

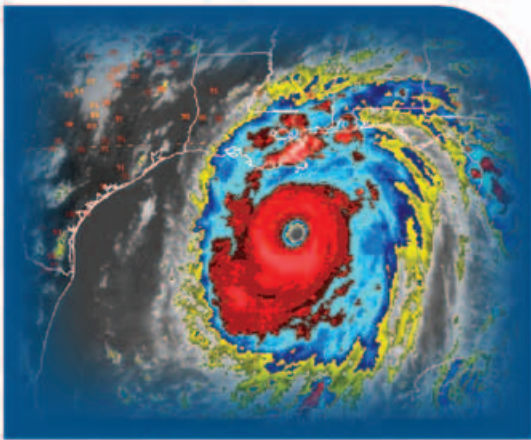
Appendix H: Educational and Outreach Materials

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H.1 Rebuilding After Disaster—Going Green from the Ground Up



Rebuilding After Disaster: Going Green from the Ground Up



About This Guide

If you're a leader in a community that has met with disaster and must be rebuilt, this guide is for you. It's intended to show how communities—big or small—can incorporate green principles and technologies like energy efficiency and renewable energy into their rebuilding plans. The information in this guide is based on the real-life experiences of two U.S. Department of Energy (DOE) teams. One team worked with city leaders in New Orleans, Louisiana, after hurricanes Katrina and Rita in 2005, and the other assisted community leaders in Greensburg, Kansas, after a devastating tornado in 2007. Although the two communities are quite different, the teams learned common lessons and found that the reasons for going green from the ground up are compelling.

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Key Distinctions

In this guide, we focus on topics related to disaster recovery as distinct from disaster response, with the two concepts defined as follows:



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Response: Immediate action, in which core emergency services and first responders—firefighters, police officers, and emergency medical technicians—mobilize in the disaster area. Specialist rescue teams (e.g., divers) or Hazmat crews may be called in. Response focuses on rescuing people, pets, and livestock; treating injuries; dealing with any loss of life; setting up emergency shelters; restoring electricity and natural gas services; supplying clean water; and clearing streets and neighborhoods of dangerous debris.

Recovery: Ongoing action with the goal of restoring the area to its pre-disaster state or better. Recovery involves rebuilding destroyed property, putting residents back to work or creating new jobs, repairing essential infrastructure, bringing all community services back online, and attracting new industries.



Galen Buller, Ingalls, Kansas/PIX 16675

Out of Crisis, Opportunity

Galen Buller, Ingalls, Kansas/Pix 16666



Every year, communities just like yours are devastated by tornadoes, floods, hurricanes, and other natural disasters. If disaster does strike your community, the initial response will focus on immediate needs. After those are met, and some of the shock wears off, the community can begin to recover. And although discouragement and despair are natural responses to a disaster, human beings are also resilient. The residents of your community are likely to want to return quickly to the way things were. There's great comfort in familiarity, and its pull is strong.

[America has always] found the capacity to not only endure, but to prosper—to discover great opportunity in the midst of great crisis.

—President Barack Obama

But as you begin to make plans for recovery, you might want to take a step back. Try to see past the devastation for a moment. Reframe that shattered glass as a clean, new window of opportunity. You can choose to make this catastrophe into an opportunity. . . not just to return to the status quo, but to grow and change. Instead of reflexively reinstating the choices of the past, why not rebuild today to better position your community for tomorrow?

One way to do this is by rebuilding your community as a model of sustainability. This means reducing energy use, using energy more efficiently, incorporating more renewable energy, and much more.

That's what Greensburg did. It's also happening in parts of New Orleans.

And it's what this guide is all about. The pages that follow explain how we're using green terminology and outline the benefits of rebuilding sustainably. Next, we present a step-by-step process for green disaster recovery (or simply "green recovery"). The guide includes suggestions based on the lessons learned in Greensburg and New Orleans along with concrete examples from both communities. Because this guide is intended as an introduction to green recovery, it includes a number of other resources for you and your community to explore. For more details about any of the federal, state, and local organizations, programs, and associations mentioned in the text, please visit the Web sites listed in the For More Information section starting on page 18.

What Happened in Greensburg and New Orleans

On May 4, 2007, Greensburg was a declining but close-knit farming community with a population of about 1,400 in Kiowa County in south-central Kansas. That night, an EF-5 tornado—the highest level on the standard meteorological scale used to estimate wind strength—plowed through the town. With winds estimated at more than 200 mph, the tornado killed ten people and destroyed or severely damaged 90% of the community.

Hurricane Katrina struck the New Orleans area in the early morning on August 29, 2005. The storm surge breached the city's levees in multiple places, leaving 80% of the city submerged, tens of thousands of victims clinging to rooftops, and hundreds of thousands scattered to shelters around the country. Three weeks later, Hurricane Rita reflooded much of the area. The devastation to the Gulf Coast by these two hurricanes has been called the greatest disaster in our nation's history. More than 1,800 people are believed to have lost their lives, and damages have exceeded \$81 billion (NOLA.com 2008).

Why Go Green from the Ground Up?

First, let's clarify what we mean by green. It's easy to get hung up on defining terms that may mean different things to different people, and you don't want your recovery efforts to stall because you can't arrive at a common definition. Even seasoned experts disagree on common explanations of all the elements embodied in the word "green". Actually, that's part of the beauty of the term . . . it encompasses so many choices. In this guide, we're aiming for simplicity and aligning with today's common parlance. So we're using the terms "green" and "going green" to encompass energy efficiency (using less energy to supply the same level of energy service) and renewable energy (energy produced from the sun, the wind, and the water, among many other sources). The terms also embody principles of



Catherine Hart, Greensburg GreenTown/PIX 16671



Catherine Hart, Greensburg GreenTown/PIX 16670

In rebuilding the Kiowa County, Kansas, courthouse—originally constructed in 1914—the community decided to salvage the original white trim along with several ornate doors from the stately and historic building.

Why Consider Energy At All?

Because it's an integral part of our daily lives, whether we think about it or we don't. Of the energy used in the United States today, residential buildings account for 21%; commercial and public buildings for 18%; industry for 32%; and transportation for 29%. According to the Energy Information Administration (EIA 2008), this energy comes from coal (22%), natural gas (19%), domestic crude oil (12%), imported petroleum (27%), various other imports (6%), and nuclear power (8%).

Natural gas and crude oil prices are volatile and subject to fluctuations outside our nation's control. That volatility leads to greater uncertainty in forecasting energy costs, which, in turn, can make lenders or investors reluctant to support new projects. Or, lenders may charge higher interest rates on loans for projects to cover what they perceive as higher risks.

sustainability, by which we mean simply that new development meets needs of today without compromising those of tomorrow. Resource conservation, recycling, and reuse, along with best practices for community and building design and construction that minimize negative environmental impacts, are the final pieces of the green picture.

In this guide, we focus primarily on energy considerations within a larger green and sustainable framework.

The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired, in value.

—Theodore Roosevelt

Rallying Greensburg Around Green Recovery

Inevitably, questions borne of despair follow incredible devastation. Should we even rebuild here? Will enough people come back? Will we ever even have a town, a city, again? In Greensburg, just days after the storm, community leaders and members came together and decided that their town was worth rebuilding. And they had some novel ideas about how to do it.

Maybe, they said, we can rebuild to use the wind that almost destroyed us to generate electricity. Rebuild to consume less energy and water and more local food. Rebuild to give our children the best and greenest school in Kansas.

These green messages resonated with local and state leaders alike, and excitement began to build about rebuilding Greensburg to truly embody its name. One by one, the townspeople embraced the green initiative.

Rebuilding as a model green community became the cornerstone of the town's new master plan and the economic development vision of the townspeople.

Today, the headline on the City of Greensburg Web site says it all:

Greensburg: Better, Stronger, Greener!



Lynn Billman, NREL/PIX 16650

The county courthouse renovation in Greensburg captures much of the structure's original design and beauty but incorporates new energy efficiency strategies including daylighting (using the existing window openings) and high-performance lighting and controls. The building also uses pipes beneath the ground to capture geothermal energy, lowering the cost of heating and cooling.

Green Choices, Community Benefits

Making green choices during disaster recovery has a number of benefits:

Lower energy bills. The large-scale rebuilding effort following a disaster is an ideal time to require or encourage high energy efficiency standards for all new and remodeled buildings. Constructing energy-efficient buildings from the ground up is much cheaper than retrofitting or upgrading down the road.

*Our choices at all levels—individual, community, corporate and government—
affect nature. And they affect us.*

—David Suzuki

Cleaner energy sources. If the disaster affected your local utility, this might be the perfect time to change the electricity mix to incorporate more renewable energy sources such as wind and solar. You might be able to negotiate a new type of power purchase agreement with the local utility, or you might build your own generation facilities to bring more renewables online.

A cleaner environment. Using energy produced from renewable sources softens your impact on the planet. Clean, renewable energy reduces the carbon emissions that contribute to global warming and significantly lowers emissions of other regulated pollutants (like sulfur dioxide and oxides of nitrogen). In addition, generating electricity from renewables can save large amounts of water—an increasingly precious commodity.

More robust economic development. When you make the commitment to greener choices in all sectors of your community, economic opportunities can follow. Green recovery can set a new focal point for economic development, place emphasis on new green-collar jobs, and improve your community's image, which in turn, can attract businesses and residents.

A renewed sense of hope. Joining other communities that are embracing different ways of building, greener community master plans, and new renewable energy sources can help create a vision of hope for your citizens and business owners. Most importantly, coming together to go green will help you recapture the values and sense of common identity that gave your community cohesiveness before the disaster.

Green communities are easier than ever to achieve. Great strides have been made in ways to reduce the amount of energy used in homes and businesses. More and more communities are successfully generating electricity from the sun and the wind. Alternative transportation technologies are accelerating in the marketplace, and hybrid electric vehicles are now readily available in most vehicle categories. Interest in alternative fuels like biodiesel and other biofuels is high. Once-abstract concepts have progressed to concrete, real-world options that are available now.



Photo courtesy of the City of Greensburg/PIX 16667

Vehicles fueled with alternatives to petroleum are on the road today, and automakers continue to pioneer new offerings each year.



Invenergy, LLC / PIX16042

Warren Greitz / PIX10598

The wind and solar power technologies that are readily available on today's market can make a significant contribution to your community's energy needs.

Crafting a Green Recovery Plan

So how do you get started? If your community already has a master development plan, an energy plan, or an energy policy, you have a head start. You can begin the green rebuilding efforts by revisiting and updating your existing plan. You're likely to find that some green projects are now possible simply because you must rebuild. If your community doesn't have any sort of master plan, take this opportunity to create one. The goal should be to develop a single, unified plan that avoids redundancy and overlap.

.....
Success always comes when preparation meets opportunity.

—Henry Hartman
.....

A suggested framework for getting there—seven sequential steps—follows. As you move through the steps and consider the associated issues and examples, make a commitment to writing everything down and being as specific as possible. Aim for quantifiable goals wherever you can, but if you get stuck, set qualitative goals and move forward. The planning process should propel progress, not stymie it.

Step 1: Identify and Bring Stakeholders Together

A *stakeholder* is anyone who has an interest in your community. Stakeholders can include everyone from city leaders (either elected or appointed)—through planning and zoning commissions, economic development councils, chambers of commerce, and public building owners—to major business owners, affected and interested homeowners, education leaders and students, and nonprofits.

Depending on the size of your community, stakeholder lists can be long. But each will bring unique perspectives and diverse ideas to the table, leading to robust brainstorming sessions. Including as many stakeholders as possible from the outset—when you hold your first planning meeting—will build community buy-in for the final plan. It also ensures that representatives of various community sectors have the opportunity to air concerns that can be addressed in the planning process.



Gaining buy-in from stakeholders is an important part of any green recovery initiative.

Lynn Billman, NREL

.....
qualitative: adj. of, relating to, or involving quality or kind
quantitative: adj. of, relating to, or involving the measurement of quantity or amount.

—Merriam Webster Unabridged Dictionary
.....

At this stage of your planning, the importance of a **green champion**—someone who is passionate about the green cause—cannot be overstated. An ideal champion will be recognized and respected both in the community and within city government. Your champion must be willing to make the time to offer ideas and information, suggest opportunities, and work to inspire others to see the possibilities. The champion will also need to establish good communications and actively involve other stakeholders as much as possible.

A Few Words About Resistance

You may meet with some resistance among those individuals and business owners who want to rebuild right now. Greensburg officials recognized that the need to reestablish revenue was urgent and real, and they wondered whether they should insist on developing a new community plan before approving any construction permits. To help them decide, they visited New Orleans and other Gulf Coast cities and saw for themselves the real-life examples of the benefits of a good plan. They came home newly energized and spoke eloquently to their business leaders about the importance of waiting just a few more months so the community could “get it right.” City and business leaders then negotiated a commitment for a tight deadline from a planning firm, worked tirelessly with that firm, and developed an award-winning community plan in a remarkably short time.

If you meet with reluctance in your community, showcase Greensburg as a shining example of getting it right.

Resistance can also stem from fear of the unknown, and the antidote is to make the unknown known. This brings us to the next key point that applies to your stakeholders—the importance of education and communication.



Lynn Billman, NREL/PIX 16668

The RnE²EW vehicle is designed to take renewable energy technologies on the road. The vehicle is equipped with solar panels and a wind turbine, which produce the power needed to run everything that requires energy during an educational event like this one in Greensburg.

Educate, Communicate, Educate and Communicate Some More

The more your stakeholders know about the topics at hand, your proposed plans, and how these relate to their place in your community, the more comfortable they'll be with new ideas and changing attitudes and behaviors. Winning community support for your green recovery plans will require you to pay deliberate attention to education and

.....
Learn everything you can, anytime you can, from anyone you can—there will always come a time when you will be grateful you did.

—Sarah Caldwell

.....



The World Wide Web offers a wealth of educational resources about energy efficiency and renewable energy. And most of the information, like the U.S. Department of Energy Web sites illustrated here, is free.

communication. Involving all your stakeholders will naturally enhance communication, but use your imagination and creativity to go a bit further.

Keep all your stakeholders up to date through communication venues like the city Web site, flyers distributed in public buildings and stores, articles in local newspapers, spots on local radio, regular and special public meetings, and announcements and reminders at group meetings to work on other topics. Greensburg communicated through all these venues at one time or another.

Your education efforts can be as simple as a printed fact sheet or as elaborate as a day-long seminar. To keep costs down, homebuilders' associations or professional green-building advocacy groups may be able to offer low-cost training in areas that apply to green recovery. Your residents and businesses may be interested in, for example:

- How much money they can save by reducing energy use in buildings
- What features make a building green or energy efficient
- How to improve insulation or windows during major repairs
- How to use alternative energy sources such as ground-source heat pumps (to capture and distribute geothermal energy), solar panels, solar hot water systems, and small wind turbines.

Local architects, engineers, contractors, and suppliers might find topics like these useful:

- Green building strategies, including integrated design
- Tax incentives for green building practices
- Continuing education courses for design professionals
- Green materials, local products, and regional suppliers.

Encourage your stakeholders to learn all they can about the experiences of others. The links in For More Information are a good place to start. So are Web searches for topics such as sustainable communities, green master planning, and green development—use your imagination!

Finally, take full advantage of the major role K-12 schools and students can play in educating stakeholders and changing attitudes and behaviors. When young people learn about clean energy, they're likely to bring that knowledge home wrapped in enthusiasm that will inspire their parents and grandparents. In Greensburg, the words of a teenager at a town meeting are thought to have been a tipping point toward green recovery: "Before the tornado, I was planning on going to college and never coming back to Greensburg. But now I want to come back. I want to help make this a model for other communities. I want to live here."



Lynn Billman, NREL/PIX 16292

Remember to include young people in your educational efforts. They have proven to be a powerful force for change.

Curricula are readily available to strengthen or start K-12 coursework on energy. Promote the development of classes or majors in energy or sustainability at your local university or four-year college, or certification classes for installers and maintenance workers at your community college. Such programs are expanding rapidly around the country. And if the local college already has expertise in sustainability, renewable energy, or efficient building construction, call on those experts to offer information and seminars.

Step 2: Choose Your Leaders

At the kickoff meeting with all your stakeholders, select a small group of local leaders from diverse parts of the community. These individuals should be able to see the big picture, and their job will be to lead the overall planning. Leaders often emerge naturally based on the strengths and preferences

of the people in the room. Or positions of authority may already have been established. Either way, encourage openness and freedom of expression to make it work.

Problems can become opportunities when the right people come together.

—Robert South

Depending on your community's unique rebuilding requirements, you'll almost certainly want to break the broader leadership team into smaller working groups. Each group will have an assigned area of responsibility. This helps carve the task at hand, which will seem overwhelming, into manageable pieces. Using the working group approach also gives each aspect of green recovery the attention it deserves.

When you're rebuilding to go green from the ground up, establishing an Energy Working Group will be particularly important. Why? Because energy and efficiency choices are an intrinsic part of the rebuilding process. When you rebuild, you'll be creating structures that should stand for 40 years or longer. Power plants last for several decades, and contracts for supplying electricity often extend for many years. As you plan for green recovery, you'll be making decisions that affect, for example:

- Land use planning
- Building restoration, repair, and reconstruction, including building codes for all types of buildings (residential, business, public, and nonprofit, among others)
- Fleet and personal vehicle replacements
- Reconstruction of fueling stations
- Reconstruction of the electricity distribution system
- City ordinances that govern distributed electricity.

Energy considerations are part of virtually every project a community takes on after a disaster.

What a Quantitative Energy-Use Baseline Looks Like

Electricity

Electricity used in Greensburg is created largely from coal-based sources.

Conversion factors: In Greensburg, the utility fuel mixes are typically 1/10 wind and 9/10 coal-fired. Therefore, 1,000 kilowatt-hours (kWh) = 594.6 pounds (lb) of CO₂ emissions.

2006 electricity usage:

9,800,000 kWh = 5,827,080 lb of CO₂

Natural Gas

In Greensburg, natural gas is the primary source for heating.

Conversion factors: 1 therm of natural gas produces 11.64 lb of CO₂.

2006 natural gas usage: 650,000 therms = 7,566,000 lb of CO₂

Transportation

Most vehicles in Greensburg are powered by fossil fuel, primarily gasoline and diesel, which are major greenhouse gas contributors. Most drivers travel alone to work or school. As the amount of driving increases, so does the amount of greenhouse gases emitted. For the purposes of this exercise, estimated figures and national averages were used:

Estimated number of vehicles in Greensburg in 2006: 577

Average annual miles driven (national average): 15,000

Average fuel efficiency (national average): 20.7 mpg

Gallons of gas driven:
(15,000 x 577) / 20.7 = 418,116 gal

Conversion factor: Every gallon of gasoline burned releases 20 lb of CO₂.

2006 transportation impact:
8,360,000 lb of CO₂

Source: Adapted from City of Greensburg, Kansas + BNIM (2008), p. 95

Step 3: Visualize and Capture the Vision

A vision excites and energizes the stakeholders and makes them believe that all things are possible, so spend some time here. Brainstorm ideas and come to consensus on what you want to achieve. Building on that common identity while adopting a new community framework can be the spark that energizes a discouraged community. When enthusiasm lags, return to the vision. It will help you remember why you're doing this in the first place.

The vision is also where you can begin making the connection between the broader goal of rebuilding sustainably and the more specific objectives that feed into that goal. Greensburg's *Vision Plan Draft* is an excellent example (City of Greensburg 2007). The 12-page working draft is broken into five topic areas: Energy, Built Environment, Water, Economic Development, and Community. In each topic area, the stakeholders identified specific targets. Under Energy, for example, they envisioned the following:

- Increase efficiency of all end uses to reduce energy demand
- Meet all energy needs through renewable generation sources
- Reduce citywide carbon dioxide (CO₂) emissions.

The stakeholders then used this draft as they worked with the planning professionals to prepare their *Greensburg Comprehensive Sustainable Plan* (City of Greensburg, Kansas + BNIM 2008).

Step 4: Get the Lay of the Land

To see where you want to go, you have to understand where you are. You'll need to assess the current situation in your community, often called "establishing a baseline." In disaster recovery, this step can have several components. For example, consider what Greensburg called the built environment: Evaluate what, if any, damaged materials can be salvaged and reused. Determine how much land is actually available for rebuilding or redevelopment. Decide whether to completely rebuild portions of your infrastructure.



Daniel Wallach, Greensburg GreenTown/PIX 16669

After the tornado, Greensburg residents regretted missing the opportunity to recycle lumber and other usable materials from the tornado debris.

We are all faced with a series of great opportunities brilliantly disguised as impossible situations.

—Charles R. Swindoll

You'll also need to know how your community once used energy. Although your Energy Working Group might find this challenging, best estimates will work. You might ask your utility companies for help. Individual use is not publicly available information, but companies are often willing to supply averages for typical residences or composite figures for a business district. Ask your major industries and the largest public energy users (such as schools, hospitals, and industries) for their energy use and costs, and enlist their support for your Energy Working Group. Ask major fleet owners about the number of various types of vehicles they had before the disaster and what fuel they used, and see if they can estimate how many miles per year each drove. This step can be time consuming, so consider soliciting local high school or college students to help gather these data.

Or, to establish a more formal, quantitative baseline, you may want to enlist an energy analyst. After the tornado, the U.S. Department of Energy contacted Greensburg's leaders to offer assistance. DOE opened an office in Greensburg and assembled a team of experts from its National Renewable Energy Laboratory (NREL). The team helped to determine Greensburg's previous energy use baseline in quantitative terms (see sidebar for an example).

Working from your baseline, you can see what you want to do differently. In terms of energy, now's the time to learn what renewable resources are available to you. You can find extensive—and often free—data on renewable resources, such as wind, solar, geothermal, and biomass on the Web. Here are three examples of the types of information available free of charge (see For More Information for specifics):

- 3TIER, a company that provides renewable energy assessment and forecast information, has developed an online assessment tool—called FirstLook—for wind and solar resources. With a couple of mouse clicks, you can identify potential locations for wind and solar installations, along with free preliminary wind and solar data about the sites. You can also purchase a FullView Site Analysis if the free information reveals promising sites in your area.
- NREL and the Environmental Protection Agency (EPA) developed a free Biomass Power Assessment Tool to enable access to county-level biomass resource data. After you select a site and define a geographic radius or boundary, the tool reports on the estimated

annual amount of biomass available from crop residues, forest waste, wood waste, landfills, and wastewater treatment plants, among other sources.

- DOE and NREL's Alternative Fuels & Advanced Vehicles Data Center hosts a free interactive map of alternative fueling stations.

Step 5: Set Your Goals

.....
*If you don't know where you are going,
you'll end up someplace else.*

—Yogi Berra
.....

Though lighthearted, Berra's quote contains an important nugget of truth. Setting goals is at the heart of the community's green recovery plan. Goals keep you on track. They keep you moving toward where you want to be, not someplace else. If you can, try to set quantitative goals. (For energy, this would be easier if you were able to quantify your energy use in Step 4.) But if that isn't possible, set qualitative



Lynn Billman, NREL/PIX 16660

The Sun Chips City Business Incubator in Greensburg is designed to offer affordable spaces for businesses getting back on their feet, as well as for new retail ventures. This building received a major funding boost from actor Leonardo DiCaprio, a well-known sustainability advocate.

goals instead. Either type of goal will help bring your community together in its understanding of energy—past, present, and future. The important thing is to set achievable goals that will allow you to move forward and experience a sense of accomplishment as a community.

You might find the following simple framework useful as you think about energy. Ask your Energy Working Group to consider how the community can:

- Reduce energy use in homes, businesses, and industrial processes
- Use more renewable energy in homes and businesses
- Decrease fossil fuel use in vehicles.

Reducing Energy Use

Simply reducing the amount of energy you use is the easiest and most cost-effective way to become more sustainable, so it makes sense to focus on this first. With buildings using 39% of the energy consumed in the United States today, green buildings can have a huge impact. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has published guidelines for reducing energy use by as much as 30% in warehouses, small retail buildings, small office buildings, and K-12 schools.

Compared to conventional buildings, a green building minimizes use of energy, water, materials, and land. Depending on construction choices, green buildings can sometimes cost no more to build than conventional buildings. If up-front costs do prove to be higher, they are offset over time by lower energy bills. When built properly, green buildings can use 30% to 50% less energy than their traditional counterparts. And once people move in, they'll be more comfortable because they will have better control over features such as lighting and temperature.

The key to minimizing construction costs for green buildings—whether they be public buildings, schools, homes, commercial buildings, or industrial plants—is using an *integrated design or whole-building approach*. Because all design team members participate in such a design process from the outset, all disciplines can weigh in on how

design decisions will affect energy use. For example, incorporating *daylighting* (a term for illuminating the interior of a building by natural means like windows or skylights), high-performance energy-efficient windows, and good insulation strategies can reduce the size of the chiller plant, which can save a significant amount of money. During an integrated design process, architects and homebuilders routinely use energy-modeling computer programs like EnergyPlus and the Building Life-Cycle Cost Program to help predict energy usage.

Ask your Energy Working Group to work with local homeowners associations, homebuilders, business owners, and bankers to encourage energy efficiency in new construction. You might also want to consider adopting a voluntary green home building program or mandatory green building codes. The National Association of Home Builders (NAHB)

Sun Chips City Business Incubator Green Features

Located on the roof of the incubator, crystalline photovoltaic solar panels convert the sun's energy to electricity, providing about 10% of the building's total energy needs.

Most of the incubator is illuminated by natural daylight through strategic window placement, light shelves, and skylights. This allows artificial lighting to be turned off, saving both energy and money.

Water from the incubator's sinks and showers—called gray water—is collected and reused to flush toilets.

Rainwater is collected and used to supplement the gray water system.

A specialized heat pump system extracts both heat and cooling from the ground through a series of vertical well shafts.

Rain gardens and other mechanisms for storm water collection allow water to naturally return to underground reservoirs.

The walls of the incubator have very high structural capacity and feature state-of-the-art protection against high winds.



Eight of the 16 townhomes in the Prairie Pointe affordable housing development have been awarded the LEED platinum for homes rating—the first ever in Kansas.

has instituted a nationally accepted green building standard and program that can serve as a model for local efforts. And DOE's Builders Challenge Program offers benefits to homebuilders who build for exceptional energy efficiency.

The U.S. Green Building Council (USGBC) has been instrumental in encouraging the design of green buildings through its Leadership in Energy and Environmental Design (LEED™) Program. LEED “points” come from a wide variety of categories, so if you're pursuing LEED certification, be specific with your architect about how much energy you want to save and which certification level you want. The USGBC also recently launched a LEED for Homes rating system. Much like the system for commercial buildings, LEED for Homes assigns points to green attributes, such as recycled materials, low water use, and energy-efficient design, among others. Extensive educational materials about USGBC programs are readily available.

Public buildings serve as the “face” of your community, setting standards and expectations through their usability and aesthetic appeal. Although it's disheartening to see your city hall, public library, school, or hospital destroyed by disaster, it's also another opportunity to show leadership by setting high energy efficiency goals or green standards for your new public buildings. In Greensburg, DOE helped the town develop and pass a resolution proclaiming that all large city buildings would be built to LEED Platinum certification standards.

In New Orleans, **schools** were at the head of the class during rebuilding. Launched in 2007, the Quick Start Initiative put five schools—one in each New Orleans City Council District—on a fast track for construction while master planning continued.

In each council district, a cross-section of neighborhood groups furnished input on site selection. The design and planning of these schools helped direct the building standards of the broader School Facilities Master Plan. At the same time, the Quick Start Initiative put students into clean, modern classroom space sooner rather than later. The master plan, which includes the goal of reducing energy consumption by 30% in all new public school construction in the city, was approved in November 2008 by the Louisiana Board of Elementary and Secondary Education and the Orleans Parish School Board. As you look to rebuild your own schools, consider taking a page from the New Orleans textbook.



When construction on the 210,000-square-foot L.B. Landry High School in New Orleans is complete, energy costs for the building—which features a solar hot water system—are expected to be 30% lower than those of the school it replaced. The city is aiming at the 30% reduction target in all new public school construction.

Homes that must be rebuilt represent a valuable opportunity to save energy in your community. Homeowners can usually recoup the slightly higher monthly mortgage payments in significantly lower energy bills (see table). In fact, for more than 30 years, the expectation of energy savings has enabled homeowners to qualify for larger loans through “energy efficient mortgages.” The savings are validated by a standardized computer system that predicts energy savings and are certified by an energy rater, such as the Residential Energy Services Network (RESNET) or a similar system from DOE called the EnergySmart Home Scale.

And homes that weren't a total loss can go green too. Although retrofitting and repairs are not as cost effective as new construction, seize every green

renovation opportunity by, for example, improving levels or types of insulation, putting in energy-efficient windows, and installing efficient heating and air-conditioning equipment and appliances. Be sure to look for ENERGY STAR labeling on all equipment and appliance purchases.

Particularly in these challenging economic times, **businesses—offices, retail stores, warehouses, and so on**—are an integral part of a successful green recovery. Your business owners can choose to rebuild in ways that will garner important benefits, both now and into the future:

- Building energy efficiency into a new structure saves money over the life of the building in terms of reduced energy use and lower operations and maintenance costs.
- Communities tend to view green businesses as socially responsible “good neighbors,” a positive perception that can boost business.
- Your businesses may be able to create green-collar jobs, which not only improves the economic health of your community, but feeds into a stronger national economy as well.
- Going green may open opportunities to expand business into new areas and introduce new products.

In Greensburg, for example, the owner of the local John Deere dealership, BTI Equipment Inc., built a new dealership designed to LEED Platinum standards, using 42% less energy than required by code, and generating electricity with an Endurance 4-kilowatt wind turbine. John Deere’s corporate di-



Lynn Billman, NREL/PIX 16661

The new BTI John Deere dealership opened for business in January 2009. An important part of Greensburg’s economy, the building features tubular skylights for daylighting, radiant floor heating, an energy-efficient wall and roof system with plenty of insulation, a waste oil boiler, recycled steel support beams, and native landscaping.

vision is now urging all its dealers to build to these standards, and the company has become a member of the Commercial Building Energy Alliance, a partnership among DOE, NREL, and key leaders in retail and other businesses that identifies opportunities for and promotes energy efficiency. Based on the Greensburg model, John Deere has redirected its business plan to promote energy-efficient, green dealerships throughout North America.

And because of BTI’s positive experience in Greensburg, the company launched BTI Wind LLC in late 2008 and early 2009. BTI Wind is the North American distributor for Canada-based Endurance Wind Turbines, and the new company’s business lines include sales, installation, and maintenance. BTI Wind set up a network of 136 distributors in 32 states and 4 provinces, adding more than 100 new direct jobs and training the existing sales force in this new green technology. The company hopes to quadruple its business in the next two years.

High Energy Efficiency Saves Money Every Month (2006 US\$)^a

Cost and Savings	Base Efficiency (30%) ^b	High Efficiency (40%)	Premium Efficiency (50%)
Estimated Incremental First Cost	\$4,000	\$7,000	\$13,000
Savings on Monthly Utility Bill ^c	\$60.25	\$76.58	\$96.83
Increase in Monthly Mortgage Payment ^d	\$17.58	\$34.25	\$58.83
Net Monthly Savings	\$42.67	\$42.33	\$38.00

^aFor a typical 2,000-square-foot home built in Greensburg, Kansas, using national average costs.

^bPercent of increased efficiency over International Energy Conservation Code (IECC) 2003.

^cEvaluated relative to typical energy code (IECC 2003).

^dBased on a 30-year mortgage at 7% APR with an increase in loan value of \$4,000 for the base option; \$7,000 for the high option; and \$13,000 for the premium option.

Local industries are likely to use significant amounts of energy, not just in the buildings that house their operations, but in the industrial processes themselves. Many leaders in manufacturing industries have adopted best business practices and new technologies to reduce their energy costs, including combined heat and power systems. Encourage your plant managers and owners to seize the opportunity for improvements instead of rebuilding their businesses just as they were. DOE has excellent programs for energy audits, best practices in energy management, and new energy-saving technologies for small and large industrial plants.

Increasing Renewable Energy Use in Your Community

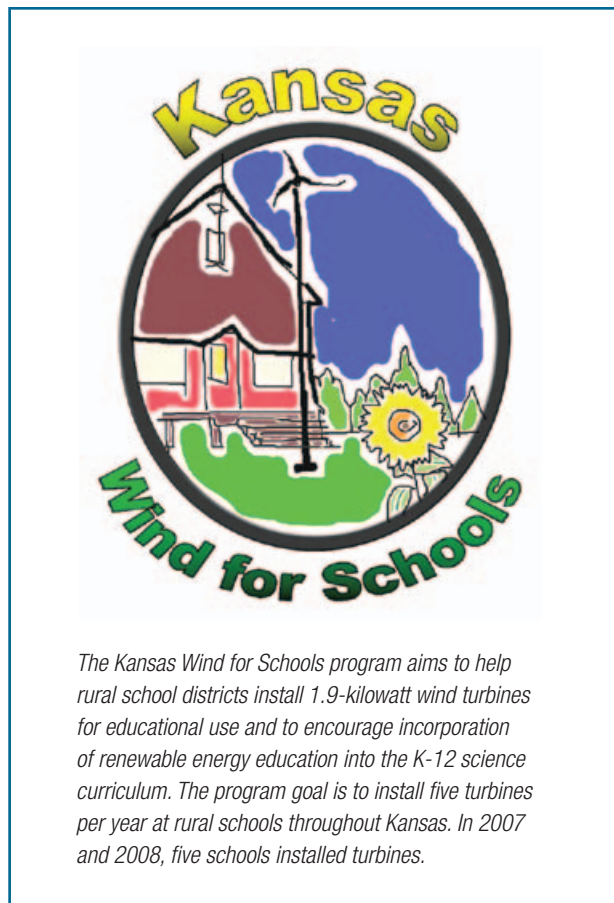
Your community is probably served by one or more utilities or rural electric cooperatives. Encourage leaders at these utilities and cooperatives to be partners in your new energy plan. They can help you understand how you can increase the amount of renewable resources in the electricity choices available to your community. Energy efficiency and renewable energy may help reduce loads on municipal systems, reducing or helping stabilize costs. You might need to enter into a short-term energy agreement while you consider longer term options. A disaster offers the opportunity to reexamine old relationships and forge new ones.

Municipal utilities can renegotiate electricity supply contracts, improve the generation mix to include more renewables, or purchase renewable energy credits (RECs) for the community. RECs are tradable environmental commodities in the United States. Although the particulars vary from state to state, RECs generally prove that 1 megawatt-hour (MWh) of electricity was generated from an eligible renewable energy resource.

New renewable energy sources, ranging from a single wind turbine to a field of solar panels, could be brought online to augment your electricity supply. The financial viability of such “distributed energy” projects will depend on your community’s proximity to transmission lines, the utility with which you establish a power purchase agreement, and financial incentives available in your location from the local utility or from state and federal government agencies.

Major energy users in your community, or individual homeowners and businesses, might be good candidates for installing a solar or wind system. For individual homes, buildings, or collections of buildings, other renewable energy systems or technologies—such as ground-source heat pumps or burners and boilers that use wood pellets or other biomass sources—might prove cost effective. “District” heating and cooling systems use one heating and cooling plant (renewable or conventional) for several buildings. Such systems have been saving energy and money for decades in areas like college campuses and downtown districts. DOE has a Wind for Schools Program that can help schools install a small wind turbine under its Wind Powering America Program.

You may already have regulations in place to allow solar panels and wind turbines in your community. These regulations might include a solar and/or wind ordinance that describes how individuals can safely install such systems; an interconnection agreement that describes how these systems can be safely connected to the utility grid; and a net metering or net



billing policy that describes how the independent power generator will be reimbursed for the electricity produced. If you don't have these documents in place, look for examples that have been successfully adopted in other cities. Or, if you established such guidelines years ago, consider reviewing newer examples and updating your guidelines. The renewable energy field is expanding rapidly, and policy innovations occur every year.

Diminishing the Use of Fossil Fuels

As you make your rebuilding plans, look for ways to reduce driving in your community. Increase the appeal of walking and biking by, for example, relocating key community functions or adding trails or bike lanes. Encourage residents to use public transportation more often through incentives, or consider adding public transportation if your community didn't have it before the disaster. Electric trolleys and shuttle buses are on the market today, and in some cases, such vehicles can even add to the "character" of your community.

Encourage residents and fleet owners to replace damaged and destroyed vehicles with vehicles that use lower amounts of fossil fuels—like gasoline/electric hybrids, small electric vehicles for short distances, and flex-fuel vehicles that run on either gasoline or E-85 (a mixture of 85% ethanol and 15% gasoline). Many vehicle models on today's market are flex-fuel ready, and sometimes drivers don't even know that they own one. Compressed natural gas is another environmentally friendly alternative fuel choice, typically for fleet vehicles that are refueled at a central location.

Designate a community leader or group to work with entities in the community that own fleets and fuel supply companies. Combining purchasing power can influence both the price of vehicles and what alternative fuels local suppliers are willing to provide.

Step 6: Find the Funds

Financing is another area that will benefit from a strong working group. Your Financial Working Group will need to take time to investigate both the disaster-related and the green financial opportunities in your location and situation. Funding may be available from a variety of sources, including

payouts from insurance companies and grants and loans from federal or state agencies. At the federal level, for example, the U.S. Department of Housing and Urban Development (HUD), the Federal Emergency Management Agency (FEMA), the U.S. Small Business Administration (SBA), and the U.S. Department of Agriculture (USDA) often make funds available after a disaster.

Small communities served by the USDA—typically 50,000 or fewer residents—have additional opportunities. The USDA's regular grant and loan programs will often cover the cost of energy-efficient features. For projects that can wait a year or so, the agency has competitive grant and loan programs specifically designed to fund energy efficiency and renewable energy projects.

When you work with disaster-assistance agencies at any level, be vocal about your wishes to rebuild differently to save energy, use lower amounts of fossil fuels, or become greener. Agency rules differ greatly. One agency might have to adhere to rigid rules about reimbursements. Another might have some flexibility. If the officials you're dealing with aren't tapped into the benefits of energy planning and energy choices, this is your opportunity to educate them. Knowing what you want and being insistent about it may open some doors.

.....
If opportunity doesn't knock, build a door.
—Milton Berle
.....

In Greensburg, the DOE/NREL team helped not only to develop renewable energy and energy-efficient business strategies, but also to assemble financing and ownership options for producing or procuring renewable energy technologies.

Going Green from the Top Down

With today's increased focus on all things green at our highest levels of leadership, opportunities abound for projects that save energy, use renewable energy, or promote green or sustainable development. When President Obama signed the American Recovery and Reinvestment Act (ARRA) into law on February 17, 2009, for example, financing mechanisms for energy efficiency and renewable energy

expanded significantly (EERE Network News 2009; Recovery.gov 2009). Some of these funds are available for a limited time, generally through state offices. ARRA and other federal financing options include:

- Energy-Efficient Community Development Block Grants
- Clean Renewable Energy Bonds (CREBs)
- State assistance on building codes (BCAP 2009)
- New Market Tax Credits (U.S. Department of the Treasury 2009).

Tax incentives, both credits and deductions, are available to promote energy efficiency and renewable energy not only at the federal level, but also in almost every state. The Database of State Incentives for Renewables & Efficiency (DSIRE) maintains a reliable, up-to-date list of financial incentives.

Utility companies also offer such incentives, and energy service companies can be important partners in your green recovery. These companies typically supply the up-front capital for energy-saving improvements, often on retrofits or repairs but sometimes on new construction. They take the financial savings from lower energy costs until they are paid back—then it's your turn to reap the benefits. Some companies have begun applying the same concepts to energy-producing projects, such as fronting the costs for a wind turbine or photovoltaic system.

Financial Help on Many Fronts

Nonprofits, volunteer organizations, and other individuals and organizations are likely to donate money, materials, and helping hands. Some organizations may be interested in donating or discounting professional services. Or they may provide volunteers for planning, project design, cost estimating, or project implementation or construction. You might want to approach, for example:

- Local universities, colleges, and community colleges



President Barack Obama signs ARRA—which includes diverse and robust investments for green projects of all types—at the Denver Museum of Nature and Science in February 2009. Before signing the bill into law, he toured the museum's installation of 465 rooftop solar panels.

- Nonprofit builders like Habitat for Humanity, Mennonite Housing, and others
- Nonprofit faith-based organizations; service organizations (such as the Rotary, Lions Clubs, Boy Scouts, and Girl Scouts, among others); and homeowners associations

Tax Incentives and Programs Encourage Green Jobs

In 2008 the Louisiana Legislature passed one of the most aggressive solar and wind tax credits in the country. As a result of this 50% tax credit, the Louisiana Community and Technical College System developed a solar installer training course to increase the number of certified solar installers in the state. This program has succeeded in training dozens of solar installers, ensuring quality installations. Also, in response to the rebuilding needs in New Orleans and a program to help low-income homeowners make their homes more energy efficient, the local utility, Entergy New Orleans, worked with Delgado Community College to develop courses to train home energy auditors, helping to develop a local green economy.

- Professional trade organizations
- Personal or corporate foundations
- State and national nongovernmental advocacy organizations for renewable energy, energy efficiency, and green or sustainable development.

To accomplish great things, we must not only act, but also dream; not only plan, but also believe.

—Anatole France

Step 7: Write the Plan

By now, you should have enough information to write a draft green recovery plan. This step can seem a bit daunting, but if you’ve been writing everything down along the way, your plan should come together relatively easily. Assign a single individual to pull all the information into a draft. Encourage the writer not to agonize over every word; the draft will be distributed to stakeholders for review and comment, and moving forward is more important than grammatical perfection. As the saying goes, “A good plan today is better than a perfect plan tomorrow.” This is particularly applicable to green disaster recovery.

When you distribute the draft to your stakeholders, set a firm deadline for comments and stick to it. You want to strike a balance between making sure that everyone has input and respecting the urgency of the recovery process. You may need to go through several iterations of your planning document until you either reach consensus or strike compromises that everyone can support. And once you have a plan, you might want to take a few moments and simply acknowledge the achievement. Your community has pulled together and crafted a good plan on which its future rests, and that sense of accomplishment can propel you through the plan’s implementation. When you hit the inevitable bump in the road as you move forward, your community can draw renewed strength from that sense of shared accomplishment.

After a disaster, your city, your town, or your community will never be the same . . . but it can be better. Although your challenges are daunting, your opportunities are even greater. By rebuilding a greener, more sustainable community, you can inspire others—of your generation and the next, in big and small cities both near and far—to do the same. If large cities like New Orleans and small towns like Greensburg can lift themselves out of devastation and take bold steps toward a greener future, your community can too.

All of us, and the planet that sustains us, will be better for it.

A Grassroots Nonprofit Helps with the Greening of Greensburg

Recognizing early on that Greensburg’s small city staff would need some help during the green rebuilding process, a sustainability advocate from nearby Stafford County, Daniel Wallach, and his wife, Catherine Hart, founded Greensburg GreenTown. Interested local citizens immediately stepped forward to serve on the nonprofit’s board of directors and then worked closely with city and county officials, business owners, and fellow residents to incorporate sustainable principles into the rebuilding process. Wallach says “This team effort is the true secret to Greensburg’s success—the fact that so many community leaders were encouraging folks with a common vision and direction.”

And because of its nonprofit status, GreenTown has been able to accept donations of green building materials, alternative vehicles, and other items with tax benefits to the donors.

Today, Greensburg GreenTown serves as an educational resource for the community and as a living example of how this type of nonprofit model can help other communities.

For More Information

Disaster Response Resources

International Association of Emergency Managers (IAEM): www.iaem.com

U.S. Department of Energy (Model Guidelines for Incorporating Energy Efficiency and Renewable Energy into State Energy Emergency Plan[s]): apps1.eere.energy.gov/state_energy_program/pdfs/emerg_plan_guide.pdf

U.S. Department of Homeland Security (DHS) Preparedness & Response: www.dhs.gov/xprepresp

U.S. Federal Response Plan: www.disasters.org/emgold/frp.htm



DOE and NREL Resources

Alternative Fuels & Advanced Vehicles
Data Center: www.afdc.energy.gov/afdc

Alternative Fueling Station Resources: www.afdc.energy.gov/afdc/stations/find_station.php

Biomass Power Assessment Tool:
rpm.nrel.gov/fbase/biopower/launch

Builders Challenge:
www.buildings.energy.gov/challenge/builders.html

Builders Challenge EnergySmart Home
Scale (E-Scale):
www.buildings.energy.gov/challenge/energysmart.html



Courtesy of BNIM

Building America Program: www.buildings.energy.gov/building_america/publications.html

Building Technology Program
Information Resources:
www.buildings.energy.gov/information_resources.html

Buildings Database:
<http://eere.buildinggreen.com>

EERE Network News:
apps1.eere.energy.gov/news

Energy Education:
www1.eere.energy.gov/education

EnergyPlus Energy Simulation Software:
apps1.eere.energy.gov/buildings/energyplus

Federal Energy Management Program (FEMP)

Building Life-Cycle Cost (BLCC) Programs:
www.femp.gov/information/download_blcc.html

Energy Cost Calculators:
www.femp.energy.gov/procurement/eep_eccalculators.html

Industrial Technologies Program:
www.industry.energy.gov

K-12 Energy Lesson Plans & Activities:
apps1.eere.energy.gov/education/lessonplans

Save Energy Now®:
www.industry.energy.gov/saveenergynow

Wind Powering America:
www.windpoweringamerica.gov/schools.asp

Greensburg Resources

City of Greensburg Web site:
www.greensburgks.org

Greensburg Sustainable Building Database:
<http://greensburg.buildinggreen.com>

Greensburg GreenTown:
www.greensburggreentown.org

Greensburg City Hall will house the city's administrative offices and council chambers and serve as a gathering space for town meetings and municipal court sessions.

Built to incorporate solar panels and geothermal technology, it will be the first LEED Platinum-certified city hall building in America. Building materials will include recycled wood and reclaimed brick left behind by the tornado. It will also have a green roof with vegetation growing on the east end of the roof. This project is on track for completion in July 2009.



Courtesy of ENIM/PIX 16674

New Orleans Resources

BuildingGreen:
www.buildinggreen.com/press/new-orleans.cfm

Global Green USA:
www.globalgreen.org/neworleans

School Facilities Master Plan for Orleans Parish:
www.sfmppop.org

Other Resources

3TIER FirstLook:
<http://firstlook.3tiergroup.com>

Alternative Energy News Public Transportation:
www.alternative-energy-news.info/technology/transportation/public-transit

American Council on Renewable Energy (ACORE):
www.acore.org

American Solar Energy Society (ASES):
www.ases.org

American Wind Energy Association (AWEA):
www.awea.org

ASHRAE Advanced Energy Design Guides
(free download):
www.ashrae.org/publications/page/1604

Database of State Incentives for Renewables
& Efficiency (DSIRE):
www.dsireusa.org

Disaster Relief Agencies:
www.disastercenter.com/agency.htm

Edison Electric Institute:
www.eei.org

ENERGY STAR:
www.energystar.gov

Federal Emergency Management Agency (FEMA)
www.fema.gov

Geothermal Energy Association (GEA):
www.geo-energy.org

Green Communities:
www.greencommunitiesonline.org and
www.epa.gov/greenkit/index.htm

International Biofuels Association (IBA):
www.internationalbiofuels.org

Interstate Renewable Energy Council (IREC):
www.irecusa.org

National Association of Energy Service Companies:
www.naesco.org

National Association of Homebuilders (NAHB)
National Green Building Program:
www.nahbgreen.org

Residential Energy Services Network:
www.natresnet.org

Southern California Edison Renewable &
Alternative Power (RAP) program:
www.sce.com/EnergyProcurement/renewables

Solar Electric Power Association (SEPA):
www.solarelectricpower.org

U.S. Department of Agriculture (USDA):
www.usda.gov and
www.rurdev.usda.gov/rbs/energy.htm

U.S. Department of Housing and Urban
Development (HUD):
www.hud.gov

U.S. Green Building Council (USGBC):
www.usgbc.org

U.S. Small Business Administration (SBA):
www.sba.gov

References

Building Codes Assistance Project (BCAP; 2009). Congressional Stimulus Compromise Retains State Energy Assistance Grants. www.bcap-energy.org/node/346. Accessed March 22, 2009.

City of Greensburg, Kansas (2007). Vision Plan Draft. www.greensburgks.org/recovery-planning/071212-VisionDocument-compressed.pdf. Accessed March 22, 2009.

City of Greensburg, Kansas + BNIM (2008). Greensburg Sustainable Comprehensive Plan. www.greensburgks.org/recovery-planning/Greensburg%20Comprehensive%20Master%20Plan%202001-16-08%20DRAFT.pdf/view. Accessed March 22, 2009.

EERE Network News (February 18, 2009). apps1.eere.energy.gov/news/archive.cfm/pubDate=%7Bd%20%272009-02-18%27%7D. Accessed March 22, 2009.

EIA (2008). Annual Energy Review 2007. Washington, DC: EIA.

IECC (2003). International Energy Conservation Code. (Washington, DC: International Code Council).

NOLA.com (2008). Katrina: The Storm We Always Feared. www.nola.com/katrina. Accessed March 8, 2009.

Raiji, A. (2002). Big & Green: Toward Sustainable Architecture in the 21st Century. (New York: Princeton Architectural Press).

Recovery.gov (2009). Web site. www.recovery.gov. Accessed March 22, 2009.

U.S. Department of the Treasury (2009). New Market Tax Credits. www.cdfifund.gov/what_we_do/programs_id.asp?programID=5. Accessed March 22, 2009.

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

For Additional Information, Please Contact:

Energy Efficiency and Renewable Energy
Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov

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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/.

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H.2 Greensburg, Kansas—A Better, Greener Place to Live



Greensburg, Kansas

A Better, Greener Place to Live

“The biggest success story in Greensburg, to me, has been the resiliency 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 is 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.



Courtesy of BNIM/PIX 16658

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.



Courtesy of BNIM/PIX 16658

Buildings Tell a Story

Buildings are obvious evidence of Greensburg's commitment to sustainability. The 95-year-old Kiowa County Courthouse (Greensburg is the Kiowa County seat), one of the few structures left after the tornado, is being renovated with sustainable features designed to earn it a LEED Gold certification—an especially admirable goal, because the facility is being modified rather than replaced. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System recognizes performance in five key areas of human and environmental health. Its top three ratings are Silver, Gold, and Platinum (highest).

Greensburg residents have taken sustainability to heart and home. Owners of more than half the new homes built after the tornado volunteered to have their homes rated for energy savings. On average, these homes should use 40% less energy than standard homes built to code. Businesses such as banks, car dealerships, and funeral homes, along with churches and a lodge have rebuilt to save energy and water, and to use environmentally friendly materials. Some of Greensburg's new buildings are showcased in this publication. If you'd like to learn more about these buildings, visit the Greensburg Greentown Buildings Database at www.greensburg.buildinggreen.com.



John Charlton, Kansas Geological Survey (KGS)/PIX 16659



Lynn Billman, NREL/PIX 16650

Greensburg residents developed a Sustainable Comprehensive Master Plan for the town's next 20 years, and the plan was adopted by the City Council. As the plan itself states, "A truly sustainable community is one that balances the economic, ecological, and social impacts of development." This balance is visible in the community's goals as stated in the master plan—goals that clearly represent solid Midwestern values.

- Be progressive while remaining unassuming
- Open doors to newcomers while maintaining traditional cultural heritage
- Provide opportunities for young people—education, jobs, a future back home
- Value the natural environment, balanced with growth and economic development
- Build a variety of durable, healthy, energy-efficient houses and buildings
- Look to renewable sources of energy, such as Greensburg's plentiful wind
- Treat each drop of water as a precious resource
- Remain affordable.

Rebuilding with Energy

As the residents of Greensburg focused their energies on rebuilding, they also kept energy efficiency, renewable energy, and other sustainability goals squarely in mind. Others might call this a goal of becoming a "net zero energy community," or reducing a community's "carbon footprint," but to Greensburg, it's just seemed like the right way to live.

The City Council passed a resolution requiring all new city buildings larger than 4,000 square feet to meet U.S. Green Building Council LEED Platinum certification and reduce energy consumption by 42% as compared to standard buildings.

The city, which operates as a municipal utility, helped to develop, and will directly benefit from, a new 12-megawatt wind energy system expected to be installed near Greensburg. This system is projected to meet the pre-tornado electricity needs of the community. The city has entered into a power purchase agreement with a “green” power provider that has promised “100% renewable electricity, 100% of the time” from their wind, hydro, and other renewable energy electricity generation sources. With these accomplishments, Greensburg does become a true net-zero-energy community. That is, an energy-efficient community that generates as much electricity from renewable energy as it uses. This means the town will not use electricity generated from fossil fuels, such as coal.

Greensburg is the first city in the world to adopt these kinds of resolutions. It sets a new standard, not just for its own citizens, but for other rural and urban communities as well. Greensburg could not have envisioned or realized its vision without contributions and support from many organizations. Along with state agencies, innovative commercial firms, and nonprofit organizations, the U.S. Department of Energy and other federal agencies, including the U.S. Department of Agriculture and the Federal Emergency Management Agency, have been extensively involved with the rebuilding effort.

Why such a commitment? Sustainable communities such as Greensburg, with energy-efficient homes and buildings, and electricity and fuels from renewable energy sources have many advantages for our nation. They have a higher regard for human health, are easier on the natural environment, are well-poised for economic growth and job creation, and through energy security, contribute to our nation’s security. And, simply put, they are better places to live.

Clean, Green Medical Care

“Good building practices make sense,” says Mary Sweet, Administrator of the Kiowa County Memorial Hospital, noting that infections will be easier to control in the new building. The facility combines all medical services in a single, highly energy-efficient structure—striving to be the first critical access hospital in the United States to meet LEED Platinum standards.

The whole building has high “R-value” insulation, and features a dual ventilation system that prevents the exchange of air between the emergency and isolation rooms and the rest of the hospital, and seamless floors and countertops that make cleaning easier and more thorough.

An onsite wind turbine helps to power the facility, a rain filtration and storage system supplies recycled (gray) water to irrigate the property and flush the building’s toilets, and daylighting (natural light) illuminates 75% of the interior, reducing the use of electric lights.

“We’re a rural health clinic,” Sweet explained. “We provide basic lab work, X-rays, basic nursing, and ambulance service. We don’t do surgery or deliver babies.” But there is room to grow along with Greensburg. “There are ways we could take the clinic space and make it into surgical space. And the area of patient rooms is designed to allow us to add on.”





Courtesy of BNIMPX 16653

High-Performance School

“We had wonderful things before the tornado,” says Darin Headrick, Superintendent of Schools for the City of Greensburg, “We had a nice community, good kids, and good schools to attend.” In 2007, the year of the tornado, the high school received the Governor’s Award as one of the top 5% of the state’s schools.

With a brand new school, all of Greensburg students will learn in a high-performance building worthy of their own high academic performance. The new two-story, 120,000-square-foot facility consolidates grades K-12 in a single campus designed to be the state’s first LEED Platinum School. It includes state-of-the-art classrooms, a library, an interactive learning center, science labs, two gyms, a cafeteria and kitchen, art and music areas, courtyards, two playgrounds, a football stadium, and track and field facilities.

This new school replaces the total square footage of all the previous school buildings, combining all grade levels in a single facility. It will serve up to about 375 students (the school currently is serving about 220 students), allowing for the town’s future growth.

Key green features include the extensive use of day-lighting (natural light) to ensure that artificial lighting is seldom necessary in most rooms. Heating and cooling are handled by geothermal heat pumps that take advantage of the difference between the earth’s and the air’s temperatures. The pumps circulate water from below the earth’s surface to warm interior air in winter and cool it in summer. The building is also highly insulated.

An onsite wind turbine meets part of the facility’s electricity needs. Rainwater is transported through the roof lines, stored in cisterns, and used to irrigate the grounds.

When completed, the school will be a great improvement over the one permanent campus structure, known as the “caf-a-gym-atorium” and the temporary classrooms the students have been in since the 2007–2008 school year.

“Before the tornado, if you asked most of the high school kids about their plans for the future, they’d say the same thing: ‘I’m going to go away to college and never come back.’ Now, they say, ‘I’m going to go to college and then come back.’ They see things here that they can impact.”

— School Superintendent
Darin Headrick

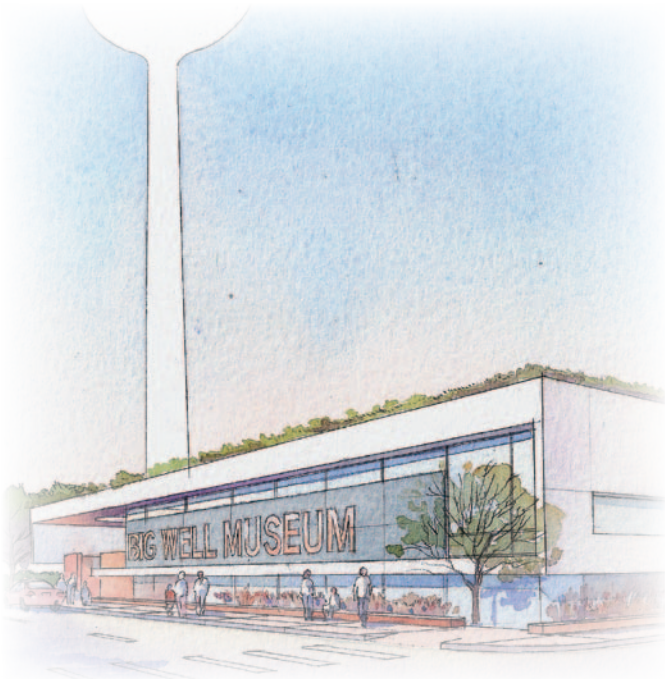
Children Today, Greensburg’s Leaders Tomorrow

If anything can forecast the lasting success of Greensburg’s bold vision, it’s the way the town’s young people envision their own futures. The town’s enthusiasm for going green has definitely inspired young people. Under the sponsorship of Greensburg GreenTown, a local nonprofit organization pivotal to the town’s rebuilding, Greensburg’s high school students established a Green Club.

Alexsis Fleener, a high school junior, is a member of the club as well as the youth representative on the Greensburg GreenTown Board of Directors. The green rebuilding program has “definitely” had an impact on her career and future plans. “My interest in environmental issues will not end with high school. I want to be in community planning and architecture,” she said. “My friends with the Green Club want to bring that to their careers too. We’d all love to come back to Greensburg.”



Courtesy of BNIMPX



Courtesy of BNIM

“Ultimately, sustainability relies on the ability to bring new, high-quality jobs to town.”
 — Greensburg Master Plan

Seeing Green for the Long Term

“We’d like to see Greensburg become the ecotourism capital of the world,” says Mayor Bob Dixon. “Companies can bring their customers here to see sustainable building products and all kinds of eco-friendly businesses. We want to be a living laboratory.”

Greensburg also hopes to attract companies that can draw on the resources of the prairie for a variety of green purposes, from research to entrepreneurial manufacturing.

One of the first new, green firms in town was BTI Wind Energy, which represents Canada’s Endurance Corporation, a manufacturer of wind turbines in the United States.

A Green Place to Grow

The two-story SunChips Business Incubator provides temporary, low-cost office space for as many as 10 small businesses rebounding from the tornado or starting from scratch. Like all structures owned by the City of Greensburg, the facility is built to LEED Platinum standards.

High-performance building materials provide maximum insulation and protection from high winds. Solar photovoltaic panels on the roof convert sunlight directly to electricity that meets about 10% of the building’s electricity requirements. A geothermal heating and cooling system taps into the earth’s temperature (warmer than outdoor air in winter and cooler in summer) to heat and cool the building.

Natural light provides most of the internal lighting, which minimizes the need for artificial lights. Water from sinks and showers is recycled and used to flush toilets. The recycled water (gray water) is supplemented by rainwater, which is collected and stored as it falls on the building.



Artist rendering of completed business incubator. Courtesy of BNIM



City of Greensburg; www.greensburgks.org/PIX 16660

A New and Better Way

Mike Estes of BTI-Greensburg, which owns and operates the local John Deere Dealership and Service Shop, says he had “only minimal interest in green building” before the 2007 tornado. “But when you have a chance to build back from scratch, you look for a new and better way.”

The dealership was one of the first businesses to rebuild. It is housed in a new, metal structure that covers 27,000 square feet and was designed to achieve LEED Platinum standards.

“No agricultural dealership has ever done anything like this—to our knowledge,” says Estes, whose family has owned BTI for four generations. Going green presented some challenges and involved some extra cost, “but we’ll see payback for pretty much everything we put in here.”

BTI’s focus on green attracted the attention of John Deere, and the corporation now uses the Greensburg facility as a standard for its dealerships. Estes says, “John Deere has a ‘Greensburg’ model that somebody can look at so they can replicate what they can use.”

The Greensburg dealership’s green features include highly insulated wall and roof systems, a highly energy-efficient heating and cooling system, and a network of skylights and mirrored reflectors that direct natural light where it is needed and reduce electricity use for lighting. Two onsite wind turbines provide electricity that offsets nearly 10% of the building’s total electricity needs.



Lynn Billman, NREL/PX 16661



Lynn Billman, NREL/PX 16651



Mike Estes and his brother established the company as a subsidiary of BTI-Greensburg, which owns the local John Deere dealership. In 2008, BTI purchased wind turbines from Endurance for its Greensburg facility and was so impressed with the quality and potential of the products that the Estes brothers chose to get into the green industry themselves.



Courtesy of BNIM

New businesses. New alternatives. New options for young people. Greensburg’s future continues to unfold, providing an ongoing example of what is possible when the people of a community come together with common purpose. In the words of Mayor Dixon, “We’ve been blessed with opportunity here, and we have a tremendous obligation to offer hope to the world.”

Creating a Green Showcase

“Green businesses, more than any other, rely on their reputation and integrity. Being connected to a community that has the same reputation they’re looking to establish gives them a jump start.”

— Daniel Wallach,
Greensburg GreenTown

Greensburg GreenTown is a nonprofit organization deeply involved in Greensburg’s new green vision and dedicated to making the town a center for ecotourism, a showcase for the latest in green technology, and a drawing card for new green businesses.

Daniel Wallach, executive director, saw the potential for green rebuilding after the disastrous tornado struck the town, several miles from his own home. He established Greensburg GreenTown soon afterward and has been a leader in the town’s redevelopment effort ever since.

Among the organization’s many projects is the building of as many as 12 “eco homes,” each with a unique design and story. All will be open to visitors for tours and overnight stays, supporting the city’s strong interest in ecotourism.

One of the first eco homes is built around a silo-shaped core, a testament to the local silo that remained standing after virtually every other structure in town was leveled by the 2007 storm.



City of Greensburg; www.greensburgks.org/PIX_16662

First in Green Lighting

One of the town's first completed green projects illuminates the downtown sidewalks and streets every night. Greensburg is the first city in the United States to use light-emitting diode (LED) lamps for 100% of its street lighting.

By replacing the old sodium vapor lights—all 303 of them—with LED fixtures, Greensburg improved outdoor lighting energy efficiency by 40% and reduced the cost of related energy and maintenance by an estimated 70%. As an added bonus, the new lamps reduce nighttime light pollution by focusing light where it is needed: on the ground rather than in the night sky.



For Additional Information

Greensburg GreenTown
204 West Florida
Greensburg, KS 67054
620-723-2790 or 620-549-3752
www.greensburggreentown.org

The Official Web Site of Greensburg, Kansas
www.greensburgks.org

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/.

Greensburg would like to acknowledge and thank the U.S. Department of Energy and its National Renewable Energy Laboratory for the assistance provided to produce this brochure.

For Additional Information, Please Contact:
Energy Efficiency and Renewable Energy Information Center
1-877-EERE-INF (1-877-337-3463)
www.eere.energy.gov

Prepared by the National Renewable Energy Laboratory (NREL)
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
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Green Where They Live

“Many Prairie Pointe residents have a better living situation now than before the storm.”

— Laura Stoltenberg,
Director of the Kiowa
County Housing Authority

The people of Greensburg are green where it counts the most: at home. As with business and government structures, housing in the community is being built with the greatest possible attention to sustainability. The Prairie Pointe Townhomes complex is a case in point.

Completed in 2008, Prairie Pointe provides affordable housing (residents' incomes may be no higher than 60% of the Kiowa County median income) in three structures with a total of 16 rental units. One building contains eight apartments; each of the remaining buildings has four units each. Eight of the 16 units received the first residential LEED platinum rating in Kansas. A single structure was submitted for rating to limit the cost of the process; all units were built to the same specifications.

Laura Stoltenberg, Director of the Kiowa County Housing Authority and Manager of Prairie Pointe, said that many Prairie Pointe residents have a better living situation now than before the storm. Rental property was limited in the past, she explained, and consisted mostly of older homes that were not energy efficient.



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Energy Efficiency &
Renewable Energy



H.3 From Tragedy to Triumph—Rebuilding Green Homes after Disaster

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, heat, drafts, 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 heat 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 batteries are integrated into the system.



Decker Homes, NREL / PIX15617

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

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

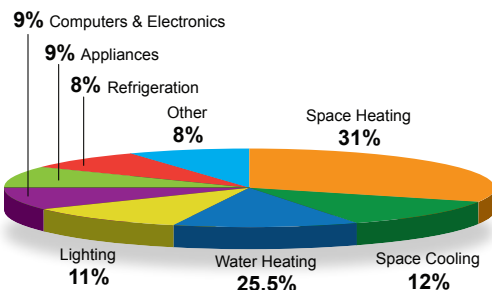
- Stimulates local economies
- Restores neighborhood pride
- Promotes cleaner environment.

Renewable Energy Benefits

- Generates electricity from the sun or wind
- Heats and cools your home quietly and naturally

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."

- Grants tax credits to homeowners
- Offers protection against rising utility bills
- Supplies reliable power after natural disasters
- Protects the environment.



How We Use Energy in Our Homes

Source: 2007 Buildings Energy Data Book

Rebuilding Green in Greensburg

After a tornado devastated their town in May 2007, the citizens of Greensburg, Kansas, turned disaster into opportunity by rebuilding as a

model “green” community. New homes will use 40% to 50% less energy than current building code. Renovated homes will use 25% less energy than current building code. Greensburg’s green housing projects include:



Mason Earles/PIX 16644

Eight of the 16 units at the Prairie Pointe Townhome complex (above) are estimated to use about 50% less energy than code.



Lynn Billman, NREL/PIX 16643

Mennonite Homes is building green homes in Greensburg, Kansas, with features such as energy-saving light bulbs, a 90% efficiency furnace, a tankless hot water heater, and efficient insulation in the walls and attic.



Stephanie Peterson/PIX 16645

The Waters family of Greensburg, Kansas, built this green home after their town was destroyed by a tornado in 2007.

Prairie Pointe Townhomes—a 32-unit complex awarded the first residential LEED (Leadership in Energy and Environmental Design) Platinum rating in Kansas.

Mennonite Homes—Mennonite Housing Rehabilitation Services, a local nonprofit group, built 10 affordable energy-efficient homes in Greensburg and plans to build 40 more that will use 50% less energy than standard homes.

Waters Home—The Waters family rebuilt their home in Greensburg using these green strategies:

- Wall and roof insulation with an R-Value greater than 25
- A ground-source heat pump for heating and cooling
- Shading east/west windows with trees and shrubs to keep the sun’s heat out in the summer and reduce cooling loads
- Light colors for surfaces and finishes to reflect sunlight deeper into the interior
- High performance windows and doors
- ENERGY STAR® computer equipment and appliances.

The home achieved a home energy rating score (HERS) of 47 in 2008, which means the home is more than 50% more efficient than a conventional home of similar size and type.

For more information about Greensburg, contact:
(620) 549-3752 or (620) 723-2790
info@greensburggreentown.org
204 West Florida
Greensburg, KS 67054

To see case studies of these and other Greensburg buildings, visit:
<http://greensburg.buildinggreen.com>

Green Home Checklist

Green construction methods can be integrated into buildings at any stage, but the most significant benefits result from using green methods in the earliest stages of a building project. Below is a checklist of green home features you can discuss with your builder.

Energy Efficiency

- ✓ **South orientation**—Build your home facing south to optimize its solar gain in winter and reduce heating loads. This also optimizes the efficiency of any renewable energy systems for producing electricity or heating water.
- ✓ **Efficient insulation**—Capitalize on one of the easiest, most cost-effective ways to save energy by using efficient insulation for foundations, walls, and roofs. Usually, the higher the R-Value of the insulation, the better it performs.
- ✓ **Seal openings and cracks**—To prevent infiltration of hot air in summer and loss of warm air in winter, properly seal openings and cracks to reduce cooling and heating costs.
- ✓ **Energy-efficient windows and doors**—Look for windows and doors with an ENERGY STAR® rating. Consider installing double-paned windows with a “low-e” glazing to hold in heat in winter and keep heat out in summer. Usually, the lower the U-Value, the better the performance.
- ✓ **Energy-efficient heating and cooling system**—Choose a high efficiency system with a cooling efficiency rating of SEER 13 (seasonal energy efficiency ratio) or higher. ENERGY STAR® SEER is 14.
- ✓ **Daylighting/passive solar gain**—Use natural light to offset electricity loads on weekends and to heat concrete, tile, or brick floors to reduce heating loads in winter. Proper window overhangs will block the summer sun and reduce cooling loads.

- ✓ **Efficient water heating**—Choose the most energy efficient water heating system you can, such as a tankless water heater, or consider installing solar water heating.
- ✓ **Lighting technologies**—Select lights that not only save energy, but also last much longer than traditional incandescent light bulbs, such as the compact fluorescent lights (CFLs) that have been easily available for some time. New technologies that use light-emitting diodes (LEDs) may also be an option. LED lamps illuminate at equivalent light levels to CFLs and can use less energy. An LED bulb can last for as many as 60,000 hours and a CFL for 10,000, compared to the incandescent’s 1,500.
- ✓ **Programmable thermostat**—Install a thermostat that automatically turns itself down when you’re at work and at night to save energy.
- ✓ **Appliances**—Install ENERGY STAR® appliances.

Water Efficiency

- ✓ **Water-efficient fixtures and appliances**—Reduce water and energy consumption (using less hot water also means using less energy) by installing low-flow sink and shower fixtures, toilets, and water-efficient dish and clothes washers.
- ✓ **Native landscaping**—Reduce water consumption by choosing plants indigenous to your area and use drip irrigation when possible.

Renewable Energy

- ✓ **Solar electricity**—Consider installing a small solar electric (photovoltaic) system on the roof to offset electrical loads. Invest in energy efficiency first to reduce system size and cost.

- ✓ **Wind electricity**—Small quiet wind energy systems are available for powering homes.
- ✓ **Geothermal heating and cooling**—The earth’s natural temperature can be used to heat and cool your home using geothermal wells and a ground-source heat pump.

Air Quality

- ✓ **Nontoxic products**—Use products that don’t contain toxic chemicals, such as paints and adhesives with low volatile organic compounds (VOCs) and formaldehyde-free insulation.
- ✓ **Ventilation**—Ventilate your home well for a good supply of fresh air. A ventilation system will control the amount of incoming fresh air to the home.
- ✓ **Heating and cooling system**—Purchase a system with high-efficiency filtration for interior and incoming air.

Sustainable Building Materials and Construction

- ✓ **Recycled materials**—Select recycled materials such as carpet, countertops, paint, and tile. Select insulation with recycled-content such as cellulose insulation.
- ✓ **Sustainably harvested or reclaimed wood**—Purchase wood certified by the Forest Stewardship Council. Some builders use reclaimed hardwood floors and siding or cork and bamboo flooring as alternatives.
- ✓ **Recycled construction waste**—Try to recycle at least 50% of the wood, cardboard, and concrete from new home projects.

Incentives for Energy Efficiency and Renewable Energy

Numerous financial incentives, such as federal and state tax credits and utility rebates, are available to help homeowners make their homes more energy efficient and to offset the cost of a renewable energy system. Many utility companies also offer net metering for grid-connected renewable energy systems, which gives homeowners credit for excess energy produced by their systems. The *American Recovery and Reinvestment Act*, signed into law on February 17, 2009, contains provisions that will financially benefit homeowners.

For more information, visit the Database of State Incentives for Renewables and Efficiency at: www.dsireusa.org.

Green Building Resources

Energy Savers

Basic information about energy efficiency and renewable energy from the U.S. Department of Energy (DOE) www.energysavers.gov

ENERGY STAR®

This program of DOE and the U.S. Environmental Protection Agency helps homeowners save energy and money through energy-efficient products and practices www.energystar.gov

Green Home Building Guidelines

Guidelines for building green homes from the National Association of Homebuilders www.nahbgreen.org/Guidelines/nahbguidelines.aspx

Residential Remodeling Guidelines

Information about remodeling an existing home to make it green www.greenhomeguide.org/documents/regreen_guidelines.pdf



Pete Beverly, NREL / PIX14163

This green home in Colorado produces as much energy as it consumes over a one-year period with the aid of a solar electric system. An illustration of this home's green features is provided by the National Renewable Energy Laboratory online at: www.nrel.gov/buildings/zero_energy.html

Renewable Energy Resources

Own Your Power! A Consumer Guide to Solar Electricity for the Home

Offers homeowners information about solar energy systems, financial incentives, and warranties and insurance along with tips for success www.nrel.gov/docs/fy09osti/43844.pdf

Small Wind Electrical Systems

A consumer's guide containing information about small wind energy systems for rural areas, including maintenance and zoning issues www.windpoweringamerica.gov/pdfs/small_wind/small_wind_guide.pdf

Geexchange

A Web site from the Geothermal Heat Pump Consortium that presents information about geothermal heating and cooling www.geoexchange.org

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

EERE Information Center
1-877-EERE-INF (1-877-337-3463)
eere.energy.gov/informationcenter

Prepared by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy; NREL is operated by the Alliance for Sustainable Energy, LLC.

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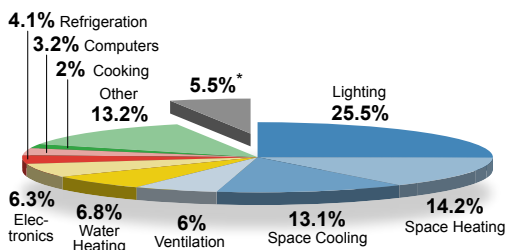
H.4 From Tragedy to Triumph—Rebuilding Green Buildings after Disaster

From Tragedy to Triumph—Rebuilding Green Buildings after Disaster

About Green Buildings

Green buildings save thousands in utility bills while making the indoor environment healthier and more comfortable for occupants. According to the U.S. Green Building Council, green commercial and public buildings on average use up to 50% less energy, emit up to 40% less CO₂, consume 40% less water, and produce 70% less solid waste. Green commercial buildings encourage the use of energy efficiency features such as effective insulation, high-performance windows, tight construction, and energy-efficient lighting, office equipment, and heating and cooling systems. Green buildings are healthier because they perform better and protect occupants against cold, heat, drafts, moisture, indoor pollutants, and noise.

Green buildings encourage the use of renewable energy to reduce a building's impact on the environment. A variety of renewable technologies are available, including small wind energy systems, geothermal heating and cooling, and solar energy systems. The most common form of renewable energy used on commercial and public buildings is solar energy. In areas with frequent storms or after a natural disaster, renewable energy can provide emergency power if batteries are integrated into the system.



How Commercial Buildings Use Energy

Source: EIA. * 5.5% is adjustment for variance in data. Energy use varies by building type. "Other" includes ATM machines, medical equipment, etc.



Courtesy of BTI-Greensburg/PX 16647

The BTI-Greensburg John Deere Dealership is up and running now and being put to the test. To ensure the systems operate as planned, the Estes brothers are undergoing a commissioning process where everything is examined: lighting systems, mechanical systems, materials used, plumbing, and more. This continuous evaluation is critical to keep an efficient, sustainable building running smoothly.

Green Benefits to Building Owners

- Provides building owners with tax credits
- Increases building value
- Better building energy performance
- Lowers utility bills for tenants
- Less tenant turnover (tenant ratio increases)
- Green buildings rent for more on average (rent ratio increases).

Green Benefits to the Community

- Stimulates local economies
- Restores community pride
- Promotes cleaner environment.

Rebuilding a business and community after a natural disaster such as a flood, hurricane, or tornado can be daunting. Turn a tragedy into an opportunity to create a healthier, more comfortable, and more energy-efficient business or public office by rebuilding "green."

Renewable Energy Benefits

- Generates electricity from the sun or wind
- Heats and cools quietly and naturally
- Grants tax credits to building owners
- Offers protection against rising utility bills
- Supplies reliable power after natural disasters
- Protects the environment.

Rebuilding Green in Greensburg

After a tornado devastated their town in May 2007, the citizens of Greensburg, Kansas, turned disaster into opportunity by rebuilding as

a model “green” community. As of September 2009 there were four LEED (Leadership in Energy and Environmental Design) Platinum certified buildings and several others attempting LEED Platinum or Gold

certification. LEED Platinum buildings use much less energy than similar conventional buildings.

Dillons Grocery Store

Completed in February 2009, the new Dillons is a hybrid between a grocery store and a gas station. The building includes a number of unique green building features such as an insulated concrete wall system, skylighting, LED lighting, and high efficiency refrigeration and HVAC equipment.

BTI-Greensburg John Deere

The John Deere farming equipment dealership in Greensburg is designed to LEED Platinum. Based on the lessons learned in Greensburg, additional John Deere dealerships are being built to maximize energy efficiency, and the company has redirected its business plan to promote energy efficient, green dealerships throughout North America. The Greensburg building includes green features such as a well-insulated roof and walls, insulated high bay doors, skylights, light tubes, energy efficient lights and equipment, wind turbines, and recycled waste oil used for heating water.

Green Public Buildings

The City of Greensburg passed a resolution that all new city-owned buildings would be LEED Platinum, including their City Hall and Business Incubator buildings. The resolution has inspired other public and commercial buildings to strive for building designs that will reach LEED Platinum or Gold, including, the Kiowa County Memorial Hospital and the Kiowa County Courthouse.

Greensburg School Complex

This K-12 school is setting a new standard for sustainable building practices. Not only is the school campus designed to LEED Platinum standards, but the school is expanding its curricula on energy and green technologies to include “hands-on” educational experiences for the students. The high school students in Greensburg have enthusiastically



Lynn Billman, NREL/PIX 16646

The Dillons grocery store in Greensburg, Kansas, hopes to set a new energy efficiency standard for rural grocery stores.



Courtesy of City of Greensburg/PIX 16648

Greensburg's new City Hall will include solar panels and geothermal technology, and will be built out of reclaimed brick and recycled wood and materials.



Courtesy of Studio 804/PIX 16649

The 5.4.7 Arts Center in Greensburg, named after the May 4, 2007, tornado that destroyed most of town, is the first LEED Platinum building in Kansas.

supported the community's goals, and formed a "Green Club." Some sustainable features planned for the new school include:

- An optimized building envelope and outdoor classrooms to reduce heating, cooling, and lighting energy loads
- Ground source/geothermal heating and cooling systems
- Natural lighting and ventilation
- Indoor water control systems
- Electricity from an onsite wind turbine (tentative).

Contact Information

For more information about Greensburg, contact: (620) 549-3752 or (620) 723-2790
info@greensburggreentown.org
 204 West Florida
 Greensburg, KS 67054

To see case studies about Greensburg buildings, visit:
<http://greensburg.buildinggreen.com>

Green Building Checklist

Green construction methods can be integrated into buildings at any stage, but the most significant benefits result from using green methods in the earliest stages of a building project. Below is a checklist of basic green building features to discuss with your builder and architect.

Energy Efficiency

- ✓ **South and north orientation**—Build facing due south to optimize solar heat gain as well as the efficiency of any renewable energy systems for producing electricity or heating water. Reducing east and west wall areas maximizes the energy efficiency of buildings with large cooling loads.
- ✓ **Daylighting**—Install large windows that allow sunlight to reach about 75% of the interior to reduce the need for artificial lights. For small buildings with high heating loads, the extra sunlight can be used to heat concrete, tile, or brick flooring, which in turn can help heat the interior. Proper window overhangs will block the summer sun and reduce cooling loads. For large buildings with high cooling loads, large north windows will maximize daylight without increasing heat gain.
- ✓ **Efficient insulation**—Capitalize on one of the easiest, most cost-effective ways to save energy by using efficient insulation for foundations, walls, and roofs. Usually, the higher the R-Value of the insulation, the better it performs.
- ✓ **Energy-efficient windows and doors**—Look for windows and doors with an ENERGY STAR® rating. Consider installing double-paned windows with a "low-e" glazing to hold in heat in winter and cool air in summer. Usually, the lower the U-Value, the better the performance.
- ✓ **Efficient water heating**—Choose the most energy efficient water heating system you can, such as a tankless water heater, or consider installing solar water heating.
- ✓ **Energy-efficient heating and cooling system**—Choose a 90% or greater efficiency furnace, a cooling system with an efficiency rating of SEER 14 (seasonal energy efficiency ratio) or higher (ENERGY STAR® is SEER 14), or a ground-source heat pump.
- ✓ **Programmable thermostat**—Install a thermostat that automatically turns itself down at night to save energy.
- ✓ **Lighting technologies**—Select lights that not only save energy, but also last much longer than traditional incandescent light bulbs, such as the compact fluorescent lights (CFLs) that have been easily available for some time. New technologies that use light-emitting diodes (LEDs) may also be an option. LED lamps illuminate at equivalent light levels to CFLs and can use less energy. An LED bulb can last for as many as 60,000 hours and a CFL for 10,000, compared to the incandescent's 1,500.

- ✓ **Occupancy sensors**—Install sensors that turn off lights in unoccupied rooms such as conference rooms and bathrooms.
- ✓ **Appliances and Equipment**—Install ENERGY STAR® appliances and office equipment to save energy.

Water Efficiency

- ✓ **Water-efficient fixtures and appliances**—Reduce water and energy consumption (using less hot water also means using less energy) by installing low-flow sink and shower fixtures, toilets, and water-efficient dish and clothes washers.
- ✓ **Native landscaping**—Reduce water consumption by choosing plants indigenous to your area and use drip irrigation when possible.

Renewable Energy

- ✓ **Solar electricity**—Consider installing a small solar electric system on the roof to offset electrical loads.
- ✓ **Wind electricity**—Small quiet wind energy systems are available for buildings in areas with sufficient open space.
- ✓ **Geothermal heating and cooling**—The earth's natural temperature can be used to heat and cool your building using geothermal wells and a ground-source heat pump.

Air Quality

- ✓ **Nontoxic products**—Use low volatile organic compound (VOC) paints and adhesives, and formaldehyde-free insulation.
- ✓ **Ventilation**—Ventilate your building appropriately for a good supply of fresh air, without wasting energy on heating and cooling.

Sustainable Building Materials and Construction

- ✓ **Recycled materials**—Select recycled or recycled-content materials such as carpet, countertops, paint, tile, and insulation.

✓ **Sustainably harvested or reclaimed wood**—Purchase wood certified by the Forestry Stewardship Council, reclaimed hardwood floors and siding, or use cork and bamboo flooring as alternatives.

✓ **Recycled construction waste**—Try to recycle at least 50% of the wood, cardboard, and concrete from the project.

Incentives for Energy Efficiency and Renewable Energy

Numerous financial incentives are available to help building owners make their buildings more energy efficient and to offset the cost of a renewable energy system. Among the incentives available are federal and state tax credits and utility rebates. Many utility companies also offer net metering for grid-connected systems, which gives building owners credit for excess energy produced by their systems. And the *American Recovery and Reinvestment Act*, signed into law on February 17, 2009, contains provisions that will financially benefit businesses.

For more information about financial incentives, visit the Database of State Incentives for Renewables and Efficiency at www.dsireusa.org.

Commercial Building Energy Alliances

Partner members of these U.S. Department of Energy (DOE) alliances help guide research and encourage industry to move toward energy-efficient design and strategies in commercial buildings www.buildings.energy.gov/commercial_initiative/alliances.html

Retailer Energy Alliance

www.buildings.energy.gov/retailer/

Hospital Energy Alliance

www.buildings.energy.gov/hospital/

Commercial Real Estate Energy Alliance

www.buildings.energy.gov/real_estate/

Green Building Resources

Energy Savers

Basic information about energy efficiency and renewable energy from DOE www.energysavers.gov

ENERGY STAR®

This program of DOE and the U.S. Environmental Protection Agency helps building owners save energy and money through energy-efficient products and practices www.energystar.gov

Commercial Buildings Energy Efficiency Practices

Guidelines from DOE for each step of the design and building process www.buildings.energy.gov/commercial/index.html

High-Performance Buildings Database

Information from DOE about more than 100 high-performance buildings <http://eere.buildinggreen.com/>

Green Building Case Studies

A database of green commercial buildings from the U.S. Green Building Council (USGBC) www.usgbc.org/LEED/Project/CertifiedProjectList.aspx

AIA Top Ten Green Buildings

The American Institute of Architects (AIA) gives awards to the top ten green buildings www.aiaopten.org/hpb/index.cfm

Green Schools Resources

EnergySmart Schools

Guidelines for building green schools from DOE www.buildings.energy.gov/energysmartschools/

Green Schools Guide

Guidelines for building green schools from USGBC <http://www.buildgreenschools.org/>

Renewable Energy Resources

Own Your Power! A Consumer Guide to Solar Electricity for the Home

Information about solar energy systems, financial incentives, and warranties and insurance along with tips for success www.nrel.gov/docs/fy09osti/43844.pdf

Small Wind Electric Systems

A consumer's guide that provides information about small wind energy systems for rural areas, including maintenance and zoning issues www.windpoweringamerica.gov/pdfs/small_wind/small_wind_guide.pdf

Geoexchange

A Web site from the Geothermal Heat Pump Consortium that presents information about geothermal heating and cooling www.geoexchange.org

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

EERE Information Center
1-877-EERE-INF (1-877-337-3463)
eere.energy.gov/informationcenter

Prepared by the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy; NREL is 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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H.5 From Tragedy to Triumph—Rebuilding with Renewable Energy after Disaster

From Tragedy to Triumph—Rebuilding with Renewable Energy after Disaster

Renewable energy is generated from sources that are “green” and naturally replenished such as sunlight, wind, and geothermal heat. This energy can power, heat, and cool buildings, and can replace traditional sources of fuel (e.g., coal and natural gas) used by utilities. Most utilities are using wind power, but other types are coming to the forefront. Every day, more individuals, businesses, and communities decide to “go green” with renewable energy.

Renewable Energy Benefits

- Generates electricity from the sun or wind
- Heats and cools quietly and naturally
- Grants tax credits to building owners
- Offers protection against rising utility bills
- Supplies reliable power after natural disasters
- Protects the environment.

Energy Efficiency First

Lower energy demand means renewable energy systems can be smaller and less expensive. Consider these basic energy efficiency strategies:

- Use efficient insulation for foundations, walls, and roofs
- Look for ENERGY STAR® doors and windows and double-paned windows with “low-e” glazing
- Seal openings and cracks to reduce cooling and heating costs



The Science & Technology Facility at the National Renewable Energy Laboratory in Golden, Colorado, incorporates a number of advanced energy efficiency and green building concepts. For example, the architecture makes good use of natural light wherever possible, and an automated system dims unnecessary artificial lighting to reduce electricity use.

Rebuilding a community, a business, or a home after a natural disaster such as a flood, hurricane, or tornado can be daunting. Tragedy can be turned into opportunity by rebuilding with renewable energy and creating healthier and more energy-efficient communities.

- Choose high-efficiency heating, cooling, and air-conditioning (HVAC) equipment
- Use daylighting (natural light), compact fluorescent lights (CFLs), and ENERGY STAR® appliances and office equipment to reduce electricity use.

Types of Renewable Energy

Solar

Solar power technologies take advantage of a large, clean, free renewable

energy source—the sun. Solar technologies are scalable—they’re suitable for very small to very large applications. There are several types of solar technologies:

Solar photovoltaics (PV) convert sunlight directly to electricity and can be installed on individual rooftops or as large “fields” of solar arrays by a utility company.

Concentrating solar power (CSP) systems concentrate the sun’s heat to drive a generator that produces electricity. Most CSP systems are installed by utility companies and may consist of a field of dishes, engines, parabolic troughs, or central power towers.

Solar heating technologies use collectors that absorb the sun’s heat for water or space heating.

Solar lighting technologies include “clerestory” windows, skylights, and solar tubes that bring sunlight into a building where light is most needed.

Passive solar heating and daylighting strategies are integrated into designs so buildings work with the sun to operate more efficiently.

Rebuilding Green in Greensburg

After a tornado devastated their town in May 2007, the citizens of Greensburg, Kansas, turned disaster into opportunity by rebuilding as

a model “green” community. Their master plan includes goals for making residential and commercial buildings more energy efficient and developing community- and small-scale renewable energy projects.



Lynn Billman, NREL/PIX 16651

The John Deere dealership in Greensburg, Kansas, owned by BTI Equipment, uses two wind turbines to produce electricity for the building and burns waste oil for heating.



Lynn Billman, NREL/PIX 16650

The Kiowa County Courthouse in Greensburg has a geothermal heating and cooling system that uses an energy efficient ground-source heat pump to circulate air that's naturally warmed and cooled in 32 deep underground wells. This is an excellent example of green historical restoration.



Lynn Billman, NREL/PIX 16652

Greensburg's new SunChips Business Incubator building offers affordable office space for small start-up businesses. Among other green features, the solar PV panels on the roof capture the sun's energy and convert it to electricity, meeting approximately 10% of the building's total energy needs.

Community-Scale Renewable Energy Projects

The City of Greensburg, which doubles as a municipal utility, is developing large-scale renewable energy resources. One project is the Greensburg Wind Farm, a joint effort of the City of Greensburg, the Kansas Power Pool, and John Deere Renewable Energy, that will consist of ten 1.25-MW wind turbines. The wind farm is expected to be operational in 2010 and will generate enough energy to power every home, business, and municipal facility in Greensburg. Excess electricity will be sold back to the local utility.

Financing for the project was supported by Native Energy Inc., which will be the exclusive marketer of Renewable Energy Certificates (RECs) from the wind farm. RECs, also called green tags, green certificates, or tradable renewable certificates, capture the environmental attributes—typically in terms of avoided emissions—of the power produced from renewable energy. They are sold separately from the electricity that runs through the grid. Usually, 1 REC represents proof that 1 megawatt-hour of electricity has been generated from an eligible renewable energy resource. Native Energy will purchase about two-thirds of the wind farm's expected RECs over 20 years.

The city is also working with surrounding counties to explore options for using agricultural wastes to produce energy.

Small-Scale Renewable Energy Projects

Greensburg completed a study outlining the opportunities for solar PV to generate electricity on individual homes and businesses. The city also has adopted an interconnection agreement and net-metering policy that will give home and business owners credit from the local utility for excess power produced by their systems. In such distributed systems, buildings both receive and send electricity to the grid through an interconnection agreement.



U.S. Environmental Protection Agency / PIX14837

At the EPA's Robert S. Kerr Environmental Research Center in Ada, Oklahoma, a retrofit to upgrade the building's mechanical system and incorporate renewable energy reduced the lab's annual energy consumption by 45%. The retrofit implemented a geothermal ground-source heat pump among other energy efficient systems. Because of these upgrades and "green tag" purchases from wind power, the Ada Lab became EPA's first zero emissions facility.

And net-metering policies allow the owner of a distributed system to get the most value for the electricity sent back to the grid.

Contact Information

For more information about Greensburg, contact:
(620) 549-3752 or (620) 723-2790
info@greensburggreentown.org
204 West Florida
Greensburg, KS 67054

To see case studies about Greensburg buildings, visit:
<http://greensburg.buildinggreen.com>

Wind

In certain areas, the wind is another resource for producing renewable energy. Wind turbines convert the wind's kinetic energy into mechanical power, which is sent to a generator that converts the mechanical power into electricity. Wind energy can also be used for specific needs such as pumping water.

Single small turbines, rated in the 5–50 kilowatt (kW) range, can power homes, ranches, or remote buildings (zoning restrictions may apply, so check with your local zoning authority).

Turbines in the 5–100-kW range may benefit commercial buildings in appropriate locations.

Utility-scale turbines from 100 kW to several megawatts (MW) are grouped together into wind farms, often 100 MW or more in total capacity, which supply power to the electrical grid in bulk.

Geothermal

Geothermal energy is heat that resides deep within the rock and fluid of the earth's crust. This energy can be harnessed to produce electricity or direct heat, or for heating and cooling buildings.

Electrical power plants use steam from geothermal reservoirs to rotate turbines that activate generators for producing electricity.

Small-scale geothermal power plants—under 5 MW— have the potential for widespread community application where geothermal resources are abundant, possibly as "distributed energy" resources (a variety of small, modular, power-generating technologies that can be combined to improve the operation of the electrical grid).

Ground-source heat pumps typically comprise a ground heat exchanger (a system of pipes called a loop, which is buried in the shallow ground near the building), a heat pump unit, and a series of ducts through which air is delivered. A fluid—usually water or a mixture of antifreeze and water—circulates through the pipes to absorb or relinquish heat. In the winter, the heat pump removes heat from the exchanger and pumps it through the ducts. The process is reversed in the summer, when the pump moves heat from the indoor air into the heat exchanger.

Biomass

When most people think of using biomass, ethanol from corn and biodiesel from soybean oil spring to mind. Other types of biomass have the potential to contribute to our energy mix as well. Dedicated energy crops such as fast-growing trees and grasses can be grown sustainably on land that is unsuitable for food crops. Forestry or agricultural residues, such as wheat straw and the stalks, leaves, and husks of the corn plant, called "stover," are all biomass. Even the organic components of municipal and industrial wastes are usable for energy production.

Biomass is used to make **liquid fuels for transportation**, as in the cases of ethanol and biodiesel.

Most of us are familiar with **consuming biomass to generate heat**. Firewood and other biomass such as corn cobs can be burned to heat buildings. Biomass can also be "pelletized" to burn more cleanly and efficiently than firewood in heating stoves.

Utilities and major industries **consume biomass directly or convert it to a gaseous fuel to generate electricity**. Many coal-fired power plants today add biomass to their coal-burning process. This practice, called co-firing, reduces emissions while producing electricity. And industries such as pulp and paper and forest products often use biomass to co-generate heat and electricity.

Some of these uses for biomass have been commercialized for a long time; other uses are in development and are not yet commercial. For example, the first pilot-scale ethanol plants that use biomass other than corn are just being constructed.

Financing Renewable Energy

Financial Incentives

Numerous financial incentives, such as federal and state tax credits and utility rebates, are available to help offset the cost of a renewable energy system. Many utility companies also offer net metering for grid-connected renewable energy systems, so consumers can get credit for power they produce but don't need. And the *American Recovery and Reinvestment Act*, signed into law on February 17, 2009, contains provisions that will financially benefit individuals, businesses, organizations, and the renewable energy industry as a whole.

For more information about financial incentives, visit the Database of State Incentives for Renewables and Efficiency at www.dsireusa.org.

Power Purchase Agreements

A power purchase agreement (PPA) is a financing mechanism created to help businesses, industrial concerns, schools and universities, and all levels of government go green with no up-front capital cost. Through these long-term contracts (about 15 years or more) a renewable energy company (PPA partner) finances, owns, and maintains the renewable energy system. The buyer agrees to purchase the electricity generated by the system from the PPA partner, which has assumed all the risks and responsibilities of ownership. At the end of the PPA term, the buyer can choose to purchase the system or extend the agreement. A PPA with predetermined electricity rates over the term of the contract helps to stabilize operating costs that were once highly variable.

Energy Efficiency and Renewable Energy Resources

Energy Savers

Basic information about energy efficiency and renewable energy from the U.S. Department of Energy (DOE)
www.energysavers.gov

ENERGY STAR®

This program of DOE and the U.S. Environmental Protection Agency (EPA) has information about energy efficiency for home and business owners as well as commercial and industrial building energy managers and operators
<http://www.energystar.gov/>

Own Your Power! A Consumer Guide to Solar Electricity for the Home

Information about solar energy systems, financial incentives, and warranties and insurance along with tips for success
www.nrel.gov/docs/fy09osti/43844.pdf

A Homebuilder's Guide to Going Solar

This guide helps builders assess the benefits of installing solar equipment or making houses "solar ready" to both their businesses and customers
www.solar.energy.gov/pdfs/44792.pdf

Small Wind Electric Systems: A U.S. Consumer's Guide

A consumer's guide containing information about small wind energy systems for rural areas, including maintenance and zoning issues
www.windpoweringamerica.gov/pdfs/small_wind/small_wind_guide.pdf

Geoexchange

A Web site from the Geothermal Heat Pump Consortium that presents information about geothermal heating and cooling
www.geoexchange.org

Exploring Ways to Use Biomass Energy

A DOE Web site that explains the different ways to use biomass
www.energysavers.gov/renewable_energy/biomass/index.cfm/mytopic=50001

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

EERE Information Center
1-877-EERE-INF (1-877-337-3463)
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H.6 From Tragedy to Triumph—Resources for Rebuilding Green after Disaster

From Tragedy to Triumph—Resources for Rebuilding Green after Disaster

These resources offer builders and architects information about building healthier, more comfortable, and more energy-efficient homes, businesses, and public buildings.

Financial Incentives

Numerous financial incentives, such as federal and state tax credits and utility rebates, are available to help offset the cost of a renewable energy system. Many utility companies also offer net metering for renewable energy systems that are connected to the grid. And the *American Recovery and Reinvestment Act*, signed into law on February 17, 2009, contains provisions that will financially benefit individuals, businesses, organizations, and the renewable energy industry as a whole.

For more information about financial incentives, visit the Database of State Incentives for Renewables and Efficiency at www.dsireusa.org.

Commercial Building Energy Alliances

Partner members of these U.S. Department of Energy (DOE) alliances help guide research and encourage industry to move toward energy-efficient design and strategies in commercial buildings

www.buildings.energy.gov/commercial_initiative/alliances.html

Retailer Energy Alliance

www.buildings.energy.gov/retailer/



Bill Timmerman, NREL/PIX 14963

The National Renewable Energy Laboratory's Science & Technology facility is designed to encompass advanced energy efficiency and "green building" concepts in systems such as lighting and HVAC.

Rebuilding a business or home after a natural disaster such as a flood, hurricane, or tornado can be daunting. These resources can help you turn tragedy into opportunity by rebuilding with energy efficiency and renewable energy to create healthier buildings and homes.

Hospital Energy Alliance

www.buildings.energy.gov/hospital/

Commercial Real Estate Energy Alliance

www.buildings.energy.gov/real_estate/

Energy Efficiency Resources

Energy Savers

Basic information about energy efficiency and renewable energy from DOE

www.energysavers.gov

ENERGY STAR®

This program of DOE and the U.S. Environmental Protection Agency (EPA) helps building owners save energy and money through energy-efficient products and practices

www.energystar.gov

Commercial Buildings Energy Efficiency Practices

Guidelines from DOE for each step of the design and building process

www.buildings.energy.gov/commercial/index.html

EnergySmart Schools

Guidelines for building green schools from DOE

www.buildings.energy.gov/energysmartschools

Green Guides and Case Studies

Green Building

Provides general information about green buildings along with case studies from EPA

www.epa.gov/greenbuilding/

Green Building Case Studies

A database of green commercial buildings from the U.S. Green Building Council (USGBC)

www.usgbc.org/LEED/Project/CertifiedProjectList.aspx

Green Home Building Guidelines

Guidelines for building green homes from the National Association of Homebuilders (NAHB)

www.nahbgreen.org/Guidelines/nahbguidelines.aspx

Green Schools Guide

Guidelines for building green schools from USGBC

www.buildgreenschools.org/

Greensburg Sustainable Buildings Database

Case studies of green commercial buildings and homes in Greensburg, Kansas

<http://greensburg.buildinggreen.com>

High-Performance Buildings Database

Information from DOE about more than 100 high-performance buildings

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

Remodeling Green Guidelines

A publication about remodeling an existing home to make it green

www.greenhomeguide.org/documents/regreen_guidelines.pdf

Top Ten Green Buildings

The American Institute of Architects gives annual awards for the top ten green buildings.

www.aiatopten.org/hpb/

Renewable Energy Resources

A Homebuilder's Guide to Going Solar

This publication helps builders assess the benefits of installing solar equipment or making houses "solar ready" to both their businesses and customers.

www.solar.energy.gov/pdfs/44792.pdf

Own Your Power! A Consumer Guide to Solar Electricity for the Home

Information about solar energy systems, financial incentives, and warranties and insurance along with tips for success

www.nrel.gov/docs/fy09osti/43844.pdf

Small Wind Electric Systems

A consumer's guide with information about small wind energy systems for rural areas, including maintenance and zoning issues

www.windpoweringamerica.gov/pdfs/small_wind/small_wind_guide.pdf

Geoexchange

A Web site from the Geothermal Heat Pump Consortium that presents information about geothermal heating and cooling

www.geoexchange.org



The atrium at the Adam Joseph Lewis Center for Environmental Studies in Oberlin, Ohio, features low-e glaze windows that hold in heat during winter and keep heat out in the summer.



Cheryl Unger, NREL/PIX 15625

This ENERGY STAR® home in Colorado uses at least 15% less energy than a typical home built to code and features a solar PV system.

Organizations and Associations

Alliance to Save Energy

Information about energy efficiency, including building green schools and commercial buildings

www.ase.org

American Architectural Manufacturers Association

Includes information and news about building green in its green building section

www.aamanet.org/general.asp?sect=1&id=315

American Council for an Energy Efficient Economy (ACEEE)

ACEEE has energy efficiency information for both residential and commercial buildings

www.aceee.org/Consumer/index.htm
www.aceee.org/buildings/commercial.htm

American Society of Heating, Refrigerating, and Air-Conditioning Engineers

Information about the latest standards for green buildings

www.ashrae.org

American Solar Energy Society

Information about using solar for green homes

www.ases.org

American Wind Energy Association

Information on wind energy projects and technology and policy development

www.awea.org

BuildingGreen.com

Information about green buildings including books on green products

www.buildinggreen.com/

Build It Green

A nonprofit organization dedicated to energy and resource efficient building in California

www.builditgreen.org

Common Fire Foundation

A nonprofit organization dedicated to teaching others about green building

www.commonfire.org/

Cool Roof Rating Council

Provides an independent rating system for cool roofs used in green buildings

www.coolroofs.org

Energy & Environmental Building Alliance

Offers educational classes and information about green buildings

www.eeba.org

Green Building Resource Center

Free design advice and information about environmentally friendly products and strategies

www.globalgreen.org/gbrc

Green Concepts

Information about environmentally friendly products and green building

www.greenconcepts.com

Geothermal Energy Association

Geothermal resource maps and listing of U.S. geothermal plants by state

www.geo-energy.org

Home Ventilating Institute

Information about ventilation systems for home and businesses

www.hvi.org

Indoor Air Quality Association

A nonprofit organization dedicated to improving indoor air quality

www.iaqa.org

National Association of Home Builders (NAHB)

NAHB Green www.nahbgreen.org and the NAHB Research Center www.nahbrc.org provide resources and information to builders about green homes and products.



The new high school in Greensburg, Kansas, is being built using green strategies such as the use of daylighting in the gymnasium to offset artificial lighting loads.

National Resources Defense Council

Information for builders about how green homes and commercial buildings can boost the bottom line

www.nrdc.org/buildinggreen

National Roofing Contractors Association

Trade association for the roofing industry that has an online “Energy Wise” roof calculator

www.nrca.net

New Homes Directory

A national directory of new green homes and communities

www.newhomesdirectory.com/green

National Recycling Coalition, Inc.

Provides waste reduction information for builders

www.nrc-recycle.org

North American Insulation Manufacturers Association

Information about various types of insulation, including fiber glass, rock wool, and slag wool insulation products. Builders can search for green products

www.naima.org

Sustainable Buildings Alliance

International organization dedicated to sustainable development and green buildings

www.sballiance.org/

Sustainable Buildings Industry Council

Provides educational classes and resources for passive solar design

www.SBICouncil.org

U.S. Green Building Council (USGBC)

USGBC has information about green commercial and residential buildings as well as the LEED (Leadership in Energy and Environmental Design) rating system for commercial buildings www.usgbc.org/. They also have a blog about green buildings

<http://blog.epa.gov/blog/category/greenbuilding>

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H.7 Rebuilding It Better—BTI-Greensburg John Deere Dealership



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Rebuilding It Better

**BTI-Greensburg
John Deere Dealership**



On May 4th, 2007, brothers Kelly and Mike Estes saw their BTI-Greensburg John Deere Dealership ruined by an EF-5 tornado. They were not alone in their loss—95% of the town was destroyed that day. So they were overwhelmed the next morning when more than 100 customers and friends arrived to help them salvage what they could.

To support the community that helped them so much, Kelly, Mike, and their family committed to rebuilding their business in a better, greener way. They wanted the new 28,000 ft² prefabricated metal building to house the world's greenest farm machinery business, attain a LEED® Platinum rating, and use the least energy possible. And they did all they could to reach these goals.



Green Goals

All of Greensburg, Kansas, is working toward becoming a model green community. The residents saw this tragedy as an opportunity to improve where they live. With the help of the U.S. Department of Energy and the National Renewable Energy Laboratory, Greensburg residents are building sustainable, energy-efficient homes, businesses, and government buildings.

The Estes brothers and the John Deere Company support this effort. In fact, the BTI-Greensburg building is the new “John Deere Place” design—a model for dealers who are building and remodeling across North America. The John Deere Company would like to see these energy-saving and environmentally-friendly features incorporated into future dealerships.

LEED® Platinum

The new building is designed to meet the requirements of the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) Platinum designation—the highest designation possible. No other metal prefabricated building has achieved LEED status—let alone LEED platinum.

Energy Conservation

Kelly and Mike set a goal of saving 42% in energy costs and looked for every opportunity to improve BTI-Greensburg’s efficiency. Experts at the National Renewable Energy Laboratory, with the U.S. Department of Energy’s support, worked with BTI-Greensburg as part of their research to reduce retail building energy use by half. They helped identify, through modeling and life-cycle analysis, the most cost-effective energy efficiency strategies.



The insulated garage door and skylights at the BTI-Greensburg service center make this large, open area very energy efficient.

Natural Lighting

Daylighting, using natural instead of electric lighting, is critical in reducing energy use. A good daylighting design brings in diffused light to minimize glare and heat. Daylighting also provides a natural sense of well-being to employees and customers.

The BTI-Greensburg building features:

- 23 skylights in the service shop, parts department, and wash bay.
- 12 tubular daylighting devices in the retail space.
- High-efficiency lights and luminaire fixtures.

To further minimize electricity use, sensors detect occupancy and turn off unneeded lights. The lighting controls also automatically balance electric lighting with daylighting for maximum savings.

Improved Insulation

Insulation is key to keeping any building at the right temperature and minimizing heating and cooling costs. Insulation is measured in R-values—the higher the R-value, the better the insulation. BTI-Greensburg exceeded standard levels in all areas by using:

- R-16 highly insulated wall panels, typically used in refrigerated warehouses: 2 times better than building code.
- R-14 insulated panels in the garage doors: 20 times better than standard practice.
- R-38 insulation in the roof: 2 times better than standard.
- R-3.8 under the slab floor to minimize heat loss.

“

Going green was important to us to be sure we’re being good citizens of Greensburg and helping the environment.

– Kelly Estes

”

The BTI-Greensburg John Deere Dealership features tubular daylighting devices that bring natural light into the showroom. This reduces electricity use, provides a better environment for employees and customers, and saves BTI-Greensburg money.





The ground breaking on February 4th, 2008, was the first step toward a new, green BTI-Greensburg building.

Efficient Heating, Ventilation, and Air Conditioning

The BTI-Greensburg building features a highly efficient radiant heating system in the concrete slab floor. The water for it is heated by recycled oil from BTI's normal operations, which reduces the need for natural gas.

A high-efficiency 16 SEER variable-air volume system provides heating, cooling, and outdoor air. Additionally, motion detectors and individual controls help minimize the use of the heating and cooling systems.

Power From the Wind

To help power the dealership, BTI installed two wind turbines (5 kW and 1.8 kW) to offset about 8% of the building's electricity use. Impressed by the 5 kW Endurance model chosen for the site, other family members are now involved in a new venture, BTI Wind Energy. It has become the North American distributor for Endurance, and has created more than 100 new green jobs at dealerships throughout the United States.

Sustainable Features

To earn a LEED Platinum rating, the Estes family followed other sustainable practices in addition to energy efficiency.

Sustainable Site

- Minimize site disturbance and control erosion.
- Reduce transportation impact by promoting the use of bicycles and fuel-efficient vehicles.
- Maximize the use of native landscaping and open space.
- Manage storm water runoff by using pervious hard surfaces such as recycled crushed concrete.
- Limit the site's heat island effect through white roofing and reflective paving.

Water Efficiency

- Plant drought-tolerant landscaping.
- Irrigate with runoff and rain water that are naturally filtered and stored in a holding pond.
- Aerate the holding pond with a wind-powered system.
- Use waterless urinals and low-flow fixtures.

Materials and Resources

- Manage and recycle construction waste.
- Have a workplace recycling plan.
- Used recycled local and regional steel and certified woods to build the structure.

Indoor Environmental Air Quality

- Control tobacco smoke.
- Ensure thermal comfort with personal heating and cooling controls.
- Use highly efficient filters and fresh air to improve indoor air quality.
- Use adhesives, woods, carpet, and paint with low volatile organic compounds.
- Provide daylight spaces and access to views.

Design Team

Owners:
The Estes Family

Builder:
Hastco Construction

Architect:
Landmark Architects

Mechanical, Electrical, and Plumbing:
Professional Engineering Consultants

Site Design:
BNIM Architects and John Deere Landscapes

Floor Plan/Layout Design:
John Deere Place

LEED Consultant:
BNIM Architects

Research Assistance:
National Renewable Energy Laboratory

Commissioning:
Midwest Engineering, Inc.

One of the new wind turbines is visible from the entrance of the BTI-Greensburg John Deere Dealership.



Great Results

The BTI-Greensburg John Deere Dealership is up and running now and being put to the test. To ensure the systems operate as planned, the Estes brothers are undergoing a commissioning process where everything is examined: lighting systems, mechanical systems, materials used, plumbing, and more. This continuous evaluation is critical to keep an efficient, sustainable building running smoothly.

Mike and Kelly are delighted with their building. It is a healthier and more comfortable environment for customers and employees, and BTI-Greensburg is expecting significantly decreased energy bills. “We’re really pleased with how it all turned out,” states Mike Estes.

The Estes are proud to contribute to the community that helped them during a crisis. They provide an excellent example of what can be done to improve the quality and efficiency of commercial buildings. This is something that will not only benefit Greensburg, but our nation as a whole.

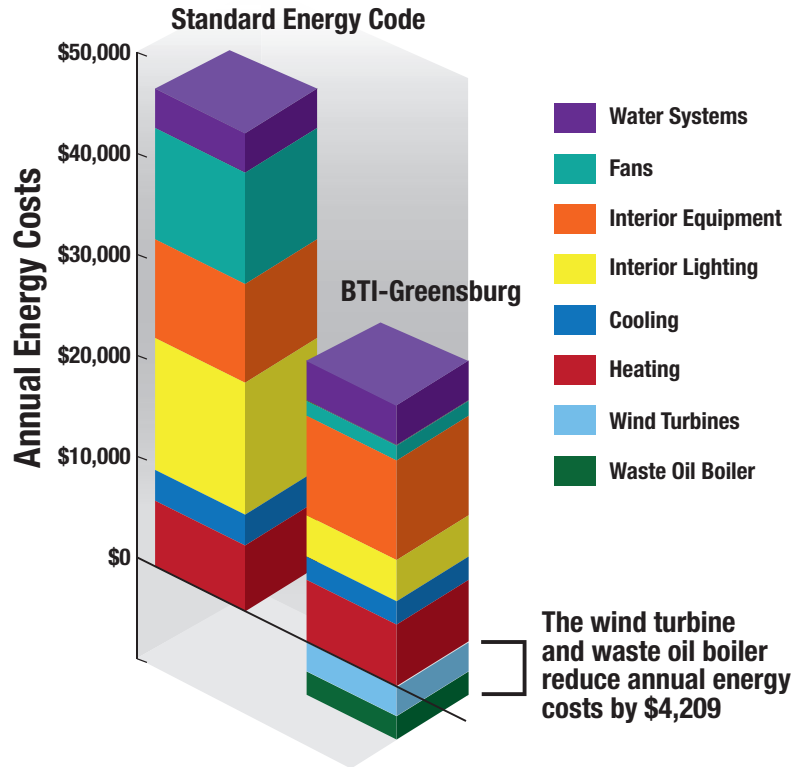


We’re proud of what we accomplished and that BTI-Greensburg is going to be a model for future John Deere Dealerships.

– Mike Estes



Annual Energy Cost Savings



Energy modeling indicates that annual energy costs for a building similar to BTI-Greensburg built to standard code, the Standard Energy Code column, would be about \$47,000. The right-hand column represents the expected annual energy costs for the BTI-Greensburg facility. The wind turbines and waste oil boiler reduce the total amount of purchased energy, so BTI-Greensburg is expected to spend approximately \$24,000 per year on energy costs—a reduction of about 50%.

For more information:

- BTI-Greensburg | 15479 US 54, Greensburg, KS, 67054 | (620) 723-3331 | www.btiequip.com
- Greensburg Sustainable Building Database | greensburg.buildinggreen.com
- Greensburg GreenTown | www.greensburggreentown.org
- Department of Energy, Building Technologies Program | www.eere.energy.gov/buildings
- National Renewable Energy Laboratory | www.nrel.gov

The U.S. Department of Energy and the National Renewable Energy Laboratory have provided technical expertise and support to the residents of Greensburg as they rebuild their homes, businesses, and government buildings.



Energy Efficiency & Renewable Energy



Prepared by the National Renewable Energy Laboratory (NREL)
 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

**H.8 Greensburg Kansas: Building a Model Green Community,
*How Would You Rebuild a Town Green?***

Case Study Database

The Greensburg High Performance Buildings Database highlights building case studies that include design details and energy information for the town's new commercial and residential green buildings. The database provides a standardized format for displaying performance information as well as a system for collecting data on topics including energy, materials, indoor environmental quality, and land use.



GREENSBURG GreenTown.

In Depth Case Studies

BTI-Greensburg John Deere Dealership, Greensburg Kansas (BTI-Greensburg John Deere)

Overview

- Location: Greensburg, KS
- Building type(s): Retail
- New construction
- 27,000 sq. feet (2,150 sq. meters)
- Project scope: a single building
- Retail setting
- Completed November 2008

The dealership is currently under construction as of August 2008.

- Rating: USGBC LEED-NC v2.2-1 Level: Goal of Platinum with 38% Energy Cost Savings

BTI-Greensburg is rebuilding a new John Deere Dealership and Service Shop in Greensburg, Kansas. 95% of the town was destroyed in a tornado in May of 2007. The retail building is attempting to achieve LEED Platinum and 38% energy cost savings. Completion is expected in late 2008.

Environmental Aspects

The dealership is designed to be fully staff using 12 skylights in the service shop and 12 tubular daylighting devices in the retail space. Well insulated wall panels have an assembly R-value of 16-18 and minimize thermal breaks typically seen in retail building construction. The high bay overhead doors include R-14 insulated panels, R-38 roof insulation (non-toxic thermal breaks to minimize the thermal breaks at the roof structure). A high efficiency 16 SEER VAV provides heating, cooling, and outdoor air to the retail space, combined with CO2 demand controlled ventilation. Hot water is provided with a combination of a waste oil boiler and natural gas boiler. Waste oil from oil changes in the service shop is stored onsite and used during the winter to offset natural gas use. Radiant slab heating minimizes heat loss during the frequent hot floor open and close cycles. Two solar hotwater (1.2 kW and 1.5 kW) provide electricity to the facility, offsetting the natural gas use of the hotwater boiler.

Project Topics

- Overview
- Process
- Energy
- Design

Greensburg GreenTown
GreenTown Home
Building Case Studies
Department of Energy in Greensburg

BTI-Greensburg, the local John Deere dealership, is designed to meet the requirements of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Platinum designation while saving greater than 38% in energy costs, and will be used as the model for future John Deere dealerships.

Stay Tuned...

Greensburg is in the early stages of rebuilding, and the Greensburg High Performance Buildings Database will continue to grow as the town does. If you are constructing a green, energy-efficient building in Greensburg, we'd love to hear about it. Visit greensburg.buildinggreen.com and click "submit a project."

To see the Greensburg case studies, visit:
greensburg.buildinggreen.com

For Additional Information, Please Contact:

Energy Efficiency and Renewable Energy Information
Center 1-877-EERE-INF (1-877-337-3463)

www.eere.energy.gov

Prepared by NREL, 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.

For more information about Greensburg, contact
(620) 549-3752 or (620) 723-2790
info@greensburggreentown.org
204 West Florida
Greensburg, KS 67054



U.S. DEPARTMENT OF
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Energy Efficiency &
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NREL
National Renewable
Energy Laboratory
Innovation for Our Energy Future

How would you rebuild a town – green?



Greensburg, Kansas:
Building a Model Green Community

DOE/GO-102009-2829 • April 2009

Cover photo courtesy of Lynn Billman, NREL

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Why Greensburg?

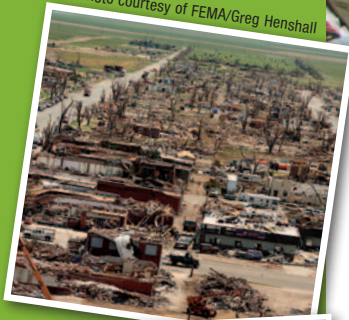
On May 4th, 2007, an EF-5 tornado tore through Greensburg, Kansas, destroying or damaging 95% of the town's homes and businesses. With the help of many partners, including the U.S. Department of Energy and the National Renewable Energy Laboratory, Greensburg is rebuilding as a model green community for rural America.

Before the tornado, Greensburg was a typical Midwestern farming town of about 1,400 people. After the tornado, Greensburg recognized the opportunity to remake their devastated town in ways that could attract new residents of all ages. Because Greensburg is a small town with limited financial resources, they wanted this new green community to be affordable.

What they lack in financial resources, Greensburg residents more than make up for in resourcefulness and ingenuity. The town has gathered a diverse group of experts and enthusiasts to help make their vision of a green community a reality.

To expedite the process, residents formed Greensburg GreenTown™, a grassroots, community-based nonprofit organization established to provide resources and support as Greensburg rebuilds. For more information, visit:

www.greensburggreentown.org



Residents of Greensburg are turning a disaster into an opportunity, both for their town and for other rural American communities.

Photo courtesy of BNIM Architects

Greensburg's Green Goals

Greensburg's city leaders and residents are working to create a community that is:

- Economically, environmentally, and culturally sustainable
- Walkable and mixed-use
- Supporting families, fostering business, and working together to spur economic growth
- A model for other rural towns

How Greensburg Is Achieving Its Goals

Build an Effective Team

Combine residents' passion and knowledge of place with resources and technical expertise from industry and government partners

Put Efficiency First!

Reduce energy use by building high-performance homes, businesses, and public buildings, and renovating to high efficiency standards

100% Renewable, 100% of the Time

Use renewable energy to generate electricity, primarily community-scale wind and distributed-scale wind or solar photovoltaics with hydropower and biofuels when needed

Rethink Local Transportation

Reduce gasoline and diesel use through alternative transportation and careful community planning

Make it Easy and Cost-Effective

Encourage residents and businesses to go green by offering incentives, technical assistance, information, training, fundraising, and other support

Set Specific Energy Goals

LEED® Platinum Buildings

Greensburg is serious about energy efficiency. It is the only city in the country that requires all city-owned buildings to meet the U.S. Green Building Council's LEED Platinum standards. In addition, city buildings will earn the maximum number of LEED energy efficiency points, resulting in a 42% energy savings compared with buildings built to current code. Many of Greensburg's commercial and institutional buildings are following suit.

Greensburg's Master Plan

The Greensburg Master Plan includes other ambitious energy goals:

- New homes to use 40% to 50% less energy than current code
- Renovated homes to use 25% less energy than before
- Electricity to come from renewable resources such as wind and solar
- Transportation system to minimize fossil fuel consumption through careful planning and alternative transportation options



Photo courtesy of NREL/Lynn Billman