

Will the winds of change be turning turbines in your yard?

by Jerry Van Someren

When energy prices escalate and speculation about the safety of the environment runs rampant, innovative Americans search for alternative forms of energy such as wind. Many of us have seen the spreading arms of large wind turbines and dreamt of how they would look in our backyards or hay fields. Realizing that wind is free adds to our idyllic state of mind as we imagine no more energy bills and never-ending revenue from the electric utilities that will purchase our energy.

Energy generated by wind has benefits.

- It is clean and emission-free.
- It is dispersed, meaning the generation takes place over a widespread area compared to a centralized generating plant, lessening long transmission lines.
- Wind turbines occupy a small footprint of the landscape.
- It is available almost anywhere.
- Wind turbines with battery banks make living in remote areas possible.

There are drawbacks to wind generation, too.

- The sporadic wind here can range from dead calm to storm force in mere minutes.
- Many people see wind turbines as unsightly structures that clutter the countryside.
- Wind turbines are as noisy as a car

traveling 70 mph.

- Compared to conventional generating systems, turbines have a short life of about 20 years.

- Wind turbines have a high maintenance cost, especially units larger than 10 kW.

- Wind turbines have a high cost for each kWh generated.

Renewable energy sources are an important component of our future energy supply.

At St. Croix Electric, we do not view the addition of renewable energy sources like wind as a threat to our core business. In fact, we presently have three sites where private citizens have the capability of generating current back into the grid (area electric lines). By integrating their production histories with the forecasts of an independent site assessor who is certified in siting but not engaged in selling equipment, we have gained insight into what to expect from wind systems operating in St. Croix County.

The answer to whether or not a wind turbine is a wise investment is blowing in the wind.

The wind in St. Croix County blows predominantly from the northwest at an average annual speed of between 11 and 12.5 mph when measured at the height of 120 ft (the optimum height for generators of 20kW or less in capacity). The wind

velocity may be much higher at times and almost non-existent at other times. With this fickle wind, smaller turbines (10kW) will likely out-produce larger units. They are built lighter, turn more easily and have a lower cut-in speed. Wind turbines take a sustained wind speed of 24 to 35 mph to produce the amount of energy for which they are rated. The assessor's projections agree with our own findings: a wind turbine operating in St. Croix County at average wind speeds will achieve about 20% of its rated capacity at best.

Do the math: costly equipment and light winds compute to low energy production and many decades before a return on investment is realized.

People wonder about the cost of wind systems. While we do not sell wind equipment, we are in contact with companies who do. Prices of the homeowner-popular 2.5 kW unit range between \$23,300 and \$35,000 installed. For evaluation purposes, consider the installation of a Proven WT 2500 turbine. This 2.5 kW output turbine produces an average of 390 kWh per month with a 12.5 mph breeze. The cost quoted to install the turbine and related equipment is approximately \$32,709. Using an average of 10¢ per kWh, the generator's output would net \$39 per month or \$468 per year. When dividing the initial cost (\$32,709) by the anticipated yearly revenue (\$468) we calculate a 69.9 year payback without adding maintenance costs. A larger \$82,500 unit like the 10 kW ARE

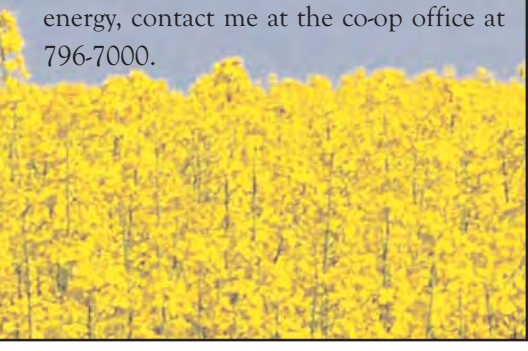
doesn't change the scenario much. Much larger turbines, like the kind seen in northern Iowa and western Minnesota will probably not be seen on our landscape because of our less-than-adequate wind resources.

Residential member/owners of St. Croix Electric have the option of connecting their generator to our lines in a *grid tie*. The grid tie allows the turbine's owners to sell excess electricity they have generated to the co-op. St. Croix Electric purchases the locally generated kWhs at net (the same price the customer pays for his kWhs from the Cooperative - presently 10.2¢ in the summer and 8.9¢ in the winter). Additional wiring and liability insurance are needed when hooking any generator to St. Croix Electric's system.

Should you invest in a wind turbine? It all depends on why you want one.

Do wind turbines work in St. Croix County? Yes they do, but given the present technology, our rolling terrain and our average wind speed, quick payback is not in the equation. If your intention for erecting a wind turbine is to make money, St. Croix County is a poor place to invest. Conserving energy makes more sense and is something we can all afford to do. If your intention is to be more environmentally friendly and do something about our growing energy needs, a wind turbine may fit into your plans.

For more information on wind energy, contact me at the co-op office at 796-7000.



Renewable energy focus:

Is solar power a bright idea or does wind energy blow it away?

by Jerry Van Someren

In Aesop's Fable "The Wind and the Sun," a battle is raging over which of the two is stronger. The wind blows hard, but the sun shines hot. Both do their best to get a traveler to remove his coat.

The sun wins the argument in the fable. Will the outcome be the same in energy production? The wind and sun both provide an environmentally friendly alternative to coal and gas-fired generating plants and neither emits the greenhouse gasses associated with global warming. This article will explore whether solar power is a viable energy source for western Wisconsin.

There are several different kinds of solar technology. Passive solar refers to a means of using sunlight for energy without involving mechanical processes. Passive solar technology converts sunlight into usable heat. The solar gain can be used for heating air, water or thermal mass. Solariums are an example of harnessing passive solar energy. The glass walls and ceiling of a solarium allow sunlight to heat walls, floors and in some cases aquariums or tanks filled with water (thermal mass). The stored heat may be released later without employing mechanical means (fans or pumps) until the heat supply is depleted.

Some of Wisconsin's most successful solar stories involve the use of solar energy to heat domestic water and to increase temperatures in swimming pools and hot tubs. These systems are often classified as active solar technology because they use mechanical means to distribute the heated air or water. Active solar systems are more successful than passive due to greatly enhanced heat transfer and transport. Active solar systems are more controllable

so the heat can be directed to different areas of a structure.

Photovoltaic (PV) is technology that converts light rays directly into electricity. This technology is not new. If you have a hand held calculator, a small PV cell probably powers it. Informational road signs that tell of traffic delays or road construction often receive their power from PV cells. Batteries usually serve as a back up energy source when light energy is low or unavailable. Therein lies the inherent problem with PV generation - when the sun goes away or decreases in brightness, the power output from PV generators suffers noticeably. As you can imagine, during the night, electric output from solar panels drops to nothing.

Back to the argument: Which is better, wind or solar generated energy? The wind says that because it blows more hours day and night than the sun shines, it's best. It says it is more intense in western Wisconsin and therefore can produce more energy. The sun, on the other hand, says it can produce energy even during cloudy days, so therefore it is better. It says strong wind gusts don't affect it since it has no moving parts. Which is the better way to go?

To answer that question, we need to ask - will a solar grid tie system work in a home in St. Croix County? The answer is yes. Solar does work and it works all over except during cloudy days when the output drops drastically. According to my research, Wisconsin averages between 4 and 4.5 "sun hours" (hours when the PV cell can produce close to its rated amount) per day. That leaves almost 20 hours of limited or no production. During the winter, our "sun hours" drop to between

2.5 and 3 hours per day, so winter production is less than robust. Still, solar does produce good clean electricity.

To further answer the argument between the wind and the sun, we need to look at the attributes of each potential energy source.

- **Solar gives off no pollution** other than during manufacture of the equipment when some of the materials used may be a concern. Wind has the same bragging rights.

- **Solar operates quietly.** Wind does not. Wind turbines produce an annoying "thumping" noise along with flicker (shading from the turning blades) and television/radio interference.

- **Solar panels are kind to wildlife.** Wind turbines are responsible for killing numerous birds and bats each year.

- **The sun is global.** It shines all over. Wind, also, is present everywhere. Like the sun, it produces better some places than others.

- **Solar panels can be mounted on any south-facing surface,** especially on roofs. They save yard space and climbing to dizzying heights isn't necessary to care for them. Wind turbines are usually perched on 100 + foot towers. Not many of us really want to climb that high.

- **Setbacks are not needed** for solar panels because they don't fly apart or topple over in a strong wind. Wind turbines have a history of destroying themselves in strong winds.

- **Solar panels need very little maintenance.** An annual rinsing with water should be all that's needed. Wind turbines, on the other hand, require continuous service including cleaning the vanes and lubricating the mechanisms.

It looks like solar has the edge, doesn't it? But what about cost?

The cost to install a solar PV array and connect it to the grid so the excess energy

can be sold back to St. Croix Electric is currently rather high. One of the major players in PV panel production is Solardyne. According to their website, the super special sale price for a 4000 watt system is \$31,743.00, not including installation or wiring the grid connection. The estimated cost for that service could add up to \$7,500.00, bringing the total cost to \$39,243.00. According to one of the government website calculators, we can expect this 4000 watt system to produce approximately 4,953 kWh of power each year. Applying our split summer/winter rate, that calculates to \$471.47 per year in expected savings/earnings. Simple division tells us that the payback for a 4000 watt PV array is somewhere around 83 years. This reinforces what I've said in the past, if a salesperson knocks on your door promising quick profits from the free energy of the sun or wind, he or she is probably lying.

Does that mean solar has no value in western Wisconsin? Not at all. Solar does have a future here. Presently the price to install PV equipment is higher than wind turbine products, but I expect them to drop in the not-so-distant future. Already companies like Nanosolar are saying they can produce a new class of PV cells for as little as \$1.00 to \$2.00 per watt. The lower price will not make solar cells produce more in St. Croix County, but it will considerably reduce installation costs.

It is my opinion that there will be a future for solar PV generation systems in our area. Technology is moving fast in this arena and research will continue until the product becomes more practical. I predict that some day every rooftop in the United States will sport a PV panel connected to the utility grid. It's a clean way of reducing our dependence on both foreign oil and power generation plants.

Does our energy future include wood, plants, and animal waste? by Jerry Van Someren

In the rush to enter the jungle of renewable energy, many people overlook the most primitive form of renewable energy: biomass. Since the day fire was discovered, biomass has been in the energy picture. Fire happened so early in history that its origin can't be established, but preserving and transporting it required a fuel source. In most cases that fuel was wood. A modern description of biomass is "the burning of biological products, such as wood and plants to produce heat, electricity, and hot water".

Wood may have been the first fuel used, but it isn't the only medium involved in today's biomass picture. Biomass energy can also be derived from agriculture (especially animal) waste, logging residues, paper, industrial waste, standing forests, pre-commercial thinnings, imperfect commercial trees, and dead or dying trees. Today energy prophets are talking about planting crops such as fast growing poplar and willow trees along with grassy crops like miscanthus, switchgrass, hemp, corn and sugarcane that would be harvested for the sole purpose of making energy.

As I mentioned above, the most widely accepted biomass technology involves the direct burning of material in order to produce energy. A wood stove is a good example of this process. To put into perspective how popular this ancient biomass technology still is today, research shows that approximately 1/2 of the world's

population still cooks with wood. While this kind of direct combustion is the simplest of biomass technology, other more exciting technologies are also being used and new possibilities are being explored.

Co-firing is a process whereby biomass is added to traditional fuel sources, such as coal. This is becoming a popular option for electric generating stations in certain areas of the Midwest where forest and industrial waste are readily available.

Burning landfill gas or gas from wastewater treatment plants (which is basically methane and carbon dioxide) is another way of tapping into biomass. When landfill gas (mostly methane) is extracted from wells drilled deeply into landfill sites, it provides a continuous flow of methane gas, which in turn generates a dependable amount of electricity.

Gasification is a process that is also seeing limited resurgence. In this pre-World War II technology, biomass, heated in the absence of oxygen, produces synthetic gas, which can then be burned for heat or routed through an engine.

Time and space prohibit me from naming many other sources of biomass energy, but resources show that additional sources of biomass fuel are being discovered daily. Things like pond scum and algae, along with a host of other annoying plants that many of us have tried hard to eradicate, suddenly are being rediscovered because they are rich in

useful oils and other "green" products.

Products of bioenergy can generally be divided into two categories, namely transportation and energy. Biofuels for transportation are ethanol and biodiesel. Most of us are familiar with ethanol because for the past several years it has been used to oxygenate gasoline. Oxygenated gasoline burns cleaner, reducing air pollution. With the greatly increased cost of diesel fuel, more and more biodiesel is being sold. While biodiesel can be made from a host of different plants, most of what is currently being used is made from oil producing seeds like soybeans or from waste vegetable oil commonly called "fryer fat". Some states like Minnesota require a certain amount of biodiesel be added or mixed to each gallon of diesel fuel sold.

Biopower (energy) is generation of electricity from biomass. St. Croix Electric's power supplier Dairyland Power Cooperative (DPC) is involved in several different kinds of generation from biomass. Currently they own three animal waste-to-energy facilities that produce a total of 2 megawatts of electricity. These "cow-power" plants use dairy manure as the energy source to generate renewable energy. DPC also purchases renewable energy from three landfill gas-to-energy biogas facilities that have a combined capacity of 14 megawatts. If things go as planned, DPC hopes to purchase up to 40 megawatts of power from a third source of biomass which is a wood waste-to-energy generating plant being recommissioned in southwestern Wisconsin. As you can see, a portion of the energy you presently use

in your home already comes from converting biomass to energy.

Producing energy from biomass takes a special situation.

Most rural homes generate small amounts of biogas from things like compost piles and septic systems, but the amount produced is miniscule and the cost of collecting and purifying the gas so it can be used is difficult to justify. St. Croix Electric does serve dairy farms that generate sizeable amounts of animal waste. These farms are looking for ways to use the biogas. The processing equipment is costly, so not too many of them have been able to rationalize the expense yet. As energy prices rise, perhaps economics will cause more people to move forward to this form of green power.

Even though energy from waste products and biomass makes perfect sense, it is not without its drawbacks. Burning mass does release its energy, but it also generates emissions we may not want to live with. For instance, if everyone started burning wood for heating and cooking, we would live in a constant cloud of smoke. Even running engine-powered generators on methane gas presents a problem with exhaust emissions. As with everything, we need to be careful so we don't create new problems while solving existing ones.

On the other hand, there are many favorable attributes of biomass energy. Unlike wind turbines that only generate when the wind blows and solar arrays that only produce when the sun shines, biomass energy is always available. Looking at energy production from an energy retailer's perspective, that feature is extremely important.