

	A	B	C	D	E	F	G	H	I	J
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1 **WIND POWER CALCULATIONS**

2

3 STUDENT \_\_\_\_\_

4 TEAM \_\_\_\_\_

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6

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8 Wind Power Calculation  $P_w = 0.5 * \rho * A * v^3$

9

10	$\rho$	AIR DENSITY	1.23
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11	A	Bade Area	m <sup>2</sup>
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12	v	Wind velocity	m/s
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( 2.2 mph = 1 m/s )

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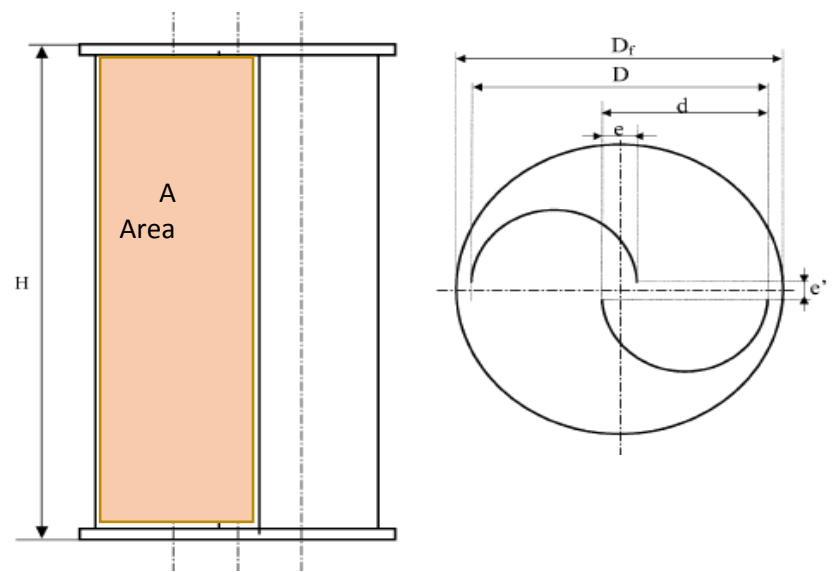
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28



29 Area Calculation

30		H	d	H	d	A
31	Areas	(in)	(in)	( m )	( m )	(m <sup>2</sup> )
32	1	11	4	0.279	0.102	0.028
33	2	11	3	0.279	0.076	0.021
34	3	10	3	0.254	0.076	0.019
35	4	9	3	0.229	0.076	0.017

36

37  $P_w$  in the maximum available power from wind

38 Betzs Law say that you can only extract 59% of the available power

39 Wind turbines convert the Betzs law power to mechanical power and in turn to electrical

40 The effeiciency that conversion varies.

41 For a Savonius wind turbine estimate 30 %

42

43

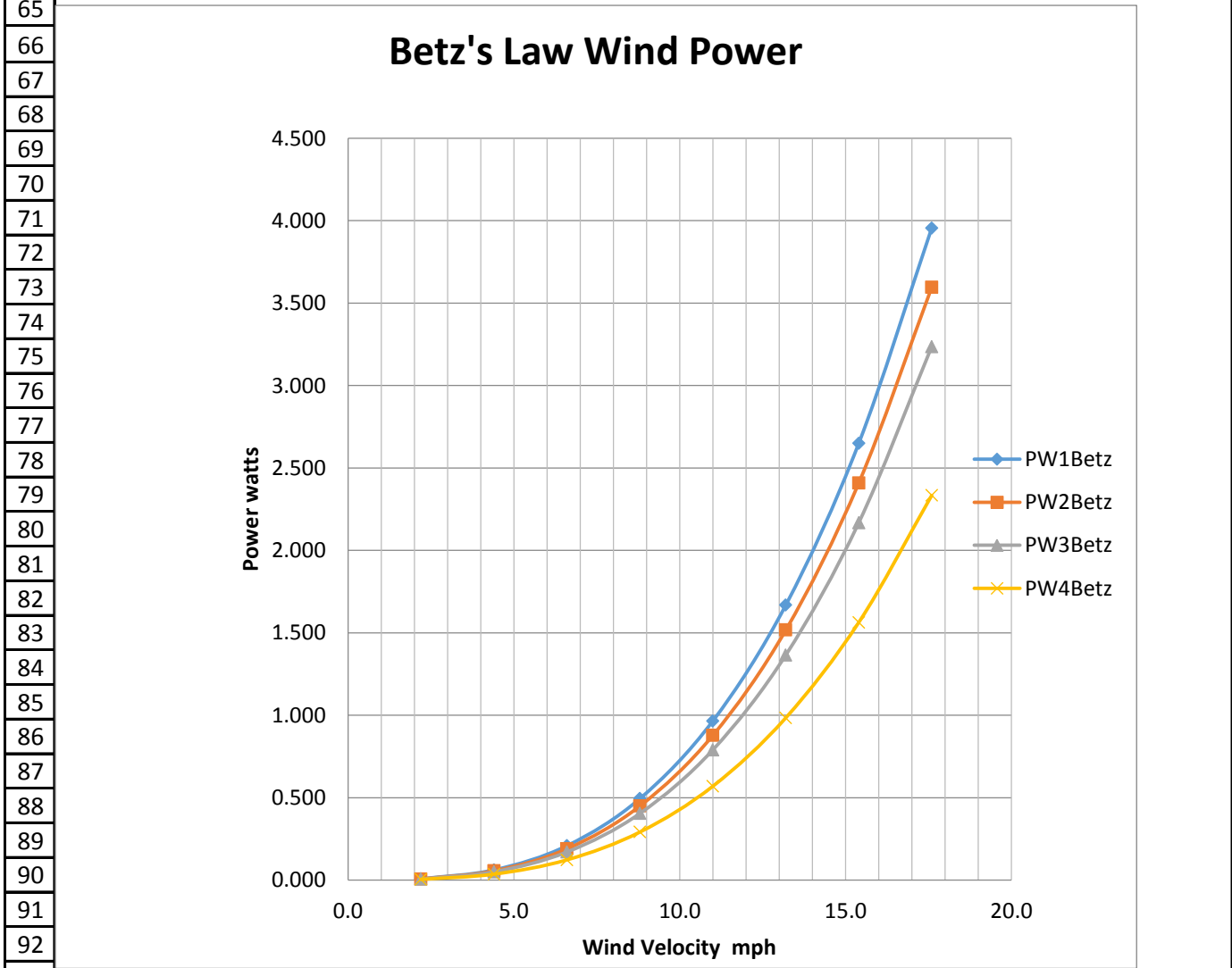
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	A	B	C	D	E	F	G	H	I	J
46										
47										
48	Power Calculation for Areas						BETZ LAW- $C_{PB}$		0.59	
49										
50	Maximum Wind Power						Betz's Law Power (0.59 maximum power)			
51	m/s	mph	watts	watts	watts	watts	watts	watts	watts	watts
52	v	v	$P_{W1}$	$P_{W2}$	$P_{W3}$	$P_{W4}$	$P_{W1Betz}$	$P_{W2Betz}$	$P_{W3Betz}$	$P_{W4Betz}$
53	1	2.2	0.017	0.013	0.012	0.011	0.008	0.007	0.006	0.005
54	2	4.4	0.140	0.105	0.095	0.086	0.062	0.056	0.051	0.036
55	3	6.6	0.471	0.354	0.321	0.289	0.209	0.190	0.171	0.123
56	4	8.8	1.117	0.838	0.762	0.686	0.494	0.449	0.405	0.292
57	5	11.0	2.182	1.637	1.488	1.339	0.966	0.878	0.790	0.570
58	6	13.2	3.771	2.828	2.571	2.314	1.669	1.517	1.365	0.984
59	7	15.4	5.988	4.491	4.083	3.675	2.650	2.409	2.168	1.563
60	8	17.6	8.939	6.704	6.094	5.485	3.955	3.596	3.236	2.334

61  
62 Graph Bet's Law Wind Power vs. Wind Velocity

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64



93

	A	B	C	D	E	F	G	H	I	J	
94	Estimate Savonious Wind Turbine Efficiency at						0.3	$C_p$			
95											
96											
97	Betz's Law Power (0.59 maximum power)						CP Power				
98	m/s	mph	watts	watts	watts	watts	watts	watts	watts	watts	
99	v	v	$P_{W1Betz}$	$P_{W2Betz}$	$P_{W3Betz}$	$P_{W4Betz}$	$P_{W1CP}$	$P_{W2CP}$	$P_{W3CP}$	$P_{W4CP}$	
100	1	2.2	0.008	0.007	0.006	0.005	0.002	0.002	0.002	0.001	
101	2	4.4	0.062	0.056	0.051	0.036	0.019	0.017	0.015	0.011	
102	3	6.6	0.209	0.190	0.171	0.123	0.063	0.057	0.051	0.037	
103	4	8.8	0.494	0.449	0.405	0.292	0.148	0.135	0.121	0.088	
104	5	11.0	0.966	0.878	0.790	0.570	0.290	0.263	0.237	0.171	
105	6	13.2	1.669	1.517	1.365	0.984	0.501	0.455	0.410	0.295	
106	7	15.4	2.650	2.409	2.168	1.563	0.795	0.723	0.650	0.469	
107	8	17.6	3.955	3.596	3.236	2.334	1.187	1.079	0.971	0.700	

