

UT Austin's Optimization Journey

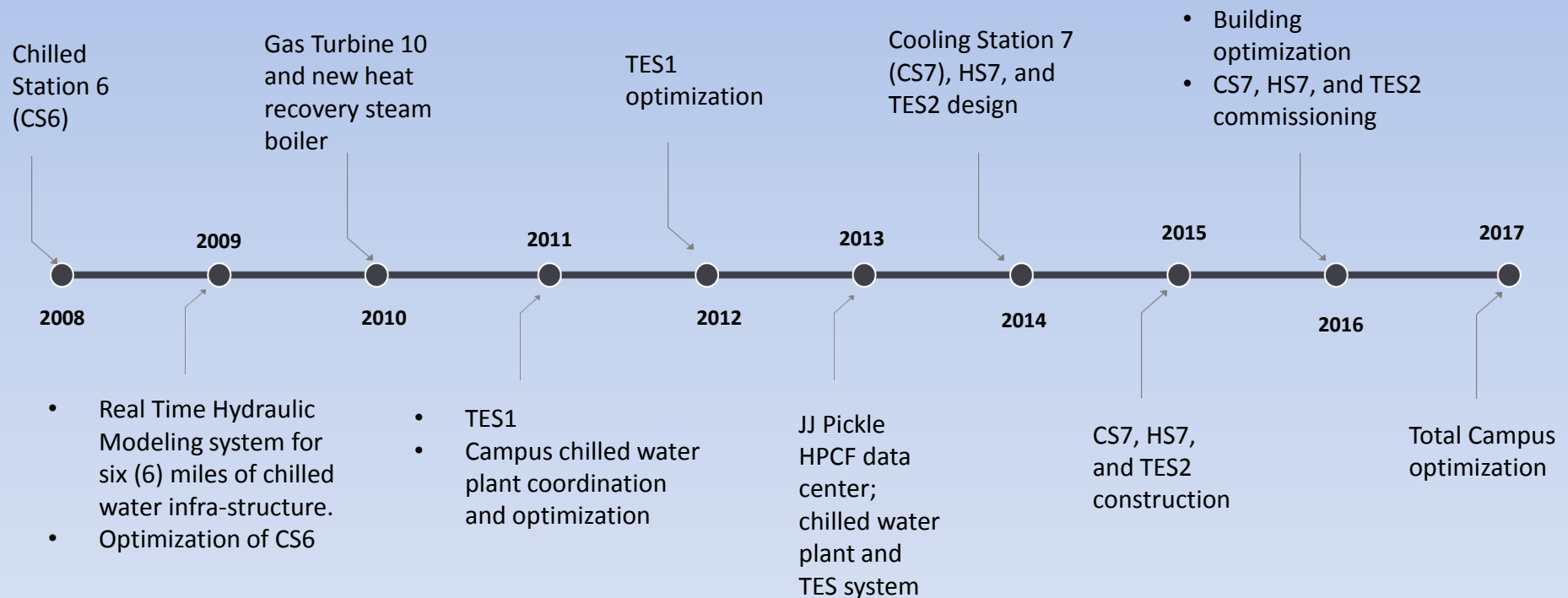


Michael Manoucheri, P.E.
Associate Director, UT Austin

Ben Erpelding, P.E.
Chief Technology Officer, Optimum Energy



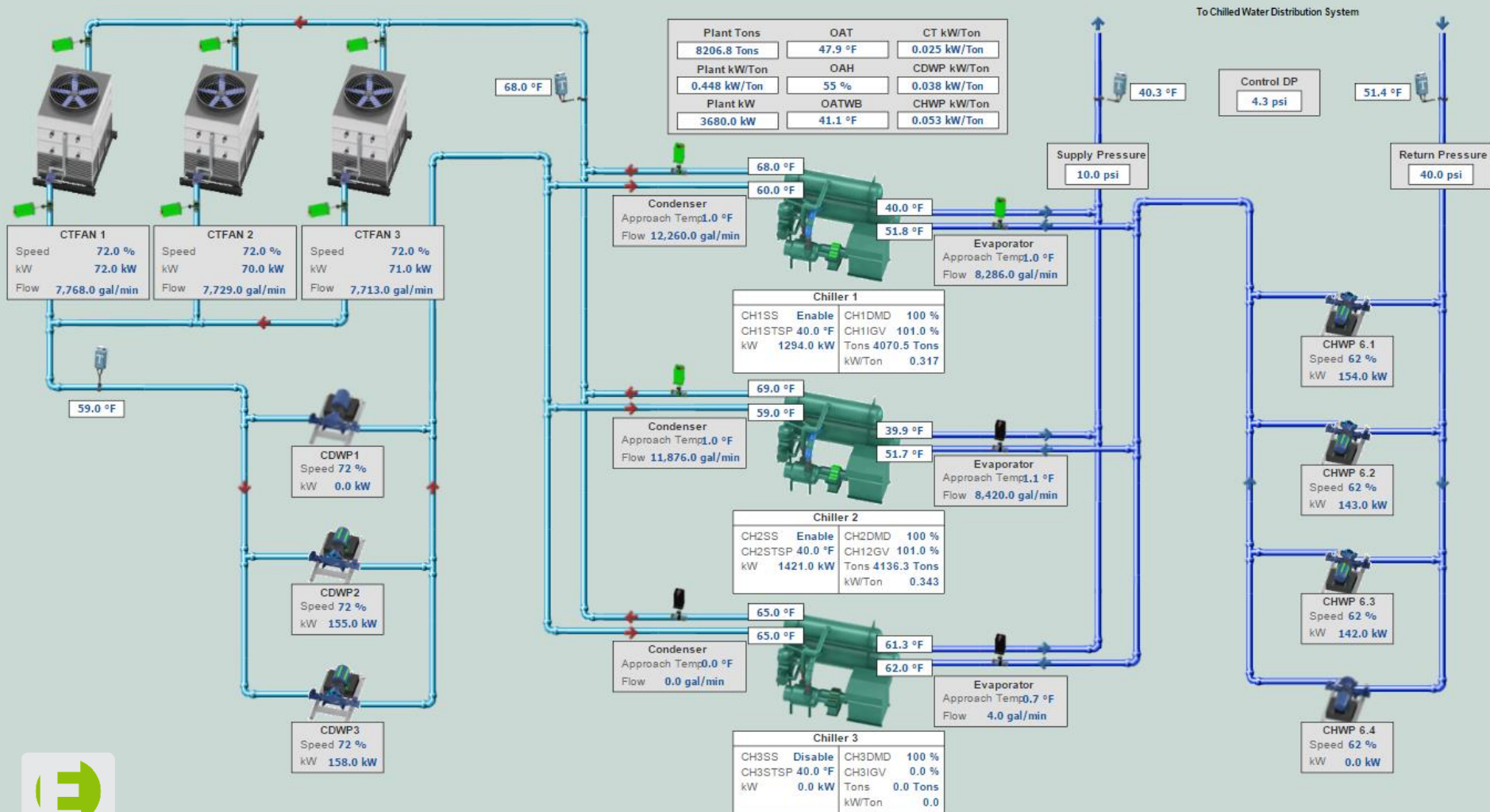
Building a First Class Operation – highest reliability, highest efficiency, and highest level of service



UT Austin's Pre 2008 Campus

- 15.3 million square ft with 160 buildings
- 2.4 million sq ft of immediate growth
- Peak load $\approx$ 65 MW typically in September, approximately 25 to 27 MW of this support Campus Chilling Stations
- Average annual load is approximately 41 MW
- Annual chilled water delivered to campus – 156 million ton-hours
- Peak chilled water load of 31,000 tons
- Peak cooling station demand measured at 27.7 MW
- Annual Power consumed to produce chilled water – 113 million kWh
- Annual “Auxiliary” Power to chilling stations – 34 million kWh
- Total Chilled Station usage = 147 million kWhs/yr
- Annual average chilled water efficiency > 0.94 kW/ton
- Campus annual steam usage 750 million lbs
- Campus peak steam usage at 220,000 lb per hour

Chilling Station No. 6 (CS6)

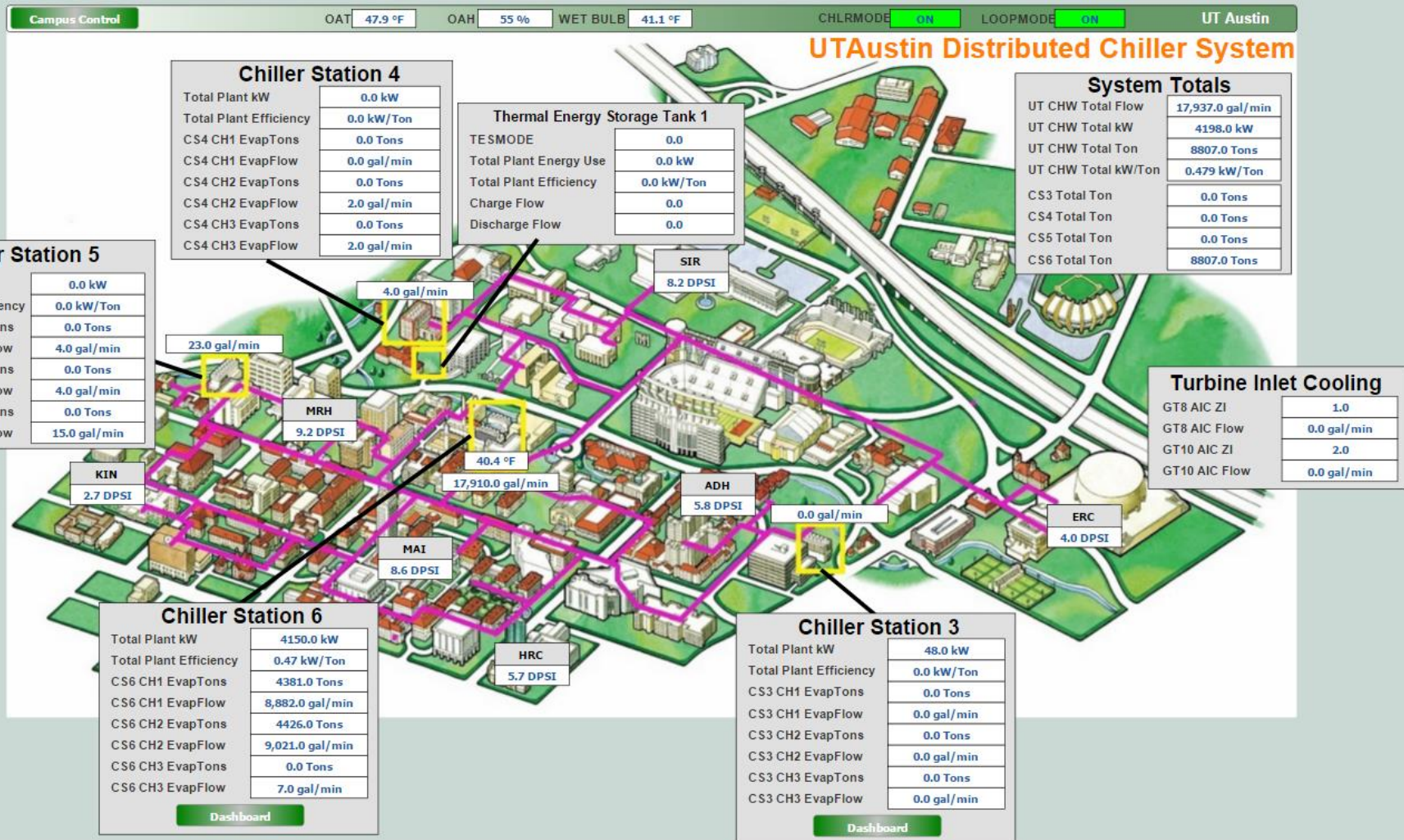


Gas Turbine 10

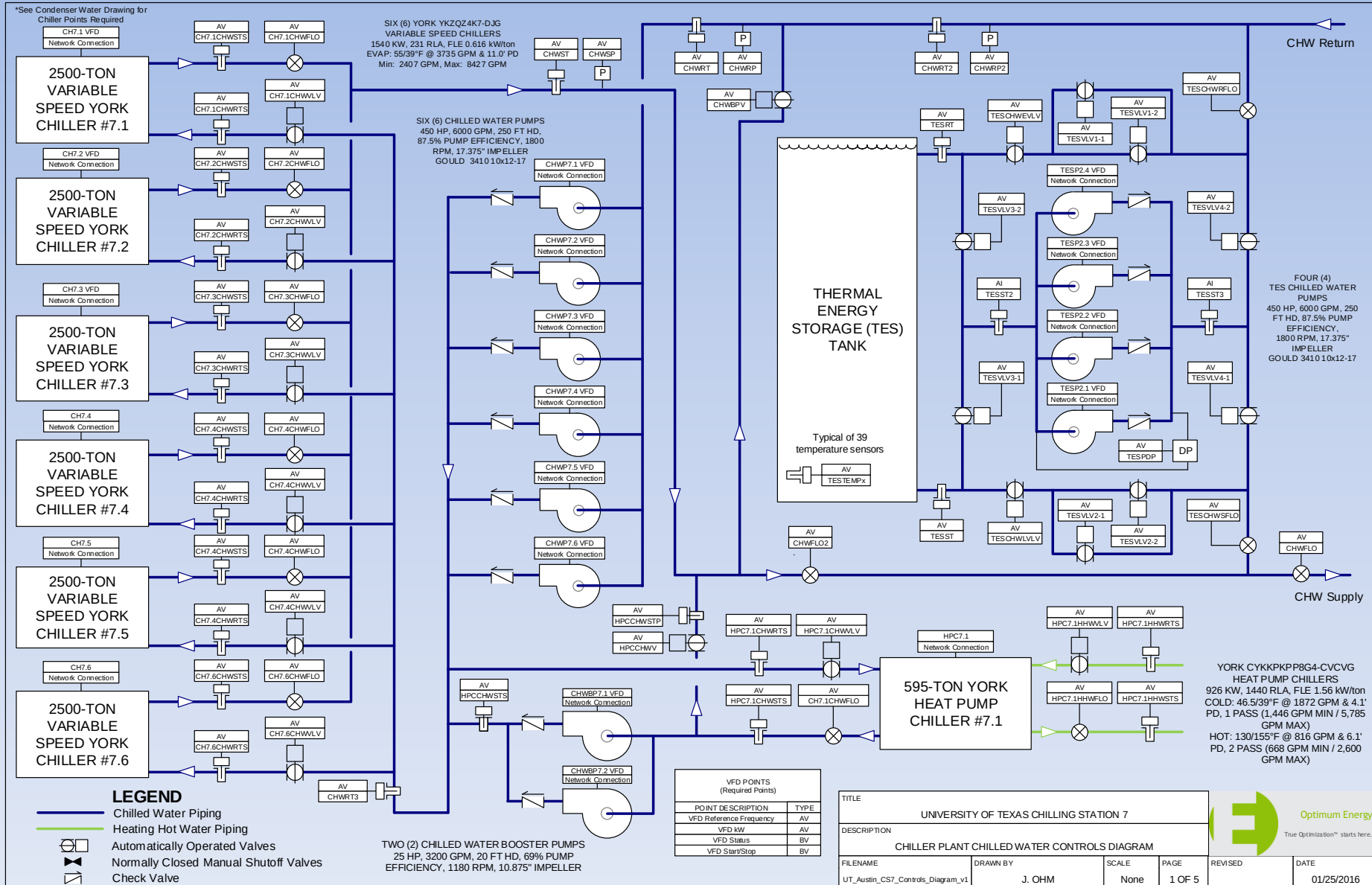
- General Electric Aeroderivative
 - LM2500+G4 DLE
 - Unit Net, KW – 32,000
 - Heat Rate – 9084 BTU/KW-HR, LHV
 - Generator Brush – BDAX 71-193ERH TEWAC
 - Generator Output – 12kV, 60 Hz
-
- GTG Load down to 75%
 - NOx: 25 PPMVD @ 15% O₂
 - CO: 25 PPMVD @ 15% O₂
 - Post Combustion NOx: 5 PPMVD @ 15%O₂



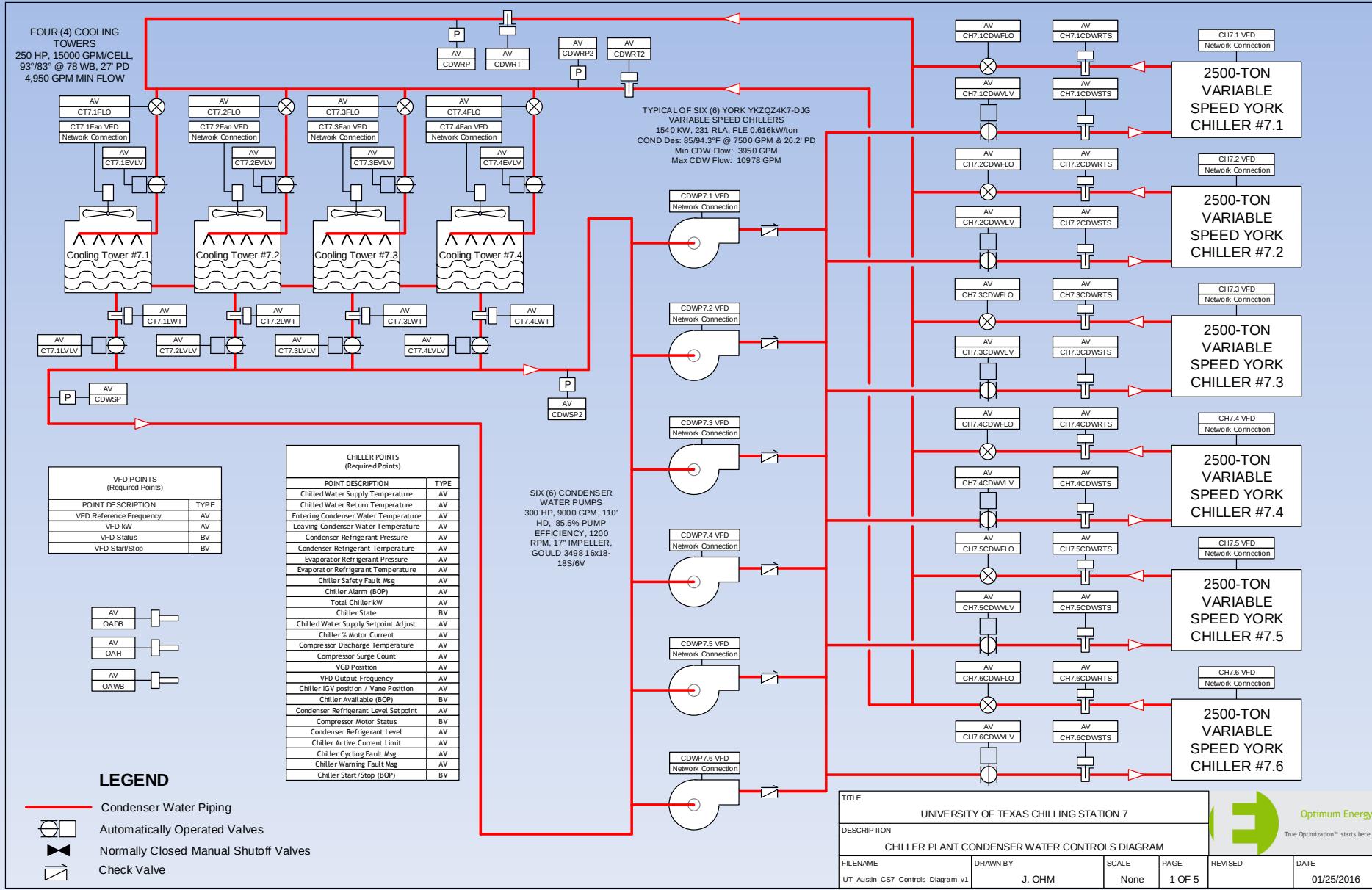
TES1 and Campus Chilled Water Coordination and Optimization



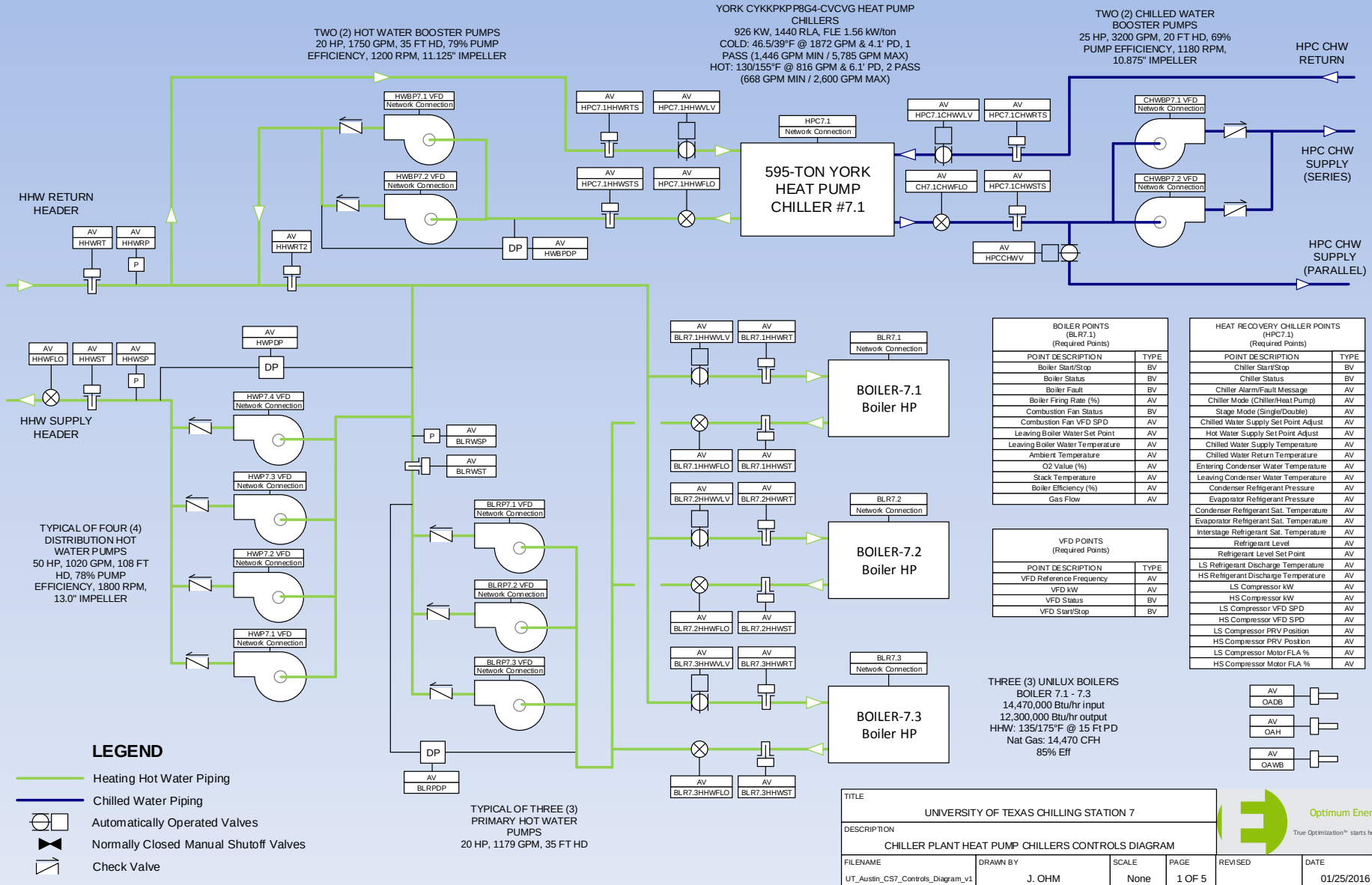
Chilling Station No. 7 (CS7)



Chilling Station No. 7 (CS7)

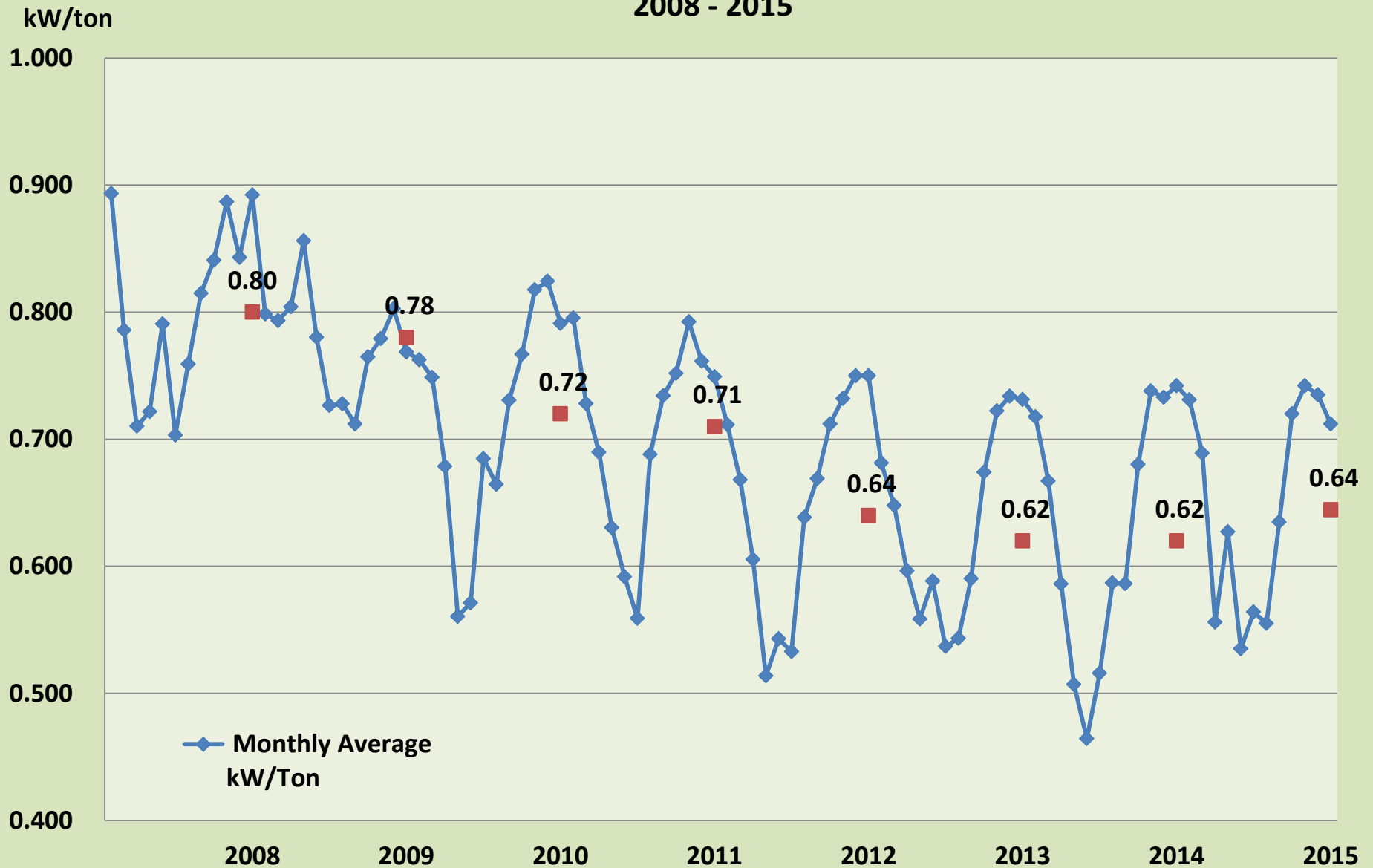


Heating Station No. 7 (HS7)





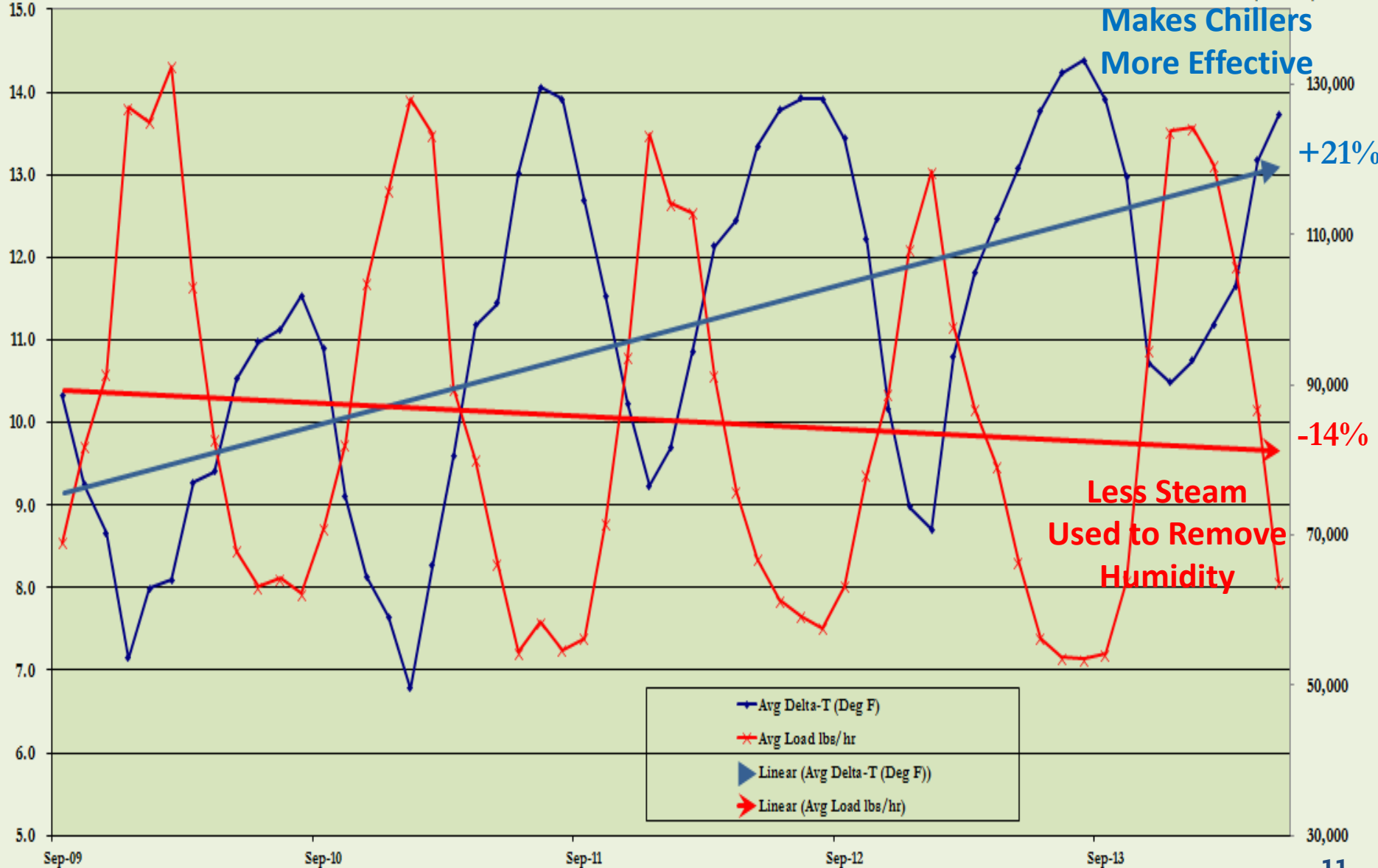
Chilling Station Performance 2008 - 2015



UT Austin - Effect of Reduced CHW Loop Differential vs Reheat Steam) FY2010 vs FY2014 (To Date)

Average Campus
Delta T (°F)

Steam To Campus
(lbs/hr)



UT Austin - Effect of Reduced CHW Loop Differential vs Peak Power and Peak Tons FY2010 vs FY2014 (To Date)

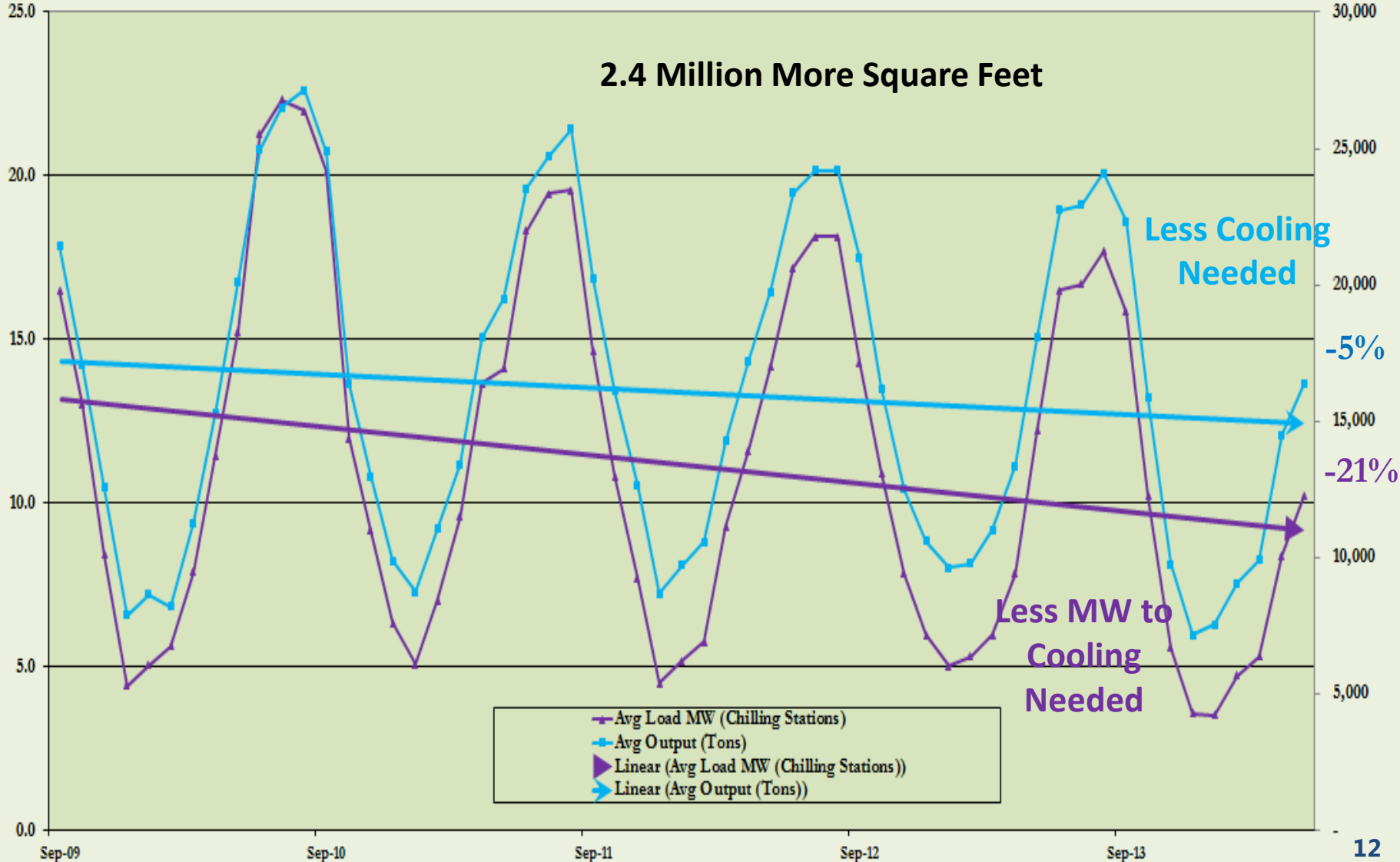
Average Peak Power
to Chilling Stations (MW)

Campus Cooling Load
(Tons)

2.4 Million More Square Feet

Less Cooling
Needed

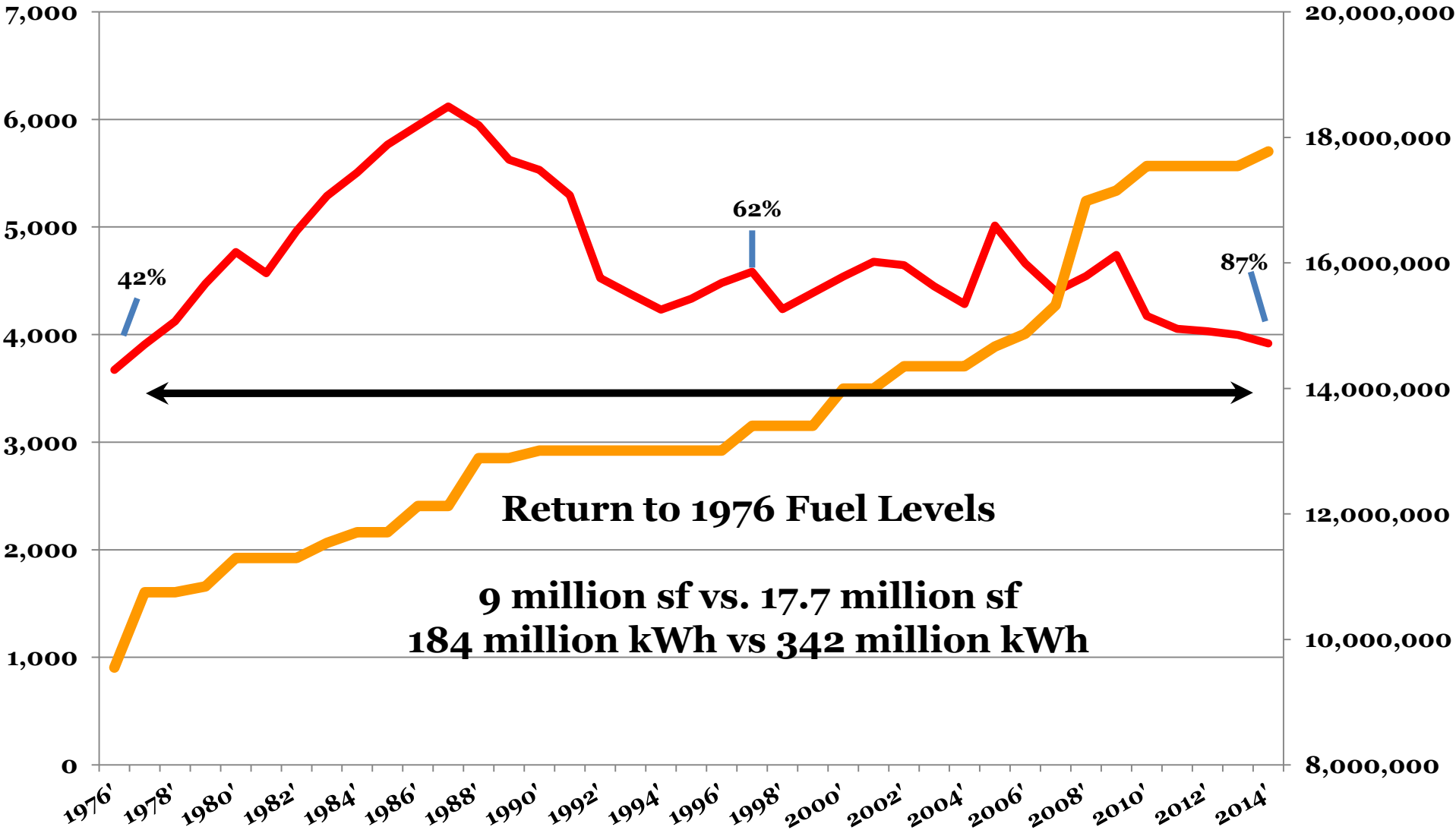
Less MW to
Cooling
Needed



Effects of Utility Improvements on Total Annual Fuel Use

MMBTU's
x 1000

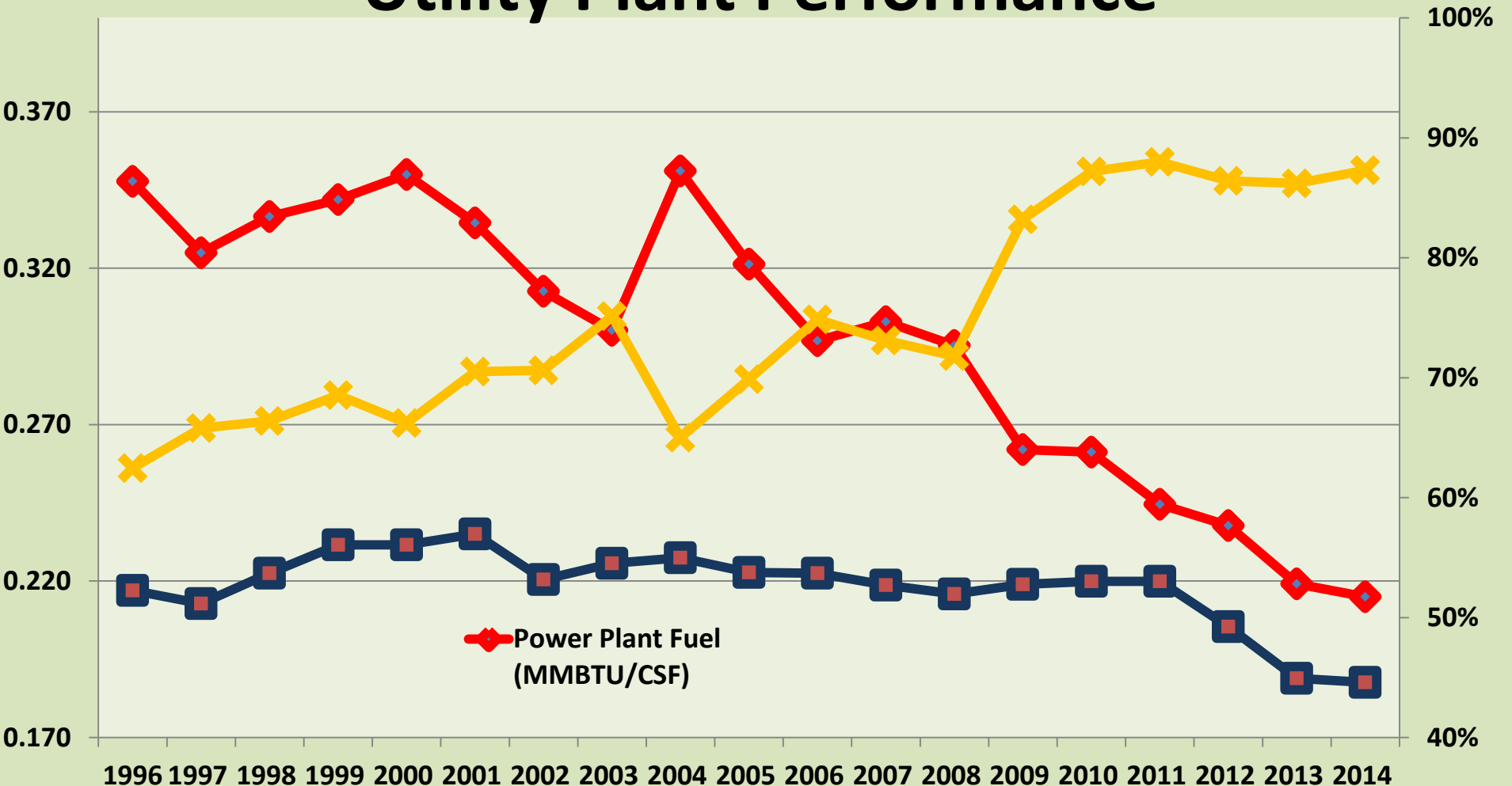
Campus Area
Served



MMBTU/CSF

Utility Plant Performance

Efficiency



Gas Savings 1996 vs 2014

12,211,000 MMBTU

Cumulative

CO₂e Avoided = 862,000 tons
Cumulative

2016 and Beyond - Efficiency and Optimization

Utilize a demand side energy and water conservation program to offset campus space growth using a portfolio management approach to select projects, execute the projects in partnership with campus stakeholders and use a measurable and verifiable methodology to validate that the portfolio objectives were met or exceeded.

- Manage the large amount of data in a manner that is manageable through graphics, efficient management of data historians, trending and modeling of energy systems.
- Since the plants are producing at such a high level of efficiency, the challenge with our Campus is that it is experiencing an unprecedented level of growth in an environment where the operational budget is not growing at the same rate. So to stretch the existing investment in plant efficiency we need to leverage it by improving the demand side. We are developing a methodical portfolio management process to do it and what will hopefully be an in-house ESCO.

UT Austin's Pre 2008 Campus

- 15.3 million square ft
- 2.4 million sq ft of immediate growth
- Peak load $\approx$ 65 MW, approximately 25 to 27 MW of this supports Campus Chilling Stations
- Average annual load is approximately 41 MW
- Annual chilled water delivered to campus – 156 million ton-hours
- Peak chilled water load of 31,000 tons
- Peak cooling station peak demand measured at 27.7 MW
- Total Chilled Station usage = 147 million kWhs/yr
- Annual average chilled water efficiency > 0.94 kW/ton
- Campus annual steam usage 750 million lbs
- Campus peak steam usage at 220,000 lb per hour

UT Austin's 2015 Campus

- 17.7 million square ft
- 1.8 million sq ft of immediate growth
- Peak load $\approx$ 58.7 MW, approximately 19 to 21 MW of this supports Campus Chilling Stations
- Average annual load is approximately 37.9 MW
- Annual chilled water delivered to campus – 129 million ton-hours
- Peak chilled water load of 30,200 tons
- Peak cooling station peak demand measured at 21.2 MW
- Total Chilled Station usage = 82.5 million kWhs/yr
- Annual average chilled water efficiency 0.64 kW/ton
- Campus annual steam usage 719 million lbs
- Campus peak steam usage at 226,000 lb per hour

Questions & Comments

Mike Manoucheri, P.E.
Associate Director – Plant Operations
Utilities and Energy Management
The University of Texas at Austin
512-471-8818
Michael.Manoucheri@austin.utexas.edu

Ben Erpelding, P.E.
Chief Technology Officer
Optimum Energy
619-417-9984
ben.erpelding@optimumenergyco.com