Texas Tech University Energy and Water Management Plan
FY 2018 Update

State Energy Conservation Office requires Texas Tech University to publish this Energy and Water Management Plan (formerly Energy Savings Program Update) in accordance with 34 Tex. Admin. Code §19.14. In addition, we report water, electricity, and natural gas consumption using Energy Star Portfolio Manager according to Tex. Gov. Code Sections 447.009 (c) and (e).

The Energy and Water Management Plan will be posted on the Operations Division website.

A. Energy Goals

1. University Energy Use

Energy units are converted to thousands of BTUs per square foot (kbtu/ft^2) to allow for comparisons of the various energy forms. Goals and energy use are therefore stated in kbtu/ft^2. Estimated savings are measured against energy consumption for the prior fiscal year.

For FY18, the campus consumed 138.59 kbtu/ft^2, an increase of 4.7% from the previous year. The goal was to reduce energy use to 129.21 kbtu/ft^2. Texas Tech fell short of the goal by 9.38 kbtu/ft^2 for the following reasons:

- Strategy of decommissioning chilled water mixing valves was experimental; cusum analysis indicates that the strategy degraded campus efficiency, increased chilled water usage, and reduced chilled water delta T, while not adversely affecting the CHACP itself. Chilled water production for FY18 is up 14% (834,256,186 gallons) compared to FY17. The increase in chilled water impacted the EUI by 6.07 kbtu/ft^2.
- Natural Gas consumption for FY18 is up 14% compared to FY17.
- Campus square footage increased by 324,771 ft^2. 72% of the increase (233,988 ft^2) is represented by two new Auxiliary buildings, Honor's Residence Hall & Sports Performance Center, which are running 24/7.
- Degree days are up 16%. Heating degree days comprise 60% of the increase. The total increase in degree days impacted the EUI by 5.19 kbtu/ft^2.
- Freeze Protection Protocol: the cost of freeze protection evolutions in FY18 increased by $78,108. Freeze Protection impacted the EUI by 0.70 kbtu/ft^2.

In Table I, the campus energy use is broken down by utility type. Electricity cost decreased by $334,088, natural gas cost increased by $230,226, so the total savings is $103,862.

Table I: University Energy Use (kbtu/ft^2): September '17 – August '18

Utility	FY17 Actual	FY18 Actual	% Change from previous year	Estimated Savings
Electricity	57.22	55.55	Down 2.9%	$334,088
Natural Gas	75.16	83.04	Up 10.5%	-$230,226
Cogeneration Steam	0.00	0.00	N/A	$0
Total	132.38	138.59	Up 4.7%	$103,862

2. Campus Electrical Use

In compliance with 34 Tex. Gov. Code §19.14, Texas Tech University had set a goal to reduce total electrical consumption by 2.5% for FY18. Table II shows the kilowatt hours per square foot (kwh/ft^2) for the campus in Lubbock County.

For FY18, electrical consumption is 16.44 kwh/ft^2, a decrease of 3.1% compared to FY17 (16.97 kwh/ft^2 for the year).

Table II: Campus Electricity Use (kwh/ft^2): September '17 – August '18 (Lubbock County)

Whole Campus Electricity Use in kwh/ft2	FY17 Reference Data in kwh/ft^2	2.5% Reduction Goal in kwh/ft^2	FY18 Actual Consumption in kwh/ft^2	Percent Increase/Decrease from previous year, by quarter
1st Quarter	4.29	4.18	4.26	Down 0.7%
2nd Quarter	3.95	3.85	3.69	Down 6.7%
3rd Quarter	4.16	4.06	4.10	Down 1.5%
4th Quarter	4.57	4.45	4.40	Down 3.7%
Yearly Total	16.97	16.54	16.44	Down 3.1%

3. Fleet Fuel Management Plan (Vehicles)

Table III below compares the percent change in miles traveled for FY17 and FY18. It indicates a 3.1% decrease in miles traveled.

Table III: Miles Traveled

	FY16	FY17	FY18
Miles Traveled	2,866,994	2,814,207	2,726,049
		-1.8%	-3.1%

Table IV below indicates that fuel efficiency has decreased by 14.2%.

Table IV: Fuel Efficiency

	FY16	FY17	FY18
Miles per Gallon	12.30	12.02	10.32
		-2.3%	-14.2%

4. Water Conservation (Thousands of Gallons)

For FY18, water consumption was 534,797 thousand gallons. This is down 6.7% compared to FY17 (573,293 thousand gallons).

Some of the decrease can be attributed to Grounds Maintenance converting a portion of irrigation service from domestic water to well water. In FY18, meters were installed on 10 water wells. We will report well water usage in FY19.

In table V below, consumption of both domestic water and sewer is down 7.1%. However, sewer rates increased by 17%.

Table V: University Water Use (Thousands of Gallons):

Utility	FY17 Actual	FY18 Actual	% Change from previous year	Estimated Savings
Domestic water	271,008	251,683	Down 7.1%	$62,744
Sewer	271,008	251,683	Down 7.1%	($49,339)
Irrigation water	31,277	31,431	Up 0.5%	($7,649)
Yearly Total	573,293	534,797	Down 6.7%	$5,755

This is the first year that Texas Tech has reported domestic water usage for eight Remote Sites. For FY18, domestic water consumption for remote sites was 9,846 thousand gallons. This is down 12% compared to FY17 (11,186 thousand gallons).

The decline in water usage can be attributed to Pantex (-23%), Tech Plaza (-78%), Library Storage (-46%), and Communication Services (-51%).

Table VII: Remote Sites (Thousands of Gallons):

Utility	FY17 Actual	FY18 Actual	% Change from previous year	Estimated Savings
Domestic Water	6,006	5,295	Down 11.8%	$4,172
Sewer	5,180	4,551	Down 12.1%	$16,958
Yearly Total	11,186	9,846	Down 12%	$21,130

CHACP #1 (Central Heating and Cooling Plant #1) well water use to the cooling towers is up 17.1% due to the same variables that drove the chilled water increase.

Table VII: CHACP #1 Well Water Use (Thousands of Gallons):

Utility	FY17 Actual	FY18 Actual	% Change from previous year
Well water	132,892	155,566	Up 17.1%
Sewer	66,446	77,783	Up 17.1%

B. Energy Reduction Measures

1. Educational and General Space

a) Free Cooling Project at Central Heating and Cooling Plant #1 – The Water Side Economizer provided over 2,311,307 tons (5.7% of total chilled water produced) of free cooling this fiscal year, an estimated savings of $41,852.

b) Back Pressure Turbine at CHACP #1 supplied 10% of the CHACP's electrical use for a cost avoidance of $160,262.

c) Analyzed annual utility bills and annual meter data to determine why Rec Center utility bills went up by $35,000 in FY17. Concluded that $22,000 was due to electric utility rate increases. The remainder was due to incorrect dollar inputs for Steam in December 16 and July 17.

d) eSight identified a low chilled water delta T (1°) on nights and weekends, and a nonfunctioning mixing valve in Art 3D.

e) Identified a chilled water meter factor error in two residence halls: Chitwood and Coleman, reducing E&G costs.

f) Completed a chilled water pump balance audit for the whole campus.

g) eSight identified high chilled water flow at the Law School due to a failed VFD.

h) LED Connections and Energy Management completed an audit of Holden Hall to propose a project for converting the existing lights to LED.

i) Completed a campus wide projection of the costs (materials and labor) to convert all interior lighting to LEDs.

j) Participated in a meeting with FP&C to delineate the desired lighting standards for future construction projects. The meeting also covered revising Division 16 standard to reflect the University's shift to all LED luminaries to conserve energy and reduce maintenance costs.

k) Participated in a meeting with FP&C to discuss the inclusion of meters on all future projects that can send data to the eSight Energy Accounting System.

l) Prepared a CUSUM analysis comparing EUIs for E&Gs and Auxiliaries, demonstrating poor performance among all campus buildings due to decommissioning of building chilled water mixing valves. Prepared work orders to correct the problem in 39 buildings.

m) Identified and corrected an errant chilled water meter factor in Jones Stadium. This will save E&Gs approximately $100,000 per year.

n) Integrated 4 chilled water meters, 9 steam meters, 1 electrical meter and 43 data points into the eSight Energy Accounting System.

o) Expanded Lumewave coverage by installing a gateway on top of CHACP 2.

p) Biology: Completed phase three of the recommissioning project at Biology.

q) Integrated six buildings to Utilivisor to aid in balancing chilled water flows.

r) Submitted 70 workorders for discrepant air handler operations.

s) Used eQuest to model the energy usage at Creative Movement Studio.

t) Completed RCx at the Library, and installed steam, chilled water, and domestic water meters.

2. **Auxiliary Space**

a) Identified rooftop DX units operating without a schedule at Rawls COBA Chick-fil-A. Michael Glass submitted a schedule. Estimated savings are $7,450 a year.

b) Met with Housing to review current trends in utility usage in all areas of Housing. Reported specific equipment discrepancies and prepared 42 related workorders.

c) Submitted energy performance reports to Student Recreation and Student Union.

d) Generated 13 HVAC work orders for specific equipment discrepancies for Athletics, Research Park, Student Wellness, and the Student Rec Center.

e) Identified high mixed air temp at the Rec Center weight room on 3/1. Investigated and prepared a work order for the non-operational air handler and leaking steam valve on 3/9.

f) Wrote a scope of work and solicited approval for BMC to have ConTech install a SYSTEM-10 BTU chilled water meter at Honor's Residence Hall.

g) Wrote a scope of work and solicited approval for TD Industries to replace and integrate 21 failed Auxiliary utility meters. Throughout the year, TDI was able to replace 6 meters.

3. Energy Audits

a) Performed 25 interior lighting audits: Agriculture Education & Communication, Aquatic Center, Architecture, Art, Bayer Plant South, Bayer Plant West, Burkhardt, College of Agricultural Sciences & Natural Resources, Classical & Modern Languages & Literatures, Education, English/Philosophy, ESB II (plans), Fisheries & Wildlife, Food Tech, Goddard, Holden Hall, Housing Services, Kinesiology & Sports Management, Media and Communications, Psychology, Rawls College of Business Administration, Southwest Collections, Student Recreation Center, Student Wellness, and West Hall.

b) Audited meters for fourteen buildings: Psychology, University Theatre, Stangel Murdough, West Village, Biology, Human Science, Talkington, Dan Law, Doak, Chitwood, Jones Stadium, Weymouth, Coleman, and Student Recreation Center.

c) Performed twenty energy audits: Murray, Horn Knapp, Weymouth, Chitwood, Hulen Clements, Wall Gates, Gordon Bledsoe, Sneed, Stangel Murdough, Coleman, Mechanical Engineering North, Media and Communications, Student Wellness, Student Recreation Center, Art 3D, Honors Dorm, Experimental

Sciences, Creative Movement Studio, Doak, and Kinesiology & Sports Management.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech is currently planning energy efficiency measures such as:

a) Ongoing HVAC recommissioning and controls upgrades.
b) Upgrading metering systems for electricity, steam, natural gas, cooling, irrigation and domestic water, and integrating them into eSight Energy Accounting System to improve energy monitoring and identification of excursions. Select meter data will be connected to Utilivisor for the purpose of balancing loads at the Central Heating and Cooling Plant #1.
c) Audit steam distribution system.
d) Monitor energy usage at the Library and Biology for verification of RCx projects.
e) Audit the domestic water meters on campus.
f) Audit the natural gas meters on campus.
g) Utilize eQuest to create energy models for campus buildings.
h) Complete the RCx of chilled water mixing systems and verify the savings.
i) Prepare monthly or quarterly energy reports for all Auxiliary units.

D. Fuel Consumption Reduction Plans

Numerous departments on campus are now utilizing electric utility vehicles and we are advising other departments to do the same when feasible.

The Vehicle Fleet Office will network with vehicle custodians to exchange information on vehicle efficiency and solicit additional best practices and other preferred initiatives for the university vehicle fleet.

The Vehicle Fleet Office will analyze fleet usage within Texas Tech University and recommend best practices for future purchases.

E. Water Management Plan

Operations Division will develop a historical analysis of water efficiency and devise a long-term water conservation strategy to include both domestic water and irrigation water. Ground Maintenance is currently installing irrigation meters for this purpose. The new irrigation meters and existing domestic water meters will be integrated into the eSight Energy Accounting System.

In FY19, Texas Tech will begin reporting well water usage at the Remote Sites.