Systems Performance Analyses of Alaska Wind-Diesel Projects

Kasigluk, Alaska

Kasigluk is a Yup'ik Eskimo village in southwestern Alaska on the Johnson River in the Kuskokwim River Delta, 26 miles northwest of the regional hub of Bethel. The community is comprised of Old and New Kasigluk, and the combined population of approximately 500 receive power from a wind-diesel power system operated and owned by the Alaska Village Electric Cooperative (AVEC).

The people of Kasigluk rely heavily on subsistence activities and commercial fishing, and poor fishing over the past few years has affected the local economy and underlined the importance of stabilizing energy prices.

AVEC's power system incorporates a modern diesel plant and three Northern Power Systems Northwind 100 wind turbines. This wind-diesel system also supplies power to nearby Nunapitchuk through a distribution intertie. The system was installed in July 2006 as part of a $16.8 million project to completely replace the power plant, upgrade the Nunapitchuk intertie, and install a new community bulk fuel tank farm. Funding was provided by the Denali Commission, Rural Utility Service, and AVEC.

The turbines provide most of the community's electrical energy needs, although the power system is not configured to operate with all of the diesels turned off.

According to AVEC, since commissioning in July 2006 through April 2008, Kasigluk's wind turbines provided about 23% of all electricity used in Kasigluk and Nunapitchuk, which has displaced nearly 65,400 gallons of diesel fuel. In 2007 alone, diesel worth $72,000 was displaced by wind (at 2008 fuel prices, this would equal about $150,000).

Wind turbines at the Kasigluk project. Northern Power Systems/ PIX15391.

Kasigluk turbines. Ian Baring-Gould/PIX16096.

Two of three wind turbines can be seen over the bulk fuel tanks of the Kasigluk Power System. Ian Baring-Gould/PIX16097.

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Turbines: Three 100-kW Northern Power Systems Northwind 100/19A turbines

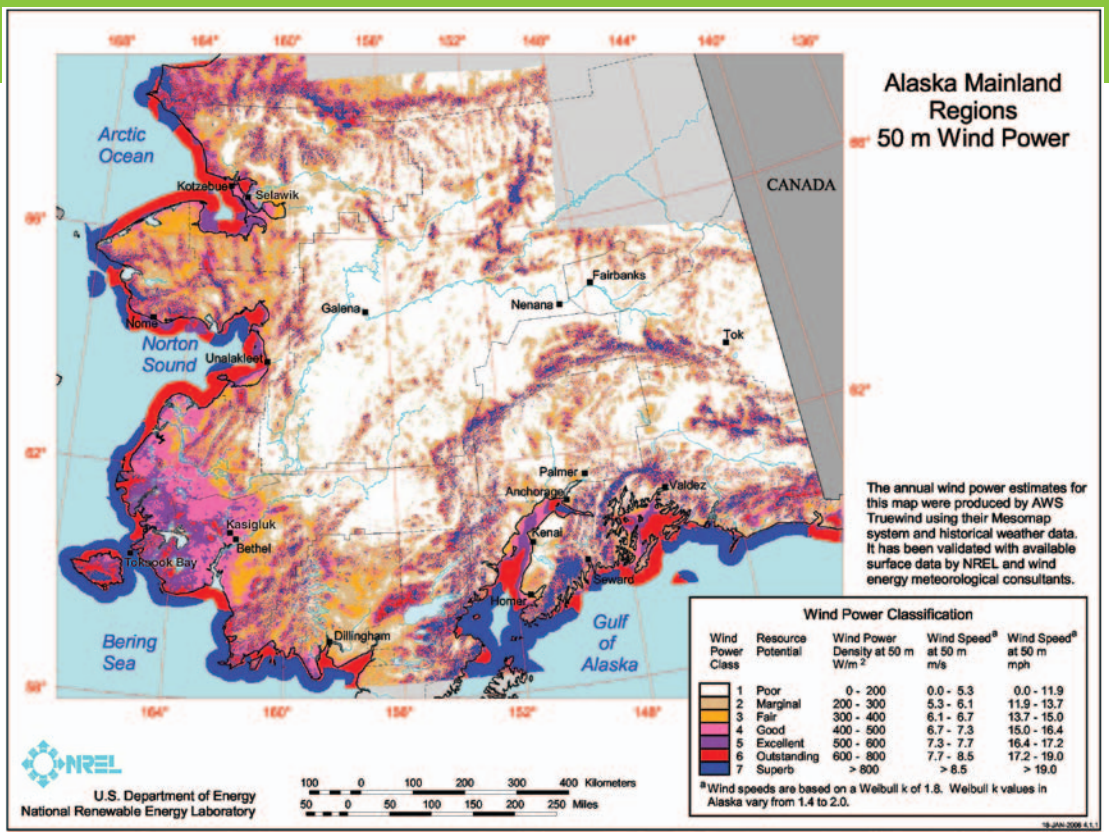
Capacity: 0.3 MW

Developer/owner: Alaska Village Electric Cooperative

Date online: 11/06

Rated power (kW): 100 kW per turbine; plant rating 300 kW

Kasigluk systems analysis: 10/8/07



Energy Flow (Based on Monthly Summations)	
Community load data	237 kW*
Average wind turbine output	42.8 kW**
Average diesel plant output	223 kW*
Thermal load data	0.2 kW**

*1/06 – 8/07, difference between output and load represents system losses and plant uses.

**11/06 – 8/07, difference between output and load represents system losses and plant uses.

Performance Characteristics Based on Energy Flow (Based on Monthly Summations)	
Average net capacity factor	14.3%**
Average net wind penetration	15.3%**
Estimated fuel savings	29,824 gallons* using FY06 PCE efficiency
Wind system availability	94% for the system; individual turbines range from 96% to 92%***

*11/06 – 8/07

**1/06 – 8/07 using FY06 Statistical Report of the Power Cost Equalization Program efficiency (available at www.akenergyauthority.org/PDF%20files/2007PCEStatisticsFY06.pdf)

***9/06 – 10/07; note that this represents the first year of turbine operation and should be considered low from a long-term perspective

Other Data	
Diesel fuel price	$1.83/gallon*
Residential electrical rate	$0.4743/kWh*
Diesel efficiency (kWh from diesel/gal)	13.71 kWh/gal*

* FY06 Statistical Report of the Power Cost Equalization Program efficiency, available at www.akenergyauthority.org/PDF%20files/2007PCEStatisticsFY06.pdf

In the tables at left, **average net wind penetration** refers to the product of total wind turbine energy output (kWh) divided by the total primary electrical load (kWh) over a given time period and provides an idea of the amount of system energy produced by wind. **Capacity factor** is the ratio of actual average power produced to the rated power of the wind plant over a defined time period and provides an indication of the wind resource and system efficiencies (capacity factors above 15% for distributed wind systems would be considered good, although the acceptable capacity factor for a specific community will depend on project and alternative fuel costs). **Wind system availability** refers to the percentage of time that the wind turbine is available to produce power. Availability above 90% for new projects in remote communities would be considered acceptable; availability above 95% is desirable.

For more information on Alaska wind-diesel projects, please contact:

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