New Prairie Homestead Technologies

Linn Grove, IA

Project Cost: $79,203

AERLP: $35,000

Loan Term: 7 yrs.

Lender: First National Bank, Rembrant, IA

Lender Share: $44,203

Est. Annual O & M: $120

Est. Payback: 32 yrs.

Installation Date: July 2000

Hybrid System Technical Specifications

PV
24 - 77 W Solarex panels
Zomeworks mounts

Wind
10 kW Bergey Excel-R
100 ft. Bergey/Rohn tilt-up guyed lattice tower

Biomass
24 V Sensible Steam "MegaDonkey" generator

Supporting Equipment
48 Trojan L16HC high capacity 395 Amp batteries & cables
Trace C-40 charge controllers
2 Trace SW-5548 Sinewave 5500W 48 V inverters
DC 250 Amp breakers
Tri-Metric meters
EQ converter

Project History

Since July 31, 2000, Grant Mangold has powered his home, workshop, and small-business office with a hybrid renewable energy system. A 10 kW Bergey wind turbine supplies more than three-quarters of his electricity, and is complemented by a 1.85 kW Solarex photovoltaic (PV) array. When wind and solar resources are lacking, Mangold occasionally relies on a biomass-powered steam generator to recharge his 48 V bank of lead acid batteries.

Mangold wanted to make full use of the renewable energy sources at his Linn Grove location, just north of Storm Lake in Western Iowa. Wind is particularly abundant there, and Mangold's efforts were motivated and assisted by the development of the 257-turbine Buffalo Ridge Wind Farm just five miles away.

He was able to use wind data gathered for the Buffalo Ridge project, along with Iowa Energy Center wind maps, to plan his system. His analysis showed that solar power also made sense in the mix because solar resources are most available in the summer when wind speeds typically ebb, but also because PV panels are low-maintenance and have a long life-cycle.

Mangold financed nearly half of the project costs with a $35,000 no-interest loan though the Energy Center's Alternate Energy Revolving Loan Program.

"The loan program was an essential element in the economic feasibility of the project," says Mangold, "and also was important to both inform and assist the local lender's involvement in the project."

System Performance

The system has consistently produced nearly all of the power Mangold needs, thanks in part to energy conservation measures he made. These included the installation of new

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Project Performance

Year	Production (kWh) PV	Wind	Total	Value ($) PV	Wind	Total
2000 - 01	1,661	6,516	8,177	149	586	736
2001 - 02	2,070	6,486	8,556	207	649	856
totals	3,731	13,002	16,733	$356	$1,235	$1,592
avg.	1,866	6,501	8,367	$178	$618	$796

[1] Notes: PV and wind output limited by actual use; AERLP loan paid-off in two years.

windows, siding, and roofs to both his home and office building, as well as the conversion to fluorescent bulbs for most of his lighting. All told, he estimates spending $20,000 on energy efficiency improvements.

Mangold believes his system is capable of producing significantly more electricity than he uses, but the output is limited by his battery capacity. He has desired from the beginning to sell excess electricity to Alliant Energy, but seven years after installing the system still had not completed the necessary electrical changes and net-metering arrangements.

Operation and Maintenance

"Good candidates for renewable energy systems should be good at recording and managing minute technical details as these aspects take considerable time, as does proper maintenance of the system," Mangold says.

In his case, this meant troubleshooting several problems just after installing the system, including an intermittent noise in the turbine; a transformer overheating due to the strong wind resources; faulty turbine controller boards and display panels; and repairs to an inverter damaged by lightning.

On an ongoing basis, it means annually lowering his tilt-down tower to inspect and clean electrical contacts, along with tightening the nuts and bolts on the turbine blades and tower anchor cables. Mangold also adjusts the angle of his PV panels twice a year for optimum performance. Every three months he adds water to his batteries, and he makes weekly inspections of the ventilation system in the battery room.

The costs associated with his maintenance routine are minimal – approximately $120 year. And overall the system has performed reliably and without major repair needs.

Overall Satisfaction

While he is pleased with the performance of the system, he says his overall feelings about the project are mixed when thinking back to his initial planning in 1999.

"It's difficult to answer due to hindsight today versus foresight then," he says, "along with changing logistics and dynamics in systems, finances, priorities, etc. Doing the project today would likely involve somewhat different technology. For example, connecting to Alliant Energy right away rather than a battery-bank system, which was the only option back then."

He says it's important to remember that an investment in renewable energy is first and foremost a commitment to using renewable resources. But he says it also involves financial trade-offs, because it "essentially amounts to 'paying ahead' for energy, rather than paying 'as used.'"

Satisfaction with a system like his, he says, "involves a philosophy of utilizing renewable energy, not simply a dollars-and-cents approach."

ALTERNATE ENERGY AERLP REVOLVING LOAN PROGRAM

The Iowa Energy Center's Alternate Energy Revolving Loan Program (AERLP) plays a supporting role in stimulating renewable energy development within the state. Since its inception in 1996, the AERLP has supported numerous wind, biomass, solar, hydro, and hybrid projects.

Successful applicants receive a low-interest loan from a combination of Energy Center and lender funds. The Energy Center provides loan funds equal to 50% of the projects financed cost (up to $250,000) at 0% interest. Matching financing must be obtained from a lender of the applicant's choice. The maximum loan term for the Energy Center's funds is 20 years.

The lending institutions are responsible for financially qualifying the borrower, while the energy center assists in technically qualifying the borrower. By partnering with expertise from lending institutions the Energy Center is able to cost-effectively process the loans in a timely manner and maximize the impact of the loan program.

Eligibility

The AERLP is open to all individuals and groups who want to build renewable energy production facilities in Iowa. Utilities that are not required to be rate-regulated are not eligible. AERLP loan funds may not be used to refinance an existing loan or be applied to existing alternate energy facilities.

Application Deadlines

January 31
April 30
July 31
October 31

For more information

Contact the Iowa Energy Center,
(515) 294-8819
www.energy.iastate.edu

The Iowa Energy Center is dedicated to improving Iowa's energy efficiency and use of renewable energy through research, demonstration, and education.

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