

Lake Metroparks Farmpark

By Andy Baker, Farmpark Administrator

The amount of daylight is on the wane as this *Naturally Speaking* goes to press. Yet over a year's time, the diffuse energy of the sun drives the annual growth of the plant life in fields and forests that in turn sustains both animals and humans. Harnessing the diffuse energy of the sun and wind is not a new concept for humans. Consider that every bite of food we take is a bit of renewable solar energy. Since humans began farming they gathered the energy of the sun in the plants and stored it to provide energy for use year-round, particularly when the sun dips toward the Southern horizon in the dead of winter. Over time, humans were able to literally harness more of the sun's energy when they harnessed cattle and then horses. Wind energy, a product of solar energy heating the earth, has also played an important role in agriculture for thousands of years by pumping water and grinding grain and, in the last century, providing electricity to isolated farms.

The way energy flows through the agricultural production system – in the past, present and future – is a key theme of Farmpark's interpretive program. Capturing solar energy for human consumption has been one of the ongoing themes of the programs at Farmpark, particularly in the Plant Science Center and the Dairy Parlor. Greenhouses are designed to let solar energy into a protected environment that shelters plants while encouraging growth by providing the maximum available sunshine when sunlight is at a minimum. *The Great Tomato Works* exhibit focuses on photosynthesis and the storage of energy in different part of the plants. In the Dairy, the theme is that of cows consuming stored solar energy in hay and passing it on to humans in milk.

As early as 1994, Lake Metroparks staff began working with a volunteer group called Sustainable Energy for Economic Development (SEED Ohio has since become part of Green Energy Ohio) to pursue further possible ways to educate the public on solar energy. In January 1997, SEED Ohio, assisted by Lake Metroparks, erected a wind-monitoring tower on one of the highest points in Lake County: at Lake Farmpark's Plant Science Center. The same year, a traditional water-pumping windmill (on the cover) was incorporated into one of the permanent outdoor gardens at the Plant Science Center, illustrating the traditional role of wind power in agriculture.

Data collected from the monitoring tower was analyzed and evaluated. Given Farmpark's educational mission and the public exposure of the facility, the members of Green Energy Ohio (GEO) and the staff at Lake Metroparks thought it worthwhile to set up a demonstration turbine. First Energy was then approached as a possible sponsor of the turbine.

At the same time, deregulation introduced other energy companies to Ohio. Lake Metroparks provided a location at Farmpark's Plant Science Center for Green Mountain Energy to construct a 26-kilowatt (kW) solar array, which was dedicated in April 2002. The array, 105 feet long by 45 feet wide, is estimated to produce 34,500 kilowatt hours (kWh) of energy per year, which goes into the electrical grid at the Plant Science Center.

Like photosynthesis, photovoltaic cells use light energy in the form of photons to excite electrons. The electrons then flow through conductive materials, creating a

moving form of energy (current) that can be harnessed to do work.

As the solar array was being built, First Energy Solutions environmental department was able to budget funds for a small demonstration wind project. Working with Metroparks staff and volunteers from GEO and Engineered Endeavors, Inc of Mentor, First Energy erected a 20 kW Jacobs wind turbine on a 100-foot monopole tower in the winter of 2002-2003. The 20 kW turbine, estimated to produce 30,000 kWh per year, is a much smaller version of the many new turbines (one megawatt and larger) being constructed throughout the country and world. In some European countries, wind power provides a significant portion of the national demand for electricity. In Denmark, fully 15% of the nation's electricity comes from wind.

The turbine at Farmpark, like the solar array, is tied into the electrical grid at the Plant Science Center. Both projects are separately metered to keep track of their production for their respective owners. The generated electricity is utilized in the Plant Science Center and excess is net metered. On a sunny, windy day, electricity is flowing away from the site.

Photovoltaic arrays and wind turbines are non-polluting ways to produce electricity. The average coal fired power plant emits 20 pounds of carbon dioxide (CO₂), per kW of electricity produced. Considering that the average Ohio home consumes about 10,000 kWh per year, it would take 1,400 mature trees to absorb the 10 tons of CO₂ produced for each household. The output of the solar array and the wind turbine are each equivalent to the consumption of three households.

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Thus, the renewable energy systems at Farmpark displace as much as 70 tons of CO₂ each year.

Another important feature of photocells and wind turbines is their ability to provide power in remote locations where the cost of putting in transmission lines would be astronomical. Consequently, solar arrays can be seen along interstate highways providing power for emergency phones, in arid regions powering pumps, on mountains providing power for telecommunication facilities, or on satellites and space stations. Photocells and turbines are also being used to provide a source of electricity for remote villages in less developed countries. In India, wind power is being developed to help bring power to 76 million households that currently don't have access to electricity.

Unfortunately, electrical energy is difficult to store. Batteries can only store limited amounts of energy and are relatively expensive. Consequently, a large solar array or wind turbine is best tied into the electrical grid where the energy is continually being consumed. However, a number of environmentalists are proposing that isolated wind farms and solar panels be used to generate hydrogen for fuel cells, a source of energy that is storable but non-polluting when consumed.

The overall goal of Lake Metroparks is to create a site that illustrates renewable energy generating technologies and interprets the ways in which solar and wind energy produces electricity and the food we consume. Presently, interactive displays are being developed with the assistance of the Ohio Department of Energy Efficiency to provide further

information on renewable energy and how the wind turbine and solar array work. The exhibit will provide basic information on each technology along with an indicator of real-time electrical generation both inside and outside the Plant Science Center. Visitors will be able to discover the many forms of renewable energy and compare their own power to that of the renewable generators.

While the output of the turbine and array at Farmpark may appear small, it provides another interpretive connection to the ultimate energy source upon which agricultural production and life on earth relies: the sun. As a result of all of the site's renewable energy features, visitors will be able to better understand the value of renewable energy for our food and future. 🌱

