



**Georgia Institute
of Technology**

Presentation

Guaranteed Energy Savings Performance Project

Greg Spiro, PE, CEM, LEED-AP
Georgia Institute of Technology
Senior Mechanical Engineer
Facilities Design & Construction
470-351-9867151
6th Street NW, Atlanta, GA 30332-0351
gspiro@gatech.edu

Donald P. Alexander, P.E, RCDD, CEM
Georgia Institute of Technology
Institute Engineer, Facilities D&C
404-894-4235
6th Street NW, Atlanta, GA 30332-0351
Don.Alexander@facilities.gatech.edu



Agenda

- *Performance Contracting Overview*

 - Guaranteed Energy Savings Performance Contracting*

 - *Statute and background*
 - *Process*
 - *GEFA's role*

- *Benefits to Georgia Tech*

- *Energy Conservation Measure (ECM) Overview*

- *Financial Benefits*

- *Questions*



Guaranteed Energy Savings Energy Performance Contracting

Enabling Legislation

Guaranteed Energy Saving Performance Contracting Act (GESPC Act)

O.C.G.A. § § 50-37-1 through 50-37-8 (2012)

Established Policy

Georgia State Financing and Investment Commission (GSFIC)

“Fiscal Requirements for Energy Performance Contracts”

Established Rules, Procedures and Documents

Georgia Environmental Finance Authority (GEFA)

“Guaranteed Energy Savings Performance Contracting State Agency Manual”



Guaranteed Energy Savings Energy Performance Contracting

According to O.C.G.A. § 50-37-2 (5)

Energy Performance Contract

- A contract for evaluation, recommendation, and implementation of one or more **energy conservation measures** which include, at a minimum, the **Design And Installation Of Equipment** and, if applicable, **Operation And Maintenance** of any of the measures implemented,
- **Guaranteed annual savings** which **must meet or exceed** the **total annual contract payments**, including **financing** charges to be incurred by the governmental unit over the life of the contract.



Guaranteed Energy Savings Energy Performance Contracting

Goals:

- Reduce energy, water, operating costs.
- Minimize risk
- Facility improvements that benefit taxpayers, employees, etc.

Advantages:

- Third party financing
- Budget neutral
- Long-term savings
- Guaranteed work and savings



Guaranteed Energy Savings Energy Performance Contracting

Disadvantages of GESPCs:

- Extra cost of the guarantee
- Overall procurement process can be lengthy
- Complexity in Management
- Organizational change and its impact on M&V and the guarantee



Guaranteed Energy Savings Energy Performance Contracting

GEFA's Role in Performance Contracting

- GEFA established as program manager by statute
- Review applications and set contract value with GSFIC
- Develop standard procedures, pre-qualified list of ESCOs, contracts, and manuals
- Provide technical assistance
- Final contract approval before agency signs contract
- Annual reporting

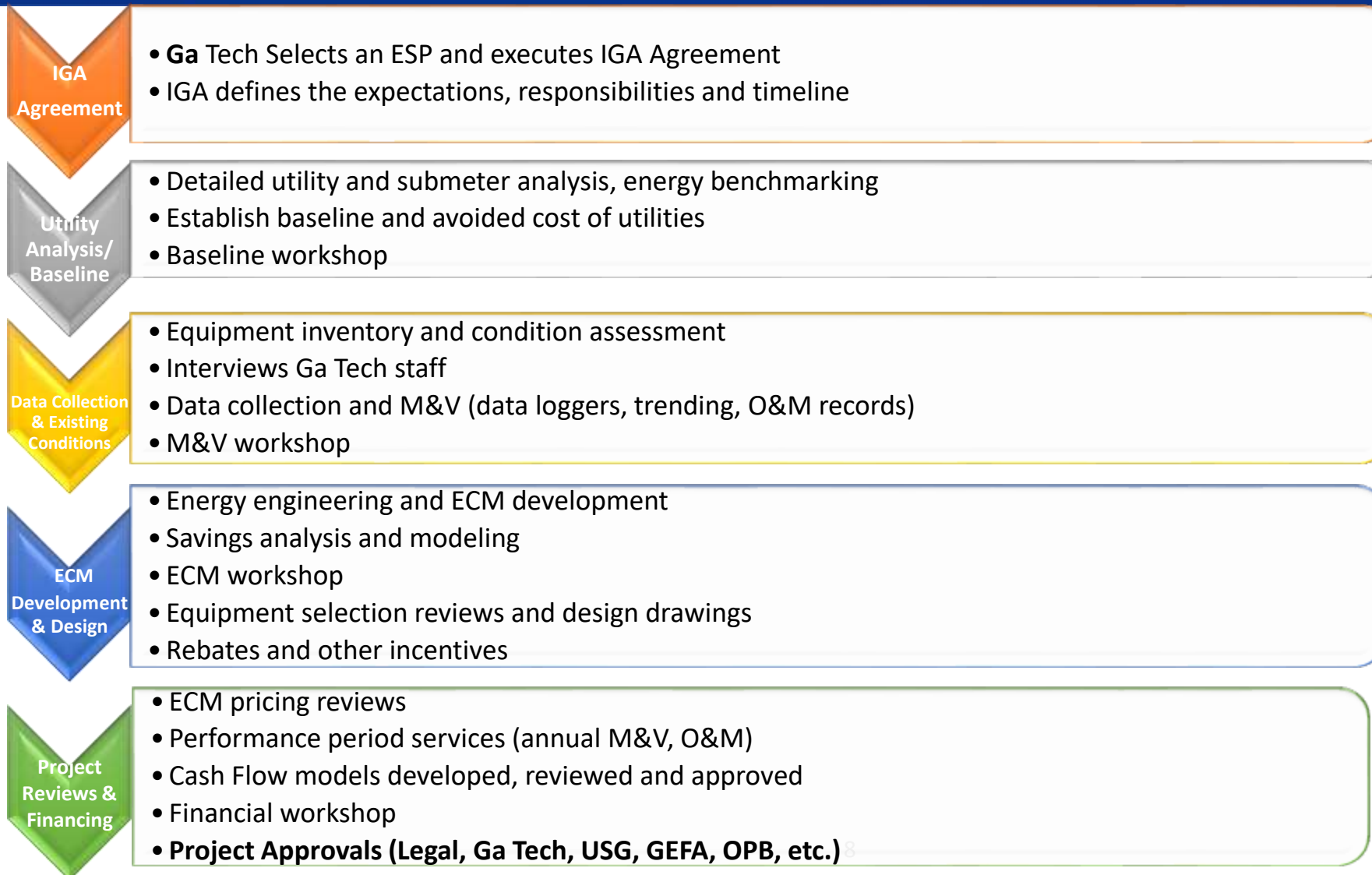


GESPC Process Steps

- State of Georgia Budget Allocation for GESPC Projects.
- Agencies submits proposals to GEFA to consider for GESPC projects
 - GEFA selects and approves Energy Savings Projects for GESPC.
 - Agencies, Issue an “Expression of Interest” (Eoi) to the State of Georgia Pre-Approved ESCO’s (Energy Saving Companies)
 - Agency advertise proposals for IGA (Investment Grade Audit) from the submitted Expression of Interest ESCOs
 - Agency evaluates and selects the best and most appropriate IGA proposal
 - Agency Signs GESPC contract, Borrows Money from Bank
 - Construction of ECMs
 - Annual M&V and Review any required contractual changes.
 - Evaluation Report of Saving vs Cost
 - Was the Savings equal to or greater than Guaranteed Savings In GESPC
 - Repeat Annual M&V and Review any required contractual changes, until completion of GESPC contract.



What to Expect During the IGA





Georgia Tech's Scope Summary

Description
ECM-1 Holland Chilled Water Plant Optimization to Reduce kw/ton of Cooling Produced
ECM-2 Holland Plant Cooling Tower Water Use Reduction, Added New Well and water treatment
ECM-9 Chilled Water Delta-T Corrections in 3 buildings for Chiller Plant Efficiency Improvement
ECM-12 Replace Water Cooled Bearings on Blower Fan Motors (2)
ECM-13 Compressor Cooling
ECM-14 to Improvements to Evaporation Sewer Credits
ECM-3 10th Street Chilled Water Plant Optimization to Reduce kw/ton of Cooling Produced



Benefits to be Received from the GESPC

Financial

- *\$13,176,201 guaranteed savings over the 7 year term*
- *Year 1 savings of \$1,674,895*
- *Net positive cash flow in year 1 of \$204,003 after loan payments*
- *An additional **\$500,000** in utility one time rebate not included in the first year savings*

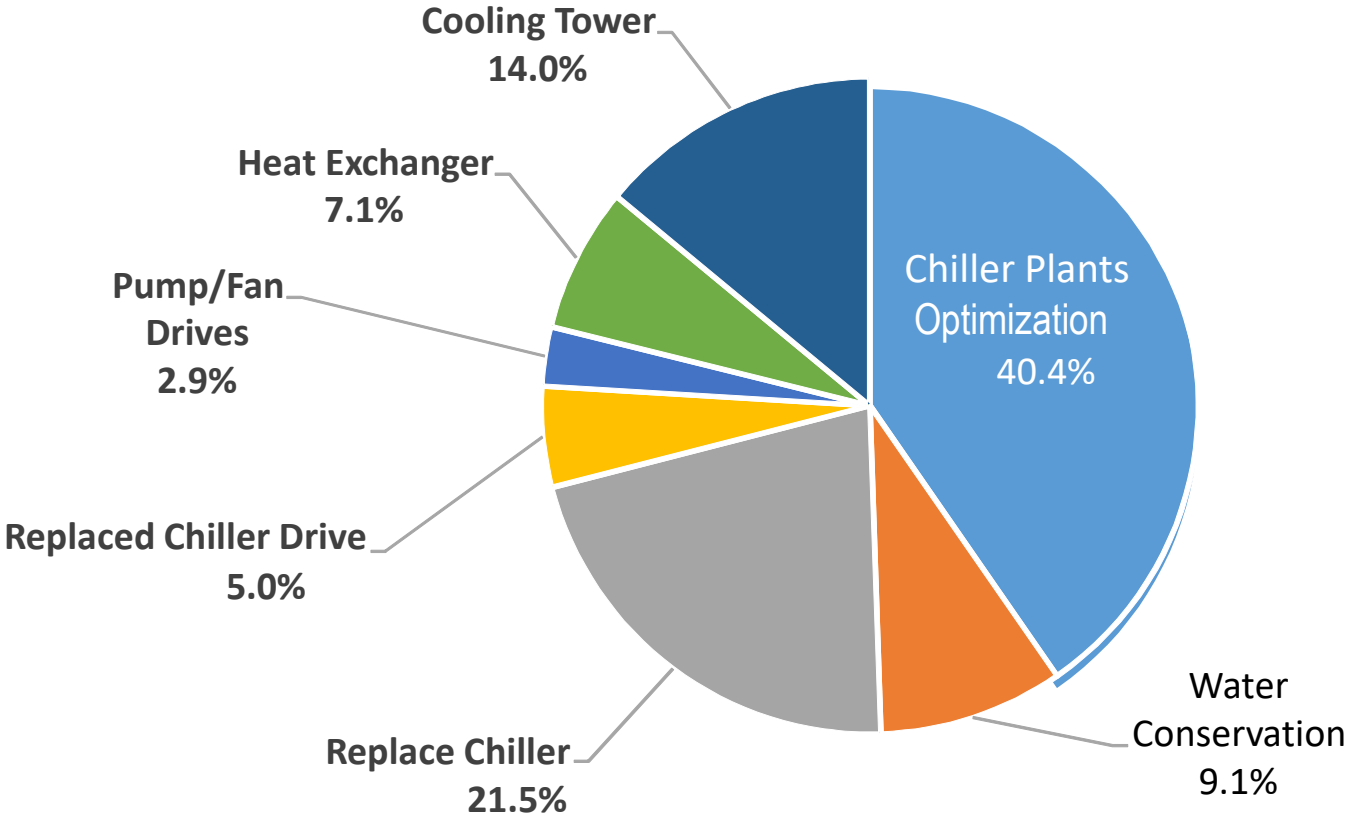
Operational

- *New chillers at Holland Plant*
- *Installed in Holland Plant and in 10th St. Chiller Plant Advanced Optimization control system.*
- *Convert from primary/secondary to variable flow secondary pumping in Holland and 10th St. Chiller Plants*
- *Implemented Continuous Remote Monitoring and reporting.*



Addressing the Needs of Georgia Tech

Project Cost Breakout





Annual M&V with Consultant Oversight

- Annual Measurement & Verification of Contract Projected savings vs. Operational Contract Savings.
- **Annual/Quarterly Calibration** of measurement devices/instruments/meters
- Schedule inspections of new/existing equipment.
- **Continuous Monitoring** of Optimization System and Chiller Plant's Operations and Efficiency with **continuous reporting by Consultant.**
- **Continuous monitoring** of Water treatment system for well water treatment by **Consultant**
Emailing Monthly Reports

Financial Summary

Contract Projected Savings per Year

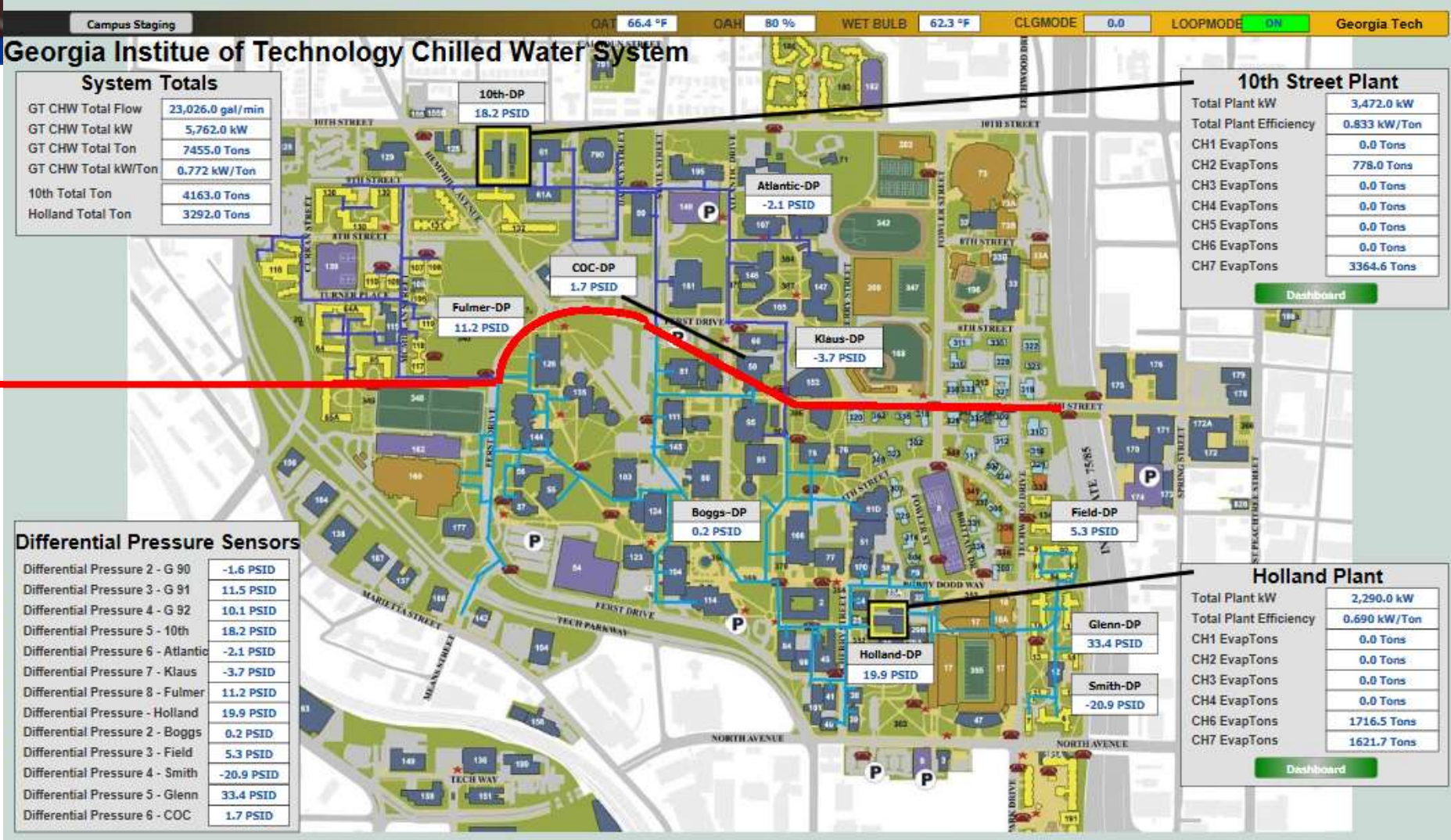
Year ³	Utility Savings ⁴	Operational Savings ⁵	Total Projected Savings	Total Guaranteed Savings	ECM Continuing Services ⁶	Debt Service Payments	Total Cost	Net Cash Flow ⁷
1	\$1,857,828	(\$15,011)	\$1,842,817	\$1,674,895	\$249,812	\$1,221,080	\$1,470,892	\$204,003
2	\$1,929,402	(\$15,311)	\$1,914,091	\$1,739,700	\$257,306	\$1,221,080	\$1,478,387	\$261,314
3	\$2,003,734	(\$15,617)	\$1,988,116	\$1,807,007	\$265,026	\$1,221,080	\$1,486,106	\$320,901
4	\$2,080,929	(\$15,930)	\$2,065,000	\$1,876,913	\$272,976	\$1,221,080	\$1,494,057	\$382,856
5	\$2,161,099	(\$16,248)	\$2,144,850	\$1,949,517	\$281,166	\$1,221,080	\$1,502,246	\$447,271
6	\$2,244,357	(\$16,573)	\$2,227,783	\$2,024,925	\$289,601	\$1,221,080	\$1,510,681	\$514,244
7	\$2,330,822	(\$16,905)	\$2,313,917	\$2,103,244	\$298,289	\$1,221,080	\$1,519,369	\$583,875
TOTAL	\$14,608,171	(\$111,596)	\$14,496,575	\$13,176,201	\$1,914,175	\$8,547,561	\$10,461,736	\$2,714,465

Contract M&V Savings FY June 1st to Jan 1st

	CONTRACT SAVINGS					COSTS		TOTAL	
Year ³	Projected Utility Savings ⁴	Projected Operational Savings ⁵	Total Projected Savings	Total Guaranteed Savings	Total M&V Savings	ECM Continuing Services ⁶	Debt Service Payments	Total Cost	Net Cash Flow ⁷
FY-17 ¹¹	\$462,001	(\$4,503)	\$457,498	\$415,739	\$304,724	\$77,368	\$305,270	\$382,638	(\$77,914)
FY-18	\$1,509,203	\$8,370	\$1,517,574	\$1,381,163.07	\$1,152,987	\$124,906	\$610,540	\$735,446	\$417,541
TOTAL	\$1,971,204	\$3,867	\$1,975,072	\$1,796,902		\$202,274	\$915,810	\$1,118,084	\$339,627



Ga Tech Chilled Water System



10th St. Chiller
Plant Zone

Holland Chiller
Plant Zone



ECM 1 - Holland Plant Upgrades

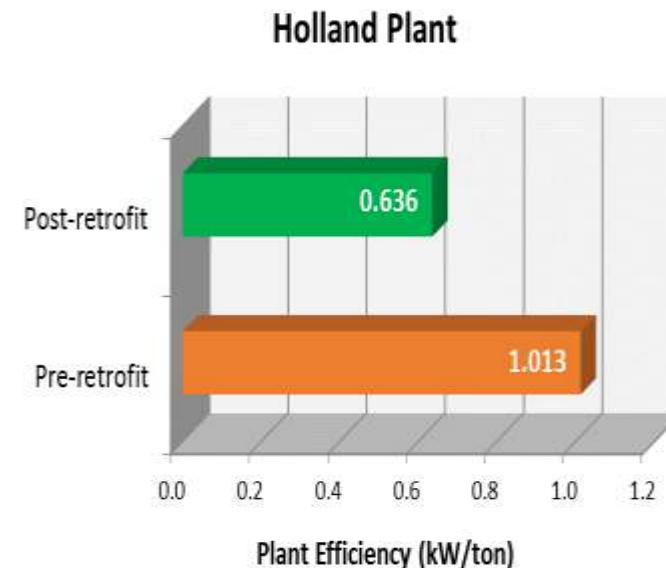


Observations:

- Plant Chillers. 4ea-CSD 1000T, 3 ea-CSD 2000T, = total 10,000T
- Constant flow primary – variable secondary CHW system design
- (2) 1060 ton chillers nearing end of useful life
- None of the chillers equipped with a VFD
- No water-side economizer currently in place
- ABB Infi Bailey 90 PLC based plant control system

Proposed Upgrades:

- Remove (2) existing McQuay chillers (#5 & 6) 2ea CSD1000 Tons
- Install (1) new 2000 ton high efficiency chiller with a VFD
- Install (1) new 4160V remote mounted VFD on chiller #7
- Convert CHW and CW systems to variable flow
- Implement chiller, tower, and pumping dispatch strategies
- Install new water well and water treatment for cooling towers.
- Install Plant Optimization system over existing plant control system
- Another project added 1ea-VSD2000T
- Chillers: 2ea-CSD1000 Tons, 2ea-VSD2000 Tons, 2ea-CSD 1989Tons, 1ea-VSD 1978 Tons,
- Total Plant Capacity 11.956 Tons





ECM 3 - 10th Street Plant Upgrades



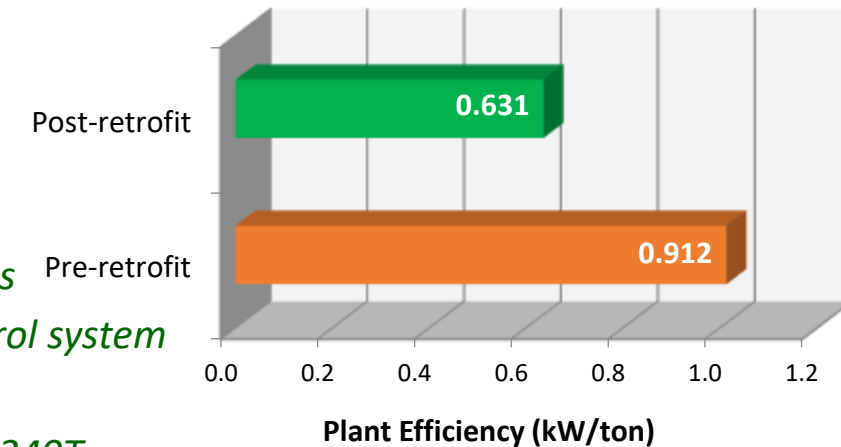
Observations:

- Constant flow primary – variable secondary CHW system design
- Chiller #7 (3000 ton York) is equipped with a VFD
- (2) 1500 ton York chillers are approaching end of useful life
- Water-side economizer in place
- ABB Infi Bailey 90 PLC based plant control system

Proposed Upgrades:

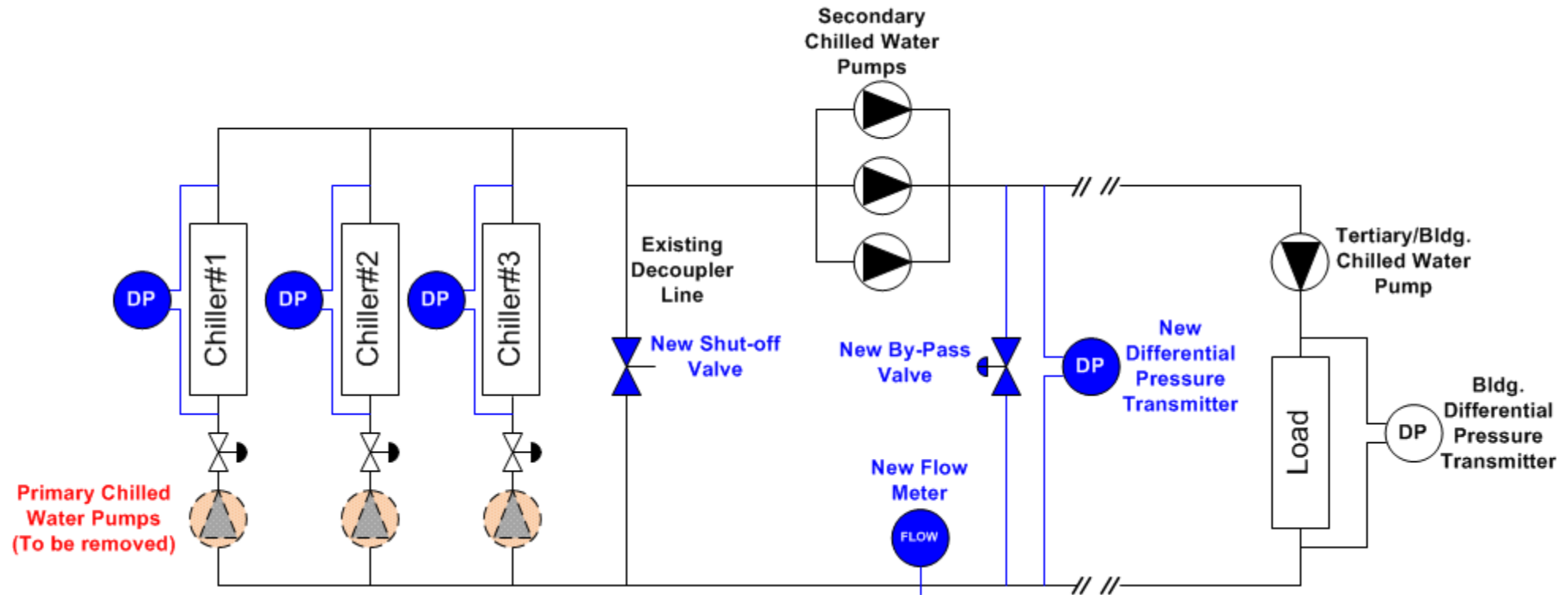
- Convert CHW and CW systems to Variable Flow
- Implement chiller, tower, and pumping dispatch strategies
- Install Plant Optimization system over existing plant control system
- Chillers
 - 2ea-CSD1500 Tons, 2ea-CSD1978 Tons, 1ea-CSD2240T, 1ea-CSD3000 Tons, 1ea-VSD3000 Tons
 - Plant Total 15,196 tons

10th Street Plant



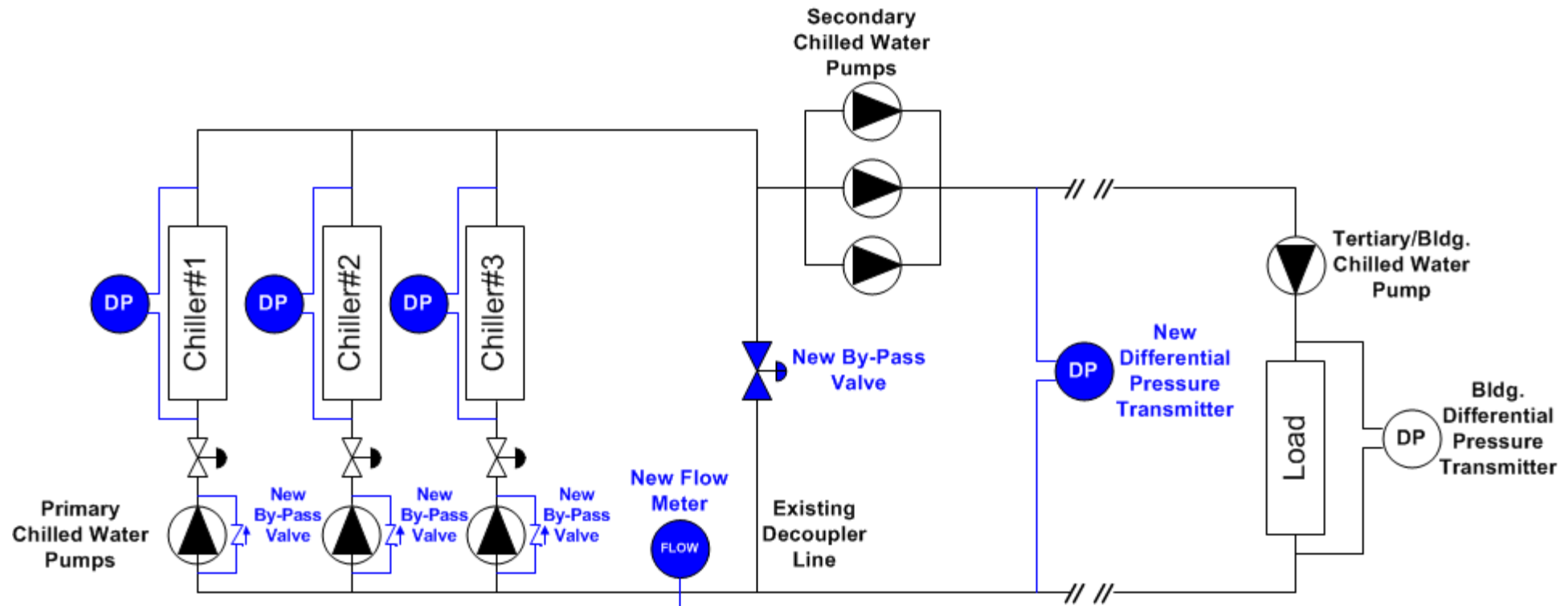


Variable Primary CHW System



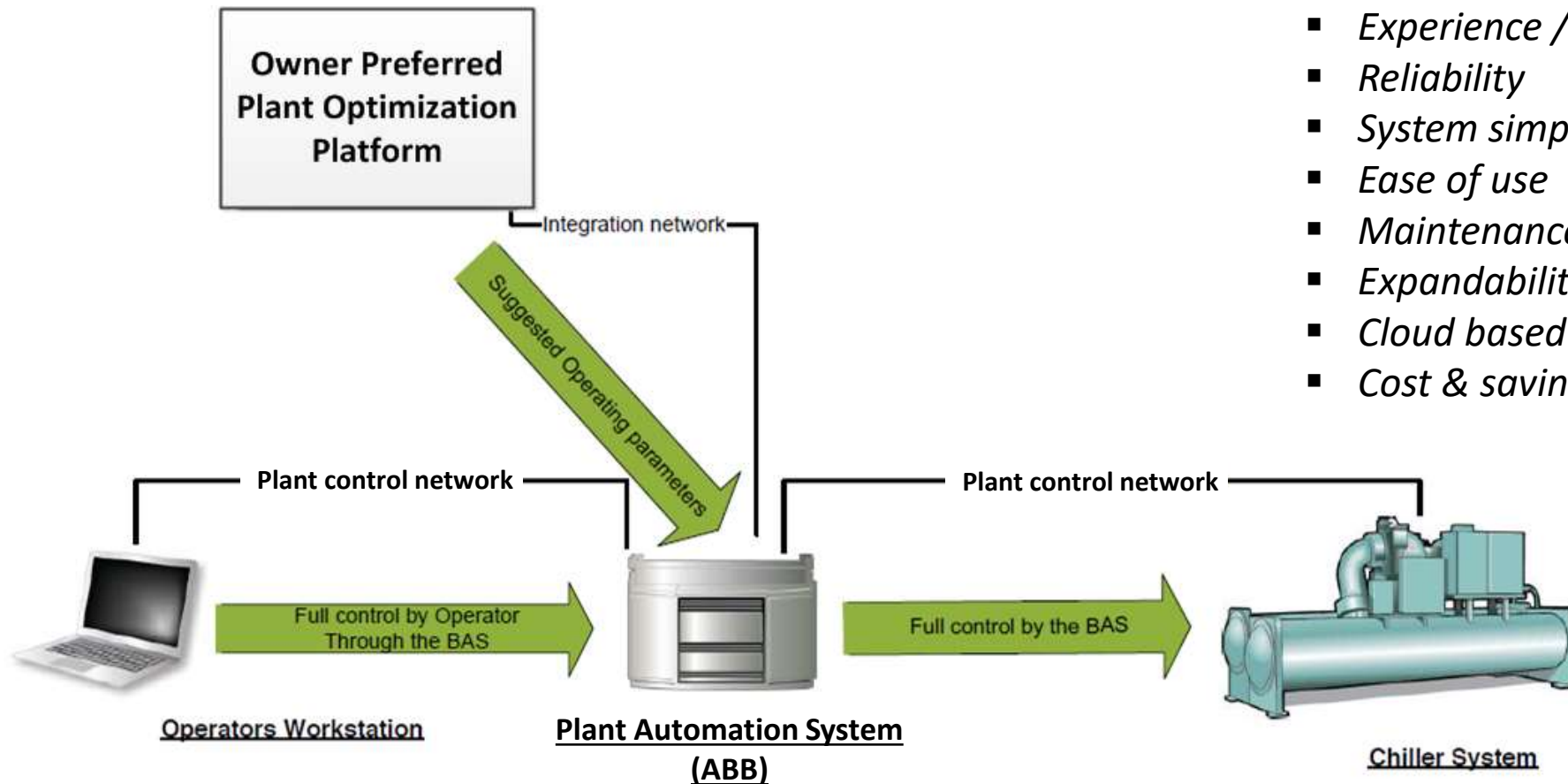


Hybrid Variable Primary CHW System





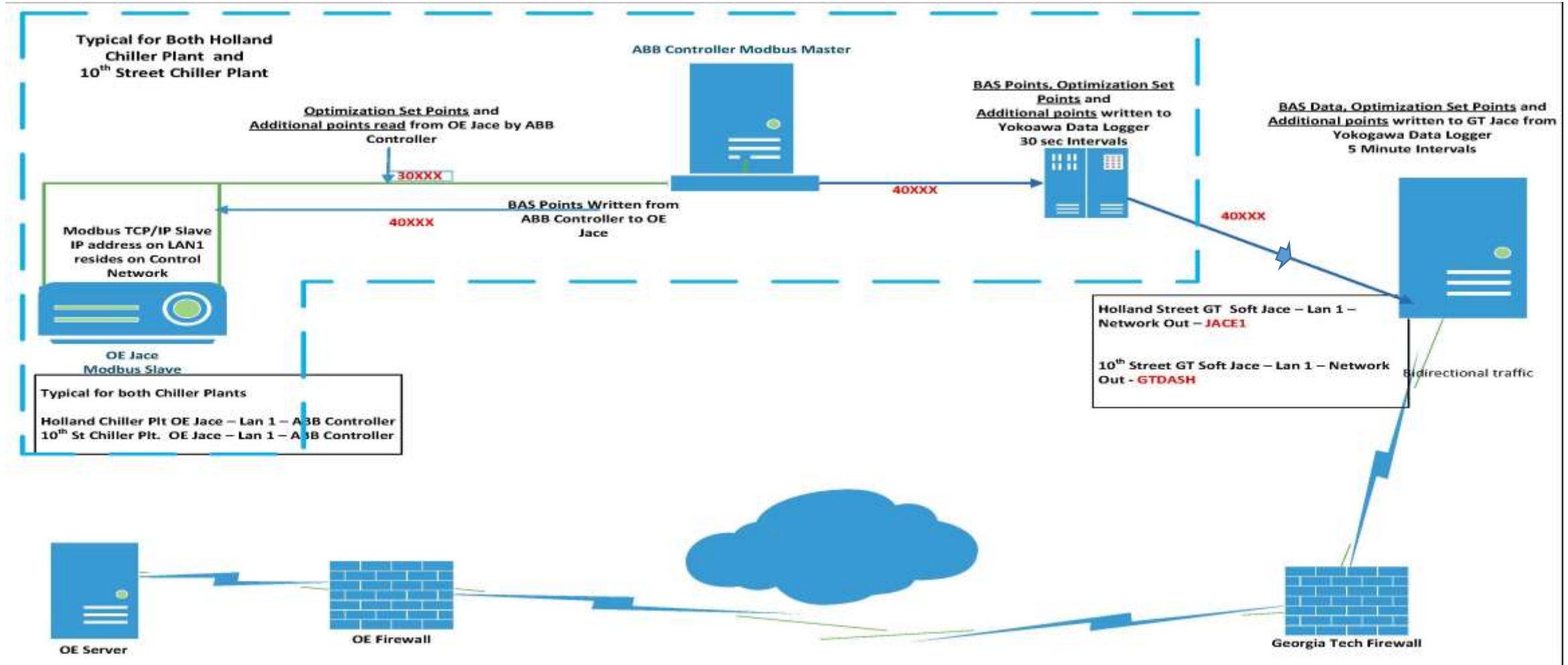
Plant Optimization Platform Selection



- *Experience / track record*
- *Reliability*
- *System simplicity*
- *Ease of use*
- *Maintenance requirements*
- *Expandability*
- *Cloud based / onsite solution*
- *Cost & savings*

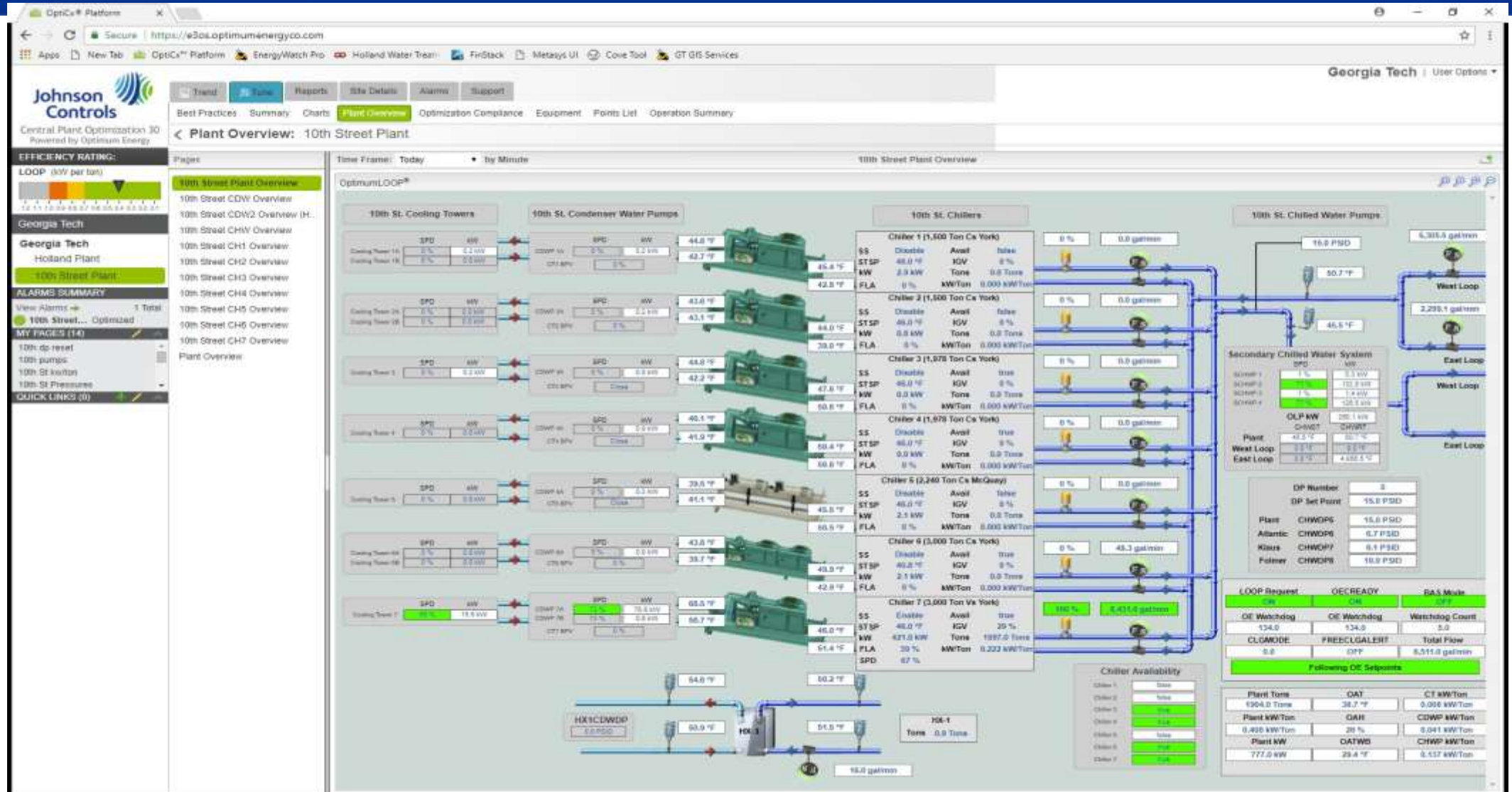


Continuous Remote Monitoring without Direct Communications.



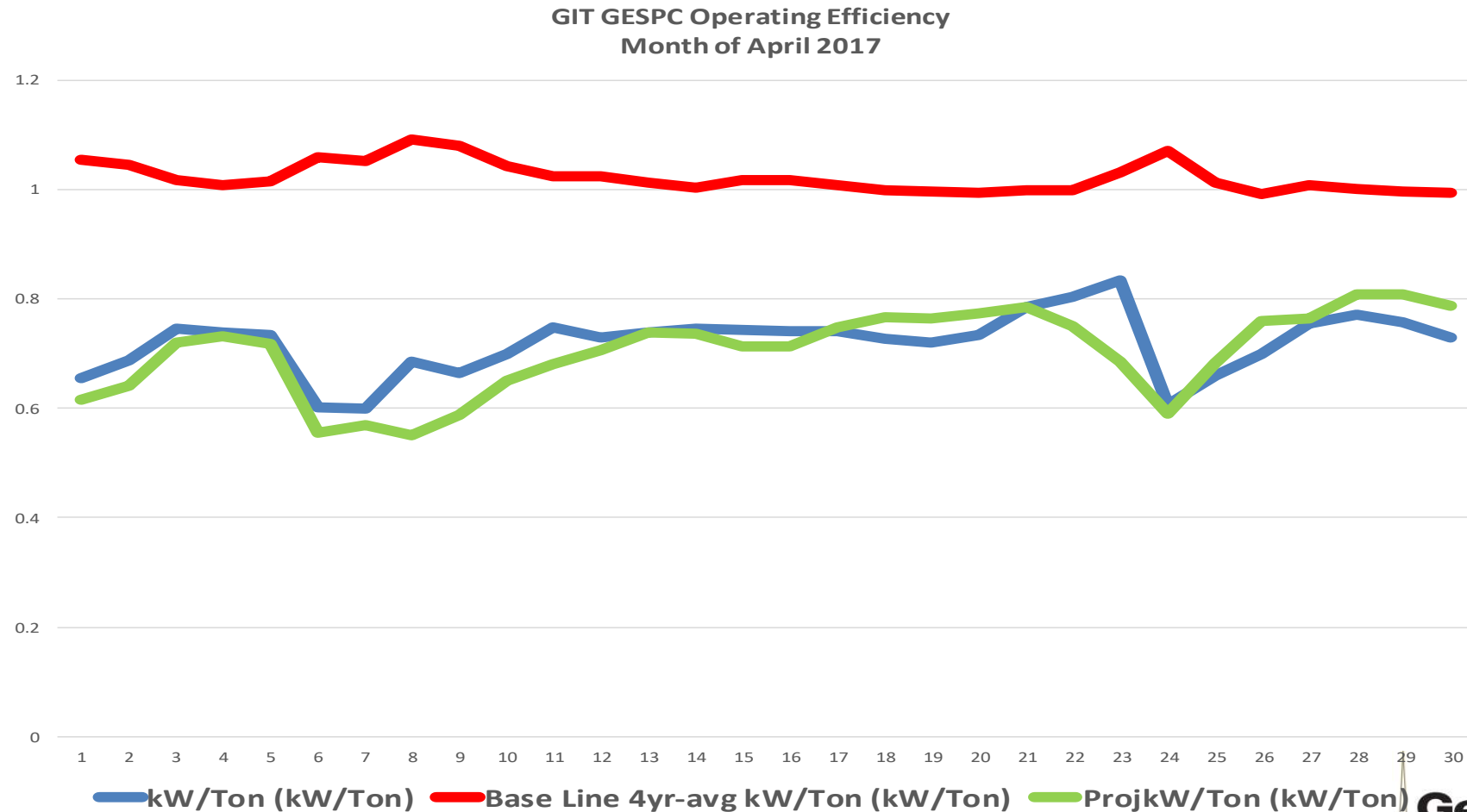


Remote Monitoring & Reporting





Online Monitoring & Reporting



ECM 9 - Delta-T Improvements

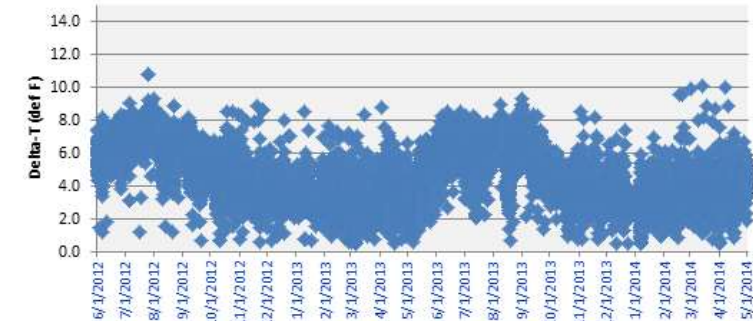
Observations:

- Low Delta-T prevents full loading of operating chillers and causes premature staging of chillers
- Low Delta-T could be caused by a combination of:
 - Chilled water flow through the chiller plant de-coupler line
 - Insufficient heat transfer through AHU chilled water coils
 - 3-way chilled water valves / wild coils with no valves
 - High building chilled water differential pressure lifting valves
 - Other controls issues (setpoints, sensor calibration etc.)

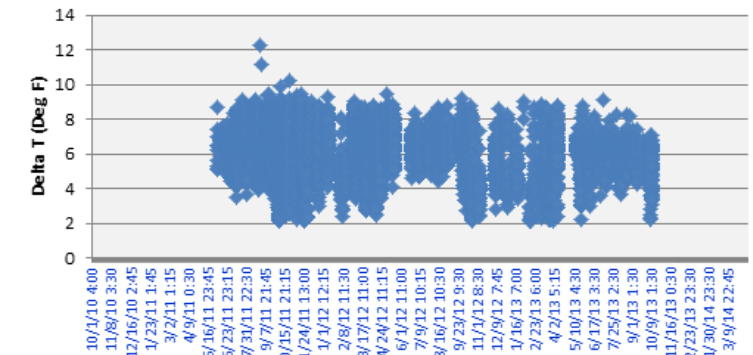
Proposed Upgrades:

- Investigate and address underlying issues on the chilled water load side that are responsible for Low Delta-T syndrome for the comprehensive optimization of the campus chilled water system

Holland Plant East Loop Delta-T

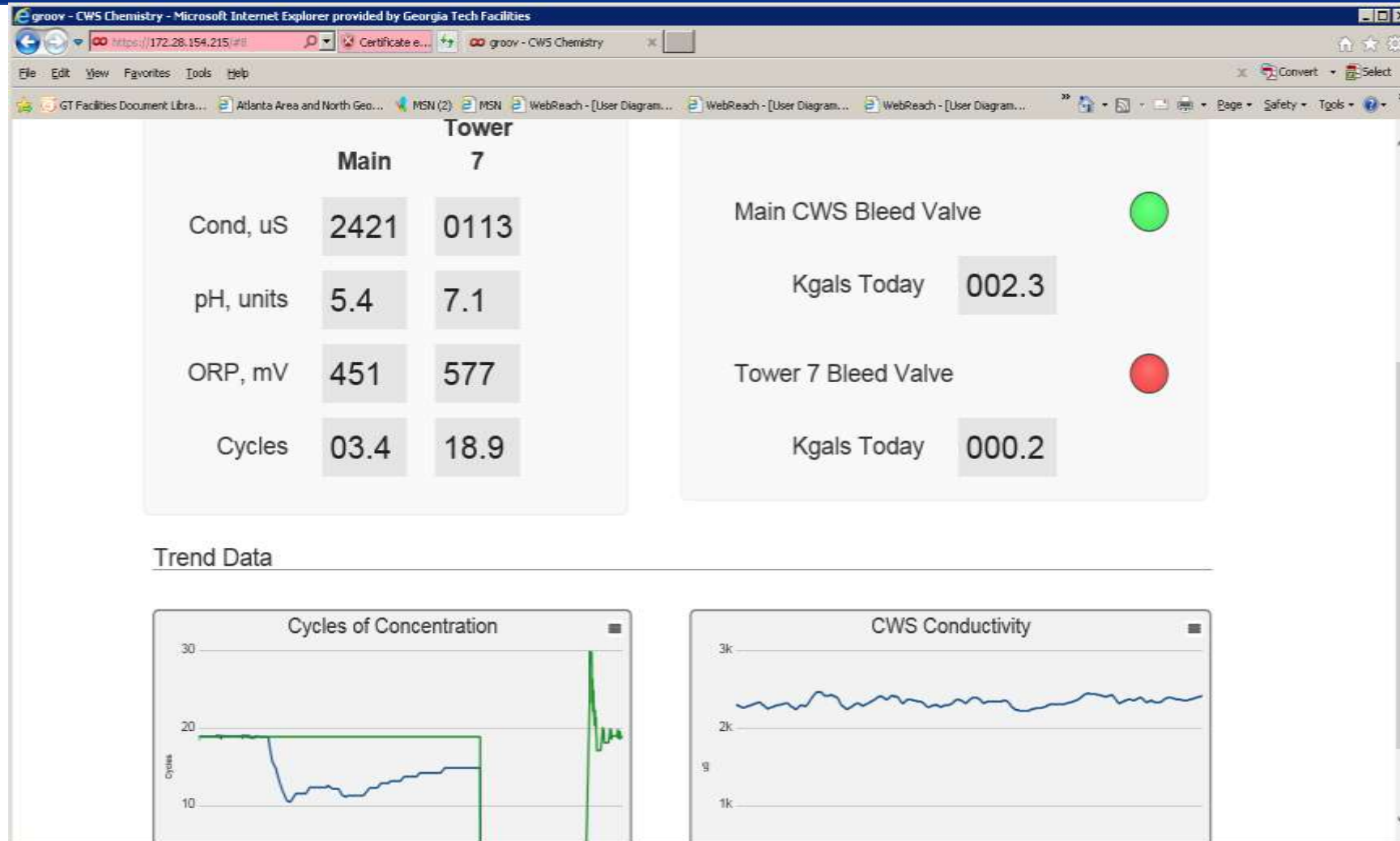


10th Street Plant - Chiller#1 Evaporator Delta-T





Online Monitoring & Reporting





Annual M&V with Consultant Oversight

With Change comes Challenge, Lessons Learned

- Adjustments required to the Baseline due to lack of well water and chiller addition
- Running the plant in hand got more difficult
- Keeping the plant in OE mode
- Finding latent issues when running the chillers more dynamically
- Use of waterside economizer at 10th St

Conclusion's:

- GESPC
 - Provided means & methods to finance a large project over mutable years.
 - Provided validated savings of energy and money.
 - *\$13,176,201 guaranteed savings over the 7 year term*
 - *Net positive cash flow in year 1 of \$ 204,003 after loan payments*

