Deploying Renewables in Remote Alaskan Communities

By Meera Kohler
Alaska Village Electric Cooperative

U.S. Dept. of Energy Program Review
Denver, CO
November 17, 2008
Who is AVEC?

- 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
- 4 wind systems serving 7 villages
- 160+ diesel generators
- 500+ fuel tanks
- 5 million gallons fuel burned
- 7,500 services
Cost of 700 Residential kwh Today

- Anchorage: $88
- Fairbanks: $135
- Juneau: $76
- Kodiak: $104
- Kotzebue: $158*
- AVEC Village: $232*
- MKEC Village: $375*
- Napakiak: $421*  
  - *After PCE
# AVEC Delivered Fuel Cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Average</th>
<th>Increase</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>1.47</td>
<td>+.18</td>
<td>+353%</td>
</tr>
<tr>
<td>2004</td>
<td>1.98</td>
<td>+.51</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>2.26</td>
<td>+.28</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>2.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>2.93</td>
<td>+.67</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>4.55</td>
<td>+1.62</td>
<td></td>
</tr>
</tbody>
</table>

Increase since 2002: $3.26 +353\%
AVEC Board’s 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…
Wind Potential for AVEC

- 39 of AVEC’s 53 villages are in 4+ wind regimes
- A high-efficiency generator yields 14 kWh/gallon
- A 100-kW turbine could produce 220,000 kWh/yr
- = 15,700 gallons
- Three units = 47,000 gallons
Many of AVEC’s villages are in Western Alaska have Class 4 or better wind regimes.
What is AVEC Doing?

Installing wind generation
- Wales, Selawik, Toksook Bay, Kasigluk, Gambell, Savoonga, Hooper Bay, Chevak and looking at more

Capturing recovered heat where feasible
- More than 40 AVEC locations

Building Interties
- Toksook Bay to Tununak
- Toksook Bay to Nightmute
- Developing HVDC concept

Welcoming new villages
Geographic and Technical Challenges

- 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 pulled out.
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
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
Other Hurdles

• Dilution of Effort
  – Federal agencies parcel out funding to a multitude of players that can only deliver tiny projects or none at all

• Ghosts of the Past
  – The 100+ Alaskan federal and state-funded wind projects of the 1980s were near universal failures that cast a blight on the industry for the next 15 years
Foundations in permafrost are a major hurdle.

Warming trends are affecting the expanse and depth of permafrost.
Geotechnical Conditions

Soils present unique challenges:

• High variability
• Lack of stability
• Climate change impacts
Poor roads, water and sewer lines, boardwalks and existing overhead power and phone lines present hurdles.
Transportation Issues
Summer Tundra/Permafrost
Difficult Environmental Conditions
Building Human Capacity

• AVEC and its contractors are building local capacity by training wind technicians who reside in the villages
• These trainees have worked in the construction and operation of the new systems
Proud new Wind Technicians Charles Green Sr. of Toksook Bay, Elias Friday of Chevak, and Lawrence Lake of Hooper Bay were 3 of 8 Native Alaskans who successfully participated in specialized 2008 O&M training at the Northern Power manufacturing facility located in Barre, Vermont.
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
Developing Local Talent

Since beginning AVEC’s wind training program, 17 have received certification: 14 from the villages of Chevak, Gambell, Hooper Bay, Kasigluk, Kongiganek, Kwigillingok, Savoonga, Toksook Bay and Tununak and 3 Anchorage technicians.
We can do this!

Thank you

Toksook Bay, Alaska

Meera Kohler
Alaska Village Electric Cooperative