TEXAS PARKS & WILDLIFE

A Guide to

Alternative Energy and Green Building

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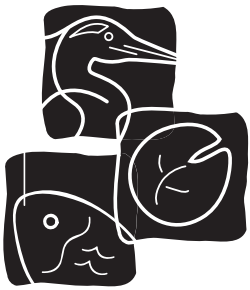


SheldonLake™

Environmental Learning Center

To help conserve resources, please take only one guidebook per group.

Welcome to the Sheldon Lake Environmental Learning Center (SLELC). The Learning Center is the 40-acre site of a former state fish hatchery and is part of the 2,800-acre Sheldon Lake State Park. **Use this guide and the descriptive signage at the Pond Center, restrooms and other facilities to learn about alternative energy and green building.**

History

Sheldon Reservoir was established in 1941 by the federal government by damming Carpenter's Bayou to impound its water for war-critical industries on Buffalo Bayou. **At that time, the spot where you are now standing was under six feet of water!**

After World War II, the state of Texas purchased the land. It became one of Texas' first wildlife management areas to provide public fishing and serve as a research facility and wintering site for ducks and geese.

The Texas Parks and Wildlife Department drained this half of the original lake and opened a fish hatchery on this site in 1954. Catfish, bass and sunfish were raised in the 28 one-acre ponds along what is now the Pond Loop Trail, and the fingerlings were then released in lakes, streams and ponds throughout East Texas. The Sheldon hatchery was closed around 1975 when it was no longer needed.

Today, after more than 30 years of natural succession, SLELC's grounds and ponds have gradually changed into a mix of trees, shrubs, vines and water plants that are rich with wildlife. The center's ponds, except for the fishing ponds, are filled only with the rainwater that falls on them. **As you walk the trail, try to notice the variations in the trees, shrubs, aquatic vegetation and water levels of the many ponds.**

Alternative Energy and Green Building

A major renovation of the SLELC's facilities was completed in 2005 to enhance the site's value and accessibility as an environmental learning center. As part of that renovation, "green building" and "alternative energy" were emphasized in the design.

"Alternative energy" (or "renewable energy") refers to the use of wind turbines, solar panels, geothermal energy and other technologies to produce electricity or perform work which otherwise would be done by burning coal, oil or natural gas.

"Green building" refers to design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and occupants and that address:

- Sustainable site planning, including "life cycle assessment"
- Safeguarding water and water efficiency
- Energy efficiency
- Conservation of materials and resources
- Indoor environmental quality*

Green building fulfills these principles by:

- using building siting and design as well as vegetation to maximize natural sunlight, shading and breezes.
- minimizing heating and cooling with thermally efficient windows and insulated walls, ceilings or roofs.
- including alternative energy systems in building design if feasible.
- utilizing local and recycled materials when possible to lower transportation and environmental impacts.
- using water efficiently through low-flow toilets, rain-harvesting, and use of water-thrifty native plants.

Look for this green building icon as you walk the site.

*Source: LEED Training Workshop, USGBC, April 2004

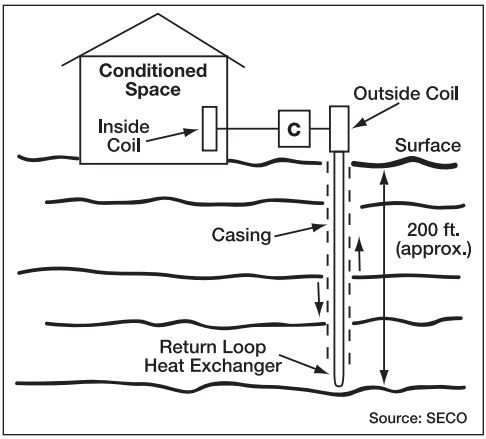
The Pond Center

This pavilion is a renovation of a 1950s-era masonry building that was used as the office, lab and garage for the old Sheldon fish hatchery. Rather than being torn down, this dilapidated building was updated into a large, open-entry pavilion for the SLELC with the addition of the canopy roof, concrete floor and restrooms.

Several of the green building features of the Pond Center are:

- Use of fly ash (a waste product from coal-burning power plants) in the concrete mix for the floors and roof columns.
- Use of Forest Stewardship Council (FSC) wood in the ceiling, which certifies the trees were sustainably harvested.
- Use of low-volatility paints and stains, which reduce air pollution emissions as compared to other paints.
- Use of energy-efficient florescent and compact florescent lighting.
- Incorporating surplus oilfield pipe into structural support members of the center and maintenance shed whenever possible.
- Capturing rainwater from the roof in two 2,500-gallon steel tanks and one 5,000-gallon concrete tank for use in irrigating Pond Center and Plaza flower beds (a 1-inch rainfall will yield approximately 2,000 gallons of water).
- Well-insulated walls and ceilings; windows open to allow cross-ventilation in fair weather.
- Use of lower-maintenance native plants in flower beds.

Geothermal Heating and Cooling



Although "geothermal heat" may make us think of geysers and red-hot lava, the Pond Center's classroom and lab are heated and cooled by a "ground-coupled geothermal" system. A conventional air conditioner extracts heat from a building and transfers the heat to the outside air through the condensing unit. The geothermal system works by transferring the building's heat to the 74°F ground rather than Houston's 94°F summertime air—a 20 degree difference!

To do this, nine 4-inch-diameter holes were drilled 250 feet into the ground just east of the bus parking. A loop of 1-inch polyethylene pipe was inserted into each hole and the upper ends connected together 5 feet below the grass into a single $1^{1}/_{4}$-inch pipe. A pump circulates water through the nine wells and back to a heat exchanger in the condensing unit on the Pond Center roof. The heat from the building is transferred to the water in the pipe and then into the cooler ground as the water circulates through the wells. **Up to a 50 percent annual reduction in electrical usage** is achieved, since the heat pump motors and fans run less; they are able to shed the building's heat more efficiently to the ground than to the air.

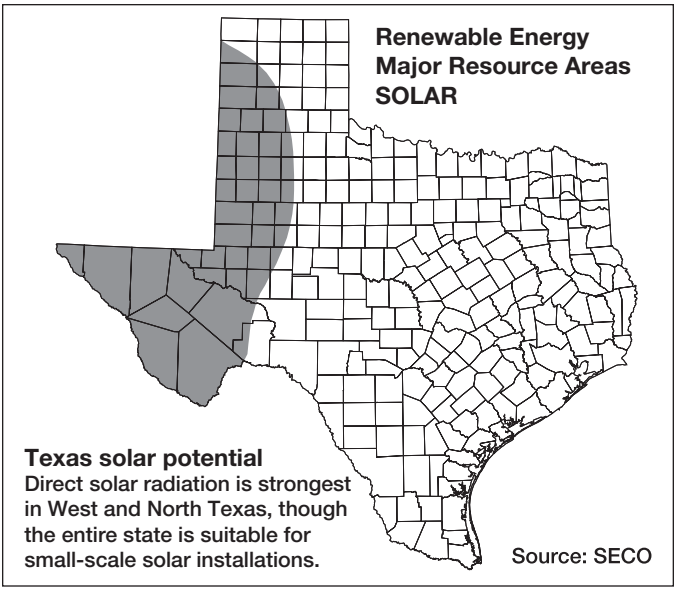
On a cold winter day, the heat pump "reverses" and is able to use the ground's constant 74-degree temperature to **warm** the circulating water and heat the Pond Center!

Photovoltaic Panels

The Photovoltaic Panel (PV) arrays are two groupings of six and eight solar panels respectively, that absorb the sun's radiant energy and convert it to usable electricity. Each panel generates 170 watts of electricity in full sun. The PV array you are standing next to is "fixed" in a due south direction that allows it to capture the maximum solar radiation each day. This panel is slanted at a 40-degree angle from horizontal, which is the most efficient angle in the winter months when the sun is low in the sky.

The second PV array is a "tracking" array. A photocell and a motor allow the array to rotate and follow the sun each day from east to west. When the sun goes down, or in very cloudy weather, the tracking array returns to its due east starting place. The tracking array produces more electricity than the fixed array, since it always keeps itself facing the sun. The tracking array is set at a 25-degree angle, which makes it more efficient at capturing the sun's rays in the summer when the sun is higher in the sky.

The PV system is inspected and certified by CenterPoint Energy to ensure that the electricity it produces can "mix" safely with the electricity sent through CenterPoint's lines to the SLELC's facilities.



While PV works in Houston, it becomes more efficient as you drive west. As the map indicates, the best place in Texas for PV is in far West Texas with its usually low humidity and cloudless skies.

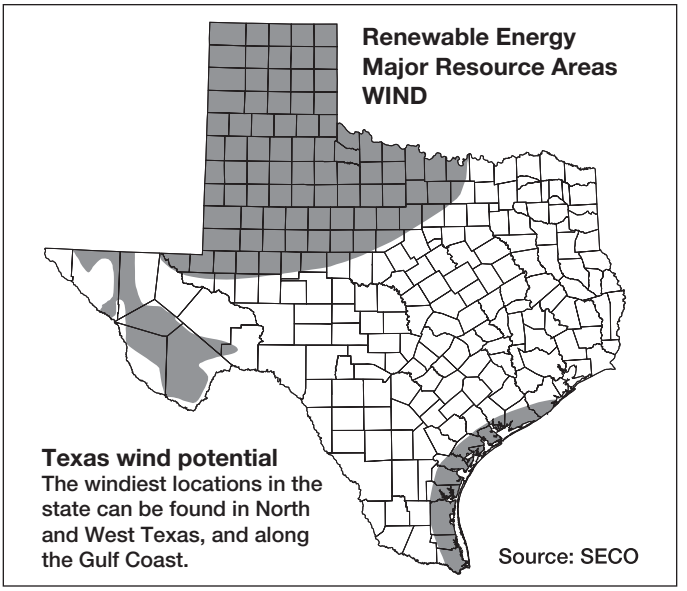
Wind Turbine

The wind turbine is 24 meters (80 feet) tall with a three-blade, 2.1-meter (6.5-foot) diameter rotor. When the wind blows about 8 miles per hour, the turbine blades begin to turn. This spins an electric generator that converts the wind's kinetic energy into usable electrical energy. The wind turbine produces a peak of 1,800 watts of electricity in a wind of 35 miles per hour. This is the maximum power that the control system can accept. When winds exceed 35 miles per hour the turbine's "extra" electricity is "dumped" as heat through an electric resistance coil. This dumping protects the turbine and its controls by limiting the amount of electricity generated by the wind turbine that is mixed with electricity to the energy grid.

As a rule, if the wind speed doubles, the amount of electricity produced increases by a factor of eight. And due to stronger winds up high, a five-fold increase in the turbine's height will yield an average of double the wind power.

This wind turbine is a "baby" compared to the 80-meter (260-foot) tall turbines with blades up to 70 meters (230 feet) in diameter found in West Texas. The open land and strong, steady winds of West Texas, the Texas Panhandle and the Central and Lower Gulf Coast make these areas the prime locations in our state for siting wind turbines to generate electricity.

While wind turbines are considered "pollution free" once manufactured and installed, they do change the appearance of the landscape and are a potential hazard to birds and bats.



Restrooms

These restrooms combine form and function! Reused bricks from Houston are getting a second life in the restroom walls and as pavers. Reused oilfield pipe and sucker rod provide structural support and ornamentation. Ipe wood from Brazil is FSC certified and resists decay for up to 50 years without any emissions-producing protective sealants. To reduce groundwater usage, commodes are "low flow" and the urinal "no flush" through the use of a special oil-filled filter that reduces odors. Ultra-efficient LED lighting supplements the natural lighting.

Solar Hot Water

Unlike the special "solar cells" of the PV system that convert solar radiation to electricity, a solar hot-water panel converts solar energy to heat using a simple black plastic liner under a clear glass cover. The heat absorbed by the liner is transferred to water running through a series of copper pipes directly behind it. In this system the water being heated in the pipes flows into a 10-gallon tank. The 10 gallons of heated water transfer their heat through a heat exchanger to the water in an 80-gallon insulated storage tank and then go back through the copper pipe to be reheated by the solar panel. When the hot-water faucet is turned on, the hot water is pumped from the 80-gallon tank to the restrooms for use.

Decks and Bridges

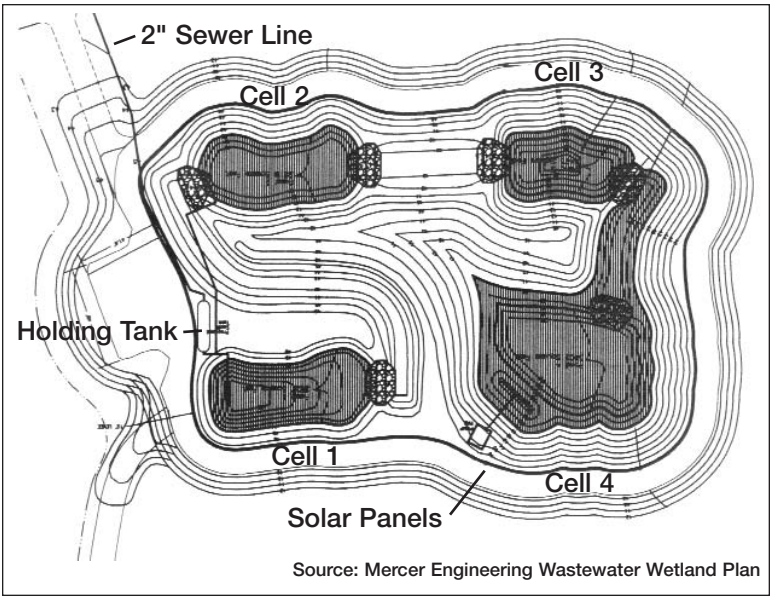
As you walk the Pond Loop Trail and other trails, notice the storage buildings, decks and bridges. All of these structures incorporate green building practices into their design. Woods used are either ipe or massarunduba (a similar durable Brazilian wood with a long working life span). Steel framing and vertical support is mainly reused oilfield pipe. Concrete support pillars use fly ash concrete. Trails are made from natural Hill Country granite instead of asphalt or concrete.

Wastewater Wetland

As a final "environmentally friendly" technology, the Learning Center has constructed a "wastewater wetland" rather than hooking up to a MUD district or using a septic field.

Effluent from the SLELC sinks and toilets flows by gravity to a lift station behind the Pond Center. The liquid sewage is pumped about 1/2 mile in a 2-inch pipe to a second holding tank. From this tank the wastewater flows by gravity through a series of four small ponds filled with water plants such as reeds and bullrush. The combination of sunlight and aerobic bacteria break the effluent down into usable nutrients for the plants and micro-flora and fauna. The wastewater is clean when it reaches the fourth pond and is allowed to evaporate or is sprayed onto the surrounding land by a solar-powered spray system.

The wastewater wetland does not have the smell and leaching problems often associated with septic systems in Houston's clay soils. The wetland also reduces carbon in the atmosphere by using less electricity from fossil-fuel burning power plants than do traditional systems and by sequestering carbon in the plant tissues.



Source: Mercer Engineering Wastewater Wetland Plan

LEED

"LEED" stands for "Leadership in Energy and Environmental Design." This program is a voluntary, consensus-based national standard for developing high-performance sustainable buildings sponsored by the U.S. Green Building Council.

LEED promotes state-of-the-art methods for sustainable site development, water conservation, energy efficiency, materials selection and indoor environmental quality.

LEED uses a set of criteria to evaluate how well a building project meets relevant standards set for schools, homes, commercial buildings, renovations and other development types. Successful completion of the LEED program results in the awarding of Bronze, Silver, Gold or Platinum certification. The Sheldon Lake Pond Center project is expected to qualify for a "Silver" rating.

Partners

These alternative energy and green building facilities were made possible through a partnership between the Texas Parks and Wildlife Department (TPWD), the State Energy Conservation Office (SECO) and the Alternative Energy Institute (AEI) of West Texas A&M University.

SECO is the state government agency responsible for increasing public awareness of alternative energy by demonstrating new technologies and by developing the infrastructure required to foster their use in Texas. SECO provided a grant to help demonstrate the use of these alternative technologies and design concepts to our Houston visitors. The **Alternative Energy Institute** provided much of the installation and coordinated with **TPWD** architects and engineers on design and construction.

Please check with the staff in the office if you have any questions.

Visit these Web sites for more information:

SECO	www.infinitepower.org
LEED	www.usgbc.org
AEI	www.windenergy.org
TPWD	www.tpwd.state.tx.us

To view the electrical output of the Sheldon Lake wind turbine or PV array in real time, check:
www.cwc-das.com/wcsd/showsite.php?site=sheldon

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www.tpwd.state.tx.us/spdest/findadest/parks/sheldon_lake/

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 PWD BK P4504-139N (1/07)
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