Texas Tech University Energy and Water Management Plan
FY 2019 Update

State Energy Conservation Office requires Texas Tech University (TTU) to publish the Energy and Water Management Plan (formerly Energy Savings Program Update) in accordance with 34 Tex. Admin. Code §19.14. In addition, Texas Tech University reports 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.

During FY19, Energy Management determined that Atmos natural gas over-burns and under-burns were improperly applied to the campus energy balance, resulting in marginally high energy use index errors for the campus. The impact on the energy use index is summarized as follows:

> In FY17, Texas Tech University reported an EUI of 132.4 kbtu/ft^2. After removal of the under burns and correctly accounting for the over burns, the EUI for FY17 should have been 130.5.
>
> In FY18, Texas Tech University reported an EUI of 138.6 kbtu/ft^2. After removal of the under burns and correctly accounting for the over burns, the EUI for FY18 should have been 132.

After correcting for the errors in FY19, the campus consumed 136.59 kbtu/ft^2, an increase of 3.5% from the previous year. The goal was to consume no more than 135.82 kbtu/ft^2. Texas Tech fell short of the goal by 0.77 kbtu/ft^2 for the following reasons:

- Campus operating hours were extended until 9pm, an increase of three hours, which impacted EUI by 0.5 kbtu/ft^2.

- New facilities increased square footage by 113,309 ft^2, and decommissioned facilities decreased square footage by 22,965 ft^2. The net campus square footage increased by 90,944 ft^2. 97% of the increase in square footage is due to the Lubbock Municipal Coliseum & Auditorium which was turned over to Texas

Tech University from the City of Lubbock. Energy to the Coliseum impacted EUI by 0.26 kbtu/ft^2.

- Degree days increased 11% net, with heating degree days accounting for 100% of the increase. This impacted the EUI by 3.29 kbtu/ft^2 and increased natural gas consumption 7.1% compared to FY18.
- Freeze Protection Protocol: the cost of freeze protection evolutions in FY19 was $42,402. Freeze Protection impacted EUI by 0.63 kbtu/ft^2.
- Building Maintenance and Construction (BMC) secured steam to campus May through August, avoiding 4.3 kbtu/ft^2 consumption of steam.

In Table I, the campus energy use is broken down by utility type. Electricity decreased by $151,208, natural gas increased by $136,933, so the net savings is $14,275.

Table I: University Energy Use (kbtu/ft^2): September '18 – August '19

Utility	FY18 Actual	FY19 Actual	% Change from previous year	Estimated Savings
Electricity	55.55	54.71	Down 1.5%	$151,208
Natural Gas	76.43	81.88	Up 7.1%	-$136,933
Cogeneration Steam	0.00	0.00	N/A	$0
Total	131.98	136.59	Up 3.5%	$14,275

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 FY19. Table II shows the kilowatt hours per square foot (kwh/ft^2) for the campus in Lubbock County.

For FY19, electrical consumption was 16.22 kwh/ft^2, a decrease of 1.4% compared to FY18 (16.44 kwh/ft^2 for the year).

Table II: Campus Electricity Use (kwh/ft^2): September '18 – August '19 (Lubbock County)

Whole Campus Electricity Use in kwh/ft2	FY18 Reference Data in kwh/ft^2	2.5% Reduction Goal in kwh/ft^2	FY19 Actual Consumption in kwh/ft^2	Percent Increase/Decrease from previous year, by quarter
1st Quarter	4.26	4.15	4.26	Down 0.1%
2nd Quarter	3.69	3.60	3.85	Up 4.4%
3rd Quarter	4.10	4.00	3.96	Down 3.5%
4th Quarter	4.40	4.29	4.16	Down 5.5%
Yearly Total	16.44	16.03	16.22	Down 1.4%

3. Fleet Fuel Management Plan (Vehicles)

Table III below compares the percent change in miles traveled for FY18 and FY19. It indicates a 9.3% decrease in miles traveled.

Table III: Miles Traveled

	FY17	FY18	FY19
Miles Traveled	2,814,207	2,726,049	2,473,481
Change		-3.1%	-9.3%

Table IV below indicates that fuel efficiency has decreased by 19.2%.

Table IV: Fuel Efficiency

	FY17	FY18	FY19
Miles per Gallon	12.02	10.32	8.34
Change		-14.2%	-19.2%

4. Water Conservation (Thousands of Gallons)

For FY19, combined water consumption (domestic and irrigation) was 244,596 thousand gallons. This was down 13.6% compared to FY18 (283,114 thousand gallons).

Decrease of domestic water can be attributed to Grounds Maintenance converting a portion of irrigation service from domestic water to well water.

In table V below, consumption of both domestic water and sewer was down 11.4%. Domestic water and sewer rates were up 5% compared to last year. Even though rates

were up for the fiscal year, Texas Tech University was able to realize domestic water and sewer savings due to decrease in consumption.

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

Utility	FY18 Actual	FY19 Actual	% Change from previous year	Estimated Savings
Domestic water	251,683	223,110	Down 11.4%	$117,964
Sewer	251,683	223,110	Down 11.4%	$57,073
Irrigation water	31,431	21,486	Down 31.6%	$42,986
Yearly Total	283,114	244,596	Down 13.6%	$218,023

This was the first year that Texas Tech University has reported well water usage for the Campus. Table VI below indicates that well water consumption was 77,373 thousand gallons for FY19. In FY20, TTU will be able to illustrate a year to year comparison of well water consumption since 10 well water meters were recently installed.

Table VI: Campus Well Water Use (Thousands of Gallons):

Utility	FY18 Actual	FY19 Actual	% Change from previous year
Well water	na	77,373	na

Table VII below indicates that domestic water consumption for remote sites was 5,114 thousand gallons in FY19. This was down 3.4% compared to FY18 (5,295 thousand gallons). The decline in water usage can be attributed to 58% reduced consumption at Slaton Library Storage.

Table VII: Remote Sites (Thousands of Gallons):

Utility	FY18 Actual	FY19 Actual	% Change from previous year	Estimated Savings
Domestic Water	5,295	5,114	Down 3.4%	$370
Sewer	4,551	4,411	Down 3.1%	$3,563

Table VIII: This was the first year that Texas Tech University reported well water usage for three remote sites: Rawls Golf Course, Junction, and New Deal. Table VIII indicates that well water consumption for these remote sites was 91,013 thousand gallons in FY19. In FY20, Texas Tech University will be able to illustrate a yearly comparison of well water consumption due to recently installed water meters.

Table VIII: Remote Well Water Use (Thousands of Gallons):

Utility	FY18 Actual	FY19 Actual	% Change from previous year
Well water	na	91,013	na

Table IX below indicates that Central Heating and Cooling Plant #1 (CHACP 1) well water use to the cooling towers was down 8.2% for FY19. The decrease in well water consumption can be attributed to the 8.6% decline in cooling degree days compared to FY18.

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

Utility	FY18 Actual	FY19 Actual	% Change from previous year
Well water	155,566	142,790	Down 8.2%
Sewer	77,783	71,395	Down 8.2%

B. Energy Reduction Measures

1. Educational and General Space

a) Free Cooling Project at CHACP 1 – The Water Side Economizer provided over 1,847,318 tons of free cooling (4.6% of total chilled water produced) this fiscal year, an estimated savings of $38,810.

b) Back Pressure Turbine at CHACP 1 supplied 16.3% of CHACP 1's electrical use for a cost savings of $183,905.

c) Integrated 2 chilled water meters, 6 electrical meters and 20 data points into the eSight Energy Accounting System and Utilivisor.

d) Installed 31 meters (chilled water, steam/condensate, domestic water).

e) Prepared CUSUM analysis comparing EUIs for E&Gs and Auxiliaries. Prepared work orders to recommission chilled water mixing valves in 57 buildings. 30 workorders were completed.

f) Submitted 161 workorders for discrepant air handler operations and chilled water return temperature setpoints. 136 workorders were completed.

g) Secured steam to campus air handlers during Summer 2019 to eliminate simultaneous heating and cooling which would decrease efficiency.

h) Used eQuest to model and project energy consumption at Athletic Dining Facility and the Womble Practice Facility.

i) Completed review of the VAVs in Biology; identified 118 VAV units that were simultaneously heating and cooling and created a workorder to have the problems corrected.

j) Implemented Self-Help Protocol to eliminate after-the-fact energy increases.

k) Identified 34 buildings to be programmed to have unoccupied setpoints. Programming has been implemented for 13 buildings.

l) Completed review of the VAVs in the Education building to verify unoccupied and occupied setpoints were programmed for each.

m) Analyzed air handler request at Human Science to run AHU 15 all summer to protect refrigeration equipment in room 605D. To avoid additional cost of $2,500 to the University, a temperature alarm and an unoccupied setpoint were added to room 605D to turn on the air handler when the room reaches critical temperature.

n) Investigated AHU 2-1 at RCOBA to determine the cause of the Dean's Suite temperature concerns. Corrected controls and mechanical failures to the Dean's Suite and created a project to modify the HVAC duct to increase airflow.

o) Avoided a $24,000 air handler exception at Child Development and Research Center by creating a project for BMC to install extended duct work and thermostat controls over the A/V Research equipment to exhaust heat from the room instead of running the air handler 24/7.

2. **Auxiliary Space**

a) Instituted monthly energy reviews with University Student Housing (USH) to report current trends in utility usage in all areas of USH. Reported specific equipment discrepancies and prepared 26 related workorders**.**

b) Created project for USH to replace VFDs for one heating water pump and two chilled water pumps at Horn-Knapp.

c) Created project for USH to replace VFDs for one chilled water pump and two heating water pumps at Murray.

d) Proposed plan for USH to submit a project for BMC and Energy Management Office to audit 5 buildings: Sneed, Wiggins, Hulen/Clement, Coleman, and Chitwood.

- Corrective actions have begun for Priority 1 items at Sneed. Priority 1 items include: replacing the freeze stat on AHU-3, repairing the fan coil unit in the mechanical room, replacing the heating water pressure sensors, and repairing the 1/3 and 2/3 steam valve actuators.

- An Opinion of Probable Cost (OPC) was submitted for Priority 1 items at Coleman.

- Audits for Hulen/Clement, Chitwood, and Wiggins are still in progress.

e) Validated savings of electronic controls upgrade at Wall/Gates, which saved USH approximately $70,000 in chilled water costs.

f) Created project to replace three chilled water control valves and set up programming to ensure that the chilled water return temperature is greater than or equal to 55° at Weymouth. Estimated savings $100,000.

g) Submitted quarterly energy performance reports to Athletics, Hospitality, Student Recreation Center, and Student Union.

h) Generated 8 HVAC work orders for specific equipment discrepancies for Athletics, United Spirit Arena, Innovation HUB, Student Wellness, and the Student Recreation Center.

i) Continuation from last fiscal year: Wrote scope of work and solicited approval for TD Industries to replace and integrate 30 failed Auxiliary utility meters. Over the past two years, TDI was able to replace 25 meters.

j) Completed audit of the Student Union Building gas use, including all gas-burning equipment. 64% increase was due to addition of gas fired reheat unit installed at new Chick-fil-A location.

k) Identified gas meter deficiency at Football Training Facility and the Frazier Alumni Center.

3. Energy Audits

a) Performed twelve interior lighting audits: Kinesiology and Sports Management, Creative Movement, Drane Hall, Development Building, Hance Chapel, Merket-McKenzie Alumni Center, Frazier Pavilion, KTXT Studio, Athletic Dining Facility, Child Development Research Center, Agricultural Science, and Human Science Cottage.

b) Performed four exterior lighting audits: Equestrian Center, TTU Main Campus, Museum, and Flint Parking Garage.

c) Audited meters for twenty-nine buildings: Chemistry, English/Philosophy, Education, Math, Law & Law Lanier, Experimental Sciences, Rawls COBA, Architecture & Art, Drane, Science, Holden Hall, Southwest Collections, Livermore, Animal Science, Terry Fuller Petroleum Engineering, Agriculture Education, Food Technology, Foreign Language, Agriculture Science, Burkhart Center, Bayer Plant Science West, Weeks Hall, Womble Practice Facility, Athletic Dining Facility, Frazier Expansion, Athletic Training Facility, Stangel/Murdough, and Art 3D.

d) Completed audit of auxiliary natural gas sub-meters for accuracy in billing; identified and corrected erroneous meter factors.

e) Performed water audit at the Leisure Pool, Competition Pool and Spa to determine the cause and extent of increased water use. Audit led to the discovery of a leak under the pool.

f) Performed eight energy audits: Horn/Knapp, Sneed, Bledsoe/Gordon, Jones AT&T Stadium, Student Recreation Center, English Philosophy, Education, and Media Communication.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech University is currently planning energy efficiency measures including:

a) Complete USH repairs which were identified in FY19 audits. Repairs in Sneed, Coleman, Hulen/Clement, Chitwood, Wiggins, and Weymouth should reduce USH energy expense by $200,000 and reduce campus EUI by 2.6 kbtu/ft^2.

b) Ongoing HVAC recommissioning and controls upgrades.

c) Upgrading metering systems for electricity, steam, natural gas, chilled water, irrigation and domestic water, and integrating 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 CHACP1.

d) Work with Facilities Planning and Construction (FP&C) to ensure meters are installed and integrated into eSight and Utilivisor during the construction process.

e) Perform building audits to identify energy efficiency measures and update Building Energy Management Profiles.

f) Systematically recommission chilled water mixing valves to increase chilled water delta T to >16°.

g) Audit steam distribution system.

h) Monitor energy usage at Library and Biology for verification of recommissioning projects.

i) Audit domestic water meters on campus.

j) Utilize eQuest to create energy models for campus buildings.

k) Prepare monthly or quarterly energy reports for all Auxiliary units.

l) Identify and document sequences of operation for all HVAC systems.

m) Implement Heat Load Protocol to optimize air handler runtime during extreme temperatures in the summer.

D. Fuel Consumption Reduction Plan

Numerous departments on campus are now utilizing electric utility vehicles; Fleet Services Office continues to advise other departments regarding the feasibility of doing the same.

The Fleet Services 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 Fleet Services Office will analyze fleet utilization for Texas Tech University and recommend best practices for future purchases.

E. Water Management Plan

Operations Division will develop historical analysis of water consumption and efficiency and devise long-term water conservation strategy to include both domestic water and irrigation water. New irrigation meters and existing domestic water meters will be integrated into the eSight Energy Accounting System and Utilivisor, as required.

In FY20, Texas Tech University will begin reporting an accurate fiscal year comparison of well water consumption for the Remote Sites and TTU Campus.