Texas Tech University Energy and Water Management Plan
FY 2024 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 compare 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.

In FY24, the campus consumed 159.31 kbtu/ft^2, a 9.6% increase of the previous year. The goal was to consume no more than 142.44 kbtu/ft^2. The following impacted Texas Tech's energy performance:

- Degree days increased by 2%. Based on CUSUM analysis, this would increase the Energy Use Index (EUI) by 0.67 kbtu/ft^2.

- Total electric consumption for the University increased by 3%. Increasing the EUI by 0.21 kbtu/ft^2.

- Campus, E&G and AUX buildings', natural gas consumption decreased by 2.71%. Realized a 0.47 kbtu/ft^2 reduction to the EUI.

- Cogeneration steam, provided at no cost to the university by a local utility company (LP&L), is accounted for in the university's energy balance. However, no dollar savings are reported under the cogeneration line, as any savings would be reflected in reduced natural gas usage. Cogeneration steam reduced the EUI by 0.12 kbtu/ft², a 97% decrease compared to last year. Although it was included in last year's report, FY23 marks the last year LP&L will operate the cogeneration station, though they did utilize it in September. As previously mentioned, an increase in natural gas consumption is expected in FY24 due to increased steam production compensating for the loss.

- Natural gas consumption at Central Heating and Cooling Plant #1 (CHACP #1) rose by 20.8%, contributing to an 18.52 kbtu/ft² impact on the EUI.
    - With electricity costs uncertain for much of the fiscal year, Operations Division strategically prioritized the use of steam chillers, which have a greater impact on the EUI (11.4 kbtu/ft²) compared to electric chillers. Steam-driven chiller operations increased by 88%, while electric chiller operations decreased by 68%. Additionally, chilled water tonnage increased by 10%.

- Although campus steam demand decreased by 1.34%, the loss of cogeneration steam raised the EUI by 4.60 kbtu/ft². In addition, condensate and steam leaks in the steam condensate tunnel system (averaging 35 gpm in condensate loss for the year), raised the EUI by 1.41 kbtu/ft².

- Chilled water production efficiency improved by 28%, allowing CHACP #1 to produce 10% more tonnage with 13.8% less water. This efficiency gain reduced the EUI by 3.23 kbtu/ft².

- Chilled water losses in the tunnel system averaged 4.21 gpm for the fiscal year, a 100% increase over last year. While the EUI impact is negligible, the overall cost increase is estimated at $22,000 compared to last year.

- Freeze Protection Protocol: if outside air drops below 32°, Texas Tech turns on air handlers and pumps to protect coils and pipes from freezing. The cost of this practice in FY24 was $261,668. Freeze Protection increased the EUI by 1.16 kbtu/ft^2.

In Table I, the campus energy use is broken down by utility type. Electricity consumption increased 0.8%, but a savings of $51,924 was realized due to a 1% reduction in rates. Natural gas consumption increased, reasons detailed above, but natural gas rates decreased by 19%. Texas Tech realized a savings of $63,155. The net decrease is $115,079.

Table I: University Energy Use (kbtu/ft^2): **September '23 – August '24**

Utility	FY23 Actual	FY24 Actual	% Change from previous year	Year to Year Cost Comparison
Electricity	54.29	54.74	Up 0.8%	-$51,924
Natural Gas	86.34	104.45	Up 21%	-$63,155
Cogeneration Steam	4.72	0.12	N/A	$0
Total	145.35	159.31	Up 9.6%	-$115,079

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 FY24. Table II shows the kilowatt hours per square foot (kwh/ft^2) for the campus.

For FY24, electrical consumption was 16.05 kwh/ft^2, a 0.3% increase compared to FY23 (16.01 kwh/ft^2 for the year).

Table II: Campus Electricity Use (kwh/ft^2): September '23 – August '24

Whole Campus Electricity Use in kwh/ft2	FY23 Reference Data in kwh/ft^2	2.5% Reduction Goal in kwh/ft^2	FY24 Actual Consumption in kwh/ft^2	Percent Increase/Decrease
1st Quarter	4.19	4.09	4.25	Up 1.3%
2nd Quarter	3.82	3.72	3.85	Up 0.8%
3rd Quarter	3.84	3.75	3.69	Down 4%
4th Quarter	4.16	4.06	4.27	Up 2.7%
Yearly Total	16.01	15.61	16.05	Up 0.3%

3. Fleet Fuel Management Plan (Vehicles)

Table III below compares the percent change in miles traveled for FY23 and FY24, showing a 20.6% increase. However, this increase is not an accurate reflection of the year-over-year comparison, as not all mileage reports were submitted in FY23.

Table III: Miles Traveled

	FY22	FY23	FY24
Miles Traveled	1,718,333	1,618,447	1,951,497
		-5.8%	20.6%

Table IV below indicates that fuel efficiency increased 20.6%. From the note above, this is not a true representation of fuel efficiency.

Table IV: Fuel Efficiency

	FY22	FY23	FY24
Miles per Gallon	7.71	12.95	15.61
		67.8%	20.6%

4. Water Conservation (Thousands of Gallons)

For FY24, combined water consumption (domestic and irrigation) was 266,337 thousand gallons. This is down 9.2% compared to FY23 (293,339 thousand gallons).

Table V: University Water Use (Thousands of Gallons): **September '23 – August '24**

Utility	FY23 Actual	FY24 Actual	% Change from previous year	Estimated Savings
Domestic water	266,182	231,290	Down 13.1%	$3,724
Sewer	266,182	231,290	Down 13.1%	$160,946
Irrigation water	27,157	35,048	Up 29.1%	($69,925)
Yearly Total	293,339	266,337	Down 9.2%	$94,745

Table VI below indicates that well water consumption was 19,459 thousand gallons for FY24, an increase of 14.4% compared to last year.

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

Utility	FY23 Actual	FY24 Actual	% Change from previous year
Well water	17,015	19,459	Up 14.4%

Table VII below indicates that domestic water consumption for remote sites was 9,351 thousand gallons in FY24. This is up 38.7% compared to FY23 (6,741 thousand gallons). Domestic water consumption at Reese 250 accounts for 68% of the increase. The Sustainability and Energy Accounting office is working with Operations and the utility company to verify the accuracy of the readings.

Table VII: Remote Sites (Thousands of Gallons): **September '23 – August '24**

Utility	FY23 Actual	FY24 Actual	% Change from previous year	Estimated Savings
Domestic Water	6,741	9,351	Up 38.7%	($36,335)
Sewer	4,185	6,500	Up 55.3%	($13,592)

Table VIII below indicates that well water consumption for remote sites was 33,008 thousand gallons in FY24. This is down 54.6% compared to FY23. The Rawls Golf Course experienced failed meters and inoperable wells for the entirety of the year. A project is in estimation to replace the meters.

Table VIII: Remote Well Water Use (Thousands of Gallons): **September '23 – August '24**

Utility	FY23 Actual	FY24 Actual	% Change from previous year
Well water	72,643	33,008	Down 54.6%

Table IX below indicates that Central Heating and Cooling Plant #1 (CHACP) well water use to the cooling towers was up 6.7%.

Table IX: CHACP #1 Well Water Use (Thousands of Gallons): **September '23 – August '24**

Utility	FY23 Actual	FY24 Actual	% Change from previous year
Well water	152,044	162,272	Up 6.7%
Sewer	76,022	81,136	Up 6.7%

B. Energy Reduction Measures

1. Educational and General Space

a) Recognized by the Association for the Advancement of Sustainability in Higher Education as a STARS Silver Institution based on its reported accomplishments in campus sustainability.

b) Free Cooling Project at CHACP # 1 – The Water Side Economizer provided over 3 million tons of free cooling (6.7% of total chilled water produced) this fiscal year, an estimated savings of $56,673.

c) Back Pressure Turbine at CHACP # 1 supplied 22.4% of CHACP's electrical use for a cost savings of $369,318.

d) Received free cogeneration steam from utility provider. Saved the University $3,421.

e) Energy Management set a target to identify $750,000 in cost avoidances for the fiscal year. By year-end, the department exceeded this goal, identifying $977,000. Of this amount, $50,000 was allocated to fund energy-saving measures, yielding $97,000 in immediate savings. The annualized savings from these projects are expected to reach $200,000.

   a. Modified the schedule for Air Handler 1 at the Architecture Building, which was running 24/7 due to an IT server. After relocating the server to the Technology Building, the air handler schedule was adjusted to the campus standard, resulting in $39,942 in savings.

b. Replaced the inoperable variable frequency drive (VFD) on Air Handler 6 at the Administration Building, which had been operating in "hand" mode. The repair saved $4,236.

c. Replaced the inoperable VFDs on Air Handlers 13 and 19 at the Library Building, which had been running continuously. This action saved $4,318.

d. Added a schedule point for Air Handler 11 at Reese 555, which had been running continuously. The change resulted in $1,639 in savings.

e. Replaced inoperable VFDs on Air Handlers 1 and 2 at the Law Building, which had been operating in "hand" mode, yielding $8,636 in savings.

f. Corrected the programming for Air Handlers 1 and 3 at Mechanical Engineering South, which were not receiving "OFF" commands as scheduled. This adjustment saved $4,306.

g. Identified faulty sensors on Air Handlers 1 and 2 at Mechanical Engineering South, causing the fans to run continuously at 100%, over-pressurizing the duct system. Replacing the sensors saved $3,172.

h. Discovered that the heating water pump at Mechanical Engineering South was running when it should have been off according to the control sequence. Replacing the faulty current transformer saved $2,115.

i. Replaced the inoperable VFD on Air Handler 3 at the Art 3D Building, which had been operating in "hand" mode. This repair saved $511.

j. Partnered with Utilivisor to analyze the energy consumption at Human Sciences and the Human Sciences Tower. Correcting the programming on Air Handlers 2, 3, and 4 resulted in $1,667 in savings.

k. Collaborated with building coordinators at Civil Engineering and Terry Fuller Petroleum Engineering to adjust air handler schedules to match building occupancy, resulting in $14,095 in savings.

l. Corrected programming for the heating water pump at Bledsoe Dorm, which had been running outside of the scheduled operation, saving $528.

f) Corrected a faulty binding for outdoor air sensor at Drane Hall keeping the units from operating as needed based on outdoor air temperature.

g) Perform PMs on the following meters: Hulen Hall – chilled water, Housing Services – chilled water and condensate, Weymouth – chilled water, Murray – chilled water, Experimental Sciences II – steam, Art 3D – condensate, Human Sciences – chilled water, and University Recreational Center – chilled water (2x).

h) Installed a new heating water pump at Law Lanier.

i) Installed meters at the following buildings: Marsha Sharp – chilled water, Civil Engineering – chilled water, Carpenter Wells – chilled water, Weymouth – chilled water,

j) Replaced outside air damper on air handler 3 at Texas Tech Plaza.

k) Made repairs and improvements at the following buildings condensate systems to increase condensate return rate back to the Central Heating and Cooling Plant: Grounds building, Biology, Art 3D, Goodard, Rawls COBA, Human Science, Human Science Tower, Physical Plant, and Science.

l) Compile a database of all water fountains in Education and General use spaces, including a subset of bottle fillers only.

m) Replaced a reheat valve on a vav at Reese 555.

n) Building automation system identified a fault in the heating water system at Agriculture Sciences. Steam valve was found to be leaking by. Project was submitted and completed to replace steam valves and actuators and update controls to electronic.

o) Identified and corrected a steam valve at Music that was not wired correctly.

p) Replaced a chilled water pump at Holden Hall.

q) Identified and corrected an alarm on the controller for the heating water system at Housing Services building.

r) A failed pump was identified on a condensate return unit, which caused flooding in a mechanical room at Rawls COBA. The pump was repaired, resulting in approximately 15 GPM of condensate being returned to the tunnel.

s) Identified that air handlers at Chemistry were not properly cooling the building due to the outside air sensor showing to be unreliable. Connection to the sensor was restored and thermal comfort improved.

t) Reviewed the building automation system graphics package for the Academic Science Building and submitted preferred outcome to Facilities, Planning, and Construction.

u) Installed Gensis Air CenterPoint Panels at the Child Development Center in June to eliminate VOCs and viable airborne microorganisms, improving indoor air quality. Through monitoring and testing, it would later be determined if there is an opportunity to decrease the prescribed or regulated use of outdoor air in the building for dilution.

v) Installed a new vav for room 101 at Texas Tech Plaza to better provide heating and cooling to the space.

w) Replaced a chilled water valve for air handler 1 at Texas Tech Plaza.

x) Installed VFDs for air handlers 2,3,4, and 6 at Texas Tech Plaza. Estimated annual savings is $15k.

y) Installed a current transformer for a relief fan at Architecture to monitor and control the speed.

z) Installed water bugs on air handlers 1, 2, and 3 at Art 3D to alert the Control Center of busted coils.

aa) Secured steam to campus air handlers during Summer 2024 to eliminate simultaneous heating and cooling which would decrease efficiency.

bb) Submitted 110 workorders for discrepant air handler operations, faulty HVAC equipment, and buildings' chilled water return temperature setpoints.

cc) Continued the upgrade of HVAC controls at Math, Animal Food Science, Music, and Psychology. Projects will continue through FY25.

2. **Auxiliary Space**

a) Identified that the chilled water pump at Wall Gates was running at 100% continuously due to a faulty differential pressure sensor.

b)

c) Collaborated with Hospitality Leadership to adjust air handler schedules to match building occupancy, resulting in $3,262 in savings.

d) Made repairs and improvements at the following buildings condensate systems to increase condensate return rate back to the Central Heating and Cooling Plant: Sneed Dorm, University Recreational Center, Hulen Clements Dorm, Carpenter Wells Dorm, and Coleman Dorm.

e) Chem Aqua to circulate cleaning chemicals through a heat exchanger at Honors Dorm to increase the efficiency of the exchanger.

f) Audited the chilled water system at Stangel Murdough and found the chilled water return valve stuck open returning below 52° to the tunnel. Actuator was found disengaged. After engaging the actuator, chilled water return temperature increased above 55°.

g) Audited the University Recreational Center and identified the need to upgrade pneumatic steam valves, controls, dampers, and variable frequency drives to increase the efficiency of the HVAC system and controls and improve occupant comfort.

h) 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**.**

i) Instituted quarterly energy reviews with Athletics, Student Union, Student Rec Center, and United Supermarket Arena to report current trends in utility usage in all areas of their buildings. Reported specific equipment discrepancies**.**

j) In effort to reduce chilled water consumption across three high rise dorms, the chilled water differential setpoint was set to 5 psi. The realized savings was $36k.

k) Replaced all pneumatic controls and valves for the chilled water system at Carpenter Wells to increase the efficiency of the chilled water system.

l) Assisted the Housing department in researching the capability of locking down thermostats in Talkington Dorm and setting the setpoints. Energy savings will be measured throughout FY25.

m) Generated 27 HVAC work orders for specific equipment discrepancies for Athletics, United Spirit Arena, Innovation HUB, Student Wellness, and the Student Recreation Center.

3. Energy Audits

a) Performed steam/condensate audit of condensate receivers on campus to identify buildings that have the condensate return water redirected to drain. Work orders were submitted for each building identified.

b) Performed five interior lighting audits: Ag Science, Mechanical Engineering North, Terry Fuller Petroleum, Innovation HUB, and Livermore.

c) Performed five plumbing audits: Ag Science, Mechanical Engineering North, Terry Fuller Petroleum, Innovation HUB, and Livermore.

d) Conducted weekly audits of the exterior lighting zones across Main Campus. The audits resulted in corrections by Operations or the estimation of larger projects to address exterior lighting needs and concerns. Additional projects are under consideration for the upcoming fiscal year.

e) Performed 19 HVAC audits: Human Science; Human Science Tower; Agriculture Education; Humanities; Education; Agriculture Science; Food Tech; Early Head Start; Livestock Arena; Art 3D; Engineering Tech Lab; Classical; Modern; Language and Literature; Media Communications; Engineering Center; Rawls College of Business; Bayer Plant Science South; Livermore; Chemical Engineering; and Drane.

f) In the fall; while steam was on to the campus; the steam/heating water system controls were audited to identify whether all heating water systems were following the Campus Standard lock-out program.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech University is currently planning energy efficiency measures including:

a) Plan to initiate a pilot project to install occupancy sensors; integrating them with lighting and HVAC controls. This will enable setback modes when areas are unoccupied; contributing to energy efficiency.

b) Plan to install the Open Blue AI system in a campus building to advance the university's Smart Campus initiative; leveraging AI for improved building operations and energy management.

c) Utilize the Water Side Economizers at CHACP # 1 to achieve electric and natural gas savings when outside air temperature allows.

d) Partnership between CHACP # 1 & Energy Management to monitor Human Science bldg. performance and determine how building and plant efficiencies correlate.

e) Continue to repair steam and condensate leaks to regain efficiencies in the production of steam for heating the campus.

f) Create a five-year plan for upgrading HVAC systems; lighting; and controls.

g) Institute monthly reviews of the Equipment Down Report and Software Override Report with goals to prioritize equipment repairs that are energy intensive.

h) Develop a Sustainability Master Plan to administer and provide guidelines for future sustainability efforts.

i) Utilize dashboards and alarms created in eSight to assist with persistent commissioning and monitoring of building utilities.

j) Perform energy assessments (building models and audits) for all priority facilities.

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

l) Continue 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 CHACP # 1.

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

n) Perform thirty-eight building audits to identify energy efficiency measures and update Building Energy Management Profiles.

o) Perform thirty-eight steam audits to identify defective steam valve and actuators.

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

q) Audit steam distribution system.

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

s) Identify and document sequences of operation for all HVAC systems. Once identified; put a schedule in place for the Control Center to regularly monitor and review for

discrepancies. If discrepancies are noted; appropriate actions will be reviewed and followed through.

t) Audit the building automation system alarms with intention to create alarm parameters and priorities.

u) Continue HVAC and controls assessment with third party vendor at Human Sciences and Human Sciences Tower. Goal is to identify 35% reduction in energy. Savings will be reported in FY25 report.

v) Identify energy efficiency measures that sum is equal to or greater than $750k in cost avoidances.

w) Continue supporting Student led organizations with their efforts in Sustainability.

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 started installing 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. Where possible; xeriscaping and desert scape landscape materials will be used to reduce maintenance and water needs.