



IDEA2021

Powering the Future: District Energy/CHP/Microgrids
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Optimized Control of a Hybrid Variable Primary, Primary-Secondary Flow Chilled Water System

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Novaspect – Tyler Peterson



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Agenda

- Who We Are
- Project Scope
- Project Objectives
- Solutions
- Results
- Next Steps



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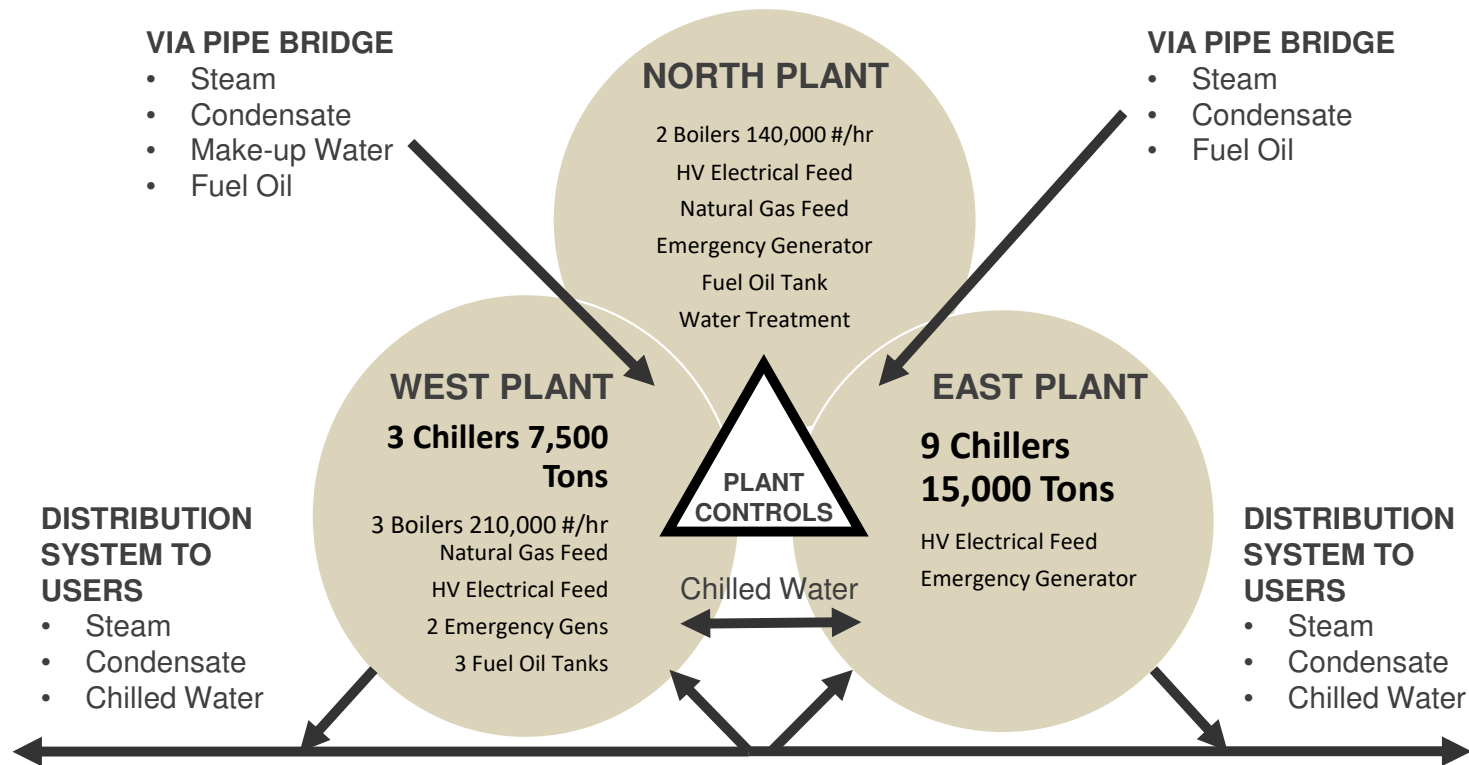


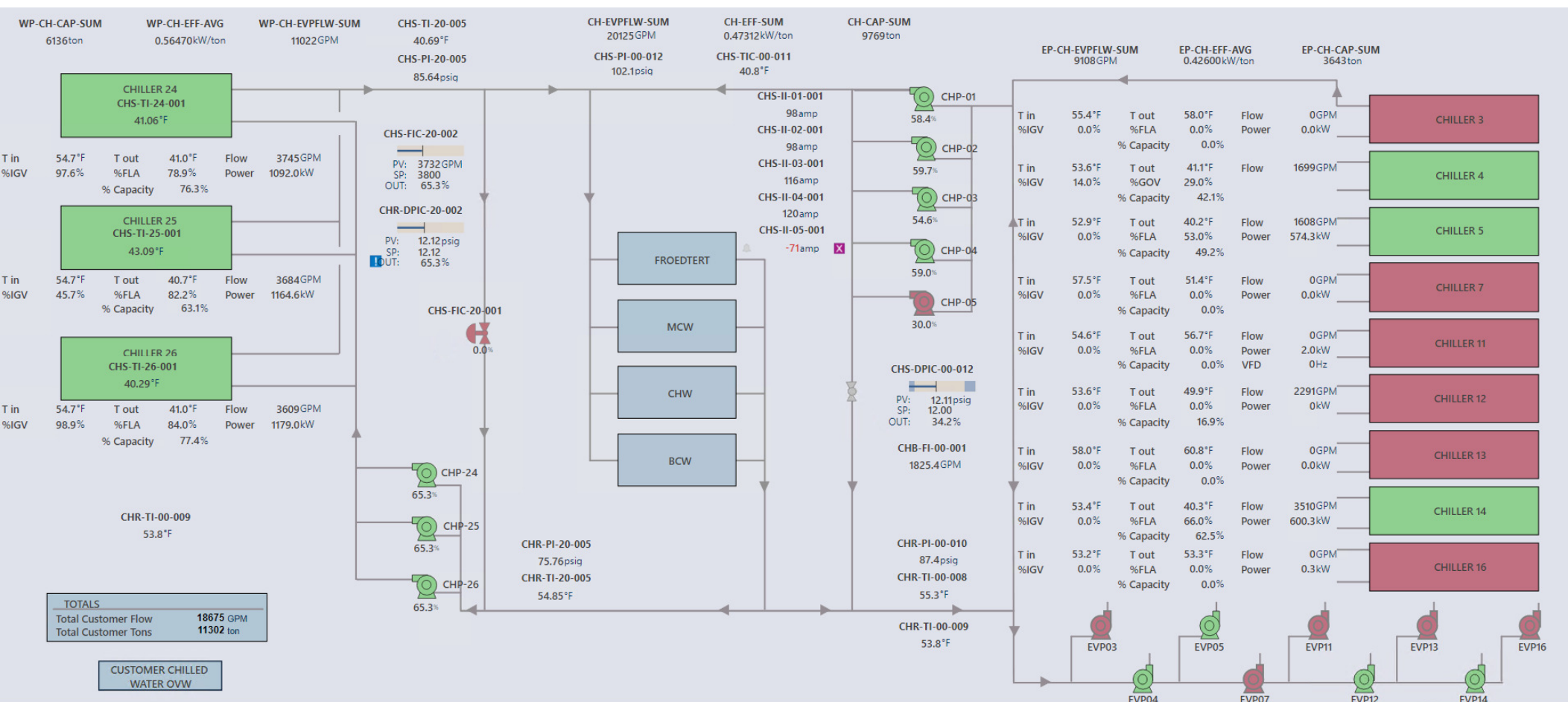
NOVASPECT



**INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION**

2016-2020 Reconstruction Outcome





Project Scope

- 2 Chiller Plants
- 13 Chillers
- 11 Cooling Towers
- 41 Pumps
- 3 Sumps
- 40 Control Valves
- 3 Discrete Valves
- 19 Campus Buildings

Project Objectives

- Ensure safe operation
- Maximize system reliability and resiliency
- Minimize operator interaction to chiller transitions
- Minimize temperature transients during chiller transitions
- Optimize combined chilled water system energy efficiency

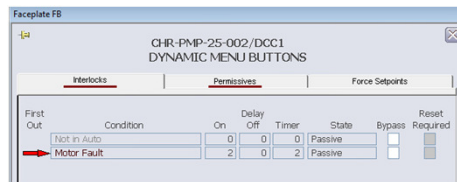


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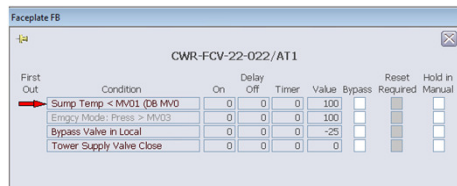


Ensure Safe Operation

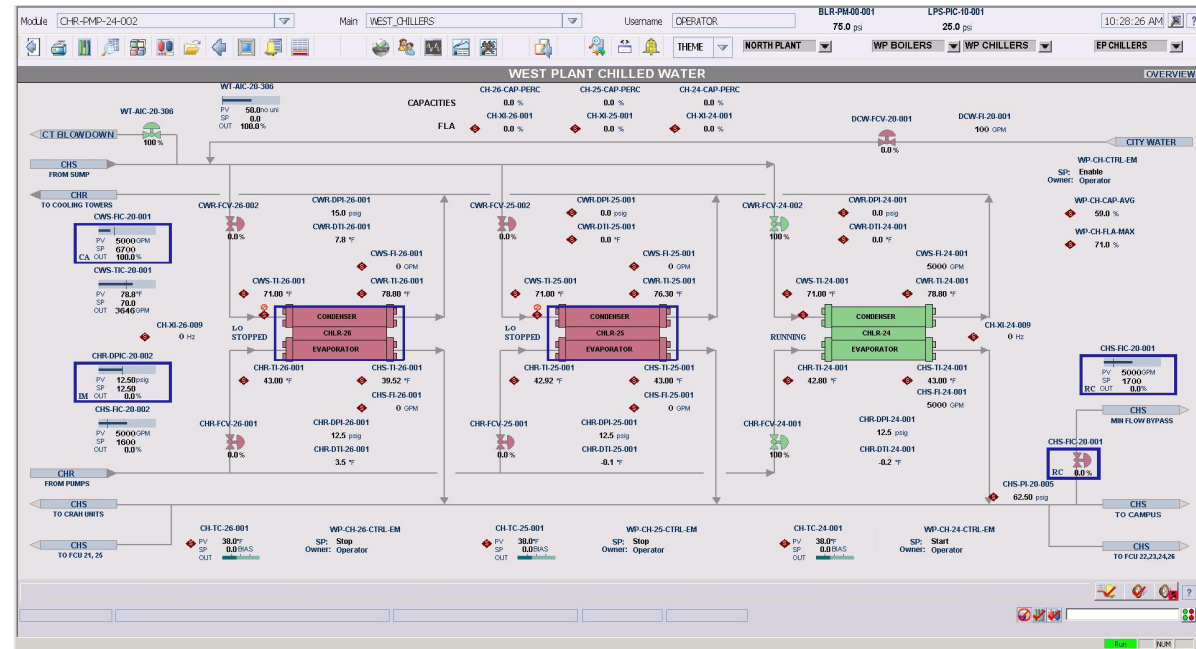
- Interlocks, Permissives, & Tracking
- Operator Prompting
- High Performance Graphics
- Simulated Operator Training



Interlocks



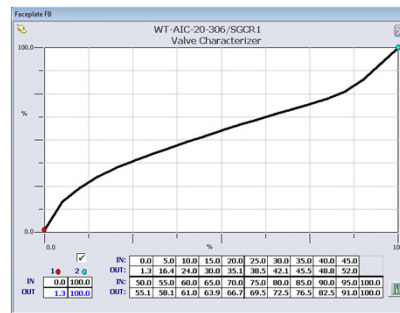
Analog Tracking



High Performance Graphics

Maximize System Reliability & Resiliency

- Pump Monitoring / Auto Start
- Instrumentation Monitoring / PV Bad
- Control Valve Position Feedback
- Control Points Hardwired
- Transparent Tuning Points
- Local Controls
- Control Valve Linearization



Control Valve Linearization

Variable	Value
01 Temp or DP Control Select	Temp Control
02 Flow Ctrl SP	1000 GPM
03 OP03	0 %
04 OP04	0 %
05 OP05	0 %
06 OP06	0 %
07 OP07	0 %
08 OP08	0 %
09 OP09	0 %
10 OP10	0 %

Operating Parameters

Variable	Value
01 Num of Pumps Running	1
02 Low FLA Time	0.5 min
03 High FLA Time	2.0 min
04 High FLA Start Limit	50.0 %
05 Low FLA Stop Limit	35.0 %
06 Next Pump Start Delay	1.0 min
07 Next Pump Stop Delay	1.0 min
08 SP - PV Deadband to Stop Ramp	0.5 %
09 NOT USED	0 %
10 NOT USED	0 %

Tuning Parameters

EP-CHIP-CTRL-EM
East Plant Chilled Water

Enable

Run Command
Please Select

AUTO **Mode** **AUTO**

OWNER: Operator
RELEASE

MESSAGE

Pump failed to start.
Trying to start another pump.

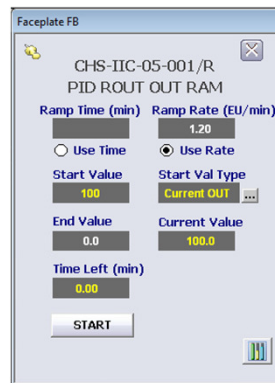
Ack Param

OP PR RT LL TN

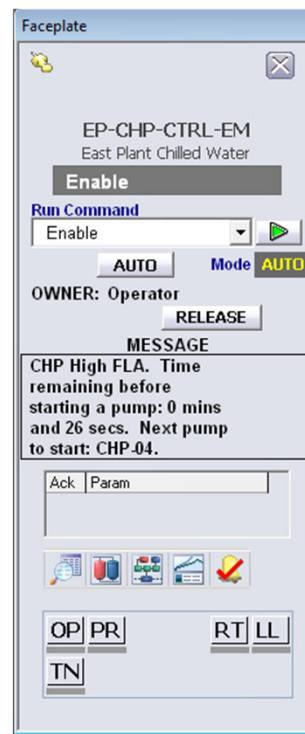
Pump Monitoring

Minimize Operator Interaction to Chiller Transitions

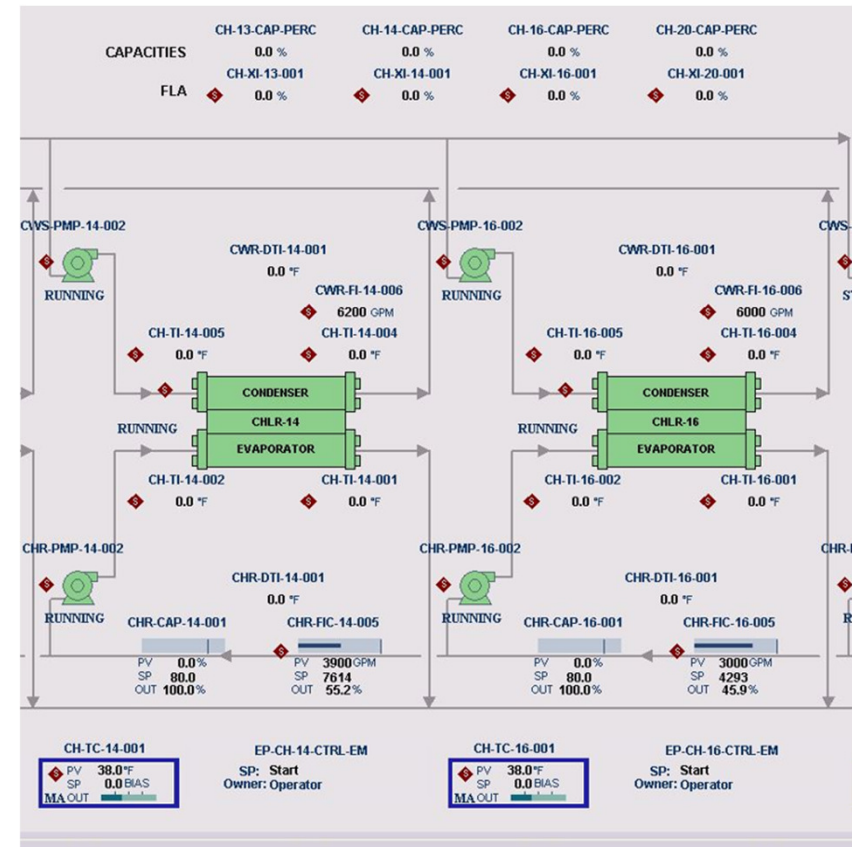
- Control EMs
- Capacity Controllers
- Auxiliary Equipment Staging
- Output Ramping



Output Ramping



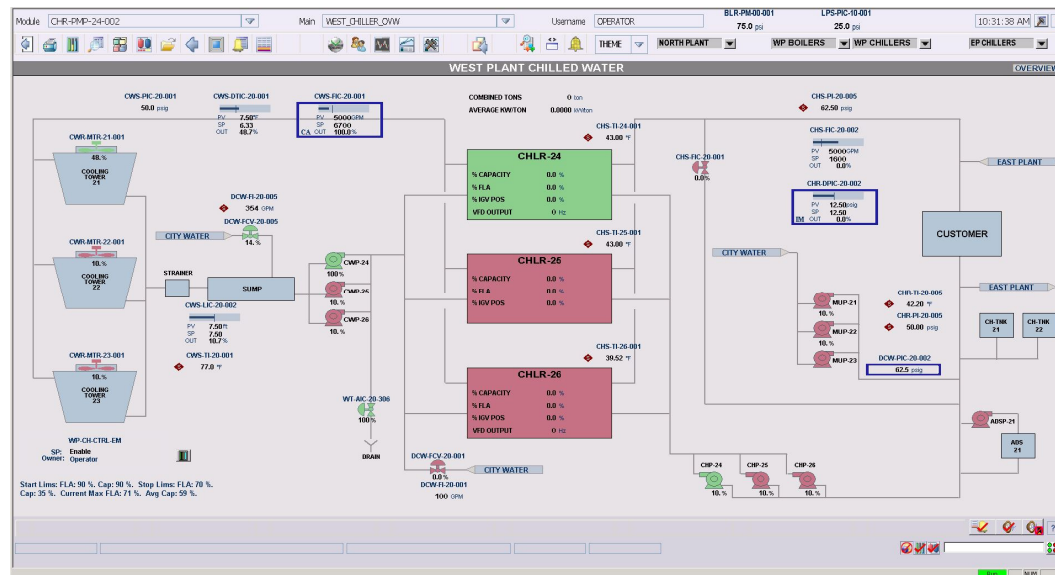
Equipment Staging



Capacity Controllers

Minimize Temperature Transients During Chiller Transitions

- Chiller Minimum Flow Requirements
- Pump / Control Valve Modulation



West Plant Chiller Overview



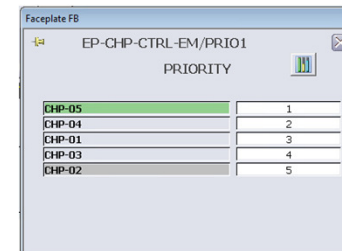
Minimum Flow Hold



Temperature Setpoint Hold

Optimize Combined Chilled Water System Energy Efficiency

- Pump Staging
- Cooling Tower Staging
- Condenser Water Flow Setpoint Control
- Cooling Tower Fan Speed Control
- Chiller Capacity Controls
- Chilled Water Differential Pressure Control
- Chilled Water Flow Control

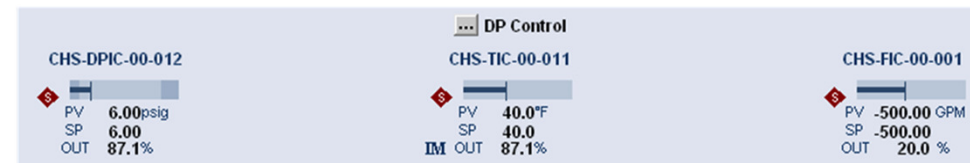


PRIORITY	
CHP-05	1
CHP-04	2
CHP-01	3
CHP-03	4
CHP-02	5

Pump Priority List



West Plant CHP Control



East Plant CHP Control

Results

- Reliability - 100% from 2019 rollout through July 2021

- Efficiency (COP):

	2019	2020	2021
June	3.41	4.72	4.92
July	3.31	4.64	4.95

- Operator Interaction

- Variable Primary Chiller evaporator and condenser balancing
- Primary-Secondary Chiller load following
- Chilled water differential pressure adjustment

Results – Temperature Transients



Next Steps

- Chiller High-Side Optimization
- Chilled Water automated differential pressure adjustment
- Primary-Secondary chiller automated load-following
- Chilled Water Pump staging optimization
- Chiller Economic Dispatch

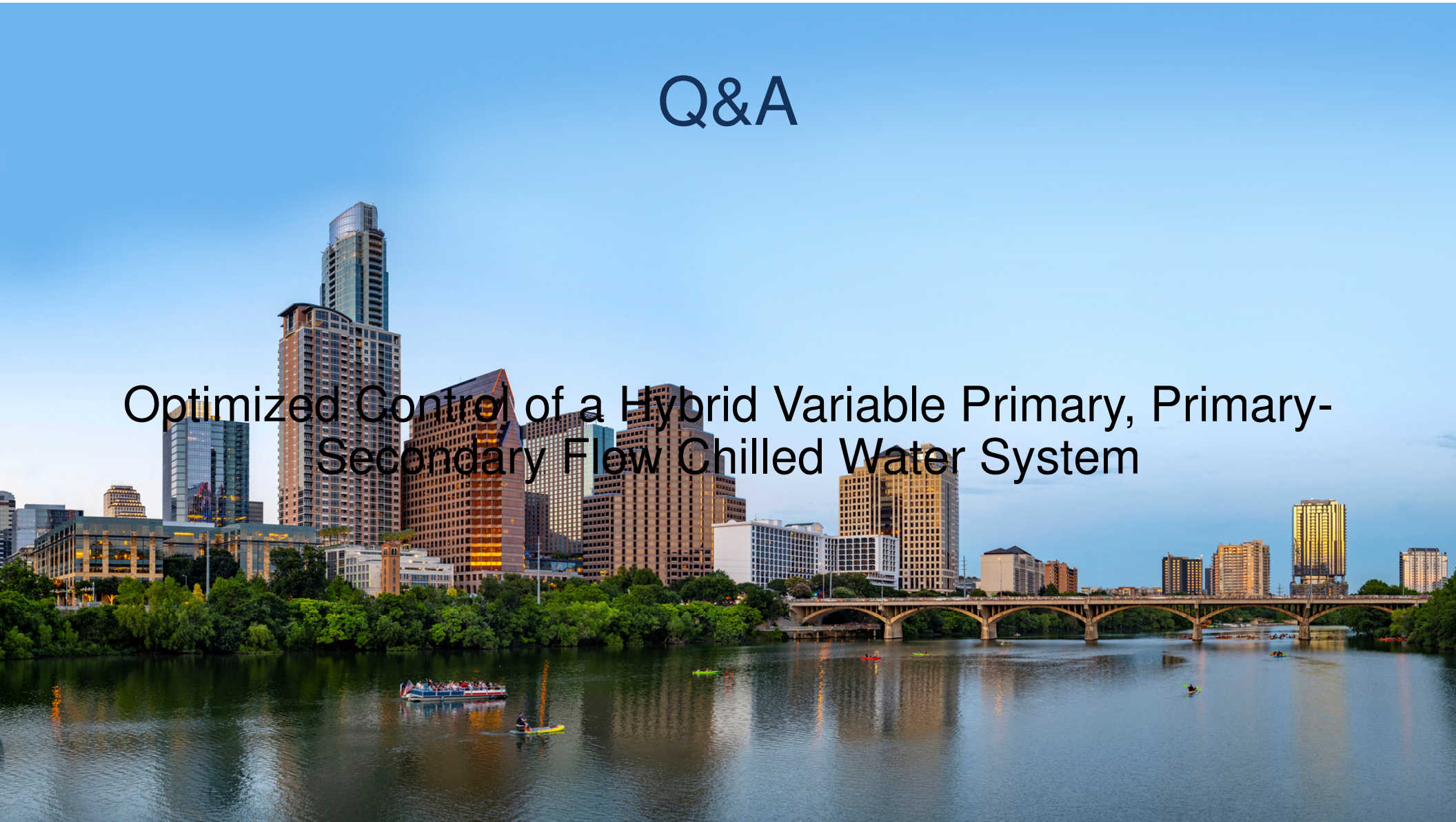


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Q&A

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Thank You!

Rory Peters



Tyler Peterson

