The market for wind-diesel power systems in Alaska and other areas has proven that the integration of wind turbines with conventional isolated generation is a commercial reality. During the past few years, the use of wind energy to reduce diesel fuel consumption has increased, providing economic, environmental, social, and security benefits to communities’ energy supply.

### Markets

**Rapidly expanding market for wind-diesel technologies:**
- 11 projects operating or under construction in Alaska; an additional 14 projects are funded
- Operating projects in almost every region of the world
- Expanded interest in Canada, Caribbean and Pacific Islands, and Antarctica.

**Alaska**
- 116 communities have a strong wind potential
- New State Energy Plan released in January 2009 shows strong wind potential in many communities (http://www.aidea.org/aea/)
- Rural communities have a potential of 90 MW to 240 MW of installed capacity
- $100 M USD renewable energy fund helps to fund remote wind projects.

**Canada**
- 40-190 MW potential in large communities and mines with loads above 10 MW, with a potential to save between loads 25 ml – 120 ml of diesel savings/yr.
- 30-130 MW potential MW in smaller communities with loads less than 10 MW, with a potential to save between loads 16 ml – 77 ml of diesel savings/yr.

### Project Examples

**Kotzebue, Alaska**
Large coastal hub community in Northwestern Alaska with a population of ~3,100
- 2-MW peak load with 700-kW minimum load and 915-kW of installed wind
- Average penetration of ~5% with wind generating 1,064,242 kWh in 2007
- Diesel fuel saving of more than 71,500 gal (270,600 l) in 2007
- Good turbine availability (92.8% 1/02 to 6/04) due to strong technical support.

**Toksook Bay, Alaska**
Power system that supplies the ~800 people of the communities of Toksook Bay and Nightmute in coastal Southwest Alaska
- Average load just under 370 kW (both Toksook and Nightmute)
- Three NW100-kW turbines and resistive community heating loads
- Installed in the fall and winter of 2006
- 24.2% average wind penetration with much higher instantaneous penetration
- Almost 700 MWh generated by wind last year, saving almost 46,000 gal (174,239 l) of fuel
- First-year turbine availability of 92.4% - currently under warranty
- Average net capacity factor of 26.0% from August 2007 to July 2008.

### Other Documented Wind-Diesel Power Systems

**Medium Penetration**
- San Clemente Island, USA
- Kasigluk, USA
- Denham, Australia
- Flores Island, Azores, Portugal
- San Cristobal, Galapagos, Ecuador.

**High Penetration**
- Wales, USA
- St. Paul, USA
- Coral Bay, Australia
- Utsira, Norway
- Mawson, Antarctica (Australia).

### Industry Challenges

**Technical**
- Lack of dispatchable load and controllers to allow higher-penetration systems
- Lack of guidelines and standards
- Lack of an established technology track record
- High and undocumented installation and operation expenses

**Institutional**
- Poor understanding of the technology by decision makers
- Lack of trained personnel and the ability to keep trained personnel in communities
- Vested interests in maintaining the existing infrastructure and systems
- Environmental, siting, or other development concerns.

**Policy**
- High capital cost and general discounting of sustainability
- Perceived risk and associated higher financial costs
- Subsidized diesel fuel markets
- Lack of consideration of environmental impacts of diesel power generation
- Lack of funding to support the development of diesel alternative systems
- Complicated and multi-jurisdictional permitting processes
- Lack of regional implementation approaches.

### Technology Advances

**Advances that Can Improve the Application of Remote Systems**
- Advanced Power Control
- Secondary dispatchable loads
- Electric or hybrid electric vehicles
- Electric heating through thermal loads
- Water desalination
- Medium-scale turbines for remote applications
- Advances in software models
- Expanded modeling capabilities in resource assessment, performance, control, and electrical response have improved the ability to understand wind-diesel systems
- New ownership models including power purchase agreements
- Advances in diesel technology, low load, and fuel injected.

### www.windpoweringamerica.gov