
CampusEnergy2021
BRIDGE TO THE FUTURE
Feb. 16-18 | CONNECTING VIRTUALLY
WORKSHOPS | Thermal Distribution: March 2 | Microgrid: March 16

REDUCING ENERGY CONSUMPTION EVEN WITH 20% CAMPUS GROWTH

The University of Texas at Austin
Utilities and Energy Management

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CampusEnergy2020
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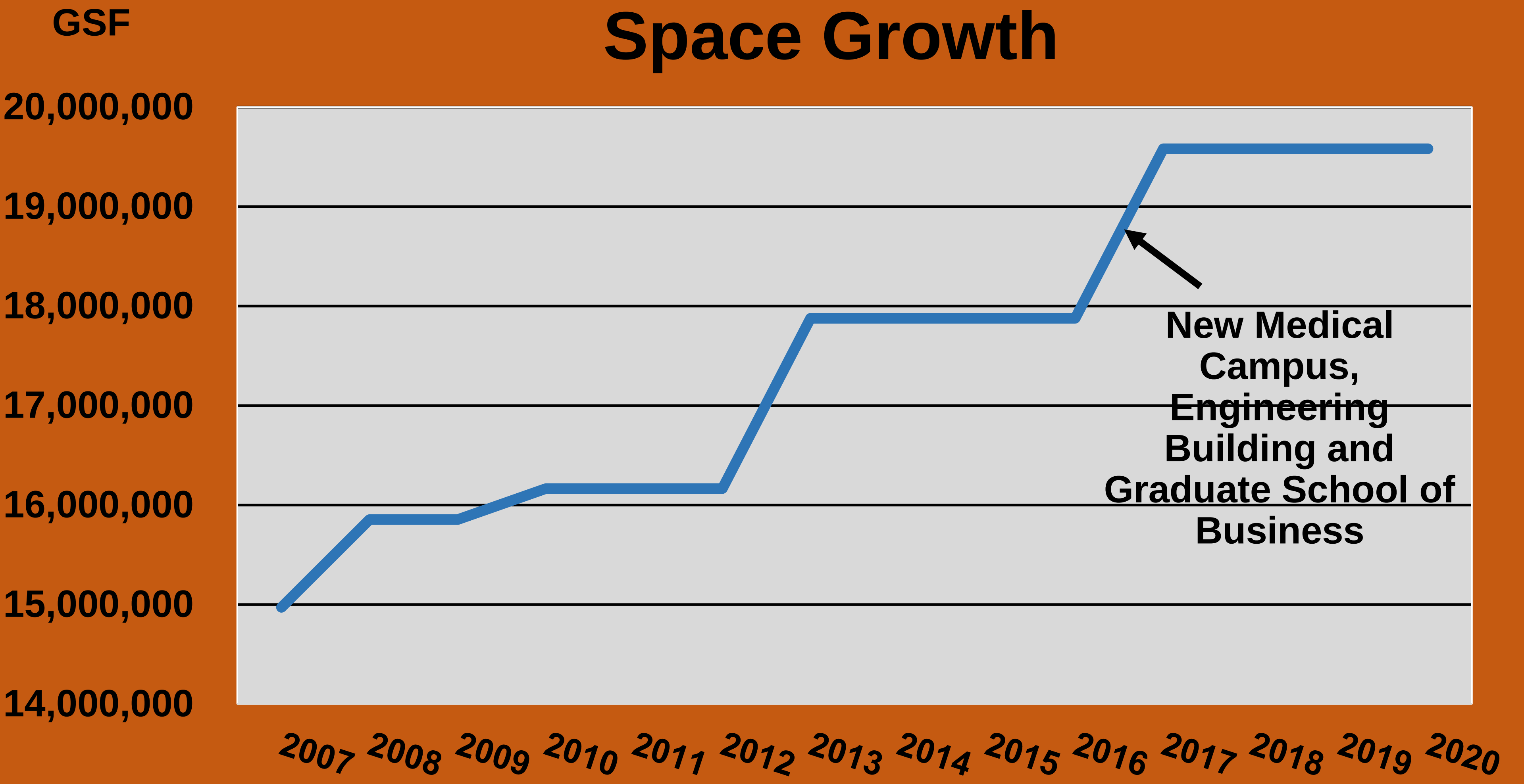
Space Growth



2018 Utility Masterplan Approach

Based on the "new building types" use a combination of historical building energy use and new building design energy load projections to determine the expected load growth over the next 12 year period

- 0-6 year period
  - 13 new buildings - 3,467,792 gsf
  - 3 buildings demolished - 323,439 gsf
- 7–12 year period
  - 11 new buildings - 1,832,732 gsf
  - 4 buildings demolished - 680,383 gsf

2018 Findings – Main Campus
Projected Load Over Next 12 Years

Peaks	CHW (Tons)	STM (mmBtu/HR)	HW (mmBtu/HR)	ELEC (MW)
Existing	31,238	275	0	59.5
Net Short Term	11,3[illegible]9	49	52	14.1
Net Medium Term	5,128	7	42	9.8
Total Projected	47,675	331	94	83.4

Findings – Electrical

Implications of exceeding 70 MW

- **Operating older less efficient generation affects cost & reliability**
- ***Serve New Buildings via Austin Energy?***
  - ***Cost and reliability impacted!***
  - ***Type of building may be impacted!***
- **New “high efficiency” generation is expensive and constrained by available plant space**

Optimize TES & Cooling Plants to Reduce Peak Power

2007 - Eliminate Steam Turbine Chillers, Add 15K Electric Chillers w/VFD's

2008 -Start Optimizing 15K ton plant and start new 4 MG TES

2009 - Start Evaluating Cooling Loop DP and VFD Pumping

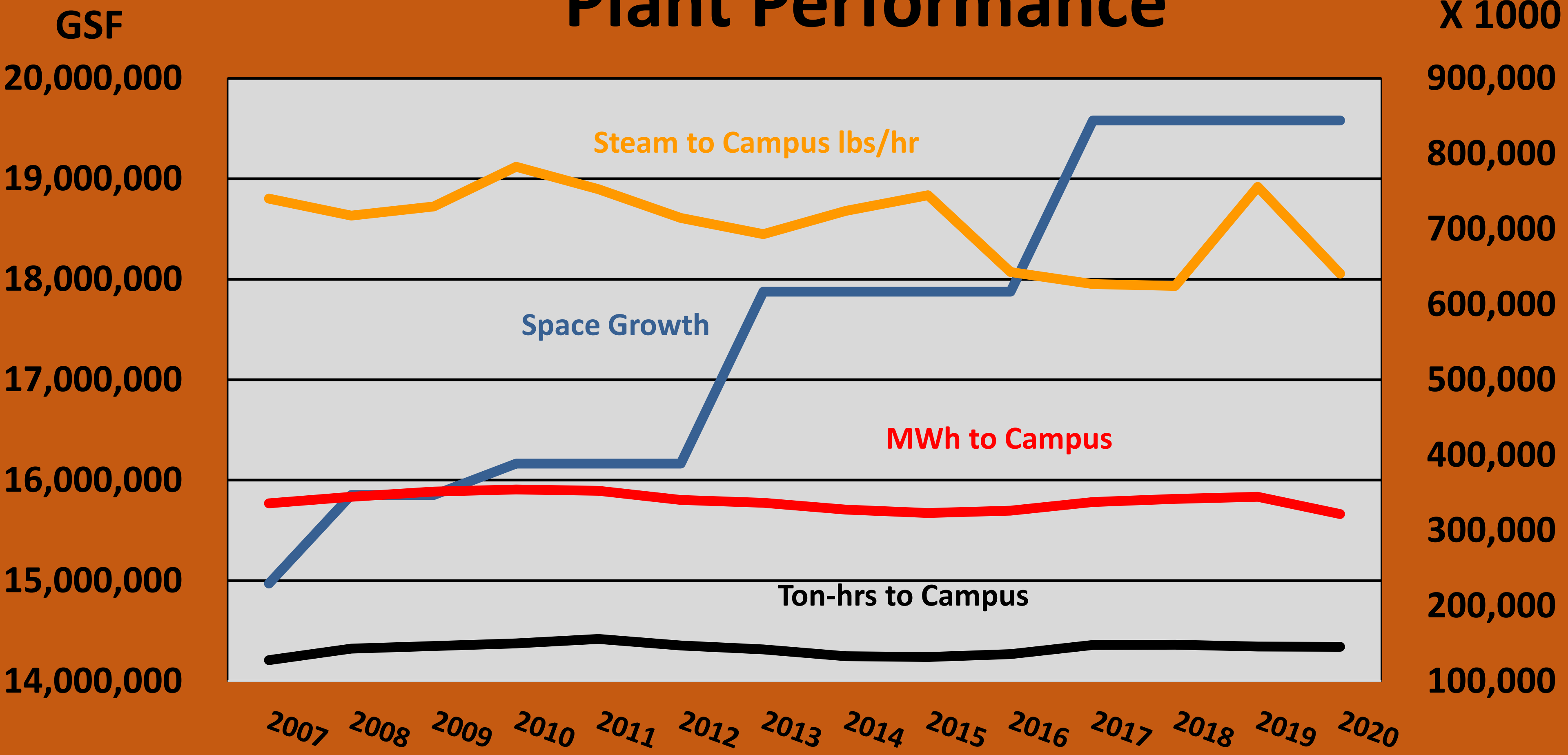
2013 - Optimize Multiple Plant Dispatch, Reduce DP to 10 to 4 psi (summer vs rest of year) (4 plants)

2014 to 2017 – Optimize use of 4 MG TES

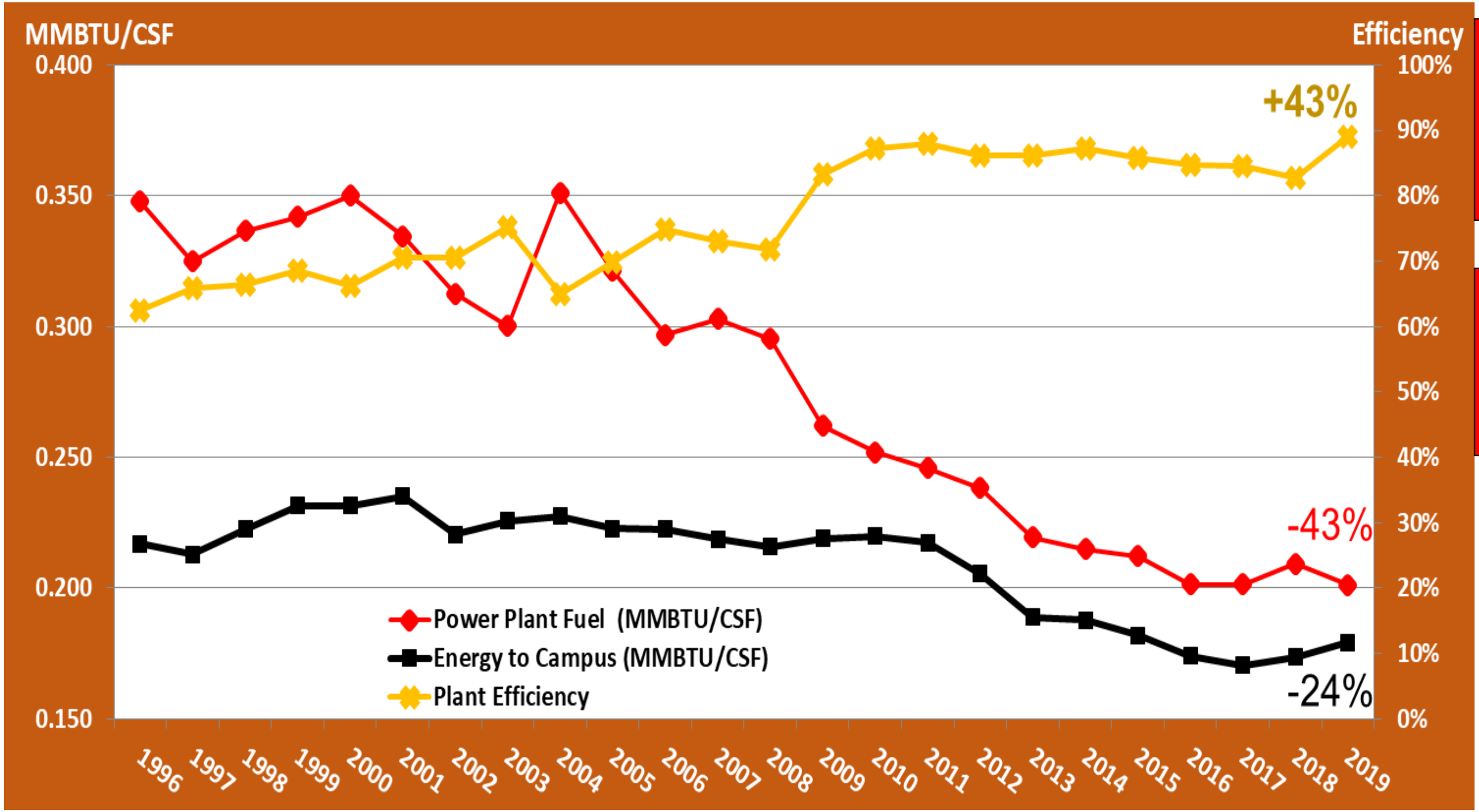
2018 - Add 15k All VFD Plant, Add VFD to 5k ton OM Chiller, Start Using 6 MG TES

2019 – Use power generation data and the weather forecast to predict how to dynamically handle cooling and optimize thermal energy storage

Plant Performance



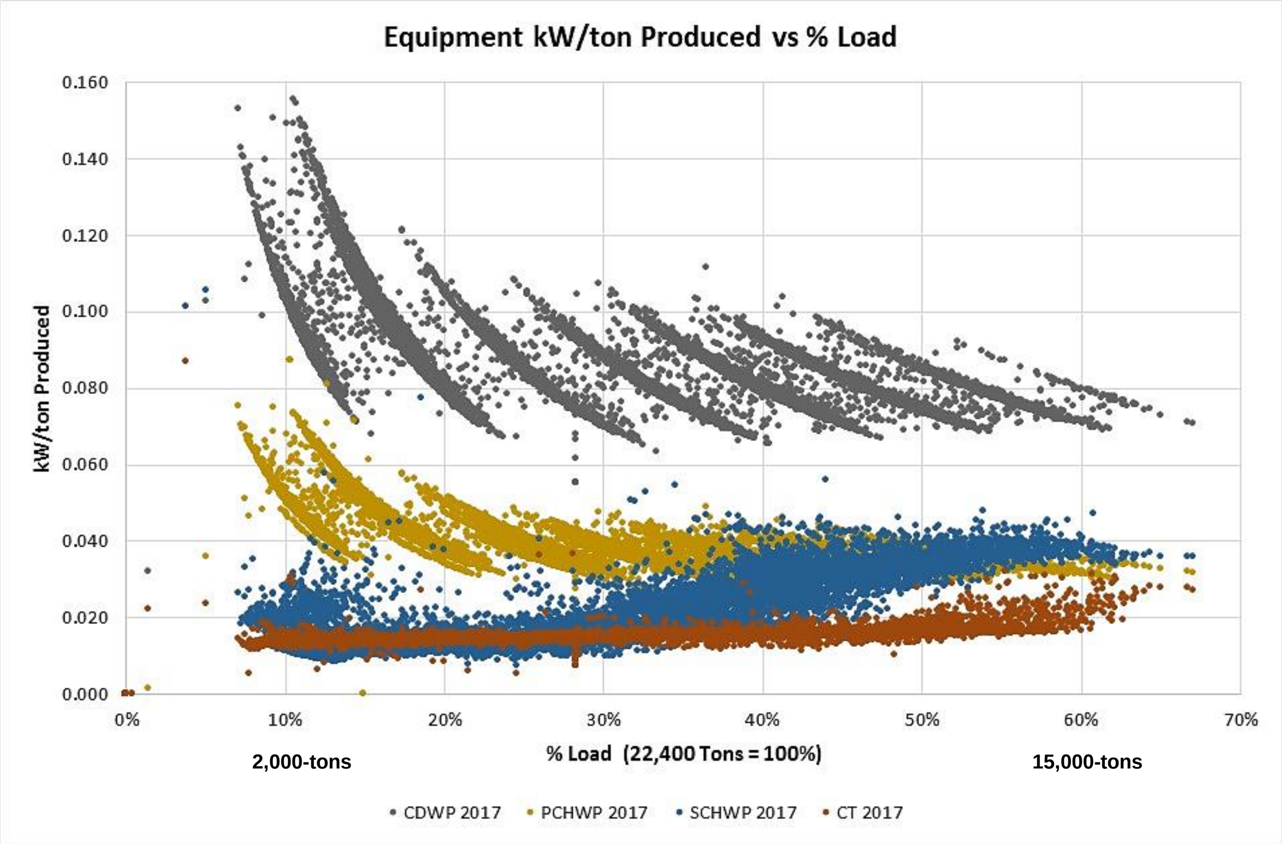
Summary of Utility Plant Performance



At $3/MMBtu = $64 Million

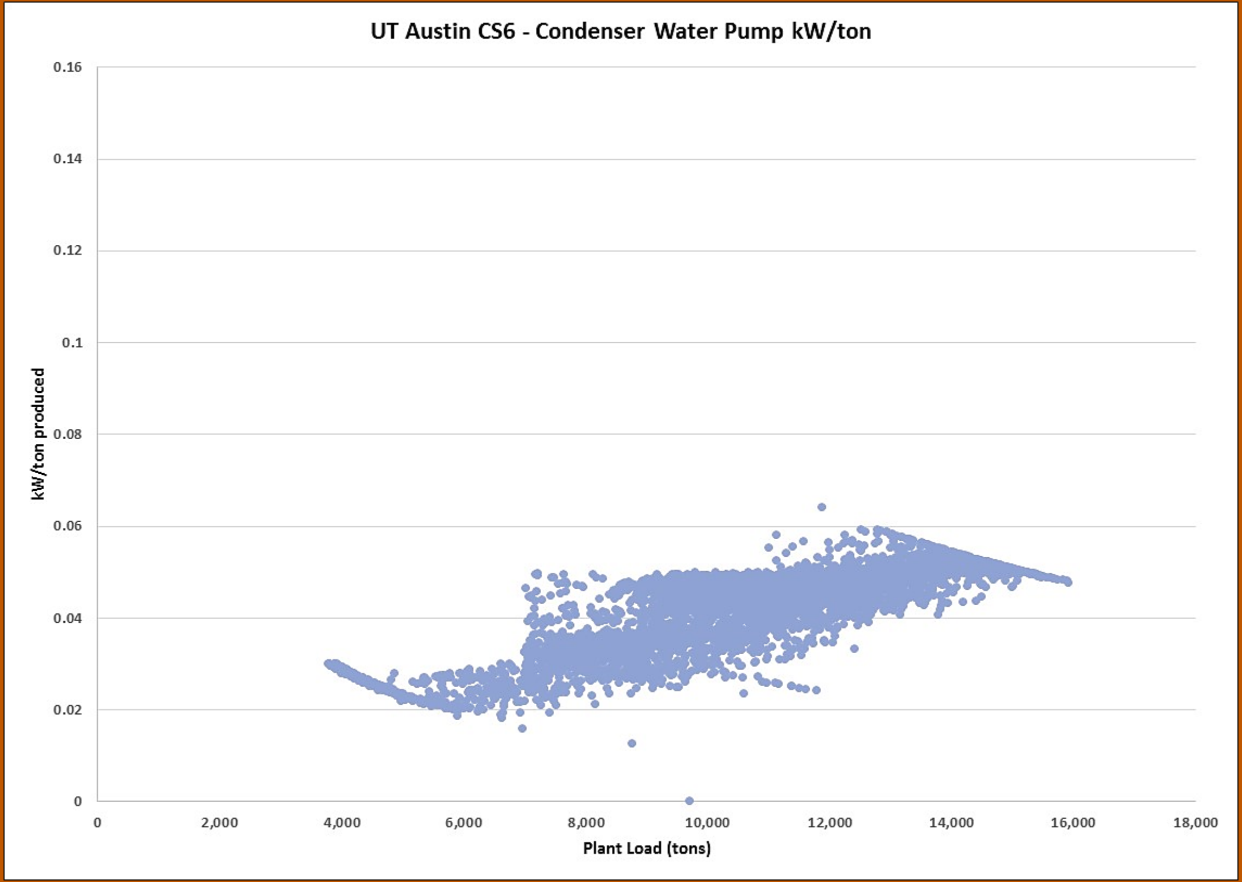
Actual Cumulative Savings = $122 Million

Auxiliary Energy Performance – Legacy Designs



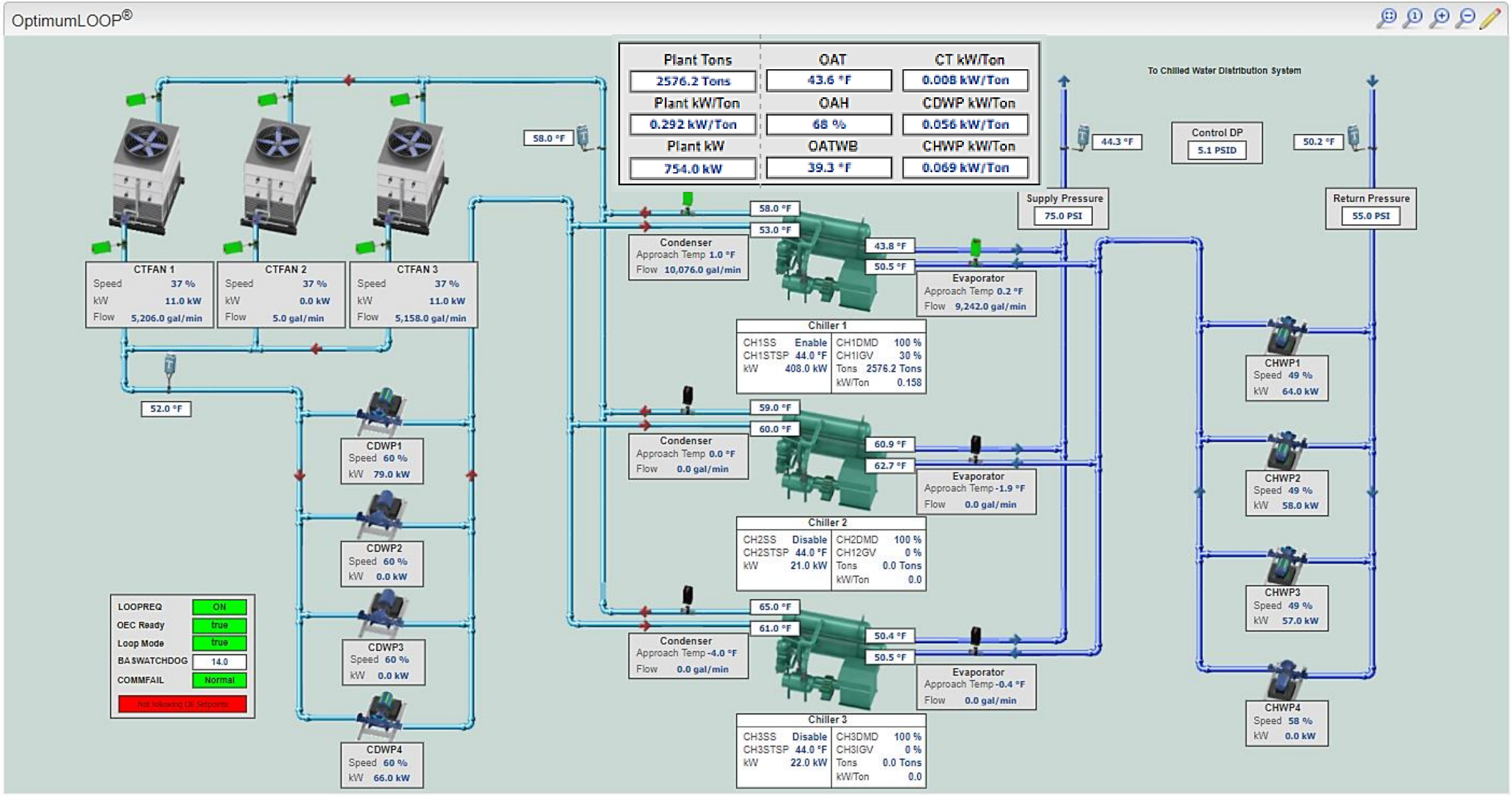
- Condenser water pump efficiency gets worse as load decreases
- Primary pumps behave exactly the same
- This is the result of constant speed pumping and lack of VFDs
- Pumps cannot adjust with load so efficiency is a step function based on the number of pumps running
- # Pumps On = # Chillers On
- **Chiller staging becomes a critical factor in overall efficiency**

Variable Speed Condenser Water Pumps – UT Austin

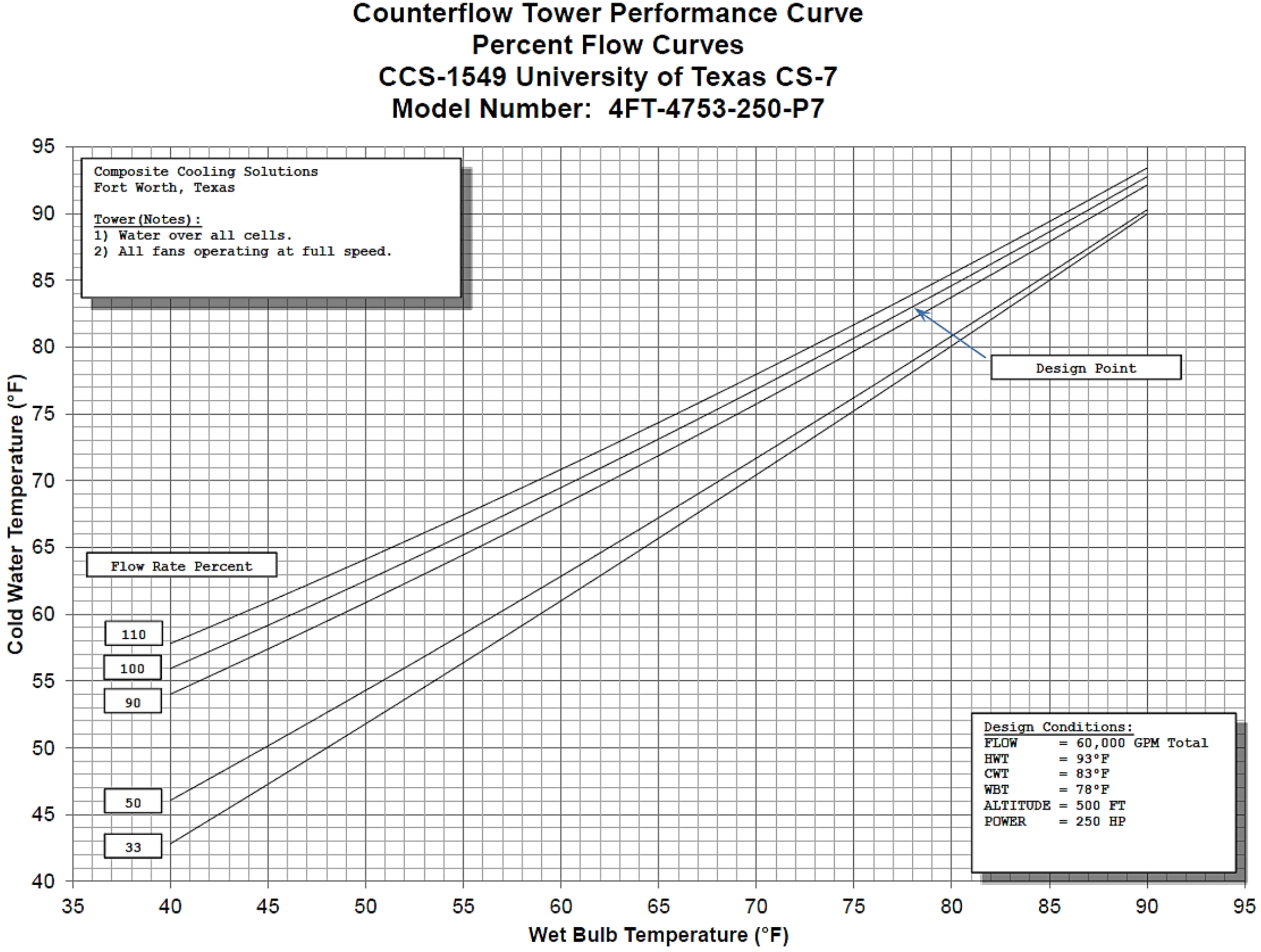


- Condenser water pump efficiency gets better as load decreases
- Variable primary-only plant (no primary secondary)
- Pumps adjust with load
- # Pumps on does not equal # Chillers On
- **Chiller staging becomes less of a factor in overall efficiency**

2008 – Optimization of 15,000-ton All Variable Speed Plant (CS6)

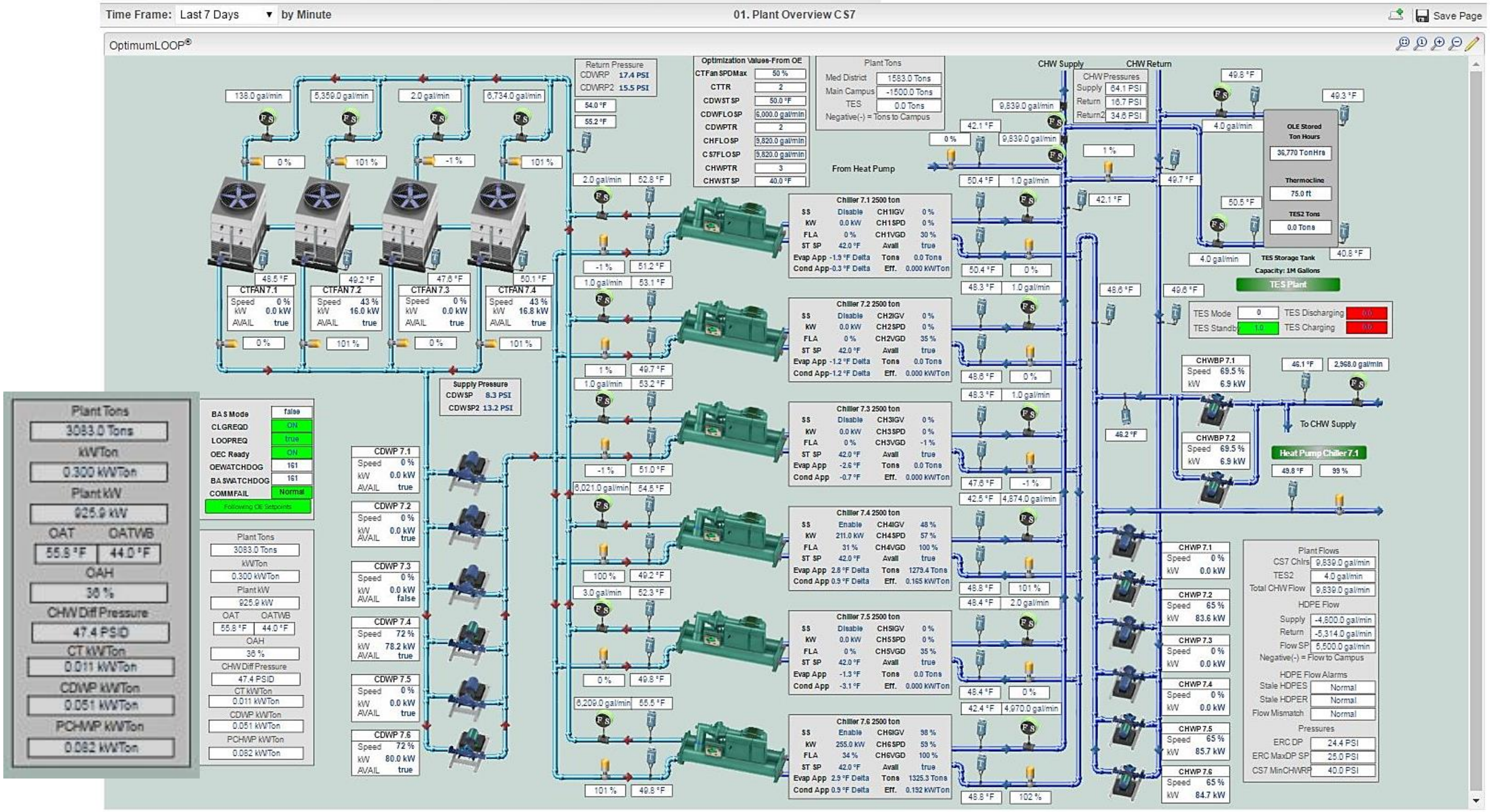


CS7 Design

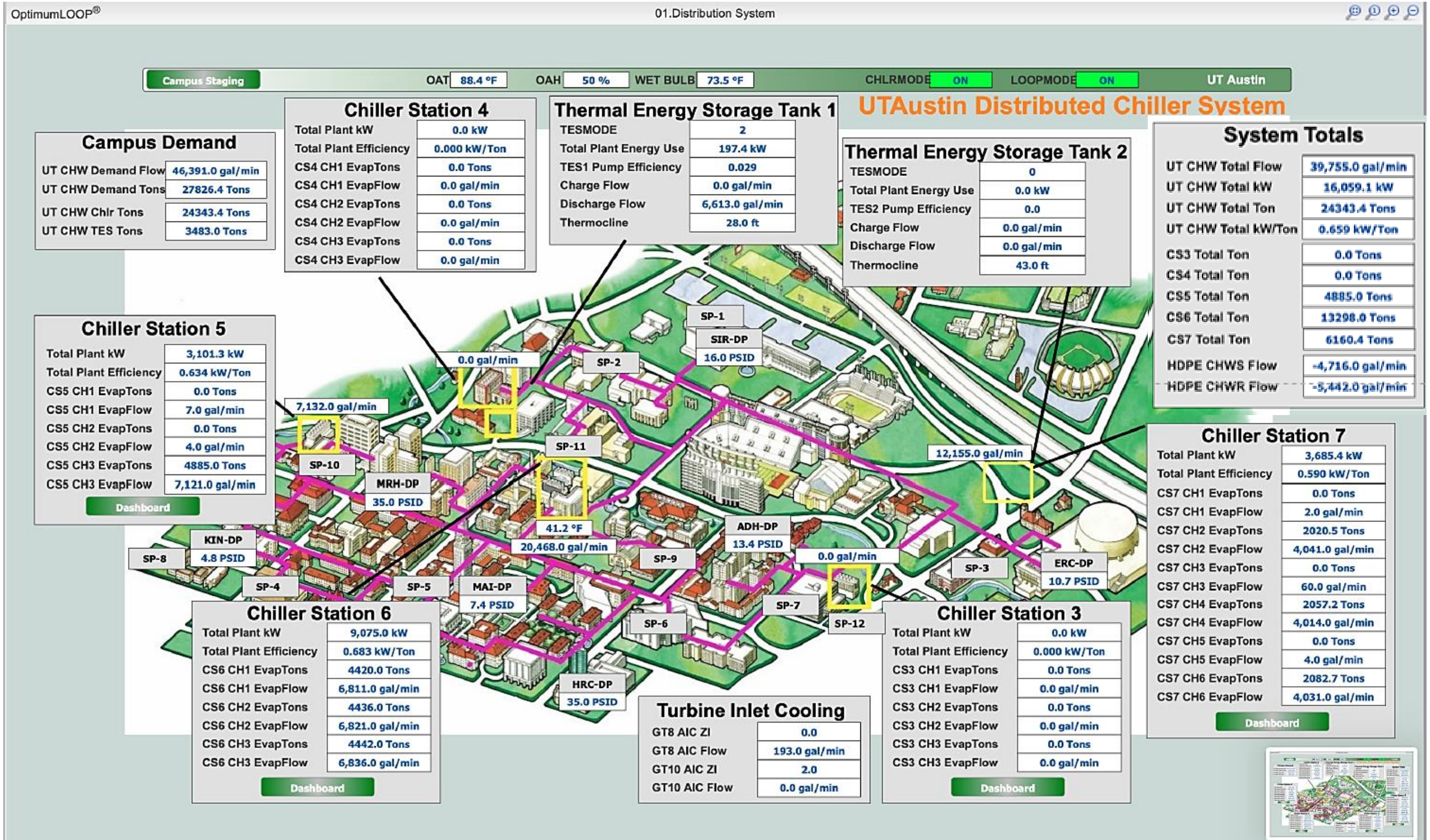


- Approach gets worse as wet bulb decreases
- Approach improves significantly at part load/flow conditions
- It is possible at 33% flow to operate at less than a 1 deg F approach
- Towers at UT Austin are consistently operating at 1.5 to 2.5 deg F approaches year round.

CS7 Optimization



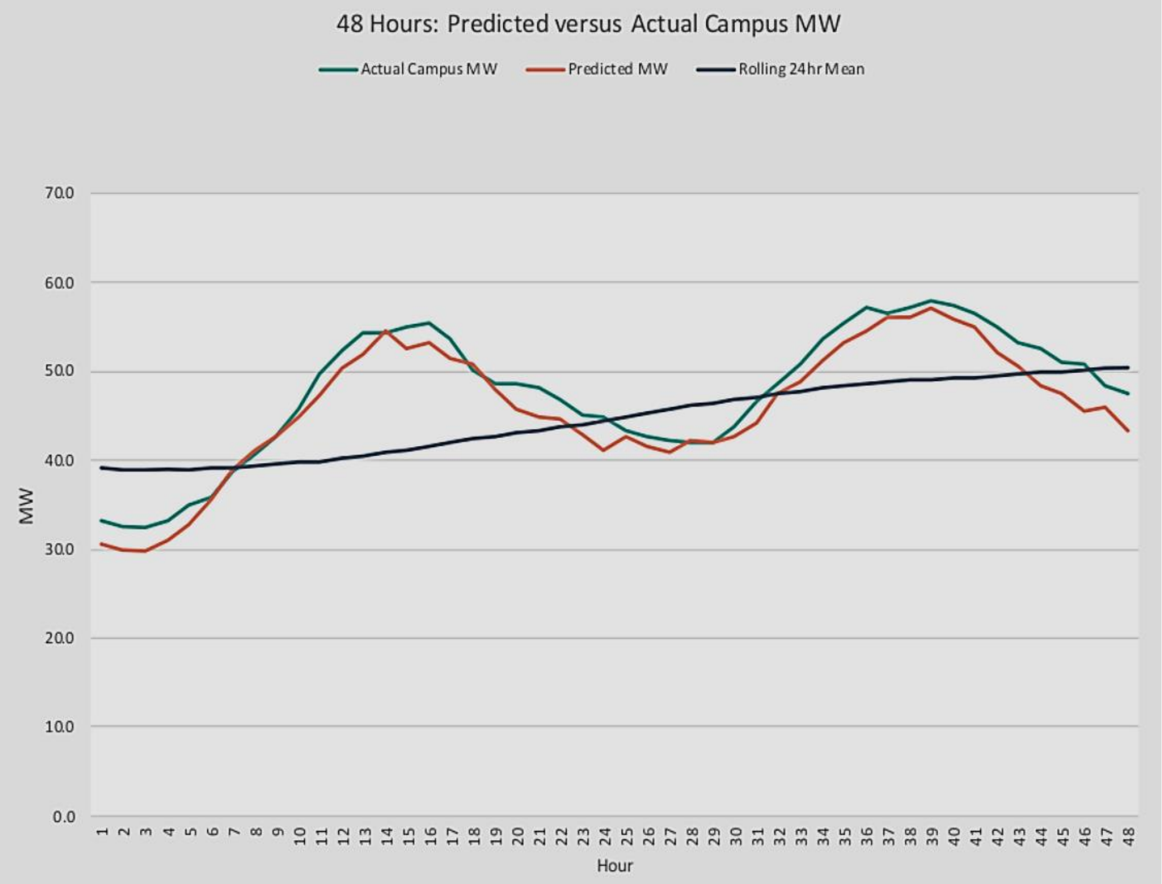
Campus Optimization



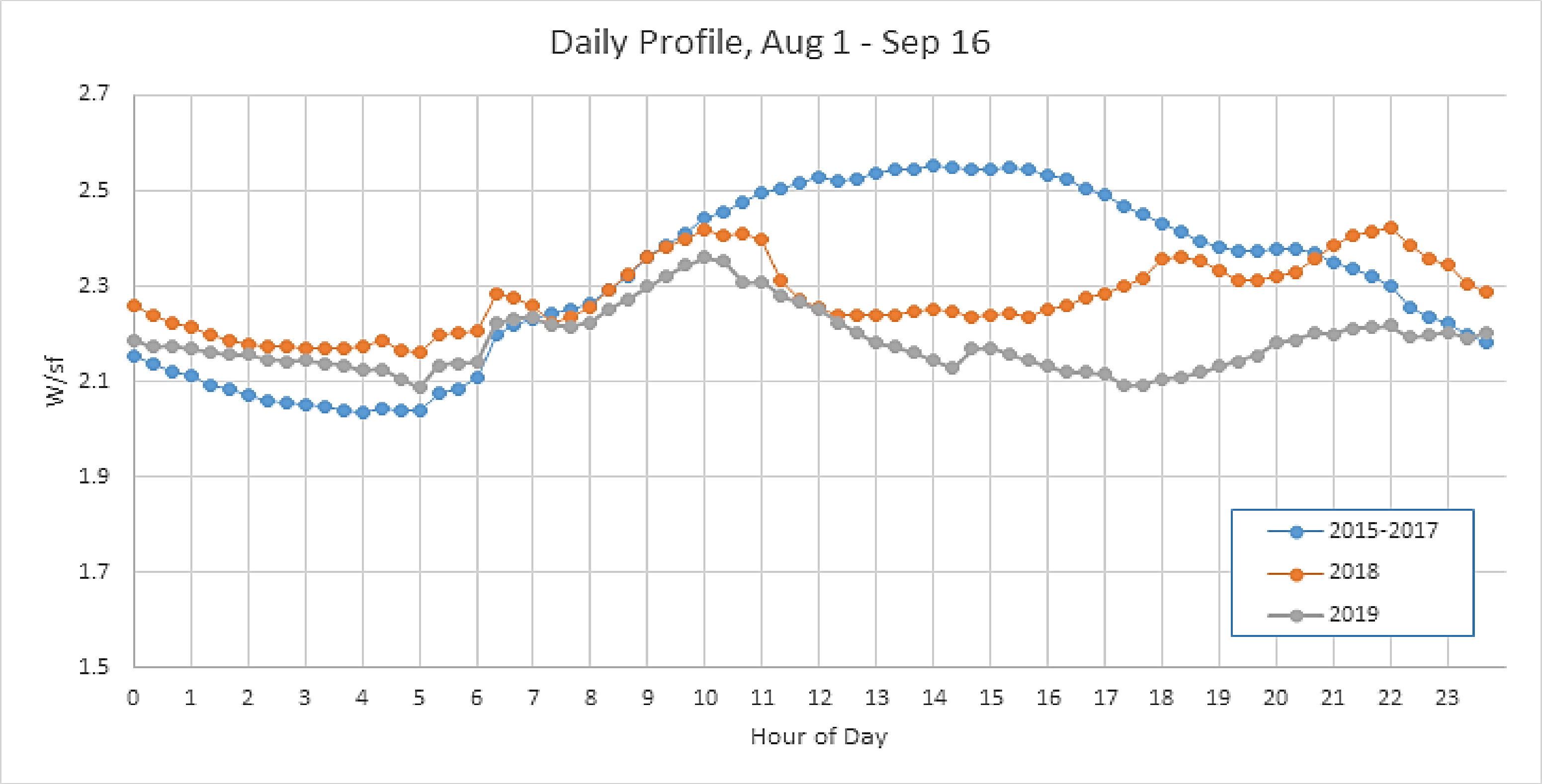
TES Dispatch Optimization

The TES control strategy is a four-step process:

1. **Project the average campus MW for the next 48 hours.**
2. **Calculate the difference between the predicted MW and the average MW**
3. **Calculate the tonnage required to reduce or increase MW to achieve the average**
4. **Calculate the flow required to reduce or increase tonnage from each tank.**

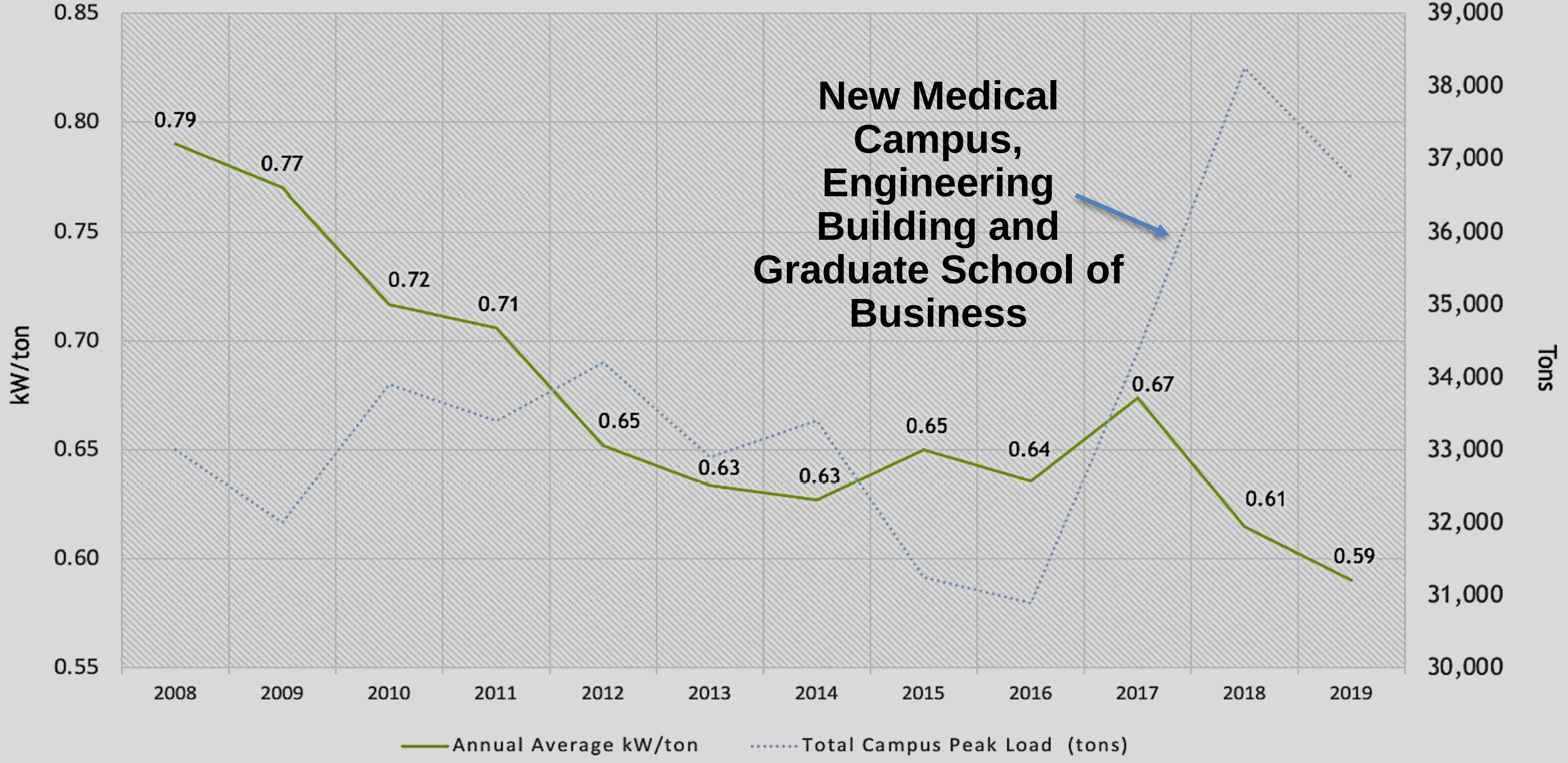


TES Dispatch Optimization Results



The peak electrical load in 2018 of 69 MW was reduced to 62 MW in 2019 though the campus space of 19.6 million sq ft was constant

Total CHW Plant Efficiency History



Questions?

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