Texas Tech University Energy and Water Management Plan
FY 2020 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 FY20, Energy Management has determined that cogen steam monthly consumption totals were miscalculated in the monthly EUI. The error represents an average 2.4% increase over the reported annual EUI totals for all fiscal years dating back to FY15. The impact on our energy use index is summarized as follows:

In FY15, Texas Tech reported an EUI of 152.17 kbtu/ft^2. After correctly accounting the cogen steam consumption totals, the EUI for FY15 should have been 153.89.

In FY16, Texas Tech reported an EUI of 151.79 kbtu/ft^2. After correctly accounting the cogen steam consumption totals, the EUI for FY16 should have been 155.90.

In FY17, Texas Tech reported an EUI of 130.50 kbtu/ft^2. After correctly accounting the cogen steam consumption totals, the EUI for FY17 should have been 134.58.

In FY18, Texas Tech reported an EUI of 131.98 kbtu/ft^2. After correctly accounting the cogen steam consumption totals, the EUI for FY18 should have been 135.36.

In FY19, Texas Tech reported an EUI of 136.58 kbtu/ft^2. After correctly accounting the cogen steam consumption totals, the EUI for FY16 should have been 140.25.

After correcting for the errors in FY20, the campus consumed 139.42 kbtu/ft^2, a decrease of 0.6% from the previous year. The goal was to consume no more than 132 kbtu/ft^2. The EUI goal was set at the beginning of the fiscal year, and Texas Tech elected to not adjust the goal after identifying the cogen steam calculation error. Therefore, Texas Tech fell short of the goal by 7.42 kbtu/ft^2 for the following reasons:

- 3.03 kbtu/ft^2 can be attributed to correctly accounting for the cogen steam consumption for this fiscal year. Cogeneration steam, provided *at no cost* to the university by a local utility company, is tabulated in the balance of university energy use, but no dollar savings are reported on the cogeneration line since they would be realized as a reduction of natural gas use.
- New facilities increased square footage by 180,700 ft^2, and decommissioned facilities decreased square footage by 117,138 ft^2. The net campus square footage increased by 63,562 ft^2. 65% of the increase in square footage is due to a new research facility on campus that is conditioned 24/7. The new buildings impacted EUI by 2.72 kbtu/ft^2.
- Freeze Protection Protocol: the cost of freeze protection evolutions in FY20 was $18,518. Freeze Protection impacted EUI by 0.13 kbtu/ft^2.

Due to the COVID 19 pandemic, Texas Tech closed the campus mid-March. During this time, the following energy saving measures were implemented and allowed for Texas Tech to realize an energy avoidance of 5.23 kbtu/ ft^2:

- Air handling equipment time schedules were either set to unoccupied or adjusted to run at a minimum. The adjusted schedules were in place April and May.
- Secured steam to campus, April through August. Submitted 39 work orders for steam/condensate leaks.
- Adjusted chilled water temperature setpoints and differential pressure setpoints at the Central Heating Cooling Plant (CHACP), avoiding 1.92 kbtu/ ft^2 of energy consumption.

Texas Tech created a staggered re-entry plan for faculty and staff which started in May. The campus prioritization was on COVID preventative measures. This led to a reduced response in work orders identifying energy efficiency measures.

In Table I, the campus energy use is broken down by utility type. Electricity decreased by $530,603, and natural gas increased by $63,906. The net savings is $466,696.

Table I: University Energy Use (kbtu/ft^2): September '19 – August '20

Utility	FY19 Actual	FY20 Actual	% Change from previous year	Estimated Savings
Electricity	54.71	51.73	Down 5.4%	$530,603
Natural Gas	81.88	84.66	Up 3.4%	-$63,906
Cogeneration Steam	3.67	3.03	N/A	$0
Total	140.26	139.42	Down 0.6%	$466,696

2. Campus Electrical Use

In compliance with 34 Tex. Gov. Code §19.14, Texas Tech University set a goal to reduce total electrical consumption by 2.5% for FY20. Table II shows the kilowatt hours per square foot (kwh/ft^2) for the campus in Lubbock County.

For FY20, electrical consumption was 15.35 kwh/ft^2, a decrease of 5.4% compared to FY19 (16.22 kwh/ft^2 for the year).

Table II: Campus Electricity Use (kwh/ft^2): September '19 – August '20 (Lubbock County)

Whole Campus Electricity Use in kwh/ft2	FY19 Reference Data in kwh/ft^2	2.5% Reduction Goal in kwh/ft^2	FY20 Actual Consumption in kwh/ft^2	Percent Increase/Decrease from previous year, by quarter
1st Quarter	4.26	4.15	4.09	Down 3.9%
2nd Quarter	3.85	3.75	4.16	Up 8.1%
3rd Quarter	3.96	3.86	3.31	Down 16.4%
4th Quarter	4.16	4.05	3.80	Down 8.7%
Yearly Total	16.22	15.81	15.35	Down 5.4%

3. Fleet Fuel Management Plan (Vehicles)

Table III below compares the percent change in miles traveled for FY19 and FY20. It indicates a 23% decrease in miles traveled which can be attributed to Texas Tech halting nonpriority travel, including research, from March to August due to COVID.

Table III: Miles Traveled

	FY18	FY19	FY20
Miles Traveled	2,726,049	2,473,481	1,895,858
		-9.3%	-23.4%

Table IV below indicates that fuel efficiency has decreased by 31.9%.

Table IV: Fuel Efficiency

	FY17	FY18	FY19
Miles per Gallon	12.02	8.34	11.0
		-30.6%	31.9%

4. Water Conservation (Thousands of Gallons)

For FY20, combined water consumption (domestic and irrigation) was 269,802 thousand gallons. This is up 10.3% compared to FY19 (244,596 thousand gallons).

36% of the increase in irrigation water can be attributed to the increase in landscape square footage. The remaining increase can be attributed to dryer weather conditions and a historic drought in Lubbock County.

In FY20, the domestic water utility provider, LP&L, replaced thirty manual read meter with remote monitoring meters. LP&L plans to replace more domestic water meters in the next fiscal year. Texas Tech expects an increase in domestic water consumption in FY21 due to enhanced meter accuracy.

Table V: University Water Use (Thousands of Gallons): September '19 – August '20

Utility	FY19 Actual	FY20 Actual	% Change from previous year	Estimated Savings
Domestic water	223,110	232,383	Up 4.2%	($31,499)
Sewer	223,110	232,383	Up 4.2%	($51,460)
Irrigation water	21,486	37,419	Up 74.2%	($77,453)
Yearly Total	244,596	269,802	Up 10.3%	($160,412)

Last year was the first year that Texas Tech University reported well water usage for the Campus. Table VI below indicates that well water consumption was 55,529 thousand gallons for FY20, a decrease of 28% compared to last year.

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

Utility	FY19 Actual	FY20 Actual	% Change from previous year
Well water	77,373	55,529	Down 28.2%

Table VII below indicates that domestic water consumption for remote sites was 4,474 thousand gallons in FY20. This was down 12.5% compared to FY19 (5,114 thousand gallons).

Table VII: Remote Sites (Thousands of Gallons):

Utility	FY19 Actual	FY20 Actual	% Change from previous year	Estimated Savings
Domestic Water	5,114	4,474	Down 12.5%	$4,048
Sewer	4,411	3,748	Down 15%	$2,247

Table VIII: Last year was the first year that Texas Tech University reported well water usage for three remote sites: Rawls Golf Course, Junction, and New Deal. This is the first year Texas Tech is able to illustrate a yearly comparison of well water for these remote sites. Well water consumption for these remote sites was 105,088 thousand gallons in FY20. This is up 15.5% compared to FY19.

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

Utility	FY19 Actual	FY20 Actual	% Change from previous year
Well water	91,013	105,088	Up 15.5%

Table IX below indicates that Central Heating and Cooling Plant #1 (CHACP 1) well water use to the cooling towers was up 2.3%.

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

Utility	FY19 Actual	FY20 Actual	% Change from previous year
Well water	142,790	146,133	Up 2.3%
Sewer	71,395	73,066	Up 2.3%

B. Energy Reduction Measures

1. Educational and General Space

a) Free Cooling Project at CHACP 1 – The Water Side Economizer provided over 471,757 tons of free cooling (2.2 % of total chilled water produced) this fiscal year, an estimated savings of $8,443.

b) Back Pressure Turbine at CHACP 1 supplied 16.6% of CHACP 1's electrical use for a cost savings of $193,681.

c) Receive free cogeneration steam from utility provider. Saved the University $106,041.

d) Improved CHACP 1 chilled water efficiencies resulting in reduced tonnage during summer operations (June-Aug) $108,980.

e) COVID Impact: Energy Efficiency Measures

   a. Adjusted AHU schedules to reduce economic impact of the campus during the COVID-19 shutdown.

   b. Monitored building control systems to identify energy waste and programming errors. Able to identify leaking valves, AHUs with mix match status, and buildings with low delta Ts.

f) Secured steam to campus air handlers during Summer 2020 to eliminate simultaneous heating and cooling which would decrease efficiency.

g) Integrated 17 chilled water meters, 1 natural gas meter, 19 steam/condensate meters, 9 domestic water meters, and 2 electrical meters into the eSight Energy Accounting System and Utilivisor.

h) Installed 9 meters (chilled water, steam/condensate, natural gas, domestic water).

i) Prepared CUSUM analysis comparing EUIs for E&Gs and Auxiliaries. Prepared work orders to recommission chilled water mixing valves and correct chilled water inefficiencies for 21 buildings. 6 workorders were completed. Campus prioritization was on COVID preventative measures which is the reason why there is a decrease in work orders submitted and completed compared to last year.

j) Submitted 67 workorders for discrepant air handler operations and chilled water return temperature setpoints. 41 workorders were completed. Campus prioritization was on COVID preventative measures which is the reason why there is a decrease in work orders submitted and completed compared to last year.

k) Added controls and setpoints for the mixing valve to allow for monitoring and control of the chilled water system at Industrial Manufacturing Systems Engineering New. Estimated annual savings is $72,000.

l) Started recommissioning HVAC equipment and controls at English Philosophy. Project will be completed in FY21.

m) Installed three chilled water valves and actuators at Bayer Plant Science South to enhance the chilled water system with the capability to use chilled water supplied from the Central Heating and Cooling Plant efficiently.

n) Implemented schedules for HVAC controls at the TTU System Building. Estimated savings is $19,000 annually.

o) Implemented schedules for HVAC controls at the TTU Downtown Center. Estimated savings is $13,000 annually.

p) Amended the Steam ON/OFF Protocol to add weekly cycling of the heating water pumps to ensure the chemicals in the piping is properly distributed.

q) Submitted a list of deficiencies in the BAS system for new construction facilities: Weeks Hall, Experimental Sciences II, Talkington Theater Expansion.

r) Identified 32 buildings that can be programmed to have unoccupied setpoints. Programming has been changed for 20 buildings.

2. **Auxiliary Space**

a) Identified that the chilled water mixing valve and actuator at Student Wellness was not following programming. The chilled water valve was adjusted, and savings will be validated in FY21.

b) 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 11 related workorders**.**

c) Replaced VFDs for one heating water pump and two chilled water pumps at Horn-Knapp.

d) Replaced VFDs for one chilled water pump and two heating water pumps at Murray.

e) Replaced chilled water and steam control valves and set up programming and graphics to monitor and control both systems at Weymouth dorm. Estimated savings is $100,000.

f) Created a project to install electronic chilled water and steam control valves for Wiggins. Estimated savings is $100,000.

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

h) Generated 20 HVAC work orders for specific equipment discrepancies for Athletics, United Spirit Arena, Innovation HUB, Student Wellness, and the Student Recreation Center.

i) Installed and integrated a gas meter into eSight for the Football Training Facility.

3. Energy Audits

a) Performed six interior lighting audits: Texas Tech Plaza, Chemical Engineering, NRHC Preservation, Dairy Barn, Ag Science Greenhouse and Week Hall.

b) Performed two exterior lighting audit: Weeks Hall and Drane Hall.

c) Audited chilled water and steam condensate meters for Auxiliary buildings to ensure correct meter factors were applied in the billing process: identified that eleven steam/condensate meters had incorrect meter factors.

d) Review construction documents for School of Veterinarian Medicine, Mariposa Station, USDA Lubbock Lab, Ag Science Greenhouse, Dairy Barn renovation, Womble Basketball Practice Facility, Talkington College of Visual and Performing Arts Phase II, Jones ATT Stadium East renovation.

e) Used eQuest to model and project energy consumption at Ag Science Greenhouse, ESB II, and Weeks Hall.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech University is currently planning energy efficiency measures including:

a) Utilize an Energy Brokerage Firm to help facilitate the migration from Lubbock Power & Light to ERCOT. The Firm will also assist Texas Tech System with developing a comprehensive energy master plan.

b) Utilize the Water Side Economizer at the CHACP to achieve electric and natural gas savings when campus load allows.

c) Retube Boiler #2 at the CHACP for reliability of capacity. Project cost is $4 million.

d) Install two 1500 ton electric chillers at CHACP 2 to increase capacity, efficiency, and diversification in the production of chilled water. Project cost is $4.5 million.

e) Perform energy assessments (building models and audits) for all E&G facilities greater than 100k square footage in accordance with the Article IV Rider Section 17.11 Energy Efficiency Savings for State Facilities.

f) 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.

g) Ongoing HVAC recommissioning and controls upgrades.

h) Identify HVAC exceptions that can be better served by supplemental units.

i) 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.

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

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

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

m) Audit steam distribution system.

n) Monitor energy usage at Weymouth, English Philosophy, Library and Biology for verification of recommissioning projects.

o) Audit domestic water meters on campus.

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

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

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

s) 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 installed GPS monitors on multiple vehicles to assist with route mapping to increase gasoline efficiency and to analyze fleet utilization for Texas Tech University and recommend best practices for future purchases. GPS monitors are still being added to vehicles around campus.

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.