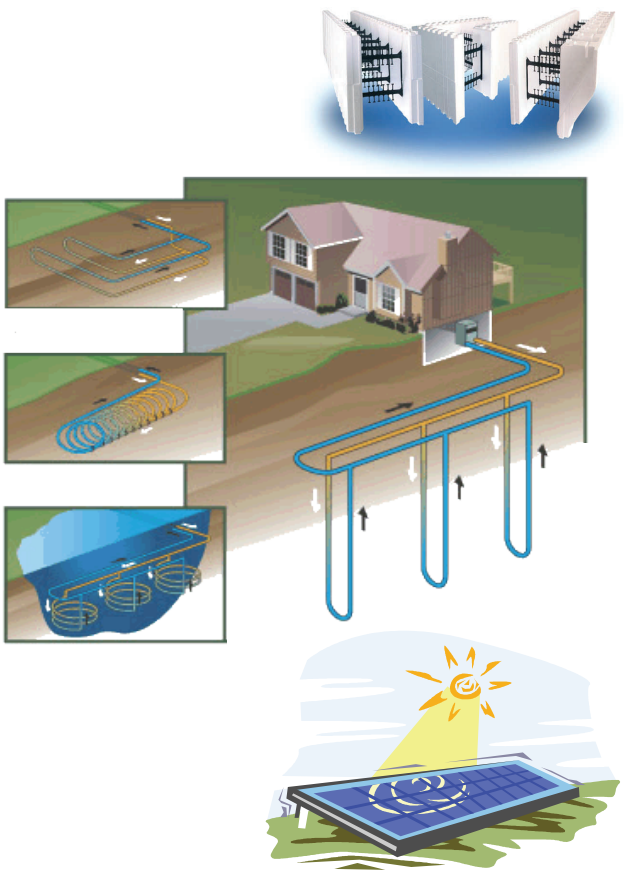
Green Building & Renewable Energy

at Navarino Nature Center



Green Ideas and Design

The Renewable Energy Education Addition at Navarino Nature Center displays and demonstrates green ideas and design. Renewable energy systems heat, cool, light and generate electricity: geothermal, passive solar and solar photovoltaic.

Conservation and energy efficiency are behind the ideas incorporated in the design: a high performance building envelope, low-toxin paints and materials, energy efficient windows and lighting, water efficient plumbing fixtures, recycled materials and locally produced sustainable materials.

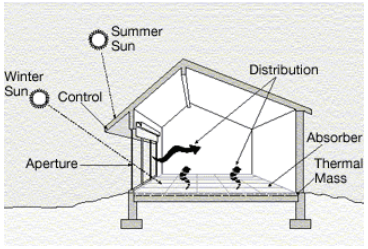
Why go Green?

In a world of rising heating / cooling and electrical costs, we need to conserve and lessen our footprint. Navarino Nature Center, cooperating with the Wisconsin Department of Natural Resources, want to model conservation in our nature center. This building will not use fossil fuels to heat and cool, and during periods of the year produce more electricity than it uses. Providing students and the public with a renewable energy education facility, which also helps the environment by reducing air and water pollution and the production of green house gases.

Navarino Nature Center, Inc.
working in cooperation with the
Wisconsin Department of Natural Resources

Renewable Energy and Green Building Features

Passive Solar Heating & Cooling



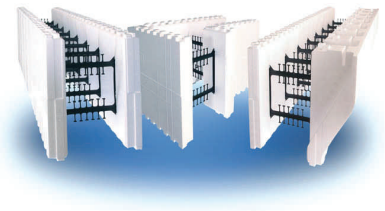
Passive solar building design uses the buildings windows, walls and floors to collect, store and distribute the sun's heat in the winter and reject solar heat in the summer. Unlike active solar heating systems, it doesn't involve the use of mechanical and electrical devices (fans, pumps) to circulate the heat. A layout with the longest walls running east-west and large windows facing south maximizes lighting and "direct heat gain" in winter, this heat is absorbed into the thermal mass of the building and distributed slowly throughout the building. During the summer months the wide roof overhang shades out summer heat gain and creates in-direct lighting.

High Performance Building Envelope

A high-performance building envelope is essential to minimize the energy required to operate the facility and maintain interior comfort levels for the occupants.

The NNC addition uses insulated concrete forms (ICF) in the lower level of the building.

What is a ICF?



ICF or Insulated Concrete Formwork is a stay-in-place concrete forming system for a steel reinforced, solid poured, monolithic concrete wall. It provides rigid polystyrene insulation with non-exposed furring, on 6 inch centers. ICF replaces poured CMU walls, tilt wall, infill and traditionally poured walls. It can be used for exterior, interior, load-bearing, and non-load bearing walls in commercial, industrial and residential construction. The 5-in-1 wall system provides wall structure, insulation, sound barrier, vapor barrier and furring in a one-step process.

The upper level walls are 2x6 structural stud walls creating a 5 1/2" fiberglass insulated cavity. The truss cavity area consists of a blown in recycled insulation.

The outside of the building envelope has been wrapped in "Gorilla Wrap", which is one of the many types of wall vapor-barriers currently available.

Interactive Displays

The lower level displays an interactive kiosk that monitors the output of energy from the PV system (provided by WE Energies) the energy usage of NNC and the weather conditions present at NNC.

The light display present in the lower level compares efficiency of LED and Florescent light bulbs to that of Incandescent light bulbs.

Also present are activities that demonstrate energy produced from PV light, wind turbine and generators.

Cool Daylighting & Advanced Lighting

Cool daylighting is the practice of using natural light to illuminate building spaces. Rather than relying solely on electric lighting during the day, daylighting brings indirect natural light into the building. Daylighting reduces the need for electric lighting and connects people to the outdoors. And it provides pleasing illumination at a fraction of the cost of the most efficient electric lights.

Lighting incorporated into the "Green" building addition is high-performance and low energy use. This includes fluorescent lighting that measures light levels to ensure a constant level of light through out the entire Great Room. LED lights are located on various areas of the building, these lights use 75% less energy than incandescent light bulbs. LED lights last 5x longer than fluorescent lights, and 50x longer than incandescent lights.

Velux © Sun Tunnel Skylights provides the means to allow passive solar lighting into deep interior areas of the building, without heat / cooling losses. These skylights are located in the lobby and stairwell areas.

Photovoltaic Power

Photovoltaic power or PV uses solar cells to convert sunlight into electricity. The cells are made from semi-conducting materials which absorb all visible light. Sunlight passes through the solar panel which agitates electrons in the cells and allows them to flow through the semi-conducting materials thus converting the light into electricity. The electricity converted from sunlight is what is known as Direct Current or DC electricity; the DC electricity is then converted into Alternating Current or AC electricity which is the form that is used to power buildings.

There are two types of systems that are used in PV, grid tied and stand alone. Grid tied systems are connected with the area power company grid systems, the extra electricity that is generated by the PV can be sold to the power company. A stand alone PV system operates independently by storing the extra electricity in batteries as a back up system.

NNC's PV system is a grid tied system made up of 84 solar panels capable of producing 14.7 kW/hr and a total energy production of 15,374 kWh/year.

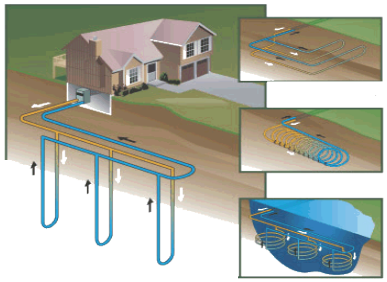
NNC's PV system was made possible through grant support from FOCUS ON ENERGY and WE Energies.

focus on energy
The power is within you.

Benefits of Photovoltaic Power

- Free energy
- Entirely Green
- Life span of at least 25-30 years
- Extra energy can be sold to the power company.
- No noise pollution
- Can be used in remote areas where power lines are limited.

Geothermal Heating and Cooling



Geothermal systems use energy from the earth to heat and cool homes and businesses. The temperature of the earth is relatively constant all year allowing it to regulate temperatures within the structure. There are two types of systems, the open loop system and the closed loop system. An open loop system uses an aquifer and a set of wells. Water from the aquifer is pumped through one well through a heat exchange pump in the building; once the water is passed through the system it is then pumped back into the aquifer through the second well.

A closed loop system consists of a series of tubing which is buried under ground at water table level; this allows the fluids to circulate constantly to and from the building. There are two types of closed loop systems, a horizontal loop system which is buried horizontally and a vertical system which is buried vertically.

The systems run by circulating fluids such as antifreeze or water through a series of loops located underground. In the winter months the fluid absorbs the heat from the earth and circulates it back to the building, the fluid then passes through a heat pump which converts and distributes the heat throughout the building. In the summer months the heat from the building is absorbed by the fluids and is pumped through the loops where the earth absorbs the heat thus cooling the fluid in the system.

Geothermal heating cooling systems use 25%-50% less electricity than the conventional methods, it also requires less surface area and the life span of the system is around 25 years.

NNC's system consists of a closed loop with 4 residential heat pumps with a 25 ton heating/cooling capacity. There are 4 trenches each containing 5 racetrack loops of tubing totaling close to 3 miles in length.

Recycled and Sustainable Materials

Great room and Lobby area of NNC display Oak and Maple trim milled from trees removed during the construction. The wood is finished with Velvit Oil © which is a natural interior finish.

The lobby and lobby restrooms feature recycled/reflective glass tiles which help to increase lighting.

The rainwater from the roof of NNC drains into the pond west of the facility and into rain barrels placed around the facility. Diverting rainwater to the pond will prolong the use for educational programs and the rain barrels make the water available for watering the landscape.

Green Building and Renewable Energy Resources

Green Building Design and Materials

Global Green
http://www.globalgreen.org/gbrc/whygreen.htm

United States Green Building Council
http://usgbc.org

Wisconsin Green Building Alliance (WGBA)
http://www.wgba.org

Building Green Guide: Sustainable Product Choices
http:/www4.uwm.edu//shwec/publications/cabinet/reductionreuse/615.SG.0502%20Update%2011.pdf

Solar Energy Society of Canada-New Energy
http://www.newenergy.org/sesci/publications/pamphlets/photovoltaic.html

U.S. Dept. of Energy—Energy Efficiency & Renewable Energy
http://www.eere.energy.gov

Wisconsin Focus on Energy
http://www.focusonenergy.com/index.jsp

Midwest Renewable Energy Association
http://www.the-mrea.org

Geothermal Heat Pump Consortium
http://geoexchange.org

Energy Center of Wisconsin
http://www.ecw.org/

Incentives

Database of State Incentives for Renewable Energyhttp://www.dsireusa.org

Educational Activities

Wisconsin K-12 Energy Education Program (KEEP)
http://www.uwsp.edu/cnr/wcee/keep/

Bringing Renewable Energy into Your House

Everything that has been incorporated into the "Renewable Energy Addition" at Navarino Nature Center could be done at your house. It is your choice. Renewable energy and green design can help to give you a healthy and efficient house that is also environmentally friendly and saves you money in the long term.

New Homes:

- Orientation to the sun to take advantage of passive solar heating and lighting.
- Build an energy efficient structure, creating a well insulated envelope that requires less energy to heat and cool.
- Low-E windows to prevent the loss of heat.
- Energy star appliances and lighting fixtures save energy.
- Green materials: lumber from sustainable forestry practices, materials that emit low toxins, recycled materials and water saving faucets.
- Use of advanced energy systems: geothermal heating / cooling, masonry heaters, photovoltaic cells, solar hot water, and wind turbines.

Existing Homes:

- Replace lights with compact florescent bulbs or LED bulbs and fixtures.
- Replace water fixtures with low flow units.
- When replacing appliances look for the Energy Star models.
- When repainting or replacing furniture or carpeting, choose low-toxic emissions.
- Also select materials that are recyclable or made with recycled content.

Navarino Nature Center is a 501c3 non-profit working in cooperation with the Wisconsin Department of Natural Resources.

Photovoltaic array at NNC is a grid-tied system in cooperation with WE energies and Focus on Energy.