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Department of
General Services



Annual Report on State Building Energy Management

Fiscal Year 2015 - 2016

Department of General Services | Real Estate Asset Management | December 2016



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BACKGROUND AND STATUTE

Tennessee Code Annotated § 4-3-1012(b)(5) requires the Department of General Services (DGS) to report on the department's activities relative to energy management. The report is to include savings realized by the state in both units of energy saved and cost-avoidance. Historically, this annual report has relied on total energy cost data due to the challenges in gathering consumption information for all state facilities.

The Department of General Services' Real Estate Asset Management Division (STREAM) directly manages an estimated 145 owned and 335 leased properties across the state. These properties commonly referred to as the FRF (Facilities Revolving Fund) portfolio, comprise more than 9 million square feet, one-tenth of the state's total real estate portfolio. STREAM has established an ongoing system for the collection of cost and consumption data for the entire FRF portfolio including historical data back to July 30, 2012. This data, in combination with software for analysis and reporting, allows measurement and trending of building performance. There is a STREAM project in progress as part of EmPower TN to establish a similar and more robust enterprise system to collect the same data for all of General Government and Higher Education.

The proven success of the STREAM real estate management model includes cost saving energy conservation as an integral part of day-to-day operations for our existing buildings. STREAM continues to refine project development for the renovation and construction of state facilities in accordance with the Office of the State Architect's High Performance Building requirements (HPBr).

This report has been prepared as required by Tennessee Code and provides information regarding energy conservation efforts, projects scheduled for fiscal year 2017, and other issues relevant to energy use and management in state owned buildings for fiscal year 2016.

EMPOWER TN ENERGY INITIATIVE

EmPower TN is Governor Bill Haslam's initiative to reduce energy costs and consumption in State of Tennessee buildings. EmPower TN is an enterprise-wide energy management strategy across the entire real estate portfolio. By measuring and controlling energy use, investing in energy efficiency projects and renewable power generation, and creating an operational environment of excellence, EmPower TN will develop a sustainable path toward utility savings by reducing utility operating costs an estimated 28% over the next 8 years, saving the state up to \$54M per year in annual avoided utility costs. This program will be a model for our local Tennessee governments and will attract the support of private and nonprofit organizations interested in promoting energy conservation, clean energy, renewable energy, and sustainable development. Strategies for energy conservation will be discussed in more detail below.

ENERGY CONSERVATION EFFORTS

The focus areas for energy conservation in state facilities are proactive maintenance; optimized operation; and smart planning, design, and construction of capital projects. Maintenance, operational, and construction decisions should create an environment to meet tenant goals and minimize the total cost of ownership. Throughout fiscal year 2016, STREAM has implemented various energy saving projects and initiatives as described below.

A. EmPower TN Projects for Energy Conservation

EmPower TN capital projects for the initial year target capital maintenance needs. Project applications from state agencies and organizations include a description of the energy efficiency measure, project cost, and savings estimate. The state is delivering \$37.5 million in energy efficiency projects including LED lighting and lighting control retrofits, existing building commissioning, building automation system retrofits, and boiler/chiller optimization. The payback considering maintenance costs avoided ranges from one or two years for lighting and building control projects and up to eleven years for the larger boiler and chiller equipment upgrades. The savings for each project is being recorded and tracked.

The following list shows progress for FY16 of the Empower funds and projects:

- Steering Comm. Recommended Total Project cost =\$28,357,705
- **Total EmPower Application Funds = \$26,024,645**
- **Remaining EmPower Funds** from \$37,500,000 = **\$11,475,355**
- Estimated Annual Utility Savings = **\$3,458,245**
- Estimated Monthly Utility Savings = \$288,604
- Average Payback for Projects = **5.7 years**
- Estimated Annual Energy Savings = 39,731,425 kWh / 135,564,660 kBtu
- Current applications for remaining funds = 15 projects totaling \$13,684,187
- Projects benefit 9 agencies (including DGS/FRF; TDOC; TDEC; TBR; UT; DHS; DCS; Mental Health; Commerce & Insurance)

B. EmPower TN Utility Data Management

In compliance with TCA § 4-3-1012 and to reduce the operational cost of state facilities, DGS has procured a software system to measure and manage utility energy consumption, demand and cost across all state facilities. This data management system collects historic and ongoing utility invoice data for all state facilities for tracking and analysis. The system is web-based to allow access by facility managers and energy managers to monitor, manage and improve our facilities. We will provide selective access to the public to show progress and for general information and education. This utility data management system is under development and will be available in 2017.

C. EmPower TN Renewable Energy

DGS has issued a notice of intent to award a power purchase agreement (PPA) for the design, delivery, installation, operation, and maintenance of solar photovoltaic (PV) electric generating and energy storage equipment at multiple sites across the State. These solar fields will be installed on state property providing generated power to be used directly by the facility and offset what would otherwise be purchased from the area utility company. The energy storage technology will create a micro-grid at the facility which will allow the facility to operate and continue its mission even in the event of a power outage.

Power purchase agreements are a common means of financing that allows the State to take advantage of the Federal Investment Tax Credit (ITC) and accelerated depreciation through an agreement with a third party. In this model, the state will have no capital outlay for the construction of the system. Monthly payments to the PPA provider will be based on the amount of energy produced at a KWh rate that is less than the current utility rate. The project total capacity including several sites is about 10 megawatts (MW) of solar production and 2 MW of energy storage with a potential savings of \$3.5 million over the 25 year contract term. At the end of the term, the state will have the option to purchase the systems for a reasonable market value. The continued savings, with no payment to the PPA provider is expected to reach more than \$2 million annually thereafter. The life of a solar panel is generally considered to be 40 years, which could provide an additional 15 years of service generating an additional savings of more than \$30 million.

D. FRF Real Estate Management Model

STREAM has created a successful model for real estate asset management that includes energy management as an integral part of daily operations. The cheapest and most abundant form of energy is the energy we save in our existing buildings from operational initiatives with no capital outlay. This whole-building approach to real estate asset management drives general operation to save cost and creates a solid foundation for additional energy conservation opportunities. The basis of this successful energy management model is project development to support tenant operational goals and mission; data collection to allow informed decision-making; and sound facility management to allow proactive and optimized system operation and maintenance.

Project development considers the goals of an organization in the broad context of asset management. This allows daily operation and capital improvement to move toward the same goal: the efficient fulfillment of the organization's mission. Within our FRF buildings, STREAM is collecting facility information including energy cost and consumption to allow data-based project development.

STREAM continues the successful collection of utility invoice data for FRF facilities through a fourth year as we develop a similar system statewide. The data will be collected at its source, shared, and organized so it is useful. This utility invoice data collection system will integrate with other state systems including Edison and Archibus and will be compatible with industry systems including Energy Star.

Facility management staff must be competent, motivated, and accountable. By placing qualified facility management in most of our FRF facilities, DGS has been able to move from reactive operation and maintenance to proactive. In the first three years, the energy consumption in our FRF buildings that are vendor managed has been reduced by approximately 20% as shown in figure 1 (this consumption data has not been normalized for weather or occupancy). Sound facility management alone saves energy cost but also provides a critical foundation for additional savings through sustainable energy conservation measures.

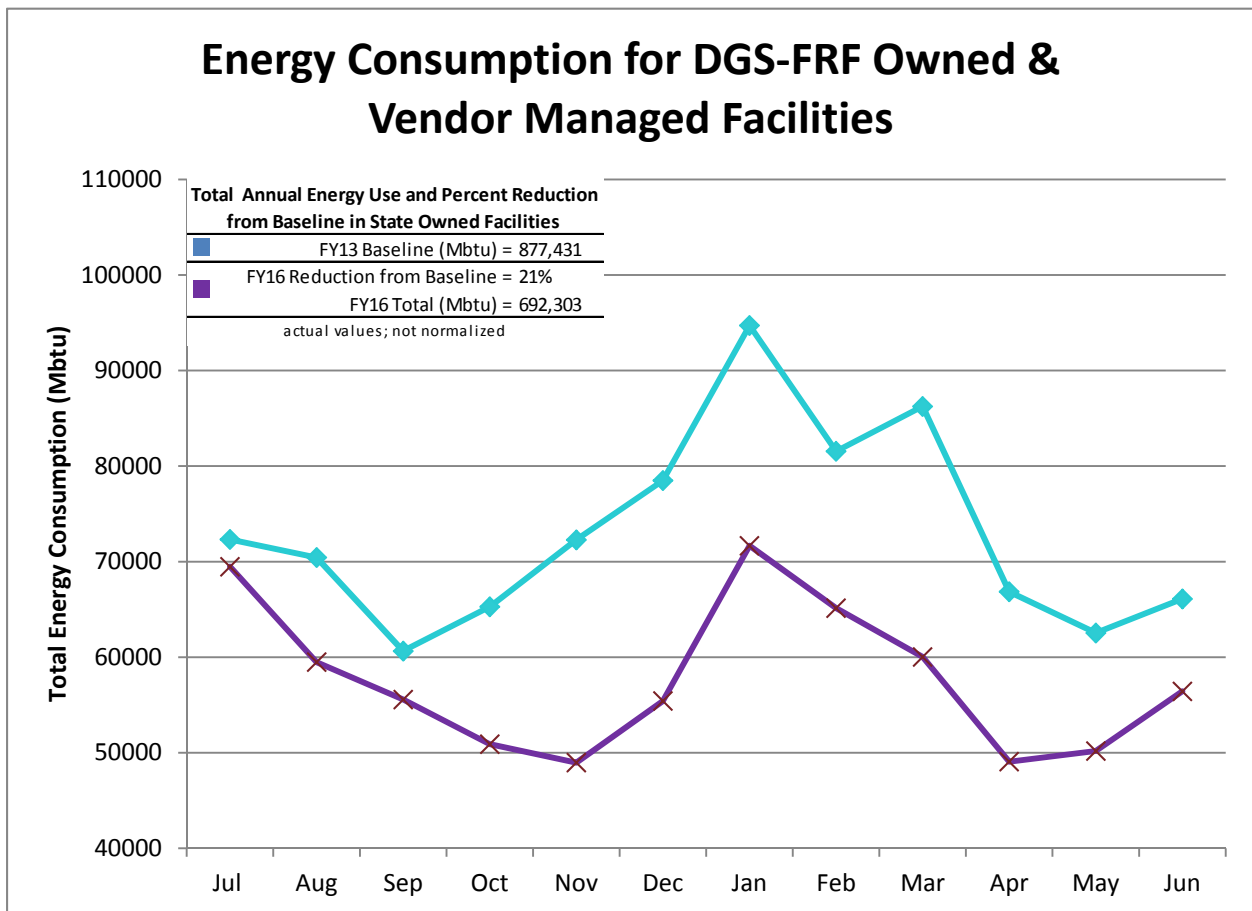


Figure 1: FRF Total Utility Cost Reduction through Operations

E. High Performance Building Program

The High Performance Building requirements (HPBr) as developed by the Office of the State Architect are required on all capital projects. The HPBr provides a consistent approach to new construction, renovation, and the operation of buildings that reflects industry best practices. The HPBr includes commissioning to make sure energy systems function optimally as designed and meet the needs of the state. The STREAM energy group provides resources for the HPBr to be included on every project. A consistent design approach across all state agencies will ensure that the unique needs of each state agency are met and will result in efficient, high-performance buildings with the lowest practical total cost of ownership.

F. Owner's Project Requirements

The Owner's Project Requirements (OPR), a part of the HPBr, is created by the State energy group as an attachment to the project charter to document expectations for function, performance and maintenance of a facility to the design team. The OPR is a requirement of the HPBr and the commissioning process as defined by industry and the State. This document is the basis for energy efficient design decisions. STREAM has also created an OPR template for lease property and for general maintenance to maintain consistency for function and systems in all state facilities. When our design teams follow the HPBr and the OPR, every capital project is an energy project with the lowest practical total cost of ownership.

G. Existing-Building Commissioning

Our greatest opportunity and the cheapest and most abundant form of energy savings is through the operation of our existing buildings. Retro-commissioning (RCx) applies the commissioning process of system performance optimization to existing buildings. Retro-commissioning is the assessment of a building's current use and the operational optimization of the existing HVAC and lighting systems to save energy costs and improve occupancy comfort and productivity. The monitoring that is an integral part of retro-commissioning allows the state to maintain building performance and avoid a drift toward inefficiency that characterizes most buildings. Ongoing commissioning, as part of the facility maintenance budget will monitor HVAC and lighting trend data to identify maintenance issues and operational drift before it gets too far from the optimal operating standards.

STREAM chose the WRS Tennessee Tower to demonstrate the savings that can be realized through retro-commissioning and the sound operation of an existing building. The retro-commissioning assessment of the WRS Tennessee Tower in late 2012 included Energy Star benchmarking and showed an opportunity for substantial energy savings. Retro-commissioning started in December 2012 by optimizing the control sequences for lighting and HVAC equipment, and the savings were immediate.

Table 1 shows the improvement in Energy Star Score from 28 to 59 and corresponding energy use intensity (EUI) reduction totaling 33.5 percent. These numbers should continue to improve

as we implement additional energy conservation measures through the ongoing commissioning program.

Billing Period	Energy Star Score	Site EUI	EUI % Reduction From Baseline
February 2013 Baseline	28	209.3	N/A
January 2016	59	139.2	33.49%

Table 1: WRS Tennessee Tower Energy Star Score and Percent Energy Reduction

Figure 2 shows the cumulative energy cost savings in the WRS Tennessee Tower since December 2012. During this time, the occupancy count in the WRS Tennessee Tower nearly doubled. These savings can be attributed to retro-commissioning, correction of deferred maintenance, the addition of reflective window film, and competent facility management. This holistic approach is representative of the STREAM energy management plan.

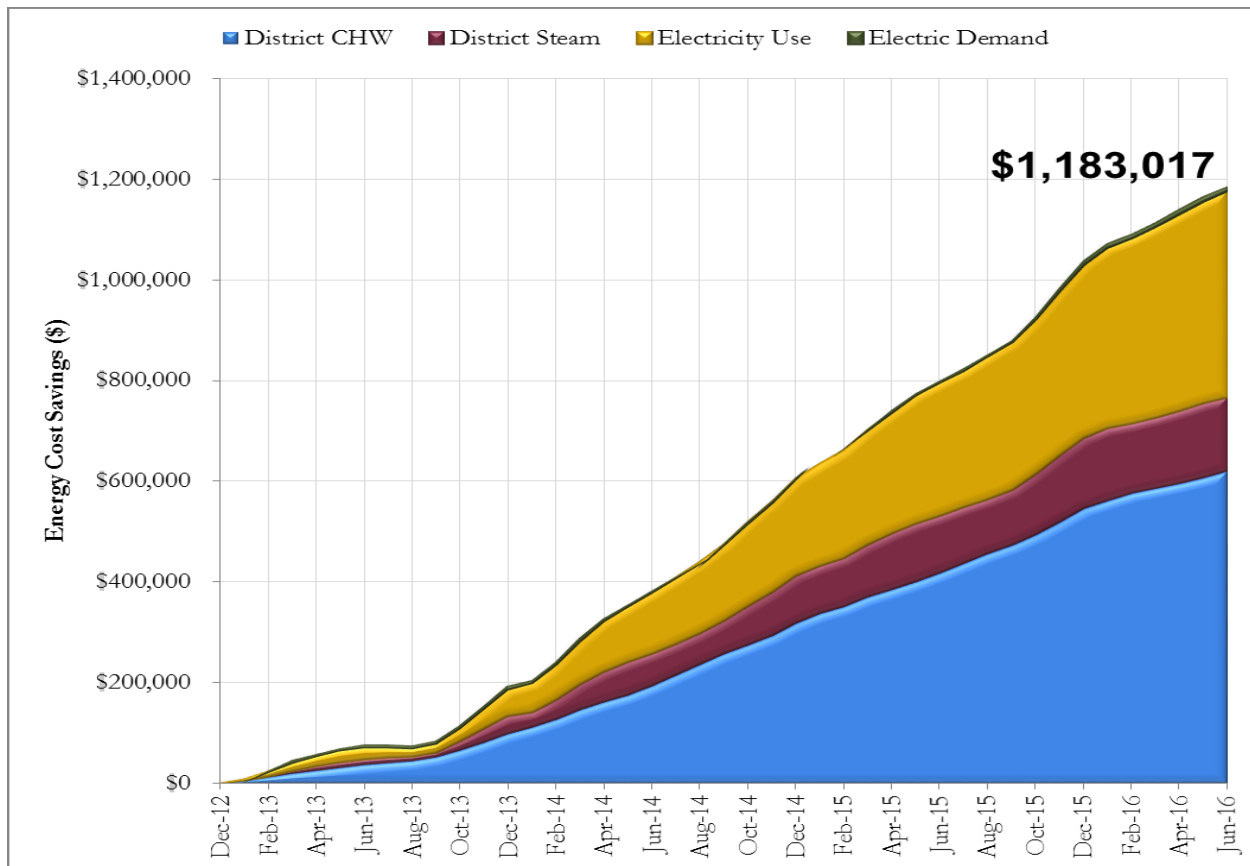


Figure 2: WRS Tennessee Tower Cumulative Energy Cost Savings

H. TVA/NES EnerNOC Demand Response Program

STREAM, in collaboration with the Nashville Electric Service, has implemented the EnerNOC Demand Response Program in 11 major state office buildings. Table 2 lists the 11 state owned facilities that are currently participating in the program and the earned amount of each from October 2011 through November 2015. Each of these buildings has an Energy Management System that allows automation of energy conservation measures to meet the target demand reduction. During a demand reduction event, these buildings reset space temperature set-points, shut off non-essential lighting, manually curtail select air conditioning units, and/or voluntarily shed non-essential loads, such as lighting, personal fans, printers, etc.

The EnerNOC program not only saves the state money, but also helps make state employees more aware of their individual contribution to energy conservation. This program is a valuable introduction into automatic demand reduction and will be included in our broad energy management program. Figure 3 depicts the energy savings realized to date from energy reduction and participation in the EnerNOC Demand Response Program.

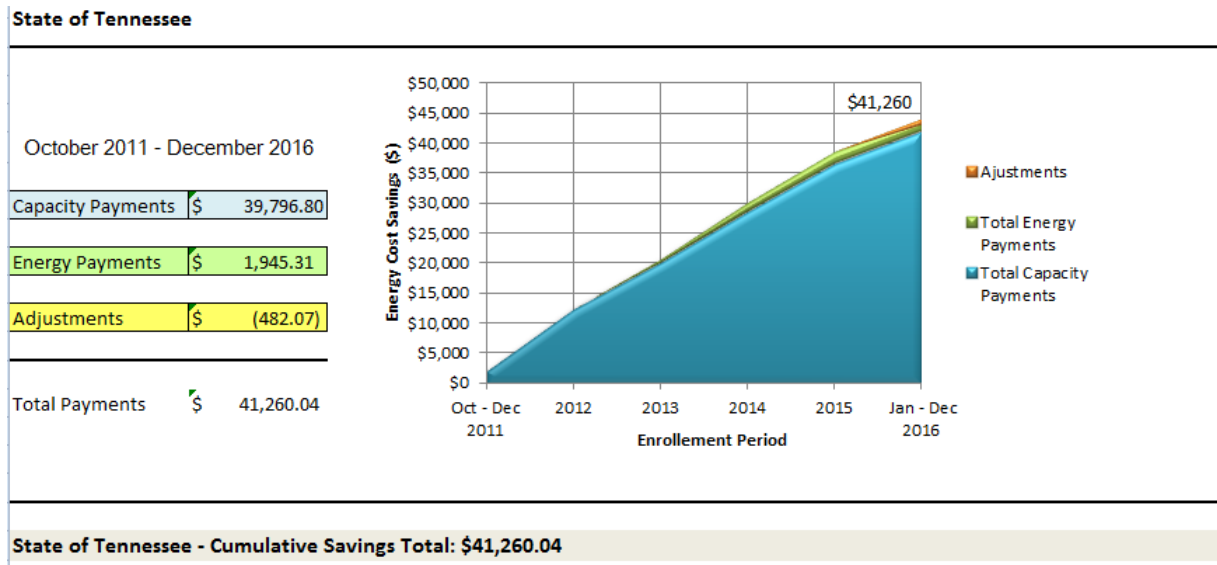


Figure 3: State of Tennessee EnerNOC Savings October 2011 – December 2016

I. Energy Star Portfolio Management

The EPA created Energy Star Portfolio Manager® as an online tool to measure and track energy and water consumption, as well as greenhouse gas emissions. Through Energy Star Portfolio Manager, certain property types such as office buildings, receive a 1-100 Energy Star score, which compares that property's energy performance to similar properties nationwide. The new Energy management software will provide a record in Portfolio Manager for each of our state buildings.

Citizen's Plaza Building in downtown Nashville received an Energy Star Score of 57 for our baseline fiscal year, July 2012 through June 2013. The score increased to 71 for fiscal year 2014 primarily through better operation and proactive maintenance. A score of 71 means it is performing better than 71% of its peers. Other top performing buildings include Andrew Johnson at 94, Davy Crocket at 95 and the WRS TN Tower at 59.

J. Wireless Control Systems and LED Lighting

Advances in light emitting diodes (LED) and wireless lighting control systems (LCS) have created enormous savings opportunity on capital projects and maintenance lighting retrofits. LED lighting is more efficient and longer lasting. These lights, in combination with wireless control systems, allow control strategies for dimming, daylight harvesting, occupancy sensors, capping, task tuning and scheduling for greater savings and a better work environment. A pilot LED lighting and wireless control project on the 24th floor of the WRS TN Tower has reduced lighting system energy consumption by more than 80%. Lighting makes up 30-40% of a building energy use, so an LED and LCS retrofit can reduce total building energy consumption by more than 28%. A whole building LED and wireless control retrofit installation is scheduled in the WRS TN Tower in 2017 with an expected savings of more than \$390,000 annually. A similar project at the DeBerry Special Needs Facility for correction is also scheduled for 2017 with an expected savings of \$524,500. Numerous other LED lighting and controls projects are part of the EmPower TN capital initiative for additional savings.

SUMMARY

The Energy group in STREAM continues to assist the Division's Capital Projects Management group to encourage energy efficiency in the design and construction of new and modified facilities. Compliance with the HPBr and the OPR are critical to the success of energy efficient design. EmPower projects will continue to be completed and monitored. The EmPower Utility Data Management system will be developed and operational in 2017. Integral energy management as part of the FRF portfolio facilities management will continue to decrease energy costs through proactive maintenance, ongoing commissioning and monitoring and optimized operational practices. LED lighting and lighting control projects through EmPower TN and capital projects funding will utilize a new delivery contract for efficient installation and quicker cost savings.

STREAM continues to evaluate and identify buildings throughout the state for opportunities to apply energy efficient technologies and practices and seek financial means needed to implement energy cost savings measures. The individual measures in this report combine to create an effective energy management program.