Wind and Wilderness

Powering Rural Alaska

By Meera Kohler
Alaska Village Electric Cooperative

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New turbines in Hooper Bay
Who is AVEC?

• Non-profit member-owned cooperative
• 53 villages
• 22,000 population
  – Would be the 4th largest city in Alaska after Anchorage, Fairbanks and Juneau
• 44% of Village Alaska population
• Anvik (smallest) 101
• Hooper Bay (largest) 1,124
• Average population 420
• Anchorage 277,498
• 94% Alaska Native
System Information

- 48 power plants
- 6 wind systems serving 9 villages
- 160+ diesel generators
- 500+ fuel tanks
- 5 million gallons fuel burned
- 7,500 services
- 75 Anchorage-based employees
- 95 Village technicians
Cost of 700 Residential kwh in 2008

- Anchorage $ 88
- Fairbanks $135
- Juneau $ 76
- Kodiak $104
- Kotzebue $158*
- AVEC Village $232*
- MKEC Village $375*
- Napakiak $421*

*After PCE
**AVEC’s Delivered Fuel Cost**

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Cost</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1.29</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>1.47</td>
<td>+.18</td>
</tr>
<tr>
<td>2004</td>
<td>1.98</td>
<td>+.51</td>
</tr>
<tr>
<td>2005</td>
<td>2.26</td>
<td>+.28</td>
</tr>
<tr>
<td>2006</td>
<td>2.26</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2.93</td>
<td>+.67</td>
</tr>
<tr>
<td>2008</td>
<td>4.55</td>
<td>+1.62</td>
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</tbody>
</table>

**Increase since 2002**

$3.26 \quad +353\%$
AVEC Board’s 2008 Goals

• Reduce diesel fuel use by 25% in 10 Years
  – 1,250,000 gallons
  – 77% of our fuel is used in Wind Class 4+ villages

• Reduce number of power plants by 50% in 10 Years
  – Interconnect another 24 villages

• Reduce non-fuel costs by 10%
  – Plant costs, depreciation, interest…
Our Wind Potential

- 39 of AVEC’s 53 villages are in 4+ wind regimes
- A high-efficiency generator yields 14 kWh/gallon
- A 100-kW turbine could displace 15,700 gallons
- Three units = 47,000 gallons

At 2008 fuel prices, wind has lowered the fuel cost by almost 1/3 in villages served by the Kasigluk and Toksook Bay projects.
Many of AVEC’s villages are in Western Alaska have Class 4 or better wind regimes.
Alaska Wind Map
Challenges to Wind Development

- Remote locations
- Complex logistics
- Difficult environmental conditions
- Small loads
- Poor soils
- Complex foundations
- Turbulence
- Low temperatures
- Icing
- Few options for remote village systems (100-500 kW)

AVEC’s work truck got stuck and needed help!
Wind Diesel Efficiency:

Penetration Levels

• Low
  • Max 30% Wind
  • Grid Connected

• Medium
  • Max 80% Wind
  • Secondary Load Control

• High
  • 100% Wind
  • Diesel Off
  • Load Control
  • Short Term Storage

Typical AVEC Systems

Savoonga
Wind Generation
Advantages

• A hedge against rising fuel costs
• Lower carbon footprint
• Reduced exposure to oil spills
• Reduced oil storage needs
## Value of 2007 Wind Production

<table>
<thead>
<tr>
<th>Location</th>
<th>2007 Production (kwh)</th>
<th>2007 Value ($)</th>
<th>2008 Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selawik</td>
<td>129,780</td>
<td>27,472</td>
<td>45,294</td>
</tr>
<tr>
<td>Kasigluk</td>
<td>442,760</td>
<td>71,753</td>
<td>156,428</td>
</tr>
<tr>
<td>Toksook</td>
<td>562,693</td>
<td>90,308</td>
<td>199,720</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,135,233</strong></td>
<td><strong>189,533</strong></td>
<td><strong>401,442</strong></td>
</tr>
</tbody>
</table>
AVEC Consolidated Power Plant and Tank Farm at Toksook Bay
Serves Tununak and Nightmute via 23 miles of intertie
Eliminated two power plants and their associated tank farms
Load consolidation made wind power at Toksook Bay more feasible
AVEC Wind Projects

2003 – Selawik
2006 – Kasigluk
  • Tieline to Nunapitchuk
2006 – Toksook Bay
  • Tieline to Tununak
  • Tieline to Nightmute
2008 – Hooper Bay
2008 – Savoonga
2009 – Gambell
2009 – Chevak

USDA has funded 1/3 of all costs!
Interconnecting Villages

Reduce the number of power plants
Larger loads make renewables like wind feasible

Existing Interties
- Kasigluk-Nunapitchuk
- St. Mary’s-Andreafsky
- Upper Kalskag-Lower Kalskag
- Mt. Village-Pitka’s Point
- Shungnak-Kobuk
- Toksook Bay-Tununak
- Toksook Bay-Nightmute
Possible Future Interties

- Brevig Mission-Teller
- St. Mary’s-Mt. Village
- St. Mary’s-Pilot Station
- St. Michael’s-Stebbins
- Emmonak-Alakanuk
- New Stuyahok-Ekwok
- Togiak-Twin Hills
- Noorvik – Kiana – Selawik (NKS)
- Ambler – Shungnak – Kobuk (ASK)
- Upper Kobuk – Lower Kobuk (ASK – NKS)
A key issue is the availability of heavy construction equipment

- Dovetailing wind projects with other local projects reduces construction costs
Wind Assessment is critical

- Determine estimated output of a project
- Avoid misplacement of a project
- Identify potential problems...
Problems Such as…

• Land ownership and land use in the area
• Geotechnical issues for foundations
• Historical and cultural resource impacts
Other challenges

• Bird issues
• Equipment accessibility
• Proximity to power lines
Foundations in permafrost are a major hurdle

Warming trends are affecting the expanse and depth of permafrost
Geotechnical Conditions
Poor roads, water and sewer lines, boardwalks and existing overhead power and phone lines present hurdles
Transportation Issues
Hauling equipment upriver between villages
Hauling equipment upriver between villages – towing a power pole
Hauling power poles by specialized sled
Hauling equipment and distribution line by specialized sled – back in the “good old days”

Kasigluk – 1970s

Hauling equipment by sled – “modern day” transportation

AVEC villages - 2008
You know you’re having a bad day when your heavy crane gets stuck.
Summer Tundra/Permafrost
Difficult Environmental Conditions
Frozen, snow- and ice-covered equipment and employees
Building Human Capacity

• AVEC and its contractors are building local capacity by training wind technicians who live in the villages.

• These trainees have worked in the construction and operation of the new systems.
Charles Green Sr. of Toksook Bay - left
Elias Friday of Chevak - middle
Lawrence Lake of Hooper Bay - right
3 of 8 Native Alaskans who received Wind Technician certificates at the Northern Power manufacturing facility in Barre, Vermont
A total of 14 village residents have received this training
Wind Technicians Lawrence Lake and Julius Bell standing by a nacelle in Hooper Bay
Wind Technician Julius Bell adjusting the rotor assembly during the installation of the NW100 wind turbines in Hooper Bay, Alaska
Questions?

Toksook Bay, Alaska

Meera Kohler
Alaska Village Electric Cooperative