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Group 3 Blade Testing Results and Analysis

This group studied the parameters of blade shape and length- in the previous class, an oval design was used by chance and appeared to produce more favorable results as compared to other shapes. The group compared the voltage and amperage generated by turbines with three lengths of half-oval, half-rectangular blades: 4 inches, 5.5 inches, and 7 inches. Each blade length had two corresponding shapes- one with the oval side attached to the hub (thus having a flat, rectangular tip), and one with the flat side attached to the hub (thus having an oval tip). Each blade has a 2 inch chord and is placed at a 15 degree pitch. Out of the entire blade length, 1 inch is used for the dowel placement.

Lessons Learned

- Flat-tipped blades produce more power than their oval-tipped counterparts initially, but not for long - the oval-tipped blades produce more power at higher wind speeds.
- Flat-tipped blades constantly produce more power the longer their blades are.
- Oval-tipped blades reach optimal power production at 5.5 in of length, with shorter lengths accelerating in power production past longer blades at higher wind speeds.
- The most efficient blade appeared to be the 5.5 in oval tip.
- As the length of the blade increases, the shape has less importance; the difference in power generated by the 7 in blades was considerably less than the differences in power outputs between the other two blade lengths' corresponding shapes
- The smaller blades (most notably the 4 in blades), regardless of shape, had a significantly higher cut-in speed.

Figure 1: Calibration Curve			
	Wind Speed (mph)		
Fan Voltage (V)	Left	Center	Right
0	0	0	0
10	0	0	0
20	0	0	0

30	0	0	0
40	2.1	2.2	2.2
50	3.1	2.8	3.1
60	4.1	4	4.4
70	5.4	5.3	6
80	7.5	7	7.6
90	9.5	9.2	9.5
100	11	10.2	11
110	11.5	11.5	12.2
120	12.1	12	12.2

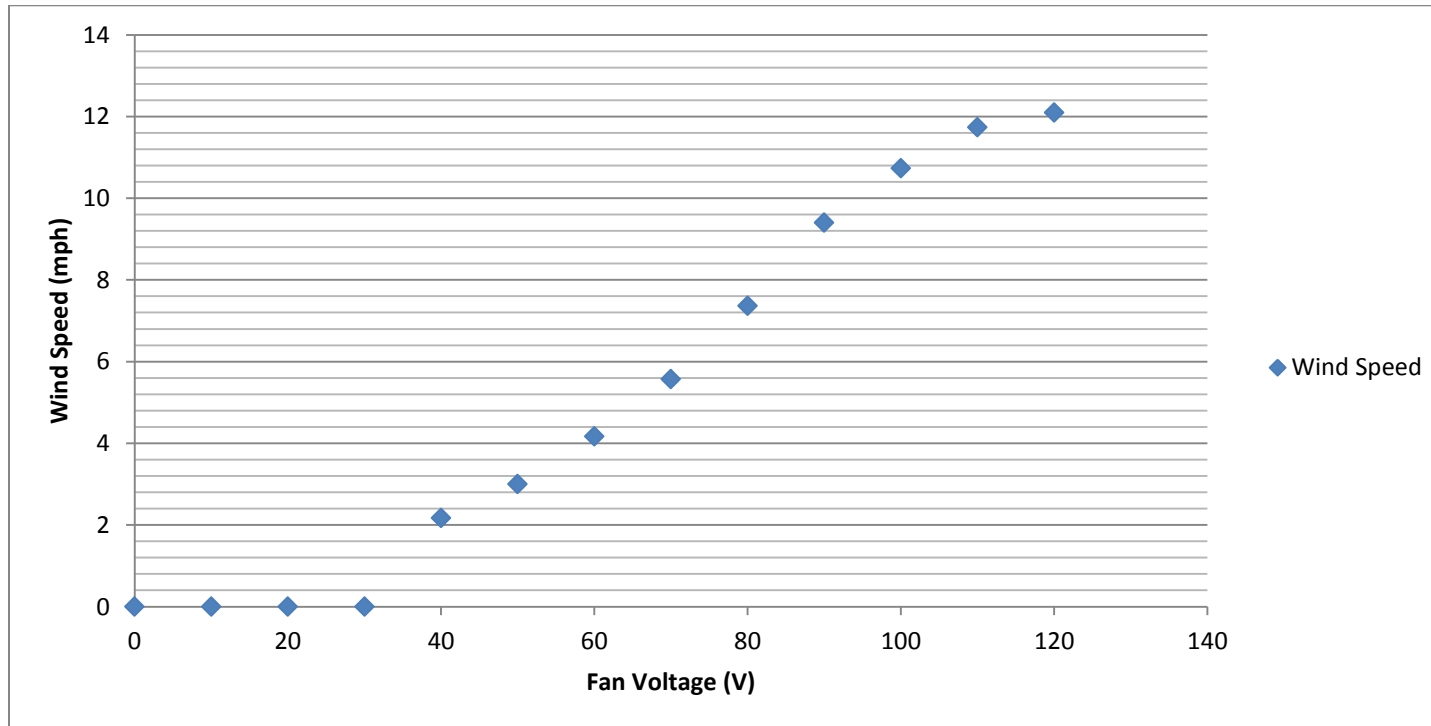


Figure 2 - Fan Calibration Curve

Figure 3: Power Generated at Different Wind Speeds (μW)						
Wind Speed (mph)	7 in Flat Tip	5.5 in Flat Tip	4 in Flat Tip	7 in Oval Tip	5.5 in Oval Tip	4 in Oval Tip
2.167	0	0	0	0	0	0
3	476	400	0	408.1	0	0
4.167	892.7	891	0	1049.6	714	0
5.567	1937.6	1326	0	1828.5	1659	0
7.367	2820	2814	1840.4	3108	3322	1320
9.4	4601.8	3600	3487.5	4335	4690.5	3190
10.7	6200	5320	4690	6106.5	7190.4	5320
11.7	6930	6355	5703.5	6767.1	7935	6772.5
12.1	7380	6820	6200	7990	8892	8160

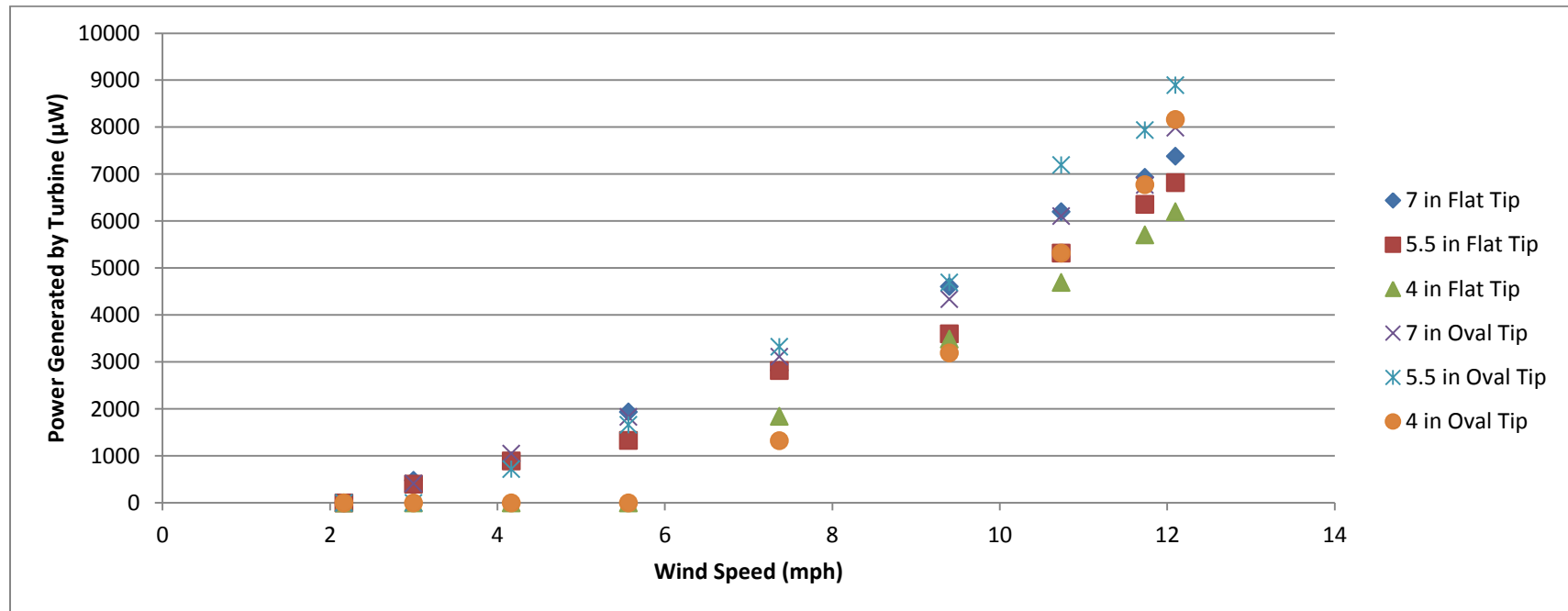


Figure 4 – Power Generated by Turbine vs. Wind Speed

Figure 5: Wind Speed vs. Power from Flat-Tipped Blades			
Wind Speed (mph)	7 in. Flat Tip	5.5 in. Flat Tip	4 in. Flat Tip
2.167	0	0	0
3	476	400	0
4.167	892.7	891	0
5.567	1937.6	1326	0
7.367	2820	2814	1840.4
9.4	4601.8	3600	3487.5
10.7	6200	5320	4690
11.7	6930	6355	5703.5
12.1	7380	6820	6200

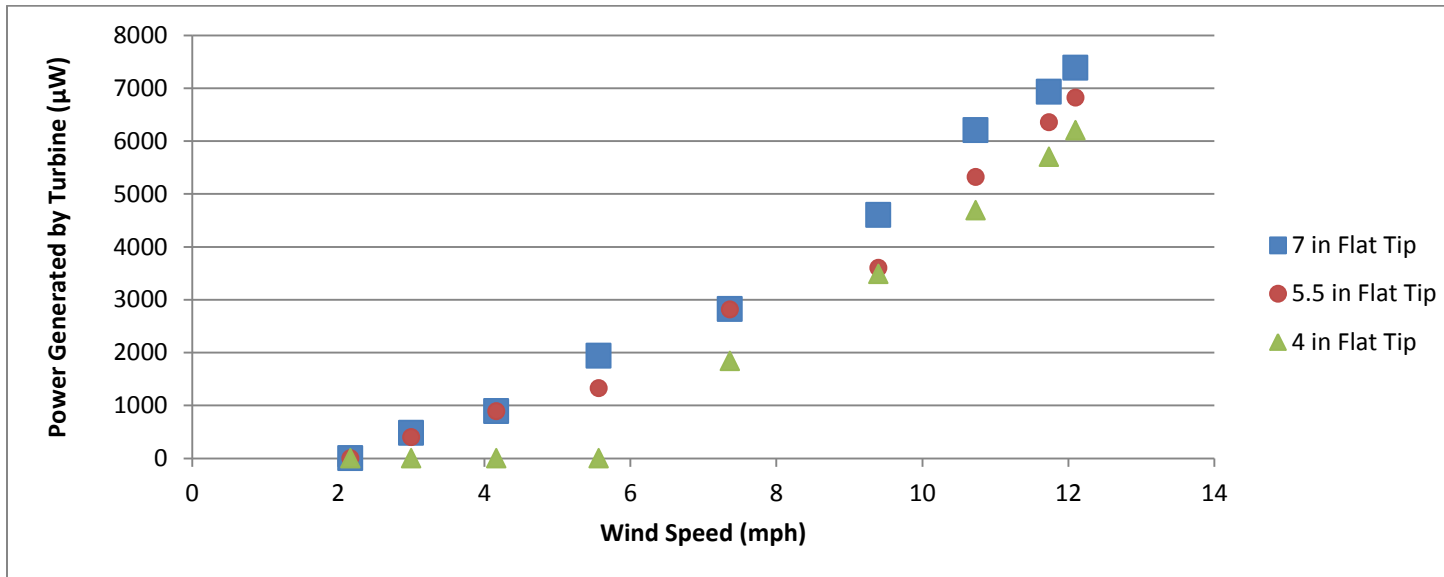


Figure 6 – Power Generated by Turbine at Various Wind Speeds for Flat Tipped Blades

Figure 7: Wind Speed vs. Power from Oval Tipped Blades

Wind Speed (mph)	7 in. Oval Tip	5.5 in. Oval Tip	4 in. Oval Tip
2.167	0	0	0
3	408.1	0	0
4.167	1049.6	714	0
5.567	1828.5	1659	0
7.367	3108	3322	1320
9.4	4335	4690.5	3190
10.7	6106.5	7190.4	5320
11.7	6767.1	7935	6772.5
12.1	7990	8892	8160

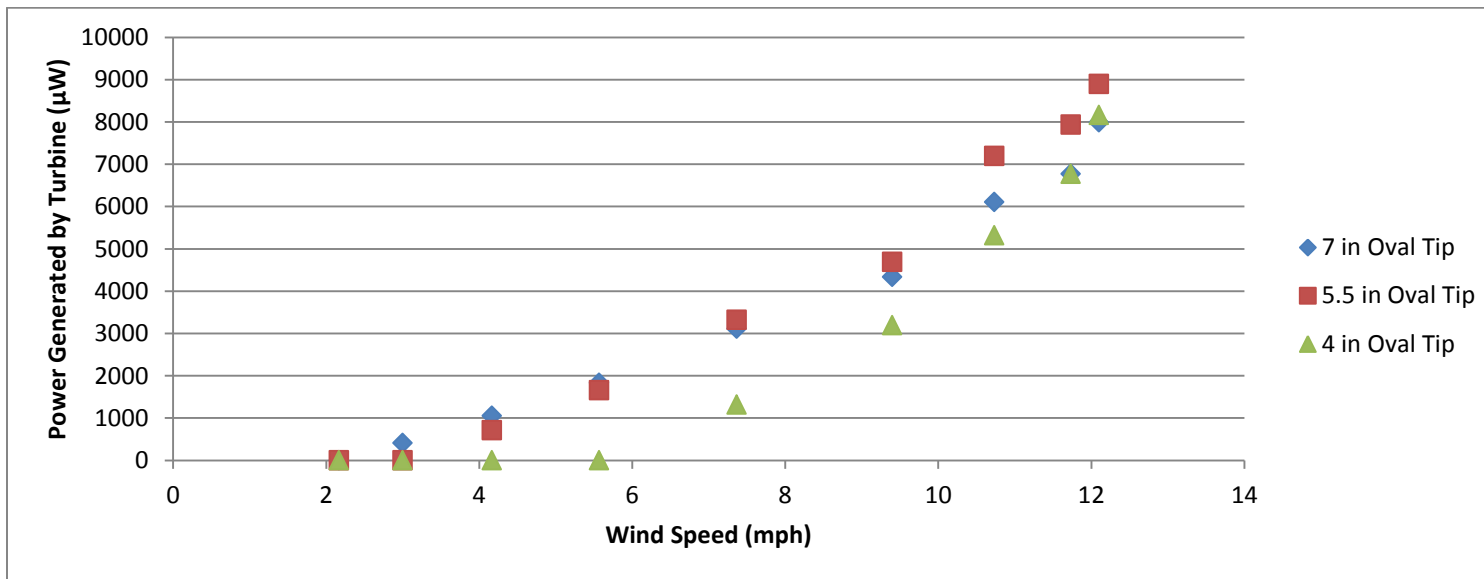


Figure 8 – Power Generated by Turbine at Various Wind Speeds for Oval Tipped Blades

Figure 9: Wind Speed vs. Power for 7 Inch Blades		
Wind Speed (mph)	7 in Flat Tip	7 in Oval Tip
2.167	0	0
3	476	408.1
4.167	892.7	1049.6
5.567	1937.6	1828.5
7.367	2820	3108
9.4	4601.8	4335
10.7	6200	6106.5
11.7	6930	6767.1
12.1	7380	7990

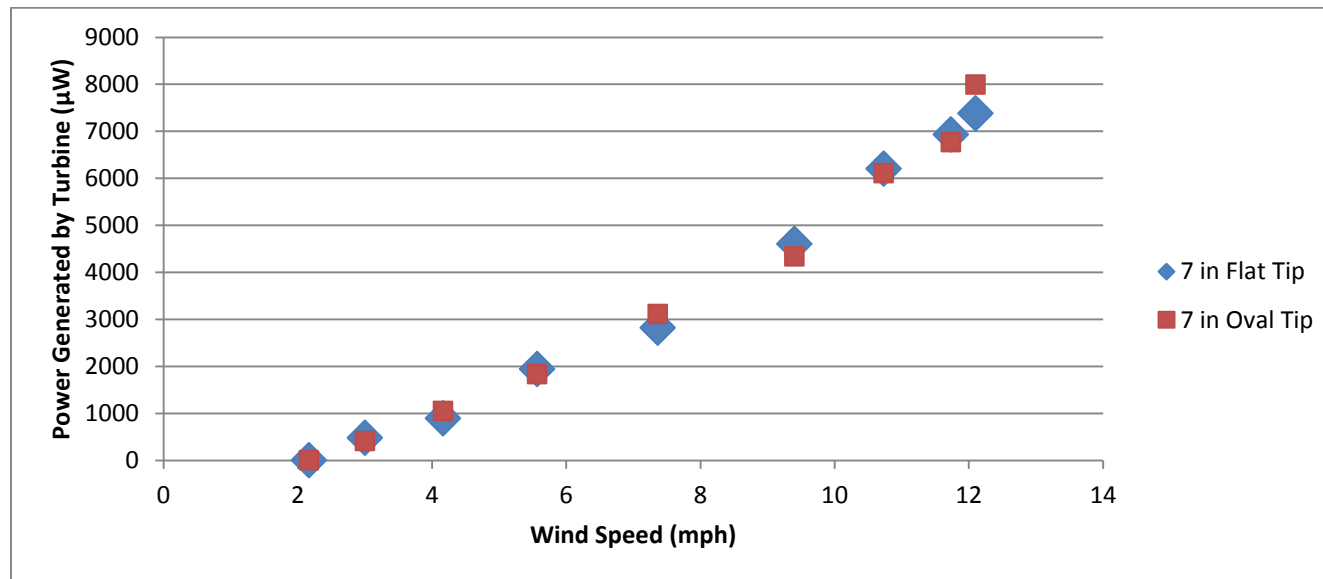


Figure 10 – Power Generated by Wind Turbine at Various Wind Speeds for 7 Inch Blades

Figure 11: Wind Speed vs. Power for 5.5 Inch Blades		
Wind Speed (mph)	5.5 in Flat Tip	5.5 in Oval Tip
2.167	0	0
3	400	0
4.167	891	714
5.567	1326	1659
7.367	2814	3322
9.4	3600	4690.5
10.7	5320	7190.4
11.7	6355	7935
12.1	6820	8892

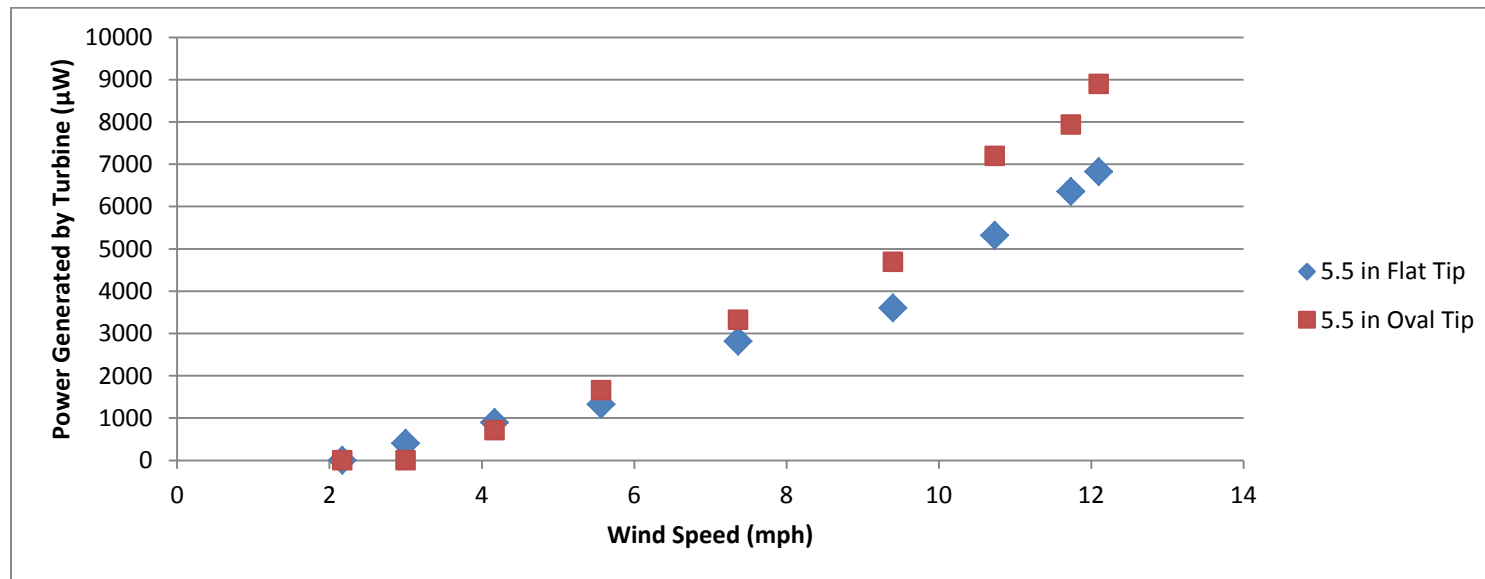


Figure 12 – Power Generated by Turbine at Various Wind Speeds for 5.5 Inch Blades

Figure 13: Wind Speed vs. Power for 4 Inch Blades		
Wind Speed (mph)	4 in Flat Tip	4 in Oval Tip
2.167	0	0
3	0	0
4.167	0	0
5.567	0	0
7.367	1840.4	1320
9.4	3487.5	3190
10.7	4690	5320
11.7	5703.5	6772.5
12.1	6200	8160

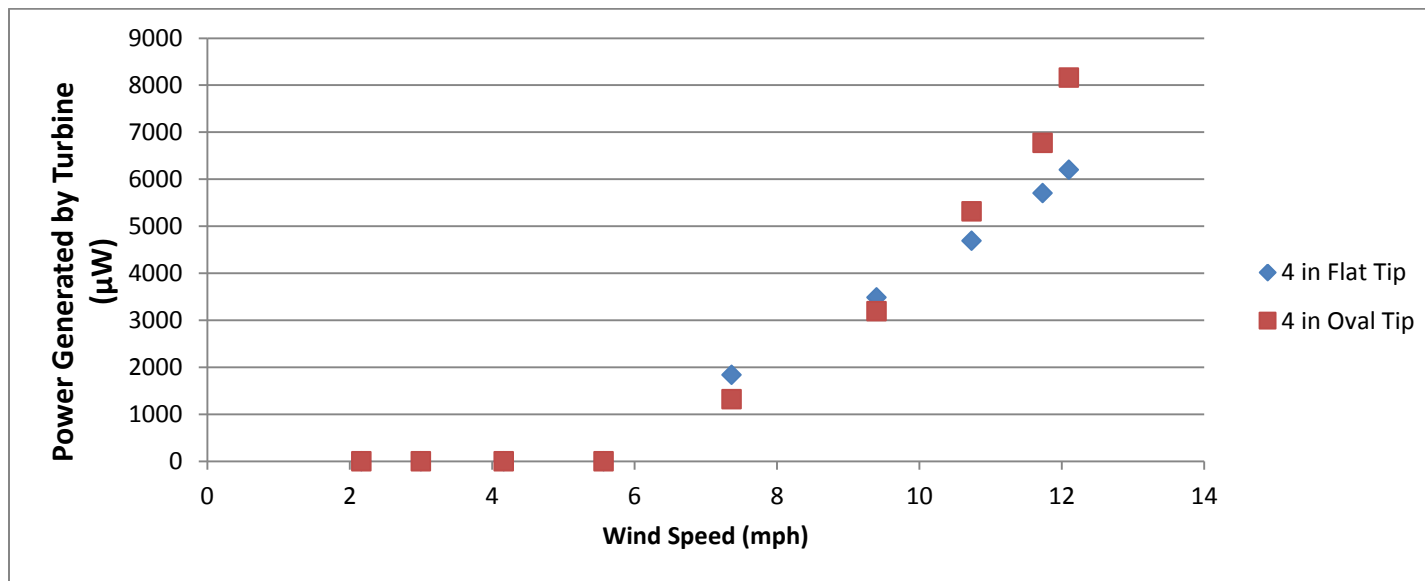


Figure 14 – Power Generated by Turbine at Various Wind Speeds for 4 Inch Blades