Demonstration of Renewable Energy Production

Purpose:

To demonstrate the potential of on farm wind and solar energy production equipment, including an analysis of both capital and operating costs.

Methods: Agriculture is in a somewhat unique situation when it comes to our potential to participate in alternative energy production. From methane digesters, to wind and solar generation, to biodiesel & ethanol; agriculture has many of the resources required, already at our disposal. This has many producers interested in the potential for alternative energy systems across our industry. With this in mind, the Halton Region Soil and Crop Improvement Association (HSCIA) have constructed a demonstration project focused on small scale wind and solar powered electricity production for 2006 and beyond.

There are many unanswered questions around these two technologies, and it is our intention to demonstrate to members of our organization, as well as the general public, the potential that exists.

To ensure the maximum exposure for this demonstration project, the HSCIA has partnered with Country Heritage Park, Milton, to both host the equipment, and also incorporate alternative energy production into its educational and awareness programming.

Results: The project began with a search for the most appropriate and affordable equipment we could find. As this technology was new to all of our directors, we felt it was important to also find a dealer who was willing to provide a high level of support.

The decision was made to purchase a Lakota windmill and additional solar equipment from True North Power Systems of Lions Head, Ontario. One of the main reasons for choosing this supplier was that True North offers 2 day training sessions to their customers as part of the package. Cecil Patterson attended this training in June and found it quite valuable. True North has also been in the industry for several years.

The equipment consists of a Lakota 12V 1KW turbine, a 60’ tower, Commander voltage controller, 1000AH battery pack, 1200w voltage inverter and 2-115W Evergreen solar

panels. This will provide approximately 900W of power for 10 hours per day on average (see energy budget below).

The biggest challenge we faced was getting the necessary approvals to begin construction. Country Heritage Park is located within the Niagara Escarpment Commission (NEC) planning area. Following an initial inquiry, it was indicated that this project would require a NEC development permit. We were told that the process would take about eight weeks. After submitting the lengthy application form we waited for several weeks for any response. During the summer months we responded to several enquiries from commenting agencies such as MTO and Ministry of the Environment.

This process was quite frustrating as it took a lot of effort to react to these requests and there did not seem to be any distinction between a small demonstration project such as this, and a full scale commercial development. There were several times when we were close to dropping the project.

Finally in early September we received our NEC development permit with no fewer than 14 conditions attached. It took several weeks to wade through these, but finally by late September we picked up the equipment and were ready to proceed with construction.

The tower sits on a concrete base with 4 guy wire assemblies connected to 4 outlying pillars. The tops of each of these must be at the same level. Milton Hydro generously donated the use of one of their auger trucks to drill the holes in which we used 24” Sono Tubes as forms. The two pillars to the left and right of the centre are slightly ahead of the centre line of the base so that the cables attached to them loosen as soon as you start to drop the tower.

The site chosen drops off towards a drainage ditch requiring that pillar to be more than three feet above grade. A laser level was used to ensure that everything was level.

After the concrete had cured for a couple of days we assembled the tower and generator and prepared all the cables to estimated lengths. Three lengths of 6 gauge copper wire plus a ground were drawn up the centre of the pipe.

As you can see the tower base is constructed with a hinge design to facilitate raising and lowering. A gin pole which is half the height of the tower is inserted into the base at a right angle to the tower. The cables from the front anchor are transferred over to this pole which acts as a lever. A cable is then attached to the pole which goes down to a pulley attached to the anchor which we hook to a truck to raise and lower the tower.

It only takes a few minutes to drop the tower to perform maintenance on the head. It took a couple of hours to adjust all the cables to the correct length after the initial erection, but these should not require much attention in the future. We used a transit to straighten the tower from both directions.

All of the hardware in the tower kit worked reasonably well with the exception of the cable clamps. Several of the clamps had bad castings and required replacement. The overall design is simple and practical and should provide years of trouble-free service.

The wires coming down the centre of the mast go into a box attached to the base and from there to a shed which we renovated and relocated to the site. The power is regulated by the Commander Load Diversion Controller. This panel takes the AC power from the alternator and rectifies it to 12V DC. When the storage device (battery) is fully charged, the commander diverts the excess power to a series of fan cooled resistors at the top of the panel. This maintains a load on the windmill to keep it from turning too fast, which will result in damage to the components, while keeping the battery fully charged.

The battery is a 1000 AH unit which is fully enclosed and will not be damaged by freezing. The unit is quite heavy. The battery feeds a 1200 W voltage inverter which converts the 12V DC power to 120 V AC. This is not a true sine wave unit so it is only used for certain applications. Most of what we intend to use the power for will be done at 12 V DC to simplify the system.

Due to the delays in construction we have been unable to set up the solar panels. Our plan is to mount them on the roof of the shed. They will be used to supplement the wind energy (we have had several periods of up to 5 days with very little wind).

Project Budget:

The following chart provides a general outline of the costs involved in this project and the potential energy produced. The revenue estimates were calculated using provincial Standard Offer Contract rates for wind and solar energy. There is no labour component in this budget as it was all donated.

Lakota Wind Generator & Controller	$2,600
Tower Kit	$1,680
Battery Pack	$2,640
2X115W Solar Panels	$1,600
Pipe for mast	$1,000
Concrete	$600
Concrete Forms	$250
Wire & Electrical	$1,000
Total Cost	**$11,370**

Electricity Produced

Wind
900W @ 33% efficiency = 7.2 kwh/day @ $.11/kwh = $0.79/day

Solar
230W @ 33% efficiency = 1.8 kwh/day @ $.42/kwh = $0.76/day

$11,370 ÷ $1.55/day = 20 years payback

Electricity produced able to operate 9 - 100W light bulbs running 10 hours per day on average.

Summary: This has, and will continue to be, an interesting project. We have certainly learned a lot about the challenges of the approval process. This experience will, unfortunately, probably have us choose sites outside of the NEC planning area in the future to conduct demonstrations. Although NEC staff was helpful in getting us through this, the process was frankly something we would prefer not to have to endure again.

The equipment itself has proven to be well received. There have been hundreds of visitors to the project, ranging from school tours, to farmers, the general public and politicians. There is an extremely high level of interest in “Green” energy.

The high initial capital cost is detrimental, we expect, to large scale adoption of this size of setup. Certainly it doesn’t appear the economics work if there is easy access to conventional hydro. However, if you needed power in a remote area, the situation would be different. With high efficiency lighting etc. available today, you could probably function quite well on the power this system will generate.

Next Steps: Over the winter we will design and manufacture the frame to mount the solar panels on the roof of the shed. These panels are about 24 X 42 inches in size, and should be oriented due South at the same pitch as the location’s latitude.

In the spring we will move the shed to the other side of the road closer to the well from which we will pump water to supply the livestock in that area of the Park. This will require

some trenching etc. We are also going to provide predator deterrent lighting for the sheep area.

Another option that we would like to explore is the possibility of using the energy to recharge the battery in an electric utility vehicle such as the electric JD Gator.

The local Horticultural Society has also been approached about the possibility of setting up a demonstration of a high intensity vegetable garden in the vicinity, utilizing water pumped from our system for sub irrigation.

We would also like to add one more solar panel to the system to keep things fully charged on those calm days. Our hope is to also develop some sort of device that will record how much energy is produced so that we can keep records of the systems output.

Acknowledgements: We would like to take this opportunity to acknowledge and thank the many people and organizations that have made this project a reality. Many of the Directors of the Halton SCIA have been active in the planning and construction of this project. Milton Hydro also came and drilled the holes for the pillars for us.

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- Ontario Soil and Crop Improvement Association
- Ontario Ministry of Agriculture, Food and Rural Affairs
- Town of Milton Community Fund
- Region of Halton Agricultural Development Fund
- Country Heritage Park
- True North Power Systems

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Location of Project Final Report: