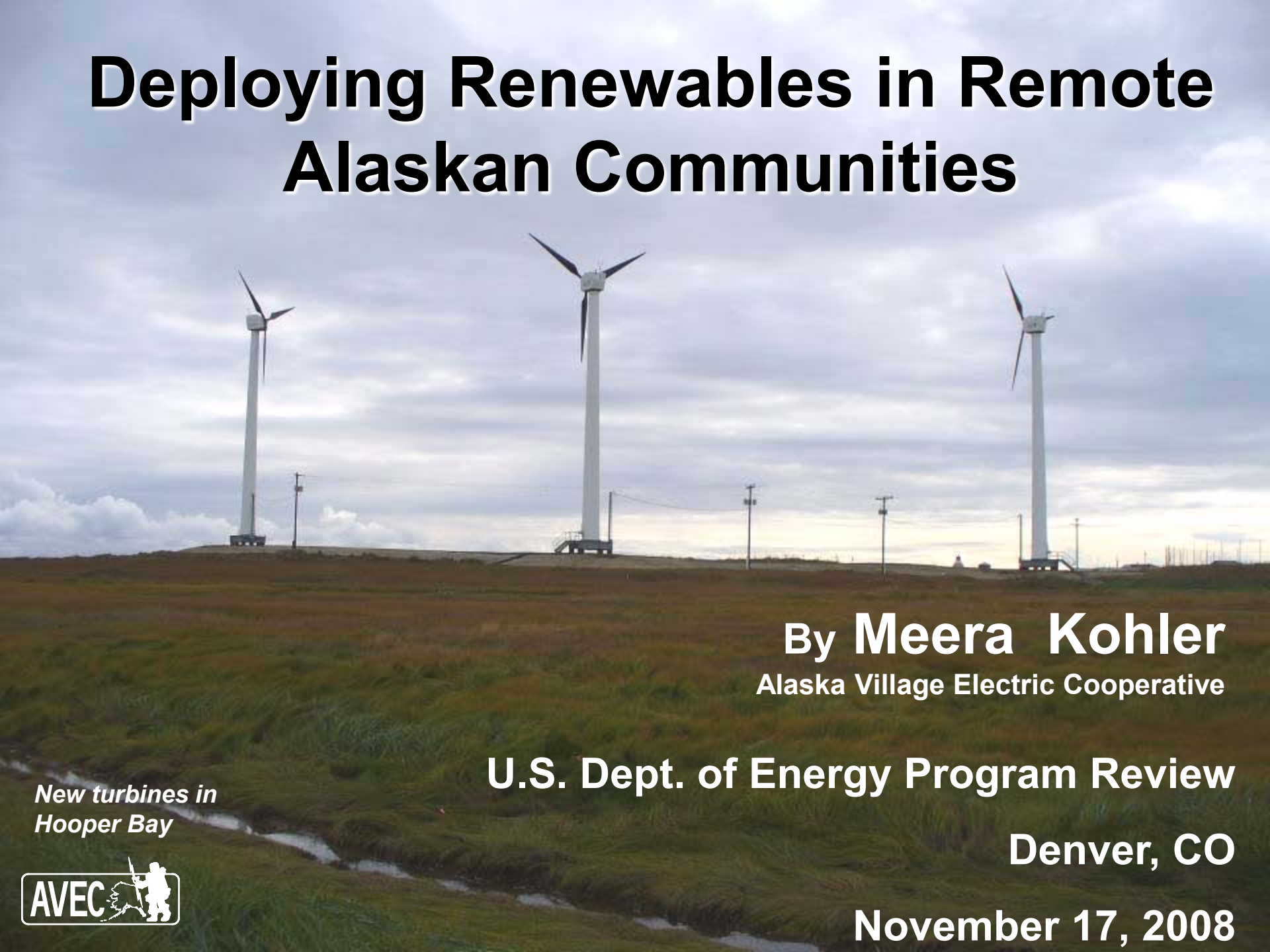
Deploying Renewables in Remote Alaskan Communities



By **Meera Kohler**
Alaska Village Electric Cooperative

U.S. Dept. of Energy Program Review

Denver, CO

November 17, 2008

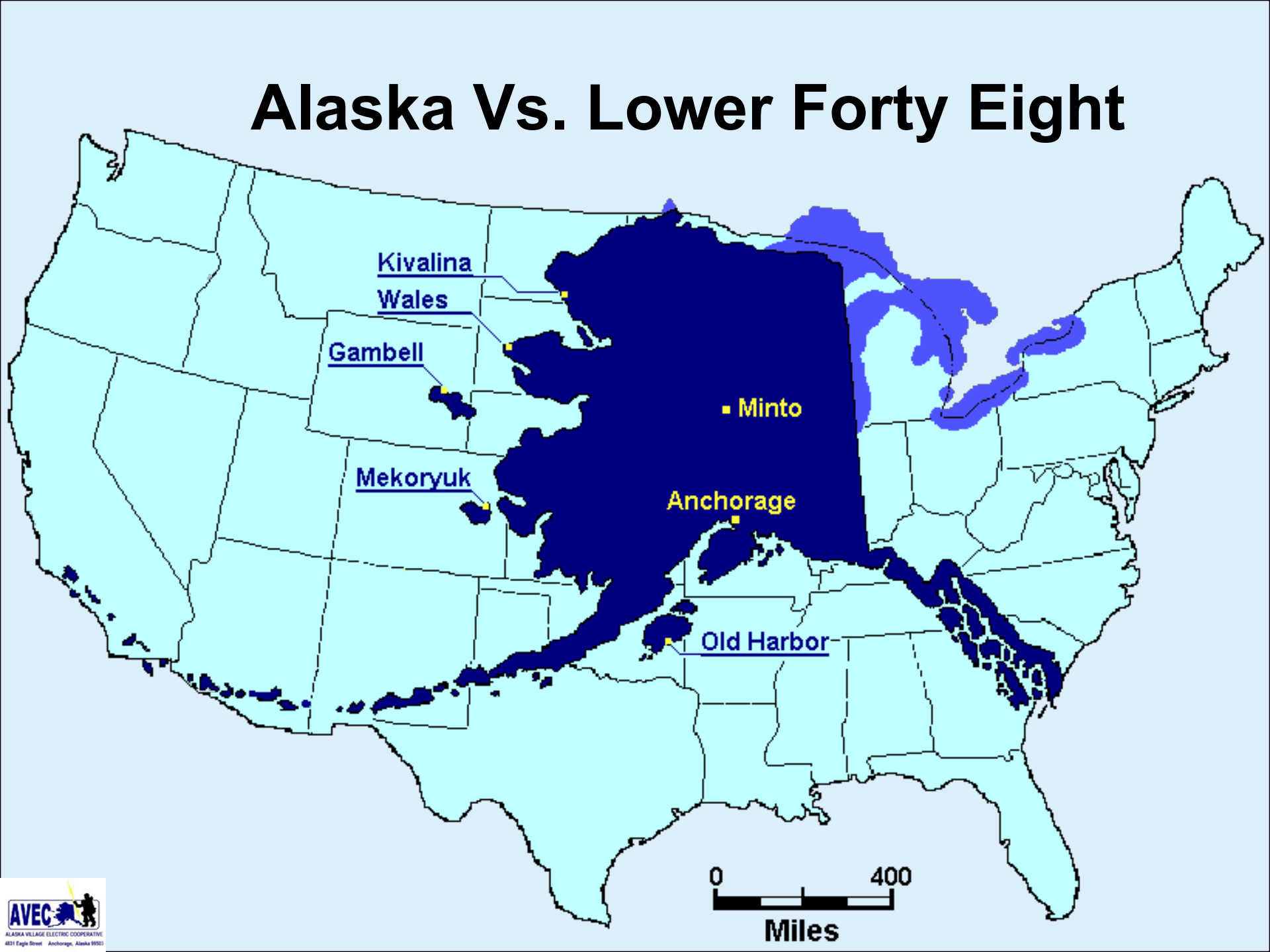
New turbines in Hooper Bay

AVEC

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

Alaska Vs. Lower Forty Eight



AVEC
ALASKA VILLAGE ELECTRIC COOPERATIVE
4831 Eagle Street Anchorage, Alaska 99503

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

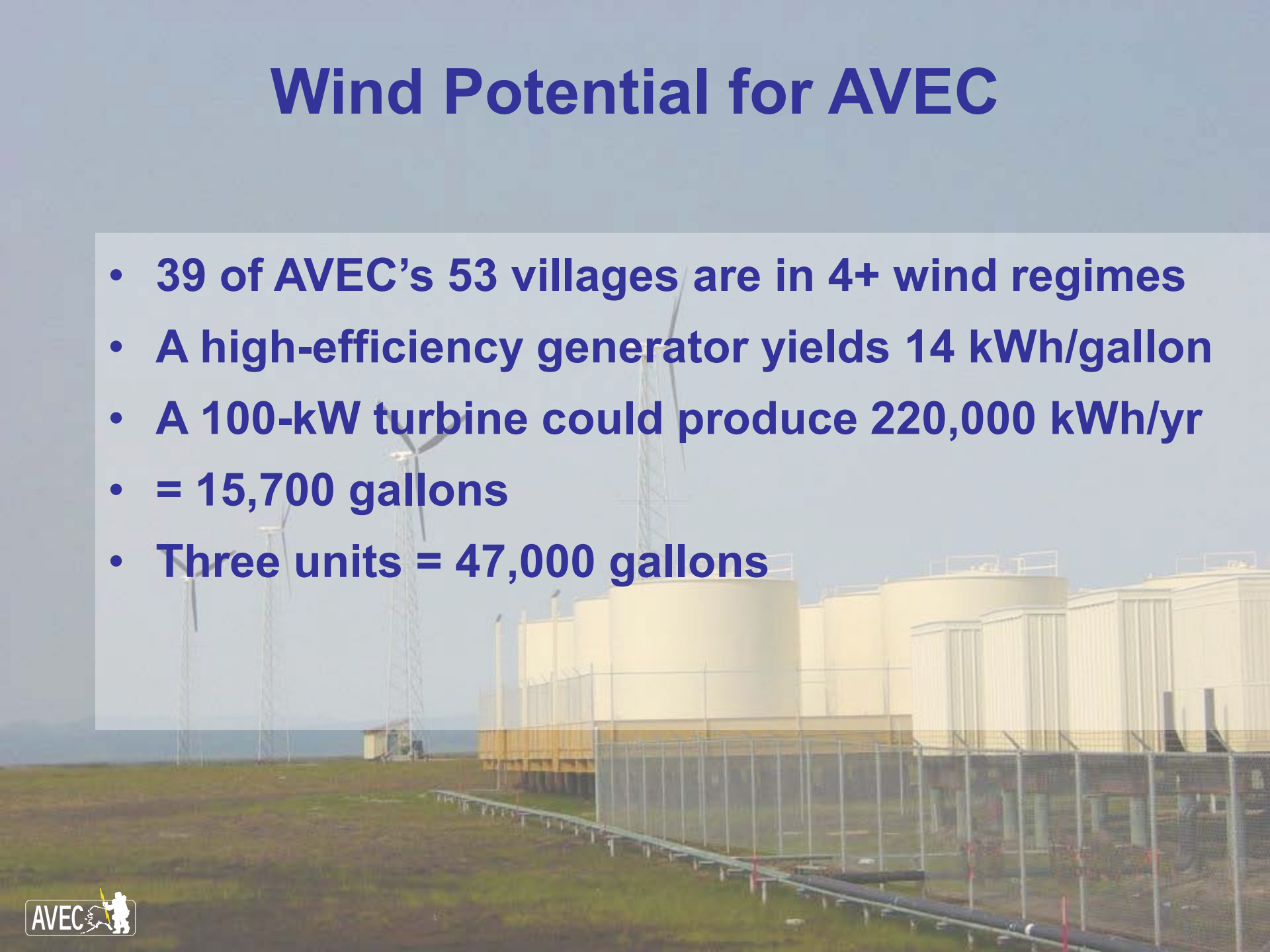
• Average 2002	1.29	
• Average 2003	1.47	+.18
• Average 2004	1.98	+.51
• Average 2005	2.26	+.28
• Average 2006	2.26	
• Average 2007	2.93	+.67
• Average 2008	4.55	+1.62
Increase since 2002	**$3.26**	**+353%**

AVEC Board's Goals

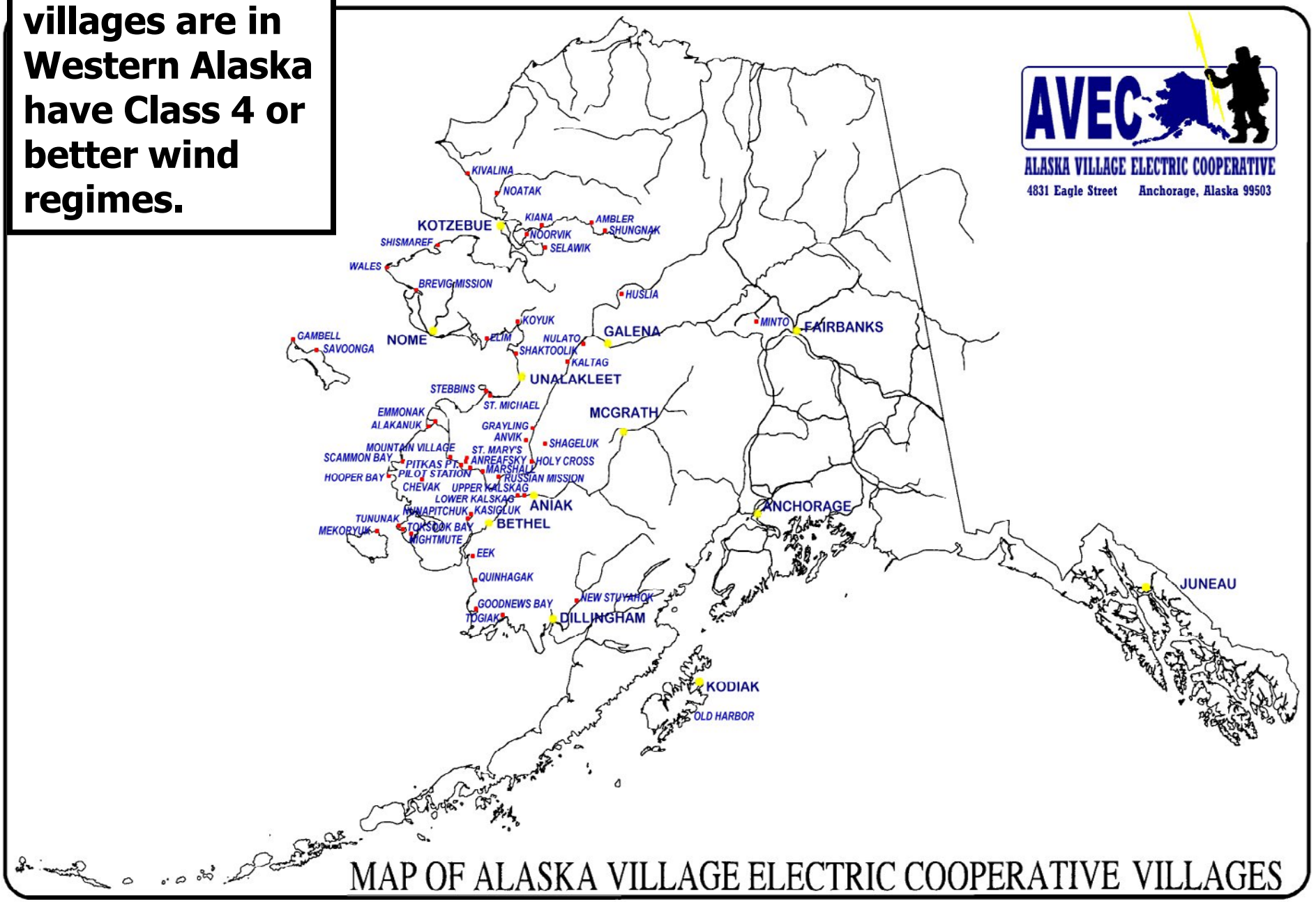
- Reduce diesel fuel use by 25% in 10 Years
  - 1,250,000 gallons
  - 77% of our fuel is used in Wind Class 4+ villages
- Reduce number of power plants by 50% in 10 Years
  - Interconnect another 24 villages
- Reduce non-fuel costs by 10%
  - Plant costs, depreciation, interest…

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

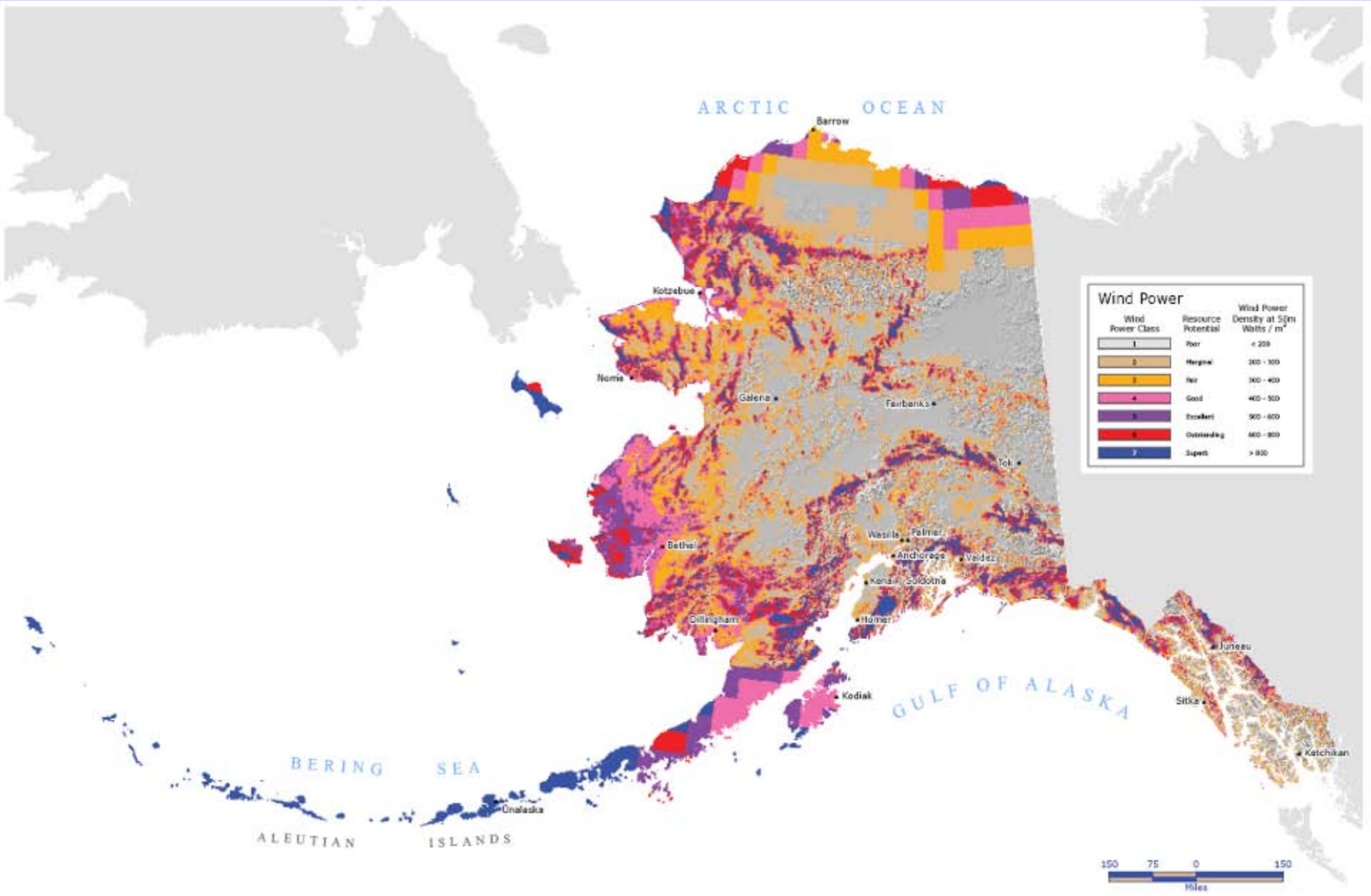


Many of AVEC's villages are in Western Alaska have Class 4 or better wind regimes.



MAP OF ALASKA VILLAGE ELECTRIC COOPERATIVE VILLAGES

Alaska Wind Map



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

- Nightmute (1998), Teller (2005), Kotlik (2007)

St. Mary's MET Tower

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

AVEC

Wind Generation Advantages

- A hedge against rising fuel costs
- Lower carbon footprint
- Reduced exposure to oil spills
- Reduced oil storage needs

Kasigluk

Value of 2007 Wind Production

		2007 $	2008 $
Selawik	129,780 kwh	$27,472	$45,294
Kasigluk	442,760 kwh	$71,753	$156,428
Toksook	562,693 kwh	$90,308	$199,720
Total	**1,135,233**	**$189,533**	**$401,442**

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

Toksook Bay, Alaska

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

AVEC

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


AVEC


AVEC

Transportation Issues


CAT

Summer Tundra/ Permafrost

Difficult Environmental Conditions


AVEC

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