TEXAS TECH UNIVERSITY
HEALTH SCIENCES CENTER™

October 5, 2018

Mr. Dub Taylor
Director
State Energy Conservation Office
111 E. 17th Street
Austin, Texas 78774

RE: TTUHSC Energy and Water Management Plan

Texas Tech University Health Sciences Center has made energy conservation and system optimization a priority for over 20 years, and has complied with the state mandated reporting requirements per Texas Government Code §447.009 (c), Texas Administrative Code Title 34/ Chapter 19/ Subchapter B, Governor's Executive Order #RP 49, and SECO directives. Our institution has consistently maintained energy utilization and cost index (EUI & ECI) values less than the average EUI and ECI values of the health related institutions in the State of Texas. We are in compliance with the water efficiency standards outlined by the applicable building codes, and SECO water conservation standards. Attached 'EXHIBIT-I' shows the energy, water, and gasoline consumption data for fiscal years 2013 through 2018. Factors such as overall institutional growth, programmatic changes, multiple campus geographies, weather fluctuations, and increased research activity, significantly influence overall energy consumption. TTUHSC continues to emphasize fuel conservation awareness with strategies such as group travel and regular preventative maintenance to best achieve savings.

The institution implemented several energy conservation projects that had positive results and notable payback periods. 'ATTACHMENT-I' shows a list of energy conservation projects that were completed during the FY2015 to FY2018 timeframe. While anticipating further growth in academics, healthcare (clinical), and research activities during the fiscal years 2019 through 2023, our institution plans on realizing annual energy utilization index (EUI) values less than 250 kBtu/sf/yr. This is below the average EUI value of 262 kBtu/sf/yr for health related institutions in the State of Texas. TTUHSC has aggressive plan to meet or exceed the requirements of the Texas Building Energy Code and Water Conservation Standards for all new construction and major renovations. Efforts will be made to improve existing building efficiency through new technologies, efficient equipment and ongoing operational improvements.

To attain the above mentioned goal, our institution has a progressive plan to implement energy and water conservation projects as detailed in the 'ATTACHMENT-II'. Projects will be prioritized and implemented based on considerations such as acceptable payback period and/ or life-cycle cost-benefit analysis, and available resources. The plan identifies potential financing strategies to implement these projects.

TTUHSC maintains specific Operating Policy and Procedures (OP) relating to the Energy Conservation Program and Utility Review. This OP makes the responsibility of Energy Conservation the obligation of every employee and department with support from HSC Facilities. 'ATTACHMENT-III' comprises the Awareness Plan in detail and the designated contact person at the institution.

Your consideration of our efforts and this information is appreciated.

Sincerely,

Gregory Lovett

Gregory D. Lovett, P.E.
Senior Director
Facilities & Safety Services

Harry F. Slife, Jr.

Harry F. Slife, Jr., PhD
Vice President
Facilities & Safety Services

Enclosure: EXHIBIT-I
ATTACHMENT I, II, III

XC: Penny Harkey,
Vice President and Chief Financial Officer, TTUHSC Finance & Administration

EXHIBIT-I
Energy, Water, Gasoline Consumption Data
FY2013 to FY2018

Fiscal Year	Energy Consumption in KBtu	Total Area (Square Feet)	EUI (KBtu/sf/yr)	Water Consumption in Tgal & (Gal/sf/yr)
FY2013	485,560,807	2,059,771	236	55,732 (27)
FY2014	490,462,422	2,069,695	237	54,362 (26)
FY2015	473,784,714	2,107,453	225	44,350 (21)
FY2016	475,788,294	2,133,896	223	52,046 (24)
FY2017	473,651,710	2,203,335	215	52,902 (24)
FY2018	471,006,151	2,223,839	212	53,973 (24)

	Gasoline Data	
Fiscal Year	Consumption, Gallons	Cost ($)
FY2013	26,678	$ 89,263
FY2014	29,410	$ 93,999
FY2015	27,986	$ 69,656
FY2016	27,851	$ 52,087
FY2017	31,321	$ 64,867
FY2018	34,881	$ 86,880

ATTACHMENT I
Energy Conservation Progress Report, FY2015 to FY2018

1. Four old and inefficient air handling units (AHUs) were refurbished with new direct digital controls (DDC), fanwall systems, steam heating, and cooling coils. The air handling units utilize pressure independent control valves for chilled water flow. Improved equipment energy efficiency and performance has been achieved.
2. HSC Facilities completed projects to retrofit four air handling units in the Lubbock HSC building, with JCI direct digital controls (DDC).
3. Most of the small renovation projects, and in-house lamp replacement projects utilized LED troffers/ LED T8 tubes/ LED downlights/ LED wallpacks. LED retrofits reduce electricity consumption, improve lighting quality, and provide better illumination.
4. 133 LED light fixtures were installed to replace aging HID fixtures in the parking lot areas at various locations. TTUHSC Engineering has been evaluating the performance and reliability of exterior LED fixtures. Exterior LED fixtures on parking lot poles have been observed to be very reliable with zero failure rate.
5. Construction of the new Academic Education Building in Odessa, is expected to be completed before the end of December, 2018. The building exceeds Texas Energy Code requirements. It has variable speed chiller, condensing boilers, low flow plumbing fixtures, and energy efficient LED lighting and control. ONCOR is expected to provide energy rebate for the installation of energy efficient chiller and lighting.
6. Construction of the new Panhandle Simulation Center building was completed in FY2017. The building has energy efficient variable refrigerant flow systems with heat recovery, condensing water heater, and energy efficient LED lighting and control. XCEL Energy provided energy rebate.
7. Planned replacement of chillers with HCFC refrigerants (R-22) to comply with evolving federal regulations. Two chillers in the Odessa Clinic building are being replaced with new chillers with zero (0) Ozone Depletion Potential (ODP) refrigerants. The project is expected to be completed by the end of December' 2018.
8. HSC Engineering has secured a four year contract with Reliant Energy thru Tradition Energy to supply power to the buildings located in Odessa, Abilene, and Midland.
9. HSC Planning prepared 'Energy Guidelines' for all new construction and renovation projects. It's in the process of being integrated to the TTUHSC Design Standards.

10. Texas A&M Energy Systems Laboratory conducted energy assessment and simulation studies of the hvac systems and energy consumption of the Lubbock HSC building. They provided a report showing potential energy savings by replacing air terminal boxes with new DDC controlled variable volume boxes. Accordingly, TTUHSC Facilities has plan to replace or retrofit terminal units on a continuous basis.
11. Twelve old and inefficient air handling units (AHUs) were replaced with new AHUs with new direct digital control (DDC), fanwall systems, steam heating, and cooling coils. The air handling units utilize pressure independent control valves for chilled water flow. Improved equipment energy efficiency and performance has been achieved.
12. The control system for AHUs, and HID lighting in the Preston Smith Library were upgraded for better control, and lower energy consumption. Based on our measurement and verification, the upgrade had a payback period of 2 years.
13. One of the chillers was replaced with a new high efficient scroll chiller at the Amarillo campus. This was done to meet our plan to phase out chillers with HCFC refrigerant (R-22) in accordance with federal regulations.
14. XCEL Energy offered free retro-commissioning opportunities to its customers. Accordingly, Energy System Associates (ESA) completed retro-commissioning of two of our buildings in Amarillo. Deficiencies were corrected. The report outlined controls upgrade, chiller replacement, and other retrofit options.
15. A new energy management control system was installed at the Women's Health Research Institute, Amarillo.
16. Several variable air volume (VAV) boxes were upgraded to DDC in various buildings.
17. Roof improvements and building envelope repairs were completed at several HSC buildings (various locations).
18. Institution adopted a plan to use F28T8 lamps for office/ laboratory etc., and LED T8 tubes or F25T8 lamps for hallway/ toilets etc.
19. All new construction and major renovations complied with applicable state energy codes and sound engineering practice.
20. Construction of a new School of Public Health building was completed in FY2016. The building is equipped with energy efficient condensing boilers, centralized air handling units with variable frequency drives (VFDs), VFD equipped pumps, and energy efficient lighting.

ATTACHMENT II
Energy Conservation Projects, Schedule, and Finance Strategies

TTUHSC has identified the following strategies for reducing the campus energy consumption. TTUHSC Facilities - Engineering has performed cost benefit analysis of all the identified energy conservation projects. Currently, these projects are in various stages such as in planning, design, construction, or assessment. The implementation schedules are prepared annually according to the availability of funds and building resources.

Projects:

Evaluate and secure funding for the following projects.

1. Continue to replace parking lot pole lights with LED light fixtures with higher efficacy and color rendering index. The retrofit lowers energy consumption up to 45% per pole and provides better light quality & appearance. Currently these light fixtures are being evaluated for performance, reliability, and maintainability.

2. Refurbish pneumatically controlled air handling units (AHU) with direct digital controls, multiple fan system, premium efficiency motors, pressure independent flow control valves, steam heating, new cooling and heating coils etc. This is mainly for the Lubbock HSC building, where AHUs are more than 30 years old.

3. Replace older pneumatic variable air volume boxes with direct digital control (DDC) boxes for accurate and precise control of space conditions. The advantages of DDC are flexible controls, PID algorithm, no controller drift, no recalibration, and cost effective based on life-cycle cost analysis.

4. Planned replacement of chillers with HCFC refrigerants (R-22) to comply with evolving federal regulations. The FY2019 plan is to replace two older chillers with new chillers with zero (0) Ozone Depletion Potential (ODP) refrigerants.

5. Installation of condensing boilers for new buildings, and for replacement of existing boilers at the end of their expected service life. Condensing boilers are up to 96% efficient, have turndown to 10%, are corrosion resistant, and can be operated at a lower inlet water temperature with a higher efficiency as compared to conventional boilers.

6. Installation of LED troffers / tubes, LED wallpacks, LED floodlights. As an example, replacement of existing F32T8 lamps and ballasts with LED 15WT8 tubes costs the same with the added benefit of energy and maintenance savings.

7. Explore installation of variable flow exhaust system for fume hoods to reduce the required total air flow when the sash is partially or fully lowered. This approach would maintain acceptable air velocity at the sash and reduce the exhaust of conditioned air.
8. Replacement of older electrical equipment, including motors and transformers. Payback period with 2% to 3% efficiency gain, is less than 5 years, as the cost of the equipment is typically 2% of the life-cycle cost.
9. Continue to identify and replace damaged, missing, or inadequate insulation.
10. Retro-commissioning of existing facilities to ensure HVAC systems are fully functional, using accurate sensors, and optimal control algorithms.
11. Upgrade existing energy management control systems in Lubbock and the regional campuses.
12. Improvements to the existing building envelopes to reduce infiltration.
13. Installation of pressure independent (PI) control valves for optimal chilled water flow control to the air handling units. TTUHSC has observed that these valves provide higher chilled water temp difference, and lower flow through the cooling coils.
14. Install hands-free, low water flow fixtures for toilets, sinks and urinals.
15. Installation of occupancy sensors to control lighting for all spaces in the HSC buildings.

Additional Tactics not requiring financing:

1. Ensure that all renovations and new building construction meet or exceed the most current edition of energy conservation code.
2. Review all utility tariffs and ensure that the most favorable terms are being realized by TTUHSC.
3. Keep abreast of new and proven technologies and apply these technologies where opportunities exist.
4. Monthly review of the energy consumption from TTUHSC facilities and the immediate investigation into any variances from plan, to correct and prevent future inefficiencies.
5. Continuously develop and update list of energy conservation projects.
6. Participate in forums presented by the State Energy Conservation Office, State Energy Advisory Group, Association of Energy Engineers, and American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

7. Maintain a process of educating, training, and communicating the policies, best practices and every day conservation practices for the occupants within the facilities TTUHSC owns, operates and leases.

Implementation Schedule for FY-19

1. Refurbish (4) air handling units with DDC, pressure independent flow control valves, and fanwall system in the Lubbock Health Sciences Center building.

2. Retrofit air handling units and variable volume boxes, with direct digital controls.

3. Install new chillers with zero (0) Ozone Depletion Potential (ODP) refrigerants to replace older and inefficient chillers with R-22 refrigerant. Plan is in motion to install two chillers in Amarillo.

4. Upgrade existing pneumatic controls in one of the equipment rooms to direct digital systems, to operate all pumps, control valves etc.

5. Install LED lighting to retrofit fluorescent tubes and ballasts on hallways, toilets, and similar spaces.

6. Install up to 100 parking lot LED fixtures to retrofit HID fixtures at various locations.

7. Retro-commissioning of control system and associated components at various locations.

8. Replace pneumatically controlled terminal boxes with DDC VAV boxes.

Financing Strategy

Listed below are some of the available methods of financing energy savings projects.

Primary

1. Internal Funding, including reinvestment of energy savings
2. Rebates from Utility Providers

Other

3. LoanSTAR Revolving Loan Program from SECO
4. Energy Performance Contracting

ATTACHMENT III

Awareness Plan

Facilities - Engineering is continuously on the lookout for means by which to communicate energy conservation practices to the personnel and patients that occupy the facilities. Avenues available to Facilities - Engineering are the announcement page of the TTUHSC and Facilities websites, memorandums, education at new hire orientations, mail services, plus the Directors of Plant Operations and Maintenance.

The key elements of TTUHSC's Utility Awareness Plan are to prevent waste and ensure conservation of resources. These initiatives are broken down into three categories: Direct (effecting change in behavior); Indirect (not designed to affect behavior, but will increase awareness); and Operations & Maintenance initiatives. Examples are listed below.

Direct Initiatives:

- Require all personnel to turn off lights, computers, printers, and any other office machine when labs and offices are unoccupied.
- Turn off lights in classrooms when classes are over.
- Strongly discourage idle classrooms from being used as study halls. The library or small study rooms are better alternatives.
- Allow vent hoods to be operated only when necessary.
- Strongly discourage the use of comfort-heating appliances to be used to supplement the building heating system.
- Instruct custodians to turn off lights in hallways and offices after cleaning.

Indirect Initiatives:

- Reduce the operating hours for air handlers and other mechanical systems.
- Reduce the temperature of water used for domestic purposes to 125°F.
- Consolidate laboratory functions.
- Install lighting occupancy sensors, where applicable.
- Ensure venetian blinds and shades are fully extended and closed as appropriate to reduce heating and cooling losses.

Operation & Maintenance Initiatives:

- Airside economizer, discharge air reset schedules, chiller staging, chilled water differential pressure control, and chilled water differential temperature control logic needs to be periodically reviewed, and incorporated or improved where applicable.
- Identify equipment that can be shut off during nights and weekends for all facilities. Also increase the band between heating and cooling temperature setpoints during unoccupied hours.
- Provide adequate deadbands between space air cooling and heating setpoints to reduce how often terminal boxes change operation modes and, where multiple boxes serve a space, minimize simultaneous heating and cooling.
- Replace filters on air handling units frequently.
- Periodically check temperature and humidity sensors for proper calibration.
- Install minimum air flow stops to ensure appropriate outside air at all times.
- Check steam traps and steam being lost through roof vents.
- Check ducts and pipes for missing or damaged insulation.
- Test and Balance (TAB) both the airside and waterside of the HVAC system.
- Perform regular preventive maintenance on all major and high energy use equipment.

Designated Contact Person

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