

# Rebuilding Green in Greensburg, Kansas:

Lynn Billman – Power Lunch – June 23, 2009

May 4, 2007 9:40 PM



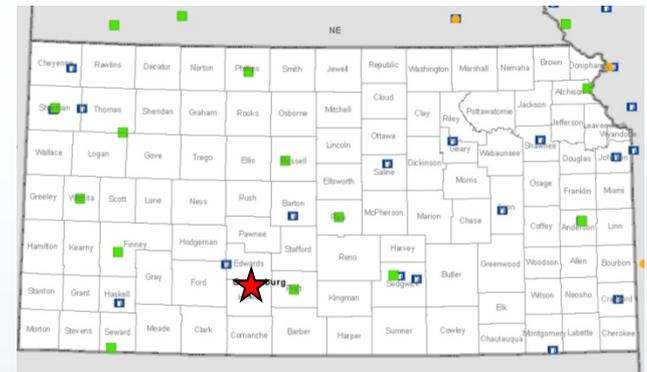
# Rebuilding Green in Greensburg, Kansas:

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May 5, 2007



# Greensburg, Kansas



- Typical midwestern farming community
- Population peaked at 2,000 in 1960; declined to 1,400 by 2006
- Older population: median age 45.6
- Low income population: \$18,054 average per capita; 8.4% below the poverty line



# Life Changing



- EF5 tornado, 205 mph winds, 1.7 miles wide
- 11 killed
- 95% of buildings destroyed or damaged



# Many Helping Hands

## City of Greensburg, Kansas



GREENSBURG  
GreenTown™



MIDWEST RESEARCH INSTITUTE

BNIM

ARCHITECTS



FEMA



EPA United States Environmental Protection Agency



<b>Name</b>	<b>Organization</b>	<b>Task</b>
Ren Anderson	NREL	Residential Building
Lynn Billman	NREL	Project Lead
Eric Bonnema	NREL	Commercial Building Support
Mary Colvin	NREL	Technology Manager
Alex Dane	NREL	Building Codes
Trudy Forsyth	NREL	Wind Energy
Mason Earles	Greensburg GreenTown	Onsite Coordination and Support
Chris Gaul	NREL	District Energy Systems, Biomass
Rachel Gelman	NREL	Biomass Resource Analysis
Alana Goodman	Greensburg GreenTown	Onsite Coordination and Support
Scott Haase	NREL	Biomass Utilization
Gerry Harrow	NREL	Alternative Transportation
Al Hicks	NREL	Communications
John Holton	IBACOS	Residential Building, Building Codes
Rene Howard	Consultant	Communications
Joe Lstiburek	Building Science Corp	Residential Building
Alex Lukachko	Building Science Corp	Residential Building
Anelia Milbrandt	NREL	Resource Assessment
Ruby Nahan	NREL	Communications
Dale Osborn	Distributed Generation Systems	Wind Energy
Dave Peterson	NREL	Biomass Resource Analysis
Betsy Pettit	Building Science Corp	Residential Building
Shanti Pless	NREL	Commercial & Public Buildings
Lauren Poole	NREL/Consultant	Communications
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Emily Schlickman	Greensburg GreenTown	Onsite Coordination and Support
John Thornton	Consultant	Renewable Generation - Solar
Andy Walker	NREL	Renewable Energy Analysis
Daniel Wallach	Greensburg GreenTown	Onsite Coordination and Support
Michael Wentz	Building Green	Buildings Database
John Wickland	Greensburg GreenTown	Onsite Coordination and Support
Tom Wind	Wind Utility Consulting	Wind Energy

# DOE/NREL Greensburg Team

- 34+ People (NREL and Subs)

# DOE/NREL Work Scope

Reduce  
Energy  
Use

- High-Performance Homes
- High-Performance Public and Commercial Buildings
- Renewable Energy – Community Scale
- Renewable Energy – Distributed Scale
- Alternative Transportation
- Onsite Coordination /Project Mgmt

Use  
Renewable  
Energy

Reduce  
Gasoline/  
Diesel Use

# Community Master Plan (BNIM)

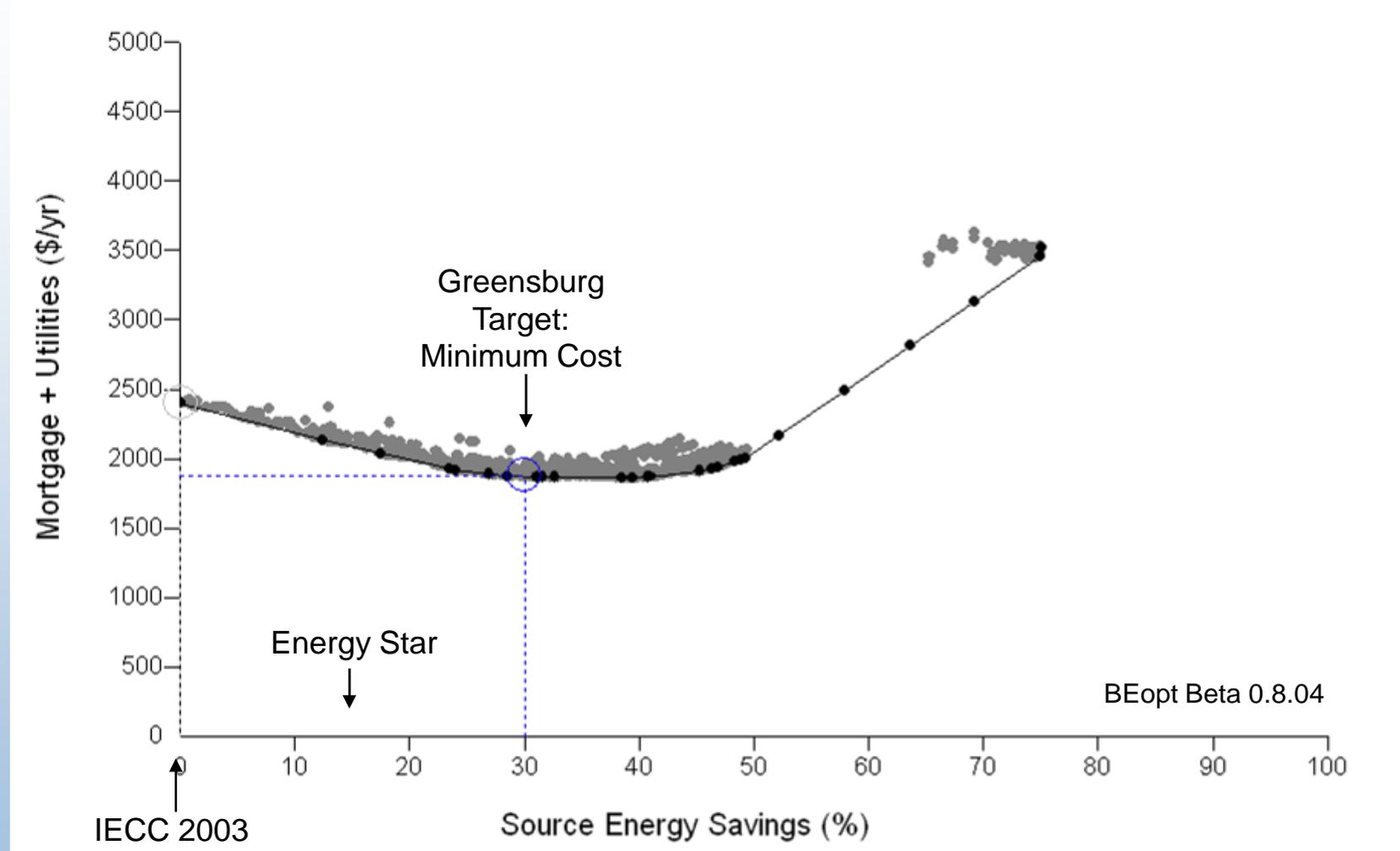


Greensburg  
Sustainable Comprehensive Plan

05.19.08



# High-Performance Homes: Designing for 30% Energy Cost Savings\*



(2000 ft<sup>2</sup>, 2-story, 16% window to floor area ratio), unconditioned basement

\*Compared to International Energy Conservation Code 2003

# Encouraging 30% or Better Energy Efficient Homes

- Gave residents info on saving money with efficiency
- Provided onsite architect to help individual homeowners esp during biggest building period
- Provided training and info for local builders, architects, engineers
- Developed full set of (free) 50% efficient house plans



<b>Cost Savings</b>	
Estimated Incremental First Cost Relative to Standard Practice	\$4,000
Annual Amortized Cost 7%, 30Year mortgage	\$211
Estimated Annual Utility Bill Savings	\$723
<b>Net Annual Savings</b>	<b>\$512</b>

# Residential Efficiency Results

- New homes average ~43% energy cost savings compared to code (HERS ratings)
- Renovations average 25% energy cost savings
- 32-unit townhome rentals; up to 50 Mennonite Housing single-family; several from a large builder should be ~50% energy cost savings (LEED Gold or Platinum level)



Prairie Point Townhomes



Commercial Group



Mennonite Housing

\*Compared to International Energy Conservation Code 2006

# High-Performance Commercial and Public Buildings

Building	Owner	Size (sf)	Design Intent	Certified Award
SunChips Business Incubator	City of Greensburg	9,580	LEED Platinum, 50% energy savings	
City Hall	City of Greensburg	4,700	LEED Platinum	
Kiowa Courthouse (Renovation)	Kiowa County	18,600	LEED Gold	
Kiowa County Commons	Kiowa County	14,800	LEED Platinum	
Kiowa County Hospital	Kiowa County	48,500	LEED Platinum	
Greensburg K-12 School	USD422		LEED Platinum	
5.4.7 Art Center	5.4.7	1,670	LEED Platinum	LEED Platinum
Prairie Point Townhomes (32 units)	Kiowa County	24,000	LEED Gold	LEED Platinum
BTI Equipment John Deere Dealership	BTI Equipment	30,000	LEED Platinum, 42% energy savings	
Dillon's Market	Dillons	8,000	High Efficiency	
Dwane Shank General Motors Dealership	Dwane and Ester Shank	8,300	LEED Certified	

# Greensburg Business Incubator

- LEED Platinum
- 53% energy cost savings
- GSHP, 6.8 kw PV



# Greensburg K-12 School

- LEED Platinum
- 25 kBtu/ft<sup>2</sup> site energy use (50% savings)
- Wind turbine planned
- Open August 2010



Greensburg High School Green Club



Courtesy of BNIM architects



# Greensburg / Kiowa County Hospital

- Goal:
  - 35% energy savings
  - LEED Platinum
- Efficiency Strategies
  - Daylighting in patient rooms, nurse's stations, and transition
  - High efficiency chiller with water side economizer and energy recovery
  - Wind turbine planned (50-250 kW)
- Partner with DOE / NREL for Energy Smart Hospitals

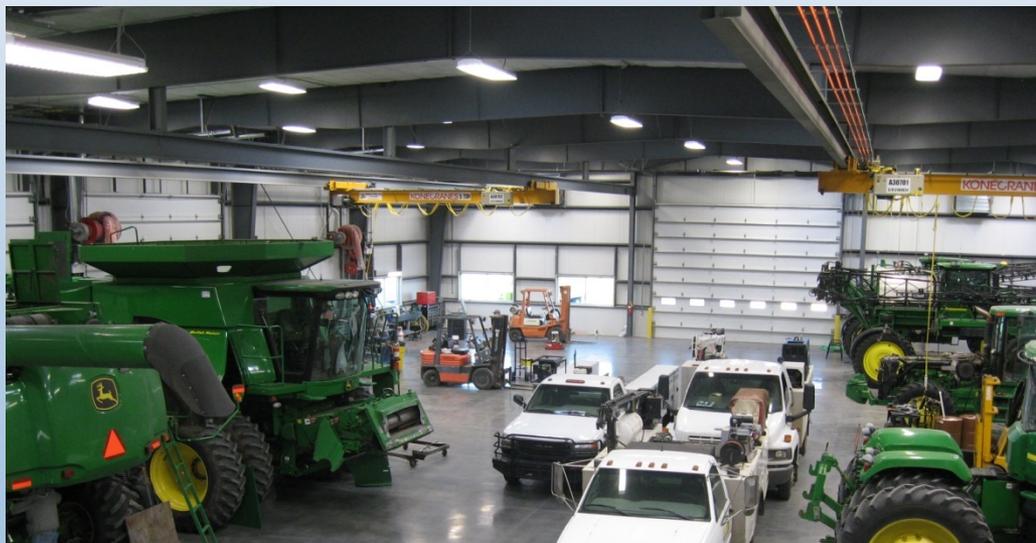


August 15, 2007



# BTI Equipment /John Deere

- Goal:
  - 50% energy cost savings
  - LEED Platinum
- Efficiency Strategies
  - Fully daylight retail and service
  - Waste oil boiler, corn/biomass pellet boiler
  - 2 Wind turbines (4 kW, 1.8 kW, 10% of load)
- JD now a partner in DOE/NREL “National Accounts”
- All JD dealerships urged to follow this example



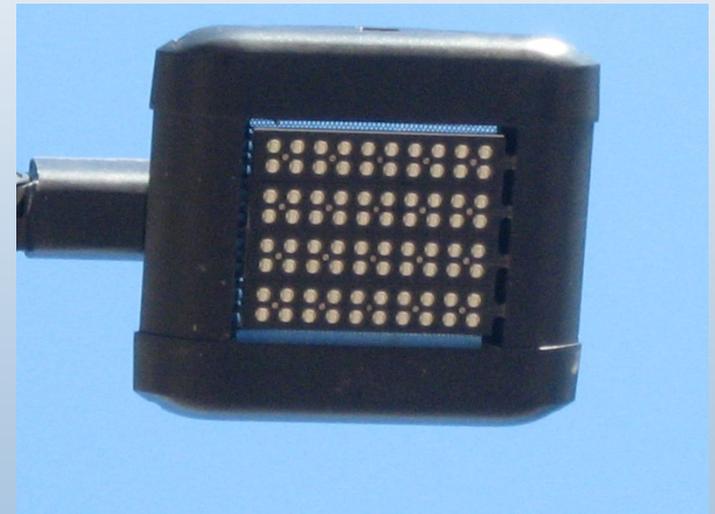
# Green Economic Development

- BTI Equipment launched a new wind business
  - North American distributor for Endurance wind turbines out of Canada
  - In nine months, 120 new wind jobs and 300 retrained sales reps
- Several visits to NWTC



# First Community in U.S. to Have All LED Streetlights

- 40% more energy efficient
- 70% less operating costs



# GreenTown and Eco-Tourism: Silo Eco-Home



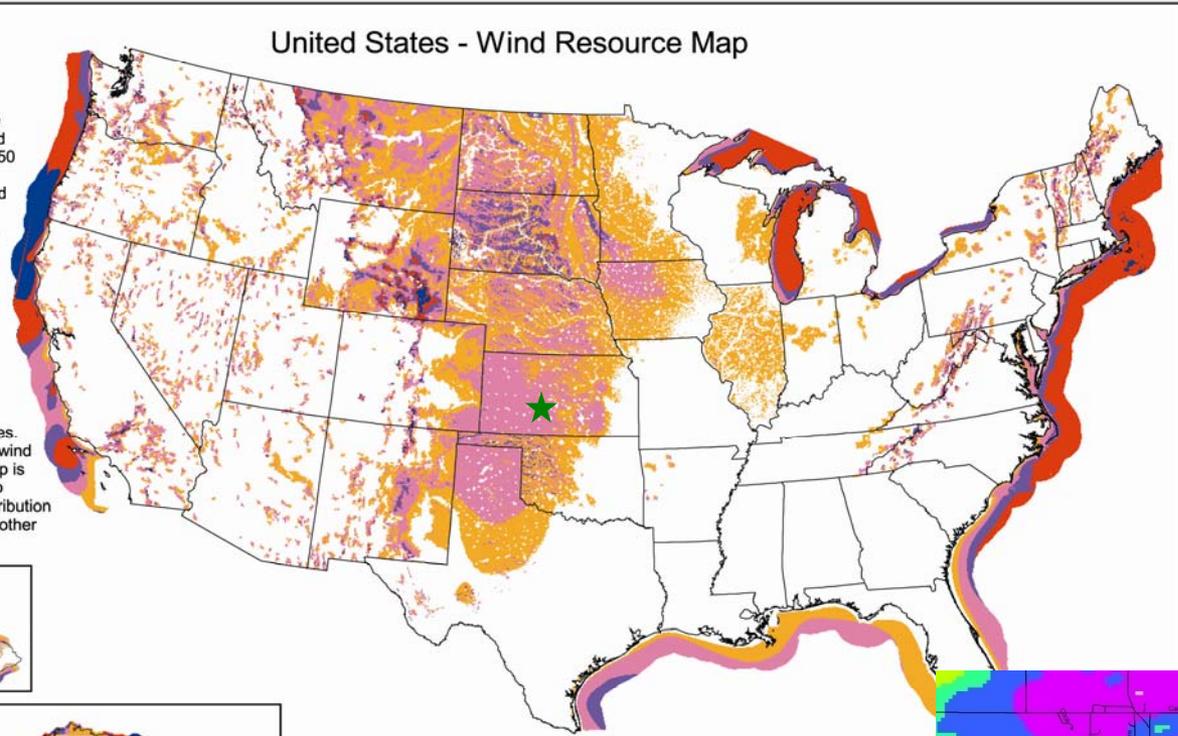
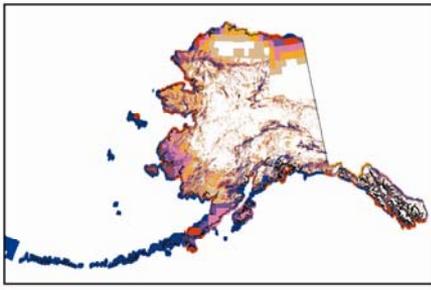
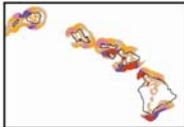
# Community Wind Power: The Obvious Choice for Greensburg

Class 4: 16 mph at 50 meters



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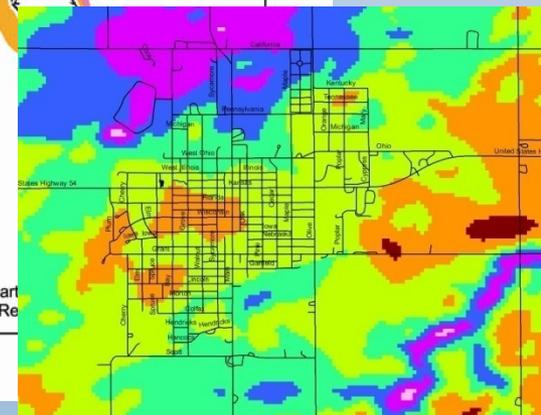
unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.



United States - Wind Resource Map

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m <sup>2</sup>	Wind Speed <sup>a</sup> at 50 m m/s	Wind Speed <sup>a</sup> at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

<sup>a</sup>Wind speeds are based on a Weibull k value of 2.0



U.S. Department of Energy  
National Renewable Energy Laboratory

# Wind Project in Process

- 4 megawatts peak before tornado
- Encouraged city to pursue wind turbine ownership (partnership flip structure)
- Found them a different power purchaser (traditional rural coop resisted)
- Visited Lamar and Springfield, Colorado
- Three rounds of wind resource data
- Developing 12.5 MW Greensburg Wind Farm
- Probable groundbreaking Aug 2009



Wind farm in  
Lamar, CO

Wind  
measuring  
equipment in  
Greensburg



# Other Distributed Renewables

- Ground Source Heat Pumps
  - Kiowa County Courthouse renovation
  - Waters home
- Photovoltaics



# Biomass Energy for Greensburg

## Wood Residues

Eastern Red  
Cedar

## Agricultural Residues

Corn stover  
Wheat straw  
Sorghum residue  
Soybean residues



County	Residues Available (bd/yr)									
	Wheat	Corn	Sorghum	Soybean	Sunflower	Cotton	Logging Residues	Other Forestry Removals	Corn Cobs	Total
<b>Barber</b>	25,283	407	4,004	1,337	46	210	161	2,818	623	34,888
<b>Barton</b>	74,604	17,556	47,399	14,320	222	-	22	-	14,760	168,882
<b>Clark</b>	469	-	9,681	345	-	-	-	-	218	10,713
<b>Comanche</b>	3,835	285	5,357	627	-	-	-	-	450	10,554
<b>Edwards</b>	31,955	39,921	18,599	21,961	60	-	-	-	31,913	144,409
<b>Ford</b>	55,368	22,632	53,863	10,214	136	-	-	-	21,533	163,765
<b>Harper</b>	96,815	146	9,270	1,821	65	496	0	-	135	108,687
<b>Hodgeman</b>	21,536	2,228	18,130	1,287	-	-	-	-	4,200	47,380
<b>Kingman</b>	78,586	5,270	8,869	6,458	185	-	-	-	3,810	103,177
<b>Kiowa</b>	17,281	15,562	12,205	12,255	24	-	-	-	15,113	72,438
<b>Pawnee</b>	59,127	21,710	35,327	16,494	52	-	-	-	18,915	151,626
<b>Pratt</b>	58,679	38,472	19,270	17,711	377	1,122	-	12,500	33,533	181,663
<b>Reno</b>	89,693	13,495	51,240	22,829	1,253	-	15	-	13,118	191,642
<b>Rice</b>	111,254	14,194	50,816	15,130	931	-	24	-	8,190	200,539
<b>Stafford</b>	35,258	18,182	20,366	14,845	85	-	-	-	31,935	120,670
<b>Total</b>	<b>759,742</b>	<b>210,058</b>	<b>364,416</b>	<b>157,632</b>	<b>3,435</b>	<b>1,768</b>	<b>222</b>	<b>15,318</b>	<b>198,443</b>	<b>1,711,034</b>

# City Policies

- Completed City RE policies
  - Interconnection agreement
  - Net billing policy
  - Wind ordinance
  - Solar ordinance
- Green Building Program
  - Voluntary residential: MOU with Kansas chpt of NAHB
  - Working on IECC 2009



# Sharing the Lessons

## Rebuilding It Better

BTI-Greensburg  
John Deere Dealership



Greensburg, Kansas A Better, Greener Place to Live

"The biggest success story in Greensburg, to me, has been the residency and determination of our citizens to make a difference in their world. We're new pioneers in the sustainability movement."

— Greensburg Mayor Bob Dixon

### There's No Place Like Home

Greensburg, Kansas in Midwestern farm country. Its 900 residents are hard-working people who love their home and their way of life. They simply will not give up when it comes to making their community a better place to live.

After the town was nearly wiped out by a massive tornado in May 2007, citizens saw the opportunity to make Greensburg something even better than it had been before. Living close to the land, they knew the value of solar and wind power and using water efficiently. When they rebuilt, they took those values to heart in a new way. The result: Greensburg is a truly green burg. It is a model of sustainable living and a standard for rural communities everywhere.



Blessed with a unique opportunity to create a strong community devoted to family, fostering business, [and] working together for future generations.

— Greensburg's Community Vision Statement

### A Vision for the Future

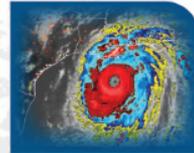
Within months of the tornado, Greensburg residents came together to create a new vision for the future. They wanted to do more than rebuild. They turned disaster into opportunity—not just for themselves but for communities like theirs all over the world.



A Better, Greener Place to Live Greensburg, Kansas



## Rebuilding After Disaster: Going Green from the Ground Up



DRAFT



## From Tragedy to Triumph—Rebuilding Green Homes after Disaster

### About Green Homes

A green home can save you thousands in utility bills and make your home a healthier and more comfortable place to live. Green homes save money with energy-saving features such as effective insulation, high-performance windows, tight construction, and efficient heating and cooling equipment and appliances. Green homes are healthier because they perform better and use green products, protecting homeowners against cold, hot, drafty, moisture, indoor pollutants, and noise. Green homes also protect homeowners against future utility rate increases for gas and electricity.

Green homes encourage the use of renewable energy, which can reduce your home's impact on the environment because it is the cleanest form of energy around. A variety of renewable technologies are available, including small wind energy systems, geothermal heating and cooling, and solar energy systems used to produce

electricity and hot water. The most common form of renewable energy used by homeowners is solar energy, which is often financed with a home mortgage. In areas with frequent storms or after a natural disaster, renewable energy can provide emergency power if homes are integrated into the system.

- Green Benefits to Homeowners**
- Lowers utility bills
  - Provides tax credits to homeowners
  - Improves a home's energy performance
  - Healthier and more comfortable home
- Green Benefits to the Community**
- Stimulates local economies
  - Restores neighborhood pride
  - Promotes cleaner environment.
- Renewable Energy Benefits**
- Provides electricity from the sun or wind
  - Heats and cools your home quietly and naturally
  - Provides tax credits to homeowners
  - Offers protection against increasing utility bills
  - Supplies reliable power after natural disasters
  - Protects the environment.

Rebuilding your home after a natural disaster such as a flood, hurricane, or tornado can be daunting. You can turn a tragedy into an opportunity to create a healthier, more comfortable, and more energy-efficient home by rebuilding your next home "green."



This home in Ohio uses a roof-integrated solar electric system to offset energy consumption.



How We Use Energy in Our Homes Source: 2007 Buildings Energy Data Book

**Building GREEN in Greensburg**

**City Hall Building**

**ENERGY EFFICIENCY FEATURES**

- A well-insulated building envelope
- Energy-efficient windows
- Energy-efficient doors
- Energy-efficient lighting
- Energy-efficient water fixtures
- Energy-efficient appliances
- Energy-efficient HVAC system
- Energy-efficient lighting
- Energy-efficient water fixtures
- Energy-efficient appliances
- Energy-efficient HVAC system

**RENEWABLE ENERGY FEATURES**

- A well-insulated building envelope
- Energy-efficient windows
- Energy-efficient doors
- Energy-efficient lighting
- Energy-efficient water fixtures
- Energy-efficient appliances
- Energy-efficient HVAC system
- Energy-efficient lighting
- Energy-efficient water fixtures
- Energy-efficient appliances
- Energy-efficient HVAC system

**LEED RATING GOAL**

ENERGY STAR  
GREEN STAR  
LEED

**GREENSBURG GreenTown.**

YOUR SOURCE FOR EVERYTHING GREEN IN GREENSBURG, KANSAS

GREENSBURG HOME CASE STUDIES HOME DEPARTMENT OF ENERGY IN GREENSBURG

## Greensburg Sustainable Building Database

Welcome to the Greensburg Sustainable Building Database, which showcases green building projects in Greensburg, Kansas.

Following the tornado in 2007, Greensburg made a commitment to rebuilding green. The case studies in this database offer ideas for that effort, and include stories about public and private single-family residential, multi-family residential, and commercial buildings. Some of the buildings have achieved certification for their environmental features, but others have not. As of March 2009 there are 2 LEED Platinum certified buildings, as well as 6 commercial buildings attempting LEED Platinum certification, and 1 attempting LEED Gold certification.

Although editors have reviewed the information in these studies for consistency and presentation, they have not, in most cases, verified the details.

To find projects of interest, navigate the map below, click on the placemark for a green project and click "view case study." There are also search options below the map.



### Sustainable Building Database

The Sustainable Building Database is provided by BuildingGreen, LLC, and the National Renewable Energy Laboratory (NREL) as part of the High Performance Buildings Database which holds information on green building projects around the nation.

For more information please visit <http://buildinggreen.com> and <http://www.nrel.gov>

Donations

DONATE NOW

VIA PAYPAL Donate

# More Info

<http://greensburg.buildinggreen.com/>

<http://www.greensburgks.org>

<http://www.greensburggreentown.org>

<http://www.TheChainofEcoHomes.org>

<http://www.planetgreen.com>

THANK  YOU  
FEMA-USDA-SKTRO  
ROTARY-SCCF-EPA  
NREL-KHRC-ELKS

