
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

A Low Carbon, Low Water Campus Heat Recovery Chiller Strategy for Moderate Climates

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GLHN
ARCHITECTS & ENGINEERS, INC

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Problem

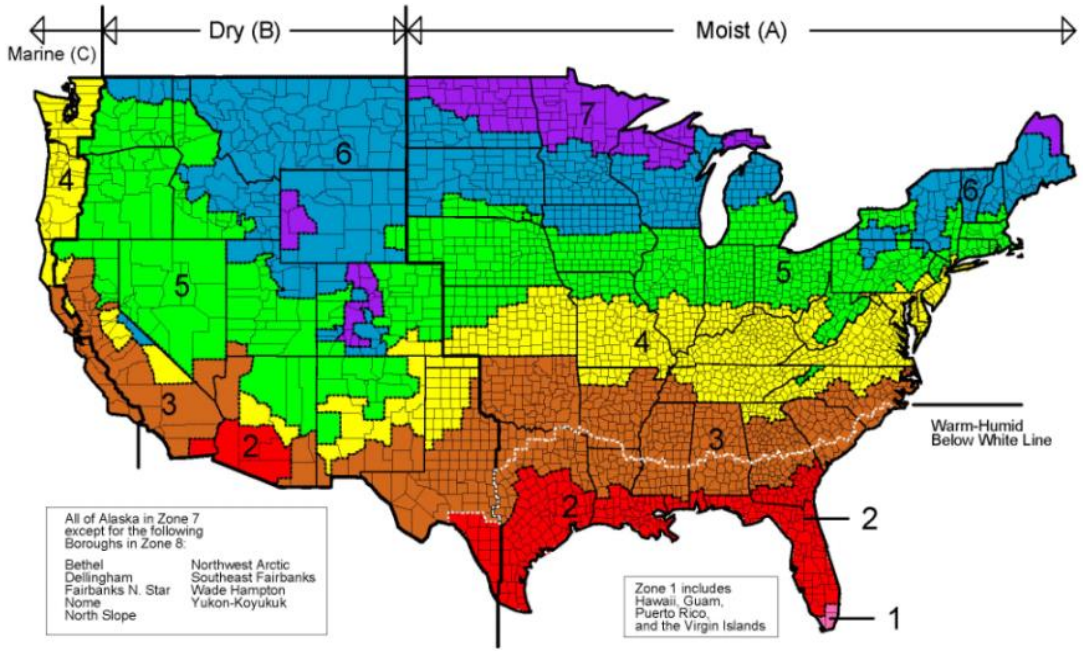
A university utility operation, facing a combination of inadequate funding, aging infrastructure, worsening reliability, diminishing quality of service, increasing maintenance and utility expense is advised that it must drastically reduce its contribution to green house gas emissions through decarbonization, and its water consumption through conservation.

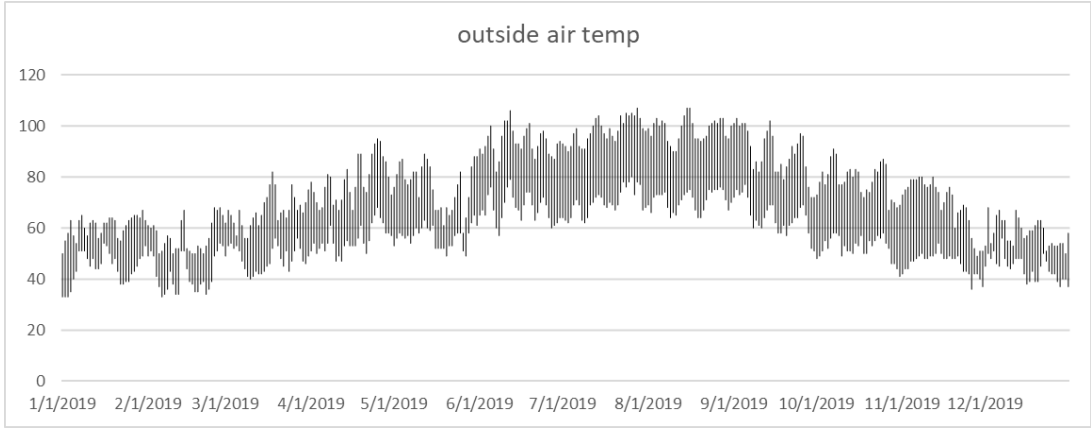
A plan that makes a substantive impact on site and source fuel combustion, while addressing renewal and deferred maintenance issues and tying the institutional carbon neutrality goal to a recurrent funding stream could solve the problem over time.

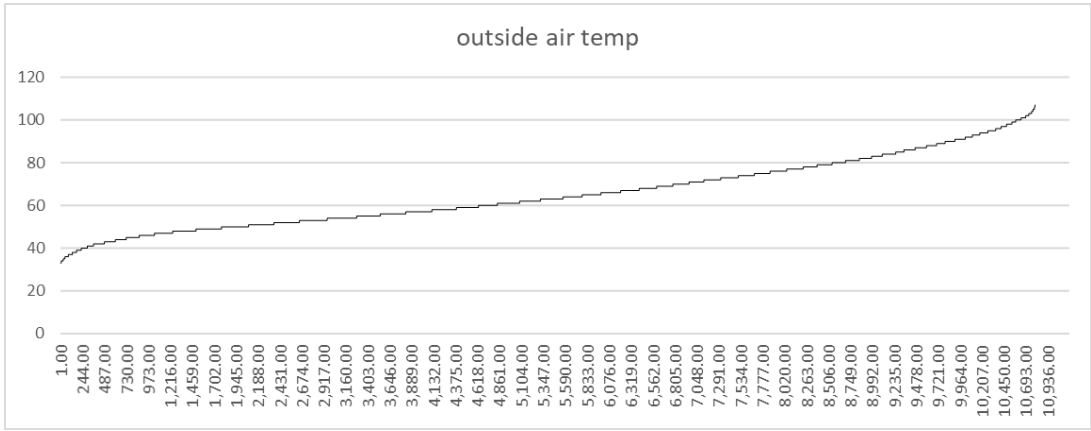
In some locales, phased implementation of **Heat Recovery District Chilling** could be an early stage of the long-term plan.

A Case Study

A 1.6 MSF University Campus in Climate Zone 4a





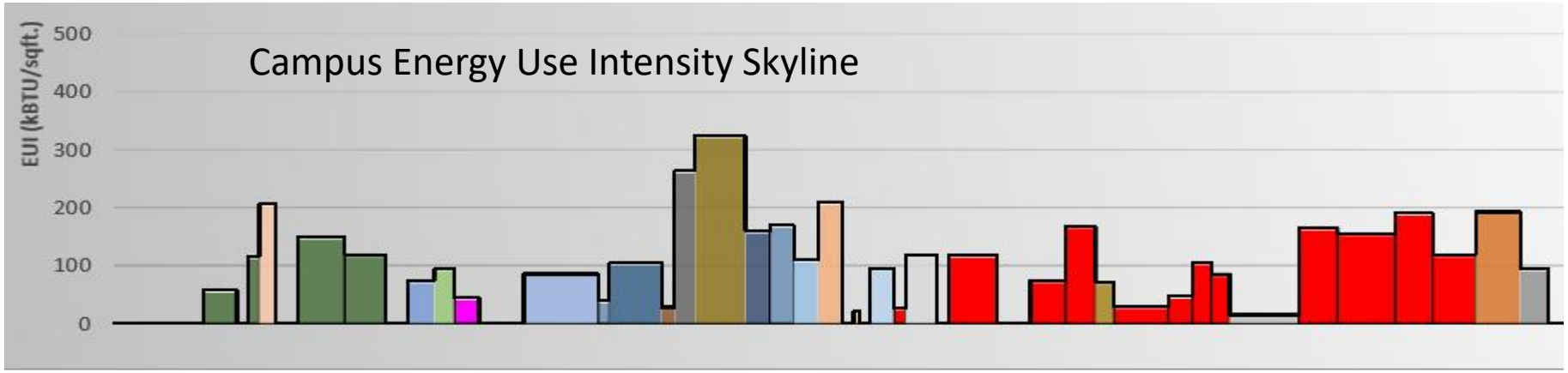


Building and Campus Stock

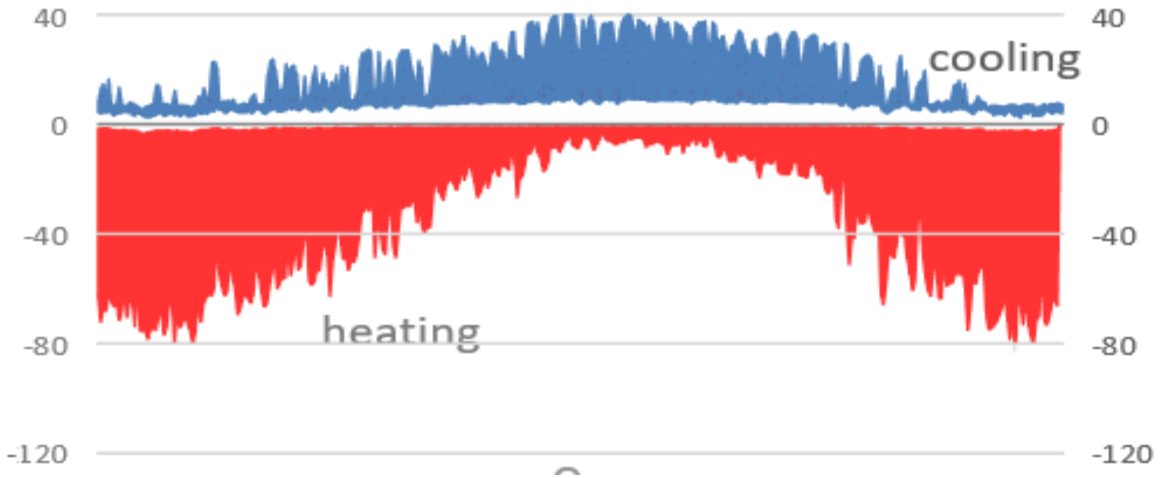
Occupancy Type	*input values here*	*input values here*	
	SF	# Bldg	avg
Large Office	175,000	4	43,750
Small Office	50,000	2	25,000
Medium Office	100,000	3	33,333
General	115,000	5	23,000
Small Retail	15,000	2	7,500
HE Classroom	125,000	4	31,250
HE Large Wet lab	80,000	2	40,000
HE Dry Lab	60,000	1	60,000
Student Union	75,000	1	75,000
Residence Life	750,000	6	125,000
Athletic	100,000	2	50,000
	1,645,000	**56**	

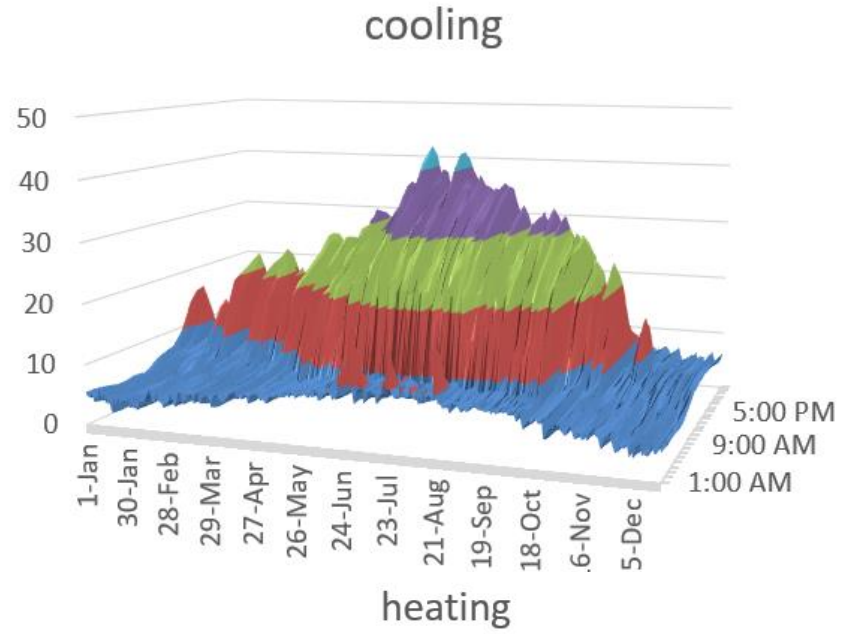
Building Characteristics
Occupancy
Function
Age
Condition
Energy code
System Type

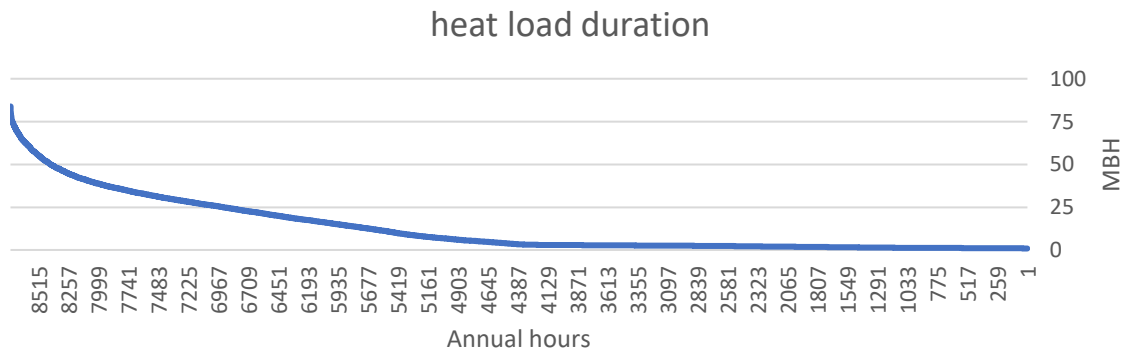
Plant and Distribution Factors
Capacity
Reliability
Condition
Configuration
Efficiency
Useful Life

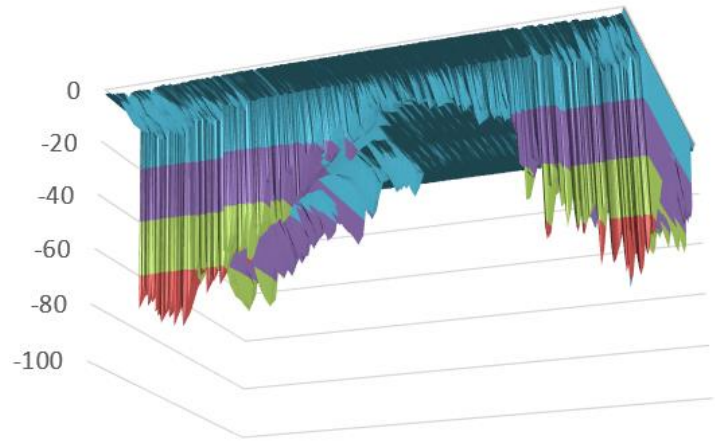


Thermal Loads

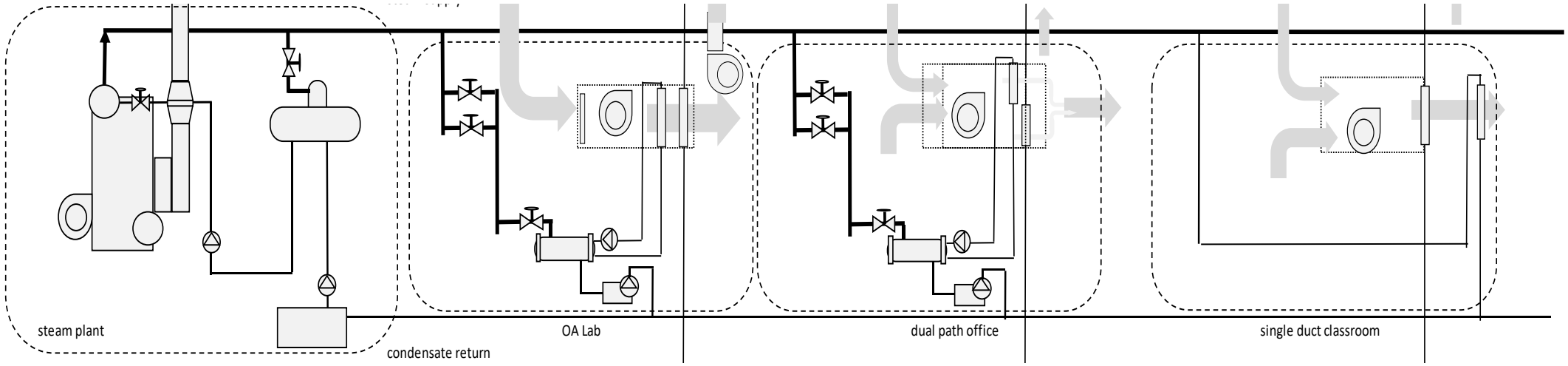






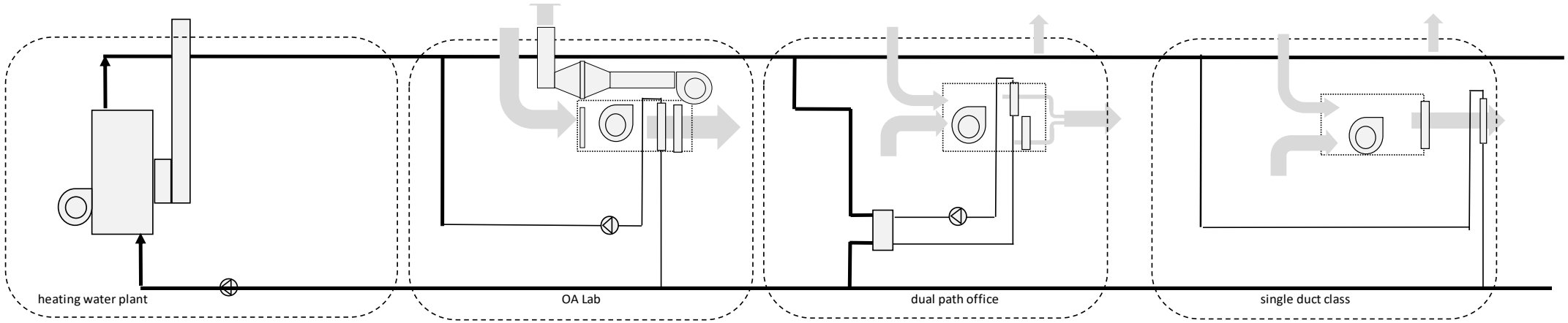


Production, Distribution, Terminal Use



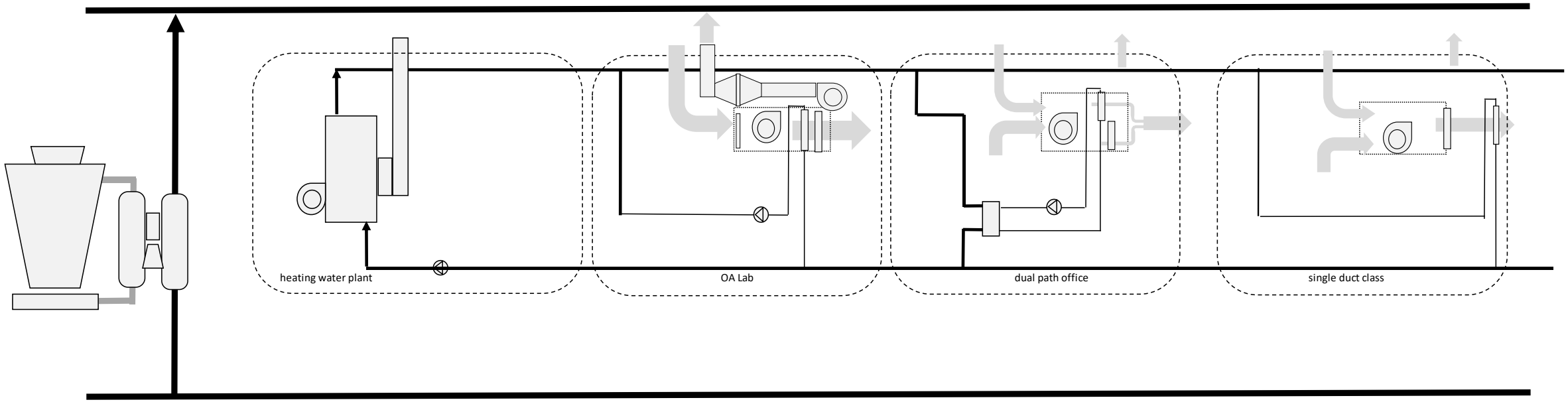
Steam: Tunnels preferred
Pipe more durable than tunnels or insulation
Thermal and mass losses all the way down
High cost welded steel and code requirements
Maintenance and Safety

Production, Distribution, Terminal Use



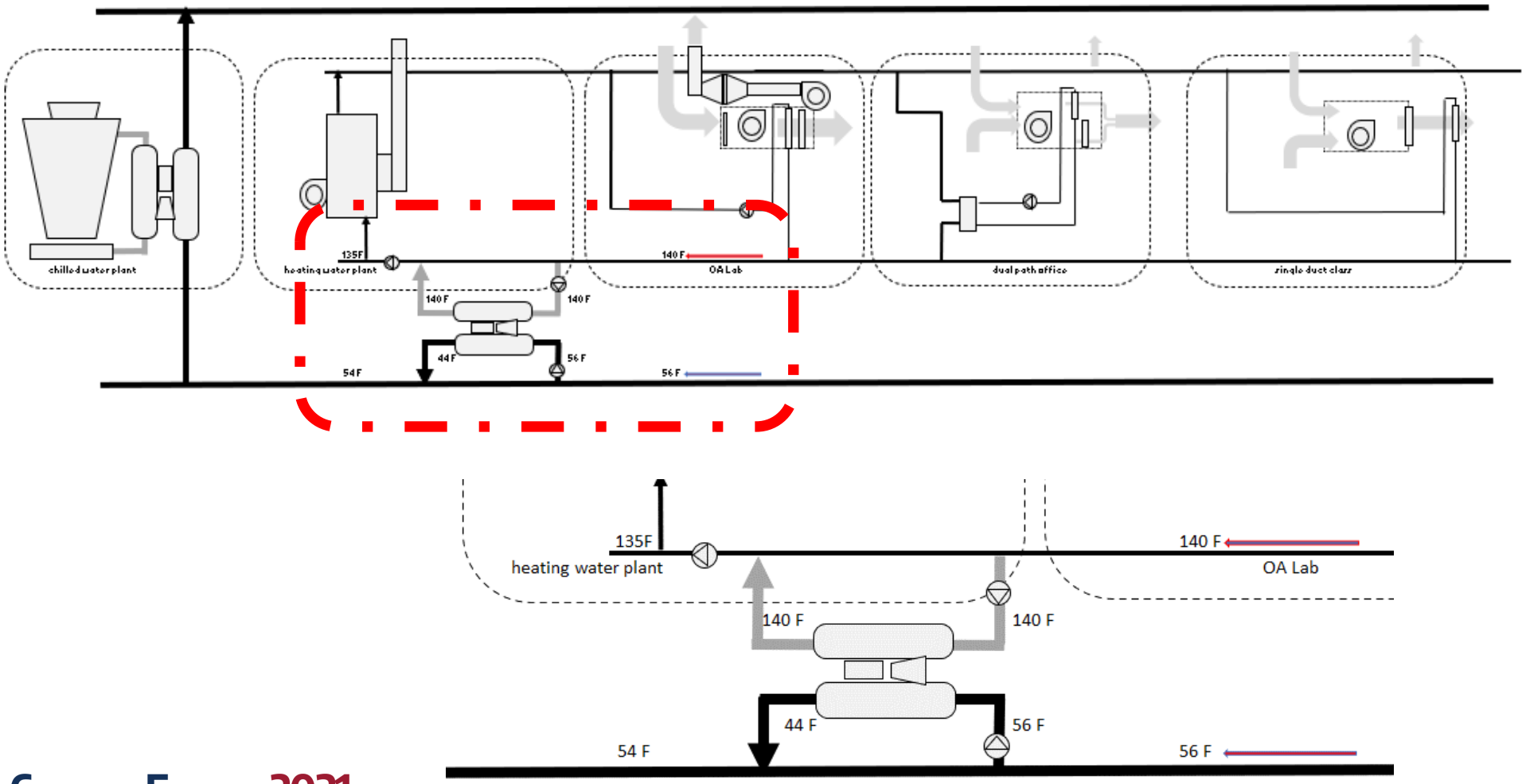
Heating Hot Water:
- Various direct buried options
- Lower driving potential for thermal loss
- Simpler operation
- Enables recovery and reuse of low temperature sources

Production, Distribution, Terminal Use

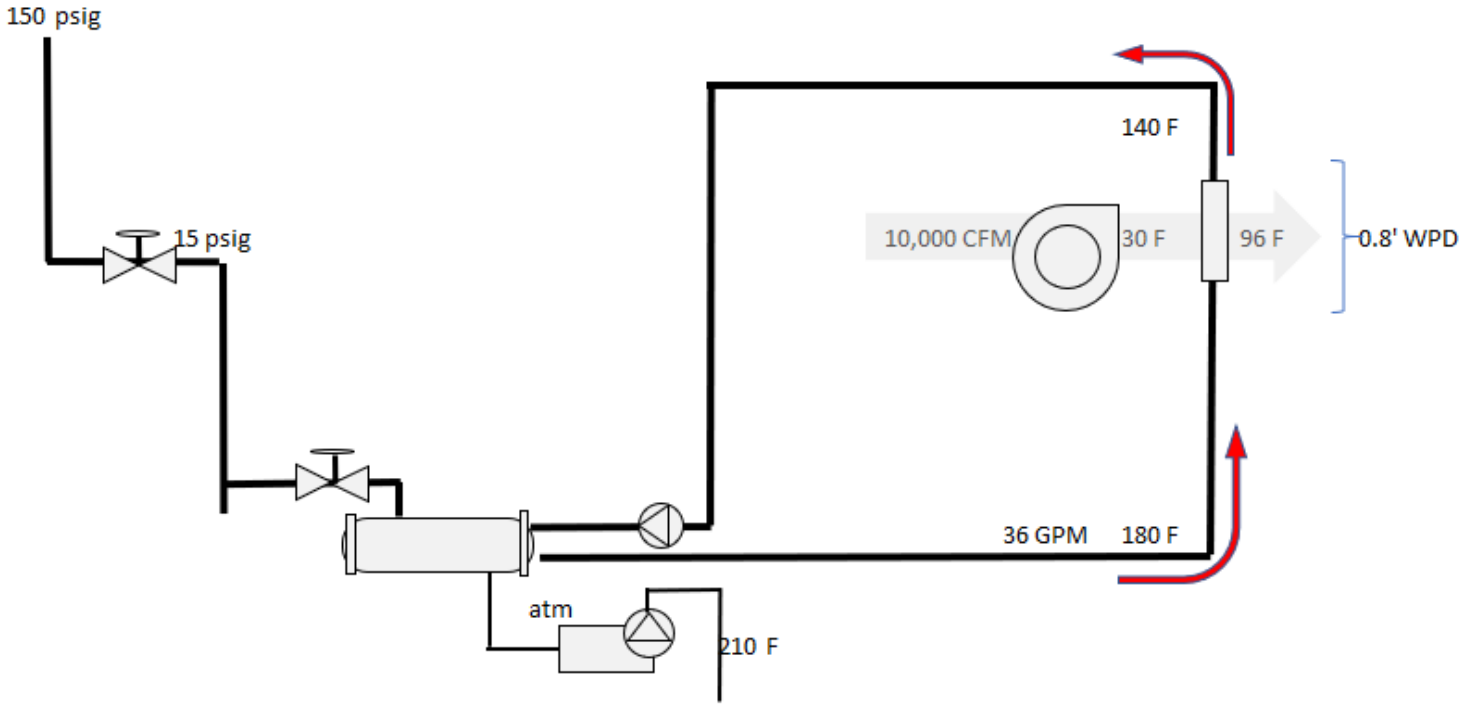


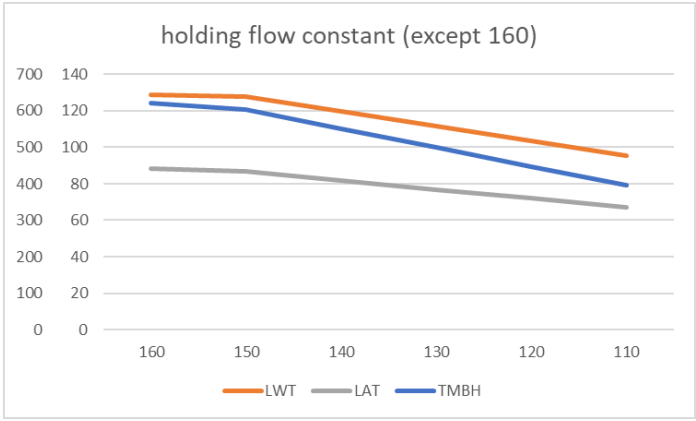
Four Pipe: Various direct buried options
Supply to Return dT -a pervasive challenge

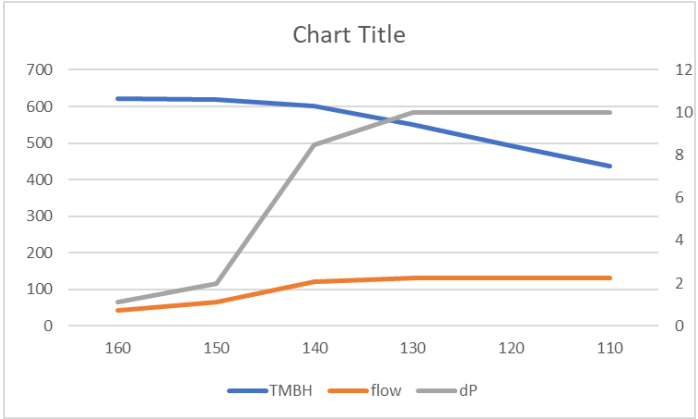
Production, Distribution, Terminal Use

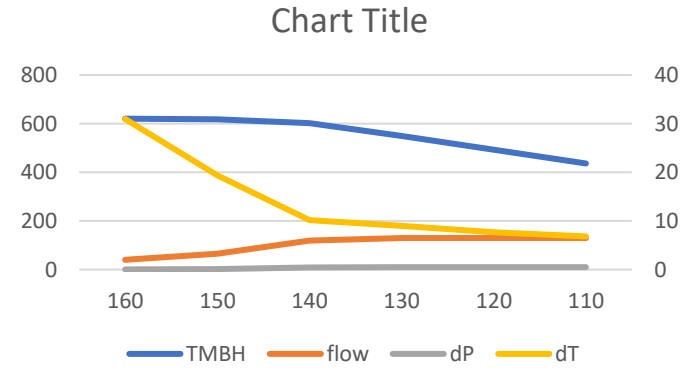


Building Heating Coil Constraints









Building Solutions

Near term

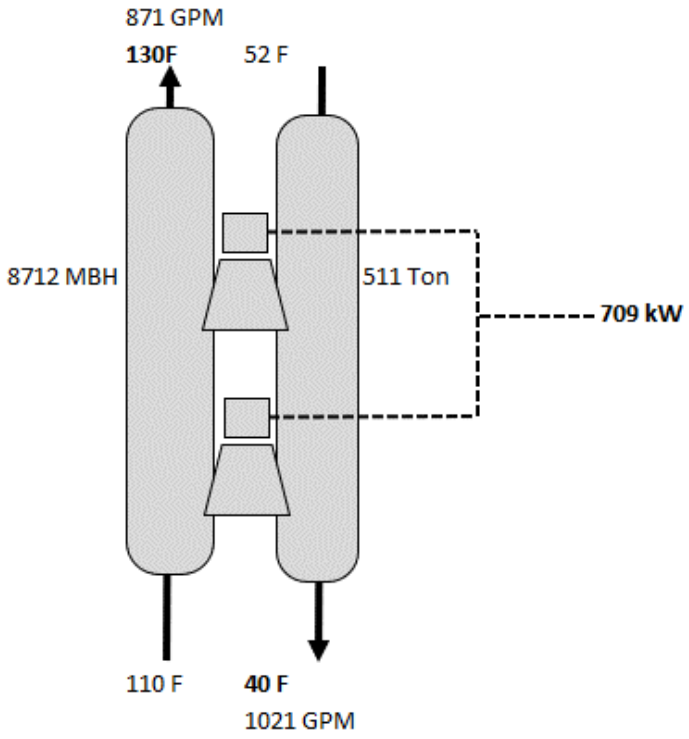
- Discharge Air Temp Reset
- Retro Commissioning
- Exhaust air heat recovery
- Add or replace coils

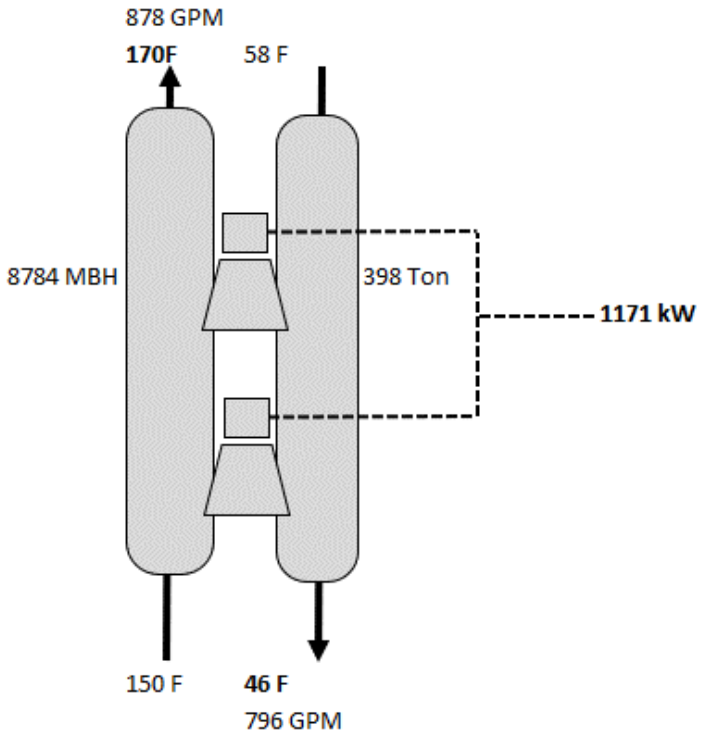
- Dual service in interim?
- In-building supplemental heat!

Long term

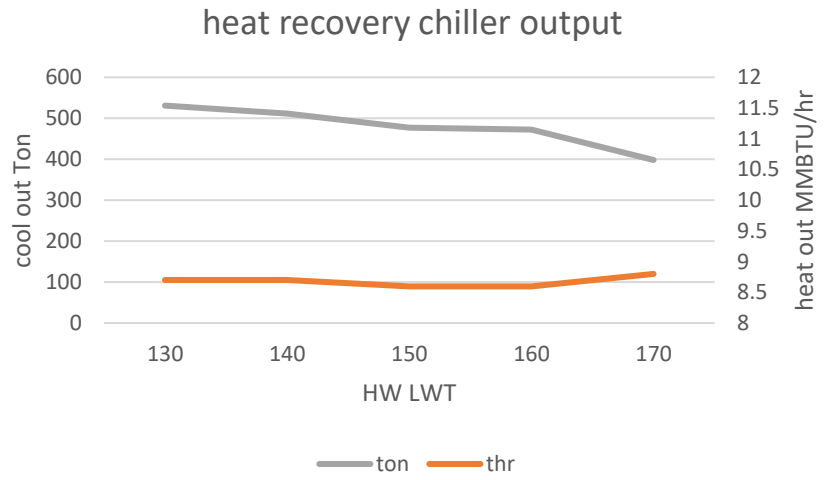
- Rewrite design standards
- AHU replacements
- Deferred Maintenance
- Consider separating lower temperature perimeters from ventilation
- Address simultaneous Heat/Cool

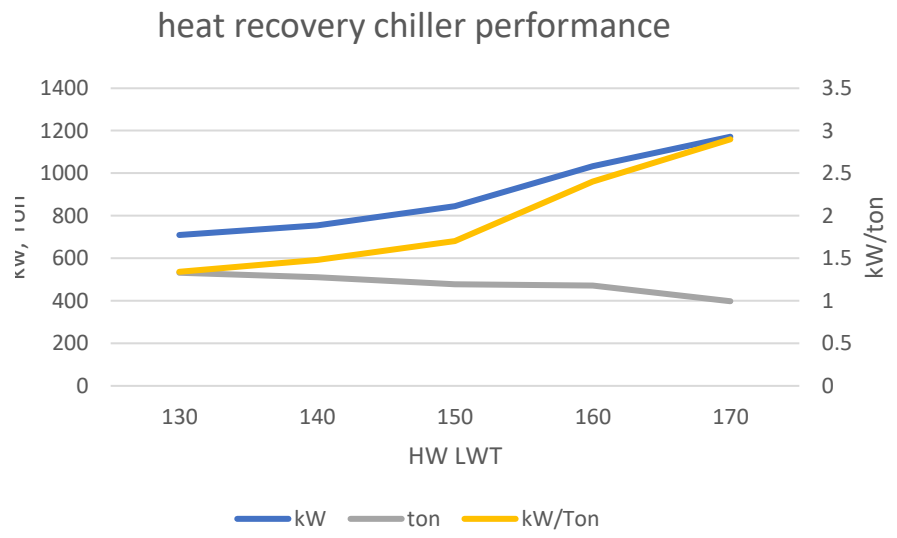
Heat Recovery Chiller Constraints



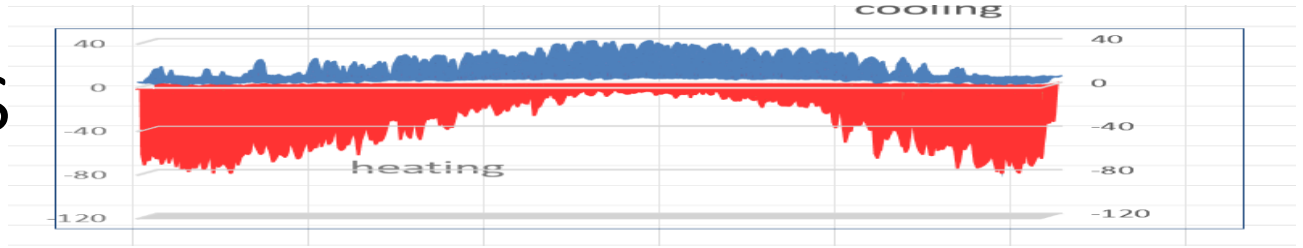


Some limits to operational boundaries





Plant Solutions



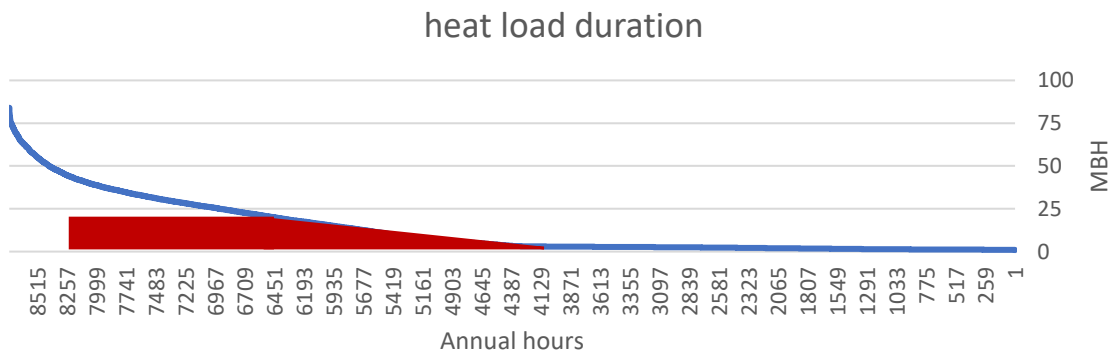
Near term

- Evaluate simultaneous H+C
- Reset HHW temp
- Side car supplement
- Natural Gas at peak
- eBoiler supplemental heat

Long term

Look for opportunities

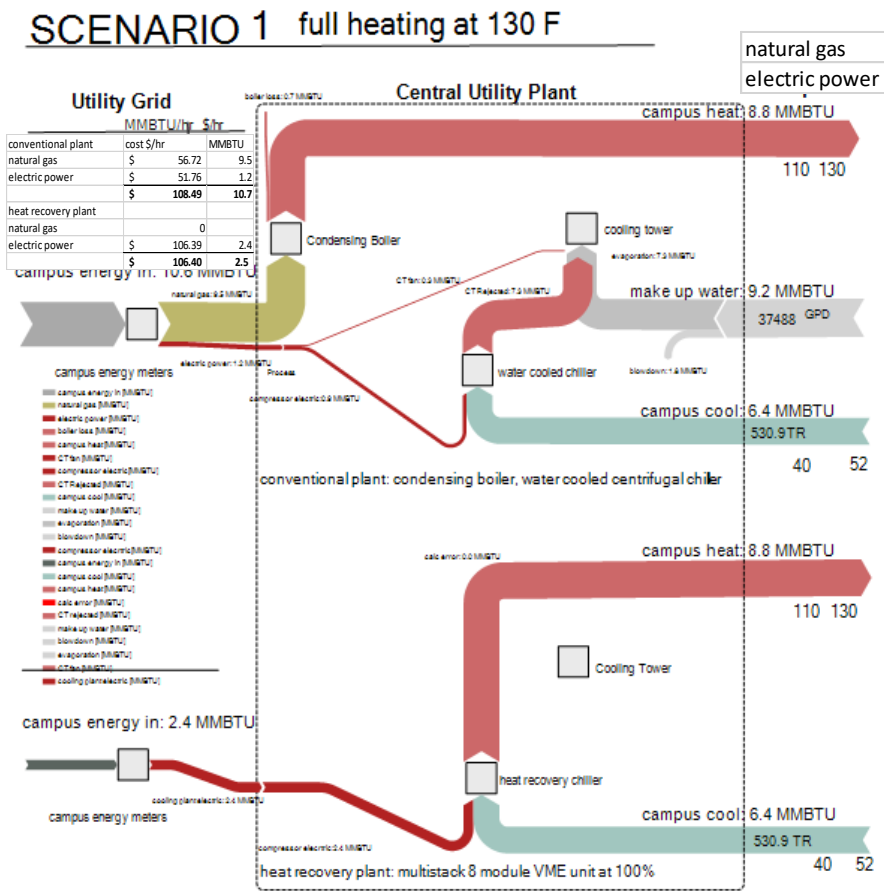
- chiller replacement
- Tower replacement
- Boiler replacement
- Tunnel repairs; HHW nodes
- Utility extensions



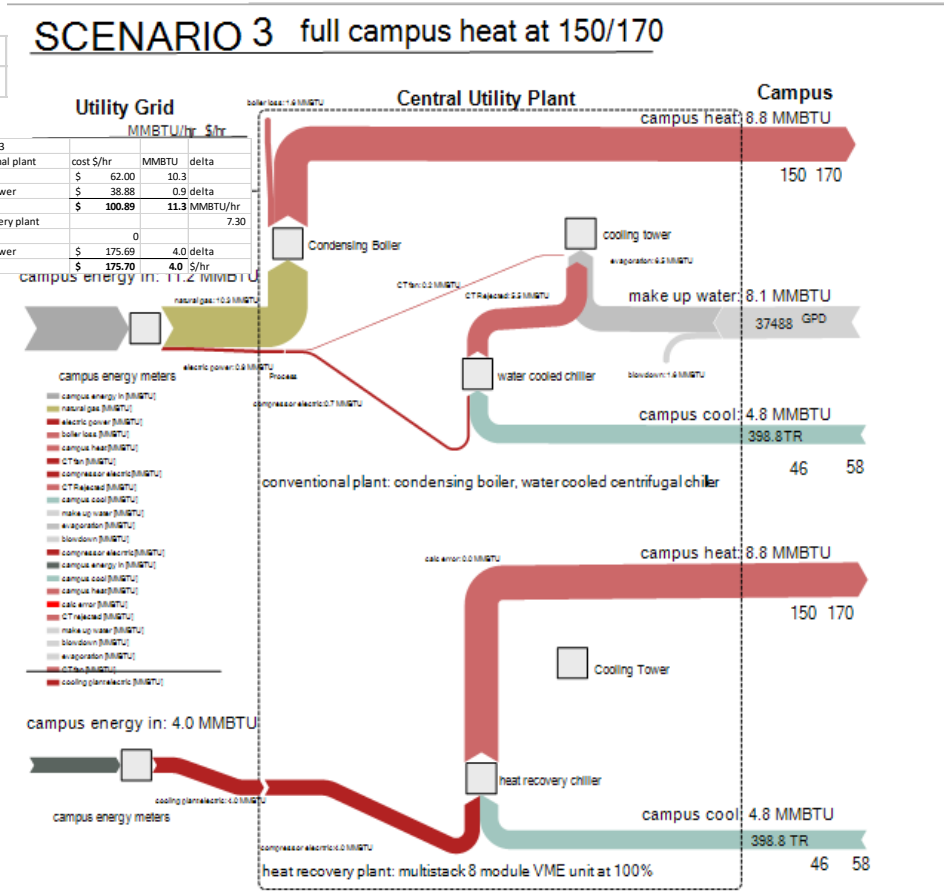
Phased Distribution Solutions

- Start small and near main or satellite plant
- Heat exchanger nodes
- Abandon irreparable tunnel strategies
- Size improvements for lower temp HHW

Graphical Comparison



natural gas	$	6.00	$/MMBTU
electric power	$	0.15	$/kWh



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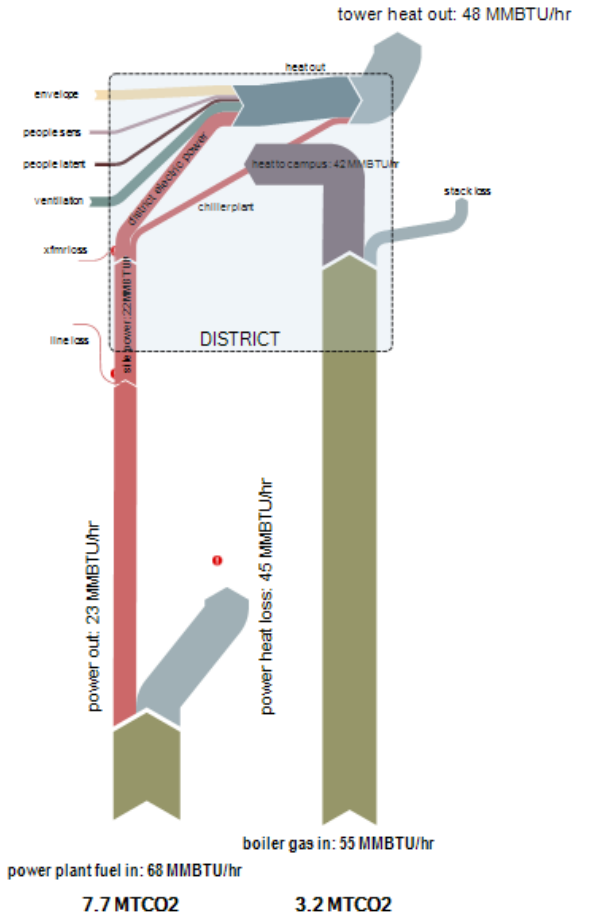
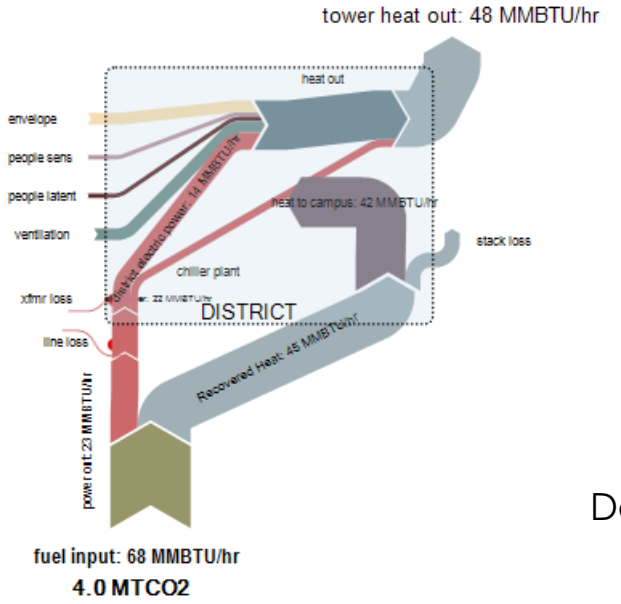
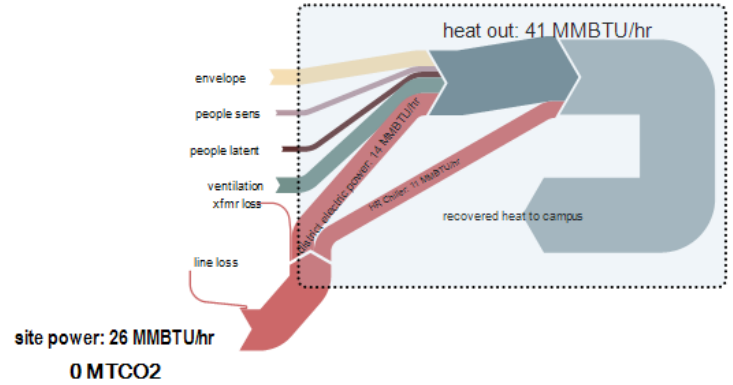


Coal fired grid power, natural gas boiler



Gas fired CHP



Decarbonized grid: Heat recovery chilling

A moment in time- Simultaneous Campus heating cooling demand
2500 Ton cooling
42 MMBTU/hr heating

A District Energy Opportunity

- Utilizes district simultaneous heating and cooling
- Reduces base loaded fuel combustion
- Enables utilization of thermal energy storage
- Integrates with microgrid demand
- Incremental phase-in

- *Way* better COP than eBoiler
- Water savings!

QUESTION?

Thank You!

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