

Self-Regulating Heat-Tracing for Hot Water Temperature Maintenance

- ***Design***
- ***Energy Savings***

Brian Larkin

Tyco Thermal Controls

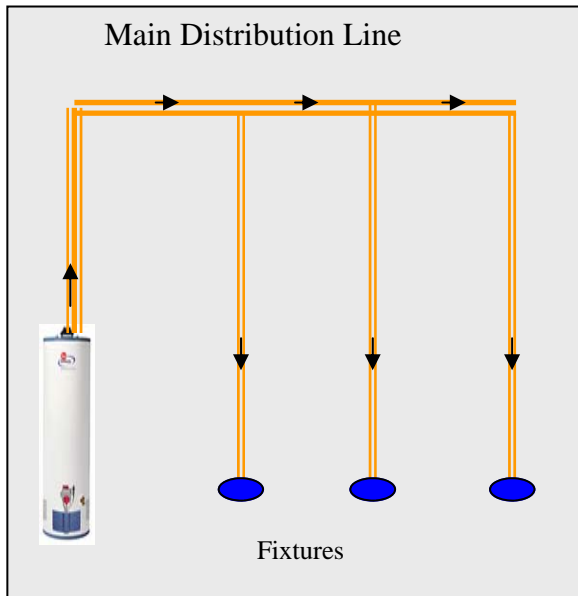


Hot Water System – Non-circulated

Heat Source = water heater
Distribution System = pipes
Fixture = faucet

Water and energy wasted.

Entire piping system cools down so very long wait time for hot water at a tap.



Hot Water System – Re-circulated Distribution System

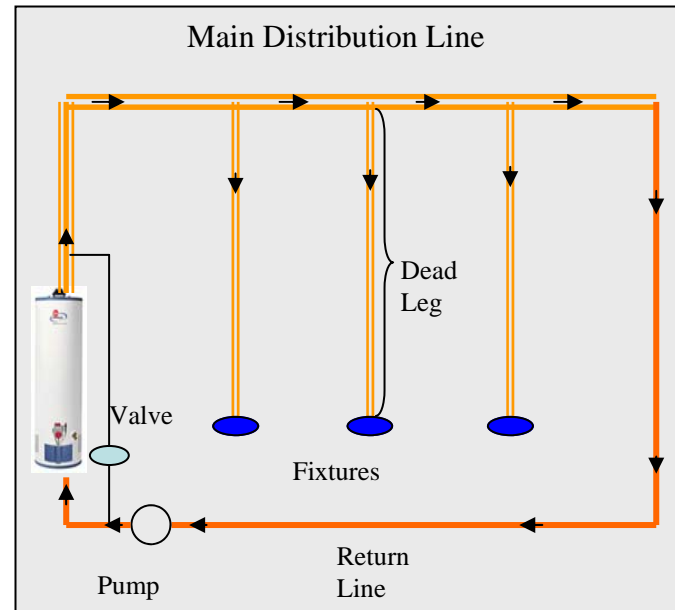
Heat Source = water heater
Distribution System = pipes
Fixture = faucet
Pump

Water and energy wasted.

Dead legs cool down creating wait time at tap.
Re-circ loop increased heat loss
Pump energy used.
Water overheat.

Reliability:

Water heater bypass or balancing valve
Pump maintenance



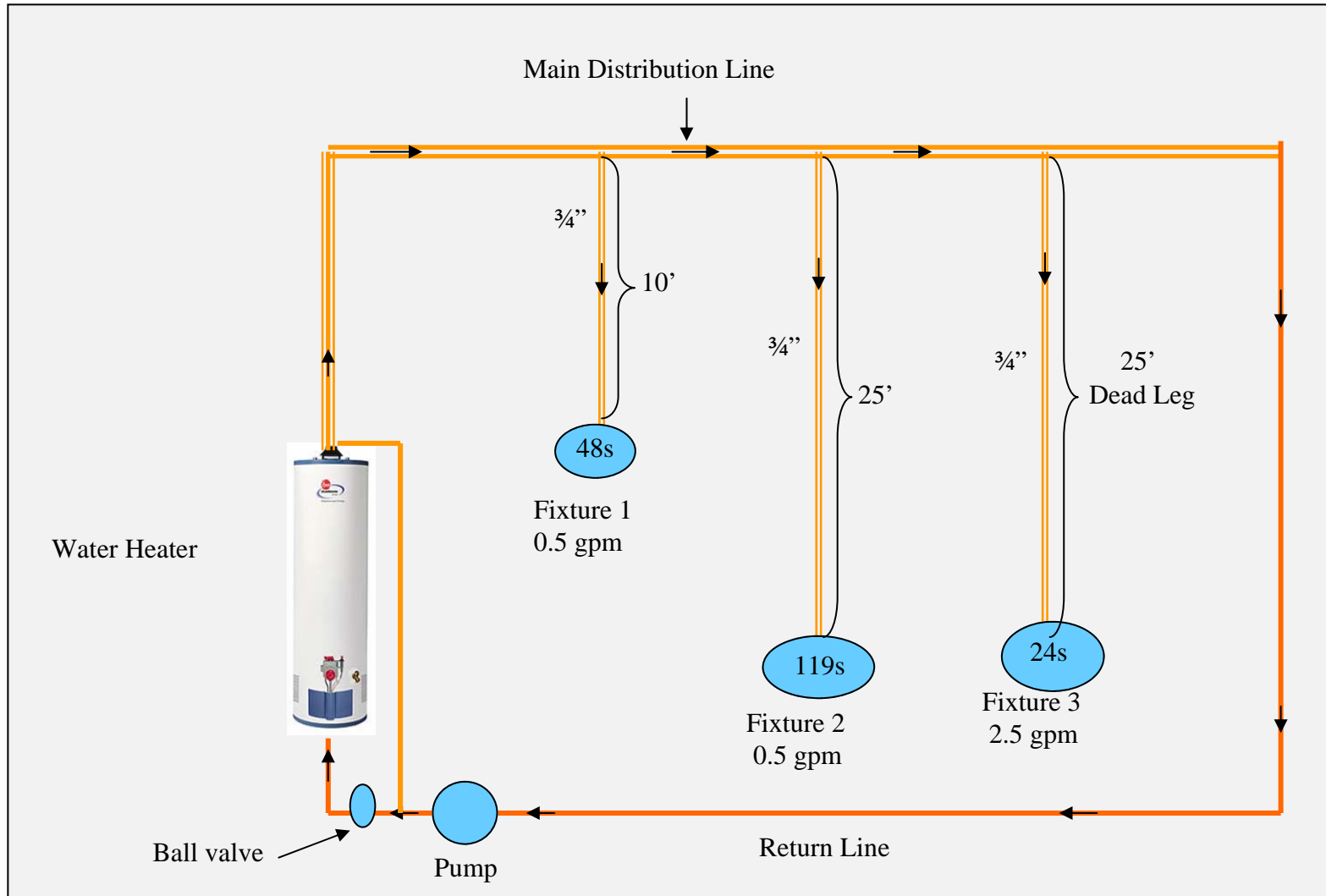
Hot Water Delivery time from ASPE on dead legs



		Delivery Time in Seconds							
Fixture Flow Rate		0.5 GPM		1.5 GPM		2.5 GPM		4.0 GPM	
Piping Length	Pipe Size	10 Ft	25 Ft	10 Ft	25 Ft	10 Ft	25 Ft	10 Ft	25 Ft
Copper	1/2"	25	63	8	21	5	13	3	8
Copper	3/4"	48	119	16	40	10	24	6	15
Steel Pipe Schd 40	1/2"	63	157	21	52	13	31	8	20
Steel Pipe Schd 40	3/4"	91	228	30	76	18	46	11	28
CPVC Schd 40	1/2"	64	159	21	53	13	32	8	20
CPVC Schd 40	3/4"	95	238	32	79	19	48	12	30
		Acceptable Performance			1-10 seconds				
		Marginal Performance			11-30 seconds				
		Unacceptable Performance			31+ seconds				

Reprinted from Domestic Water Heating Design Manual, Second Edition, Chapter 14: "Recirculating Domestic Hot Water Systems."
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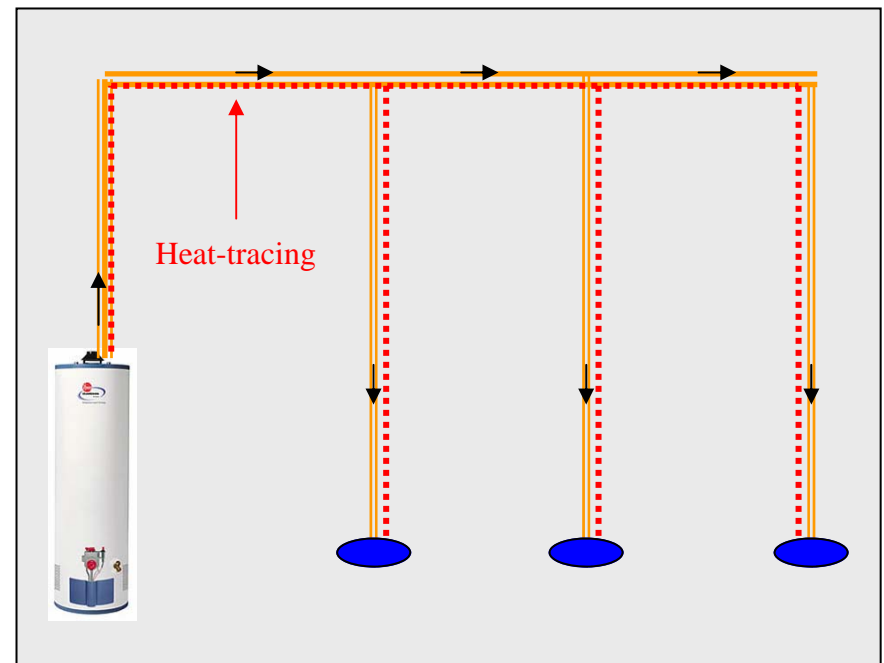
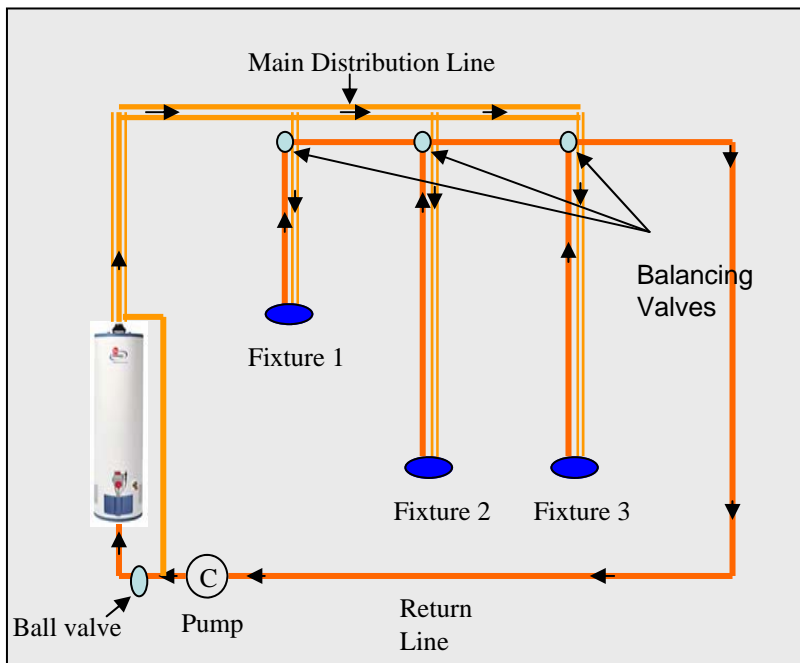
Time to tap example



How do you get hot water to the fixture faster?

To satisfy water deliver time there are a few ways to provide hot water to the fixture:

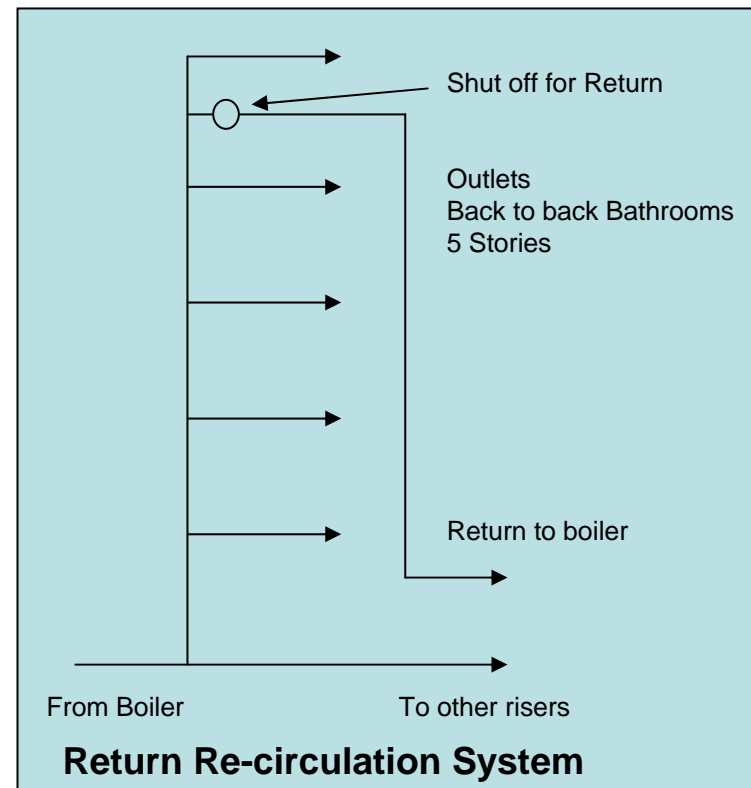
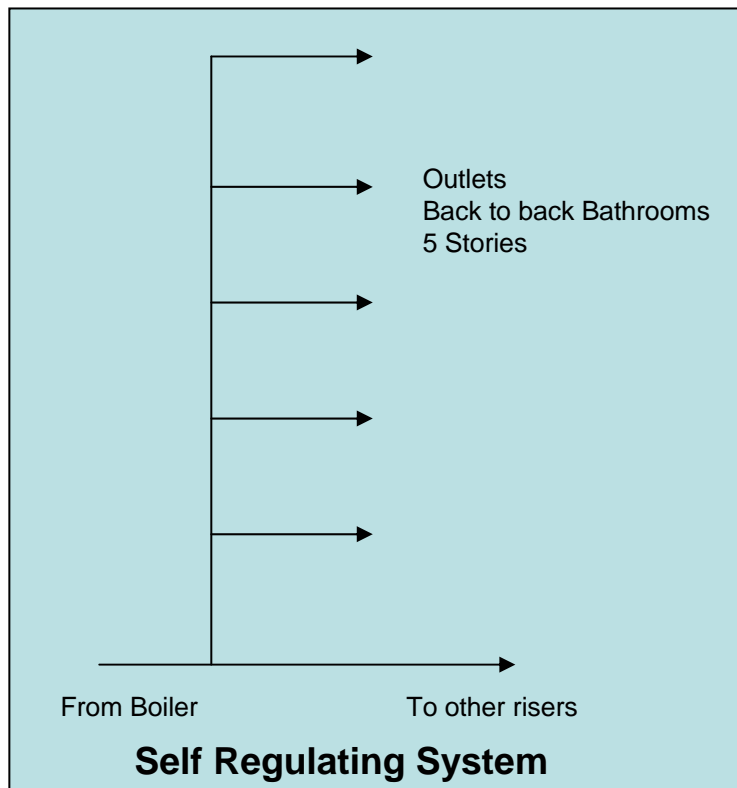
- Shorter dead legs
- Re-circulate to fixture
- Smaller diameter branches
- Point of use hot water heaters
- Electrical heat tracing



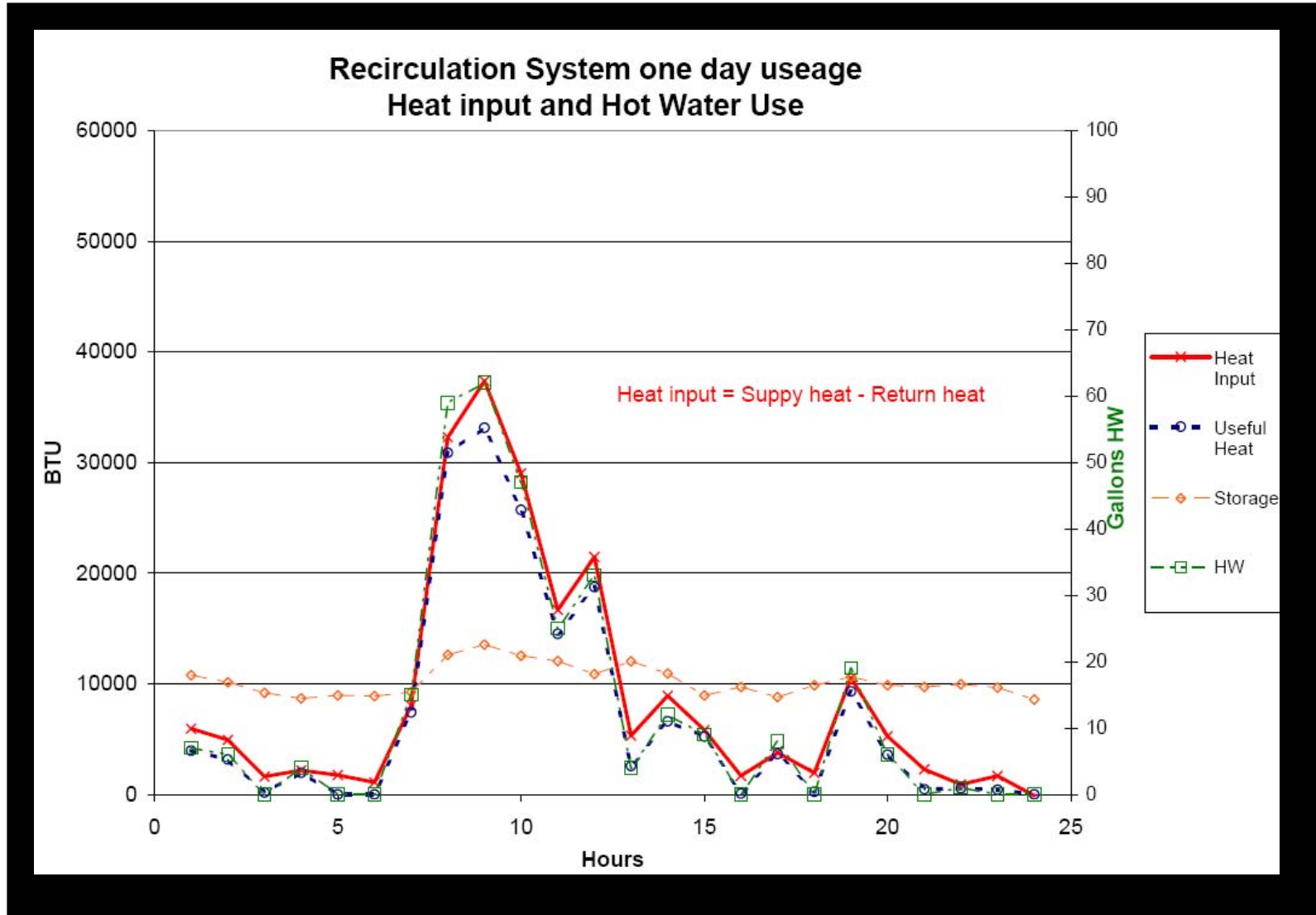
Stevens Institute Energy Study



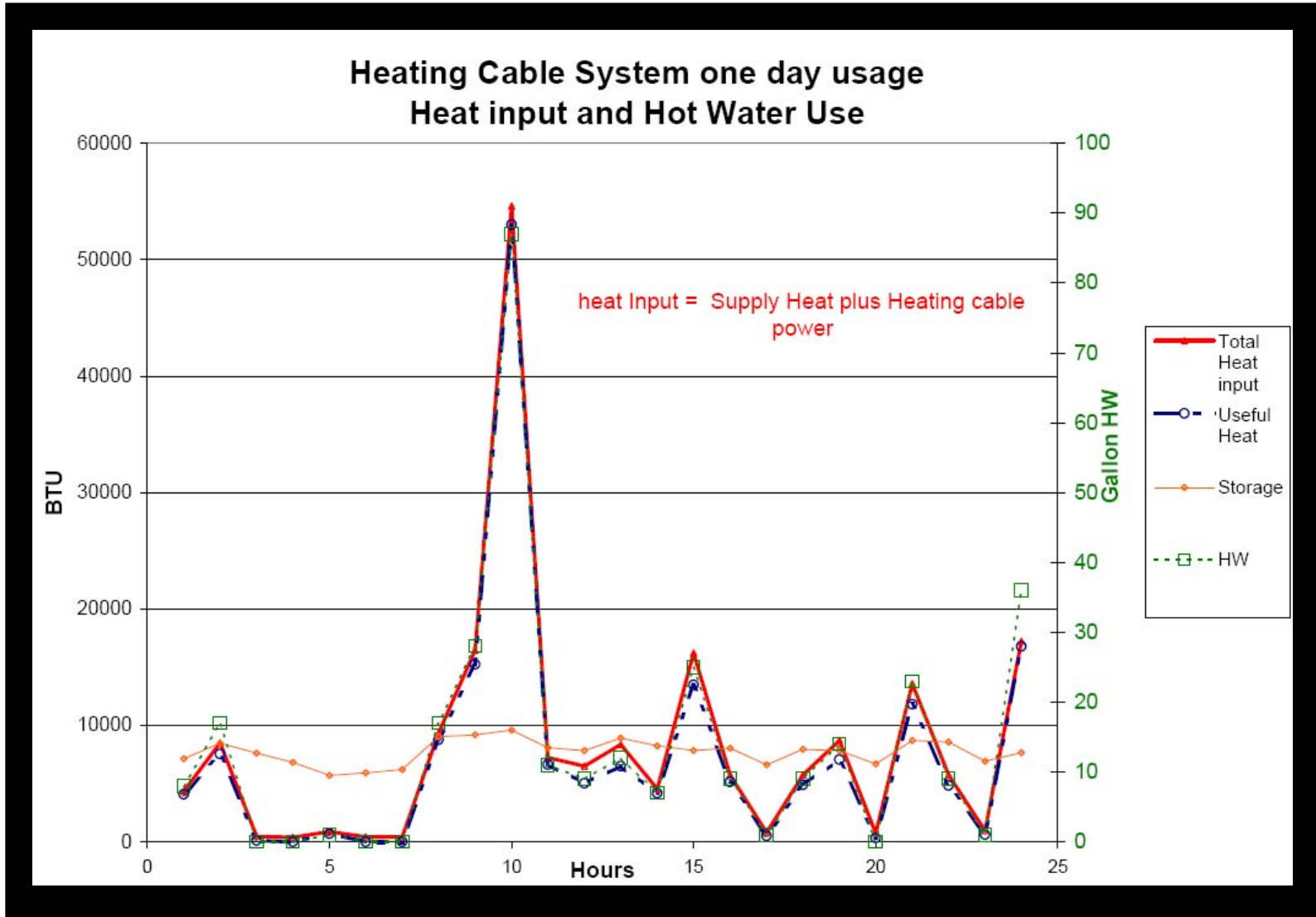
- Study published in Plumbing Engineer April 1986
 - Self-regulating heating cable Vs. Re-circulation system.
 - 5 story Dormitory 10 back to back bathrooms.
 - Cut-off valve installed on re-circulation loop to alternate between systems.
 - Only main distribution addressed in this study (Branch lines not included)
 - Energy use for hot water heater and heating cable monitored.
 - Water use measured. (Equal for this study)



Test Results: Circulation Usage



Test results: Heating cable Usage



Study Conclusions

