



REBUILDING IT BETTER: GREENSBURG, KANSAS

On May 4, 2007, a massive tornado destroyed or severely damaged 95% of Greensburg, Kansas. Since then, city and community leaders have been committed to rebuilding the town as a model sustainable rural community.

Experts from the U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) are working with city leaders, business owners, and residents to identify ways to incorporate energy efficiency and renewable energy technologies into the new buildings. Ultimately, these technologies could be replicated in other communities recovering from disaster.

Kiowa County Memorial Hospital

The original Kiowa County Hospital was destroyed in the tornado and rebuilt green. In fact, the hospital's design team took one of the most energy-intensive building types and designed a first-of-its kind energy-efficient hospital, while still meeting functional and safety requirements.

The 50,000 square-foot building includes 15 acute-care beds, rural health and specialty clinics, an emergency department with two trauma rooms, physical/occupational therapy and radiology departments, a laboratory, and other support areas.

The new hospital in Greensburg is projected to achieve more than 40% energy savings when compared to a hospital built to standard code thanks to features such as an on-site wind turbine.

100% Renewable Energy, 100% of the Time

The Greensburg Wind Farm consists of 10 1.25 megawatt (MW) wind turbines that supply 12.5 MW of renewable power to the town. That's enough energy to power every house, business, and municipal building in Greensburg.

The town will use only about 1/4 to 1/3 of the power generated to reach its "100% renewable energy, 100% of the time" goal.

Excess power will be placed back on the grid and offered as renewable energy credits for other Kansas Power Pool and NativeEnergy customers.

The wind farm was completed in the spring of 2010. John Deere Renewable Energy built the wind farm and maintains the project. It was funded by the U.S. Department of Agriculture Rural Development.



High performance windows increase natural light, decreasing electricity costs.



The building features tile that is manufactured regionally and made from recycled content.

LEED® Platinum

Completed in March 2010, the Kiowa County Memorial Hospital is built to achieve the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Platinum designation. If awarded, the hospital will be the first critical access hospital in the nation to achieve the LEED Platinum rating.

NREL, with the support of DOE, provided technical assistance to determine the most cost-effective energy efficiency strategies. Many of the efficiency measures included in the Kiowa County Memorial Hospital have been incorporated into the *Advanced Energy Design Guide for Small Hospitals and Healthcare Facilities*, an energy efficiency guide developed by DOE/NREL in collaboration with national professional societies.

Energy Conservation

In order to reach their LEED Platinum certification goal, the hospital design team had to consider and implement numerous energy conservation and

efficiency measures, including lighting; insulation; heating, ventilation, and air conditioning (HVAC); and renewable power sources.

Lighting

- Highly efficient T5 fluorescent and compact fluorescent luminaries maximize energy efficiency without sacrificing visual comfort or patient care
- LED sources for accent lighting, exterior walkways, and parking lot lighting provide energy-efficient illumination
- Light-sensing dimmers and motion sensors minimize artificial light use
- Daylighting in common spaces, corridors, patient rooms, and administration areas illuminates 75% of the interior
- High performance, low-E, double-glazed windows allow natural light to offset electrical lighting

“ The tornado not only destroyed our community and hospital—it caused a major shift in how we make decisions. In rebuilding, we learned not to look at the initial cost only, but to look at environmental impact, long term cost savings, and sustainable and renewable resources. ”

Mary Sweet, Administrator
Kiowa County Memorial Hospital



Daylighting in corridors illuminates 75% of the hospital's interior.

Building Envelope and Insulation

- R-25 sprayed polyurethane foam on precast panels and interlocking metal studs provides a continuous thermal break
- Spray-sealed joints on top, bottom, and between panels provides a vapor and air barrier

HVAC

- Ultra high-efficiency magnetic bearing chiller with secondary unit reclaims waste heat for reheat and domestic water heating
- Ventilation air is pre-conditioned via energy recovery wheels, reducing the load on heating and cooling systems
- Variable air volume system provides air distribution and dynamically adjusts air flow to meet loads while maintaining pressurization

Wind Power

- On-site, grid-tied, 50 kilowatt (kW) wind turbine generates 220,000 kWh annually to partially off-set the hospital's energy use

Sustainable Features

The new hospital includes numerous sustainable features to help reduce overall water use by 57%. Additionally, the features provide the site with a healthy indoor and outdoor environment for the hospital's employees, patients, and visitors.

Sustainable Site

The integrated building design of the hospital provides quality views from all patient rooms, while walking paths incorporated into the healing garden and patio microclimate promote the healing strategies of the hospital. Patients and visitors can walk the paths and, through built-in signage, learn what LEED certification is and how the hospital plans to achieve it. Light colors are used on the building's roof and paved areas to reduce the ground heat-island effect.

Water Efficiency

The hospital has reduced waste water by 50% thanks to an on-site bioswale filtration system that removes impurities from excess rainwater and facility gray water (laundry, showers, and lavatories). Low-flow fixtures are used

throughout the hospital and collected rainwater is used to flush toilets. Collected rainwater also provided initial landscape irrigation.

Materials

Hospital design team members set a goal to use recycled materials for 30% of the building's materials. Interior finishes, including tile and recycled rubber floors, help to meet this goal.

Air Quality and Indoor Environment

With the majority of patients, visitors, and staff inside the hospital, an environment that is safe, sanitary, and comfortable is imperative. To create this environment, the hospital utilizes a ventilation system that prevents air exchange between emergency and isolation areas and the rest of hospital, and demand-control ventilation to ensure continuous fresh air and appropriate carbon dioxide levels. Since Kansas weather can become very humid, a rain screen system on the hospital's exterior provides moisture control. The hospital uses a filmless x-ray, which eliminates the need for dangerous chemicals, and seamless countertops and floors to help reduce infection rates.

An on-site filtration system helps reduce wastewater by 50%.



Design Team

Owners:

Kiowa County

Construction Manager:

Murray Company

Architect:

Health Facilities Group, LLC

Mechanical and Plumbing Engineering:

Midwest Engineering, Inc.

Electrical Engineering:

Professional Engineering Consultants

Civil Engineering and Landscape:

MKEC Engineering Consultants, Inc.

Energy Modeling:

Midwest Engineering, Inc.

Chapek Engineering

Commissioning:

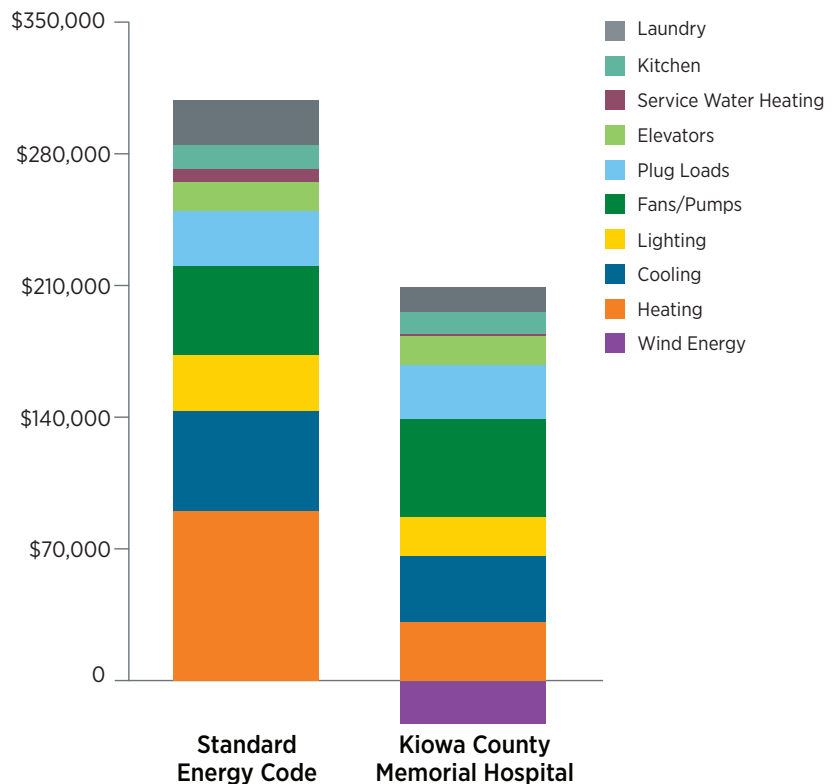
Midwest Engineering, Inc.

Results

According to energy analysis modeling results, the new hospital is 32% more energy efficient than an ASHRAE-compliant building of the same size and shape. Applying the savings from the 50 kW wind generator, the hospital achieves an additional 8% in annual electrical savings for a total savings of approximately 40%.

Thanks to the high-efficiency HVAC and heat recovery system, the efficient building envelope, and the City of Greensburg's 12.5 MW wind farm helping to provide power, the hospital was able to eliminate the need for an expensive boiler backup system, as well as the gas service, piping, and equipment flues associated with natural gas fired heating equipment. These savings offset the cost of the heat recovery system and high-efficiency equipment and make the hospital an electricity-only site.

Annual Energy Cost Savings



Energy modeling indicates that annual energy costs for a building similar to Kiowa County Memorial Hospital built to standard code (the left column) would be approximately \$308,700. The right column represents the expected annual energy costs for Kiowa County Memorial Hospital. Thanks to the Greensburg Wind Farm, on-site wind turbine, and other energy efficiency measures, the hospital's total annual energy costs are expected to be approximately \$186,100—a reduction of more than 40%.

Cover photo credit: Catherine Hart, Greensburg GreenTown/PIX 17013.
Pages 2-4: Joah Bussert, Greensburg GreenTown/PIX 17015, 17042, 17040, 17041, and 17043.

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Energy Efficiency &
Renewable Energy

For additional information please contact:
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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

This document is one in a series of documents outlining the options for and benefits of rebuilding green after a disaster. The series draws on lessons learned by teams from the U.S. Department of Energy and its National Renewable Energy Laboratory as they helped the townspeople of Greensburg, Kansas, rebuild green after a devastating tornado. To see the other documents in this series, visit www.buildings.energy.gov/greensburg/.

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