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Project Snapshot:

Alternative Transportation Options on St. Paul Island, Alaska

An assessment of various technologies that would enable the use of wind energy to run a fleet of shuttles for tourism and residential transit on St. Paul Island, Alaska

Project Background

St. Paul Island is a remote community in the middle of the Bering Sea, about 750 miles west of Anchorage. The municipal electric utility operates a diesel power plant to meet the community's electrical, heating, and transportation needs, making it extremely sensitive to the price of oil. As with many communities located in coastal areas of western Alaska, St. Paul Island has high average wind speed, thus excellent potential for harnessing wind power for electricity.

In 1999, a high-penetration, no-storage wind-diesel power system was installed by TDX Power and Northern Power Systems to run an industrial facility and airport complex (POSS Camp) on St. Paul. For the most part, the project was privately funded and initially included a 225 kW Vestas V27 wind turbine. This project was later expanded and now includes three V27 turbines, two 150 kW Volvo diesel engine generators, a synchronous condenser, a 27,000 liter insulated hot water tank, approximately 305 m (1,000 feet) of hot water piping, and a microprocessor-based control system capable of providing fully automatic plant operation.

The primary goal of the installation was to reduce energy costs while maintaining stable and reliable power. The electrical load for this industrial facility averages about 70 kW, but the system also supplies the primary space heating for the facility, using excess power from the wind generators and thermal energy from the diesel plant. When the wind generation exceeds demand by a specific margin, the engines automatically shut off and the wind turbine meets the electrical demand with excess power diverted to the hot water tank.

When wind power is insufficient to meet the load, the engines are engaged to provide continuous electric supply as well as energy to the hot water system as needed. The total 500 kW wind-diesel co-generation system cost approximately $1.2 million. According to TDX, the system has eliminated $200,000 per year in utility electric charges and $50,000 per year in diesel heating fuel.

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Project Need

TDX is committed to displacing imported fuels to the island to the greatest extent possible, including fuels used for transportation. TDX operates small buses to transport locals in the winter and tourists in the summer, but the rising price of imported fossil fuels makes this, and all transportation, increasingly costly. The possibility of using the island's abundant wind energy and the turbines to power a new fleet of transit vehicles is intriguing. This 2009 study was needed to determine feasibility of different alternative transportation options, meeting specifications for tours and residential transit.

Project Description

This project assessed various technologies that would use wind energy to run a fleet of shuttles for St. Paul Island: two vehicles for tours and two for the residential route. The five alternative technologies were: hydrogen fueled vehicles (both fuel cell and internal combustion engine), plug-in hybrid electric vehicles, all-electric vehicles, and compressed air vehicles.

Project Findings

None of the technologies assessed provided an economically viable alternative to conventional diesel-powered vehicles. The hydrogen options suffered from the high cost and power requirements of hydrogen production as well as the high cost and immaturity of the hydrogen-fueled vehicles. The plug-in hybrid-electric vehicles have a total 3-year cost that is five times that of a new diesel fleet at current market pricing, with insignificant savings in diesel fuel consumption. The all-electric vehicles do not have sufficient range to meet the specifications, and the vehicles are 10 times more expensive than diesel vehicles at today's cost. There is no available compressed air vehicle that meets the specifications.

The only potentially viable option is to use both electric vehicles and diesel internal combustion engine vehicles, which have a relatively low total 3-year cost (under $1 million) as well as significant reduction (about 50%) in diesel consumption.

Next Steps

Recommendations are to wait at least a few years before proceeding with a wind-to-vehicle project. Most likely, plug-in hybrid electric vehicle costs will decrease in coming years, while reliability and range increase. Furthermore, if small-scale wind systems continue to be deployed, system designers will be better able to address the concern of intermittent power input to battery charging systems.

There are also other options for expanding the use of wind energy on St. Paul Island. TDX could negotiate a power sales agreement with St. Paul Municipal Electric Utility, which could lower or stabilize the cost of electricity. Testing large-scale batteries for electrical energy storage to displace additional diesel fuel and allow longer stretches of diesel-off mode may also be an option. Alternatively, TDX could consider demonstrating smaller-scale electric vehicles for transportation; TDX could design and build vehicles such as 4WD pick-ups or passenger vans that best suit their unique rural setting.

Project Funding Partner
Tanadgusix Corporation (TDX)