

Wind Resource Assessment

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Outline

- Why measure the wind?
- How to measure the wind
- Analyzing the data
- What's next?



Why Measure the Wind?

$$\text{Power} = \text{Density} \times \text{Area} \times (\text{Velocity})^3$$

- Density depends on temperature & elevation
- Area depends on the wind turbine (area swept by the blades)
- Velocity depends on the location & height



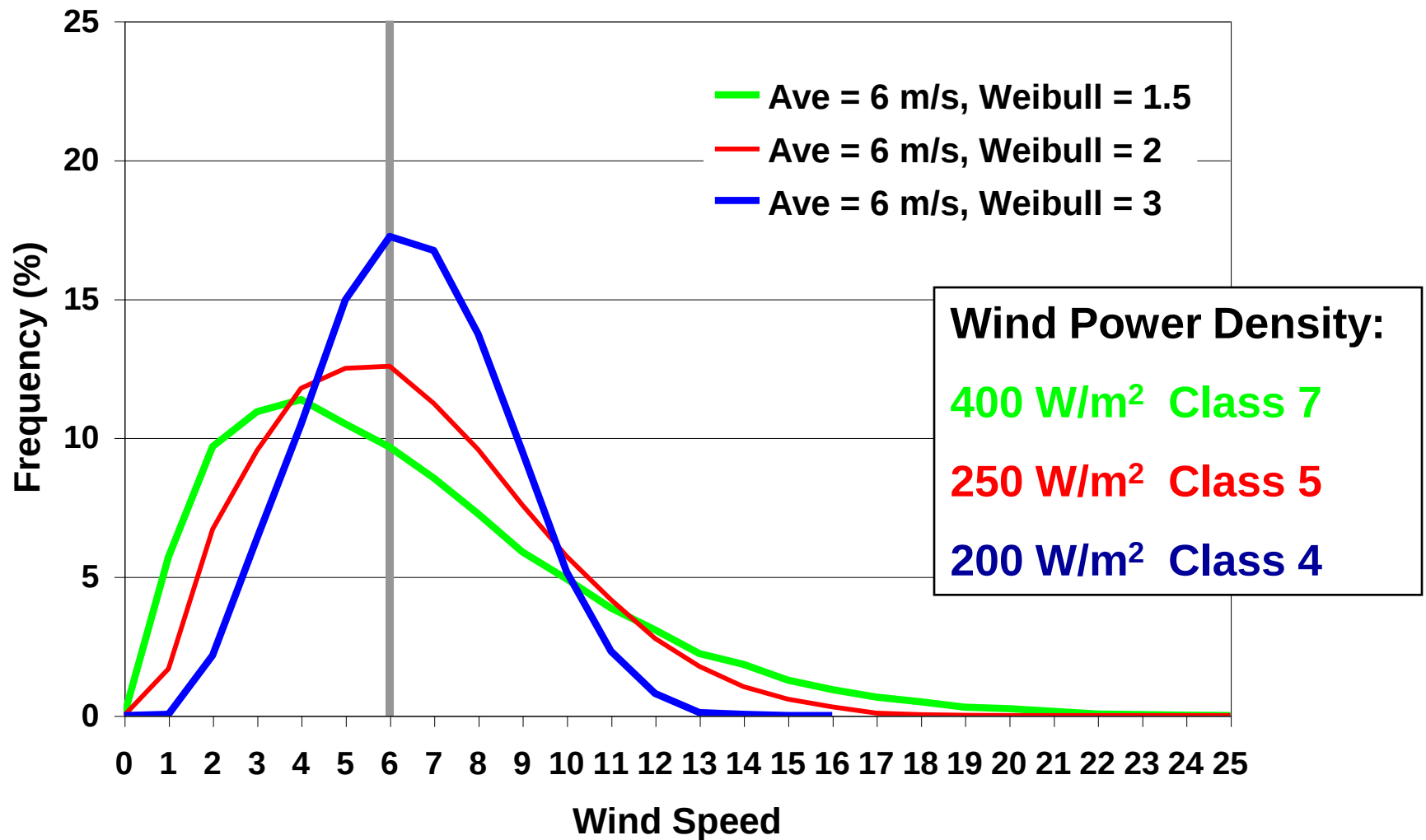
Why Measure the Wind?

Classes of Wind Power Density							
Class	10 m		30m		50m		Rating
	WPD (W/m ²)	Speed (m/s)	WPD (W/m ²)	Speed (m/s)	WPD (W/m ²)	Speed (m/s)	
1	<100	<4.4	<160	<5.1	<200	<5.6	Poor
2	100 - 150	4.4 - 5.1	160 - 240	5.1 - 5.8	200 - 300	5.6 - 6.4	Marginal
3	150 - 200	5.1 - 5.6	240 - 320	5.8 - 6.5	300 - 400	6.4 - 7.0	Fair
4	200 - 250	5.6 - 6.0	320 - 400	6.5 - 7.0	400 - 500	7.0 - 7.5	Good
5	250 - 300	6.0 - 6.4	400 - 480	7.0 - 7.4	500 - 600	7.5 - 8.0	Excellent
6	300 - 400	6.4 - 7.0	480 - 640	7.4 - 8.2	600 - 800	8.0 - 8.8	Outstanding
7	>400	>7.0	>640	>8.2	>800	>8.8	Superb

-Different heights

-Based on wind power density; not wind speed

Wind Speed vs. Power Density

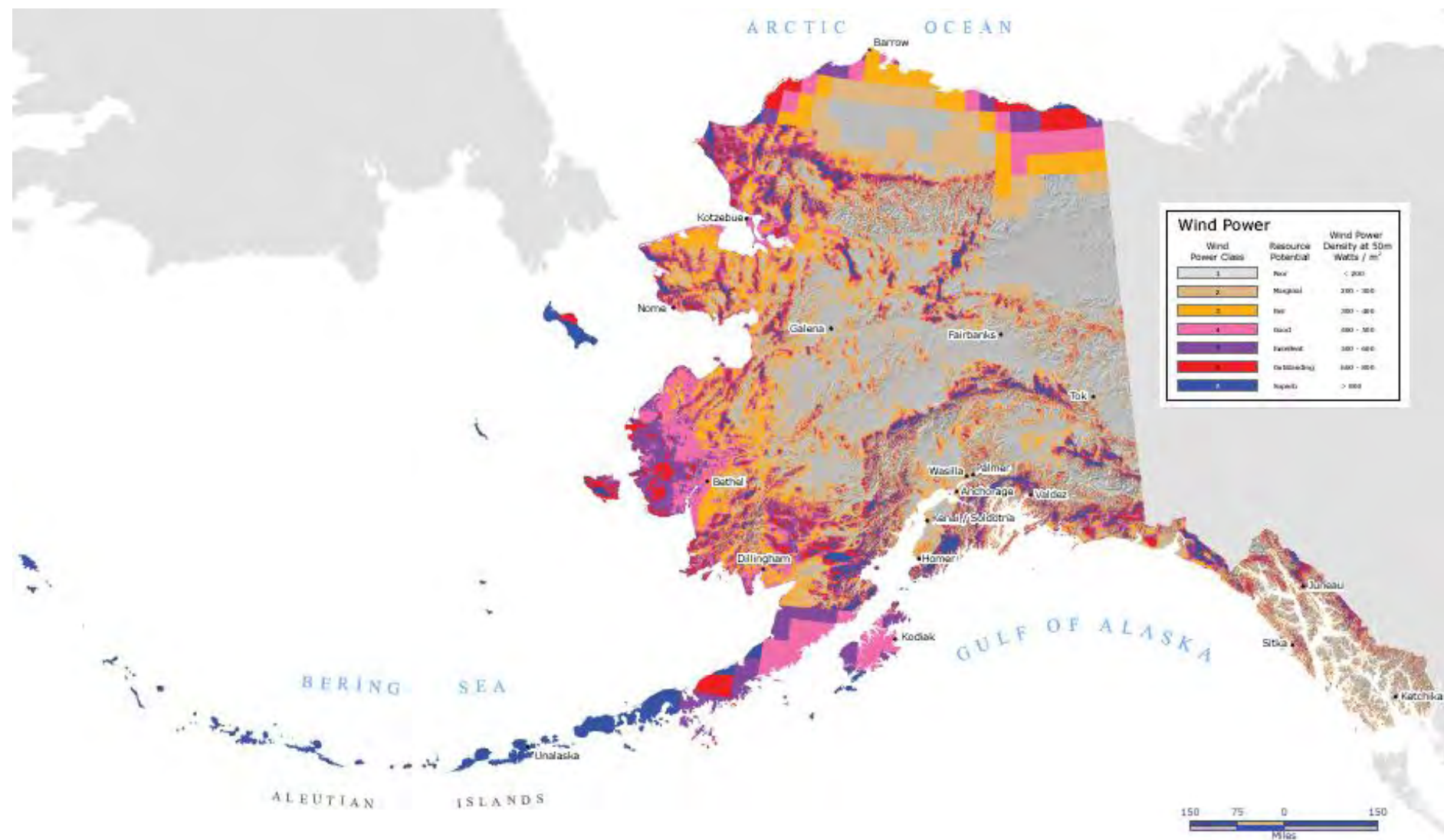


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Wind Map of Alaska



Anemometer Loan Program

Met tower kit includes:

- Anemometers
- Wind vane
- Temperature sensor
- Data logger
- 100-foot tower



State Anemometer Loan Program

AEA provides:

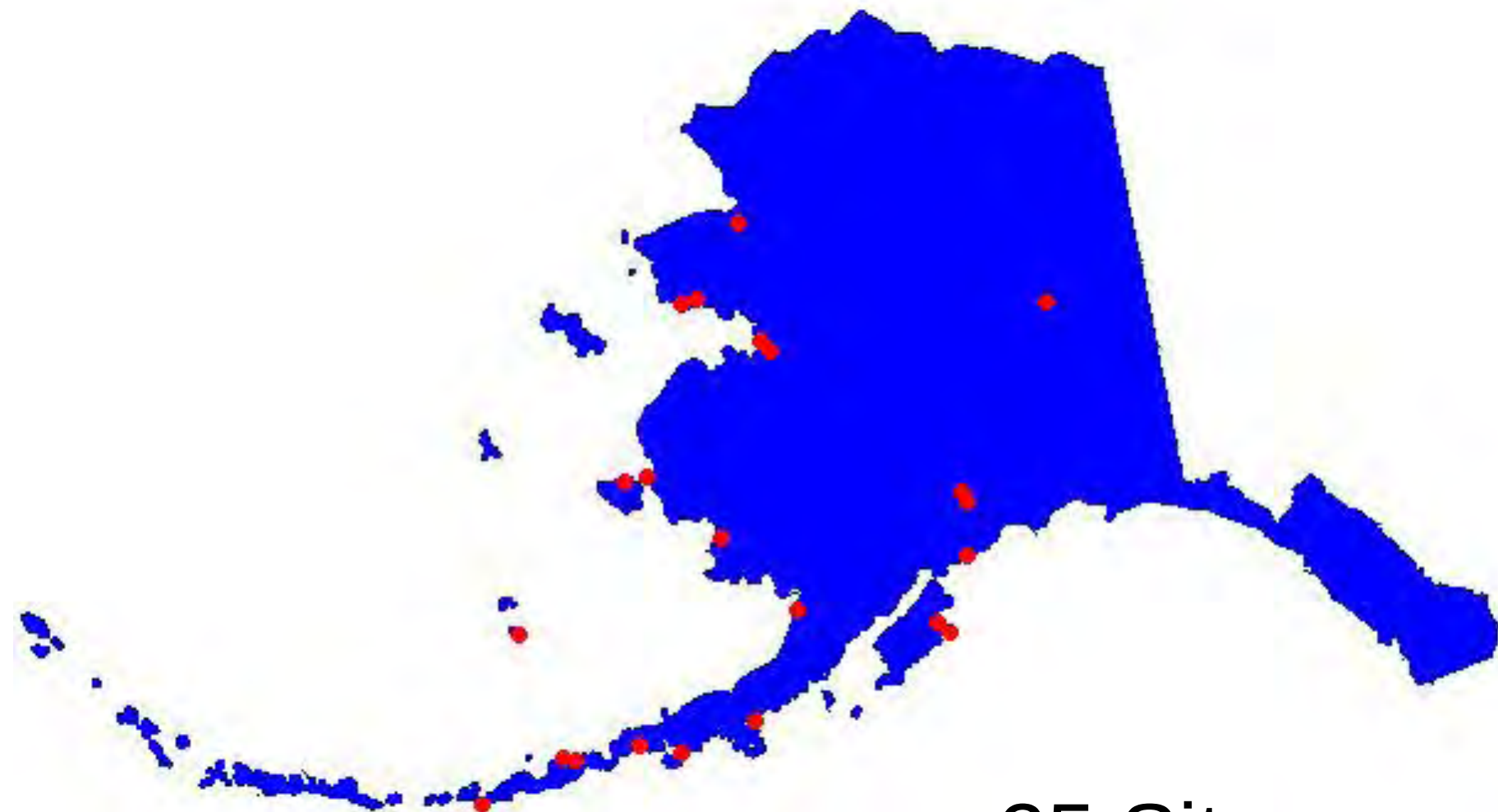
- Tower kit
- Installation assistance
- Technical assistance

Community provides:

- Land use for 1 year of monitoring
- Installation assistance
- Maintenance
- Data collection



Location of Met Towers



25 Sites

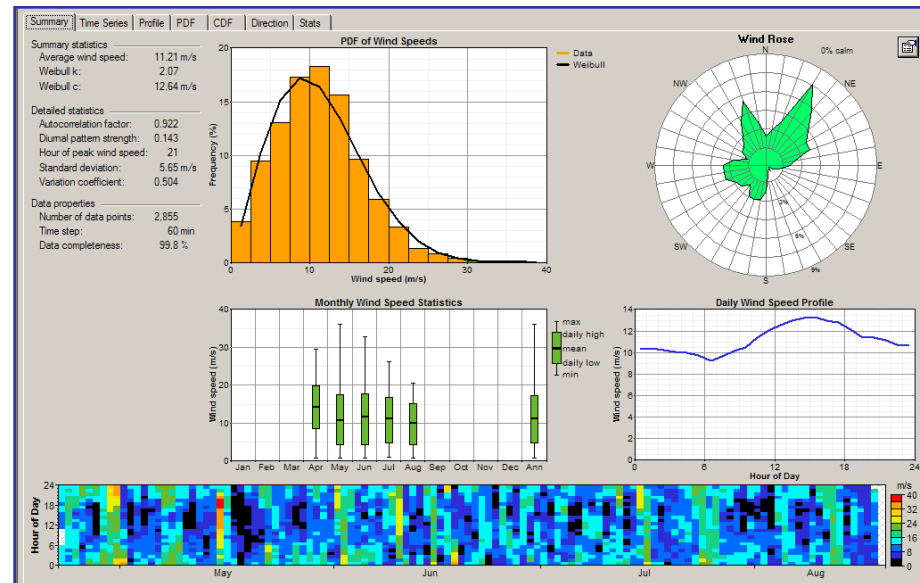
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Data Analysis Software

- NRG Data Retriever Software (www.nrgsystems.com)
- Excel spreadsheets
- Windographer (www.mistaya.ca)
- WindFarm

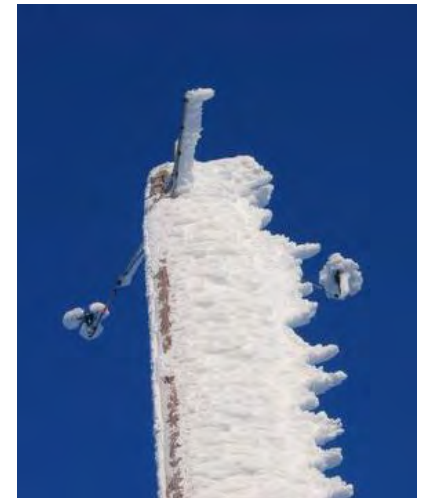
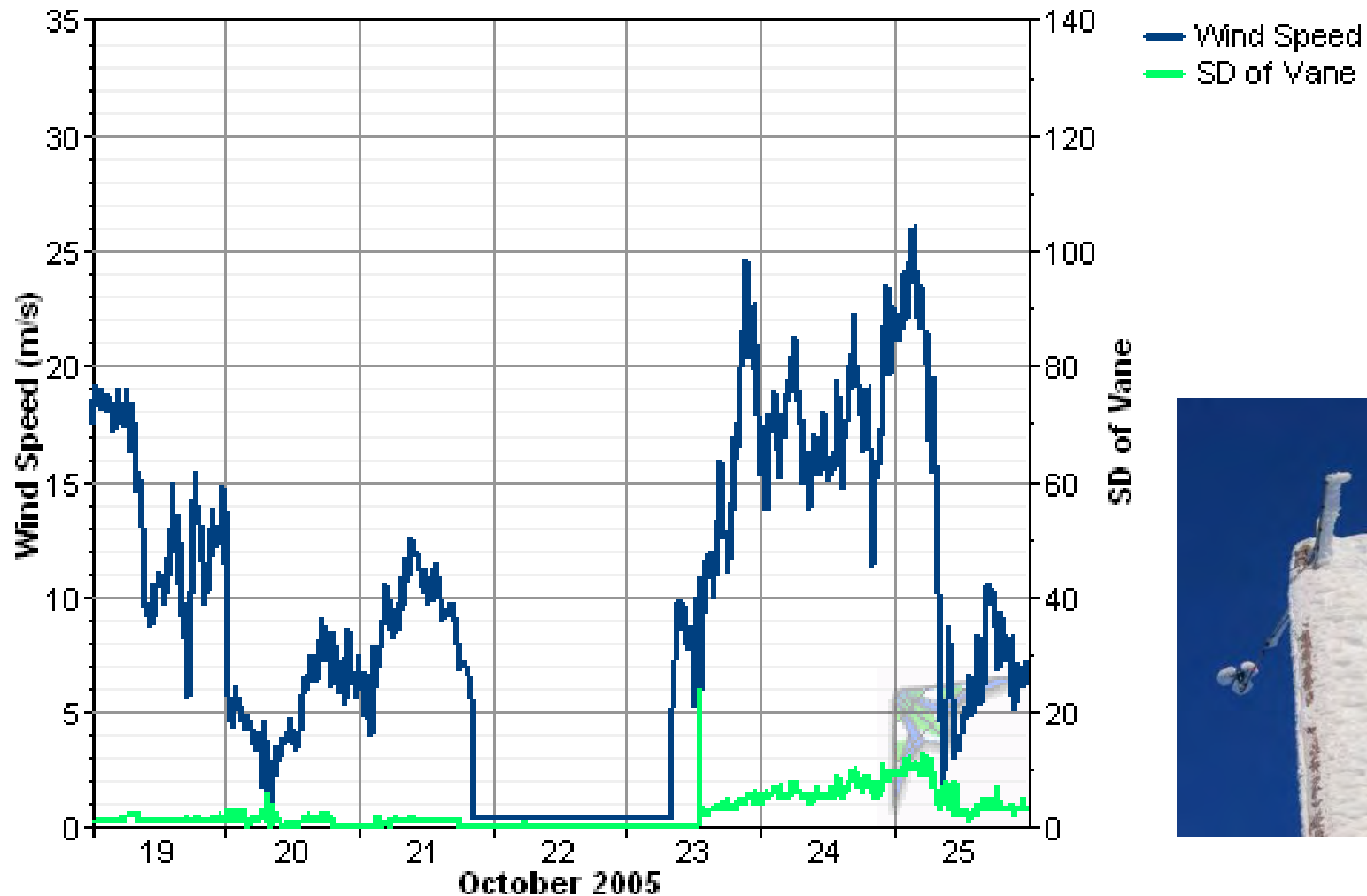


Quality Control

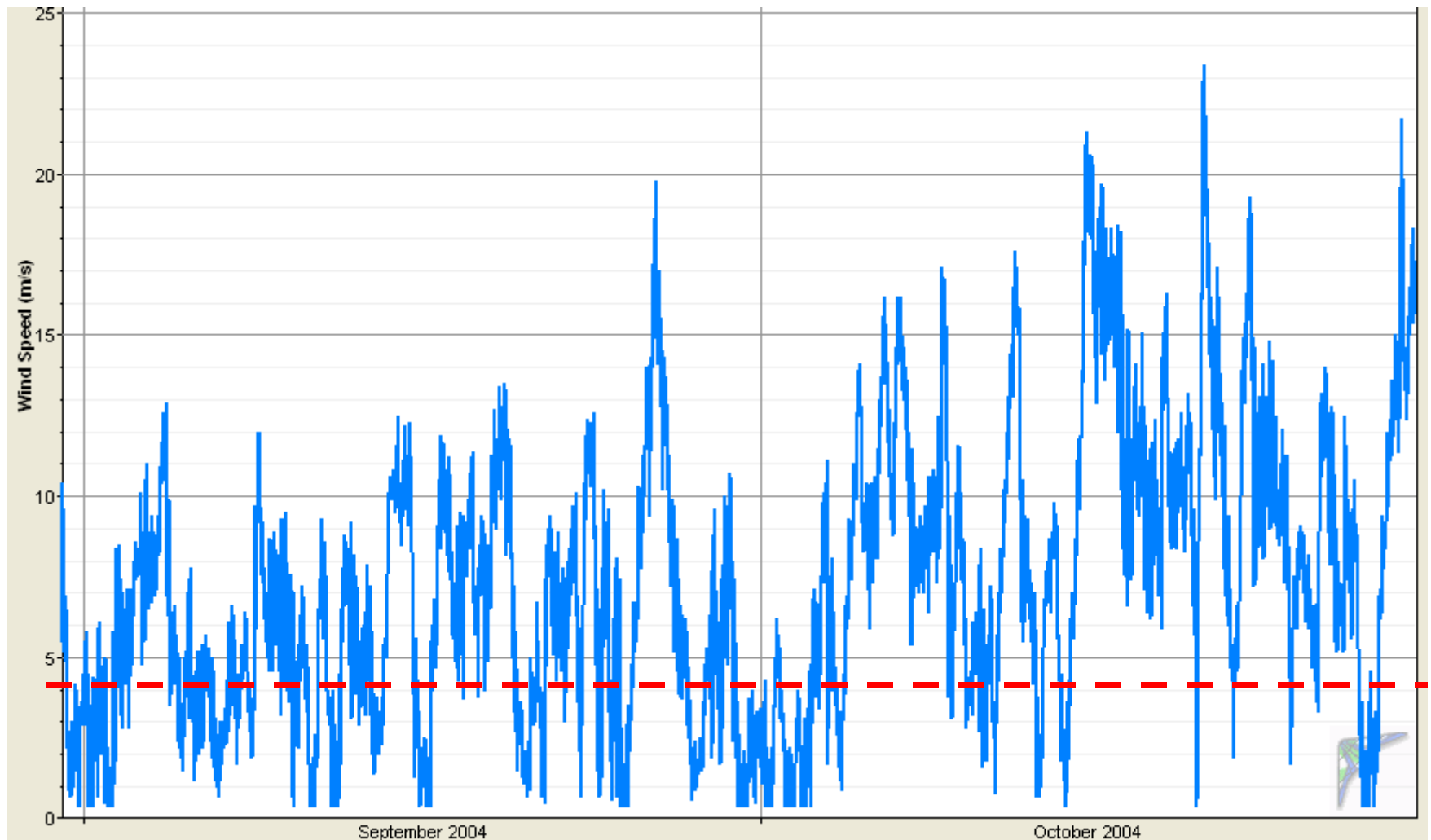
- Min/Max values
- Metric Units
- Vane offset is correct
- Tower shadow
- Icing of sensors



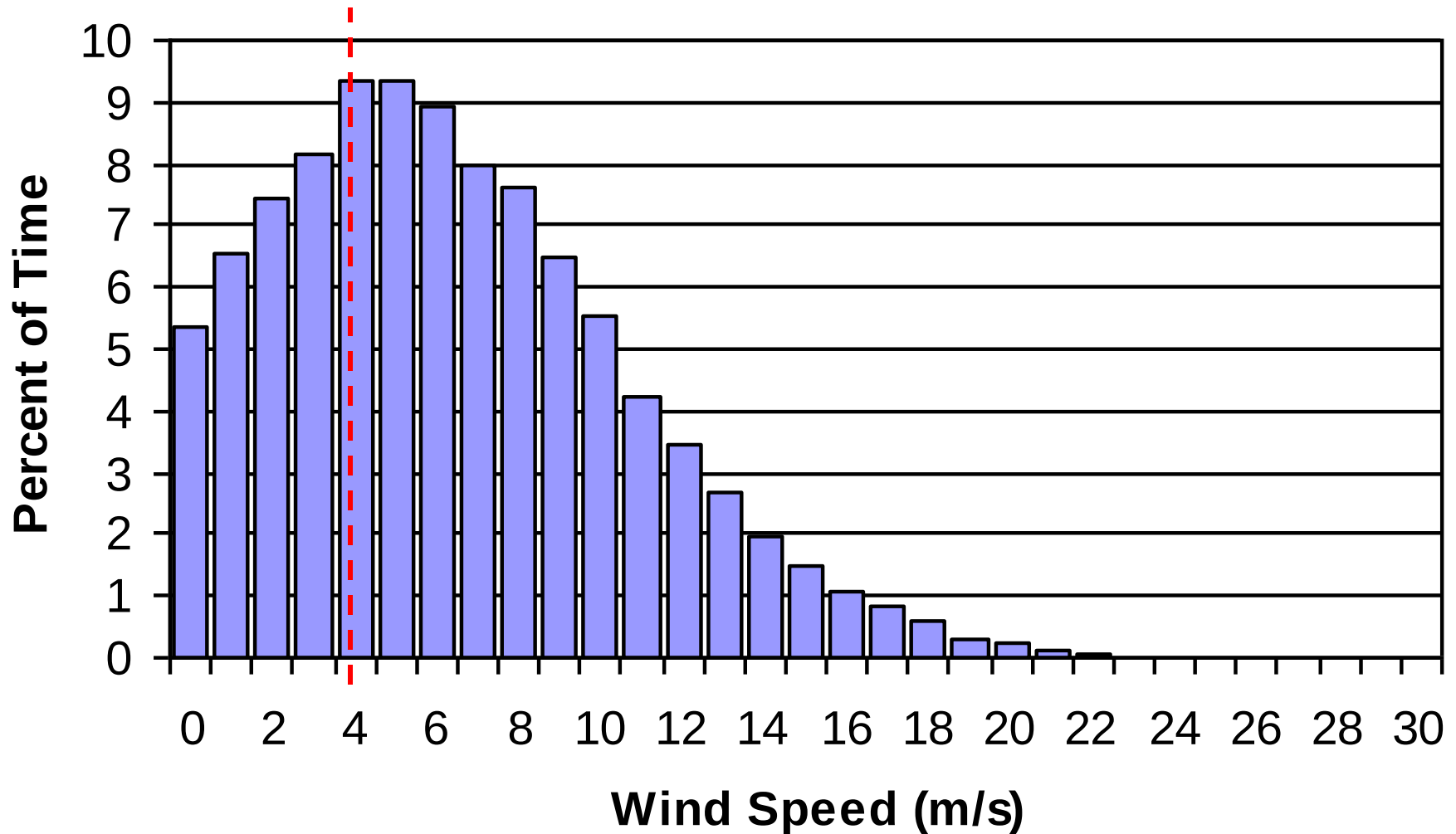
Icing Event



Time Series Data

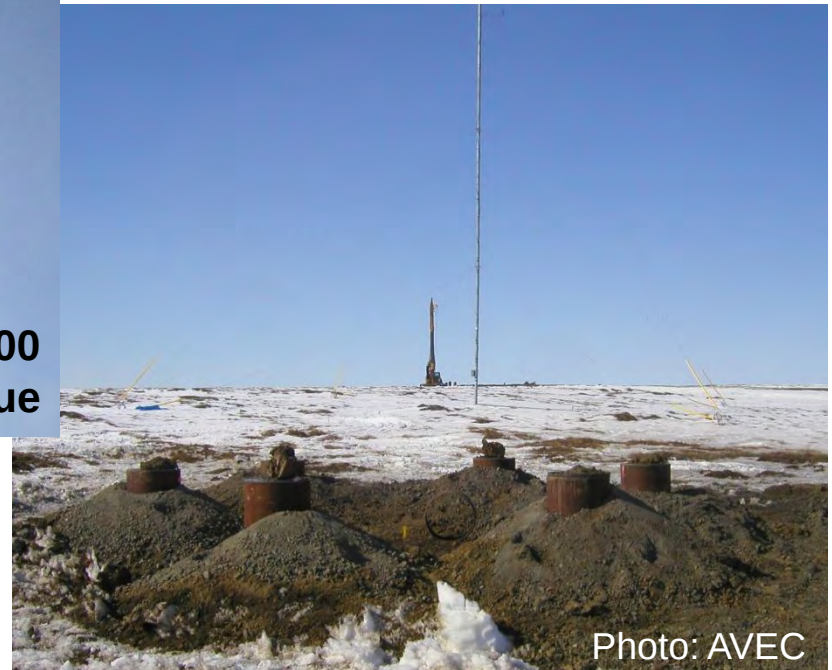
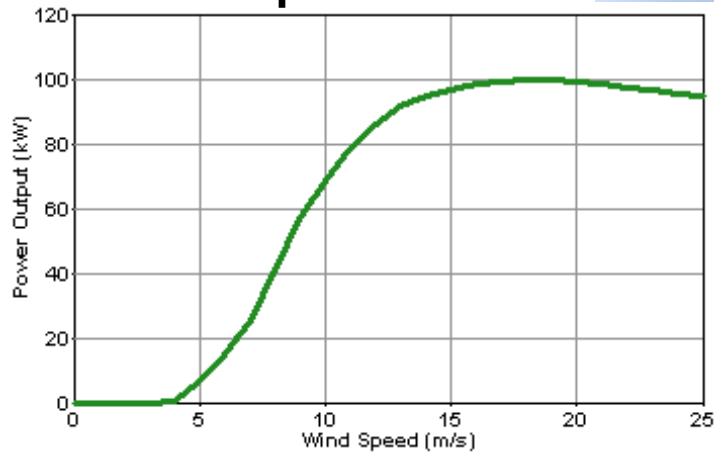


Wind Frequency Distribution



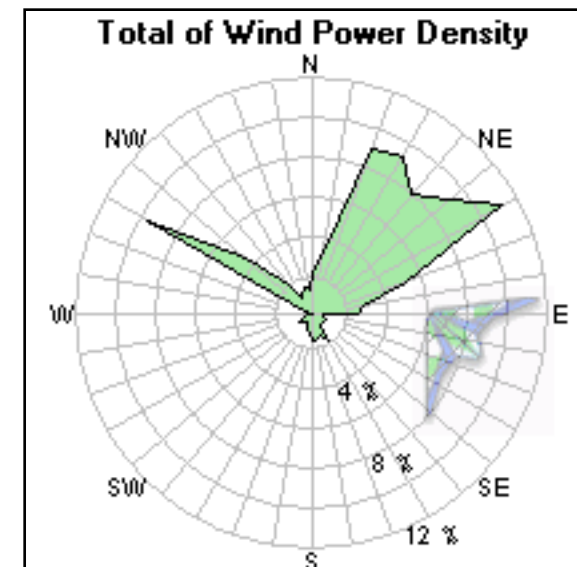
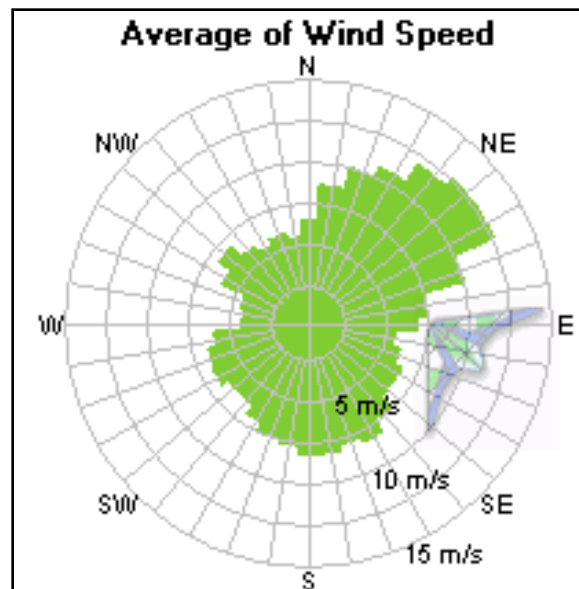
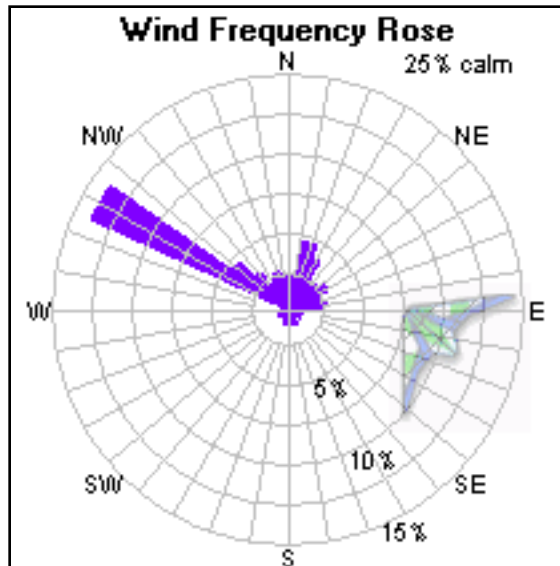
Potential Wind Power Production

NW100 power curve



Toksook Bay wind turbine construction

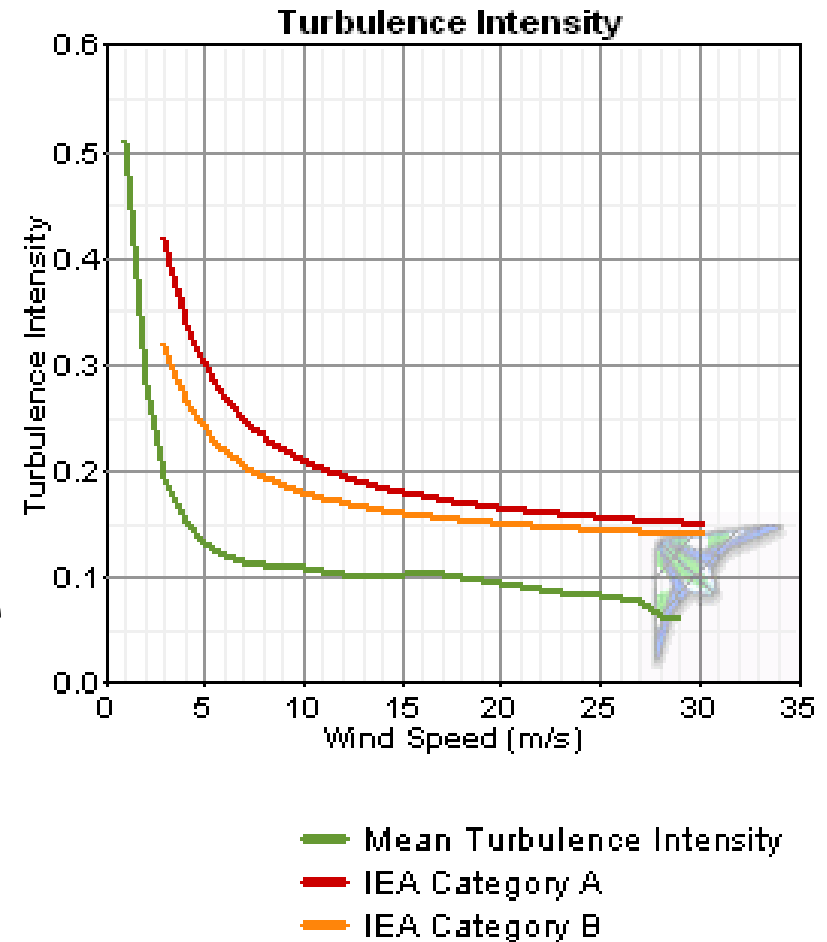
Wind Rose



Turbulence Intensity

$$TI = \frac{SD_{\text{windspeed}}}{AVE_{\text{windspeed}}}$$

- <0.15 Low
- 0.15 to 0.25 Moderate
- > 0.25 High



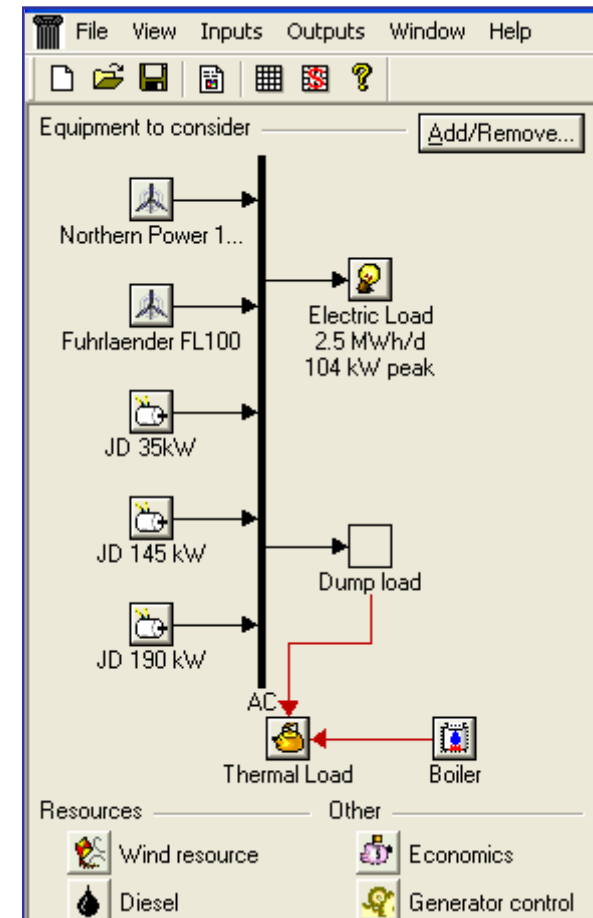
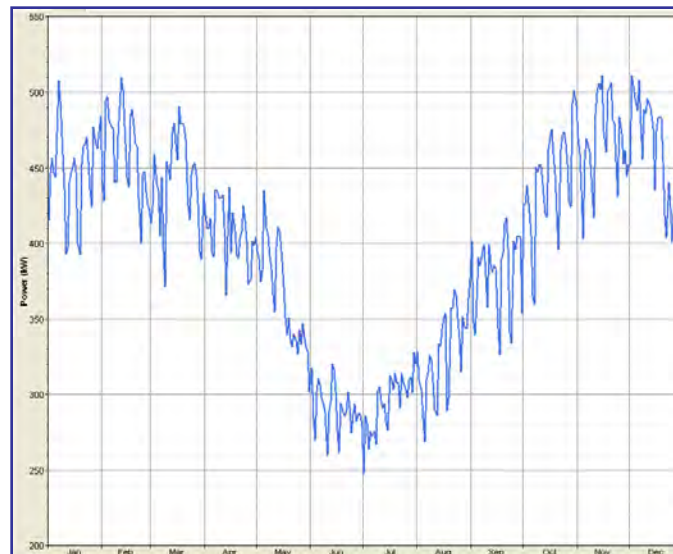
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Feasibility Studies

- How many wind turbines?
- What kind of wind turbines?
- How much fuel would be saved?
- What's the payback?



Computer Models

- RETScreen (www.etscreen.net)
- Hybrid2 (www.ceere.org)



HOMER

THE OPTIMIZATION MODEL FOR DISTRIBUTED POWER

- Available FREE at www.nrel.gov/homer
- Developed by the National Renewable Energy Laboratory

Wind Energy Program Website

Address <http://www.akenergyauthority.org/programwind.html>

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www.akenergyauthority.org/programwind.html

Wind Programs

>> Wind Energy Program

AEA's wind energy program provides information and technical assistance, wind monitoring equipment, and educational opportunities for Alaskans interested in this increasingly viable energy source.

Anemometer Loan Program
(equipment for onsite monitoring of wind resource)

Resource Assessment Data
(get data files and reports of wind data measured at various locations across the state)

Wind Map
(find out the power potential of your location on the wind resource map)



(AVEC NW 100 in Kasigluk)