

Update of wind measurement at the Kluane Wind Project site.

By JP Pinard, PhD, PEng. 28 January 2014



Summary

Over one year of wind measurements have now been collected at the Kluane Wind Project site and the data has been analysed and correlated to Burwash Landing's airport to provide an estimate of long term mean wind speed at the site. While the wind speed at 50 m above ground level (AGL) was 6.2 m/s for the October 2012 to November 2013 period the projected long term mean wind speed is estimated to be 6.8 m/s (projected to 2001-2013 period). The Burwash airport wind measurements show that the average wind speed during the 2012-13 period was at 93% of long term average. These recent measurements projected to long term are consistent with previous measurement campaigns and reports. The business plan used a long term mean wind speed of 6.9 m/s at 50 m AGL for calculating wind energy production.

Introduction

In order to confirm past measurement campaigns¹ a met tower (meteorological tower, wind measurement tower or mast) was installed on September 30, 2012 using funding provided by the Cold Climate and Innovation Centre (Yukon Research Centre/Yukon College). The met tower was installed at the location identified in Figure 1, about 4 km north of Destruction Bay along the Alaska Highway. The wind measurements are used to confirm that the proposed wind project using three WindMatic 17s – 95kW wind turbines on 50 m towers will produce enough wind energy to provide an economic return on Kluane First Nation's investment.

The met tower has been measuring wind speeds at 30, 40, 50, and 60 metres (m) above ground. The met mast is also equipped with wind direction sensors at 30, 50, and 60 m, temperature sensors at 2 and 60 m, and a solar pyranometer at 3 m above ground.

The measurement period covered in this update covers from September 30, 2012 to November 4, 2013. The site measurements are compared to the Burwash Landing airport hourly wind speed data which for the purpose of this study cover a 13-year period from 2001 to end of 2013. The met site's wind measurements are correlated to the airport measurements to provide a long term estimate of the wind speed at the project site.

Measurement Results

During this measurement period at the wind project site, the mean wind speeds were about 6.2 m/s at 50 m AGL. The mean wind speeds are shown in Table 1 and Figure 2 below.

The mean wind speed at the Burwash airport was 3.3 m/s (at 10 m AGL) for the 2001-2013 period and 3.1 m/s (at 10 m AGL) for 30 Sept, 2012 to 4 Nov, 2013 period. This indicates that the wind speed at the airport during the 2012-13 measurement campaign are 93% of long term (13 years) mean wind speed. Although this was a low wind year we expect that it will reflect long term average. Other studies made by the author² indicate that wind speeds in the Southern Yukon over the past 60 years have been increasing. This is in part due to increased storm activity in the North Pacific Ocean.

A correlation analysis (measure-correlate-predict using linear least squares method and comparing in 8 direction sectors) between the two sites indicates that the long term average wind speed is expected to be 6.8 m/s at 50 m AGL. The business plan for the Kluane Wind Project prepared by Frontier Power Systems³ used 6.9 m/s to calculate wind energy output.

The long term estimate at 30 m AGL is 6 m/s, which is consistent with previous measurement campaigns¹.

¹ Report by JP Pinard and John Maissan: Burwash Landing and Destruction Bay Wind-Diesel Prefeasibility Update, October 2010. Prepared for Yukon Electrical Company Limited.

² Peer-reviewed study by JP Pinard: Wind Climate of the Whitehorse Area, 2007. Published in Journal Arctic.

³ Report by Carl Brothers of Frontier Power Systems: Kluane First Nation Wind-Diesel Project Business Plan, June 2012. Prepared for Kluane First Nation.

The monthly mean long term wind speed at the site is expected to range from roughly 5.2 m/s (all at 50 m AGL) in January to 8.2 m/s in May and also at 8.0 m/s in September. Most of the high winds, 7 m/s and above occur from April to October, see Figure 3.

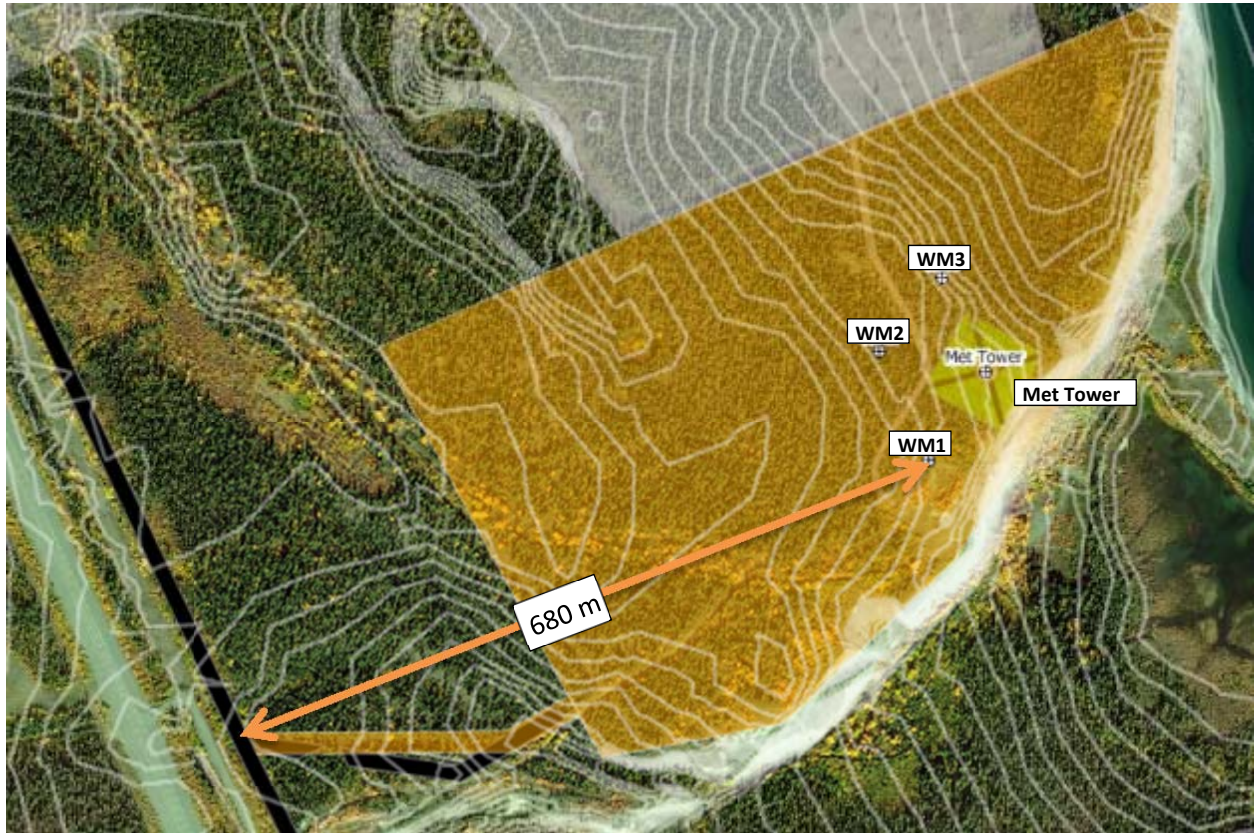


Figure 1 - Aerial map showing location of the met tower (green square with X). Map also shows the land parcel that is reserved for the wind project and the proposed new locations for the three wind turbines (WM1, WM2, WM3).

Table 1 - Mean speeds at various heights in m above ground level (AGL). Time steps indicate the number of 10-minute intervals used to calculate the means.

Wind Speed Sensor	Height (m AGL)	Time Steps	Mean Wind Speed (m/s)
Speed 60 A	60	57,444	6.533
Speed 60 B	60	57,444	6.342
Speed 50 A	50	57,444	6.174
Speed 50 B	50	57,444	6.322
Speed 40 A	40	57,444	5.894
Speed 40 B	40	57,444	5.971
Speed 30	30	57,444	5.509

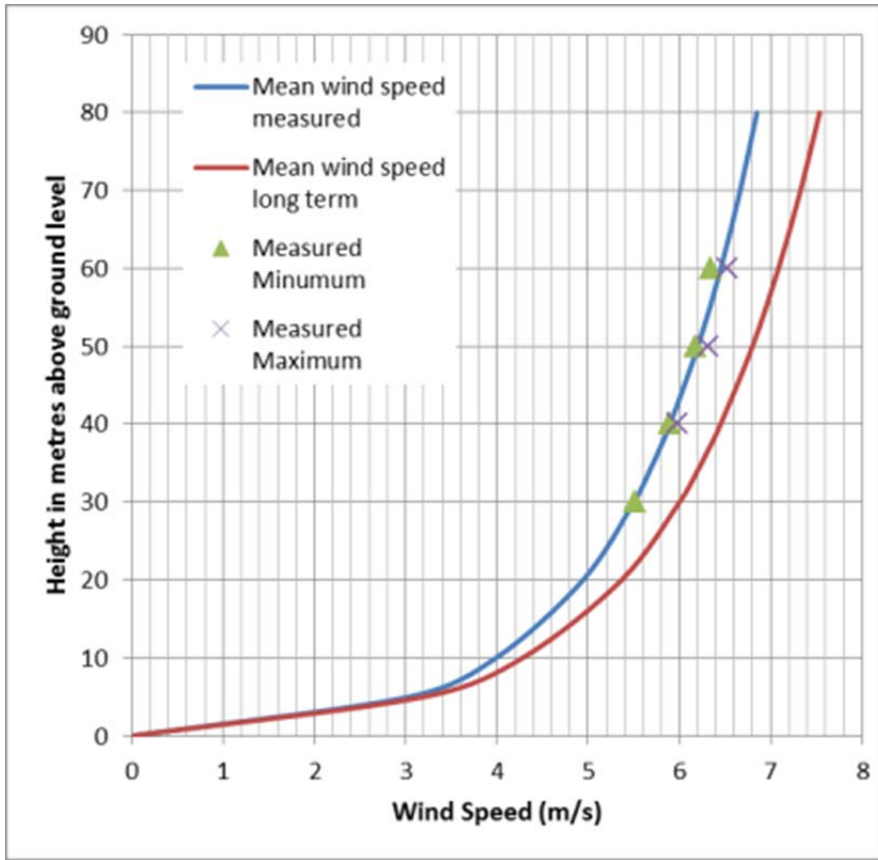


Figure 2 - Vertical profile of horizontal wind speed measured and projected at the wind project site.

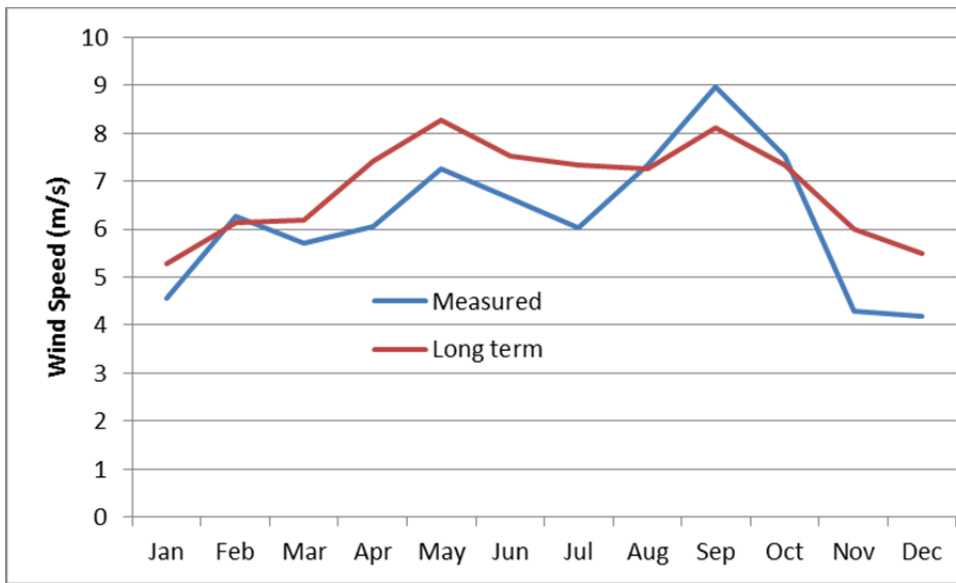


Figure 3 - Monthly mean wind speed measured and projected to long term (2001-2013) at the wind project site.