



LEADING THE WAY IN NET ZERO ENGINEERING

Kentucky is No. 1 in net-zero

State first in U.S. to build schools that generate renewable energy

By Ken Seibert



Richardsville Elementary in Barren County is the first public school in the nation to feed more energy back to the power grid than it uses.

Kentucky is leading the nation in the construction of net-zero energy public schools. Texas is the only other state with a potential net-zero project, but it has yet to begin construction. Kentucky's public school systems, meanwhile, have substantially completed two net-zero energy schools with another in the planning stage.

Richardsville Elementary (Warren County Public Schools) is the first operational net-zero energy school in the nation. It opened for classes in October and cost \$14.2 million. The architectural firm for this project was Sherman Carter Barnhart and the mechanical/electrical engineering firm was CMTA.

Turkey Foot Middle School (Kenton County School District) opened for the 2010 fall semester and cost \$28 million. The architectural firm for this project was PCA, and the mechanical/electrical engineering firm was CMTA.

Both schools generate renewable electrical energy via solar photovoltaics (PV). Richardsville's solar PV system became operational in November. Turkey Foot Middle is a bigger school with a much larger solar PV system. The system is being constructed in two phases, with the first to be completed in early 2011.

A net-zero building generates renewable electricity; it is utility grid connected and annually supplies to the grid as much energy as it consumes.

Kentucky's success in designing and constructing energy efficient schools planted the seed for net-zero energy schools. In 2006, Mark Ryles, past director of facilities for the Kentucky Department of Education (KDOE), initiated the net-zero energy discussion. The design teams collaborated with the school districts and state agencies to develop a net-zero concept that focused on drastically reducing energy consumption. Renewable power is expensive, so



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minimizing installed capacity was critical. The goal was to establish a project financial model with a 15-year return on investment.

The solar panels are the most visible and exciting public component of net-zero, but the strategies used to reduce energy consumption make it financially viable. A few of these strategies are: geothermal heating and cooling; advanced outside-air delivery systems; natural lighting of classrooms in lieu of artificial illumination (daylighting); insulated concrete-form exterior walls; kitchen improvements; and new classroom technology equipment. All building systems have real-time electrical monitoring to verify performance.

The solar PV systems are a combination of "thin film" and "mono-crystalline" panels. Thin film is flexible, slightly thicker than a rubber mat and easy to install on a flat roof. It is cost effective but needs more roof area to collect the necessary solar radiance to generate electricity.

Mono-crystalline PV (the more familiar glass panel) is usually a little more expensive and must be installed with the proper orientation to the sun. It requires less surface area to generate power than thin film, but requires a structural system for mounting.

Richardsville Elementary's system has a total generation capacity of 348 kilowatts (kW) with a first cost of \$2.75 million. Turkey Foot Middle Phase I system is 400 kW with a first cost of \$3 million. The roof of a new, adjacent technology center will provide the needed area for phase II of the PV system.

Creating a 15-year financial model for the solar PV was challenging due to the fact that federal tax incentives applicable to private businesses are not available to school districts. The return on investment was enhanced by local utility company programs encouraging renewable energy production. On-site solar power generation is a benefit to utility companies because the energy production peaks during summer afternoons when the greatest demand on the nation's electrical grid occurs.

Tennessee Valley Authority, the power generating utility for Warren County, will purchase all power generated at \$0.12/kilowatt hour greater than the selling price. Duke Energy, utility generator for Kenton County, intends to purchase the solar renewable energy credits (SRECs) from the school system. At current prices, the SRECs will yield \$80,000-\$100,000 annually.

Many of the building system changes that have made these projects highly energy efficient are now being incorporated into other building types. Geothermal is being integrated into hospitals. Solar photovoltaics can be financially viable for commercial office projects when considering federal and state tax incentives, SREC income and reduced electrical cost. A recent Louisville solar PV project resulted in an eight-year payback.



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Until recently, the East and West Coasts were leaders in the application of renewable energy and energy efficient design. Kentucky is now recognized as a national leader with the development of energy efficient school construction and cutting edge net-zero energy projects.

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<http://www.lanereport.com/3171/2010/12/state-first-in-u-s-to-build-schools-that-generate-renewable-energy/>