TEST SUMMARY REPORT

Manufacturer	**Supernova Technologies Pvt. Ltd.**
Wind Turbine	**SNT 6, Off- grid, 48 V DC**
Test Report Number	**PT3-PP-07, January 2012** **PT3-SFT-08, January 2012** **PT3-DT-09, June 2012**

1. **Introduction:** The report summarises the Power Performance measurement, Duration Test and Safety & Function test carried out on SNT 6, in accordance with the international standard of IEC 61400-12-1 for "Power Performance Measurements of electricity producing wind turbines" and IEC 61400-2 for "Design Requirements for Small Wind Turbine". The SNT 6 is a three bladed, upwind variable speed turbine. The rotor swept area of the turbine is 14.25 m^2. The turbine was tested in the battery charger configuration with a charge controller voltage of 48 V DC. The measurements were carried out at Wind Turbine Research Station, Kayathar during the period July 10, 2010 to June 22, 2012.

2. **TURBINE RATING BASED ON TEST MEASUREMENT:**

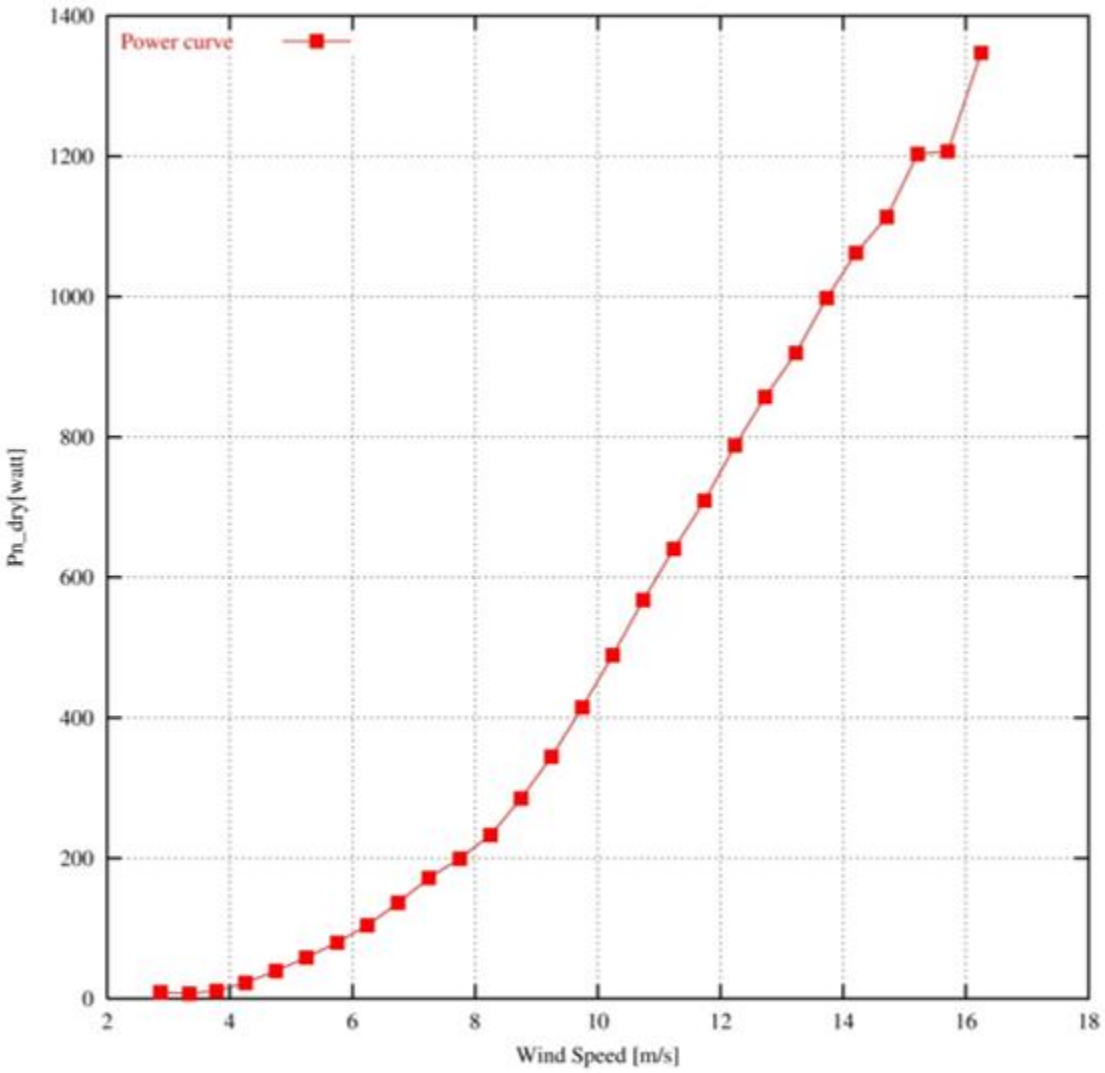
Reference Annual Energy	819 kWh @ Annual average wind speed 5 m/s
Reference Power	600 W @ 11 m/s
Peak Power	1270 W @ 16.25 m/s

3. **Annual Energy Production (At Sea Level Air Density 1.225 kg/ m^3)**

Mean Wind Speed (m/s)	AEP Measured (kWh)			AEP Extrapolated (kWh)		
	AEP	Std. Dev	%	AEP	Std. Dev	%
4	402	79	19.65	402	79	19.65
5	819	100	12.21	822	100	12.16
6	1365	119	8.72	1400	119	8.5
7*	1933	134	6.93	2094	137	6.54
8*	2413	145	6.01	2842	153	5.38
9*	2748	150	5.46	3580	165	4.60
10*	2936	150	5.11	4250	174	4.09
11*	3004	147	4.89	4811	180	3.74

* In-complete as per IEC 61400-12-1 (As per IEC 61400-12-1, estimations of AEP –measured shall be labelled as "incomplete" when calculations show that the AEP-measured is less than 95 % of the AEP- extrapolated.)

4. Power Curve (data corrected for standard dry air density of 1.225 kg/m3)



5. Power Curve with Uncertainty Budget

A: Bin no. [ ]
B: Wind speed [m/s]
C: Electrical power, adjusted for density variations [W]
D: Slope of power curve $\Delta P/\Delta v$ [W/(m/s)]
E: $\Delta P/\Delta t$ [W/(degK)]
F: $\Delta P/\Delta B$ [W/(mBar)]
G: Cp [ ]
H: Category A uncertainty [W]
I: Category B uncertainty [W]
J: Total uncertainty [W]
K: Counts [ ]

A	B	C	D	E	F	G	H	I	J	K
1	2.87	8.7	247.96	0.03	0.01	41.954	0	0	0	138
2	3.34	6.7	-4.16	0.02	0.01	20.644	0.6	12.3	12.3	1763
3	3.78	10.4	8.25	0.04	0.01	21.935	0.3	12.3	12.3	768
4	4.26	21.3	23.15	0.07	0.02	31.684	0.4	12.5	12.6	10929
5	4.75	37.6	32.85	0.13	0.04	40.139	0.5	12.8	12.8	10987
6	5.25	55.3	35.6	0.19	0.05	43.811	0.6	13	13	11334
7	5.75	75.3	40.02	0.26	0.07	45.416	0.7	13.2	13.2	10867
8	6.24	98.4	46.7	0.34	0.1	46.328	0.8	13.6	13.6	9945
9	6.74	128.9	60.9	0.45	0.13	48.145	1	14.5	14.5	8633
10	7.25	162.2	66.31	0.56	0.16	48.839	1.1	15	15	7687
11	7.75	188.1	51.26	0.65	0.19	46.265	1.1	14.2	14.3	7719
12	8.25	219.6	63.36	0.76	0.22	44.823	1.2	15.2	15.2	754
13	8.75	268.7	98.51	0.93	0.27	45.993	1.3	18.4	18.5	7104
14	9.24	324.6	112.78	1.13	0.32	47.093	1.5	20.3	20.4	6314
15	9.75	390.4	130.56	1.36	0.39	48.3	1.7	22.8	22.9	5754
16	10.24	459.7	139.93	1.6	0.45	49.016	2	24.6	24.7	4828
17	10.74	533.3	147.3	1.85	0.53	49.292	2.4	26.2	26.4	3847
18	11.24	601.4	137.22	2.09	0.59	48.542	2.9	25.8	26	2971
19	11.74	666	128.88	2.31	0.66	47.161	3.6	25.6	25.9	2136
20	12.24	739.2	146.76	2.57	0.73	46.202	4.5	28.7	29.1	1543
21	12.73	803.7	131.65	2.79	0.79	44.654	5.7	27.7	28.3	1117
22	13.23	862	116.04	2.99	0.85	42.641	7	26.6	27.5	760
23	13.73	935.7	147.59	3.25	0.92	41.417	9.3	31.6	32.9	471
24	14.21	996.5	127.3	3.46	0.98	39.809	12.2	29.8	32.2	260
25	14.71	1044.4	94.99	3.63	1.03	37.575	17.5	26.6	31.8	141
26	15.22	1128.7	167.24	3.92	1.11	36.706	27	37.3	46.1	64
27	15.71	1132.2	7.26	3.93	1.12	33.476	36.1	21.7	42.1	31
28	16.25	1266.4	247.96	4.4	1.25	33.826	64.4	52.8	83.2	14

6. **Duration Testing:** The turbine has successfully completed the duration test for an IEC Class III turbine during the test period. An operational time fraction of 95.48 % was achieved. The average turbulence intensity recorded at 15 m/s during the test

period was 11.35%. The maximum instantaneous wind speed recorded was 18.9 m/s on 18th July 2011.

7. **Safety & Function Testing:** The turbine successfully completed the tests for Loss of Load and Emergency Stop under normal operation. The turbine performance with respect to power & speed control, over speed protection, battery overvoltage protection and yaw system control were observed to be within manufacturer specified limits.

8. **Manufacturer supplied Turbine Specification**

General Configuration	Make, Model	SUPERNOVA TECHNOLOGIES Pvt Ltd, SNT-6
	Rotation Axis	Horizontal
	Orientation	Upwind
	Number of blades	3
	Rotor diameter (m)	4.26
	Hub height (m)	20
Performance	Rated Electrical Power (W)	3500
	Rated wind speed (m/s)	11
	Cut-in wind speed(m/s)	2.5
	Cut-out wind speed (m/s)	15
Rotor	Swept area (m2)	14.25
	Rotational Speed (rpm)	0-300
	Blade pitch	Fixed 15^{O}
	Direction of rotation	Anti-Clockwise
	Over-speed control	Yawing and Dump Load
Yaw System	Wind Direction Sensor	Furling tail
	Yaw control method	Free yaw
Tower	Type	Tilt-up tripod tower
	Height (m)	20

Battery Charger	Model	SNT-6
	Manufacturer	SUPERNOVA TECHNOLOGIES Pvt Ltd
	Nominal Battery Voltage (V) DC	48
	Maximum output power (W)	3500