



CLEAN TENNESSEE ENERGY GRANT STATE FACILITY PROJECTS

FY20 ANNUAL REPORT

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

OFFICE OF POLICY AND SUSTAINABLE PRACTICES

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Executive Summary

Background

In 2011, Tennessee and several other states were awarded financial compensation from a settlement with the Tennessee Valley Authority (TVA) relating to violations of the federal Clean Air Act. A part of the consent decree obligated TVA to provide Tennessee with \$26.4 million to fund energy reduction and air quality improvement projects during a five-year grant process. The Tennessee Department of Environment and Conservation (TDEC) was designated by the Governor as the lead state agency to develop and manage a process for selection and implementation of these projects for Tennessee. TDEC determined that the purpose of the grant would be to provide capital for eligible entities to conduct activities that promoted social, economic, and environmental well-being in the state of Tennessee.

Cause and Effect

By providing technical assistance and resources to these entities, TDEC leveraged additional resources to strengthen social, environmental, and economic goals. Supporting clean energy and energy efficiency projects has allowed State entities, including state parks, state buildings, Army National Guard facilities, and university facilities managed by the Tennessee Board of Regents, to increase sustainability and create a more environmentally friendly, resource-conscious, and healthier state.

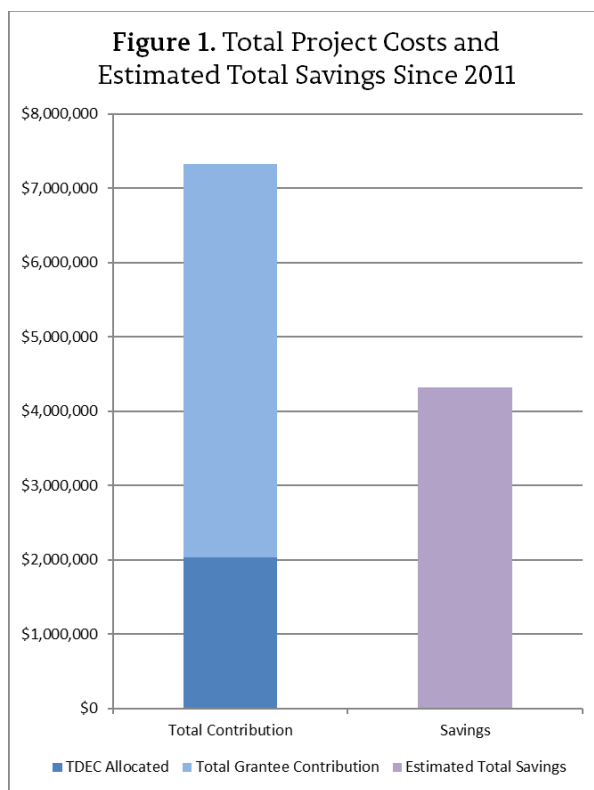
As designed by TDEC, the Clean Tennessee Energy Grant (CTEG) identified and funded projects that result in emissions reductions, utilization of new technology, and support of environmental and economic goals across the state. The CTEG provided financial assistance to municipal government, county government, utility districts, and other entities created by statute (e.g. airport authority, housing authority) in Tennessee to purchase, install, and construct projects that fit into one of the following categories:

- **Clean Alternative Energy:** Examples include biomass, geothermal, solar, wind
- **Energy Conservation:** Examples include lighting, HVAC improvements, improved fuel efficiency, insulation, idling minimization, wastewater treatment technologies
- **Air Quality Improvement:** Reduction of Carbon Dioxide (CO₂), Sulfur Dioxide (SO₂), Volatile Organic Compounds (VOCs), Oxides of Nitrogen (NO_x), Hazardous Air Pollutants (HAPs), and Greenhouse Gases

Financial and Environmental Impacts

As shown in Figure 1, since 2011 TDEC has awarded approximately \$2 million in funding to ten state grantees in support of projects promoting alternative energy resources and technologies, energy conservation, and air quality improvement. Grantee matching funds or in-kind contributions, such as volunteer labor, materials, equipment, and professional fees, have totaled over \$5.3 million¹. Since 2011, grantees have avoided an estimated **\$4.3 million**² in energy costs as a result of projects awarded through CTEG awards. Most grantees have experienced or anticipate payback periods ranging from 3-28 years.

Energy efficiency projects reduce energy consumption, which in turn reduces the need to generate power. Depending on the generation source, the process of generating power can result in production of harmful air emissions, such as CO₂. Between fiscal years 2012 and 2018, grantees eliminated large amounts of these harmful air pollutants through innovations in the built environment by integrating renewable energy technology and efficiency measures into both new construction and rehabilitation projects. Since the inception of the grant, these projects have improved the efficiency of energy consumption resulting in the cumulative reduction of energy demands by an estimated **7.6 million kilowatt-hours (kWh)**³ and reduced CO₂ emissions by **7,544 tons of carbon dioxide equivalents (CO₂e)**⁴.



Appendices

Appendix I of this report provides tables that detail the costs and estimated and actual savings for each of the projects selected from Round 1 through Round 6. These savings are based on data provided by grantees in their annual reports.

Appendix II of this report provides summaries describing each energy saving project that was completed and the benefits it will provide the grantees operations or community.

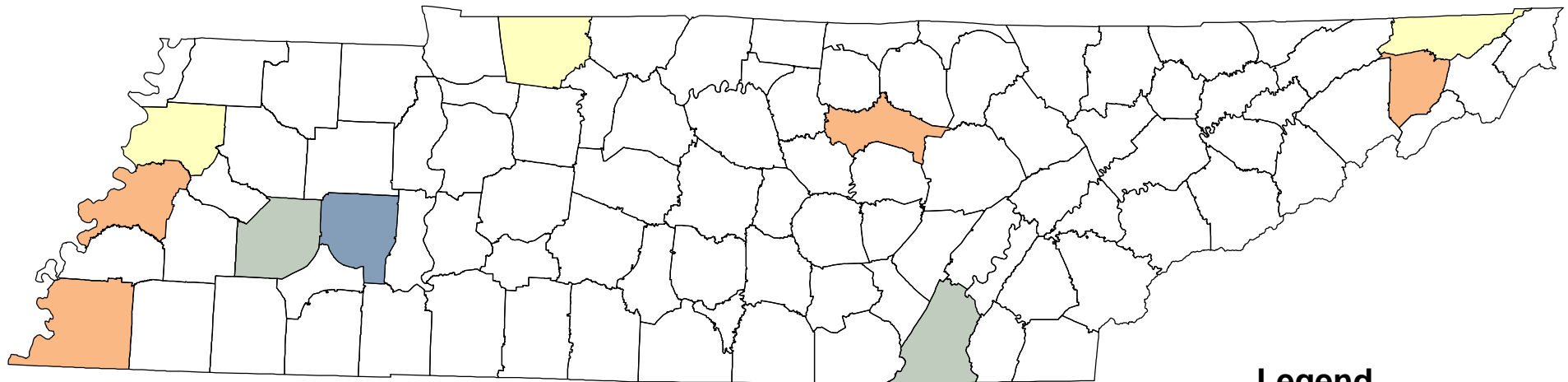
¹ State grantees were not required to provide the grantee match as required by external grantees

² Based upon data provided by grantees in Annual Energy Savings Reports. Cost savings based upon [US Energy Information Association](#) data

³ Based upon data provided by grantees in Annual Energy Savings Reports

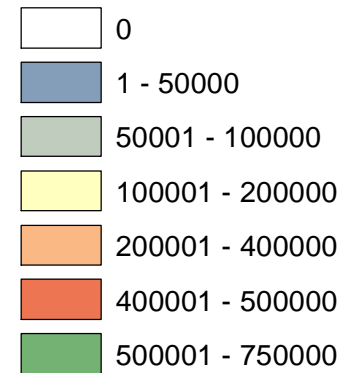
⁴ [EPA Greenhouse Gas Equivalent Calculator](#) converted usage data to CO₂e

Internal CTEG Funding per County



Legend

Internal Funding



APPENDIX I

STATE PROJECTS

PROJECT NAME	PROJECT DESCRIPTION	COMPLETION DATE	TOTAL PROJECT COST	ESTIMATED ANNUAL SAVINGS			ESTIMATED SIMPLE PAYBACK (years)	AVERAGE ACTUAL ANNUAL SAVINGS SINCE PROJECT COMPLETION			ACTUAL SIMPLE PAYBACK (years)	total project cost savings	total project energy savings	total project emissions reductions
				COST (\$)	ENERGY (kWh)	EMISSIONS (TONS CO ₂ e)		COST (\$)	ENERGY (kWh)	EMISSIONS (TONS CO ₂ e)				
ROUND 1 FY2012														
Nissan Leaf Davidson County	Purchased five Nissan Leafs and two charging stations	11/30/2012	\$188,260	\$28,444	164,000	127	6.6	\$1,538	19,021	15	122.4	\$12,304	152168	120
Northeast State Community College Washington County	HVAC upgrades	9/15/2014	\$396,909	\$14,082	140,820	116	28.2	\$4,377	43,765	34	90.7	\$26,259	262592	204
Tennessee Technological University Putnam County	Installation of natural gas boiler to replace coal-fired boiler	12/31/2014	\$1,069,381	\$378,330	497,568	408	2.8	\$453,922	398,000	310	2.4	\$2,723,532	2388000	1860
University of Tennessee - Chattanooga Hamilton County	Installation of 25 kW solar array and 24 SEER Geothermal HVAC system at Alternative Vehicle Testing Facility	12/31/2014	\$131,321	\$8,254	72,000	59	15.9	\$4,581	35,350	28	28.7	\$27,486	212100	168
ROUND 2 FY2013														
East Tennessee State University Washington County	Passive solar heating system at student recreation center, LED lighting, and web-based dashboard	10/31/2015	\$288,530	\$49,467	549,640	451	5.8	\$14,988	149,884	117	19.3	\$59,953.50	599535	468
ROUND 3 FY2014														
East Tennessee State University Washington County	Replace three coal-fired boilers with natural gas	11/1/2017	\$3,250,000	\$292,000	8,103,889	6648	11.1	\$424,929	720,000	561	7.6	\$1,274,787	2160000	1,682
TNCAT - Newbern Dyer County	Installation of new HVAC chilling unit	7/1/2016	\$225,834	\$14,911	67,788	56	15.1	\$10,203	96,254	75	22.1	\$30,608	288762	225
ROUND 4 FY2015														
Jackson State Community College Henderson County	Upgrade to LED lighting at Jackson State Community College	7/31/2016	\$47,800	\$10,900	86,226	71	4.4	\$4,123	41,226	32	11.6	\$16,490.40	164904	128
TCAT Ripley Lauderdale County	Upgrades include LED lighting and HVAC unit and controls. Installation of a 75kW solar array	7/31/2016	\$650,000	\$38,160	196,000	161	17.0	\$6,243	52,814	41	104.1	\$24,971	211254	1763
University of Memphis - Jackson Campus Madison County	Replacement of gas fired boiler with high efficiency boiler	11/1/2016	\$188,485	\$19,794	467,013	383	9.5	\$7,184	71,844	56	26.2	\$28,737.50	287375	224
ROUND 5 FY2016														
University of Memphis - Ned McWherter Library Shelby County	Replacement of water cooled chillers with variable speed high efficiency chillers	2/1/2018	\$485,000	\$31,879	354,215	291	15.2	NR	NR	NR	NR			
ROUND 6 FY2017														
Austin Peay State University Montgomery County	LED Lighting retrofits in seven campus buildings	7/1/2018	\$400,000	\$54,747	576,284	473	7.3	\$90,035	900,348	702	4.4	\$90,035	900348	702.0
TOTAL			\$7,321,520	\$940,968	11,275,443	9,244	7.8	\$932,087	1,628,157	1,269	6.9	\$4,315,163	7627038	7544

APPENDIX II

Round 1

Project Summaries



Northeast State Community College

Northeast State Community College received a grant to replace an outdated and inefficient HVAC system at the Johnson City Downtown Centre that is now the location for the Johnson City/Washington County teaching site. The original system was installed in 1986 and could no longer support the activities housed in this facility. The College installed two high-efficiency boilers purchased from Lochinvar Corporation, based in Middle Tennessee, as part of the HVAC system replacement. The Lochinvar system has a 10:1 turndown feature that allows the boilers to turn down to 10% of capacity without cycling, preventing needless energy loss. Having two units permits the use of one or both of the units as demand dictates.



Tennessee Technological University

Tennessee Technological University (TTU), located in Cookeville, received a grant for a retrofit of its existing coal fired steam plant which primarily utilized stoker coal. The retrofit resulted in the complete transition from coal to natural gas and increased the average boiler efficiency. To achieve this transition, one boiler's stoker coal feeder assembly was removed and replaced by 3 natural gas burner assemblies; the project also involved the installation of three new Limpsfield LCN 88 burners, a new control model, a 120 HP combustion air gas with VFD for speed control, gas and pilot train for all burners, as well as all required ductwork, piping, and engineering design work. Electrical consumption by the TTU steam plant was reduced by eliminating the need to operate an air compressor necessary for coal transport and ash removal. This has resulted in maintenance personnel being able to work on other projects instead of having to operate the compressor.



University of Tennessee at Chattanooga

The Center for Energy, Transportation, and the Environment at the University of Tennessee at Chattanooga received grant funds for the installation of solar panels and a geothermal HVAC system on the Advanced Vehicle Test Facility (AVTF) building at its campus in Hamilton County. The resulting installation will be capable of generating more energy than the facility consumes, making it one of the first Energy Plus Buildings in the Tennessee Valley. The AVTF was selected for the project since its size is representative of a small commercial and/or manufacturing operation. The project serves as a demonstration of how a conventional commercial building can be converted into an Energy Plus Building.



TN Department of Environment and Conservation – Nissan LEAFs

The State of Tennessee purchased five Nissan LEAF electric vehicles for its fleet and added two charging stations located in the Tennessee Tower parking garage. The cars have zero emissions and are made in Tennessee. Replacing five motor pool vehicles with the electric LEAFs for urban travel substantially reduces the emissions that can cause adverse health conditions due to air quality non-attainment. Replacing a conventional vehicle with an electric vehicle in a metro area reduces volatile organic compounds, carbon monoxide, sulfur oxides, nitrogen oxides, and particulates. All five of the cars are located in Davidson County and used by State of Tennessee employees.

Round 2

Project Summary



East Tennessee State University

East Tennessee State University (ETSU) is a regional state university with approximately 15,000 full time students located in Johnson City. ETSU has implemented a passive solar heating system to provide heating at the Center for Physical Activity using Solar Wall technology. The technology displaces 20-50% of the traditional heating load & corresponding GHG emissions. This technology has been used by multiple industrial and government organizations. Another project replaced library lighting with LED technology, which greatly reduces electrical demand. Finally, a web based utility called MyEnergyPro is being utilized at the two largest dorms to provide students detailed data on energy use and educational content on how to reduce, as well as provide a platform for campus housing energy competitions. This platform supports electrical energy conservation at the dorms in a directly measurable form. Installations at other universities have resulted in positive and measureable change. All three of these campus projects reduce emissions and improve air quality.

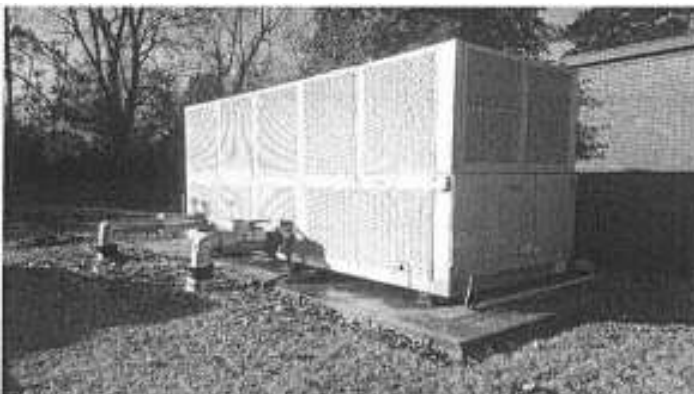
Round 3

Project Summaries



East Tennessee State University

ETSU has a coal fired power plant that generates electricity for use on campus. The existing boiler plant consisted of five steam boilers. Two boilers used natural gas and three used coal. The three coal boilers were installed in 1961 with various controls and efficiency upgrades completed over time. ETSU proposed to replace one of the three coal boilers with a new natural gas-fired steam boiler. The benefits of this replacement were energy savings, maintenance cost savings, and the elimination of ash disposal. The average efficiency of the coal-fired boilers was 65%-70%. Replacement of the boiler with a natural gas-fired steam boiler improved the efficiency to 81.5-82%.

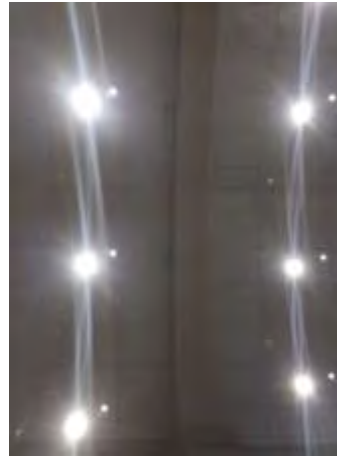
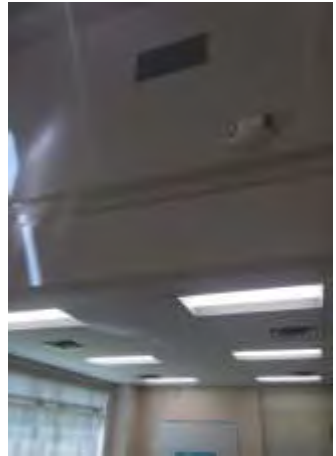
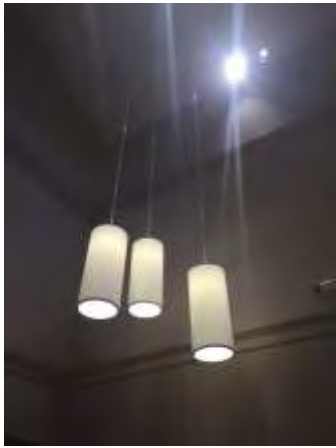


TCAT - Newbern

Tennessee College of Applied Technology at Newbern has completed HVAC improvements at the campus. The HVAC Chiller unit had been marginally effective resulting in unmanageable energy costs for heating and cooling. The unit was 19 years old and the efficiency and technology were simply outdated. The project involved the purchase and installation of a new HVAC chiller unit and the design and purchase of a new air handler unit to replace the current, undersized unit. The project also repaired and replaced the HVAC's inside controls to ensure they were working properly.

Round 4

Project Summaries



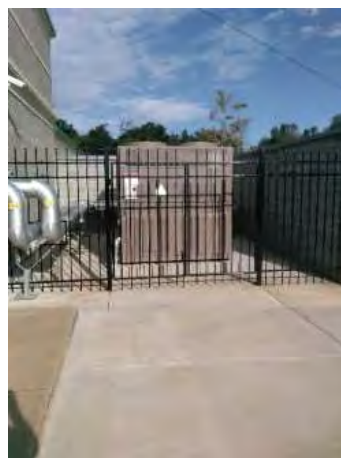
Jackson State Community College

Jackson State Community College in Henderson County implemented energy conservation measures with the successful upgrade of the lighting at the Lexington-Henderson County Center of Jackson State. This facility is jointly owned by both the City and County. The project included the installation of 16 new light fixtures throughout the building. The new system has reduced energy consumption and energy costs while reducing the need for frequent bulb replacement and disposal. Additionally, the public is more comfortable in the surroundings.



TCAT - Ripley

The Tennessee College of Applied Technology at Ripley completed an energy efficiency and renewal project on the main campus. TCAT-Ripley is a single story structure with 35,586 total square feet. The original structure was built in 1997. The project involved the replacement of the previous 20 year old HVAC Chiller unit, updating HVAC controls, retrofitting existing lighting with LEDs and the installation of lighting controls. The occupancy sensors for the LED lights reduce the amount of time the lights are on when they aren't in use.



University of Memphis – Jackson Campus

The University of Memphis' Jackson Campus utilized grant funds for the update. Hyde Hall, a three story 49,515 square foot classroom building built in 1965. The mechanical system for the building consisted of constant volume air handling units with chilled water coils and hot water recoils. The boiler was original to the building, in poor condition, and in need of immediate replacement. The project replaced the existing gas fired boiler with a new high efficiency boiler. The update decreased energy use and cost due to the upgrade in efficiency. Balancing of the hydronic system, connection of new equipment to the fire alarm system, and connecting existing electrical service were all parts of the project as well.



Round 5

Project Summary



University of Memphis

The McWherter Library is the University of Memphis's main campus library and provides the campus and guests access for research and continuing education. Due to the nature of the building, the mechanical system is required to operate 24/7 to maintain proper temperature and humidity for the integrity of the collections. The previous mechanical system consisted of two 330 ton water cooled chillers located in the main mechanical room and backup chilled water from the campus central loop. The project consisted of replacing one 330 ton water cooled chiller with a new variable speed high efficiency chiller and converting the existing cooling tower to variable speed.

Round 6

Project Summary



Austin Peay State University

The Winfield Dunn Center, first occupied in 1975, is the athletics center on Austin Peay State University's downtown campus in Clarksville, TN. The building is over seven stories tall, with an area of 131,970 gross square feet and a 7,257-seating capacity, and is home to the university's basketball and volleyball programs. Due to its consumption of large amounts of electricity because of its size, high use and lack of controls, it was a prime candidate for an LED retrofit. All of the indoor lighting at the Winfield Dunn Center was retrofitted from fluorescents to LEDs, which were also compliant with ESPN TV standards and requirements for broadcasting. With the project being completed under budget, remaining funds were used to install LED lighting in the university's Woodward Library. The energy savings from this project will help pay for the replacement of the building's air handling units, add variable speed drives, convert the controls from pneumatic to digital electronic, and add variable-air volume (VAV) boxes in the future.

