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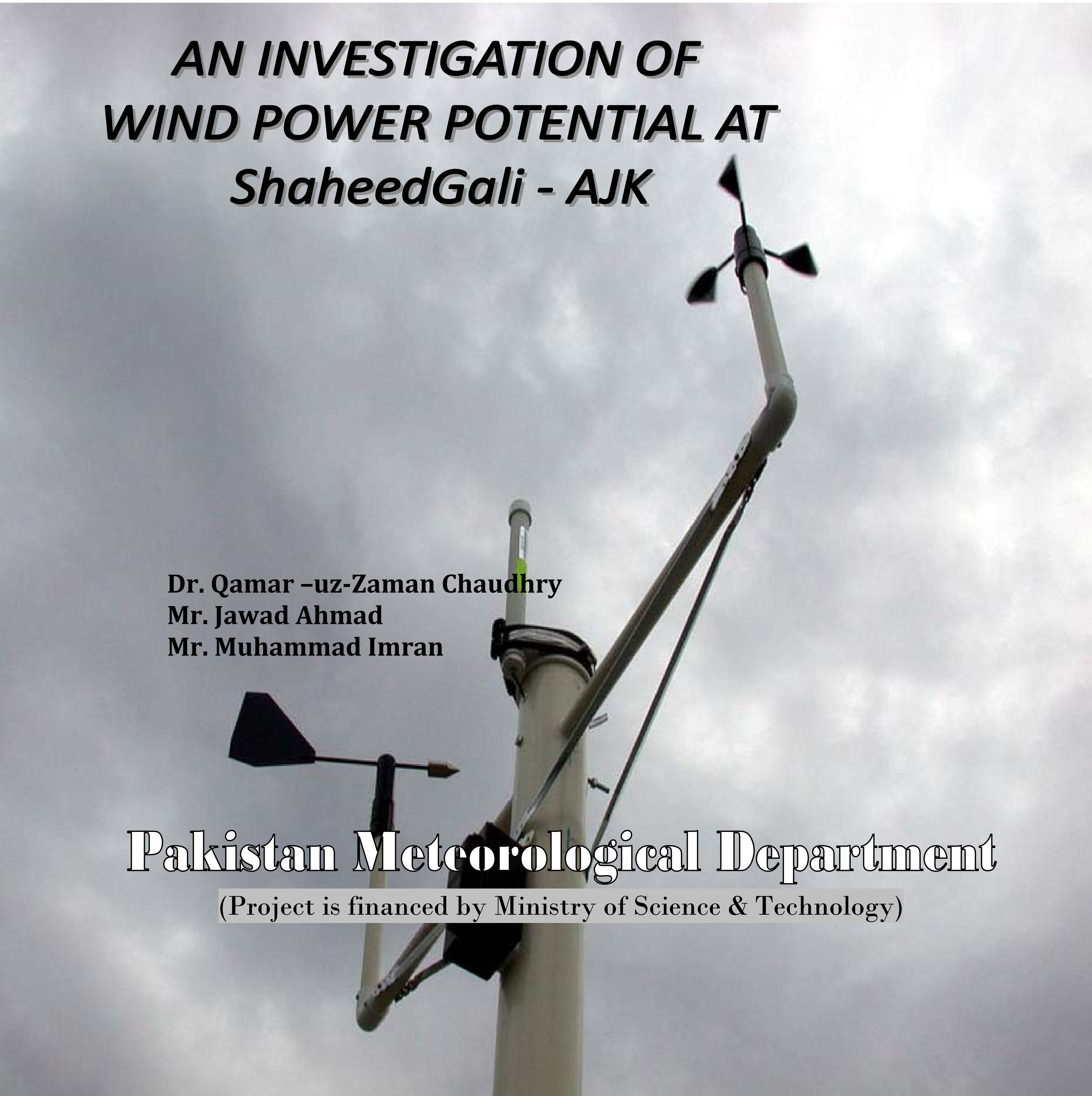

AN INVESTIGATION OF WIND POWER POTENTIAL AT ShaheedGali - AJK

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(Project is financed by Ministry of Science & Technology)

Executive Summary

Pakistan Meteorological Department (PMD) conducted a wind power potential survey of the northern areas of Pakistan. Funding for this project was provided by the Ministry of Science & Technology. Under this wind data was collected at 42 sites along the Northern parts of the Country.

In this report the analysis based on one year wind data has been presented along with the wind generated electric power at ShaheedGali, AJK. Wind data with ten minute average speed and direction were collected at 10 meters and 30 meters height and 50 meters values were computed from models.

At 50 meters we have the annual average wind speed of 5.39 m/s during twelve months May-2007 to April-2008 the highest of 6.53 is observed in May 07. Seasonal Diurnal Wind variation indicates that maximum wind speed is available in the morning and evening through-out the year. Wind frequency distribution shows that during 12.3% of the time wind speed is 5 m/s or above.

Sometimes simply wind speed averages do not give the true picture of the wind power optional of an area. For the purpose it is common to assign areas to one of the seven wind classes based on “wind power density” of the area. Monthly and annual wind power density has been computed and added in the report. The annual power density of ShaheedGali is 208.19 w/m^2 according to international wind classification, this power density categorize ShaheedGali as a below marginal site for wind power generation. Though monthly power density values indicates that the power density is blow marginal category but this is compensated by very high values during summer months especially in June and July.

Wind generated electric power has as also been computed on hypothetical 600Kw wind turbine and its hourly, monthly and annual values has been added in this report. The annual power production form a single 600kw wind turbine come out to 949,755 kWh which shows the capacity factor of 18% for ShaheedGali. Internationally it is accepted that if any site has a capacity factor of 25% and above than that site is suitable for installation of economically viable wind power farms. As such ShaheedGali and surrounding areas can be classified as no suitable site for installing big economically viable wind farms.

1. Introduction:

Wind energy is the fastest growing renewable energy source today. A continued interest in wind energy development worldwide has produced steady improvements in technology and performance of wind power plants. New wind power projects have proven that wind energy not only is cost competitive but also offers additional benefits to the economy and the environment.

A steady supply of reasonably strong wind is necessary requirement for utilizing the power in the wind. Development of wind energy depends upon a clear understanding of wind resources. Site location, turbine performance and physical effects of turbulence and energy extraction represent a few of the issues that must be addressed by anyone interested in developing wind energy.

As such any plan to develop wind energy must begin by understanding the wind resource. Where are the best potential wind sites located? How much energy could be extracted from the wind at those sites?

1.1 Characteristic of wind:

The global winds are caused by pressure differential across the earth's surface. The amount of solar radiation absorbed at the earth's surface is greater at the equator than at the poles. This variation in incoming heat sets up convective cells in the lowest layer of the atmosphere. In the simplest form air rises at the equator and sinks at the poles. However the rotation of the earth complicates this simple heat transfer. A series of circulations are set up in both northern and southern hemispheres.

The areas of the globe where air is descending are zones of high pressure and where the air is ascending, low-pressure zones are formed. The pressure gradient drives the flow of air from high to low pressure, thus causing the wind. The wind is then acted on the corriolis force due to the earth's rotation. The resultant wind is turned easterly or westerly. On a smaller scale, wind is created because of temperature difference between land and sea and mountains and valleys. The local topographical features and roughness of the terrain also cause air movements.

2.0 Wind Mapping Project of Pakistan Meteorological Department:

As any plan to develop wind energy must begin by understanding the wind resources. Where are the best potential wind sites located? How much energy could be extracted from the wind at those sites? Will the wind turbine performance be affected by the turbulence or other wind resource characteristics?

To answer these questions and to provide wind resource database for the different potential parts of the country, Pakistan Meteorological Department prepared a phased programme. Government of Pakistan, Ministry of Science and Technology provided the necessary funding for undertaking the Phase II. Second phase covers the Northern areas of Pakistan.

2.1 Study Area:

The project area for the wind mapping Phase-II covers the Northern areas of Pakistan including Districts are Swat, Dir, Chitral, Gilgit, Skardu, Haripur, Shangla, Buneer, Nowshara, Peshawar, Mohmad Agency, Khyber Agency and Azad Kashmir.

Forty-Two stations for collecting wind data have been installed to study the wind regime as shown in Map-1. The list of stations is given below:

Fatehpur, Bahrain, Kalam, Khawazakhaila, Malamjabba, Tahash, Khungipayan, Dir, Tarbella, Nizampur, Warsak, Chitral City, Drosh, Mirkhani, Shagore, Garam Chasma, Khagozi, Reshan, Mastuj, Kalash, Ayune, Astore, Bunji, Chillas, Gilgit, Gupis, Sost, Passu, Aliabad, Shigar, Barapayan, Sermik, Lowaramaina, Ramatkore, ShahidaSir, Danakool, ShaheedGali, Moorti Pahari, Rangla, Pedar, Lempiapatian, Dargaye.

ShaheedGali is situated in Muzaffarabad, AJK. Latitude & Longitude of ShaheedGali is:
Latitude = 34.23°, Longitude = 73.25°

2.2 Data source:

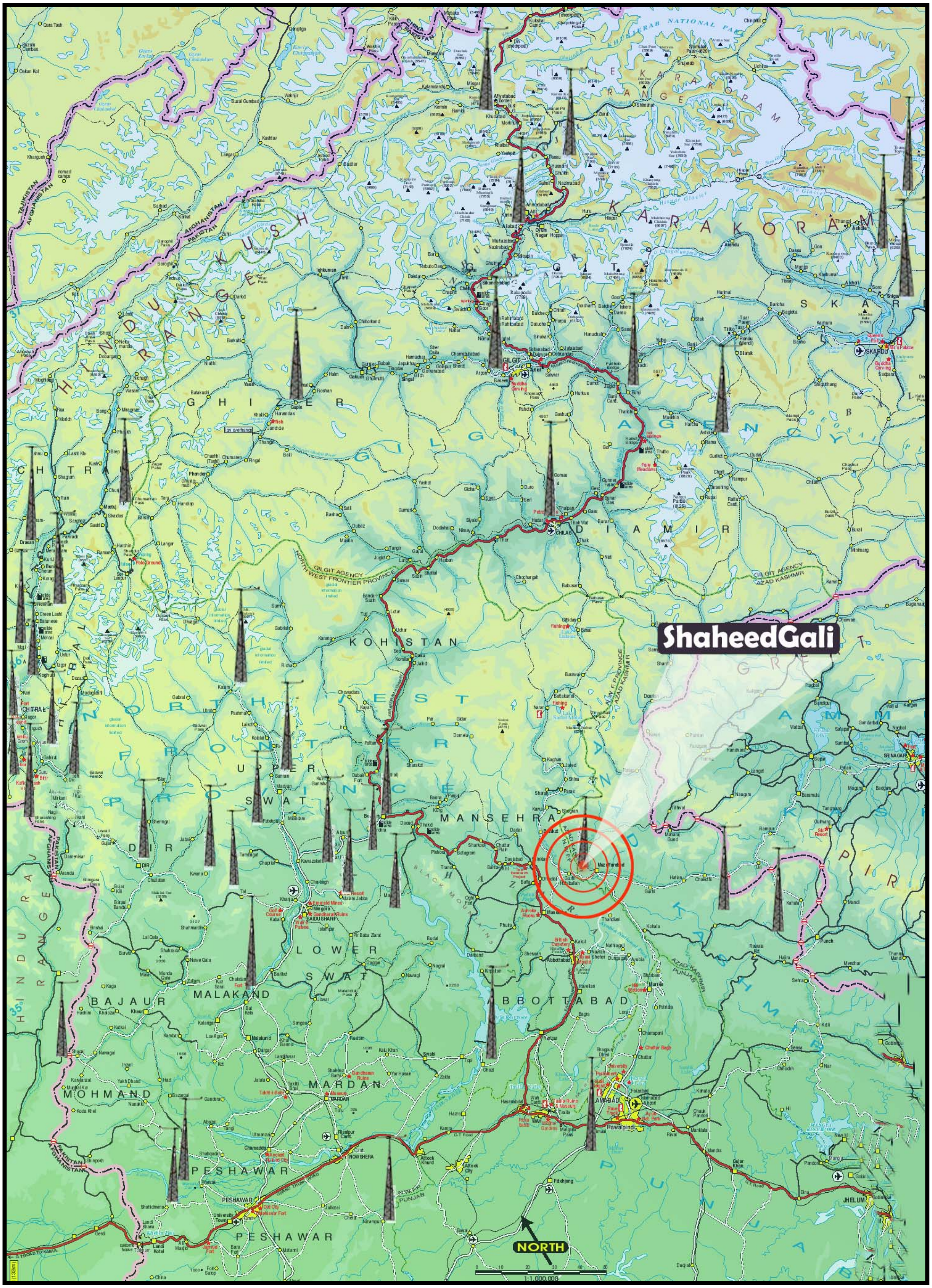
To undertake this study 30-meter high towers are erected at the locations mentioned above. On each of these high towers two wind speed anemometers are installed at the height of 10 meters and 30 meters, respectively; wind vane for recording wind direction is installed at 30 meters height. NRG automatic data loggers have been installed to record data at each site. These data loggers are recording, ten-minute average wind speed at both level, ten-minute average wind direction, and 10-minute average minimum and maximum wind speed. While selecting the above-mentioned locations for wind monitoring; the main objective was to identify potentially windy areas that also possess other desirable qualities of wind energy developed site. Further following guidelines as far as possible were also kept in mind while choosing an exact location for monitoring towers.

- Towers are placed as for as possible away from the local obstruction to the wind
- Selected location should be representative of the majority of the site.

Since sating a tower near obstructions such as trees or building can adversely affect the analysis of the site's wind characteristics such as magnitude of wind resource, wind shear and turbulence levels the tower in most cases are placed as for as possible away from local obstructions to the wind. But where this rule could not be followed, the tower was placed at horizontal distance of 10 times the height of the obstruction in the prevailing wind direction as required internationally. The following parameters have been recorded during the study.

i. Wind speed ten minute average at 10 & 30 meters
ii. Maximum wind speeds during 10 minutes
iii. Minimum wind speeds during 10 minutes
iv. Wind direction ten minutes average at 30 meters

Every month a team of observers and Maintenance Engineers visit site to inspect the instruments and to download the data on a laptop. Finally, the data is compiled and analyzed at Renewable Energy Research Cell established at Meteorological Department Islamabad.



Map-1: Shows 42-Towers Installed in Wind Mapping Project in Northern Areas

3.0 Methodology; Analysis & Discussion:

3.1 Wind speed variation with height:

Wind speed tends to increase with height in most locations, a phenomenon known as wind shear. The degree of wind shear depends mainly upon on two factors, atmospheric mixing and the roughness of the terrain.

Atmospheric mixing typically follows a daily cycle driven by solar heating. At the hub height of a wind turbine, this cycle often causes wind speeds to increase in the daytime and decrease at night. However, the range of variation between night and day typically diminishes as hub height increases. At a height of approximately 50 meters, it weakens or may even disappear in some cases.

Terrain roughness also affects wind shear by determining how much the wind is slowed near the ground. In areas with a high degree of roughness, such as forests or cities, near- surface wind speeds tend to be low and wind shear high, whereas the converse is true in areas of low roughness such as flat, open fields. Wind shear may be greatly reduced or eliminated where there is an abrupt change in terrain height such as a sea cliff or mountain ridge.

To save money wind measurements sometimes are taken at a lower height than the wind turbine tower. In that case, it is essential to measure wind shear at different times of day in different seasons to accurately predict the performance of a wind power plant. The shear can be measured by monitoring wind speeds at two or three heights on a tower. Since wind turbines produce much more power in stronger winds, wind turbine designers try to put turbines on the tallest possible towers. At some point, however, the increased cost of towers outweighs the benefits. With current wind turbine technology, the optimum tower height for large wind machines appears to be approximately 40 to 50 meters.

For saving money in this survey also the wind has been recorded at 10 & 30 meters and for calculating the wind speed at 50 meters the following two methods has been used in this study.

3.1.1 *Log Law:*

The turbulent mixing in the atmosphere may be considered in a similar way to molecular mixing (this is called k theory). Assuming the mixing is dominated by mechanical mixing due to shear forces a relationship of wind speed with height is derived.

$$u = \frac{u_*}{k} \ln\left(\frac{z - D}{z_o}\right)$$

Where

u_* is the friction notify

k is the von Karman constant

$\mathbf{Z_0}$ is the roughness length

D is the displacement height

The von Karman constant is generally taken as 0.4. The roughness length Z_o is related to the vegetation cover of the area. The values of roughness length are given in Table-1. The displacement height D is the height above the roughness elements where the flow is free. For most vegetation it is small and is generally treated as zero. For large roughness elements like trees and building in towns it is not negligible and is the order of the average height of the elements. The **log law** may only be used for heights above D. Turbines are rarely sited in forests or towns, so D is usually taken as zero.

The wind speed at any height z can then be computed provided that the wind speed at a height Z_R is known. Thus:

$$\frac{u}{u_R} = \frac{\ln\left(z / z_o \right)}{\ln\left(z_R / z_o \right)}$$

Where
U_R is the wind speed at reference height Z_R

The reference height is usually 10m or 30m as this is the height at which mean wind data is generally collected.

3.1.2 ***Power Law:***

Engineers often prefer to use a Power Law to describe the increase in wind speed with height, as it is easier to evaluate.

$$\frac{u}{u_R} = \left(\frac{z - D}{z_R} \right)^{\alpha}$$

Where:
α is the power law exponent
u_R is the wind speed at reference height z_R

The power law exponent typically varies between 0.1 and 0.32 depending upon the landscape type. A value of 1/7 is often quoted as a reasonable value for the power law exponent in countryside. The exponent can be calculated from the roughness length.

$$\alpha = \frac{\ln\left(\ln\left(z / z_o \right) \big/ \ln\left(z_R / z_o \right) \right)}{\ln\left(z / z_R \right)} \approx \frac{1}{\ln\sqrt{\frac{z \cdot z_R}{z_o}}}$$

Where: Z is the measurement height
Z_R is the reference height
Z_0 is the roughness length

The power law exponent therefore varies with the interval between the two measurement heights. The power law should be carefully employed since it is not a physical representation of the surface layer and does not describe the flow nearest to the ground very well. Both the log law and the power law are simplified expressions of the wind profile. They are valid in flat homogeneous terrain. So they do not include the effects of topography, obstacles or changes in roughness or stability.

Table 1: Typical values of surface roughness length Z_O and power law exponent α for various types of terrain

Type of terrain	Z_0	α
Mud Flats, Ice	10^{-5} to $3x\ 10^{-5}$	
Calm Sea	$2x10^{-4}$ to $3x10^{-4}$	
Sand	$2x10^{-4}$ to 10^{-3}	0.01
Mown Grass	0.001 to 0.01	
Low Grass	0.01 to 0.04	0.13
Fallow Field	0.02 to 0.03	
High Grass	0.04 to 0.1	0.19
Forest and Woodland	0.1 to 1	
Built up area, Suburb	1 to 2	0.32
City	1 to 4	

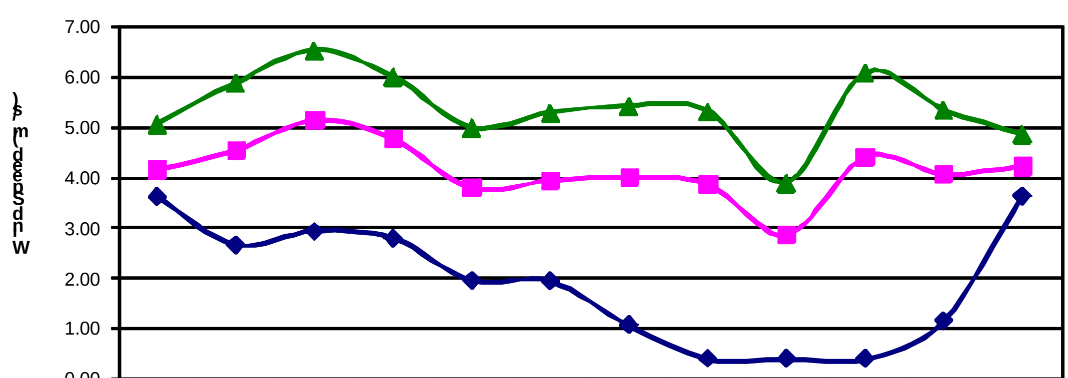
3.2 Average Wind Speed:

By using above mentioned methods the wind speed at 50 meters has been computed and monthly average of these wind speed at 50 meters height have been given in Fig 2 in graphical as well as tabular form.

Fig-1 shows monthly average wind speed at height of 10 meters, 30 meters and 50 meters from May 2007 to April 2008. At 30 meters height, we have the maximum average wind speed of 5.16 m/s during May, 2007. At 50 meters we have the annual average wind speed of 5.39 m/s from May-2007 to April 2008 and the highest average wind speed of 6.53 m/s is observed during May 2007.

Fig-1

Monthly Average Wind Speed at ShaheedGali (m/s)



	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
AWS 10m	3.63	2.67	2.95	2.80	1.97	1.95	1.07	0.40	0.40	0.40	1.16	3.65
AWS 30m	4.17	4.55	5.16	4.78	3.80	3.95	4.01	3.89	2.87	4.42	4.09	4.23
AWS 50m	5.06	5.88	6.53	6.00	5.00	5.28	5.42	5.32	3.89	6.08	5.34	4.86

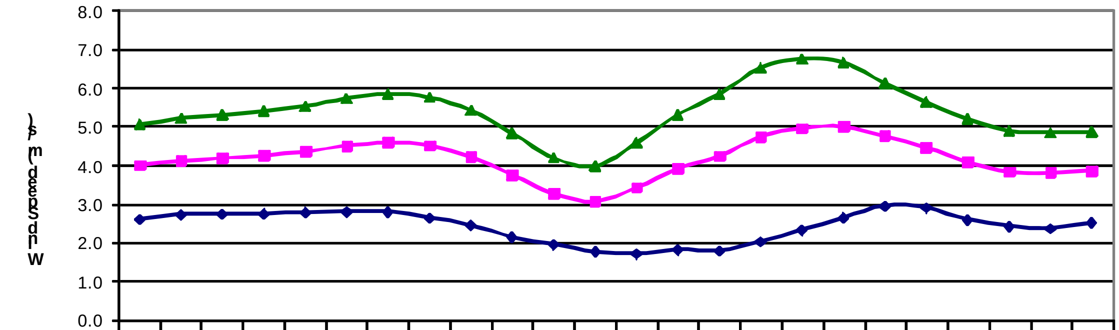
Months

3.3 Diurnal Wind speed Variation:

Fig-2 shows the annual diurnal wind speed variations at ShaheedGali. The wind speed is generally equal during day and night time, it reaches maximum in evening which is around 5.0 m/s and 6.74 m/s at 30 meters and 50 meters height respectively.

Fig-2

Annual Diurnal Variation Wind Speed at ShaheedGali



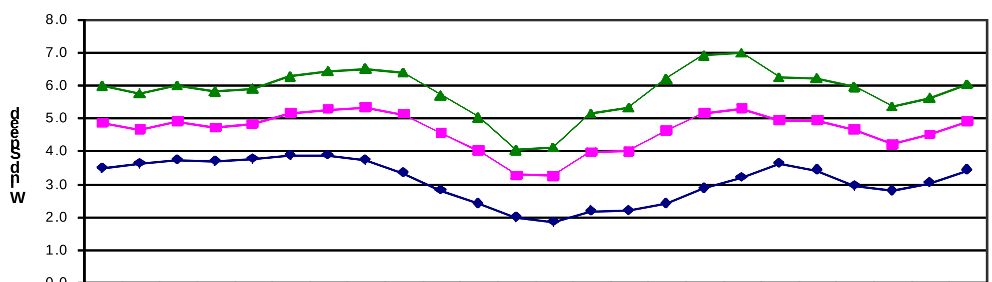
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WS 10m	2.6	2.7	2.7	2.7	2.7	2.8	2.7	2.6	2.4	2.1	1.9	1.7	1.7	1.8	1.7	2.0	2.3	2.6	2.9	2.9	2.5	2.4	2.3	2.5
WS 30m	4.0	4.1	4.1	4.2	4.3	4.5	4.5	4.5	4.2	3.7	3.2	3.0	3.4	3.9	4.2	4.7	4.9	5.0	4.7	4.4	4.0	3.8	3.8	3.8
WS 50m	5.0	5.2	5.3	5.4	5.5	5.7	5.8	5.7	5.4	4.8	4.1	3.9	4.5	5.3	5.8	6.5	6.7	6.6	6.1	5.6	5.1	4.8	4.8	4.8

PST (Hours)

Fig-3, Fig-4, Fig-5 and Fig-6 shows the seasonal diurnal wind speed variations at ShaheedGali for (Mar-May), (Jun-Aug), (Sep-Nov) and (Dec-Feb) respectively. Seasonal wind speed is generally higher during daytime and low during night in ShaheedGali.

Fig-3

Diurnal Variation Wind Speed at ShaheedGali (Mar to May)

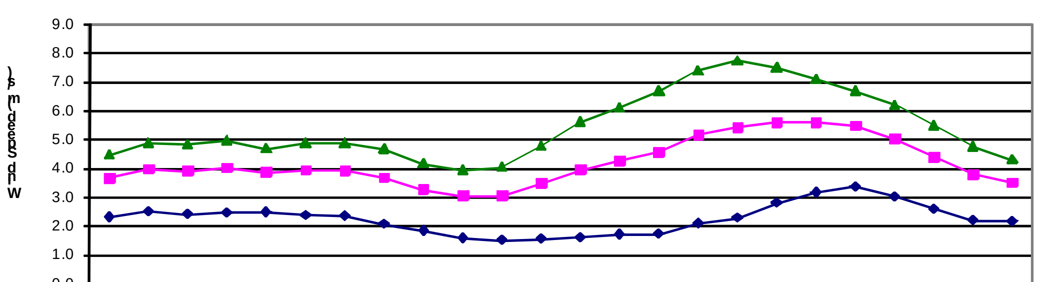


	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Ws 10m	3.5	3.6	3.7	3.7	3.8	3.9	3.9	3.7	3.3	2.8	2.4	2.0	1.8	2.2	2.2	2.4	2.9	3.2	3.6	3.4	2.9	2.8	3.0	3.4
WS 30m	4.8	4.6	4.9	4.7	4.8	5.1	5.3	5.3	5.1	4.5	4.0	3.3	3.2	4.0	4.0	4.6	5.2	5.3	4.9	4.9	4.7	4.2	4.5	4.9
WS 50m	6.0	5.8	6.0	5.8	5.9	6.3	6.4	6.5	6.4	5.7	5.0	4.0	4.1	5.1	5.3	6.2	6.9	7.0	6.2	6.2	5.9	5.3	5.6	6.0

PST (Hours)

Fig-4

Diurnal Variation Wind Speed at ShaheedGali (June to Aug)

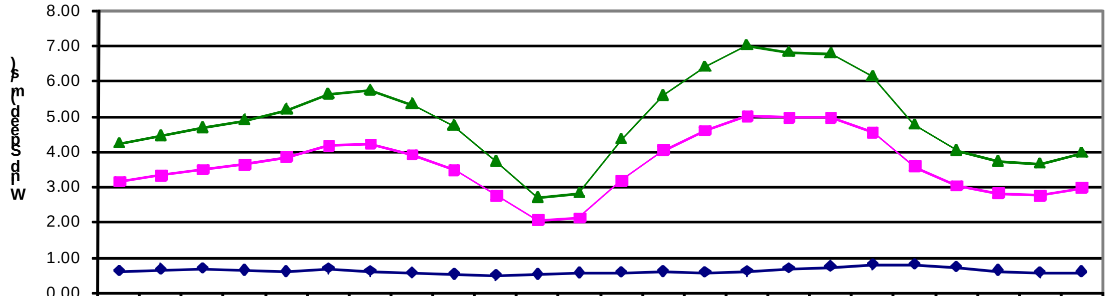


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	2.3	2.5	2.4	2.4	2.5	2.4	2.3	2.0	1.8	1.6	1.5	1.5	1.6	1.7	1.7	2.1	2.3	2.8	3.2	3.4	3.0	2.6	2.2	2.2
WS 30m	3.7	4.0	3.9	4.0	3.9	3.9	3.9	3.7	3.3	3.0	3.1	3.5	3.9	4.3	4.6	5.1	5.4	5.6	5.6	5.5	5.0	4.4	3.8	3.5
WS 50m	4.5	4.9	4.8	4.9	4.7	4.9	4.9	4.7	4.1	3.9	4.0	4.7	5.6	6.1	6.7	7.4	7.7	7.5	7.1	6.7	6.2	5.5	4.7	4.3

PST (Hours)

Fig-5

Diurnal Variation Wind Speed at ShaheedGali
(Sep to Nov)

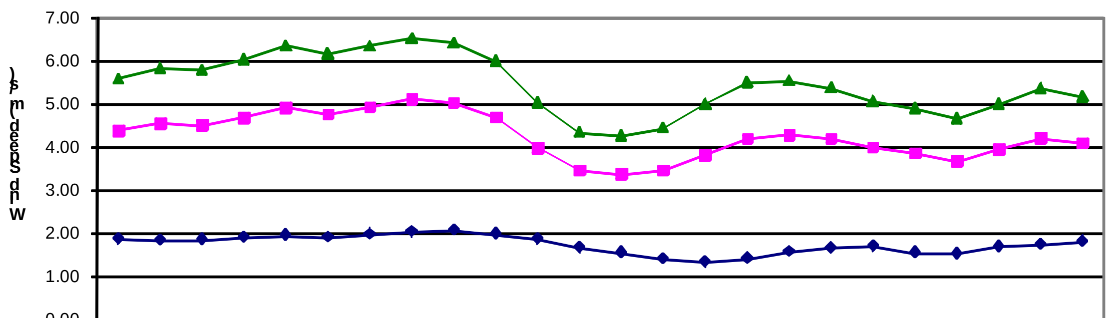


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.7	0.7	0.8	0.7	0.6	0.5	0.5
WS 30m	3.1	3.3	3.4	3.6	3.8	4.1	4.2	3.9	3.4	2.7	2.0	2.1	3.1	4.0	4.5	4.9	4.9	4.9	4.5	3.5	3.0	2.8	2.7	2.9
WS 50m	4.2	4.4	4.7	4.9	5.2	5.6	5.7	5.3	4.7	3.7	2.7	2.8	4.3	5.6	6.4	7.0	6.8	6.8	6.1	4.8	4.0	3.7	3.7	4.0

PST (Hours)

Fig-6

Diurnal Variation Wind Speed at ShaheedGali
(Dec to Feb)



	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	1.8	1.8	1.8	1.8	1.9	1.9	1.9	2.0	2.0	1.9	1.8	1.6	1.5	1.4	1.3	1.4	1.5	1.6	1.6	1.5	1.5	1.6	1.7	1.8
WS 30m	4.3	4.5	4.5	4.6	4.9	4.7	4.9	5.1	5.0	4.6	3.9	3.4	3.3	3.4	3.8	4.1	4.2	4.1	3.9	3.8	3.6	3.9	4.2	4.0
WS 50m	5.5	5.8	5.7	6.0	6.3	6.1	6.3	6.5	6.4	5.9	5.0	4.3	4.2	4.4	4.9	5.4	5.5	5.3	5.0	4.8	4.6	4.9	5.3	5.1

PST (Hours)

3.4 Wind speed Frequency Distribution:

Wind speed frequency distribution can simply be obtained by plotting the different wind speeds against their frequencies / relative frequencies. For obtaining frequency distribution the following two procedures are necessary.

3.4.1 *Binning of Data:*

The sorting of the data into narrow wind speed bands is called binning of the data. In our case a bin width of 1m/sec has been used e.g. a measured wind speed of 3.5 m/sec would be placed in 3<X<=4 m/sec bin. The central value of each bin i.e. 0.5 m/sec, 1.5 m/sec etc has been used in calculations and frequency distribution group.

3.4.2 *Relative Frequency:*

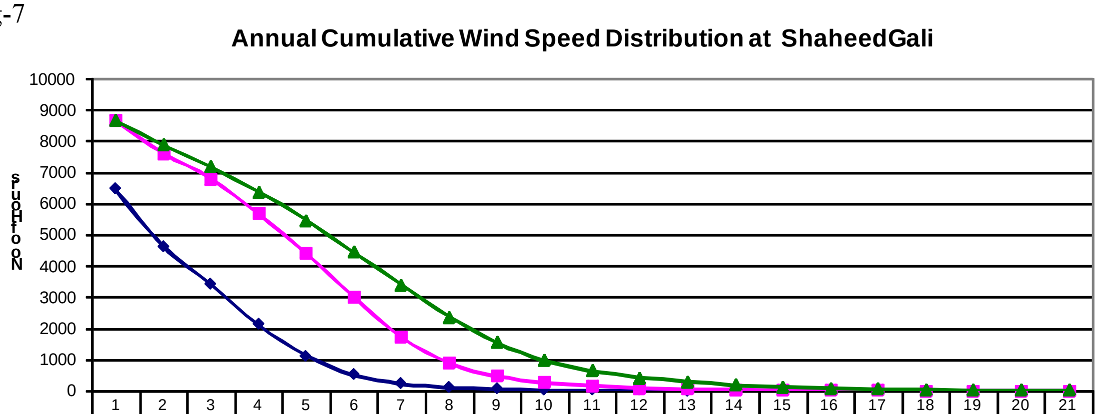
It is proportional wind speed in each bin. It can be viewed as the estimate of probability of given wind speed in the bin. Relative frequency is defined as

R .F = probability P (Vi) = Frequency of given wind speed / Total period

3.4.3 *Annual Cumulative Wind Frequency:*

Fig-7 shows the Annual Cumulative Wind Frequency distribution at three heights 10, 30 and 50 meters. The analysis indicate that in a year at a height of 30 meters during 4402 hours the wind speed is greater than equal to 5 m/s whereas at 50 meters, during one year 5450 hours the wind speed is equal or greater than 5m/s.

Fig-7



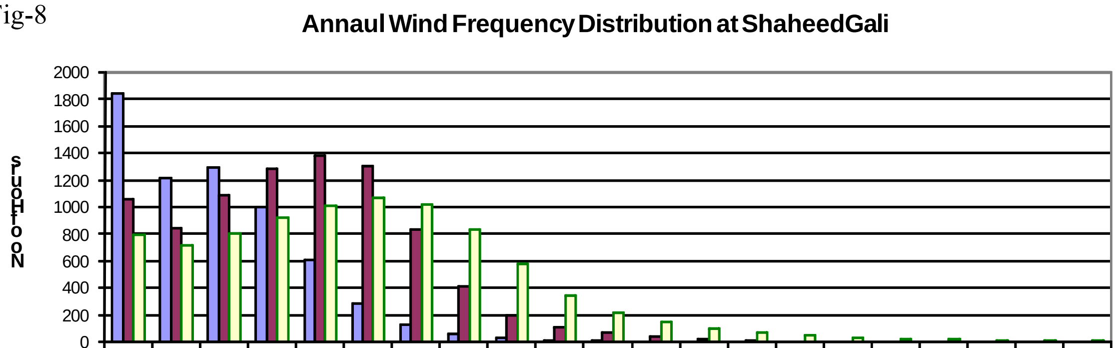
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
CWS 10m	6469	4629	3411	2118	1117	511	226	103	49	23	13	7	4	3	2	1	1	0	0	0	0
CWS 30m	8677	7614	6774	5686	4402	3015	1715	880	469	268	157	86	47	27	16	11	7	5	3	2	1
CWS 50m	8677	7889	7173	6369	5450	4446	3383	2364	1537	965	628	417	275	183	122	79	51	32	22	15	10

Wind Speed (m/s)

3.4.4 *Wind Frequency Distribution:*

Fig-8 shows the Annual wind frequency distribution at ShaheedGali. We can see that at 50 meters during 1004 hours wind speed is 5 m/s, 1063 hours speed is 6 m/s, 1019 hours speed is 7 m/s, 827 hours speed is 8 m/s and during 573 hours the wind speed is 9m/s and so on. This indicates wind potential in this area.

Fig-8



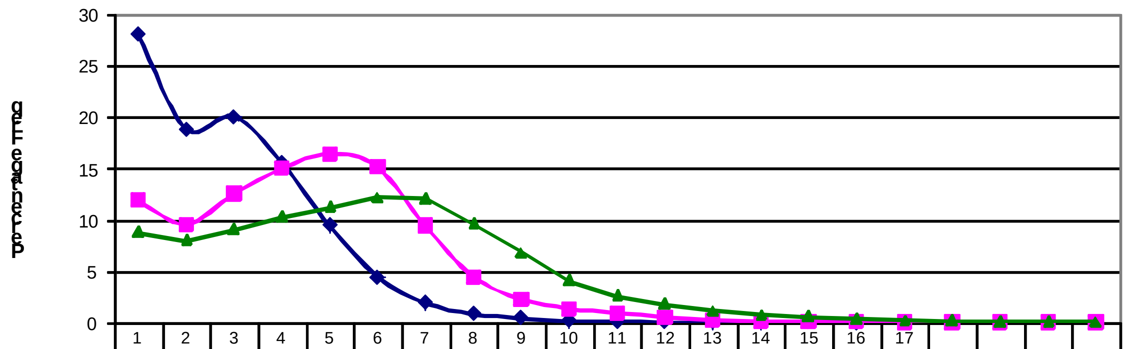
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
CWS 10m	1840	1217	1293	1001	607	284	123	54	26	10	5	3	2	1	1	0	0	0	0	0	0
CWS 30m	1063	840	1088	1285	1387	1300	835	412	201	111	71	39	20	11	5	4	2	3	1	1	1
CWS 50m	788	715	804	920	1004	1063	1019	827	573	337	211	142	92	61	43	27	19	11	6	5	10

Wind Speed (m/s)

Fig-9 gives the frequency distribution in percentage. At 50 meters we find that during 11.2% of time wind is 5m/s, 12.3% of the time 6m/s and 12.1% of the time it is 7m/s. whereas at 30 meters height we get 16.4% of the time wind speed 5m/s, 15.1% of the times 6m/s and 9.5% of the time 7m/s.

Fig-9

Annual Percenatge Wind Frequency Distribution at ShaheedGali



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17				
WS 10m	28.1	18.8	20.1	15.6	9.4	4.4	1.9	0.9	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WS 30m	11.9	9.5	12.5	15.0	16.4	15.1	9.5	4.4	2.3	1.3	0.9	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
WS 50m	8.8	8.0	9.0	10.3	11.2	12.3	12.1	9.6	6.8	4.1	2.6	1.8	1.2	0.8	0.6	0.4	0.2	0.1	0.1	0.1	0.1

Wind Speed (m/s)

3.4.5 *Seasonal Wind Frequency Distribution:*

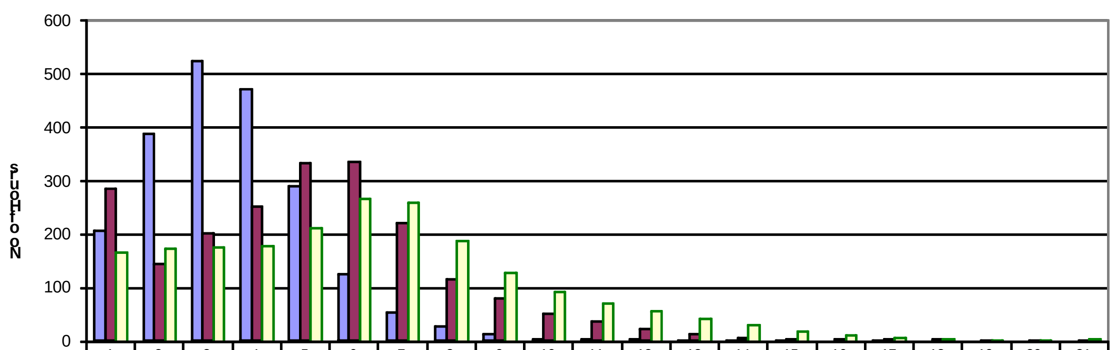
Figures 10–17 gives seasonal wind frequency distribution and percentage wind frequency distribution.

March– May

Fig-10 shows frequency distribution during the months of Mar to May. We can see that in this period at 30 meters height during 333 hours we get 5m/s, 334 hours 6m/s, 221 hours 7m/s. Similarly at 50 meters we get 212 hours 5m/s, 267 hours 6m/s, 259 hours 7m/s, 188 hours 8m/s, 129 hours 9m/s, 93 hours 10m/s.

Fig-10

Wind Frequency Distribution at ShaheedGali (Mar- May)

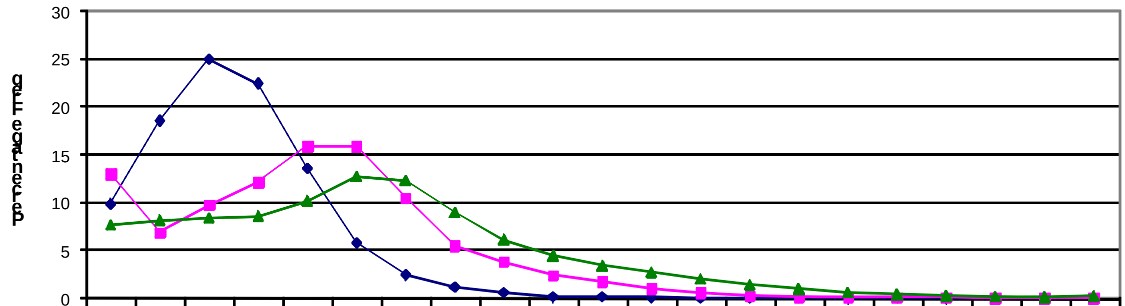


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
WS 10m	206	386	523	472	289	125	53	25	13	3	3	2	1	1	1	0	0	0	0	0	0
WS 30m	284	144	202	252	333	334	221	115	79	50	37	21	12	5	3	3	2	2	1	1	0
WS 50m	167	174	177	178	212	267	259	188	129	93	71	57	43	30	20	12	8	6	3	3	4

Wind Speed (m/s)

Fig-11

Percentage Wind Frequency Distribution at ShaheedGali (Mar- May)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15						
WS 10m	9.87	18.5	24.9	22.4	13.5	5.78	2.46	1.18	0.62	0.15	0.15	0.10	0.06	0.06	0.05	0.00	0.01	0.00	0.00	0.00	0.00
WS 30m	12.9	6.89	9.75	12.1	15.8	15.9	10.5	5.49	3.84	2.41	1.77	1.01	0.58	0.25	0.13	0.13	0.09	0.11	0.05	0.04	0.02
WS 50m	7.66	8.16	8.42	8.58	10.1	12.7	12.3	8.96	6.12	4.44	3.41	2.74	2.06	1.45	0.98	0.59	0.40	0.28	0.16	0.14	0.23

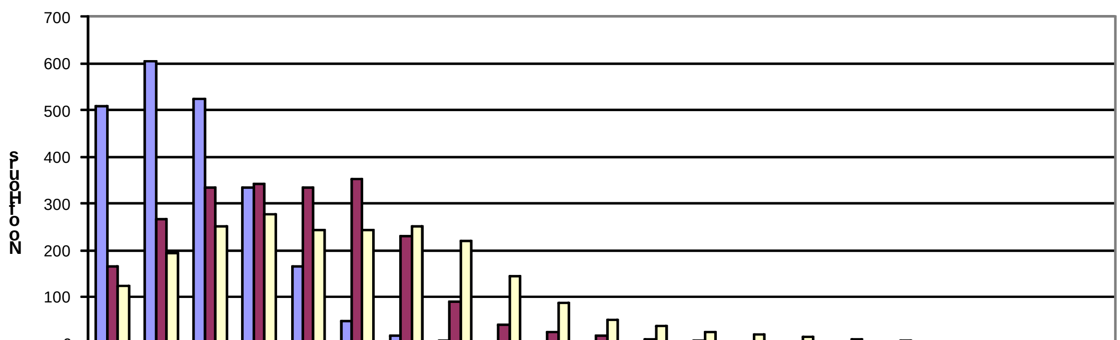
Wind Speed (m/s)

Similarly the above mentioned seasonal frequency distribution percentage terms have been presented in figure 11.

<u>Jun– Aug</u>

Fig-12

Wind Frequency Distribution at ShaheedGali (Jun - Aug)

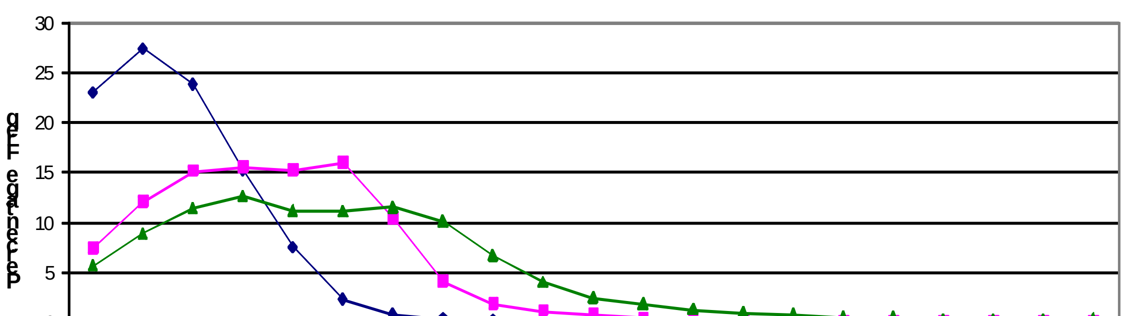


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
WS 10m	508	605	524	334	163	48	15	6	3	1	0	0	0	0	0	0	0	0	0	0	0
WS 30m	163	265	334	341	334	352	229	90	40	25	17	9	5	3	1	0	0	0	0	0	0
WS 50m	123	193	250	276	244	243	252	221	145	86	51	37	26	19	15	9	8	3	2	2	3

Wind Speed (m/s)

Fig-13

Percentage Wind Frequency Distribution at ShaheedGali (Jun - Aug)



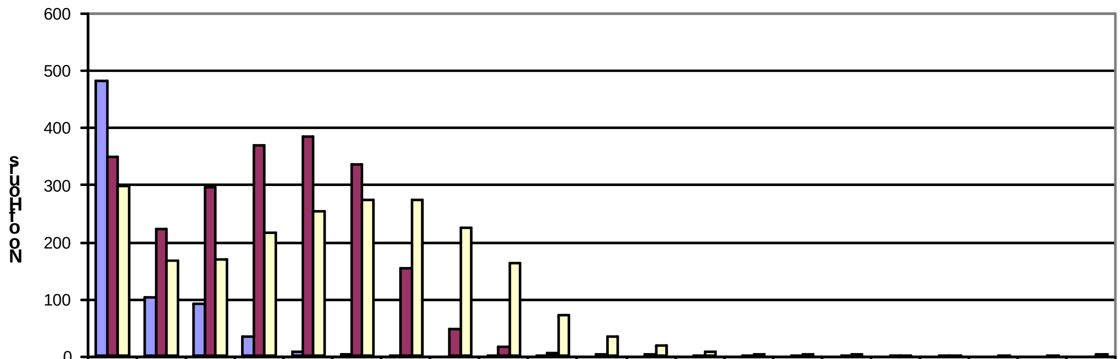
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15						
WS 10m	22.91	27.31	23.74	15.16	7.46	2.20	0.70	0.29	0.14	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
WS 30m	7.35	11.98	15.11	15.43	15.13	15.95	10.39	4.09	1.81	1.13	0.76	0.39	0.23	0.12	0.05	0.01	0.01	0.02	0.00	0.01	0.02
WS 50m	5.54	8.71	11.31	12.52	11.04	11.00	11.40	10.01	6.57	3.91	2.33	1.70	1.19	0.87	0.68	0.43	0.36	0.12	0.10	0.08	0.15

Wind Speed (m/s)

September – November

Fig-14 and 15 shows wind frequency distribution and percentage frequency distribution during the months of September to November respectively.

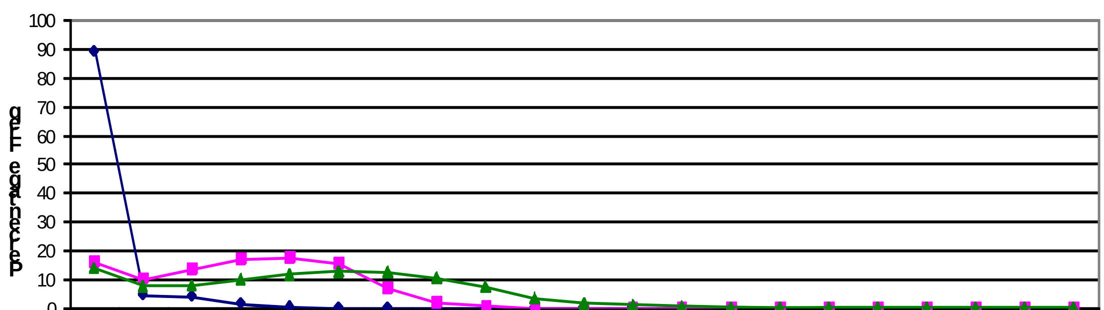
Fig-14 **Wind Frequency Distribution at ShaheedGali (Sep- Nov)**



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
WS 10m	483	102	91	33	8	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WS 30m	349	223	295	369	384	335	153	47	17	4	4	3	1	0	1	0	0	0	0	0	0
WS 50m	299	166	170	215	253	275	273	226	162	71	33	18	8	4	3	3	2	1	1	1	2

Wind Speed (m/s)

Fig-15 **Percentage Wind Frequency Distribution at ShaheedGali (Sep- Nov)**



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15						
WS 10m	89.03	4.72	4.23	1.52	0.35	0.11	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WS 30m	16.10	10.20	13.48	16.86	17.54	15.32	7.02	2.14	0.76	0.19	0.16	0.13	0.04	0.01	0.03	0.01	0.01	0.01	0.00	0.00	0.00
WS 50m	13.80	7.59	7.78	9.85	11.57	12.55	12.46	10.31	7.42	3.26	1.52	0.82	0.35	0.16	0.14	0.15	0.07	0.07	0.03	0.03	0.09

Wind Speed (m/s)

<u>Dec – Feb</u>

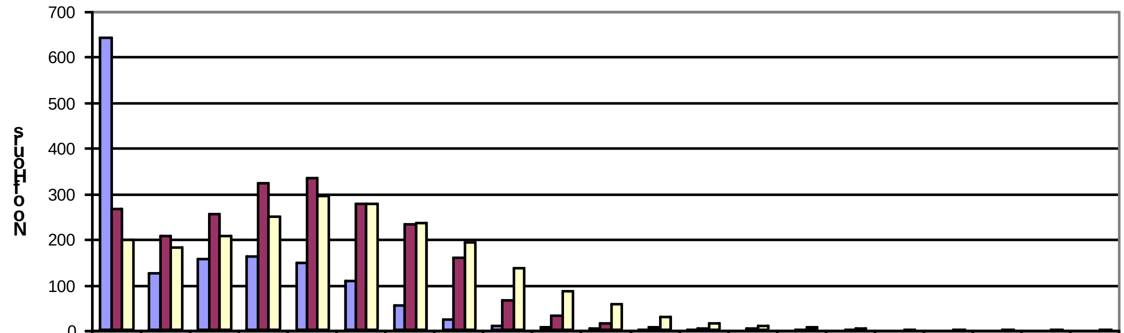
Fig-16 shows frequency distribution during the months of December to February. We can see that in this period at 30 meters height during 336 hours we get 5m/s, 279 hours 6m/s, 232 hours 7m/s.

Similarly at 50 meters we get 295 hours 5m/s, 278 hours 6m/s, 236 hours 7m/s, 192 hours 8m/s, 137 hours 9m/s, 86 hours 10m/s.

Similarly the above mentioned seasonal frequency distribution percentage terms have been presented in figure 17.

Fig-16

Wind Frequency Distribution at ShaheedGali (Dec-Feb)

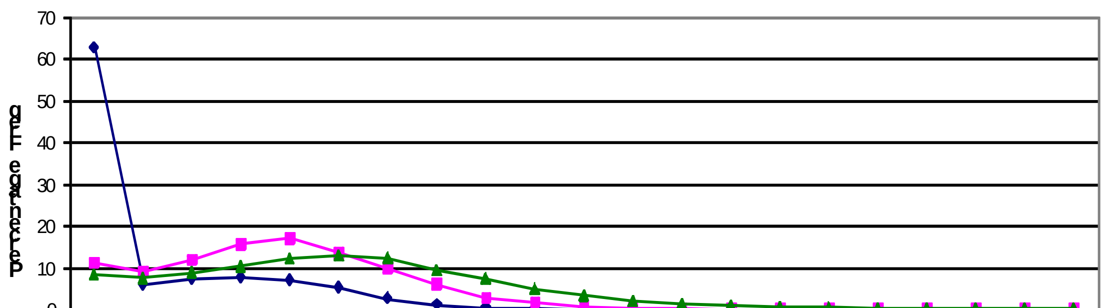


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
WS 10m	644	124	155	163	147	109	55	23	10	6	2	1	0	0	0	0	0	0	0	0	0
WS 30m	267	208	257	323	336	279	232	160	65	32	13	7	3	3	1	1	0	0	0	0	0
WS 50m	199	182	207	250	295	278	236	192	137	86	56	30	15	9	5	3	1	1	0	0	0

Wind Speed (m/s)

Fig-17

Percentage Wind Frequency Distribution at ShaheedGali (Dec - Feb)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15						
WS 10m	62.55	5.83	7.27	7.61	6.96	5.20	2.60	1.09	0.46	0.28	0.09	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WS 30m	11.19	9.08	11.81	15.63	17.03	13.39	9.88	6.01	2.73	1.61	0.85	0.40	0.19	0.12	0.07	0.02	0.00	0.00	0.00	0.00	0.00
WS 50m	8.13	7.35	8.65	10.07	12.00	12.71	12.10	9.23	7.20	4.72	3.18	1.85	1.17	0.67	0.41	0.25	0.12	0.08	0.03	0.03	0.03

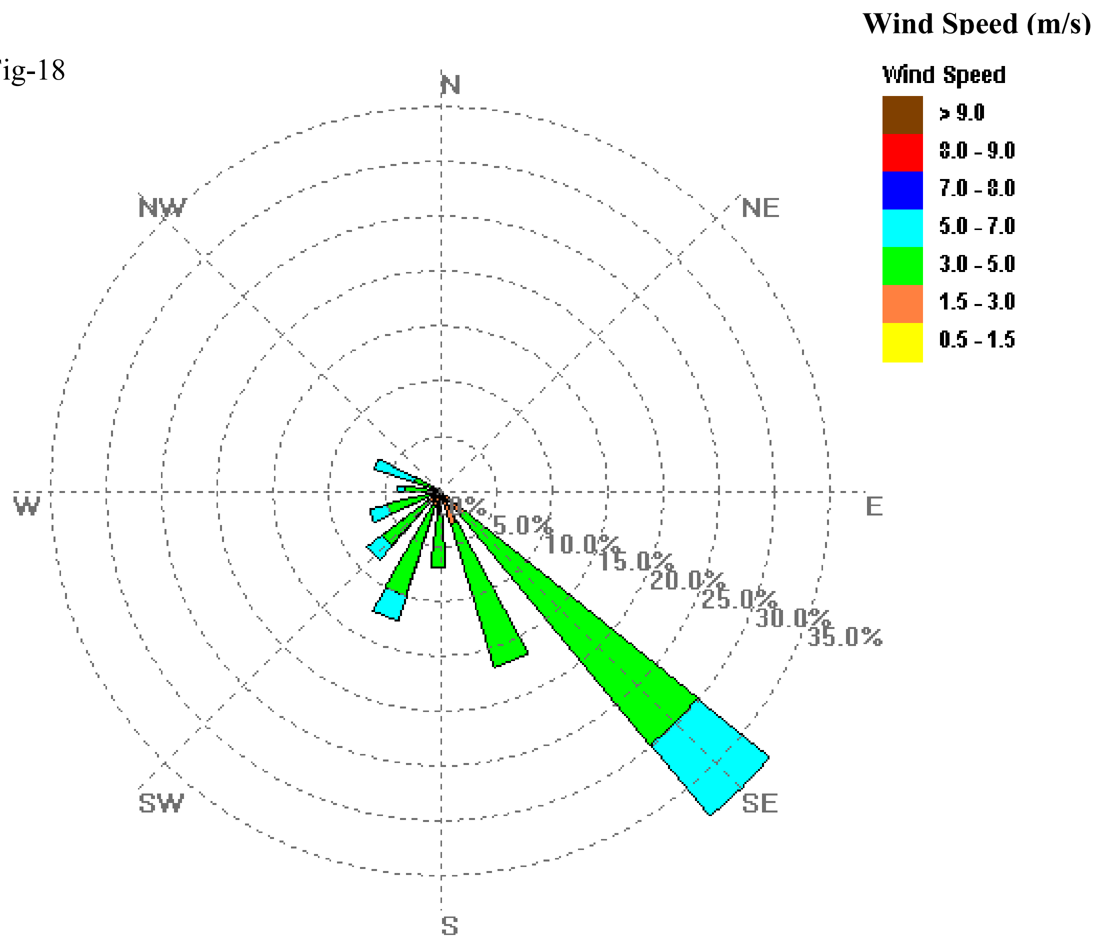
Wind Speed (m/s)

3.5 Wind Rose:

Fig-18 shows the Wind Rose Graph based on 12 months data from March 2007 – February 2008 collected at 30 meters height. Wind Rose indicates that most of the time the wind direction is South and South East. The average wind speed is 4.16 m/s and the percentage of wind speed greater than 5m/s is 19.2%.

Wind Rose at ShaheedGali (30m height during 12 months)

Fig-18



Average Wind Speed	Wind greater than 5 m/s	Comments
4.16 m/s	19.2%	

3.6 Wind speed statistic:

3.6.1 *The statistical Mean:*

It is the average of a set of n numbers. Mathematically, we can write

$$Mean = \frac{\left[\sum_{i=1}^{n} x_i\right]}{N}$$

The Mean Wind Speed V can be calculated by the formula.

$$V = \sum_{i=1}^{n} V_i P(V_i)$$

Where Vi is the central wind speed of bin 1 and P(Vi) is the probability/relative frequency that the wind speed has in bin i.

3.6.2 *Variance:*

It is one of the several indices of variability that statistician, use to characterize the dispersion among the measures in a given set of data. Mathematically, variance is written as

$$\text{Variance} = \sigma^2 = \sum (X_i - V)^2$$

Where V is mean of data set

In case of wind speed data, we can write it, as

$$\sigma^2 = \sum V_i^2 P(Vi) - (V)^2$$

3.6.3 *Standard Deviation*

It is the square root of the variance, denoted by σ

$$\sigma^2 = (\sigma)^{1/2} = \sum \left(V_i^2 P(V_i) - (V)^2 \right)^{1/2}$$

3.7 Wind power density:

While investigating a wind power potential of an area, the average values of wind speed does not truly represent this potential because lot of information regarding frequency distribution of wind speed is suppressed in the process of averaging wind speed. As such the most important values for estimating the wind power potential of a given site is the value of the wind power density or the available theoretical instantaneous power from the wind. This available wind power in the wind is the flux of Kinetic Energy crossing the wind energy conversion system and its cross – sectional area.

Like water flowing in the river, wind contains energy that can be converted to electricity using wind turbines. The amount of electricity that wind turbines produce depends upon the amount of energy in the wind passing through the area swept by the wind turbines blades in a unit of time. This energy flow is referred to as the wind power density.

A key aspect of wind power density is its dependence on wind speed cubed. This means that the power contained in the wind increases very rapidly with wind speed; if the speed doubles, the power increases by a factor of eight. In practice, the relationship between the power output of a wind turbine and wind speed does not follow a cubic relationship. Below a certain minimum speed, the turbine does not have enough wind to operate, whereas above a certain speed its output levels off or begins to decline. In very high winds the turbine may even be shut down to prevent damage to it.

Wind power density also depends on air density. At higher attitudes, air density decreases and, as a result, so does the available power. This effect can reduce the power output of wind turbines on high mountains by as much as 40 percent compared to the power that could be produced at the same wind speeds at sea level. Air density depends inversely on temperature: colder temperatures are favorable for higher air densities and greater wind power production.

3.7.1 *Wind power classes:*

To simplify the characterization of the wind power potential, it is common to assign areas to one of seven wind classes, each representing arrange of wind power density at the special height above the ground. The standard International wind power classifications are shown in Table 2.

Table-2: International Wind Power Classification

Class	Resource Potential	30m Height		50m Height	
		Wind Speed m/s	Wind Power W/m²	Wind Speed m/s	Wind Power W/m²
1	---	0 – 5.1	0 – 160	0 – 5.6	0 – 200
2	Marginal	5.1 – 5.9	160 – 240	5.6 – 6.4	200 – 300
3	Moderate	5.9 – 6.5	240 – 320	6.4 – 7.0	300 – 400
4	Good	6.5 – 7.0	320 – 400	7.0 – 7.5	400 – 500
5	Excellent	7.0 – 7.4	400 – 480	7.5 – 8.0	500 – 600
6	---	7.4 – 8.2	480 – 640	8.0 – 8.8	600 – 800
7	---	8.2 – 11.0	640 – 1600	8.8 – 11.9	800 – 2000

By and large, the areas being developed today using large wind turbine are ranked as class 5 and above. Class 4 areas are also being considered for further development as wind turbines are adopted to run more efficiently a lower wind speeds. Class1 and class2 areas are not being deemed suitable for large machines, although a smaller wind turbine may be economical in areas where the value of the energy produced is higher

3.7.2 ***Power of wind Energy:***

A parcel of Wind possesses kinetic energy

$$E = \tfrac{1}{2} mV^2$$

From this, power density is calculated as

$$P = \tfrac{e}{t} = \tfrac{1}{2}\ \tfrac{dm}{dt}\ V^2$$

Where dm/dt is the mass of air following time.

From fluid dynamics, it can be proved that

$$dm/dt = \varphi AV$$

Volume of cylindrical cross section can be written as

$$V = \pi r^2 L \qquad \text{---------------} \quad (1)$$

Where r is radius of cylinder and L is length of it.

The wind moving with velocity V travels this distance L in time t so

$$S = L = Vt,$$

So equation L takes the form

$$V = \pi r^2 Vt$$

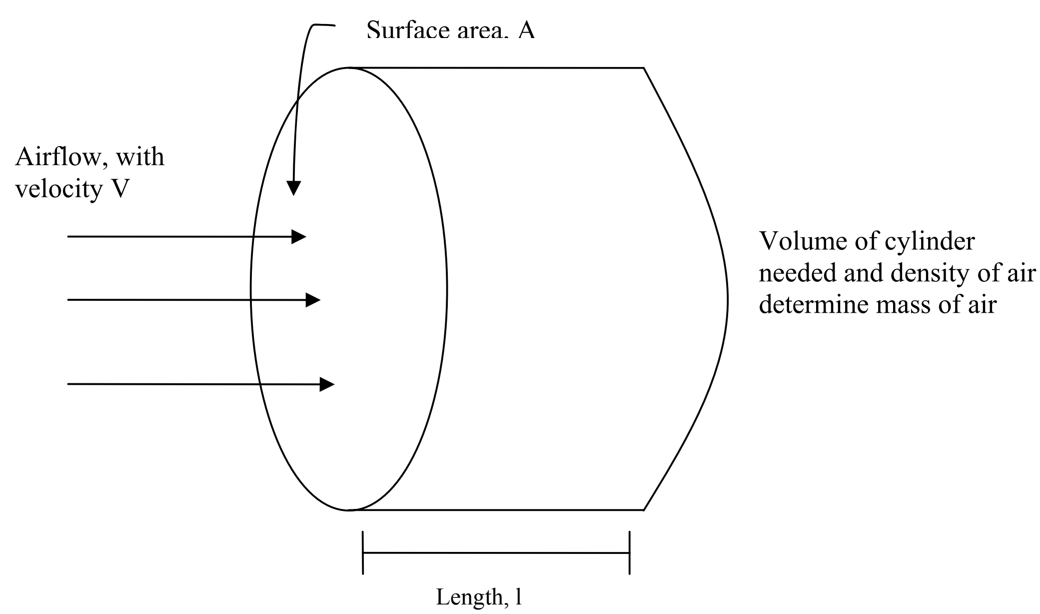
Now mass of wind can be written as

$$M = \varphi Avt$$

Differentiating

$$dm/dt = \varphi AV\, d/dt(t) = \varphi AV$$

Where φ is density of wind and others parameters have been defined in diagram.



So the power is then,

$$P = \frac{1}{2}\,\frac{dm}{dt}\,V^2 = \frac{1}{2}\varphi AVT/t\;V^2$$

$$= \frac{1}{2}\varphi AV^3$$

And power density

$$P/A = \frac{1}{2}\,\varphi V^{\,3}$$

Density of wind at mean sea level is 1.225 kg/m^3

At 15° C, The area depends upon the size of the rotor. Therefore, it is clear that power density chiefly depends on wind velocity and goes up as a cube of it.

3.7.3 ***Wind power calculation using Mean wind Speed:***

Wind power calculated from Mean wind speed is not true representative of wind power. In real world, the wind varies constantly. Actual wind power density at most sites can rang from 1.0 to 3 times greater then that calculated. For example, we take wind speed of 5, 7 and 8 m/sec respectively the respective power densities are 76 wat/m^2, 210 watt/m^2 and 313 watt/m^2. The average of which is 200 watt/m^2. On the other hand, the average wind speed is 6.7 m/sec and power density of average wind is 181 watt/m^2. So the power of wind calculated by mean wind speed is less than the actual power present in wind i.e. Mean wind speed is not true representative for the wind power calculations.

To overcome this drawback we find some alternative arrangement, which reduces the deficit. The Weibull distribution is the best fit of wind data to calculate wind power based on mean wind speed and variance/standard deviation.

3.7.4 ***Weibull distribution:***

The Weibull distribution (named after the Swedish physicist W. Weibull, who applied it when studying material strength in tension and fatigue in the 1930s) provides a close approximation to the probability laws of many natural phenomenons. It has been used to represent wind speed distribution for application in wind loads studies for sometime. In recent years most attention has been forced on this method for wind frequency applications not only due to its greater flexible and simplicity but also because it can give a good fit to experimental data.

The Weibull distribution function, which is a two-parameter function, has been found to fit much wind data with acceptable accuracy is expressed mathematically as

$$\phi(u) = \frac{k}{c}\left(\frac{u}{c}\right)^{k-1} \exp\left(-\left(\frac{u}{c}\right)^{k}\right)$$

Where:

u is the wind speed
c is the scale parameter with units of speed
k is the shape parameter and is dimensionless

When k = 2 the distribution reduces to Rayleigh distribution and if k=1 an exponential distribution is found. These are special cased of Weibull distribution.

Solving the equation, we find that the scale factor c is closely related to the mean wind speed for the site.

$$\overline{u} = c\tau\left(1 + \frac{1}{K}\right)$$

Where τ ***is the complete gamma function***
Similarly

$$\overline{u^{n}} = c^{n}\tau\left(1 + \frac{n}{k}\right)$$

And so

$$\overline{u^{3}} = c^{3}\tau\left(1 + \frac{3}{k}\right)$$

The available power density is obtained:

$$E = \frac{1}{2}\varphi c^{3}\tau\left(1 + \frac{3}{k}\right)$$

Where

E is the power density in watts / m^2

The shape factor k is related to the variance of the wind

$$\sigma^2 = c2\left[\left(1+\frac{2}{k}\right)-\left(\tau\left(1+\frac{1}{k}\right)\right)^2\right]$$

The two Weibull parameters k and c may be derived from site data.

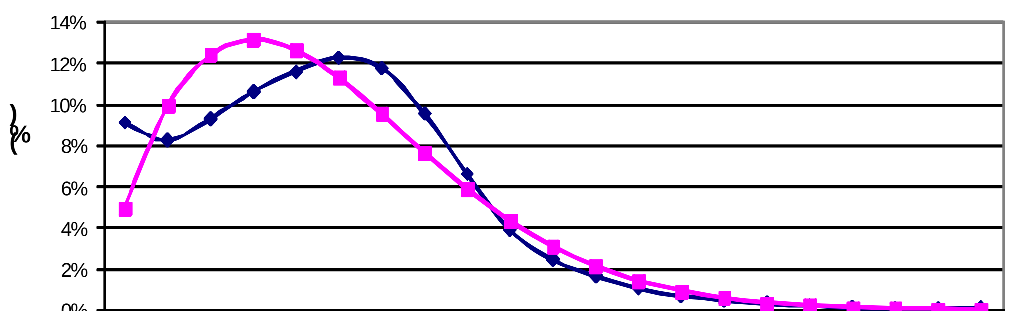
A measure of the confidence of the fit of the Weibull curve to the real data is also returned. Often the Weibull curve is a good fit to the most of the data, but a poor fit to some. If the poor fit is in the low wind speed range, i.e. below cut in it may be possible to ignore the poor fit as this portion of wind does not contribute greatly to the overall power production.

The mathematical description of the wind frequency allows us to match with the turbine power curve. Thus a measure of the average total power capture in a year is achieved. Additionally the choice of turbine cut in and furling speed may be chosen to maximum the total energy capture.

3.7.5 ***Weibull Parameters:***

Fig-19 shows the Weibull fit to the relative frequency of wind speed.

Fig-19 **Relative Frequency an Weibull Probability at ShaheedGali (50 m height)**



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
R.F 50m	9.1	8.2	9.3	10.	11.	12.	11.	9.5	6.6	3.9	2.4	1.6	1.1	0.7	0.5	0.3	0.2	0.1	0.1	0.1	0.1
Weibull 50m	5.0	9.9	12.	13.	12.	11.	9.5	7.6	5.9	4.3	3.1	2.1	1.4	0.9	0.6	0.3	0.2	0.1	0.1	0.0	0.0

Wind Speed (m/s)

The Weibull parameters for three different heights 10 meters, 30 meters and 50 meters are given in Table-3 along with other key results of analysis. If we look at the shape parameters K and scale parameter C for 50 meters height we can find that the shape parameter K varies over a wind range from the lowest of 1.33 during November to the highest of 2.34 during the month of October with a annual value of K being 1.76.

The lowest values of the scale parameter C 4.22 is observed in November while the highest value of 7.31 is obtained in May and with an annual value of 5.92.

3.7.6 *Average Wind Speed & Standard Deviation:*

In Table-3 monthly average wind speed and standard deviation at three different heights are also given. The average wind speed values for 10 meters and 30 meters height have been obtained from the recorded data, whereas the values for the 50 meters height have been computed by using the power law as explained in the earlier section.

At 10 meters height the annual average wind speed is 2.40 m/s with Standard deviation of 1.51, at 30 meters this average speed is 4.11 m/s with Standard deviation of 2.37.

At 50 meters the monthly average wind speed varies from the lowest of 3.88 m/s in November to highest of 6.50 m/s during May. Whereas the average wind speed is 5.28 m/s with Standard deviation of 3.16.

3.7.7 *Power Density:*

The monthly power densities for three different heights 10meters, 30meters and 50meters have also been given in Table-3. At 10 meters this power density varies between 9.01 W/m^2 January to 46.48 W/m^2 in December with Average of 25.97 W/m^2.

At 30 meters height the power density varies from 82.60 W/m^2 in January to 91.83 W/m^2 in December and the average values is about 94.94 W/m^2.

At 50 meters height the power density of ShaheedGali varies from 204.80 W/m^2 in January to 132.91 W/m^2 in December. The average power density of the area is 208.19 W/m^2.

Table-3: Monthly Average Wind, St. Deviation and Wind Power Density at ShaheedGali

10 m					
	Avg V (m/s)	St Dev	C (m/s)	K	P/A (w/m^2)
January	1.22	1.35	1.15	0.89	9.01
February	3.63	2.17	4.07	1.75	64.75
March	3.59	1.78	4.05	2.14	50.70
April	2.62	1.40	2.96	1.98	21.29
May	2.89	1.81	3.23	1.66	34.89
June	2.75	1.64	3.08	1.75	**28.04**
July	1.93	1.22	2.15	1.64	**10.52**
August	1.91	1.24	2.13	1.60	10.62
September	1.10	1.01	1.14	1.10	3.90
Average	**2.40**	**1.51**	**2.66**	**1.61**	**25.97**
30 m					
	Avg V (m/s)	St Dev	C (m/s)	K	P/A (w/m^2)
January	4.04	2.26	4.56	1.88	82.60
February	4.20	2.79	4.67	1.56	116.58
March	4.14	3.04	4.54	1.40	131.51
April	4.50	2.47	5.07	1.92	110.98
May	5.10	2.88	5.74	1.86	**167.75**
June	4.73	2.49	5.34	2.01	**123.32**
July	3.74	2.10	4.21	1.87	**65.70**
August	3.90	2.16	4.40	1.90	**73.51**
September	3.94	2.19	4.44	1.89	**75.82**
October	3.84	1.73	4.33	2.38	**56.83**
November	2.84	2.09	3.11	1.39	42.80
December	4.29	2.25	4.84	2.01	91.83
Average	4.11	2.37	4.61	1.84	94.94
50 m					
	AvgV (m/s)	St Dev	C (m/s)	K	P/A (w/m^2)
January	5.34	3.17	6.00	1.76	204.80
February	4.88	3.10	5.45	1.64	170.88
March	5.09	3.61	5.61	1.45	230.99
April	5.88	3.34	6.62	1.85	257.99
May	6.50	3.78	7.31	1.80	**359.69**
June	6.00	3.35	6.76	1.88	**269.26**
July	4.97	3.12	5.56	1.66	**177.60**
August	5.28	3.26	5.91	1.69	**208.60**
September	5.41	3.22	6.07	1.75	**213.74**
October	5.33	2.43	6.01	2.34	153.57
November	3.88	2.99	4.22	1.33	118.29
December	4.86	2.54	5.49	2.02	132.91
Average	5.28	3.16	5.92	1.76	208.19

ESTIMATING WIND GENERATED ELECTRIC POWER OUTPUT

Appendix-I

Monthly Average Diurnal Variation of Wind Generated Electric Power Output.

Appendix-II

Hourly Wind Generated Electric Power Output

4.0 **Estimating Wind Generated Electric Power Output**

The average power output of wind energy conversion technologies (WECT) is a very important parameter since it determines the energy output over time thereby influencing the economic feasibility of a wind project. It is by far more useful than the rated power, which does not account for the variability of wind velocity thereby easily overestimating energy revenues. The average power of wind turbine, $\overline{P_{WT}}$, is the power produced at each wind speed multiplied by the fraction that wind speed is experienced, integrated over all possible wind speeds. In integral form this can be expressed as (Manwell et al., 2002; Borowy and Salameh, 1996):

$$\overline{P_{WT}} = \int_0^\infty P_{WT}(v)df(v)$$

This integral can be replaced with a summation over bins, N_B, to calculate the average wind turbine power (Manwell et al., 2002).

$$\overline{P_{WT}} = \sum_{j=1}^{N_B} \left\{ \exp\left[-\left(\frac{v_{j-1}}{c} \right)^k \right] - \exp\left[-\left(\frac{v_j}{c} \right)^k \right] \right\} P_{WT}\left(\frac{v_{j-1} + v_j}{2} \right)$$

Please note that the relative frequency, f_j/N, corresponds to the term in brackets and the power output is calculated at the midpoint between v_{j-1} and v_j .

The available power at any given wind speed *v* that is convertible by a turbine is defined by (Manwell et al., 2002 Johnson, 1985)

$$P_{WT}(v) = \frac{1}{2} \rho A C_p \eta \upsilon^3$$

Where η is the drive terrain efficiency (i.e. generator power/rotor power), C_p, is the machine power coefficient. In an idealized wind turbine no losses are experienced and the power coefficient, C_p, is equal to Betz' limit (i.e. $C_{p,Betz} = 16/27$) and $\eta = 1$. Of course, in reality both the drive terrain efficiency and the power coefficient cannot be maximized. The extent to which the power output is limited by physical laws as well as engineering inefficiency is dependent on the specific characteristics of individual wind turbine types. This aspect will be discussed further in the analysis of the case study.

WECTs have a range of different power output performance curves, which need to be recognized when estimating the potential power output. The power output performance curves are not only defined by parameters such as the power coefficient and the drive terrain efficiency but also constrained by cut-in speed, furl-out speed and rated wind speed. Where the cut-in wind seed, v_c, is the minimum wind velocity to generate power from a turbine, the rated wind speed, v_R, is the wind speed at which the 'rated power' of a WETC is achieved and generally corresponds to the point at which the conversion efficiency is near its maximum and furl-out wind speed, v_F, is the wind speed at which the turbine shuts down to prevent structural damage.

To account for the above-mentioned constraints we can formulate a novel formula for the average electrical power output of a turbine, $\overline{P_{WTA}}$:

$$\overline{P_{WTA}} = \begin{cases} \sum_{j=1}^{N_B} \left\{ \exp\left[-\left(\frac{v_{j-1}}{c} \right)^k \right] - \exp\left[-\left(\frac{v_j}{c} \right)^k \right] \right\} P_{WT}\left(\frac{v_{j-1} + v_j}{2} \right) & (v_c \leq v \leq v_R) \\ \sum_{j=1}^{N_B} \left\{ \exp\left[-\left(\frac{v_{j-1}}{c} \right)^k \right] - \exp\left[-\left(\frac{v_j}{c} \right)^k \right] \right\} P_{WT}(v_r) & (v_R \leq v \leq v_F) \\ 0 & (v < v_c \text{ and } v > v_F) \end{cases}$$

The energy production of the wind turbine WE(t) over time t can thus be calculated as

$$\mathrm{WE(t)} = \overline{P_{WTA}}\, t$$

Another way of stating the energy output from a wind turbine is to look at the capacity factor for the turbine in its particular location. The capacity factor CF, is the actual energy output over a given period of time, WE(t), divided by the theoretical maximum energy output (i.e. this means that the machine is constantly running at its rated output) during the selected time-span, RO(t). This can be formulated as

$$CF = \frac{WE(t)}{RO(t)}$$

Theoretically capacity factor vary from 0 to 100%. In practice they usually range from 20 to 70% and mostly be around 20-30 percent. However, the economic feasibility of a wind turbine does not of course depend on the capacity factor of a wind turbine alone but also depends on the costs of alternative power systems. Therefore, a low capacity factor does not automatically render a wind turbine project unfeasible.

In order to maximize the energy output of a given wind regime the optimum wind speed, v_{opt}, needs to be determined. The optimum wind speed indicates at what wind velocity most energy is available in a given wind regime. It is at this particular wind speed that engineers should ensure that the power coefficient is most efficient to allow for the highest energy conversion of a turbine. The optimum wind speed can be calculated as follows (Lu et al., 2002):

$$v_{opt} = c\left(\frac{k+2}{k} \right)^{\frac{1}{2}}$$

In this regard, the power density of a turbine is a good comparative indicator to show the average power output per m^2 of wind swept area, A, at a given site. This can be defined as

$$\text{Power Density} = \frac{\overline{P_{WTA}}}{A}$$

Another important aspect of that critically determines the energy output of a turbine is elevation. In many cases the available recorded wind speed data has been measured at a lower level than the planned hub height of the wind turbine. As wind velocity increases vertically the recorded wind speed data can be adjusted using the following standard formula (Borowy and Salameh, 1996.) where v is the projected wind speed, v_i the wind speed at reference height, H the hub height of a turbine, Hi the reference height and α the power-law exponent.

$$v = v_i \left(\frac{H}{H_i} \right)^{\alpha}$$

α is often quoted to have a value of 1/7 and is seen as a reasonable power law exponent for even and unobstructed landscapes. However, where WECT development is planned either offshore or near woodlands or close to any other non flat terrains this value can differ subsequently and a more through analysis of α is necessary. Justus as well as Counnihan offer mathematical solution for ‘fitting’ α to these environments (Manwell et al., 2002).

4.1 **Hypothetical Wind Generated Electric Power**:

A **wind turbine** is a machine for converting the kinetic energy in wind into mechanical energy. If the mechanical energy is used directly by machinery, such as a pump or grinding stones, the machine is usually called a windmill. If the mechanical energy is then converted to electricity, the machine is called a wind generator.

Hypothetical wind generated electric power output at ShaheedGali has been estimated by using the 600KW wind turbine bonus 600/44 MK IV type. The cut in wind speed of this turbine is 3m/s and cutout wind speed is 25m/s. Rotor diameter of this turbine is 44 meters and hub height has been taken as 50 meters. The monthly and annual wind generated electric power outputs at ShaheedGali are shown below in graphs and table-4.

Table-4: Hypothetical wind generated electric energy output & capacity Factor for a Bonus 600/44MK IV Turbine at ShaheedGali.

PMD Calculator (using 50M)				
Month	**Input W/m^2**	**Output W/m^2**	**C.F.**	**KWh / Month**
January	216	74	19%	83,352
February	180	62	16%	65,371
March	244	72	18%	81,534
April	272	90	23%	98,146
May	379	111	28%	125,458
June	284	93	24%	102,140
July	187	64	16%	72,537
August	220	73	19%	82,754
September	225	76	19%	83,117
October	162	63	16%	71,456
November	125	41	10%	45,236
December	140	54	14%	60,657
Annual	207	71	18%	949,755

Wind Turbine specification	
Turbine	Bonus 600 / 44 MK IV
Power	600 KW
Cut in Wind	3 m/s
Cut out wind	25 m/s
Rotor Diameter	44 m
Hub height	50 m

Figure 20 shows the average diurnal variation of wind generated electric energy output at ShaheedGali (May-Apr). The graph shows that the maximum power is produced at about 10 PM; of course, this is the same time when we have the maximum wind speed in 24 hours. Figure 21 & 22 shows the monthly and daily wind generated electric power output. Figure 21 depicts that at ShaheedGali the wind have more potential in the month of September as compared to other months. Figure 23 to 34 shows the monthly average diurnal variation of wind generated electric energy output.

Fig-20

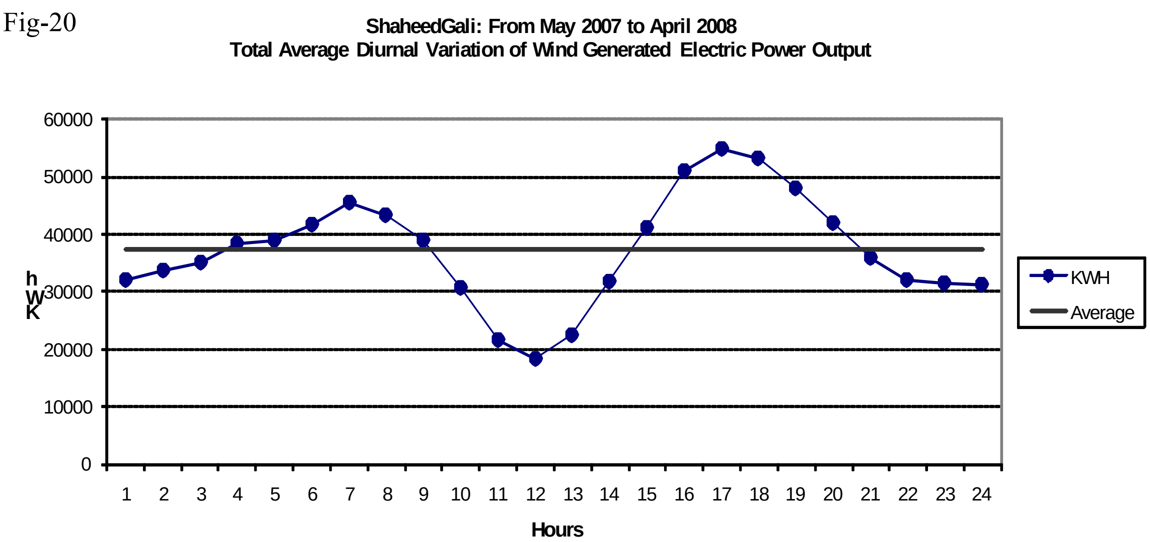


Fig-21

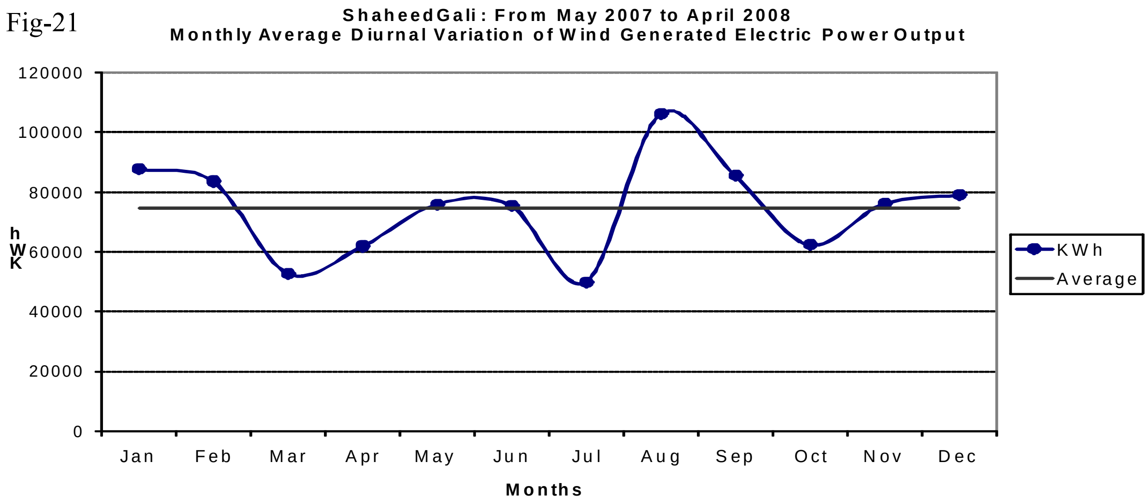


Fig-22

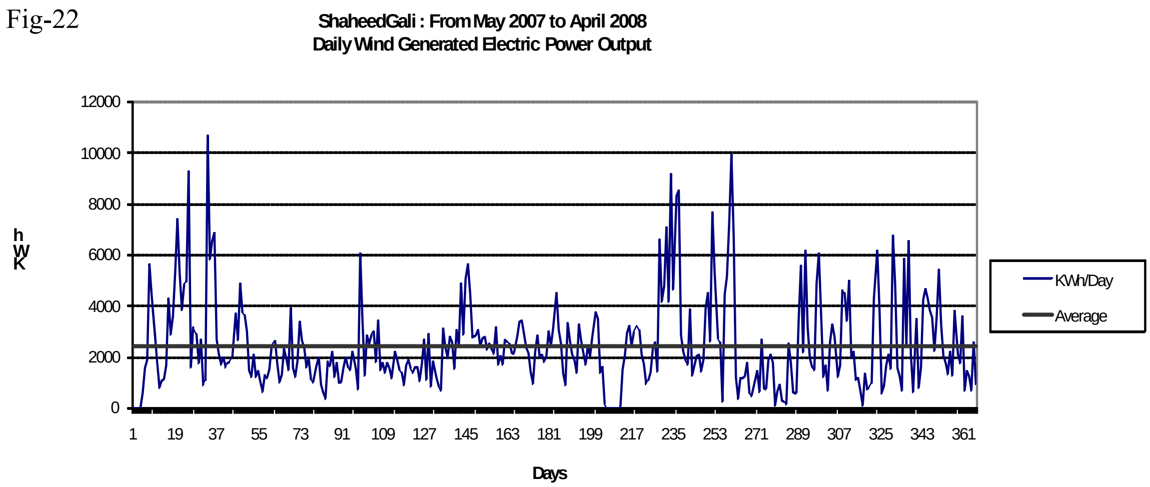


Fig-23

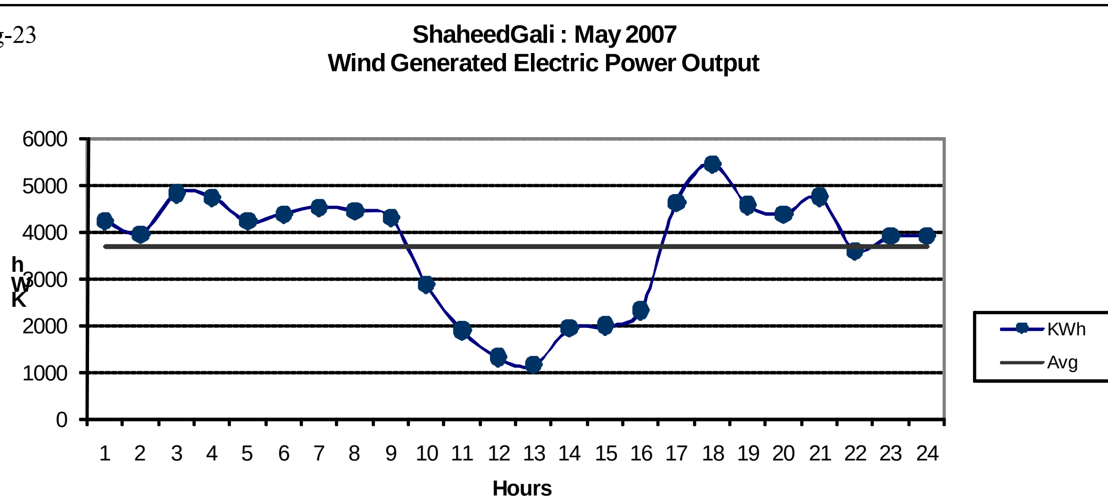


Fig-24

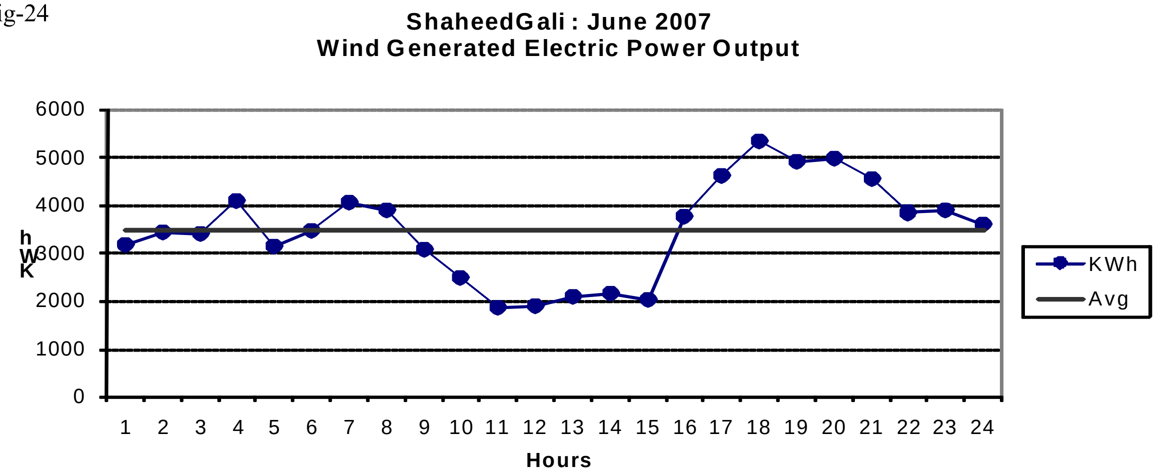


Fig-25

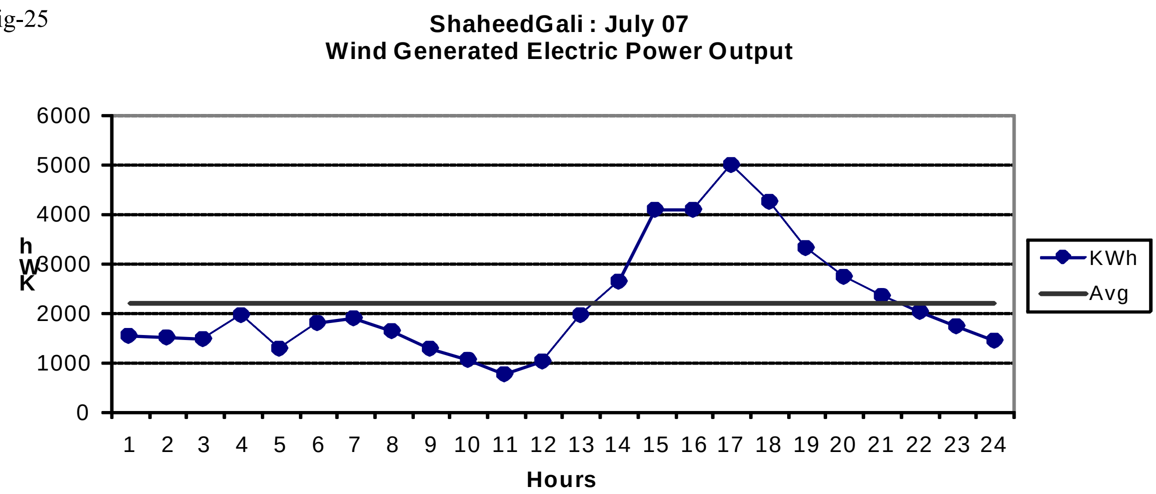


Fig-26

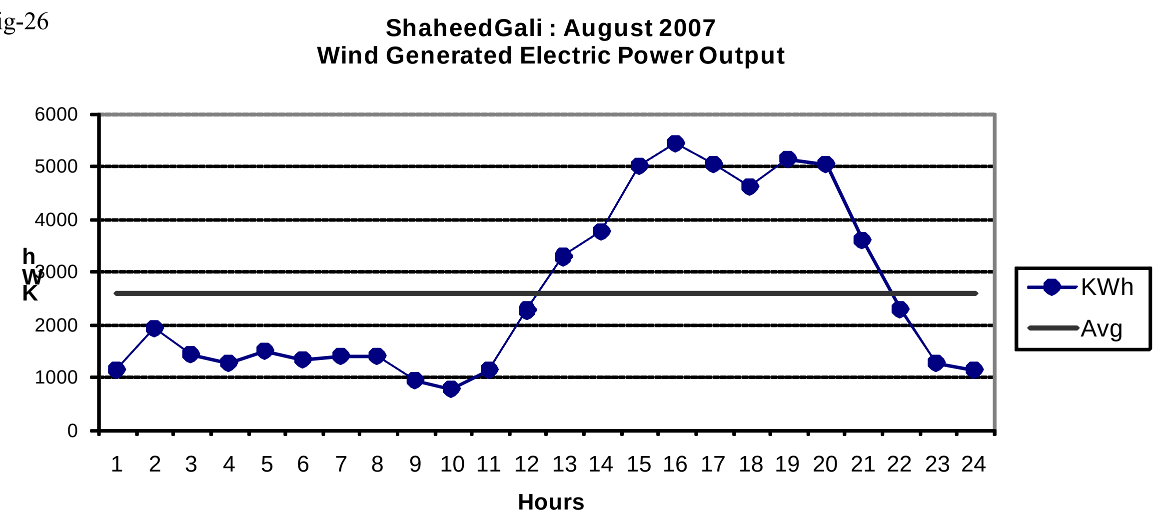


Fig-27

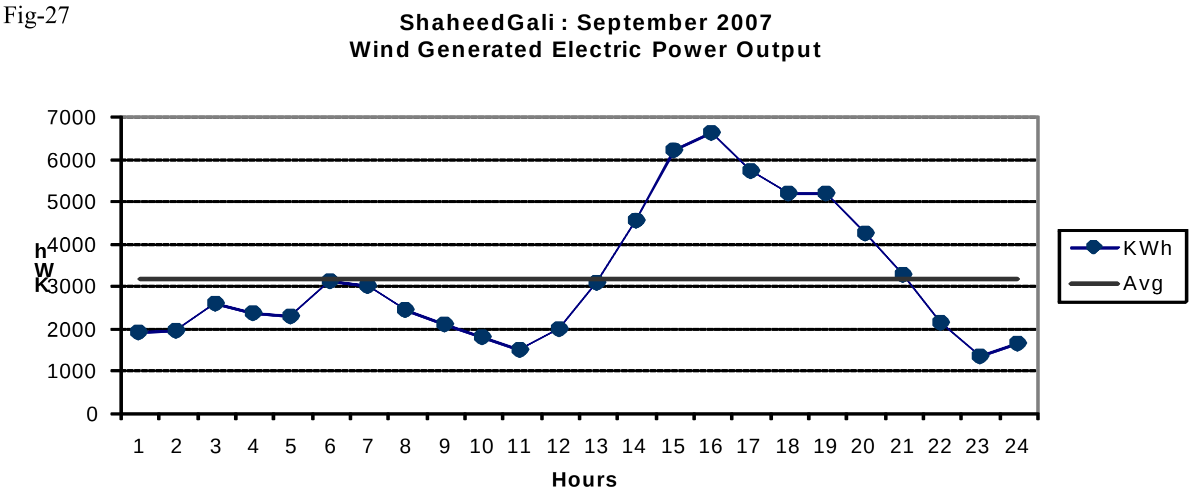


Fig-28

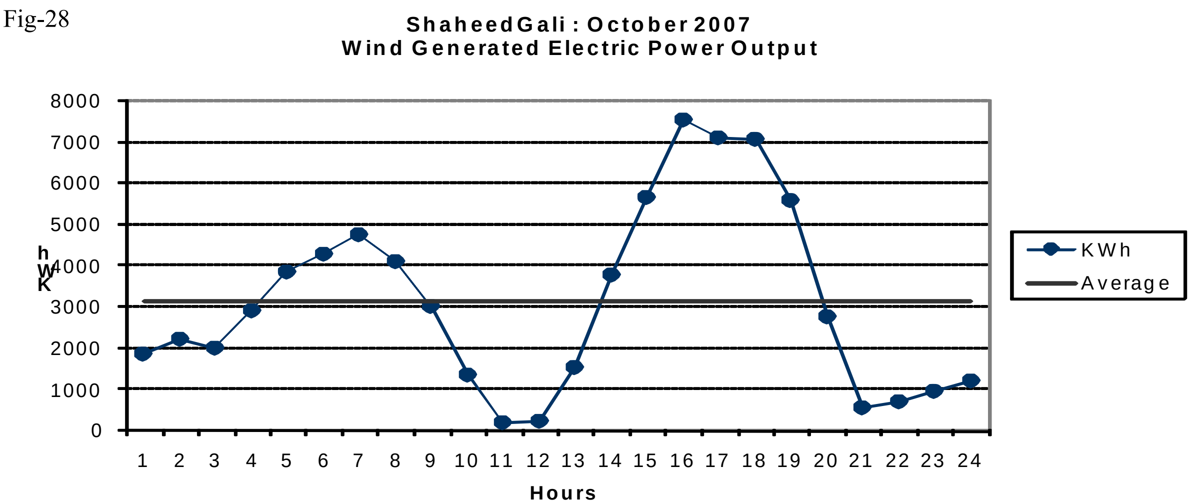


Fig-29

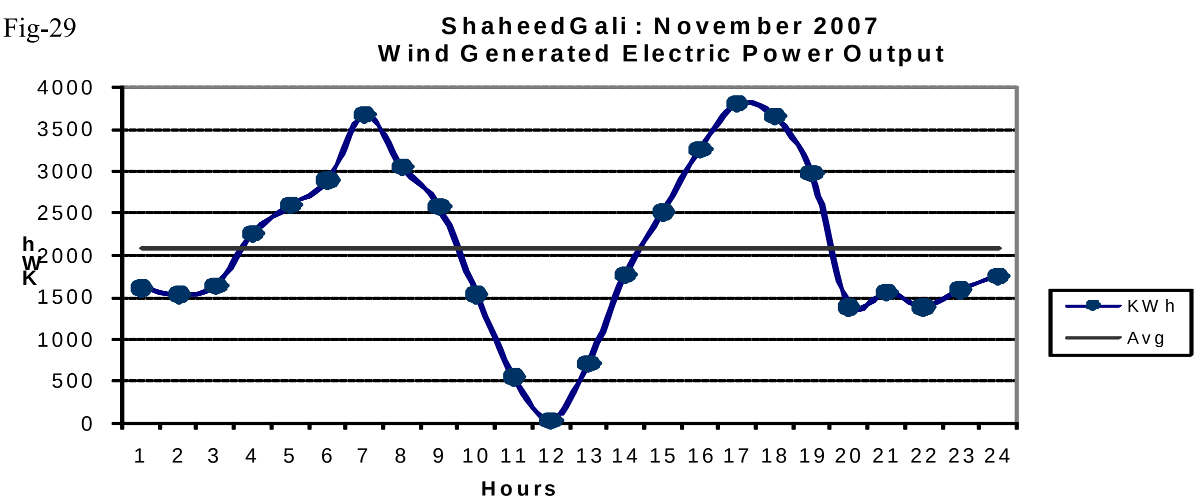


Fig-30

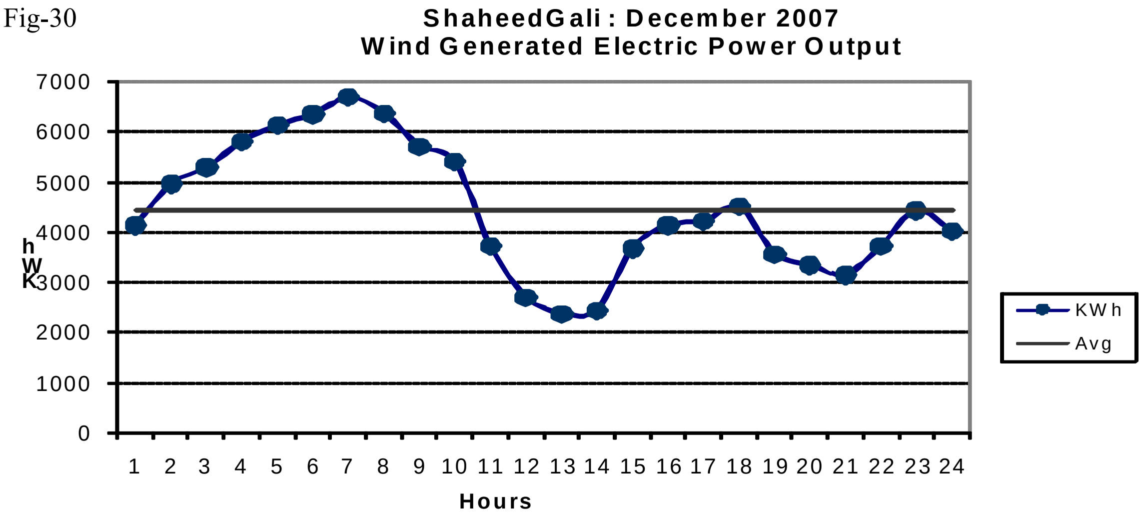


Fig-31

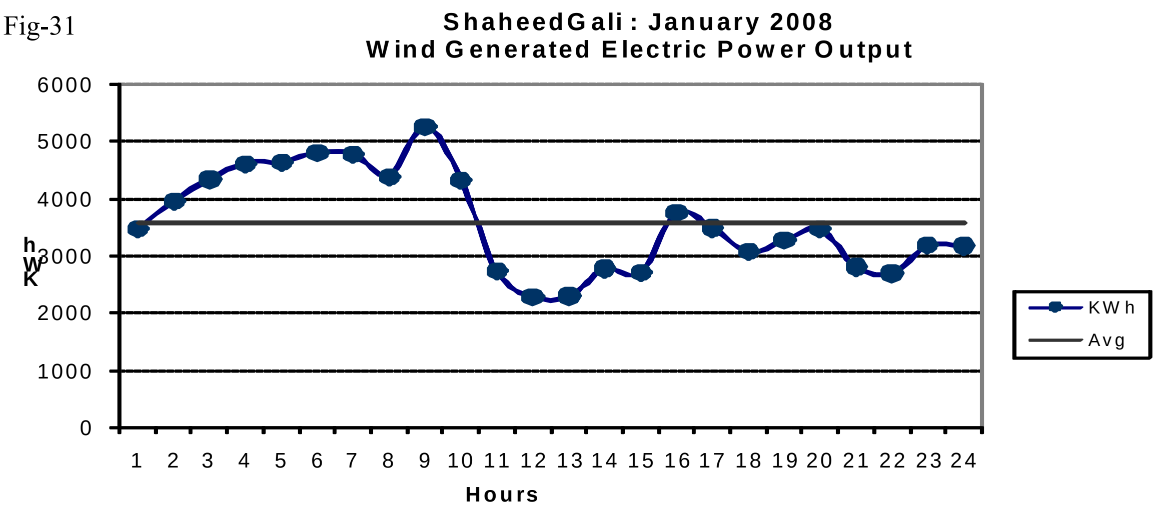


Fig-32

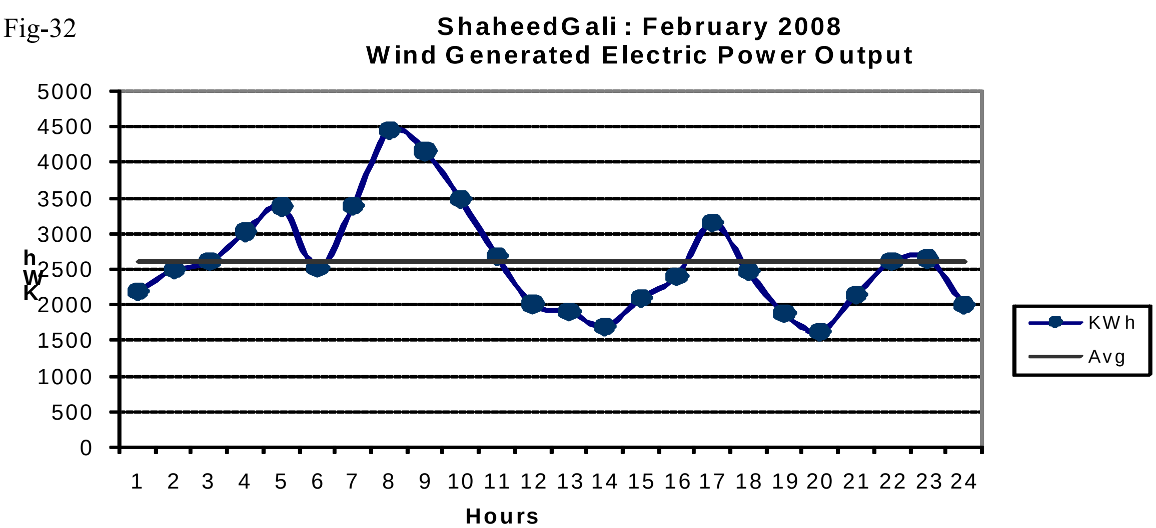


Fig-33

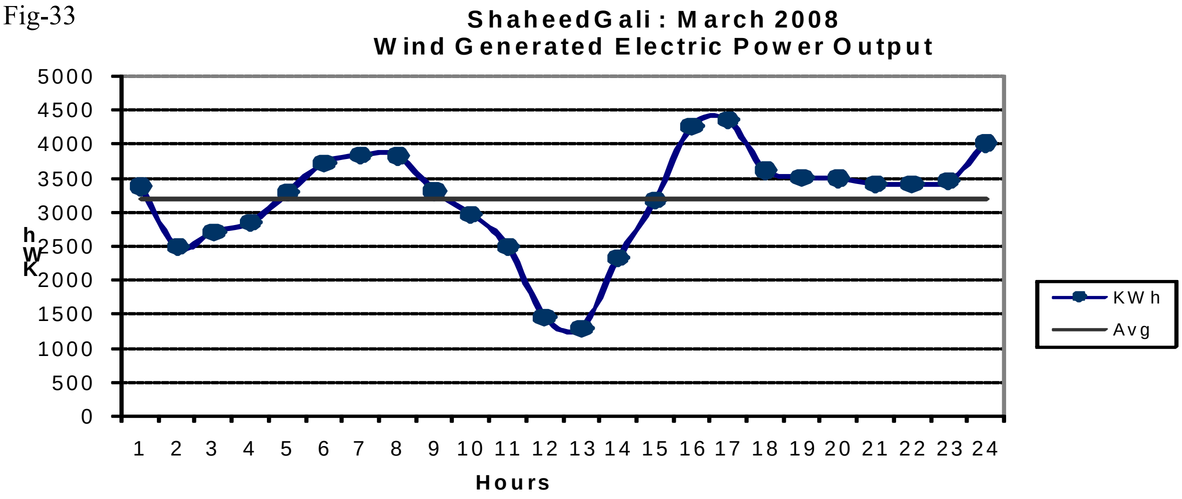
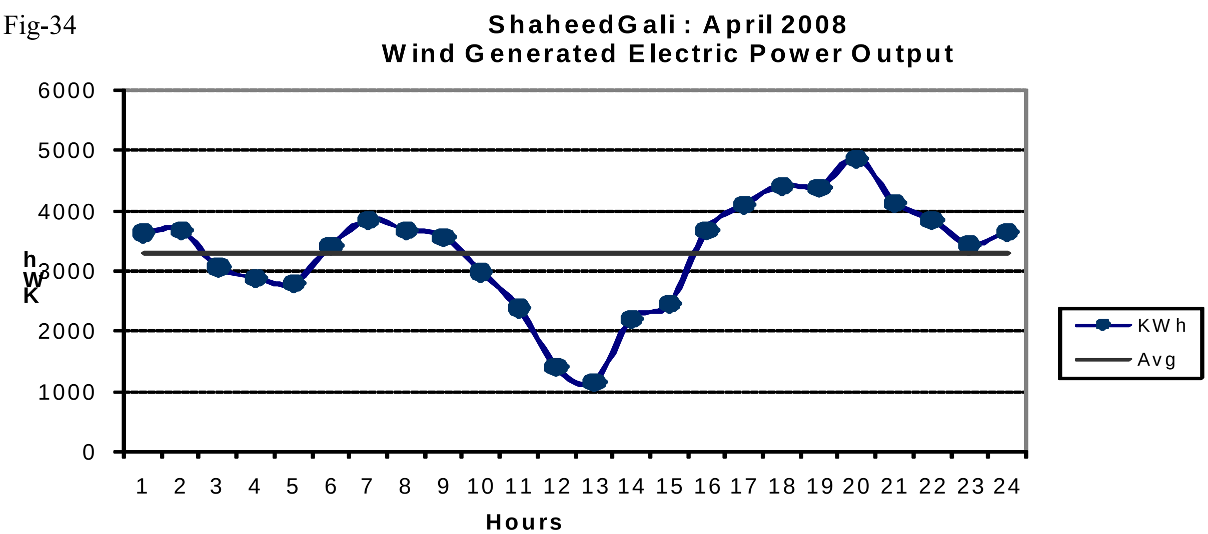

ShaheedGali : March 2008
Wind Generated Electric Power Output
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
KWh
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours
KWh
Avg

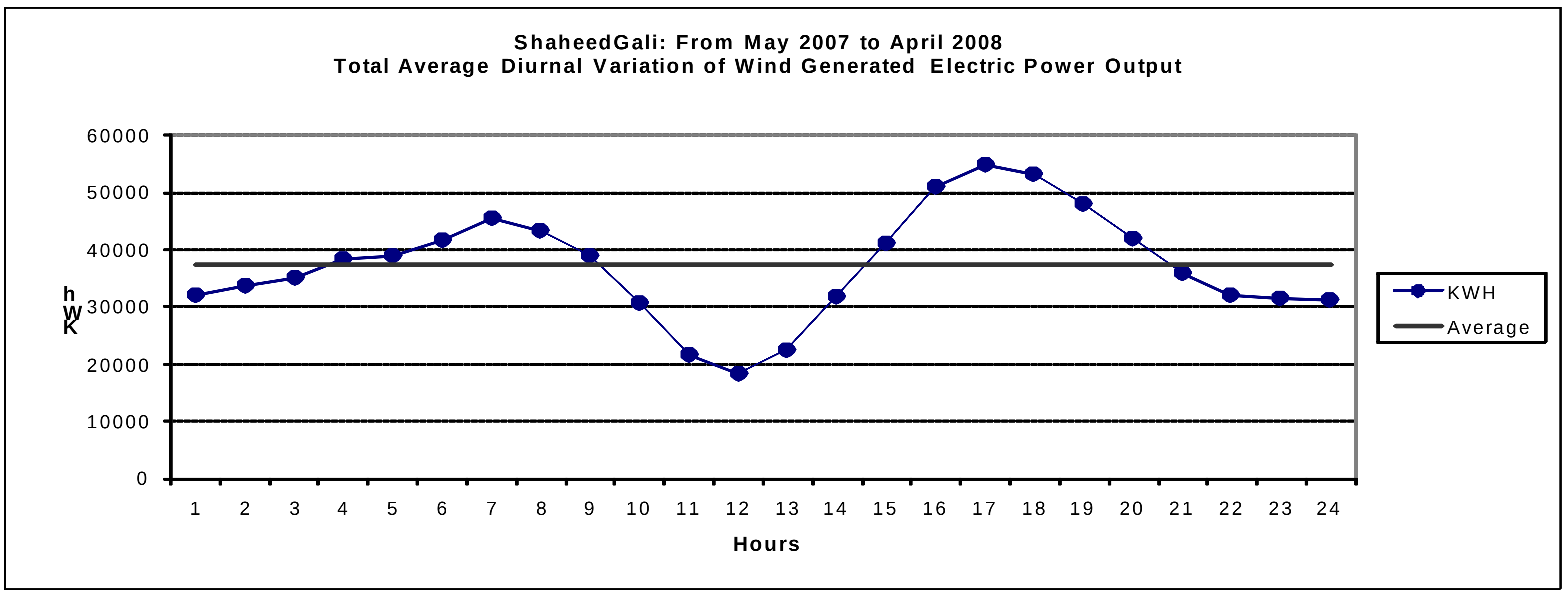
Fig-34


ShaheedGali : April 2008
Wind Generated Electric Power Output
6000
5000
4000
3000
2000
1000
0
KWh
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hours
KWh
Avg

Appendix-I

ShaheedGali **May 2007 to April 2008** **Wind Power Output of Bonus 600/44 Turbine (12 Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
May	4215	3942	4813	4713	4206	4364	4516	4435	4285	2849	1866	1296	1134	1913	1973	2296	4612	5435	4559	4352	4735	3579	3894	3889	**87873**
Jun	3174	3428	3386	4091	3148	3456	4038	3884	3080	2486	1864	1911	2081	2157	2015	3762	4614	5326	4917	4958	4536	3840	3903	3580	**83636**
Jul	1536	1515	1486	1972	1287	1800	1898	1633	1296	1060	770	1030	1954	2630	4074	4065	4976	4246	3315	2718	2337	2026	1740	1458	**52822**
Aug	1129	1912	1434	1286	1488	1342	1413	1392	957	786	1147	2268	3279	3739	4983	5413	5017	4584	5131	5036	3576	2287	1279	1128	**62004**
Sep	1901	1932	2572	2342	2295	3096	3000	2440	2094	1775	1476	1962	3060	4547	6193	6623	5719	5197	5180	4226	3258	2127	1334	1639	**75989**
Oct	1863	2241	1999	2910	3861	4302	4759	4117	3035	1378	211	241	1536	3776	5671	7539	7096	7073	5599	2764	566	732	965	1238	**75471**
Nov	1595	1523	1626	2250	2580	2871	3658	3032	2563	1523	540	30	702	1759	2501	3242	3783	3636	2961	1373	1548	1373	1579	1741	**49990**
Dec	4115	4929	5261	5781	6106	6315	6658	6343	5671	5385	3694	2677	2353	2419	3647	4110	4185	4480	3541	3314	3120	3706	4402	3993	**106204**
Jan	3455	3934	4317	4584	4615	4778	4750	4371	5238	4300	2702	2260	2269	2753	2688	3729	3466	3052	3244	3448	2779	2668	3161	3153	**85715**
Feb	2158	2468	2583	3007	3359	2490	3377	4435	4142	3460	2659	1983	1886	1664	2074	2369	3134	2440	1856	1599	2121	2585	2628	1982	**62458**
Mar	3358	2465	2692	2830	3270	3699	3826	3810	3287	2950	2476	1435	1267	2304	3153	4251	4339	3597	3493	3479	3387	3389	3438	4001	**76195**
Apr	3612	3645	3040	2857	2774	3394	3823	3653	3549	2957	2356	1376	1127	2184	2422	3650	4078	4396	4368	4843	4113	3824	3410	3629	**79079**
KWH	**32111**	**33933**	**35209**	**38623**	**38990**	**41908**	**45714**	**43545**	**39197**	**30908**	**21762**	**18469**	**22647**	**31846**	**41393**	**51051**	**55018**	**53462**	**48164**	**42109**	**36077**	**32136**	**31733**	**31430**	**897435**
Average	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	**37393**	



ShaheedGali May 2007 Wind Power Output of Bonus 600/44 Turbine (Month's Summary)

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.3	21.2	32.4	18.3	6.8	0.0	36.3	61.6	150.5	122.8	22.9	0.7	16.6	40.8	**581**
6	177.1	87.7	79.8	87.7	142.6	114.9	121.1	130.7	114.9	35.3	5.5	0.0	1.3	8.4	0.0	1.3	39.0	142.6	85.5	93.4	24.2	6.1	14.8	49.3	**1563**
7	9.0	69.5	51.2	55.9	99.0	83.2	146.6	125.1	51.2	5.5	0.7	15.4	25.9	7.7	9.0	147.5	454.1	360.0	71.0	4.8	6.1	61.0	7.7	30.5	**1898**
8	52.7	152.6	37.7	151.8	457.8	512.5	383.0	565.8	474.4	346.5	228.3	146.6	86.3	50.3	44.6	25.8	191.4	191.4	140.5	101.9	185.2	443.3	358.9	303.4	**5632**
9	530.5	356.3	541.3	457.2	361.9	392.3	306.6	203.3	134.7	71.9	37.1	2.0	0.7	5.5	22.2	66.2	190.2	188.7	18.7	38.0	60.3	23.7	269.5	113.2	**4392**
10	105.3	68.5	71.9	146.6	167.6	142.6	109.2	166.4	130.7	91.1	51.2	17.2	18.3	30.6	59.2	13.7	252.7	107.7	284.5	477.0	170.8	31.7	82.1	28.8	**2825**
11	30.5	55.9	85.5	20.0	12.6	5.5	44.0	7.7	69.5	83.2	36.2	60.6	30.6	12.6	23.0	35.5	382.8	345.2	203.2	55.0	60.6	15.9	6.8	11.9	**1694**
12	0.7	0.7	0.0	4.2	39.0	77.4	6.8	15.4	33.3	50.3	6.8	6.8	37.1	44.6	8.4	24.8	43.1	77.6	110.9	114.9	63.8	4.2	9.7	3.3	**783**
13	2.6	3.9	6.1	23.0	11.9	45.6	87.7	60.6	32.4	3.9	0.0	1.3	15.9	2.0	41.8	126.8	161.2	241.7	133.0	36.2	11.9	0.0	0.0	12.6	**1062**
14	21.2	18.3	27.7	12.6	27.7	20.1	27.7	35.3	11.3	0.0	0.0	40.1	74.2	154.5	138.6	154.5	166.4	134.7	55.0	21.2	4.2	0.0	0.0	0.0	**1145**
15	7.7	31.5	71.9	36.2	12.6	45.5	35.1	23.0	2.0	2.0	0.0	8.4	110.9	113.2	221.6	159.7	79.8	254.8	132.6	60.6	19.5	0.0	2.6	213.5	**1645**
16	552.1	597.4	586.7	551.6	186.2	329.7	365.7	221.9	144.9	113.2	99.0	74.2	99.0	44.6	44.6	6.1	9.0	3.3	50.3	87.7	56.9	2.6	0.7	51.2	**4279**
17	36.0	100.4	144.4	333.9	348.6	186.3	151.8	195.3	101.3	130.7	74.2	4.8	0.0	0.7	22.2	190.2	281.1	206.0	142.6	91.1	114.9	48.4	0.0	5.5	**2910**
18	0.0	16.6	55.0	101.3	51.2	71.9	146.6	178.2	150.5	55.0	30.6	9.7	37.1	42.1	37.1	45.6	15.4	175.7	222.0	458.2	429.8	294.9	539.8	408.5	**3572**
19	557.3	412.4	517.4	358.6	333.1	371.0	332.3	347.9	409.6	385.4	268.0	86.3	12.6	2.0	15.9	160.6	209.7	171.6	77.6	85.5	60.6	36.4	1.3	107.5	**5320**
20	166.5	70.5	306.6	493.5	144.6	272.6	562.0	574.4	487.8	402.1	138.6	91.1	40.9	6.8	5.5	27.7	144.9	495.3	487.5	563.8	562.7	493.5	464.9	372.0	**7375**
21	208.5	346.5	439.5	380.5	368.4	346.5	112.8	159.5	538.8	241.7	159.7	71.9	14.4	119.9	120.4	34.5	1.3	4.8	36.2	18.1	443.3	408.2	443.3	231.1	**5249**
22	280.5	241.4	171.4	71.9	33.3	9.7	67.2	74.2	79.8	166.4	216.4	178.2	122.8	308.2	178.2	229.8	71.0	99.6	228.3	211.7	276.9	216.4	101.3	215.1	**3850**
23	292.4	345.2	431.2	307.6	333.1	281.4	321.1	228.3	192.9	122.8	83.2	50.3	55.9	134.2	105.0	116.4	204.5	179.1	393.8	166.7	5.5	79.1	293.4	129.0	**4852**
24	159.7	91.1	142.6	150.5	167.6	122.8	146.6	87.7	99.0	16.6	5.5	1.3	0.7	16.6	34.2	206.0	393.3	601.6	532.7	570.1	570.8	203.5	104.9	498.3	**4924**
25	387.1	342.6	572.8	463.6	522.3	477.0	512.5	489.4	475.5	261.6	226.4	363.7	146.6	75.1	143.9	217.9	562.0	583.6	570.3	405.7	543.6	361.9	281.4	305.5	**9292**
26	138.6	122.8	91.1	99.6	60.6	68.5	107.1	114.9	223.6	74.2	45.6	9.0	41.3	306.0	13.7	2.0	8.9	16.6	9.0	0.0	0.0	0.0	15.3	48.4	**1617**
27	0.7	0.7	5.5	9.7	15.4	9.7	6.1	8.4	0.7	0.7	0.7	13.1	94.0	256.4	204.1	68.0	64.8	119.8	254.8	443.3	421.6	431.2	334.5	408.3	**3172**
28	320.0	191.4	130.7	134.7	99.0	87.7	107.0	228.6	130.3	60.6	48.4	20.1	23.0	26.9	85.7	100.2	294.5	346.5	103.2	7.7	45.9	69.5	126.8	107.0	**2895**
29	99.0	87.7	66.3	95.7	66.3	146.6	118.8	71.9	55.0	37.1	18.3	1.3	7.7	66.3	367.3	23.5	11.5	0.7	36.2	11.9	0.7	103.3	217.9	54.5	**1765**
30	13.7	79.8	71.9	114.9	77.6	99.0	134.7	71.9	61.6	30.6	16.6	0.7	1.3	42.7	20.1	71.4	330.8	324.8	29.2	95.0	517.9	204.0	159.7	107.5	**2677**
31	66.3	50.3	107.0	50.3	66.3	44.6	55.9	49.3	79.8	61.6	19.5	0.7	3.9	17.7	0.0	40.1	12.6	0.0	0.0	9.7	55.0	39.9	40.9	32.4	**903**
KWh	**4215**	**3942**	**4813**	**4713**	**4206**	**4364**	**4516**	**4435**	**4285**	**2849**	**1866**	**1296**	**1134**	**1913**	**1973**	**2296**	**4612**	**5435**	**4559**	**4352**	**4735**	**3579**	**3894**	**3889**	**87873**

ShaheedGali **June 2007** **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	69.5	51.2	95.7	68.5	83.2	87.7	101.3	126.8	99.0	51.2	18.3	2.0	0.7	15.9	24.2	11.8	0.0	9.7	27.7	30.6	13.1	2.0	42.7	56.6	1089
2	1.3	240.2	512.5	553.0	529.8	510.0	584.9	595.2	565.6	454.1	482.7	483.7	474.4	317.1	466.2	342.6	346.5	204.5	281.1	520.8	601.7	576.1	576.1	454.1	10674
3	522.6	520.3	0.0	446.2	216.4	16.6	4.8	83.4	126.8	166.4	107.0	88.7	14.4	101.3	54.5	139.7	424.3	518.7	268.2	429.9	291.4	330.8	513.3	450.8	5836
4	474.4	408.3	366.8	221.9	74.2	84.6	154.5	241.4	299.4	307.9	181.0	216.4	110.9	113.2	134.7	93.4	132.0	325.7	515.1	538.8	466.2	321.3	392.3	347.9	6522
5	254.5	330.8	415.2	346.5	173.1	345.5	321.1	347.9	217.6	130.7	85.5	39.9	6.1	5.5	37.4	143.6	448.9	474.4	549.6	496.0	509.2	500.2	387.9	312.8	6880
6	200.2	118.0	281.4	328.4	195.9	231.3	204.8	178.2	178.2	146.6	71.9	35.3	9.7	5.5	3.3	11.3	15.4	82.1	69.5	83.1	7.7	5.5	61.9	144.9	2670
7	105.3	210.0	87.7	93.4	101.3	126.8	179.5	171.6	171.6	77.6	30.6	2.0	2.6	38.0	75.7	51.2	66.3	154.0	132.6	118.8	55.0	16.6	7.1	0.0	2075
8	24.2	55.9	45.5	79.8	134.7	101.3	167.6	126.8	101.3	48.7	2.0	1.3	22.9	15.4	1.3	56.3	230.0	196.6	183.3	50.3	27.0	0.7	24.2	15.4	1712
9	35.3	24.8	71.0	87.7	77.4	50.3	61.6	91.0	6.8	5.5	2.0	4.2	63.8	119.4	101.3	192.6	372.0	373.4	145.4	71.9	24.2	4.2	9.0	5.5	2000
10	22.2	59.2	85.5	118.8	71.9	60.6	113.2	231.1	107.0	99.0	38.0	2.6	0.0	0.7	0.7	69.5	72.7	229.5	93.5	49.3	15.9	18.3	11.3	24.8	1595
11	46.6	66.6	114.9	87.7	88.7	101.3	178.2	126.3	118.8	48.4	6.8	6.8	9.7	6.1	102.9	188.7	71.9	126.8	178.2	64.8	8.4	15.9	4.8	6.8	1776
12	67.2	9.7	1.3	2.0	5.5	15.4	35.3	17.2	4.8	6.1	2.0	4.2	6.1	2.0	24.2	405.9	481.4	308.4	211.7	19.5	16.6	35.3	56.9	107.2	1846
13	203.7	93.4	74.2	55.9	99.0	91.1	35.3	18.3	2.6	15.4	6.1	6.1	5.5	21.6	16.4	38.4	199.7	19.5	3.3	43.0	281.1	323.5	217.9	118.8	1990
14	45.6	27.0	80.4	204.5	179.5	190.1	142.6	83.2	74.2	23.0	15.4	6.1	113.2	114.7	101.2	284.2	465.6	296.8	268.0	381.5	235.0	64.3	150.5	150.4	3697
15	81.4	64.8	26.9	108.5	32.3	54.0	99.0	25.3	42.7	66.3	30.6	71.9	71.9	22.7	25.6	437.5	163.7	333.4	242.9	192.6	93.4	55.0	134.7	178.2	2655
16	229.5	241.4	107.0	39.9	17.7	109.5	543.6	443.3	320.0	216.7	385.4	197.8	60.6	23.0	1.3	190.8	17.7	217.9	203.3	364.5	206.0	235.0	216.4	287.1	4875
17	195.3	56.9	95.1	421.6	280.3	344.4	456.4	196.6	23.0	12.6	1.3	27.7	50.3	29.8	8.4	102.8	61.9	41.3	216.4	119.4	321.3	347.9	158.4	179.5	3748
18	134.7	179.5	159.7	146.6	154.5	256.1	107.0	215.1	178.2	178.2	41.1	1.3	0.0	1.3	4.8	2.0	97.8	101.0	229.5	215.1	202.0	254.5	384.1	385.4	3629
19	139.9	146.6	154.5	154.5	134.7	98.9	53.0	99.0	25.9	30.6	2.0	0.0	1.3	0.7	13.1	126.2	75.6	405.4	255.3	281.4	184.7	126.8	254.5	215.1	2979
20	118.8	62.5	119.4	142.6	107.0	134.7	71.8	24.8	87.7	74.2	10.8	6.8	3.3	17.2	2.0	44.8	27.7	43.1	166.4	71.9	60.6	30.6	4.8	0.0	1433
21	0.0	38.3	109.2	30.5	6.8	6.8	2.0	0.0	0.0	0.7	11.5	79.8	68.5	154.5	138.6	134.7	125.1	77.6	71.9	83.2	67.2	14.8	0.0	0.0	1221
22	1.3	12.6	32.4	17.2	25.9	15.4	21.2	21.2	18.3	1.3	11.8	118.8	146.6	179.5	236.6	205.8	205.8	256.4	121.1	40.8	165.9	150.4	72.7	9.0	2088
23	82.1	99.0	46.6	6.1	6.8	0.0	0.0	7.7	45.6	69.5	17.2	30.5	14.1	11.9	7.7	1.3	93.4	109.2	126.8	130.7	166.4	83.2	40.9	15.4	1212
24	0.7	11.3	9.7	18.3	2.0	0.0	0.0	2.0	6.8	23.0	74.2	118.8	138.6	164.8	158.4	171.6	134.7	134.7	74.2	83.2	60.6	32.4	11.9	0.0	1432
25	2.6	1.3	1.3	1.3	10.6	22.1	10.2	2.6	0.7	0.0	0.0	49.8	185.0	318.2	6.1	21.9	107.0	71.9	55.9	18.3	70.5	42.7	0.7	0.7	1001
26	48.8	118.8	83.1	40.9	6.8	2.0	1.3	0.0	45.6	4.2	3.3	0.7	21.3	100.0	27.7	5.5	4.2	8.4	0.0	0.7	27.7	50.3	39.9	18.3	659
27	5.5	2.6	6.8	29.5	44.6	14.4	1.3	0.7	0.0	0.0	2.0	13.7	63.8	71.9	93.4	159.7	154.5	167.6	114.9	150.5	79.8	56.9	45.6	0.7	1280
28	2.0	0.0	2.6	2.0	5.5	12.6	39.9	9.7	0.7	0.0	4.2	51.6	244.0	37.1	25.9	1.3	1.3	3.3	61.6	281.1	242.9	107.5	21.9	1.3	1160
29	8.4	110.8	122.8	114.9	126.8	169.2	143.9	143.2	7.7	12.4	16.6	52.2	5.5	28.8	71.9	77.4	7.7	35.3	50.3	25.9	35.1	38.0	51.2	37.1	1493
30	50.3	66.3	77.6	122.8	155.7	203.3	203.3	254.5	203.3	216.4	203.3	190.1	166.4	118.8	50.3	50.3	9.0	0.0	0.0	0.7	0.0	0.0	9.7	55.9	2408
KWh	3174	3428	3386	4091	3148	3456	4038	3884	3080	2486	1864	1911	2081	2157	2015	3762	4614	5326	4917	4958	4536	3840	3903	3580	83636

ShaheedGali July 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	88.3	228.3	178.2	126.8	121.1	46.6	71.9	30.6	56.9	45.6	6.1	3.3	3.5	43.7	126.8	209.7	228.3	110.9	93.4	114.9	107.0	70.5	121.5	408.1	2642
2	274.1	133.9	5.5	235.5	93.4	159.7	217.9	178.2	99.0	60.6	37.1	0.0	6.1	66.3	55.9	29.5	12.6	38.0	7.7	0.7	6.1	6.8	0.0	0.0	1724
3	1.3	3.3	0.0	42.7	178.2	126.8	69.5	34.5	17.1	77.6	9.7	2.0	0.7	9.7	50.3	45.6	118.8	71.9	30.6	66.3	11.8	1.3	20.1	15.4	1005
4	37.1	3.3	0.7	1.3	0.7	2.0	1.3	0.0	0.0	0.7	6.8	4.2	17.1	76.7	55.9	198.3	368.4	190.1	134.7	91.1	60.6	30.6	21.2	0.0	1302
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.4	35.3	55.9	93.4	114.9	107.0	118.8	142.6	85.5	113.2	229.5	99.0	267.8	271.9	307.3	253.8	2311
6	191.4	189.9	24.0	24.8	88.1	87.4	96.8	110.9	74.2	12.4	0.0	0.7	63.8	117.2	91.7	122.8	126.8	110.9	60.6	85.5	60.6	85.5	67.2	27.7	1921
7	20.0	25.9	68.5	77.6	37.1	8.4	1.3	0.7	53.7	37.1	2.0	5.5	102.9	130.7	178.2	228.3	120.0	100.2	72.3	20.1	58.2	50.3	67.6	15.4	1481
8	79.8	209.7	128.3	555.0	56.6	446.0	427.0	339.5	241.4	269.5	138.6	126.3	17.2	5.5	0.0	4.2	125.1	154.5	154.5	154.5	107.0	134.7	46.6	11.3	3933
9	0.0	27.0	79.8	69.5	27.7	55.9	64.8	87.7	30.6	21.9	0.7	4.8	9.7	36.2	134.7	242.9	166.4	114.9	107.0	134.7	66.3	29.5	2.0	27.7	1542
10	37.1	45.6	6.1	32.7	18.3	4.2	0.0	0.0	0.0	0.7	12.6	35.3	50.3	82.1	190.1	114.9	130.7	122.8	99.0	114.9	77.6	66.3	13.7	0.0	1255
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	3.3	50.3	77.6	118.8	228.3	192.6	204.5	159.7	216.4	178.2	107.0	122.8	49.3	55.0	27.7	7.1	1804
12	1.3	0.0	0.7	5.5	5.5	0.7	0.0	2.0	0.0	0.0	2.6	55.9	138.6	281.8	381.8	356.3	360.0	479.8	275.2	111.8	281.4	158.4	261.1	242.9	3403
13	216.8	132.1	409.3	325.9	217.9	158.4	121.1	107.5	20.0	195.7	178.9	4.2	13.7	15.4	99.6	99.0	75.7	15.4	49.3	26.9	2.6	75.5	44.1	14.4	2619
14	58.2	91.1	99.0	87.7	110.9	154.5	67.2	107.0	79.8	21.3	0.7	0.0	2.6	4.2	2.0	2.0	0.7	12.4	379.2	290.6	178.9	217.6	192.9	192.9	2353
15	221.9	139.2	207.0	113.2	50.3	35.1	32.4	101.3	63.8	23.0	2.6	5.5	6.1	0.7	4.8	43.7	146.6	93.4	107.0	122.8	35.3	25.9	7.7	0.0	1589
16	0.7	2.6	0.7	3.3	30.5	67.2	77.6	87.7	55.0	15.4	2.6	2.0	34.2	75.1	256.1	216.4	294.5	321.3	138.6	99.0	99.0	45.6	1.3	0.0	1926
17	0.0	4.2	27.7	35.3	45.6	5.5	236.7	76.1	30.5	16.6	13.1	14.4	15.4	3.3	0.0	7.7	184.6	282.9	39.9	44.6	30.6	18.3	6.1	2.0	1141
18	2.6	3.3	3.3	19.5	51.2	51.6	1.3	2.6	2.0	0.0	0.0	16.6	118.8	126.8	142.6	83.2	79.8	93.4	107.0	71.9	45.6	6.8	1.3	0.7	1032
19	1.3	2.0	3.9	1.3	0.0	2.0	3.3	3.3	8.4	0.7	3.5	101.3	158.4	268.0	229.5	241.4	229.8	183.0	24.8	0.7	25.9	129.0	59.2	7.1	1687
20	0.0	0.0	0.7	1.3	2.0	9.7	2.6	21.2	0.7	0.0	13.1	119.4	256.5	154.5	375.5	146.6	69.5	283.1	152.8	51.6	45.2	82.1	179.5	7.7	1975
21	12.4	9.0	0.0	0.7	0.7	1.3	49.8	55.6	4.2	0.0	0.0	1.3	11.3	11.9	1.3	107.5	190.1	99.6	103.6	107.0	49.3	29.5	31.3	53.5	931
22	35.1	24.8	8.4	5.5	14.1	15.9	55.0	45.6	40.9	24.8	7.7	0.0	0.0	28.2	59.9	66.3	43.7	79.0	20.0	4.2	11.3	0.0	0.7	0.0	591
23	0.0	0.0	0.7	11.9	12.6	30.6	8.4	1.3	2.6	0.0	0.0	0.7	0.0	0.0	4.2	60.6	50.3	19.5	0.0	34.5	93.4	37.4	21.3	0.7	390
24	30.6	55.9	24.8	21.9	12.6	11.3	4.8	2.0	0.7	5.5	7.7	25.9	74.2	151.8	347.9	235.7	158.4	126.8	216.7	134.7	138.6	33.3	9.0	19.5	1850
25	6.8	8.4	4.2	15.4	12.6	9.7	11.9	1.3	0.0	3.5	60.6	83.2	146.6	166.4	215.1	142.6	190.1	178.2	99.0	114.9	85.5	55.9	7.7	35.1	1655
26	44.6	14.4	12.6	21.2	21.2	19.5	2.0	0.7	0.0	2.6	1.3	23.0	107.0	138.6	142.6	163.7	527.7	135.1	175.5	191.4	146.6	112.8	138.6	77.6	2220
27	128.3	129.0	69.8	51.6	23.5	198.8	171.6	26.9	91.1	85.5	63.8	6.1	1.3	0.7	0.0	0.7	0.0	11.3	1.3	23.5	24.8	69.5	33.3	10.6	1223
28	14.1	2.0	14.4	50.3	23.0	6.8	56.9	42.7	0.0	0.0	20.6	55.9	91.1	99.0	170.3	280.0	254.5	154.5	122.8	118.8	66.3	66.3	30.6	11.3	1752
29	0.0	13.7	91.8	24.8	0.0	34.5	7.7	34.5	75.4	0.0	9.5	42.7	60.6	93.4	107.0	67.6	131.9	122.2	37.7	15.9	9.7	9.7	14.8	15.9	1021
30	27.7	3.9	9.7	9.0	32.3	50.3	37.1	126.3	229.8	54.5	5.5	0.0	4.2	4.2	8.4	29.5	99.0	114.9	91.1	50.3	12.6	9.7	0.7	0.0	1010
31	4.8	12.6	6.1	1.3	0.0	0.0	0.0	0.0	0.0	0.0	29.5	77.6	99.0	138.6	318.6	216.4	190.1	134.7	77.6	99.0	83.2	40.9	4.2	0.0	1534
KWh	1536	1515	1486	1972	1287	1800	1898	1633	1296	1060	770	1030	1954	2630	4074	4065	4976	4246	3315	2718	2337	2026	1740	1458	52822

ShaheedGali August 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	9.7	25.9	30.6	8.4	119.4	29.8	38.9	0.7	0.7	18.3	4.2	11.9	67.2	66.3	91.1	126.8	178.2	256.5	390.6	311.6	52.5	155.2	3.9	0.0	1998
2	24.2	55.9	4.2	0.0	15.3	34.2	21.9	163.7	45.6	51.2	45.6	11.9	0.0	8.4	28.7	30.5	107.0	93.4	154.5	282.9	216.4	86.6	47.7	71.9	1601
3	11.9	1.3	0.0	21.9	35.3	121.1	77.6	88.7	0.7	9.0	61.6	50.3	99.0	107.0	55.0	55.0	49.3	93.4	77.6	99.0	91.1	158.4	83.1	50.3	1497
4	38.0	138.3	48.1	18.8	6.1	0.0	2.0	0.7	0.7	3.9	46.6	77.6	241.4	142.6	204.5	155.7	126.8	114.9	204.5	281.1	115.5	54.5	136.9	18.1	2177
5	32.4	66.3	54.5	27.7	4.8	9.0	12.4	0.0	0.7	4.2	75.1	154.5	138.6	66.3	35.3	21.9	91.1	146.6	204.5	231.1	99.6	2.0	23.0	72.8	1574
6	198.1	209.6	4.2	0.7	0.7	8.4	0.0	53.4	83.2	23.0	9.0	44.6	32.4	9.7	1.3	0.0	1.3	12.4	19.5	2.0	0.0	11.8	4.8	8.4	738
7	35.3	146.6	122.8	113.2	333.1	370.2	589.0	584.4	493.5	371.0	151.8	411.3	368.1	444.5	485.2	333.6	114.9	39.9	45.6	114.9	85.5	80.8	93.4	107.0	6035
8	130.3	228.3	229.5	130.7	211.5	229.8	215.1	154.5	74.2	39.9	0.7	3.3	79.0	190.1	134.7	333.1	294.5	154.5	203.3	130.7	166.4	83.1	7.7	3.9	3429
9	18.3	12.6	12.6	21.2	18.3	9.0	20.1	0.7	2.6	0.0	26.0	75.1	191.4	119.4	132.6	171.6	29.8	75.1	91.1	142.6	77.4	11.9	4.8	4.2	1268
10	0.0	0.0	0.7	0.0	9.7	9.7	0.0	0.7	0.0	16.6	163.7	346.5	385.4	244.5	130.7	228.3	241.4	215.1	191.4	146.6	171.6	166.4	121.1	38.0	2828
11	8.4	0.0	9.0	18.3	25.9	30.6	9.0	5.5	23.0	71.9	159.7	217.6	229.8	134.7	296.3	332.1	154.5	190.1	190.1	166.4	142.6	79.8	28.8	1.3	2525
12	12.6	24.8	9.7	8.9	5.5	35.3	32.3	22.2	21.3	24.8	66.3	121.1	126.8	294.8	369.4	393.7	241.4	164.7	268.2	216.4	157.9	51.1	63.2	123.2	2855
13	265.5	42.1	56.9	88.7	44.6	45.6	7.7	0.7	0.7	0.7	1.3	4.8	75.5	130.7	294.5	142.6	166.4	229.8	267.7	344.1	126.3	102.4	267.9	271.0	2978
14	40.1	251.9	154.5	178.2	254.8	130.7	142.6	129.0	32.7	6.1	0.0	0.0	11.8	68.5	166.4	65.5	4.8	90.8	5.5	13.1	22.2	9.0	10.6	52.4	1841
15	90.2	179.9	429.4	399.5	165.9	82.4	85.5	33.3	138.6	90.3	12.6	0.0	0.0	12.6	97.2	229.5	241.4	241.4	215.1	228.3	268.0	171.2	2.0	0.0	3414
16	12.4	0.0	0.0	0.0	0.0	2.0	2.0	1.3	0.0	0.0	0.0	21.6	114.9	66.3	68.5	218.1	229.5	166.4	267.7	190.1	118.8	43.7	1.3	0.0	1524
17	7.7	11.9	9.0	1.3	24.2	20.6	7.1	4.2	0.0	0.0	2.0	48.8	107.0	79.8	60.6	99.0	178.2	242.7	256.1	307.9	192.9	93.4	4.2	3.5	1762
18	16.6	9.0	0.0	4.8	0.7	0.7	2.0	0.0	0.0	2.0	66.6	113.2	69.5	45.6	61.6	150.5	91.1	142.6	178.2	122.8	134.7	114.9	50.3	4.2	1381
19	1.3	2.0	8.4	9.7	1.3	6.1	23.0	16.6	1.3	5.5	48.4	71.9	178.2	158.4	269.5	333.1	269.5	77.6	79.8	93.4	77.8	2.0	28.8	13.1	1776
20	18.8	60.6	53.7	8.4	2.6	5.5	7.7	22.2	12.6	7.7	13.1	3.5	24.8	12.6	61.6	110.9	203.3	147.8	178.2	134.7	190.1	154.5	79.8	28.2	1543
21	0.7	9.7	1.3	0.0	0.7	5.5	15.4	1.3	1.3	4.2	30.6	85.5	113.2	178.2	107.0	183.5	82.1	50.3	60.6	74.2	107.0	72.9	10.2	1.3	1196
22	8.9	0.0	2.0	6.8	6.8	9.7	12.6	2.6	4.8	0.0	2.0	69.5	99.6	242.9	334.5	307.6	241.4	204.5	154.5	178.2	142.6	74.2	25.9	51.2	2183
23	14.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.6	41.7	51.2	79.8	196.6	334.8	203.3	158.4	134.7	166.4	114.9	122.8	115.5	22.4	125.1	1897
24	68.9	0.0	0.0	4.8	4.8	5.5	23.0	24.2	3.5	1.3	5.5	2.0	15.3	61.6	158.4	122.8	170.3	142.6	202.0	254.8	143.9	35.1	9.0	55.9	1515
25	1.3	276.8	65.2	77.9	27.0	17.2	34.5	0.0	0.0	0.0	2.0	21.2	18.3	39.9	102.9	126.8	241.4	154.5	140.9	39.8	17.2	1.3	1.3	9.7	1417
26	21.2	39.9	40.9	7.7	18.3	10.2	0.7	2.0	11.9	15.4	6.8	4.2	23.4	20.0	61.0	15.9	204.9	143.0	94.0	93.7	1.3	42.7	40.9	3.5	923
27	4.8	25.9	23.0	64.8	80.6	18.8	5.5	66.6	0.0	0.0	0.0	4.8	38.0	163.7	198.3	118.8	99.0	178.2	202.0	196.6	122.8	55.9	15.9	2.6	1687
28	20.1	66.3	44.6	55.9	49.3	18.4	4.8	3.3	1.3	0.0	2.0	39.9	77.6	91.1	179.5	256.4	268.0	143.9	109.2	171.6	122.8	122.8	31.5	0.7	1881
29	0.0	2.0	0.0	0.0	0.0	26.3	5.5	0.0	0.0	0.0	17.1	46.6	77.6	118.4	114.9	202.0	190.1	228.3	154.5	122.8	122.8	83.2	39.9	0.0	1552
30	1.3	0.0	0.0	0.0	0.0	0.7	0.0	7.7	1.3	5.5	58.2	93.4	134.7	118.8	99.0	114.9	142.6	154.5	179.5	130.7	77.6	35.3	11.3	6.1	1373
31	15.4	23.0	19.5	7.7	21.3	49.3	15.4	2.0	0.7	0.7	27.7	60.6	60.6	105.3	248.2	229.8	204.5	154.5	178.2	99.0	88.7	15.4	7.1	0.7	1635
KWh	1129	1912	1434	1286	1488	1342	1413	1392	957	786	1147	2268	3279	3739	4983	5413	5017	4584	5131	5036	3576	2287	1279	1128	62004

ShaheedGali September 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	0.7	20.6	59.2	4.8	16.6	13.1	11.3	23.5	33.5	20.6	4.8	92.5	107.0	101.3	178.2	267.7	154.5	154.5	146.6	122.8	75.1	9.0	0.0	0.0	**1618**
2	24.2	12.6	6.8	18.3	1.3	9.0	0.7	2.0	11.3	4.8	0.0	22.9	97.2	229.5	80.4	43.7	179.5	79.8	55.0	85.5	85.5	17.2	0.0	0.0	**1067**
3	0.0	1.3	0.0	5.5	10.8	24.8	2.0	0.0	0.0	14.8	1.3	133.5	281.1	242.9	146.6	142.6	178.2	122.8	130.7	85.5	99.0	55.9	23.0	24.8	**1727**
4	0.0	0.0	0.7	0.7	2.6	1.3	2.0	2.0	0.0	0.0	8.4	61.6	101.3	216.4	293.2	143.8	127.9	510.3	223.8	376.9	406.7	85.5	26.9	93.4	**2685**
5	118.8	93.4	51.1	1.3	1.3	11.3	86.3	151.8	190.9	121.1	71.9	35.3	9.0	0.0	0.0	0.0	2.0	3.9	0.0	0.0	1.3	7.7	51.2	107.0	**1116**
6	166.4	48.4	96.6	35.3	24.0	15.4	17.1	55.0	21.3	0.0	100.0	44.2	61.6	281.1	504.3	417.8	397.5	268.6	107.0	2.0	17.1	26.9	22.1	176.6	**2906**
7	109.2	14.1	22.4	24.8	0.7	74.5	38.0	8.4	57.2	94.0	60.6	4.8	0.7	9.7	2.0	1.3	6.1	3.3	1.3	20.1	110.9	113.2	46.6	20.1	**844**
8	30.5	77.6	39.9	50.3	32.4	87.7	23.0	2.0	0.0	0.0	0.0	6.8	1.3	15.2	223.1	475.5	179.5	67.2	66.0	150.1	91.1	114.9	35.3	35.3	**1804**
9	45.6	35.1	39.9	27.7	2.6	7.7	4.8	0.0	0.0	0.0	0.0	4.8	15.4	8.4	0.0	4.8	27.7	218.3	303.8	228.0	100.0	31.6	17.1	36.2	**1160**
10	49.3	109.2	91.1	87.7	56.9	44.6	61.6	46.6	2.6	0.0	0.0	0.7	7.7	4.2	20.6	51.2	4.8	8.4	45.6	93.4	69.8	1.3	0.0	0.7	**858**
11	31.9	101.3	43.7	0.7	0.0	19.5	51.2	71.9	30.6	52.4	2.0	54.5	70.5	9.0	0.0	0.0	11.9	28.2	51.2	6.8	10.2	21.3	0.7	17.2	**686**
12	85.5	66.3	209.7	158.0	75.7	121.1	183.5	242.9	254.5	87.7	4.8	12.4	101.3	99.0	169.3	190.1	190.1	215.1	268.0	242.7	79.8	45.6	2.0	0.7	**3106**
13	3.9	0.7	2.6	12.6	12.6	6.8	1.3	0.0	0.0	0.0	37.1	77.6	85.5	163.7	394.9	431.2	430.0	203.3	190.1	166.4	85.5	49.3	18.3	6.1	**2379**
14	0.0	0.0	0.7	0.0	3.3	6.1	8.4	5.5	0.0	18.8	74.2	158.4	166.4	228.3	333.1	307.6	91.3	188.9	218.0	47.7	4.8	0.7	56.9	39.9	**1959**
15	6.1	21.9	0.0	27.0	91.0	107.0	71.9	33.3	2.6	0.0	30.5	126.8	167.6	229.5	268.0	268.2	281.1	241.4	358.6	215.1	114.9	77.6	51.2	0.7	**2792**
16	0.0	2.0	0.0	28.8	30.6	9.7	45.6	0.7	2.0	5.5	54.5	204.5	208.5	241.4	381.5	451.5	268.4	154.5	61.3	106.7	204.8	121.1	0.0	0.0	**2583**
17	12.6	39.9	27.7	12.6	9.7	46.7	9.0	15.9	32.7	12.4	67.9	190.1	107.0	43.6	131.3	110.9	182.7	118.4	74.5	0.0	12.4	9.0	142.6	152.8	**1562**
18	82.1	95.7	75.1	88.7	122.8	130.7	142.6	56.6	23.0	4.2	0.0	37.1	99.0	154.5	293.2	358.6	215.1	307.9	294.2	268.0	130.7	77.6	9.0	0.0	**3066**
19	24.8	50.3	24.8	91.1	85.5	23.0	2.0	0.7	2.6	0.0	8.4	112.5	178.2	305.5	432.5	409.6	243.2	217.9	203.3	31.9	21.9	22.7	0.0	0.0	**2492**
20	0.7	0.7	6.1	28.8	115.5	107.0	113.2	88.3	37.1	387.6	489.4	24.2	171.9	406.5	549.3	470.3	269.7	203.3	216.4	158.0	397.5	254.8	190.1	203.3	**4889**
21	202.0	242.9	382.8	444.5	294.5	321.1	360.0	228.3	130.0	223.6	31.7	22.4	4.8	1.3	0.0	12.6	1.3	2.6	0.0	0.0	4.2	0.7	3.5	8.4	**2923**
22	32.4	55.9	34.2	53.0	315.1	483.4	480.9	294.2	269.5	179.5	190.1	119.4	343.3	419.1	382.8	126.8	154.5	118.8	229.5	228.3	114.9	178.2	101.3	154.0	**5059**
23	132.0	101.3	170.3	184.7	107.0	344.2	139.9	75.1	55.0	152.4	94.9	60.6	21.3	0.0	38.0	212.4	531.7	449.1	601.0	598.7	561.0	419.1	348.8	215.1	**5614**
24	267.7	306.6	432.5	421.6	281.1	380.2	241.7	373.4	531.6	304.3	118.8	33.3	2.0	0.7	56.6	114.9	71.9	75.1	126.8	17.2	9.7	99.6	122.8	60.6	**4450**
25	23.0	41.7	68.5	126.8	93.4	196.6	229.5	179.5	86.2	7.7	0.0	27.0	93.4	130.7	178.2	281.4	254.5	294.5	256.4	67.6	33.3	24.8	3.9	86.3	**2785**
26	146.1	71.9	146.6	87.7	44.6	39.9	42.7	23.0	3.3	0.0	4.8	53.5	154.5	215.1	306.6	293.2	345.2	228.3	241.4	228.3	77.6	5.5	22.2	44.6	**2826**
27	107.5	87.7	71.9	44.6	55.9	43.1	190.9	15.3	0.0	0.0	20.0	229.5	256.4	516.7	380.2	108.5	100.0	26.3	54.0	295.0	202.3	215.4	5.5	14.5	**3041**
28	109.2	117.2	196.2	87.7	118.8	171.1	51.2	99.0	39.9	15.4	0.0	1.3	20.1	30.5	87.7	266.3	334.5	241.4	228.3	107.0	62.9	28.4	1.3	23.5	**2439**
29	30.3	71.9	55.0	48.4	134.7	134.7	281.4	203.3	99.0	26.3	0.0	1.3	61.6	121.1	171.6	419.1	294.5	242.7	146.6	61.3	28.8	12.6	30.6	71.9	**2748**
30	58.7	44.0	216.4	138.6	154.5	114.9	107.0	142.6	178.2	42.1	0.0	8.4	64.3	122.8	190.1	241.4	190.1	202.0	281.1	215.1	44.2	0.0	1.3	45.6	**2803**
KWh	**1901**	**1932**	**2572**	**2342**	**2295**	**3096**	**3000**	**2440**	**2094**	**1775**	**1476**	**1962**	**3060**	**4547**	**6193**	**6623**	**5719**	**5197**	**5180**	**4226**	**3258**	**2127**	**1334**	**1639**	**75989**

ShaheedGali October 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	56.9	77.4	118.8	134.7	151.8	77.4	177.4	85.5	99.0	34.5	2.0	0.0	4.2	30.5	60.6	113.2	192.6	281.1	241.4	171.6	37.6	17.2	61.6	71.9	**2299**
2	142.6	68.5	79.8	47.4	32.4	53.5	216.4	216.4	241.4	144.9	3.5	4.8	74.2	130.7	150.5	40.9	179.5	369.4	273.6	13.7	1.3	0.0	3.5	26.9	**2516**
3	66.3	39.9	0.0	166.4	183.5	126.8	185.0	129.0	138.6	45.8	1.3	0.7	2.0	9.5	80.2	271.4	147.2	51.6	159.7	74.2	62.8	154.5	43.7	146.6	**2286**
4	76.4	142.6	178.2	216.4	256.1	146.6	178.2	130.7	107.0	93.4	8.4	0.0	0.0	43.9	128.1	193.9	7.1	0.7	0.7	0.0	42.4	4.2	66.3	118.8	**2140**
5	93.4	134.7	158.4	216.4	229.5	241.4	254.5	166.4	130.7	35.5	1.3	0.0	20.0	80.2	142.6	373.4	360.0	126.8	154.5	76.7	0.7	39.8	51.6	60.6	**3149**
6	171.6	114.9	56.9	32.4	59.2	122.8	154.5	71.9	66.6	0.0	0.0	4.8	53.0	85.5	167.6	241.4	172.7	81.4	0.0	0.0	24.8	4.2	13.7	4.8	**1704**
7	0.0	2.0	15.4	2.6	33.3	79.8	105.3	119.4	11.5	0.0	0.0	16.6	114.9	158.4	154.5	229.5	321.3	268.0	254.8	107.0	16.6	21.9	9.7	9.7	**2052**
8	0.7	9.7	37.1	75.1	68.9	85.5	113.2	30.6	23.0	2.0	15.4	0.7	13.7	69.5	61.6	183.0	409.6	215.1	190.1	107.0	8.9	9.0	4.2	1.3	**1735**
9	59.7	45.6	99.6	166.4	118.8	107.0	118.8	122.8	179.5	114.3	0.0	15.9	93.4	107.0	126.8	216.4	192.6	203.3	241.4	184.7	18.1	23.0	44.6	55.9	**2655**
10	44.6	6.1	10.8	66.3	79.8	158.4	167.6	183.5	130.7	13.1	0.0	11.3	77.6	146.6	206.0	373.4	256.1	281.1	215.1	87.7	0.7	17.2	55.9	25.9	**2615**
11	60.6	55.0	61.6	50.3	71.9	86.1	158.4	114.9	91.0	9.7	0.0	4.8	71.9	113.2	236.6	254.5	203.3	307.6	268.0	191.4	18.1	30.6	35.3	50.3	**2545**
12	56.9	63.4	95.7	66.3	115.5	170.3	166.4	107.5	74.2	17.2	0.7	0.7	30.6	38.0	167.6	229.5	280.3	192.6	190.1	69.8	8.4	3.3	6.1	60.6	**2211**
13	63.8	45.6	52.2	113.2	118.8	182.2	126.8	105.3	60.6	55.0	23.5	4.2	51.6	134.7	146.6	231.1	171.6	138.6	76.4	7.7	47.7	77.6	77.6	39.9	**2152**
14	44.6	44.6	77.6	192.6	166.4	191.4	216.7	255.8	134.7	64.2	6.1	4.2	4.2	87.7	261.6	361.3	256.1	281.1	91.4	4.2	4.8	4.8	24.8	24.8	**2806**
15	45.6	126.8	122.8	130.7	126.8	191.4	254.5	254.8	242.9	79.8	36.2	16.6	2.0	152.4	307.6	268.2	184.6	392.3	118.4	101.3	13.7	8.4	23.5	170.3	**3371**
16	122.8	46.6	54.0	74.3	216.4	154.5	203.3	154.5	109.2	71.9	40.1	0.0	30.5	188.7	421.1	504.3	307.0	228.3	294.2	204.5	13.1	0.7	3.5	7.1	**3450**
17	48.1	191.4	60.6	91.1	93.4	61.9	99.0	85.5	20.1	3.5	0.0	2.0	102.9	265.4	455.3	466.2	356.3	154.5	204.8	93.4	19.5	2.0	30.6	4.2	**2911**
18	12.6	20.1	0.0	16.6	16.5	30.6	35.3	39.9	20.1	0.0	0.0	64.8	166.4	204.8	216.4	372.0	318.9	268.2	307.6	183.5	35.1	1.3	14.8	4.2	**2350**
19	102.9	83.1	0.7	38.9	126.8	122.8	79.8	76.1	0.0	0.0	20.1	1.3	11.3	164.9	134.7	183.5	196.6	321.1	269.5	166.4	53.7	1.3	2.6	0.7	**2158**
20	0.7	12.6	32.4	4.2	20.1	18.3	3.3	50.3	4.2	5.5	0.7	55.9	71.9	83.2	93.4	146.6	254.5	254.8	93.4	51.2	13.7	8.4	50.3	49.3	**1379**
21	39.9	35.3	50.3	48.4	32.0	50.8	14.8	6.1	2.6	0.7	0.0	4.8	55.9	60.6	77.4	85.5	99.0	154.5	122.8	15.9	1.3	6.1	0.7	24.2	**989**
22	33.3	130.7	166.4	74.2	107.0	167.6	191.4	190.1	99.0	66.6	2.6	4.2	3.5	109.2	134.7	204.5	142.6	158.4	122.8	9.5	23.0	20.1	27.7	9.7	**2199**
23	40.8	79.8	74.2	215.1	172.8	122.8	86.8	190.9	91.1	60.6	14.5	0.0	58.0	126.8	191.4	241.4	281.4	268.2	294.5	102.9	2.0	24.2	46.6	32.4	**2819**
24	27.7	17.2	18.7	118.8	178.2	154.5	158.4	166.4	35.3	4.8	0.0	3.3	61.0	85.5	126.8	107.0	158.4	190.1	178.2	163.7	11.9	6.1	0.7	9.0	**1982**
25	64.2	39.2	38.9	118.8	74.2	119.4	150.5	159.7	142.6	82.1	10.2	0.7	48.4	50.3	15.9	101.3	202.0	178.2	203.3	83.1	4.2	55.0	71.9	66.3	**2080**
26	60.6	55.0	55.9	28.8	39.2	56.4	48.7	87.7	79.8	25.1	0.7	2.0	23.0	71.9	99.0	114.9	166.4	204.5	190.1	216.4	26.3	42.7	79.0	31.0	**1805**
27	1.3	0.0	5.5	93.4	113.2	97.2	126.8	114.9	101.2	4.8	0.0	4.8	59.2	166.4	242.9	254.8	216.4	203.3	167.6	67.2	4.2	8.4	1.3	0.0	**2055**
28	68.9	107.5	95.7	27.6	268.1	360.0	296.0	150.5	99.6	45.6	5.5	0.0	32.4	144.9	202.0	254.5	256.1	281.1	179.5	72.7	2.6	40.9	3.3	31.0	**3026**
29	93.4	166.4	30.5	94.9	142.6	121.1	134.7	101.3	40.9	32.4	1.3	0.0	54.5	130.7	203.3	321.1	254.5	242.7	134.7	12.4	14.8	45.6	16.6	15.4	**2405**
30	39.9	77.6	55.9	80.8	150.5	190.1	216.4	154.5	254.5	154.5	8.9	11.8	87.7	216.4	215.1	254.5	178.2	345.2	190.1	107.2	11.3	23.0	56.9	24.8	**3106**
31	122.8	202.0	94.9	107.0	298.1	454.1	320.0	294.5	203.3	110.8	7.7	0.7	56.3	318.9	443.3	346.5	373.4	429.9	170.4	17.1	23.0	30.6	37.1	60.6	**4523**
KWh	**1863**	**2241**	**1999**	**2910**	**3861**	**4302**	**4759**	**4117**	**3035**	**1378**	**211**	**241**	**1536**	**3776**	**5671**	**7539**	**7096**	**7073**	**5599**	**2764**	**566**	**732**	**965**	**1238**	**75471**

ShaheedGali November 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	15.9	93.4	109.2	107.0	108.5	299.1	481.1	293.4	125.6	27.6	4.2	0.7	39.9	54.0	125.1	203.3	320.3	204.5	216.4	134.7	47.4	1.3	0.7	35.3	**3048**
2	61.6	87.7	92.5	20.0	130.7	178.2	241.4	107.0	87.7	97.4	43.1	0.7	69.5	154.5	122.8	107.0	191.4	228.3	241.4	180.7	31.0	5.5	21.3	5.5	**2507**
3	6.1	30.5	0.0	134.7	75.5	21.3	96.0	126.3	125.1	13.7	15.9	0.0	33.3	60.6	91.7	118.8	122.8	67.2	25.9	51.2	91.1	10.8	6.1	0.7	**1325**
4	11.8	21.3	0.7	17.1	3.5	42.1	60.6	61.3	24.2	47.4	3.5	0.0	8.9	39.9	74.2	130.7	101.3	30.6	15.9	9.0	45.6	55.0	56.9	38.0	**899**
5	49.3	125.1	89.3	216.4	146.6	133.0	158.4	86.1	77.4	9.0	0.0	0.0	72.7	216.4	254.5	294.2	393.6	461.1	242.4	8.9	45.6	50.3	58.7	115.1	**3304**
6	129.0	55.9	134.7	281.6	198.1	216.4	242.9	159.7	69.5	23.0	17.7	0.7	28.8	44.6	71.9	216.4	254.5	154.5	107.5	17.7	39.9	83.2	25.9	64.3	**2638**
7	114.9	45.6	27.7	21.9	126.8	178.2	134.7	166.4	109.2	27.7	0.0	0.7	61.9	126.8	267.7	228.3	190.1	99.0	93.4	20.6	1.3	0.7	0.0	55.9	**2099**
8	87.7	27.7	95.7	77.4	71.8	110.9	68.5	118.8	51.2	40.9	45.1	0.0	0.7	23.0	44.6	74.2	126.8	307.6	294.2	142.6	50.0	5.5	12.6	12.6	**1890**
9	25.3	68.2	24.2	63.8	146.6	146.6	77.6	83.2	29.5	9.7	9.0	0.0	11.9	9.7	9.7	55.0	82.1	154.5	216.4	125.1	27.6	4.8	21.2	15.4	**1417**
10	6.1	13.7	95.7	66.3	55.9	60.6	61.9	114.9	138.6	183.5	54.4	2.0	0.7	39.9	48.4	63.8	228.3	281.1	228.3	165.2	426.0	254.5	358.9	305.5	**3254**
11	293.4	166.4	142.6	159.7	229.5	241.4	196.6	113.2	122.8	45.6	1.3	0.0	21.9	44.6	85.5	74.2	83.2	130.7	158.4	33.8	8.4	25.9	118.8	146.6	**2644**
12	121.1	55.9	68.5	142.6	71.9	138.6	205.0	198.1	178.2	107.0	43.7	0.0	24.2	71.9	183.5	190.1	134.7	107.0	29.8	17.7	34.5	0.7	4.2	1.3	**2130**
13	1.3	44.6	8.4	23.0	50.3	25.9	54.5	85.5	90.7	58.7	4.2	0.0	32.4	122.8	154.5	229.8	215.1	122.8	103.6	11.8	15.4	55.9	60.6	126.8	**1698**
14	61.7	63.8	40.9	163.7	118.8	178.2	204.5	215.1	87.7	30.6	0.0	0.7	44.6	71.9	142.6	99.0	170.3	294.2	196.2	12.4	5.5	67.2	109.2	35.3	**2414**
15	18.3	37.1	71.9	118.8	101.3	138.6	130.7	164.7	122.8	63.8	1.3	4.8	75.1	107.0	93.4	166.4	154.5	101.3	154.5	73.6	20.6	39.9	53.0	5.5	**2019**
16	37.9	69.5	110.9	91.7	153.6	140.5	190.1	178.2	166.4	27.7	4.8	0.0	0.0	48.4	179.5	307.6	215.1	307.9	94.0	8.9	32.7	91.1	182.2	159.7	**2798**
17	82.1	138.6	158.4	191.4	241.4	268.0	296.0	256.4	307.6	281.4	134.7	7.7	0.0	56.3	122.8	154.5	206.0	184.7	75.1	7.7	24.2	111.5	241.4	217.6	**3765**
18	79.8	60.6	191.4	170.3	223.1	210.0	176.8	192.9	358.9	269.5	94.9	0.0	7.7	49.3	101.3	154.5	228.3	294.5	334.5	105.3	12.4	14.8	46.6	91.7	**3469**
19	93.4	35.3	40.9	56.9	107.0	24.8	143.9	133.0	50.3	26.9	2.6	0.0	8.2	99.0	215.1	178.2	118.8	21.3	20.6	1.3	0.0	0.0	0.0	0.0	**1377**
20	7.1	0.0	12.4	113.2	203.3	35.1	242.9	165.9	192.6	121.1	40.1	0.0	0.0	0.0	0.0	181.5	242.9	45.3	5.5	0.0	0.0	0.0	0.0	0.0	**1609**
21	0.0	0.0	0.0	0.0	1.3	11.8	133.0	4.2	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**151**
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.5	1.3	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7**
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	**1**
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.7	565.6	423.0	78.2	242.7	**1510**
30	291.3	281.8	110.5	12.4	14.5	71.9	60.6	7.7	43.7	9.5	17.7	11.8	159.7	318.6	112.8	15.2	2.6	38.0	107.0	44.6	23.0	71.9	121.1	66.3	**2014**
KWh	**1595**	**1523**	**1626**	**2250**	**2580**	**2871**	**3658**	**3032**	**2563**	**1523**	**540**	**30**	**702**	**1759**	**2501**	**3242**	**3783**	**3636**	**2961**	**1373**	**1548**	**1373**	**1579**	**1741**	**49990**

ShaheedGali December 2007 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	133.0	61.6	138.6	105.3	134.7	134.7	79.8	179.5	268.0	190.1	107.0	107.0	74.2	82.1	109.2	44.1	50.3	61.6	55.0	130.7	178.2	166.4	178.2	166.4	2935
2	166.4	146.6	166.4	126.8	110.9	99.6	99.0	166.4	154.5	146.6	61.6	5.5	18.1	126.8	294.5	321.1	307.6	254.5	203.3	95.7	4.2	12.6	23.0	118.8	3230
3	61.6	59.2	0.0	146.6	146.6	101.3	172.8	216.4	134.7	101.3	35.1	31.0	19.5	93.4	107.0	29.5	46.6	176.8	137.0	0.0	114.0	307.6	119.4	53.4	2410
4	22.9	228.3	380.4	318.9	268.4	268.4	408.3	159.7	51.2	165.5	109.1	41.9	1.3	1.3	38.0	60.6	71.9	99.6	13.1	20.6	51.2	17.2	35.3	110.9	2944
5	142.6	215.1	192.6	204.5	347.9	235.2	242.9	217.9	228.3	216.4	77.5	1.3	0.7	4.8	0.7	49.3	55.9	101.3	4.8	39.2	55.0	138.6	241.4	188.7	3203
6	254.8	196.6	69.5	48.4	235.0	151.2	333.4	176.6	56.8	159.7	54.0	38.0	17.2	7.7	38.0	126.8	179.5	281.4	134.7	17.7	27.6	122.8	178.2	178.2	3084
7	133.0	91.1	178.2	135.9	107.9	60.6	101.3	254.5	76.7	44.6	32.4	14.1	0.0	29.8	178.2	63.8	95.7	217.6	74.2	127.9	69.8	2.0	0.7	0.0	2090
8	55.9	55.9	23.0	26.3	50.9	71.9	18.1	68.2	150.5	107.0	70.3	4.8	85.3	99.0	107.0	138.6	167.6	46.9	3.5	28.7	99.0	85.5	113.2	52.2	1729
9	45.6	32.7	0.0	0.0	12.6	55.9	107.0	58.4	20.6	15.2	12.4	18.7	13.1	5.5	174.5	15.9	17.2	50.3	60.6	83.2	49.3	60.6	30.6	23.0	963
10	87.7	12.4	0.0	0.7	61.6	71.9	26.9	122.8	79.8	21.9	0.7	0.0	2.0	0.0	33.5	49.3	13.1	11.9	45.6	45.6	60.6	142.6	91.1	74.2	1056
11	15.4	55.9	29.5	38.0	87.7	55.9	66.3	126.8	107.0	67.2	4.2	0.0	0.0	36.6	103.0	146.6	178.2	150.5	83.1	7.7	4.8	2.0	0.0	3.5	1370
12	20.1	4.8	19.5	11.9	124.3	192.6	77.4	0.0	18.1	255.0	393.5	142.6	216.4	171.6	104.5	17.4	55.9	40.9	24.8	27.6	99.0	166.4	87.7	9.0	2281
13	85.5	72.9	122.8	108.5	130.7	67.2	95.7	71.9	126.8	99.6	63.8	60.6	99.0	122.8	170.3	217.6	166.4	228.3	93.4	146.6	45.6	50.3	51.2	60.6	2558
14	49.3	95.7	126.8	114.3	38.0	102.9	133.0	32.4	61.6	30.6	19.5	0.0	0.7	2.6	2.0	0.0	0.0	0.0	0.0	12.4	50.3	53.0	192.6	331.3	1449
15	154.5	179.5	268.0	281.4	241.4	254.5	445.1	329.5	391.2	485.2	442.0	294.2	281.1	110.9	93.4	91.1	122.8	87.7	171.1	340.6	346.5	321.1	415.0	428.6	6576
16	266.9	306.6	307.6	381.5	372.0	256.1	216.4	321.1	280.0	319.7	294.8	210.0	71.9	7.7	0.7	37.1	66.3	60.6	3.5	8.4	37.1	147.7	110.9	79.0	4163
17	72.3	397.5	346.5	321.1	179.5	495.3	439.2	228.3	142.6	204.5	254.8	122.8	48.4	1.3	26.9	114.9	13.7	3.3	21.9	144.9	268.0	347.9	294.2	281.1	4771
18	281.1	428.6	489.7	398.2	333.1	381.8	451.5	385.4	477.0	444.5	358.6	356.5	188.7	217.6	228.4	155.7	138.6	177.8	230.8	254.5	294.5	191.4	110.9	109.2	7084
19	202.0	356.0	366.1	254.5	321.1	383.0	230.8	228.3	281.1	231.3	29.8	0.0	14.1	66.3	99.0	55.9	8.4	4.2	10.6	61.6	37.4	242.2	522.3	177.8	4184
20	134.2	114.9	141.4	379.4	297.8	599.7	558.2	482.4	320.0	350.1	138.6	368.4	509.2	432.5	447.4	541.4	555.0	470.6	420.9	585.8	422.9	315.7	371.0	209.8	9167
21	493.9	547.6	182.8	567.9	482.5	165.2	171.1	295.2	217.5	221.9	79.8	6.8	8.4	6.8	2.6	1.3	26.6	209.9	211.1	109.6	91.1	144.9	204.5	215.1	4664
22	167.6	195.3	242.9	319.7	197.8	295.0	381.8	417.8	346.5	268.0	290.8	395.4	146.6	184.7	197.8	393.6	427.9	460.8	571.3	570.7	491.9	457.7	477.7	396.2	8295
23	536.8	591.6	541.1	582.2	503.8	525.4	578.5	544.0	548.5	432.5	346.5	321.5	333.1	134.7	134.7	118.8	222.1	215.7	219.5	166.4	191.4	82.4	280.3	398.7	8550
24	259.2	123.9	386.4	304.0	305.3	56.9	192.6	320.0	327.4	228.1	2.0	4.2	62.1	55.6	0.0	4.2	44.6	79.8	25.8	45.6	1.3	1.3	0.0	0.7	2831
25	0.7	33.0	77.4	134.7	93.4	101.3	126.8	99.0	50.3	20.6	0.0	21.3	85.5	166.4	215.1	267.7	281.4	166.4	114.9	61.6	8.4	0.0	20.9	35.1	2182
26	35.1	55.9	68.5	69.8	192.6	228.3	133.0	101.3	74.2	87.7	13.1	0.0	0.7	2.0	68.5	254.5	166.4	107.0	130.7	26.0	0.7	23.0	38.0	8.4	1885
27	5.5	36.2	41.3	66.3	95.7	154.5	71.8	45.5	114.9	71.9	15.9	0.0	0.7	45.6	129.0	166.4	130.7	178.2	77.4	0.0	11.8	68.5	76.4	87.7	1692
28	99.0	75.1	125.4	30.5	253.8	350.8	294.2	294.5	373.4	229.5	344.2	110.9	24.0	41.3	228.3	228.3	241.7	268.0	184.7	67.2	4.8	3.3	6.8	0.0	3880
29	0.0	4.2	66.3	113.2	133.0	75.5	29.0	31.3	0.0	0.0	1.3	0.0	13.7	66.3	122.8	178.2	114.9	122.8	114.9	48.4	0.0	1.3	1.3	56.3	1294
30	47.1	39.9	61.0	76.1	55.9	119.4	146.6	74.2	59.2	17.2	1.3	0.0	8.4	55.9	142.6	190.1	190.1	130.7	91.7	25.6	0.0	4.2	61.6	56.9	1656
31	85.5	114.9	101.3	114.9	190.1	203.3	229.5	294.2	133.0	151.8	39.8	0.0	9.7	39.9	49.3	30.6	27.7	15.4	7.7	13.7	3.5	25.9	67.2	82.1	2031
KWh	4115	4929	5261	5781	6106	6315	6658	6343	5671	5385	3694	2677	2353	2419	3647	4110	4185	4480	3541	3314	3120	3706	4402	3993	106204

ShaheedGali January 2008 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	69.5	74.2	166.4	121.1	91.1	113.2	179.5	166.4	143.9	269.2	74.2	12.4	0.0	0.7	18.8	1.3	93.7	142.6	107.0	93.4	44.6	1.3	24.7	61.6	**2070**
2	16.6	45.6	74.2	122.8	99.0	113.2	167.6	118.8	105.3	99.0	25.3	0.0	0.7	3.9	39.9	44.6	107.0	93.4	25.9	12.4	0.7	0.0	88.7	66.3	**1471**
3	107.0	159.7	0.0	191.4	190.1	55.0	134.2	99.0	332.1	191.4	159.7	48.4	1.3	0.0	0.0	0.0	7.1	35.3	23.0	0.0	2.6	1.3	55.0	82.1	**1875**
4	87.7	146.6	83.1	87.7	179.5	151.8	254.5	154.5	332.1	344.1	99.5	5.5	0.0	20.6	126.6	102.9	47.7	75.5	160.8	268.4	125.1	65.3	529.3	481.4	**3930**
5	370.7	185.0	366.0	589.1	455.3	511.5	145.7	28.2	7.7	39.9	87.7	254.5	158.4	93.6	144.9	183.5	241.4	241.7	107.5	16.6	6.1	48.7	44.0	184.5	**4512**
6	216.4	204.5	333.4	159.7	116.4	8.4	0.0	50.3	120.3	139.9	93.4	85.5	40.9	142.2	3.5	3.5	7.1	54.4	159.7	159.1	40.5	118.8	138.2	254.8	**2651**
7	141.0	154.5	334.5	254.2	298.1	140.5	332.3	360.0	427.5	388.5	204.2	355.7	347.9	482.4	382.7	434.0	288.2	242.7	486.1	554.8	432.3	450.9	149.7	11.3	**7654**
8	159.5	405.7	408.3	421.6	241.4	281.6	372.0	130.7	99.0	29.2	79.8	9.0	16.6	1.3	163.7	518.5	450.3	379.0	396.3	241.4	216.4	191.4	64.8	56.9	**5334**
9	45.6	17.7	68.5	54.4	143.0	398.2	279.2	115.5	241.9	146.1	53.1	173.1	247.1	86.1	15.2	76.0	46.1	42.1	31.0	59.6	176.8	165.5	53.4	24.5	**2759**
10	152.4	209.3	60.9	156.8	131.3	79.8	87.7	57.8	93.4	35.3	11.3	39.9	60.6	340.2	275.7	428.1	331.1	34.3	0.0	0.0	0.0	0.0	0.0	0.0	**2586**
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	4.2	26.6	12.4	17.1	4.8	0.0	0.7	0.0	1.3	24.8	61.6	36.2	22.4	50.3	**266**
12	39.9	83.2	138.6	281.4	231.1	228.3	319.7	384.1	358.6	227.6	72.7	117.1	206.0	142.6	231.3	155.7	154.5	215.1	160.0	107.0	146.6	216.4	165.9	55.0	**4438**
13	211.3	346.5	333.1	370.7	396.2	421.6	242.9	305.8	368.5	346.5	204.5	50.5	0.0	0.0	18.3	15.4	12.6	6.1	7.7	104.5	357.6	333.1	384.2	321.1	**5159**
14	321.1	369.4	321.5	243.4	439.5	463.1	553.8	431.2	525.9	489.7	363.2	158.4	231.1	40.9	79.8	99.0	126.8	146.6	154.5	356.3	421.6	394.9	229.5	268.0	**7229**
15	178.2	379.4	493.5	478.0	405.7	560.7	466.2	482.4	522.3	506.9	419.1	321.1	372.0	421.6	346.5	360.0	369.4	499.4	455.3	478.0	186.7	199.9	569.6	424.8	**9897**
16	427.3	293.4	524.4	456.4	566.0	549.4	490.1	547.1	381.5	310.5	170.3	229.5	203.3	241.4	216.4	254.5	34.3	24.2	164.8	320.5	179.5	36.3	93.4	66.6	**6781**
17	58.4	0.7	32.6	1.3	3.5	2.0	0.7	30.3	130.7	88.7	44.6	74.2	107.0	113.2	71.9	50.3	122.8	43.1	45.5	18.1	7.7	34.5	5.5	109.1	**1196**
18	217.5	50.6	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	5.5	24.2	29.8	0.0	2.0	0.7	1.3	0.0	0.0	1.3	0.0	0.0	0.0	56.1	**390**
19	79.8	110.1	4.2	4.8	5.5	36.4	67.2	85.5	9.7	31.7	4.2	5.5	2.0	5.5	113.2	154.5	94.9	71.6	69.5	125.1	59.2	24.2	0.0	3.5	**1168**
20	35.3	7.7	1.3	70.2	45.2	2.0	4.8	25.9	20.0	2.0	4.8	3.5	40.9	61.6	101.3	79.8	306.8	130.7	96.6	99.0	56.9	4.8	1.3	0.7	**1203**
21	27.7	44.6	21.2	39.8	55.0	61.6	107.0	166.4	87.7	44.6	39.9	20.1	20.1	4.8	0.7	11.8	77.6	77.6	91.1	20.0	0.0	0.7	96.5	122.8	**1239**
22	155.7	191.4	30.6	122.8	85.3	40.8	142.6	140.9	158.4	77.6	13.1	0.0	0.0	8.9	0.0	306.9	204.5	93.9	0.0	0.0	3.5	1.3	3.5	1.3	**1783**
23	7.1	19.5	9.7	40.8	86.1	25.9	6.8	5.5	9.7	9.7	0.7	0.0	0.0	1.3	13.1	139.5	8.4	5.5	44.6	60.6	60.6	30.6	16.6	0.7	**602**
24	5.5	30.5	11.3	27.7	40.9	23.0	25.9	55.0	44.6	21.9	1.3	6.1	6.8	23.0	20.0	24.7	20.9	15.9	4.8	2.0	11.9	4.2	6.1	23.0	**457**
25	20.1	15.4	30.6	39.9	24.8	49.3	39.9	17.2	2.0	1.3	6.8	0.7	0.0	0.0	1.3	91.0	109.2	99.0	114.9	91.1	79.8	20.6	0.0	0.7	**856**
26	5.5	0.0	1.3	5.5	8.4	0.7	5.5	0.0	0.0	0.7	1.3	30.6	83.6	417.8	196.6	93.4	66.3	63.8	121.1	25.9	8.9	30.5	122.8	152.8	**1443**
27	66.3	50.3	94.5	35.3	30.6	45.6	74.2	55.0	30.6	18.3	2.6	3.3	20.1	9.7	6.8	3.9	0.0	4.2	4.8	4.8	0.0	14.8	37.1	50.3	**663**
28	45.6	102.9	210.0	94.0	107.0	231.3	55.3	151.8	477.0	281.1	333.4	171.1	45.2	5.5	27.7	15.4	24.8	39.9	24.0	36.2	30.6	61.6	82.1	23.0	**2676**
29	85.5	113.2	48.8	32.4	3.3	4.8	5.5	12.4	6.8	70.2	34.5	3.5	7.7	48.4	56.3	44.8	6.1	30.6	25.9	66.3	30.6	21.9	2.6	43.7	**806**
30	68.5	59.2	35.3	35.3	35.3	32.4	71.9	35.3	45.6	12.6	21.2	9.7	1.3	0.0	0.0	20.6	50.3	60.6	83.2	60.6	12.4	0.0	1.3	6.1	**758**
31	32.4	63.8	79.8	44.6	101.3	146.6	117.2	158.0	155.7	71.9	66.3	20.1	6.1	19.0	8.9	15.3	54.5	83.2	77.6	40.1	18.7	159.0	173.1	150.5	**1864**
KWh	**3455**	**3934**	**4317**	**4584**	**4615**	**4778**	**4750**	**4371**	**5238**	**4300**	**2702**	**2260**	**2269**	**2753**	**2688**	**3729**	**3466**	**3052**	**3244**	**3448**	**2779**	**2668**	**3161**	**3153**	**85715**

ShaheedGali February 2008 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	99.0	71.9	146.6	254.8	211.5	138.6	157.0	191.4	168.9	114.9	45.6	9.7	1.3	3.9	2.0	0.0	17.7	93.4	56.9	39.9	1.3	11.8	130.7	126.8	**2095**
2	126.8	102.9	43.7	74.2	39.9	45.6	100.6	83.2	122.8	85.5	32.4	6.1	0.0	0.0	60.0	58.7	138.6	99.0	158.4	203.3	38.0	45.6	66.3	12.4	**1744**
3	9.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.9	18.3	12.6	7.7	0.0	2.0	0.0	0.7	12.6	5.5	0.0	0.0	0.0	9.0	**97**
4	0.0	0.7	6.1	18.3	11.5	9.0	4.2	25.3	51.2	9.5	32.4	27.7	37.4	2.6	75.1	19.5	45.6	58.4	42.1	40.9	90.0	5.5	34.5	16.6	**664**
5	55.9	48.4	1.3	17.4	18.1	0.0	0.0	0.0	0.7	32.6	45.6	93.4	142.6	93.4	38.0	9.0	21.2	60.6	55.9	49.3	39.9	39.9	35.3	4.8	**903**
6	23.0	12.6	0.0	0.7	0.7	1.3	11.9	14.8	27.7	37.1	3.9	6.8	21.2	12.6	18.3	18.3	2.0	0.0	27.7	15.4	24.8	2.0	2.0	30.6	**315**
7	39.9	9.7	32.7	29.8	27.7	0.0	4.8	25.9	19.0	1.3	2.0	0.0	2.6	9.7	1.3	13.1	18.8	16.6	8.2	0.0	0.0	0.0	0.0	0.0	**263**
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4	35.3	30.6	25.9	15.3	3.3	0.0	0.0	0.7	0.7	6.1	12.6	9.0	16.6	**164**
9	61.6	107.0	152.8	31.0	57.2	109.2	357.5	360.0	190.2	99.0	85.5	134.7	85.5	60.6	49.3	35.3	18.3	25.9	12.6	55.9	85.5	134.7	134.7	103.0	**2547**
10	146.6	138.6	166.4	146.6	114.9	74.2	93.4	93.4	135.9	179.5	43.7	18.3	12.6	1.3	0.0	4.2	131.5	176.6	23.0	13.1	0.0	11.5	18.3	6.8	**1750**
11	9.7	12.4	8.4	0.0	6.1	14.8	12.6	0.0	0.0	11.3	3.9	2.0	0.0	45.6	89.8	115.5	138.6	74.2	55.9	20.1	5.5	36.2	3.5	0.0	**666**
12	0.7	4.2	0.0	0.7	0.0	0.7	12.4	25.3	1.3	1.3	2.0	0.0	0.0	31.7	79.8	126.8	146.6	71.9	55.0	32.4	0.0	0.0	0.7	12.6	**606**
13	39.9	25.9	30.5	87.7	126.3	166.4	229.5	228.3	420.4	446.5	373.4	254.5	158.4	15.8	12.6	33.3	55.9	71.9	56.9	35.3	87.7	130.7	130.7	209.7	**3428**
14	122.8	178.2	134.7	241.7	343.9	241.4	242.9	243.4	440.7	204.5	130.7	99.0	66.3	42.7	1.3	25.1	536.5	410.2	333.4	320.0	368.4	318.6	354.9	183.5	**5585**
15	158.0	86.3	130.7	142.6	215.1	178.2	182.2	191.4	142.6	130.7	134.7	51.2	12.6	0.0	11.3	30.6	1.3	0.7	2.0	0.0	12.4	56.3	192.5	130.7	**2194**
16	381.5	191.4	146.6	93.4	77.4	170.3	33.5	462.3	600.2	567.7	447.4	413.7	358.6	372.0	293.4	190.1	179.5	114.9	85.5	102.9	166.4	267.4	307.0	126.8	**6150**
17	122.8	134.7	118.8	151.8	158.4	91.1	206.0	166.4	178.2	154.5	69.5	1.3	42.4	179.5	281.4	347.9	228.3	192.6	86.7	9.0	37.1	94.9	55.0	71.9	**3180**
18	166.4	171.6	134.7	166.4	176.8	138.6	179.5	191.4	99.0	91.1	91.1	60.6	12.4	1.3	45.6	26.3	0.0	0.7	41.7	24.8	18.3	24.2	33.3	56.9	**1952**
19	74.2	85.5	126.8	142.6	134.7	254.5	191.4	107.5	93.4	142.6	77.6	12.6	3.9	0.0	0.0	18.8	0.0	0.0	0.0	0.0	7.7	11.9	45.6	59.7	**1591**
20	45.6	91.1	107.5	196.6	137.0	180.7	232.6	357.3	130.1	0.7	0.0	0.0	0.0	0.0	0.0	11.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	**1491**
21	0.0	0.0	0.0	0.7	0.7	1.3	176.9	478.8	254.5	324.6	365.8	177.1	514.8	509.2	536.5	396.3	268.1	134.2	126.8	23.7	164.8	154.1	190.2	71.0	**4870**
22	129.4	541.6	570.5	516.9	370.8	191.0	287.1	322.0	109.7	68.2	2.0	2.6	114.3	18.3	30.6	344.3	520.5	458.5	370.7	333.4	280.3	281.4	153.3	50.3	**6067**
23	30.5	75.1	112.8	256.4	313.6	74.2	45.6	45.6	95.7	71.9	44.6	128.3	178.2	167.6	281.1	216.4	294.2	269.5	154.4	54.4	190.1	242.9	178.2	170.3	**3691**
24	85.5	130.7	130.7	83.1	142.6	134.7	99.6	20.1	27.7	11.3	25.9	30.6	21.2	7.7	0.7	2.0	1.3	0.7	0.0	0.7	0.0	28.8	66.3	170.3	**1222**
25	126.8	134.7	49.3	45.6	334.4	53.5	68.5	114.9	132.0	79.8	37.1	11.9	1.3	40.9	56.9	138.6	133.0	23.0	27.7	51.2	0.7	0.0	0.7	15.4	**1678**
26	40.9	20.0	0.0	0.0	0.0	0.7	0.0	31.9	56.9	20.1	14.4	9.7	25.9	8.4	85.5	146.6	191.4	67.3	0.0	0.0	0.0	0.0	0.7	0.0	**720**
27	0.7	2.0	1.3	1.3	0.7	2.6	8.4	257.1	294.5	192.9	229.5	255.8	4.8	5.5	8.4	35.3	35.3	11.9	15.9	87.4	269.5	280.3	330.8	236.6	**2568**
28	61.6	82.1	228.3	306.9	333.4	217.6	281.1	217.6	254.5	377.7	294.5	121.0	24.8	0.7	0.0	0.7	9.7	5.5	40.9	74.2	107.5	126.8	93.4	17.4	**3278**
29	0.0	1.3	2.6	0.7	5.5	0.0	157.6	179.5	94.0	3.3	3.9	1.3	0.0	0.0	0.0	0.0	0.0	1.3	4.8	5.5	118.8	266.9	60.6	71.9	**979**
KWh	**2158**	**2468**	**2583**	**3007**	**3359**	**2490**	**3377**	**4435**	**4142**	**3460**	**2659**	**1983**	**1886**	**1664**	**2074**	**2369**	**3134**	**2440**	**1856**	**1599**	**2121**	**2585**	**2628**	**1982**	**62458**

ShaheedGali March 2008 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	125.9	0.7	0.0	2.0	283.8	502.0	488.8	457.4	356.0	126.8	163.7	55.9	4.2	1.3	0.7	0.0	8.4	25.9	23.0	30.6	5.5	9.0	23.0	93.4	**2788**
2	67.2	36.0	0.0	0.0	1.3	0.7	0.0	0.0	0.0	3.5	20.6	24.8	5.5	27.0	7.1	13.1	55.0	17.1	0.0	0.7	1.3	102.1	417.8	433.7	**1234**
3	153.2	3.9	0.0	178.2	150.5	163.7	179.5	30.5	34.8	293.7	204.8	70.9	0.0	0.0	0.0	0.0	1.3	2.6	3.3	3.9	52.9	2.6	5.5	135.8	**1672**
4	228.3	223.1	370.2	346.5	333.1	326.1	271.5	171.0	184.9	206.0	280.8	254.8	154.5	93.4	60.6	24.8	39.9	55.0	93.4	267.7	201.0	210.0	130.7	77.6	**4605**
5	281.4	134.2	142.6	178.2	229.8	211.1	344.4	473.2	405.7	330.8	281.4	242.9	110.9	66.3	87.7	39.9	89.3	216.4	267.7	183.5	68.5	55.0	12.4	36.6	**4490**
6	110.9	87.0	75.7	81.7	281.8	318.9	380.4	217.6	36.0	60.3	322.3	149.7	171.4	132.6	165.6	257.8	68.5	117.2	210.0	8.4	9.0	38.0	36.2	87.7	**3425**
7	93.4	99.0	79.8	145.7	99.0	142.6	91.0	146.6	107.0	24.8	4.2	58.7	196.6	421.2	466.5	496.0	526.4	453.8	107.9	29.8	69.5	482.2	436.3	229.5	**5007**
8	405.7	382.7	178.2	146.6	119.4	107.0	74.2	99.0	77.6	99.0	83.2	55.0	9.7	2.6	0.7	0.0	26.3	99.6	3.5	0.0	0.0	0.0	0.0	0.0	**1970**
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	20.9	203.3	385.9	520.3	116.0	4.2	183.5	126.8	191.4	254.5	122.8	87.7	**2218**
10	66.3	83.2	71.9	99.0	83.2	44.6	33.8	11.9	27.7	17.2	6.8	2.6	2.0	45.9	51.1	93.4	184.7	35.7	0.0	85.8	51.7	0.7	0.0	21.3	**1120**
11	3.5	0.7	0.7	0.0	0.0	0.0	13.1	39.9	7.7	0.0	0.7	0.7	32.3	114.9	75.1	18.8	11.9	120.3	271.0	107.0	107.0	101.3	44.6	93.4	**1164**
12	55.5	0.0	0.7	0.0	0.0	0.0	0.0	23.5	61.6	35.3	49.3	15.4	6.8	0.7	4.8	87.8	97.3	0.0	58.0	99.0	25.6	1.3	0.0	0.0	**623**
13	0.0	0.0	0.0	0.0	0.0	0.7	0.7	2.0	0.0	8.4	20.1	4.8	0.0	8.4	39.8	19.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**105**
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	1.3	92.1	126.8	179.5	281.1	307.6	133.5	77.6	85.5	13.1	0.0	0.0	22.1	**1321**
15	0.0	0.0	0.0	0.0	0.0	23.5	0.7	107.2	114.9	40.9	9.0	2.0	34.5	66.3	99.6	124.1	99.6	49.8	0.0	0.0	0.7	0.0	0.0	0.0	**773**
16	0.0	0.7	0.0	0.0	0.7	0.0	0.0	0.0	69.5	79.8	44.6	44.6	5.5	9.5	79.8	154.5	204.5	128.0	0.0	0.0	0.0	0.0	0.0	0.0	**822**
17	0.7	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.7	4.2	4.8	11.9	15.9	0.0	0.0	0.0	3.3	3.3	112.0	241.1	42.4	179.5	358.6	**979**
18	179.5	231.5	142.6	234.6	85.5	231.1	142.6	235.2	266.1	229.5	154.5	107.0	40.9	9.7	14.8	29.8	85.5	66.3	107.0	154.0	384.1	331.8	303.2	504.3	**4271**
19	242.7	178.2	154.5	175.5	203.3	130.3	42.7	53.7	184.7	134.7	126.8	44.6	11.3	53.5	333.1	515.9	528.2	566.4	498.3	525.7	228.3	431.2	443.3	345.2	**6152**
20	317.4	382.8	454.1	372.0	305.5	381.5	381.8	256.4	268.5	217.9	91.1	56.9	30.6	5.5	7.7	83.2	158.4	70.5	4.8	0.0	0.0	0.0	0.0	0.0	**3846**
21	0.7	6.8	6.1	3.9	2.6	2.0	0.7	0.0	0.0	71.3	39.9	5.5	0.7	8.4	24.8	121.1	112.5	24.2	44.2	16.6	87.7	8.9	0.0	0.0	**588**
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	19.5	23.0	6.1	30.6	44.6	66.3	94.9	2.6	0.0	0.0	0.0	304.3	72.8	82.1	60.7	**837**
23	66.6	64.8	50.3	60.6	83.2	107.0	85.5	93.4	74.2	49.3	18.3	2.0	5.5	77.4	171.6	261.6	236.3	28.8	24.2	30.6	12.6	24.8	35.3	25.9	**1689**
24	32.7	66.3	109.2	101.3	152.8	118.8	254.8	138.6	77.6	77.6	66.3	39.9	12.6	55.0	15.3	191.0	321.1	97.4	66.3	55.0	12.4	12.6	9.7	32.3	**2116**
25	79.8	55.9	45.6	61.6	87.7	114.9	178.2	118.8	91.1	83.2	51.2	5.5	1.3	72.3	79.8	91.1	93.4	123.2	40.9	49.3	8.4	4.2	4.2	0.7	**1542**
26	21.9	66.3	45.6	7.7	10.2	84.6	80.8	216.4	58.7	9.0	11.9	33.8	226.7	486.3	484.0	513.1	602.5	557.6	583.5	570.7	567.6	584.1	473.2	474.4	**6770**
27	378.1	79.8	190.2	95.7	303.6	240.7	281.4	254.5	254.5	257.9	103.6	35.3	11.9	6.8	4.8	60.9	268.0	386.4	316.8	342.9	229.5	190.1	215.1	267.7	**4776**
28	178.2	130.7	114.9	68.5	71.9	107.0	91.1	126.8	91.1	71.9	55.0	9.7	1.3	53.0	79.8	74.2	14.8	39.8	0.0	0.0	0.0	0.0	87.7	85.3	**1553**
29	91.0	45.6	71.9	114.9	107.0	91.1	66.3	77.6	138.6	79.8	19.5	2.0	0.0	68.5	150.5	67.6	22.1	10.6	0.0	0.0	0.0	0.0	0.0	0.0	**1224**
30	0.0	18.3	44.6	51.2	56.9	56.9	60.6	71.9	66.3	39.9	15.4	2.6	2.6	2.0	0.0	0.0	0.7	8.2	0.0	0.0	0.0	0.7	20.6	155.0	**674**
31	177.5	86.8	342.3	304.3	216.4	192.9	281.6	387.1	202.0	281.1	203.3	95.7	32.4	25.3	15.9	15.9	55.9	156.0	504.8	594.0	514.0	428.6	354.9	372.0	**5841**
KWh	**3358**	**2465**	**2692**	**2830**	**3270**	**3699**	**3826**	**3810**	**3287**	**2950**	**2476**	**1435**	**1267**	**2304**	**3153**	**4251**	**4339**	**3597**	**3493**	**3479**	**3387**	**3389**	**3438**	**4001**	**76195**

ShaheedGali April 2008 **Wind Power Output of Bonus 600/44 Turbine (Month's Summary)**

Dt./Hrs	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24 Hrs
1	178.2	131.3	21.3	129.3	171.1	166.4	138.6	142.6	154.5	178.2	138.6	60.6	35.3	2.6	2.0	4.8	56.1	72.3	9.5	26.3	166.4	130.7	166.4	166.4	**2449**
2	142.6	119.4	146.6	159.7	121.1	114.9	139.7	132.9	61.9	60.6	186.3	108.5	141.3	518.5	485.2	536.8	419.0	369.9	573.3	506.6	393.6	465.4	332.3	333.1	**6569**
3	376.9	397.5	0.0	165.2	210.0	154.5	101.9	40.9	55.0	85.5	30.6	3.9	2.0	5.5	15.3	229.5	139.9	35.3	29.2	11.8	0.0	0.0	6.8	0.7	**2097**
4	0.0	3.9	9.7	2.6	75.1	49.3	17.2	0.7	8.4	1.3	9.0	0.7	67.5	134.7	50.8	9.5	2.0	0.0	8.9	48.4	19.5	24.8	23.0	53.5	**620**
5	60.6	66.3	134.7	242.9	104.0	158.0	34.8	179.1	77.4	155.7	46.1	101.5	61.9	146.6	92.7	185.2	124.1	191.4	203.3	268.0	345.5	268.0	113.2	113.2	**3474**
6	61.6	85.5	12.4	8.4	51.2	38.0	15.4	8.4	8.4	0.0	0.0	0.7	0.0	20.0	61.0	59.2	75.1	39.9	77.6	13.7	0.7	0.0	36.2	114.7	**788**
7	71.9	91.1	93.4	12.6	123.4	260.5	282.0	332.5	91.4	0.0	0.0	0.7	0.0	0.0	12.6	37.1	13.1	0.0	0.7	11.9	0.0	2.6	9.0	122.9	**1569**
8	24.8	127.7	319.2	5.5	70.2	158.4	93.4	122.8	217.9	420.4	466.9	217.9	184.6	159.7	159.3	30.6	125.1	85.5	105.3	280.5	169.2	320.0	235.2	138.6	**4238**
9	202.1	106.5	219.0	319.4	206.1	344.4	130.7	107.0	105.3	187.6	190.1	79.8	37.1	183.0	22.4	130.7	126.8	179.5	254.8	241.8	234.6	254.5	434.3	394.9	**4692**
10	368.4	372.0	185.0	380.4	228.3	179.5	268.0	201.8	118.8	192.6	130.7	146.6	61.6	45.6	113.2	185.0	114.9	134.7	293.4	241.4	112.8	117.2	68.5	37.6	**4298**
11	272.0	414.1	231.5	166.0	11.9	19.0	79.8	45.6	60.6	83.2	28.7	0.7	0.7	40.8	125.1	107.2	21.3	52.1	418.8	573.3	517.4	367.9	71.9	115.5	**3825**
12	151.8	372.0	158.0	79.8	93.4	146.6	345.8	130.7	122.8	83.2	77.6	66.3	105.3	27.3	13.7	133.6	340.6	203.3	115.5	217.3	191.2	107.5	126.8	126.8	**3536**
13	254.8	158.4	71.9	93.4	166.4	155.7	229.5	244.2	215.1	132.0	55.9	55.9	16.6	0.7	9.7	20.1	32.7	0.0	0.0	0.0	8.4	38.0	117.5	160.0	**2237**
14	66.3	101.3	118.8	96.6	37.1	107.0	113.2	104.8	154.5	93.4	24.2	9.5	31.7	4.8	303.4	176.8	481.1	258.0	35.5	49.6	166.5	136.2	499.4	364.5	**3534**
15	306.9	258.2	244.0	138.6	218.1	198.1	316.8	134.5	178.3	130.4	398.2	288.4	94.0	51.2	48.4	35.1	53.1	230.4	180.3	540.1	494.5	587.2	134.2	132.0	**5391**
16	305.8	153.3	130.7	82.1	24.8	85.5	64.8	74.2	583.5	260.7	55.9	1.3	24.2	9.0	2.0	93.4	280.3	293.7	256.4	175.5	79.8	60.6	107.0	74.2	**3278**
17	91.1	130.7	281.1	139.9	126.3	294.5	159.7	85.5	77.6	30.6	40.9	40.9	71.9	24.8	26.6	91.1	107.0	55.0	39.9	24.8	5.5	0.7	12.6	69.5	**2028**
18	55.9	74.2	93.4	126.8	151.8	83.2	118.8	91.1	91.1	66.3	24.8	15.4	2.0	0.7	105.6	163.7	151.8	99.0	114.9	42.7	6.1	20.1	27.7	20.6	**1748**
19	17.2	60.6	17.2	69.5	93.4	60.6	66.3	67.2	67.2	5.5	0.0	2.0	4.2	45.6	71.9	87.7	118.8	179.5	126.8	56.9	48.4	1.3	5.5	72.3	**1345**
20	75.5	12.6	80.8	143.9	138.6	178.2	114.9	256.4	74.2	83.2	51.2	13.7	11.8	108.5	146.6	126.8	126.8	107.0	114.9	99.0	77.6	15.9	4.8	50.3	**2213**
21	19.5	79.8	9.5	5.5	55.0	64.8	107.0	113.2	61.6	31.7	0.0	7.7	40.9	114.9	91.1	126.8	99.0	94.0	39.9	7.7	22.1	9.5	16.6	79.9	**1298**
22	166.4	138.2	142.6	83.1	133.0	69.5	77.6	203.9	126.8	107.5	39.9	8.4	13.1	79.8	75.1	317.7	393.7	294.5	372.0	346.8	217.6	219.2	110.9	66.3	**3803**
23	15.4	11.9	30.6	24.2	0.7	15.9	30.5	2.0	5.5	1.3	12.6	2.6	1.3	1.3	0.0	38.0	150.6	408.0	536.5	345.5	67.1	56.3	73.8	268.0	**2099**
24	118.4	87.7	166.4	101.3	68.5	93.4	71.9	49.3	85.5	35.3	15.4	0.7	20.0	74.2	101.3	114.9	68.5	110.9	71.9	30.6	11.9	56.9	152.8	71.8	**1779**
25	45.6	55.0	113.2	70.5	93.4	79.8	32.4	109.2	79.8	49.3	35.3	10.6	0.0	15.4	15.4	78.8	32.6	470.6	111.1	583.5	576.7	452.8	320.0	165.2	**3596**
26	80.8	0.0	0.7	0.0	0.7	0.0	0.0	44.5	30.6	23.0	113.2	39.9	37.4	248.6	9.7	0.7	0.0	0.0	0.0	60.2	0.0	0.0	0.0	0.0	**690**
27	0.0	0.0	8.2	10.6	0.0	82.0	376.6	242.9	141.1	129.0	77.6	71.9	38.0	2.0	23.5	94.0	47.5	86.4	0.0	0.0	0.0	0.0	0.0	0.0	**1431**
28	0.0	0.0	0.0	0.0	0.0	36.6	101.3	114.9	79.8	74.2	20.1	1.3	21.9	55.9	126.8	203.3	190.1	89.3	47.5	0.0	0.0	0.0	0.0	48.2	**1211**
29	82.1	35.7	0.0	0.0	0.7	0.0	77.4	68.5	107.0	74.2	25.9	2.0	0.0	40.1	35.3	29.7	51.2	27.0	1.3	4.2	14.8	11.8	0.0	0.0	**689**
30	0.0	0.0	0.0	0.0	0.0	0.0	116.8	202.0	307.6	180.7	60.6	16.6	1.3	22.9	76.4	202.8	135.8	229.0	229.4	35.1	165.9	99.0	203.3	268.2	**2554**
KWh	**3612**	**3645**	**3040**	**2857**	**2774**	**3394**	**3823**	**3653**	**3549**	**2957**	**2356**	**1376**	**1127**	**2184**	**2422**	**3650**	**4078**	**4396**	**4368**	**4843**	**4113**	**3824**	**3410**	**3629**	**79079**