



Wind power is a relatively mature technology in Alaska, and can be found in many rural communities. The turbines pictured here help offset diesel use in the village of St. Paul in the Pribilof Islands.



Wind power can be found along the road system as well as in remote areas, like this system in Wales.

Wind Technology Briefing

Wind power systems can be found along the Alaska road system as well as in remote areas. Total installed capacity exceeds 60 MW, with installations ranging from 40 kW to 24 MW.

Current Installations in Alaska

Data for this briefing was extracted from approximately 40 applications to the Alaska Energy Authority (AEA) Renewable Energy Fund (REF), Rounds 1 through 8.

Key Performance Metrics

The key finding for wind power systems was that the cost-per-kilowatt of wind turbines decreased as the installation size increased, with the exception of transmission and integration costs, which did not vary significantly. Individual costs were tested for correlations with region and year, but in most cases these factors were not significant.

The minimum design lifetime for wind turbines is 20 years, and for planning purposes, this figure is typically used.

Capacity factors ranged from approximately 10-40%, depending on the rated wind speed, height of the wind turbines, and resolution of the wind power class map. A turbine rated for low wind speeds will have a higher capacity factor at low wind speeds than one rated for high wind speeds, whereas a turbine rated for high wind speeds may have a higher capacity factor at high winds due to a higher cutoff wind speed. Taller wind turbines experience higher wind speeds, which generally result in higher capacity factors.

ACEP Wind Projects

[Wind-Diesel Hybrid Power System](#)

[Wales Diesel-Off High Penetration Wind System](#)

[KidWind Challenge](#)

[Nome Wind-Diesel System Overview](#)

[Grid Bridging Systems Tools Development](#)

[Energy Storage Sizing Study for Nome to Increase Wind Power Utilization](#)

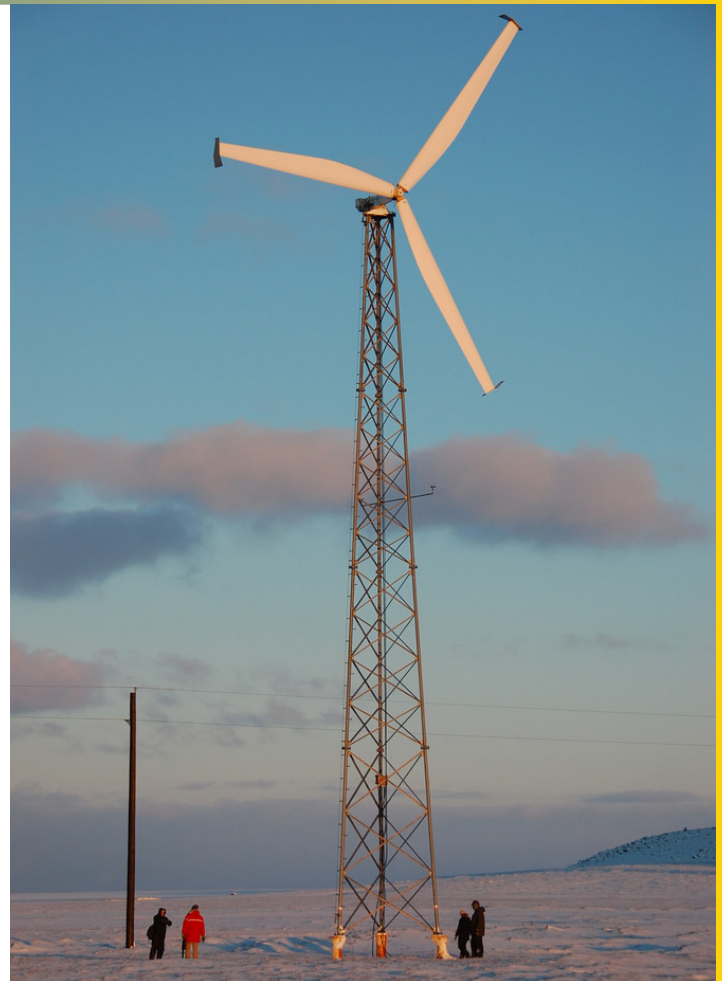


Technology Trends

Wind power technology is relatively mature in Alaska. Turbines typically function at a high availability for their full design life, and sometimes longer. The market in Alaska, in general, is moving toward larger and more powerful wind turbines, often with gearless direct-drive generators. Due to the size of communities in Alaska as well as other factors, turbines are smaller than average. One option to displace diesel use in communities is to install overcapacity wind farms together with energy storage and converting wind to heat energy. Robust direct-drive turbines (such as NPS 100 and EWT 900) are currently popular in Alaska because they are widely available.

Technology Gaps & Barriers to Success

The remoteness of communities in Alaska leads to higher transportation, infrastructure, and maintenance costs. There are significant economies of scale to be gained with larger wind turbines, though the size of wind turbines is limited by the small size of Alaska's communities and the challenges of integrating high amounts of wind power into microgrids. Achieving higher penetrations of wind power is complicated because it will increase excess wind generation and require more complex integration equipment.



The community of Wales on the Bering Sea was one of the first to bring a wind-diesel system onto its electric grid in the late 90s. The lessons learned there have helped inform many other projects across Alaska.

Recommendations

Systems that integrate high amounts of wind power with other forms of energy need to be demonstrated, including techniques for demand-side management and converting wind to heat. Improvements and reduction in costs of integration equipment such as energy storage systems will help achieve higher penetrations of wind power.

An integrated approach is needed that looks at low-hanging fruit and potential partnerships between government and industry. Funding is a major issue hampering grid improvements, and state, federal, and private funds could help with this implementation.



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