Agenda

• Brief Thermo Systems Introduction
• Project Introduction
  • Facilities Overview, Drivers, and Goals
• Design and Implementation Strategies
• Dashboard Reporting and Billing Enhancements
• Project Outcome
• Take Away Points
Thermo Systems is a national full-service automation and information provider, excelling in design-build control systems engineering and specializing in managing and delivering turnkey projects for our EPC & AE partners.

We ensure success by serving as a project life-cycle partner, acting as a single point of responsibility from start to finish and providing dedicated support along the way.

- 85+ employees and growing
- Privately held by founding partners who are active in the day-to-day operation
- New Jersey based LLC founded in 1998
- Offices nationwide

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Site Introduction

Midtown Thermal Control Center (MTCC)
Site Introduction

**Midtown Thermal Control Center (MTCC)**

**Energy Distribution System**
- 4 miles of steam and chilled water piping
- Fiberoptic controls throughout system
- Steam header leaving the plant - 20"
- **Chilled water header leaving the plant - 42"**

**Energy Transfer Stations**
- 13 chilled water and steam heat exchangers located at various locations within customer sites
- Transfer point of product for billing
- Chilled water delivered at 42°F
Utility assets and infrastructure include:

- **Chiller Plant**
  - Fourteen (14) chillers with 16,200-ton capacity
  - 40,000 GPM pumping capacity with 42°F production temperature

- **Boiler Plant**
  - Three (3) saturated steam boilers with 220,356 lb/hr capacity

- **Cogeneration Plant (CHP)**
  - 5.5 MW of generation with 72,000 lb/hr steam generation

- **Customer District Energy Loop**
  - Thirteen (13) Energy Transfer Stations (ETS) with dedicated metering PLCs
Chiller Plant Optimization/Controls Retrofit Drivers:

- Reduce costs of goods sold (COGS)
- Reduction of energy usage and increase in efficiency
- Consistent operational standards of chiller plant
- Corporate mandate to reduce carbon footprint
- Poor visibility of remote buildings
- Proprietary/highly manual billing systems
- Multiple independent systems controlled by one DCS processor

Chiller Plant Optimization/Controls Retrofit Goals:

- Improve overall operational efficiency
- Reduce electric consumption by 20% (9,000,000 kwh)
- Maximize asset deployment
- Non-proprietary/scalable system that would require minimal operator interaction/training
Project Approach

Bottom-up and Phased Approach

Field Level Instrumentation

Floor Level Controllers
ETS Level Controllers

Plant Level Integrated SCADA System

Plant Level Optimization System

Enterprise Level Billing System
Enterprise Level Visualization and Reporting System
Step 1: Controls Retrofit

- A robust and resilient plant control system (PCS) required design and phased implementation
  - Needed to minimize downtime for minimal customer interruptions to service
  - Developed transition plan for phased implementation after complete design coordination approved:
    - DA/Boiler Feedwater
    - Boiler CCS w/ PanelView
    - Data Concentrator for ETS
    - CHW Balance of Plant (BOP)
    - Remote Terminal Units (RTUs)
    - New billing software via transaction manager
    - Steam metering upgrade/standardization
Step 2: Historical/Asset Data Collection
- Collect hourly tag data for over 300 CHW BOP points for 12 month period to ensure multiple season review
  - Used for basis of benchmarking, current operating conditions, and data comparisons
- OEM asset data sheets to develop compressor maps and pumps curves
- Measurement and Verification (M&V) on existing assets
- Report development of potential savings/return on investment (ROI)

Step 3: Equipment Upgrades
- VFDs added to cooling tower fans
- VFDs added to condenser water pumps
- Additional flow/temperature for CHW and steam added for accuracy and data collection
Step 4: Utility Rebate

- The optimization team and owner coordinated and applied for the efficiency rebates after the M&V and ROI were performed.

Step 5: System Integration

- Optimization platform was integrated with the upgraded PCS for the overall controls/efficiency upgrade as a phased approach:
  - Sandbox testing of algorithm (software factory acceptance test)
  - Manual driving/manipulation of plant assets with algorithm
  - Automation control of chiller plan – 100% hands off from operations
Step 6: Dashboarding and Reporting

- Monitors installed around plant and executive area to display pertinent dashboards, real-time, and historic reports
- Actual chiller data performances displayed including:
  - Approach temperatures/pressures
  - Energy utilization
  - District chilled water parameters from ETS
PCS Controls Enhancement

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Dashboard & Reporting

Percent Saving over 2011: 62.8%
Instant Demand Saving: 1332.9kW

Plant Power: 705.6 kW

GPM/Cell: 1006.6
Command Speed: 10.00%

Atlantic City
18°F
Light Snow
TWO NPS

CWR: 35°F
CWS: 51°F
CWP Flow: 855.2 gallons/minute
PRF Flow: 6140 gallons/minute

Capacity: 2426.8 Tons

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Dashboard & Reporting

MTCC Plant Chilled Water System Performance

- Chiller 1 KW/TON: 0.00
- Chiller 2 KW/TON: 0.00
- Chiller 3 KW/TON: 0.00
- Chiller 4 KW/TON: 0.00
- Chiller 5 KW/TON: 0.47
- Chiller 6 KW/TON: 0.56
- Chiller 7 KW/TON: 0.00
- Chiller 8 KW/TON: 0.58

Total Plant KW/TON: 0.78

Total Plant Consumption KW: 2661

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Dashboard & Reporting

Taj Mahal Plant KPI

Chiller 1 KW/TON 0.00
Chiller 2 KW/TON 0.00
Chiller 3 KW/TON 0.00
Chiller 4 KW/TON 0.00
Chiller 5 KW/TON 0.00
Chiller 7 KW/TON 0.72
Chiller 8 KW/TON 0.91

Chiller 1 Tons 0
Chiller 2 Tons 0
Chiller 3 Tons 0
Chiller 4 Tons 0
Chiller 5 Tons 0
Chiller 7 Tons 910
Chiller 8 Tons 818

Plant CHW KW/TON 0.87
Plant Steam (MMBTU/Hr) 42.00

Plant Total Daily Ton-Hrs 511359
Plant Steam Daily MMBTU 463

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Key Savings Metrics:

• Reduced chiller plant kw/ton from 0.83 to 0.64
• Reduced electric consumption by 10,000,000 kwh/year
• COGS reduction of $500,000+/year
• Earned $500,000 Utility rebate
• Controls retrofit performed with minimal downtime due to phased approach
• PCS/Optimization platforms went live on schedule
• Meaningful efficiency gains achieved <1 week operation
Take Away Points

- Upfront engineering for complex phased PCS retrofit, historical plant operating conditions, and asset efficiency curves served as good foundation for smooth optimization upgrade
- FATs helped to minimize troubleshooting on live system and communication requirements from PCS to optimization platform
- Provided distributed PLC system with highly accurate metering additions for robust and resilient control system/optimization platform/billing software
- Dashboard and reporting capabilities allow for quick view into the system’s operating conditions for a more high level operator interaction
Questions & Answers

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