Information Sources

Wisconsin Focus on Energy
www.wifocusonenergy.com

Renewable Energy Yellow Pages
www.doa.state.wi.us/depb/boe/publications/yelpages.asp

Midwest Renewable Energy Association
(MREA)
www.the-mrea.org

Energy Center of Wisconsin
www.ecw.org

Wisconsin Daylighting Collaborative
www.daylighting.org

Wisconsin Energy Star Homes (WESH)
www.weccusa.org

RENEW Wisconsin
www.renewwisconsin.org

WisconSUN
www.wisconsun.org

Wisconsin Green Building Alliance
(WGBA)
www.wgba.org

Energy & Environmental Building Association (EEBA)
www.eeba.org

U.S. Green Building Council
www.usgbc.org

Environmental Building News
www.buildinggreen.com

Oikos Energy Info Clearinghouse
www.oikos.com

Crest Solstice Energy Information Clearinghouse
www.solstice.crest.org

GreenHouse Network
www.greenhousenet.org

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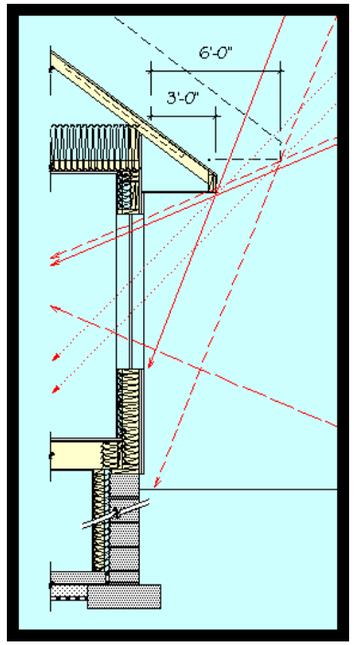
Renewable Energy In Buildings



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Renewable Energy Design Concepts

Renewable Energy is constantly replenished and will not run out. Renewable or Clean Energy can be purchased as "green" power from local utilities or generated by individuals on-site.

Passive Solar Heating & Cooling

Buildings collect, store and distribute the sun's heat by virtue of their design. An east/west elongated layout exposes more of the interior to the sun in winter and is easier to shade in summer. The choice and placement of windows or "glazing" maximizes winter heat gain and minimizes summer heat gain. Additional interior thermal mass stores the energy and minimizes internal temperature fluctuations. "Direct gain" designs allow the winter sun to penetrate deep into the interior. "Indirect and isolated gain" designs use a sunspace or mass wall between the exterior and interior occupied spaces. Passive cooling uses thermal chimneys and promotes cross-ventilation, often augmented by "whole-house" fans.

Active Solar Heating & Domestic Hot Water

Buildings incorporate systems to mechanically collect, store and distribute solar heat. One or more collector panels are used to circulate warm air, water or other liquid through a glazed component that allows a rapid temperature rise. This heat is then stored in a tank or container and circulated through the interior space. Systems are sized to provide a major share of the space-heating load or to provide sufficient hot water for domestic use.

Photovoltaic Electricity

Photovoltaic (PV) electricity is converted directly from sunlight. Sunlight strikes the surface of a panel, generating electricity in the form of “direct” or DC current that is stored in batteries for later use or used immediately to operate lights, appliances and equipment designed to operate on DC. Since most buildings use “alternating” or AC current, an inverter is used to convert the DC to AC for conventional use.

PV systems can be stand-alone “off-grid” systems with no utility connection, or “grid-tied” systems that allow excess electricity to be sold back to the utility. PV systems can consist of fixed panels arranged in banks of flat collectors or in sets of “tracking” collectors.

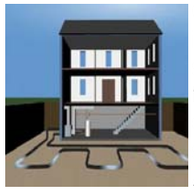
“Building-Integrated” Photovoltaic Panels (BIPV) are building elements, such as roof panels, shingles or glazing, that have integral PV components. PV systems are “modular”, with the ability to add panels and expand as conditions allow.

Hydroelectric Energy

Hydroelectric or “low-head hydro” energy, uses a water turbine to convert gravity-induced current on streams and rivers into electricity. Hydro tends to be continuous, more reliable and lower maintenance than for most other renewable energy systems.

A hydroelectric energy system can be “off-grid” or “grid-tied” and can be used in combination with a PV or Wind system.

Geothermal Heating & Cooling



Geothermal energy utilizes an electric ground-source “heat pump” and the temperature of the earth or groundwater to store and harvest heat. A “closed-loop” system circulates water or liquid through tubes buried in trenches or in drilled wells. An “open-loop” system draws water from wells or a body of water and discharges it to repeat the cycle.

The circulated water enters the heat pump at the near-constant ground temperature and a small fraction of this temperature is exchanged with a refrigerant in the heat pump. The equipment raises the pressure and temperature and this heat is exchanged with a separate internal water loop. This hot water is circulated to heat the interior.

The process can be reversed for summer cooling to remove excess interior heat and discharge it to the ground.

Wind Energy

Wind Energy is produced as electricity generated by a wind-turbine, typically mounted on a tall tower to reach the higher wind speeds present above trees and other landscape features.

As with Photovoltaic electricity, it is generated as DC current that can be stored in batteries or converted to AC current.

A wind energy system can be “off-grid” or “grid-tied” and can also be used in combination with a PV system.

Wood Energy

Wood energy is stored during the tree’s growth. When used properly, advanced-design wood stoves will burn wood efficiently, producing low emissions and little wasted energy. Some designs use “catalytic” combustors to provide more complete combustion and reduce pollution, or employ secondary combustion to optimize the burning of gases by maintaining high temperatures. Other designs utilize wood pellets or other agricultural-based fuels.

Long-term radiant heat storage and distribution can be accomplished with a Central Masonry Heater, that employs a special refractory masonry core and extended flue/heat-exchange channel to absorb heat from a relatively short and hot fire. They combine high efficiency and very low emissions.

Biomass Energy

Biomass energy refers to energy produced from the decomposition of organic material, such as manure and waste from harvesting crops. In the production of ethanol, farm crops themselves are the source of the energy.

Anaerobic digestion of manure is the most common process and produces “Biogas,” composed of Methane, Carbon Dioxide and other gases. A byproduct is the conversion of organic Nitrogen in the manure into liquid Ammonia fertilizer. The biogas can be burned as a fuel to operate equipment, heat buildings or power turbines for electricity generation.

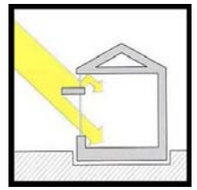
Hybrid Energy, Co-generation & Fuel Cells

Hybrid energy refers to using a combination of fuel types, often combining renewable energy in tandem with fossil fuels to generate electricity or operate equipment.

Co-generation energy captures the waste heat or energy produced in one process for use in another, such as providing heat to nearby structures.

Fuel Cells convert the chemical energy in Hydrogen to useable electricity, without combustion.

Distribution Strategies



In “Passive” systems, the mass contained in the building materials absorbs and re-radiates the solar heat in the occupied spaces. Concrete slabs, tile, masonry and extra-thick drywall or plaster are commonly used for thermal mass. Proper sizing and covering glazing at night enhances the performance of passive systems.

Passive designs can be in any style but typically have a majority of the windows on the south face.

In “Active” systems, the warmer air or water is distributed through ductwork, hydronic radiators, or hydronic loops in a slab. Active systems can be combined in tandem with a conventional heating system to provide supplemental heat when desired. Active designs can also be in any style but building-mounted collector panels often affect roof pitch and appearance.