

Nashville, Tennessee



Photo: City of Nashville

Nashville

CASE STUDY

SOLAR
OUTREACH



PARTNERSHIP

Nashville, Tennessee

Nashville, the capital of Tennessee, is located in Davidson County on the Cumberland River in the north-central part of the state. The Census Bureau reports that Nashville has a population of 636,464 (2013 estimate) within 475 square miles. In 1962, Nashville became the first fully unified metro government in the United States² when citizens of Davidson County and the City of Nashville voted to consolidate competing and duplicative services and merged the two governments.

Since then, Nashville has elected six mayors, the most recent being Karl Dean. First elected in 2007, Dean is now serving a second term. A forty-member metro council—thirty-five members elected by district and five members elected at-large—provides legislative authority. The Metro budget for the 2015 fiscal year³ was \$1,891,647,000.

The Greenest City in the Southeast

Nashville, a city known mostly for country music and a downhome vibe, is also becoming known for sustainability initiatives. Soon after taking office in 2007, Mayor Dean announced that he wanted to make Nashville the greenest city in the Southeast.⁴ The Brookings Institute's ranking of Nashville as one of the country's top ten largest per capita metro carbon emitters⁵ helped fuel his call for action. He also recognized that, in addition to environmental gains, green initiatives were a key part of the city's economic development.

In 2008 to make progress toward this goal, Dean issued an executive order to create the [Green Ribbon Committee on Environmental Sustainability](#).⁶ Among the committee's twenty-seven appointed members was Dean's wife, Anne Davis, managing attorney for the Southern Environmental Law Center. The group was convened to study and recommend steps for making Nashville a more livable city with clean air, clean water, open spaces, transportation infrastructure, and sustainable energy use.

About the same time, Dean signed the [U.S. Mayor's Climate Protection Agreement](#). In February 2009, under the direction of Nashville Electric Service and the

Green Ribbon Committee, Nashville's Health Department completed a baseline greenhouse gas inventory to understand the levels of emissions from transportation, building heating and cooling, and other sources in order to develop substantive goals on reducing them.

In June 2009, after completing [three phases of work](#), which included a public survey and workshops, the committee presented [Together Making Nashville Green](#), a summary report with sixteen goals and seventy-one recommendations. Among the recommendations were goals for energy efficiency and green building, including two specific recommendations:

- "Complete a solar installation at a high-profile public building in Nashville with a kiosk inside that displays solar output and energy use" (page 21).
- "All new public or publicly funded construction and renovation over 5,000 square feet (or \$2M, whichever is lower) will be LEED Silver certified or comparable 3rd party verified system (with a focus on optimizing water usage) by 2012" (page 22).

Music City Center: Nashville's Living Room

Another of Mayor Dean's initiatives took root before he took office. In 2004, following [a report](#) that recommended expanding the existing convention center or constructing a new one in downtown Nashville, a committee was formed to study the options. Two years later, the committee recommended the construction of a new facility that would be large enough to accommodate 75 percent of the nation's convention and visitor market. When Mayor Dean was elected in 2007, he saw the project as an opportunity to demonstrate Nashville's commitment toward becoming a greener city and embraced the project.

The new Music City Center broke ground in 2010 and opened in May 2013. It specifically addressed the two recommendations in the Green Ribbon report cited above: [a solar installation on a high-profile public building that achieved LEED status and a focus on optimizing water usage](#).

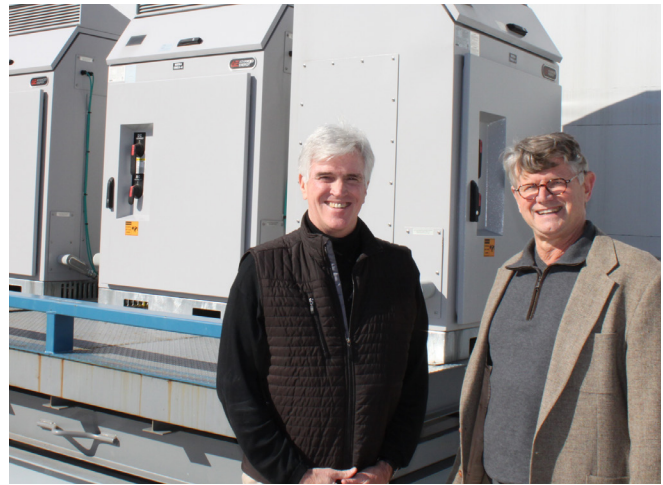


The green and solar roof of the Music City Center

The five-story, 1,200,000-square-foot [Music City Center](#) (MCC) is the largest capital construction project in the city's history, and it carries a LEED Gold certification from the [U.S. Green Building Council](#). Its roof features a 191,000-square-foot green section designed for storm-water retention and urban heat island reduction. Planted with fourteen different types of vegetation, this section spans four acres. A rainwater collection tank within the building can store up to 360,000 gallons of rainwater, which is then used to irrigate outdoor landscaping and provide water to hundreds of toilets in the building.

Another section of the roof features a 211 kilowatt (kW) solar array in the shape of a stylized guitar (it's Nashville, after all!). The 845-panel system is the largest solar installation in the city, generating approximately 271,000 kilowatt-hours (kWh) per year. To ensure optimal performance from the system, the design calculations were done to accommodate placement of the panels on a shade-free solar window on December 21—the winter solstice—using a technique known as [inter-row spacing](#). Estimates are that over a twenty-five-year period, the clean electricity from the array will offset nearly 5,000 tons of carbon dioxide emissions—the equivalent of taking 920 cars off the road.

The MCC is visually stunning building that lies at the civic center of one of America's best-known cities. However, at street level, one of the building's most impressive features—the installation of the solar array—completely escapes the eye. Unlike other systems in the state, this system is not tied to the [Tennessee Valley Authority](#) (TVA) grid but instead functions "[behind-the-meter](#)." Systems installed behind-the-meter



Ron Merville, Energy Source Partners, and Steve Johnson, Light Wave Solar

use 100 percent of the solar electricity generated on-site rather than first sending power to the grid. The MCC solar system is the first of its kind in the state and provides an important look at the future of solar.

Designing an Array Behind the Meter

As plans for the new convention center were being developed, it became clear that a solar installation would help the building meet the requirements of LEED Gold certification. But according to Ron Merville, president and chief executive officer of Energy Source Partners, the firm that designed the array, the city was very clear that including a solar system on the new building had to do more than make environmental sense; it also had to make financial sense. And installing solar through the TVA structure did not appear to be able to accomplish that.

Most systems in the state are tied to the TVA grid, and the owners receive a premium for each kilowatt of energy generated. Often, developers of municipal projects find it necessary to enter into a partnership with a private company or to establish a power purchase agreement (PPA) to use investment tax credits or depreciation to help get a return on a project. But this was not the best path according to Merville, who sought a different way for the city to benefit from the capital expense of installing solar panels on what was certain to be a very high-profile project.

As Merville studied the plans for the building, he realized that the large glass windows on the southern and western sides would heat up as the sun was at its



Solar Array on MCC

peak—exactly when the solar energy system would peak. This allowed for a supply-and-demand match that would maximize the site’s efficiency. In an effort to develop the best solar model for the MCC, Merville examined records from the Nashville Electric Service (NES) and the TVA’s rate structure to identify peak demand periods—periods that also coincide with the time of day service providers charge more for power. According to Merville, “more” meant “by a factor of more than 100 times [\$24+ per kwh instead of .12 per kwh].” The rate that utilities charge for electricity often fluctuates according to demand volume and time of day. It is called a demand charge and illustrates how rates are driven by a host of factors.

Merville opted for a solar system design that would offset the electricity used in the building when electricity costs the most. “In terms of dollars, the 200 kW system would generate between \$40,000 and \$50,000 a month for the MCC,” he said. “Since the capital cost was just under a million dollars, it’s a very short pay-back—it’s two or three years at the most. But in order to do that, we couldn’t go to the grid with power. We had to turn the power into the building. We had to go behind the meter.”

Merville took his proposed power generation calculations and project design to the engineers and managers at NES and asked them to evaluate the project using their own financial analysis methodology so he could verify his calculations. NES confirmed that MCC would be saving money during peak periods: it would “peak shave” the demand charges. Had the project gone through the meter, it would have been accounted for by NES; having NES evaluate the project helped prove that the behind-the-meter approach would work. To ensure



Panels on the MCC demonstrate inter-row spacing

that everything would actually work as planned and to meet all the proper safety standards and precautions, a parallel operating agreement was signed with NES giving that company the right to inspect the facility through the process and after it was completed.

The behind-the-meter approach also saved money in the construction of the array. According to Steve Johnson, president of Light Wave Solar (the MCC installer), if the array had been tied to the grid, TVA would have required it to connect from the roof to an underground vault under the sidewalk, which would have involved running a lot of conduits. “It would’ve been disproportionate to the size of the system and added more cost to the system,” he said. “Connecting behind the meter meant that power could be run from the roof down to the first appropriately sized distribution panel and tie in there, [which cost much less]. So we’re essentially back-feeding the building’s electrical distribution system with solar.”

The Solar Future: A Good Investment for Municipalities

There was no special financing (e.g., a PPA, or a utility program incentive) used to help install the system. The MCC and the City of Nashville bought and paid for the equipment and own it outright. The innovative behind-the-meter aspect of the project brings the added benefit of offsetting energy at times of peak demand when rates are also at their peak. While there are up-front costs to solar, Johnson noted that “[a city] may have the capital expense up front, but it’s extremely low risk. Solar, for the most part, is a one-time expense. The fuel cost for solar is flat. Main-

tenance is very slight. We're seeing solar as a more and more viable source and necessary component of the energy portfolio for a municipality."

Solar continues to trend toward behind-the-meter installations, particularly with larger-scale projects where end users who are subject to demand charges can use all the electricity that is generated. Sometimes it can be difficult to install large solar projects and tie them to the grid. "Over the last couple of years we have had problems with the [TVA] programs constantly changing," Johnson said. "The incentive levels have reached capacity. In the GPP program [Green Power Providers], for example, you're only allowed a total of 10 megawatts, which is not very much solar for an area that stretches into seven states. . . . That's not much solar for the under-50 kW market. Behind the meter will be the next wave of solar installations in Tennessee and across the TVA region." The TVA region covers seven states: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia.

According to a spokesperson in TVA's Renewable Energy division, "cost-effective, renewable energy is an important part of TVA's diverse portfolio of energy-generating sources. To support this diversity, TVA offers multiple renewable energy programs, which have been in existence for a number of years. Of course, with a market that is changing as rapidly as renewable energy, continuous improvement of such programs is a necessity to ensure their long-term viability." TVA works in partnership with local power companies, academia, solar developers, environmental advocacy groups, and other government agencies to hone its renewable energy programs, allowing it to remain current with dynamic market conditions while also meeting the needs of its business partners and the 9 million residents of the Tennessee Valley whom TVA, in conjunction with local power companies, serves.

TVA sees sustainability as a significant trend, a primary factor in the development of both the Volkswagen Plant, located in Chattanooga, TN and the Music City Center. "Businesses are increasingly interested in LEED certification, energy efficiency, and a host of other factors that enable them to run their businesses sustainably. These factors seem to be driving more and more business decisions," said a Neil Placer, Senior Manager for Renewable Energy Solutions at TVA. TVA is a proponent of sustainable business practices. From its Valley Sustainable Communities program to the EnergyRight® and Renewable Solutions team, TVA works closely with local power companies and businesses to promote sustainability by offering a portfolio of programs and providing reliable, low-cost, and cleaner energy.

TVA is currently in the process of updating its Integrated Resource Plan (IRP), which will consider how much of each type of resource, such as energy efficiency and renewable generation, TVA should pursue in meeting the needs of the valley over the short- and long-term planning horizon. A draft of the IRP will be made available for public input in the late spring of 2015.

The solar system on the roof of the MCC is operating beautifully and represents the achievement of many of the city's goals. The center itself stands as an example of sustainability and can help attract business to the city. It also demonstrates the success of the Green Ribbon Plan and showcases a new way of making solar work in an age of shrinking incentives and challenges to renewable portfolio standards.

Lessons Learned

Because Nashville's leadership sought sustainable options for the city's buildings, codes and permitting were streamlined to ensure that solar installations did not face delays and roadblocks.

The most important lesson to be learned from this project, though, is that the most obvious course of action may not always work or yield the best results over time. The city wanted to install solar on the new convention center. Initially, it was ready to take the standard approach and tie the system to the grid; had it chosen that route, however, it would have achieved a very different outcome. By thinking innovatively, it was able to develop a system larger than what could have been built at the time under the TVA program and to use 100 percent of the energy and receive 100 percent of the value of its system. Not only does the MCC save energy and money for the city, but it is also a model for large-scale electricity users. The convention center makes an important statement about the viability and benefits of renewable energy, and how renewable energy can be incorporated into a local government's economic development and climate change policy.

Interviews and Contacts

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Endnotes

1. Unless otherwise noted, photos were taken by authors and information was obtained through interviews with the individuals listed under “Contacts.”
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