

University of Illinois at Urbana-Champaign
Chilled Water Project:
*Unique Funding Mechanisms in a
Capital Constrained World*

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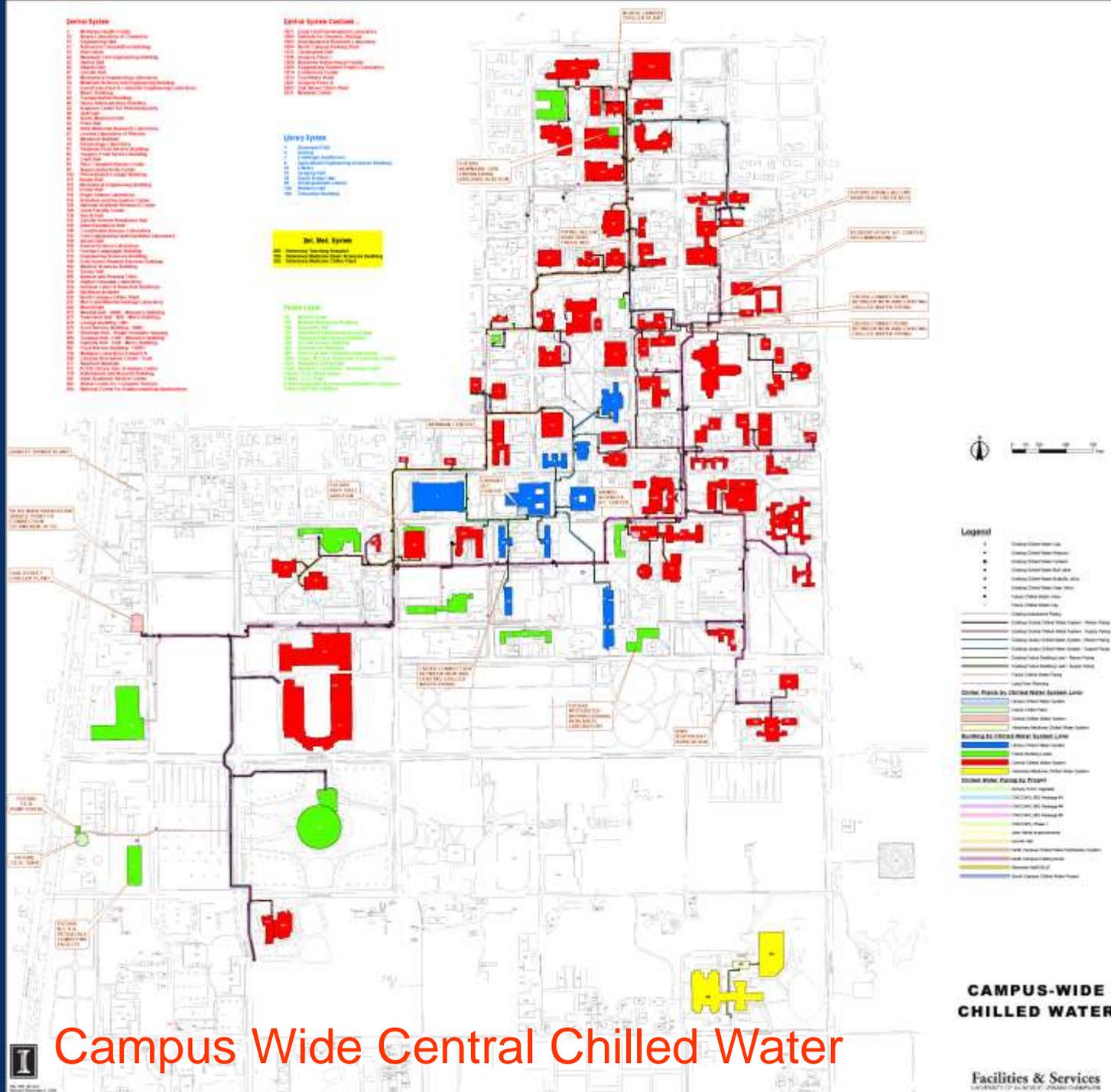
Agenda

- Campus & chilled water system overview
- Funding source for chilled water projects
- Project details
- Why this project – steam vs. electric chillers
- Summary

CWCCW

Buildings Red Summer 2009

- 79 Buildings
- 34,000 Tons connected load
- 27,500 Tons Calculated Diversified Load
- 24,500 T Peak Actual for 2008
- 29,700 Tons Installed Production
- 14 Chillers
- 3 Plants
- No CHW Pumps or Compressors in Buildings



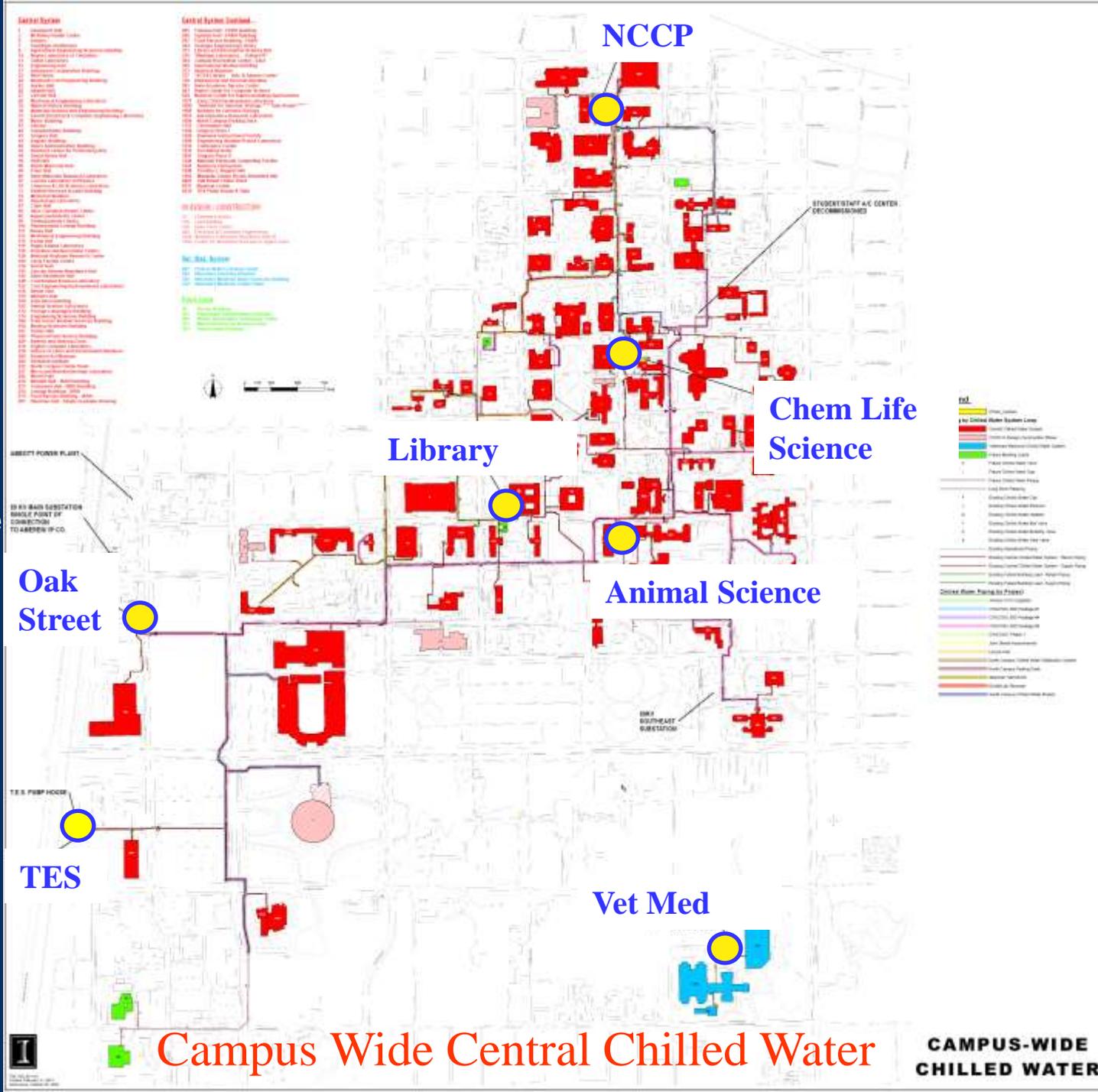
CWCCW Plants

Interconnected

- Oak Street
- NCCP
- Animal Science
- Library
- Chem Life Science
- TES Tank

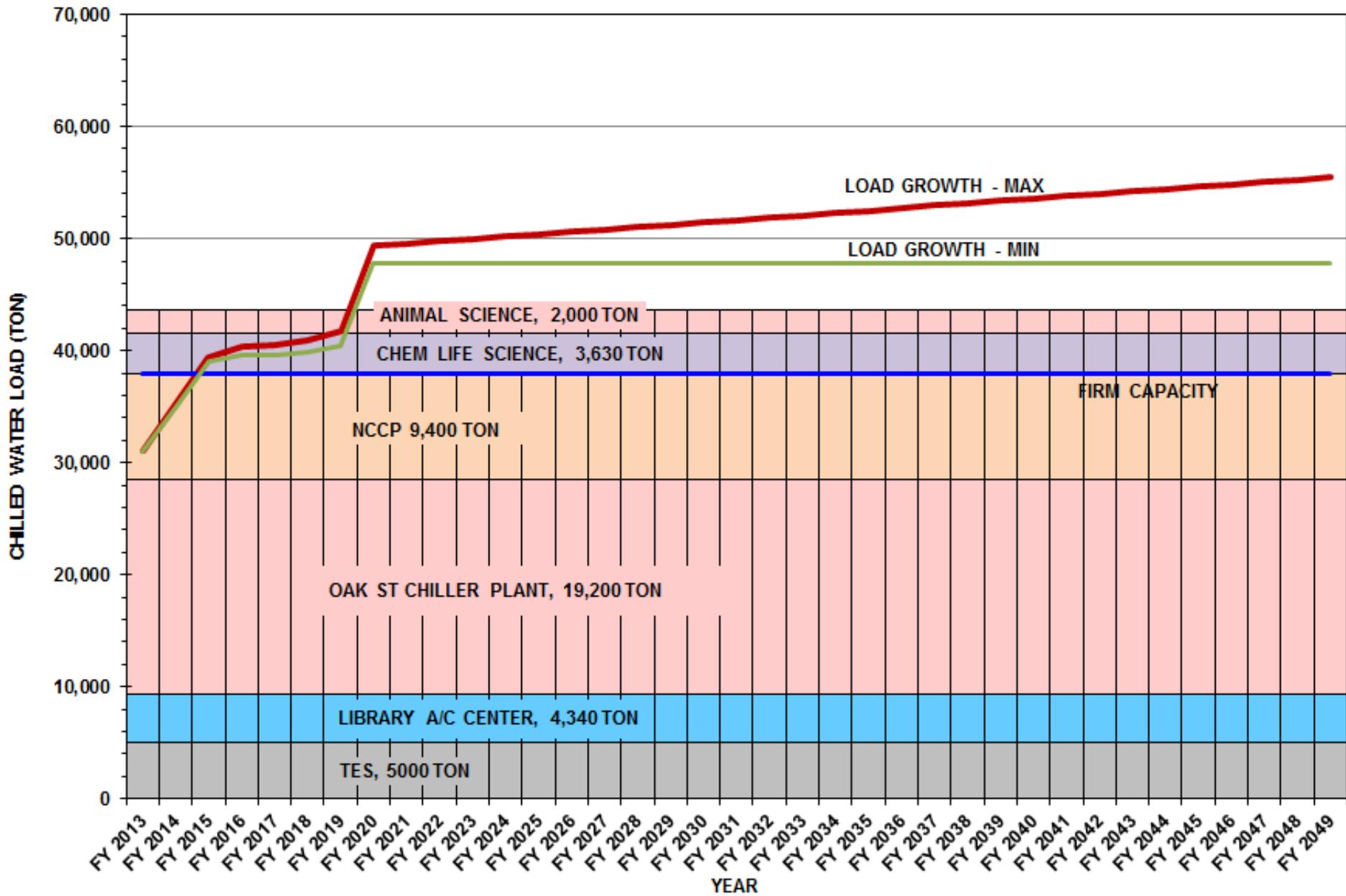
Separate

- Vet Med



CHILLED WATER CAPACITY VS. FUTURE LOAD

Prior to Chiller Expansion



Funding Strategy

- Total cost = \$11.5 million
 - 5600 Ton Dual Compressor Elec
 - 2800 Ton 13.8 KV Elec VFD
 - 2 Cooling Tower Cells
- Fund Sources
 - Grants from State of Illinois - \$0.6 million
 - Capital R & R 3 yrs Replacement Reserve – \$4.2 M
 - Chilled Water Capacity Charge Account - \$6.7 M
- Project Delivery by EPC
 - Cost savings ` \$ 1.2 M / yr.

Illinois Energy Now

Public Sector Energy Efficiency Program 2012-2013

HVAC and Water Heaters Incentive Worksheet				
Electric Equipment Type	Code	Size Category	Qualifying Efficiency	Incentive
Unitary and Split System Air Conditioning and Air Source Heat Pump	EH0	< 65,000 Btuh (5.4 tons)	≥ 15 SEER	\$100 per Ton
	EH1	≥ 65,000 Btuh and < 240,000 Btuh (5.5 - 20 Tons)	≥ 12 EER	\$100 per Ton
	EH2	≥ 240,000 Btuh and < 760,000 Btuh (21- 63 Tons)	≥ 10.8 EER	\$100 per Ton
	EH3	≥ 760,000 Btuh (63 tons)	≥ 10.2 EER	\$100 per Ton
Water-Cooled Chillers	EH4	ALL	Level 1 (see specifications)	\$33.00 per Ton
	EH5		Level 2 (see specifications)	\$66.00 per Ton
Air-Cooled Chillers	EH6	ALL	Level 1 (see specifications)	\$50.00 per Ton
	EH7		Level 2 (see specifications)	\$100.00 per Ton
Room Air Conditioners	EH8	ALL	See specifications	\$83.00 per Ton
PTAC/PTHP Packaged Terminal Air Conditioners or Heat Pumps	EH9	ALL	EER > 13.08-(0.2556 x Btuh Capacity/1000)	\$50.00 per Ton

Illinois Energy Now

Water Cooled Chiller

Water- and Air-cooled Chillers

Incentive applies for new chillers where rated kW/ton for the Integrated Part Load Value (IPLV) is less than or equal to the qualifying Level 1 and Level 2 efficiency shown in the table below. The chiller efficiency rating must be based on AHRI Standard 550/590-2003 for IPLV conditions and not based on full-load conditions. The chillers must meet AHRI Standards 550/590-2003 and be UL listed. The refrigerant must comply with local codes. The AHRI net capacity value should be used to determine the chiller tons. **A manufacturer specification sheet with the rated kW/Ton-IPLV or COP-IPLV must accompany the application.** Qualifying efficiencies for chillers are summarized below.

Chiller type	Size (Tons)	Level 1 kW per Ton IPLV	Level 2 kW per Ton IPLV
Scroll or Helical-Rotary	< 150	0.55	0.49
	150 to 299	0.52	0.46
	>= 300	0.49	0.43
Centrifugal	< 300	0.54	0.48
	300 to 599	0.49	0.44
	>= 600	0.49	0.43
Reciprocating	ALL	0.63	0.56
Air-Cooled	ALL	1.04	0.86

Grant Funding

DCEO FY2012: 5,631 Ton Machine (Chiller 7)

Level 1 kW/Ton IPLV: 0.49 (\$33.00/Ton)

Level 2 kW/Ton IPLV 0.43 (\$66.00/Ton)

Chiller 7 Performance: 0.422

Total Grant Dollars Awarded: \$371,646

DCEO FY2013: 2,804 Ton Machine (Chiller 6)

Level 1 kW/Ton IPLV: 0.49 (\$33.00/Ton)

Level 2 kW/Ton IPLV 0.43 (\$66.00/Ton)

Chiller 6 Performance 0.400

Grant Dollars Awarded: \$185,064

Bonus Incentive From DCEO for Completing Work Prior to Feb 14, 2013 (14%): \$25,909

Total Grant Dollars Awarded: \$210,973

New Cooling Loads on CCWS

- Chilled Water Capacity Charge Account
 - Started in 1997 with Plan for CCWS
 - Version 3 in FY '08 1970 \$/Ton (+3% / yr)
 - Based on total connected load of HX (coils).
- Provided to Project from CCWS funds
 - Capacity in Central Plant
 - Branch Piping to Building
 - Metering and Building Entrance Control
- Also funded 6.5 M Gal TES (5400 Tons NPCF)
- Provided \$ 30 M for CCWS Expansion 17 yrs
- Current balance \$ 900,000

Project Goals

- Capacity, capacity, capacity
- Highly efficient
- Get back to fuel flexibility



Chillers #3 & #4

Current Oak Street Plant



Chiller # 5



Chillers #1 & #2

Oak Street Chiller Plant

First Floor Space Available

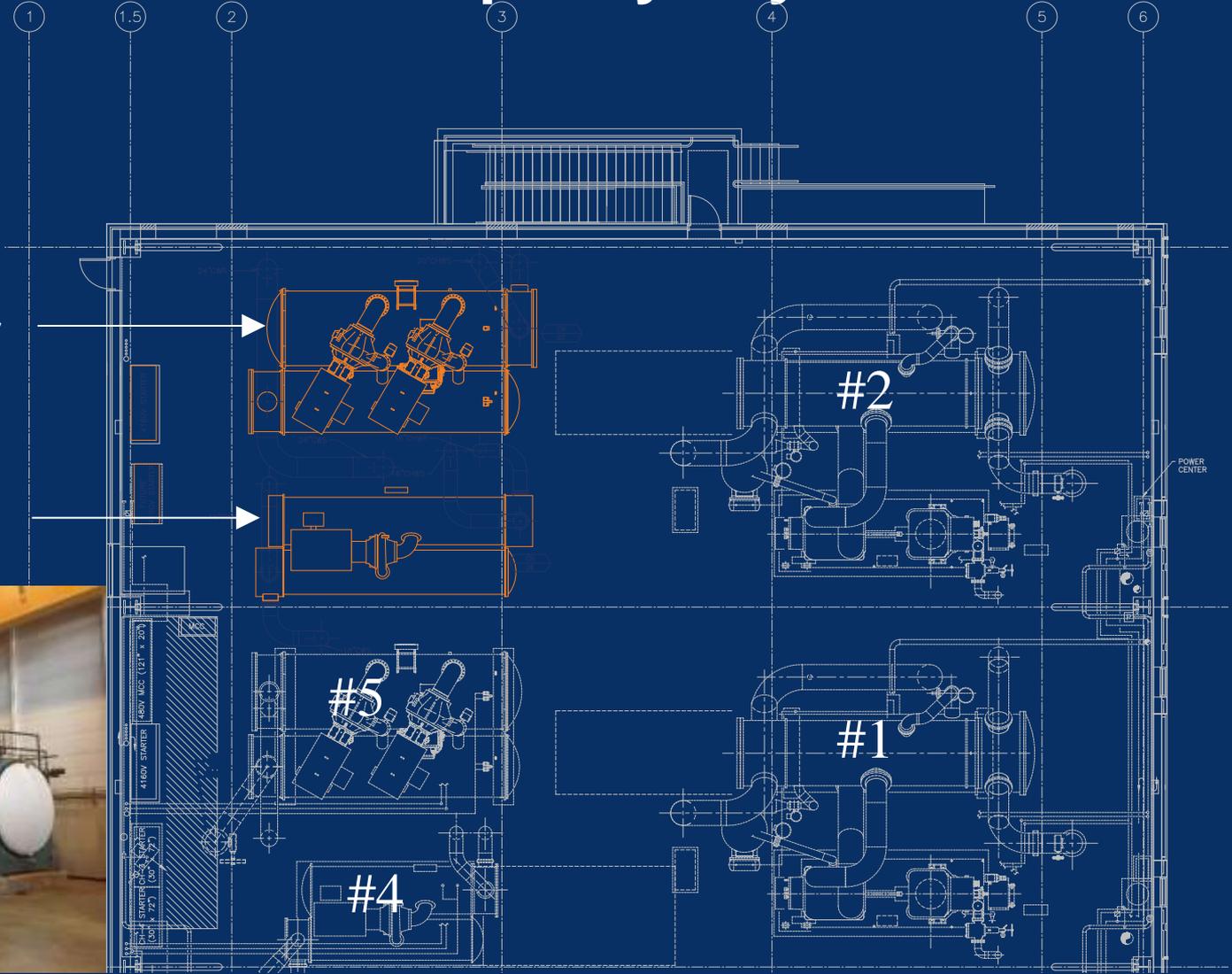


Oak Street Chiller Plant

First Floor Max. Capacity Layout

5,600 Ton
Duplex Chiller

2,800 Ton
VSD Chiller



Oak Street Chiller Plant

Other Project Components



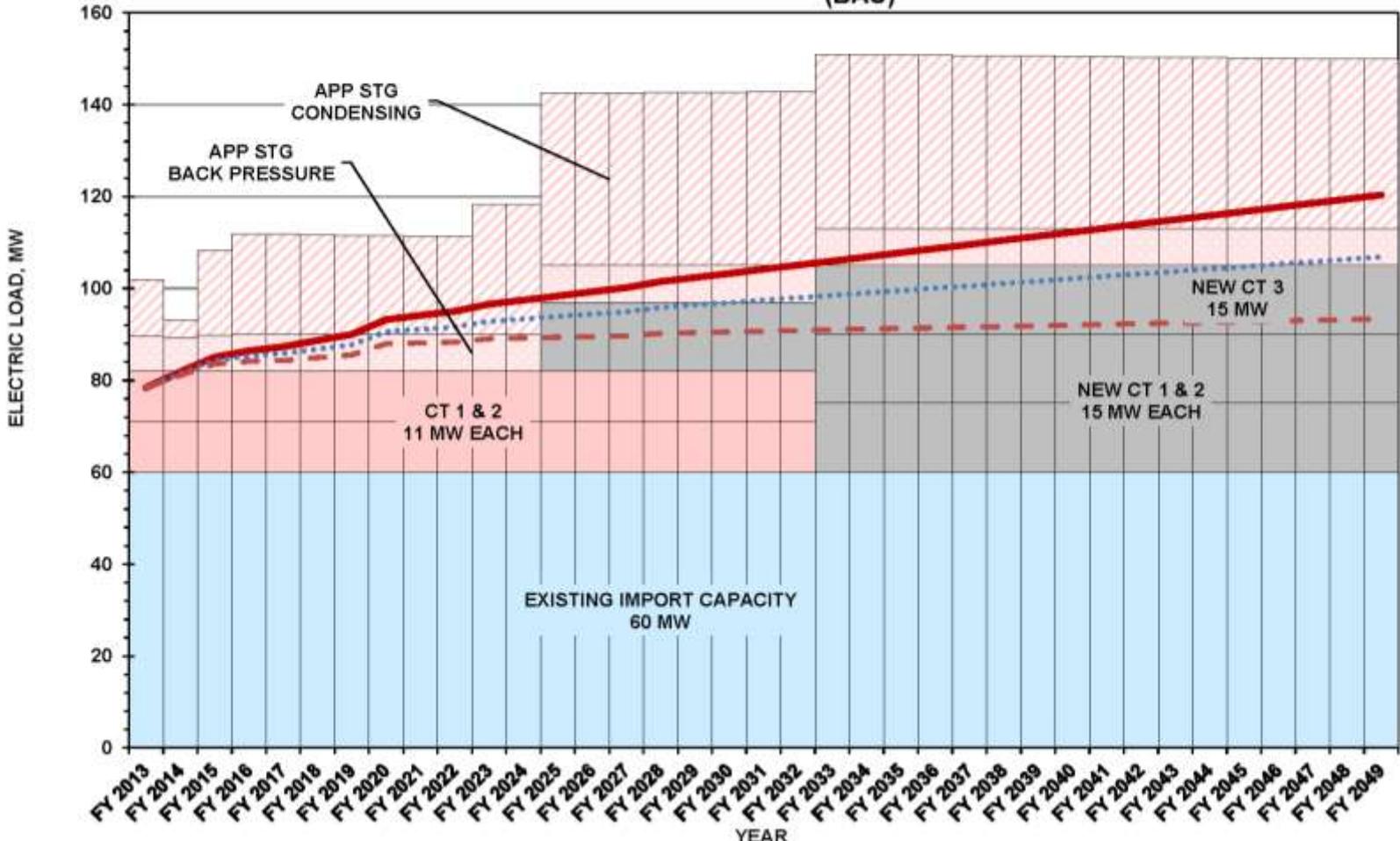
Steam vs. Electric

- Electrically constrained
- Capacity constrained
- Operationally constrained

Electric Load Summary

- EXISTING IMPORT CAPACITY
- APP COND
- FUTURE ELECTRIC LOAD, 75K GSF/YR
- APP BP
- FUTURE ELECTRIC LOAD, 150K GSF/YR
- FUTURE ELECTRIC LOAD, 0 GSF/YR

ELECTRIC CAPACITY VS. FUTURE LOAD (BAU)

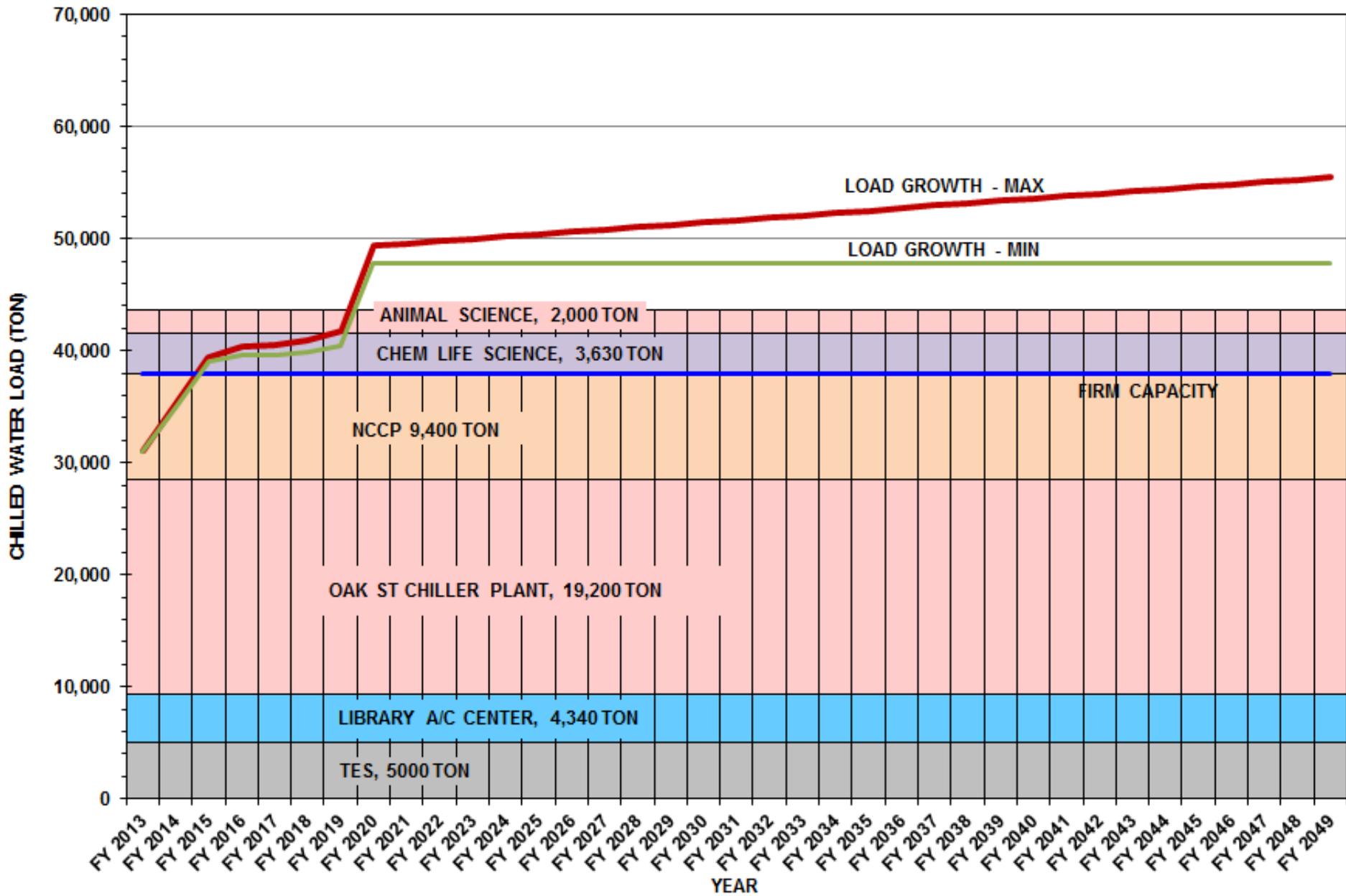


Steam vs. Electric

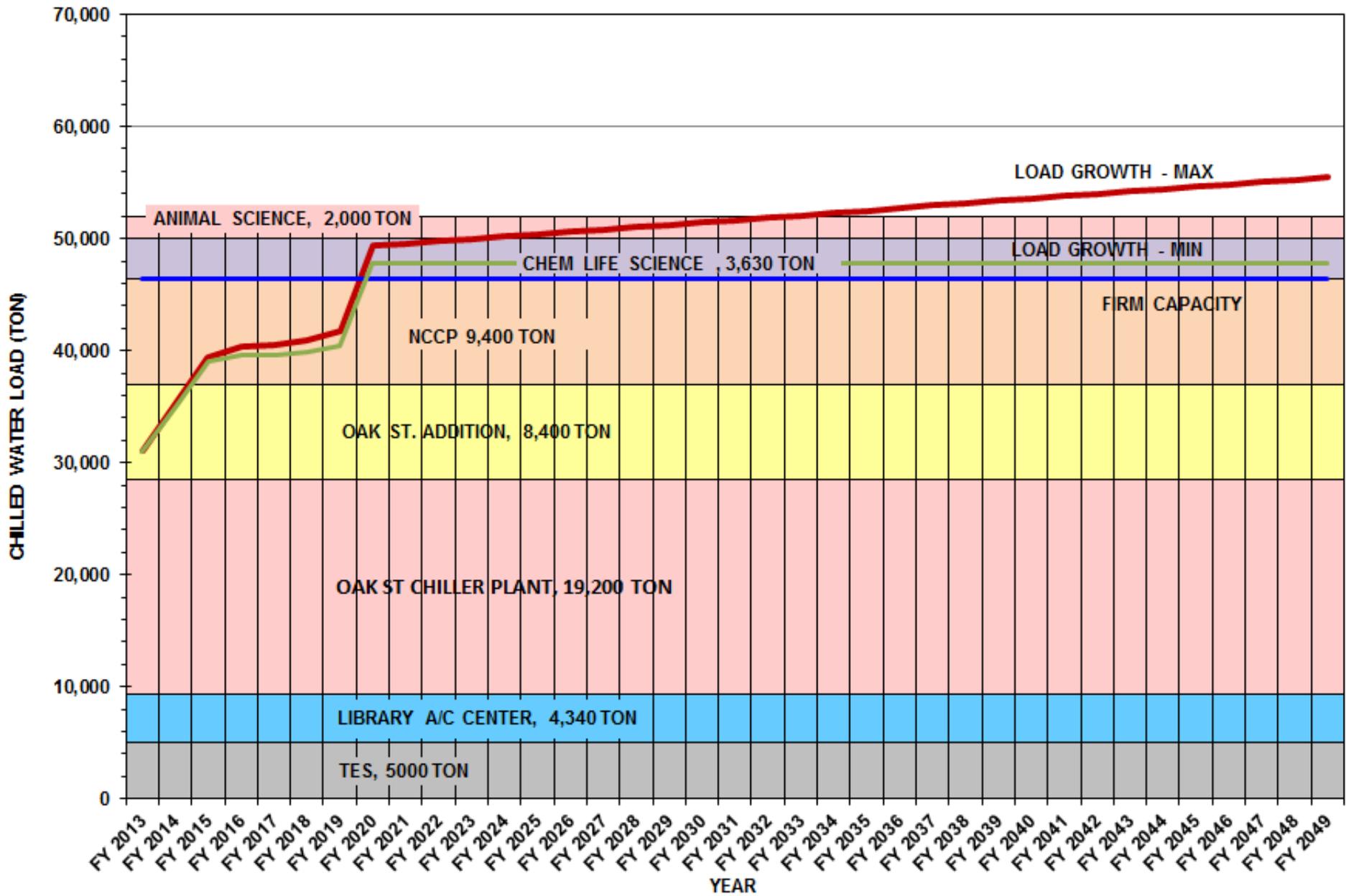
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CHILLED WATER CAPACITY VS. FUTURE LOAD

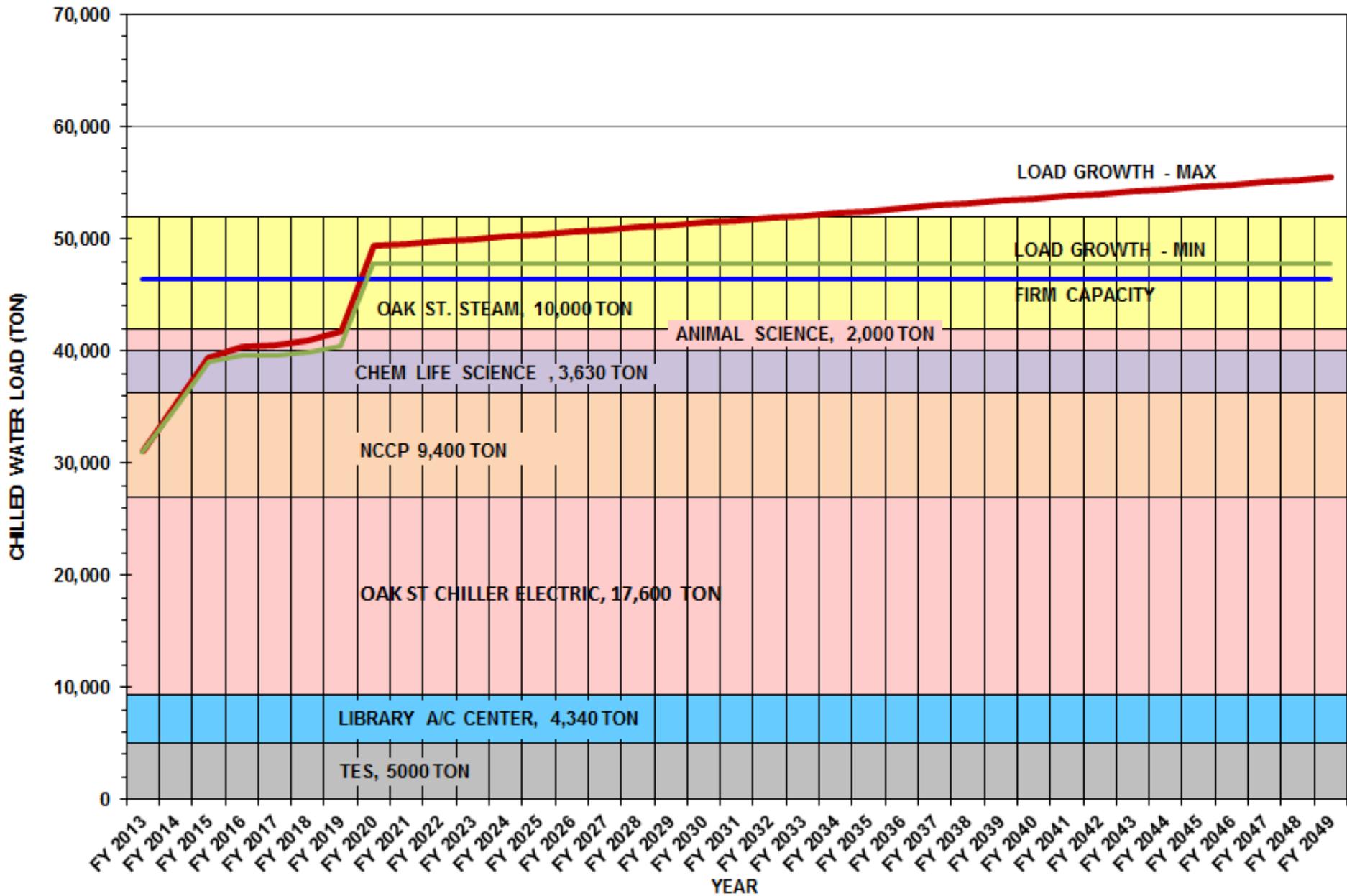
Prior to Chiller Expansion



CHILLED WATER CAPACITY VS. FUTURE LOAD After Chiller Expansion



CHILLED WATER CAPACITY VS. FUTURE LOAD After Chiller Expansion

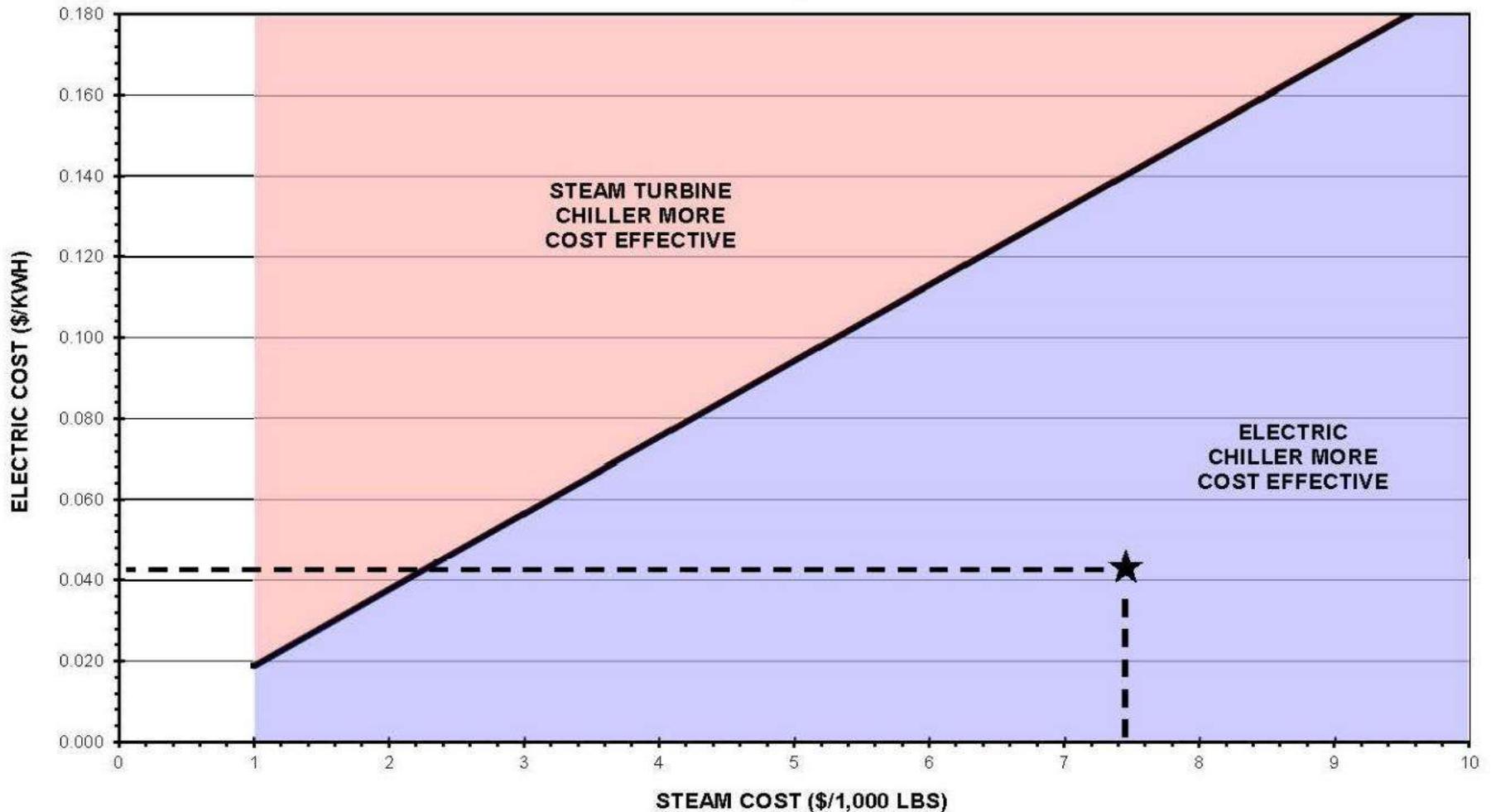


Steam vs. Electric

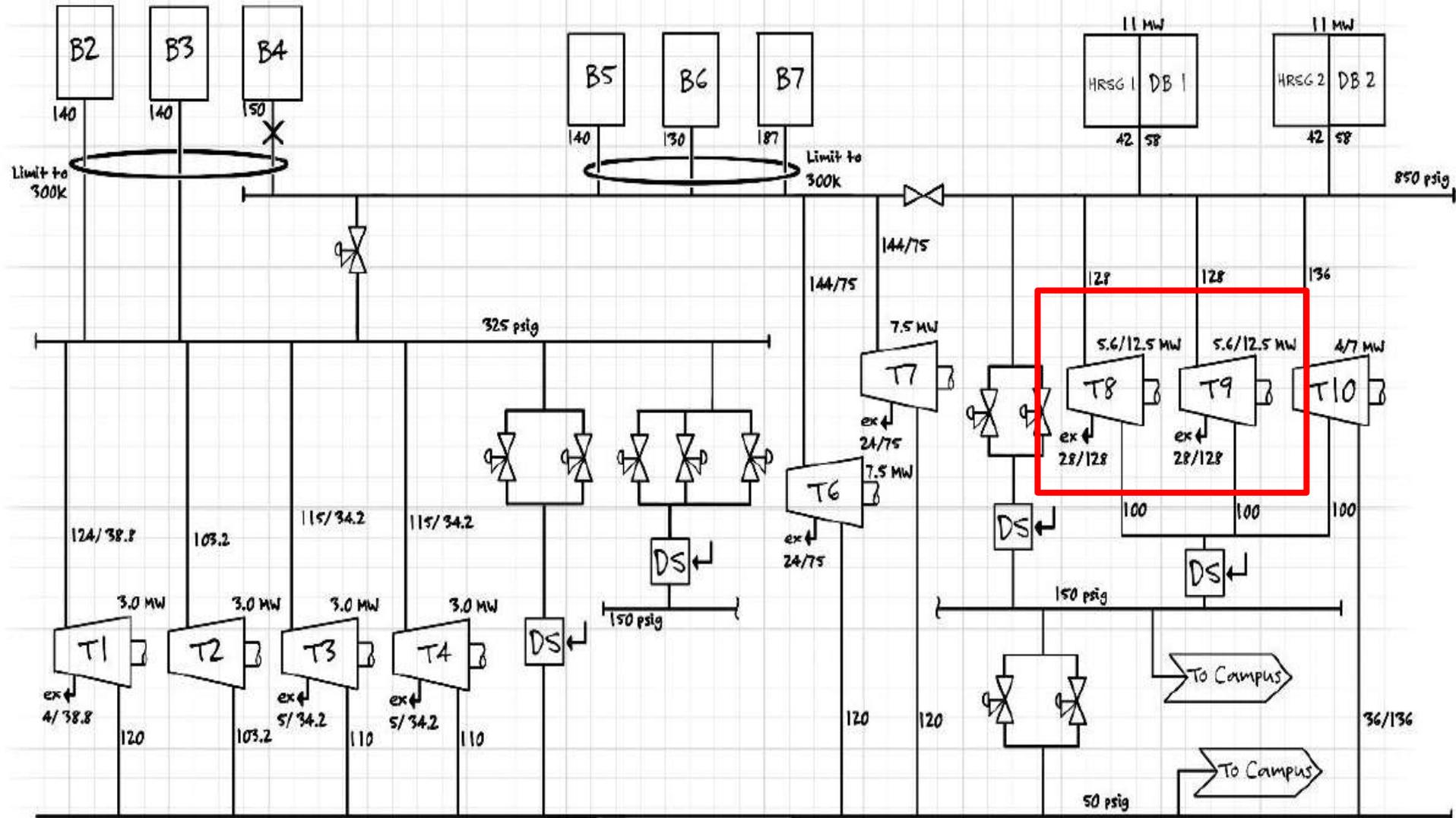
- Electrically constrained
- Capacity constrained
- Operationally constrained

Steam Turbine vs. Electric Chiller Operational Cost

STEAM TURBINE VS ELECTRIC CHILLER OPERATION
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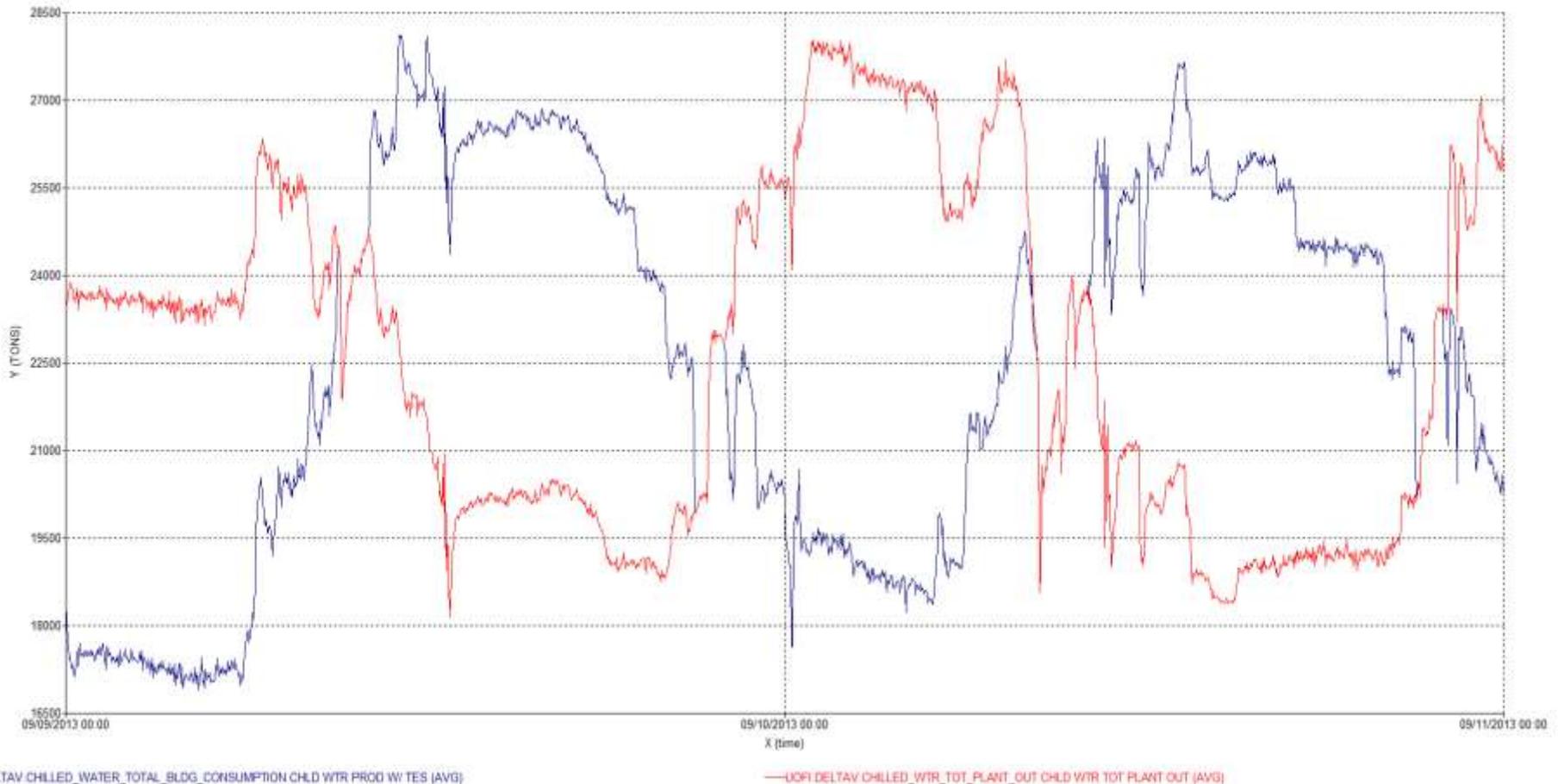


Abbott Power Plant



Chilled Water Load Profile with Chiller Output Profile

DNA History Plot



Summary

- Reinstated fuel flexibility
- Maximized capacity in available space
- Added much needed cooling tower capacity
- Re-purpose 5,000 ton steam chillers
 - Free cooling duty
 - Peaking capacity
 - Bridge for electrical import restrictions