



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 Courthouse

Originally built in 1914, Kiowa County Courthouse is one of the few buildings that survived the force of the Greensburg tornado: 205-mile-per-hour winds that left a path of destruction 1.7 miles wide. However, the building did not go unscathed; it was severely damaged by a vehicle that crashed through the roof, allowing rain to fall inside for three days and cause interior damage. Luckily, most of the County's paperwork was salvaged thanks to quick action taken by the community the day after the tornado.

The renovated tri-level Kiowa County Courthouse is projected to save \$23,800 annually on energy costs. It houses the County health, extension, and appraiser offices; Treasurer's, Register of Deeds, County Clerk, and County Commissioner's offices; and the courtroom, district court, County Attorney, and district judge offices.

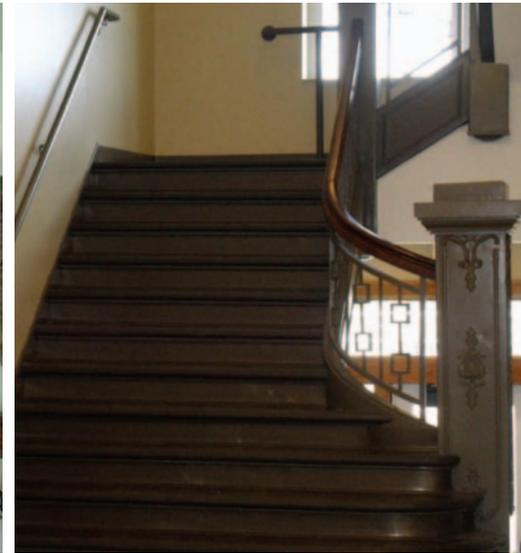
100% Renewable Energy, 100% of the Time

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.



The courthouse's original handcrafted decorative banister and railing system (shown to the left during initial renovation) were brought up to code and refinished with environmentally friendly stains, sealants, and paints (right).

Broken windows and chunks of missing brick removed by flying debris added to the sustained damage, but the concrete walls of the courthouse remained intact. Rather than tear down the building, the County chose to restore and renovate a piece of local history.

LEED® Gold

Completed in July 2009, the building was renovated with sustainable and energy-saving technologies while staying true to the structure's original design. It is designed to meet the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Gold designation. If awarded, it will be the first courthouse in Kansas to achieve the rating.

NREL, with the support of DOE, provided technical assistance and energy modeling training to the design team so that the most cost-effective energy strategies were well integrated.

Energy Conservation

Thanks to a state-of-the-art renovation plan, the courthouse has implemented the following measures.

Lighting and Daylighting

- The building was originally designed to be daylit and naturally ventilated, as electric lights or air conditioning were not yet available; the renovation plan attempted to make full use of the original daylighting design while using high-efficiency lighting and controls
- Broken windows were replaced with high-performance low-E windows; existing windows were restored to allow for more daylighting
- Dimming sensors and controls in the court room and all office spaces allow lighting to automatically adjust based on the amount of natural daylight available
- Motion sensors turn lights off when spaces are unoccupied
- High-efficiency troffer-style light fixtures use 1/3 less energy than standard acrylic troffers
- A lighting relay system sweeps all lights off at a predetermined time
- Low-wattage high intensity discharge and light emitting diode lamps provide parking, ambient, and façade lighting

“ The renovated courthouse is far more energy-efficient than the original. We have blown in foam insulation and replaced the old glass block windows with energy-efficient windows so that there are no leaks. In addition, geothermal wells and computerized lighting have cut our energy costs by half, and we believe we will save 200,000 gallons of water per year with our 15,000-gallon cistern. These improvements have created a much improved working environment for our employees. Any costs incurred by going green will be recouped in a few years, returning savings to the County for other worthwhile projects. ”

Gene West, Kiowa County Commission Chairman



The door on the east entrance to the courthouse was restored to match the original entrance as closely as possible.

Building Envelope and Insulation

- Existing brick veneer and 17-inch-thick concrete structure were salvaged
- Spray-foam insulation added to the interior of the existing walls and roof deck saves on heating and cooling costs and prevents mold
- High-performance glass minimizes solar gain and heat loss

Heating, Ventilation, and Air Conditioning

- An all electric multi-stage ground source heat pump system extracts heat and cold from the ground through a series of thirty-two 300-foot-deep wells
- Water is circulated throughout the building to individual heat pumps using energy from the loop system to condition spaces using high-efficiency motors, fans, and compressors
- Outdoor air is provided to each heat pump with exhaust recovery ventilators
- A variable speed fan modulates the outside air flow based on carbon dioxide sensors in the courtroom gallery

Sustainable Features

The renovation of the courthouse allowed designers to address building code, accessibility, health, and safety issues in addition to making the building a true symbol of Greensburg's strength and sustainability.

Water Efficiency

As part of a rainwater harvesting system, filters were added to existing downspouts to divert clean rainwater to a 15,000-gallon underground storage tank. When needed, a pump filters the stored rainwater into an indoor filtration/holding tank where it is used to flush toilets throughout the building, saving an estimated 20,000 gallons of water each month. Dual flush toilets, waterless urinals, and low-flow lavatories and shower heads reduce the amount of potable water demand by an estimated 70%.

Salvaged Materials

In addition to the original concrete walls, the restoration team salvaged and refurbished all the original wood doors throughout the courthouse. The west and north doors, special to the courthouse because of the handcrafted

and historical decorative glazing throughout, were also restored. More than 96% of the original hexagonal tile floor was recovered. In areas where the tile was not salvageable, the design team specified similar hexagonal floor tile to match. The new and old tiles match so well that most visitors cannot tell where the original tile and new tile are patched together.

Existing benches for seating in the courtroom were salvaged as well as shelving units in the courthouse. A handcrafted decorative banister and railing system along the open west stairwell was updated and brought up to code and refinished using low volatile organic compound stains, sealants, and paints.

Waste Management Plan

During the reconstruction process, a waste management plan was implemented to designate controls and contractually mandate that the plan be followed. Recycled items were sorted on site, individually weighed at the local CO-OP, and then sent to the Recycle Center at the South Landfill. No one was allowed to throw away any waste without clear justification.

A ground source heat pump system helps eliminate the need for centralized equipment like boilers and chillers.



These efforts were an enormous success, diverting more than 2 million pounds—or 96%—of waste from the landfill. Additionally, Kiowa County has been able to use the diverted recycled materials, such as crushed concrete, as an aggregate base for roads and other building projects.

Design Team

Owners:

Kiowa County, Kansas

Builder and Construction Manager:

Coonrod & Associates Construction Co., Inc.

Structural, Mechanical, and Electrical Engineering:

Professional Engineering Consultants

Energy Modeling:

Professional Engineering Consultants

National Renewable Energy Laboratory

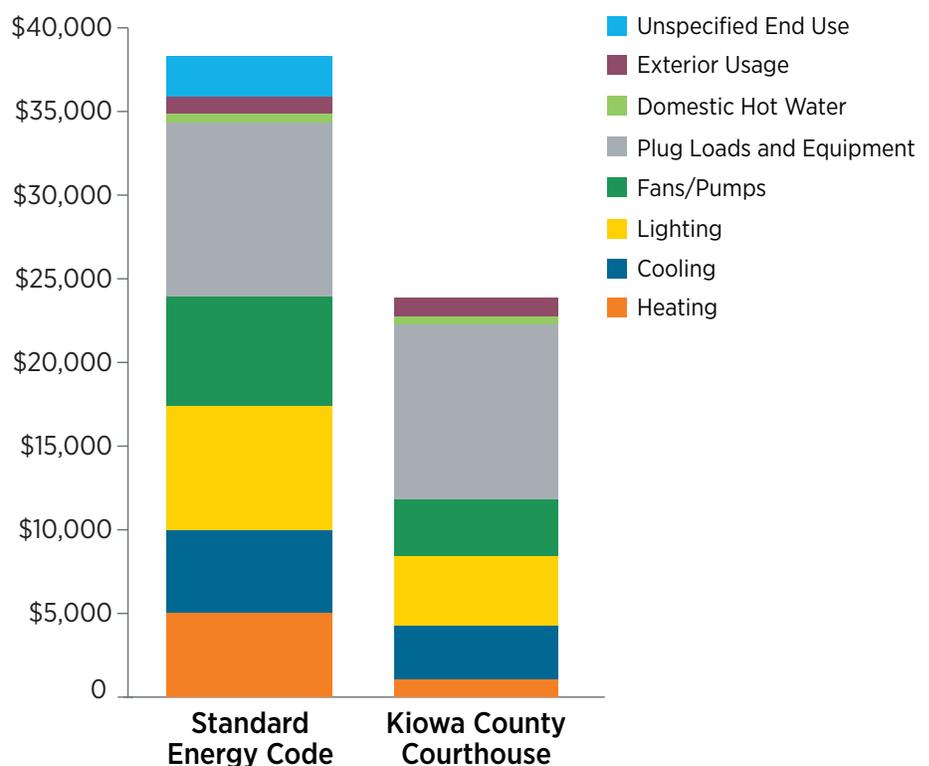
Commissioning:

Allied Laboratories

Results

According to energy analysis modeling results, Kiowa County Courthouse is 37% more energy efficient than an ASHRAE 90.1-2004 energy code minimum courthouse. Maintenance costs are expected to be greatly reduced due to the ground source heat pump system. Life expectancy of the system is projected to increase due to the elimination of centralized equipment such as a chiller and boiler. Additionally, the all-electric heating and hot water system takes advantage of the abundant renewable electricity from the Greensburg Wind Farm.

Annual Energy Cost Savings



Energy modeling indicates that annual energy costs for a building similar to the original Kiowa County Courthouse built to standard code (the left column) would be approximately \$38,300. The right column represents the expected annual energy costs for the refurbished Kiowa County Courthouse. Thanks in part to the ground source heat pump system, energy-efficient lighting, and the Greensburg Wind Farm, the courthouse's total annual energy costs are expected to be approximately \$23,800—a reduction of more than 37%.

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Renewable Energy

For additional information please contact:
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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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