

Knoxville, Tennessee



Photo: City of Knoxville, TN ¹

Knoxville

CASE STUDY

SOLAR
OUTREACH



PARTNERSHIP

Knoxville, Tennessee

Founded in 1791 where the French Broad and Holston Rivers converge to form the Tennessee River, Knoxville is the largest city in eastern Tennessee and the third-largest in the state, behind Memphis and Nashville. It is situated in a broad valley, with the Cumberland Mountains to the northwest and the Great Smoky Mountains to the southeast. These two mountain ranges help provide a moderate climate with four distinct seasons and an annual average temperature of 58 degrees. The city boasts an extensive greenway system that extends more than fifty miles, linking nature preserves, parks, and historic sites with each other and with populated areas.² The City of Knoxville has a population of 178,874 and occupies 104 square miles; Knoxville is governed by a mayor and a nine-member city council.

The growth of solar in Knoxville, including the creation of a sustainable solar infrastructure, resulted from renewable energy programs established by the [Tennessee Valley Authority \(TVA\)](#) and three overlapping programs funded by the American Recovery and Reinvestment Act (ARRA) and the U.S. Department of Energy (DOE): [Solar America Cities](#), the [Tennessee Solar Institute](#), and the [Rooftop Solar Challenge](#).

The Tennessee Valley Authority

TVA, a corporation owned by the U.S. government, provides electricity for 9 million people in seven southeastern states, as well as flood control, navigation, and land management for the Tennessee River system; TVA also assists utilities and state and local governments with economic development. One of TVA's goals is to help the Tennessee Valley become one of the nation's leading providers of low-cost, cleaner energy by 2020. To move toward that goal, TVA created several renewable and clean-energy programs:

- [Green Power Switch](#) allows consumers to support renewable energy production by buying “blocks” of energy produced by solar, wind, or methane-recovery sources.
- [Renewable Standard Offer](#) promotes the development of larger renewable energy systems—

between 50 kilowatts (kW) and 20 megawatts (MW)—in the TVA service area. Eligible systems include solar, wind, biomass (direct combustion or gasification), and methane recovery.

- [Solar Solutions Initiative](#) is a pilot program that provides incentives for Tennessee Valley solar projects that use solar panels manufactured and installed by companies in the valley; to be eligible, projects must yield at least 50 (kW) and no more than 1 MW of direct current.
- [Green Power Providers](#) provides technical support and incentives to encourage homeowners and businesses to produce renewable energy. The sources may be solar, wind, biomass, or small-scale hydropower, and the program applies to systems with a generating capacity of at least 500 watts, with a maximum of 50 kW.

TVA reviews the pricing and capacity levels associated with these programs annually.

Solar America Cities

In 2008, DOE designated Knoxville as a partner in the Solar America Cities program, which is designed to make solar a mainstream energy source in American cities. The designation included an award of \$200,000 from the Solar America Cities program, a \$100,000 matching award from TVA, and technical assistance worth \$200,000 from DOE. TVA and [Knoxville Utilities Board \(KUB\)](#), which handles Knoxville's electricity needs, both pledged additional technical and staff assistance. The financial and technical assistance Knoxville gained through the program helped the city expand and accelerate the adoption of solar energy by residents and businesses, and placed particular emphasis on incorporating solar into city planning, choosing appropriate technologies, structuring project financing, updating zoning and building codes, training qualified installers, and conducting outreach to educate consumers.

The Solar America Cities partnership jump-started efforts to create a sustainable solar infrastructure. At the time it received the grant, Knoxville had few solar deployments—but, with the help of regional partners,



Solar array on the Knoxville Convention Center ³

such as TVA, Oak Ridge National Lab, The University of Tennessee, KUB, and others, the city increased its solar capacity from 15 kW to more than 1 MW in three years.

Knoxville’s solar installations include systems of varying capacity: a 4.5 kW system sits atop the [Knoxville Area Transit](#) building, which was awarded silver-level LEED (Leadership in Energy & Environmental Design) certification. Using a third-party financing model, the city installed an additional, 90 kW photovoltaic (PV) system on the convention center roof, which complements earlier efficiency upgrades, as well as the previous installation of a 30 kW system put in place through the city’s Energy Service Performance Contract. The 90 kW convention center third party financing model was undertaken through a public-private partnership between [FLS Energy](#) and [Green Earth Solar](#), and [TVA](#) generates 115,000 kilowatt hours (kW) per year, and is projected to save up to \$685,000 over forty years. FLS pays the city an annual roof lease of \$10,000 for the first seven years; in year seven, the city has an option to purchase the system outright, at its depreciated cost.⁴

Once the city owns the system, the expected annual income will be \$27,400 per year. There are also a number of non-monetary benefits, however:

- offsetting the energy equivalent of nine homes
- an annual carbon dioxide (CO₂) reduction of eighty tons
- good public relations for the city
- an opportunity to demonstrate community and state leadership
- establishing the success of the third-party financing model
- educational opportunities for convention guests.

In September 2012, Knoxville announced the opening of twenty-four electric-vehicle charging stations in city garages and other facilities. Two of the stations derive some of their power from solar panels: the Coliseum Garage, with a 14.4 kW array, and the Market Square Garage, with an 8.64 kW array. Both are capable of offsetting heavy on-site usage. According to Susanna Sutherland, manager of the city’s Office of Sustainability, the charging stations “will make it easier for local electric-vehicle owners to plug in while they’re at work, and make the commute home with a fully charged battery. This is critical infrastructure to encourage the use of vehicles that consume less energy and produce fewer emissions.”

Solar America Cities also partnered with Knox Heritage, a local preservation group, and [Ijams Nature Center](#). Working together, Knox Heritage and the city renovated an [1888 Victorian home](#), to demonstrate that solar can be integrated into historic communities⁷. Solar-generating film was installed on the building’s standing-seam metal roof, hiding it from the public eye. A solar hot-water system was also installed. Because Knoxville currently lacks standards for solar installations on historic structures, Kaye Graybeal, historic preservation planner for the Knoxville–Knox County Metropolitan Planning Commission (MPC), said that the city obtains guidance from the National Park Service’s Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings, which specifically discusses solar technology. The few historic projects in Knoxville that have requested solar installations have been reviewed and approved case by case by the city; as long as panels are not located on the forward-facing roof, the installations are usually approved. The MPC recently received a grant from the Tennessee Histori-



Solar arrays at the Knoxville Coliseum and Transit Center ⁵

cal Commission to look closely at Knoxville’s guidelines and specifically revise them to include solar and energy-efficiency standards.

At Ijams Nature Center, a three-hundred-acre protected wildlife habitat just a few miles outside of Knoxville, a 15 kW solar array provides power to the park. Working with the Solar America Cities program, the center also developed an interactive educational exhibit that teaches visitors how to be good consumers of solar technologies.

Although the installations made possible by the Solar America Cities initiative have helped the city with energy offsets, Knoxville’s education and outreach efforts are equally important. Jake Tisinger, project manager in Knoxville’s Office of Sustainability, noted that despite having begun with “almost no capacity, no education, no outreach,” Knoxville saw “an opportunity to develop the industry at all levels and establish the connections between entities,” and has since “developed best practices in the areas of education, training, and streamlined process.”

Through free [Solar Technology 101](#) workshops and training, a website, and an annual Solar Fair, the Solar America Cities program has educated and connected hundreds of citizens, local and state agencies, and nonprofit organizations. The website enables users to identify [local renewable energy companies](#) and helps connect potential customers with valuable resources. The Solar America Cities program also helped inspire the creation of green professional development classes at [Pellissippi State Community College](#). Online classes on PVs and solar hot-water installation began in the



Solar thin film on a renovated 1888 Victorian Home, Knoxville, TN ⁶

spring of 2009, and a comprehensive course curriculum on solar PVs has been offered since the fall of that year.

Harvey Abouelata, president of [ARiES Energy](#), believes that the importance of the outreach efforts cannot be overestimated:

Solar America Cities was a huge education for people. It put solar in front of folks and normalized it. Workshops were an endorsement of the technology. The education initiatives connected the dots—it connected

lots of people to lots of other people, [and] . . . helped connect . . . to even more people. It enabled the solar industry to experience a surge of interest and activity. The program was the great education piece to the puzzle, which is really what we needed.

The Tennessee Solar Institute

Launched by Governor Phil Bredesen and funded by ARRA, the Tennessee Solar Institute (TSI) was a state-wide solar energy and economic development program focused on job creation, education, renewable power production, and technology commercialization.⁸ The TSI was created for the purpose of distributing ARRA funds and did so through two grant programs. As a Center of Excellence the [University of Tennessee](#) (UT) and [Oak Ridge National Laboratory](#), and TSI brought together scientists, students, policy makers, and industry partners to generate transformative change in the field of solar. A main goal of the initiative was to stimulate economic activity while positioning Tennessee as a leader in the solar industry. In support of economic growth, approximately \$23.5 million was allocated to establish the Solar Opportunity Fund—the funding source for both [Solar Innovation Grants](#) and [Solar Installation Grants](#).

Solar Innovation Grants

The primary intent of the Solar Innovation Grant Program was to [strengthen the value chain](#) of Tennessee's solar industry, principally through productivity improvements and cost reductions achieved through energy efficiency measures and the adoption of renewable energy in the applicant's primary place of business. Of the eighty projects for which TSI provided \$7.25 million in 2010 and 2011, several were located in Knoxville. All funded activities were consistent with [DOE's State Energy Program](#), and the activity categories:

- **Technical assistance:** Grantees obtained the resources and assistance needed to implement sustainable, applicant-specific clean-energy programs that reduce energy use and support job creation in the applicant's principal place of operation (sixteen grantees).
- **Workforce development:** Grantees participated in workforce development projects that included applicant-specific education and training related to the manufacturing, sale, installation, and

maintenance of solar systems and equipment (twenty-five grantees).

- **Renewable energy products:** Grantees incorporated renewable energy products in their place of operation, with the intent of reducing energy consumption and greenhouse-gas emissions. These improvements also demonstrated commercially available renewable-energy technologies to potential customers (thirteen grantees).
- **Process improvements:** Grantees integrated manufacturing-process improvements that increased overall efficiency and productivity (nine grantees).
- **Technology improvements:** Grantees added new technologies and methods to speed up the deployment of products and create opportunities for entry into new markets (five grantees).
- **Facilities and equipment improvements:** Grantees reduced energy consumption through traditional energy-efficiency retrofits, including facility upgrades and the installation of energy-efficient equipment (twelve grantees).

In 2012, TSI released two reports detailing the demand for and needs to continue the development of solar in the state. The first report, [The Tennessee Solar Value Chain: Predictive Model for Estimating Growth of Tennessee's Solar Industry](#) was written in conjunction with UT's Center for Industrial Services and Department of Industrial and Information Engineering, and was based on detailed data from thirty-three solar companies throughout the state. Among other findings, the report indicated that the state's solar installers had the capacity to install as much as ten times the amount of solar that had been installed statewide in 2011. The report also identified four factors that were influencing solar energy demand in Tennessee: installation cost, electric rates, grant availability, and tax incentives. Among the challenges identified as limiting current and future growth were the following: lack of public awareness of the benefits of solar energy and its potential impact on the state.

- lack of standardization in two areas: (1) interconnection with utilities and (2) local permitting. (Uniformity would help reduce installation time and costs.)
- lack of sufficient solar-specific training and education for newly hired employees of solar companies.
- the risk that the sudden expiration of current incentives would slow the momentum of the industry statewide.

A second report, *Tennessee's Solar Value Chain: A Workforce Development Needs Assessment* identified more than two hundred organizations in Tennessee's solar industry, detailed the growth of the state's solar sector, and identified specific needs that must be met if Tennessee's solar sector is to reach its full potential.

Solar Installation Grants

By funding the purchase and installation of small-scale solar PV systems, Solar Installation Grants sped the statewide deployment of solar energy, which helped to reduce operating costs for businesses. Two rounds of grants were offered: the first in June 2010, and the second in August 2011. As of July 31, 2012, 156 installations were complete across the state and in 41 counties including Knoxville. System sizes ranged from 4.2 kW to 200 kW, and collectively represented 6.8 MW of energy.

The grants were spread across all nine U.S. congressional districts in the state, and grantees included commercial, industrial, and agricultural businesses. The economic impact was more than \$35.9 million, and close to 97,000 work hours were reported from federal and leveraged funds for the installation program. According to figures derived from a DOE calculator, expected reductions are 9,520 metric tons of greenhouse gases and seventy-five metric tons of criteria air pollutants.⁹ As of 2008, less than 1 MW of electricity was produced by solar PV systems in Tennessee. With the help of TSI statewide solar generation capacity was at 17 MW by the end of 2011

Workforce Development Training

TSI was also charged with developing strategic partnerships with solar industry firms and providing a range of technical assistance, policy development, education, and training through meetings, conferences, and workshops. The nine basic workshops TSI offered on solar PV across the state covered a variety of topics, including PV history and market developments, solar concepts and terminology, PV safety, and PV system components and on-site configurations. More than two hundred Tennesseans have taken advantage of this training. The UT Center for Industrial Services also offers periodic solar-related training, on topics that include code compliance for utility inspectors and building and code inspectors; solar PV installation; and firefighter safety for solar installations.

At the conclusion of some courses, an entry-level Certificate of Knowledge exam, endorsed by the North American Board of Certified Energy Practitioners (NABCEP) is

given. NABCEP certification is the gold standard for PV and solar thermal installation certification, and NABCEP certificate programs for renewable energy professionals are offered throughout North America.

Tennessee Rooftop Challenge

In partnership with UT, TSI received \$622,960 from DOE's [Rooftop Solar Challenge](#) to improve the efficiency and reduce the costs of installing solar on homes and businesses.¹⁰ The goal of the initiative was to make it easier for Americans to go solar by streamlining permit processes, updating planning and zoning codes, improving standards for connecting solar power to the electrical grid, and increasing access to financing. To achieve the goals of the initiative, the UT-led team identified four cities to work with: Knoxville, Franklin, Memphis and Nashville.

One of the most significant products of this effort—referred to as the Brooks report—reviewed the practices of each electrical distributor and proposed a model for interconnecting PV systems statewide, and thereby streamlining the process for installing residential solar. According to Jake Tisinger, the report provides “instructions for how to do solar, based on where you are in the process. No matter where you are, you can look at this report and schematic and know what to do and who to talk to.”

The UT/TSI team also developed an integrated app for smartphones and tablets that guides users through the application process.

The Legacy

Much of the solar infrastructure in Knoxville was made possible by funding and incentives that are no longer available. However, the programs facilitated the creation of a sustainable market. [Efficient Energy of East Tennessee](#) (EETN), [Sustainable Future](#), and [ARIES Energy](#) are three companies that continue to install creative and significant solar projects throughout Knoxville and the surrounding region, using various financing models. EETN is notable for a 200 kW ground-mount installation in nearby Oak Ridge, and for 50 kW systems at twelve schools in Campbell County, about forty-five minutes north of Knoxville, which generate revenue by producing energy that is sold to TVA. David Bolt, the founder of Sustainable Future, was recently honored by the White House as a Champion of Change for his work demonstrating that corporate environmental leadership makes sense for both businesses and communities.

Recently, an especially creative approach to partnering yielded a project at the [Knoxville Zoo](#): a 48 kW array—made up of 196 solar panels and producing 55,595 kWh of electricity per year— that sits atop the roof of the elephant barn in the Stokely African Elephant Preserve. Harvey Abouelata, president of ARIES Energy, developed the public-private partnership that made the project possible. The zoo leases the roof of the barn to Wampler’s Farm Sausage, a Lenoir-City-based company that paid for the \$180,000 system, which was constructed and installed by ARIES Energy. As part of the partnership agreement, the zoo’s concessions sell Wampler’s and Family Brands products—such as Cades Cove barbecue, and Elm Hill hot dogs and bacon. The zoo gets credits for the solar energy it produces through the TVA’s [Green Power Providers Program](#). According to Lisa New, the zoo’s interim executive director, in 2013, the zoo’s board of directors created a sustainability committee to look at ways to conserve energy and resources: “the installation is a big step in the zoo’s efforts to ‘go green’—and one it could not afford itself.” The solar installation helps the park reduce its carbon footprint, supports environmental conservation, saves on electrical costs puts the Knoxville Zoo in a leadership position with other zoos all over the country in sustainability.

The City of Knoxville currently purchases 375 Green Power Switch blocks each month, which helps produce 56,250 kWh hours of renewable energy in the Tennessee Valley—enough to provide forty-five homes with pure renewable energy every month. This—along with the solar PV arrays on four city owned rooftops, the LEED certification awarded to the convention center, and the LEED Silver certification awarded to the transit center—convinced TVA to nominate the city for the 2013 Community of the Year award. Green Power Switch presented leadership awards in thirteen categories, and Knoxville won in the Customer Leadership division. In her response, Mayor Madeline Rogero said, “The City of Knoxville is always working toward a comprehensive sustainability program that embraces renewable energy initiatives. . . . It is such an honor to be recognized for our support of TVA’s renewable goals and the Green Power Switch program.”¹¹ For the future, the City of Knoxville intends to continue its commitment to solar.

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Endnotes

- 1 “City of Knoxville,” <http://www.cityofknoxville.org/>
- 2 Unless otherwise noted, all information in this case study was obtained through interviews with the individuals listed under “Contacts.”
- 3 “City of Knoxville,” <http://www.cityofknoxville.org/sustainability/2014workplan.pdf>
- 4 “City taps creative financing for new solar project,” March 20, 2012, <http://www.flseenergy.com/index.php/2012/92-city-taps-creative-financing-for-new-solar-project>
- 5 “City of Knoxville,” <http://www.cityofknoxville.org/>
- 6 “Knox Heritage,” <http://knoxheritage.org/properties-for-sale/1880s-victorian-in-fort-sanders/>
- 7 “City of Knoxville,” http://www.cityofknoxville.org/press_releases/content/2009/0527c.asp
8. TSI was part of the larger [Volunteer State Solar Initiative](#).
- 9 There are six air pollutants that are commonly found throughout the United States: ozone, carbon monoxide, nitrogen dioxide, particulate matter, sulfur dioxide and lead. The U.S. Environmental Protection Agency (EPA) calls these air pollutants “criteria pollutants”. The EPA has regulated these six pollutants by first developing health-based standards (primary standards) intended to protect our health.
- 10 “UT Team Takes on Energy Department’s Rooftop Solar Challenge,” University of Tennessee <http://tntoday.utk.edu/2012/04/11/rooftop-solar-challenge/>
- 11 “TVA Program Honors Knoxville as Community of the Year,” City of Knoxville http://www.cityofknoxville.org/Press_Releases/Content/2013/0424d.asp

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