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# High Performance Schools

## The Kentucky Experience

NASEO



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# Kentucky High Performance Schools: Accomplishments (since 2009)

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-  Increased sq ft space – by 6.3%
-  Decreased total energy usage – by 6.5%  
(EUI dropped from 65 to 57.6 kBtu/sf/yr, or 11%)
- Cumulative energy cost savings: \$68.5 million
- ENERGY STAR Schools:
  - Total: 344 – sq ft equal to 592 football fields
  - Ky 3<sup>rd</sup> nationally, per capita
  - 24% of all schools in state
  - 65% increase in last 3 years
  - 14 school districts with 100% ENERGY STAR (of 174 districts)
  - 13% of Kentucky's ENERGY STAR schools have scores above 95.
- First Net-Zero Energy K-12 School in USA, Richardsville, KY



# Why Schools?

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## Schools...

- Are centers of the community
- Get lots of traffic and exposure
  - Provide credible demonstration, i.e. if its good enough for the school, maybe worth looking into...?
- Are natural centers for education
- Plant seeds for the future
- Serve as “extension” agents – i.e. kids talking around the dinner table
- Foster local economic development

# Kentucky High Performance Schools: Timeline

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- 2000+ Began High Performance Schools Workshops
- 2007+ Began public recognition of ENERGY STAR schools
- 2009-2012 ARRA funds
  - School Energy Managers Program (SEMP)
  - Green and Healthy Schools Program (GHS)
  - Kentucky Energy Efficiency Program for Schools (KEEPS)
  - National Energy Education Development (NEED) Project
- 2013-2015 SEP and compliance settlement funds
  - SEMP
  - NEED
- 2014 Utility order
  - SEMP

# What is a High Performance School?

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Photo courtesy Sherman-Carter-Barnhart Architects

- Healthy and Productive Environment
- Cost Effective to Operate and Maintain
- Sustainability
- Reduced energy consumption saves districts money
- School Facility as 3-D Classroom
- School as agent to educate community

# Integrated Design Process

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Creating a school with these characteristics is not difficult, but does require an integrated, whole-building approach to the design process.

Engage all stakeholders in:

- Design
- Construction
- Operation

Expectations:

- Architect vs. Engineers
- Set standards, e.g. energy use index (EUI), orientation, etc.



# Kentucky Program Elements

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- ENERGY STAR recognition events – simple & cheap!
  - Certificate signed by Governor
- High Performance Schools Workshops – since 2000
- National Energy Education Development Project (NEED)
  - Teacher workshops, student energy teams
- Green and Healthy Schools Program
  - Multi-media student-led investigations and projects
- School Energy Managers Program (SEMP)
  - Energy managers across the state – often shared by multiple districts

# Partnering with ENERGY STAR®

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- Facilities among the top 25 percent of all comparable buildings.
- Measure a year's worth of energy-use data.
- ENERGY STAR buildings must receive at least 75 out of 100 points in EPA's rating system.
- Kentucky currently has 344 ENERGY STAR schools, ranking 5<sup>th</sup> for absolute highest number and 3<sup>nd</sup> per capita among the 50 states.
- EUI (kBtu/sf/yr) values dropped over past six to seven years

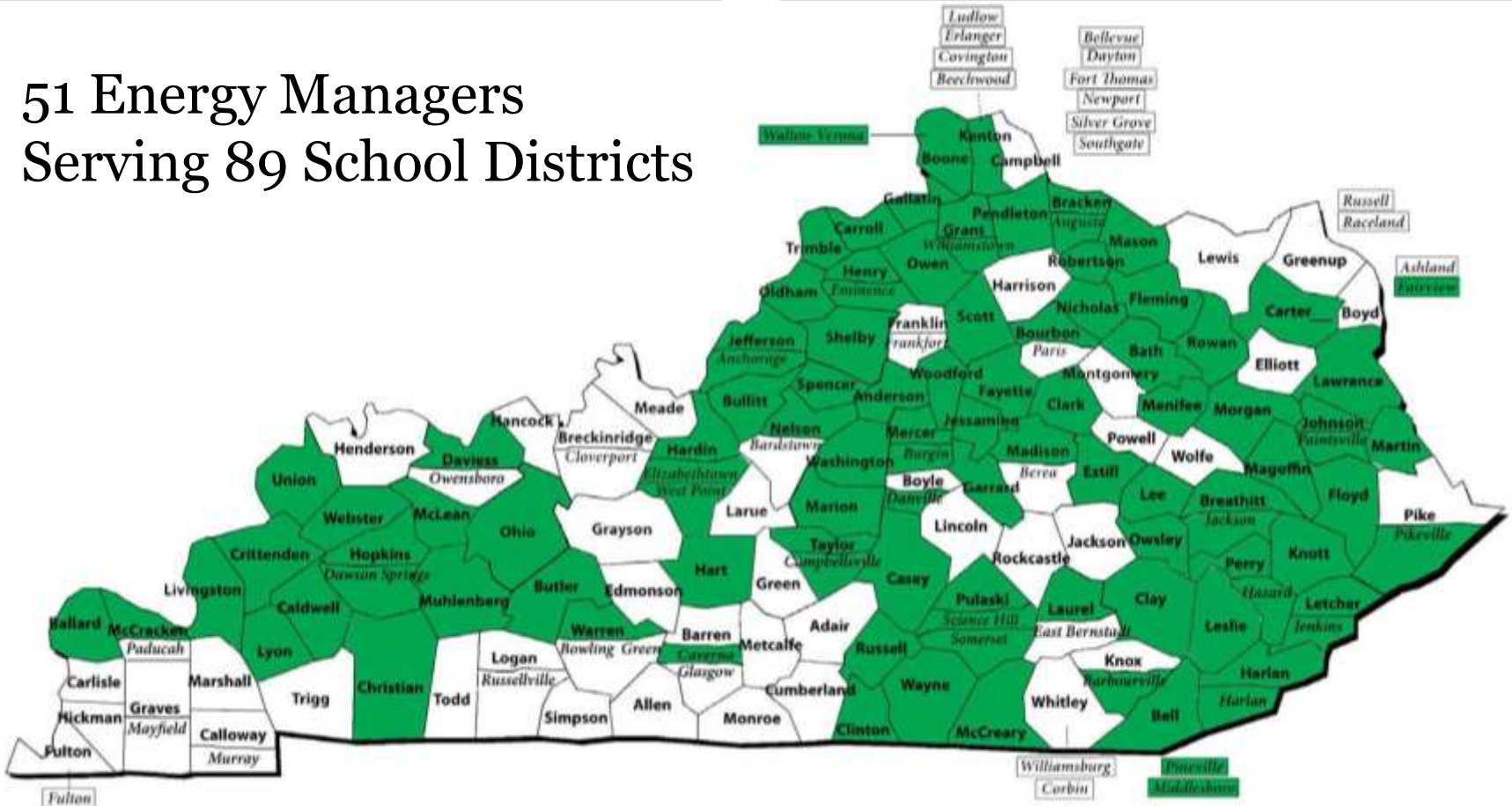




# Kentucky School Energy Managers

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51 Energy Managers  
Serving 89 School Districts



# NEED/Green & Healthy Schools

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- Teacher energy education workshops
- Student energy teams
  - Students issue tickets for appliances left on
- Student projects
  - Posters and reports – panel reviewed and scored
  - In-school implementation projects, e.g. vending miser
- Student presentations
  - Poster sessions at annual event
- Student recognition and awards
- Student as educator/agent of change in community

# The Net Zero Concept – the Next Step

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## Questions:

- Could we create building that **consumes minimal amount of energy?**  
Could we then offset that by allowing it to **produce clean energy?**
- **Net Zero** – connected to the power grid, produces as much energy as it uses annually, and is so efficient that the addition of renewable energy sources to meet the energy needs becomes cost effective.
- **Net-Zero Ready** – facility designed with components and building strategies integrated to achieve state-of-the art energy efficiency – at or below 25 kBtus/sf/yr – with hardware and engineering to readily accept renewable energy installations at a later date.

# Designed Net-Zero Ready

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Year School Built 2010

School Building Size 133,000 sf

PV installation completed April 2012

Consuming 25 kBtu/sf/yr before PV

443 kW solar PV

Construction Cost - \$200/sf with solar PV

Building Performance - 13 kBtu/sf w/ PV (May 2012-April 2013)

## **Turkey Foot Middle School Kenton County School District**



# Turkey Foot Savings Comparison

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Photo courtesy Kenton County School District

## **New vs. Old** Turkey Foot Middle School Comparison

**2011-2012 Savings of \$56,395**

	<b>Old TF School</b>	<b>New TF School</b>	<b>% Difference</b>
Square Footage	66,523	133,000	100% increase
EUI (kBtu/sf)	79.2	13.6	83% decrease
Annual Energy Cost	\$94,954	\$38,558	59% decrease

# Net Zero Energy Schools

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## Richardsville Elementary School

- First net-zero energy public school in the United States.
- 72,285 sf with over 500 students
- Uses 75% less energy than average US school.
- Produces as much energy as it consumes with a 349 kW solar array.



Warren County, Kentucky Photo courtesy Sherman-Carter-Barnhart Architects



Cost: \$12.4 million - without solar  
\$15.2 million - with solar  
[Today would cost only \$13.2 M]

Photos Courtesy Sherman-Carter-Barnhart Architects

# Richardsville Elementary

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- ✓ Registered as a LEED Gold School with the USGBC, making it as environmentally friendly as it is energy efficient.
- ✓ Constructed at a cost equal to a conventional school.
- ✓ Teaches students environmental stewardship by involving them in monitoring the building's performance.
  - Student energy teams analyze the school's plug-in devices and lighting.
  - Student monitored recycling program.
  - The weather station, part of the outdoor classroom, helps students monitor solar panel efficiency.



349 kW solar panel array

# Make it very efficient!

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- ✓ High Performance Building Envelope
- ✓ Active Day lighting
- ✓ Geothermal HVAC
- ✓ Monitoring Controls
- ✓ Dedicated Outside Air System with Energy Recovery and CO<sub>2</sub> Sensors
- ✓ Alternative Renewable Energy Source
- ✓ Green Kitchen Strategies
- ✓ Operations and Maintenance Plan
- ✓ Wireless Computer Technology



# Take-Aways

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- Schools excellent leader for community change
- Efficiency does not have to cost more
- A comprehensive approach includes many components
  - Design/construction
  - O&M
  - Behavior
  - Education
- Change takes time



# ***KY Energy and Environment Cabinet***

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