Kake, Alaska Wind Resource Report

Kake met tower, photo provided by SEACC

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Project Background (from SEACC)

In 2010, Southeast Alaska Conservation Council (SEACC) partnered with the Organized Village of Kake (OVK) and Kake Tribal Corp. to install a 34 meter meteorological tower as a first step in exploring wind potential near the village of Kake, Alaska. Like many other rural Southeast communities, Kake relies completely on diesel fuel for electricity, heating and transportation needs. At present, residents pay more than 60 cents per kilowatt hour for electricity and up to six dollars per gallon for heating oil, resulting in significant economic and social hardships in this Alaska native community. The Organized Village of Kake has been a leader in working to address these issues, and together they and SEACC are exploring sustainable ways of living in the Tongass Forest that preserves the region's world class environment, communities, and cultures. SEACC will continue to work with their partners at OVK, Kake Tribal Corp. and the State of Alaska to further explore the feasibility of wind power to deliver affordable, renewable energy to Kake.

Summary

The wind resource measured at the Kake met tower site is very good with measured wind power class 5 by measurement of wind power density (Class 4 if considering only mean annual wind speed). Given the moderately cool temperatures of Kake test site, air density is moderately higher than standard conditions, leading to the robust annual wind power density average. By other measures important for wind power analysis, the site has a relatively low extreme wind probability but high turbulence; the latter apparently due to specific siting of the met tower near a moderately high forested hill. It is unlikely though that the general area of Kupreanof Island experiences similarly high turbulence.

Met tower data synopsis

Data dates	May 14, 2010 to November 3, 2011 (18 months); operational
Wind power class	Class 5 (excellent), based on wind power density
Wind power density mean, 34 m	510 W/m^2
Wind speed mean, 34 m	6.61 m/s (14.8 mph)
Maximum wind speeds	27.7 m/s (10-min avg); 39.8 m/s (gust)
Weibull distribution parameters	k = 1.52, c = 7.27 m/s
Wind shear power law exponent	0.328 (high)
Roughness class	4.08 (description: suburban)
IEC 61400-1, 3rd ed. classification	Class III-B (at 30 meters), Class III-S (at 20 meters)
Turbulence intensity, mean (at 34 m)	0.126 (at 15 m/s)
Calm wind frequency (at 34 m)	43% (< 4 m/s) (18 mo. measurement period)

Test Site Location

A 34 meter NRG Systems, Inc. tubular-type meteorological (met) tower is installed on a high headland on the northwest side of Kupreanof Island approximately 7.7 km (4.8 miles) straight-line distance northwest of the village of Kake, but 19 km (12 miles) by road. Kupreanof Island hosts extensive forestry operations and compared to the original virgin forest cover, the site is relatively open and clear due to past logging activity. The site is well exposed to the south and west although a moderately high hill is directly east-northeast and much higher terrain exists a further 1.5 km to the northeast. This site was

chosen because of its potential for wind power potential and its relative proximity to Kake. The wind resource Kake itself (at sea level) is likely insufficient for wind power development due to topographic features and forest cover; however, there are hilltops closer to the village that warrant further study.

Photo of test site, view to the northeast

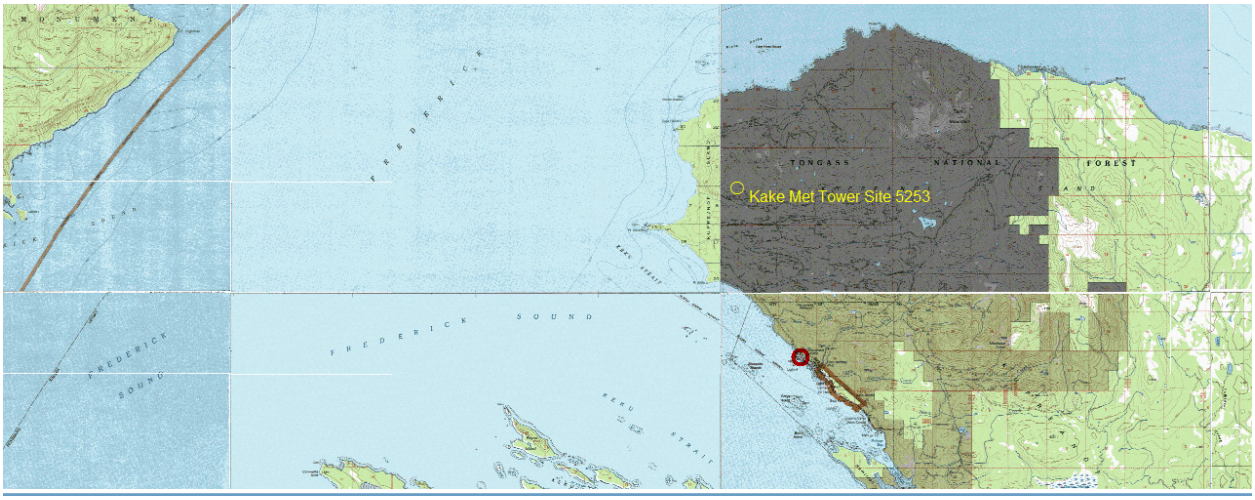
Site information

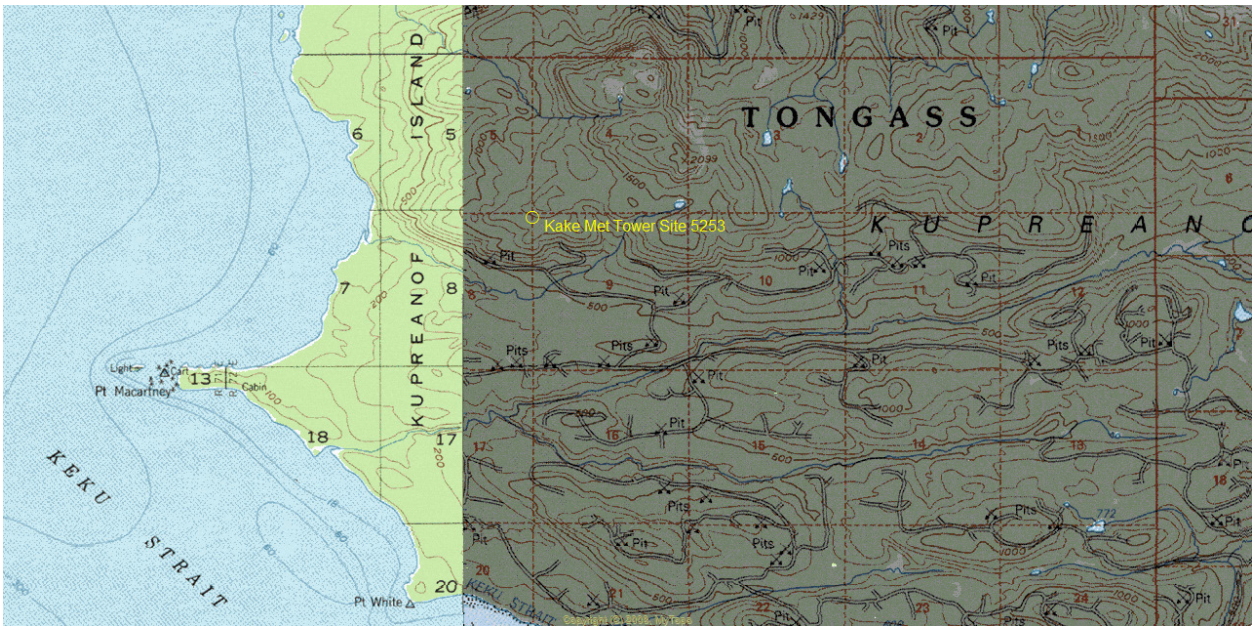
Site number	5253
Latitude/longitude	N 57° 02.352” W 133° 59.394”
Time offset	-9 hours from GMT (Yukon/Alaska time zone)
Site elevation	390 meters (1,280 ft.)
Datalogger type	NRG Symphonie Plus, 10 minute time step
Tower type	Tubular tall tower, 6-inch diam., 34 meter height

Tower sensor information

Channel	Sensor type	Height	Multiplier	Offset	Orientation
1	NRG #40 anemometer	34 m A	0.758	0.40	Not recorded
2	NRG #40 anemometer	34 m B	0.755	0.39	Not recorded
3	NRG #40 anemometer	20 m	0.755	0.38	Not recorded
7	NRG #200P wind vane	34 m	0.351	150	150° T
9	NRG #110S Temp F	3 m	0.244	-123.5	N

Topographic maps





Google Earth image, Kupreanof Island

Data Quality Control

Data quality is very good with data recovery of all three anemometers greater than 98 percent and data recovery of the wind vane nearly 97 percent. Data recovery of the temperatures sensor was 100 percent. Data loss is limited to winter months only and undoubtedly attributable to icing events which are characterized by non-variant output of the anemometers at the minimum offset value (essentially

zero) and by non-variant output of the direction vane at the last operable direction. This occurs when the temperature is near or below freezing (0° C).

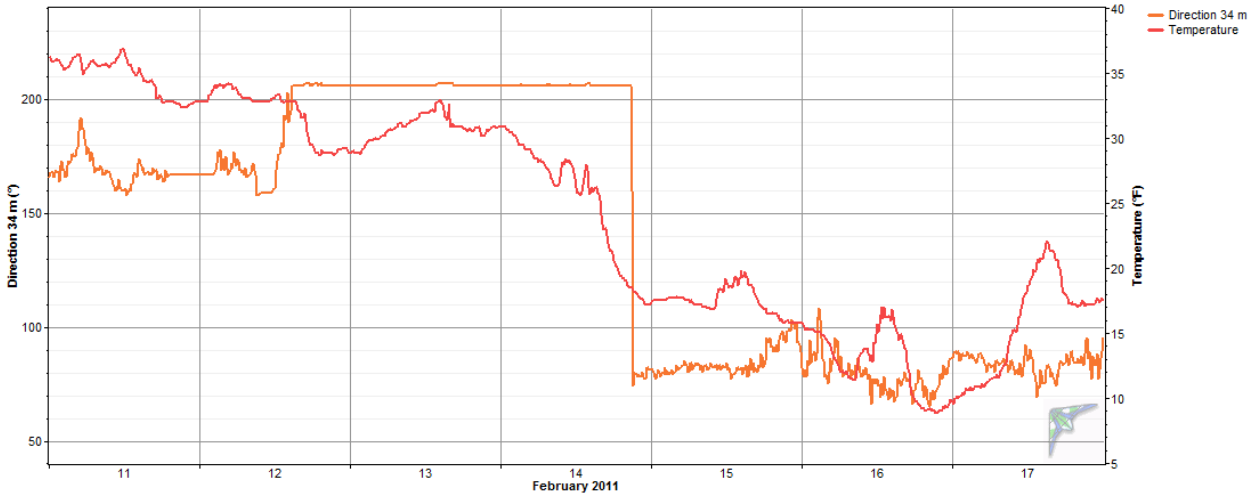
Sensor data recovery table

Year	Month	Possible Records	Valid Records	34 m A Recovery Rate (%)	34 m B Recovery Rate (%)	20 m Recovery Rate (%)	Vane Recovery Rate (%)	Temp Recovery Rate (%)
2010	May	2,592	2,592	100.0	100.0	100.0	100.0	100.0
2010	Jun	4,320	4,320	100.0	100.0	100.0	100.0	100.0
2010	Jul	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2010	Aug	4,464	4,463	100.0	100.0	100.0	100.0	100.0
2010	Sep	4,320	4,320	100.0	100.0	100.0	100.0	100.0
2010	Oct	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2010	Nov	4,320	4,204	97.3	92.7	97.3	84.5	100.0
2010	Dec	4,464	4,464	100.0	98.1	100.0	83.3	100.0
2011	Jan	4,464	4,330	97.0	97.0	97.9	92.9	100.0
2011	Feb	4,032	3,407	84.5	84.6	81.2	83.8	100.0
2011	Mar	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2011	Apr	4,320	4,320	100.0	100.0	100.0	100.0	100.0
2011	May	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2011	Jun	4,320	4,320	100.0	100.0	100.0	100.0	100.0
2011	Jul	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2011	Aug	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2011	Sep	4,320	4,320	100.0	100.0	100.0	100.0	100.0
2011	Oct	4,464	4,464	100.0	100.0	100.0	100.0	100.0
2011	Nov	354	354	100.0	100.0	100.0	100.0	100.0
All data		77,538	76,662	98.9	98.5	98.8	96.9	100.0

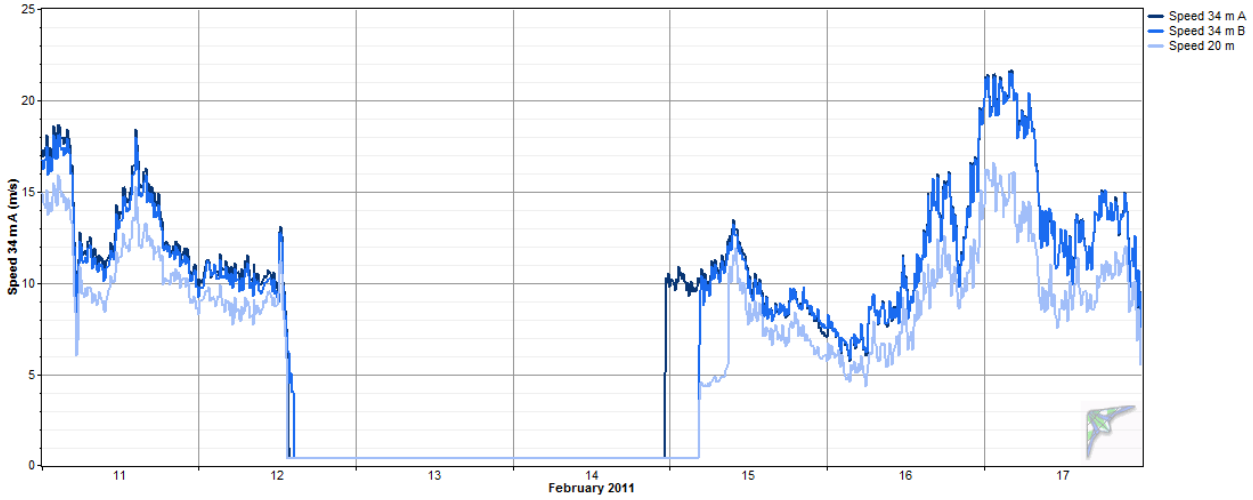
Icing Event

The Kake met tower site is at an elevation of 390 meters. Although destructive rime icing has been observed at this elevation elsewhere in Alaska, the Kake climate is too moderate for such conditions. But, freezing rain and other similar cold climate events do occur on occasion which can compromise anemometer and wind vane data. These are not likely however to seriously impede wind turbine operations.

Apparent icing event, February 2011, temp and wind vane data



Apparent icing event, February 2011, anemometer data



Wind Speed

Anemometer data obtained from the met tower, from the perspectives of both mean wind speed and mean wind power density, indicate an excellent wind resource. Mean wind speeds are greater at higher elevations on the met tower, as one would expect, although perhaps more than expected. Note that cold temperatures contributed to a higher wind power density than standard conditions would indicate for the measured mean wind speeds.

Anemometer data summary

Variable	Speed 34 m A	Speed 34 m B	Speed 20 m
Measurement height (m)	34	34	20
Mean wind speed (m/s)	6.18	6.12	5.17
MMM wind speed (m/s)	**6.61**	**6.53**	**5.49**
Max wind speed (m/s)	27.7	27.1	24.7

Weibull k, annual	1.52	1.60	1.62
Weibull c (m/s), annual	7.27	7.26	6.12
Mean power density (W/m²)	454	422	252
MMM power density (W/m²)	**510**	**479**	**281**
Mean energy content (kWh/m²/yr)	3,977	3,697	2,210
MMM energy content (kWh/m²/yr)	4,465	4,192	2,460
Energy pattern factor	3.2	3.0	3.0
Frequency of calms (%)	42.5	42.3	48.2
1-hr autocorrelation coefficient	0.954	0.954	0.951
Diurnal pattern strength	0.025	0.022	0.012
Hour of peak wind speed	24	24	24

MMM = mean of monthly mean, or *annualized*

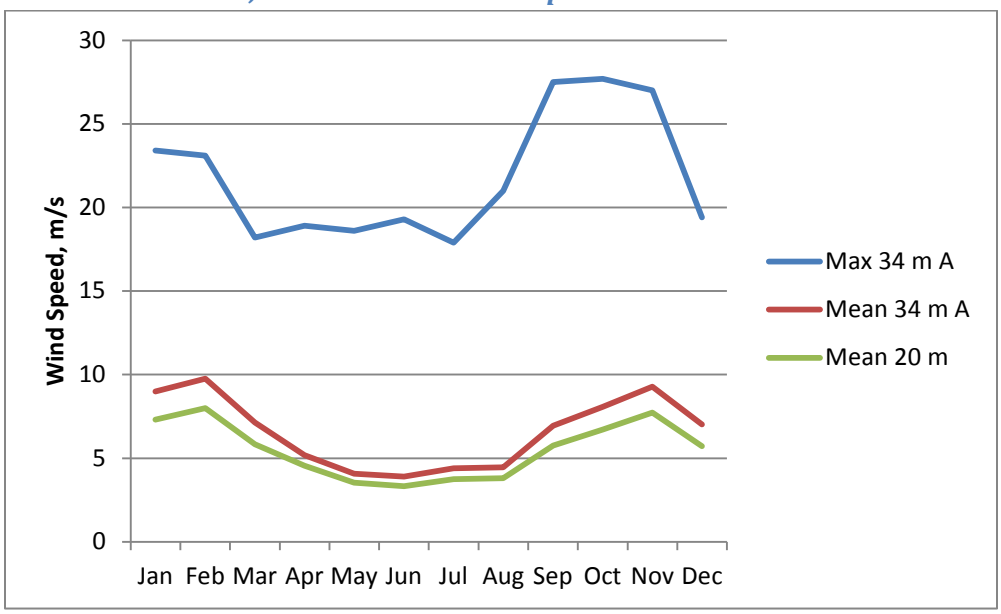
Time Series

Time series calculations indicate high mean wind speeds during the winter months with more moderate mean wind speeds during summer months. This correlates well with the a typical Alaska village load profile where winter months have a high electric load and heat demand and summer months see a much lower demand for electricity and heat. The month-specific daily wind profiles indicate relatively even wind speeds throughout the day with slightly higher wind speeds during night hours.

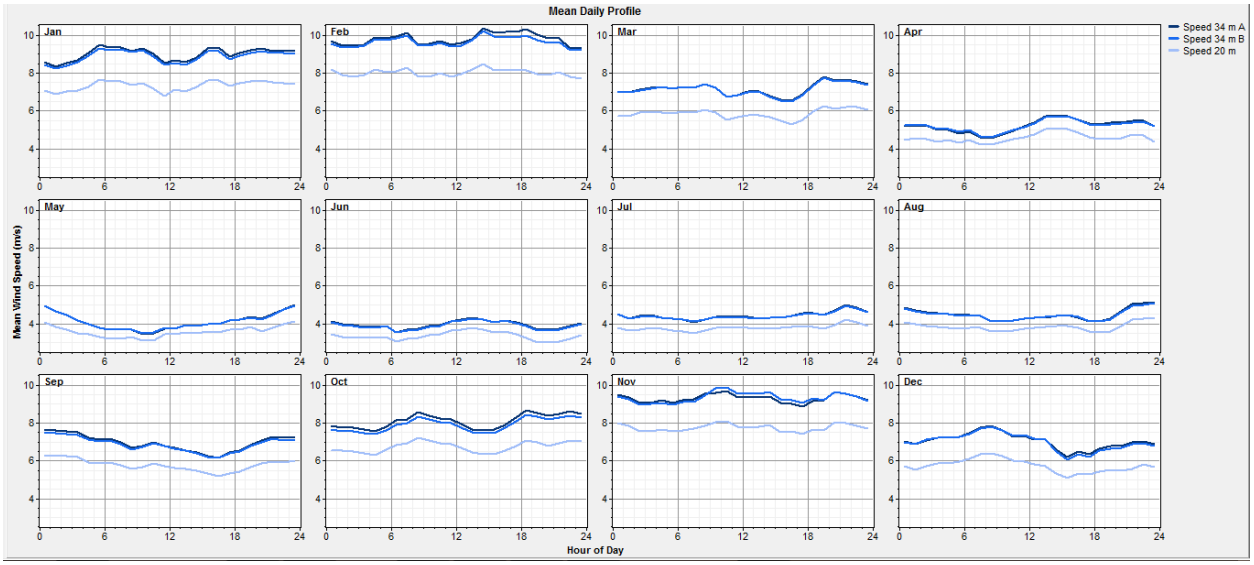
34 m A anemometer data summary

Month	Mean (m/s)	Max (m/s)	Gust (m/s)	Std. Dev. (m/s)	Weibull k (-)	Weibull c (m/s)
Jan	8.99	23.4	31.5	4.15	2.20	10.05
Feb	9.77	23.1	34.9	5.49	1.69	10.82
Mar	7.14	18.2	25.8	4.04	1.74	7.96
Apr	5.18	18.9	25.4	3.90	1.35	5.66
May	4.08	18.6	24.3	3.26	1.34	4.47
Jun	3.91	19.3	26.2	3.29	1.26	4.23
Jul	4.41	17.9	23.5	3.26	1.38	4.83
Aug	4.46	21.0	26.9	3.82	1.24	4.80
Sep	6.94	27.5	37.2	5.02	1.34	7.54
Oct	8.08	27.7	39.8	5.20	1.47	8.86
Nov	9.28	27.0	37.9	5.77	1.51	10.20
Dec	7.02	19.4	25.0	4.09	1.70	7.83
Annual	6.61	27.7	39.8	4.27	1.52	7.27

Annual time series, mean and max wind speed



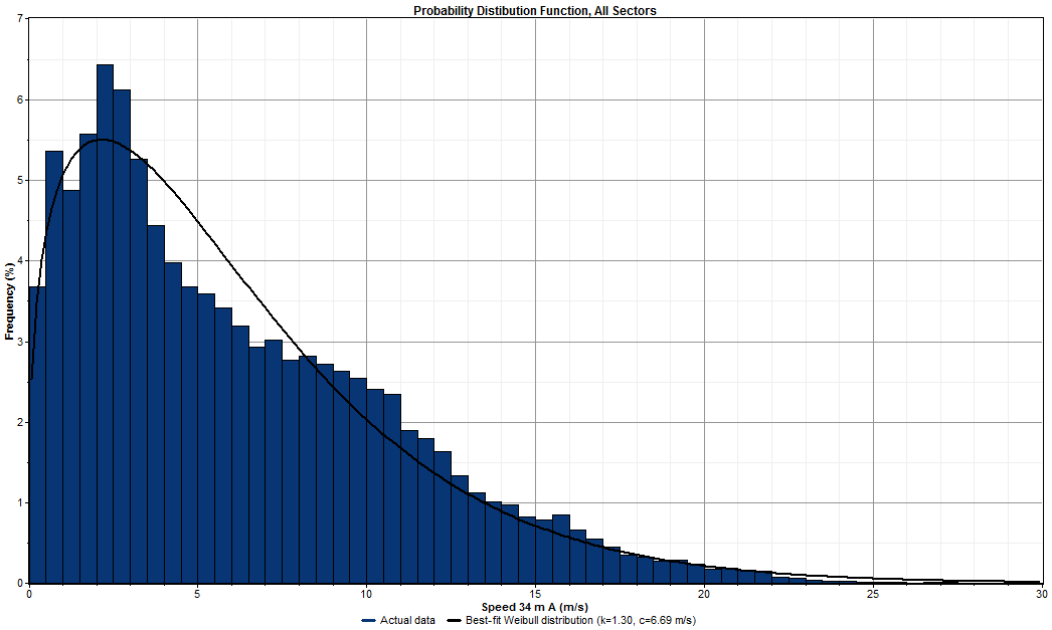
Daily wind profiles (per month)



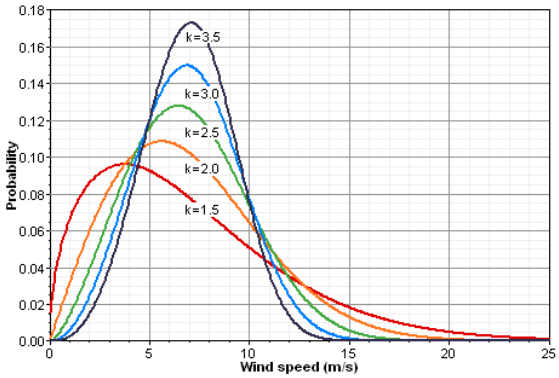
Probability Distribution Function

The probability distribution function (PDF), or histogram, of the Kake met tower wind speed indicates a shape curve dominated by lower wind speeds, as opposed to a “normal” shape curve, known as the Rayleigh distribution (Weibull k = 2.0), which is defined as the standard wind distribution for wind power analysis. As one can see in the PDF of 34 m A anemometer, the most frequently occurring wind speeds are between 2 and 5 m/s with a few wind events exceeding 25 m/s (the cutout speed of most wind turbines; see following wind speed statistical table). Note that the Weibull k value is unusually low and indicative, as one can see, of a site somewhat dominated by calm winds (defined as less than 4 m/s, the cut-in wind speed of most turbines) but periodically exposed to high winds.

PDF of 34 m A anemometer (18 months' data)



Weibull k shape curve table



Occurrence by wind speed bin (34 m A anemometer)

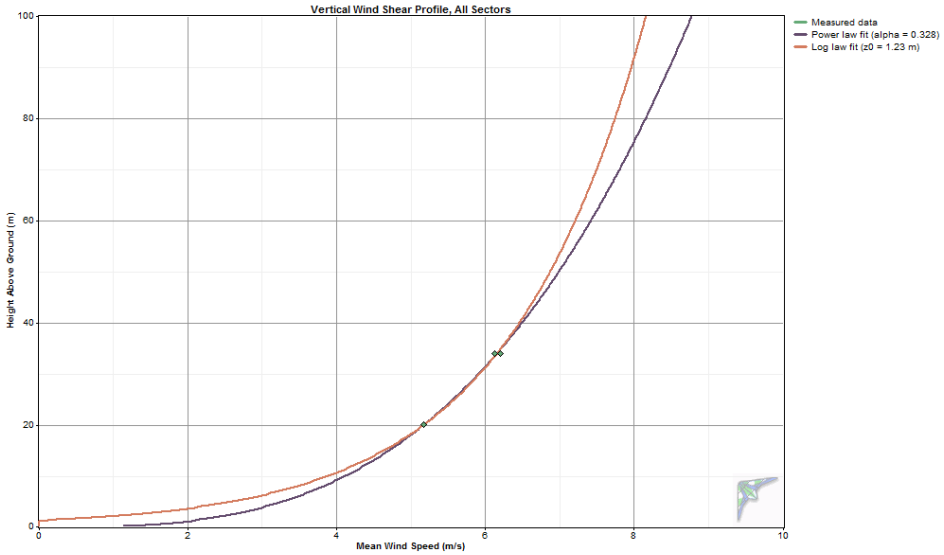
Bin Endpoints (m/s)		Occurrences			Bin Endpoints (m/s)		Occurrences		
Lower	Upper	No.	Percent	Cumul.	Lower	Upper	No.	Percent	Cumul.
0	1	6,929	9.04	9.0	15	16	1,243	1.62	95.9
1	2	8,002	10.44	19.5	16	17	925	1.21	97.1
2	3	9,615	12.54	32.0	17	18	609	0.79	97.9
3	4	7,430	9.69	41.7	18	19	458	0.60	98.5
4	5	5,864	7.65	49.4	19	20	407	0.53	99.0
5	6	5,364	7.00	56.4	20	21	282	0.37	99.4
6	7	4,690	6.12	62.5	21	22	238	0.31	99.7
7	8	4,433	5.78	68.3	22	23	108	0.14	99.9
8	9	4,238	5.53	73.8	23	24	46	0.06	99.9

9	10	3,963	5.17	79.0	24	25	27	0.04	100.0
10	11	3,641	4.75	83.7	25	26	19	0.03	100.0
11	12	2,825	3.69	87.4	26	27	8	0.01	100.0
12	13	2,281	2.98	90.4	27	28	10	0.01	100.0
13	14	1,637	2.14	92.5	28	29	0	0.00	100.0
14	15	1,370	1.79	94.3	29	30	0	0.00	100.0

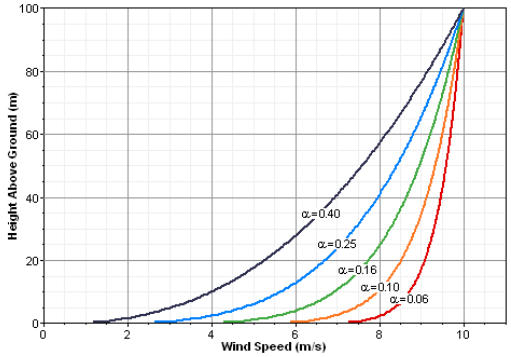
Wind Shear and Roughness

A wind shear power law exponent (α) of 0.328 indicates high wind shear at the site. Related to wind shear, a calculated surface roughness of 1.23 meters (indicating the height above ground level where wind velocity would be zero) indicates very rough terrain (roughness description: suburban) surrounding the met tower. These data clearly indicate that the location of the met tower near a relatively high forested hill immediately adjacent to the site substantially reduced wind speeds measured by the 20 meter anemometer. This resulted in a high wind shear and high roughness classifications. Undoubtedly, both indices are much lower at a more open site on Kupreanof Island, provided surrounding tree cover is minimal.

Vertical wind shear profile



Comparative wind shear profiles



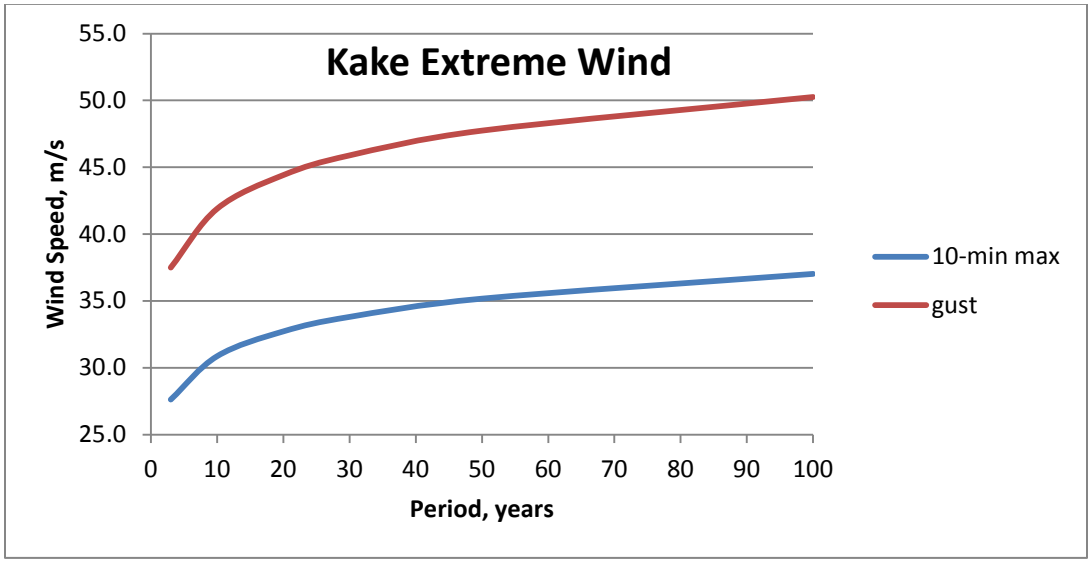
Extreme Winds

A modified Gumbel distribution analysis, based on monthly maximum winds vice annual maximum winds, was used to predict extreme winds at the Kake met tower site. Eighteen months of data though are minimal at best and hence results should be viewed with caution. Nevertheless, with data available the predicted Vref (maximum ten-minute average wind speed) in a 50 year return period (in other words, predicted to occur once every 50 years) is 35.2 m/s. This result classifies the site as Class III by International Electrotechnical Commission 61400-1, 3rd edition (IEC3) criteria. IEC extreme wind probability classification is one criteria – with turbulence the other – that describes a site with respect to suitability for particular wind turbine models. Note that the IEC3 Class III extreme wind classification, which appears to apply to the Kake met tower site, is the lowest and most common classification. All wind turbines are designed to operate in IEC3 Class III sites.

Site extreme wind probability table, 34 m A data

	V_{ref}	Gust	IEC 61400-1, 3rd ed.	
Period (years)	(m/s)	(m/s)	Class	V_{ref}, m/s
3	27.6	37.5	I	50.0
10	30.9	41.9	II	42.5
20	32.7	44.4	III	37.5
30	33.8	45.9	S	designer-specified
50	35.2	47.7		
100	37.0	50.3		
average gust factor:	1.36			

Extreme wind graph, by return period



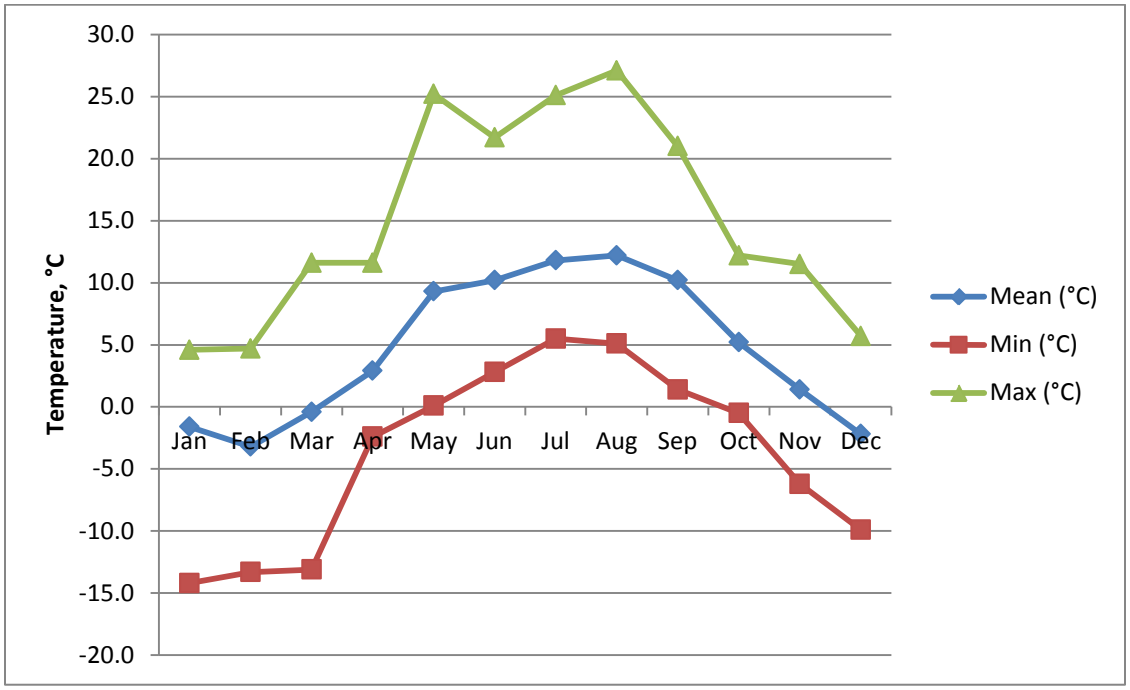
Temperature, Density, and Relative Humidity

The Kake met tower site experiences warm summers and cool winters with resulting higher than standard air density. Calculated mean-of-monthly-mean (or annual) air density during the met tower test period exceeds the 1.180 kg/m^3 standard air density for a 390 meter elevation by 2.9 percent. This is advantageous in wind power operations as wind turbines produce more power at low temperatures (high air density) than at standard temperature and density.

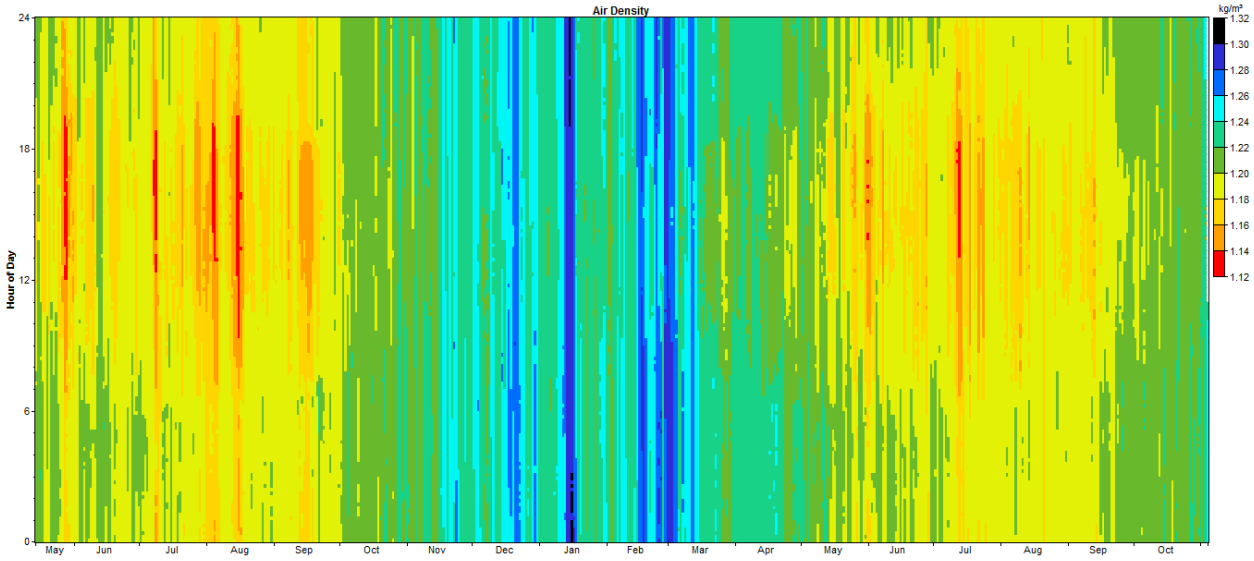
Temperature and density table

	Temperature						Air Density		
Month	Mean (°F)	Min (°F)	Max (°F)	Mean (°C)	Min (°C)	Max (°C)	Mean (kg/m³)	Min (kg/m³)	Max (kg/m³)
Jan	29.1	6.4	40.2	-1.6	-14.2	4.6	1.242	1.214	1.302
Feb	26.3	8.1	40.5	-3.2	-13.3	4.7	1.249	1.213	1.297
Mar	31.3	8.5	52.9	-0.4	-13.1	11.6	1.236	1.184	1.296
Apr	37.3	27.6	52.8	2.9	-2.4	11.6	1.221	1.184	1.245
May	48.8	32.2	77.4	9.3	0.1	25.2	1.194	1.130	1.233
Jun	50.3	37.0	71.0	10.2	2.8	21.7	1.190	1.143	1.222
Jul	53.2	41.9	77.2	11.8	5.5	25.1	1.183	1.130	1.210
Aug	53.9	41.2	80.7	12.2	5.1	27.1	1.182	1.123	1.211
Sep	50.3	34.6	69.8	10.2	1.4	21.0	1.190	1.146	1.227
Oct	41.4	31.1	53.9	5.2	-0.5	12.2	1.211	1.181	1.236
Nov	34.5	20.9	52.7	1.4	-6.2	11.5	1.228	1.184	1.262
Dec	28.1	14.2	42.2	-2.2	-9.9	5.7	1.244	1.209	1.280
Annual	40.4	6.4	80.7	**4.7**	**-14.2**	**27.1**	1.214	1.123	1.302

Temperature graph



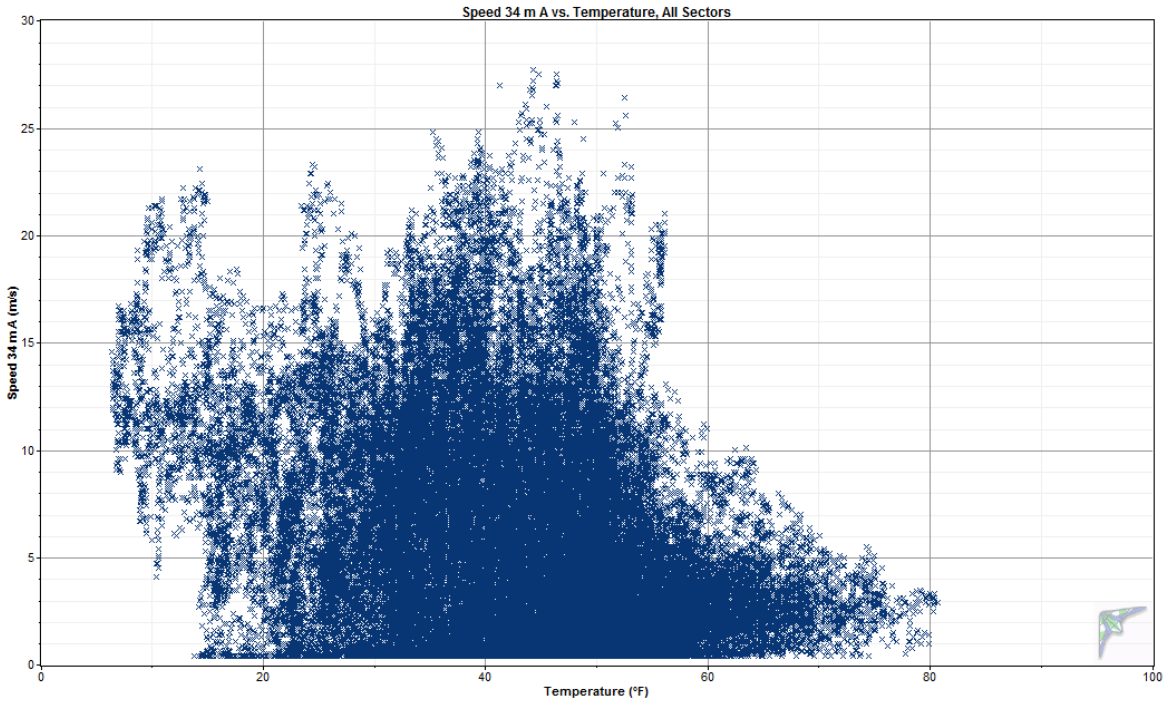
Air density DMap



Wind Speed Scatterplot

The wind speed versus temperature scatterplot below indicates fairly warm temperatures at the Kake met tower site with most above freezing temperatures most of the time. During the met tower test periods, temperatures did not fall below, nor even approach, -20°C (-4°F), which is the minimum operating temperature for most standard-environment wind turbines. Note that the arctic-capable features (ratings to -40°C) of wind turbines in wide use in Alaska are not necessary in Kake and would be an unnecessary expense.

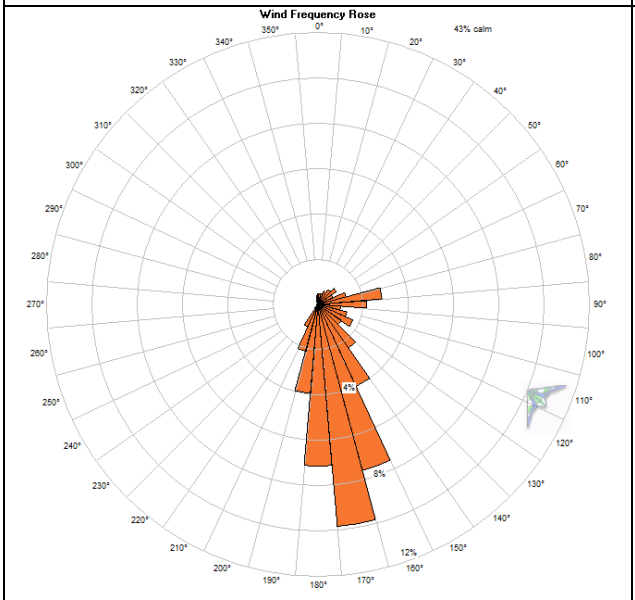
Wind speed/temperature



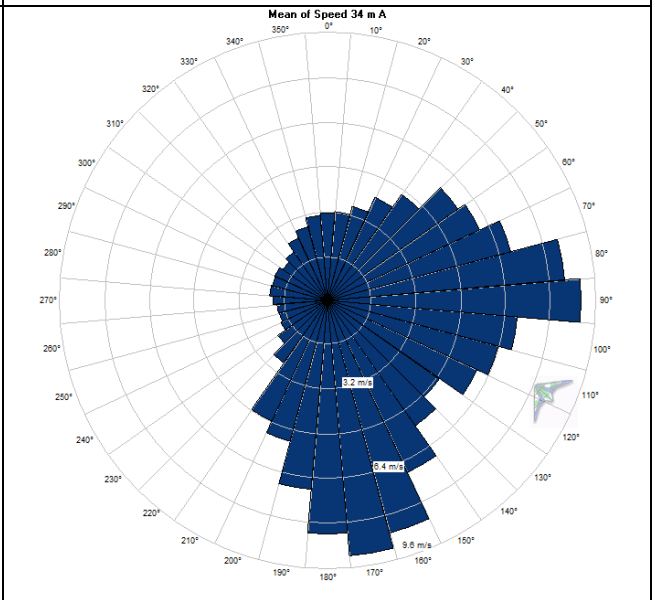
Wind Direction

Wind frequency rose data indicates that winds at the Kake met tower site highly directional, with southerly wind predominating. The mean value rose indicates that easterly winds, when they do occur, are of high energy and hence likely are storm winds. The wind energy rose indicates that for wind turbine operations, power-producing winds are dominated by southerly winds. Easterly power winds occur to a lesser degree and appear to be limited to late winter months. Calm frequency (the percent of time that winds at the 34 meter level are less than 4 m/s, a typical cut-in speed of larger wind turbines) was a relatively high 42 percent during the met tower test period (18 months of data).

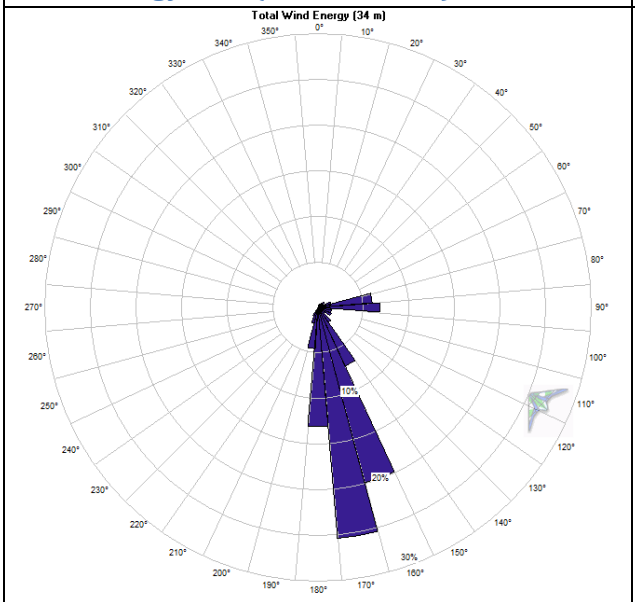
Wind frequency rose



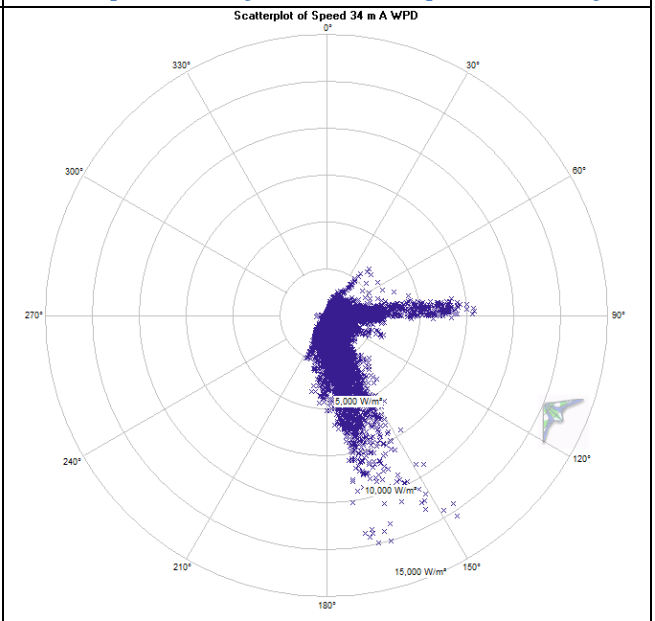
Mean value rose (34 m A anem.)



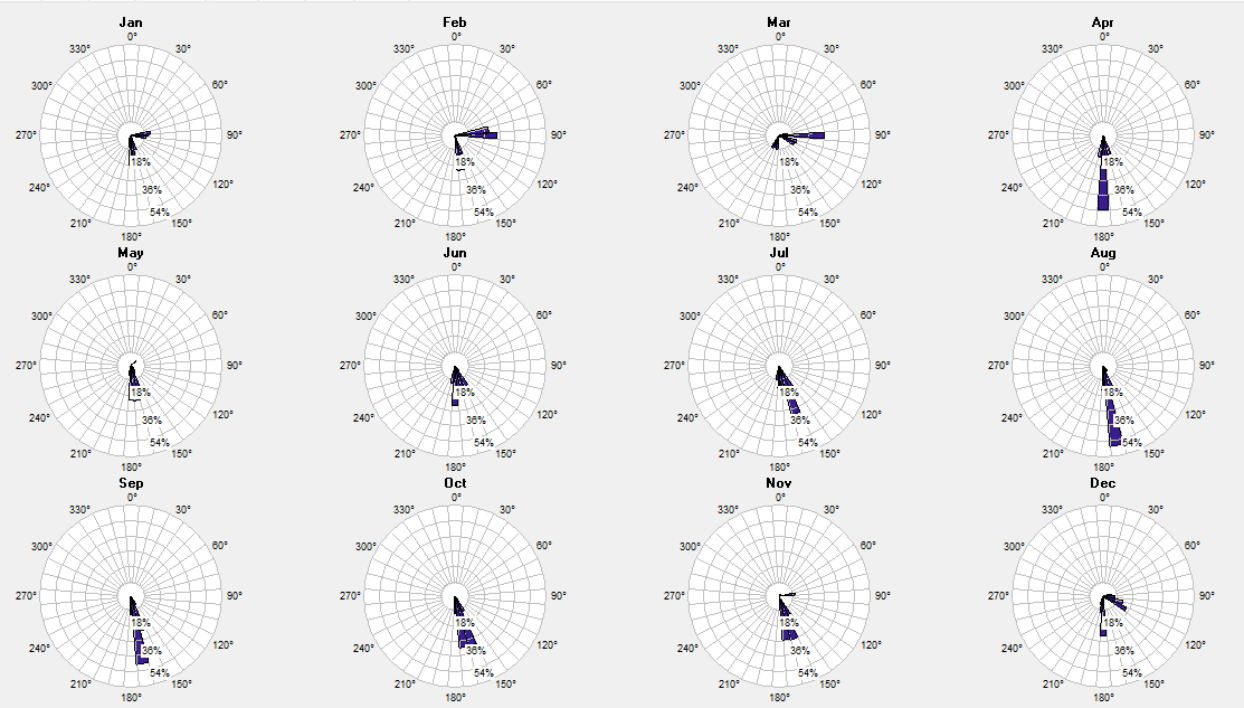
Wind energy rose (34 m A anem.)



Scatterplot rose of 34m A wind power density



Wind density roses by month (common scale)



Turbulence

Turbulence intensity (TI) at the Kake met tower site is higher than normally expected with an IEC 61400-1, 3rd edition (IEC3) classification of turbulence category B at 34 meters. Note that the IEC3 classification of turbulence category S (special conditions) at 20 meters is very high. Terrain features to the east of the site – undoubtedly the moderately high forested hill near the tower – are inducing very high turbulence during periods of strong easterly winds. Interestingly though, the prevailing southerly winds also exhibit relatively high turbulence with at IEC3 category B classification, even though there are no obvious terrain obstructions in the direction of that sector. This is likely due to the general forest cover (albeit young growth conifers) in the area surrounding the met tower site.

Turbulence synopsis

	34 m A anem.			20 m anem.			Legend	
Sector	Mean TI at 15 m/s	Repres. TI at 15 m/s	IEC3 Category	Mean TI at 15 m/s	Repres. TI at 15 m/s	IEC3 Category	IEC3 Categ.	Mean TI at 15 m/s
all	0.126	0.160	B	0.174	0.220	S	S	>0.16
315° to 045°	0.163	0.187	S	undef.	undef.	undef.	A	0.14-0.16
045° to 135°	0.139	0.195	B	0.247	0.280	S	B	0.12-0.14
135° to 225°	0.123	0.150	B	0.166	0.200	S	C	0-0.12
045° to 135°	undef.	undef.	undef.	undef.	undef.	undef.		

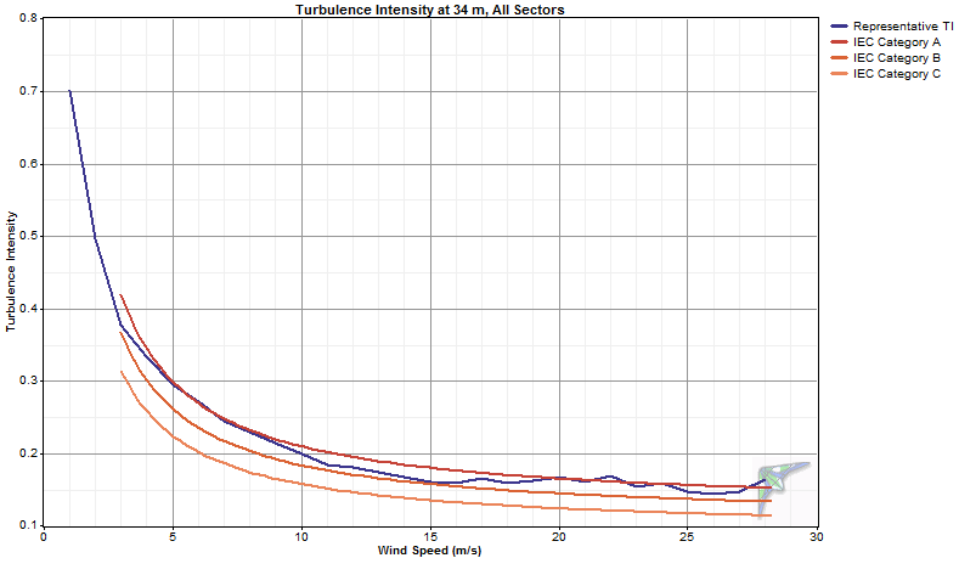
Notes: undef. means no data records in 15 m/s bin in referenced sector

TI = turbulence intensity

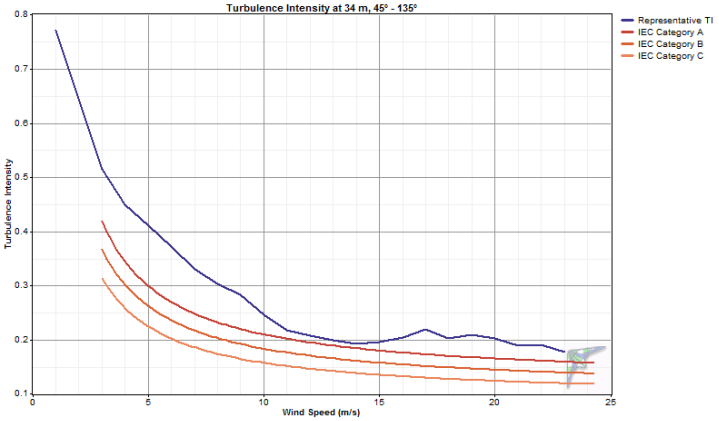
Turbulence at 34 meter level

Turbulence intensity at the 34 meter level (top of the met tower) is shown in the graphics below.

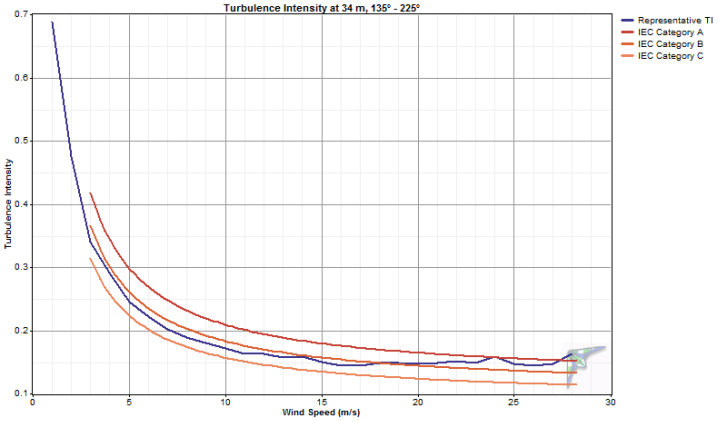
Turbulence intensity, 34m A, all direction sectors



Turbulence intensity, 34m A, 045° to 135° True



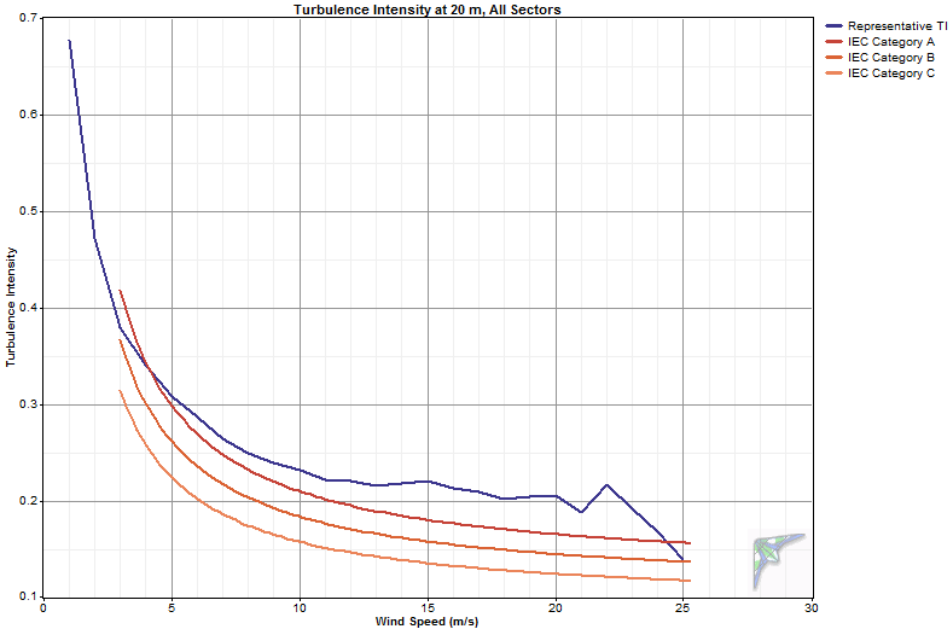
Turbulence intensity, 34m A, 135° to 225° True



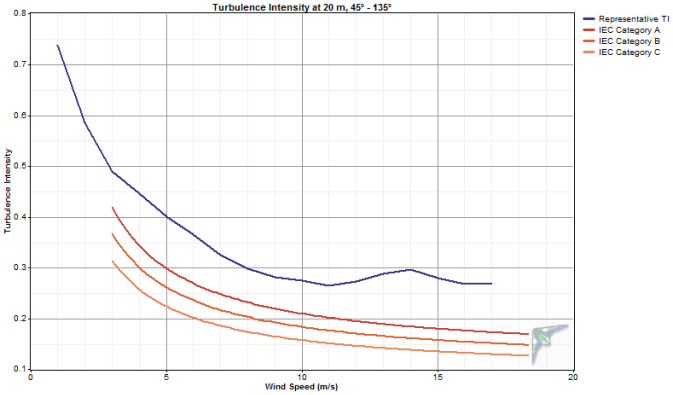
Turbulence at 20 meter level

Turbulence intensity at the 20 meter level of the met tower is shown in the graphics below.

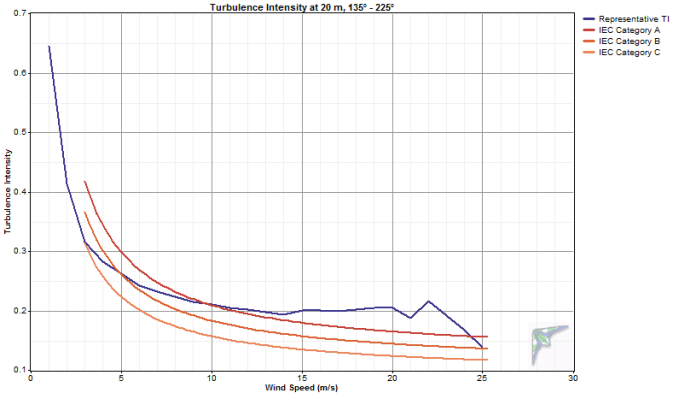
Turbulence intensity, 34m A, all direction sectors



Turbulence intensity, 20 m, 045° to 135° True



Turbulence intensity, 20 m, 135° to 225° True



Turbulence table, 34m A data, all sectors

Bin Endpoints Lower (m/s)	Upper (m/s)	Records in Bin	Mean TI	SD of TI	Representative TI	Peak TI
0.5	1.5	7,844	0.508	0.151	0.702	1.444
1.5	2.5	9,197	0.319	0.138	0.496	1.056
2.5	3.5	8,716	0.238	0.108	0.376	0.821
3.5	4.5	6,444	0.207	0.099	0.333	0.972
4.5	5.5	5,568	0.184	0.087	0.295	0.640
5.5	6.5	5,059	0.172	0.077	0.271	0.545
6.5	7.5	4,555	0.159	0.067	0.245	0.462
7.5	8.5	4,279	0.151	0.060	0.229	0.481
8.5	9.5	4,100	0.146	0.054	0.215	0.437
9.5	10.5	3,790	0.141	0.044	0.198	0.360
10.5	11.5	3,243	0.135	0.038	0.183	0.342
11.5	12.5	2,633	0.136	0.035	0.181	0.392
12.5	13.5	1,889	0.133	0.031	0.173	0.302
13.5	14.5	1,517	0.130	0.029	0.168	0.341
14.5	15.5	1,225	0.126	0.027	0.160	0.298
15.5	16.5	1,153	0.127	0.025	0.159	0.253
16.5	17.5	759	0.129	0.028	0.165	0.254
17.5	18.5	513	0.128	0.025	0.159	0.233
18.5	19.5	436	0.129	0.026	0.163	0.249
19.5	20.5	319	0.133	0.026	0.167	0.233
20.5	21.5	272	0.132	0.023	0.161	0.213
21.5	22.5	171	0.137	0.024	0.168	0.219
22.5	23.5	76	0.128	0.019	0.153	0.199
23.5	24.5	34	0.133	0.021	0.160	0.196
24.5	25.5	26	0.126	0.017	0.148	0.163
25.5	26.5	8	0.125	0.015	0.144	0.144
26.5	27.5	12	0.129	0.014	0.147	0.152
27.5	28.5	3	0.128	0.028	0.164	0.156

Wind Turbine Performance

The selection of suitable wind turbines for a wind power project in Kake is beyond the scope of this report, but for initial planning purposes, predicted annual energy output and capacity factor for the 100 kW Northwind 100 B model (21 meter rotor, 37 meter hub height) and 225 kW Aeronautica AW29-225 (29 meter rotor, 40 meter hub height) are presented below.

Note that the Alaska Energy Authority considers 82 percent turbine availability (percent of time that the turbine is operational and available to produce power, irrespective of wind speed) as the default value for planning village power projects. Many wind turbines in rural Alaska operate with better than 82 percent availability, but for a number of reasons some operate with lower than 82 percent availability.

For this turbine performance analysis, the power law exponent for shear calculation was assumed to be a more conservative 0.140, not the measured value of 0.328, which undoubtedly is too high. An artificially high power law exponent would result in turbine performance predictions biased high when extrapolated to hub heights higher than 34 meters.

Wind turbine performance, 100% availability

	Northwind 100/B/21				Aeronautica AW29-225			
Month	Hub Height Wind Speed (m/s)	Mean Net Power Output (kW)	Mean Net Energy Output (kWh/yr)	Net Capacity Factor (%)	Hub Height Wind Speed (m/s)	Mean Net Power Output (kW)	Mean Net Energy Output (kWh/yr)	Net Factor Capacity (%)
Jan	9.1	53.8	40,059	53.8	9.2	117.5	87,445	52.2
Feb	9.9	58.0	38,975	58.0	10.0	127.9	85,934	56.8
Mar	7.2	39.3	29,238	39.3	7.3	84.7	63,029	37.7
Apr	5.2	21.8	15,669	21.8	5.3	45.5	32,765	20.2
May	4.1	13.0	9,642	13.0	4.2	25.9	19,233	11.5
Jun	4.0	12.6	9,066	12.6	4.0	25.6	18,397	11.4
Jul	4.5	15.5	11,505	15.5	4.5	31.3	23,254	13.9
Aug	4.5	16.1	11,952	16.1	4.6	33.1	24,646	14.7
Sep	7.0	34.4	24,803	34.4	7.1	74.2	53,429	33.0
Oct	8.2	43.7	32,502	43.7	8.3	94.9	70,625	42.2
Nov	9.4	51.4	36,989	51.4	9.5	112.6	81,071	50.0
Dec	7.1	37.1	27,574	37.1	7.2	79.3	58,972	35.2
Annual	6.7	33.1	287,974	33.1	6.8	71.0	618,800	31.6

Wind turbine performance, 82% availability

	Northwind 100/B/21				Aeronautica AW29-225			
Month	Hub Height Wind Speed (m/s)	Mean Net Power Output (kW)	Mean Net Energy Output (kWh/yr)	Net Factor Capacity (%)	Hub Height Wind Speed (m/s)	Mean Net Power Output (kW)	Mean Net Energy Output (kWh/yr)	Net Factor Capacity (%)
Jan	9.1	44.1	32,848	44.1	9.2	96.4	71,705	42.8

Feb	9.9	47.6	31,960	47.6	10.0	104.9	70,466	46.6
Mar	7.2	32.2	23,975	32.2	7.3	69.5	51,684	30.9
Apr	5.2	17.9	12,849	17.9	5.3	37.3	26,867	16.6
May	4.1	10.7	7,906	10.7	4.2	21.2	15,771	9.4
Jun	4.0	10.3	7,434	10.3	4.0	21.0	15,086	9.3
Jul	4.5	12.7	9,434	12.7	4.5	25.7	19,068	11.4
Aug	4.5	13.2	9,801	13.2	4.6	27.1	20,210	12.1
Sep	7.0	28.2	20,338	28.2	7.1	60.8	43,812	27.1
Oct	8.2	35.8	26,652	35.8	8.3	77.8	57,913	34.6
Nov	9.4	42.1	30,331	42.1	9.5	92.3	66,478	41.0
Dec	7.1	30.4	22,611	30.4	7.2	65.0	48,357	28.9
Annual	6.7	27.1	236,139	27.1	6.8	58.3	507,416	25.9