



## 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.

### City of Greensburg SunChips® Business Incubator

One year after the tornado, construction began on the new City of Greensburg SunChips® Business Incubator. The goal was to create a building that would provide affordable office space for small, start-up businesses in the town. The \$2.9 million building was funded by the United States Department of Agriculture (USDA), Frito-Lay SunChips division, and actor Leonardo DiCaprio.

### LEED® Platinum

The City of Greensburg passed a resolution that all new city-owned buildings would be built to the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Platinum standards. To help accomplish this goal, NREL, with the support of DOE, provided technical assistance and conducted highly advanced life-cycle energy models to optimize the design of the building and determine the most cost-effective energy strategies.

The new Business Incubator in Greensburg is projected to achieve more than 50% energy savings when compared to a similar building constructed to standard code. This is due in part to renewable energy features such as a 6.8-kilowatt (kW) photovoltaic system and ground source heat pump system.

## 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.

Completed in the spring of 2010, the wind farm was built and is being maintained by John Deere Renewable Energy.



White paint on the overhanging air system maximizes daylight from above.



Energy-saving continuous dimming controls are used in retail spaces like the Green Bean Coffee Co.

Completed in May 2009, the Business Incubator not only achieved LEED Platinum status with greater than 50% energy savings—it became the first LEED Platinum certified municipal building in Kansas. The 9,580-square-foot building features five street-level retail shops and nine second-level professional service offices. It provides an affordable, temporary home where businesses can grow over a period of several years before moving out on their own to make way for new start-up businesses. The wide variety of merchants and professionals that occupy the Business Incubator are both long-time and new Greensburg residents.

### Energy Conservation

As a LEED Platinum building, the Business Incubator incorporates the following energy efficient and renewable energy technologies and practices.

#### Lighting

- Even with an east-facing store front, glazing was oriented to optimize south- and north-facing daylighting and passive solar gain, while controlling summer gains with overhangs

- East-facing glazing was recessed to minimize early morning glare and unwanted solar gain
- Strategic window placement and south-facing clerestories provide natural daylight, which allows artificial lighting to be turned off, resulting in significant energy savings for the building
- Skylights that have a reduced solar heat gain coefficient compared to a conventional unit help reduce space heating demand in the winter and control it in the summer
- Motion sensors are used in all zones except the retail spaces, which feature continuous dimming controls to maintain a constant light level, resulting in an additional 5% to 10% energy savings over the life of the light bulbs
- The 3-step dimming controls in the offices decrease costs by taking advantage of daylight to gradually reduce the amount of lighting output
- These measures reduced the lighting power density by 31% from a conventional building

“ The Incubator is doing exactly what it’s supposed to do—right in the middle of rural America. We’re helping to hatch businesses, turn them on to Main Street, and bring new ones into their Incubator spaces. ”

Bob Wetmore  
Greensburg Economic Development Director



The geothermal heat pump system provides heating and cooling to the building.

### Insulation

- Continuous R-22 insulated concrete form walls increase efficiency and durability
- Continuous R-30 above-deck roof insulation saves energy
- R-10 insulation in the concrete slab perimeter minimizes heat loss

### Heating, Ventilation, and Air Conditioning (HVAC)

- A specialized ground source heat pump system provides heating and cooling by extracting both through 21 vertical well shafts, 340 feet deep each
- The all-electric heating and hot water system takes advantage of the abundant renewable electricity from the Greensburg Wind Farm
- The heat pumps use high-efficiency variable speed motors and fans
- Each heat pump has an enthalpy-controlled economizer and employs demand control ventilation in which a carbon dioxide sensor is used to determine the correct amount of outdoor air required

- An energy recovery ventilator system optimizes energy used to heat and cool the building
- Ultrasonic/infrared combination sensors control the amount of HVAC needed based on room occupancy

### Building Control Systems

- Sophisticated building management software and a dedicated computer server constantly monitor and optimize all building functions, including fire and safety

### Solar Power

- A 6.8-kW photovoltaic system provides approximately 10% of the building’s total energy needs

### Sustainable Features

To earn a LEED Platinum rating, the Business Incubator building incorporates sustainable practices in addition to energy efficiency to provide a healthy indoor and outdoor environment for the building tenants and visitors.

### Water Efficiency

Rainwater and water from the building’s sinks and showers is collected to supplement the graywater system, which flushes toilets and provides landscape irrigation. Rain gardens and other best-management practices for stormwater collection allow water to naturally re-enter the underground reservoirs in the earth.

### Materials and Resources

Building materials were chosen for storm resistance, durability, and low maintenance. Walls were designed for wind resistance and a rainscreen system with cement fiberboard panels provides moisture protection. Color-coded recycle bins are located throughout the building. Environmentally-friendly cleaners and recycled paper products are used whenever possible.

### Air Quality and Indoor Environment

The bathroom exhaust fans use a 70% total effective energy recovery ventilator that also provides the minimum outdoor air for each space.



Studio 54 Glass Art not only occupies a green building, but also sells green by collecting glass debris left over from the tornado and incorporating it into pieces of jewelry and stained glass.



## Design Team

### Owners:

City of Greensburg

### Builder:

Compton Construction Corporation

### Architect:

MVP Architects

### Mechanical, Electrical, and Plumbing:

Professional Engineering Consultants, P.A.

### Site Design:

BNIM and Professional Engineering Consultants, P.A.

### Floor Plan/Layout Design:

McCluggage Van Sickle & Perry

### LEED Consultant:

BNIM

### Energy Modeling:

National Renewable Energy Laboratory

### Commissioning:

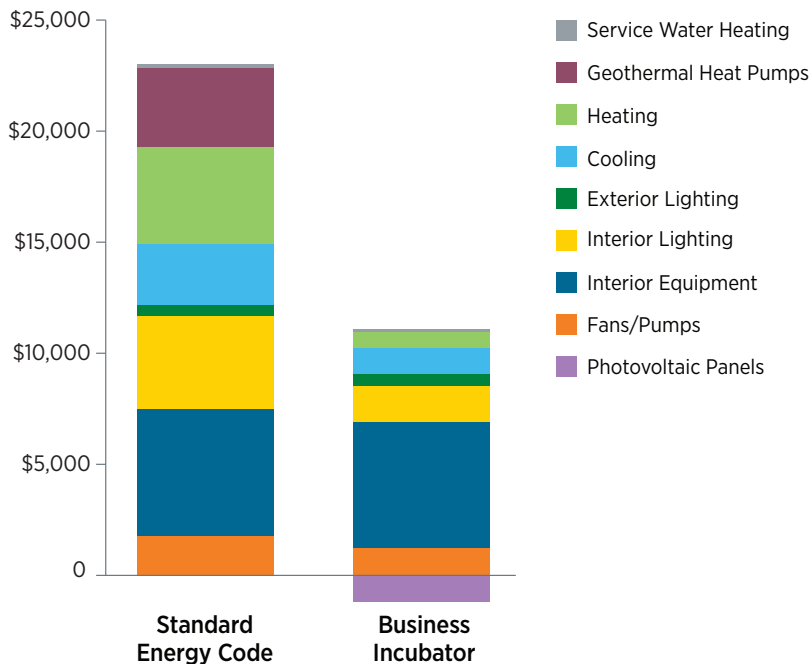
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## Business Incubator Already a Success

Studio 54 Glass has occupied the Business Incubator building since February 2009 and is benefitting from the low rent, low utilities, and general low cost of doing business. Owner Scott Reinecke has noticed other benefits too, such as a decrease in the build-up of dust on their shelves and automatic lighting that can be controlled to highlight their displays. The central location of the building and popularity due to the media attention Greensburg has received has brought in customers from all around the world.

The Kiowa County Economic Development and Kiowa County Chamber of Commerce office is also conveniently located in the Business Incubator building and helps start-ups write their business plan and secure funding. One business has already been successful enough to move out of the building and into a new retail development across the street. Greensburg Economic Development Director Bob Wetmore is actively working with more than 30 prospects interested in moving into the building and the surrounding county.

## Annual Energy Cost Savings



Energy modeling indicates that annual energy costs for a building similar to the Business Incubator built to standard code (Standard Energy Code column) would be about \$23,000. The right-hand column represents the expected annual energy costs for the Business Incubator building—a savings of more than 50%. Lighting power density is reduced by 31% from a conventional building and the photovoltaic system will provide approximately 10% of the building's total energy needs. The geothermal heating system will reduce annual energy costs by more than \$3,500.

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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/](http://www.buildings.energy.gov/greensburg/).

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