A Proactive Approach to Growth - Texas A&M Utility Master Planning Update

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CampusEnergy2018:
SHARING SOLUTIONS,
SUSTAINING OUR FUTURE

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TEXAS A&M UNIVERSITY OVERVIEW

5,200 acres; 800+ buildings; 30 million GSF served

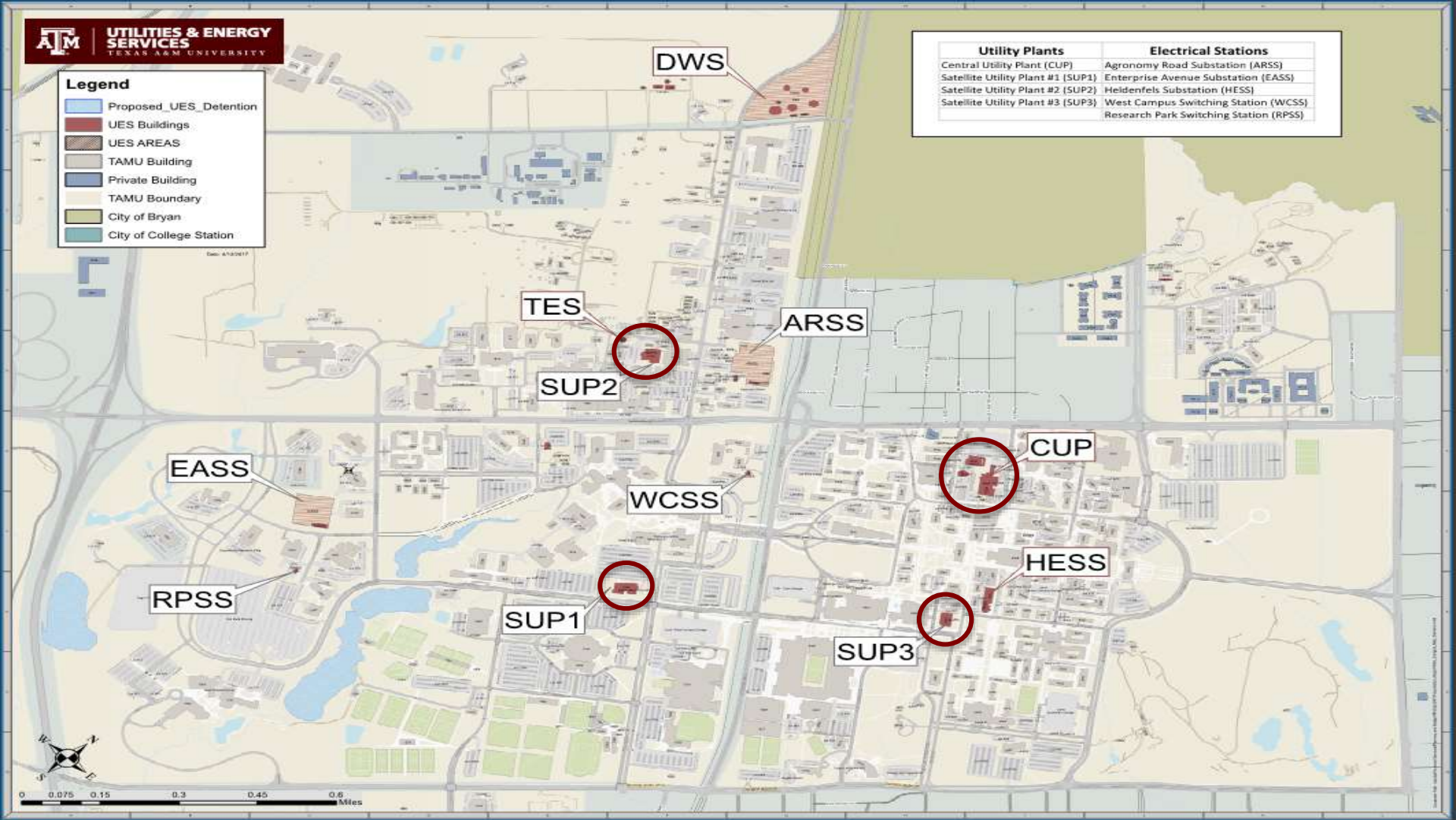
4 million GSF added since 2016

Over 68,500 students with 11,000 faculty and staff

Seven utility plants - CUP, SUP1, SUP2, SUP3, RELLIS, HSC, MCB

Utility Plant Capacities:

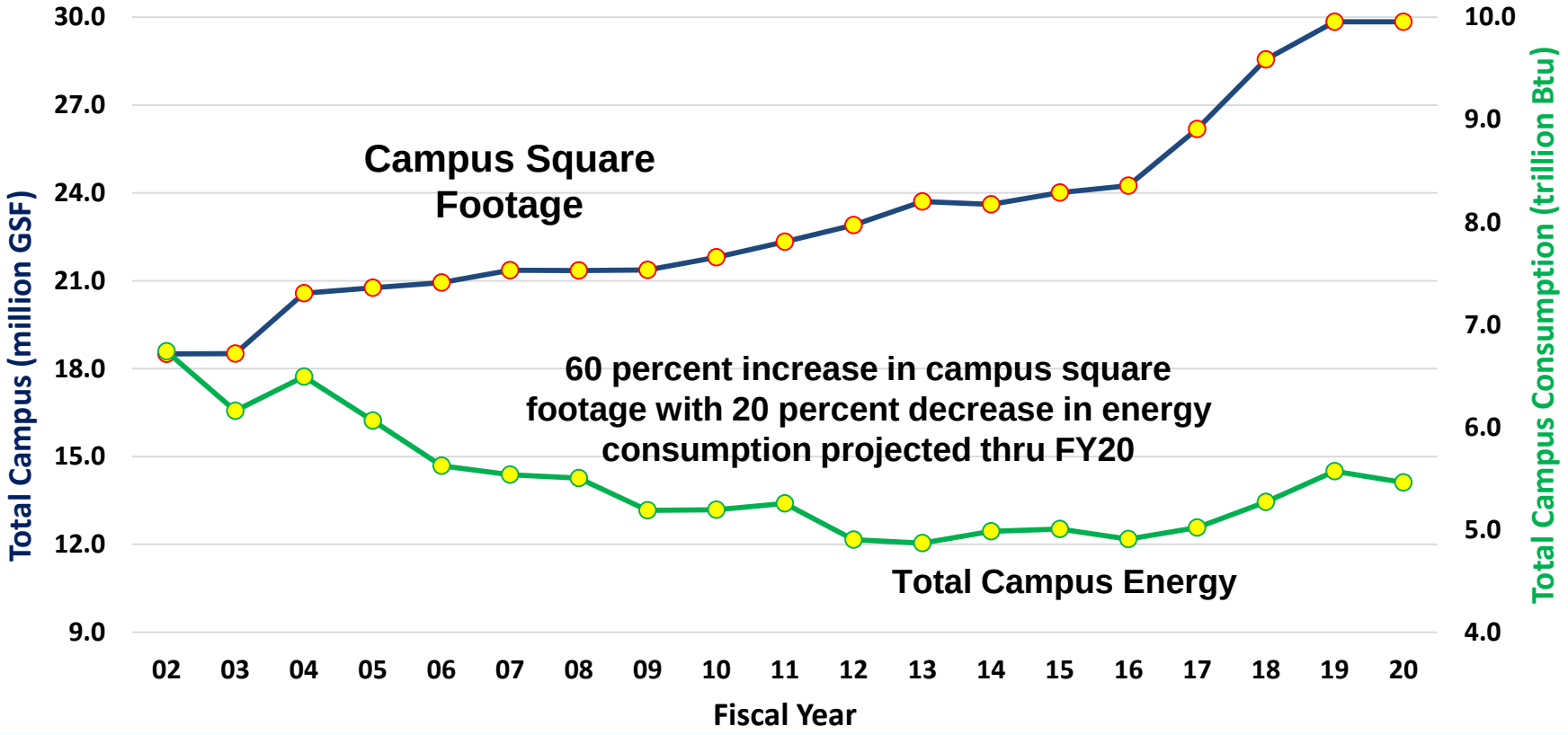
- 50 MW power generation
  - 34 MW gas turbine
  - 16 MW with two steam turbines
- 65,000 tons of cooling (both electric & steam)
- 440,000 pph of steam
- 600 million Btu/hr of heating hot water


UTILITIES & ENERGY SERVICES
TEXAS A&M UNIVERSITY
Legend
Proposed_UES_Detention
UES Buildings
UES AREAS
TAMU Building
Private Building
TAMU Boundary
City of Bryan
City of College Station
Utility Plants
Central Utility Plant (CUP)
Satellite Utility Plant #1 (SUP1)
Satellite Utility Plant #2 (SUP2)
Satellite Utility Plant #3 (SUP3)
Electrical Stations
Agronomy Road Substation (ARSS)
Enterprise Avenue Substation (EASS)
Heldenfels Substation (HESS)
West Campus Switching Station (WCSS)
Research Park Switching Station (RPSS)
DWS
TES
ARSS
SUP2
CUP
EASS
WCSS
HESS
RPSS
SUP1
SUP3
0 0.075 0.15 0.3 0.45 0.6 Miles

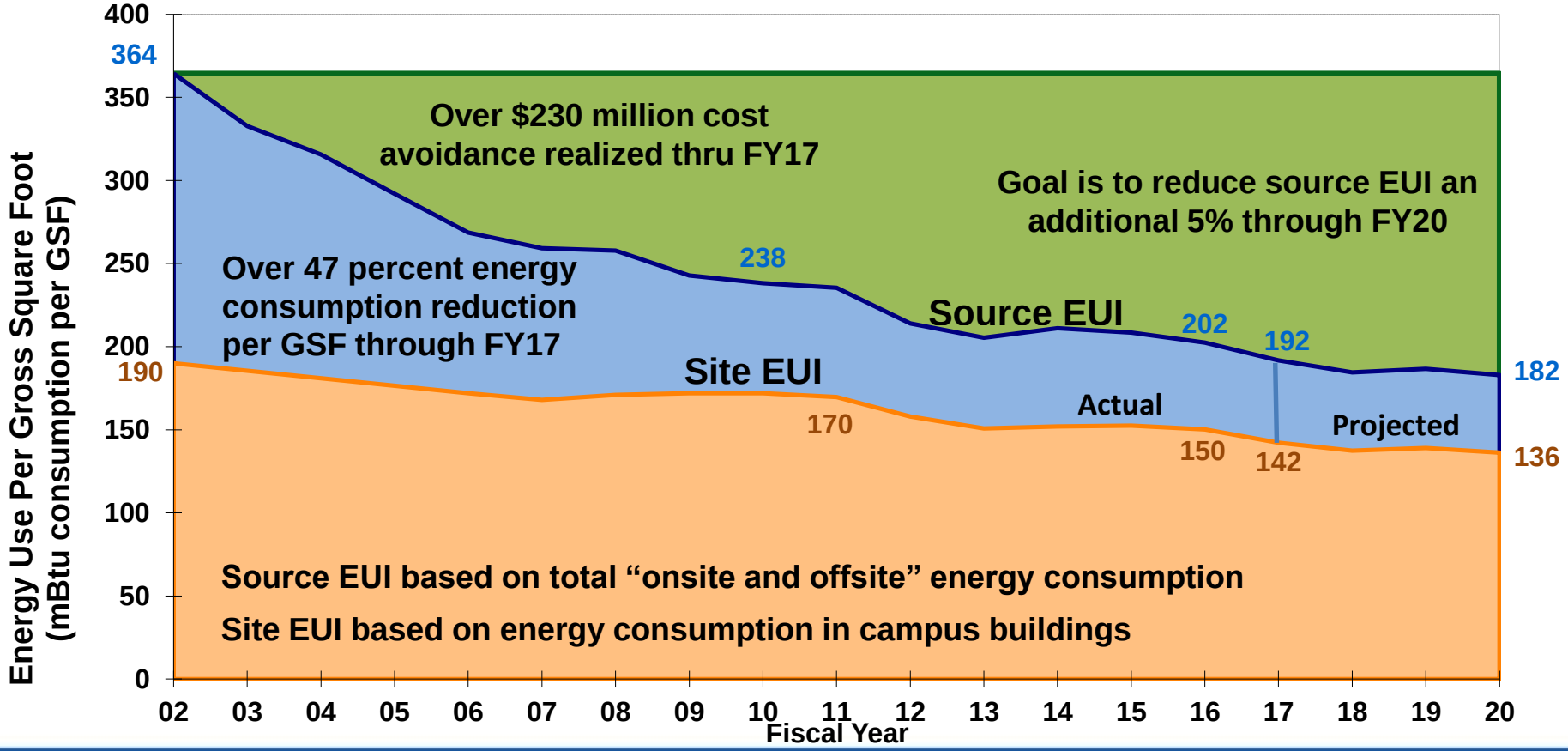
INTRODUCTION TO TAMU UES

PROCUREMENT	TRANSMISSION	PRODUCTION	DISTRIBUTION	METERING & BILLING	DEMAND-SIDE MANAGEMENT
Calculate and **nominate** campus electricity & NG requirements **Specify** annual and monthly **consumption quantities** Review and recommend **payment of invoices** Serve on TAMU **energy procurement and risk management** committee	**TAMU owns:** • Domestic water transmission system **Atmos owns:** • HP (600 psi) NG transmission system to CHP facility **BTU owns:** • 138kV electrical transmission system (ERCOT) **Supply coordination** • Atmos • BTU • ERCOT	**Management of:** • Four campus utility plants • Moore Connally Building utility plant • Health Science Center utility plant • RELLIS utility plant • Solid Waste & Recycling Services • 2 wastewater treatment facilities • Domestic water systems **Production of:** • Electricity • Chilled Water (for cooling) • Hot Water (for heating) • Domestic Water (hot & cold) • Steam	**TAMU owns and operates campus delivery systems:** • 12.5kV Electrical • Domestic Water (hot & cold) • Chilled Water • Heating Hot Water • Steam • Sanitary Sewer • Storm Drainage **HSC Campus (Bryan)** **RELLIS Campus** **Atmos owns:** • LP & IP natural gas distribution systems	**2,500+ revenue-quality meters** in over 500 buildings Manage **utility rate model** and rate setting Manage **customer invoicing and utility cost recovery** • Operating budget • Capital upgrades • Purchased energy	**Building automation** and **HVAC operation** **First response** to ensure **customer comfort** and **environmental control** **Energy Stewardship** **Energy Performance Improvement (EPI)** **Energy management services** **Design review** and capital project coordination Customer requests thru AggieWorks Center **Capital renewal** and upgrade

CAMPUS GSF VS ENERGY CONSUMPTION



ENERGY USE INTENSITY – CONSUMPTION PER GSF



UTILITY AND ENERGY INITIATIVES

- Comprehensive Building Utility Metering
- Combined Heat and Power (CHP)
- Energy Consumption Reductions - $30 million invested over six years
- Energy Stewardship Program
- Energy Performance Improvement (EPI) Program
- Energy Action Plan (EAP) 2020
- Chilled Water Optimization Program
- Utilities & Energy Design Standards
- Utilities & Energy Master Planning
- Utility Infrastructure Capital Investment

UTILITY MASTER PLANNING

Primary Issues Addressed in 2017 UMP

- Capacity
- Reliability
- Future Load Growth
- Demand Side Management
- Design Standards
- GHG Emissions

MASTER PLANNING BENEFITS

Why another Utility Master Plan?

- Significant campus expansion
- Aging equipment/systems required upgrades
- Desire to expand scope of proven ECRMs

Delayed Savings are LOST Savings

MASTER PLANNING STEPS – OUR PROCESS

Streamlined Master Planning Approach

- 2012 UMP vs 2018 UMP
- Match load projections to Campus Master Plan
  - Engagement of all stakeholders from the start
- Worked very closely with UES staff and management
- Design Standards – captured “Tribal Knowledge”
- Focused on thoughtful capacity additions
  - **Load/Duration Curve was key to success!**

MASTER PLAN RESULTS

Key Growth Areas by 2037

- Chilled Water
  - **40%** on East Campus, **98%** on West Campus
- Heating Water
  - **32%** on East Campus, **100%** on West Campus
- Domestic Hot Water
  - **Little to no growth** in central production & distribution
- Electrical
  - **70%** overall

MAJOR PROJECTS AND UPGRADES

$226 million in projects identified by 2037 (FY17 dollars)

- Two Satellite Utility Plant Expansions
- New Satellite Utility Plant Construction
- Additional Heat Recovery Chiller Capacity
- Consolidation of UES personnel in a new building
- Minimization of centralized process steam
- Aggressive Demand Side Management Program
- Upgrades based on age, condition, and capacity

MAJOR PROJECTS AND UPGRADES – FIRST 5 YEARS

DESCRIPTION	LOCATION	SYSTEM	REPLACEMENT TYPE	COST (FY17 DOLLARS)	COST ESC TO INSTALL YEAR
FY18-FY22					
CUP CT-13/14-P1 3 REPAIR-CAPACITY	CUP	CHW	REPAIR-CAPACITY	$ 202,000	$ 202,000
SUP2 HHWB201 17 MMBTU REPLACEMENT	SUP2	HHW	REPLACEMENT	$ 930,000	$ 960,000
SUP2 HHWB202 17 MMBTU REPLACEMENT	SUP2	HHW	REPLACEMENT	$ 930,000	$ 960,000
SUP3 DHWB301/302 17 MMBTU REPLACEMENT	SUP3	DHW	REPLACEMENT	$ 1,030,000	$ 1,160,000
CUP CT13-P2 REPAIR-CAPACITY	CUP	CHW	REPAIR-CAPACITY	$ 834,000	$ 859,000
CUP CT-15 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 87,500	$ 90,000
CUP CT-16 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 88,000	$ 91,000
DISTRIBUTION RESEARCH, FD-1 24"/12"	DISTRIBUTION	DIST	ADDITION	$ 4,106,000	$ 4,357,000
DISTRIBUTION SOUTHSIDE, IPDD-2 12"/6"	DISTRIBUTION	DIST	ADDITION	$ 465,000	$ 494,000
SUP2 HHWB 500 BHP ADDITION	SUP2	HHW	ADDITION	$ 1,475,000	$ 1,570,000
BAS SIEMENS CONTROL UPGRADES - PHASE 1	CAMPUS BUILDINGS	CNTRL	UPGRADE	$ 9,190,000	$ 9,750,000
UTILITY PLANT CONTROL UPGRADES	UTILITY PLANTS	CNTRL	UPGRADE	$ 7,000,000	$ 7,400,000
MCB CH901-902 & CT901-902 225 TON REPLACEMENT	MCB	CHW	REPLACEMENT	$ 1,300,000	$ 1,500,000
CUP CT14-P3 REPAIR-CAPACITY	CUP	CHW	REPAIR-CAPACITY	$ 266,500	$ 283,000
CUP CT-17 REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 88,000	$ 93,000
CUP CT-21 REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 75,000	$ 80,000
SUP2 CT201-203 UPGRADE	SUP2	CHW	UPGRADE	$ 400,000	$ 424,000
HX-1 2020 -20 MMBTU REPURPOSE	HX-1	DHW	REPURPOSE	$ 220,000	$ 250,000
DISTRIBUTION CAMPUS FRONT, FD-6-3 24"/12"	DISTRIBUTION	DIST	ADDITION	$ 1,110,000	$ 1,213,000
CUP STEAM SYSTEM IMPROVEMENTS	CUP	STM	UPGRADE	$ 1,680,000	$ 1,834,000
SUP1 CH107/108 2500 TON ADDITION	SUP1	CHW	ADDITION	$ 16,200,000	$ 18,200,000
SUP1 HRC109 1200 TON ADDITION	SUP1	CHW	ADDITION	$ 4,100,000	$ 4,600,000
CUP CT-22 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 32,000	$ 35,000
CUP CT-23 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 32,000	$ 35,000
CUP HX-7 60 MMBTU REPLACEMENT	CUP	HHW	REPLACEMENT	$ 680,000	$ 760,000
BAS SIEMENS CONTROL UPGRADES - PHASE 2	CAMPUS BUILDINGS	CNTRL	UPGRADE	$ 5,000,000	$ 5,600,000
CUP CT-24 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 94,000	$ 106,000
CUP CT-25 N/A REPAIR-MAINT	CUP	CHW	REPAIR-MAINT	$ 94,000	$ 106,000
SUP3 HHWB303 17 MMBTU REPLACEMENT	SUP3	HHW	REPLACEMENT	$ 900,000	$ 1,050,000
DISTRIBUTION WEST, P2-2, P3-1A 24"/12"	DISTRIBUTION	DIST	ADDITION	$ 3,662,000	$ 4,246,000
DISTRIBUTION RESEARCH, P2-4 18"/10"	DISTRIBUTION	DIST	ADDITION	$ 751,000	$ 871,000
DOMESTIC WATER SYSTEM NORTHEAST END EXPANSION 12"	DOMESTIC WATER SYSTEM	DCW	ADDITION	$ 570,000	$ 660,000
UES BUILDING DEVELOPMENT	UES	UES	NEW CONSTRUCTION	[illegible]	9,750,000
FY18-FY22 TOTALS				**$ 72,002,000**	**79,589,000**

STEAM SYSTEM EVALUATION

Site Investigation

- General Condition
- Tunnel Structure
- Piping Supports
- Pipe Condition
- Efficiency/Safety

Load Analysis

Options Evaluated

- Continued Distribution
- Local Boiler Generation
- Equipment Upgrades/Retrofits
- **$~200k cost avoided**

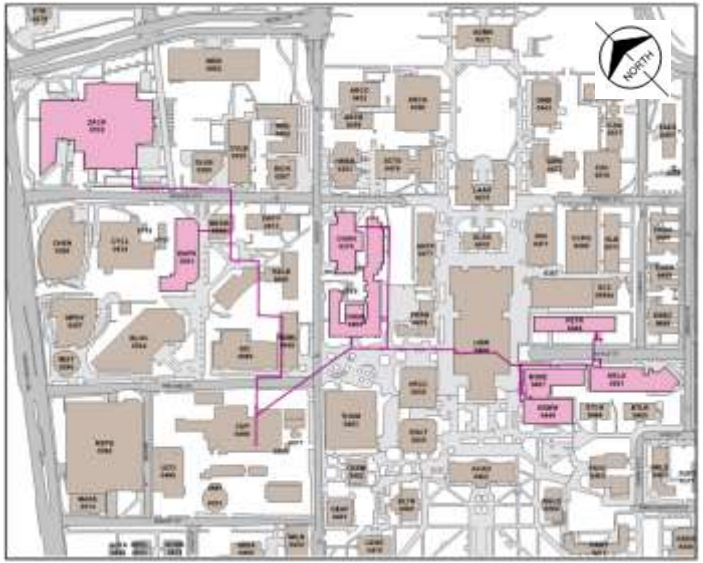


Table 9-7: Steam and Tunnel System Improvements Recommendations

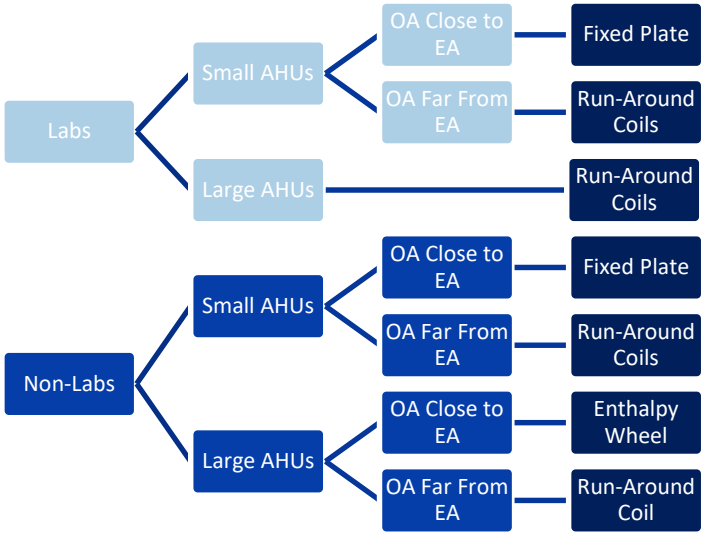
Description	Cost
Replacement of End-User Equipment	$220,000
Retrofit of End-User Equipment	$55,000
New Steam Supply to CHEM Complex	$230,000
Structural Improvements – Tunnel	$470,000
Other Mechanical Improvements – Tunnel	$130,000
Indirect Costs	$575,000
Total Cost	**$1,680,000**

DEMAND SIDE MANAGEMENT– HEAT RECOVERY

Opportunity: Historical failure and improper design of exhaust air Heat Recovery

Recommendation: Design and operate the most efficient, maintainable, commercially available system for the appropriate air classifications.

	Fixed Plate HX	Enthalpy Wheel	Heat Pipe	Run-Around Coil
Cool Savings	$3,671	$16,568	$2,824	$3,106
Heat Savings	$5,841	$9,996	$4,493	$4,942
Fan Savings	$(1,526)	$(1,526)	$(1,653)	$(1,653)
Aux Savings	$-	$(170)	$-	$(1,023)



DEMAND SIDE MANAGEMENT– LABS

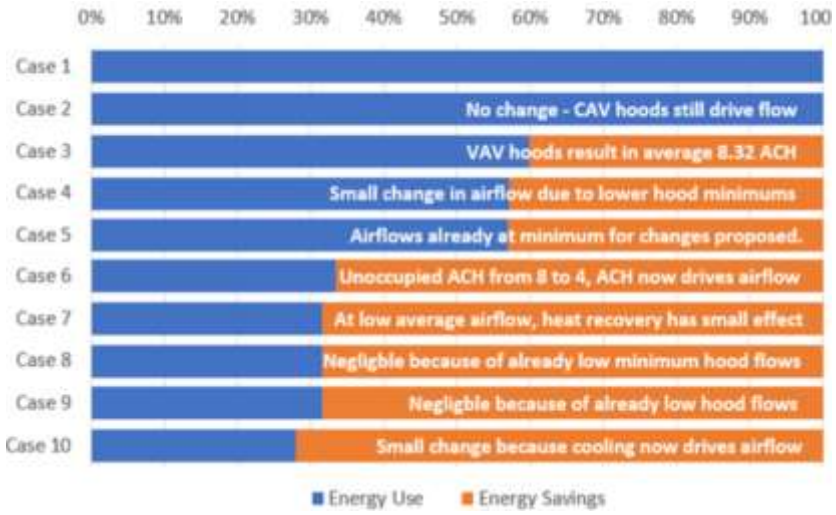
Opportunity: Increase energy efficiency in laboratories and 1,712 fume hoods on campus.

Recommendation: Strategically invest in the right kinds of labs, and in the right order.

Lab Incremental Opportunities

Case	Description	Relative Capital Investment
Case 1	Baseline - Constant Air Volume (CAV) Supply, Exhaust, and Hoods	n/a
Case 2	VAV Supply, CAV Hoods	$$$
Case 3	VAV Hoods and Supply	$$$$
Case 4	Minimum hood airflows to ANSI Z9.5. Unocc sash position lowered to 20%	$
Case 5	Minimum room airflow setpoints to 8 ACH when occupied	$
Case 6	Add room occ sensors, minimum airflow setpoints at 4 ACH when unoccupied	$$
Case 7	Add air-side heat recovery, run-around coils	$$$
Case 8	Fume hood zone presence sensors, with unocc face velocity = 60 fpm	$$
Case 9	Automatic sash closers. Unocc sash position = 0%	$$
Case 10	Demand-based ventilation. ACH 4/2	$$

Energy Savings Potential



DEMAND SIDE MANAGEMENT– OTHER OPPORTUNITIES

Opportunity: Continue utilizing technology, people, and programs to reduce energy use

Recommendation: Build on the success of past programs to enable further energy reduction to offset campus load growth.

- Look at DSM investments as “utility system assets”
- Replace obsolete and limiting controls components to prevent loss of functionality and data
- Integrate best available technologies and programming into the controls replacements, to realize a return on the larger investment.
- Investigate the potential of FDD software complimenting existing real-time monitoring

ENERGY AND GHG SAVINGS

Key Features of Plan

- Over 2/3 of the total emissions (298,550 MTCDE) related to energy
- GHG output from existing buildings **- reduce by 1.5% annually**
- GHG output from new buildings – **reduce by 1% annually**
- Campus carbon output associated with energy consumption will be **reduced by approximately 20%** when compared to a baseline of current carbon intensity

NEXT STEPS

Communicate and Sell the Plan!

- Utilities & Energy Services, Finance, Administration, Campus Community

Implement Strategic Plan

- Near-term projects are first priority

Adjust Plans and Priorities as appropriate

- UMPs must be kept current and relevant
- Update UMP every five years

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