



BIOMASS



GEOTHERMAL



HYDROPOWER



SOLAR



WIND

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COURTESY OF WISCONSIN SOLAR USE NETWORK (WISCONSUN)

The Bircher home uses a well-balanced mix of sustainable building strategies, including natural materials, airtight construction, solar water heating, solar electricity, ENERGY STAR appliances, and high efficiency heating and cooling equipment.

Homes built today should be keeping families warm and dry in 2050 and perhaps 2100. But do your plans for building a new home consider the future? Think about the possibility of rapidly increasing energy costs. Energy efficient, renewable homes can use 30 percent to 100 percent less energy than a typical home built to Wisconsin's current Uniform Dwelling Code.

An energy efficient, renewable home offers other benefits as well. It is in tune with nature and is a pleasant and comfortable place to live. It doesn't need to cost much

more, be a headache to operate or look out of place. It can also increase your self-reliance and security, while maintaining its value and helping protect the environment.

This fact sheet provides guidelines for building an energy efficient, renewable home, beginning with basic design and efficiency strategies, and then incorporating passive solar design and renewable energy generation.

### CHOOSE AN APPROPRIATE BUILDING SITE

When considering a building lot, choose a home site open to the south. A passive solar home design can incorporate solar features on any wall facing south.

- Homes built into south-facing slopes allow the basement to be open to daylighting and passive heating, increasing liveable space.
- Homes built into south-facing slopes can also more easily take advantage of earth berming. Earth berming uses the earth to help insulate the home.
- Trees, particularly deciduous trees that shade the home, will keep a home cooler in the summer.
- Shade trees or shrubs planted along the west and north walls reduce heat gain on summer afternoons and heat loss from winter winds.

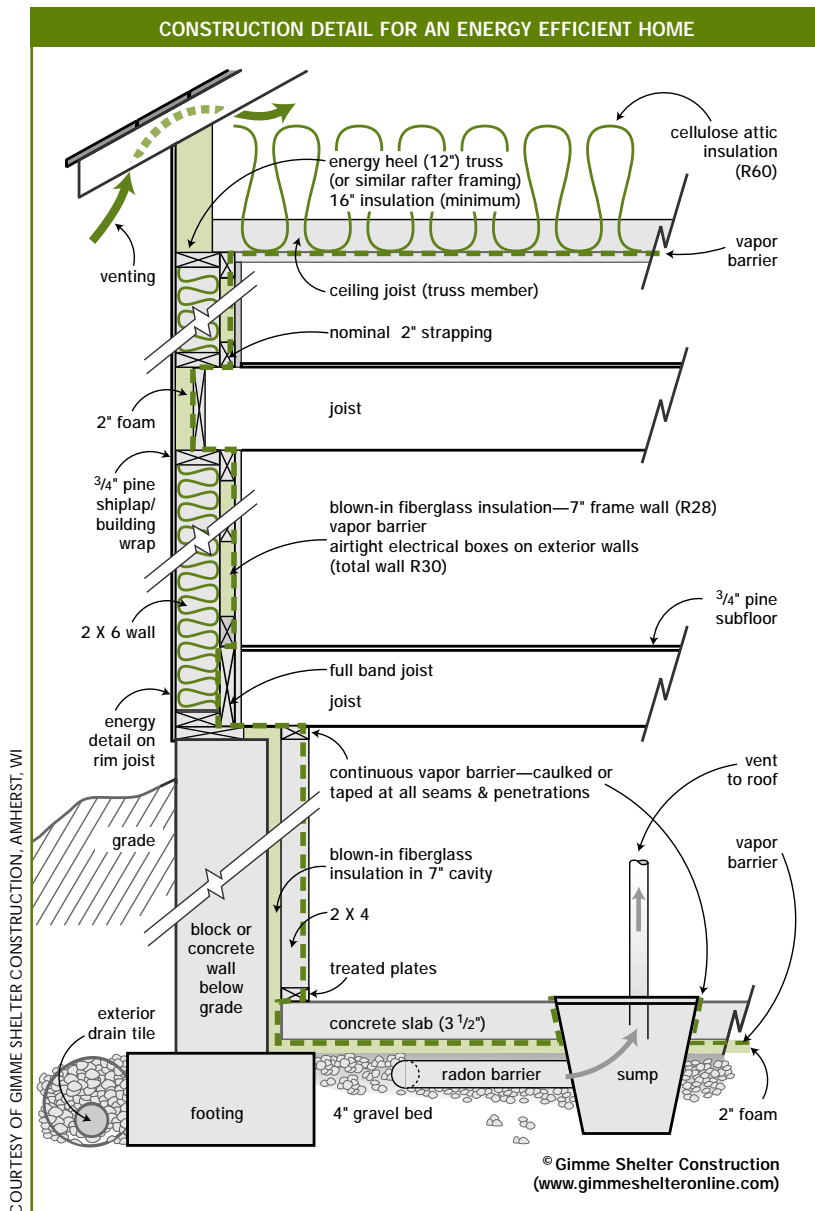


### IS YOUR HOME AVERAGE?

Over twenty years, the average single-family home in Wisconsin:

- spends \$30,000 for energy
- requires 80 tons of coal for electricity\*
- uses enough natural gas to fill a football field to a depth of 35 feet
- generates 600,000 pounds of CO<sub>2</sub>

\*NOTE: Wisconsin-generated electricity is primarily from coal (75 percent) and nuclear power (20 percent).



## MAKE THE MOST OF ENERGY EFFICIENCY

Design your home to minimize its energy requirements. Doing so has two benefits. First, energy efficiency strategies typically cost less than solar or wind technologies, particularly when included in the original construction. Second, the more energy efficient your home is, the less energy you use. Consequently, if you decide to install a renewable energy system, it can be smaller and significantly less expensive.

### Consider a “Not So Big House”

Choosing to build a smaller home is a critical step toward being energy efficient. The author of *The Not So Big House: A Blueprint for the Way We Really Live* suggests:

- Build or buy a house that’s one third smaller than the current average-sized home for a family the size of yours.
  - If you’re not going to use a given space every day, don’t build it.
  - Think quality over quantity and comfort over size.
- Not so big houses tend to have living, cooking and dining spaces that are integrated in an open space without walls, which is an ideal fit with a passive solar home design.

### Insulate your home

Heating and cooling accounts for 50 percent to 70 percent of the energy used in a home. Constructing your home’s shell with a continuous envelope of insulation is critical. Choosing the appropriate amount of insulation and installing it correctly are also important. Walls, windows, attics and foundations should be insulated beyond what is required by state code. The Davenport home has wall and attic R-values of 28 and 60, respectively.

### Seal and ventilate

Air leakage accounts for 25 percent to 40 percent of the energy used to heat and cool a typical home. Energy efficient construction minimizes air leakage with careful framing details; application of exterior house wraps and flashing; and sealing all gaps and seams using sealants, foams and tapes. A tight home, equipped with a controlled air ventilation strategy, maintains its air quality, durability and comfort. Controlled air ventilation systems can be as simple as automatic kitchen and bathroom fans or as sophisticated as a whole house ventilation system that uses a heat recovery ventilator (or heat exchanger) to reduce energy losses.

### Install a non-electric heating system

The most wasteful use of electricity is as a source of heat. Furnaces, heaters, water heaters, stoves and clothes dryers are examples of appliances that use a lot of energy and will likely operate more efficiently when powered by something other than electricity. Efficient heating options include natural gas or propane, cordwood and wood pellets, and solar power for space and water heating.

### WHAT DOES ENERGY STAR® MEAN?

There are more than 13,000 products that carry the ENERGY STAR label. ENERGY STAR qualified products are among the smartest products you can possibly buy. Appliances with the ENERGY STAR label use much less energy than conventional products and save money every time you use them. They deliver the same or even better performance, and are found among the best name brands in the world. Look for ENERGY STAR air conditioners, refrigerators, dishwashers, washing machines, ceiling fans, lights and dehumidifiers when shopping for appliances for your new home. For more information visit [energystar.gov](http://energystar.gov).



### CONSIDER IN-FLOOR SPACE HEATING

In-floor hydronic heating systems add comfort and can use many fuels, including natural gas, propane, solar panels and wood. An in-floor system can begin its life using natural gas and easily evolve to other fuels in the future.

### INCORPORATE PASSIVE SOLAR DESIGN

Passive solar design is the use of the sun and wind to heat, cool and light your home without the addition of mechanical or electrical devices. This is accomplished by siting the home with proper solar orientation, strategic placement of windows and the use of specific building materials to create thermal mass.

- Locate windows primarily on the south side of the home. Avoid large windows on the west and north sides because they take the brunt of the heat during summer and the wind during winter.
- Include properly sized roof overhangs that protect south-facing windows from summer sun, but allow the winter sun to enter and warm the home.
- Add thermal mass to maintain the interior temperature. Thermal mass absorbs the sun's heat in the daytime and radiates it into the room at night. The most commonly used materials that provide thermal mass include rock, brick and concrete—which are used in floors, walls, fireplaces or interior divider walls.

### Employ passive cooling elements

- Use an open floor plan.
- Strategically place operable windows to make use of prevailing breezes for cooling the house at night.
- Install operable skylights to keep hot air moving up and out.

People who build an energy efficient renewable home with passive cooling find that air conditioning is not needed as often.

### Bring natural light into your home

Using the sun as an indoor light source is known as daylighting. Most passive solar homes are daylit naturally by the south-facing windows. However, during the winter, when direct sunlight enters the home, glare may become an issue.

- Daylighting is best done with reflected “cool” light. Small, shaded windows mounted high on all but the north walls of the home provide the best daylighting. Skylights that get direct sunlight should be avoided.
- Light-colored paint reflects light into the home.
- Reflective sunlight tubes can provide plenty of light without significantly increasing heat gain or loss through the roof. These are particularly useful for windowless areas.



(top) A passive solar-heated vestibule in the Rezabek/Strous house functions as an “airlock” that reduces cold air infiltration. The long window on the left faces south and heats the stone tiles inside.



(left) The masonry fireplace in the Hoerr home is fitted with a high efficiency wood burning stove. As exhaust rises through the masonry, the stones warm and radiate heat to the living room, supplementing the heat provided directly by the stove.

COURTESY OF DESIGN COALITION, ARCHITECTS, MADISON, WI

(below) The Davenport home combines passive and active solar heating technologies. South facing windows heat the house during the day while ten roof-mounted solar collectors heat a fluid that flows beneath the house and warms 200 tons of sand and concrete. By nighttime, the thermal mass is warm enough to heat the house by radiating up through the floor.



COURTESY OF WISCONSIN SOLAR USE NETWORK (WISCONSUN)



The Rezabek/Strous home combines wind, solar electric technology and batteries in a hybrid system that is designed to provide all their electricity needs.

#### USE RENEWABLE WATER AND SPACE HEATING

- Solar hot water panels can easily meet half of your home's hot water needs. Today's solar water heaters are both dependable and economical.
- Wood stoves<sup>1</sup> with water jackets can also be used for water heating.
- Solar hot water or air panels can be integrated into a home to provide space heating, as can wood stoves.

#### GENERATE RENEWABLE ELECTRICITY

Once your home's electricity requirements are minimized it becomes easier and less costly to meet your needs with a renewable energy system. If your budget is limited you may want to invest initially in energy efficiency and also make your home "renewable ready" (e.g., proper solar orientation and spaces for water pipes and electrical conduits). Renewable energy systems can be added when your finances allow.

#### On-site renewable electricity production

The two most common ways to produce renewable electricity are with solar electric panels and wind turbines.

#### Solar electric (photovoltaic) systems

Solar electric systems convert sunlight into electricity. A properly sized solar electric system can meet all the electricity needs of an energy efficient home. If the system includes a battery bank to store electricity for nighttime

use and during cloudy periods, the home need not be connected to the utility power grid.

#### Wind turbines

Wind turbines are best suited for rural sites where the wind is unimpeded, and where noise and visibility issues are less controversial. However, even rural sites need to be carefully analyzed to determine if the wind resource is adequate to produce the desired amount of electricity. Turbines are normally installed on towers more than 80 feet tall in an open and windy location. Wind turbines need regular maintenance.

#### Utility-provided green power

Most Wisconsin electric utilities offer renewable electricity through green power rates for people who choose not to install their own renewable energy system. With modest increases in your electricity bill you can meet all your electricity needs with renewable power.

#### MORE INFORMATION

##### [focusonenergy.com](http://focusonenergy.com)

Contact Focus on Energy to learn more about renewable energy choices. We have fact sheets and case studies featuring solar water heating, solar electricity, passive solar design, wind turbines and wood stoves. Renewable energy incentives are also available. Call 800.762.7077 for more information.

#### The Not So Big House: A Blueprint for the Way We Really Live

Sarah Susanka and Kira Obolensky, 1998, Taunton Press. The goal of this book is to help readers create a smaller home that better serves their lifestyles, personalities and values.

##### [energystar.gov](http://energystar.gov)

The ENERGY STAR Web site offers information on high quality energy efficient appliances that will help make your energy efficient, renewable home a reality.

#### Wisconsin ENERGY STAR Homes

Wisconsin ENERGY STAR<sup>®</sup> Homes can assist builders and buyers with selecting appropriate levels of insulation, noting common air sealing issues and completing site visits during construction to ensure these details are implemented. Visit the New Homes section on [focusonenergy.com](http://focusonenergy.com) for more information.

<sup>1</sup>Wood stoves may not be suitable for urban applications. Focus on Energy strongly recommends wood stoves that meet EPA Phase-2 emission requirements.

Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency and use of renewable energy, enhance the environment, and ensure the future supply of energy for Wisconsin. For information about the Focus on Energy services and programs, call 800.762.7077 or visit [focusonenergy.com](http://focusonenergy.com).