Aleutian Pribilof Islands Wind Feasibility and Energy Weatherization and Training

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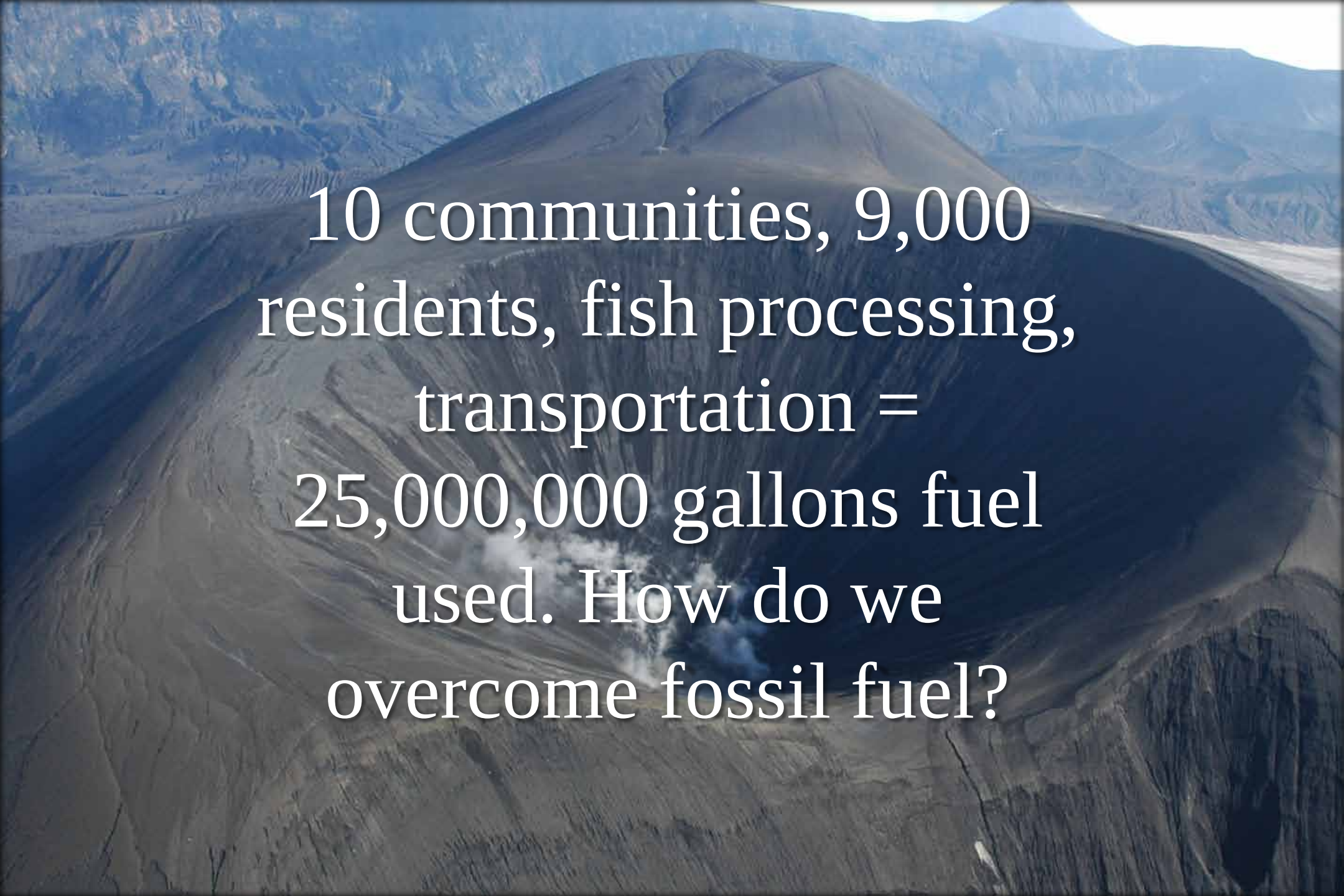
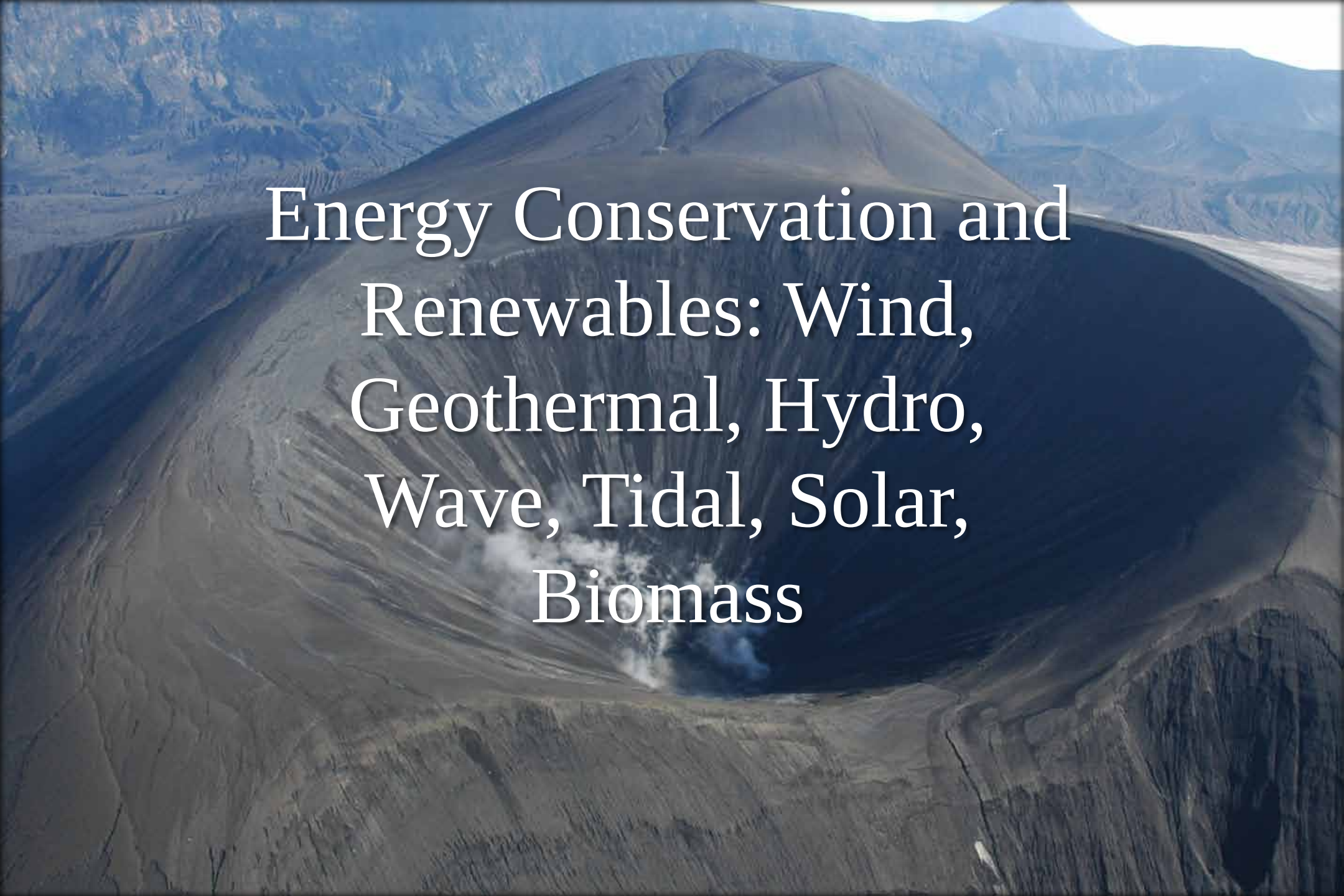
2005 Wind Feasibility Studies: False Pass, Nikolski Sand Point, St. George, and Current Wind Energy Development Status

Communities	KwH Cost	KwH (1,000,000)	Diesel Demand (1,000 gals)	KwHs Per Gallon
King Cove	0.26	3.79	162	23
Akutan	0.32	0.52	44	12
Unalaska	0.36	34.48	2,194	16
False Pass	0.42	N/A	N/A	N/A
St. Paul	0.46	4.59	389	12
Sand Point	0.52	4.03	317	13
AVERAGE	**0.53**	**2.21**	**177**	**14**
Nikolski	0.60	N/A	N/A	N/A
Cold Bay	0.64	2.53	213	12
Adak	0.71	1.54	213	7
Nelson Lagoon	0.74	0.38	33	12
Atka	0.77	0.35	42	8

KwH Cost: Data from the State's FY09 annual PCE reports.
KwH Sold: Same data source. Kilowatt hours of energy sold, not total hours generated. Express in KwH millions.
Diesel Demand (gals): Same data source. Amount of diesel fuel by gallons (thousands) required to produce total KwHs sold.
KwHs Per Gallon: Same data source. The relatively high KwH Per Gallon in King Cove is directly related to more than 50% of KwHs sold are produced by the Delta Creek Hydroelectric facility.
AVERAGE: Due to the magnitude of the Unalaska power generation facility, their data has not been included in this category.

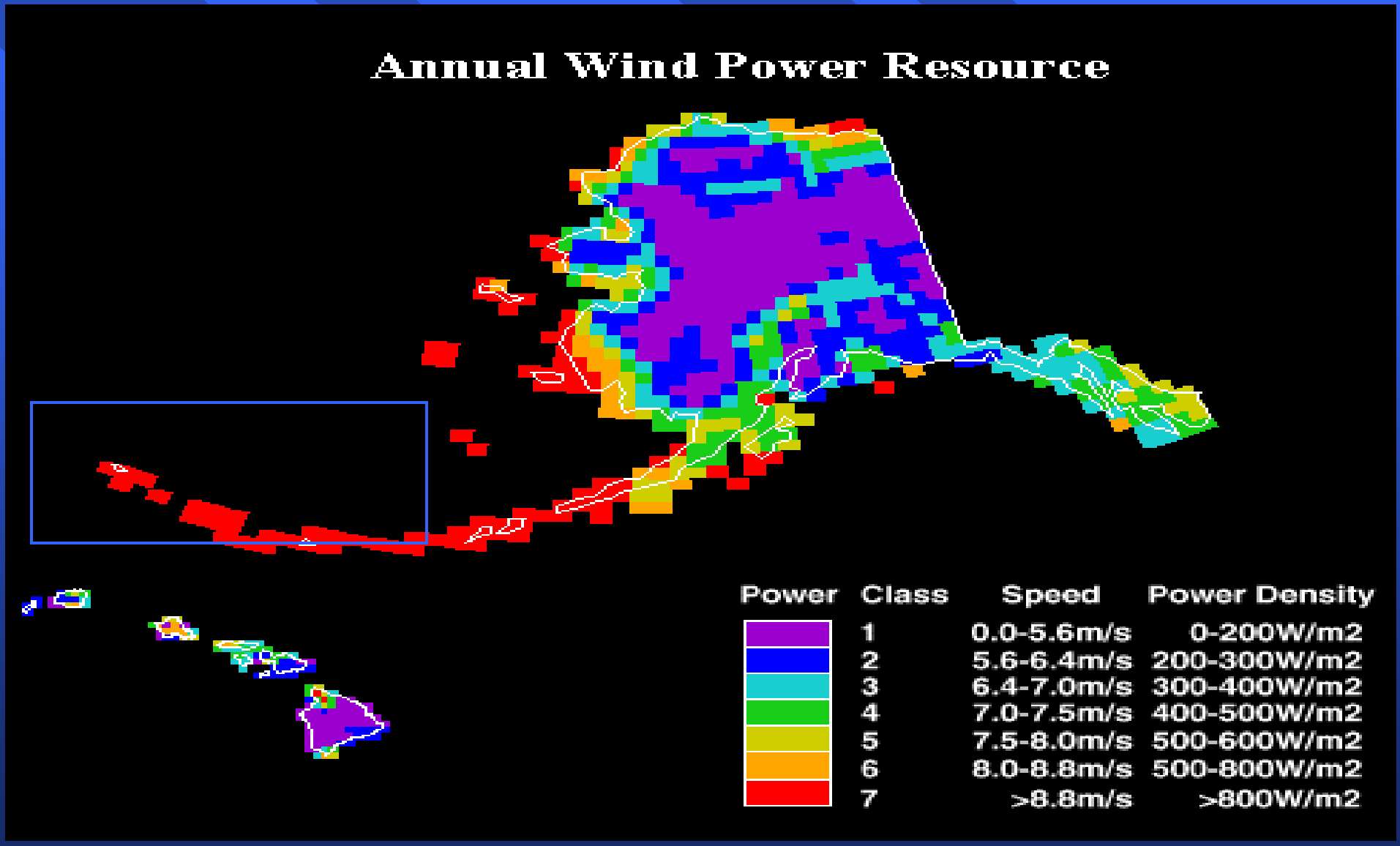
National average $0.1021/KwH
Denver average $0.085/KwH
Anchorage average $0.14/KwH

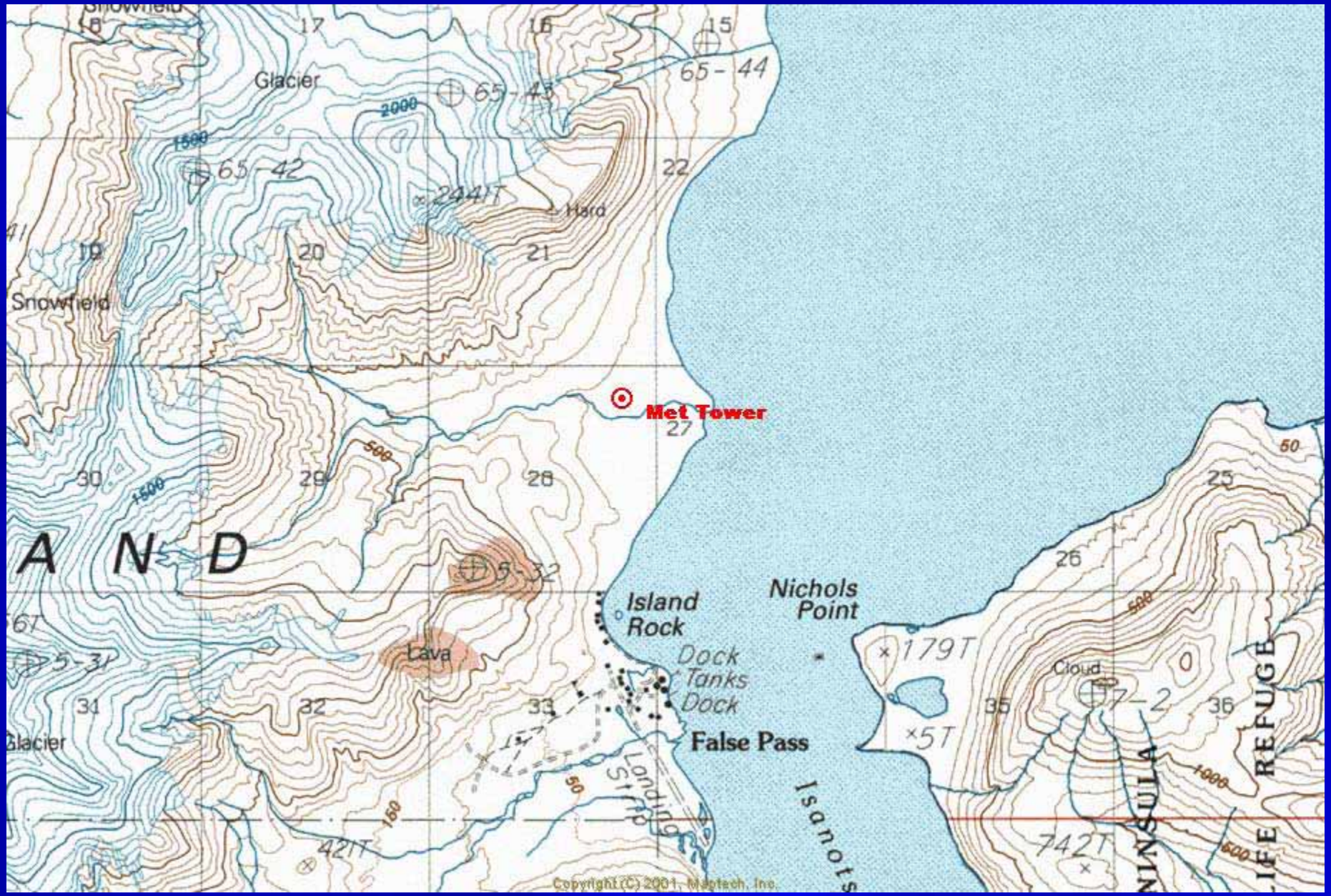

10 communities, 9,000 residents, fish processing, transportation = 25,000,000 gallons fuel used. How do we overcome fossil fuel?



Energy Conservation and Renewables: Wind, Geothermal, Hydro, Wave, Tidal, Solar, Biomass

World Class Wind: Aleutian and Pribilof Islands




Glacier
65 - 43
65 - 44
65 - 42
2000
1500
2441T
Hard
Snowfield
Met Tower
A N D
5-32
5-31
Island Rock
Nichols Point
Lava
Dock
Tanks
Dock
False Pass
Landing
Isanots
179T
Cloud
7-2
5T
742T
421T
Glacier
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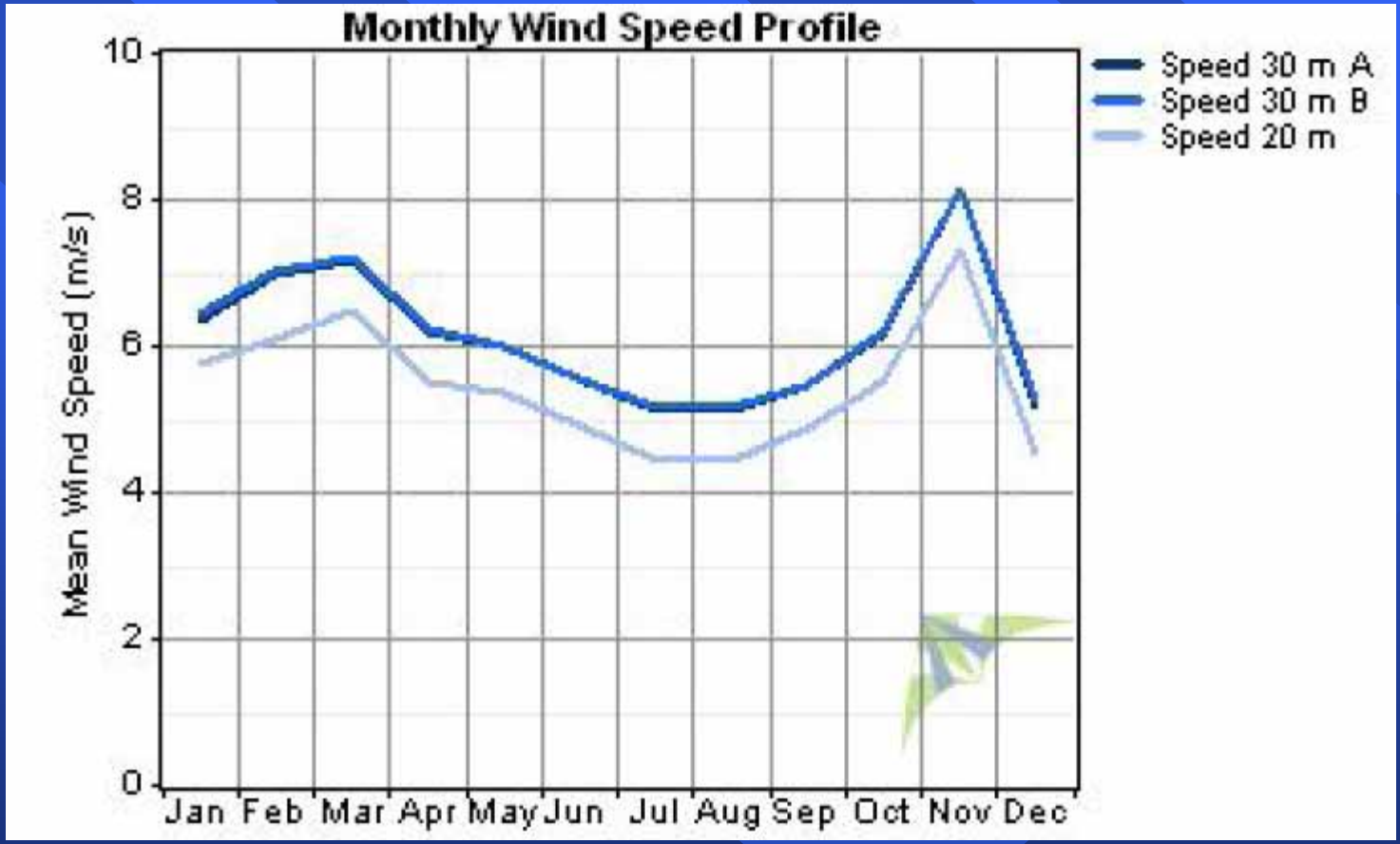
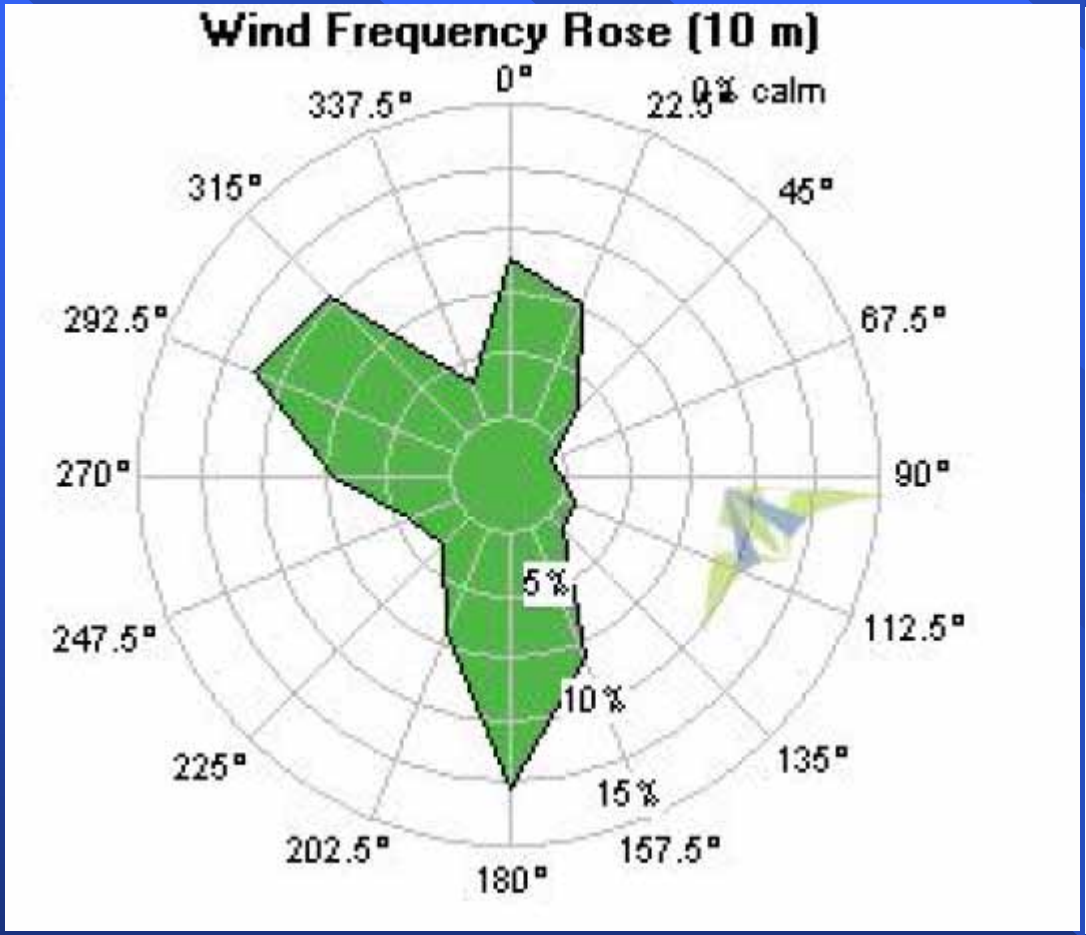
FALSE PASS

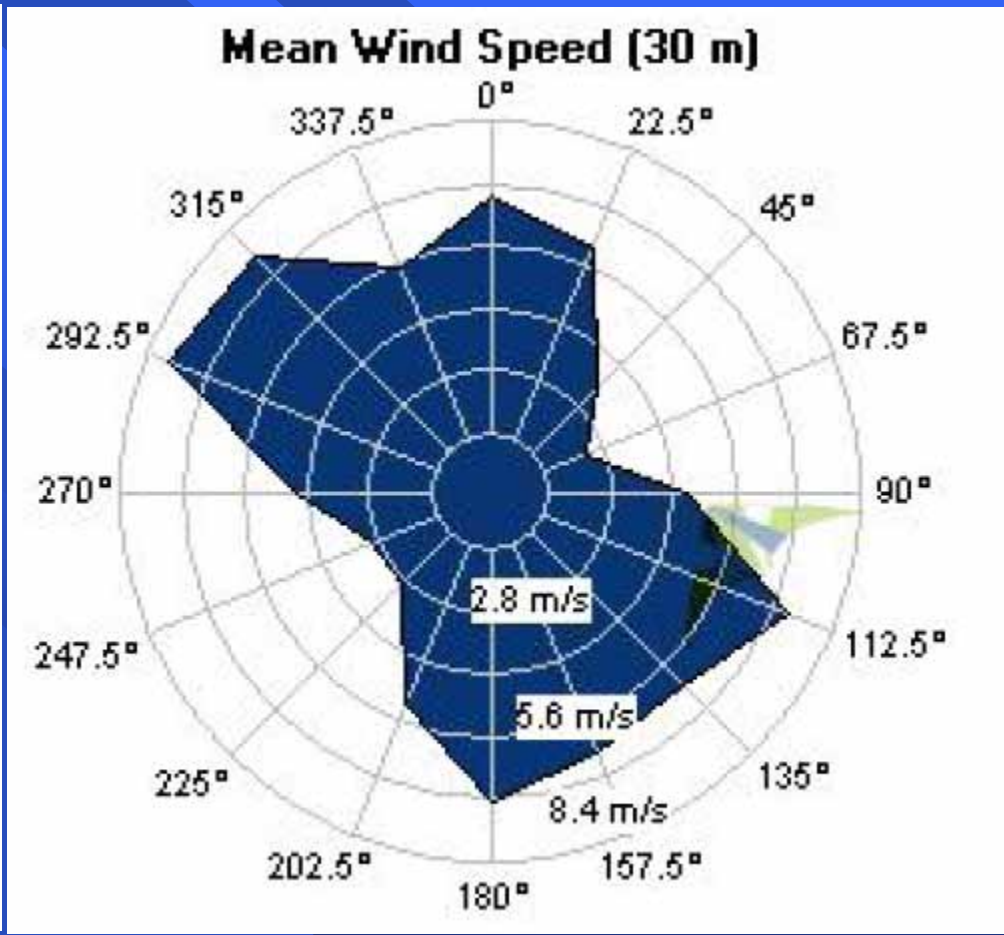
A bear chewed through wiring in July 2005, delaying data collection.

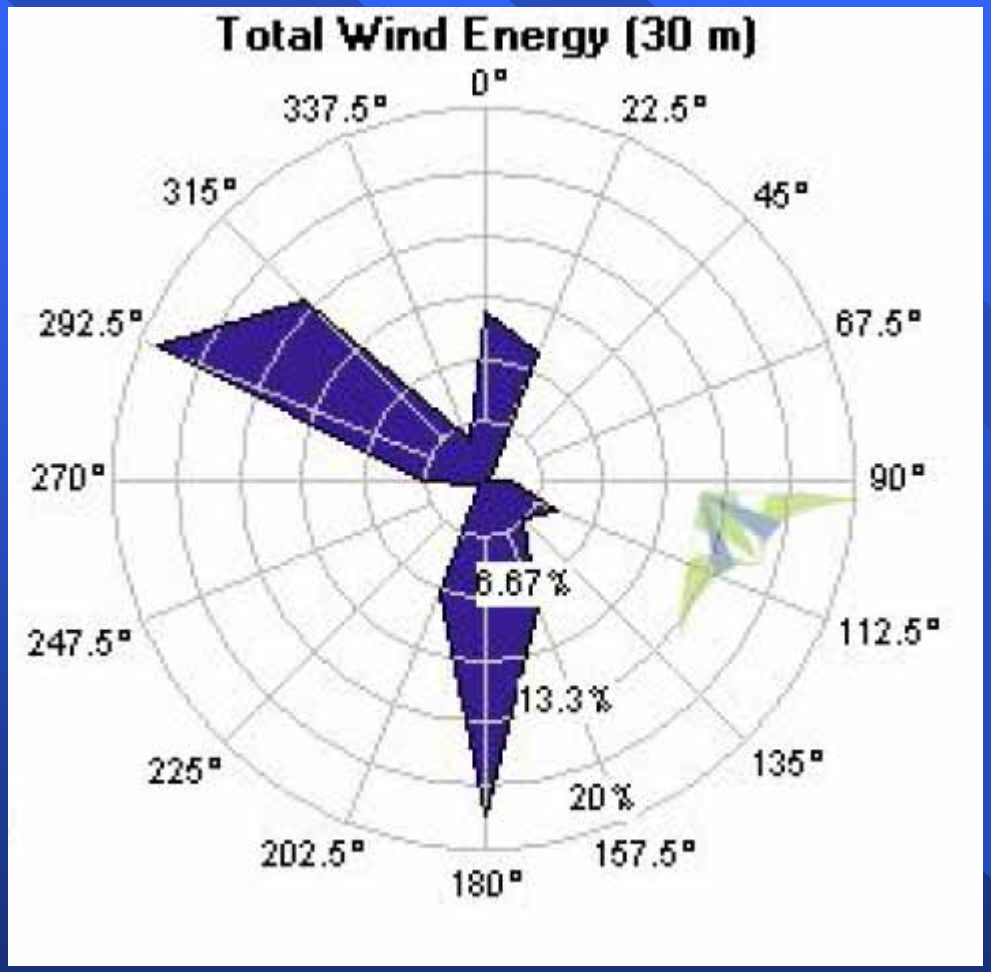
Mia Devine and George Jackson raise the data logger.

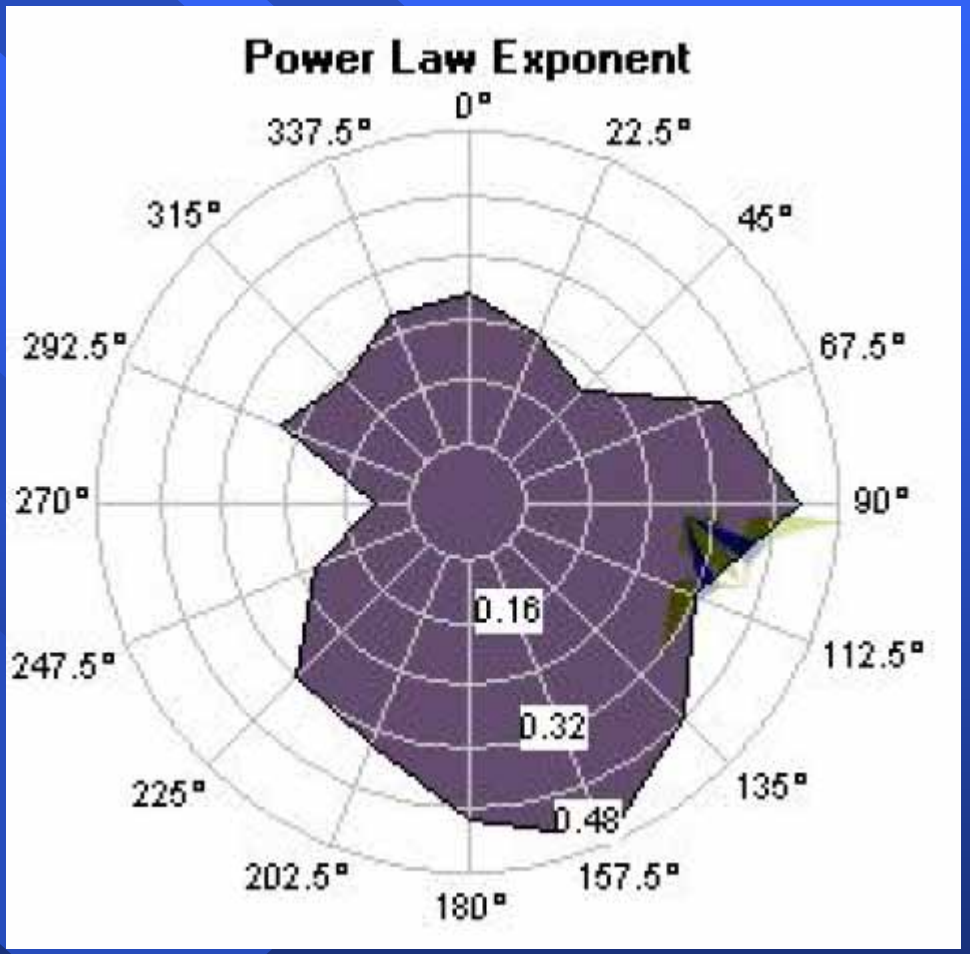
Raising the data logger to 25’ in November 2005 prevented repeat damage. But attempts to install the predator proof fence around the tower (required by USFWS) were abandoned after persistent bear “intervention”.

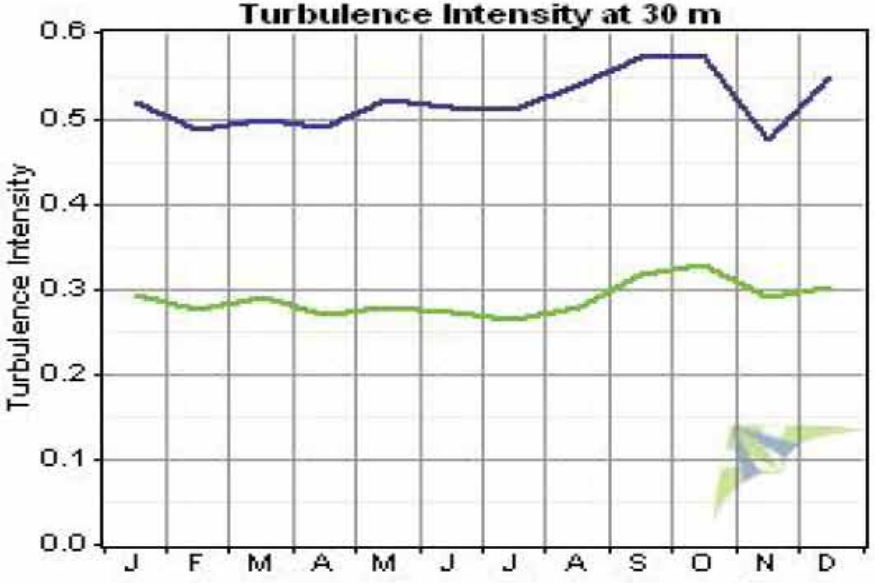

Monthly Wind Speed Profile
Mean Wind Speed (m/s)
10
8
6
4
2
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Speed 30 m A
Speed 30 m B
Speed 20 m

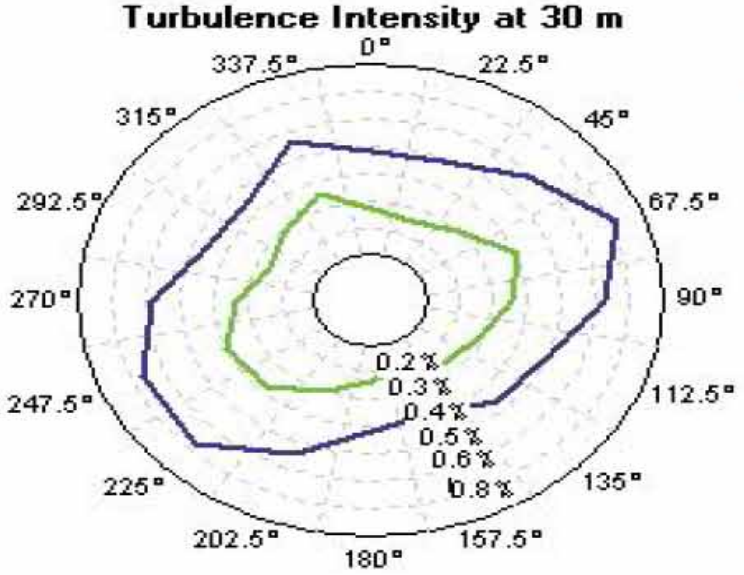

Wind Frequency Rose (10 m)
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
0% calm
5%
10%
15%

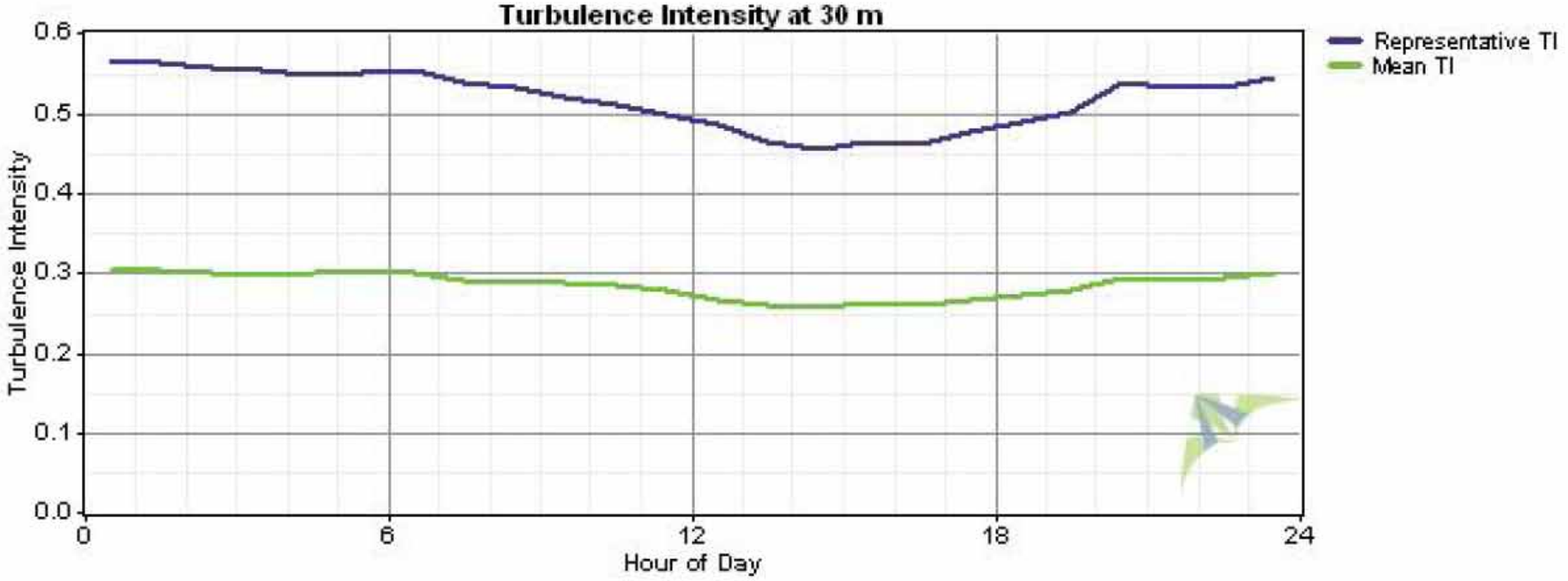

Mean Wind Speed (30 m)
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
2.8 m/s
5.6 m/s
8.4 m/s


Total Wind Energy (30 m)
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
6.67%
13.3%
20%


Power Law Exponent
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
0.16
0.32
0.48

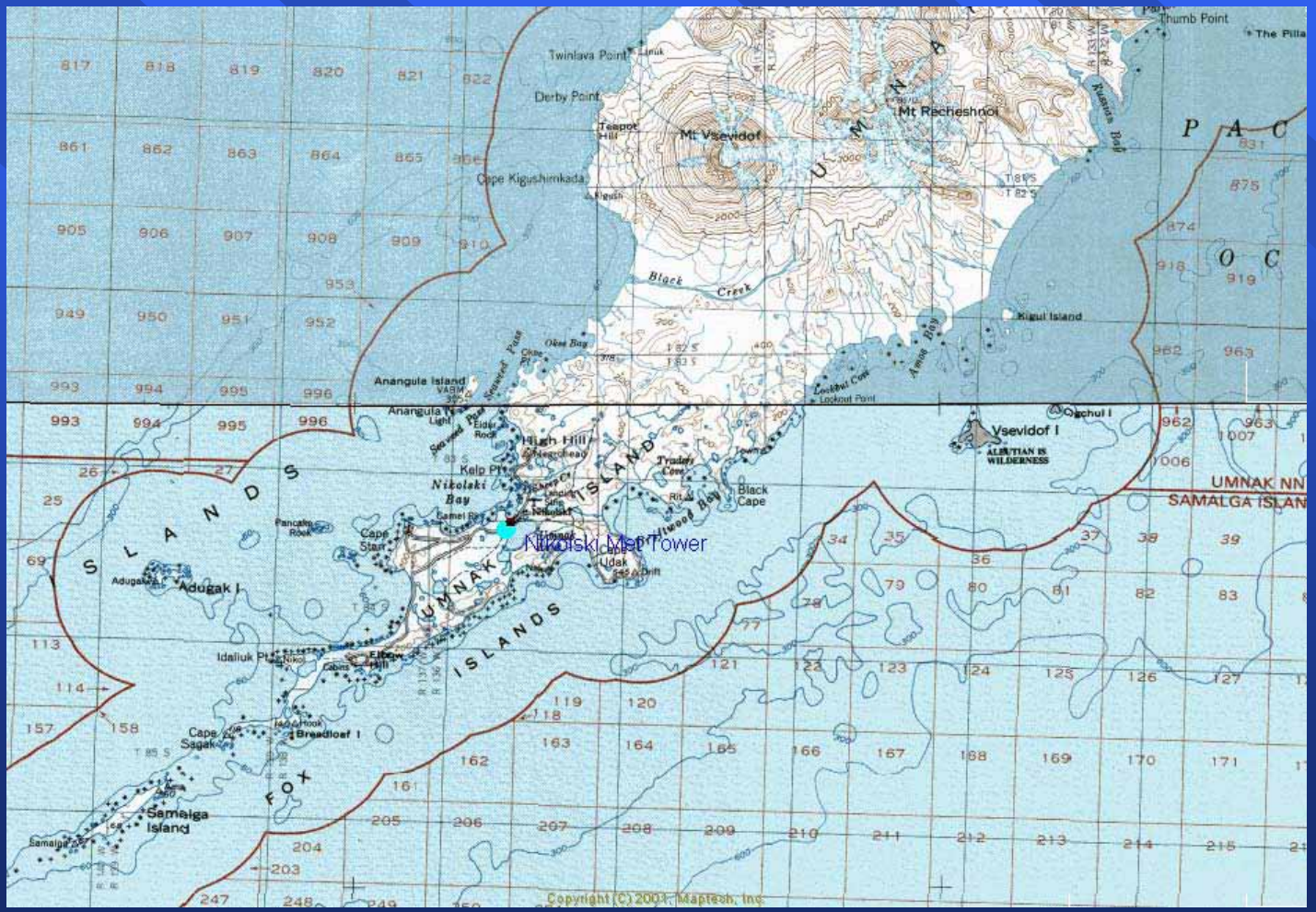

Turbulence Intensity at 30 m
Turbulence Intensity
0.6
0.5
0.4
0.3
0.2
0.1
0.0
J F M A M J J A S O N D


Turbulence Intensity at 30 m
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
0.2%
0.3%
0.4%
0.5%
0.6%
0.8%
Representative TI
Mean TI


Turbulence Intensity at 30 m
Turbulence Intensity
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
6
12
18
24
Hour of Day
Representative TI
Mean TI

Wind or Tidal?

Nikolski


Twinlava Point
Derby Point
Teapot Hill
Mt Vsevidof
Mt Recheshnoi
Cape Kigushimkada
Black Creek
Kigul Island
Anangula Island
Anangula Pt
Hush Hill
Kelp Pt
Nikolski Bay
Trader Cove
Black Cape
Nikolski Met Tower
Vsevidof I
ALEUTIAN IS WILDERNESS
Adugak I
Idaliuk Pt
Cape Sagak
Breadloaf I
Samalga Island
UMNAK ISLAND
FOX ISLANDS
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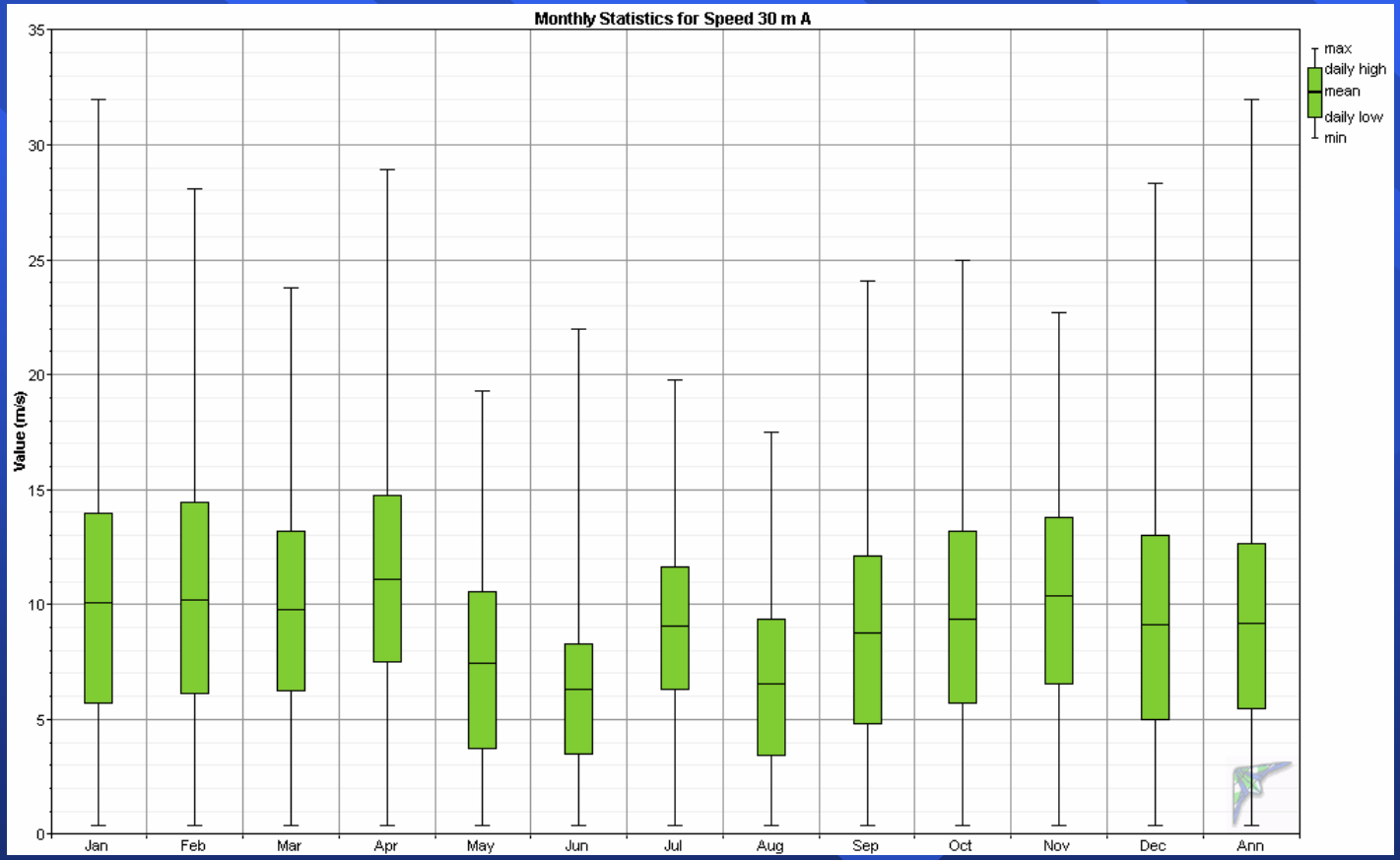
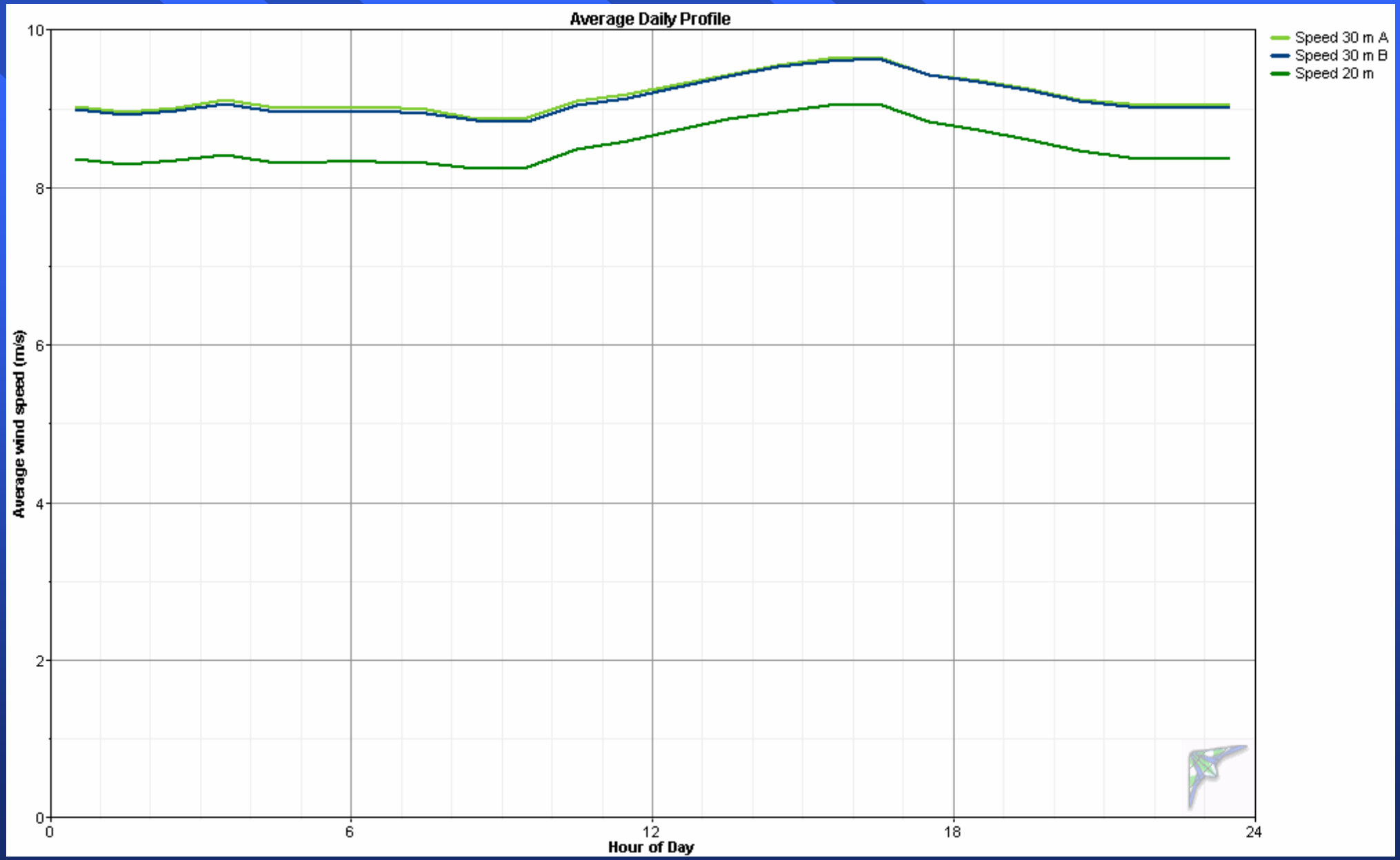
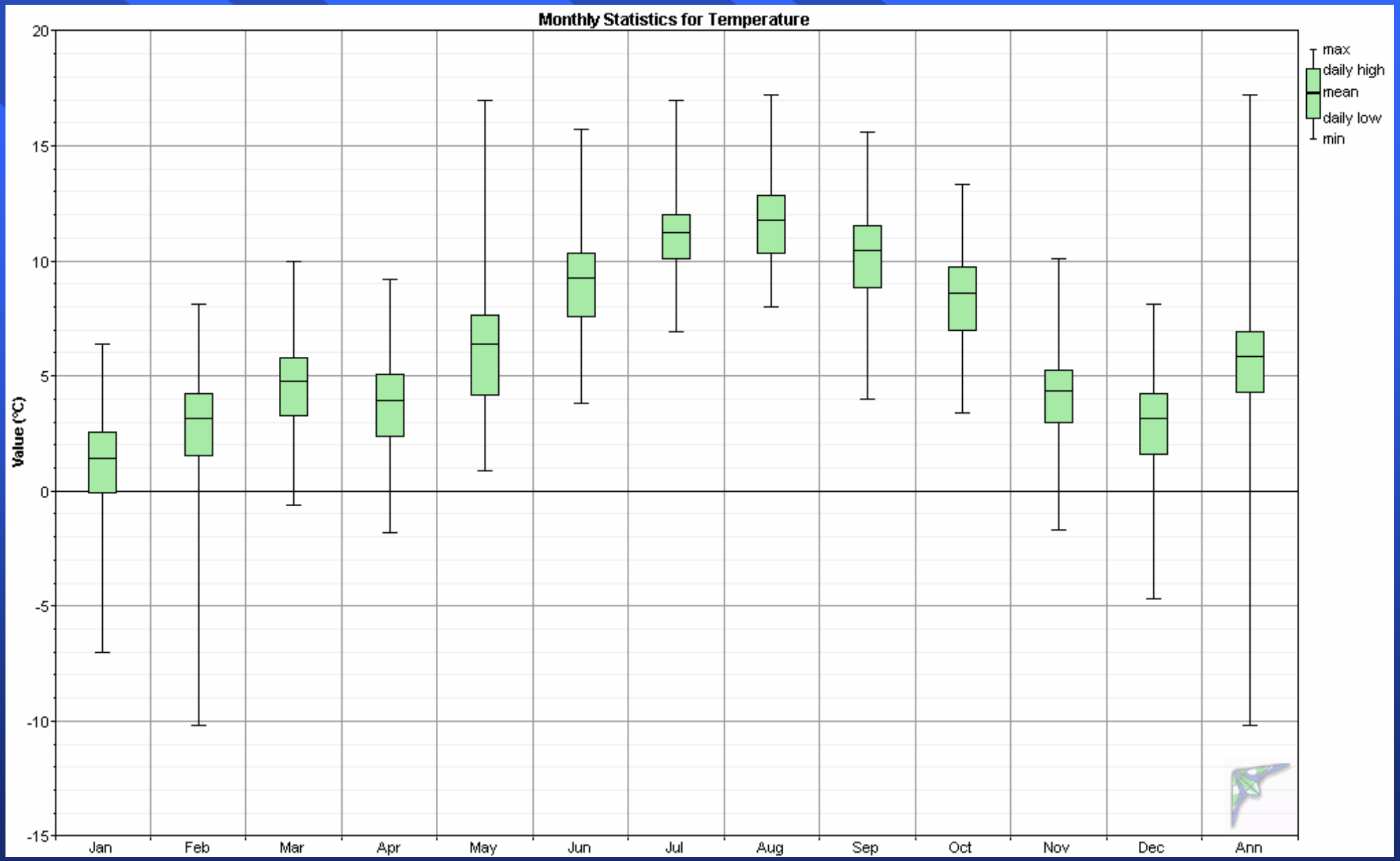
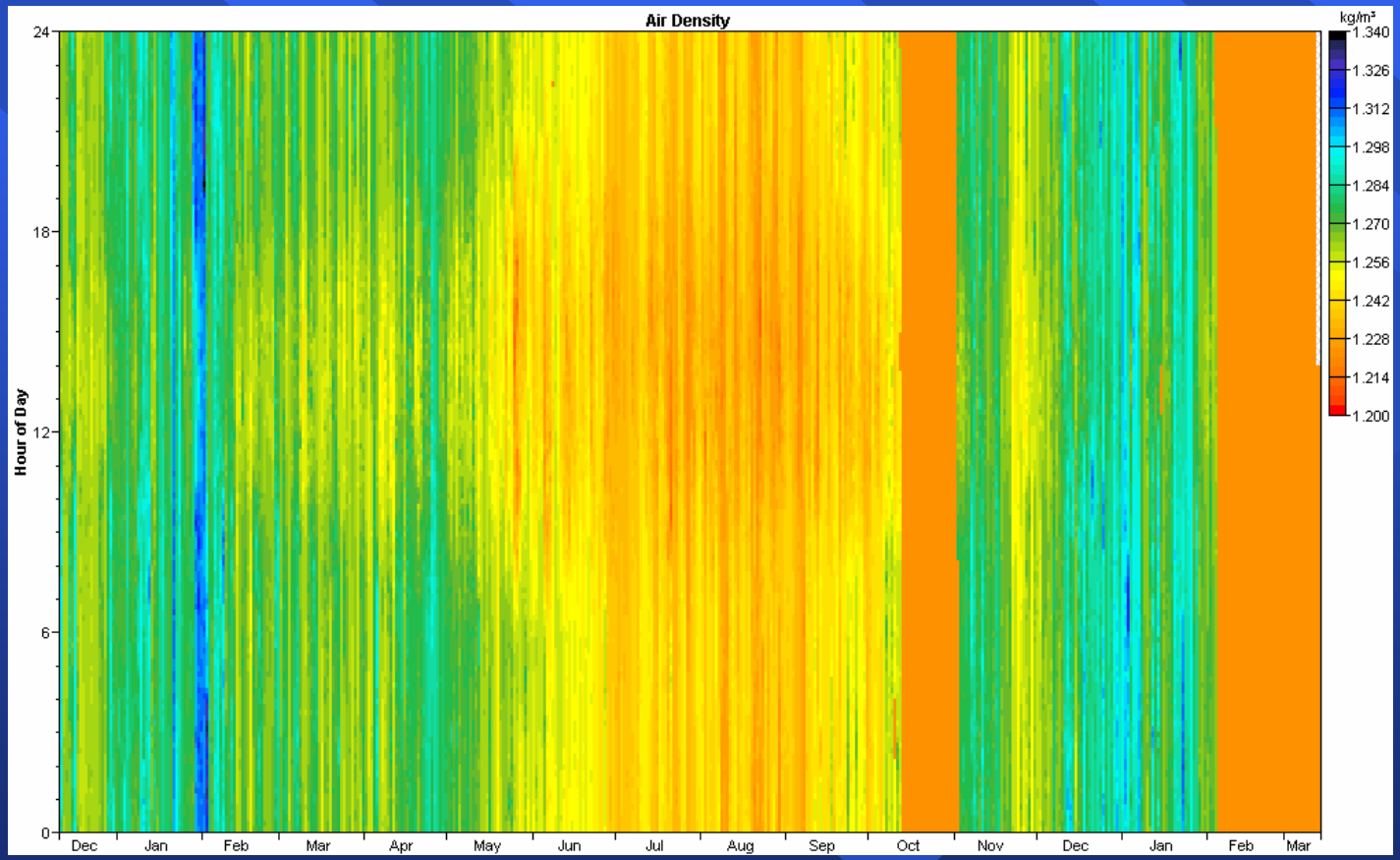
Average Wind Speed 9.01m/s



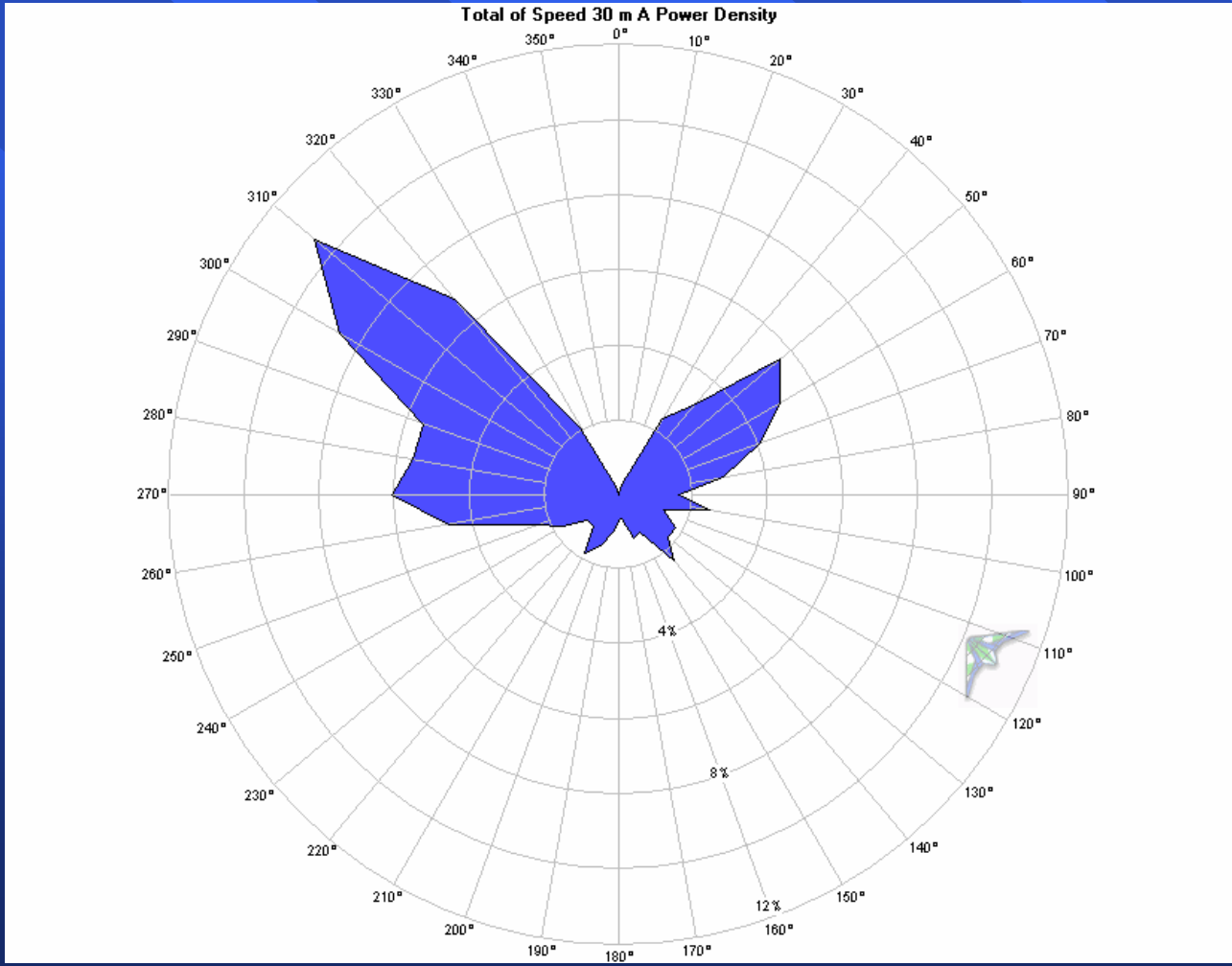

Average Daily Profile
Speed 30 m A
Speed 30 m B
Speed 20 m
Average wind speed (m/s)
10
8
6
4
2
0
0
6
12
18
24
Hour of Day


Monthly Statistics for Temperature
Value (°C)
20
15
10
5
0
-5
-10
-15
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Ann
max
daily high
mean
daily low
min

Air Density Map

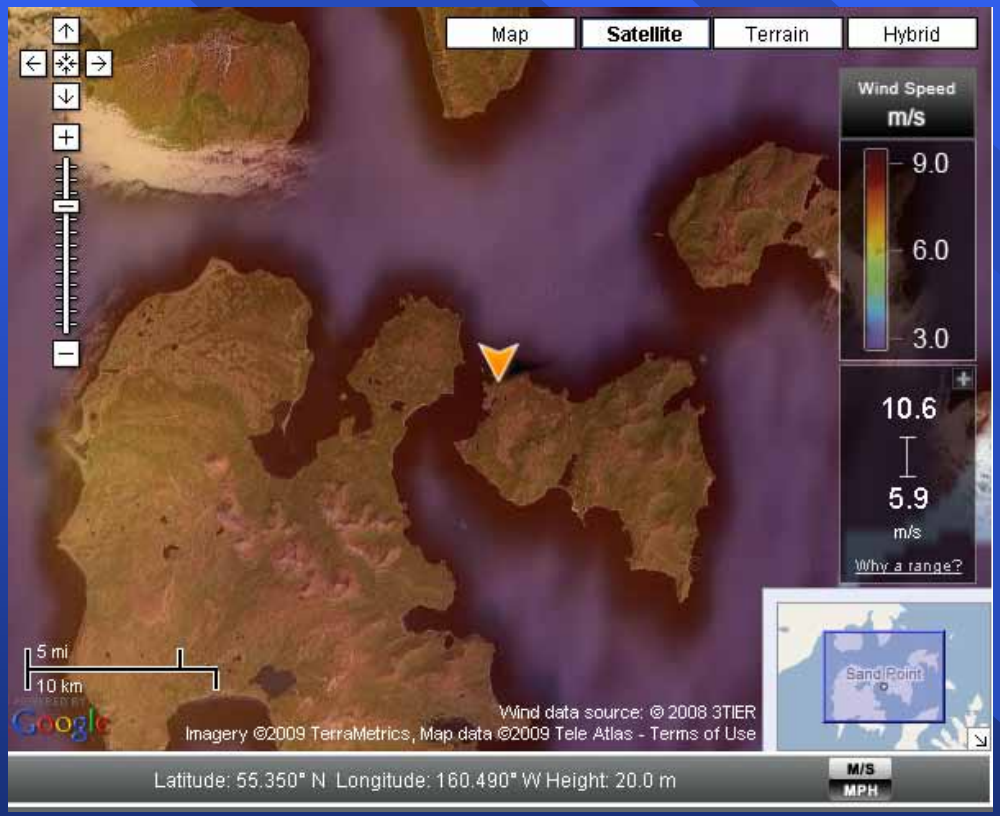


Power Density Rose at 30m



- Population 30
- 2010 kWh generated = 243,043
- Integrate the 65kW wind turbine with the 179 kW diesel plant
- Install hot water “dump loads” in the Lodge and School
- Install Waste Heat Recovery System to Community Center
- Peak Load 90kW
- Projected fuel savings: 15,500 gal./yr.

Sand Point


Map
Satellite
Terrain
Hybrid
Wind Speed
m/s
9.0
6.0
3.0
10.6
5.9
m/s
Why a range?
5 mi
10 km
Sand Point
Wind data source: © 2008 3TIER
Imagery ©2009 TerraMetrics, Map data ©2009 Tele Atlas - Terms of Use
Latitude: 55.350° N Longitude: 160.490° W Height: 20.0 m
M/S
MPH


N55.39°
N55.37°
N55.35°
N55.33°
N55.31°
W160.59°
W160.57°
W160.55°
W160.53°
W160.51°
W160.49°
W160.47°
W160.45°
W160.43°
W160.41°
W160.39°
Sand Point Anemometer
Sand Point
Sand Point Reference Site
Google

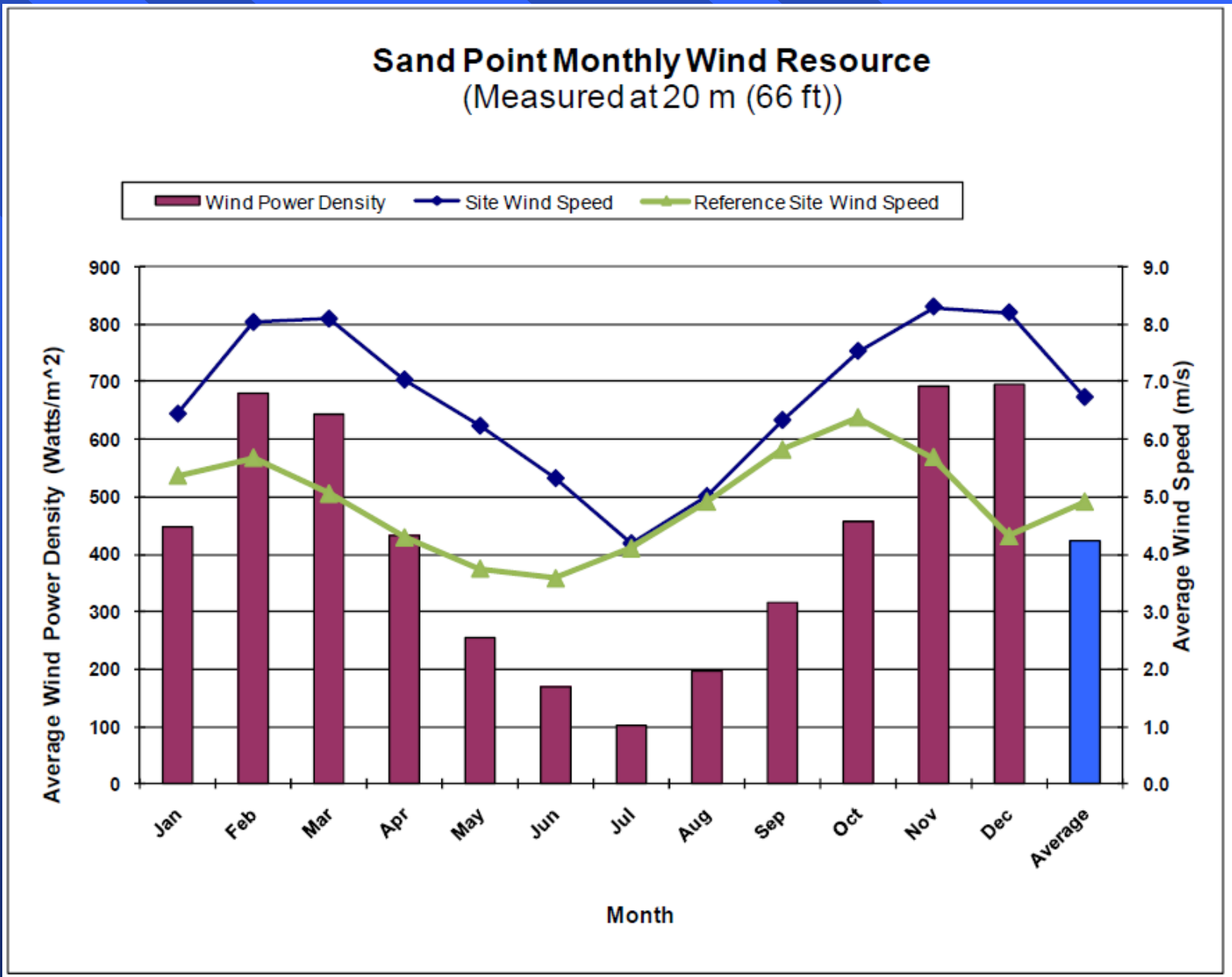


Figure 6: Monthly average and annual average wind power density and wind speed.

Wind Frequency and Power Direction

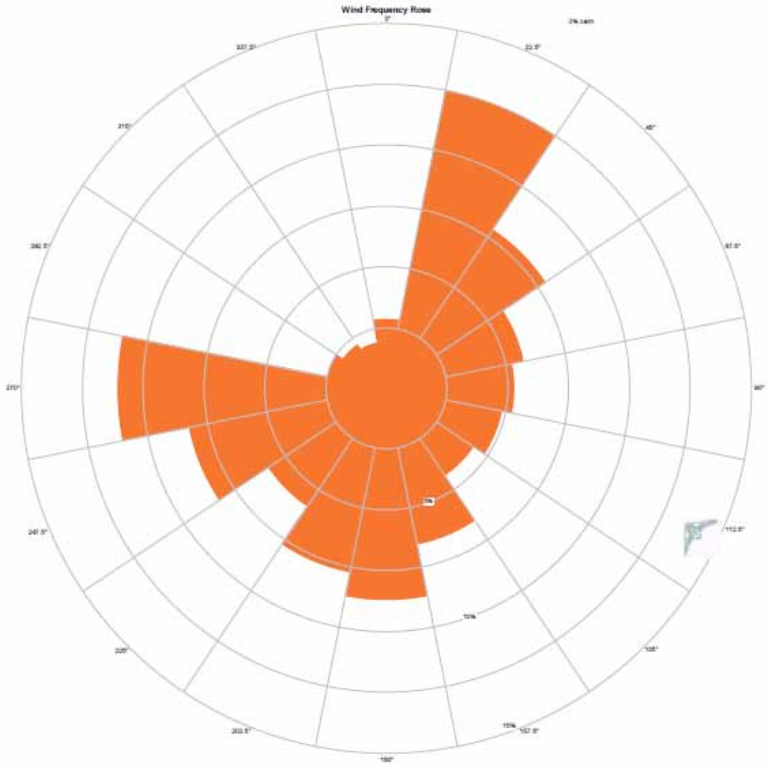


Figure 8A: Frequency by direction.

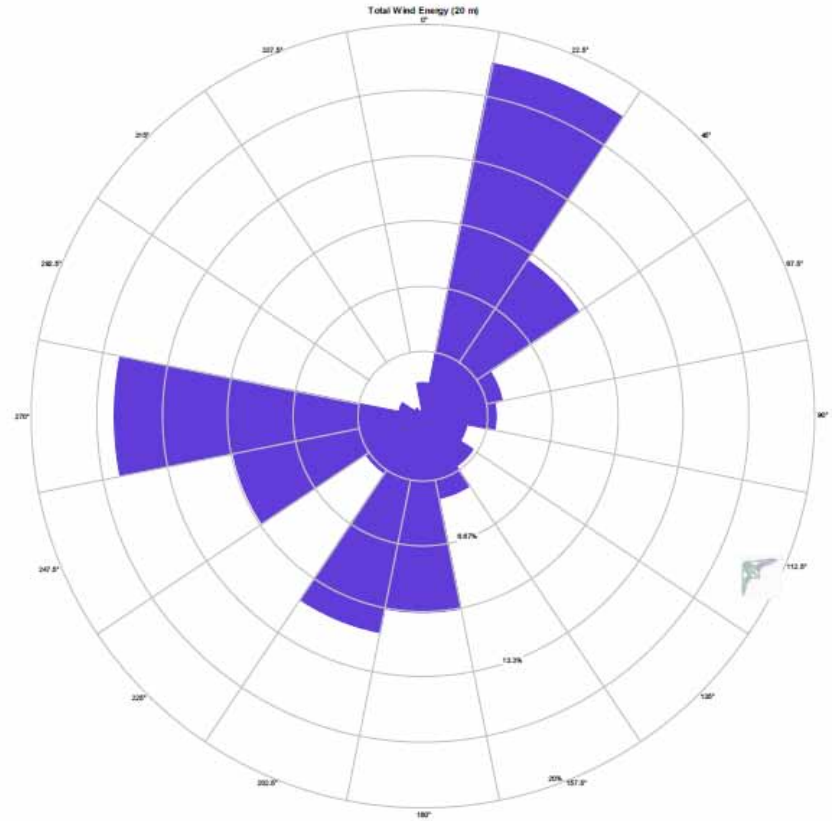
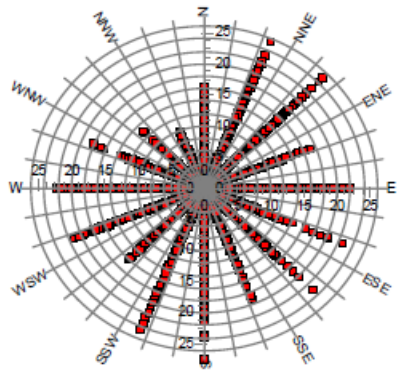


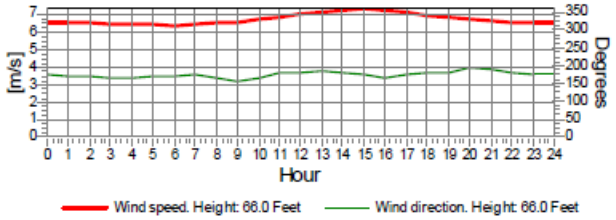
Figure 8B: Energy by direction.

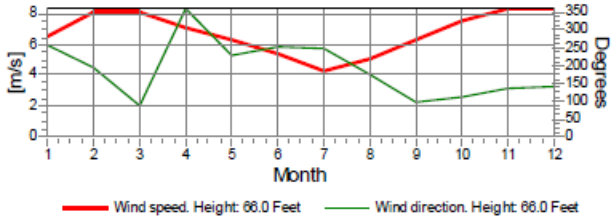


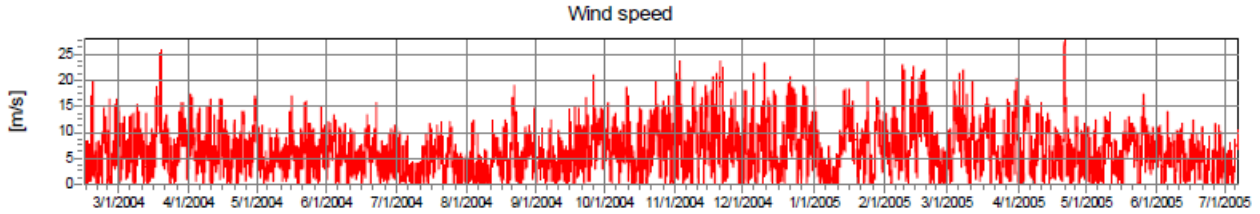
Wind speed [m/s]

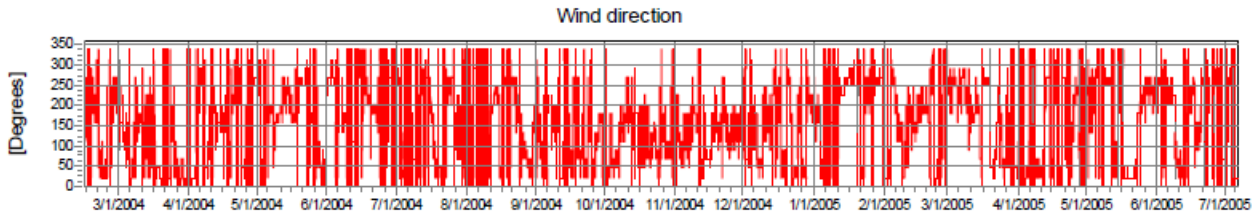
Monthly mean values of wind speed in m/s

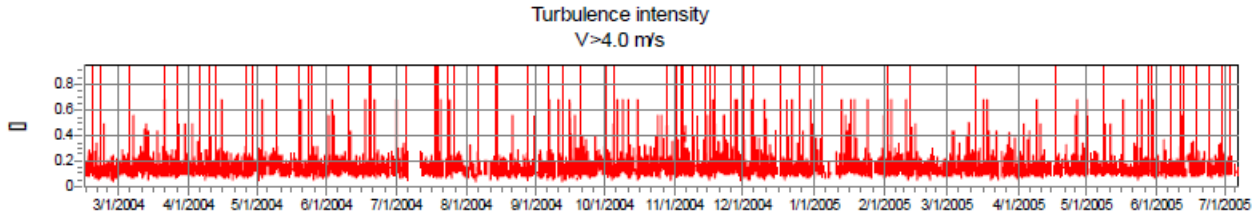
Month	2004	2005	mean	mean of months
Jan		6.5	6.5	6.5
Feb	6.5	8.9	8.0	7.7
Mar	7.8	8.5	8.1	8.1
Apr	7.2	7.0	7.1	7.1
May	5.8	6.7	6.3	6.3
Jun	5.7	5.1	5.4	5.4
Jul	4.3	4.2	4.3	4.2
Aug	5.0		5.0	5.0
Sep	6.3		6.3	6.3
Oct	7.5		7.5	7.5
Nov	8.3		8.3	8.3
Dec	8.3		8.3	8.3
mean, all data	6.6	7.0	6.8	
mean of months	6.6	6.7		6.7











	Average Wind Speed (m/s)	Average Power Density (W/m^2)
Average Annual Wind Speed & power density	6.7 m/s (14.9 mph)	424 W/m^2
Average wind speed & power density for best month (December)	8.2 m/s (18.2 mph)	694 W/m^2
Average wind speed & power density for worst month (July)	4.2 m/s (9.3 mph)	101 W/m^2
Estimated Resource @ 50 meters	7.6 m/s (16.9 mph)	640 W/m^2

Figure 5: Wind Data Summary

SAND POINT
Population 958

Projected fuel savings 152,000 gal/yr.

A DOE required eagle study held up this project for 3 years. These 2 old turbines/eagle perches will be dismantled as a mitigating effort.

- 2 refurbished Vestas V39-500 kW wind turbines to be installed summer 2010.

- Excess electricity will go to hot water tanks in the school and clinic.

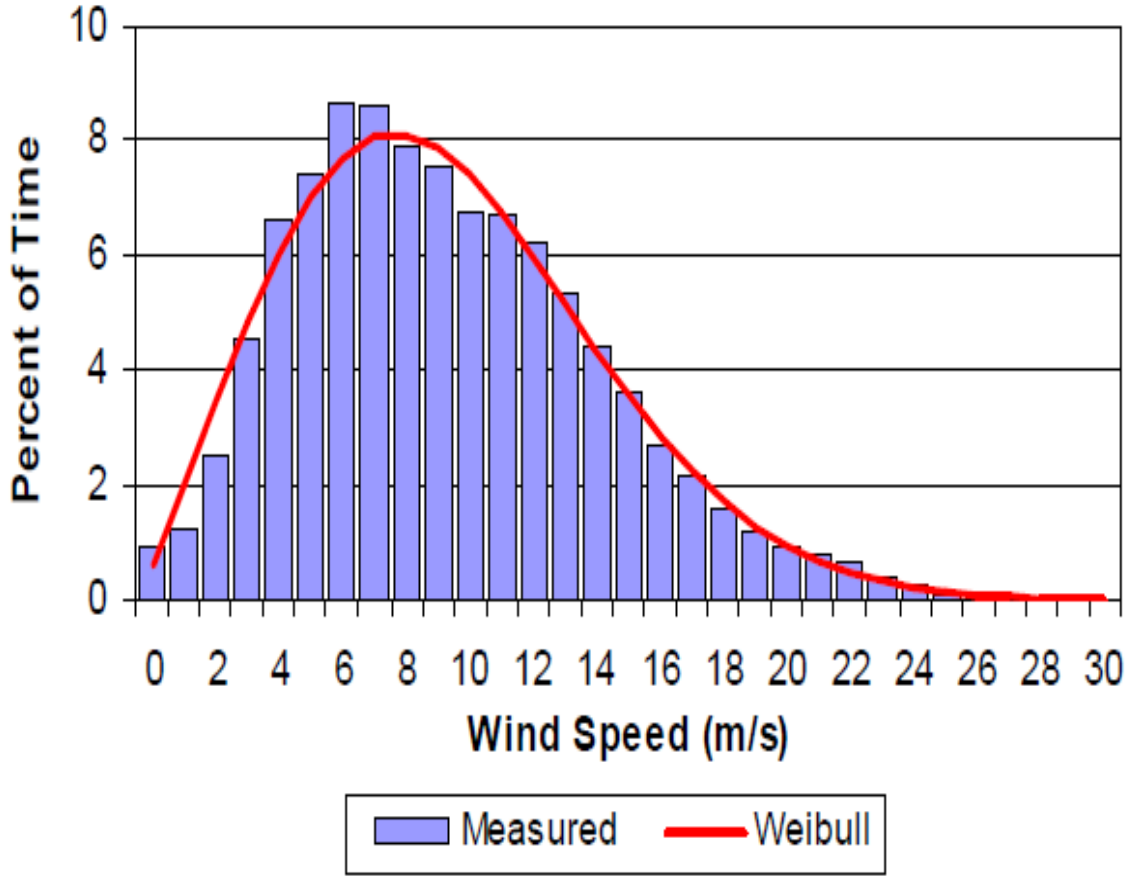
- Waste Heat Recovery System already supplements heat to the utility offices and apartments above.

St. George, Bering Sea

No trees here! Just a 30m met tower.

Table 2. Data Recovery Rates for St George Met Tower Data

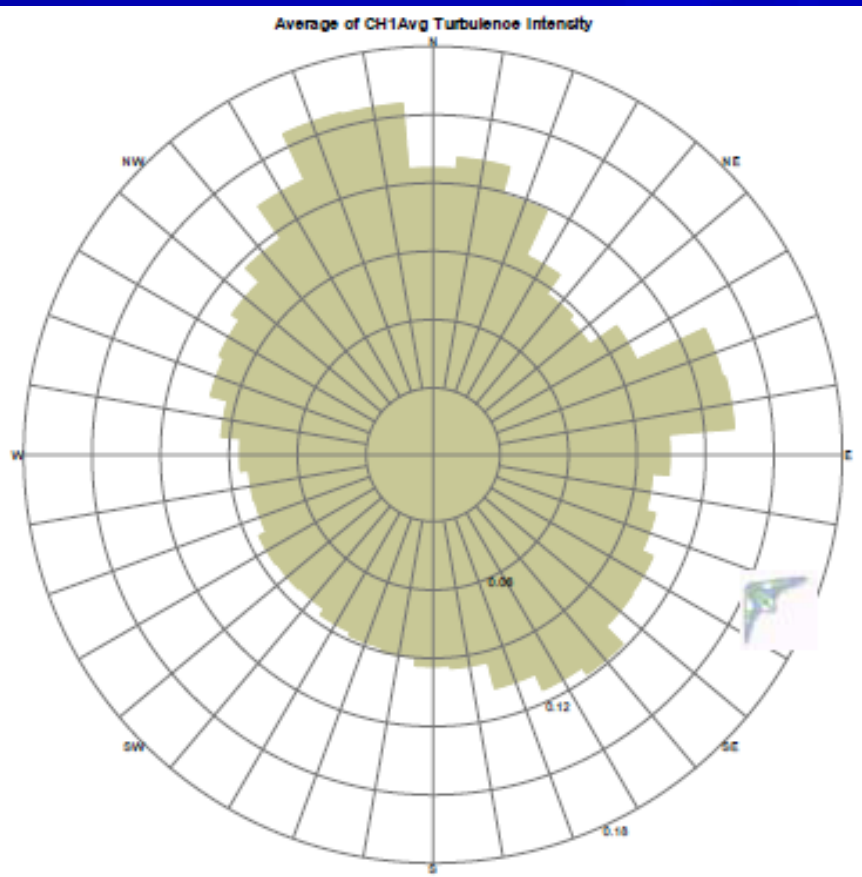
Month	% Data Recovered
January	100.0%
February	99.9%
March	99.7%
April	99.9%
May	100.0%
June	100.0%
July	100.0%
August	100.0%
September	100.0%
October	100.0%
November	100.0%
December	99.9%
Annual Avg	**100%**



Bin m/s	Measured Hours
0	83
1	112
2	221
3	400
4	580
5	651
6	760
7	757
8	691
9	661
10	594
11	586
12	546
13	465
14	387
15	317
16	239
17	189

Bin m/s	Measured Hours
18	140
19	106
20	79
21	68
22	55
23	37
24	22
25	9
26	4
27	1
28	0
29	1
30	1
31	1
32	0
33	0
34	0
Total:	8,760

Figure 2. Wind Speed Frequency Distribution of St George Met Tower Data, Sept 2004 – Oct 2005



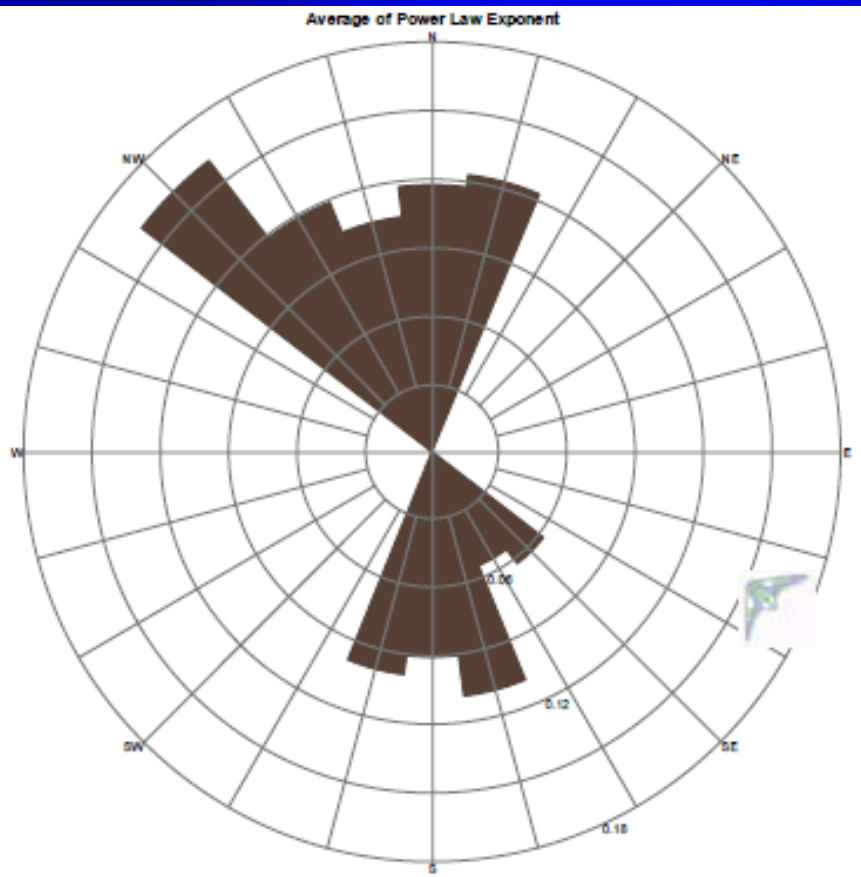


Figure 4. Turbulence Intensity and Wind Shear by Direction at St George Met Tower Site

Figure 5. ASOS Equipment in Saint George (source: Ed Doerr, NOAA)

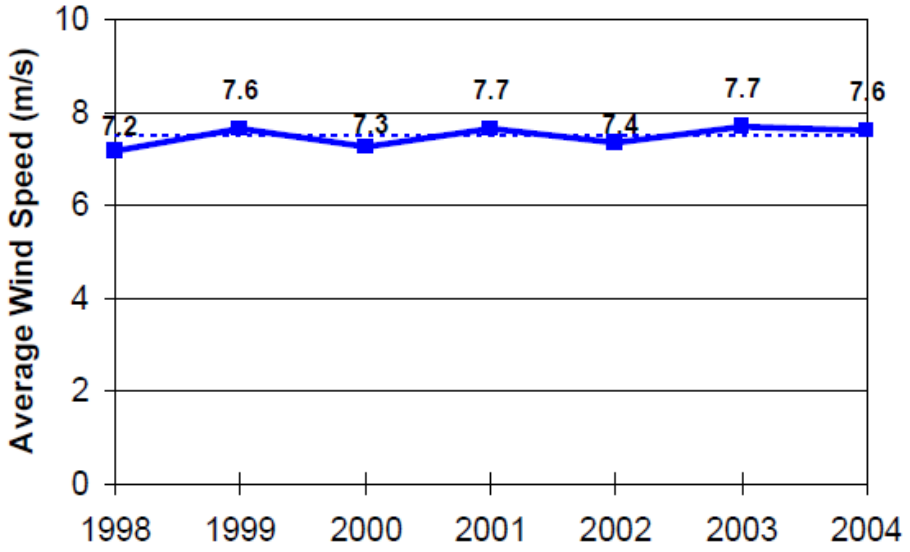


Figure 6. Annual Average Wind Speeds at Saint George Airport Weather Station, 10-m Height

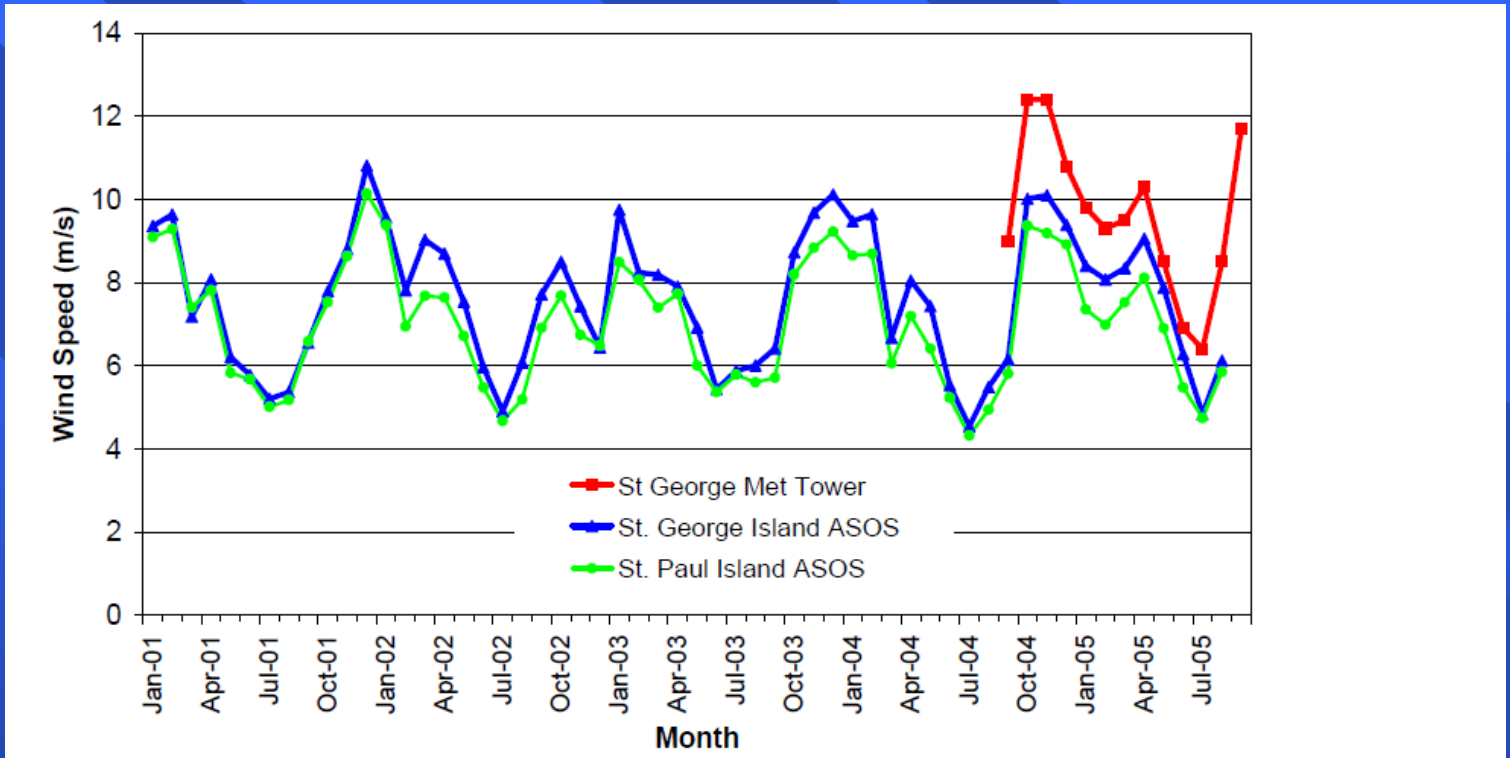


Figure 7. Comparison of Average Monthly Wind Speeds Between Met Tower and ASOS Measurements

Table 9. Summary of Power Production Potential of Saint George Met Tower Site

Average Wind Power Density (30m height)	921 W/m^2
Wind Power Class	7+
Rating	Superior

Energy Conservation

§Educate community members in region how to conserve energy

§Utilize local resources – IGAP, Tribal/City leadership to lead and coordinate conservation program activities.

§Motivate community members to conserve energy and be energy wise like the communities have become conscientious about recycling and cleaning up their community.

§Implement conservation programs; the continuation of AHA weatherization programs, APIA's conservation education project, development of energy efficient greenhouses for food production, and IGAP energy conservation projects.

§Raise awareness that Energy Conservation practices by consumers and weatherization improvements of structures reduce energy consumption.

APIA's Energy Conservation Education project:

- Trained and hired one technician for Akutan.
- Looking for other energy conservation technicians in our villages.
- Energy Conservation Workshops: King Cove, January 20-21

  Building science basics
  Airtightness
  Ice dams
  Lighting and appliances
  Heating and hot water
  Doors and windows
  Insulation
  Ventilation

- ***Objective 1:*** Identify and hire three part-time local community members that desire to learn weatherization techniques as Energy Technicians.

- ***Objective 2:*** Train Energy Technicians in methods of weatherization assistance and energy conservation.

- ***Objective 3:*** Develop an active listing of regional residential homes that require weatherization.

- ***Objective 4:*** Energy Technicians will perform weatherization on identified regional residential homes.

Water-saver shower heads	45
Toilet valve replacement kits	55
Water pipe insulation kits (4 each)	73
Toilet tank insulation liners	14
Hot water tank insulation kits	36
CFLs and LEDs	882
Window shrink kits	48
Cans spray foam	299
Door draft stoppers	62
Duct and weatherproof tapes	88
Plastic vapor barrier rolls	32
Door thresholds	18
Foam tape weather-stripping	116
Caulking tubes (silicone and paintable)	356
Electric foam outlet sealers	820


04.14.2011


DUAL

Energy Savers Tips Booklet being revised

If the total energy saved by installing these products is a 25% reduction (electrical and heating, both of which are usually produced by combustion of diesel fuel), and the average Alaska home produces 32,000 pounds of CO_2 each year, so we have saved about: 66 homes x 16 tons of CO_2 each year x .25 = 264 tons of CO_2 each year.

Nikolski energy efficient green house project for growing local food items. A proposal for a Sand Point greenhouse is being developed and Nikolski is considering purchasing a second.

Alternative Homes: Anaktuvuk Pass Prototype Home

St. Paul Pop. 450

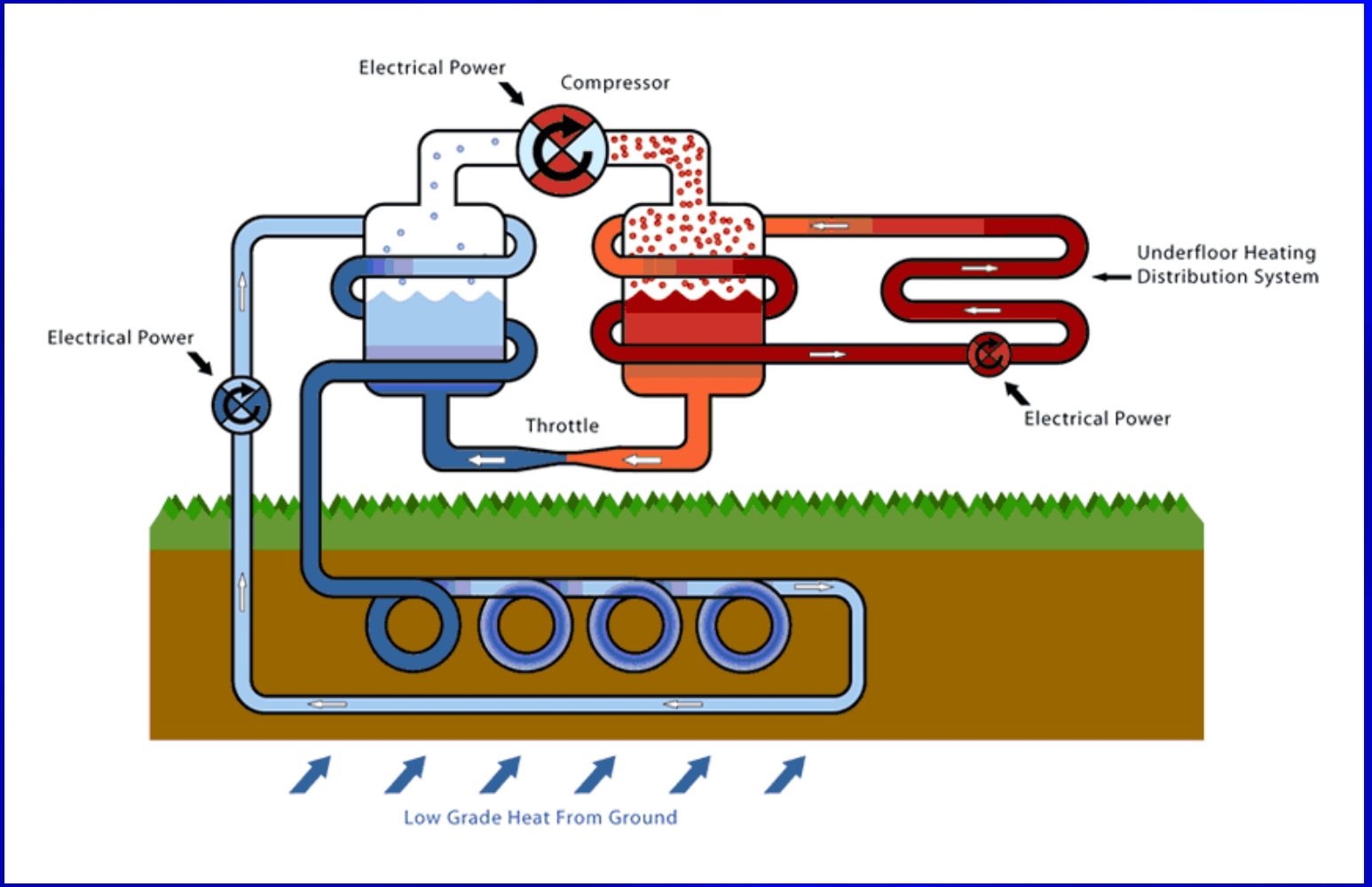
Vestas V27-225 kW wind turbines

Barefoot Motors Electric ATV

On Unalaska Island, near Mount Makushin a geothermal survey resulted in the drilling of a deep hole with temperatures exceeding 400ºF. The 4 inch diameter test hole was estimated to be able to produce as much as 4 MW of power.

Akutan wells encountered very high geothermal gradients, water and steam at 359 F, and all indications are that we have a production-quality resource in Hot Springs Bay Valley that will support our plan to develop a 10-12 Megawatt power system.

Unalaska and Akutan geothermal projects - district heating proposal.



The Atka hydro power

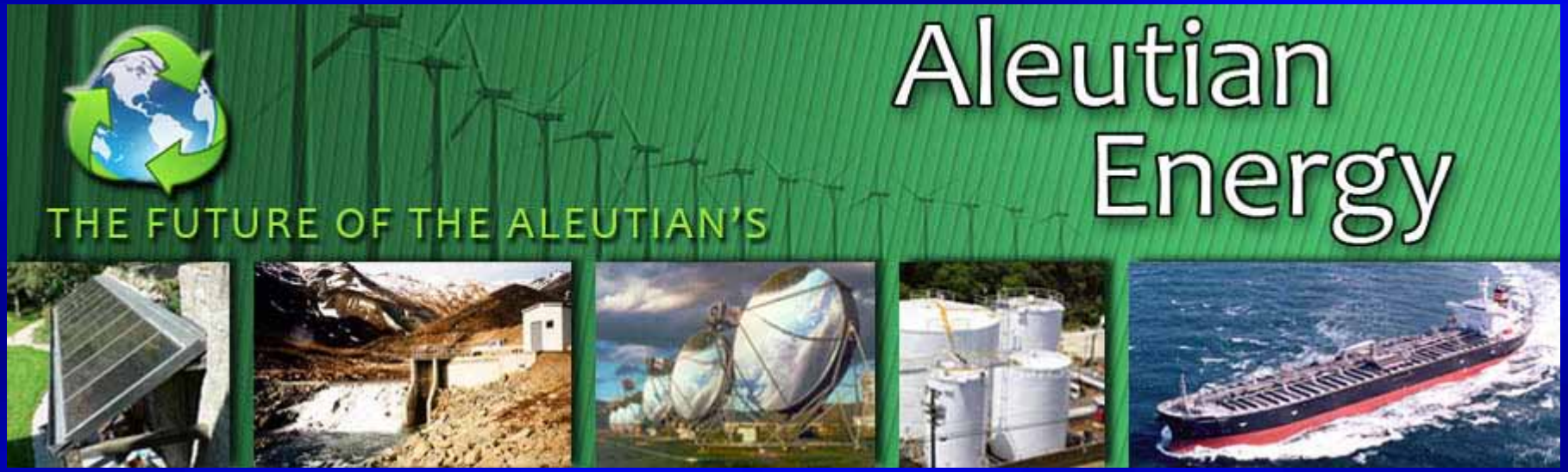
Adak hydro and wind feasibility assessment project underway
(Adak Hydro: 1000 GPM, 700 feet head)

Fish oil is currently being produced in the region and used as fuel. Biodiesel could also be produced using the region's abundant renewable energy to produce biodiesel from growing algae.

In the Works:

1. False Pass tidal proposal received good reviews from DOE.

2. Department of Interior – Tribal Energy Project Alaska
3. Aleutian Energy Plan Development



http://aleutianenergy.org/preview/index.html