

## Measured Energy Use

### Energy Demand

357,000 Kwh/year

### Renewable Energy Supply

366,000 Kwh/year

20 year average

Source: **Photovoltaic**

### Net Energy Use

(9,000) Kwh/year

Size: **72,300 sf**

Completion Date:  
December 2010

### NZEB Lessons Learned:

The design team recently completed the construction of a similar size elementary school for the same school district. That school is operating at 28 kBtus/sf-year. Our energy provider, Tennessee Valley Authority, measured energy usage in that building to understand where energy was being consumed. The goal was to identify other opportunities to reduce energy, which included:

- Kitchen power consumption
- Computer power consumption
- Ventilation

The team applied the “lessons learned” from that study to design a NZE school.

**Team**  
Client: Warren County Schools  
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**Project Description:** Richardsville Elementary School is located in Bowling Green, Kentucky. The building is two floors and built to accommodate 500 elementary school students. The design strategy for this project was to focus on energy conservation. The goal was to design a school that annually consumes 18 kBtu/sf/year.

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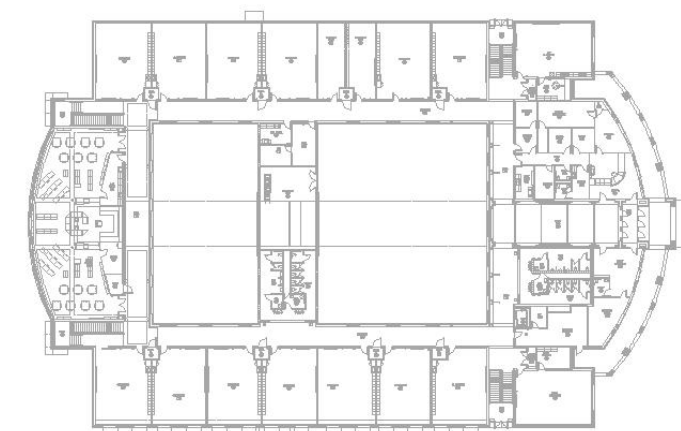


**NZEB Strategies: Geothermal HVAC:** the enhanced system designed for this school includes distributed pumping and dual compressor heat pump units. The **outside air ventilation system** is a demand control type and uses a single 100 percent outside air, variable volume, heat recovery air handling unit. CO<sub>2</sub> sensing is measured through the use of a pneumatic air tubing system that allows centralized testing of air quality in each classroom. Based on the measured air quality ventilation air is either increased or decreased through the use of variable air volume boxes to satisfy room conditions.

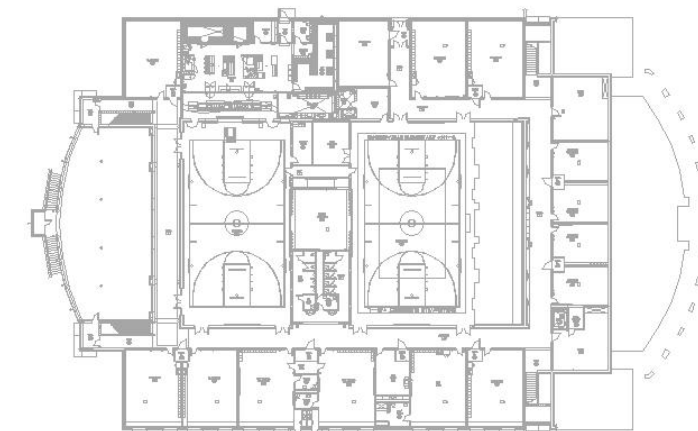
**Thermal envelope:** The two-story, rectangular design was chosen to provide an efficient shape that would minimize exterior surfaces. ICF wall construction was chosen to improve the thermal envelope’s performance. **Daylighting:** The classrooms are daylit through the use of exterior glazing and Solatubes®.

The lighting systems are dimmable based on the measured light levels. A priority was efficient lighting systems and they are designed to operate at 0.68 w/sf.

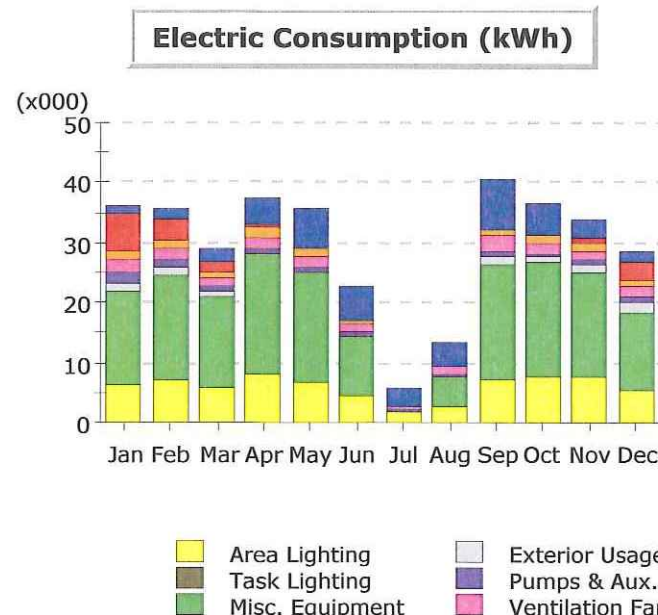
**Kitchen:** All type II hoods are being installed, which drastically reduces exhaust air requirements. Also more efficient cooking equipment, along with efficient cooking techniques are being used. **Computers:** The benchmarked school indicated 8% of power was being used by the computer/data systems. The Kentucky Department of Education allowed this to be a prototype wireless school (first in Kentucky) utilizing all laptop computers. This also allowed the design team to eliminate two computer labs. **Energy modeling:** The energy model was completed using Equest. The design team collaborated extensively with the building operators and staff to predict scheduling, kitchen and plug loads.



Main Level



Lower Level



**Power generation:** The project utilizes 208 kw of roof mounted thin film solar photovoltaics and 140 kw of mono-crystalline photovoltaic panels.