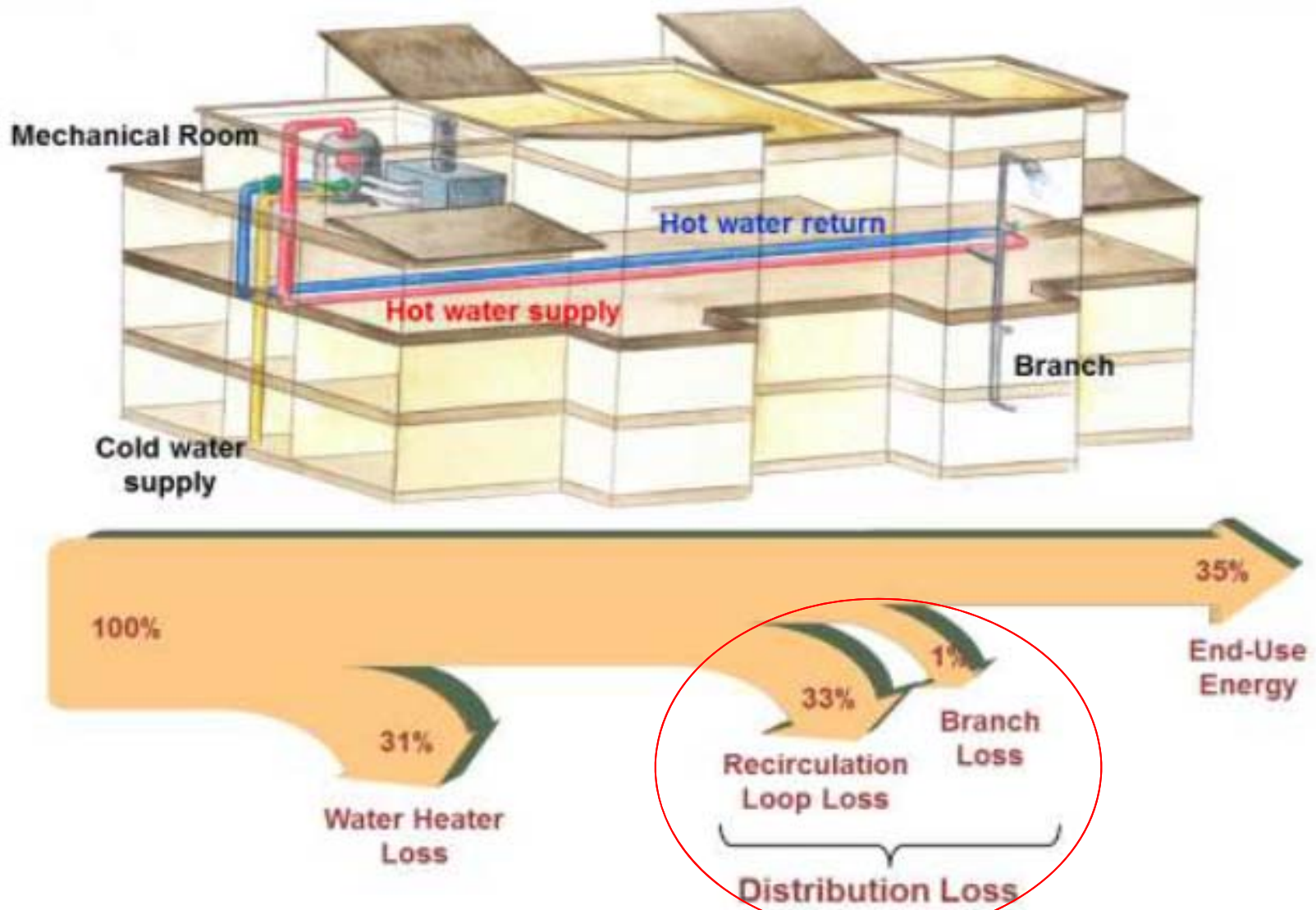


Energy Research on Improving the Balancing and Mixing of Domestic Hot Water

California Energy Commission
Funded Research Project

CDHW Energy Flow

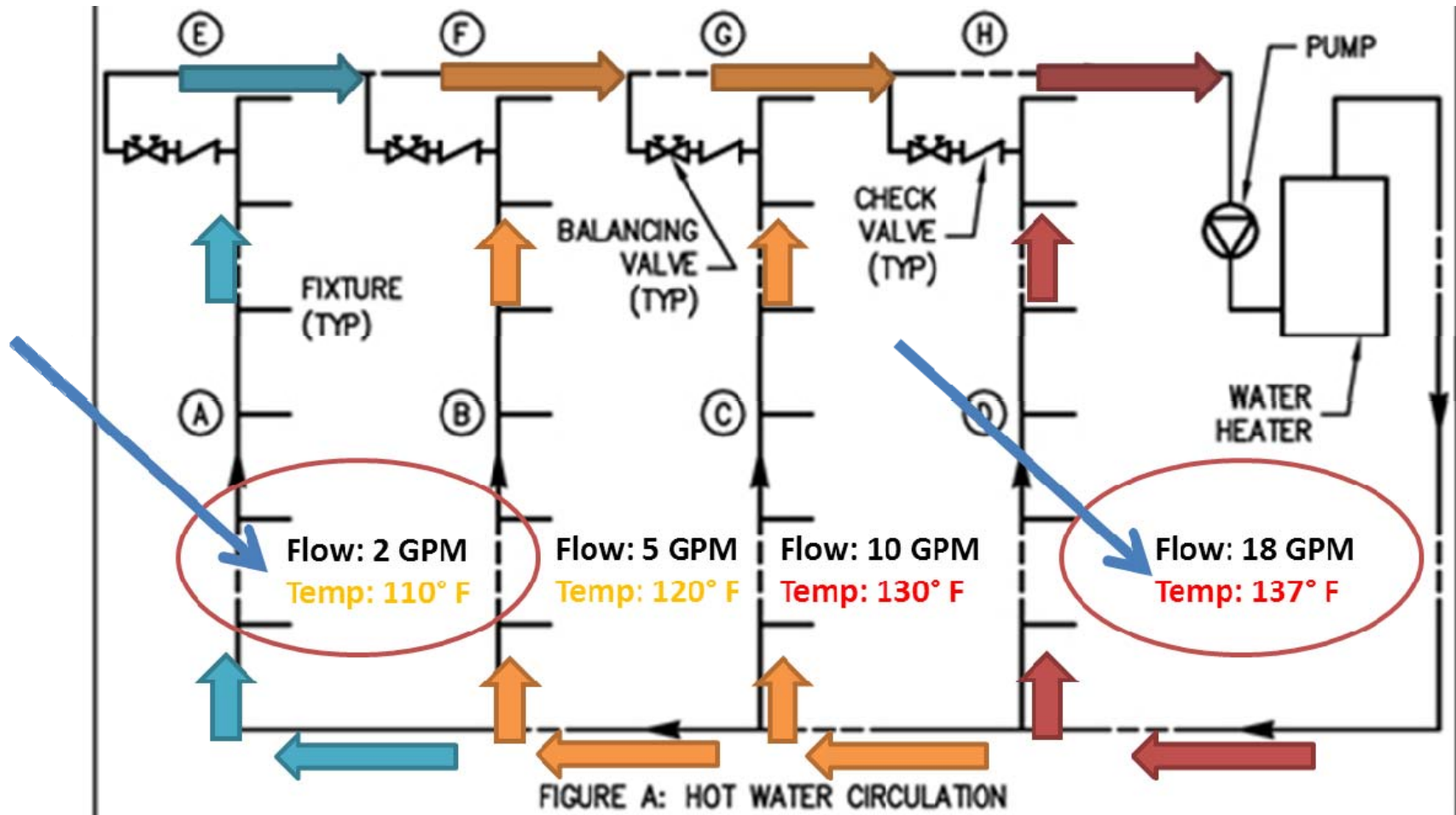


Graph courtesy of California Utilities Statewide Codes and Standards Team, "Multifamily Central DHW and Solar Water Heating", Oct. 2011

Research Focus

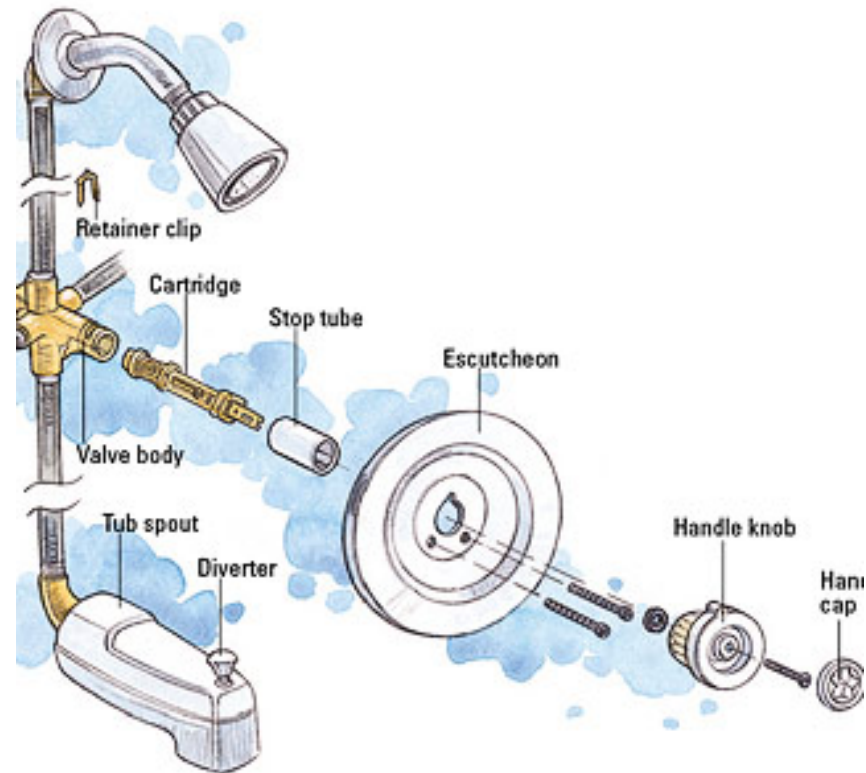
- **Unbalanced Recirculation Loops-** The problem of recirculation loops not having proper balancing valves to equalize water flow rates and temperatures throughout the network of pipes.
- **Fixture Crossover-** The problem associated with faulty faucet and shower fixtures, which allows cold water to infiltrate the hot water piping

What is unbalanced Circulation?

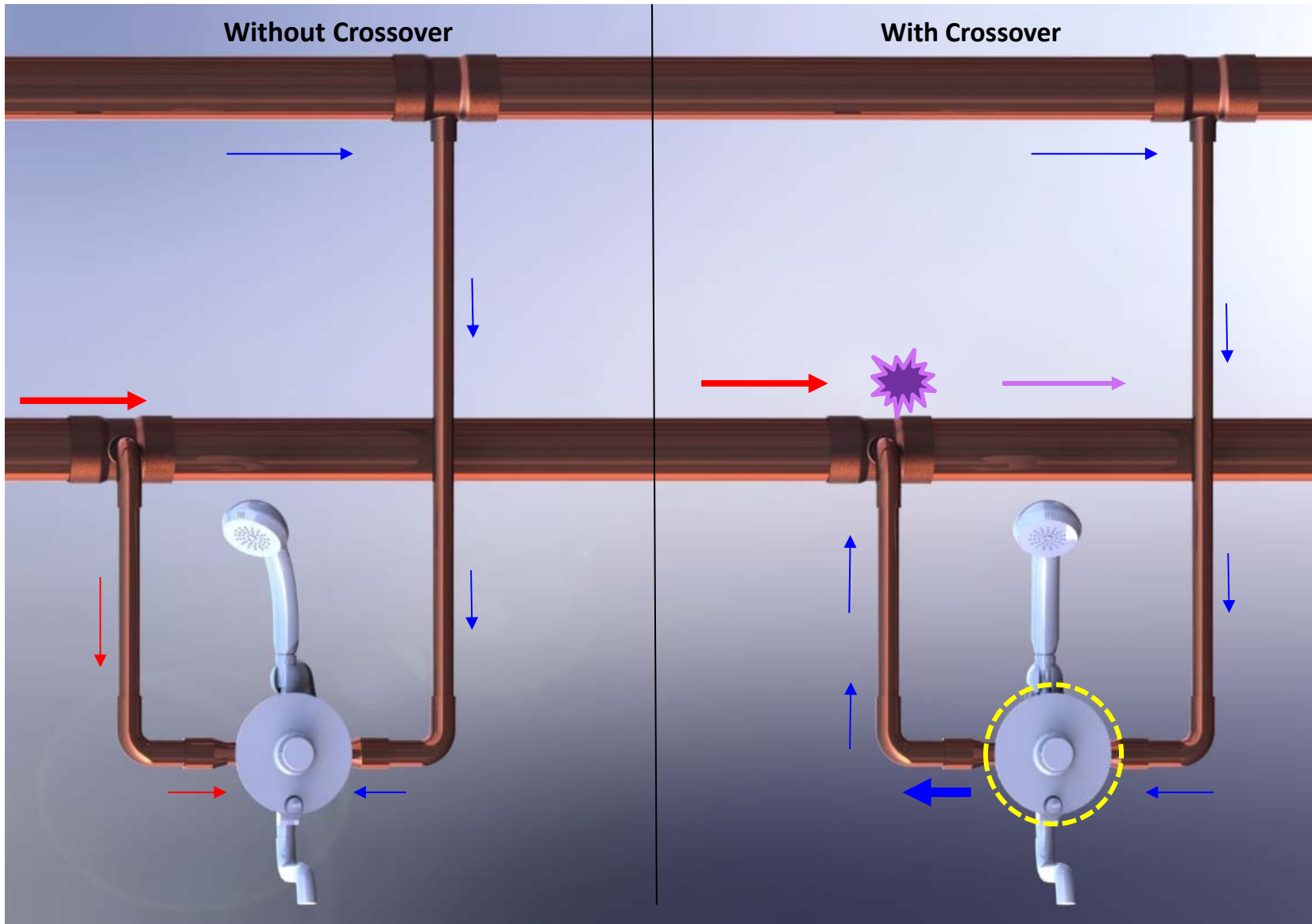


What is Crossover?

- When faulty mixing valves cause 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?



Mixing Valve and Cartridge



Research Goals

- How to detect Crossover? → Identify the frequency of crossover issue
- How wide spread is the issue? → Develop method to test and identify it
- How much energy is wasted? → Evaluate ideal fix to reduce or eliminate issue
- Potential for energy and financial saving? → Savings potential

Experimental Setup at Lab Facility



The Tests

Method	Scenario 1 Result	Scenario 2 Result	Verification	Notes
Pressure Gauge Method	Detected	Not Detected	Method Validated	Quickest, building-level test
Water Flow Method	Detected	Not Detected	Method Validated	Building-level and pinpointing detection possible
Eatherton Method	Detected	Not Detected	Method Validated	Pinpointing detection possible, non-invasive
Temperature Differential Method	N/A	N/A	Invalid	Can be indicative of crossover
Pump Control Method	N/A	N/A	Invalid	Discarded, but may reveal crossover symptoms
Water Meter Method	Detected	Not Detected	Method Validated	Only possible in some buildings

How To Test For Crossover

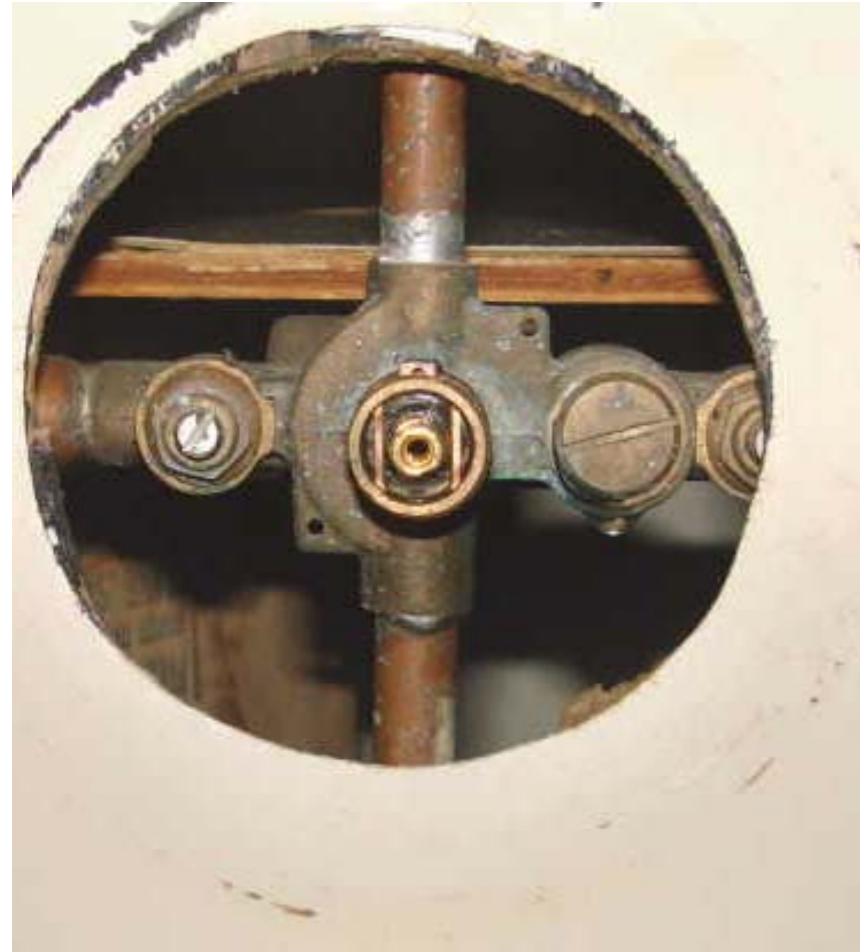
Pressure Gauge Method

- System for detecting crossover within a building
- Will not pinpoint exact location of crossover, only discover if happening somewhere in the building
- Can be quickly and easily performed on any building

Eatherton Method

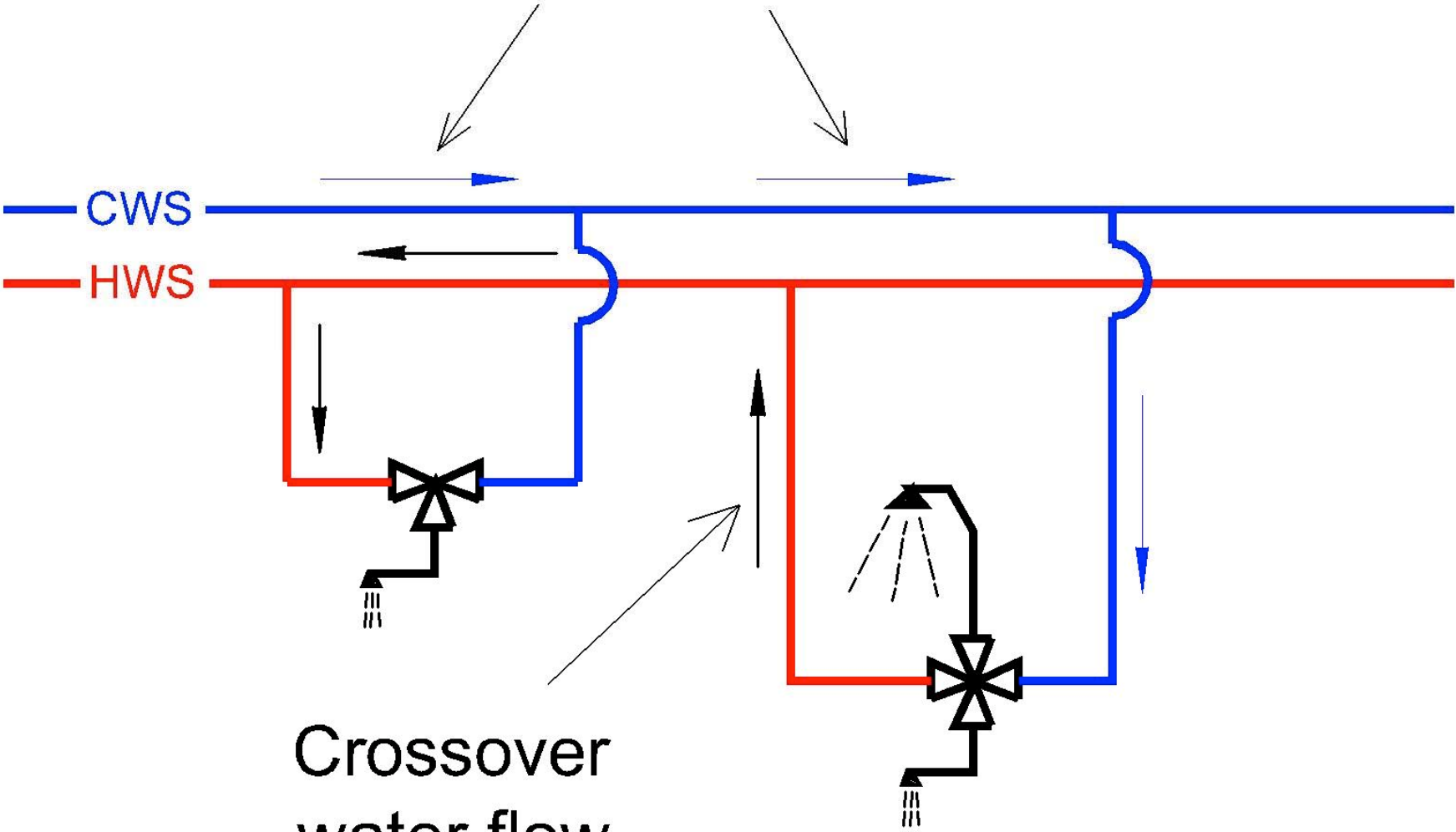
- System for detecting crossover at the fixture point
- Helps determine if a particular mixing valve is failing and needs fixing
- Can be easy or difficult to conduct, depending on how the fixture is set up

Accessing the Mixing Valve



Conducting the Eatherton Method

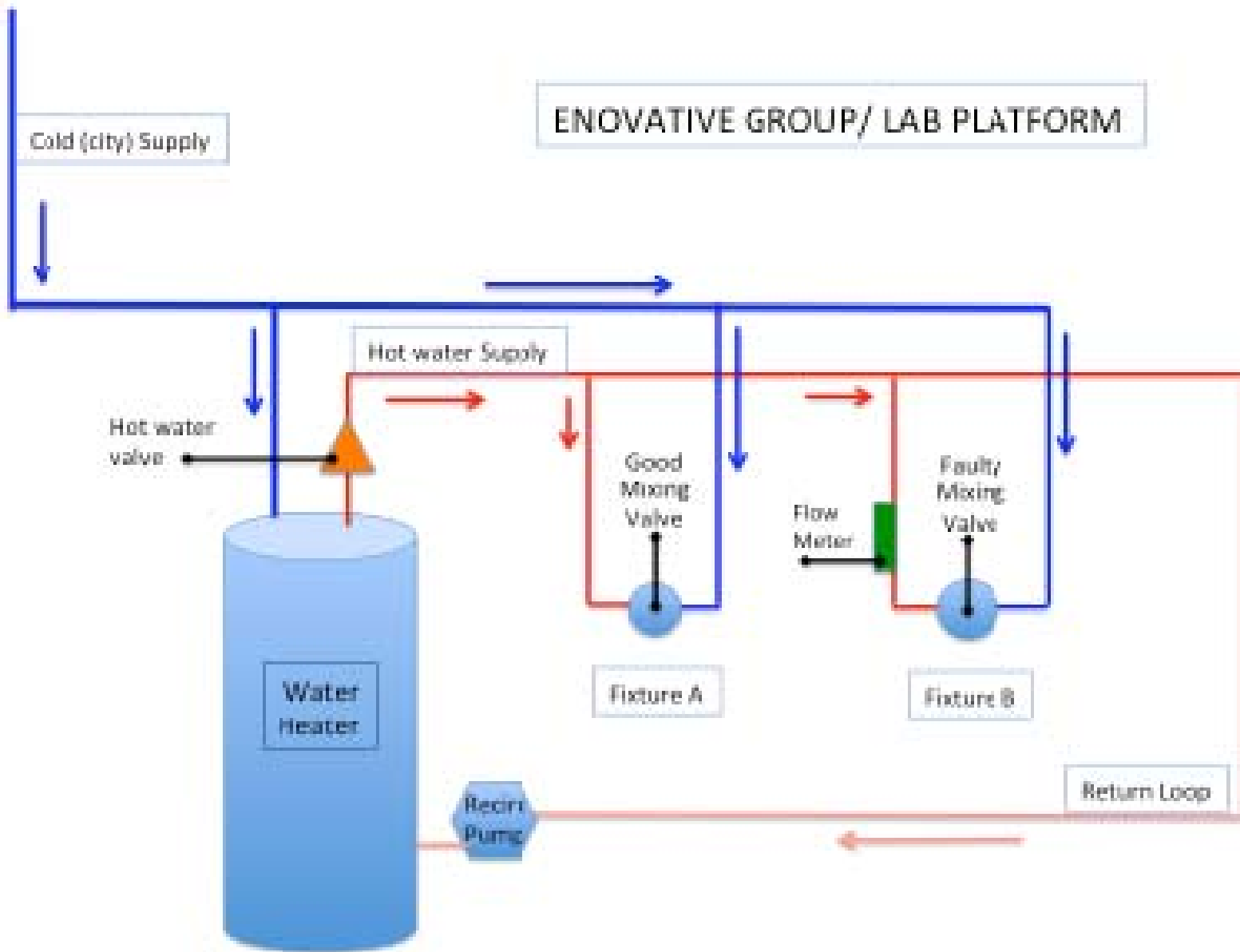
Normal water flow



Crossover water flow



ENOVATIVE GROUP/ LAB PLATFORM



Initial Results

- Out of 100 buildings tested so far, about half have tested positive for crossover in the building
- Level of severity has ranged from mild to severe
- Potential for energy savings may be substantial



Project Next Steps

Baseline data collection

- Currently tracking 5 building with existing crossover issues
- Will begin data collection on another 5 next month

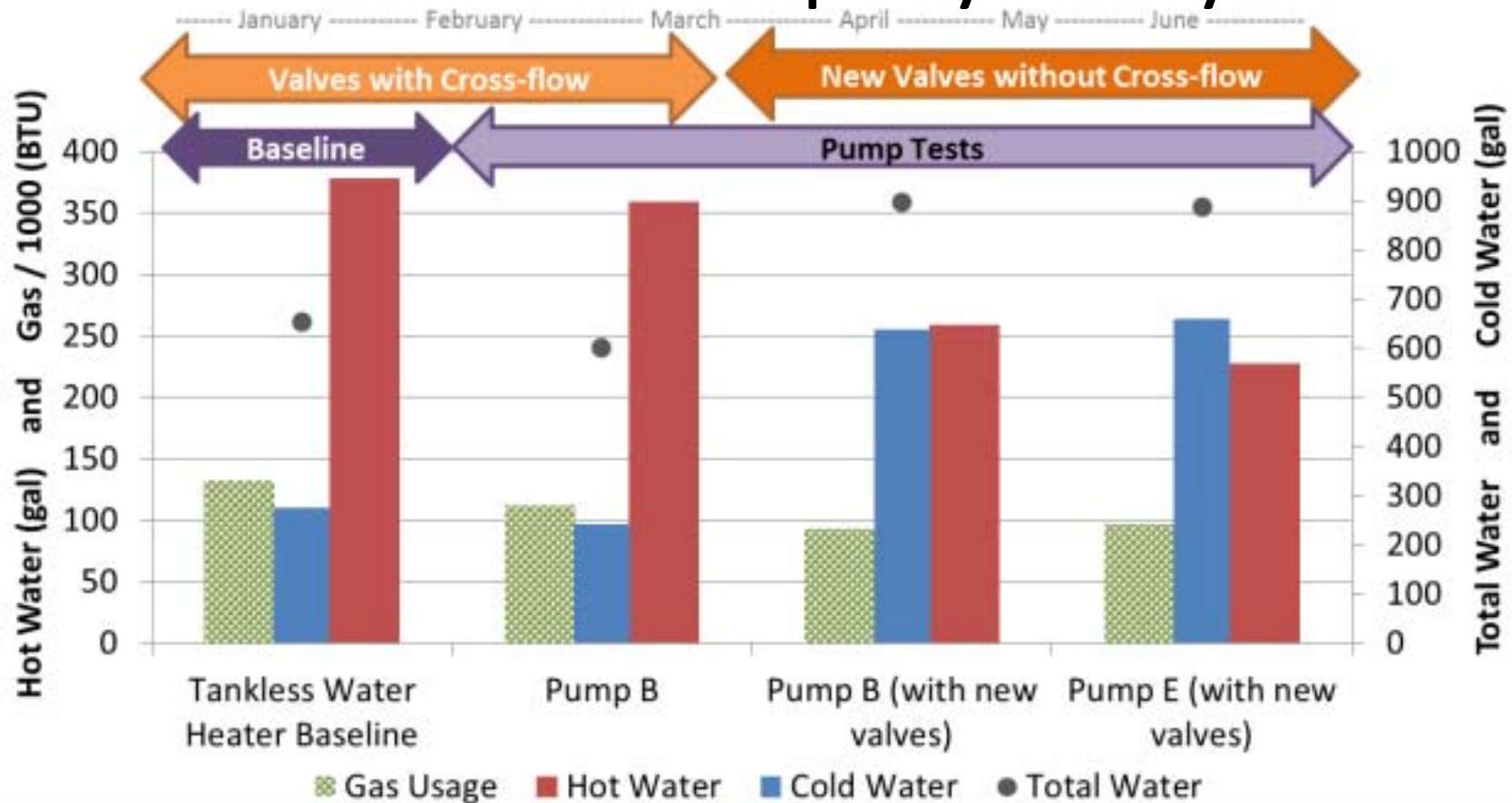
Repair crossover

- After 2-3 months baseline data collection, will replace all faulty mixing valves and eliminate crossover

Post-fix data collection

- Post data collection will calculate any resulting efficiency gains

SoCalGas Company Study



<http://aceee.org/sites/default/files/pdf/conferences/hwf/2015/7D-Nones.pdf>

Gas savings – 15% to 30%

Hotwater savings – 5% to 40%

New Valves (no crossover) Increased gas and hot water

savings **INNOVATIVE**[®]

Project Future Tasks

- Task 5 – Recommendations for codes & standards update (August, 2016)
- Task 6 – Technology Transfer (December, 2016)
- End of Project (June, 2017)

Thank You

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