IDEA 2014

Moving Community Energy Forward

105th Annual Conference & Trade Show

Seattle, Washington | June 8-11, 2014

Improve System Efficiency and Reduce Construction Cost with Low Temperature District Cooling

Case Study: McCormick Place Convention Center, Chicago, IL

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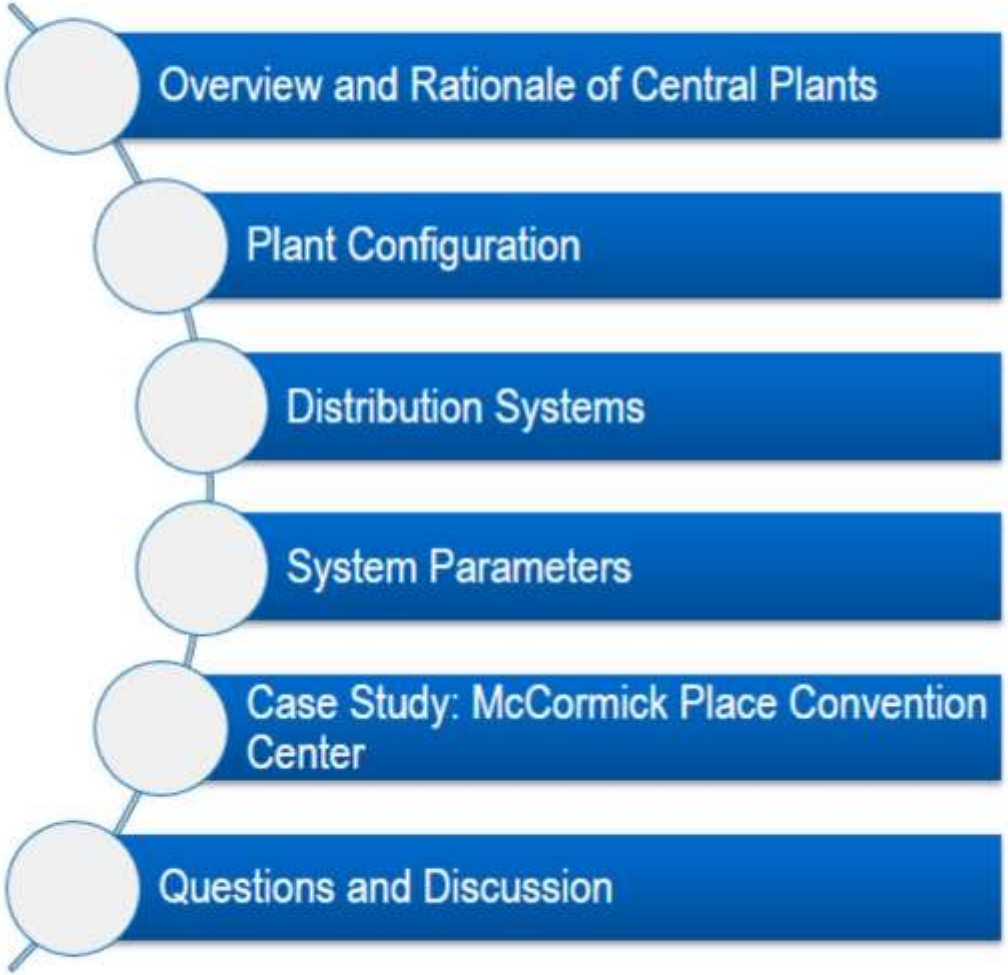
Agenda



Learning Objectives:

- Central Plant Conceptualization
- Increase Plant Efficiency
- Low Temperature Application
- Low Flow Systems Evaluation
- Distributed District Plants
- Campus Master Planning

Rationale for Central Plant

Operations

Capital Investment

Increase Efficiency

Reduce Maintenance

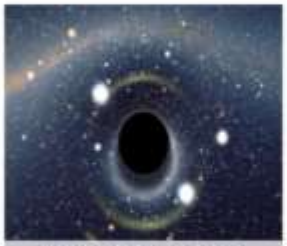
Centralize Noise and Vibration

Reduce Installed Capacity

Increase Plant Safety

Improve Flexibility

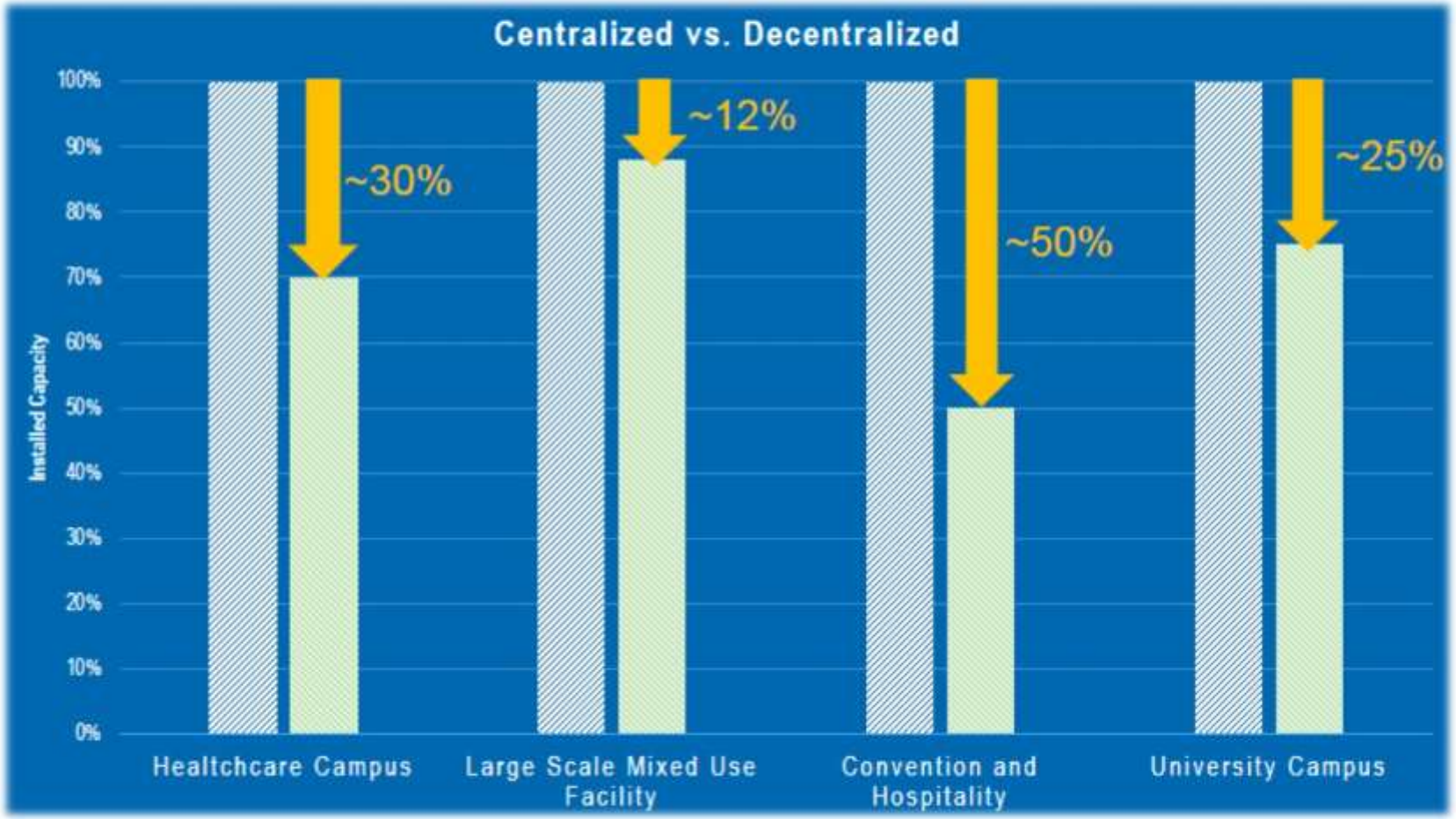
Increase Reliability



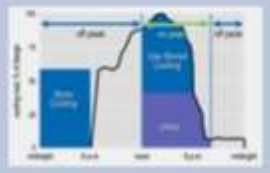
Reduce Space

Reduce Fuel Consumption

Centralized vs. Decentralized – Plant Capacity



Thermal Storage systems - Potential Benefits



Lower utility costs

- Lower on-peak electrical consumption (kWh)
- Lower on-peak electrical demand (kW)

Smaller equipment size

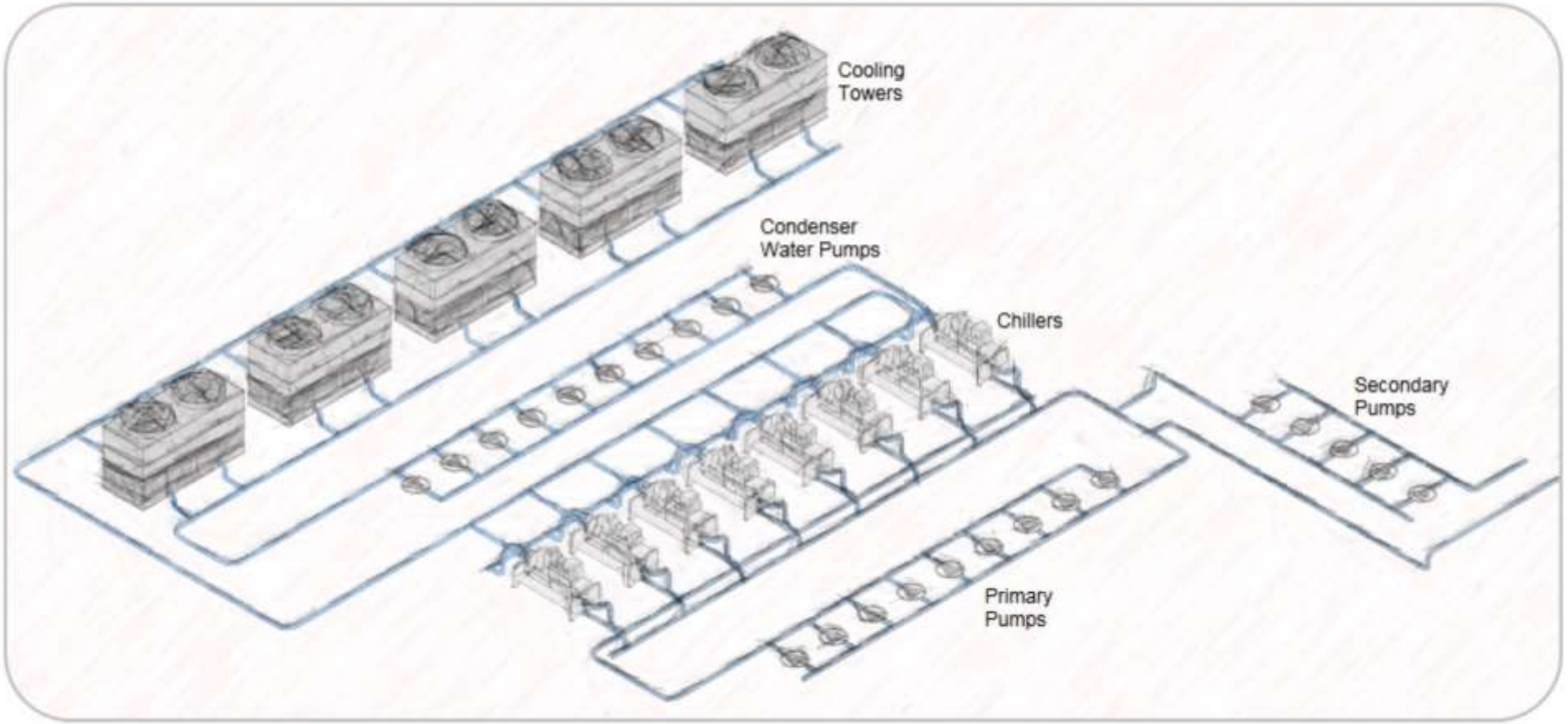
- Smaller chiller
- Smaller electrical service (A)

Reduced installed cost

- May qualify for utility rebates or other incentives

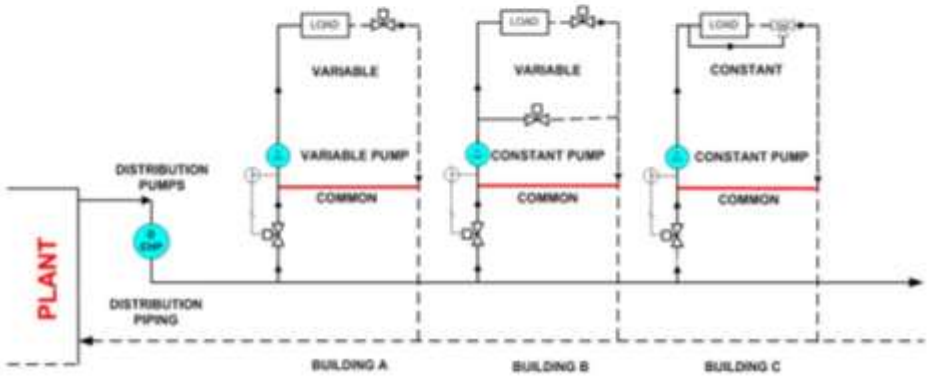
Distribution System

Typical Central/District Cooling Plant

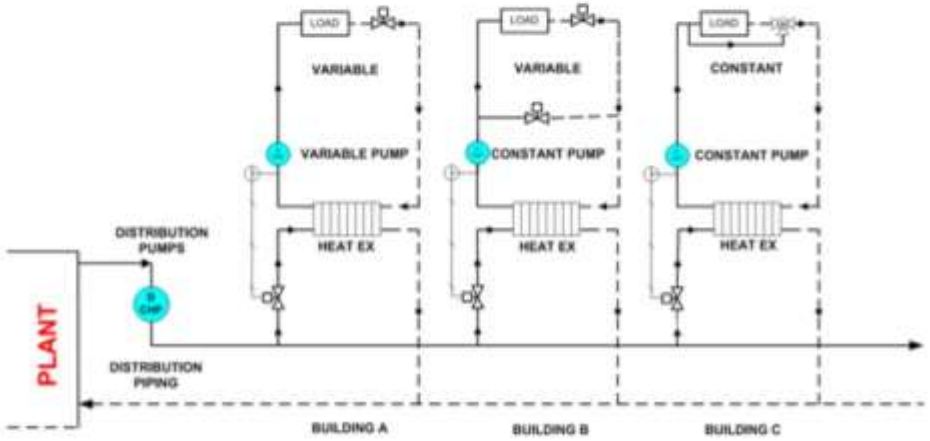


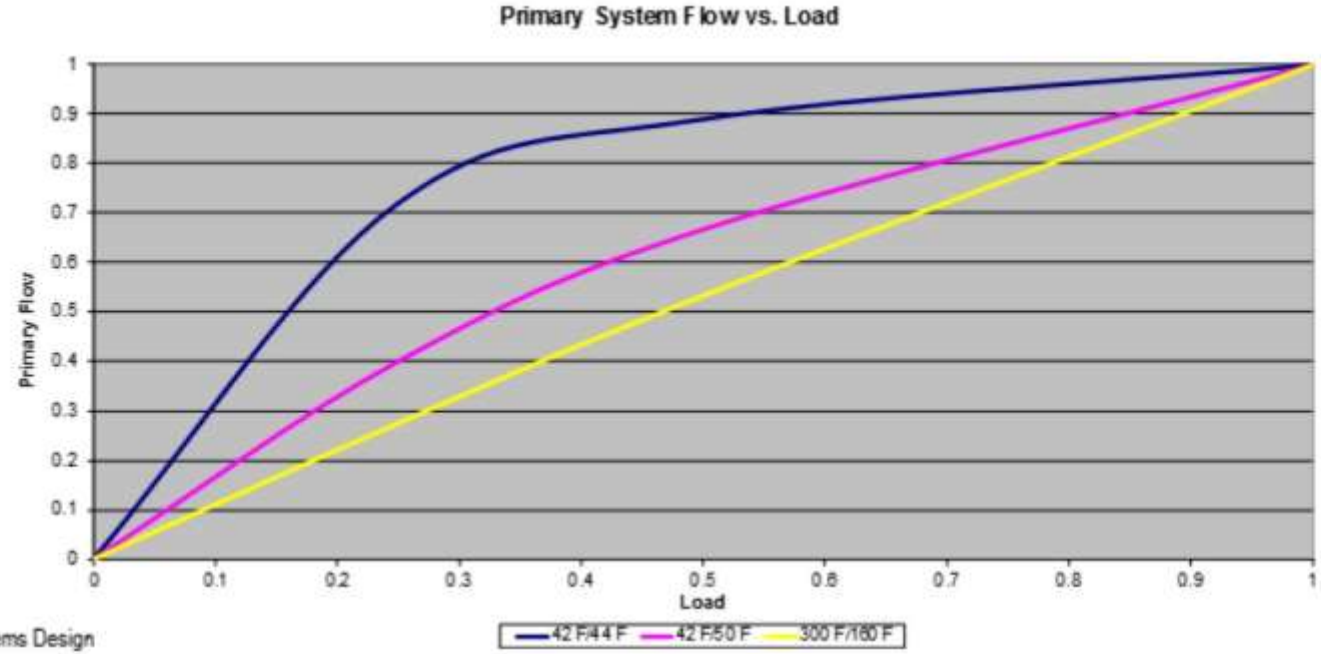
Chilled Water Distribution

INTEGRAL PRIMARY-SECONDARY PIPING



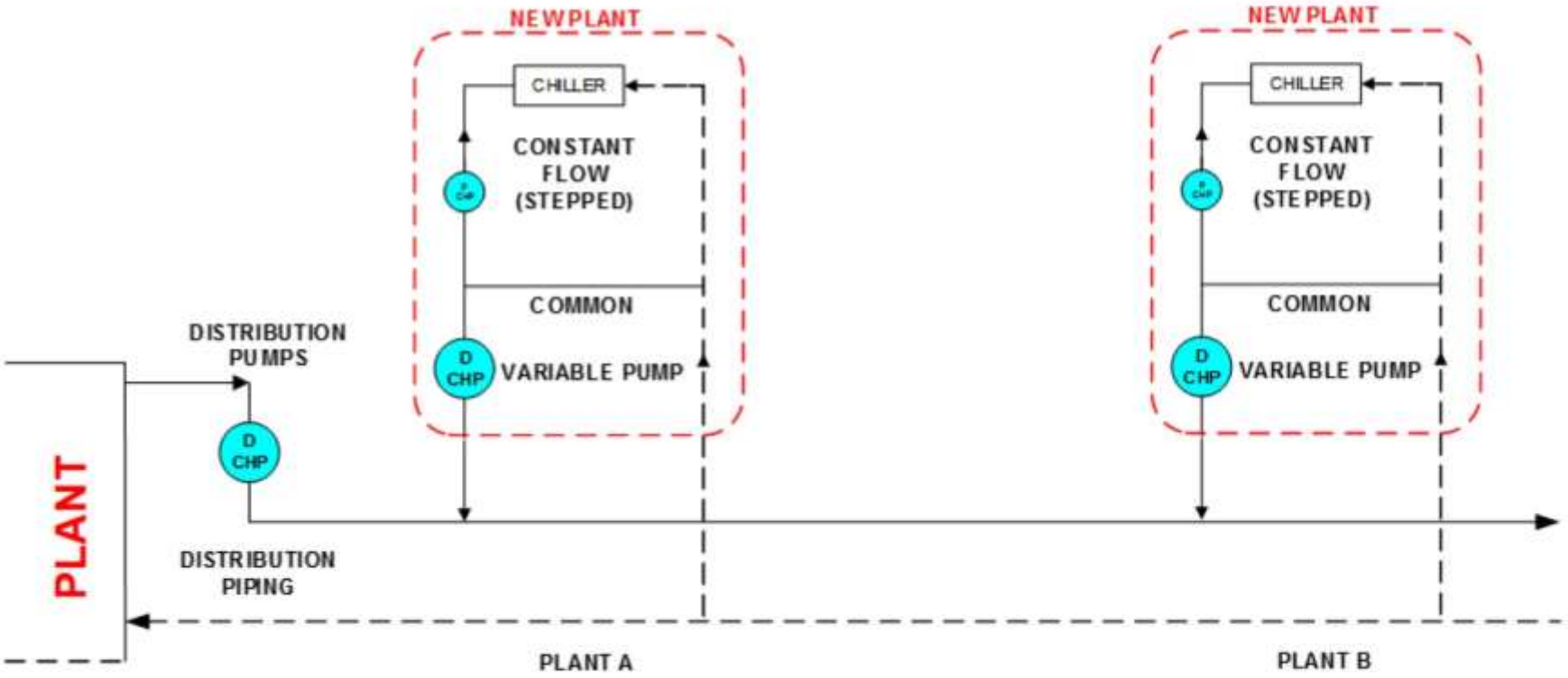
HEAT EXCHANGER PRIMARY-SECONDARY PIPING



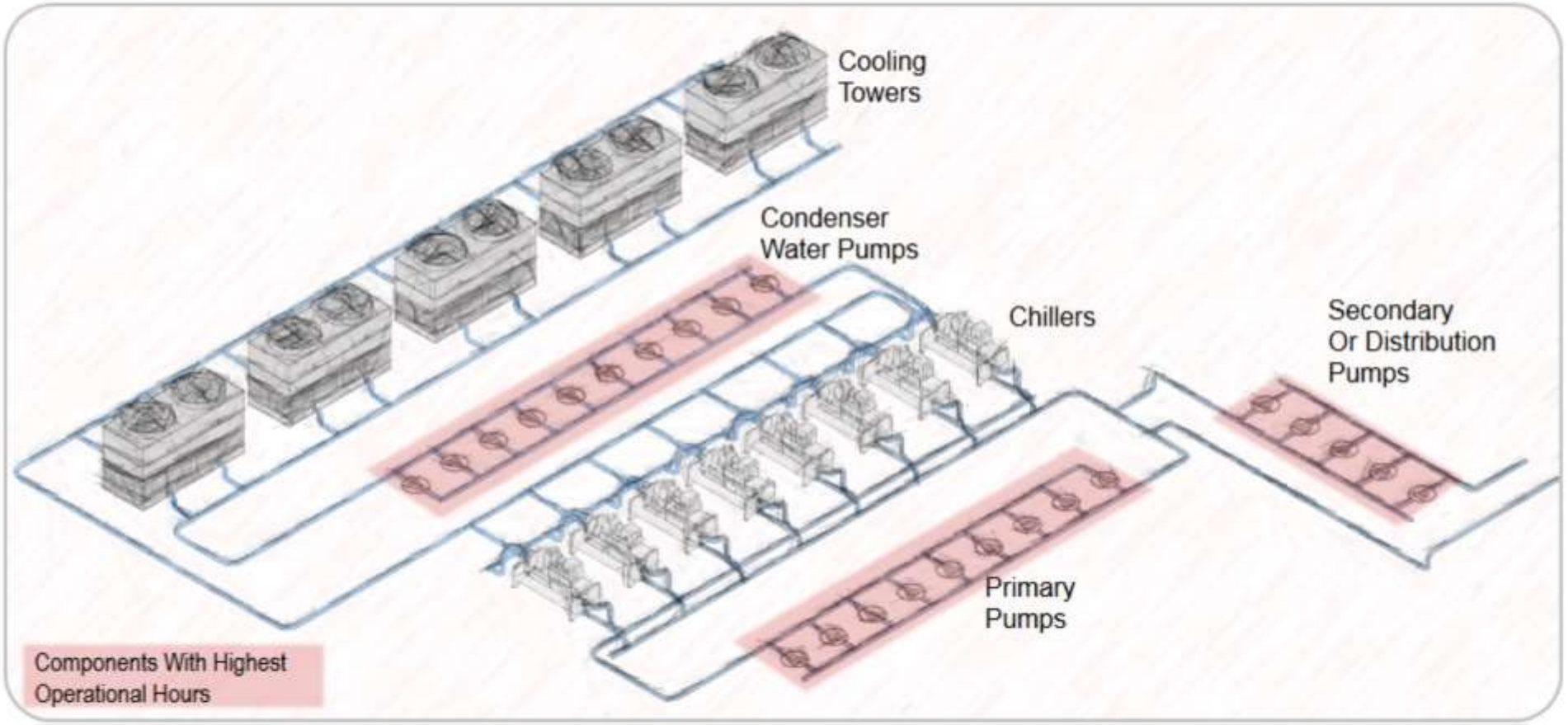


Integration of Future Cooling Plants

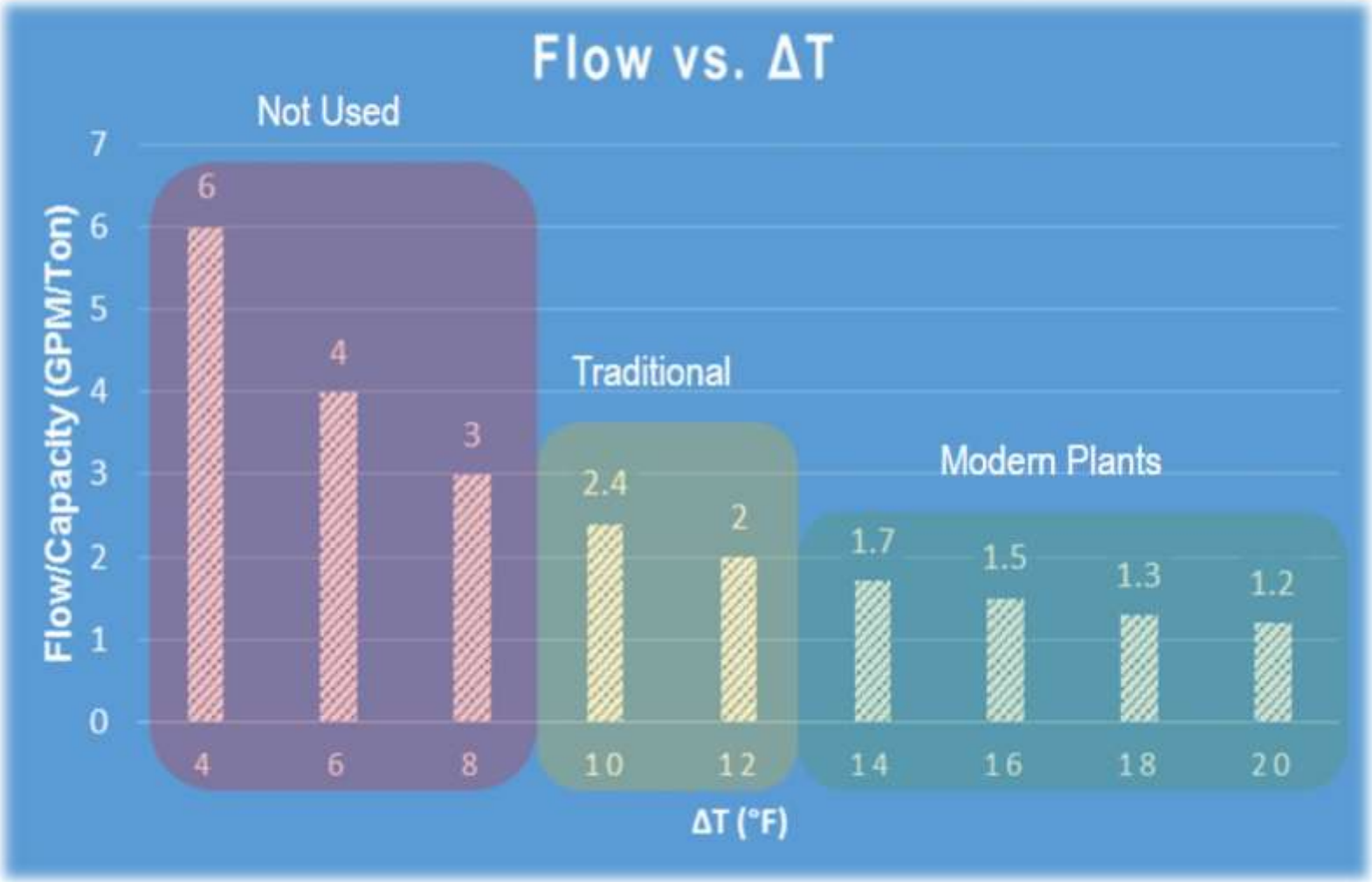
PRIMARY COOLING PLANT – FUTURE ADDITIONS/EXPANSIONS



Typical Central/District Cooling Plant



Central Plant Hydronic Flow

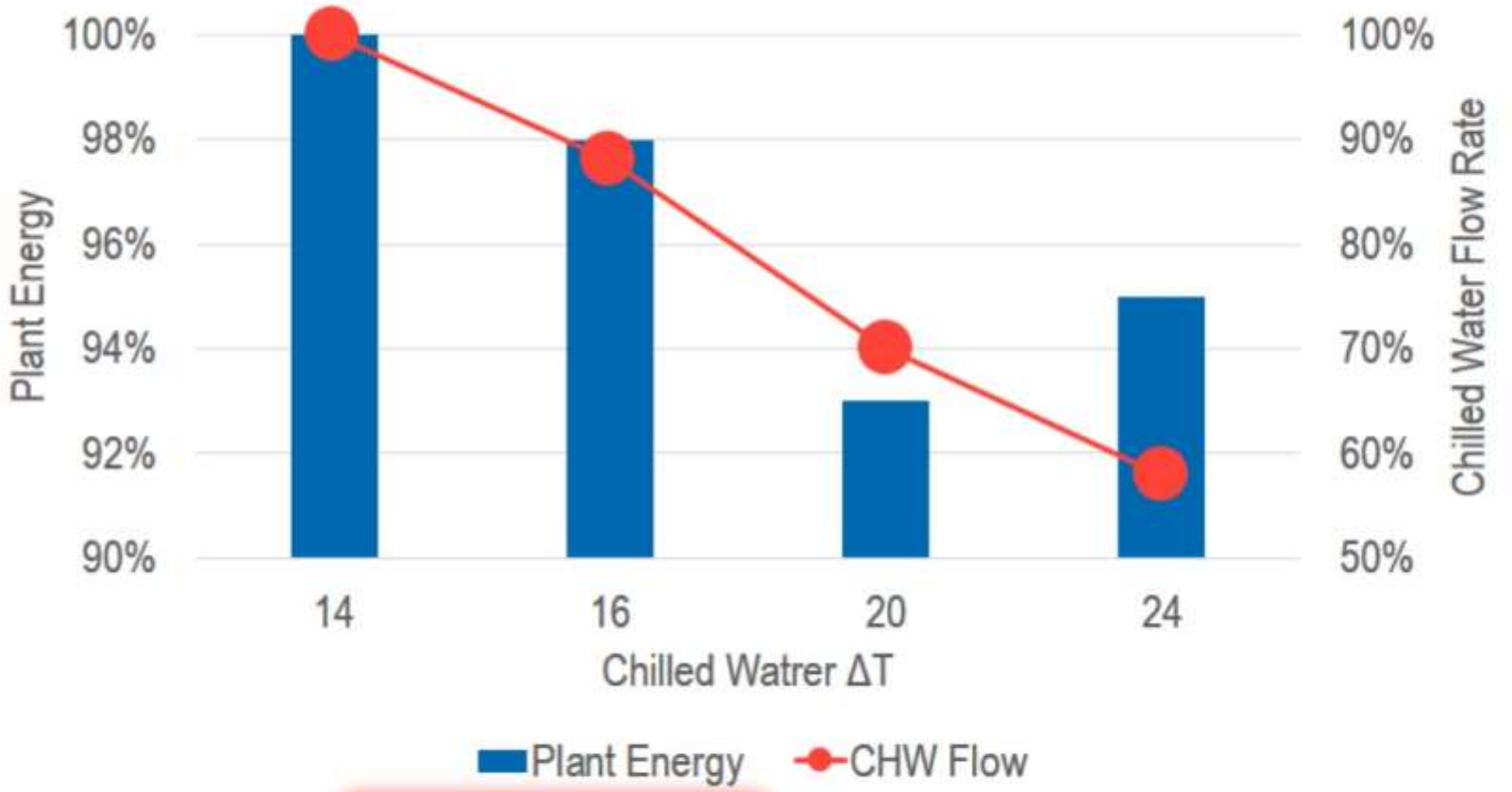


Comparative Plant Parameters – 800 Ton Capacity

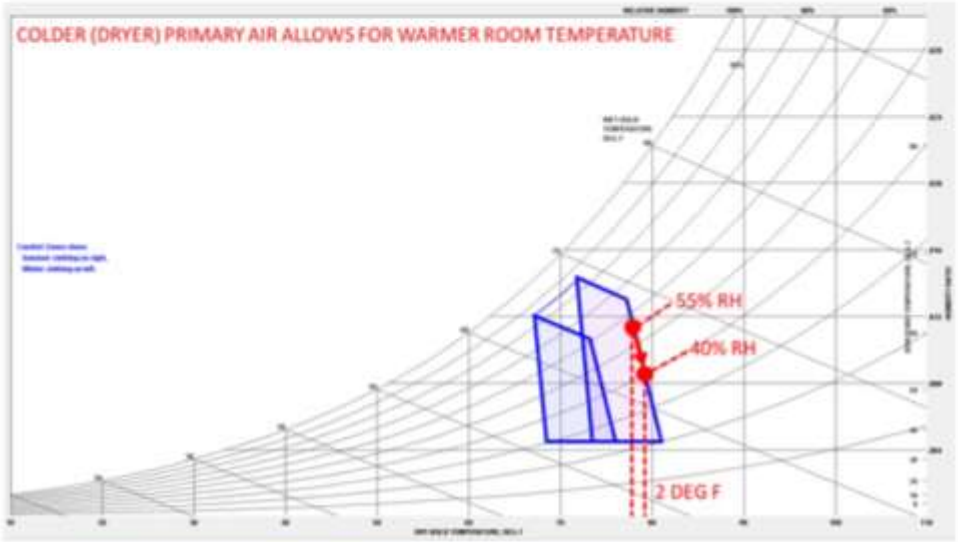
	Traditional	Efficient	
Chilled Water Supply	44°F	41°F	
Cooling Coil WTR	10°F (2.4 gpm/ton)	16°F (1.5 gpm/ton)	37.6% Flow Reduction
Cooling Tower Range	10°F (3.0 gpm/ton)	15°F (2.0 gpm/ton)	33.3% Flow Reduction
Chiller Power	0.580 kw/ton	0.651 kw/ton	+0.071 kw/ton
Chilled Water Pump Power	0.065 kw/ton	0.020 kw/ton	-0.045 kw/ton
Cooling Tower Power	0.040 kw/ton	0.030 kw/ton	-0.010 kw/ton
Condenser Water Pump Power	0.054 kw/ton	0.019 kw/ton	-0.035 kw/ton
Plant Power	0.739 kw/ton	0.720 kw/ton	-0.019 kw/ton

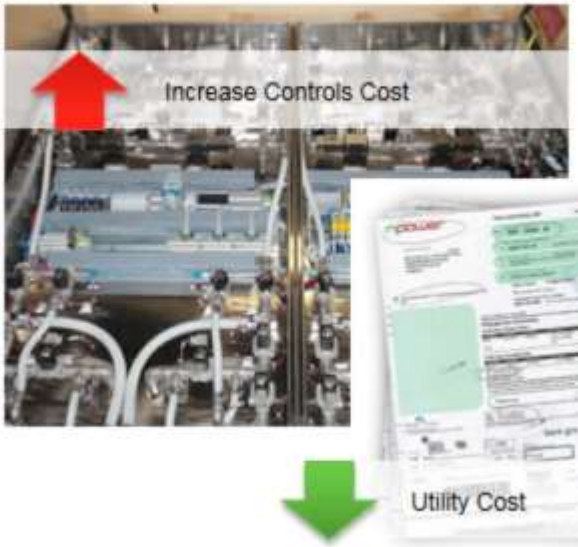



Plant Energy and Systems Chilled Water Flow



Overall System Impact





District Cooling Plant - Chicago Thermal


Plant #2 Franklin and Van Buren
60,000 Ton-hrs Ice Storage


25,000 Tons Installed Capacity Each


Plant #1 State and Adams
66,000 Ton-hrs of Ice Storage

Campus Cooling Plant - Emirates Palace

Seven Star Palace Hotel & Conference Center

Abu Dhabi, UAE

Royal Palaces
Minister Suites
Guest Rooms
Atrium
Ballroom
Conferencing Facility
Restaurants
Shops
Parking Garage

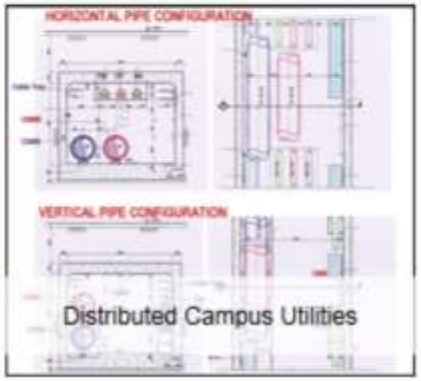
2,500,000 Square Feet

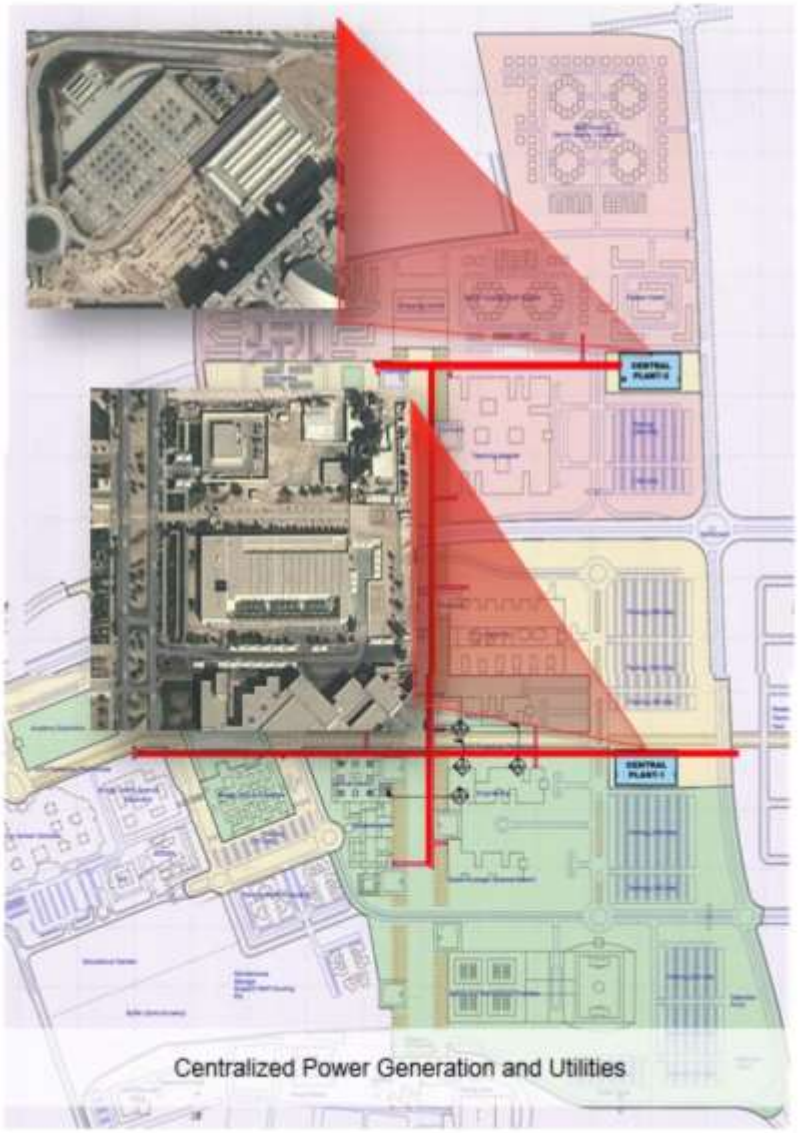
Central Plant and Site Services

Design Conditions:

42/58 CHWS/R
10,000 Ton Central Plant

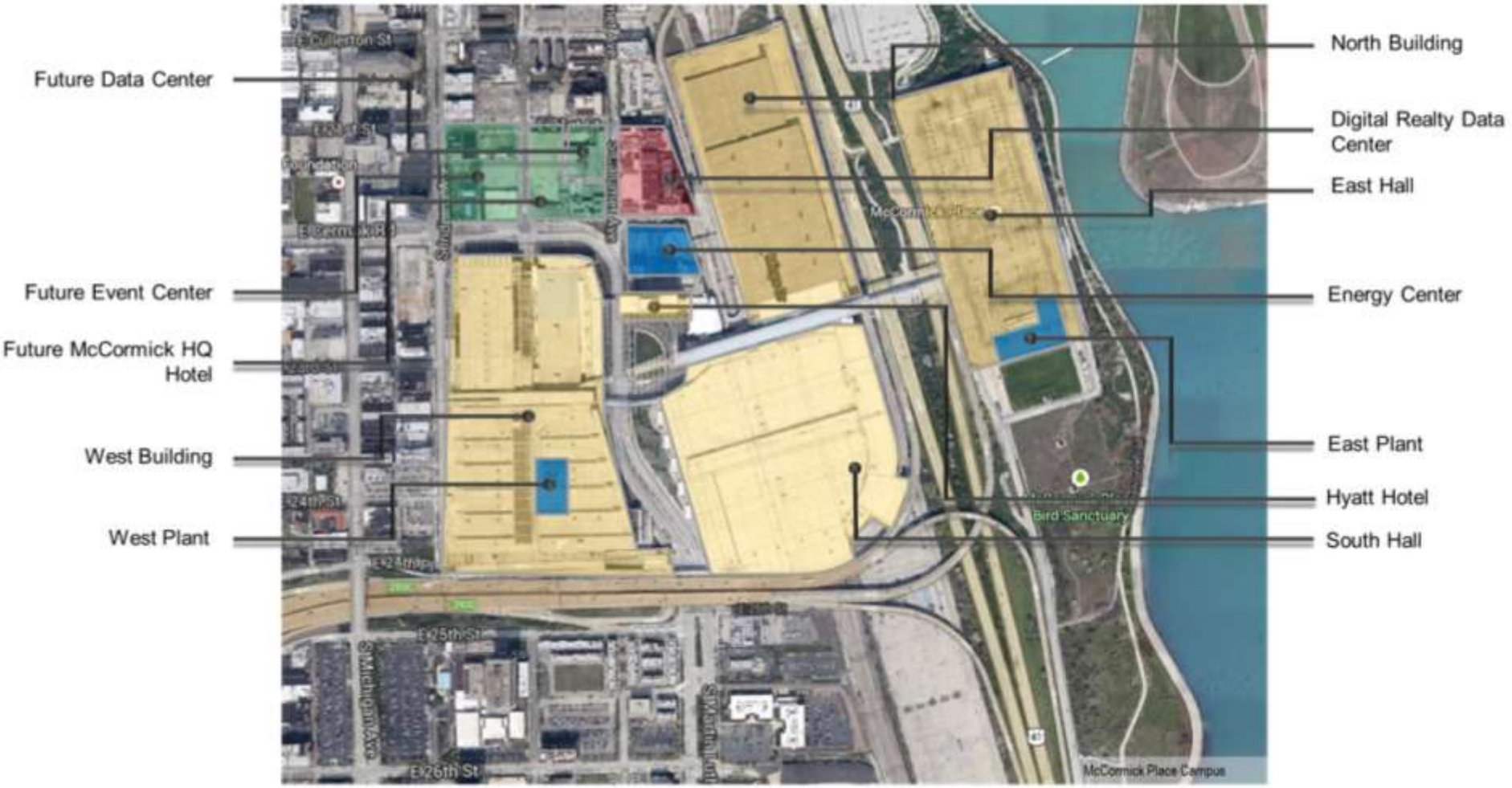
Campus Cooling Plant - Education City





Case Study - McCormick Place

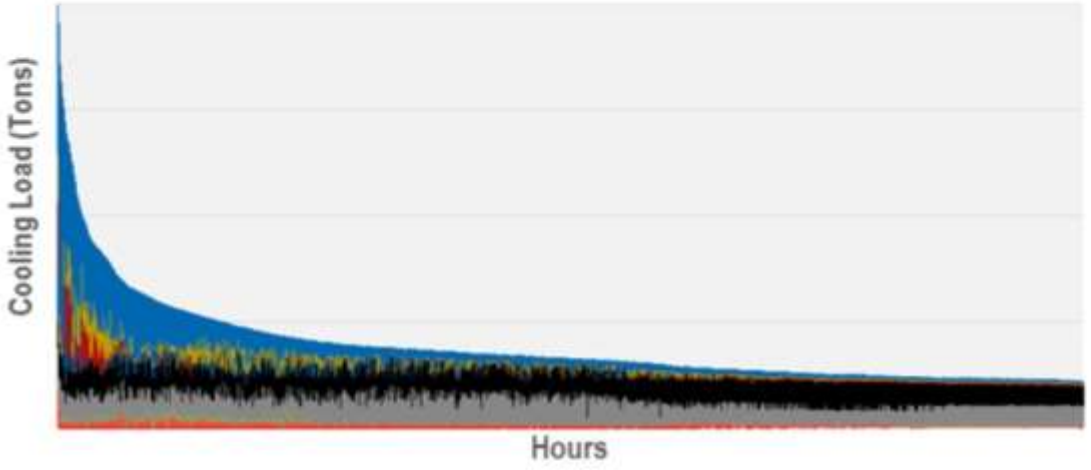
Explore the Campus



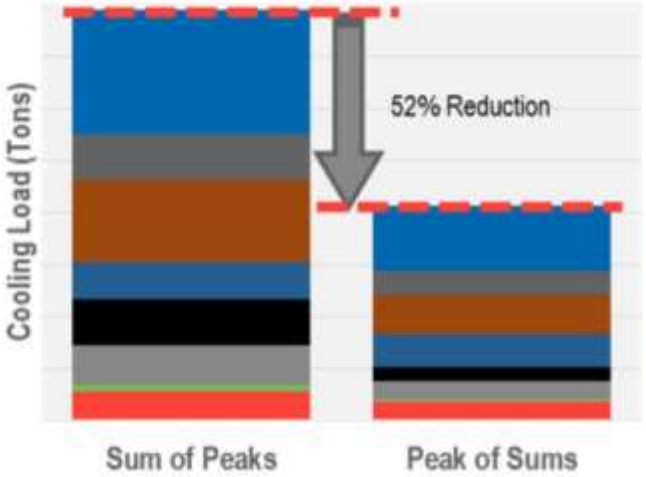
Plant Exploration

Cooling Load

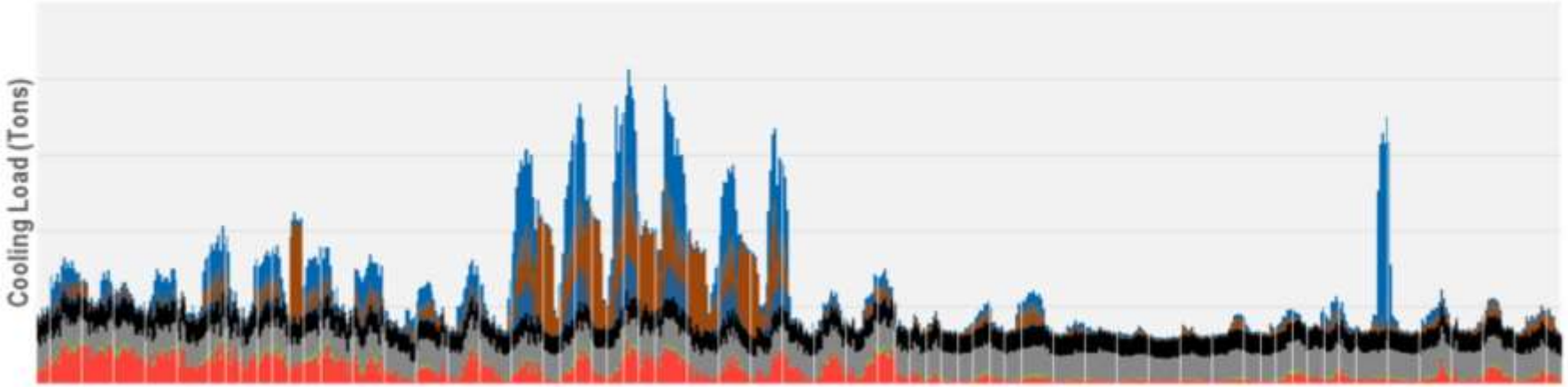
Annual Peak Load Profile



Campus Peak



Campus Peak Month



Design Parameters

Chilled Water

- 27°F Primary Chilled Water Supply
- 56°F Chilled Water Return
- 22% Ethylene Glycol
- Over 100 miles of Hydronic Piping

Building Distribution

- Decoupling with Heat Exchangers
- 34°F Secondary Chilled Water Supply
- 58°F Chilled Water Return

Air Distribution

- 45°F Supply Air
- Induction diffusers
- Over 50 miles of Duct Distribution

The Final Destination

1 Million CFM of Airflow Reduced

Over $3 Million of Equipment Savings

Reduced Maintenance

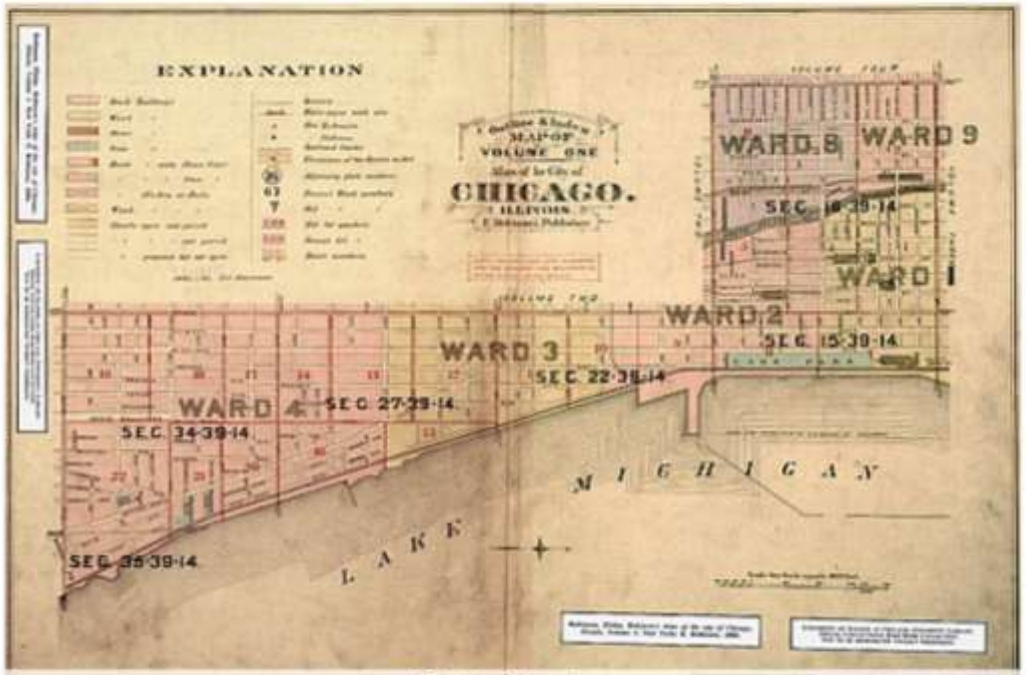
Reduced flow by over 30,000 GPM

Increased Efficiency

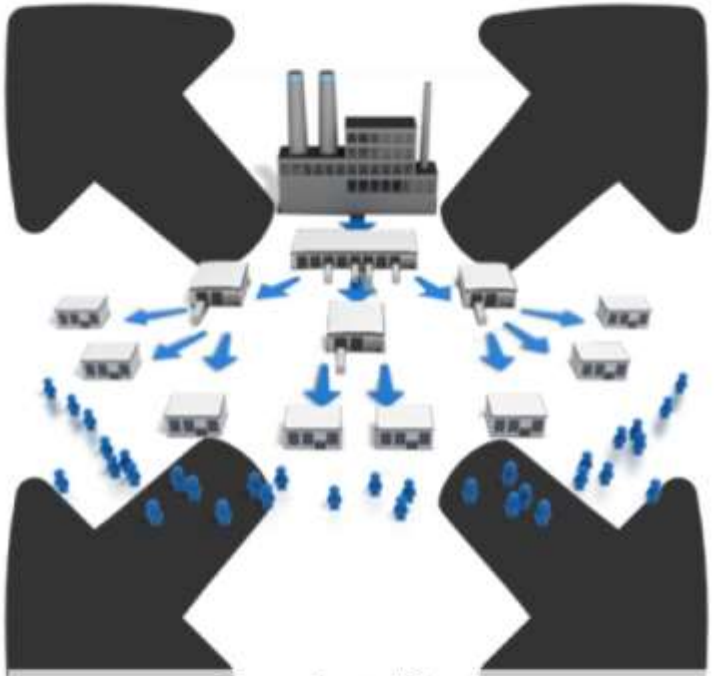
50% Reduction in Piping

System Savings

On-going Optimization – District Plants



Master Planning



Expansion and Growth

Plant Development

New Buildings and Campuses

Plant Renovations

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ESD

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Thank You, Questions?

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