REGIONAL ECONOMIC WIND DEVELOPMENT IN RURAL ALASKA , PART I - IDENTIFYING REGIONAL POTENTIAL

Bethel Regional Wind Development Workshop

Bethel, January 10-11, 2008

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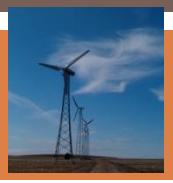



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Alaska Energy Authority

Public Corporation with Alaska Industrial Development and Export Authority

- Infrastructure Owner
- Coordinates Statewide Planning
- Develops Energy, Renewable Energy & Energy Efficiency Systems
- Conducts Training and Education
- Administers PCE
- Finances Projects

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AEA's Mission

Assisting in the development of safe, reliable, and efficient energy systems throughout Alaska, which are sustainable and environmentally sound.

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Presentation Overview

- Alaska Energy Overview
- Wind Resource Alaska
- Wind Development Barriers
- Technical Wind Development Potential
- Next Steps


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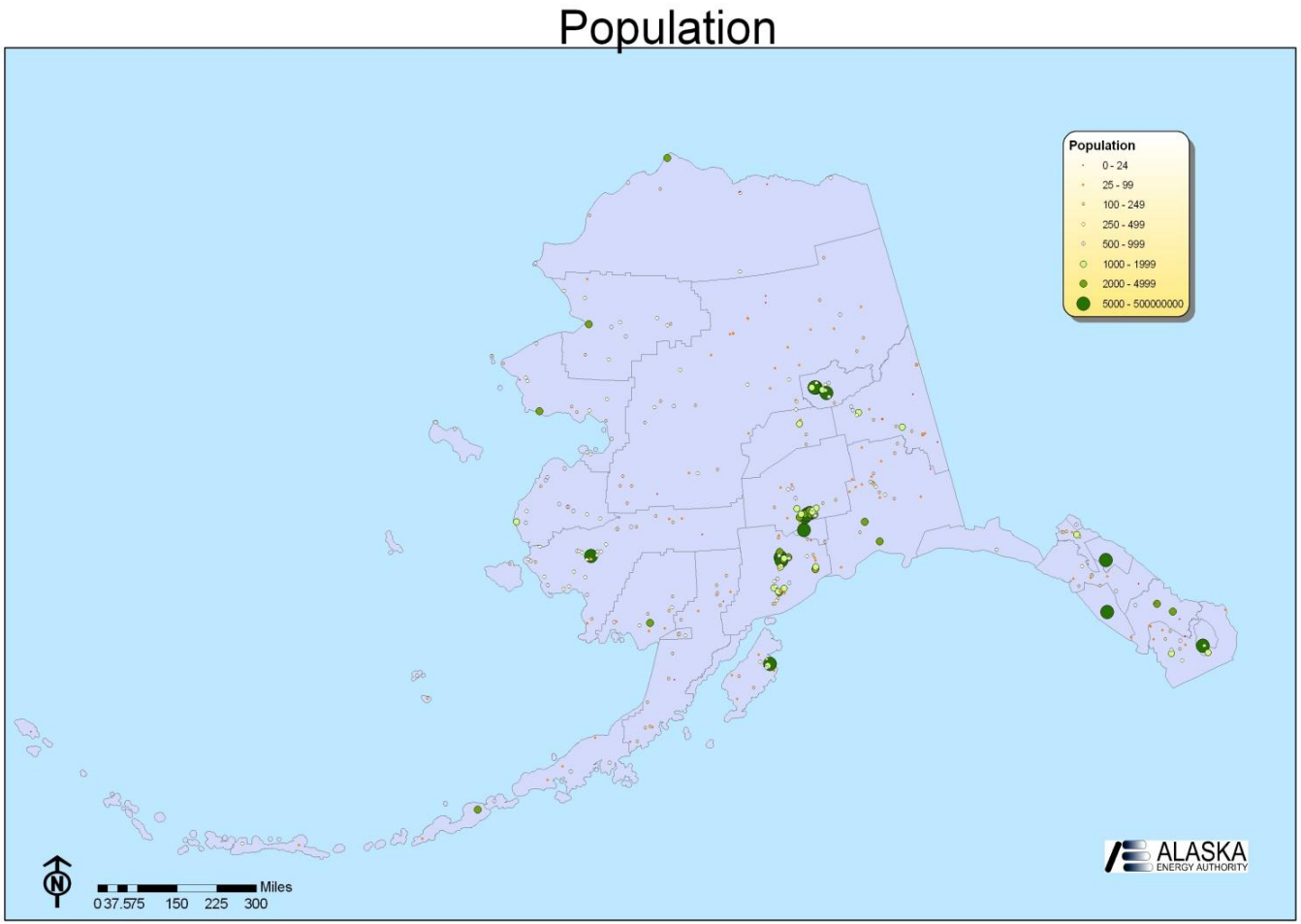
Almost 50% of all Alaskan's live in rural areas



Population 2006 Census: 653,313

Anchorage: 282,813

Juneau: 30,650
Fairbanks: 30,552

Rural Communities: 309,298 in 343 populated places

Source: DCCED, Map AEA.

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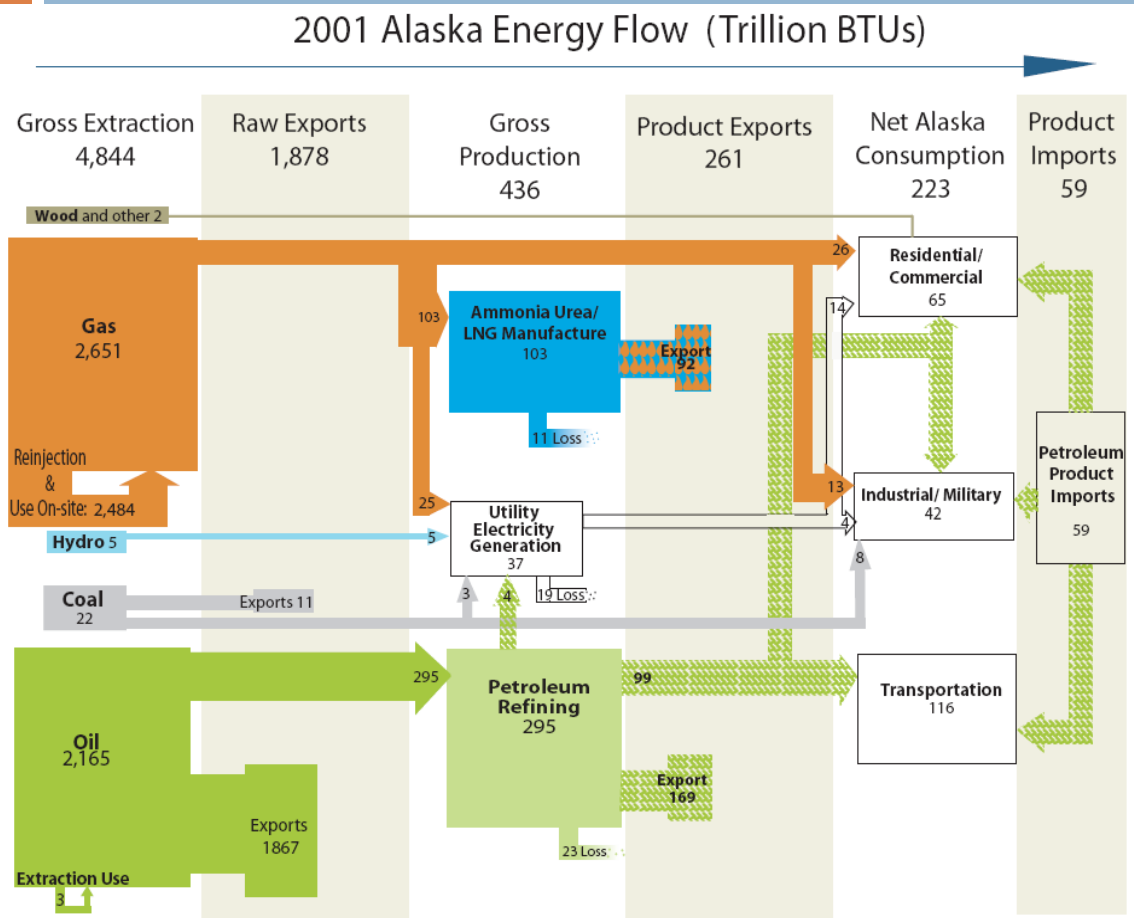
Statewide Energy Issues



Source: UAA ISER 2003

- In 2001 4.8 trillion BTU of energy were produced in Alaska
- Mostly from Oil and Gas
- About 85% of the oil Alaska produces is exported
- Alaska is importing about 30% of its exported refined petroleum back

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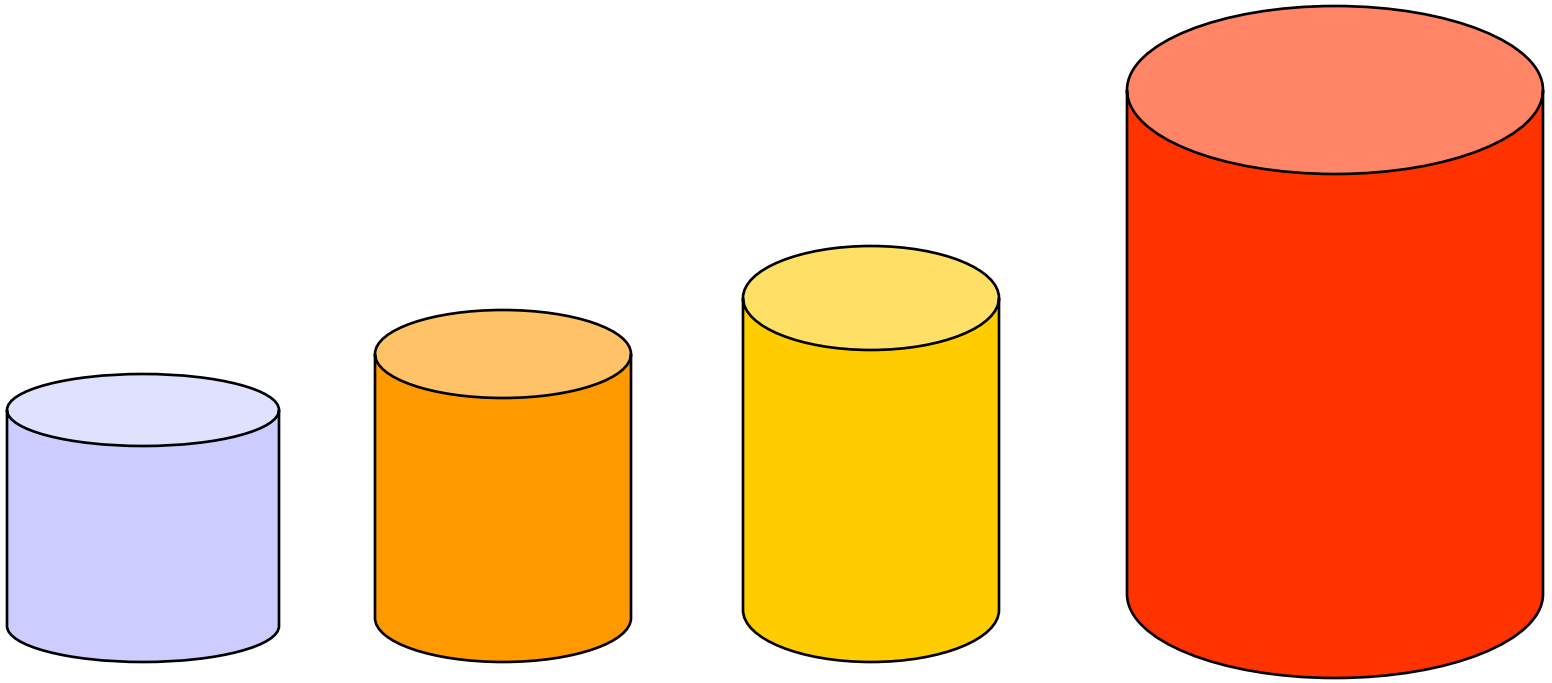
Breakdown of "Typical Village" Power Price

38 ct/kWh



Gen. and Admin 14%

Renewal and Replacement 19%

Operation and Maintenance 21%

Fuel 46%

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Source: AEA 2006

Wind Resource in Alaska

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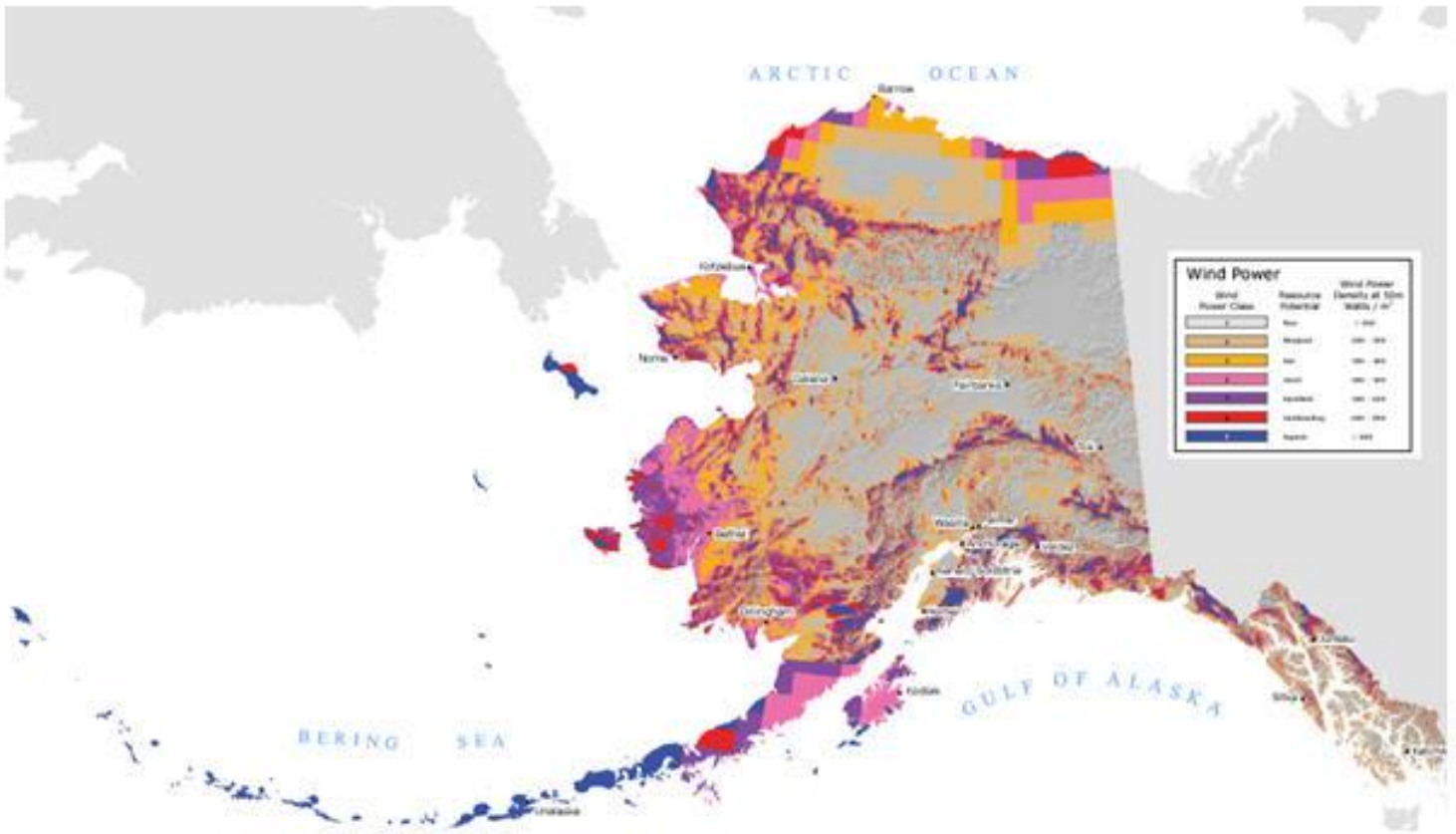
Wind Map of Alaska



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www.akenergyauthority.org/programwind.html

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Wind Projects in Alaska

Total Installed Capacity 2775 kW

St.Paul 775kW

Kasigluk 300kW

Toksook Bay

300kW

Selawik 260kW

Kotzebue 1000 kW

Note: Not all projects are displayed

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Why Regional Development?

- Access to capital networks
- Access to networks that allow communities, regional entities, entrepreneurs and businesses to share ideas and explore contracting opportunities
- Access to a highly skilled workforce or to worker training programs
- Hub-Cities acting as O&M training and supply centers
- Job creation
- Consortium of entities that is responsible for implementing regional wind development able to offer management services.
- Shared Risk, i.e. wind turbine bulk purchases, strategic development and construction
- Long-term local commitment through shared resources(e.g. O&M, R&R.)
- Regional Programmatic Environmental Assessment shortens development time and reduces funding needs.

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Wind Development Barriers

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Wind Development Barriers

- **Economy –** rural economy characteristics

- **Infrastructure –** The majority of villages are not connected to a road system, they are only accessible via air and sea/river.
- **Wind-Diesel Hybrid Technology -** The specialized design of wind-diesel hybrid systems, is a niche application of wind generation technology that covers, compared to large, grid connected wind facilities, a relative small market sector worldwide. The major barrier is the limited specialized knowledge of the integration design and associated equipment interactions, such as switchgear, and energy storage.

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Wind Development Barriers - continued

- **Equipment -** Current turbine development in the wind industry is targeted to multi-megawatt wind generators. The application for these machines in rural Alaska is limited due to electrical load demand, construction equipment, and maintenance requirements. However, large size wind turbines are believed to be an appropriate choice for larger rural load centers. For smaller applications the equipment choice is limited. Two emerging trends for the Alaska market are visible. One market sector caters towards decommissioned, refurbished wind turbines (50kW – 500 kW). The second market sector is the small to medium size new wind turbine sector (50kW-100kW).

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Wind Development Barriers - continued

- **Operation and Maintenance -** The repair skill, spare part availability, remoteness of location, complexity of system, and responsiveness of technical support are factors that have to be taken into consideration in the decision making process. A dedicated, long-term O&M plan is a key factor for a sustainable project. Due to the difficulties in performing repairs during a long rural Alaska winter or delayed delivery, the downtime for a wind system can be several months.
- **Technology Acceptance -** A successful wind diesel system is a community development project that requires support from the local leadership, the residents, and the local utility. Extensive and early local outreach is a positive contributing factor for a sustainable project (i.e. School classes, participation in Met-Tower installation, town meeting presentations etc.).


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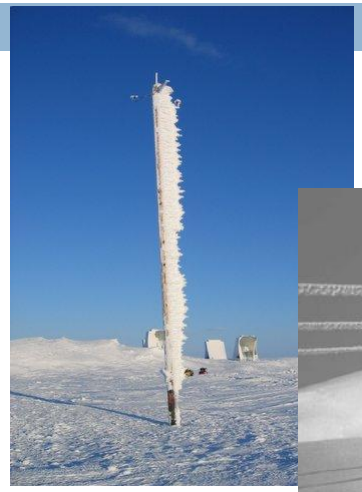
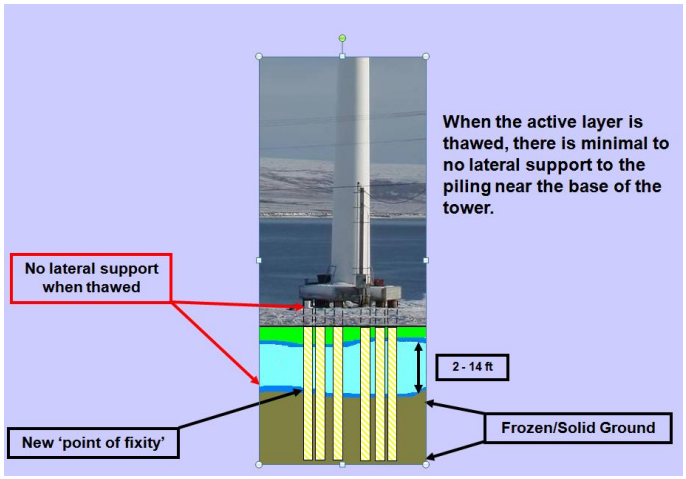
Wind Development Barriers - continued

- Climate –
  - Icing
  - Thawing Permafrost
  - Coastal Erosion
  - High Wind Speeds





Source: AVEC, Toksook Bay, AK

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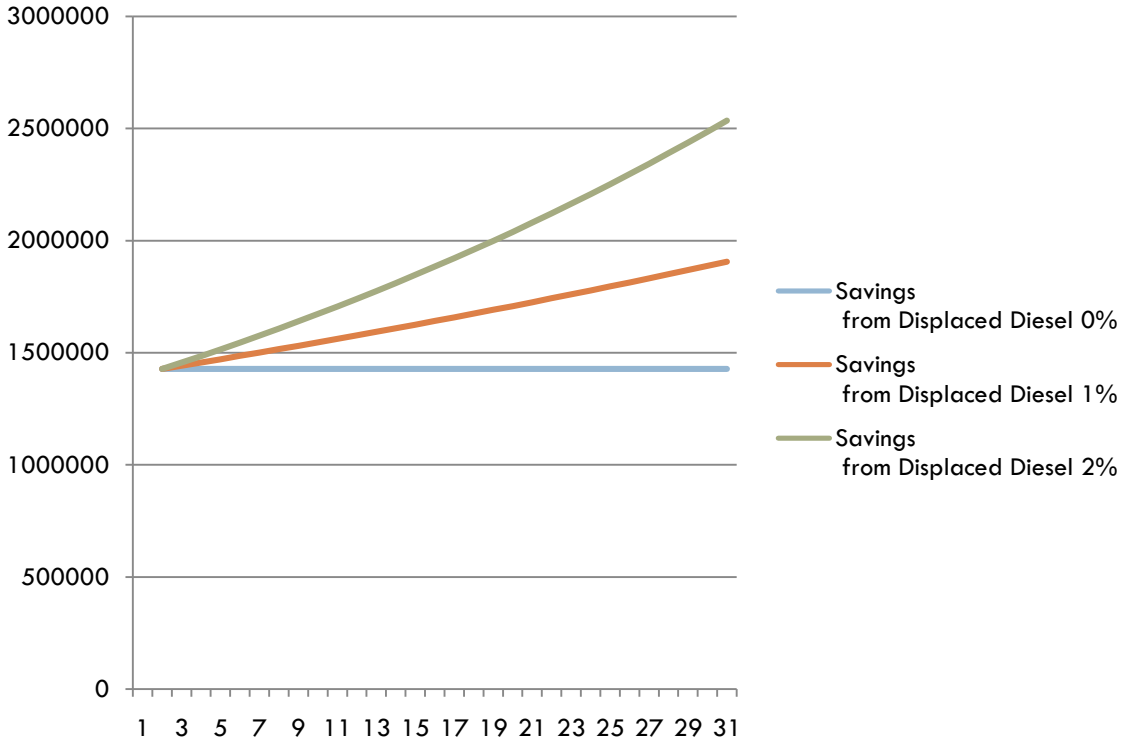
Wind Development Benefits

- Diesel Savings / Stable Cost of Energy



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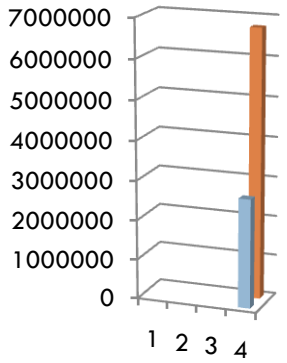
Wind Development Benefits continued..

- Energy Independency
- Additional Revenues from Green Tag Sales

		3MW		
		Diesel Fuel Price Scenario		
		0%	1%	2%
	Capacity Factor	34%	34%	34%
	Annual Diesel Savings [gal]	562,031	562,031	562,031
	Annual Diesel Savings [$]	$1,427,559	$1,655,249	$1,930,444
	Annual GHG emission reduction [t_{CO2}]			
No Green Tag Sales	NPV [$]	2,745,414	$4,911,166	$7,354,978
	Simple Payback [years]	12.1	12.1	12.1
	Positive Cashflow [years]	12.1	11.1	10.3
	B/C ratio	1.23	1.41	1.61
	ALCS	$184,535	$330,108	$494,370
	COE [$/kwh]	$0.14	$0.13	$0.12
With Green Tag Sales	NPV [$]	$6,758,986	$8,924,738	$4,864,729
	Simple Payback [years]	9.5	9.5	13.3
	Positive Cashflow [years]	9.5	9	11.5
	B/C ratio	1.56	1.74	1.95
	ALCS	$764,145	599,883	$326,986
	COE [$/kwh]	$ 0.11	$ 0.10	$ 0.09



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Wind Development Benefits continued..

- Green House Gas Emission Reduction
- Carbon Tax ?

Base case GHG emission factor (tCO2/MWh)	Proposed case GHG emission factor (tCO2/MWh)	End-use annual energy delivered (MWh)	Gross annual GHG emission reduction (t_{CO_2})
1.019	0.000	8,993	9,168

@ $24/tCO2 ~ $200,000 annually
in carbon tax savings

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Wind Development Benefits continued..

- Potential annual savings of case study:

Diesel Savings	$1,427,559
Carbon Tax Savings	$220,025
Green Tag Sales	$359,700
Total 'Savings'	$2,007,283

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Technical Wind Development Potential

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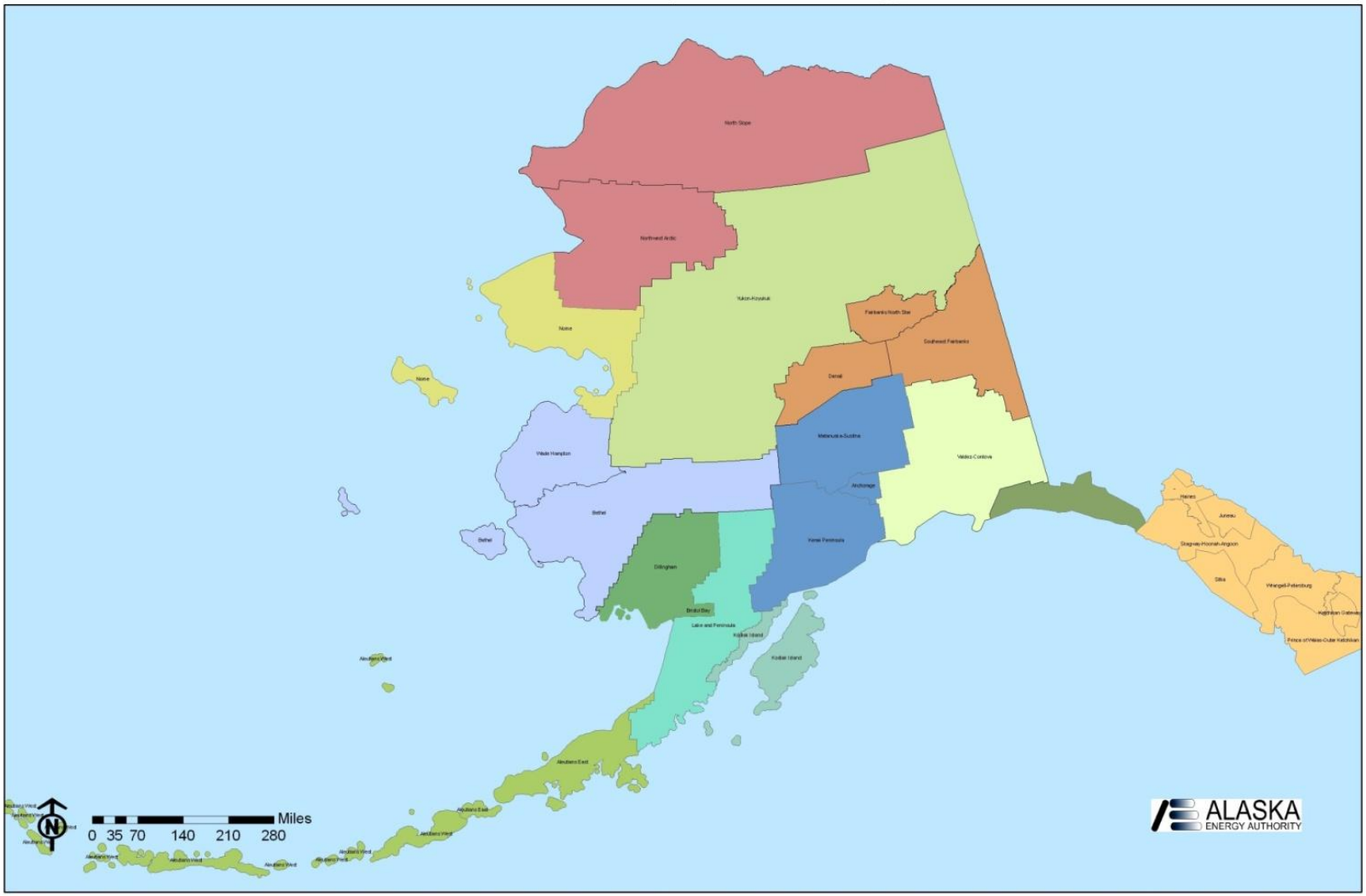
Wind Development Regions



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Methodology

- **Database** - Community name, Census area, Coordinates, Population, Fuel Cost, Wind Class
- **Ranking** - Wind 70%, Population 25%, Fuel Cost 5%
- **Filter –**
  - Filter I - The ranking results were equally divided into four categories, each represent 25% of the total amount of ranked villages.

Percentile	Suitability
100-75	Outstanding
74-50	Excellent
49-25	Good
24-0	Fair

  - Filter II - Population numbers were divided into eight groups of community size.
    - For each community the average and peak load was determined based on the FY2007 PCE data.
    - An average load for each population category within the respective region was calculated.

Population	Category
>5,000	metropolitan
2000 - 4,999	large
1000 - 1,999	extensive
500 - 999	medium
250 - 499	intermediate
100 - 249	small
25- 99	limited
0-24	camp

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Methodology continued

- Filter III - In the last phase a combination of low load and low ranking was applied to determine the elimination of villages unsuitable for wind development.

	Filter				
	Dismiss		**Allow**		
Population	25- 99	limited	>5,000	metropolitan	Population
	0-24	camp	2000 - 4,999	large	
Ranking	49-25	Good	1000 - 1,999	extensive	
	24-0	Fair	500 - 999	medium	
			250 - 499	intermediate	
			100-75	Outstanding	Ranking
			74-50	Excellent	
	Allow combination of:				
	Good	metropolitan			

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Results

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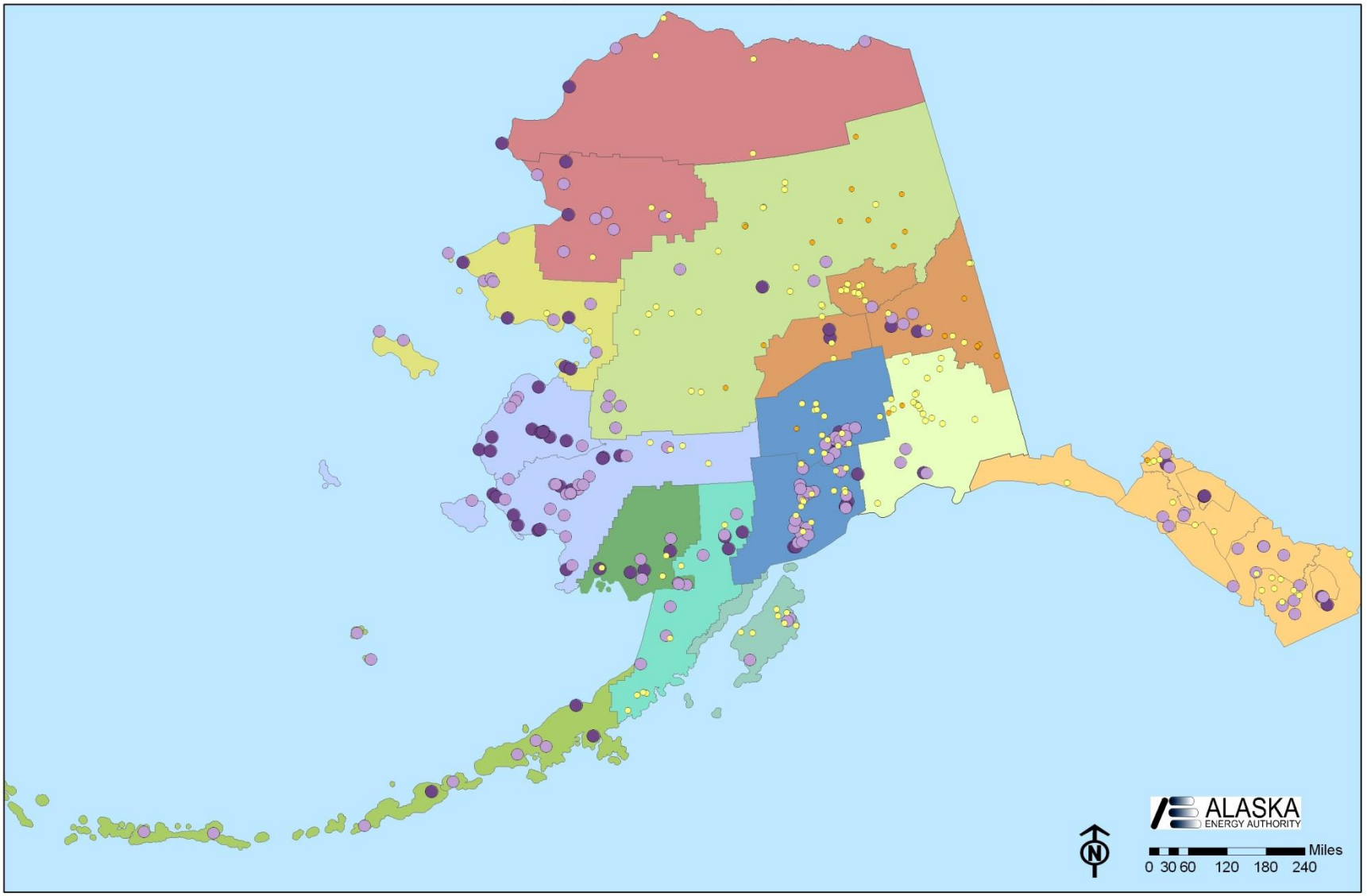
Wind Development Regions - Ranking



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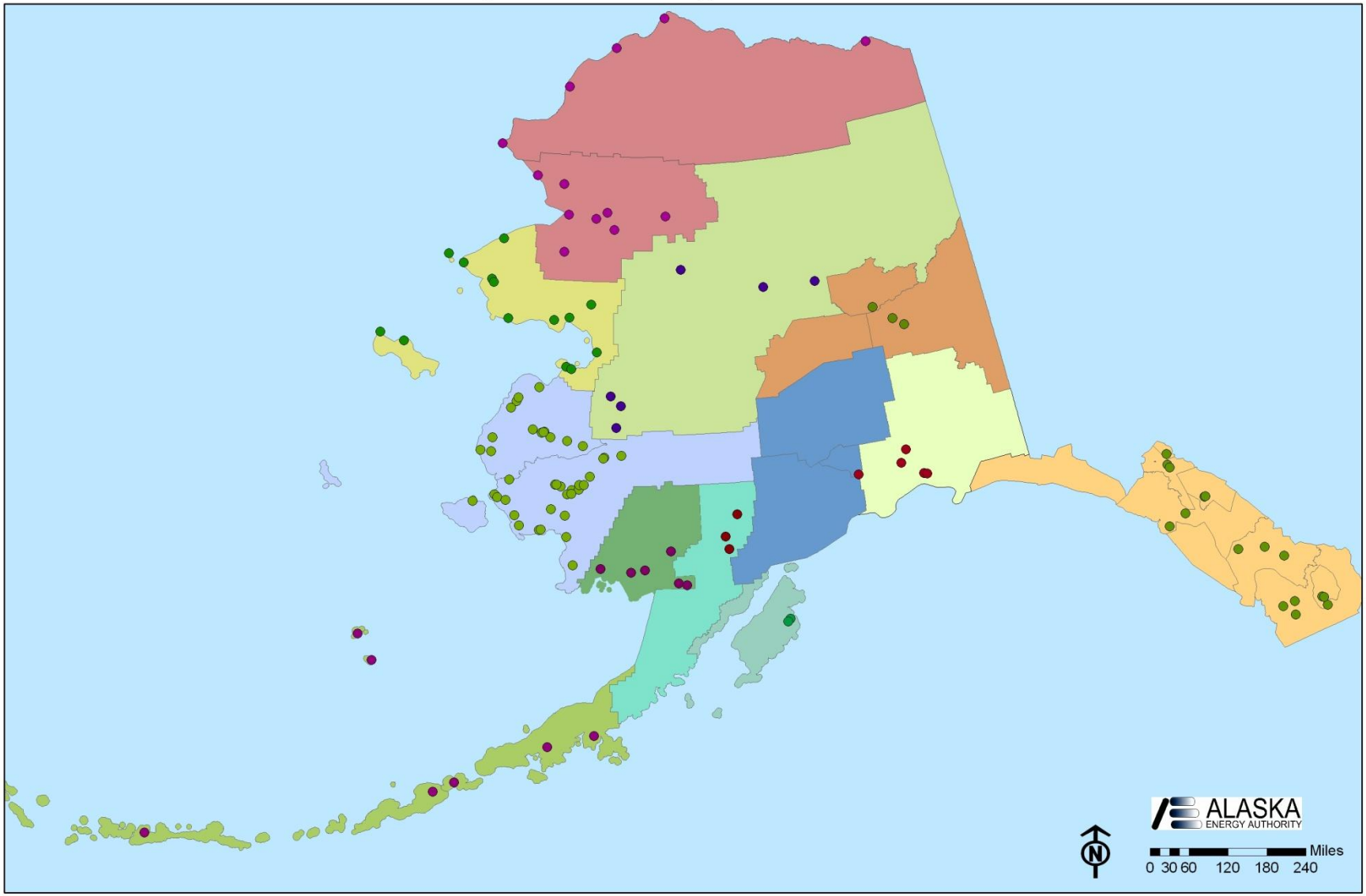
Wind Development Regions - Filtered Results



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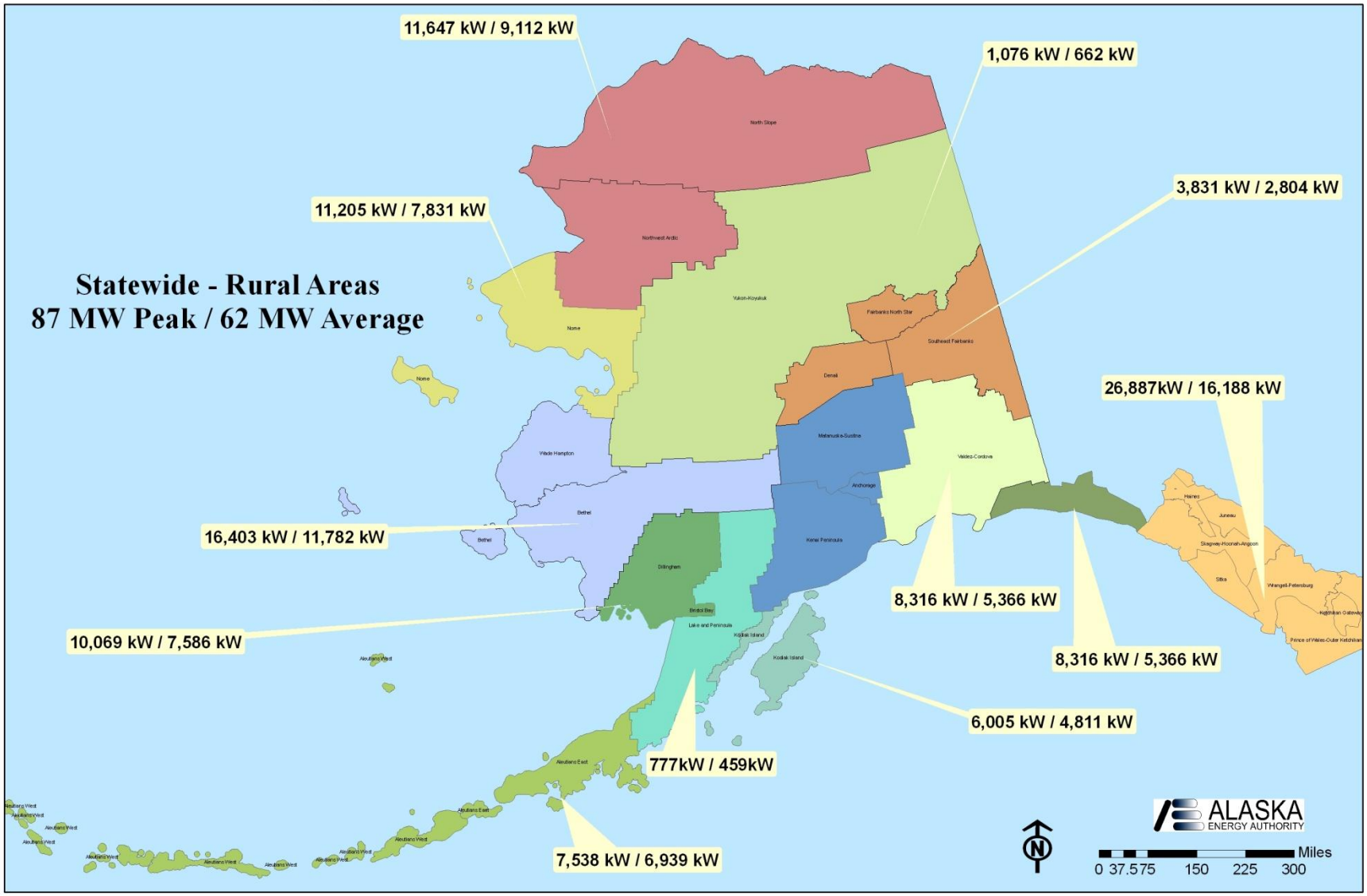
Regional Load Demand - Filtered Results



Source: PCE FY07, Map AEA

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Regional Load Demand in Developable Communities

Although the load demand can only indirectly support wind development projections, it servers as a reasonably good first estimate to identify potential installed capacity options. Additional capacity can be estimated if services generated by wind (i.e. heat, export) are desired.

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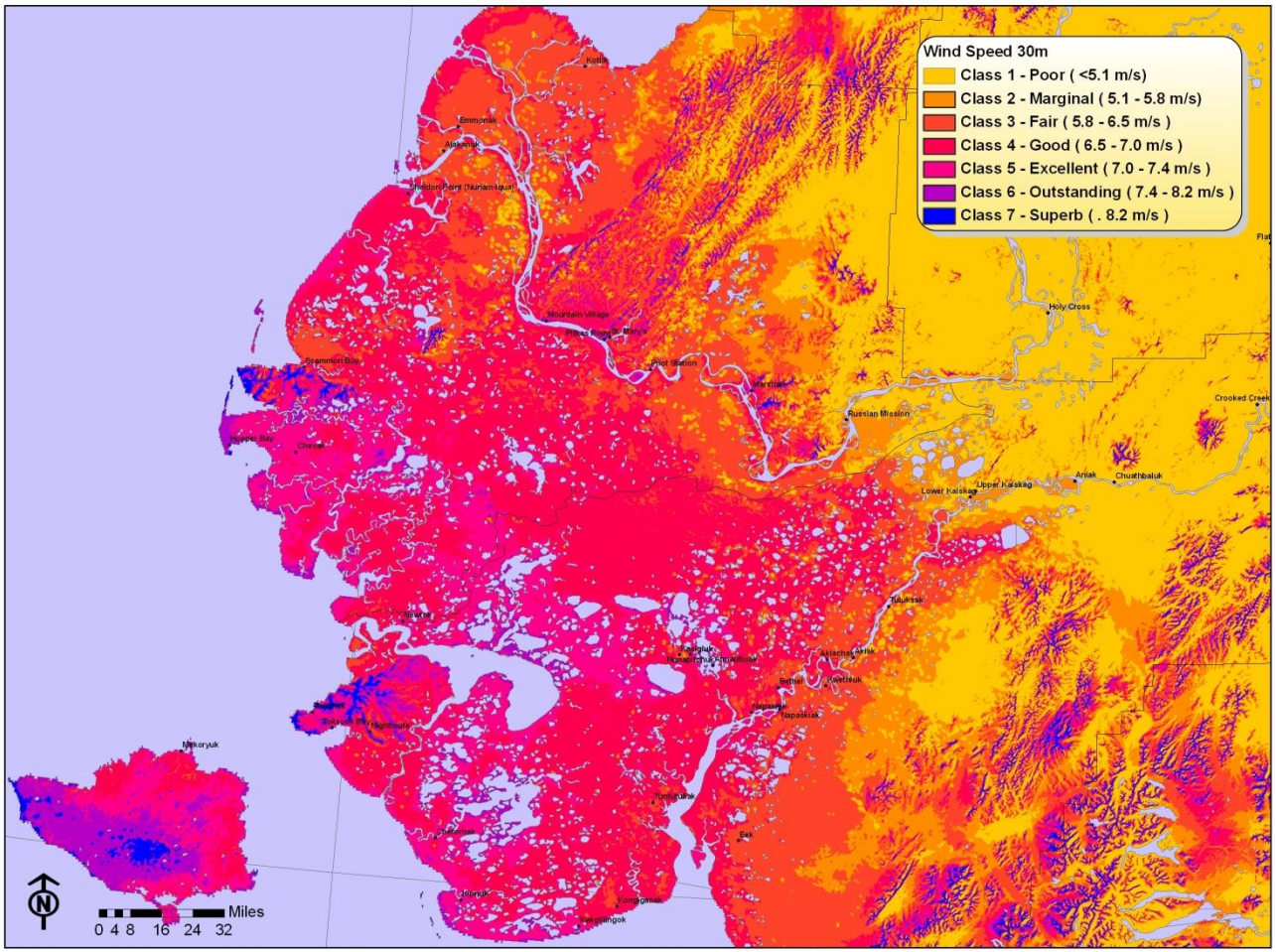
Wind Resource in Western Alaska

Wind Resource in the Y-K Delta



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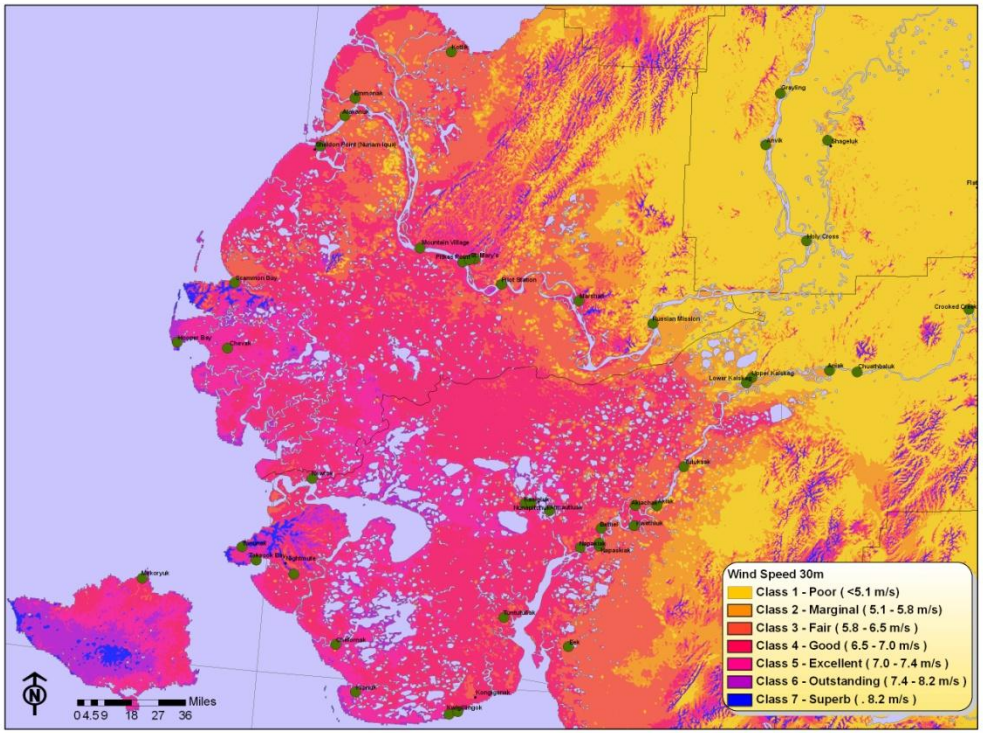
Ranking Results

Wind Resource in Western Alaska
Ranking Results



COMM_BORO_NAME	Result_100
Mountain Village	100.0
Scammon Bay	98.6
Hooper Bay	92.0
Saint Mary's	91.2
Marshall	90.7
Tuntutuliak	64.0
Tok	26.9
Kipnuk	86.0
Chevak	82.4
Aniak	81.6
Kwigillingok	81.6
Pitkas Point	80.6
Kongiganak	80.2
Bethel	78.9
Pilot Station	78.1
Unalaska	78.6
Andreafsky	76.0
Platinum	75.3
Lower Kalskag	73.1
Kotlik	72.6
Atmautluak	72.1
Chefornak	72.1
Mekoryuk	71.8
Russian Mission	68.6
Napakiak	68.3
Newtok	66.9
Kasigluk	64.8
Nunapitchuk	64.8
Kwethluk	64.5
Tuluksak	55.0
Akiachak	63.8
Nightmute	63.0
Alakanuk	60.3
Emmonak	60.3
Napaskiak	58.8
Napaskiak	58.8
Nunam Iqua	56.8
Quinhagak	55.8
Eek	55.2
Trapper Creek	27.6
Oscarville	49.4
Chuathbaluk	48.8
Goodnews Bay	45.3
Akiak	44.7
Red Devil	44.1
Crooked Creek	35.3
Lime Village	30.2
Slana	32.7
Stevens Village	9.5

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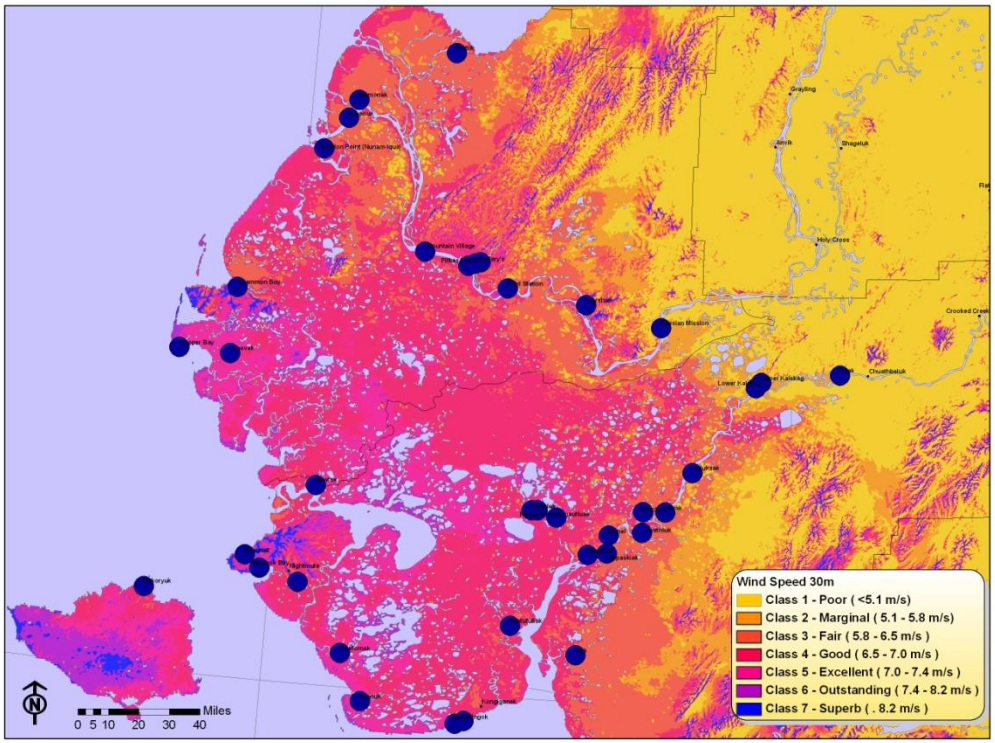
Filtered Results

Wind Resource in Western Alaska
Filtered Results



Community	Peak Load [kW]	Ave Load [kW]
Mountain Village	380	284
Scammon Bay	380	284
Hooper Bay	472	289
Saint Mary's	380	284
Marshall	186	100
Tununak	186	100
Toksook Bay	380	284
Kipnuk	380	284
Chevak	380	284
Aniak	380	284
Kwigillingok	186	100
Pitkas Point	114	73
Kongiganak	186	100
Bethel	6,005	4,811
Pilot Station	380	284
Upper Kalskag	186	100
Andreafsky	114	73
Lower Kalskag	186	100
Kotlik	380	284
Atmautluak	186	100
Chefornak	186	100
Mekoryuk	114	73
Russian Mission	186	100
Napakiak	186	100
Newtok	186	100
Kasigluk	380	284
Nunapitchuk	380	284
Kwethluk	380	284
Tuntutuliak	186	100
Akiachak	380	284
Nightmute	114	73
Alakanuk	380	284
Emmonak	380	284
Napaskiak	186	100
Napaskiak	186	100
Nunam Iqua	114	73
Quinhagak	380	284
Eek	186	100
Tuluksak	186	100
Goodnews Bay	114	73
Akiak	186	100
	16,403	**11,782**

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Conclusion

- Regional Development is preferred in areas with a high density of developable project sites.
- Regional Development has the benefit of industry clusters (access to technology, knowledge, supply, local economy)
- Alaska has several regions suitable for a regional development approach.
- Identification of developable project sites serve as basis for further decision making processes (i.e. for turbine supplier, regional government, state government, support service supplier, training provider)
- This study presents the technical basis for discussions about regional wind development only. An actual implementation process has to be developed with the input of all stakeholders.


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Next Steps

- **Study Phase II –** Detailed evaluation of regional economic impacts.

- **Study Phase III –** Development of a 'best practices guide' for the successful implementation of a regional economic wind development initiative.

Timeframe: Approximate 6-8 months.

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"We do not inherit the earth from our ancestors,

We borrow it from our children."

Native American Proverb

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REGIONAL ECONOMIC WIND DEVELOPMENT

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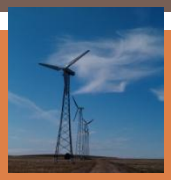



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