

Texas Tech University Energy Savings Program FY 2017 Update

The Texas Tech Energy Savings Program Update is being submitted in accordance with Governor’s Executive Order RP-49, Energy Conservation by State Agencies and Health and Safety Code, § 388.005(f).

A. Energy Goals

1. University Energy Use

Energy units are converted to thousands of BTUs per square foot (kbtu/ft²) to allow for comparisons of the various energy forms. Goals and energy use are therefore stated in kbtu/ft². Estimated savings are measured against energy consumption for the prior fiscal year.

For FY17, the campus consumed 132.38 kbtu/ft², a decrease of 12.8% from the previous year. Texas Tech surpassed the FY17 goal of 150.1 kbtu/ft² by 17.72 kbtu/ft² even though the total campus area increased by 240,000ft² and student population increased by 459. The following energy efficiency measures contributed to the improvement:

- The installation and performance of two electric chillers reduced natural gas consumption by 21.4%.
- Controls retuning of Library, Biology, Music and Student Union Building.
- Freeze Protection Protocol: the cost of freeze protection evolutions is down 17% (\$10,509).
- The eSight Energy Accounting System identified excessive chilled water and steam use around campus.
- Installed two new 200 HP VFD-driven direct-drive motors on Cooling Towers 5 and 6 at Central Heating and Cooling Plant #1.

In Table I, the campus energy use is broken down by utility type. Electricity cost increased by \$217,203, but the total savings is \$378,214.

Table I: University Energy Use (kbtu/ft²): **September ‘16 – August ‘17**

Utility	FY16 Actual	FY17 Actual	% Change from previous year	Estimated Savings
Electricity	56.13	57.22	Up 1.9%	-\$217,203
Natural Gas	95.65	75.16	Down 21.4%	\$595,417
Cogeneration Steam	0.01	0.00	Down 100%	\$0
Total	151.79	132.38	Down 12.8%	\$378,214

2. House Bill 3693, Regular Session, 2007

In compliance with House Bill 3693, Texas Tech University had set a goal to reduce total electrical consumption by 2.5% for FY17. Table II shows the kilowatt hours per square foot (kwh/ft²) for the campus in Lubbock County.

For FY17, electrical consumption is 16.97 kwh/ft², an increase of 2.4% compared to FY16. This increase is attributable to the 2.7% increase in campus area, utility cost for new construction, and operation of two electric chillers. The electric chillers consumed an additional 9,491,000 kWh but were responsible for most of the FY17 energy reduction since their operation reduced natural gas consumption by 21.4%.

Table II: Campus Electricity Use (kwh/ft²): **September '16 – August '17**
(Lubbock County)

Whole Campus Electricity Use in kwh/ft²	FY 16 Reference Data in kwh/ft²	2.5% Reduction Goal in kwh/ft²	FY 17 Actual Consumption in kwh/ft²	Percent Increase/Decrease from previous year, by quarter
1st Quarter	4.19	4.08	4.29	Up 2.4%
2nd Quarter	3.98	3.88	3.95	Down 0.6%
3rd Quarter	4.00	3.90	4.16	Up 3.9%
4th Quarter	4.39	4.29	4.57	Up 3.9%
Yearly Total	16.56	16.15	16.97	Up 2.4%

3. Fleet Fuel Management Plan (Vehicles)

Texas Tech University set a goal to reduce consumption of gasoline by 11,651 gallons for Fiscal Year 2017 (a 5% reduction).

In FY17, consumption of gasoline increased by 1,157 gallons versus FY16. Fleet size also increased by 2 vehicles during the same period.

Table III: Historical University Vehicle Fleet Data**September '16 – August '17**

	FY16 Gallons Consumed	FY17 Goal (5% decline)	FY17 Gallons Consumed	Percent Change
1st Quarter	64,082	60,878	61,806	Down 3.6%
2nd Quarter	53,744	51,057	50,940	Down 5.2%
3rd Quarter	63,541	60,364	64,044	Up 0.8%
4th Quarter	51,645	49,063	57,379	Up 11.1%
Total	233,012	221,361	234,169	Up 0.5%

Table IV below compares the percent change of gas used to percent change in miles traveled for FY16 and FY17. It indicates a 1.8% decrease in miles traveled.

Table IV: Miles Traveled

	FY15	FY16	FY17
Miles Traveled	2,654,632	2,866,994	2,814,207
		8.0%	-1.8%

Table V below indicates that fuel efficiency has decreased by 2.3%.

Table V: Fuel Efficiency

	FY15	FY16	FY17
Miles per Gallon	11.63	12.30	12.02
		5.8%	-2.3%

4. Water Conservation (Thousands of Gallons)

For FY17, water consumption was 573,293 thousand gallons. This is down 1.3% compared to FY16 (580,578 thousand gallons).

Domestic water is down 1.4%, even though student enrollment is up 1.3% and campus square footage is up 2.7%. Some of the decrease can be attributed to Grounds Maintenance converting a portion of irrigation service from domestic water to well water.

Grounds Maintenance is in process of installing well water meters, so they are not currently reporting well water used by the main campus.

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

Utility	FY16 Actual	FY17 Actual	% Change from previous year	Estimated Savings
Domestic water	274,894	271,008	Down 1.4%	\$29,259
Sewer	274,894	271,008	Down 1.4%	\$126,992
Irrigation water	30,790	31,277	Up 1.6%	-\$7,380
Yearly Total	580,578	573,293	Down 1.3%	\$163,631

CHACP #1 (Central Heating and Cooling Plant #1) well water use to the cooling towers is down 6.9%.

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

Utility	FY16 Actual	FY17 Actual	% Change from previous year
Well water	142,712	132,892	Down 6.9%
Sewer	71,356	66,446	Down 6.9%

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 2,535,254 ton-hours of free cooling this fiscal year, an estimated savings of \$53,263.
- b) Back Pressure Turbine at CHACP #1 supplied 14% of the CHACP’s electrical use for a cost avoidance of \$179,137.
- c) In FY16, a 6,500 ton steam driven chiller was replaced with two VFD driven electric chillers with a combined capacity of 6,200 tons. Project cost was \$6.2 million. TTU Energy Management performed analysis of electricity and steam balance at CHACP 1 by way of validating energy savings associated with operating the electric chillers. Energy projections suggested that the electric chillers would decrease our EUI by 19.9 kbtu/ft². Actual savings were 17.74 kbtu/ft². Kilowatts per ton are down 21.5% from FY15, the preconstruction reference period.

- d) Completed the installation of two new 200 HP VFD-driven direct-drive motors on Cooling Towers 5 and 6 at CHACP #1. Cooling tower efficiency improved by 16% as is shown by the reduction of kilowatt usage to produce cooling. See item c) above.
- e) Integrated 17 chilled water meters, 16 steam meters, 8 condensate meters, 3 gas meters, 1 RO meter, 4 domestic water meters and 9 electrical meters and 117 data points into the eSight Energy Accounting System.
- f) Wrote a scope of work and solicited approval for TD Industries to install and integrate 9 utility meters and ancillary devices in four buildings.
- g) Expanded LED exterior lighting coverage with the Lumewave control system by 56,250ft².
- h) Biology: Completed phases 1 and 2 of a three-phase recommissioning project at Biology. Electrical use is down 3.5%.
- i) Facilitated installation of lighting control software for Maddox Engineering Research Center, Industrial Manufacturing and Systems Engineering, and the Systems Office Building.
- j) Identified the need for installation of a VFD at Mechanical Engineering North air handler unit 6E. Projecting a 40% reduction in power for the unit.
- k) Investigated and analyzed energy and dollars wasted by an inoperable energy recovery system (run around unit) at Innovation Hub. The cost exceeds \$12,000 annual and does not include waste from the overridden heating coil. Insufficient data was available for that purpose.
- l) Troubleshooting of heat loads in a new conference room at the Department of Education avoided \$60,000 in extended hour operations.
- m) Modified operational measures with customers at several buildings: Bayer Plant Science South, Bayer Plant Science West, Human Sciences, and Kinesiology and Sports Management. The customers agreed to curtail their air handler exceptions, saving over \$37,485 per year.

2. Auxiliary Space

- a) Junction Campus: Performed a cost/benefit analysis for replacement of the HVAC systems on Packard House.
- b) Housing: Identified several air handlers with leaking steam valves.

3. Energy Audits

Texas Tech completed an exterior lighting audit of the entire campus.

Ten meter audits were completed for E&G buildings: Civil Engineering, Media & Communication, Electrical Engineering, Electrical Engineering Annex, Human Sciences, Human Sciences Tower, Mechanical Engineering North, Mechanical Engineering South, Biology, and Industrial Manufacturing and Systems Engineering.

Findings in Civil Engineering, Human Sciences, Mechanical Engineering, and Human Sciences Tower identified the need to set up a project to replace controls on valves in each building.

Completed six energy audits for United Supermarket Arena, Jones Stadium, Computer Center, Maddox Engineering Research Center, Bayer Plant Science West, and Mechanical Engineering North.

Completed 21 meter audits for auxiliary buildings to collect meter and pipe data to plan meter upgrades and integration into the eSight Energy Accounting System.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech is currently planning energy efficiency measures such as:

- Ongoing HVAC recommissioning and controls upgrades at Library, Biology, Student Union Building, and the Music Building.
- Upgrading metering systems for electricity, heating, cooling, irrigation and domestic water, and integrating them into eSight Energy Accounting System to improve energy use 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.
- Audit steam distribution system.

D. Fuel Consumption Reduction Plans

The Central Warehouse dedicated a driver and delivery vehicle to serve the whole Operations Division, thereby minimizing the number of campus runs.

The Vehicle Fleet Management 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 facilitate an analysis of 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.