Pakistan Meteorological Department

A STUDY OF WIND POWER POTENTIAL AT MALAMJABBA - NWFP

Technical Report No. PMD-16/2008

(Preliminary report based on 12 months data)

November-2008

Executive Summary

Pakistan Meteorological Department (PMD) conducted a wind power potential survey of the northern areas of Pakistan. Funding for this project was given 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 Malamjabba (Swat), NWFP. Wind data with one 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 2.15 m/s during twelve months August-2006 to July-2007 the highest of 4.90 is observed in November. Seasonal Diurnal Wind variation indicates that maximum wind speed is available in the morning thought-out the year. Wind frequency distribution shows that during 17% 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 Malamjabba is 50.48 w/m according to international wind classification, this power density categorize Malamjabba 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 winter months especially in November and December.

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 11650 kWh which shows the capacity factor of 3% for Malamjabba. 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 Malamjabba 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, Besham, Moorti Pahari, Rangla, Pedar, Lempiapatian, Dargaye.

Malamjabba is situated in district Swat. Latitude & Longitude of Malamjabba is:
Malamjabba -- Latitude=34.47º Longitude=72.34º

2.2 Data source:

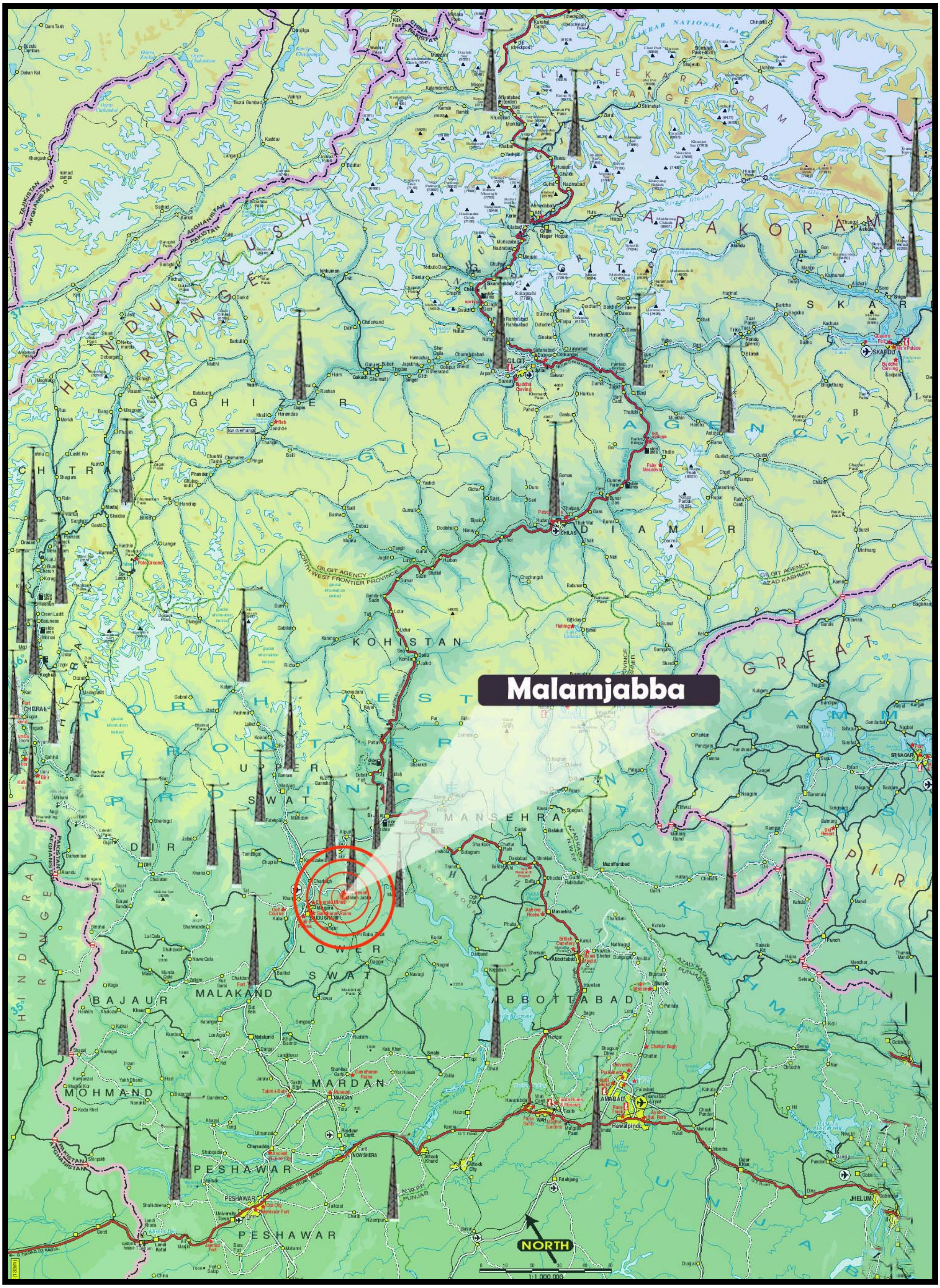
To undertake this study 30-meter high towers are erected at the locations mentioned above. On each of these high towers two wind speed anemometers are installed at the height of 10 meters and 30 meters, respectively; wind vane for recording wind direction is installed at 30 meters height. EWI and NRG Automatic data loggers have been installed to record data at each site. These data loggers are recording, one-minute and ten-minute average wind speed at levels, five-minute temperature, 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 siting 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 one minute average at 10 & 30 meters
ii. Wind speed 10 minute average at 10 & 30 meters
iii. Maximum wind speeds during 10 minutes
iv. Minimum wind speeds during 10 minutes
v. Wind direction five minutes average at 30 meters

Every month a team of observers and Maintenance Engineers visits these sites 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
$\mathbf{Z_o}$ 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.

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

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

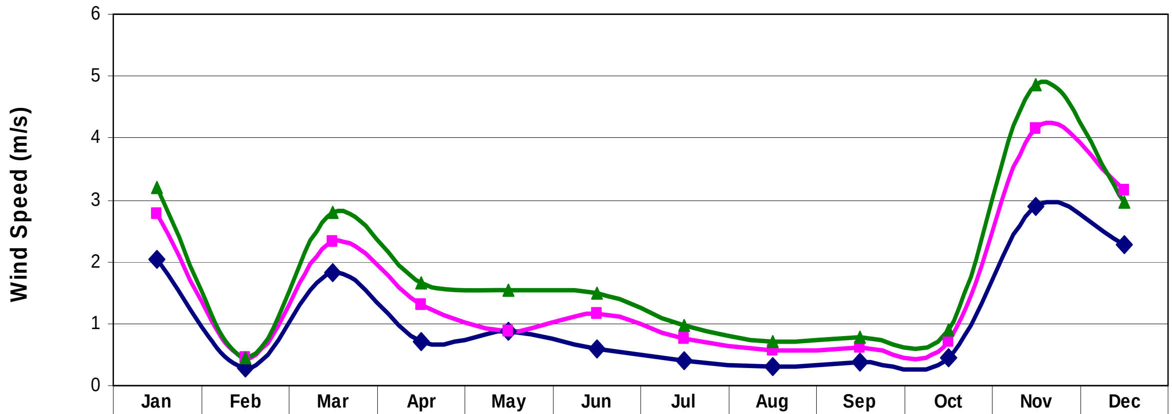
Type of terrain	Z_0	α
Mud Flats, Ice	10^{-5} to $3x\ 10^{-5}$	
Calm Sea	$2x10^{-4}$ to $3x10^{-4}$	
Sand	$2x10^{-4}$ to 10^{-3}	0.01
Mown Grass	0.001 to 0.01	
Low Grass	0.01 to 0.04	0.13
Fallow Field	0.02 to 0.03	
High Grass	0.04 to 0.1	0.19
Forest and Woodland	0.1 to 1	
Built up area, Suburb	1 to 2	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. At 30 meters height, we have the maximum average wind speed of 4.2 m/s during November, 2007. At 50 meters we have the annual average wind speed of 2.0 m/s from January-December and the highest average wind speed of 4.9 m/s is observed during November.

Fig-1



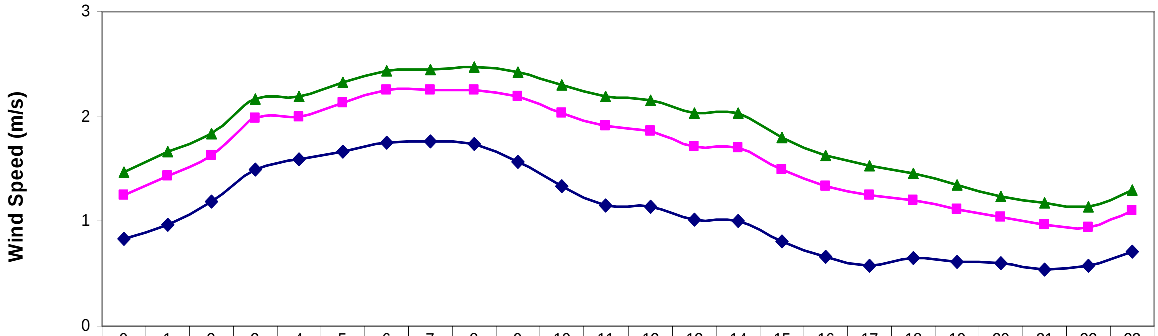
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
AWS 10m	2.0	0.3	1.8	0.7	0.9	0.6	0.4	0.3	0.4	0.4	2.9	2.3
AWS 30m	2.8	0.4	2.3	1.3	0.9	1.2	0.8	0.6	0.6	0.7	4.2	3.2
AWS 50m	3.2	0.5	2.8	1.7	1.5	1.5	1.0	0.7	0.8	0.9	4.9	3.0

3.3 Diurnal Wind speed Variation:

Fig-2 shows the diurnal wind speed variations at Malamjabba for 1 year (Jan-Dec). The wind speed is generally higher from early morning to 1200 noon and after it goes down. At morning time it reaches maximum, wind speeds are around 2.3 m/s and 2.5 m/s at 30 meters and 50 meters height respectively. Figure-2 shows that the maximum wind speed during morning times at 50 meters height reaches to 2.5 m/s at 8 am (PST).

Fig-2

Annual Diurnal Variation Wind Speed at Malamjabba
January to December



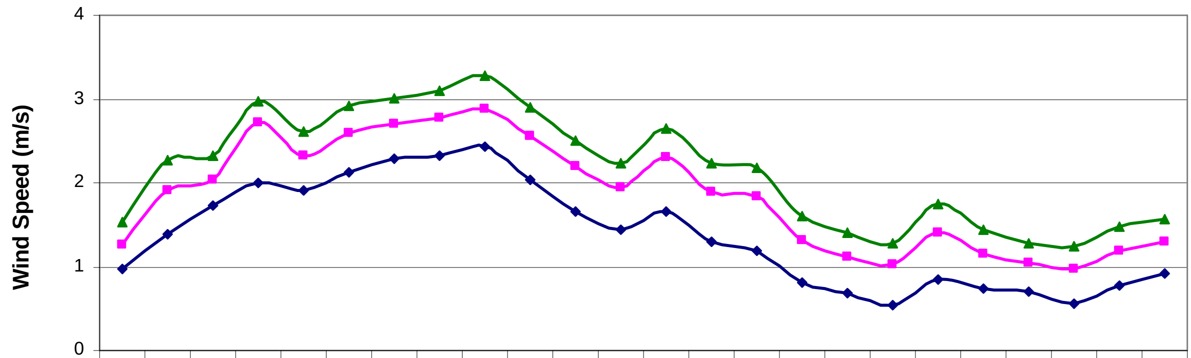
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	0.8	1.0	1.2	1.5	1.6	1.7	1.8	1.8	1.7	1.6	1.3	1.2	1.1	1.0	1.0	0.8	0.7	0.6	0.7	0.6	0.6	0.5	0.6	0.7
WS 30m	1.2	1.4	1.6	2.0	2.0	2.1	2.3	2.3	2.3	2.2	2.0	1.9	1.9	1.7	1.7	1.5	1.3	1.3	1.2	1.1	1.0	1.0	0.9	1.1
WS 50m	1.5	1.7	1.8	2.2	2.2	2.3	2.4	2.4	2.5	2.4	2.3	2.2	2.2	2.0	2.0	1.8	1.6	1.5	1.5	1.3	1.2	1.2	1.1	1.3

PST (Hours)

Fig-3, Fig-4, Fig-5 and Fig-6 shows the quarterly wind speed variations at Malamjabba for (Jan-Mar), (Apr-June), (Jul-Sep) and (Nov-Jan) respectively. The wind speed is generally higher in 1st and 4th quarter of the year as compared to 2nd and 3rd quarter.

Fig-3

Diaurnal Variation Wind Speed at Malamjabba (Jan-Mar)

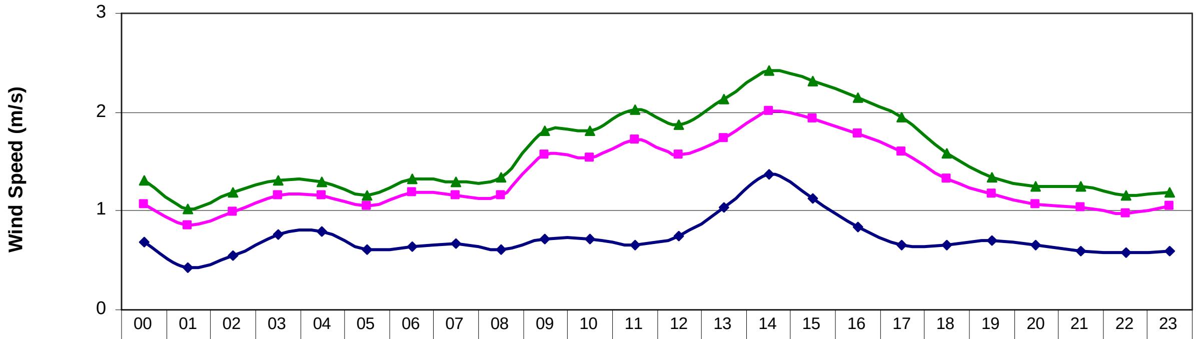


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	1.0	1.4	1.7	2.0	1.9	2.1	2.3	2.3	2.4	2.0	1.7	1.4	1.7	1.3	1.2	0.8	0.7	0.5	0.8	0.7	0.7	0.6	0.8	0.9
WS 30m	1.3	1.9	2.0	2.7	2.3	2.6	2.7	2.8	2.9	2.6	2.2	2.0	2.3	1.9	1.8	1.3	1.1	1.0	1.4	1.2	1.1	1.0	1.2	1.3
WS 50m	1.5	2.3	2.3	3.0	2.6	2.9	3.0	3.1	3.3	2.9	2.5	2.2	2.7	2.2	2.2	1.6	1.4	1.3	1.7	1.4	1.3	1.2	1.5	1.6

Wind Speed (m/s)

Fig-4

Diaurnal Variation Wind Speed at Malamjabba (April-June)

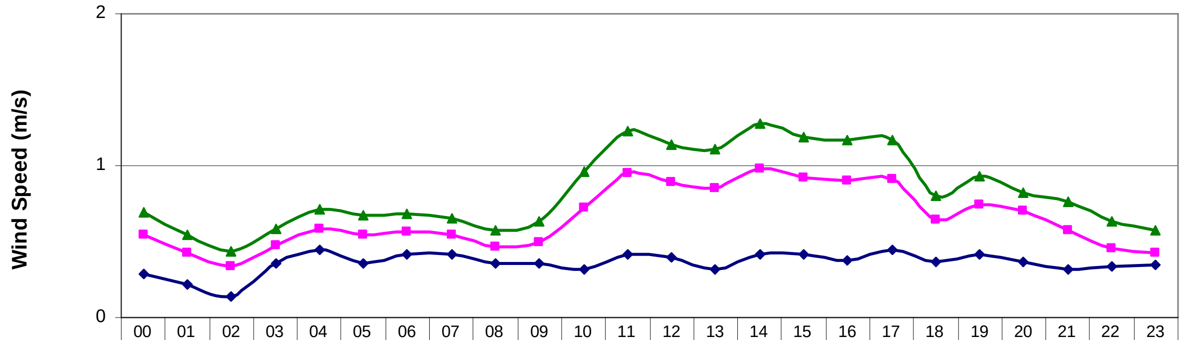


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	0.7	0.4	0.6	0.8	0.8	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.8	1.0	1.4	1.1	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6
WS 30m	1.1	0.9	1.0	1.2	1.2	1.1	1.2	1.2	1.2	1.6	1.5	1.7	1.6	1.7	2.0	1.9	1.8	1.6	1.3	1.2	1.1	1.0	1.0	1.0
WS 50m	1.3	1.0	1.2	1.3	1.3	1.2	1.3	1.3	1.3	1.8	1.8	2.0	1.9	2.1	2.4	2.3	2.1	1.9	1.6	1.3	1.2	1.2	1.2	1.2

Wind Speed (m/s)

Fig-5

Diaurnal Variation Wind Speed at Malamjabba (July-Sept)

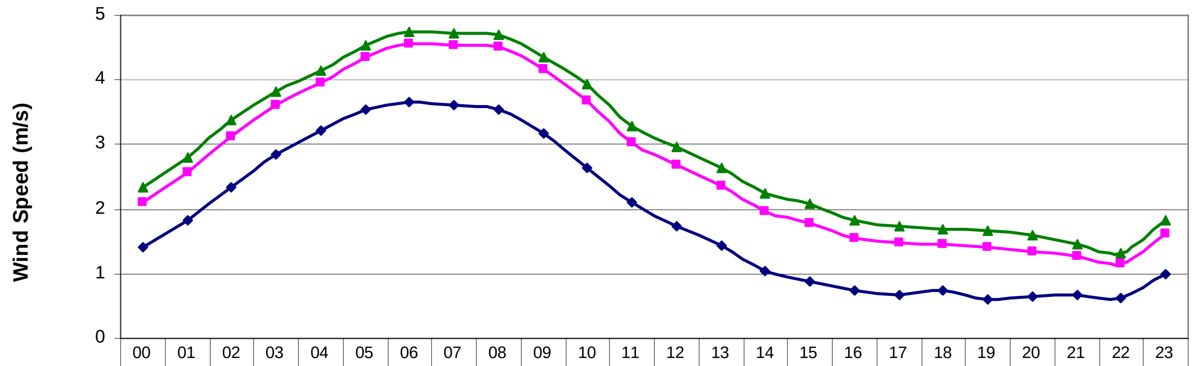


	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
WS 10m	0.3	0.2	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.3	0.3
WS 30m	0.5	0.4	0.3	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.7	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.6	0.7	0.7	0.6	0.5	0.4
WS 50m	0.7	0.5	0.4	0.6	0.7	0.7	0.7	0.7	0.6	0.6	1.0	1.2	1.1	1.1	1.3	1.2	1.2	1.2	0.8	0.9	0.8	0.8	0.6	0.6

Wind Speed (m/s)

Fig-6

Diaurnal Variation Wind Speed at Malamjabba (Oct-Dec)



	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	1.4	1.8	2.3	2.9	3.2	3.6	3.7	3.6	3.5	3.2	2.6	2.1	1.7	1.4	1.0	0.9	0.7	0.7	0.7	0.6	0.7	0.7	0.6	1.0
WS 30m	2.1	2.6	3.1	3.6	4.0	4.3	4.6	4.5	4.5	4.2	3.7	3.0	2.7	2.4	2.0	1.8	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.6
WS 50m	2.3	2.8	3.4	3.8	4.1	4.5	4.8	4.7	4.7	4.4	3.9	3.3	3.0	2.6	2.2	2.1	1.8	1.7	1.7	1.7	1.6	1.5	1.3	1.8

Wind Speed (m/s)

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

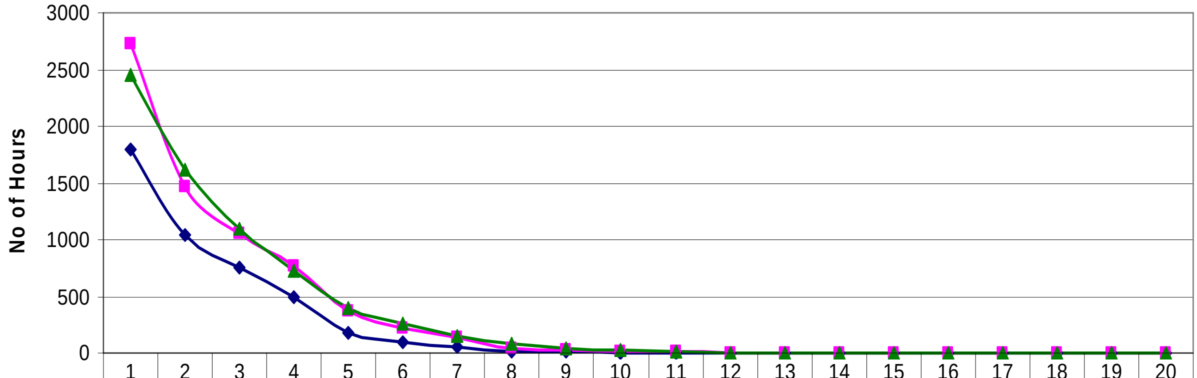
R .F = probability P (V_i) = Frequency of given wind speed / Total period

3.4.3 *Annual Cumulative Wind Frequency:*

Fig-7 shows the Annual Cumulative Wind Frequency distribution (January to December) at three heights 10, 30 and 50 meters. The analysis indicate that in twelve months period at a height of 30 meters during 374 hours the wind speed is equal or greater than 5 m/s whereas at 50 meters, during 404 hours the wind speed is equal or greater than 5m/s.

Fig-7

Annual Cumulative Wind Speed Distribution at Malamjabba



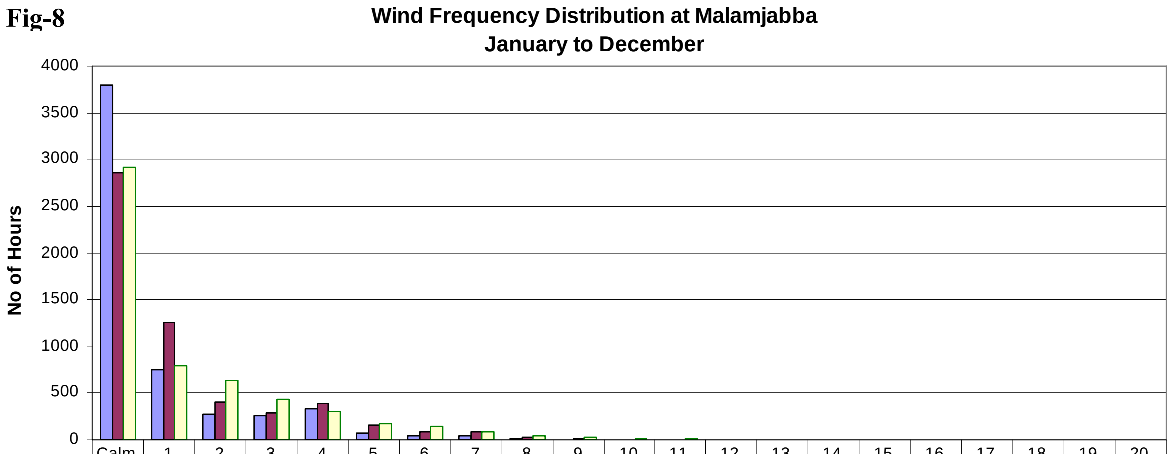
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CWS 10m	1794	1039	758	499	173	101	59	20	10	4	1	0	0	0	0	0	0	0	0	0
CWS 30m	2727	1464	1057	771	374	222	132	47	24	14	7	2	1	0	0	0	0	0	0	0
CWS 50m	2455	1621	1090	728	404	265	149	76	46	25	12	6	3	1	0	0	0	0	0	0

Wind Speed (m/s)

3.4.4 *Wind Frequency Distribution:*

Fig-8 shows the Annual frequency distribution at Malamjabba during January-December. We can see that at 50 meters during 177 hours wind speed is 5 m/s, 143 hours speed is 6 m/s, 85 hours speed is 7 m/s and so on.

Fig-8

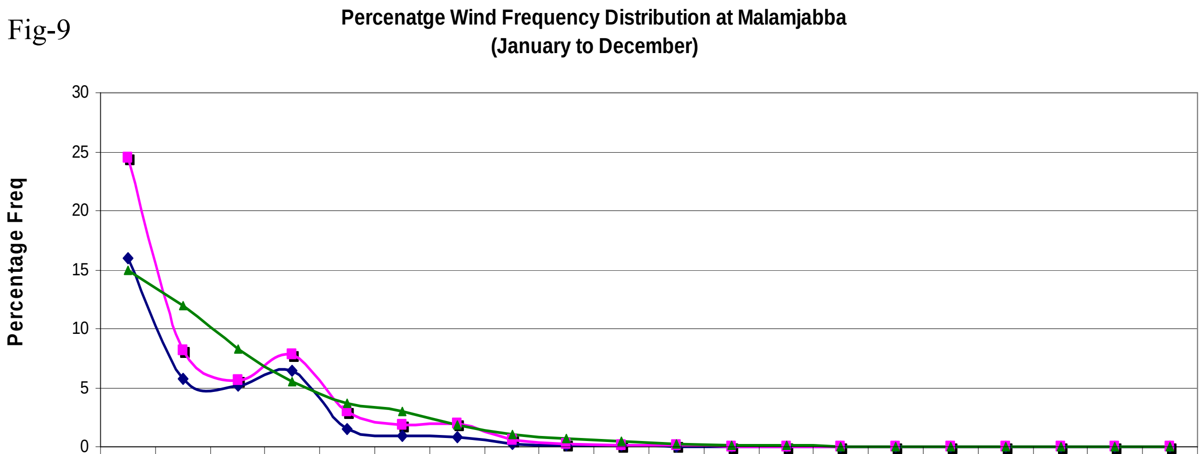


	Calm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CWS 10m	3796	755	281	258	327	71	42	39	10	6	3	1	0	0	0	0	0	0	0	0	0
CWS 30m	2863	1263	407	286	397	152	89	85	22	11	6	6	1	0	0	0	0	0	0	0	0
CWS 50m	2910	795	640	435	296	177	143	85	41	28	16	9	7	3	2	1	0	1	0	0	0

Wind Speed (m/s)

Fig-9 gives this frequency distribution in percentage. At 30 meters we find that during 3.0% of time wind is 5m/s, 1.8% of the time 6m/s and 1.9% of the time it is 7m/s. whereas at 50 meters height we get 3.7% of the time wind speed 5m/s, 3.0% of the times 6m/s and 1.9% of the time 7m/s.

Fig-9



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WS 10m	16.0	5.8	5.2	6.4	1.5	0.9	0.8	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0	0	0	0	0	0
WS 30m	24.5	8.1	5.6	7.8	3.0	1.8	1.9	0.5	0.3	0.2	0.1	0.0	0.0	0.0	0	0	0	0	0	0
WS 50m	14.9	12.0	8.3	5.5	3.7	3.0	1.9	1.0	0.7	0.4	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0	0	0

Wind Speed (m/s)

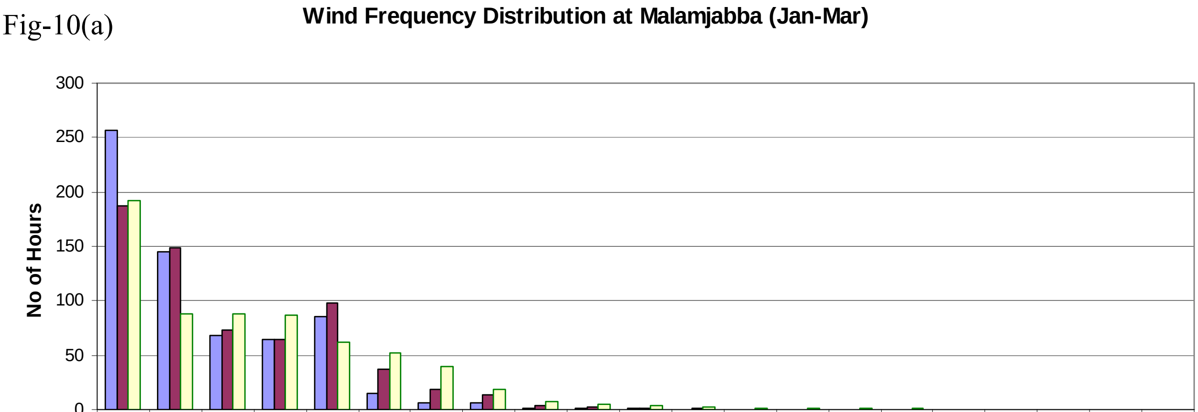
3.4.5 *Seasonal Wind Frequency Distribution:*

Figures 10–13 gives quarterly wind frequency distribution and distribution in percentage.

1st Quarter (Jan – Mar)

Fig-10(a) and Fig-10(b) shows the Frequency distribution and percentage wind frequency distribution during the months of January to March respectively.

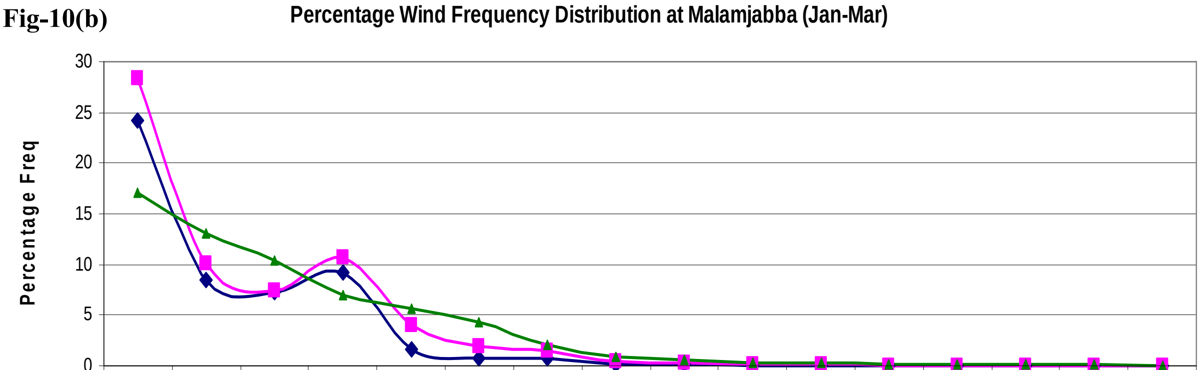
Fig-10(a)



	Calm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WS 10m	257	145	68	65	85	15	6	6	2	1	1	0	0	0	0	0	0	0	0	0	0
WS 30m	188	149	73	64	98	37	18	13	4	2	2	1	0	0	0	0	0	0	0	0	0
WS 50m	192	88	88	86	62	52	40	19	8	5	3	2	2	1	1	1	0	0	0	0	0

Wind Speed (m/s)

Fig-10(b)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
WS 10m	24.1	8.4	7.3	9.2	1.7	0.7	0.7	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0
WS 30m	28.3	10.1	7.4	10.7	3.9	2.0	1.5	0.5	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0
WS 50m	17.1	13.1	10.4	6.9	5.6	4.3	2.0	0.8	0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.0

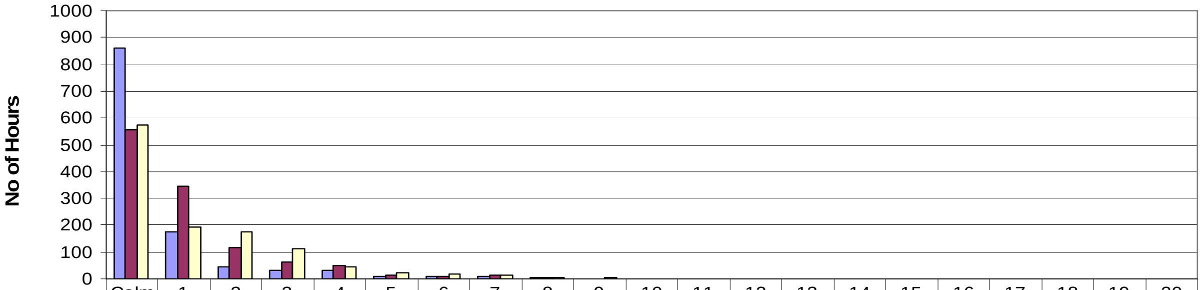
Wind Speed (m/s)

2nd Quarter (Apr – June)

Fig-11(a) and Fig-11(b) shows the Frequency distribution and percentage wind frequency distribution during the months of April to June respectively.

Fig-11(a)

Wind Frequency Distribution at Malamjabba (April-June)

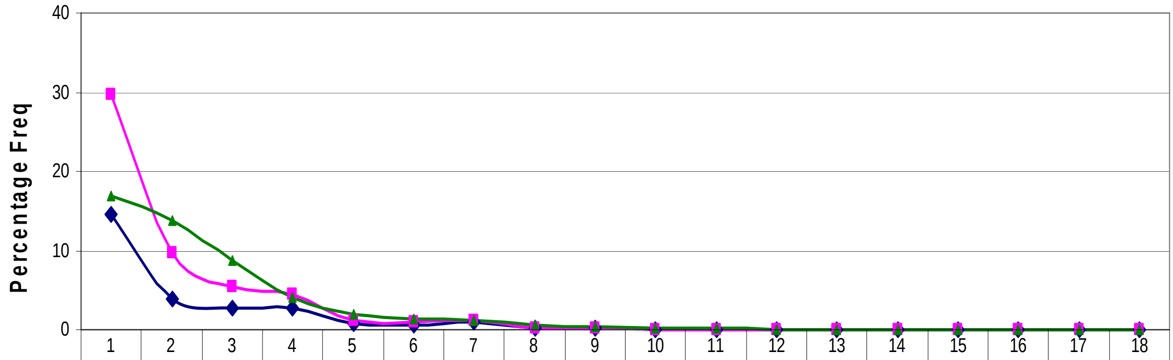


	Calm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WS 10m	860	175	44	31	29	7	7	10	3	2	1	0	0	0	0	0	0	0	0	0	0
WS 30m	555	347	115	62	51	13	10	11	3	1	0	0	0	0	0	0	0	0	0	0	0
WS 50m	573	194	173	111	47	24	17	13	6	5	2	2	1	1	0	0	0	0	0	0	0

Wind Speed (m/s)

Fig-11(b)

Percentage Wind Frequency Distribution at Malamjabba (Apr-June)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WS 10m	14.7	3.9	2.7	2.6	0.7	0.6	0.9	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0	0	0	0
WS 30m	29.8	9.7	5.4	4.5	1.1	1.0	1.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
WS 50m	17.0	13.8	8.8	4.0	1.9	1.4	1.1	0.6	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

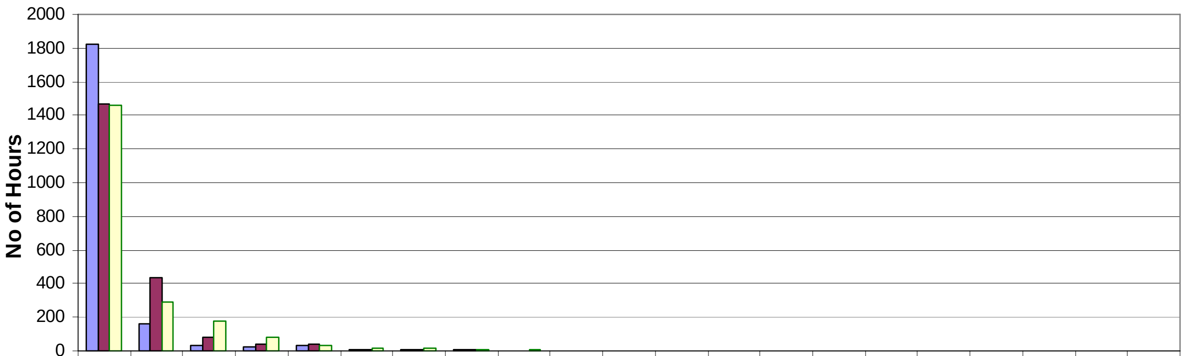
Wind Speed (m/s)

<u>3rd Quarter (July – Sept)</u>

Fig-12(a) and Fig-12(b) shows the Frequency distribution and percentage wind frequency distribution during the months of April to June respectively.

Fig-12(a)

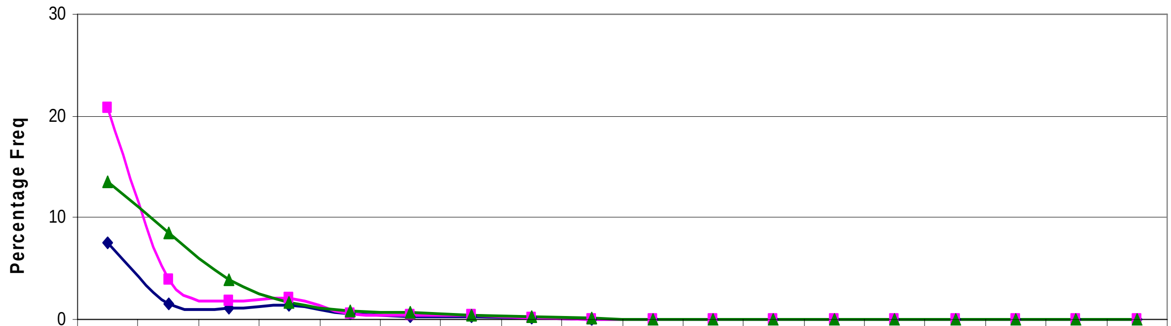
Wind Speed Distribution at Malamjabba (July-Sept)



	Calm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WS 10m	1824	159	34	24	30	10	7	7	2	1	1	0	0	0	0	0	0	0	0	0	0
WS 30m	1466	439	81	39	43	12	8	8	2	1	0	0	0	0	0	0	0	0	0	0	0
WS 50m	1459	287	180	82	36	19	16	9	5	3	1	1	1	0	0	0	0	0	0	0	0

Wind Speed (m/s)

Fig-12(b) **Percentage Wind Frequency Distribution at Malamjabba (July-Sept)**



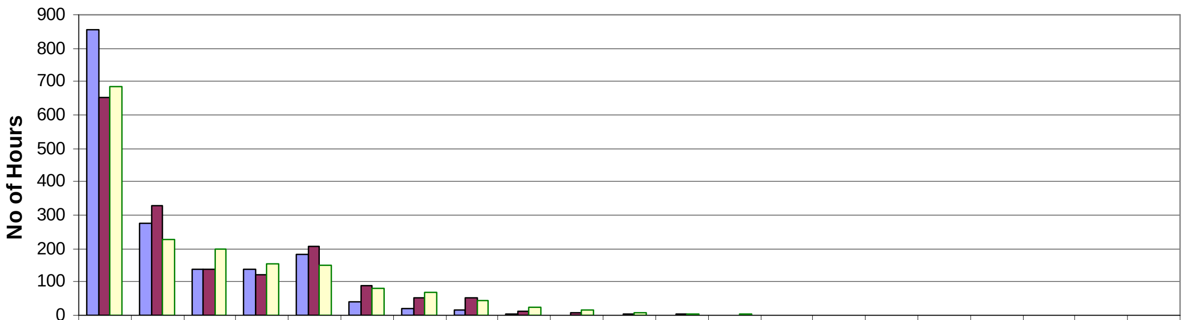
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WS 10m	7.6	1.6	1.2	1.4	0.5	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0	0	0	0
WS 30m	20.8	3.9	1.9	2.0	0.6	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0
WS 50m	13.6	8.5	3.9	1.7	0.9	0.7	0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0	0

Wind Speed (m/s)

4th Quarter (Oct – Dec)

Fig-13(a) and Fig-13(b) shows the Frequency distribution and percentage wind frequency distribution during the months of April to June respectively.

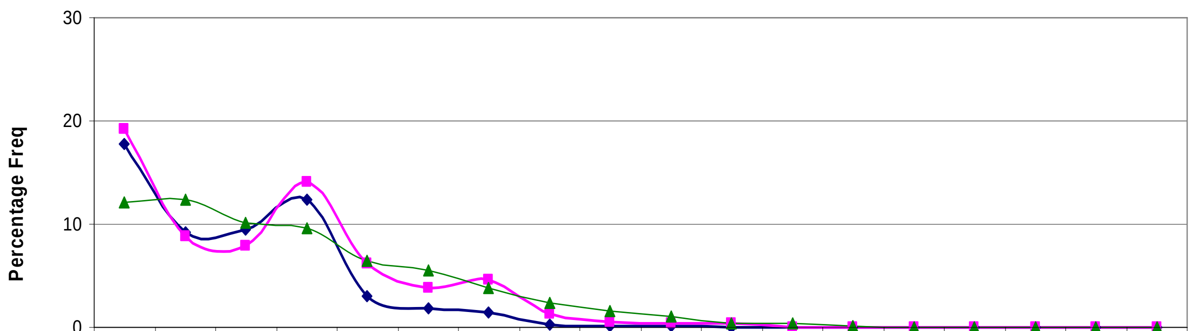
Fig-13(a) **Wind Speed Distribution at Malamjabba (Oct-Dec)**



	Calm	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WS 10m	854	276	136	139	183	39	22	16	4	1	1	0	0	0	0	0	0	0	0	0	0
WS 30m	654	328	137	120	205	90	53	53	14	6	4	4	1	0	0	0	0	0	0	0	0
WS 50m	686	226	198	156	151	83	71	44	23	15	9	4	3	1	0	0	0	0	0	0	0

Wind Speed (m/s)

Fig-13(b) **Percentage Wind Frequency Distribution at Malamjabba (Oct-Dec)**



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WS 10m	17.7	9.2	9.5	12.4	3.0	1.9	1.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0	0	0	0
WS 30m	19.2	8.8	7.9	14.0	6.2	3.9	4.7	1.3	0.6	0.4	0.4	0.1	0.0	0.0	0.0	0	0	0
WS 50m	12.1	12.4	10.1	9.6	6.4	5.6	3.8	2.4	1.6	1.0	0.4	0.3	0.1	0.0	0.0	0	0	0

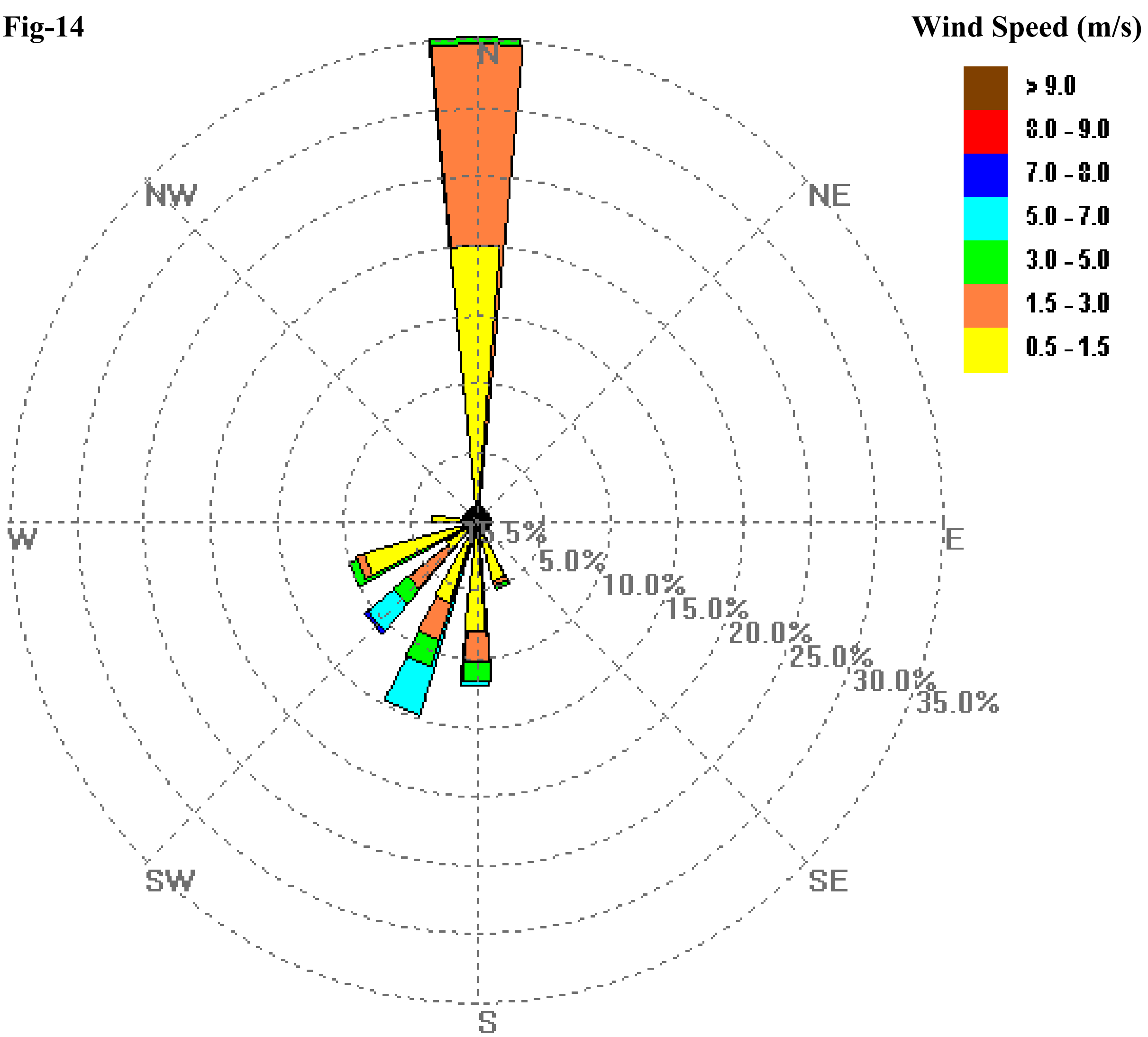
Wind Speed (m/s)

3.5 Wind Rose:

Fig-14 shows the Wind Rose based on 12 months data from August 2006 – July 2007 collected at 30 meters height. Wind Rose indicates that the wind direction is mostly towards North and sometimes between south and south west. The average wind speed is 1.6m/s and the percentage of wind speed greater than 5m/s is 7.5%.

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

Fig-14



Wind Speed Range (m/s)	Percenatage	Average Wind Direction
0.5 - 1.5	55.5%	212.0 degree
1.5 - 3.0	29.2%	
3.0 - 5.0	7.5%	
5.0 - 7.0	7.5%	
7.0 - 8.0	0.42%	

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

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

From this, power density is calculated as

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

Where $\frac{dm}{dt}$ is the mass of air following time.

From fluid dynamics, it can be proved that

$$\frac{dm}{dt} = \varphi AV$$

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

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

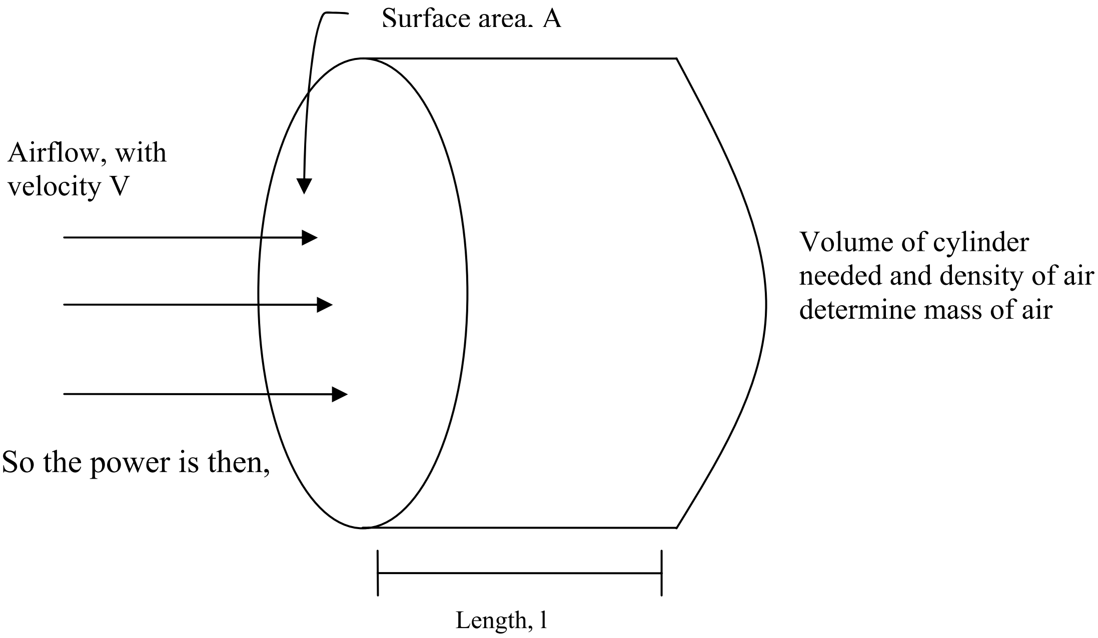
Now mass of wind can be written as

$$M = \varphi Avt$$

Differentiating

$$\frac{dm}{dt} = \varphi AV \frac{d}{dt(t)} = \varphi AV$$

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



So the power is then,

$$P = \tfrac{1}{2}\ {}^{dm}\!/_{dt}\ V^2 \ = \tfrac{1}{2}\varphi AVT/t\ V^2$$
$$= \tfrac{1}{2}\varphi AV^3$$

And power density

$$P/_{A} = \tfrac{1}{2}\varphi V^{\ 3}$$

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 ring 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.

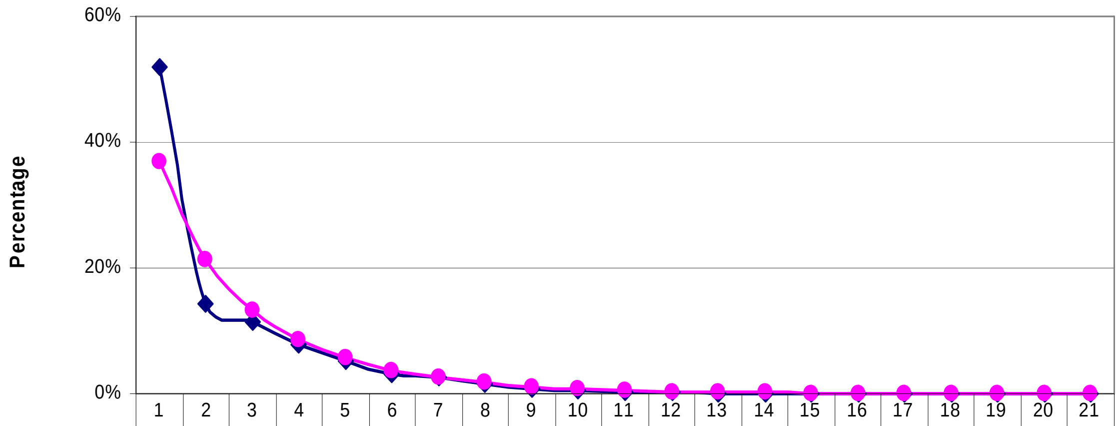
The mathematical description of the wind frequency allows us to match with the turbine power curve. Thus a measure of the average total power capture in a year is achieved. Additionally the choice of turbine cut in and furling speed may be chosen to maximum the total energy capture.

3.7.5 ***Weibull Parameters:***

Fig-15 shows the Weibull fit to the relative frequency of wind speed.

Fig-15

Relative Frequency an Weibull Probability at Malamjabba (50 m height)



Wind Speed (m/s)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
R.F 50m	52.1	14.2	11.4	7.8%	5.3%	3.2%	2.6%	1.5%	0.7%	0.5%	0.3%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Weibull 50m	36.8	21.2	13.2	8.5%	5.6%	3.7%	2.5%	1.7%	1.2%	0.8%	0.5%	0.4%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%

Source: Pakistan Meteorological Department

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 0.83 during August to the highest of 1.48 during the months of November and February with an annual value of K being 1.04.

The lowest values of the scale parameter C, 0.94 is observed in August while the highest value of 5.26 is obtained in November and with an annual value of 2.16.

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 and log law as explained in the earlier section.

At 10 meters height the average wind speed is 1.41 m/s with Standard deviation of 1.33, at 30 meters this average speed is 1.88 m/s with Standard deviation of 1.54. At 50 meters the monthly average wind speed varies from the lowest of 1.04 m/s in August to highest of 4.76 m/s during November. Whereas the average wind speed is 2.15 m/s with Standard deviation of 2.04.

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 19.65 W/m^2 January to 26.30 W/m^2 in December with Average of 13.56 W/m^2.

At 30 meters height the power density varies from 38.41 W/m^2 in January to 55.71 W/m^2 in December and the average values is about 24.70 W/m^2.

At 50 meters height the power density of Malamjabba varies from 62.85 W/m^2 in January to 93.13 W/m^2 in December. The average power density of the area is 50.48 W/m^2.

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

	10 m				
	AvgV (m/s)	**St Dev**	**C (m/s)**	**K**	**P/A (w/m²)**
January	2.23	1.59	2.46	1.44	**19.65**
February	0.90	0.63	0.99	1.48	**1.24**
March	2.00	1.98	2.02	1.01	**28.58**
April	1.08	1.23	1.00	0.87	**6.75**
May	1.21	1.39	1.11	0.85	**9.95**
June	1.01	1.47	0.75	0.66	**14.12**
July	0.83	1.14	0.66	0.71	**6.16**
August	0.76	0.90	0.69	0.83	**2.70**
September	0.76	0.87	0.71	0.87	**2.42**
October	0.85	0.99	0.79	0.85	**3.54**
November	2.89	2.02	3.20	1.48	**41.27**
December	2.41	1.78	2.64	1.39	**26.30**
Average	**1.41**	**1.33**	**1.42**	**1.04**	**13.56**
	30 m				
	AvgV (m/s)	**St Dev**	**C (m/s)**	**K**	**P/A (w/m²)**
January	2.91	1.92	3.23	1.57	**38.41**
February	1.12	0.71	1.25	1.64	**2.07**
March	2.47	2.32	2.53	1.07	**47.29**
April	1.55	1.37	1.63	1.15	**9.99**
May	1.70	1.52	1.78	1.13	**13.57**
June	1.43	1.59	1.35	0.89	**14.69**
July	1.10	1.24	1.03	0.88	**6.92**
August	0.94	0.98	0.92	0.96	**3.41**
September	1.00	1.02	0.99	0.98	**3.88**
October	1.06	1.10	1.04	0.96	**4.90**
November	4.07	2.52	4.55	1.68	**95.53**
December	3.21	2.22	3.55	1.49	**55.71**
Average	**1.88**	**1.54**	**1.99**	**1.20**	**24.70**
	50 m				
	AvgV (m/s)	**St Dev**	**C (m/s)**	**K**	**P/A (w/m²)**
January	3.29	2.35	3.63	1.44	**62.85**
February	1.24	0.87	1.37	1.48	**3.25**
March	2.72	2.68	2.74	1.01	**71.42**
April	1.84	2.10	1.71	0.87	**33.65**
May	1.99	2.30	1.83	0.85	**44.79**
June	1.69	2.47	1.27	0.66	**67.11**
July	1.26	1.74	1.00	0.71	**21.73**
August	1.04	1.23	0.94	0.83	**6.95**
September	1.13	1.29	1.05	0.87	**7.83**
October	1.17	1.35	1.08	0.85	**9.11**
November	4.76	3.33	5.26	1.48	**183.91**
December	3.67	2.72	4.02	1.39	**93.13**
Average	**2.15**	**2.04**	**2.16**	**1.04**	**50.48**

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 train 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 η = 1. Of course, in reality both the drive train 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 train 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, $\overline{P_{WTA}}$:

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

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 Malamjabba 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 Malamjabba along with the capacity factor are given in table 4.

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

PMD Calculator (using 50M)				
Month	**Input W/m^2**	**Output W/m^2**	**C.F.**	**KWh / Month**
January	60	22	6%	24,931
February	3	0	0%	496
March	74	23	6%	25,569
April	34	10	3%	11,452
May	45	13	3%	15,039
June	63	13	3%	14,325
July	21	6	2%	6,889
August	7	2	1%	2,448
September	8	2	1%	2,710
October	9	3	1%	3,347
November	176	56	14%	61,296
December	89	31	8%	35,302
Annual	**31**	**11**	**3%**	**11,650**

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

The **watt-hour** (symbol W·h or Wh) is a unit of energy. It is most commonly used on household electricity meters in the form of the kilowatt-hour (kW·h or KWh), which is 1,000 watt-hours. Figure 16 shows the average diurnal variation of wind generated electric energy output at Malamjabba (Jan-Dec). The graph shows that the maximum power is produced at about 8 AM; of course, this is the same time when we have the maximum wind speed in 24 hours. Figure 17 & 18 shows the monthly and daily wind generated electric power output. Figure 17 depicts that at Malamjabba the wind have more potential in the month of December as compared to other months. Figure 19 to 30 shows the monthly average diurnal variation of wind generated electric energy output.

Fig-16

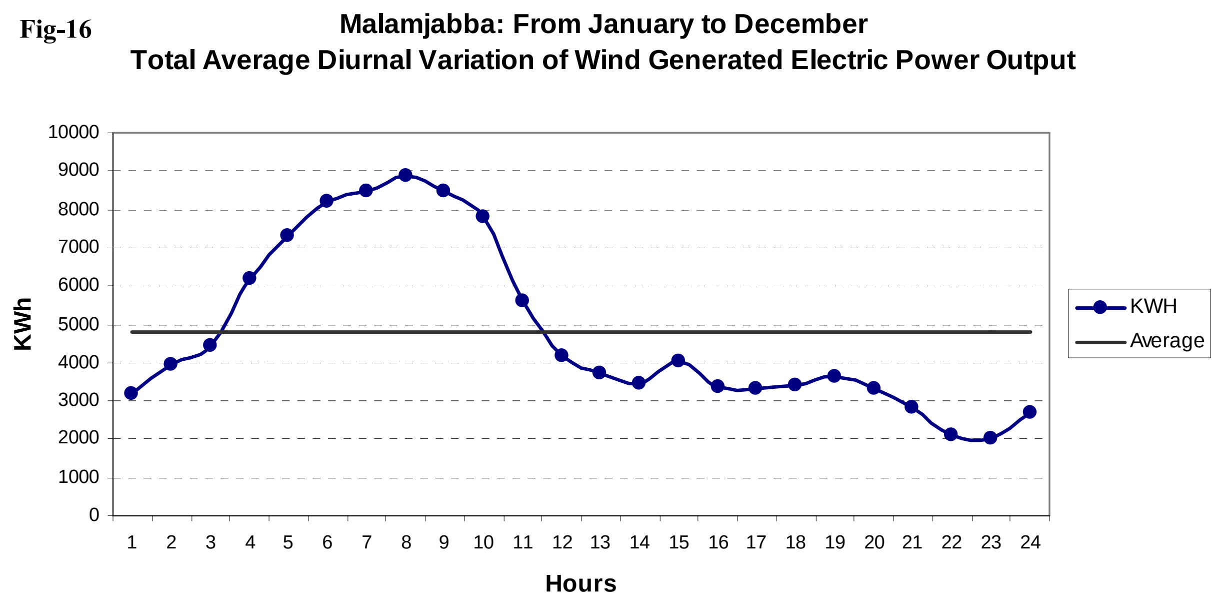


Fig-17

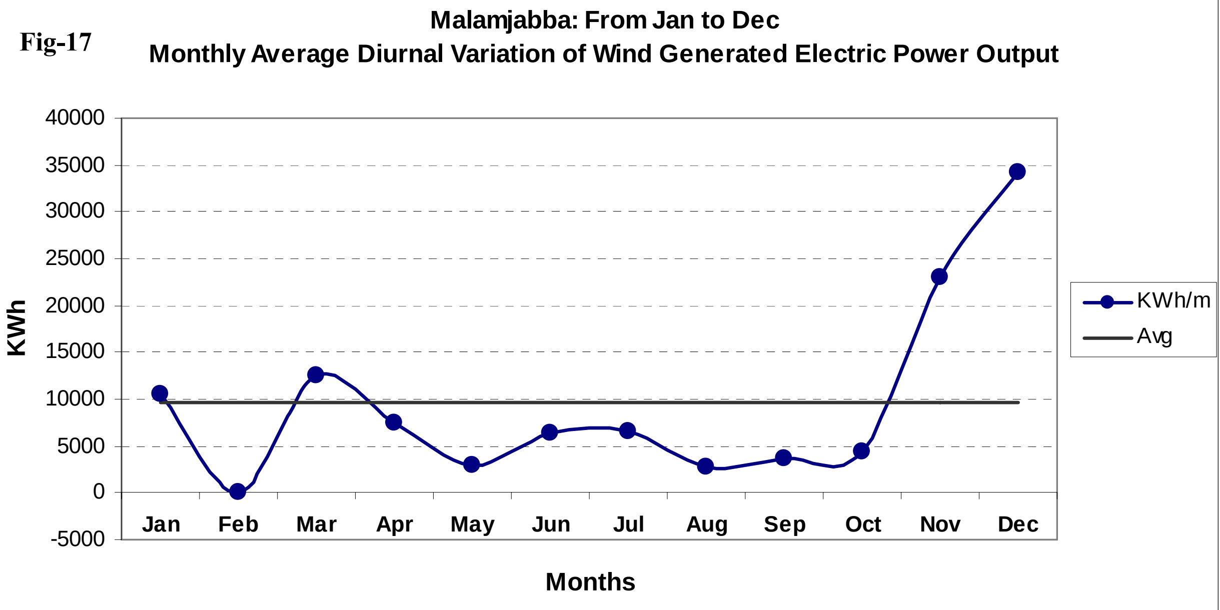


Fig-18

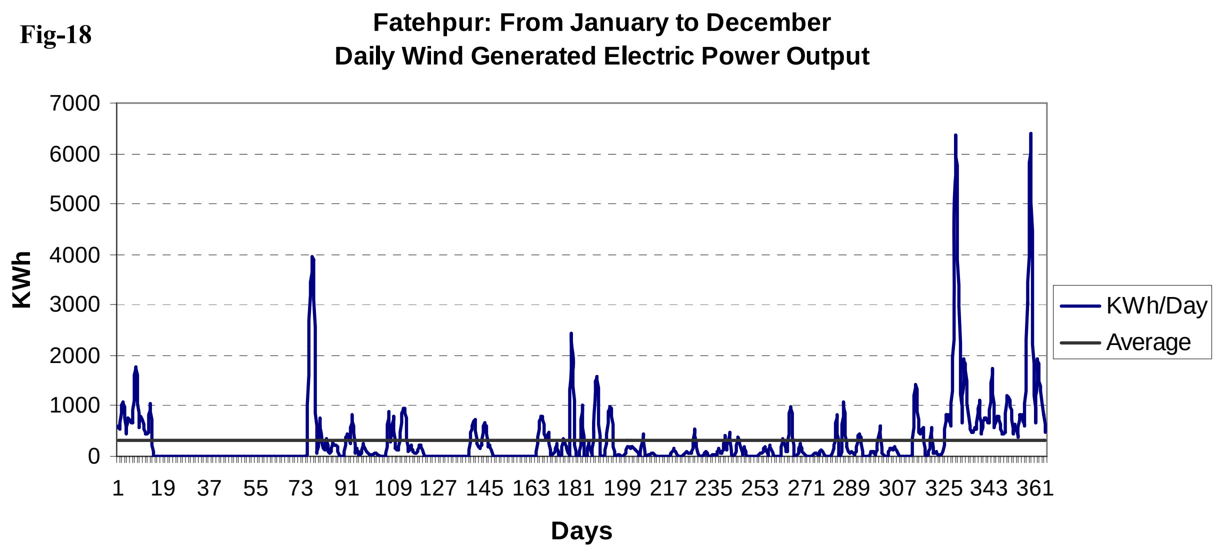


Fig-19

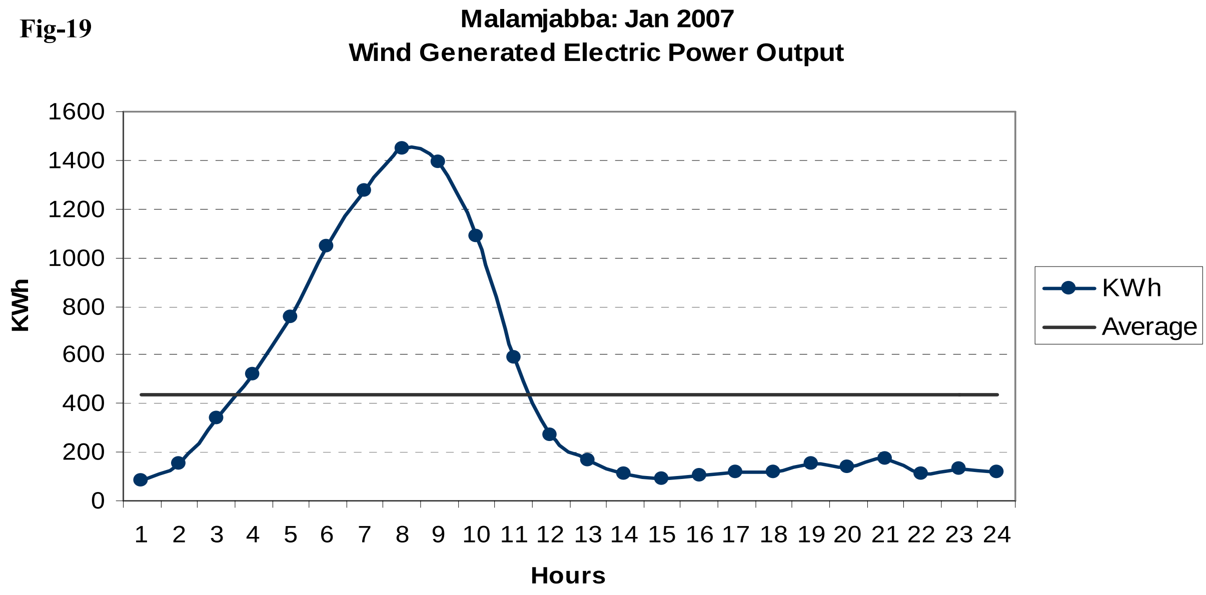


Fig-20

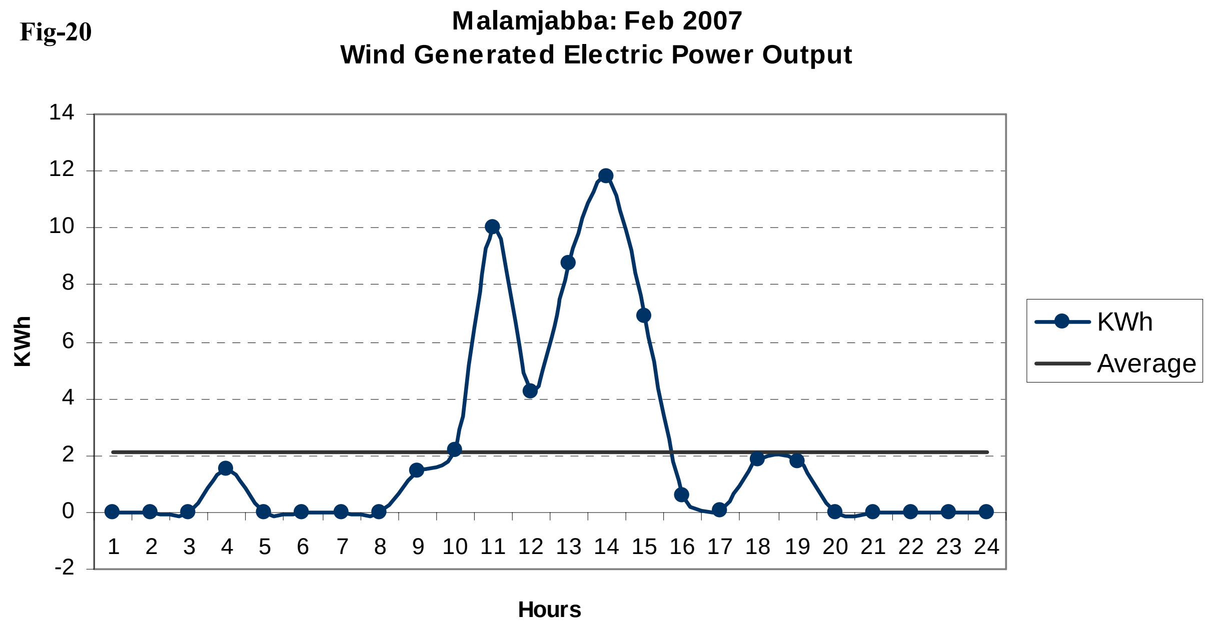


Fig-21

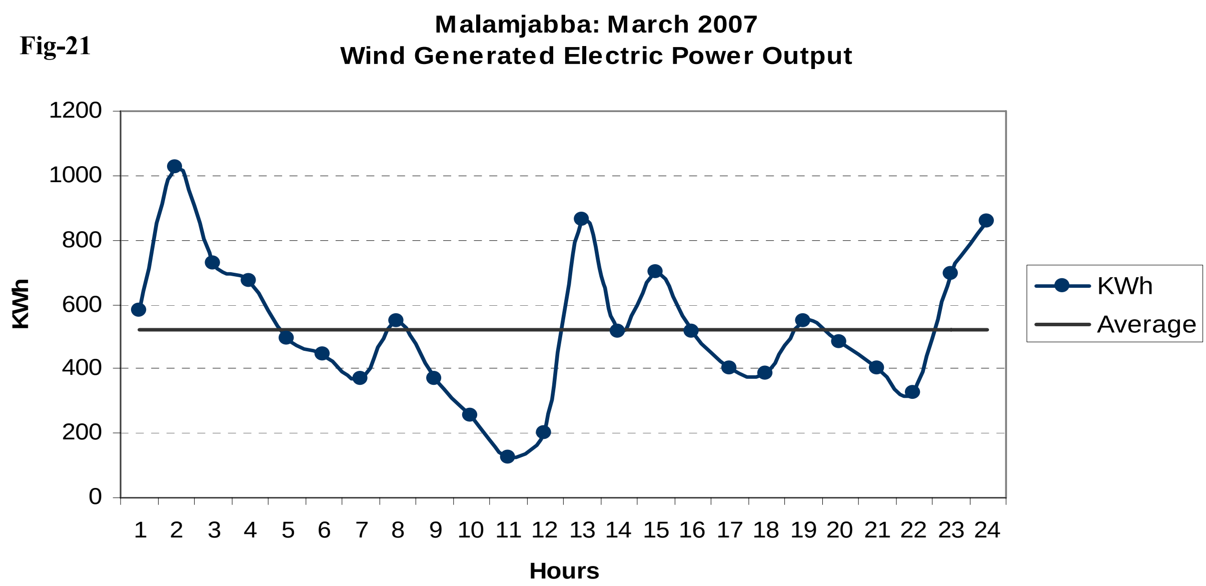


Fig-22

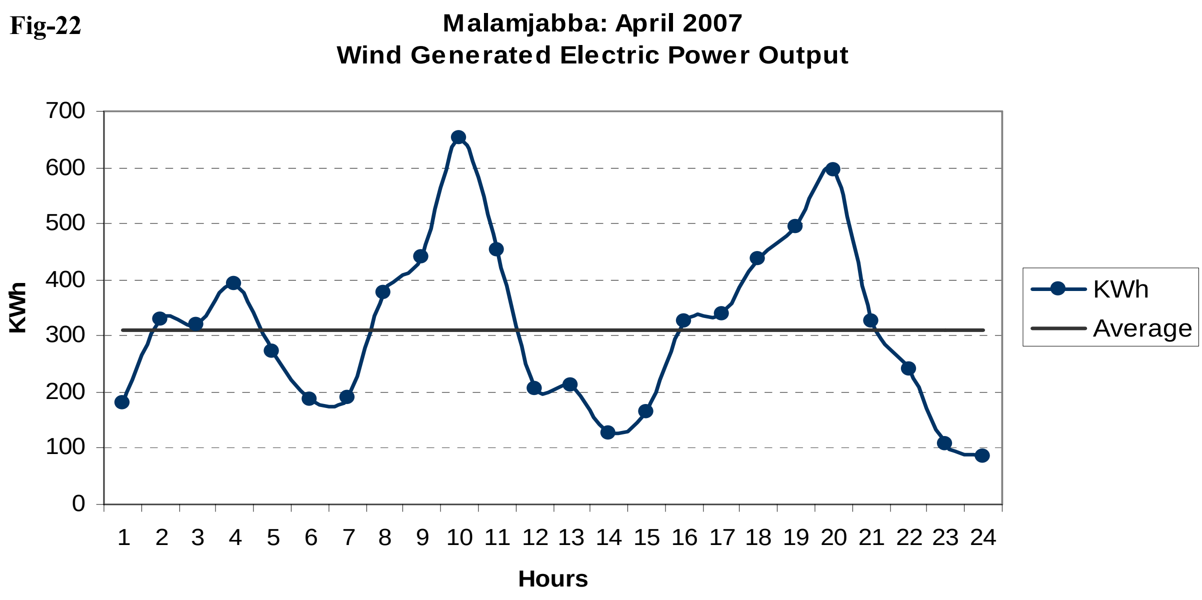


Fig-23

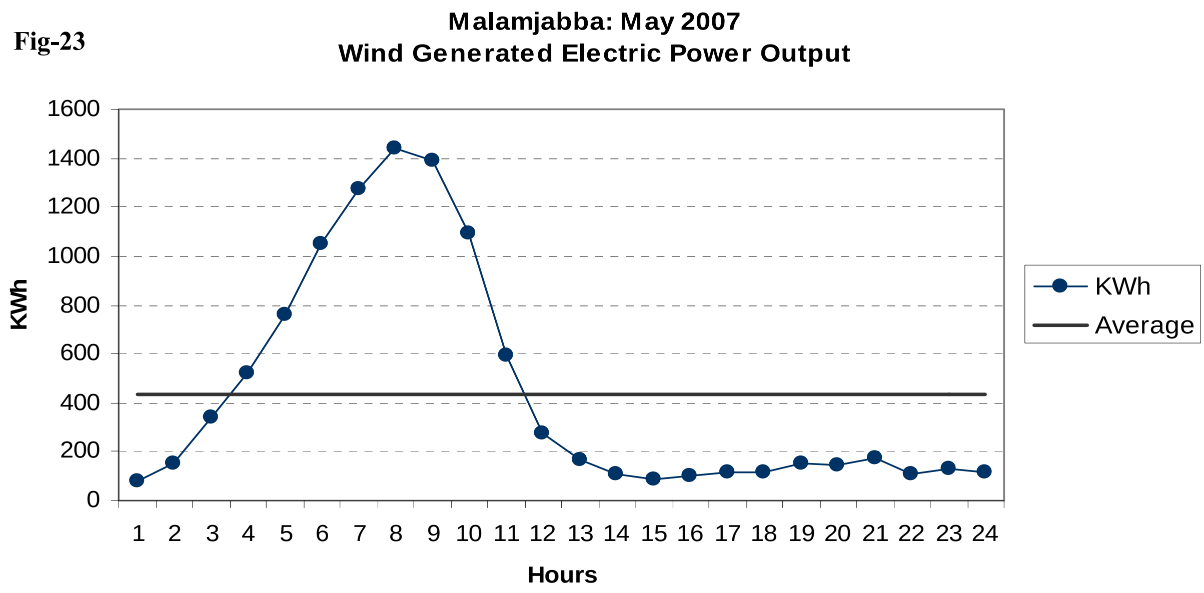


Fig-24

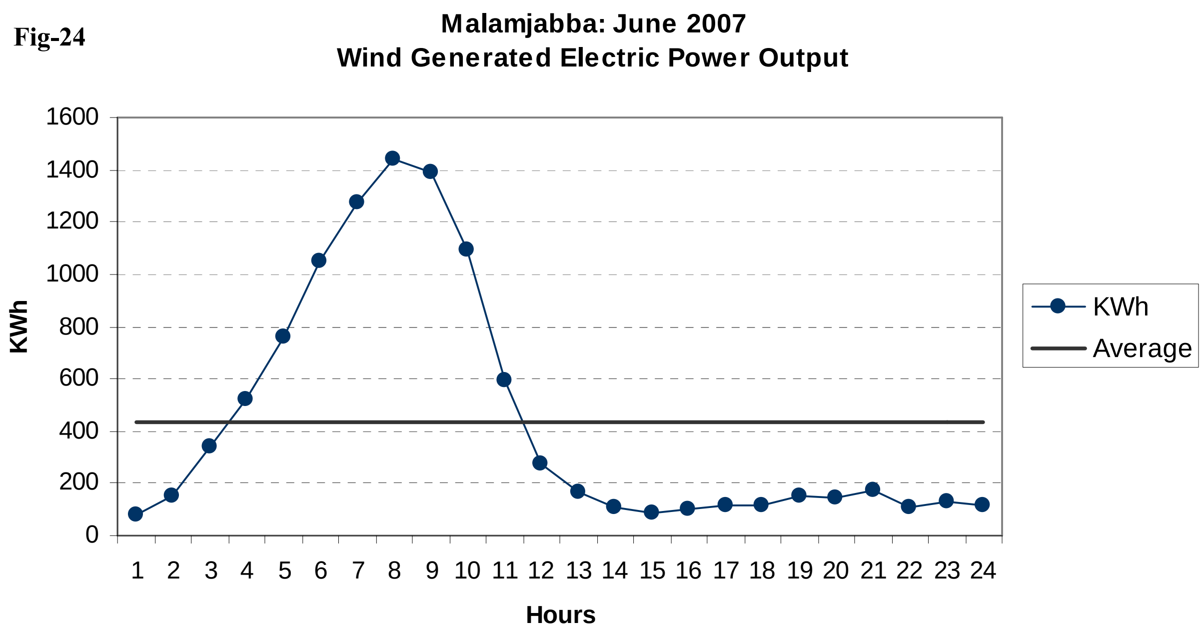


Fig-25

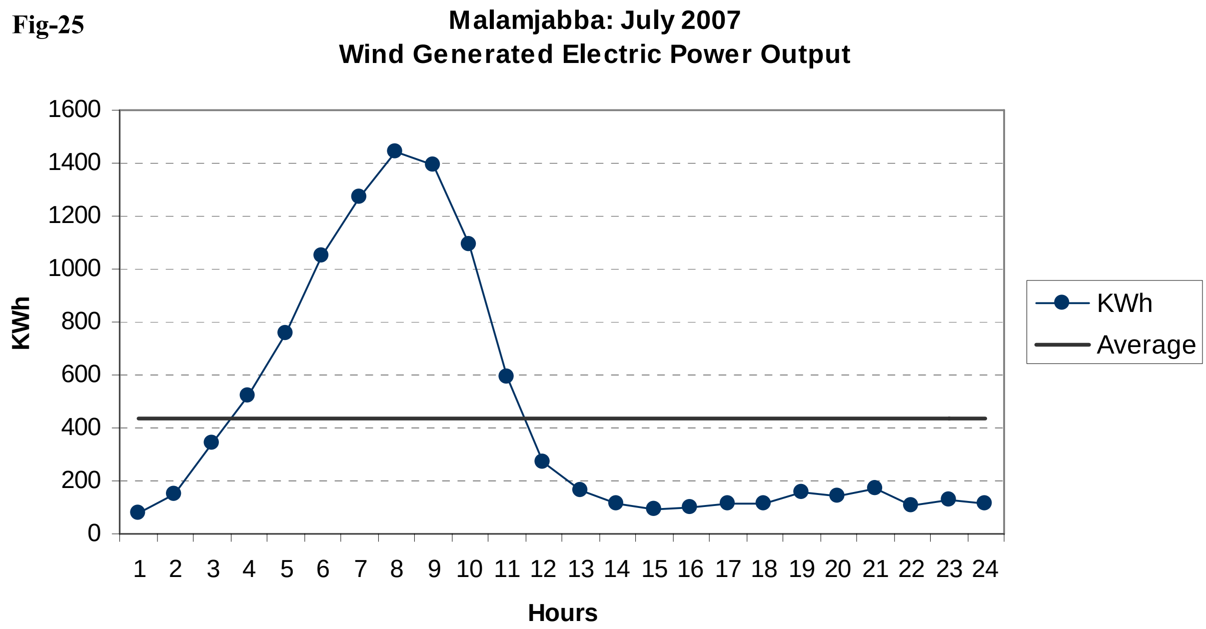


Fig-26

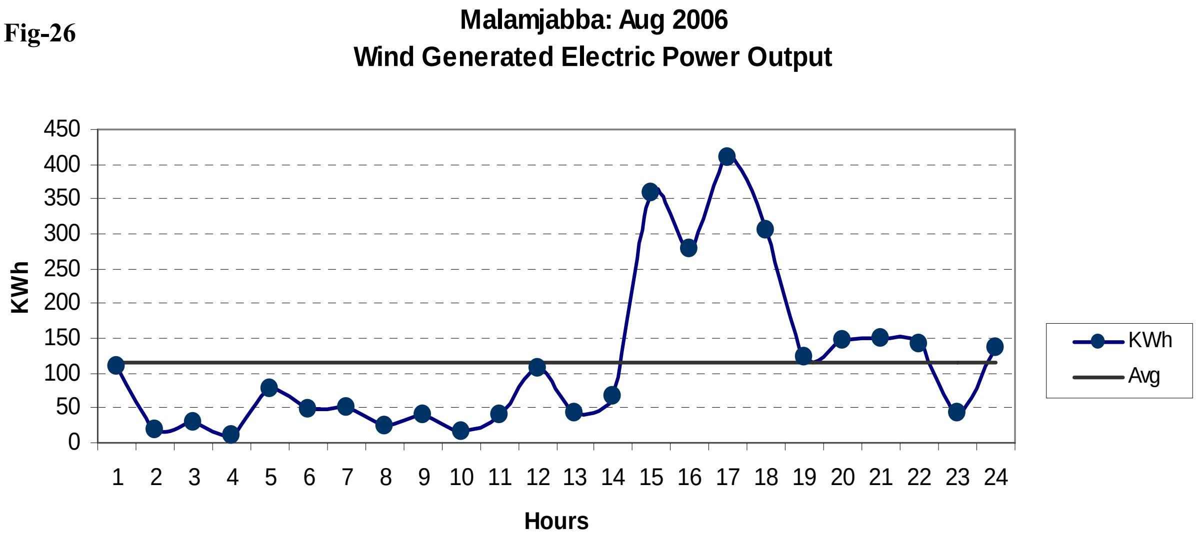


Fig-27

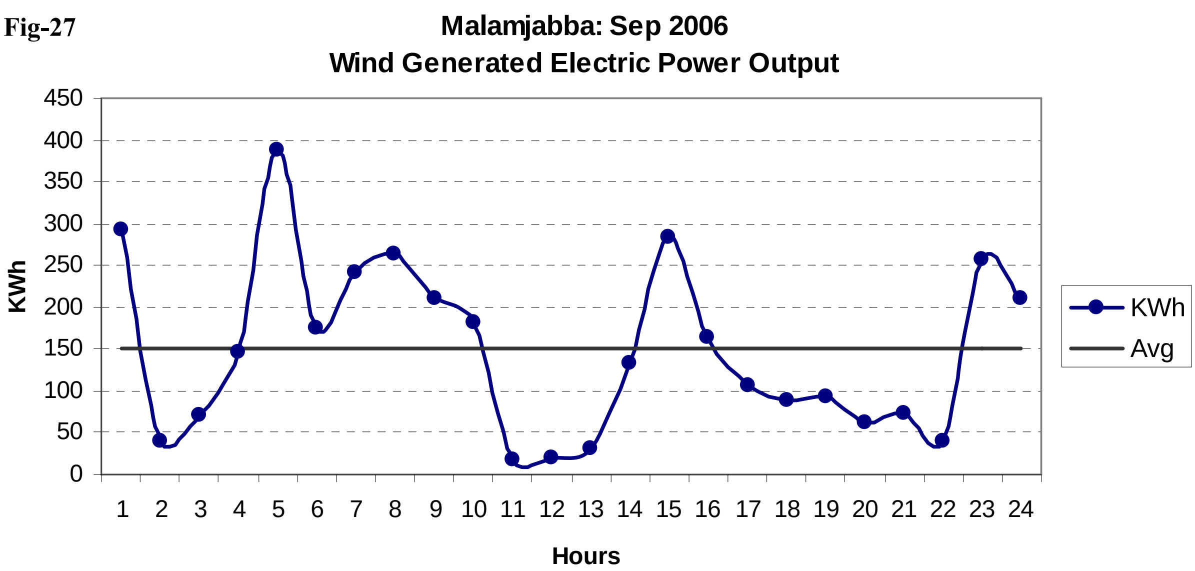


Fig-28

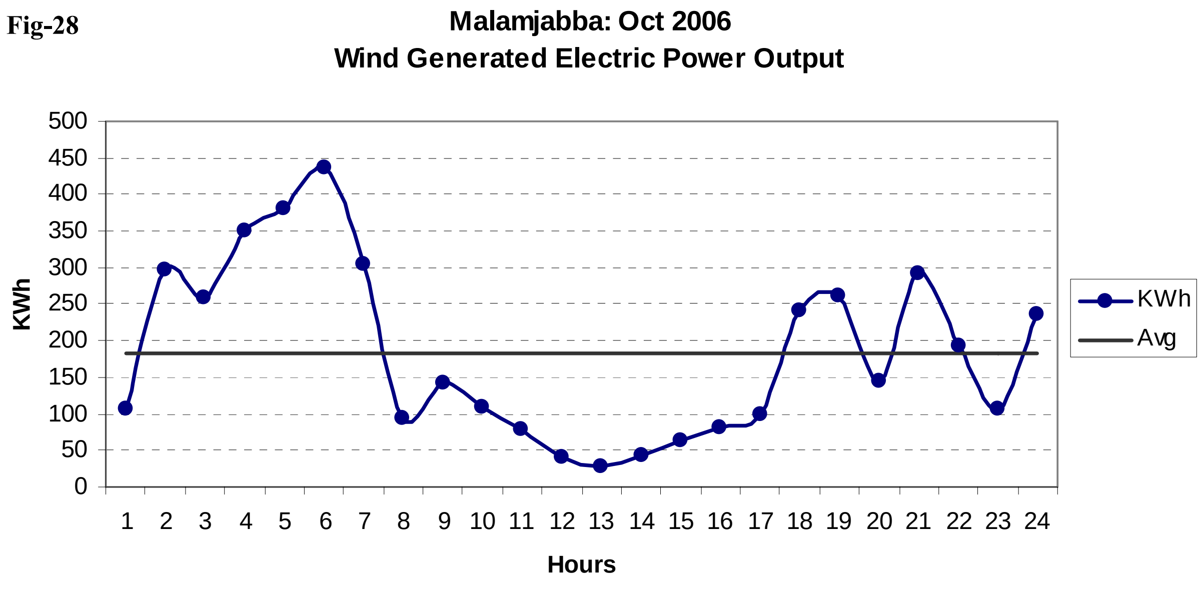


Fig-29

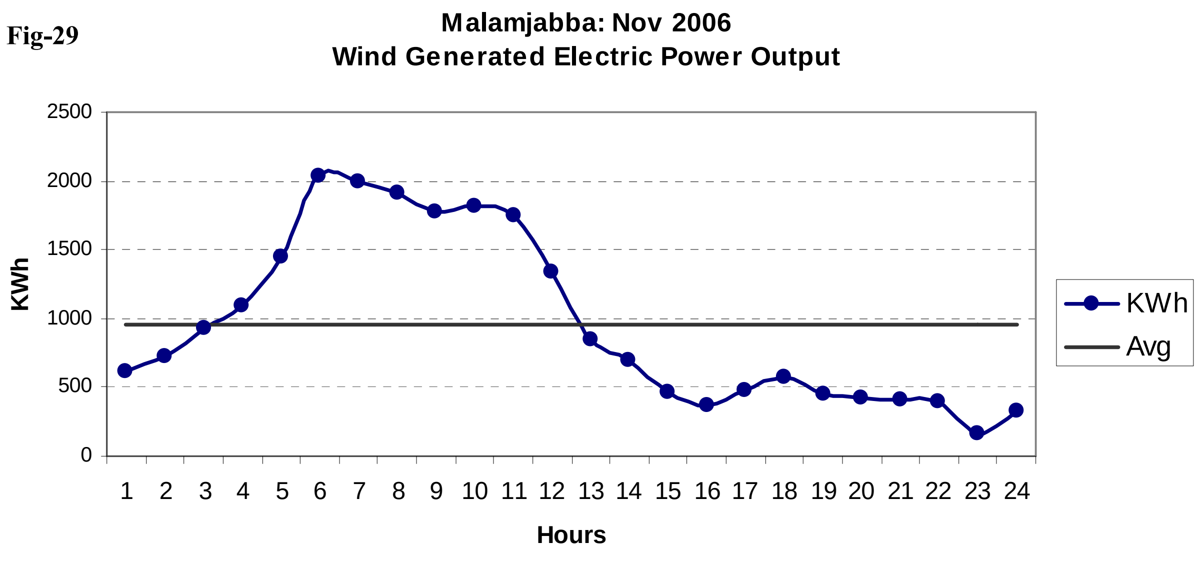
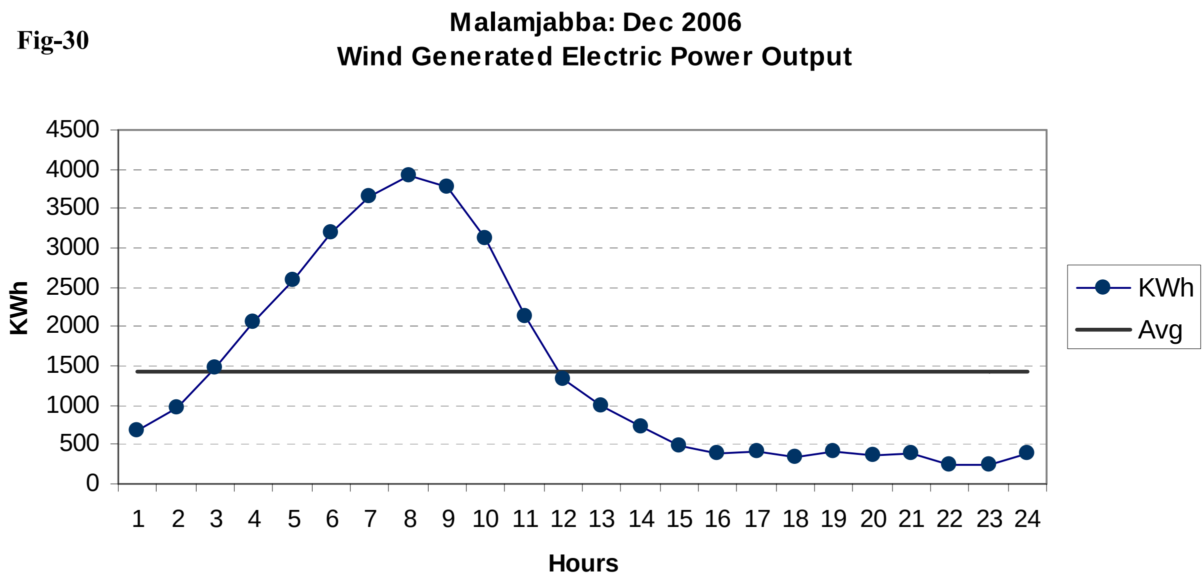
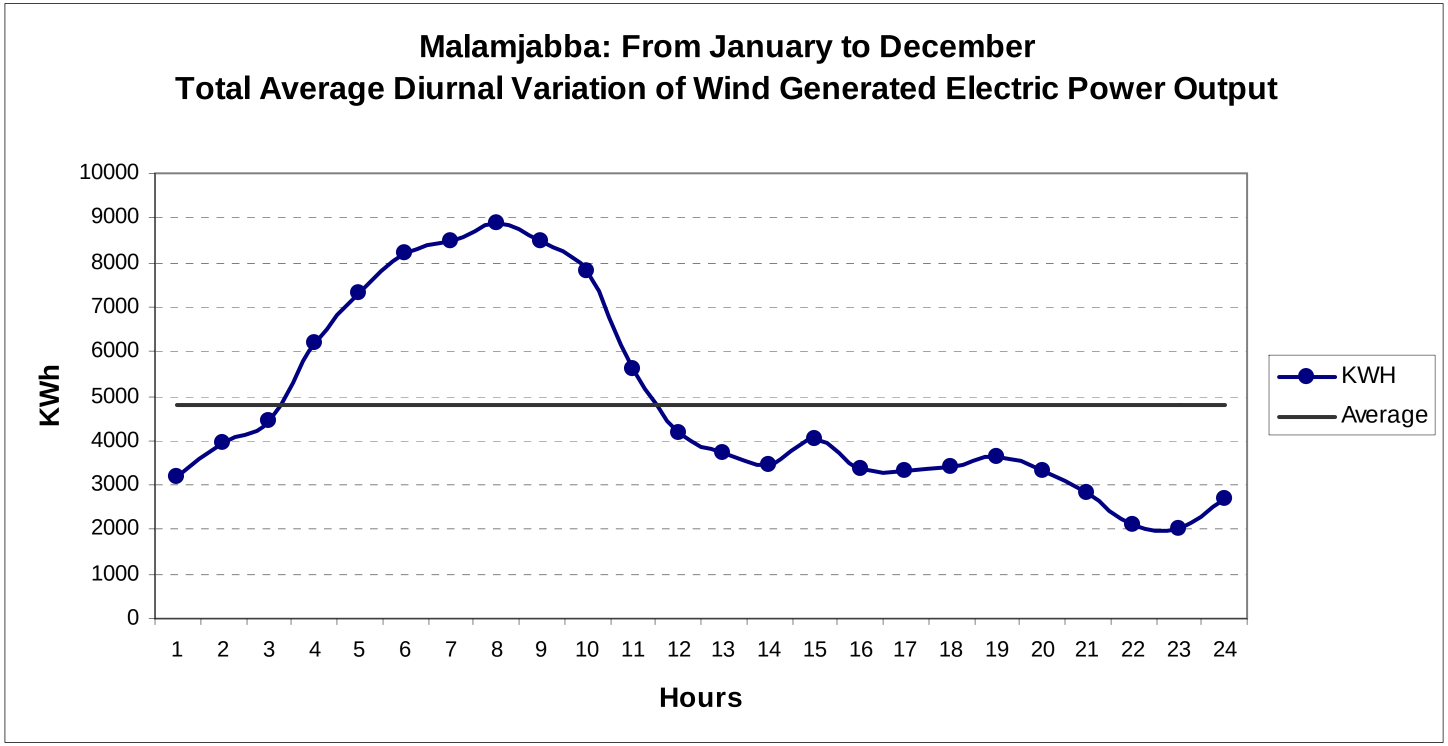


Fig-30



Malamjabba **January To December** **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
Jan-07	81	152	340	519	757	1049	1274	1444	1391	1090	590	273	166	112	90	101	117	118	155	142	174	110	130	118	**10492**
Feb-07	0	0	0	2	0	0	0	0	1	2	10	4	9	12	7	1	0	2	2	0	0	0	0	0	**51**
Mar-07	581	1024	730	674	494	445	370	546	367	256	123	199	861	516	700	518	401	385	547	485	404	324	694	859	**12504**
Apr-07	181	328	319	392	273	188	189	377	440	652	454	205	214	128	164	325	339	436	495	594	326	242	106	85	**7452**
May-07	236	26	73	140	63	87	96	32	49	163	86	190	136	349	259	227	236	68	28	78	29	46	60	244	**3003**
Jun-07	231	67	59	135	168	17	32	2	96	207	186	230	258	607	911	728	447	369	538	468	424	167	55	68	**6472**
Jul-07	98	282	141	665	658	550	286	280	207	174	159	231	165	71	249	176	277	475	516	413	158	205	149	21	**6607**
Aug-06	109	18	28	11	78	49	50	23	39	17	40	107	43	66	360	280	411	304	124	148	149	141	43	138	**2778**
Sep-06	293	41	71	147	388	174	242	264	210	181	18	20	31	134	285	164	107	89	94	63	73	41	257	210	**3597**
Oct-06	107	298	259	349	382	437	305	94	143	110	79	39	27	44	65	82	100	241	263	146	292	194	107	236	**4401**
Nov-06	611	727	931	1091	1449	2031	1988	1907	1773	1815	1742	1336	842	700	459	364	480	579	453	420	415	399	163	329	**23005**
Dec-06	676	978	1479	2054	2599	3182	3664	3914	3779	3118	2139	1322	984	727	480	399	408	348	406	368	382	254	249	388	**34295**
KWH	**3203**	**3941**	**4430**	**6181**	**7309**	**8209**	**8497**	**8883**	**8496**	**7786**	**5627**	**4156**	**3737**	**3466**	**4028**	**3365**	**3323**	**3414**	**3621**	**3325**	**2826**	**2123**	**2013**	**2696**	**114657**
Average	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	**4777**	



Malamjabba August 2006 **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	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
6	0.0	0.0	0.0	0.0	5.9	2.9	19.9	4.6	4.0	3.8	2.4	0.9	0.1	0.0	0.1	0.4	1.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5	47
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	17.7	24.3	7.9	4.4	92.0	147
8	93.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.3	0.0	0.9	5.4	0.1	0.1	0.0	0.0	101
9	0.0	0.0	0.0	0.0	0.0	0.1	1.2	0.0	0.0	0.0	0.2	0.1	0.3	0.1	3.7	2.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	9
10	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.6	1.3	0.3	0.0	0.1	0.0	0.0	0.0	0.0	10.8	0.1	14
11	0.0	0.1	4.2	0.0	0.0	0.0	0.0	8.9	7.7	0.0	0.0	0.5	0.0	3.0	1.3	1.6	0.3	0.9	0.2	0.0	0.3	0.0	0.0	0.0	29
12	1.5	0.3	0.0	0.0	0.0	0.0	2.9	0.6	0.4	0.0	0.1	1.3	0.1	0.3	0.0	0.0	0.7	10.0	33.0	27.7	1.1	0.0	3.2	22.3	106
13	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.3	1.7	7.3	0.3	0.3	38.2	0.3	0.0	0.0	49
14	0.0	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5	26.3	0.0	0.0	0.2	0.3	0.0	0.5	0.0	0.6	2.5	0.0	0.0	1.4	48
15	0.0	0.0	2.1	0.0	47.8	0.0	0.0	7.4	26.4	8.2	0.1	0.1	0.5	19.2	120.7	75.1	182.6	51.0	4.7	0.0	0.2	0.0	0.0	0.0	546
16	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.4	0.2	0.0	0.1	0.4	0.2	0.1	0.1	113.1	20.0	35.8	2.1	0.5	8.4	0.0	183
17	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.2	0.5	0.5	1.9	0.5	3.0	2.2	0.1	1.2	0.0	0.3	0.3	0.3	11
18	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.5	0.9	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	3
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	1.7	0.9	1.3	4.2	2.0	0.6	4.6	0.1	0.2	0.8	0.1	0.1	4.4	21
20	4.0	2.3	3.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.1	2.3	6.4	13.7	4.1	8.7	21.3	7.3	6.4	0.3	2.6	0.0	83
21	0.4	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.5	0.3	0.7	0.3	0.6	0.1	0.1	0.3	0.1	0.7	0.1	0.0	0.0	4
22	2.2	0.7	0.0	0.2	18.8	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.7	0.1	0.2	5.5	0.5	0.2	0.1	0.5	0.0	43
23	0.0	1.3	8.2	10.0	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.5	0.5	1.0	0.3	1.4	3.2	0.4	0.7	0.2	0.8	2.5	0.2	0.0	33
24	0.0	0.0	0.0	0.0	0.0	26.7	16.5	0.0	0.0	0.0	0.1	0.3	0.5	0.1	1.8	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	46
25	0.0	0.4	1.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.8	0.1	0.0	0.2	25.2	116.0	3.3	3.9	0.0	0.0	1.8	0.2	0.6	154
26	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	2.2	0.3	0.2	0.2	1.3	11.1	0.3	19.6	0.3	5.1	12.2	1.8	1.8	58
27	7.0	9.7	0.1	0.0	0.2	0.1	2.4	0.1	0.0	2.4	0.0	4.4	3.1	2.3	153.4	107.6	45.9	50.1	0.5	0.0	0.0	16.7	0.1	0.0	406
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	0.1	0.0	0.0	1.8	22.7	1.4	0.0	10.6	85.0	2.1	0.0	124
29	0.2	2.0	9.0	0.1	2.7	1.4	0.0	0.0	0.0	0.0	17.3	66.0	34.2	32.0	61.6	44.7	35.8	27.6	10.7	50.3	55.7	9.4	0.0	0.0	461
30	0.0	0.0	0.0	0.9	0.3	4.4	7.3	1.6	0.4	0.5	0.7	0.3	0.6	0.8	0.1	0.5	0.3	0.5	0.0	0.0	0.1	0.0	0.0	0.5	20
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.2	0.5	0.6	0.6	0.8	0.1	1.4	0.5	0.0	0.0	0.0	3.9	8.5	14.1	32
KWh	**109**	**18**	**28**	**11**	**78**	**49**	**50**	**23**	**39**	**17**	**40**	**107**	**43**	**66**	**360**	**280**	**411**	**304**	**124**	**148**	**149**	**141**	**43**	**138**	**2778**

Malamjabba September 2006 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	62.7	9.4	0.5	0.4	1.9	0.4	0.0	42.1	115.7	131.0	0.8	0.1	1.6	0.2	0.4	0.1	0.0	1.7	0.9	0.5	0.3	0.1	0.0	0.7	372
2	0.5	0.5	0.3	0.0	0.0	9.9	8.5	4.6	0.9	0.0	0.0	0.0	0.1	7.5	7.7	8.2	4.2	0.1	2.5	16.4	10.9	32.0	154.1	57.1	326
3	26.3	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5	0.1	46
4	0.0	0.0	0.0	17.0	63.3	47.1	8.9	52.4	8.5	0.1	0.0	0.0	0.5	0.0	0.0	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	198
5	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.8	0.1	0.8	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5
6	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.6	0.1	0.3	0.1	0.5	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	2.6	2.6	3.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.9	0.7	3.1	4.1	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	10
9	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	1.0	0.3	0.3	0.2	0.4	0.0	0.3	0.0	0.0	0.0	0.0	0.1	4
10	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.5	0.5	0.9	0.6	0.7	0.4	12.1	35.5	4.6	2.1	6.0	0.0	0.1	0.4	65
11	3.6	5.6	3.9	0.7	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.3	2.4	1.3	6.1	2.3	5.2	0.4	0.0	0.9	15.0	2.3	30.7	28.5	110
12	80.5	4.2	2.8	1.0	2.0	0.0	0.0	0.7	1.3	3.5	0.4	1.6	3.9	6.0	6.7	3.3	0.5	0.1	0.6	8.3	35.0	4.3	9.5	0.0	176
13	1.3	0.4	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.2	0.1	0.2	0.7	0.0	0.0	3.1	0.0	1.6	0.0	0.0	0.0	9
14	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.6	3.5	109.9	58.4	42.4	3.8	0.1	0.0	0.0	0.0	0.0	0.0	219
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.5	0.0	0.1	0.3	5.2	2.2	3.3	7.8	5.3	0.0	0.0	0.0	0.0	0.0	40
16	0.0	0.0	0.0	0.0	0.0	3.4	0.7	0.0	0.0	0.0	0.0	0.5	2.0	0.6	0.3	0.8	0.7	0.7	0.4	0.0	0.0	0.0	0.0	0.0	10
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.7	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
18	0.0	0.0	0.0	0.0	0.8	0.6	0.0	0.0	0.0	0.1	0.0	0.5	0.7	0.1	2.6	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6
19	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.5	1.2	97.4	131.7	69.1	27.8	0.1	0.1	0.0	0.1	0.0	2.5	10.2	352
20	2.9	3.6	50.4	8.5	0.0	6.3	13.0	0.4	0.0	0.0	0.4	2.2	2.8	0.8	0.3	0.6	1.8	0.1	0.0	0.5	0.8	0.4	0.2	1.1	97
21	0.0	0.0	6.2	44.6	18.2	0.2	17.7	13.0	2.2	0.2	0.9	1.0	1.8	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.1	107
22	62.4	1.0	6.0	74.4	296.0	104.9	186.2	144.2	64.6	27.2	11.1	0.0	0.1	1.2	1.5	1.6	0.0	0.1	8.1	0.1	0.0	0.0	0.0	0.0	991
23	0.0	0.0	0.0	0.0	1.5	0.1	0.1	1.5	0.1	0.1	0.3	0.5	1.9	1.3	0.8	0.9	0.0	0.0	0.0	0.0	0.0	1.4	3.2	1.3	15
24	1.2	0.0	0.0	0.0	0.1	0.5	4.1	0.2	0.2	0.1	0.1	0.8	0.7	0.6	0.0	0.4	1.1	0.3	0.0	0.0	0.7	0.0	0.0	2.0	13
25	8.5	1.5	0.0	0.3	3.9	0.0	0.0	0.0	0.0	0.0	0.6	0.3	0.2	0.4	0.4	0.2	0.5	0.0	0.0	0.0	0.0	0.0	30.6	1.8	49
26	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	1.2	0.0	0.5	2.6	2.8	37.9	67.2	34.2	2.3	0.0	7.6	106.6	264
27	30.7	13.5	0.0	0.0	0.1	0.0	0.8	2.0	14.5	3.4	0.2	5.6	1.0	0.5	0.5	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74
28	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.7	1.8	1.8	0.3	0.3	0.6	0.0	0.7	0.0	0.0	0.2	0.0	0.0	6
29	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.8	2.2	0.1	0.1	0.3	0.3	2.7	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	9
30	1.6	0.0	0.0	0.0	0.0	0.0	2.0	0.6	0.0	0.0	0.1	0.4	0.9	2.4	0.3	1.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	9
KWh	293	41	71	147	388	174	242	264	210	181	18	20	31	134	285	164	107	89	94	63	73	41	257	210	3597

Malamjabba October 2006 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	1.4	1.6	14.3	7.6	0.1	0.5	2.5	0.1	0.1	1.5	1.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	**31**
2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	3.3	1.7	2.0	1.6	1.1	0.0	16.5	1.8	0.9	0.6	0.3	24.1	**55**
3	16.0	3.6	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.3	0.3	2.1	1.4	2.7	7.3	6.9	0.3	1.4	0.0	0.0	0.0	0.0	**45**
4	0.0	0.0	0.5	0.8	0.2	0.1	0.0	0.0	0.0	0.0	3.8	3.2	0.3	1.9	12.0	1.7	0.5	10.6	10.5	21.6	26.3	11.7	8.0	1.0	**115**
5	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.5	1.7	1.4	0.0	0.0	0.9	1.6	2.6	3.2	0.1	0.5	2.7	0.6	0.0	0.0	3.8	**21**
6	1.7	0.2	0.7	4.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9	0.8	0.9	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	**11**
7	0.0	0.1	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.5	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	**3**
8	1.8	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	**4**
9	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1	0.0	0.0	0.2	1.8	0.0	0.1	0.2	1.2	0.0	0.2	0.0	0.0	13.0	5.4	0.0	131.3	**154**
10	22.6	123.2	109.7	223.6	248.1	9.4	0.6	2.3	30.4	26.9	6.5	3.5	2.0	0.7	0.0	0.1	0.0	0.0	0.1	0.0	0.0	1.9	0.5	0.5	**812**
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.1	0.1	1.2	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3**
12	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.8	0.0	0.0	0.0	0.0	1.9	17.3	0.2	35.6	16.8	10.4	0.3	**85**
13	48.2	166.3	80.0	55.4	106.4	271.6	176.5	45.2	43.1	5.5	6.8	0.1	0.0	0.0	0.3	0.0	5.0	20.7	27.4	0.5	1.2	0.1	0.8	0.1	**1061**
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	25.1	54.0	2.2	4.4	22.5	47.4	24.3	0.0	0.0	**180**
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	1.3	0.0	3.3	30.7	16.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**52**
16	0.0	0.0	0.0	0.0	0.0	0.0	18.1	9.9	11.0	2.8	1.3	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	18.5	25.4	3.2	0.6	**92**
17	0.0	0.0	20.0	6.6	0.7	0.5	0.0	0.0	7.5	0.5	0.1	0.6	0.0	0.3	0.5	0.3	0.0	0.0	1.4	0.0	0.0	0.0	0.1	3.0	**42**
18	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.3	3.3	9.1	15.0	26.3	32.6	**89**
19	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.4	0.5	3.6	173.1	147.3	65.2	23.1	21.7	4.3	0.2	**440**
20	0.3	0.0	0.8	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	1.1	0.3	0.0	0.2	2.9	0.0	0.1	0.1	**7**
21	0.5	0.2	0.0	0.0	0.0	0.0	0.1	0.5	1.8	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.1	0.3	0.7	1.3	0.0	0.2	0.0	0.0	**6**
22	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1**
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	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.4	0.2	0.0	0.0	0.1	4.6	82.3	1.2	7.5	1.6	**98**
25	0.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.1	4.5	1.6	0.1	0.0	10.8	**19**
26	9.8	0.0	0.0	0.1	0.0	0.0	10.9	1.1	0.0	0.0	0.0	0.0	0.2	1.0	24.4	41.6	21.8	0.0	12.0	1.6	0.1	0.0	1.9	10.7	**137**
27	0.1	2.2	41.5	46.2	2.3	128.7	81.0	4.7	21.8	13.2	21.5	7.4	0.0	0.0	0.0	0.0	1.9	24.9	22.2	13.9	29.1	69.7	43.9	15.1	**591**
28	3.2	1.3	3.5	10.6	22.4	9.2	6.2	1.6	0.2	9.9	3.7	0.8	0.9	0.3	0.9	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	**75**
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	1.4	1.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4**
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1**
31	0.0	0.0	0.0	0.0	0.0	1.7	3.1	28.7	25.4	47.3	31.5	14.6	11.4	0.1	0.2	0.1	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.0	**165**
KWh	**107**	**298**	**259**	**349**	**382**	**437**	**305**	**94**	**143**	**110**	**79**	**39**	**27**	**44**	**65**	**82**	**100**	**241**	**263**	**146**	**292**	**194**	**107**	**236**	**4401**

Malamjabba November 2006 **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	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.2	0.1	0.0	0.0	0.1	10.6	66.5	55.0	4.2	0.3	**138**
2	6.3	54.9	44.1	7.6	25.6	21.9	10.6	2.6	0.1	0.6	0.3	0.5	0.4	0.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**176**
3	0.0	0.0	0.0	0.0	0.3	2.8	28.6	35.4	2.6	0.0	0.0	0.1	0.7	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**71**
4	0.0	0.0	4.6	6.0	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	**11**
5	0.0	0.0	0.2	0.0	0.1	2.8	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4**
6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	**1**
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	1.2	0.5	0.8	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**3**
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.7	**2**
9	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	1.1	0.0	0.5	24.0	9.0	0.7	0.0	0.0	**36**
10	0.0	0.0	0.1	2.3	68.6	86.4	1.0	0.1	5.9	214.0	314.2	308.6	17.8	44.4	44.4	15.9	0.1	7.5	31.8	5.8	35.0	185.9	9.3	41.1	**1440**
11	147.0	24.9	87.0	67.0	15.1	37.5	1.9	15.5	0.1	1.7	28.9	0.6	0.0	0.1	0.3	0.9	67.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**495**
12	0.0	0.0	0.0	0.0	0.0	227.0	166.5	34.7	0.0	0.2	1.5	0.2	0.3	0.0	0.0	0.0	0.1	1.4	0.5	0.0	0.0	0.0	0.2	0.5	**433**
13	0.1	0.0	0.0	0.5	0.0	0.7	0.0	1.1	0.2	10.5	11.7	47.4	31.5	0.0	2.2	7.0	88.2	94.6	115.9	73.3	46.7	11.1	9.0	4.1	**556**
14	1.6	13.3	0.4	0.7	0.5	0.1	0.0	0.1	0.5	0.2	0.4	0.1	0.3	0.0	0.0	0.8	0.7	0.6	0.1	0.0	4.2	0.5	0.0	0.0	**25**
15	0.3	0.8	2.1	0.3	0.3	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.2	7.3	4.6	0.3	0.0	4.3	3.5	0.1	0.0	**27**
16	0.1	0.6	0.1	0.7	1.4	8.2	22.9	1.4	0.4	40.9	111.9	26.1	11.0	0.0	0.0	0.0	0.0	185.1	50.4	61.5	45.5	0.3	0.0	1.3	**570**
17	0.9	6.5	8.2	0.3	3.2	28.2	0.0	0.2	0.0	0.0	1.2	0.0	0.0	0.0	1.3	0.5	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0	**63**
18	10.9	0.0	0.1	0.1	0.0	0.8	2.6	0.1	3.7	4.1	1.7	0.5	3.6	1.1	0.5	3.1	7.1	33.8	6.8	0.1	0.1	0.4	1.3	0.5	**83**
19	3.8	0.4	0.1	0.1	0.4	0.0	0.1	0.8	0.1	0.9	1.9	2.1	0.2	0.0	0.1	0.4	14.8	1.1	0.3	0.3	0.1	1.7	2.6	0.7	**33**
20	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.4	2.1	0.0	0.0	6.9	7.3	14.7	1.0	5.5	0.5	0.2	0.7	0.1	0.0	0.0	**40**
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.7	25.9	28.0	18.4	15.9	7.8	3.1	2.9	3.0	4.7	8.6	31.8	47.4	**229**
22	66.3	35.1	80.2	72.8	67.3	60.4	84.2	68.8	69.1	71.4	47.3	18.3	21.5	14.2	12.6	3.4	7.4	13.9	5.2	1.3	0.1	0.6	0.4	3.3	**825**
23	18.8	31.9	57.9	76.2	70.7	79.4	99.3	88.1	66.0	82.3	68.1	33.6	20.6	26.3	2.3	0.5	0.1	0.5	0.0	0.8	0.0	0.0	0.0	0.0	**824**
24	0.5	1.7	5.9	2.3	28.6	50.9	62.4	99.7	137.3	85.3	57.5	31.6	24.0	16.5	1.9	2.0	0.8	1.6	4.2	2.4	2.9	0.8	3.7	8.8	**633**
25	30.2	34.6	53.9	79.7	151.7	189.4	208.3	243.6	271.6	269.4	297.2	226.6	209.5	113.6	94.4	70.7	64.3	52.2	65.4	94.2	87.9	61.8	28.4	46.0	**3045**
26	110.2	184.1	184.9	277.4	370.5	434.3	465.4	495.2	472.0	469.5	407.0	367.2	345.8	359.6	235.2	207.6	193.6	149.7	162.5	137.2	93.2	46.2	64.2	142.8	**6375**
27	182.8	212.8	252.0	255.9	271.8	272.1	261.7	297.9	278.9	207.5	152.9	124.6	74.6	66.5	33.7	6.2	10.0	3.4	0.0	0.5	0.5	0.2	0.1	0.0	**2966**
28	0.1	0.1	28.4	49.9	50.7	64.9	92.8	85.7	87.3	80.8	64.1	37.3	14.9	5.4	0.9	1.5	0.6	3.7	4.2	1.8	0.6	1.2	0.0	1.1	**678**
29	12.7	57.4	74.7	107.3	179.1	277.5	288.5	256.8	221.0	182.4	129.7	68.8	36.7	15.0	0.4	1.8	2.9	2.6	1.4	2.4	0.8	0.1	0.0	0.7	**1921**
30	17.8	67.7	46.2	84.3	143.5	185.6	191.3	178.3	156.3	92.9	42.5	9.1	1.6	0.0	1.9	8.3	5.0	1.4	0.0	0.7	11.8	20.3	7.5	29.7	**1304**
KWh	**611**	**727**	**931**	**1091**	**1449**	**2031**	**1988**	**1907**	**1773**	**1815**	**1742**	**1336**	**842**	**700**	**459**	**364**	**480**	**579**	**453**	**420**	**415**	**399**	**163**	**329**	**23005**

Malamjabba December 2006 **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	36.9	18.0	67.1	82.4	108.5	84.1	132.7	116.4	86.6	55.2	19.3	14.5	2.9	1.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	1.4	0.6	0.2	828
2	1.6	9.6	7.6	19.1	44.9	56.1	55.4	94.1	91.0	59.2	24.0	3.7	0.9	0.7	0.7	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	470
3	0.1	1.6	0.0	31.9	35.4	55.3	80.7	128.5	78.1	67.6	50.2	18.8	13.5	0.7	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.2	0.6	8.1	573
4	3.3	6.8	24.6	39.6	42.4	70.6	72.6	51.0	38.6	51.1	34.5	7.8	14.8	41.6	22.2	7.2	0.0	0.0	1.4	0.0	0.0	0.1	0.0	0.0	530
5	0.0	1.3	21.4	52.0	72.8	90.2	149.6	228.6	196.8	108.7	92.3	57.7	38.0	5.7	0.7	0.3	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.3	1117
6	1.5	9.5	16.2	7.6	18.8	23.2	49.4	62.8	87.6	83.4	42.1	22.4	4.4	2.0	1.8	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.8	0.9	435
7	0.3	6.3	16.3	30.3	31.5	61.4	84.7	108.1	121.9	103.3	67.3	57.3	38.1	21.0	6.3	0.7	2.5	1.4	0.5	1.3	0.9	0.2	0.4	0.0	762
8	0.1	9.2	29.6	53.8	47.7	61.4	88.4	95.6	109.8	79.2	45.2	31.1	19.4	6.2	1.4	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.2	679
9	0.2	7.3	20.1	31.7	61.4	89.8	82.2	56.0	56.1	62.3	16.8	8.0	3.3	7.2	7.5	5.7	16.2	22.3	15.9	24.0	17.3	6.7	20.8	18.1	657
10	17.2	29.9	41.3	70.2	77.9	91.7	101.6	79.2	71.6	89.6	44.8	11.9	6.5	23.5	37.6	78.7	86.1	92.6	121.1	114.5	158.4	112.3	106.1	88.7	1753
11	59.3	35.7	72.1	45.4	52.9	52.9	65.1	62.4	46.2	44.0	30.1	10.9	21.0	6.5	0.4	0.0	5.7	0.3	1.0	0.1	1.5	1.0	0.0	0.1	615
12	0.4	2.8	32.9	50.5	72.5	97.6	113.8	110.3	108.4	87.8	56.2	21.3	13.3	4.8	5.7	0.3	0.0	0.1	1.0	1.2	0.0	0.0	0.0	0.0	781
13	0.0	5.4	22.8	29.0	47.6	71.1	74.8	87.3	94.6	108.0	42.2	20.1	8.2	2.6	1.5	5.6	5.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	627
14	0.0	0.1	1.6	5.1	42.2	70.9	60.6	69.3	95.1	59.3	21.9	9.9	2.3	0.5	0.8	0.1	0.0	0.2	0.5	0.1	0.0	0.0	0.0	0.0	441
15	0.1	1.4	1.0	23.5	24.7	55.7	60.5	69.9	85.6	116.4	29.1	5.8	1.4	0.3	1.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	477
16	1.8	11.2	11.9	24.8	72.8	121.5	155.9	224.0	219.1	108.6	80.2	62.4	29.7	16.3	7.6	9.4	16.3	5.6	0.8	0.0	3.3	13.1	2.4	3.8	1203
17	15.0	32.7	80.4	91.8	104.8	112.2	132.3	131.7	138.6	89.2	70.5	26.2	3.5	0.3	0.1	0.0	0.0	0.3	0.4	0.5	0.1	0.0	0.0	0.0	1031
18	2.0	11.1	25.1	34.1	45.1	53.4	56.2	53.2	64.9	58.3	29.6	6.3	1.5	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	442
19	0.0	1.7	7.4	14.5	34.5	60.6	82.8	82.7	74.3	102.2	70.0	47.8	18.6	19.3	3.0	0.7	1.5	1.0	2.5	2.3	6.1	1.3	2.6	3.5	641
20	31.7	75.4	94.5	138.3	37.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	377
21	66.0	38.8	78.9	71.7	66.6	62.5	88.4	63.2	71.5	67.2	43.9	15.8	23.5	10.8	11.2	3.8	11.0	10.1	5.1	0.9	0.1	0.7	0.6	6.0	818
22	20.5	35.0	60.6	79.6	68.5	91.0	97.6	82.4	64.4	79.0	66.1	27.1	22.9	22.5	1.4	0.5	0.4	0.2	0.0	0.8	0.0	0.0	0.0	0.3	821
23	0.8	2.5	4.5	5.1	32.3	55.2	67.8	97.9	140.5	78.4	55.1	26.4	29.3	8.5	2.2	1.4	1.2	1.8	4.4	1.8	3.1	0.5	4.3	10.6	635
24	33.0	37.8	55.9	89.0	156.2	200.4	209.5	247.4	274.2	275.9	281.6	230.6	197.9	102.2	97.3	63.5	64.8	52.1	69.7	90.1	95.7	50.3	26.1	51.9	3053
25	127.2	188.6	195.4	303.9	367.9	438.1	472.5	499.7	465.1	464.2	408.9	358.9	343.3	341.5	237.7	200.3	179.5	146.8	177.7	124.5	80.0	42.7	73.3	155.3	6393
26	184.8	226.5	239.9	268.0	278.6	265.4	261.9	297.8	277.6	195.3	153.4	106.3	72.1	64.5	26.6	6.6	8.6	3.1	0.0	0.8	0.1	0.3	0.0	0.1	2938
27	0.0	2.2	34.7	50.6	52.9	71.7	93.5	79.2	87.3	79.1	64.2	29.4	14.3	3.5	1.4	0.8	0.8	5.6	2.5	1.4	1.2	0.6	0.0	2.1	679
28	16.2	64.1	85.9	112.4	186.9	281.3	293.7	249.1	217.0	168.0	127.8	60.3	34.3	9.9	0.2	2.3	2.6	2.5	1.3	2.8	0.5	0.1	0.0	0.8	1920
29	26.5	67.1	50.1	93.1	155.1	190.6	190.3	172.9	148.9	76.5	36.1	8.2	1.5	0.0	2.2	8.4	5.0	0.9	0.0	0.8	13.7	19.5	9.9	36.4	1314
30	27.5	25.3	72.7	83.5	108.0	90.5	129.9	118.8	75.9	51.7	16.4	11.3	2.7	1.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.8	0.3	0.3	818
31	1.6	12.7	6.6	21.1	50.1	55.5	60.1	94.1	91.8	49.5	19.8	3.4	0.8	0.9	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	470
KWh	676	978	1479	2054	2599	3182	3664	3914	3779	3118	2139	1322	984	727	480	399	408	348	406	368	382	254	249	388	34295

Malamjabba January 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	0.1	1.8	21.0	31.6	41.0	55.4	95.1	123.0	70.4	68.0	44.1	16.5	11.3	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.2	1.5	7.4	**590**
2	3.5	9.4	27.8	40.5	42.7	74.8	71.4	48.3	36.9	51.9	29.6	7.5	18.9	38.7	22.4	3.9	0.0	0.3	1.1	0.0	0.0	0.1	0.0	0.0	**530**
3	0.0	3.4	0.0	57.7	73.9	97.7	161.3	235.7	172.6	112.3	83.2	57.3	31.3	3.7	0.7	0.3	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.3	**1092**
4	2.3	10.3	17.4	8.0	17.7	28.6	53.4	65.8	88.2	78.9	37.7	18.4	2.6	2.2	1.6	0.1	0.4	0.3	0.1	0.0	0.0	0.0	1.3	0.3	**435**
5	1.8	4.9	21.1	31.1	32.3	75.6	81.2	104.2	128.8	94.3	67.8	55.0	34.7	16.5	4.9	1.1	2.4	1.0	0.8	1.2	0.7	0.2	0.4	0.0	**762**
6	0.1	12.3	37.8	49.0	51.2	61.9	93.5	93.5	114.4	69.1	43.5	28.1	17.3	5.3	1.3	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.2	**679**
7	0.8	10.2	20.2	37.6	67.5	86.5	78.4	55.3	61.1	54.4	15.2	5.3	3.2	9.7	4.8	7.6	21.4	15.9	17.4	29.0	12.0	7.7	23.2	15.7	**660**
8	17.2	35.7	43.0	70.7	80.9	92.1	102.0	77.6	73.6	84.4	36.7	12.1	8.0	24.0	44.9	80.2	83.9	99.0	133.1	109.7	159.2	100.3	103.6	93.7	**1766**
9	51.2	39.3	72.1	41.6	53.8	54.1	71.4	54.6	47.2	41.5	25.7	15.8	14.9	5.6	0.4	1.1	4.6	0.3	1.0	0.1	1.8	0.8	0.0	0.1	**599**
10	0.5	2.8	43.2	50.5	76.9	102.6	107.0	118.3	103.6	83.2	51.7	15.7	13.6	3.2	5.7	0.0	0.0	0.1	1.0	1.1	0.0	0.0	0.0	0.0	**781**
11	0.0	10.3	18.7	36.2	52.8	68.4	75.9	90.8	99.9	98.6	36.5	16.2	7.2	2.3	1.3	6.9	4.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	**627**
12	0.0	0.1	2.1	7.1	50.7	71.0	60.0	72.4	95.8	50.4	18.0	8.8	2.3	0.2	0.8	0.0	0.0	0.3	0.3	0.1	0.0	0.0	0.0	0.0	**441**
13	0.1	1.5	3.5	25.4	26.9	58.2	62.4	69.7	98.7	99.7	23.3	4.7	0.8	0.4	1.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	**477**
14	3.5	10.3	11.9	32.4	88.2	122.2	160.8	234.9	199.7	102.9	77.3	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1056**
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
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	0.0	0.0	**0**
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	0.0	0.0	0.0	0.0	0.0	**0**
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
KWh	**81**	**152**	**340**	**519**	**757**	**1049**	**1274**	**1444**	**1391**	**1090**	**590**	**273**	**166**	**112**	**90**	**101**	**117**	**118**	**155**	**142**	**174**	**110**	**130**	**118**	**10492**

Malamjabba February 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	0.1	0.1	1.6	2.1	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6
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	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.2	2.9	0.3	1.7	1.8	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.2	0.7	2.9	7.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	4.9	0.7	0.8	1.1	3.9	0.3	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	12
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
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	0.0	0.0	0
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	1.5	1.8	0.0	0.0	0.0	0.0	0.0	3
26	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
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
KWh	0	0	0	2	0	0	0	0	1	2	10	4	9	12	7	1	0	2	2	0	0	0	0	0	51

Malamjabba March 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.5	4.4	1.9	7.5	18.1	**35**
17	46.0	90.8	81.6	99.9	104.1	63.1	52.4	51.5	34.9	32.6	10.1	46.8	131.6	89.3	20.1	14.5	82.4	45.7	69.2	171.5	237.6	57.0	231.2	312.5	**2176**
18	90.4	344.2	381.2	329.2	250.1	281.3	169.0	288.0	101.3	87.9	39.3	1.2	121.3	160.9	62.4	136.3	135.1	12.2	36.4	47.9	14.4	43.7	342.3	495.4	**3971**
19	367.9	440.0	149.9	136.0	75.8	30.7	25.4	28.4	50.3	58.3	49.1	88.3	242.4	230.8	460.2	253.6	132.6	305.1	333.7	167.4	29.6	175.5	70.2	5.8	**3907**
20	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.2	25.7	28.1	17.5	1.6	1.8	30.6	20.3	3.8	2.3	3.2	**141**
21	4.5	42.5	0.0	0.1	1.8	0.6	0.6	0.0	0.0	7.2	2.9	31.5	324.2	15.4	124.8	75.7	31.0	11.7	15.1	13.1	25.2	17.4	0.0	0.1	**745**
22	2.4	2.4	0.1	0.3	1.8	35.9	63.8	61.6	72.8	4.6	0.5	11.7	3.6	6.4	2.3	0.0	0.1	0.0	0.0	0.5	0.3	0.0	13.8	2.3	**287**
23	0.2	10.2	27.9	16.7	4.6	1.7	1.4	0.3	1.1	0.4	1.4	10.0	9.3	1.3	0.5	8.8	0.1	0.0	0.3	1.0	1.2	12.6	16.1	7.8	**135**
24	6.7	35.2	72.7	89.9	56.0	19.8	2.0	32.8	11.4	0.8	0.2	0.1	0.8	2.5	0.5	0.0	0.0	0.0	0.0	5.1	1.6	9.6	0.9	0.1	**349**
25	0.0	1.7	0.7	0.0	0.0	3.9	9.6	0.1	0.1	0.9	8.8	2.3	20.9	6.5	2.0	0.5	0.0	0.6	0.3	1.4	0.0	0.0	0.0	0.0	**60**
26	5.9	27.6	0.5	0.0	0.0	4.0	45.1	42.0	75.1	35.9	2.6	0.7	3.0	1.1	0.1	0.0	1.2	3.0	24.4	5.4	0.0	0.1	0.9	11.1	**290**
27	53.9	28.9	15.5	2.4	0.0	0.0	1.0	41.2	20.3	27.8	7.6	6.7	3.1	0.3	1.2	0.3	0.9	0.0	0.0	0.0	7.9	2.2	8.2	2.0	**231**
28	2.7	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.2	0.1	5.2	65.8	38.7	62.0	0.0	0.0	0.0	**176**
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	0.0	0.0	0.0	0.0	0.0	**0**
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
KWh	**581**	**1024**	**730**	**674**	**494**	**445**	**370**	**546**	**367**	**256**	**123**	**199**	**861**	**516**	**700**	**518**	**401**	**385**	**547**	**485**	**404**	**324**	**694**	**859**	**12504**

Malamjabba April 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	0.1	0.0	56.6	188.9	82.6	44.3	0.8	0.9	2.0	0.6	0.1	0.4	54.2	11.8	0.0	0.0	0.0	0.0	0.0	443
2	0.0	0.0	0.0	7.4	8.7	0.5	0.0	55.2	46.3	4.9	0.7	9.4	2.1	0.1	0.2	4.6	31.5	13.5	52.8	23.7	0.0	0.0	0.0	0.0	261
3	0.0	0.0	0.0	0.1	2.3	3.0	2.1	4.3	70.1	258.2	247.6	39.4	90.7	34.9	21.0	54.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	828
4	0.0	0.0	0.0	1.5	0.5	0.5	9.1	1.8	3.1	6.3	0.8	11.1	11.6	2.4	5.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56
5	0.0	0.0	0.0	0.0	0.3	0.7	6.2	5.8	16.0	30.3	32.3	20.6	26.8	28.7	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	168
6	0.0	0.0	0.1	10.9	6.3	0.9	2.4	2.8	0.3	1.0	0.8	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27
7	0.0	0.0	11.6	19.8	23.9	27.8	12.5	13.4	0.1	0.5	0.3	0.0	0.0	0.0	2.1	23.1	20.8	36.2	8.5	1.3	3.5	13.3	24.9	8.4	252
8	10.0	37.2	31.0	34.0	26.9	10.6	2.6	5.0	1.7	0.3	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	160
9	0.0	0.0	0.0	0.0	0.4	4.2	1.7	29.7	11.8	1.4	1.7	3.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54
10	0.0	0.0	0.0	0.0	0.0	0.1	0.8	4.1	3.9	6.1	5.7	7.8	1.9	0.0	1.1	2.3	0.0	0.0	0.0	0.0	0.1	1.5	0.2	0.0	36
11	0.3	0.0	0.1	0.0	0.0	0.1	0.5	3.9	6.6	9.5	3.5	3.6	6.1	1.4	0.1	0.0	0.1	0.0	0.3	3.0	0.2	0.0	0.0	0.1	39
12	1.1	0.1	0.9	28.5	2.7	4.3	20.9	1.5	2.0	4.4	5.5	3.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.7	0.0	77
13	0.0	0.0	0.0	0.0	0.0	1.0	2.7	3.7	2.9	4.1	5.6	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.5	0.0	1.7	3
17	0.7	3.9	14.5	35.9	50.2	8.3	4.7	3.5	0.2	0.1	0.0	0.1	0.5	0.5	0.0	0.4	6.8	9.5	47.5	319.2	232.2	135.4	1.4	0.1	876
18	0.0	0.0	0.0	0.1	4.6	6.5	4.0	0.1	22.4	165.5	23.7	13.2	4.7	0.9	3.3	6.7	9.2	5.7	0.1	0.2	1.3	0.6	0.2	2.0	275
19	0.0	0.7	0.0	0.6	0.0	6.1	28.5	5.2	0.1	1.0	0.5	1.2	3.4	7.4	13.9	93.9	110.3	54.3	201.0	164.6	29.2	34.5	32.2	0.5	789
20	0.0	0.0	0.0	0.0	10.3	53.4	48.6	13.0	2.0	6.2	2.2	2.8	3.4	2.9	0.7	0.8	0.2	2.9	0.0	0.0	0.0	0.0	0.1	0.0	149
21	0.0	1.2	3.5	16.9	11.4	20.8	0.2	35.5	0.9	0.0	0.1	0.5	2.0	8.2	11.3	9.5	4.2	1.1	0.0	0.0	0.1	0.0	0.0	0.0	127
22	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.8	2.8	4.2	4.5	3.6	14.2	22.8	11.3	35.9	59.0	62.2	16.9	45.7	29.2	8.1	321
23	108.1	276.8	236.4	166.8	87.3	1.9	4.5	4.6	0.3	3.0	3.5	11.3	2.3	5.5	0.5	3.2	12.3	6.5	2.5	0.1	0.0	0.0	0.0	0.0	938
24	0.0	0.1	15.0	53.2	16.2	31.7	25.6	31.8	5.4	0.2	1.6	3.9	6.8	1.5	54.7	44.4	38.4	175.3	99.7	10.7	4.3	0.2	0.0	0.1	620
25	0.0	0.5	5.3	6.3	0.5	0.0	0.0	0.1	4.7	6.3	16.8	11.9	5.5	2.3	5.1	7.9	6.9	9.9	1.7	0.2	6.1	6.7	1.7	0.0	106
26	0.0	0.0	0.1	0.8	1.1	0.0	9.4	57.3	32.0	33.0	42.6	29.8	2.2	8.3	7.6	4.7	4.0	1.8	0.7	0.0	0.0	0.0	0.1	0.0	235
27	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.9	8.4	6.3	5.0	12.5	20.8	7.7	7.9	11.6	8.6	2.0	0.1	6.7	3.8	1.3	0.1	0.0	104
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	1.5	2.2	6.8	9.7	4.8	3.9	1.7	0.7	0.0	0.4	0.0	14.8	0.3	48
29	1.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	4.8	2.6	3.7	1.5	2.6	20.7	65.3	22.2	7.6	1.9	26.9	2.7	0.3	63.5	228
30	59.1	7.3	0.4	9.5	19.3	5.6	1.9	37.6	9.7	20.3	0.6	6.6	9.9	1.7	0.8	6.3	5.2	3.1	1.2	0.1	0.0	0.0	0.4	0.3	207
KWh	181	328	319	392	273	188	189	377	440	652	454	205	214	128	164	325	339	436	495	594	326	242	106	85	7452

Malamjabba 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
20	186.7	0.1	65.6	122.2	14.3	29.8	64.1	15.3	18.0	2.0	3.7	13.3	1.8	1.3	0.3	0.0	1.5	11.1	11.0	0.5	0.0	7.8	16.4	3.8	590
21	0.1	0.1	0.0	0.2	0.4	0.0	0.0	0.3	0.0	4.3	0.3	6.7	0.3	1.5	41.8	205.7	218.3	51.1	8.5	21.7	10.3	35.2	34.6	95.1	737
22	26.2	13.0	0.9	0.7	1.1	1.7	13.7	4.1	5.9	0.9	0.2	1.5	0.2	0.5	0.4	1.1	0.3	0.0	0.5	32.3	4.3	0.6	0.4	129.9	240
23	1.1	0.0	0.0	0.0	0.3	9.1	3.5	1.5	3.9	7.6	32.8	69.4	3.3	0.6	3.1	0.5	0.0	0.8	1.5	0.0	1.4	1.1	2.0	1.9	145
24	0.8	1.5	3.6	4.5	5.8	7.0	3.7	3.6	16.3	36.6	22.1	43.0	20.8	1.3	0.0	0.0	0.7	4.5	6.0	23.8	12.5	1.1	5.3	2.5	227
25	1.0	0.4	0.0	0.0	0.1	0.0	0.7	0.7	1.8	0.3	0.0	0.0	99.1	343.6	195.8	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	650
26	0.0	4.5	0.9	0.1	1.6	5.8	4.9	0.9	0.0	98.1	9.6	6.5	10.8	0.7	17.8	13.5	15.1	0.7	0.3	0.0	0.1	0.0	1.4	10.8	204
27	20.0	6.2	2.4	12.5	39.4	33.9	5.6	6.0	2.7	13.4	17.7	49.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	209
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	0.0	0.0	0.0	0.0	0.0	0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
KWh	236	26	73	140	63	87	96	32	49	163	86	190	136	349	259	227	236	68	28	78	29	46	60	244	3003

Malamjabba 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0**
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.5	70.5	101.6	16.4	1.2	0.2	0.0	0.0	0.6	1.0	**238**
16	0.1	0.1	4.8	0.3	7.3	0.7	0.3	0.1	0.0	5.7	10.9	24.4	79.1	221.2	179.0	192.8	1.9	1.1	8.4	2.1	0.3	1.4	3.8	36.7	**783**
17	222.5	45.8	10.9	4.7	0.1	0.0	0.5	0.1	0.0	0.0	0.9	0.2	0.3	31.4	92.8	151.2	4.7	5.4	1.5	0.4	0.0	1.3	1.9	6.7	**583**
18	1.9	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.3	9.9	93.4	119.7	89.8	6.1	5.3	0.0	0.0	0.1	6.0	0.0	**335**
19	0.9	6.9	17.6	0.2	0.7	0.0	0.0	0.0	0.0	0.3	2.4	2.0	1.7	35.0	115.8	91.3	155.8	6.0	0.0	2.9	5.2	11.3	14.8	5.0	**476**
20	0.9	0.5	1.9	0.3	0.0	0.0	0.0	0.0	0.0	0.8	1.9	2.5	1.1	0.5	0.3	1.2	1.5	5.5	2.9	0.3	0.0	0.0	0.0	0.0	**22**
21	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.6	5.0	8.1	5.9	4.0	7.8	6.5	9.2	5.4	1.2	0.0	0.0	0.0	0.0	0.0	**54**
22	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.7	0.4	0.8	2.6	7.7	9.1	13.3	13.8	7.2	4.6	2.5	0.6	12.7	124.7	40.4	12.1	0.1	**254**
23	0.1	7.1	5.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.4	3.3	1.0	1.4	0.8	4.2	0.9	0.3	0.0	0.1	0.0	0.0	**27**
24	0.0	0.0	0.0	0.1	0.0	0.1	4.2	0.1	0.1	0.1	0.1	1.0	1.0	5.5	4.6	3.9	2.8	4.6	2.0	0.0	0.0	0.1	0.0	0.0	**30**
25	0.0	0.1	0.0	1.6	0.1	0.0	0.0	0.5	0.0	0.5	39.4	125.6	20.3	42.2	0.8	6.2	6.4	3.6	8.3	0.7	0.0	71.2	15.6	10.0	**353**
26	2.6	2.1	15.2	1.3	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.9	0.8	0.8	6.9	13.9	93.8	35.1	0.3	0.0	0.1	0.0	0.0	**174**
27	0.0	0.2	0.0	22.3	1.4	0.0	0.2	0.0	0.0	0.0	0.1	0.4	0.1	1.6	0.6	0.2	0.2	17.8	0.3	0.1	0.6	0.1	0.0	0.0	**46**
28	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.7	56.9	93.5	27.9	37.7	119.0	234.6	353.1	68.4	36.0	174.7	465.8	440.7	287.6	37.3	0.1	2.0	**2436**
29	0.0	0.5	2.2	104.5	155.5	11.6	26.0	0.1	39.0	104.4	94.2	19.7	17.3	3.5	0.1	0.0	17.4	22.2	4.3	7.0	6.0	3.9	0.3	6.8	**647**
30	2.5	2.8	0.1	0.0	3.2	4.2	0.3	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.9	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	**15**
KWh	**231**	**67**	**59**	**135**	**168**	**17**	**32**	**2**	**96**	**207**	**186**	**230**	**258**	**607**	**911**	**728**	**447**	**369**	**538**	**468**	**424**	**167**	**55**	**68**	**6472**

Malamjabba 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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.1	0.0	0.0	1.0	0.3	0.2	0.1	0.0	0.0	2
2	72.0	123.2	99.3	232.8	313.2	111.4	2.1	2.4	0.0	0.1	0.1	0.1	0.3	4.9	26.6	3.7	13.3	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1006
3	0.0	0.0	0.0	0.0	1.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.1	1.1	2.3	1.0	1.2	0.2	0.0	0.0	0.0	0.0	0.0	12
4	0.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.1	0.0	0.9	0.5	0.1	3.5	0.1	0.0	0.0	0.0	0.0	0.0	7
5	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.5	1.3	0.8	0.5	0.6	0.4	0.1	9.7	2.0	224.3	41.9	11.0	0.3	2.7	296
6	0.0	0.3	2.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.7	1.2	0.5	0.1	0.5	0.0	0.0	0.0	0.0	0.0	1.1	7
7	0.0	0.1	0.0	1.2	0.2	1.1	16.2	69.1	120.5	17.0	1.2	0.5	1.8	2.0	0.3	0.5	0.1	0.5	2.3	18.0	4.3	130.6	90.2	2.0	480
8	2.6	103.3	28.4	369.7	320.4	343.5	184.5	150.4	58.1	0.7	0.3	0.3	0.2	0.5	3.3	0.9	0.9	0.5	0.8	9.8	0.1	2.8	0.3	0.1	1582
9	0.0	0.0	0.0	0.0	0.0	3.5	23.3	6.0	5.5	0.2	0.1	1.0	0.6	1.8	2.3	2.9	5.7	3.8	0.1	0.0	0.4	0.0	0.0	0.0	57
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	2.2	1.3	1.4	1.4	0.1	0.0	0.0	0.2	0.0	0.1	7
11	2.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	1.4	2.7	2.0	3.2	3.8	4.0	2.2	1.3	0.0	0.9	0.0	0.1	0.0	1.9	27
12	0.0	2.6	0.2	0.5	0.1	0.3	0.1	0.3	0.1	0.4	0.7	1.7	0.1	0.0	2.1	9.6	55.3	22.1	112.1	2.6	24.4	0.5	1.6	2.5	240
13	0.8	1.7	0.6	0.0	0.5	0.0	4.8	38.2	3.8	111.8	146.0	204.3	143.8	20.7	3.4	74.6	20.8	120.2	60.0	40.4	0.0	0.0	0.0	0.0	996
14	0.0	0.0	0.5	7.0	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.2	3.5	1.8	0.7	1.7	78.1	57.7	219.4	70.1	24.8	10.1	2.1	2.4	481
15	0.2	0.2	0.3	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.3	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	3
16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.4	0.7	0.7	16.6	0.1	1.2	0.2	0.1	0.0	0.3	0.1	21
17	0.0	1.0	1.0	1.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.6	1.5	0.0	7.3	1.8	0.0	0.0	0.0	0.0	0.0	0.0	16
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	0.4	0.9	4.3	1.6	1.2	0.0	0.0	1.5	0.0	0.0	0.0	0.0	11
19	0.0	0.1	2.5	0.3	0.0	0.0	0.0	0.0	0.1	0.0	2.2	2.2	2.5	3.7	7.3	6.6	3.1	0.9	0.8	0.1	0.1	7.6	12.7	7.9	61
20	6.3	5.1	2.2	3.0	0.5	0.4	0.3	0.0	0.0	1.4	0.8	1.2	0.8	0.4	0.3	4.1	28.4	16.6	3.4	5.4	35.1	29.0	37.0	0.0	182
21	1.3	0.0	0.0	0.0	0.6	33.3	52.0	13.1	16.7	5.1	0.0	4.5	0.7	0.0	3.8	21.1	1.5	0.1	0.4	0.4	0.1	0.0	0.0	0.1	155
22	0.1	35.6	0.1	47.4	17.0	45.7	1.4	0.0	1.3	0.0	0.1	6.4	0.9	0.1	0.1	2.5	22.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	181
23	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.0	0.7	1.0	0.2	59.1	28.3	13.0	6.1	10.7	0.5	0.0	122
24	9.2	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.5	2.3	2.6	3.1	6.0	6.2	3.4	12.5	14.9	2.0	0.3	0.1	70
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9	1.1	1.3	2.0	0.8	1.5	0.2	0.3	0.0	0.1	0.1	0.3	0.0	9
26	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.7	0.5	11.9	168.5	17.8	6.4	160.0	79.5	0.1	0.0	0.1	2.7	0.1	449
27	0.3	2.7	0.0	1.4	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	1.4	2.0	1.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.1	13
28	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.7	2.3	6.5	0.9	6.1	0.0	0.1	0.3	0.1	0.0	0.0	17
29	0.0	0.3	3.3	0.0	0.5	0.1	0.1	0.0	0.5	0.2	1.8	0.7	2.4	6.8	2.1	3.7	2.3	0.9	0.1	13.3	4.9	0.1	0.1	0.0	44
30	2.5	0.1	0.0	0.4	0.0	7.2	0.1	0.0	0.1	36.1	2.8	0.0	0.0	0.1	0.3	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51
31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.7	0.7	0.7	0.0	0.3	0.1	0.4	0.0	0.0	0.0	0.0	3
KWh	**98**	**282**	**141**	**665**	**658**	**550**	**286**	**280**	**207**	**174**	**159**	**231**	**165**	**71**	**249**	**176**	**277**	**475**	**516**	**413**	**158**	**205**	**149**	**21**	**6607**