

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Wind Turbine - Wind Tunnel Data and Calculatic Fall 2016															
2	VAWT-2															
3																
4	Measured						Calculated									
5	Wind Velocity Target	Wind Velocity Actual	Load Resistor	Load Voltage	Generator Frequency	Rev./min	Wind Power	Generator Power	Rotor Tip Speed	Tip to Speed Ratio	(Electrical) Power Coefficient					
6	(mph)	(mph)	(ohms)	(v-rms)	(Hz)	(rpm)	(watts)	(watts)	(m/s)	(ratio)	(ratio)					
7	v	v	R _L	V _L	F	rpm	P _W	P _E	Ω	λ	C _p					
8	9	9.08	100000	1.26	8.01	240	1.641	0.000	2.076	0.503	0.000					
9		9.08	4700	1.25	7.97	239	1.641	0.000	2.066	0.500	0.000					
10		9.08	27	0.69	7.08	212	1.641	0.027	1.835	0.445	0.016					
11		9.08	15	0.5	6.7	201	1.641	0.032	1.737	0.421	0.020					
12		9.08	10	0.39	6.6	198	1.641	0.036	1.711	0.414	0.022					
13		9.08	5	0.243	6.3	189	1.641	0.044	1.633	0.396	0.027					
14		9.08	1	0.037	3.7	111	1.641	0.020	0.959	0.232	0.012					
15	11	11.07	100000	1.67	10.6	318	2.973	0.000	2.747	0.546	0.000					
16		11.07	4700	1.68	10.6	318	2.973	0.001	2.747	0.546	0.000					
17		11.07	27	0.98	9.6	288	2.973	0.054	2.488	0.494	0.018					
18		11.07	15	0.72	9.35	281	2.973	0.066	2.423	0.482	0.022					
19		11.07	10	0.56	9.04	271	2.973	0.075	2.343	0.466	0.025					
20		11.07	5	0.34	8.8	264	2.973	0.087	2.281	0.453	0.029					
21		11.07	1	0.062	8.3	249	2.973	0.057	2.151	0.428	0.019					
22	13	13.1	100000	2.09	13.1	393	4.928	0.000	3.395	0.570	0.000					
23		13.1	4700	2.06	12.9	387	4.928	0.001	3.343	0.561	0.000					
24		13.1	27	1.22	12.1	363	4.928	0.083	3.136	0.527	0.017					
25		13.1	15	0.91	11.7	351	4.928	0.106	3.032	0.509	0.022					
26		13.1	10	0.72	11.5	345	4.928	0.123	2.981	0.501	0.025					
27		13.1	5	0.475	11.1	333	4.928	0.170	2.877	0.483	0.034					
28		13.1	1	0.071	10.6	318	4.928	0.075	2.747	0.461	0.015					
29	15	15	100000	2.51	15.54	466	7.398	0.000	4.028	0.591	0.000					
30		15	4700	2.24	15.1	453	7.398	0.001	3.914	0.574	0.000					
31		15	27	1.55	14.7	441	7.398	0.134	3.810	0.559	0.018					
32		15	15	1.13	14.5	435	7.398	0.163	3.758	0.551	0.022					
33		15	10	0.9	14.3	429	7.398	0.193	3.706	0.544	0.026					
34		15	5	0.55	13.9	417	7.398	0.227	3.603	0.528	0.031					

Wind Turbine Variables

Height H =	23	(cm)
Diameter D =	16.5	(cm)
Coil Resistance R _G =	13.8	(ohms)
Sweep Area A =	0.03795	m ²

Generator v/100rpm 0.5

Conversion Factors and Constants

rpm = 30 F Ω
 1 rps = rpm/60 Ω
 λ
 1 m/s = 2.2 mph π

$\rho = 1.23$ 1 in. = 0.0254 m

Equations

A = D H Sweep Area

$P_W = 0.5 \rho A v^3$ Available Wind Power

$P_E = V_L^2 (1 + R_g / R_L) / R_L$

$\Omega = \pi D * rps$ (m/s D (meters))

$\lambda = TS / v$ (Turbine tip speed/ wind speed)
 v (m/s)

$C_p = P_E / P_W$ Power Coefficient

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
35		15	1	0.085	13.5	405	7.398	0.107	3.499	0.513	0.014					

