

State Facility Utility Management



Utility Data Analysis Report

Executive Summary

Prepared by the Department of Environment and Conservation's State Facility Utility Management (SFUM) team pursuant to Tenn. Code Ann. § 4-3-1012(3), this first-of-its-kind report highlights the features and benefits of the State of Tennessee's Utility Data Management (UDM) platform in supporting collection and analysis of State facility utility usage, cost, and rate data for State Fiscal Years (FY) 2019 and 2020.

As a central hub for ongoing and historical electric, water/sewer, natural gas, chilled water, steam, and propane billing data, the UDM platform provides State agencies and Higher Education institutions with the value-added ability to remotely track, benchmark, and report utility usage while automating the collection of monthly utility invoices for approximately 8,000 facilities across four organizational groups: General Government, the University of Tennessee (UT) System, Locally Governed Institutions, and the Tennessee Board of Regents (TBR).

SFUM's analysis of utility data for these facilities shows the State of Tennessee spent roughly \$174 million on utilities in FY2020, with electric representing 65% of total expenditures. FY2020 marked a 7.5% decrease in State utility costs compared to FY2019, largely resulting from utility usage reductions from pandemic-related changes in occupancy and operations within the building portfolio.

This report provides in-depth utility usage and cost data and analysis by utility and by each organizational group and highlights case study examples of the UDM platform's features and benefits, such as accommodating remote and alternative workplace solutions, greater visibility of utility usage and billing anomalies, increased ability to identify energy conservation opportunities within State facilities, and enhanced accountability and capability for cross-functional collaboration.

Work on the FY2021 report has already begun, and the SFUM team anticipates a Spring 2022 distribution. In the meantime, the SFUM team is continuing to provide technical assistance and additional training opportunities to UDM end-users (e.g., State fiscal personnel, utility and facility managers and building maintenance personnel, sustainability professionals) from across the four organizational groups in order to maximize the utilization of the UDM.

Questions about this report or requests to become a registered UDM platform user can be directed to the SFUM team at tdec.sfum@tn.gov.

Table of Contents

1.0 Introduction	1
1.1 About SFUM	1
1.2 Utility Data Management	1
1.3 Objective of State Facility Utility Data Analysis Report.....	2
2.0 UDM Platform Overview	3
2.1 Scope and Platform Configuration	4
2.1.1 State Portfolio	4
2.1.2 Project Implementation.....	5
2.1.3 Bill Payment Integration with Edison.....	5
3.0 UDM Utilization & Benefits	6
3.1 Functionality.....	6
3.2 User Benefits.....	6
4.0 State Utility Cost & Usage Reporting.....	8
4.1 Methodology.....	8
4.2 Observations.....	8
4.3 Data Reconciliation	8
4.4 Overall State Portfolio: FY2020.....	9
4.5 Comparison of FY2019 and FY2020	10
4.5.1 Costs.....	11
4.5.2 Rates.....	11
4.5.3 Usage.....	11
4.6 FY2019 – FY2020 Utility Usage and Cost Discussion.....	12
4.6.1 Electric.....	12
4.6.2 Water/Sewer.....	14
4.6.3 Natural Gas.....	15
4.6.4 Chilled Water, Steam, and Propane	16
4.7 Analysis by Organization Group for FY2020	20
4.7.1 General Government	20
4.7.2 Tennessee Board of Regents (TBR)	20
4.7.3 Locally Governed Institutions (LGIs)	21
4.7.4 The University of Tennessee (UT) System	21

4.7.5 Organization Group Utility Observations.....	22
5.0 Additional UDM Utilization Highlights.....	23
5.1 Facilitation of Alternative Workplace Solutions (AWS)	23
5.2 Discovery of Unauthorized Charges	23
5.3 Ascertainment of Billing Irregularities.....	23
5.4 Billing Discrepancy Validation.....	23
5.5 Obsolete Meter Recognition	24
6.0 UDM Utilization Case Studies	25
6.1 Tracking Energy Savings	25
6.2 Leveraging UDM Data to Effect Change	26
6.3 Detection of Energy Spikes and Water Leaks	26
6.4 Trends and Budget Forecasting	30
7.0 Looking Ahead.....	31
Appendix A – UDM Report and Dashboard Reference	32
Appendix B – Utility Usage Calculations.....	34
Appendix C – List of General Government Agencies.....	35
Appendix D – List of TBR Community Colleges	36
Appendix E – List of TBR Tennessee Colleges of Applied Technology	37
Appendix F – List of Figures and Tables	38
Appendix G - Abbreviations	41
Acknowledgment and Disclaimer	43
Image and Icon Attribution	43

This page intentionally left blank.

1.0 Introduction

1.1 About SFUM

Residing in the Office of Energy Programs (OEP) within the Tennessee Department of Environment and Conservation (TDEC), the State Facility Utility Management (SFUM) team provides State General Government agencies and Higher Education institutions with actionable energy and utility usage insights through the collection, analysis, and reporting of utility billing data. SFUM was formed in January 2017, following the issuance of Executive Order 63, which transferred the building management statutory responsibilities for State-owned and -managed properties from the Department of General Services to TDEC (Tenn. Code Ann. §§ 4-3-1012 and 4-3-1017-1019). Among these responsibilities are the analysis and reporting on the State's aggregate annual energy costs and usage, (Tenn. Code Ann. § 4-3-1012(3)), which is the subject of this report.

1.2 Utility Data Management

To address the abovementioned statutory requirement, SFUM developed and manages a Utility Data Management (UDM) platform that collects and stores data from the State's utility bills for State-owned and -managed facilities. The UDM platform allows the SFUM team, UDM end-users, and other stakeholders to analyze utility data, track costs and usage, audit bills, and report on general energy practices.

As a central hub for utility data, the UDM platform provides State agencies and Higher Education institutions with the value-added ability to remotely track, benchmark, and report energy use while automating the collection of monthly utility invoices for approximately 8,000 facilities across four organizational groups: General Government; the University of Tennessee (UT) System; Tennessee Board of Regents (TBR); and Locally Governed Institutions (LGIs).

This report details the benefits of UDM platform utilization for facility managers, accounting staff, and administrators alike. Chief among these: the ability to accommodate remote and alternative workplace solutions, identification of billing discrepancies, automated bill entry to reduce human errors occurring from manual bill entry and time spent manually entering bills, and greater accountability and capability for cross-functional collaboration.

Several case studies included in this report highlight the successful integration of the UDM platform used in State General Government operations. For example, the UDM platform has assisted in tracking savings at the William R. Snodgrass Tennessee Tower office building following the execution of various energy conservation measures (ECM). Other examples include the leveraging of UDM data to effect change where high usage and costs were visible at Cove Lake State Park and the detection of abnormal increases in energy and water use by the Department of Correction and the Department of Military.

1.3 Objective of State Facility Utility Data Analysis Report

The overarching goal of this report is to communicate the State's utility cost and usage to a broader audience and to underscore the capabilities and benefits of the UDM platform, which has facilitated the transition away from manual data collection, entry, and analysis. This report compares utility usage data for State Fiscal Year (FY)¹ 2019 and 2020 by organizational group and the six types of utility commodities: electric power (electric), water/sewer, natural gas, chilled water, steam, and propane.

Key observations for the overall State portfolio include:

- The State spent \$173,708,750 on energy and water utilities in FY2020 across all State-owned and -managed facilities.
- Electric is the largest utility cost, comprising 64.6% of all utility costs in FY2020.
- Electric, water/sewer, and natural gas accounted for 95.6% of all utility costs in FY2020.
- An overall decrease in utility costs between FY2019 and FY2020 equaled \$14,003,327 (7.5%), a result of utility usage reductions and a decrease in average utility rates.
- There was a marked reduction in utility usage and associated costs in March, April, and May of FY2020 for electric, water/sewer, natural gas, and chilled water. The reduced usage and costs are largely attributed to changes in occupancy and operation within the portfolio following the onset of the COVID-19 pandemic in early March 2020.

¹ The State of Tennessee Fiscal Year runs from July 1 to June 30 for the following calendar year. For example, FY2020 encompasses July 1, 2019 to June 30, 2020.

2.0 UDM Platform Overview

The UDM platform serves as a central repository for the historical and ongoing utility cost and usage data² of approximately 8,000 State-owned and -managed facilities, representing approximately 105 million sq. ft., and is predominantly used for utility tracking, reporting, and benchmarking for General Government agencies and Higher Education institutions and bill payment integration for General Government agencies.³

The UDM serves the 77 General Government agencies and Higher Education public institutions and contains data regarding approximately 8,800 accounts and 10,600 utility meters.

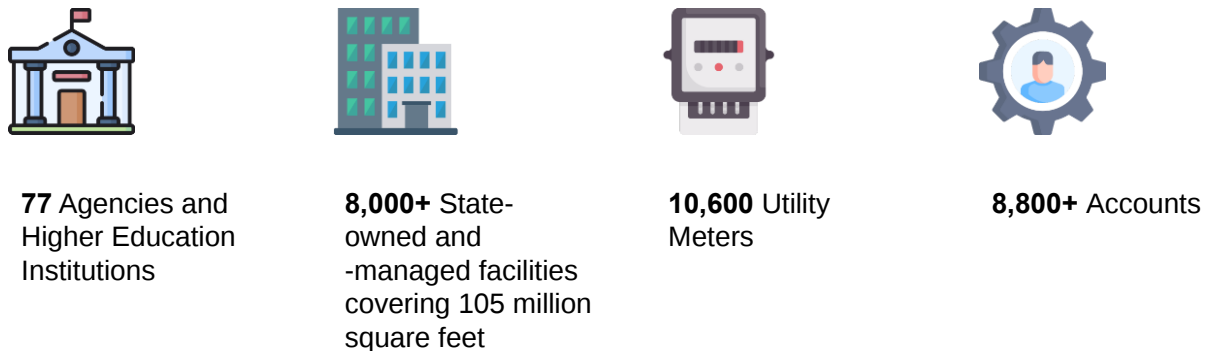


Figure 2.0.1 – UDM Platform Scope

Since launching the UDM platform in 2019, the SFUM team has been providing aggregated utility usage and cost data for these facilities to help fiscal personnel, State building maintenance, utility and facility managers, sustainability professionals, and technical assistance providers gain actionable insights into their utility data. Before the UDM platform, obtaining this data required significant effort to locate utility accounts, gather utility bills, and manually enter data. As a result, utility cost and usage data were rarely analyzed by State personnel.

² Cost and usage data for most utilities are predominately captured monthly. Some utility bills are captured on a quarterly or other basis.

³ For FY2020, the UDM platform contains utility bill data for 99.1% of the utility meters (as of January 11, 2021) that have been identified for General Government agencies and Higher Education institutions.

2.1 Scope and Platform Configuration

2.1.1 State Portfolio

The SFUM team and the UDM software vendor, EnergyCAP, completed the 3-year project development, configuration, and implementation in May 2019. During this period, the SFUM team and vendor worked with facility managers, sustainability managers, and accounts payable staff for each of the 77 General Government agencies and Higher Education institutions to create the desired organizational groupings and hierarchy structures related to buildings, meters, and accounts.

Once the appropriate hierarchy structures were created, SFUM input each building's unique building data into the platform, including address, latitude and longitude, square footage, original construction date, and use type. In addition, customized fields were created to meet specific needs, including building status, county, management type, and building ownership. General Government agencies and Higher Education institutions that own or manage facilities are shown in Table 2.2.1.

Table 2.1.1 – State Entities with Owned or Managed Building Stock (by Organization Type)

	General Government ⁴	University of Tennessee (UT) System ⁵	Locally Governed Institutions (LGIs)	Tennessee Board of Regents (TBR) ⁶
Asset Portfolio	25 Agencies	• UT Agricultural Services • UT Chattanooga • UT Health Science • UT Knoxville • UT Martin • UT Space Institute	• Austin Peay University • East Tennessee State University • Middle Tennessee State University • Tennessee State University • Tennessee Technology University • University of Memphis	• 27 Tennessee Colleges of Applied Technology • 13 Community Colleges
Share of Portfolio (% of sq. ft.)	39%	26%	25%	10%

⁴ See Appendix C for full list of General Government agencies.

⁵ The SFUM team is in the process of adding UT Southern to the UDM. Due to the date the campus was acquired, it will not be included in this annual report until the report for FY2022 is issued.

⁶ See Appendices D and E for full list of Community Colleges and Tennessee Colleges of Applied Technology, respectively.

2.1.2 Project Implementation

To include as much historical data as possible, SFUM worked with EnergyCAP to collect historical billing data from the 355 utility vendors providing service to State facilities. Historical bills were collected as far back as each utility's billing system would allow, in some cases back to July 2012. The SFUM team has established ongoing duplicate billing⁷ for all Higher Education institutions and any non-General Government Executive branch agencies that opted out of the UDM platform accounts payable integration with Edison.

The UDM platform captures each line item and charge from a utility bill, which may include usage, cost, demand, power factor, customer charges, miscellaneous fees, credits, and penalties and erroneous or unauthorized charges such as taxes and charitable contributions. Bill line items associated with telecommunications, refuse, and vehicle fuels are captured in the UDM platform only if they appear as a line item on a utility bill.

2.1.3 Bill Payment Integration with Edison

The UDM platform was successfully integrated with the General Government's bill payment system, Edison, through collaborative efforts with Finance and Administration's (F&A) Division of Accounts, Edison team, and Strategic Technology Solutions (STS). This integration covers 22 of 25 General Government Executive Branch agencies and makes the process for bill review, approval, payment, and reconciliation substantially more efficient. The UDM platform bridges communication gaps and promotes collaboration between staff, while proactively mitigating potential utility billing errors through automated bill audits and utility data reports that allow for faster, more detailed analysis.

⁷ In order to capture billing data for State entities not using the UDM platform for utility bill pay approval, the SFUM team established a method of receiving a physical or electronic duplicate bill (or the data from bill) to enter into the UDM platform.

3.0 UDM Utilization & Benefits

3.1 Functionality

The UDM platform is the hub for the State of Tennessee's utility and energy data. With the ability to provide analysis and reporting functions that were not readily available in the past, UDM is a tool for State personnel to improve their operations.

Facility managers along with energy and sustainability managers can use UDM's energy dashboards and report templates to identify potentially energy-inefficient facilities, assist in the evaluation of energy conservation projects, support measurement and verification (M&V) efforts, track emissions, and obtain U.S. Environmental Protection Agency (EPA) ENERGY STAR® ratings or other building certifications.

Accounting and budget staff can use UDM to identify billing errors, create utility budget forecasts, and share standardized reports with leadership. Further, the inclusion of accounts payable integration into the UDM platform streamlines the utility bill accounting workflow. Automating bill entry, improving bill auditing, and simplifying cost allocations save accounting and budget staff valuable time that can be spent on other tasks.

The UDM platform allows accounting, energy management, and sustainability professionals to work together to improve building operations by centralizing the State's utility bill data and providing powerful analysis tools with an easy-to-use web interface.

3.2 User Benefits

Facility managers across the State have benefitted from UDM in the following ways:

- **Data-driven detection of leaks:** Frequent usage data reviews and utility bill audits allowed for early detection and identification of leaks.
- **Increased visibility:** Before UDM, many facility management staff lacked access to and visibility of utility cost and usage data.
- **Enhanced reporting and analysis:** End-users can generate reports and perform analysis with much greater detail and speed than before.
- **Better benchmarking:** With UDM, facility management staff can compare Energy Use Intensity (EUI) across similar building types at organizational, multi-organizational, or State portfolio levels to identify best-performing buildings and associated energy management practices.

General Government's accounts payable staff have benefitted from UDM through:

- **Improved AWS:** As a web-based platform, UDM promotes alternative workplace solutions (AWS) for account payable staff.
- **Increased communication:** Bridges communication gap between centralized and remote accounts payable staff and promotes collaboration between accounts payable and facility management staff.
- **Bill entry automation / Reduced billing errors:** Eliminates manual bill entry errors and reduces accounts payable staff time needed to enter utility bills, allowing resources to be applied to other tasks.
- **Process standardization:** Streamlined or standardized F&A Division of Accounts and Edison utility business processes across agencies.
- **Bill auditing:** Easier identification of questionable bills, billing errors, and unauthorized charges by utility service providers.
- **Greater accountability:** The platform provides tracking for accounts payable user workflow steps and activities.
- **Late fee mitigation:** UDM reports can identify bills that have not been received from the utility vendor before they are past due.

"UDM has freed an average of 60-90 minutes per day per DGS AP staff member, as they no longer have to scan invoices to be attached to vouchers or key data. This has resulted in more time available to process invoices."

– DGS Central Accounting Assistant Director

"Before UDM, TDEC AP staff members would spend 7.5 hours entering invoices, and reconciliation could take three days. This is now reduced to 2.4 hours for review and approval, with reconciliation occurring daily."

– TDEC Accounting Manager

4.0 State Utility Cost & Usage Reporting

4.1 Methodology

For this report, SFUM performed the first in-depth analysis of the State's utility data. Sections 4.2-4.4 present a high-level analysis of the State building portfolio, including the General Government Executive Branch agencies, the UT System, TBR, and LGIs. Section 4.5 provides an overview of utility cost and usage.

SFUM accessed the cost and usage information in the UDM platform, which contains over 99.1% and 97.2% of utility billing data for known State accounts for FY2020 and FY2019, respectively.⁸ (These percentages do not include the utility propane, as some agencies procure propane via purchase orders outside the UDM platform.) The analysis is limited to monthly data, as not all State-owned or -managed facilities offer data at greater intervals.

4.2 Observations

The SFUM team observed a marked decline in utility-related expenditures between FY2019 and FY2020, in large part due to the onset of the COVID-19 pandemic that resulted in telecommuting for many State employees. Lower occupancy during this time dramatically reduced the need for electric power, which is the State's largest contributor to overall utility costs.

Utility data analysis at the organizational level focused on FY2020 only. Key observations for FY2020 include:

- Only two of the four organization groups utilize all six utilities – General Government and LGIs.
- The largest cost and usage utility for each group is electric.
- The least cost and usage utility for each group is propane.
- General Government is the greatest contributor to overall utility costs at \$70,075,132 and TBR is the lowest contributor to overall utility costs at \$22,172,641.

4.3 Data Reconciliation

The SFUM team carried out data analysis using a dataset output from 14 different organization group databases within the UDM platform as well as an all-State database that is comprised of the data from the 14 databases. Although the data refer to the same portfolio of State buildings, the

⁸ The cost and usage figures reported are subject to change as any missing bills are obtained and entered, or in the event, SFUM is notified of additional accounts covering this timeframe by an agency or campus.

real-time nature of the platform can lead to minor differences in the usage or cost values for the different datasets. Discrepancies in total costs between the all-State portfolio database in UDM and the individual organization group databases in the UDM platform represent a negligible error margin of total State energy costs as outlined in Table 4.3.1.

Table 4.3.1 – FY2020 Comparison of Cost Totals for All-State and Individual Databases

Description	Value
All-State portfolio database	\$173,708,750
Organization group database total	\$173,706,606
Confidence Error (\$)	\$2,144
Confidence Error (%)	.00123%

4.4 Overall State Portfolio: FY2020

Analysis of utility data in UDM reveals that the State of Tennessee spent \$173,708,750 on energy and water utilities in FY2020 across all State-owned and -managed facilities, with nearly two-thirds (or 64.6%) of FY2020 utility costs reported in the UDM platform were spent on electricity. Figure 4.4.1 shows the percentage utility mix by utility.

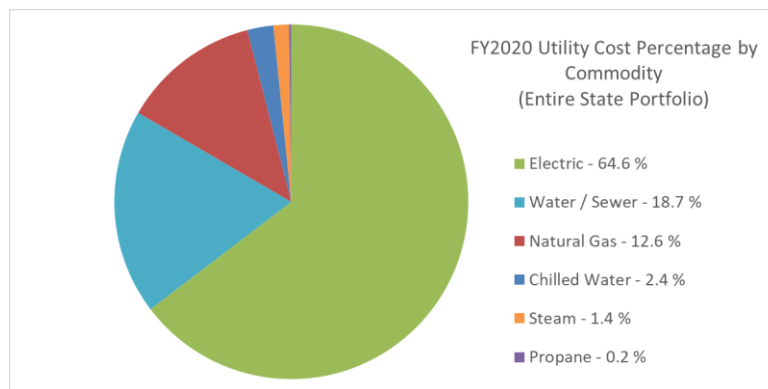


Figure 4.4.1 – FY2020 Utility Cost Percentage by Utility

Energy and water usage vary by month as weather and use patterns change. For example, September 2019 had the highest total cost at \$16,329,801 during FY2020, driven by unusually hot weather and higher than normal water use. April 2020 had the lowest total monthly cost at \$11,548,756, driven by a combination of mild spring weather and COVID-19 impacts to operations. Figure 4.4.2 shows a chart of FY2020 utility costs by month.

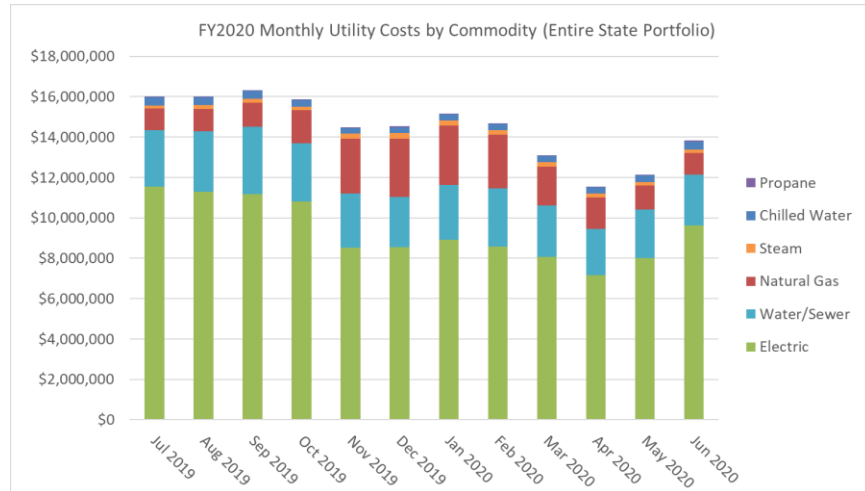


Figure 4.4.2 – FY2020 Actual Utility Costs by Month

4.5 Comparison of FY2019 and FY2020

A year-to-year comparison of utility data focused on costs, rates, and usage. As evidenced by data in Table 4.5.1, usage played the greatest role in reducing total FY2020 State utility expenditures compared with the prior year.

Table 4.5.1 – FY2019-2020 Changes in Usage, Average Blended Rate Change, and Overall Cost Changes

Utility Commodity	Total Cost Change (\$)	Cost Change (%)	Cost Impact - Average Blended Utility Rate Change (\$)	Cost Impact Average Blended Utility Rate Change (%)	Cost Impact Usage Changes (\$)	Usage Changes (%)
Electric	-\$10,584,940	-8.6%	-\$1,207,733	-1.1%	-\$9,377,207	-7.6%
Water	\$1,225,858	3.9%	\$313,471	1.0%	\$912,386	2.9%
Natural Gas	-\$3,824,317	-14.8%	-\$3,601,576	-14.1%	-\$222,742	-0.9%
Chilled Water	-\$115,543	-2.7%	\$288,548	7.5%	-\$404,091	-9.5%
Steam	-\$473,212	-16.1%	-\$172,397	-6.5%	-\$300,815	-10.2%
Propane	-\$231,173	-39.8%	-\$153,609	-30.5%	-\$77,564	-13.3%
Total	-\$14,003,327		-\$4,533,296		-\$9,470,031	

4.5.1 Costs

The State benefitted from a net reduction of \$14,003,327 (7.5%), in overall utility costs in FY2020, down from \$187,712,077 in FY2019. The overall cost reduction was driven by significant decreases in electric and natural gas costs of \$10,584,940 (8.6%) and \$3,824,317 (14.8%), respectively. The source of cost reductions can be attributed to a combination of ongoing energy savings strategies, COVID-19 operational impacts during the last quarter of FY2020, and lower average utility rates. These factors are explained further in sections 4.5.2 and 4.5.3. Meanwhile, water/sewer costs increased by \$1,225,858 (3.9%) over FY2019, in part due to an increase in usage and higher average blended rates. All other utilities had cumulative cost reductions due to lower usage and lower average blended utility rates.

4.5.2 Rates

The rates of each utility can vary depending on a variety of factors, including global utility prices, regional weather patterns, local utility cost structures, and the ability to recover costs related to infrastructure. In FY2020, the State benefitted from an overall decrease in costs due to lower average blended utility rates for four of the six utility commodities tracked in UDM. Average lower utility rates in FY2020 accounted for 32.4% of the total \$14,003,327 net reduction in overall utility expenditures compared to FY2019. In other words, lower rates saved the State a total of \$4,533,296. This is attributed to rate reductions in natural gas (\$3,601,576), electric (\$1,207,733), and steam and propane (\$326,006). Meanwhile, average rates for both chilled water and water/sewer increased between FY2019 and FY2020, accounting for \$602,020 in additional costs.

The changes in average utility rates seen in the UDM data largely match regional and national trends in utility costs, namely that:

- Natural gas and propane prices continued to decline during these FYs.
- The Tennessee Valley Authority's (TVA) average electric wholesale rates for its local power companies have declined due to lower fuel, operating, and debt service expenses.
- Water/sewer average blended rates have increased slightly.
- The remaining \$9,470,031 in cost reductions can be attributed to lower usage, discussed further in the next section.

4.5.3 Usage

Of the \$14,003,327 net cost reduction outlined in Section 4.5.1, 67.6% (\$9,470,031) is attributed to a reduction in usage (see Table 4.5.1) for five of the six utility commodities, ranging from 0.9% and 13.3% between FY2019 and FY2020. Only water/sewer showed an increase in usage of 2.9% in FY2020.

With a decrease of \$9,377,207, electricity represented the greatest usage-related cost reduction between FY2019 and FY2020. This reduction was a result of a 7.6% decrease in usage, equaling

101,845,505 kWh. Natural gas usage dropped by 0.9%, (427,948 Therms⁹), representing a cost decrease of \$222,742. For chilled water, a 9.5% reduction in usage of 1,756,856 Ton-hr¹⁰ resulted in savings of \$404,091. However, this reduction was offset in part by a higher average blended rate, meaning the net reduction was only \$115,543 for FY2020. Water/sewer was the only utility where usage increased. The State used 2.9% more water/sewer (97,569 kGal) at a cost increase of \$912,386 for FY2020. Propane usage went down by 13.3% (63,031 Therms), resulting in cost savings of \$77,564.

4.6 FY2019 – FY2020 Utility Usage and Cost Discussion

Due to some utility contract agreements, where costs are fixed regardless of usage or are tiered based on usage milestones, costs may not necessarily follow the usage profile over a given fiscal period. A greater degree of data analysis and explanation for disparities in cost and usage can be determined by exploring interval data for the building portfolio, which is available upon request by utility service providers. The level of granularity can range from fifteen-minute intervals of usage to a monthly data set.

The scope of this report includes monthly data only.

4.6.1 Electric

Electric power use is by far the largest utility expense for the State, accounting for nearly two-thirds of utility costs each year. Electricity powers most of the building and facility systems, including lighting, air conditioning, some heating, computers, elevators, etc. Air conditioning and heating are typically the biggest electricity consumers. Electricity use changes seasonally, as air conditioning needs increase in the summer and decrease in the fall and spring. During the colder winter months, electrically driven heating, including heat pumps and resistance heating, increase electricity usage.

Figures 4.6.1a and 4.6.1b show month-to-month usage and cost variability for FY2019 and FY2020.

⁹ A therm is a unit of heat energy equal to 100,000 British thermal units (Btu). It is the quantity of heat that is needed to raise the temperature of one pound of water by one-degree Fahrenheit. One therm is equal to 100 cubic feet of natural gas (CCF).

¹⁰ A ton hour is a cooling service equivalent to 12,000 Btu of cooling, measured as a function of the gallons of chilled water.

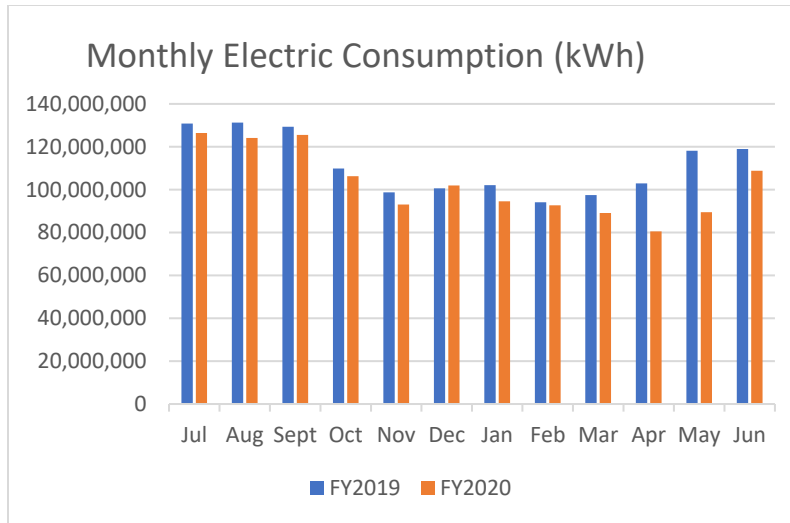


Figure 4.6.1a – Monthly Electric Usage from FY2019 to FY2020

For FY2019, electric usage peaked in August 2018 at 131,304,034 kWh and then trended down to a low of 94,142,567 kWh in February 2019. Usage then increased in June 2019, where usage reached 118,946,008 kWh.

There is a notable reduction in usage during November 2018 and December 2018, which is attributed to a combination of mild weather and holiday periods when building occupation is lower and lighting and HVAC needs are reduced.

FY2020 electric usage followed a similar trend, although there were two key points to note. First, in line with the 7.6% decrease noted earlier, nearly all months' usage was lower than in FY2019, apart from December 2019 where there was a 1.3% increase. Secondly, due to a combination of mild weather and COVID-19 operational impacts, usage markedly decreased for March (-8.6%), April (-21.8%), May (-24.2%), and June (-8.5%) in FY2020 as compared to the same period in FY2019.

Prior to COVID-19 operational impacts in March 2020, electric costs and usage were noticeably lower, likely due to ongoing energy reduction strategies. On average, the State used 3.6% less each month in FY2020 compared to FY2019.

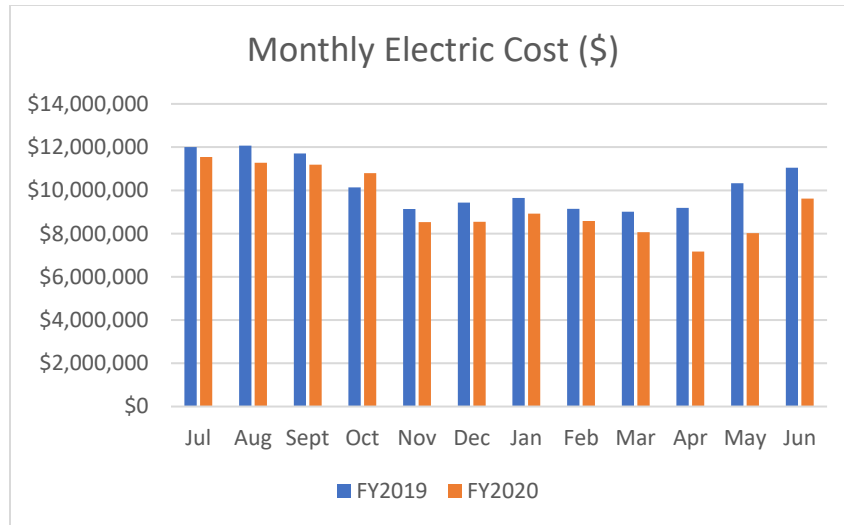


Figure 4.6.1b – Monthly Electric Costs from FY2019 to FY2020

4.6.2 Water/Sewer

FY2019 and FY2020 both followed a similar usage trend between July and February, where FY2020 usage was higher than FY2019 usage month to month. From March to May FY2020, water/sewer usage was lower than the same months in FY2019. The greatest usage for FY2019 occurred in April 2019, at 330,550 kGal. (This usage appears excessive and requires further investigation; the associated costs are lower and reflective of a usage level around 274,065 kGal, which would be in line with the March and May 2019 trend.) The greatest water/sewer usage for FY2020 was realized in July 2019, amounting to 384,821 kGal. The lowest FY2019 usage took place in January 2019 (227,380 kGal), and the lowest FY2020 usage took place in April 2020 (215,422 kGal).

As shown in Figure 4.6.2a, the greatest increase in usage in FY2020 over FY2019 levels occurred in July at 28.9%. The greatest decrease in usage in FY2020 from FY2019 came in April at -34.8%.

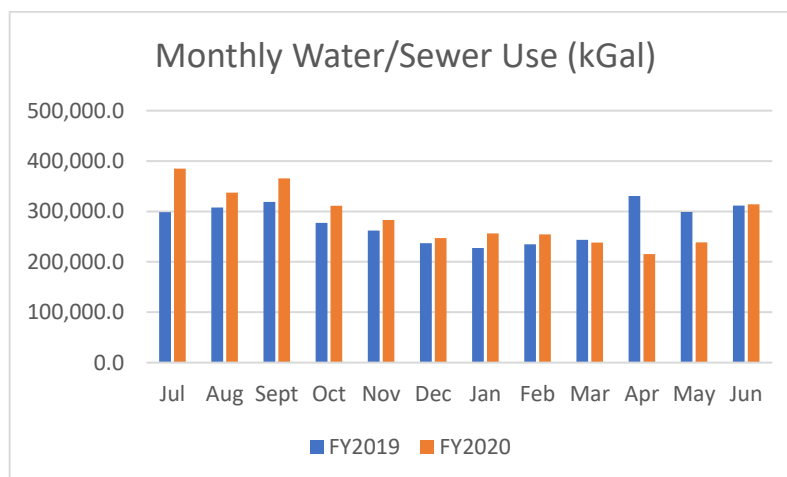


Figure 4.6.2a – Monthly Water/Sewer Use from FY2019 to FY2020

The COVID-19 pandemic has contributed to the reduction in usage, although it is not considered to be the sole reason for the decrease. Other capital expenditures to address energy usage, such as infrastructure upgrades, revised building use, or changes in employee deployment across facilities may also have had an effect. While the UDM platform data can identify anomalies in usage and cost data, it cannot identify causal issues.

The reduction in usage in FY2020 after March is in line with the onset of operational measures that were instituted in State buildings because of the pandemic. Figure 4.6.2b shows monthly water/sewer costs for both FY2019 and FY2020.

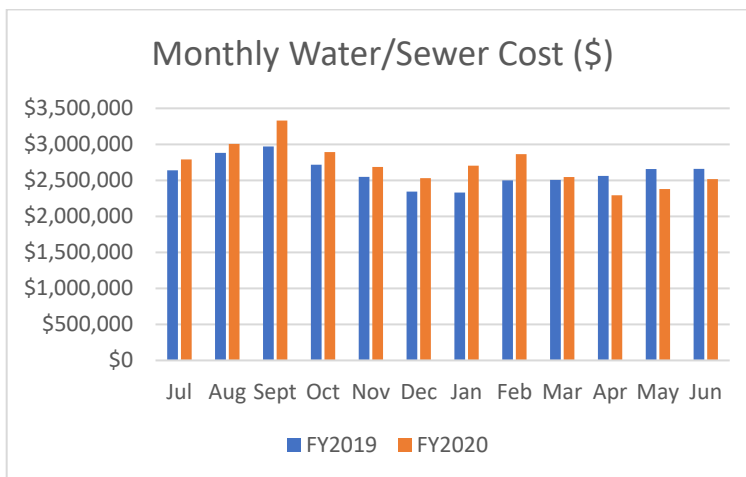


Figure 4.6.2b – Monthly Water/Sewer Costs from FY2019 to FY2020

Building occupancy dropped from the latter part of March onward, and this had a direct effect on water/sewer usage. April 2020 usage of water/sewer, impacted by operational changes due to the COVID-19 pandemic, was the lowest across both fiscal years. There was an overall average blended rate increase of 1.0% for water/sewer in FY2020. There were eight months of increased usage, which also resulted in an overall increase in usage of 2.9% and combined to result in an overall increase in costs for FY2020 of 3.9%.

The costs for water/sewer peaked in September for FY2019 and FY2020, with September 2019 achieving a \$3,330,531 (12.1%) increase over September 2018. The water/sewer costs in April 2020 achieved an FY2020 low to \$2,393,188 (-10.5%) from FY2019. The greatest variation in costs was in January with an increase of \$374,104 (16.1%) in FY2020, and the least variation occurred in March with an increase of \$40,503 (1.6%).

4.6.3 Natural Gas

Natural gas is primarily used for space heating and water heating in State facilities. Therefore, natural gas usage increases in the winter months as heating demands are higher and decreases in the summer months when gas is used primarily for water heating. As discussed previously, the overall use of natural gas in FY2020 was down slightly by 0.9% from FY2019, which could be the

result of a milder winter in FY2020 than FY2019. However, with average blended rates down 14.1%, the cost differences by month were consistently lower in FY2020, with the small exception of a 4.3% increase in May 2020. Figures 4.6.3a and 4.6.3b show monthly natural gas use and costs between FY2019 and FY2020.

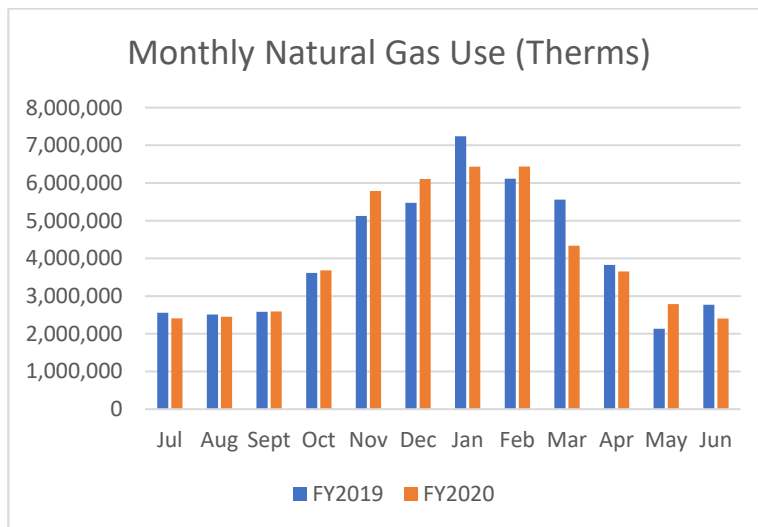


Figure 4.6.3a – Monthly Natural Gas use from FY2019 to FY2020

The lowest usage was 2,135,454 Therms in May of FY2019 and 2,403,720 Therms in June in FY2020. In the winter months, usage peaked at 7,238,404 Therms in January in FY2019 and to 6,436,303 Therms in February for FY2020. Overall, the total cost saving was \$3,824,317 (14.8%).

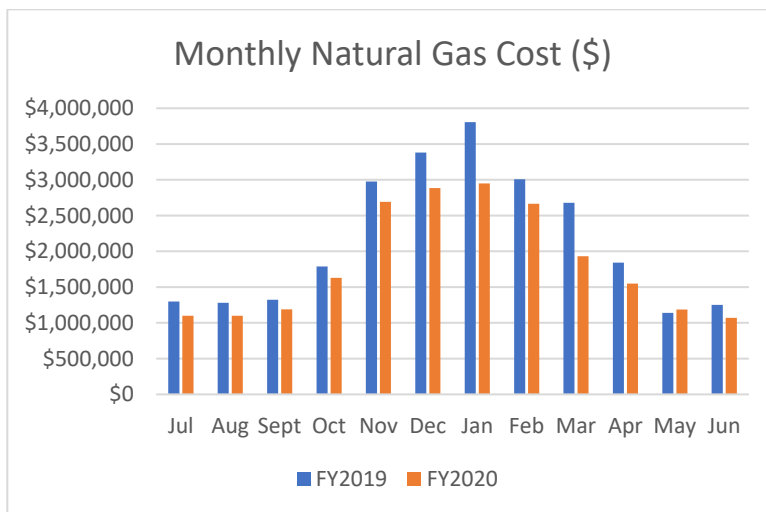


Figure 4.6.3b – Monthly Natural Gas Costs from FY2019 to FY2020

4.6.4 Chilled Water, Steam, and Propane

Chilled water, steam, and propane utilities collectively accounted for \$7,768,499 in FY2019 and \$6,948,571 in FY2020. Chilled water usage and cost followed similar monthly trends and variability in

FY2019 and FY2020. Figure 4.6.4a shows monthly chilled water use for FY2019 and FY2020.

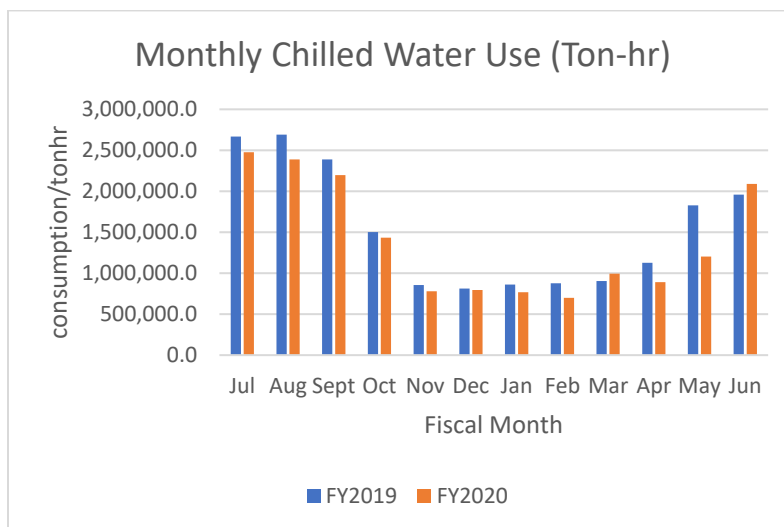


Figure 4.6.4a – Monthly Chilled Water Use from FY2019 to FY2020

There was an overall net reduction in both usage and cost from 2019 and 2020 at 1,756,855 Ton-hr (or -9.5%) and \$115,542 (-2.7%) in FY2020 as compared to FY2019. The greatest monthly reduction occurred in May with a difference of -625,014 Ton-hr, or a -34.2% decrease in usage, likely driven by a combination of COVID-19 operational impacts and milder-than-normal weather. The lowest usage and cost trend occurred from November through April for FY2019 and FY2020. Figure 4.6.4b shows monthly chilled water costs from FY2019 to FY2020.

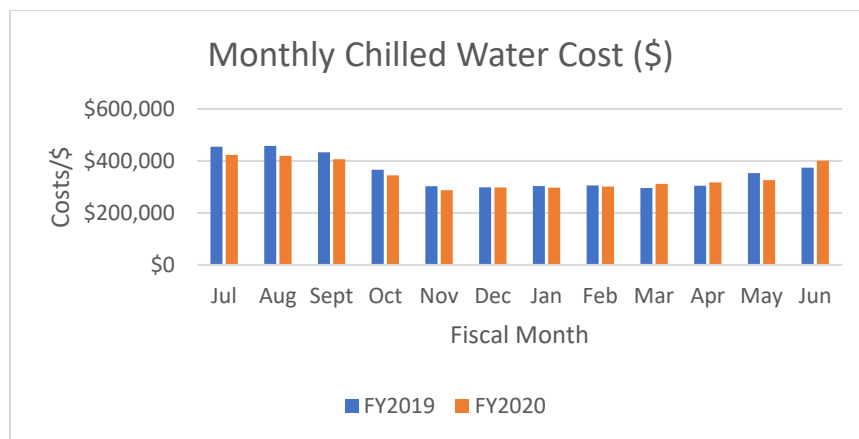


Figure 4.6.4b – Monthly Chilled Water Costs from FY2019 to FY2020

The costs for both FY2019 and FY2020 followed a maximum deviation of between 7.2% and -8.4%, although there was an increase in average blended chilled water rates of 7.5% across the portfolio. Compared to other utilities, usage reductions for chilled water do not directly correlate to reduced costs, since the contracted rates for chilled water have higher fixed charges and lower variable charges.

The key observations for steam are similar for both FY2019 and FY2020, as evidenced in Figures 4.6.4c and 4.6.4d. The usage and costs follow a bell curve trend profile, with usage peaking in January FY2019 29,224 MLB. FY2020 usage reached 24,503 MLB, which represents a 16.2% reduction from FY2019.

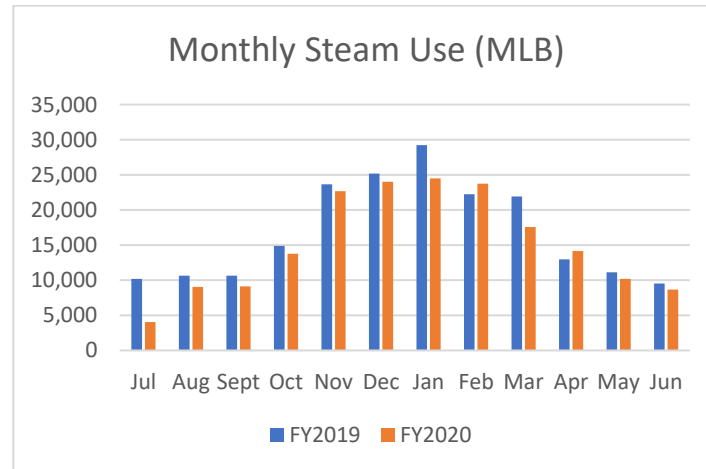


Figure 4.6.4c – Monthly Steam Use from FY2019 to FY2020

The least usage occurred in June 2019 at 9,520 MLB in FY2019 and July 2019 at 4,050 MLB in FY2020. The month-on-month greatest change occurred in July FY2020, in which there was a 60.3% decrease in usage. This is attributed to occupancy and COVID-19 operational impacts.

Chilled water, steam, and propane costs peaked in December 2018, at \$367,012 for FY2019, and November 2019 at \$260,99,0 for FY2020. Almost all FY2020 months experienced lower costs, with the greatest percentage savings achieved (44.9%) when comparing the month of July costs against FY2019. The smallest percentage change in costs occurs when comparing June FY2020 from FY2019, with an increase of \$1,679 (a nominal 0.9%).

As Figure 4.6.4d shows, the greatest difference in costs for any month took place in December, where a savings of \$107,656 (-29.3%) was realized in FY2020 as compared to FY2019 December costs.

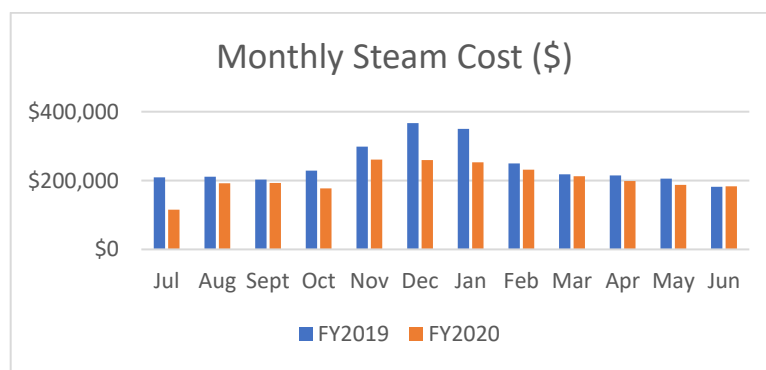


Figure 4.6.4d – Monthly Steam Costs from FY2019 to FY2020

Since propane deliveries often occur “on-demand,” when storage tanks require a refill, the propane usage and cost data sets do not follow a consistent delivery and billing schedule. And as mentioned in Section 4.1, the percentage of yearly propane data captured in the platform is difficult to determine because procurement methods differ between State entities. That said, propane makes up a small portion of the State’s utility costs. Figure 4.6.4e displays the propane usage data captured for both FY2019 and FY2020.

The data, evidenced in Figure 4.6.4e, show higher usage between November to April for both FY2019 and FY2020, as expected due to the colder weather during these months. Comparing the two fiscal years, FY2019 saw nine months of greater usage levels – except for August, December, and June.

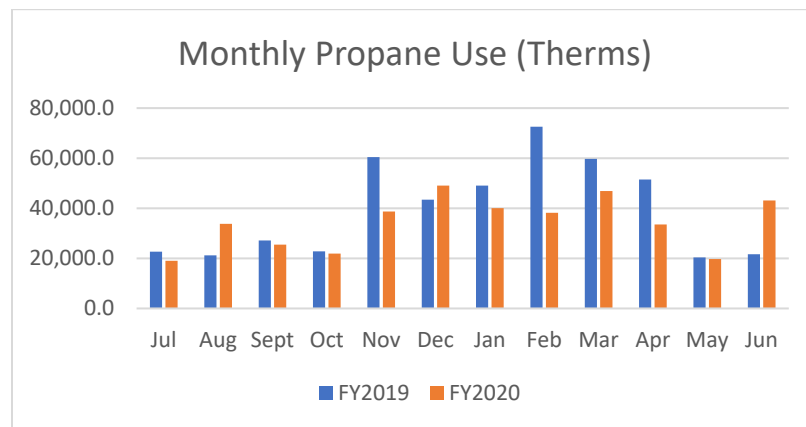


Figure 4.6.4e – Monthly Propane Use from FY2019 to FY2020

The highest FY2019 usage occurred in February 2019, at 72,545 Therms, and 49,032 Therms in December 2019 for FY2020. The lowest usage months occurred in May 2019 (FY2019), at 20,359 Therms, and in July 2019 at 19,017 Therms (FY2020). The greatest difference in usage occurred in February, with a year-over-year decrease in FY2020 of 34,368 Therms (-47.4%).

Concerning monthly costs of propane, all FY2020 months were lower than FY2019, with the notable exception of June.

The highest costs were incurred in February at \$86,056 for FY2019 and December at \$49,516 for FY2020. The greatest decrease in costs was for February with a decrease of \$52,092 (-60.5%). Overall FY2020 reduced costs by \$231,173 (-39.8%) from FY2019. Figure 4.6.4f shows a detailed breakdown of propane costs by month for FY2019 and FY2020.

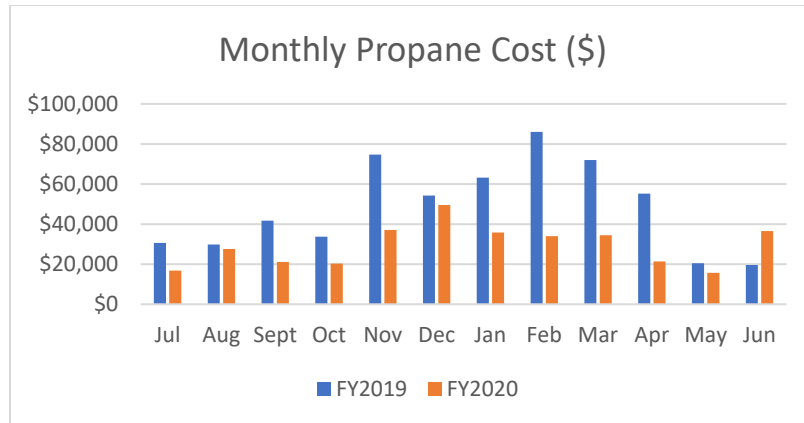


Figure 4.6.4f – Monthly Propane Costs from FY2019 to FY2020

4.7 Analysis by Organization Group for FY2020

4.7.1 General Government

The total utility costs for General Government¹¹ in FY2020 was \$70,075,132, of which electric accounted for the largest portion at \$46,546,364 (66.4%), followed by water/sewer at \$12,392,546 (17.7%). Propane incurred the lowest cost at \$344,560, or just under 0.5%. Table 4.7.1 shows the utility commodity mix for General Government.

Table 4.7.1 – FY2020 Utility Cost and Percentage by Utility Commodity – General Government

Utility Commodity	FY2020 Cost for General Government by Utility Type			
	Use	UOM	Cost	Cost %
Electric	443,274,915	kWh	\$46,546,364	66.4%
Water/Sewer	1,715,479	kGal	\$12,392,546	17.7%
Natural Gas	13,698,765	Therms	\$5,988,779	8.5%
Chilled Water	12,220,518	Ton Hr	\$3,213,574	4.6%
Steam	105,283	MLB	\$1,589,309	2.3%
Propane	403,777	Therms	\$344,560	0.492%
Total			\$70,075,132	

4.7.2 Tennessee Board of Regents (TBR)

The total utility costs for TBR during FY2020 amounted to \$22,172,641. The largest utility again was electric, which represented \$17,661,971 or 79.7% of total costs. Natural gas made up 11.5%, or \$2,539,836. Combined, electricity and natural gas made up 91.1% of the total TBR FY2020 utility mix. Table 4.7.2 shows the utility mix for TBR. No TBR sites have steam or chilled water utilities.

¹¹ The totals for General Government are comprised of the 25 agencies owning or managing facilities.

Table 4.7.2 – FY2020 Utility Cost and Percentage by Utility Commodity - TBR

Utility Commodity	FY2020 Utility Costs for TBR			
	Use	UOM	Cost	Cost %
Electric	181,665,063	kWh	\$17,661,971	79.7%
Water/Sewer	204,184	kGal	\$1,970,734	8.9%
Natural Gas	4,385,318	Therms	\$2,539,836	11.5%
Propane	0	Therms	\$100	0.00045%
	Total		\$22,172,641	

4.7.3 Locally Governed Institutions (LGIs)

LGIs paid \$32,019,107 in total utility costs for FY2020. Electric power accounted for \$16,771,096, or 52.4%. Natural gas and water/sewer each represented 21% of the total cost. Propane was the smallest contributor, with a total cost of \$5,666, or 0.017%. Table 4.7.3 shows the utility mix for the six LGIs.

Table 4.7.3 – FY2020 Utility Cost and Percentage by Utility Commodity – LGIs

Utility Commodity	FY2020 Utility Costs for LGIs			
	Use	UOM	Cost	Cost %
Electric	221,645,206	kWh	\$16,771,096	52.4%
Water/Sewer	774,957	kGal	\$6,718,981	21.0%
Natural Gas	14,381,315	Therms	\$6,728,002	21.0%
Chilled Water	4,496,002	Ton Hr	\$919,905	2.9%
Steam	76,218	MLB	\$875,457	2.7%
Propane	5,734	Therms	\$5,666	0.0%
	Total		\$32,019,107	

4.7.4 The University of Tennessee (UT) System

The UT system had a total utility cost of \$49,439,727 for FY2020. Electric accounted for the largest component at 63.2%, or \$31,231,319. The smallest contributor was natural gas with a cost of \$6,709,706, or 13.6%. Table 4.7.4 shows the utility mix for the UT System.

Table 4.7.4 – FY2020 Utility Cost and Percentage by Utility Commodity – UT System

Utility Commodity	FY2020 Utility Costs for UT System			
	Use	UOM	Cost	Cost %
Electric	417,465,168	kWh	\$31,231,319	63.2%
Water/Sewer	890,732	kGal	\$11,498,701	23.3%
Natural Gas	16,645,838	Therms	\$6,709,706	13.6%
	Total		\$49,439,727	

4.7.5 Organization Group Utility Observations

A summary is shown in Table 4.7.5 of the total costs for each utility and its associated percentage for each organization group. Not all organizations utilize all six utilities. While all groups presented a similar ranking for the utility profiles, the percentages varied. The exception to this is natural gas.

Although General Government is the largest organizational group in terms of facility square footage, it is not the largest purchaser of natural gas. Many Higher Education institutions, such as Austin Peay State University, Tennessee Tech University, and the University of Tennessee, have their own physical plants that utilize natural gas and electricity to produce steam and chilled water to efficiently heat and cool buildings on campus.

Several General Services' Facility Revolving Fund (FRF) buildings within General Government purchase steam and chilled water from the loop running in downtown Nashville, as indicated in the steam and chilled water utility breakdown in Table 4.7.5.

The total FY2020 cost of all utilities was \$173,706,606. Table 4.7.5 below shows the percentage of total utility costs across organization types.

Table 4.7.5 – FY2020 Percentage of Total Utility Costs for All Organization Groups

Organization Type	Electric	Water	Natural Gas	Chilled Water	Steam	Propane
General Government	41.5%	38.0%	27.3%	77.7%	64.5%	98.4%
TBR	15.7%	6.0%	11.6%			
LGIs	14.9%	20.6%	10.6%	22.3%	35.5%	1.6%
UT System	27.8%	35.3%	30.5%			
Total	\$112,210,750	\$32,580,963	\$21,996,323	\$4,133,479	\$2,464,766	\$350,326
Share of All FY2020 Utility Costs	64.4%	18.8%	12.6%	2.4%	1.4%	0.2%

5.0 Additional UDM Utilization Highlights

5.1 Facilitation of Alternative Workplace Solutions (AWS)

The UDM platform supports AWS and workplace flexibility for General Government agency accounts payable staff by providing a central repository for utility bills that can be accessed from any location through the online platform. Utility bills are automatically uploaded into the platform, removing the need for accounts payable staff to access paper bills and/or scan and upload bills to another system. Multiple end-users can work in the platform simultaneously to review, approve, edit, etc. the same batch of bills or a different batch of bills. Additionally, the platform facilitates team collaboration with the use of bill notes, assigned flags, shared dashboards, and reporting features. In other words, the UDM platform's ability to track, record, and date individual user activities accommodated agency fiscal personnel to work from home during the COVID-19 pandemic.

5.2 Discovery of Unauthorized Charges

The UDM platform has assisted General Government accounts payable staff to identify and seek utility vendor reimbursement for unauthorized charges, such as charitable contributions and taxes or other fees from which the State is exempt. For General Government, 85% of utility bills are automatically drafted for payment by the utility provider. In FY2020, the UDM platform documented those utilities charged General Government agencies a total of \$22 in "round-up" charitable contributions and \$14,974 in taxes on bills set up for autopay. Agency efforts with utility providers have resulted in unauthorized charges being removed from future bills in the utility provider's bill system and the issuance of some credits for the accounts.

5.3 Ascertainment of Billing Irregularities

The UDM platform's bill audit notifications have helped numerous General Government agency accounting departments identify inconsistencies in their billing, such as the amount due on the bill summary compared to the total of the bill's itemized statement charges. The Department of Mental Health avoided overpaying a utility provider \$4,911 after the UDM platform flagged a discrepancy where the itemized meter statement charges did not match the amount due on the bill summary page. The Department of Correction's utilization of the UDM bill audit notifications resulted in being alerted to overcharges due to a faulty meter, for which the utility provider issued a reimbursement of \$63,012.

5.4 Billing Discrepancy Validation

A key benefit of the UDM platform is its ability to help agencies validate billing discrepancies. For example, erroneous charges were being billed to the University of Tennessee Health Science Center

(UTHSC) by utility provider Memphis Light, Gas, and Water (MLGW) for a building that was purchased in July 2016 by UTHSC from the University of Memphis. MLGW sought payment of \$85,000 in back charges for demand and usage over the prior three years. The MLGW charges were refuted by UTHSC because the building had remained vacant since the purchase. The UDM platform allowed UTHSC to compare the building's demand and usage data before and after they acquired it. As a result, UTHSC was able to establish a baseline that disproved MLGW's initial assessment.

5.5 Obsolete Meter Recognition

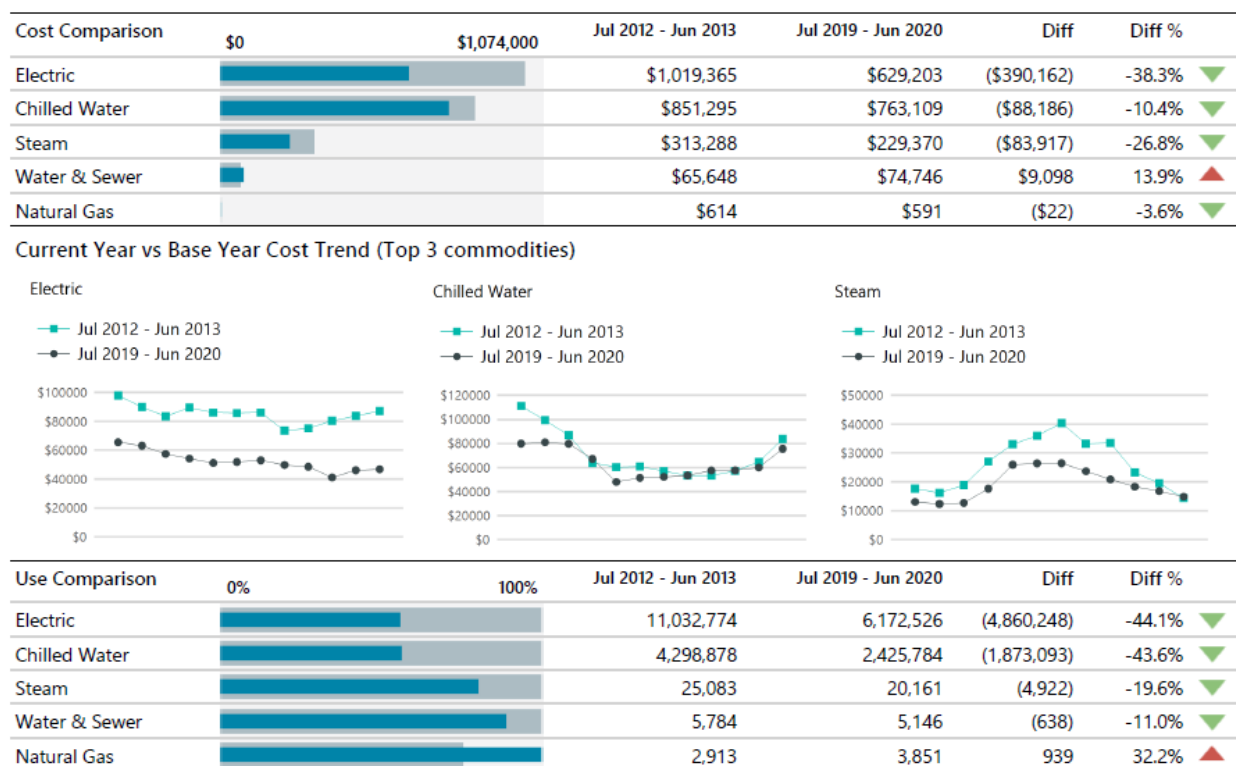
A further benefit of the UDM platform is its capability to assist end-users in identifying obsolete utility meters. In one case study, Tennessee State Park Managers were able to utilize reports and data from the UDM to locate inactive meters that showed minimum access or flat rate fees with no corresponding usage data. These fees were eliminated by closing the utility accounts at issue and removing the related physical utility meters.

6.0 UDM Utilization Case Studies

6.1 Tracking Energy Savings

The UDM platform has assisted end-users in tracking and capturing energy savings from implemented energy efficiency projects and improved facility maintenance. The William R. Snodgrass Tennessee Tower, an 831,400 sq. ft. office building with ~2,000 employee occupants, has benefited from various energy efficiency measures, from the installation of LED lighting and controls to upgraded mechanical systems. The UDM platform provided facility management with a tool to compare the monthly energy use, cost, and performance of the building to its baseline year. The William R. Snodgrass Tennessee Tower building reduced its overall usage by 17.2% from 2020 compared to 2013, and its overall expenditures by 13.0%.

Figure 6.1.1 shows how the UDM platform Monthly Building Manager Report compares energy reduction savings from FY2013 to FY2020.



[A.1] Figure 6.1.1 – Monthly Building Manager Report (UDM Report)

6.2 Leveraging UDM Data to Effect Change

With the aid of the UDM platform, Tennessee State Parks (TSP) personnel at Cove Lake State Park (CLSP) identified abnormally high usage and costs. Further evaluation revealed that the costs had increased significantly over a period of a few years without any accompanying increase in park attendance or added points of usage, such as new facilities or campgrounds (See figures 6.2.1a and 6.2.1b). CLSP personnel worked with the utility provider to identify issues and leaks, but no leaks of significant volume were located to date and continual repairs have become necessary to maintain the water system operation. TSP utilized the UDM platform to review and compare historical cost and usage for CLSP and determined that the water system in its entirety was faulty. Because of the UDM and diligence of CLSP personnel, TSP was positioned to submit a capital maintenance project request to replace the CLSP water system. That request was funded in the capital projects budget for FY2022.

	Cove Lake State Park		Report-06 - Year-over-Year Comparison		
			Use, Jul - Jun		
Commodity Name	Jul 2017 - Jun 2018	Jul 2018 - Jun 2019	Jul 2019 - Jun 2020	Change over FY2018-FY2020	
Water & Sewer	6,141	9,026	20,925	14,784	131.8 %

[\[A.2\]](#) **Figure 6.2.1a** – Year-over-Year Use Comparison Report for CLSP (UDM Report)

	Cove Lake State Park		Report-06 - Year-over-Year Comparison		
			Cost, Jul - Jun		
Commodity Name	Jul 2017 - Jun 2018	Jul 2018 - Jun 2019	Jul 2019 - Jun 2020	Change over FY2018-FY2020	
Water & Sewer	\$153,866	\$169,221	\$214,983	\$61,117	39.7 %

[\[A.2\]](#) **Figure 6.2.1b** – Year-over-Year Cost Comparison Report for CLSP (UDM Report)

6.3 Detection of Energy Spikes and Water Leaks

Major water leaks have also been detected through utilization of the UDM platform by facility managers and accounts payable personnel for the Department of Correction, Department of Military, Public Defenders Office, General Services, and Department of Environment and Conservation TSP. These generated significant reimbursements and credits to the State that may never have been identified without the UDM platform's ability to track, compare, and analyze utility usage and costs.

- The Department of Correction received two credits for an underground water leak from the Town of Mountain City Water Department for \$38,203 and \$230.
- The Department of Military facility managers detected a water leak on the main supply line that services the 500 and 501 Volunteer Training Site (VTS) Smyrna buildings (Figure 6.3.1a). The facility manager reported the high-water usage for the two Smyrna Utilities accounts to the Military's Maintenance Zone Manager, who worked with site personnel to find and repair the water leak. They received a credit of \$955.



Figure 6.3.1a – Department of Military Water Leak

- With the UDM water usage dashboard shown in Figure 6.3.1b and 6.3.1c, the data shows clearly when the supply line leak occurred and allowed for quick coordination and troubleshooting between staff to find and address the issue both from the maintenance and repair side as well as the accounting side.

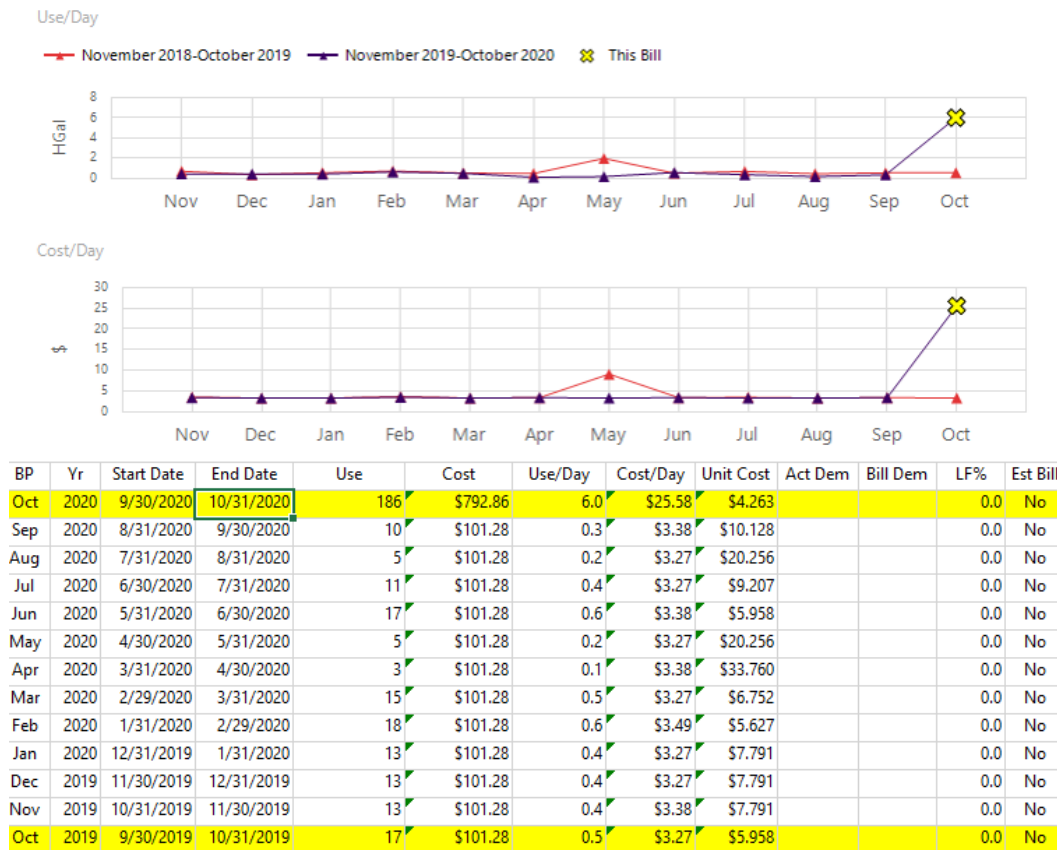


[\[A.3\]](#) **Figure 6.3.1b** – Department of Military October 2019 Water Usage with Water Leak (UDM Dashboard)



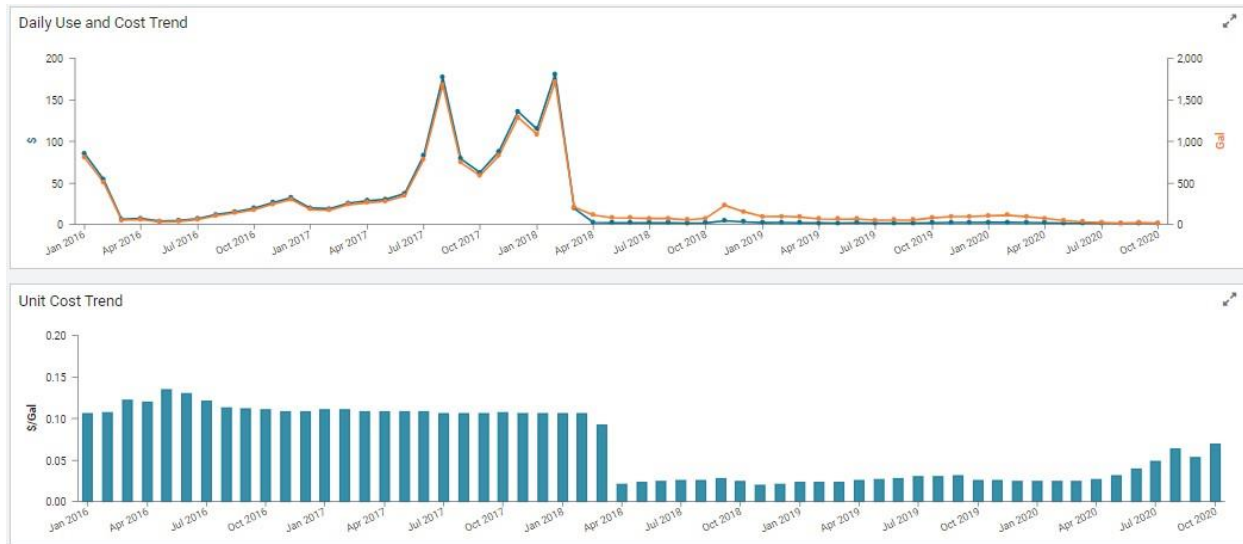
[A.3] **Figure 6.3.1c** – Department of Military October 2020 Water Usage after Water Leak Repair (UDM Dashboard)

- For the Public Defender’s Conference (PDC) central accounts payable staff, the UDM platform alerted them of a water leak at one of their leased remote facilities. The UDM system flagged a substantial monthly increase in the cost of PDC’s normal water service utility bill. Accounts payable staff’s review and comparison of the monthly bills to previous bills in the UDM platform identified water costs that were seven times higher than the normal bill -- water usage for October for the prior year increased from 1,700 gallons in 2019 to 18,600 gallons for the 2020 billing month (Figure 6.3.1d). The Public Defenders Conference Office Manager notified the building landlord, who was unaware of the issue. Follow up investigation revealed that two of the three office toilets were leaking. As a result, the Public Defenders Conference office received a \$637 bill adjustment from the utility provider after repairs were made by the landlord.



[\[A.4\]](#) **Figure 6.3.1d** – Public Defenders Conference Bill Analysis Report (UDM Report)

- Jones Lang LaSalle's (JLL) utilization of the UDM platform resulted in the discovery of a water leak at one of the Department of General Services' (DGS) leased properties in Fayetteville. The average monthly water cost of approximately \$60 / month had increased for the duration of the water leak to \$1,000 / month and had been as high as \$5,600 / month. The leak cost DGS an estimated \$26,000 annually. JLL informed the landlord and DGS of the issue, resulting in the repair of an underground water leak. General Services received a \$4,000 sewer credit from Fayetteville Public Utilities. Before the UDM platform (see the cost trends shown in Figure 6.3.1e), JLL may not have discovered the leak because they did not have access to the DGS utility bills.



[A.5] **Figure 6.3.1e** – DGS Water Use and Cost Trends before and after the Water Leak Repair (UDM Dashboard)

6.4 Trends and Budget Forecasting

The SFUM team analyzed TSP's monthly utility trend data in the UDM platform to determine the impact of COVID-19 and/or changes in operations on individual Parks' utility cost and usage (electric, natural gas, and water/sewer). As shown by Figure 6.4.1, TSP realized avoided costs of approximately \$388,000 for the months of March-June 2020, as compared to the previous year. Considering the decrease in revenue during this timeframe, the total of avoided utility costs informed TSP's fiscal decisions for the remainder of FY2020 and assisted with their budget planning for FY2021.



Calendarized Cost

Report-10 - Two-Year Comparison

Commodity not equals Propane

Topmost Place Name equals TN State Parks

Commodity Name	Commodity Code	Calendarized Cost (\$)	Mar 2019 - Jun 2019 Mar 2020 - Jun 2020	% Difference
Electric	ELECTRIC		\$1,332,479	\$1,057,606 -20.6 % 
Water & Sewer	WATERSEWER		\$849,571	\$759,621 -10.6 % 
Natural Gas	NATURALGAS		\$48,569	\$25,998 -46.5 % 
Total			\$2,230,620	\$1,843,225 -17.4 % 

[A.6] **Figure 6.4.1** – Two-Year Cost Comparison Report for Tennessee State Parks for Months March – June (UDM Report)

7.0 Looking Ahead

The UDM platform has extensive capabilities that can provide a more comprehensive analysis of the State's utility usage and costs over and above what the SFUM team and current State end-users have been able to explore and benefit from to date. The SFUM team, the UDM software provider, EnergyCAP, utility providers, and end-users have been exploring greater utility and functionality within the UDM platform, such as the ability to obtain interval usage data from certain utility providers to assist operations, maintenance, and capital projects initiatives. We look forward to sharing these updates with our UDM platform end-users in the coming months.

Access to the UDM platform is available to all State employees of participating General Government agencies, TBR schools, UT System schools, and Locally Governed Institutions (for more information, see Appendices C-E). Questions about this report or requests to become a registered UDM platform user can be directed to the SFUM team at tdec.sfum@tn.gov.

Appendix A – UDM Report and Dashboard Reference

A.1 – Figure 6.1.1 Monthly Building Manager Report (UDM Report)

This graphic is pulled from the Monthly Building Manager Report – Report-22 in the UDM platform.

Reports in UDM can be accessed from the REPORTS  module.

Description:

It is a utility report for building managers showing monthly use, cost, and performance vs a previous year. Pie charts and tabular data break out use and cost for each utility. Cost trend charts are displayed for the top three utilities. HDD and CDD statistics are available when grouping by building.

A.2 – Figure 6.2.1a Year-Over-Year Cost Comparison Report for CLSP (UDM Report)

Figure 6.2.1b Year-Over-Year Use Comparison Report for CLSP (UDM Report)

This graphic is pulled from the Year-over-Year Comparison – Report-06 in the UDM platform.

Reports in UDM can be accessed from the REPORTS  module.

Description:

The report is a tabular comparison of two or more years of data for a given object type: accounts, buildings, utilities, cost center, meters, place types, or vendors. Results are sorted alphabetically by the selected object. Percentage change is provided for the two most recent years in the report. Actual, calendarized, and normalized data are all available

A.3 – Figure 6.3.1b Department of Military October 2019 Water Usage (UDM Dashboard)

Figure 6.3.1c Department of Military October 2020 Water Usage after Water Leak Repair (UDM Dashboard)

This graphic is pulled from the Dashboard widget ‘Trend Chart’ in the UDM platform. Dashboard

widgets can be accessed from the Dashboards  module > My Dashboards > select + (add Dashboard) > Title Dashboard > select created Dashboard > click icon  to unlock Dashboard > select + (add content) > type ‘Trend Chart’ in the filter bar > select Add to Dashboard.

A.4 – Figure 6.3.1d Public Defender’s Conference Bill Analysis Report (UDM Report)

This graphic is pulled from the Bill Analysis Report – Report-13 in the UDM platform. Reports in UDM can be accessed from the REPORTS  module.

Description:

The report helps you spot and analyze abnormal bills. As each bill is created, separate quadratic regressions of use, cost, and demand vs. average mean daily temperature in the billing period are run for the bill and 24 months of history.

A.5 – Figure 6.3.1e DGS Water Use and Cost Trends before and after the Water Leak Repair (UDM Report)

This graphic is pulled from a ‘Power View’ in the UDM platform. Power Views for a utility can be accessed from the Building & Meters  module > Actual Data tab > Trends tab

A.6 – Figure 6.4.1 Two-Year Cost Comparison Report for Tennessee State Parks for Months March – June (UDM Report)

This graphic is pulled from the Two-Year Comparison – Report-10 in the UDM platform. Reports in UDM can be accessed from the REPORTS  module.

Description:

The report compares year-over-year values for a user-selected data type and ranks values from highest to lowest. Available data types include a variety of use, cost, and unit cost metrics. Data can be aggregated by account, meter, building, utility, cost center, place type, or vendor.

Appendix B – Utility Usage Calculations

B.1 – Table 4.5.1 FY2019-2020 Changes in Usage, Average Blended Rate Change, Overall, and Avoided Costs

Calculations for each utility(totals):

Usage change (%)=	$\frac{\{(FY2020 \text{ usage})-(FY2019 \text{ usage})\}}{\{(FY2019 \text{ usage})\}}$
Average Rate change (%)=	$\frac{\{FY2020(cost/usage) - FY2019(cost/usage)\}}{\{FY2019(cost/usage)\}}$
Overall cost change (%)=	$\frac{\{FY2020 \text{ cost}-FY2019 \text{ cost}\}}{\{(FY2019 \text{ cost})\}}$
Cost impact of Rate change (\$)=	$\{(FY2020usage*FY2020average \text{ rate})\}-\{(FY2020usage*FY2019average \text{ rate})\}$
Cost impact of Usage (\$)=	$(FY2019cost-FY2020cost) - (cost \text{ impact of rate change})$
Total cost impact (\$)=	$(FY2020cost-FY2019cost)$

Appendix C – List of General Government Agencies

Department of Agriculture / Forestry
Department of Children's Services
Department of Commerce and Insurance
Department of Correction
Department of Economic & Community Development
Department of Education
Department of Environment and Conservation
Department of General Services
Department of Health
Department of Human Services
Department of Intellectual & Development Disabilities
Department of Mental Health & Substance Abuse Services
Department of Military
Department of Safety & Homeland Security
Department of Transportation
Department of Tourist Development
Department of Veterans Services
Legislative Services
National Civil Rights Museum
Tennessee Bureau of Investigation
Tennessee District Attorneys General Conference
Tennessee District Public Defenders Conference
Tennessee Rehabilitative Initiative in Correction
Tennessee Secretary of State
Tennessee Wildlife Resources Agency

Appendix D – List of TBR Community Colleges

Chattanooga State Community College
Cleveland State Community College
Columbia State Community College
Dyersburg State Community College
Jackson State Community College
Motlow State Community College
Nashville State Community College
Northeast State Community College
Pellissippi State Community College
Roane State Community College
Southwest Tennessee Community College
Volunteer State Community College
Walters State Community College

Appendix E – List of TBR Tennessee Colleges of Applied Technology

TCAT Athens
TCAT Chattanooga
TCAT Covington
TCAT Crossville
TCAT Crump
TCAT Dickson
TCAT Elizabethton
TCAT Harriman
TCAT Hartsville
TCAT Hohenwald
TCAT Jacksboro
TCAT Jackson
TCAT Knoxville
TCAT Livingston

TCAT McKenzie
TCAT McMinnville
TCAT Memphis
TCAT Morristown
TCAT Murfreesboro
TCAT Nashville
TCAT Newbern
TCAT Oneida / Huntsville
TCAT Paris
TCAT Pulaski
TCAT Ripley
TCAT Shelbyville
TCAT Whiteville

Appendix F – List of Figures and Tables

Figures

Reference No	Description	Page
Figure 2.0.1	UDM Platform Scope	3
Figure 4.4.1	FY2020 Utility Cost Percentage by Utility	9
Figure 4.4.2	FY2020 Actual Utility Costs by Month	10
Figure 4.6.1a	Monthly Electric Usage from FY2019 to FY2020	13
Figure 4.6.1b	Monthly Electric Costs from FY2019 to FY2020	14
Figure 4.6.2a	Monthly Water / Sewer Use from FY2019 to FY2020	14
Figure 4.6.2b	Monthly Water / Sewer Costs from FY2019 to FY2020	15
Figure 4.6.3a	Monthly Natural Gas Use from FY2019 to FY2020	16
Figure 4.6.3b	Monthly Natural Gas Costs from FY2019 to FY2020	16
Figure 4.6.4a	Monthly Chilled Water Use from FY2019 to FY2020	17
Figure 4.6.4b	Monthly Chilled Water Costs from FY2019 to FY2020	17
Figure 4.6.4c	Monthly Steam Use from FY2019 to FY2020	18
Figure 4.6.4d	Monthly Steam Costs from FY2019 to FY2020	18
Figure 4.6.4e	Monthly Propane Use from FY2019 to FY2020	19

Figure 4.6.4f	Monthly Propone Costs from FY2019 to FY2020	20
Figure 6.1.1	Monthly Building Manager Report (UDM Report)	25
Figure 6.2.1a	Year-Over-Year Use Comparison Report for CLSP (UDM Report)	26
Figure 6.2.1b	Year-Over-Year Cost Comparison Report for CLSP (UDM Report)	26
Figure 6.3.1a	Photo of Department of Military Water Leak	27
Figure 6.3.1b	Department of Military October 2019 Water Usage with Water Leak (UDM Dashboard)	27
Figure 6.3.1c	Department of Military October 2020 Water Usage after Water Leak Repair (UDM Dashboard)	28
Figure 6.3.1d	Public Defender's Conference Bill Analysis Report (UDM Report)	29
Figure 6.3.1e	DGS Water Use and Cost Trends before and after the Water Leak Repair (UDM Dashboard)	30
Figure 6.4.1	Two-Year Cost Comparison Report for Tennessee State Parks for Months March – June (UDM Report)	30

Tables

Reference No	Description	Page
Table 2.1.1	State of Tennessee Entities with Owned or Managed Building Stock (by Organization Type)	4
Table 4.3.1	FY2020 Comparison of Cost Totals for All-State and Individual Databases	9
Table 4.5.1	FY2019-2020 Changes in Usage, Average Blended Rate Change, and Overall Cost Changes	10
Table 4.7.1	FY2020 Utility Costs and Percentage by Utility Commodity – General Government	20
Table 4.7.2	FY2020 Utility Cost and Percentage by Utility Commodity - TBR	21
Table 4.7.3	FY2020 Utility Cost and Percentage by Utility Commodity – LGIs	21
Table 4.7.4	FY2020 Utility Cost and Percentage by Utility Commodity – UT System	22
Table 4.7.5	FY2020 Percentage of Total Utility Costs for All Organization Types	22

Appendix G - Abbreviations

AWS – Alternative Work Solutions

CLSP – Cove Lake State Park

CCF – Cubic foot

ECM – Energy Conservation Measure

EPA – Environmental Protection Agency

EUI – Energy Use Intensity

DGS – Department of General Services

F&A – Finance and Administration

FRF – Facility Revolving Fund

FY2020 – Fiscal Year 2020 (July 1, 2019 – June 30, 2020)

FY2019 – Fiscal Year 2019 (July 1, 2018 – June 30, 2019)

HVAC – Heating, Ventilation, and Air Conditioning

JLL – Jones Lang Lasalle

kGal – Kilo-gallon

kWh – Kilo-watt hour

LED – Light Emitting Diode

LGI – Locally Governed Institutions of higher education (i.e., Austin Peay State University, East Tennessee State University, Middle Tennessee State University, Tennessee State University, Tennessee Technological University, and University of Memphis)

M&V – Measurement and Verification

MLB – Million Pounds (of Steam)

MMBtu – Million British Thermal Units

MLGW – Memphis Light Gas & Water

OEP – TDEC Office of Energy Programs

SFUM – State Facility Utility Management

STS – Strategic Technology Solutions

Sq. ft. – Square foot / feet

TBR – Tennessee Board of Regents (27 Tennessee College of Applied Technology (TCAT) schools, and 13 community colleges)

TDEC – Tennessee Department of Environment & Conservation

TVA – Tennessee Valley Authority

UDM – Utility Data Management

UT – University of Tennessee

UTHSC – University of Tennessee Health Science Center

VTS – Volunteer Training Site (Department of Military)

Acknowledgment and Disclaimer

This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the State Energy Program Award Numbers DE-EE0008295 and DE-EE0009487. This report was prepared as an account of work partially sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

OEP SFUM partnered with [Milepost Consulting](#) for the compilation and formatting of this report.

Image and Icon Attribution

Photo of William R. Snodgrass TN Tower and War Memorial, "William Snodgrass Tennessee Tower behind Memorial at the War Memorial Plaza in downtown Nashville, Tennessee" acquired from alamy.com. All other photos are courtesy of TDEC and State of Tennessee staff.

Icons developed by smalllikeart, smashicons, fjstudio, freepik, and Dinosaur labs and sourced from www.flaticon.com.