



STRATEGICALLY TRANSITIONING FROM
STEAM TO HOT WATER

JACOBS®

OUTLINE

- Brief History
- Hot Water Advantages
- Site Distribution Analysis
- Summary



A BRIEF DISTRICT HEATING HISTORY

- Holly Steam Combination Company– First Commercial District Heating (1877)
- Denver's District Steam System – Oldest in Operation (1880)
- Post WWII Era – Low Cost Energy
- District Energy St Paul – Largest North American Hot Water District Heating (Present)



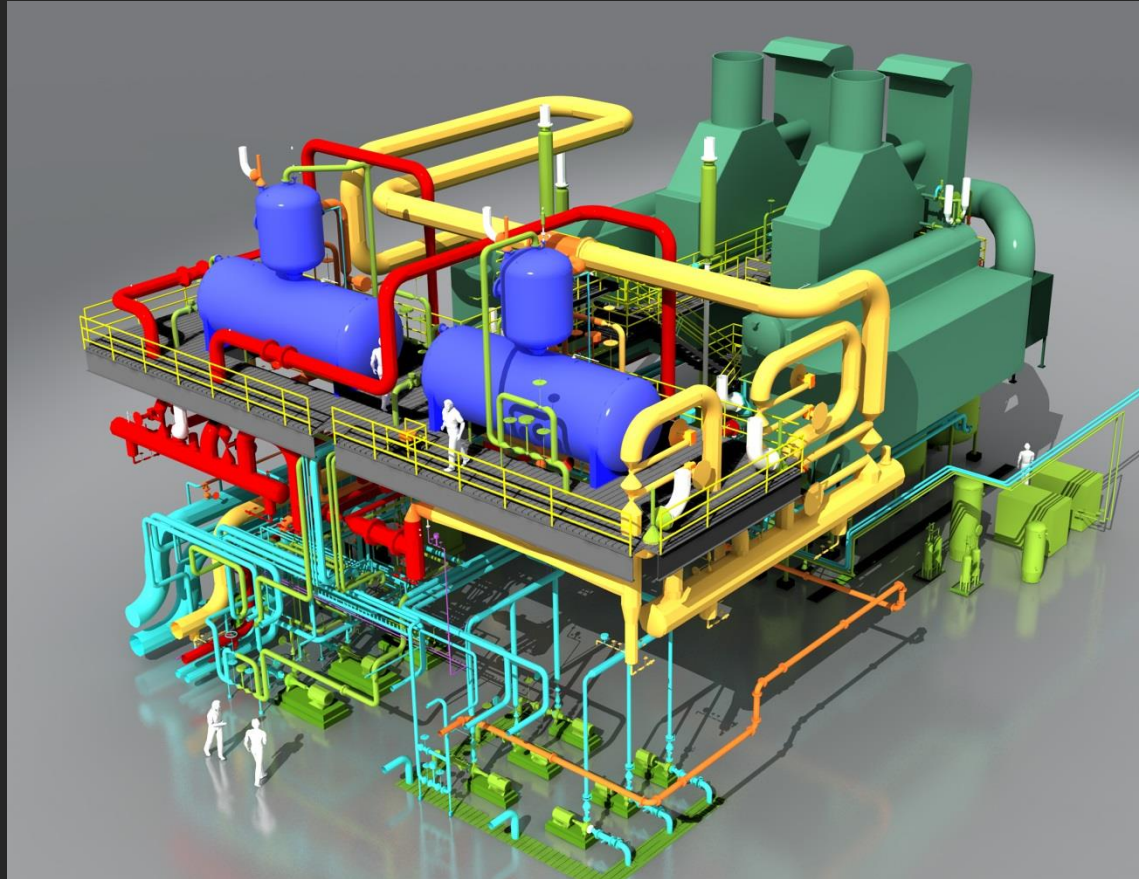
HOT WATER SYSTEM ADVANTAGES

- Less required maintenance
- Less steam knowledge in developing workforce
- Modern buildings utilizing hot water heating



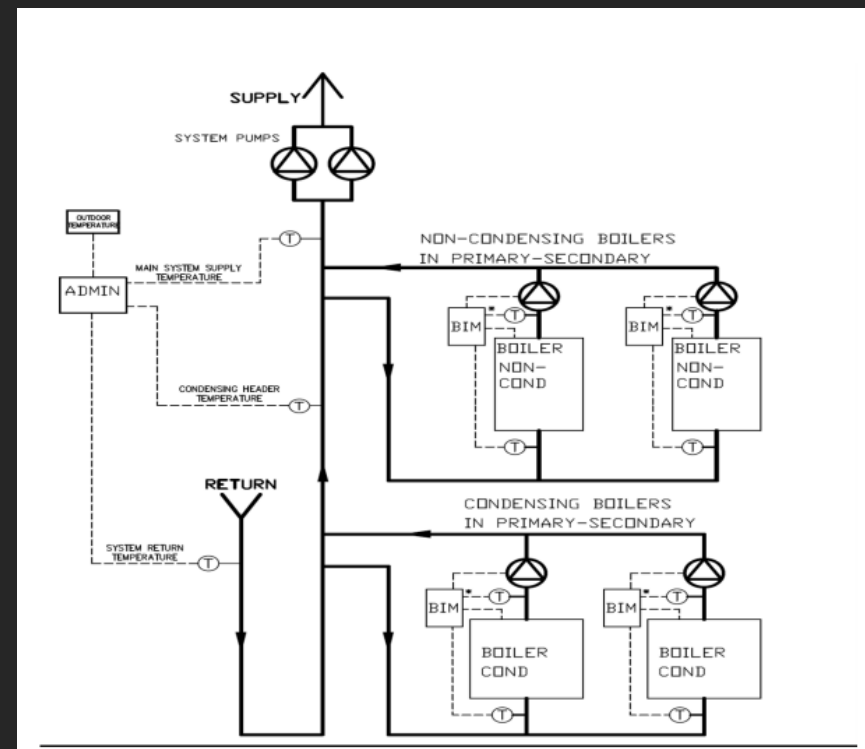
HOT WATER SYSTEM ADVANTAGES – GENERATION

- Steam System Components:
 - Boiler
 - Deaerator
 - Feedwater Pumps
 - Blowdown Vessel
 - Flash Tanks
 - Condensate Receivers
 - Condensate Pumps
 - Water Treatment



HOT WATER SYSTEM ADVANTAGES – GENERATION

- HW System Components:
 - Boiler
 - Primary/Secondary Pumps
 - Air Separator
 - Expansion Tank



HOT WATER SYSTEM ADVANTAGES – GENERATION

- **Lower flue gas temperature increases combustion efficiency**
- **Supply water reset control**
- **Less idle/cycling losses**
- **Lower conductive losses to ambient**
- **Little/no make-up water costs**
- **Lower chemical treatment costs**

HOT WATER SYSTEM ADVANTAGES – GENERATION

- Increased System Efficiency
 - Solar Thermal Heating
 - Geothermal
 - Cogeneration
 - Condensing Boilers
 - Thermal Storage
 - Heat Recovery Chillers
 - Waste Heat Recovery



HOT WATER SYSTEM ADVANTAGES – DISTRIBUTION

- **Lower temperatures = less heat loss**
- **Utilize lower cost insulating materials**
- **Safety – System leaks are less dangerous**
- **Higher likelihood of corrosion in condensate return system**
- **Reduced number of expansion loops**
- **No condensate recovery vaults.**

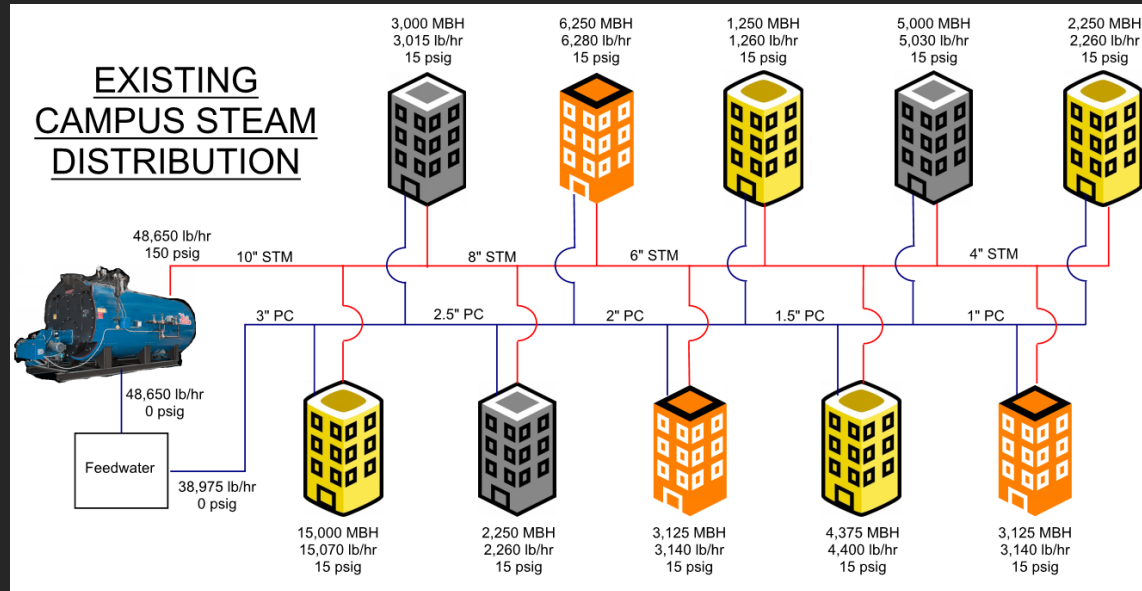
HURDLES IN CONVERSION

- Replacement of existing Steam Distribution piping.
- Heat Transfer stations and customer connections must be replaced.
- Higher pumping energy



SITE DISTRIBUTION ANALYSIS - STEAM

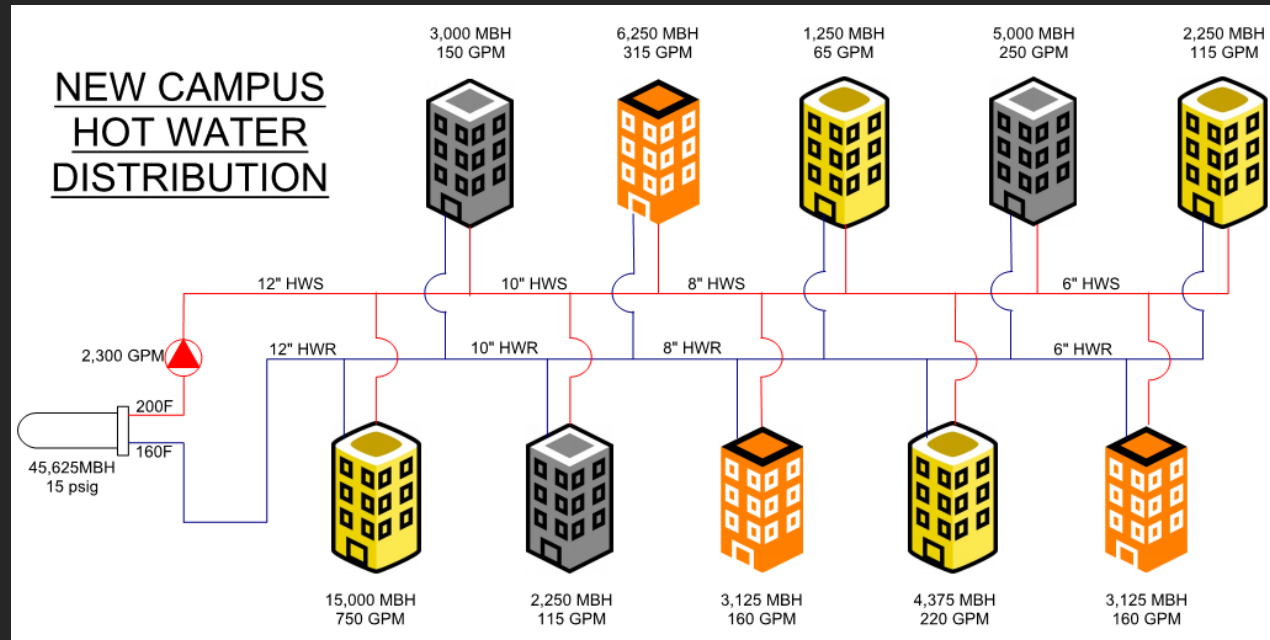
- 10 Buildings
- ~ 1 Mile of Distribution Piping
- 150 psig Distribution
- 15 psig at Building
- Steam-to-Hot Water Heat Exchangers at Building
- Atmospheric Pumped Condensate



Distribution Type	Total Building Demand		Distribution		Condensate Return		Heat Input Req'd
	Heat Load	Mass Flow	Losses	Total Flow	Flash Losses	Total Return	MBH
	MBH	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	
Steam	45,625	45,850	3,100	48,950	1,325	47,625	48,000

SITE DISTRIBUTION ANALYSIS – HOT WATER

- Same Network as Steam
- 2,400 MBH in Steam Demand Savings
- 149.6°F at furthest building.



Distribution Type	Total Building Demand		Distribution				Heat Input Req'd
	Heat Load	Flow Rate	Losses	Total Flow	Pump		
	MBH	GPM			HP	kW	MBH
Hot Water	45,625	2,300	-	2,300	101	75	45,625

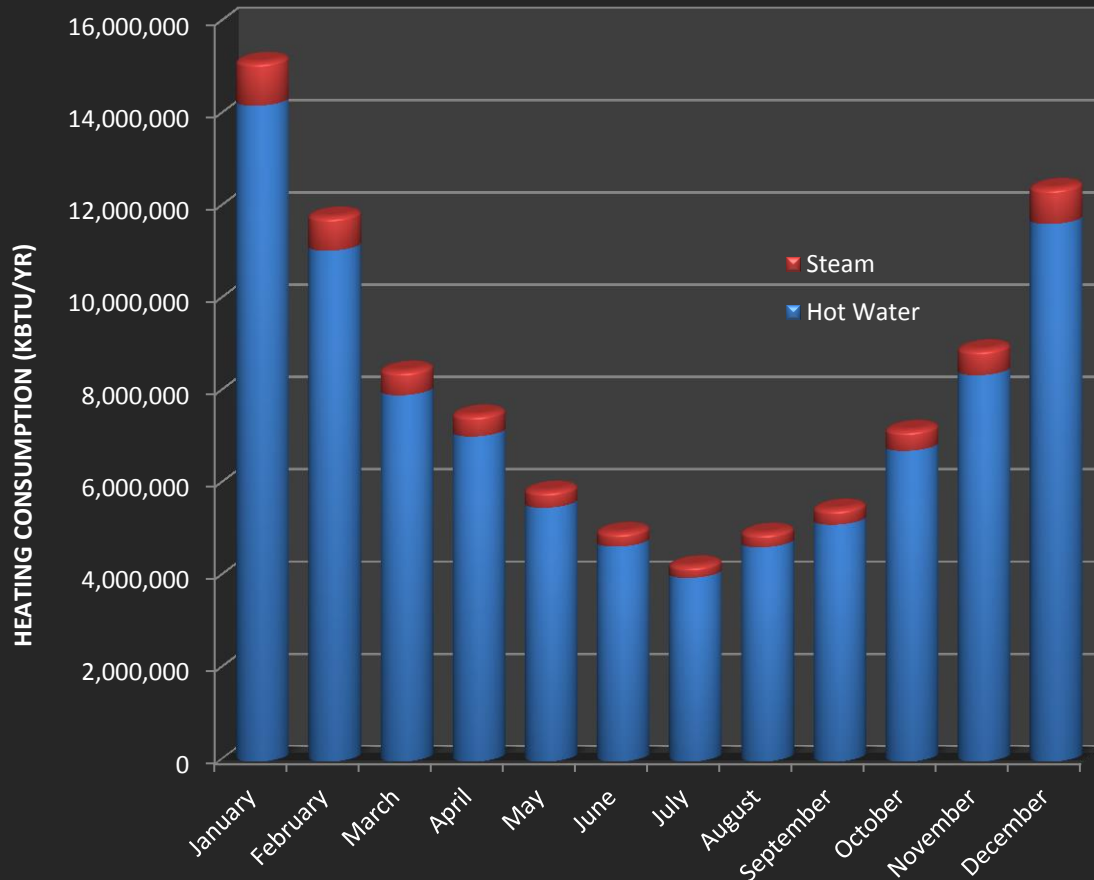
SITE DISTRIBUTION ANALYSIS - DEMAND

Distribution Type	Total Building Demand		Distribution		Condensate Return		Heat Input Req'd
	Heat Load	Mass Flow	Losses	Total Flow	Flash Losses	Total Return	MBH
	MBH	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	
Steam	45,625	45,850	3,100	48,950	1,325	47,625	48,000

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	Heat Load	Flow Rate	Losses	Total Flow	Pump		MBH
	MBH	GPM		GPM	HP	kW	
Hot Water	45,625	3,045	-	3,045	101	75	45,625

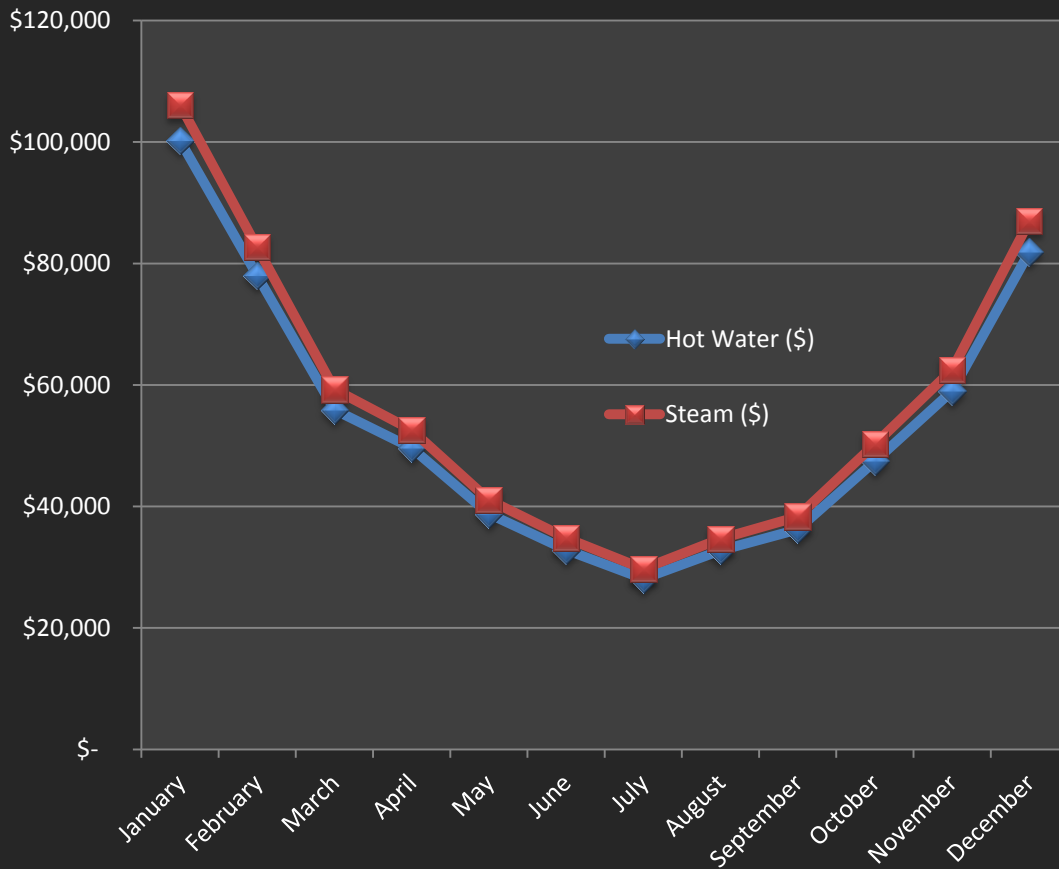
- 5% Reduction in Heating Demand

SITE DISTRIBUTION ANALYSIS - CONSUMPTION



- Heating Consumption
 - 950MMBTU peak difference
 - 505MMBTU average difference

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 - 950MMBTU peak difference
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SITE DISTRIBUTION ANALYSIS – COST ANALYSIS

Option	Cost Difference					Simple Payback
	Capital	Energy	Water	Nat Gas	Maintenance	
Steam vs Hot Water	(\$1,859,123)	(\$3,973)	\$390	\$42,423	\$84,400	15.09 Yrs

- 20 Year Life Cycle Considered
- 49 Steam Traps (Five Year Life Expectancy)
- New Water to Water Heat Exchangers
- New Variable Volume Hot Water Pumps (60 HP ea)

SUMMARY

- **Less Maintenance Required on Hot Water Systems**
- **Hot Water Distribution is more Energy Efficient**

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