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CampusEnergy2020
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FEBRUARY 10-14 ▲ SHERATON DENVER DOWNTOWN ▲ DENVER, CO

The University of Texas at Austin
Utilities and Energy Management

PARALLEL TES SYSTEMS: IN IT TO TWIN IT!

Optimizing parallel Thermal Energy Storage tanks at The University of Texas at Austin

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UT Austin Campus Overview

- 60,600 cooling tons capacity (main campus)
- 20M GSF, 2% added annually
- 10MGal Thermal Energy Storage (TES) capacity
- 38k tons, 66MW peak demand (2017)
- 33k tons, 60MW peak demand (2019)
- 0.69kW/Ton Avg. (2017)
- 0.59kW/Ton Avg. (2019)

A Tale of Two Tanks

- First TES Tank Commissioned in 2007
  - Four MGal, 35k ton-hr capacity
  - Manual Dispatch via Operations personnel
  - Automated via Optimum Energy in 2014
  - Benefits include enhanced efficiency, resiliency, mitigate need for new power generation at 1/10th the cost.

TES-2 Commissioned in 2017

- Six MGal, 45k ton-hr capacity
- Provides resiliency to new Dell-Seton Medical Campus
- Automated dispatch via Optimum Energy offsets 6MW peak power demand - 2019
- Hydraulic Diversity from TES-1 necessitated complex controls solutions

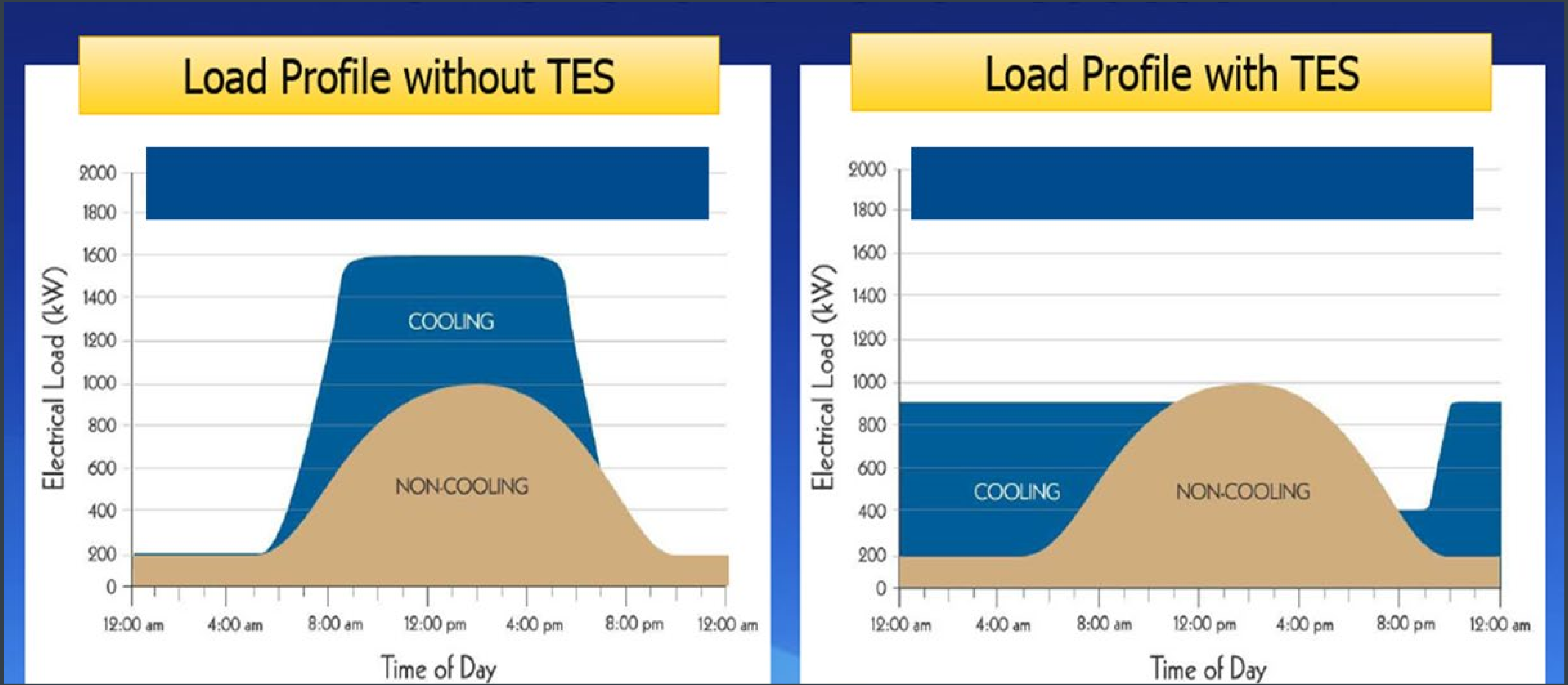
Resiliency Benefits

- Added Redundancy: TES operation can supplement outage of largest chilling station
- Allows greater dependency on newer variable speed chillers
- Finite flow variability enhances campus dP control

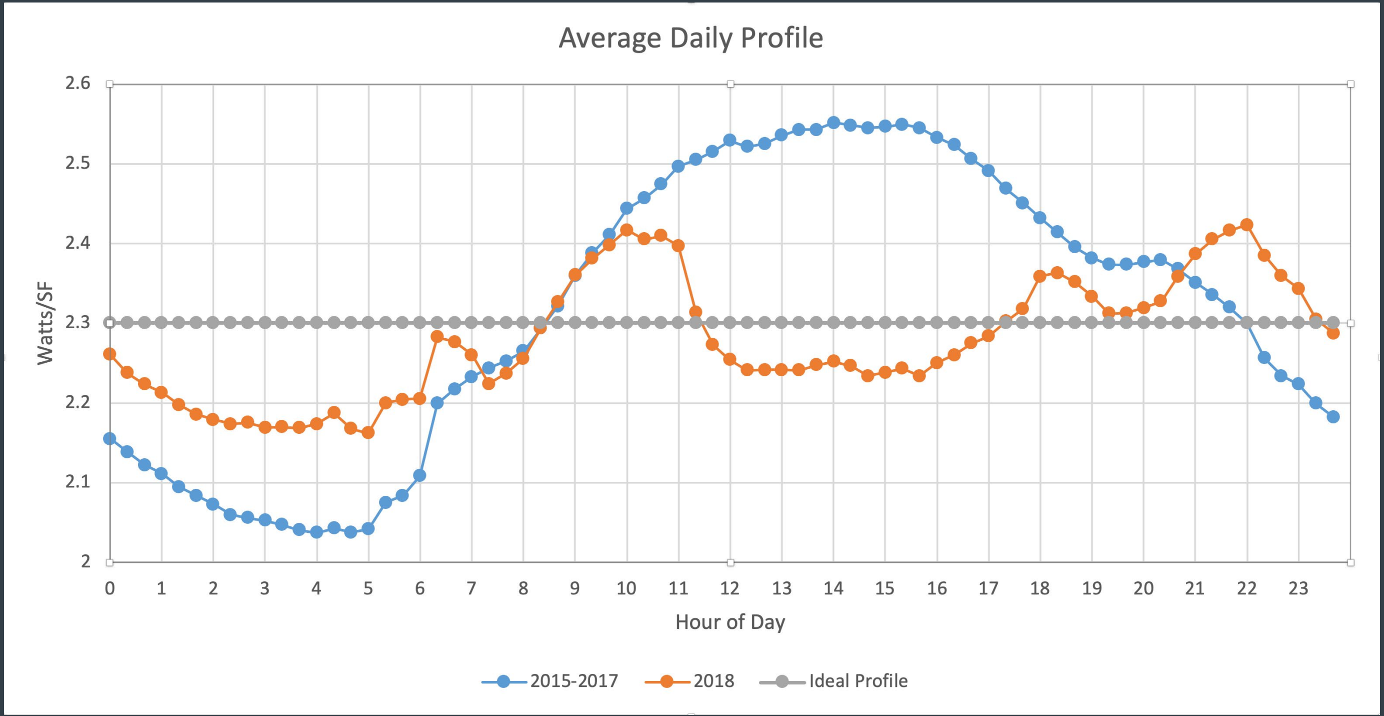
Efficiency Benefits

- Allows use of most efficient variable speed chillers
- More CHW production at night when WB depressed
- CGT’s maintain higher loads near efficiency peaks – improves heat rate
- Lengthens run time for more efficient CTG-10

Optimized Dispatch Profile - Example

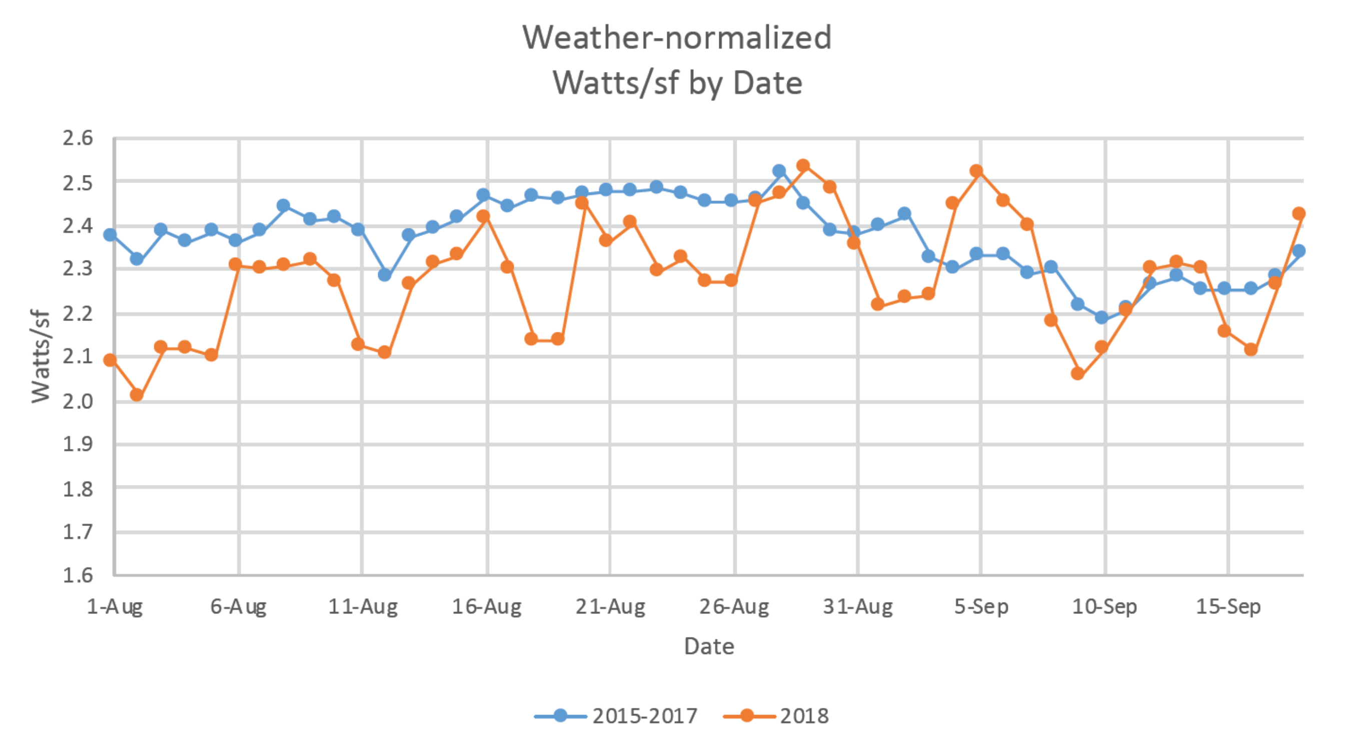


Ultimate Goal: Flat Campus Load



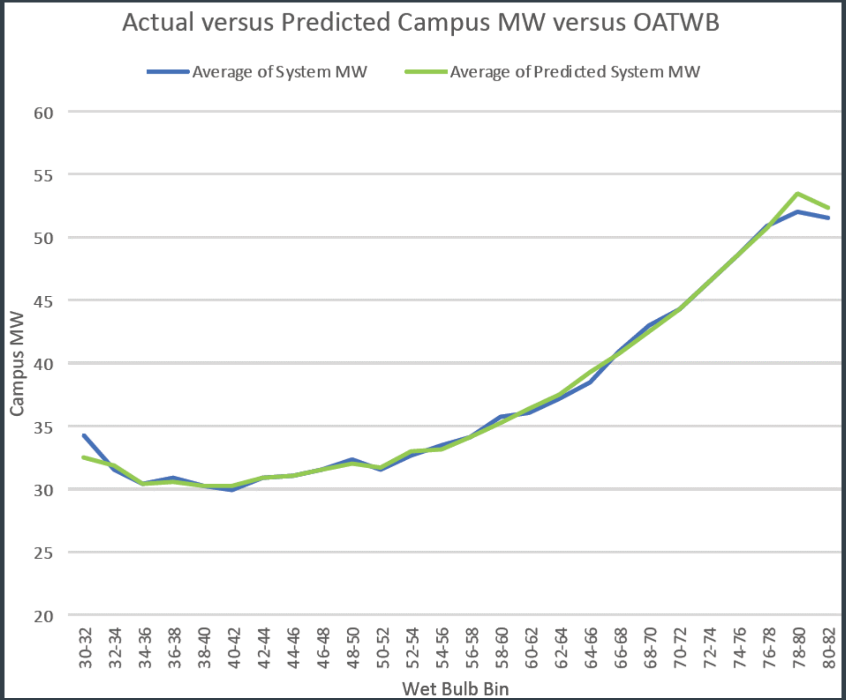
Addition of TES-2 with improved dispatch controls strategy flattens UT Austin's electrical load profile within a 10% bandwidth.

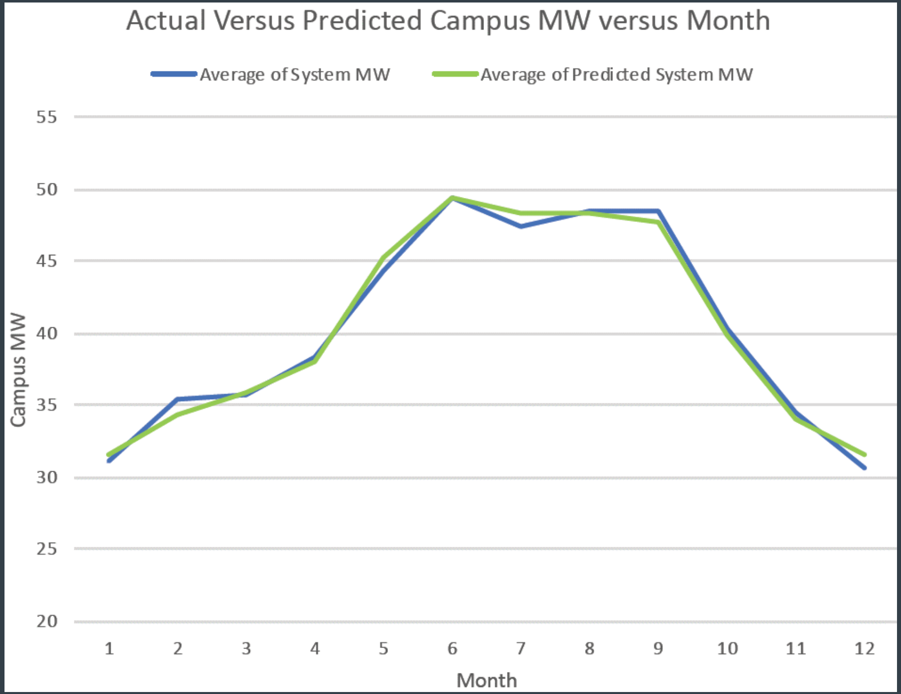
Realized Efficiency Gains



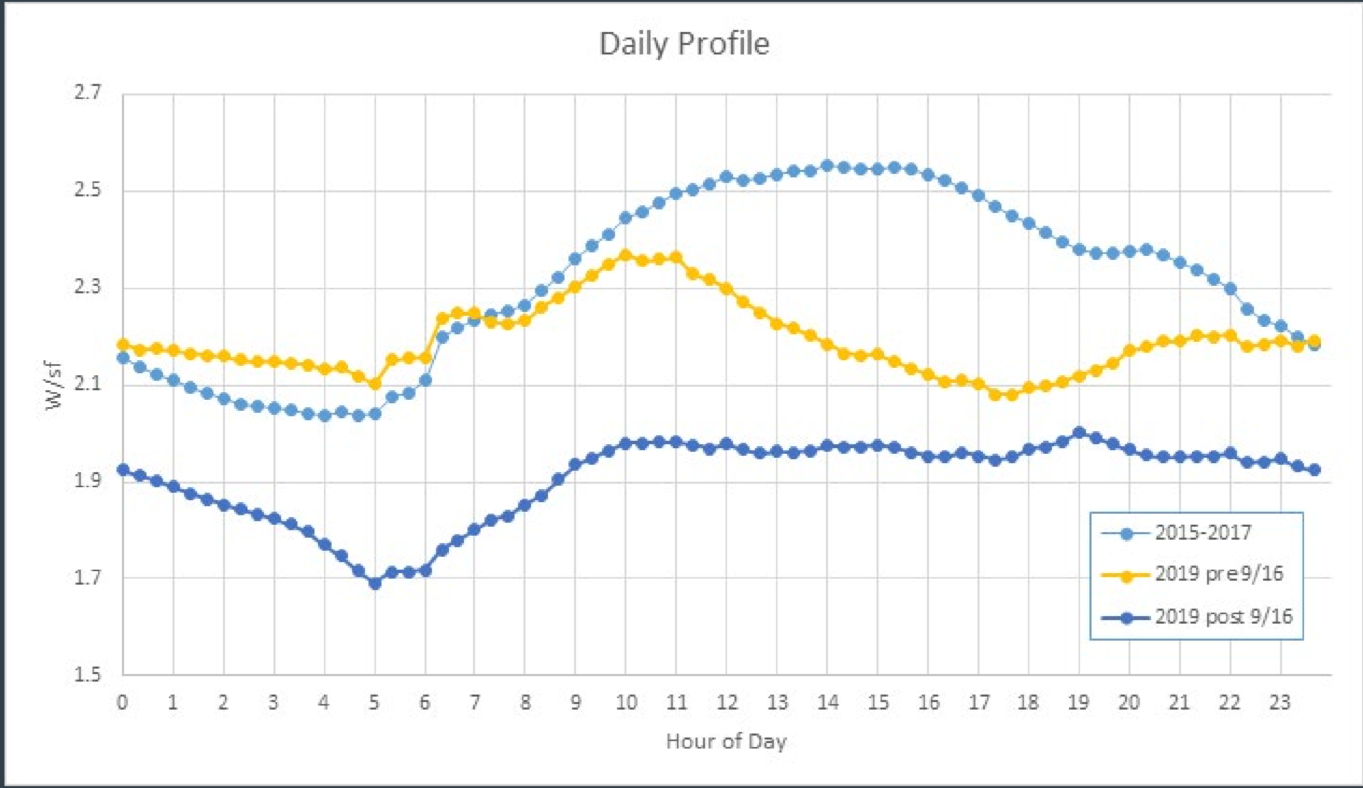
Normalized space energy use over similar occupancy and weather conditions highlight the reduction in fuel gas consumption.

Regression Modeling



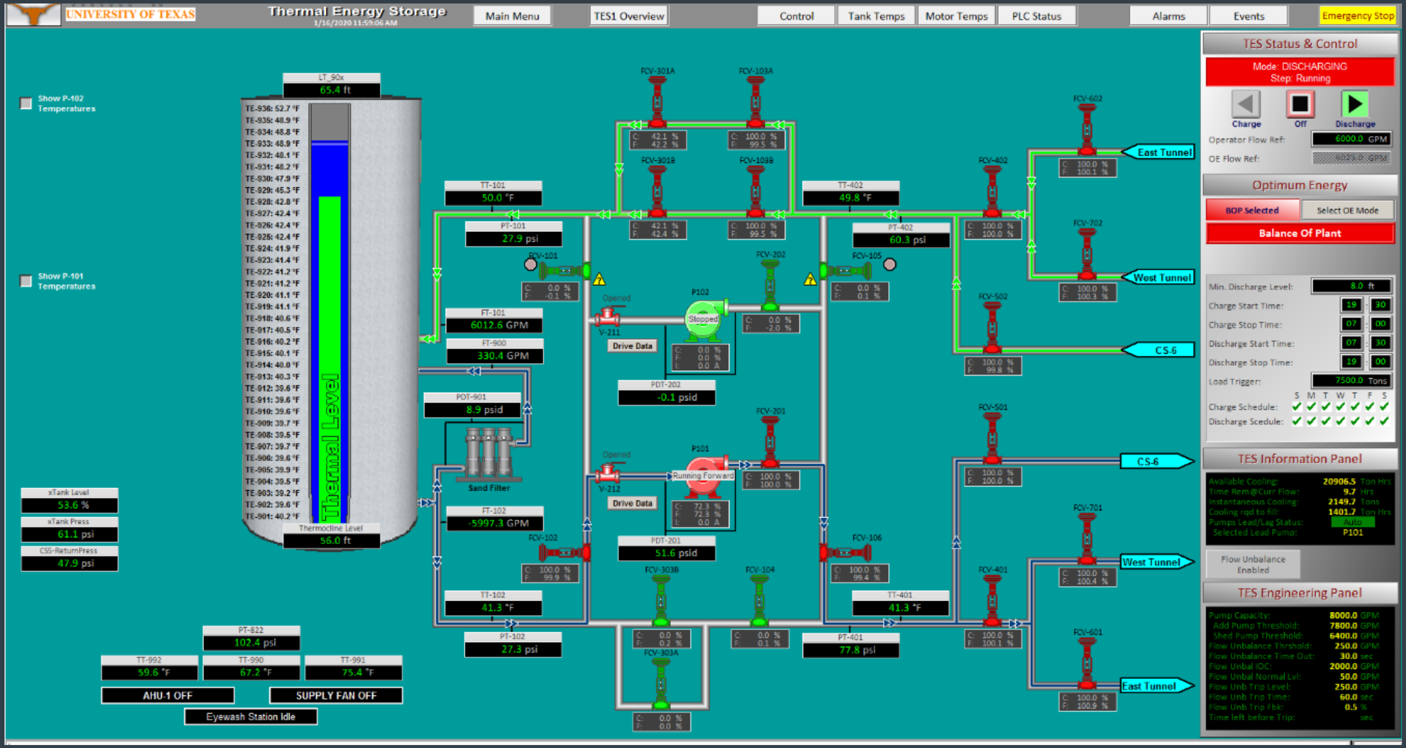


Regression-based Optimization



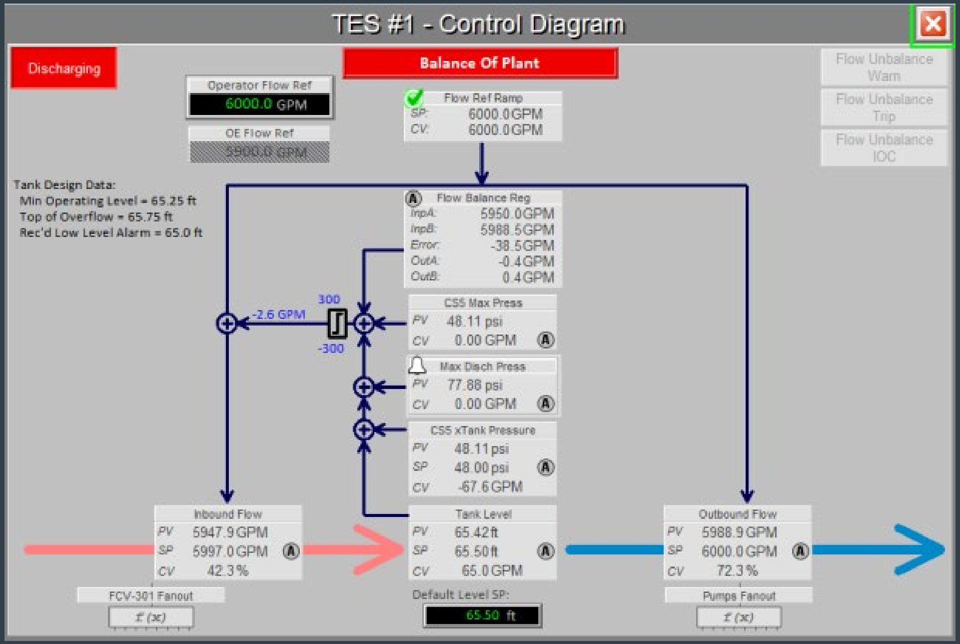
Three phases of TES dispatch optimization highlight achieving ultimate goal of flat electrical generation load profile.

Controls Strategy

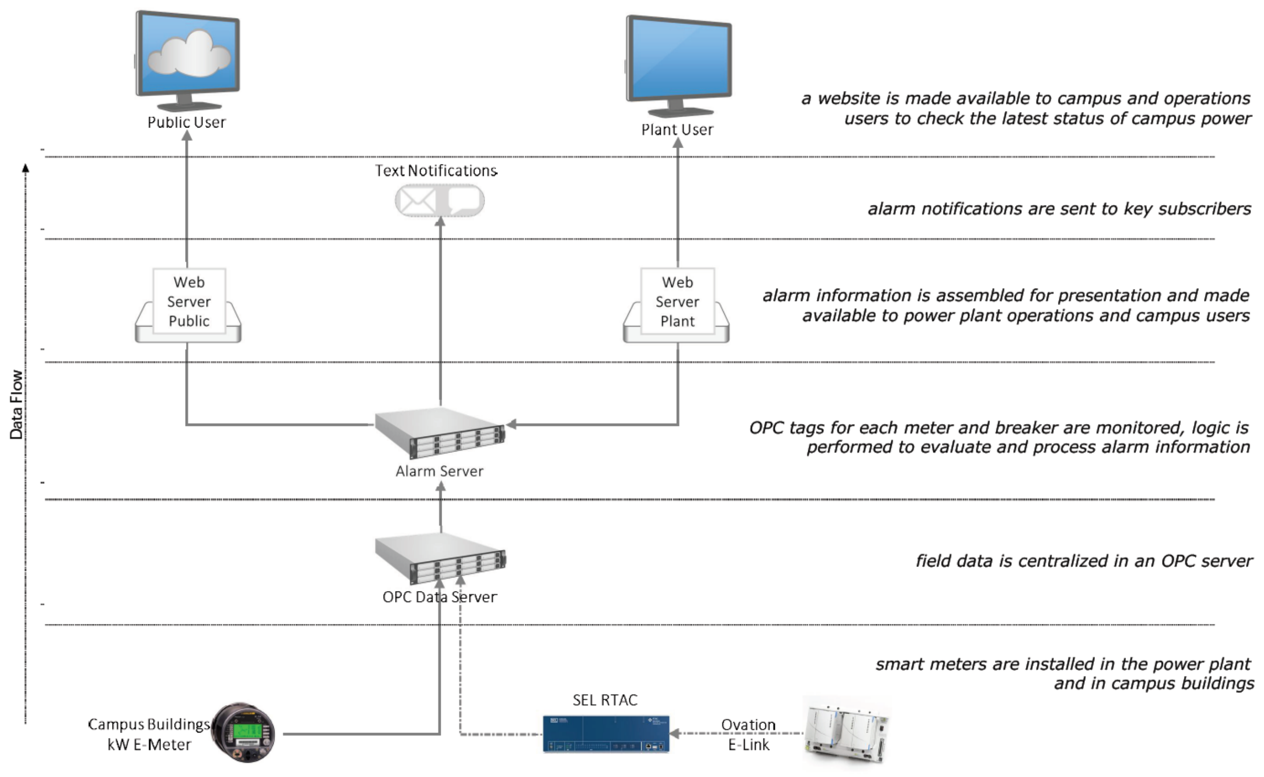


Controls Strategy

- Push-Pull Controller
  - Pump – Outflow
  - Valves – Inflow
- Flow bias (Negative = flows out more)
  - TES tank level
  - CS5 exp. Tank pressure
- Safety Interlocks (time-inverse)
  - CHWS pressure
  - CS5 CHWR pressure



Controls/Network Topology



Lessons Learned

- Relational Controls inadequately responsive.
- Future-proof – Beneficial system will eventually be essential system.
- Overlapping goals require prioritization and compromise.
- Tanks are beautiful – to engineers.
- Maintenance planning/scheduling still critical.
- Regression modeling requires trial and error.

Questions?

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Thank You!

…and please feel free to reach out to us.

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