Interconnected
Renewable Energy Systems

Nature is our model. It guides us in our organic kitchen gardens, from which we harvest about seventy percent of our food, and illuminates our pathway toward more self-reliant and ecologically mindful living. Our decisions related to employing renewable energy systems were no different.

All our renewable energy systems were added incrementally, as budgets permitted. The evolution of the once fossil-fuel-based farm to an organic, sun and wind powered Inn Serendipity homestead is further detailed in our book, *Rural Renaissance: Renewing the Quest for the Good Life*.

Our first entry into renewable energy systems, paralleling our energy conservation efforts, was to add a solar thermal system in our home for domestic hot water and, two years later, a woodstove for heat in the winter. Developing a hybrid renewable energy system consisting of both solar and wind electricity generation enables us to eventually produce an energy surplus which we'd bank on the grid. Excess electricity generated, coming as a credit check from our utility, is used to offset summer electricity use and anticipated maintenance costs for the entire hybrid renewable energy system (mostly for wind turbine maintenance, since neither of us want to be dangling from the top of our wind turbine tower).

To become eco-effective, our lifestyle and workstyle need to compliment our goals to generate more electricity than we use in our all-electric home and business. Since implementing energy conservation measures and lifestyle changes, our electricity use was reduced about 40-percent from previous owners, now averaging about 8,000 to 9,000 kWhs/year (for home, business, and farm). On the horizon, we'll be exploring ways to achieve

Ingredients for "the Good Life"

Each of us has a different vision of what "the Good Life" means to us personally. As any life-long quest, various elements will ebb and flow with time. Some may already be a foundation of our daily lives; some provide future goals. Collectively, our good life components add up to a life and livelihood in harmony with the Earth, synergistically blending a variety of elements and images that ground and fuel us personally.

Drawing inspiration from the seasons, what composes your vision of the good life? What images, ideas and inspirations jump to mind? Brainstorm statements for each season below.

Spring: Renewal (ideas, renewable energy, freshness)
1.
2.
3.

Summer: Weeding (decluttering, prioritizing, foods)
1.
2.
3.

Fall: Harvest (gratitude, preparation, preservation)
1.
2.
3.

Winter: Planning (dormancy, celebration, community)
1.
2.
3.

Like a quilt, these various elements of the Good Life blend together in a colorful and connected pattern. Each piece has its unique purpose, supporting the next one. Take your statements from above and arrange them in whatever pattern suits you to create a vision statement for your Good Life. See the last page for our Good Life vision. Cut that page off and send it to a friend, post it somewhere you can read, or use it as mulch in your garden.

net-zero emissions from our use of our car (presently a Geo Metro) and other transportation. Our ten second walking commute to our office on the second floor was our first step.

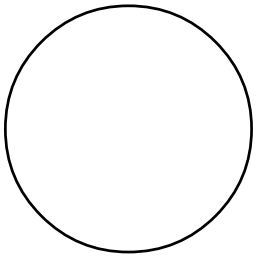
We're not tinkerers. Nor are we financially independent. Our systems were selected based upon their reliability, affordability and the recommendations from the hired experts who made our renewable energy journey possible. Our success at employing the renewable energy systems would not have been possible without these experienced guides, plus numerous neighbors pitching in with a tractor or construction expertise, and statewide funding through the Focus on Energy program and WisconSUN program that we secured for many of these projects. In our quest for energy independence, we rediscovered social and community interdependence. For our wind generator project, we even invited a Penn State engineering student class to help us evaluate our renewable energy options.

Many definitions of "sustainability" exist today. In our case, we focus on a definition that emphasizes the self-reliant local community while recognizing the responsibility we have as global citizens. Sustainability is an ideal, something we're always working toward. Sustainable living balances the economic, ecological and social needs of all life with that of our own, while enhancing those possibilities for future generations. Sustainable living values diversity, creativity and passion; it's not about the growth of wealth or stuff. Rather, it's about creating livable communities and fostering greater social and economic equity while preserving and restoring the ecosystems on which we depend.

Our goals as individuals, global citizens and business owners are to plant more trees than we've used, help cultivate a bioregional and sustainable food system that is more secure for us and our community, completely offset the carbon dioxide emissions caused by our energy use (the largest contributor to global warming), live a fossil-fuel-free life, and feed the flames of our imagination. We have our lifetime to do it. While there are limits to growth (this planet can only sustain so many people), there's no limit to development of a better way of living, one filled with creativity, adventure, security, nature and meaning.

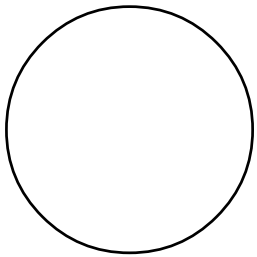
Connecting to the Good Life

The "Good Life" cannot be bought or sold. It's about finding that inner balance and soulful calling that catapults us up every morning to live a passionate, fulfilling, and meaningful life in a living economy and healthy community.



How is your awake-time committed in an average week? (fill in the pie with slices)

- Work/employment
- Commuting
- Housekeeping/errands
- Care for kids/family



What do you value? (fill in the pie with slices)

- Heath and well-being
- Nature/outdoors
- Doing meaningful activities
- Being with kids/family
- Spiritual care

Rather than earn a living, we're striving to make a life that's filled with those activities, relationships and meaning that allow us to develop ourselves and our talents and transform our dreams into reality. We're reminded — every time we get a small pebble in our shoe — that you don't have to be big to make a difference.

Before leaving our corporate careers, we discovered that we lived in ways that did not reflect our values and spent our time building bank accounts (or paying off loans and credit cards) but draining our joy of living. Our time pie chart had become mostly work, errands, and escape-coping strategies for dealing with the stress and pace of life. Rather than run away, we embarked on a journey to discover new ways.

Conservation & Efficiency

Our household in its everyday operation uses energy, water, air, and an ever-expanding amount of materials. Our journey toward sustainability involves returning to a lifestyle and household where mindful consumption catapults us forward to living more in balance with a healthy and vibrant ecosystem. We've learned that flexibility and creativity are essential to incorporating green products and appliances into a more sustainable lifestyle, and that such changes come incrementally, and often at a premium. As we see it, that premium is the dividend reserved for the silent stockholder: the environment.

Conservation and efficiency — the two most important aspects of our approach to responsible energy use — inspire us through their remarkable simplicity of implementation and through their stunning effectiveness. Conservation means using less. Efficiency means using the energy we need as carefully and optimally as possible. Some folks have interpreted conservation to mean extreme measures like reading by oil lamps and giving up refrigeration. But we felt that for our approach to living to succeed, it should be one that most of the world's population could embrace. Furthermore, before talking about generating our own electricity, we needed to nearly exhaust energy conservation efforts. Energy conservation is the most cost-effective first step within the limits of our budgets and situation.

Energy Conservation

We did not want to replace something just because it was not an Energy Star appliance, unless it would immediately translate into significant energy savings (as was the case with our refrigerator). We've realized, too, that our conservation efforts have even broader potential. Given that we run a B&B, work from a home office, and have any number of other work and personal projects on the go, our conservation and efficiency decisions flow seamlessly across our work and personal lives. Energy conservation remains the most cost-effective means to become less wasteful and more self-reliant.

Energy Efficiency

What energy we do use, we try to use as efficiently as possible. Based on utility records, we've discovered that we're using about 40 percent less energy than the former owners did, putting us below the average single family home in Wisconsin of about 10,000 kWh/year. Selecting energy efficient appliances immediately helped reduce the amount of energy we used, which saved us money and reduced our impact on the environment.

Among the changes are:

- Adding or retrofitting fluorescent lights into existing sockets. About ninety percent of the energy used by an incandescent bulb is given off as heat, not as the light that we actually want.
- Using the EPA's Energy Star label to guide our decisions regarding appliances. This logo identifies products that have been evaluated and qualify for the Energy Star seal for energy efficiency.
- Our front-loading Maytag clothes washer uses 50 percent less water than the average top-loading machine and about 37 percent less electricity per year.
- A refrigerator's electricity needs make up 12 percent of an average electricity bill, so the Sun Frost we purchased reduces our bill by about $50 per year. Energy Star refrigerators now available are also cost-effective options.
- For our home office space, an Energy Star Panasonic room air conditioner with the an Energy Efficiency Ratio (EER) of 10.0 (the highest rating). For the rest of the house, we usually do what worked before the advent of air conditioning: open the windows at night when it's cool and close them during the day.
- With our "low E" double-pane windows, the cool nighttime air is trapped in the house and heat kept out.

Our Investment Tip

What $10 investment provides a guaranteed return of 120 percent per year, tax-free? Switching one incandescent light bulb to a compact fluorescent bulb.

Capturing Heat From Sunlight

Domestic Hot Water (# 2 on map)

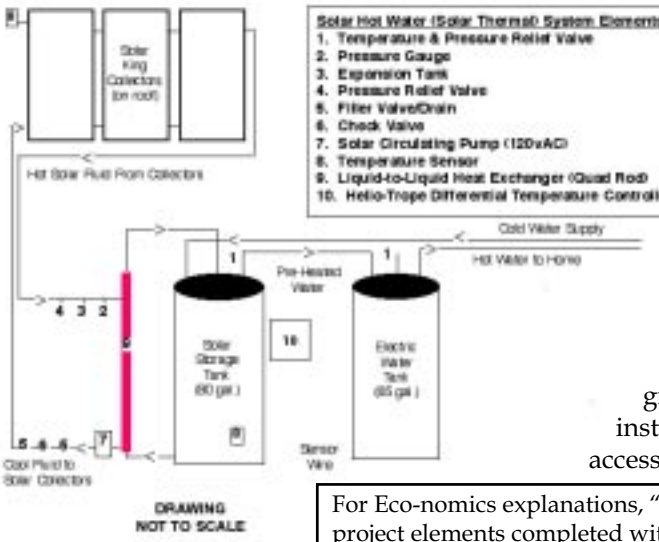
Recognizing that about 10-15% of an average home's energy use goes toward heating hot water, we added three 4-foot by 8-foot flat-plate American Solar King solar collectors for a domestic solar hot water system, placed on our south facing roof at about a 45-degree angle and optimized for spring and fall solar gain.

© John Ivanko

Solar thermal system for domestic hot water, alongside dormer with low-E windows.

Our collectors, like so many of our other systems, are experiencing a second life. In the case with these collectors, they had previously been installed on the Packerland meat processing facility in Green Bay, Wisconsin. We're proponents of the reuse and recondition economy. It's estimated that each collector will collect an average of over 24,000 Btus per sunny day, according to our installer, Bob Ramlow, with Artha Renewables of Amherst, Wisconsin.

The non-toxic and stable inhibited propylene glycol is used in our closed-loop active solar thermal systems. The transfer fluid, when heated by the sun to a temperature greater than in the basement storage tank, controlled by the Heliotrope DTT-84 differential temperature controller, is then pumped into the basement with a super-efficient Grundfros 1/12-H.P. pump and passed through a Quad Rod heat exchanger where the heat is transferred to the water from our well. The hot water is stored in a locally purchased standard 80-gallon Rheem water tank that is connected to our existing 65-gallon electric water heater and tank.The installed cost (including our labor) was $4,264, less a utility rebate at the time of $1,500. Had we to do it over, we would have mounted the collectors on the ground for easier installation and winter access (to knock off snow).



For Eco-nomics explanations, "in kind" refers to project elements completed without incurring financial expenses (i.e., donated labor, scavanged materials, etc.). Estimated payback is based on $.10/kWh.

Eco-nomics

Domestic Solar Hot Water

Cost	
+ Financial	$3,769
+ In-kind	$ 495
- State Rebate	($1,500)
TOTAL	$2,764
Wisc. Avg.(FOE)	*$7,000 (est.)*
Est. Payback:	5-6 years

Solar Thermal Liquid-to-Air System for the Greenhouse & Passive Solar (# 7 on map)

For the 1,200 square foot greenhouse, the solar thermal system, designed by our neighbors Phil and Judy Welty (formerly with Solar Use Now of Wisconsin), collects heat with ten 4-foot by 10-foot Gulf collectors, also reused from previously dismantled systems.

The heat is pumped in a glycol solution through underground insulated piping into a heat exchanging coil of 120 feet of 3/4-inch copper piping, allowing the heat to be transferred and stored in 780 gallons of water in several fiberglass tanks inside the greenhouse. The stored heat is then transferred to the air inside the greenhouse through a McQuay liquid-to-air heat exchanger in a way similar to how an automobile's radiator-cooling system cools the engine, except we are heating the greenhouse.

Judy and Phil Welty setting posts for solar collectors.

In the middle of the winter, the collectors — angled about 52-degrees for optimal solar gain — capture about 240,000 BTUs on each sunny day. So when it's a frigid, but sunny, 10-degrees Fahrenheit outside, the collectors will heat up the water tanks inside to more than 90-degrees Fahrenheit.

In contrast to the active solar thermal system, a passive solar thermal system uses no pumps to circulate fluid. Since water is among the most effective materials to store heat energy, our greenhouse includes a 250-gallon passive solar tank along with two Kalwall Cylinders filled with water, both of which directly absorb solar energy passing through the insulated south-facing windows. The greenhouse also incorporates a phase change salt tube in which the salt crystals turn to liquid when heated and release heat slowly as they return to a solid.

The goal, and on-going experiment, with the greenhouse (in progress) is to have a net-zero heating cost by utilizing both passive and active solar thermal systems, passive solar design, and the super-insulating qualities of walls that are made from straw bales (see page 12). In traditional greenhouses, with as much as 45 percent of the annual operation costs associated with heating, successfully growing with net-zero heating cost means more profit per niche vegetable or fruit crop sold or more efficiently meeting our food needs. It's likely that papayas, bananas and kiwi will be grown.

The installed cost (including our labor, all reused solar thermal equipment and the Welty's expertise) was about $19,000, less a utility rebate at the time of $1,500.

Eco-nomics

10 Collector Solar Thermal System to Heat Greenhouse.

Est. Cost	
+ Financial	$10,634
+ In-kind	$8,400
- Rebate	($1,500)
TOTAL	$17,534
Wisc. Avg.(FOE)	*$26,000 (est.)*
Est. Payback:	5-6 years

Electricity From Renewable Energy

Photovoltaic (PV) System (# 5 on map)

The generation of electricity using renewable energy for our home and business came in two phases. First, we added a 480 Watt PV system, estimated to generate about 536 kWh/year, based on about 15-percent line and inverter loss and a Wisconsin .60 solar gain ratio. Four 120-watt Kyocera PV panels were attached to a Unirac fixed rack which we cantilevered off the south-facing wall of an existing equipment shed. The rack is adjusted four times a year, roughly midway between the equinoxes and solstices.

Eco-nomics
.5 kW photovoltaic system.

Est. Cost	
+ Financial	$5,527
+ In-kind	$2,825
- Rebate	($3,536)
TOTAL	$4,816

Wisc. Avg. (FOE) $9,513 (est.)
Est. Payback: 90 years

The PV system was a part of a May, 2002 installation workshop with the Midwest Renewable Energy Association (MREA). Students with the PV installation class ran a short DC line through the wall into an Advanced Electronics 1,000 Watt inverter, then tied it into the nearest breaker box in the equipment shed. We sized our inverter to allow us to expand our system to include additional modules.

The installed cost (including in-kind labor from the instructor, students, neighbors, and ourselves) was $8,352, less statewide grants of $3,000 from the WisconSUN program (Wisconsin Energy Center) and $536 from the Wisconsin Focus on Energy Cash Back Reward program.

Wind Turbine System (# 3 on map)

Sitting high on the ridge where we can see for many unobstructed miles in every direction, our farm bids well for electricity generation with a wind turbine — our second phase of renewable energy production. After a partially state-funded (Focus on Energy) site assessment completed by Mick Sagrillo, with Sagrillo Power & Light, it was estimated that a 10 kW Bergey XL-S system, with an annual wind speed of 13 mph at the tower height of 120-feet, would generate about 1,130 kWh/month, or 13,560 kWh/year.

Dr. Jack Matson's Penn State engineering capstone class also visited our site prior to our decision to select our present system. The students evaluated both our energy use patterns (electricity load) and presented several renewable energy options.

Our most significant investment in renewable energy generation was completed in May, 2003 when we added, again, as a MREA educational workshop, a grid-connected 10 kW Bergey wind turbine system on a 120-foot guyed lattice tower. It's critical to place the turbine as high as possible, budgets permitting, for consistently higher wind speeds. According to Focus on Energy, going from a wind speed of 10 mph to 12 mph can almost double the turbine output. The tower, purchased used, was placed about 300 feet southeast

If 5-percent of Wisconsin's 60,000 farms (and farm-based businesses) had similar wind turbines by 2007, the 3,000 turbines would generate 60 million kWhs per year. This energy produced would be enough for 6,000 single family homes (the average Wisconsin home consumes 10,000 kWh/year), or the equivalent of a 5 MW coal fired power plant with a 95-percent capacity factor.

SOURCE: WISCONSIN FOCUS ON ENERGY
www.focusonenergy.org

of the house, well within the "fall lines" of our rectangular shaped property. We needed to upgrade our electric service to the farmstead to a 200 amp service.

The Bergey was rebuilt by Lake Michigan Wind & Sun, with any parts most likely to wear replaced with new ones. The new 11.5-foot redesigned blades were added to reduce the sound of the turbine when spinning and the latest generation inverter, GridTek 10 Power Processor, added in the basement to complete the conversion of "wild AC" to 60 hz AC. The installed cost (including significant in-kind labor from the instructor (Sagrillo), students, many neighbors, and ourselves) was $39,465, less a statewide grant of $15,595 from the Wisconsin Focus on Energy Cash Back Reward program.

With respect to our grid intertie energy systems with our public utility, Alliant Energy, a simple contract, certificate of liability insurance in excess of $300,000, equipment specification sheets, and a lockable external AC disconnect (to allow our utility to isolate our system when needed) were necessary for the project. Our local Alliant Energy representative was fantastic to work with throughout the entire process.

© John Ivanko

Crew from MREA's wind turbine installation educational workshop.

Our only unanticipated aspect of the system came with the arrival of our first "credit" electric bill in December of 2003, whereby the surplus electricity generated was at a rate below our 100-percent Second Nature "Earth Steward" green energy program that we participated in since its availability. While we have a parallel meter, we are only able to "bank" (and get a credit for) our excess generation at Alliant Energy's retail rate, not the "green energy" rate due to the way the green energy is purchased by our utility.

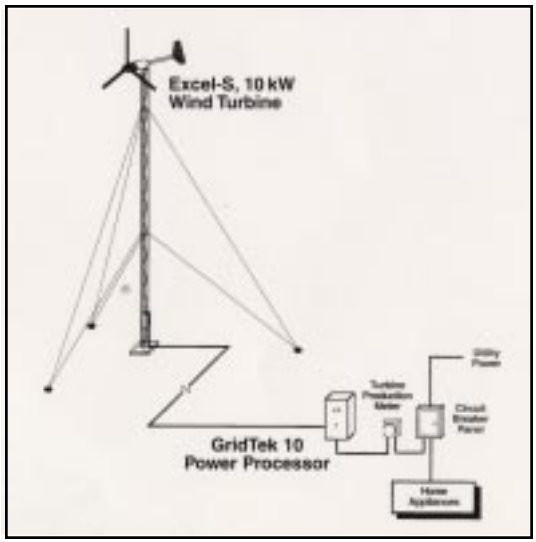
Eco-nomics

10kW wind turbine system.

Est. Cost	
+ Financial	$31,075
+ In-kind	$8,390
- Rebate	($15,595)
TOTAL	$23,870

Wisc. Avg. (FOE) $47,264 (est)

Est. Payback: 15-17 years



Bergey Wind Company

Block diagram of basic grid interconnected wind turbine system (at right).

Gardening and Harvesting (# 4 on map)

Until the middle of the last century, farms were diversified, integrated family-based enterprises. Chickens pooped and naturally fertilized the garden; surplus chicken eggs were sold for extra income. Seeds were saved for next year's garden or crop. Chores were shared and the family was fed by the food grown on premise.

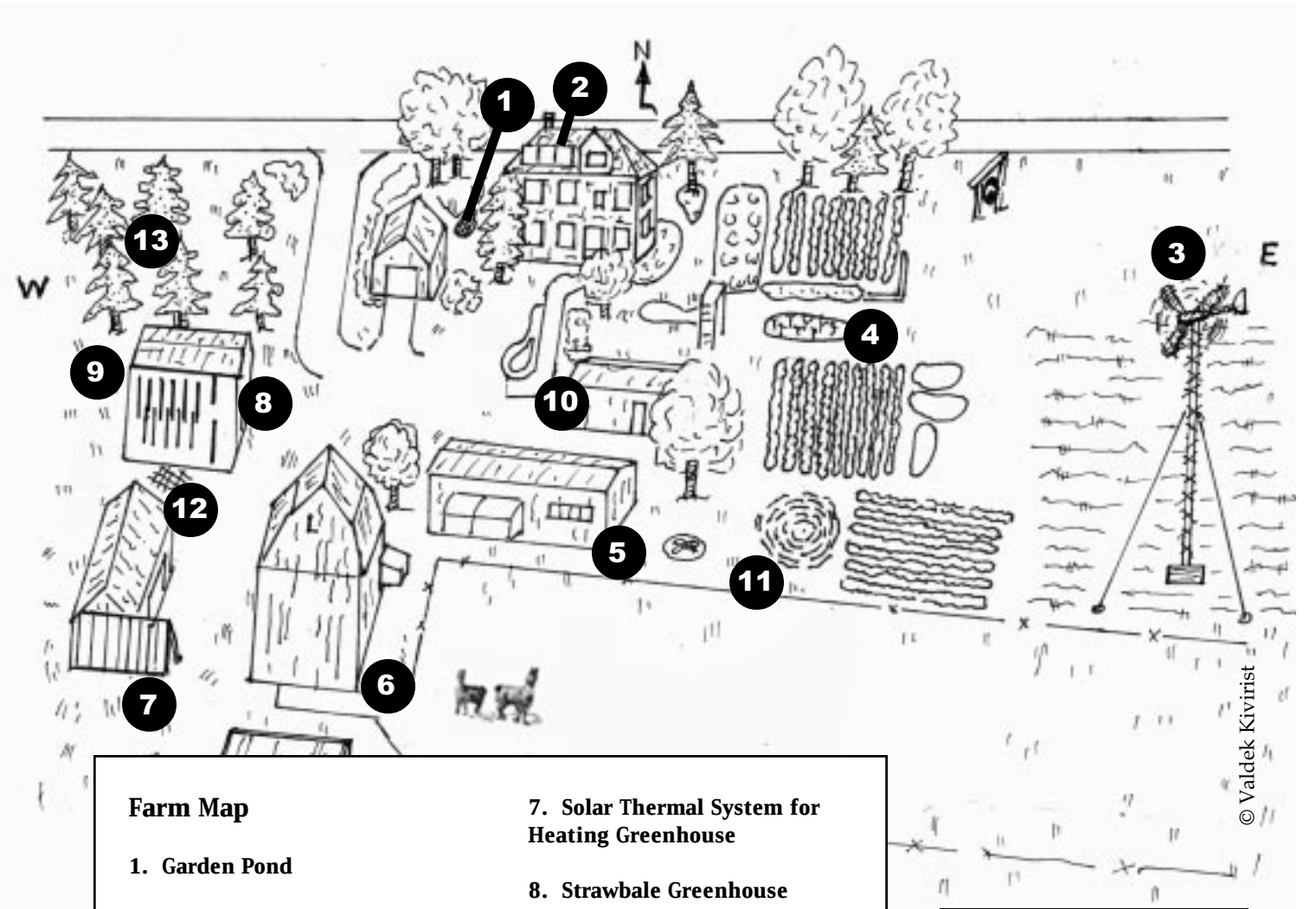
Our farmstead once reflected such diversity, and it's something we are trying to gradually recreate, on more sustainable terms for today's times. Our chickens have taken up residence in the coop, after an absence of about forty years. The old granary is now a strawbale-insulated greenhouse. An easy-access herb bed is right out the back door, vigorously greeting guests with a whiff of basil and chives. Llamas reign over the former alfalfa field and are the new tenants of our dairy barn.

Our son, one-year-old Liam, with an organically grown apple for homemade applesauce.

For about seventy percent of the food we eat, we rely on what grows well in our gardens — and what we enjoy eating. We care for three main growing fields just east of our house: the north field, measuring 40 by 70 feet; the south field, measuring 50 by 82 feet; and the far south field, measuring 40 by 48 feet. In these fields are thirty raised bed rows of tomatoes, potatoes, spinach, beets, beans, peppers, cabbage, lettuce, sweet peas, strawberries, pumpkins, zucchini, broccoli, cucumbers, onions, carrots, and a variety of "experimental" crops, such as collard greens and Swiss chard. Similar to the Victory gardens of the 1940s, our gardens consistently provide fresh fruits and vegetables, for which we don't have to leave the farm.

Edible landscaping means designing with nature; cultivating plants that provide needed foods for ourselves as well as for wildlife in our area. We find ourselves grazing while walking around the farm, since so many fruits and vegetables ripen at different times of the year. And because no chemical insecticides, fungicides or herbicides are used, we can nibble away right in the garden. By creating an edible landscape, we're maintaining, establishing or expanding plantings of raspberries, grapes, cherries, apples, black currants, strawberries and a wide selection of herbs (including dill, basil, cilantro, lemon balm, chives).

Without question, plants are the most efficient solar collectors ever. Nothing comes close to their effectiveness at capturing sunlight and converting it — through photosynthesis — into carbohydrates, the basic fuel of all animals. It's this process that causes us to endeavor to foster an energized, living soil that builds a bank of nutrients and dead organic matter, some of which we end up eating as sweet peas, tomatoes, and cucumbers. To further this natural nutrient cycle and to prevent the energized soil from washing away, we employ numerous organic growing strategies, including three-year crop rotations, application of compost, heavy mulching in the summer, interplanting, and growing in French intensive raised beds.



Farm Map

1. Garden Pond

2. Solar Thermal System for Domestic Hot Water

3. 10 kW Bergey Wind Turbine (for electricity)

4. Kitchen Gardens (3 fields)

5. Photovoltaic (PV) System (for electricity)

6. Llama Pasture & Barn

7. Solar Thermal System for Heating Greenhouse

8. Strawbale Greenhouse

9. Savonius Rotor (vertical axis wind turbine for electricity generation)

10. Chicken Coop

11. Labyrinth

12. "Life-Size" Chess Set

13. Perimeter Evergreens (for windbreaks and shelterbelts)

Eco-nomics

Item	Value
Living soil	priceless
Clean water	priceless
Cleaner air	priceless
Safe "playground" for Liam	priceless
Biodiversity	priceless
Scenic views	priceless
Est. Payback:	Immediate

Winter Heating with a Woodstove (inside house)

We don't mind getting snowed in with our Lopi Endeavor woodstove ablaze, using dry, seasoned, hardwoods that are readily available locally. We can snuggle self-sufficiently around the stove, strategically placed between our kitchen and front room. By using an efficient high tech Lopi non-catalytic woodstove, our winter heating bill has plummeted, conversations around the hearth mushroomed, reliance on fuel oil largely eliminated (except when we're away for a long period and use the existing oil furnace to keep our pipes from freezing), and environmental impacts lessened. According to the Midwest Renewable Energy Association, the cycle of burning of wood and regrowth of trees produces no net increase in carbon dioxide to the atmosphere. We make sure our tree planting efforts replace the equivalent number of trees that we end up burning.

Travis Industries, Inc. (Lopi Endeavor)

The Lopi stove is among the cleanest burning large stoves ever tested, in part because of their design, use of fire brick (which helps the firebox burn at higher temperatures) and baffles which insure that the gases are burned in the combustion chamber. The five-sided convection combustion chamber, or firebox, circulates oxygen needed for combustion around the stove and pushes the warm air back into the room. The installed cost (including in-kind labor from ourselves) as $3,462.

The new woodstove models have up to 75 percent fewer emissions according to the E.P.A. which implemented woodstove standards in 1990. In contrast, an open fireplace sends up to 80 percent of a fire's heat up the chimney and significantly contributes to air pollution since incomplete combustion of gases occurs. The key to burning wood is burning all the gases that the wood releases which are not only dangerous if left unburned, but contain over 50 percent of the available energy. The gases burn only at temperatures in excess of 1,100-degrees Fahrenheit, which can rarely be achieved other than through modern airtight woodstoves.

Eco-nomics

Woodstove for heat.

Cost

• Financial	$3,312
• In-kind	$ 150
TOTAL	$3,462

Est. Payback: 4-5 years

Practical Steps for Harvesting the Wind & Sun

(1) Exhaust Energy Conservation & Efficiency Options: According to the MREA, for about every $1 spent on conservation or efficiency, it's equivalent to $3 spent (or saved) on renewable energy generation systems.

(2) Investigate Renewable Energy System Options & Funding: Renewable energy fairs, workshops, books and websites provide the tools and know-how. See resources at the end of this guide for places to turn.

(3) Site Assessment: This will help determine your renewable energy resources, usually conducted by experienced professionals whose opinions often help in the final determination of possible grants and rebates.

(4) Apply for Funding Support: Secure funding if available.

(5) Connect with Community: Talking with neighbors about the familiar windmills breaks the ice; little or no electric bill tends to hold the interest.

(6) Zoning Permits & Public Hearing (if applicable): Usually for larger systems or towers higher than 100 feet, the county and city/township requirements vary widely by county. Knowledge of other systems and Wisconsin Statutes (99-00, 66.0401) related to solar and wind energy helps.

(7) Order Equipment: Allow as much time as possible and sort out alternatives to shipping costs.

(8) Sign Grid Interconnect Contract with Utility (as needed): Avoid costly surprises by making sure the utility is involved.

(9) Pour Foundations (as needed): Given all the cell towers going up, choose contractors with related experience.

(10) Installation of System: If possible, hire those who have the know-how to troubleshoot problems. Welcome helping hands or host educational workshops.

(11) Monitor System: Routine maintenance and "visual" monitoring is needed, much like your vehicle.

Powering the Good Life

The good life is about living more self-reliantly, simply, mindfully, and meaningfully. Generating our own electricity and better meeting our energy needs locally is an important part of our ability to achieve a sense of the good life.

After exhausting all the possible energy conservation and efficiency changes to save energy costs, adding our renewable energy system headed off, or completely eliminated, annual energy expenses. Instead of costing $450 a winter to heat our home-based business, it now costs almost nothing. The hybrid wind-solar electric system should offset about $1,000 in electric bills paid each year.

If you're running a business, don't miss out on the tax credit and accelerated depreciation. When available, why not cash in on the Federal renewable energy tax credit of $1.8 cents per kWh generated for wind (or 10 percent tax credit for solar energy equipment)?

Besides the tax credit, there's the ability to accelerate the amortization for the generator with the Federal Modified Accelerated Cost Recovery System (MACRS; Section 169 of the Internal Revenue Code), by which businesses can recover investments in solar, wind and geothermal property through depreciation deductions. Our grants, also, may be exempt from federal taxation, since they were primarily used for conserving or producing electricity. Consult your tax advisor for the latest information.

Building with Straw Bale and Earthen Plaster (# 8 on map)

Building with straw bales means that, with a little help, even the most inexperienced homeowner or builder can build a house, shed, or other functional structure, while rekindling a connection to the environment. Additionally, the organic nature of this medium offers both aesthetics and energy efficiency, with R-values ranging from R-35 to R-50. Strawbale walls are remarkably strong, provide better fire resistance, help alleviate sick building syndrome, and use a renewable resource that's often an agricultural waste product.

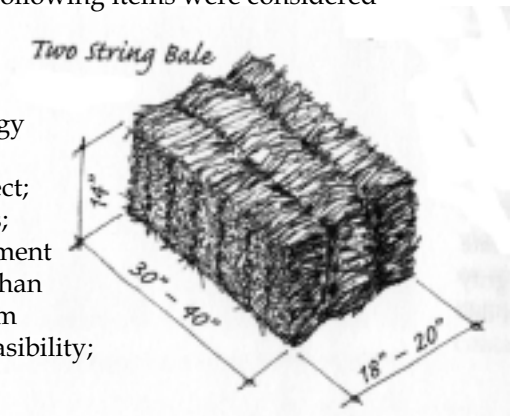
© Jason Perry/www.deathbike.net

Pre-plaster, south-facing interior straw bale insulated walls.

The two main types of straw bale construction are post and beam infill and load bearing. With post and beam infill construction, straw bales are inserted between supporting studs and other framing which supports the roof. Load bearing construction, more often challenged by zoning and commercial codes, means that the roof and windows are supported by the straw bale walls.

There are many creative ways to build useful and practical buildings with straw bale, and no two structures seem to be the same since so much is based on local knowledge, materials, needs and economy. Most straw bale buildings involve a community of helpers attracted to the materials, camaraderie and sense of accomplishment achieved after a day of stacking bales or plastering. It's a modern day revival of the barn raising.

Our straw bale greenhouse is oriented south, with south, east, and west-facing walls containing glass glazing (some insulated) with the remainder of the structure in-filled with straw bale and covered with 2-inches of cement-based stucco on the exterior and a locally procured clay-based stucco on the inside. The following items were considered in our design of the greenhouse: climatic appropriateness; minimization of the embodied energy — the energy needed to grow, harvest, extract, manufacture or otherwise produce a product — represented in the project; bio-regionalism and local sourcing of building materials; aesthetics, efficiency and eco-effectiveness; the enhancement of biodiversity; cost (strawbale is not typically cheaper than more conventional approaches); consideration of William McDonough's Hannover Principles; replicability and feasibility; consideration of the impacts on the Seventh Generation.



Savonius Rotor Vertical-Axis Wind Turbine (# 9 on map)

Innovation and experimentation is a constant for us. Spearheaded by neighbors and friends, Phil and Judy Welty, we're exploring a low-cost, drag-based design of an experimental vertical-axis wind turbine. The design of the Savonius turbine, originally patented by Sigurd Savonius in 1929, uses low wind speeds blowing along the Earth's surface to turn a paddle — in our case, two cut-off steel barrels.

The low-cost generator is estimated to generate about 300 kWhs/ year. Because the rotor does not seek wind direction, output is not reduced. However, low revolutions per minute (RPM) requires "gearing up" to drive the generator. While the cut-in wind speed is lower, the ground wind speed is much lower than a tower mounted wind turbine.

The electricity (DC) generated by the Savonius rotor is tied into several DC-powered pumps and the excess electricity used to supplement the heat in the water tanks. This system is off grid. Routine lubrication of the gears is necessary, but made easy by the ground placement of the generator.

Eco-nomics

Savonius turbine system.

Est. Cost	
+ Financial	$ 300
+ In-kind	$1,000
TOTAL	$1,300
Est. Payback:	43 years

Six Main Steps in Straw Bale Construction:

1. Pouring the foundation, framing, and adding the roof. Although probably the most skill-intensive part of the whole process, these aspects need not be particularly complex. For load bearing construction, only the foundation needs to be done at this stage.

2. Stacking bales. With an enthusiastic crowd, it's amazing how fast a wall or building can go up. Additional detail work needs to be completed prior to the stacking of bales in places where moisture might possibly enter the wall; for example where the straw bales come in contact with the foundation.

3. Adding lath. Lath, which in strawbale construction often means chicken wire netting, is added to interior and exterior walls to allow plaster to adhere more readily.

4. Stitching. Stitching involves using polytwine to stitch up the walls, thus compressing the loose straw and connecting the lath (and other elements) together.

5. Plastering. Often the most messy, fulfilling, and fun step, plaster is usually applied in three layers of varying thickness to cover the bales and create a smooth wall surface. The first thick coat is called the "scratch coat." This coat is usually scored, or scratched, to allow the second coat (the "brown" coat) to adhere. The brown coat smoothes out the surface and fills in any major depressions. The final "finish coat" goes on very thin, can be colored, and is often followed by a sponging technique to create texture. Specific recipes for each tend to depend on the purpose, structure and climate.

6. Finishing the carpentry work. Adding windows, doors, and vents and, in the case of load bearing construction, the roof, makes up this final stage.

Assessing Our Impacts: Ecological Footprints

What if our planet couldn't sustain its human population? Many scientists already believe that we're experiencing an era known as the planet's sixth extinction, during which millions of plant and animal species are being wiped out forever. Millions of people go without food, safe drinking water and adequate shelter — daily.

According to Mathis Wackernagel and William Dees of Redefining Progress, if everyone lived the way we do, we would need 2.8 planet Earths to support our lifestyle. Wackernagel and Rees define an ecological footprint, measured in biologically productive acres, in their ground-breaking book, *Our Ecological Footprint*, as "the land and water area that would be required to support a defined human population and material standard indefinitely." Our total ecological footprint, which combines the impacts of our food needs, mobility, shelter and use of goods and services, is 12 acres. In comparison, our footprint is about half of the average American of about 24 acres (the equivalent of about 30 football fields); an average Italian uses about 9 acres. As our society encourages us more and more to be part of a"global economy," our bananas, clothing, furniture and cars come from increasingly far-off places, exacting an ever-increasing toll on the resources of the planet.

By better understanding our resource needs and being more careful in how we dispose of our wastes, we are working toward whittling down our footprint to a level that is life-sustaining. We realize that many of our actions, lifestyle, and livelihood changes, such as adding a wind turbine system to produce electricity, could not be expressed in the easily completed ecological footprint quiz offered by Redefining Progress, but our Internet calculations serve as reminders as to how far we've yet to go.

It's never been harder to edit out the word consumer in our conversation and daily life. We are not the possessions or services we consume. Yet we catch ourselves using the word, referring to people as consumers. But people are not consumers, as if it's our destiny to shop, buy, use, and throw things out. People are people — or citizens, humans, and among the animals in the animal world. While we have needs, our wants have gotten the best of us. It's the wants that compel us to work so hard to make so much money to try and satisfy what can't be satisfied through things.

Happiness is a state of mind — the intersection between mind, body and spirit that occurs when we are doing what we love to do, and living in a way that is aligned with nature. That said, we recognize that there are things we purchase, like a computer or photovoltaic panels, that help us on our journey toward a more self-reliant, interconnected and sustainable life. Just don't call us consumers. Call us intentional humans, mindful participants in a living system, or carbon-based life forms.

"Net Zero" Emission Living

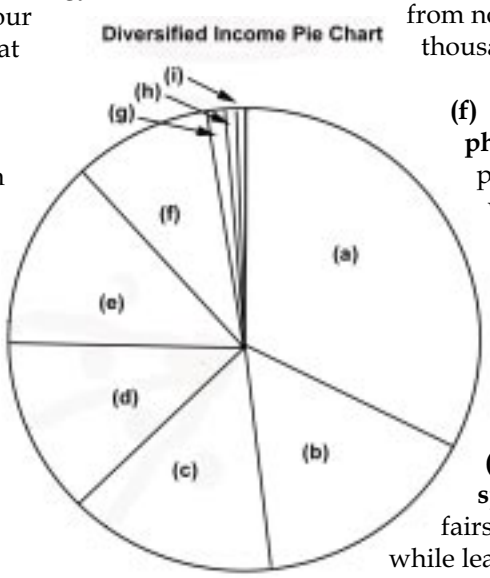
By planting trees on our land, supporting tree planting programs and simplifying our needs, we try to offset our impact on global warming caused by the combustion of fossil fuels like gasoline, fuel oil and coal.

The non-profit organization Trees for the Future offers the ability to buy tree planting certificates to help off-set (or sequester) the emissions created from travel and a wide variety of other activities. As of 2004 through their program, Inn Serendipity has helped plant about 1,700 trees which, on average, will sequester about 50 pounds of carbon dioxide from the atmosphere per tree (or about 2,550,000 pounds in total) over the next thirty years.

Right Livelihood

Our highly diversified income-producing portfolio is in stark contrast to our singular advertising executive job with one boss, one paycheck, one cubicle. In addition to helping advertise socially and environmentally questionable products, our work at the agency generated little personal satisfaction. By working from home, we cancelled the commute, controlled our business energy use, and integrated our life with our business to craft a "workstyle" that was less stressful.

Today, our work and projects follow the seasons and changes in the marketplace of ideas and our passions. For each, the corresponding percentage of income is noted, though it changes from year to year.



(a) Inn Serendipity Woods cabin rental (32%): We manage cabin rental contracts, web site marketing, and guest relations while also maintaining the cabin and property.

(b) Inn Serendipity Bed & Breakfast (17%): We manage all facets of this two bedroom bed & breakfast, sharing cleaning, breakfast preparations and hosting guests.

(c) Consulting (13%): Because of our varied backgrounds and educational experiences, we've consulted on projects ranging from database management to public relations, as well as advertising and marketing endeavors for non-profit groups or our local chamber of commerce.

(d) Special projects (11%): Sometimes one-time opportunities offer the ability to generate our electricity or work on specially funded projects. This is the most serendipitous aspect of our income.

(e) Authoring books (11%): Much more involved than writing for magazines or newspapers, authoring books provides an avenue to address in a comprehensive and artistic way those issues closest to our hearts. Income varies greatly from nothing in one year, to several thousand dollars in another.

(f) Freelance writing and photography (10%): Among our passions is the need to express in words or photographs how we interpret the world. John's photography and writing clients are varied and international, with a focus on travel, environmental issues and sustainable development.

(g) Workshop facilitation and speaking (4%): Conferences and fairs allow us to share our perspectives while learning about the many inspiring ways others have embarked on similar journeys. From the Upper Midwest Organic Farming Conference to the Penn State Green Design Conference, our presentations or workshops hopefully jumpstart others into action and reinvigorate our commitment.

(h) Farm direct agricultural products (1%): We sell free-range chicken eggs, surplus flowers, vegetables, fruits and herbs grown on the farm, and eventually, unique, niche agricultural crops grown in the strawbale greenhouse.

(i) Cottage retail store (1%): We sell our books, photography prints and hand-made mugs to B&B guests.

Resources

Rural Renaissance Network (RRN),
a program of **Renewing the Countryside**
Website: www.ruralrenaissance.org
The RRN empowers the rural renaissance movement by providing educational resources and how-to information to individuals, families and communities wishing to support "right livelihood" and creative, healthy, ecologically mindful and socially responsible living in rural and small town communities across North America.

Midwest Renewable Energy Association (MREA)
Website: www.the-mrea.org
Hosting the world's largest renewable energy and sustainable living fair, the MREA also features the ReNew the Earth Institute headquarters which demonstrates how energy independence is viable today with a hybrid system incorporating solar electric, solar thermal, wind and woodstove heat to meet energy needs.

Wisconsin Focus on Energy
Website: www.focusonenergy.com
Offers resources, funding, and fact sheets for conservation and renewable energy options in Wisconsin.

Appropriate Technology Transfer to Rural Areas (ATTRA)
Website: attra.ncat.org
Offers a variety of resources and helpful factsheets for managing farm operations and marketing agricultural products, including harvesting renewable energy and starting agritourism operations.

Redefining Progress
Website: www.rprogress.org
Examine your ecological footprint through this interactive and informative website.

Database of State Incentives for Renewable Energy (DSIRE)
Website: www.dsireusa.org
Locate what incentives or renewable energy rebates might be available in your state.

Windustry
Website: www.windustry.org
From large-scale to small residential wind turbine systems, this nonprofit program offers extensive wind turbine information and the ability to locate systems throughout the US.

Sustainable Sources
Website: www.greenbuilder.com
From a straw bale directory to green building resources, this site has it all.

US Department of Energy: Energy Efficiency and Renewable Energy Portal
Website: www.eere.energy.gov
A gateway to online documents and resources for energy efficiency and renewable energy.

Institute for Local Self Reliance's New Rules Project
Website: www.newrules.org
Offering resources on ways to rebuild local economies, invigorate democracy, strengthen the sense of community and plan for the next generation, the New Rules Project addresses agriculture, electricity, environment, equity, finance, governance, retail, sports, information, and taxation sectors.

Trees for the Future
Website: www.treesftf.org
Offers a variety of programs to off-set carbon dioxide emissions resulting from travel on airplanes, cars, and other vehicles, or your business operations.

National Tour of Solar Homes
Website: www.ases.org
Coordinated by the American Solar Energy Society, this annual national tour held early October offers the opportunity to visit and tour homes and businesses that incorporate a myriad of renewable energy, energy conservation products, and green design elements into their homes or offices.