

FINAL REPORT

Executive Summary

In 1999 the Siyeh Development Corporation of the Blackfeet Tribe (Siyeh), Town of Browning (TOB), Indian Health Service (IHS), Blackfeet Indian Housing Authority (BIHA), Bergy Windpower, and Glacier Electric Co-Op, partnered up to install four Bergy wind turbines at the TOB's wastewater treatment facility wherein the electricity generated by the turbines would be used by the facility.

There have been some problems associated with the project. They range from personnel issues, technical problems and equipment problems.

Objectives

The objectives of the U.S. Department of Energy's Wind Field Verification Project were to conduct research and development of renewable energy resources. This project was to require Siyeh, FVP recipient, to perform the following project objectives using small wind turbines:

1. Purchase, install, and test a small wing turbine at the National Renewable Energy Laboratory's (NREL) National Wind Technology Center (NWTC) for safety, performance, noise, and duration.
2. Upon the completion of the testing at the NWTC, extend the testing at a host site location.

Siyeh was also required to create quarterly reports concerning the performance, activities concerning the turbines and the environment, and issues confronted during the quarterly testing period.

Project Activities

The following is a chronological account of the activities for this project since its inception:

- Oct. - Dec. 1999:
 - o Project plans developed.

- Turbines assembled and erected.
 - Dec. 10th Inverter #1 came on-line; remaining 3 came on-line Jan 21, 2000.
 - Turbines in this quarter experienced wind speeds regularly in excess of 60 mph and on 2 occasions in excess of 100 mph.
 - Beginning of the inverter problems; fault out and generation is halted.
 - Local electric co-op approves net-metering system installed on their line.
- Jan. - Dec. 2000:
 - Inverter problems continued:
 - Retrofit of inverters created functionality problems.
 - Temperatures problems.
 - Personnel problems:
 - Siyeh goes through management change.
 - Project progress was slowed as a result of the resignation of the project manager.
 - Siyeh under suspension and is removed from suspension in 4th quarter.
 - Additional \$22,000 requested and approved for budget.
 - All site work was completed.
 - Turbines reported to be working properly.
 - DAQ installed.
 - NREL and Trace technologies working to remedy the problems with the inverters.
 - MOA between Town and Siyeh approved by DOE.
 - Data acquisition is slow and in some quarters no data was acquired.
 - DAS designed and ordered at a cost of \$3535.00
 - Project officer was changed from Doug Hooker to Lizana Pierce.
- Jan. - Dec. 2001:
 - Inverters problems continue. Since the inception of the project the inverters have been problematic and never have they all worked at the same time. Trace Technologies have removed and repaired some of them at their facility, did on-site repairs and have replaced some completely.

At the end of this year there was still one that did not work.

- Data being collected and converted by Town personnel.
- Jan - Dec. 2002:
 - Inverters continue to have technical problems. At no time this year have there been more than two inverters working at the same time.
 - The wind turbines have performed flawlessly.
 - Data continues to be collected and converted by Town personnel.

Data Results

- Performance

As previously stated there were problems with the inverters and as a result performance was affected and was only viable during certain periods as a direct result.

Below is a synopsis of the performance of the turbines in the years listed.

2/24/2000-3/23/2000: Total Kwh: 514.8 (only one turbine producing power during this time period).

10/28/2000-11/09/2000: Total Kwh: 290.8 (3 turbines worked during some of the time during this period).

The following data was compiled from 10 data collections in 2002 and 7 in 2003. Total days in 2002 are 73 and 60 in 2003.

2002	kWatt1_MAX_H	kWatt2_MAX_H	kWatt3_MAX_H	kWatt4_MAX_H
Total	252.8068594	13.09291905	267.0605347	271.2403958
Average	244.6691311	0.33848844	156.0605974	299.8248282
	Total Hours	Average Hours		
	804.200709	700.8930452		
2003	kWatt1_MAX_H	kWatt2_MAX_H	kWatt3_MAX_H	kWatt4_MAX_H
Total	577.9436188	-2.273284757	-2.289850019	609.8877171
Average	373.4913792	-0.779428307	-1.024459727	259.6350247
	Total Hours	Average Hours		
	1183.268201	631.3225159		

- Safety

This project has shown that since the beginning to the end the element of danger was eliminated because strict safety procedures were followed. Even when the inverters were

essentially burnt as a result of the excess Kw no person was injured or even threatened to be hurt.

- Noise

Without having the properly decibel reading equipment the operators were unable to take noise reading. They were however able to give real world accounts. Talking to the Town of Browning waste plant operators indicated that the turbines were almost not noticeable during very low winds but when the winds reached what they perceived as winds above 10 mph the noise level increased. The sound that they described was similar to a helicopter but without the sound of the engine, no thudding, and about 50% as loud. The sound from the turbines can be heard when within approximately 200 yards. Asking residents in a housing project approximately 500 yards from the turbines they say they don't even notice or hear turbines.

- Duration

The time frame for this project was as written in the grant to take 9 months for construction and 41 months wherein the project remained under the cooperative agreement.

Lessons Learned

Looking at the data compiled above shows us that in 2002 11.01 hours of kw produced. In 2003 11.06 hours of kw was produced based on the data available. Using this data shows us that the lack of functioning inverters created an enormous problem for the project. What could have been is a question that surely needs to be answered in this project.

Other lessons learned during this project are the following:

- Personnel issues can create problems with a project and more specifically the time factor. If there is a change in management it would be wise to recover all data, information and contacts that the management person initially operating the project was in control of.
- Trace technologies products, the inverters, was not designed to handle the conditions that they were subjected to in this project. Higher average sustained winds produced constant higher power from the Bergey turbines and at times appears to have exceeded the 10Kw limit the turbines were designed to produce

therefore spiking past the capabilities of the inverters.

- Though Trace made an observation that the placement of the inverters within the treatment facility was the problem plaguing the inverters because of the high moisture content within the building but after removal and construction of new building problems still continued to plague the inverters. Adding other observations and history within this project an observation of Trace products would be that either the spike limits of the inverters are 10kw, were not tested for long sustained conversion of power at or near the maximum limits, or the product does not have the capability of handling a spike out side the limits of the product.
- Bergy turbines are able to produce more than the 10Kw for which they are rated. This fact is known as a result of a data screen on one of the inverters that was damaged and displayed 11Kw power produced.

Conclusion

With properly operating inverters the production of energy from the turbines would have been significantly more and reduced the overall grid energy consumption by the treatment facility far less than what amounted to little or nothing.

The turbines performed without any major problems and appear to be a reliable alternative energy source applicable in commercial and non-commercial applications.

Trace technologies inverters maybe the standard choice for converting power from Bergy turbines in significantly lower rated wind areas but for high wind areas such as this one the inverters failed.

If these units are to be considered viable products for areas of high winds then one of three things must take place. Either the inverters by Trace need to be enlarged in capacity handling, another brand of inverter needs to be used, or a limiter needs to be placed on the turbines to prevent them from exceeded their design parameters.

Finally, without the daily observations from "scientist" or "engineer" types to conduct any other observations or tests beyond the capabilities of the personnel conducting the

observations on this project the only real test results lie within the data that was accumulated with the data retriever and delivered in the quarterly reports to the Department of Energy.