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PRELIMINARY EVALUATION OF WIND ENERGY POTENTIAL AT BATNA IN ALGERIA

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ABSTRACT: *In this study we analyzed ten years of daily wind speed data at the region of Batna . The wind power availability is estimated. Annual mean values of wind speed and power were also calculated and discussed and frequency distribution of daily totals of wind speed data were counted and illustrated.*

KEYWORDS: *renewable energy, wind turbine, wind velocity, Weibull distribution.*

1. INTRODUCTION

✓ The aim of my present work is to establish an accurate assessment of wind energy resource in the region of Batna (NE of Algeria).

✓ This is the first step of the study and the ultimate goal is to set a techno -economical evaluation of hybrid power system (wind and solar), CNEPRU Project.

2. RESULTS AND DISCUSSION

2.1. WIND SPEED DATA

Windographer was used to analyze raw wind data (1999 to 2008).

⇒ Average wind speed: **4.36 m/s**

⇒ Long term seasonal wind speeds: higher from March to September

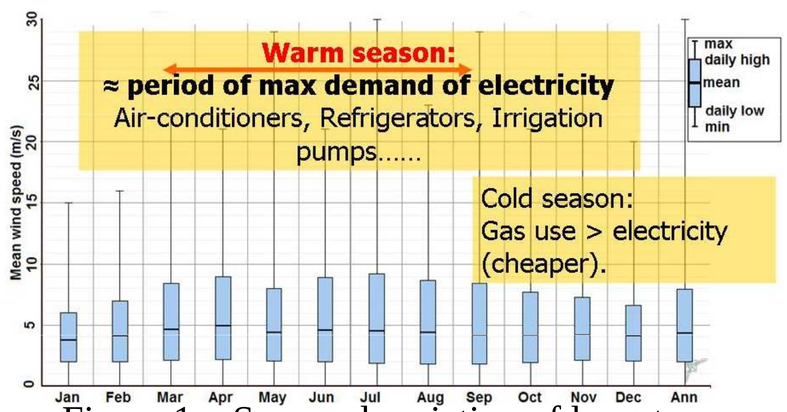

Figure 1. : Seasonal variation of long-term mean wind speed

⇒ higher wind speeds; between 09:00 and 18:00.

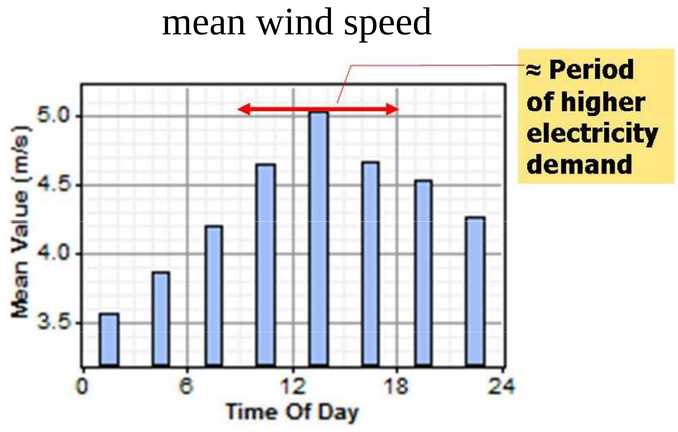

Figure 2. : Mean daily speed

⇒ Mean wind speed variation with altitude:

$$V_2 = V_1 \left(z_2 / z_1 \right)^{\alpha} \qquad (1)$$

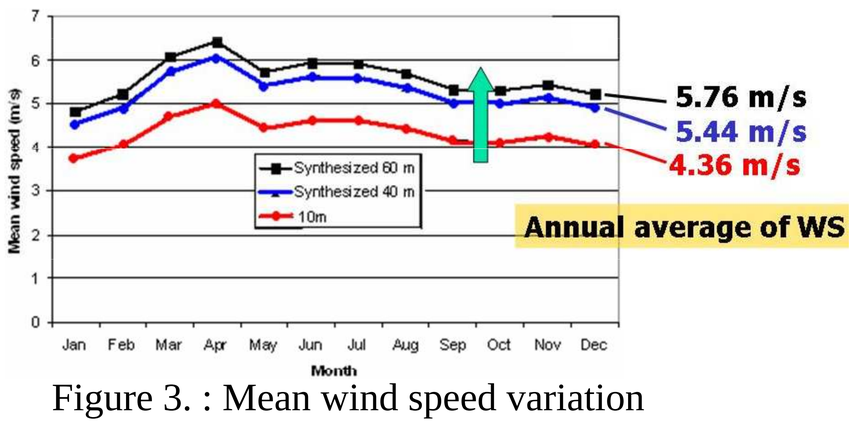

Figure 3. : Mean wind speed variation with altitude

⇒ Wind speed frequency distribution:
We used Weibull "PDF" to evaluate wind speed potential (Fig. 4):

$$f\left(V\right) = k/c\left(V/c\right)^{k-1} exp\left[-\left(V/c\right)^{k}\right] \qquad (2)$$

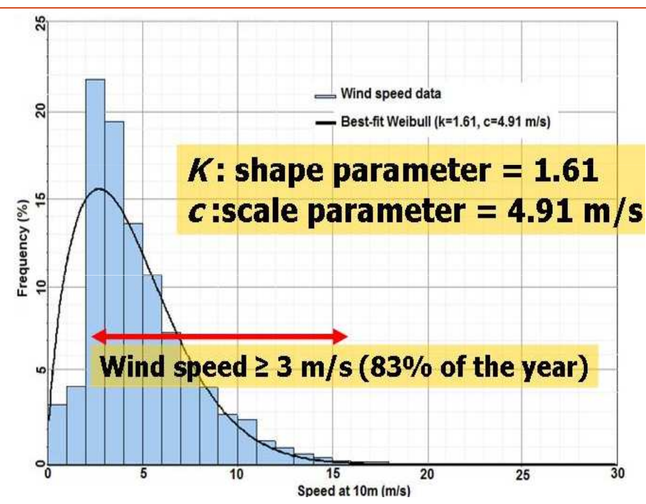

Figure 4. : Wind speed frequency distribution

2.2. CHOICE OF WIND TURBINES

Considerations:
- Wind potential of the region of Batna.
- Machines with good performance/reasonable cost.

Table 1. : Main characters of 5 different commercial wind turbines

Type	Manufacturer	Blades	D(m)	Nom. Speed (m/s)	Nom. power (kW)	Cut-in speed (m/s)
Bergey Excel-R	Bergey Windpower Co	3	6.7	11	7.50	4
Bergey Excel-S	Bergey Windpower Co	3	6.7	16	10	3
Bergey XL.1	Bergey Windpower Co	3	2.5	18	1	2.5
Fuhrländer FL	Enercon	3	21	11.5	100	3
Enercon E33	Lorax energy	3	33.4	13	335	3

< Mean WS 4.36 m/s

➢ Energy output of 5 types of wind turbines was calculated:

$$E = N_h \int P\, dV = N_h C_p \frac{1}{2} \rho A \int V^3 f(V)\, dV \qquad (3)$$

⇒ mean wind energy output is proportional to hub height see Fig.5. and Fig.6.

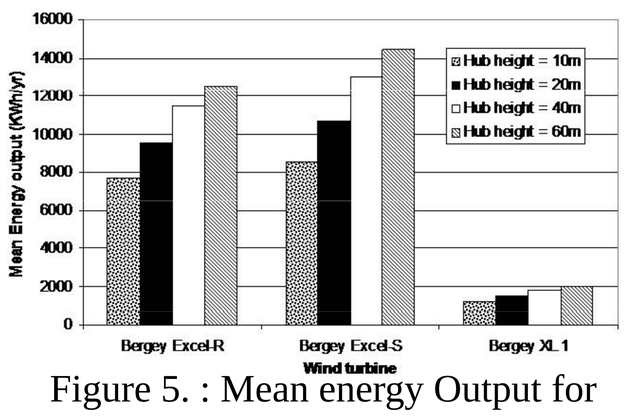

Figure 5. : Mean energy Output for Bergy (Excel-S, Excel-R and XL.1)

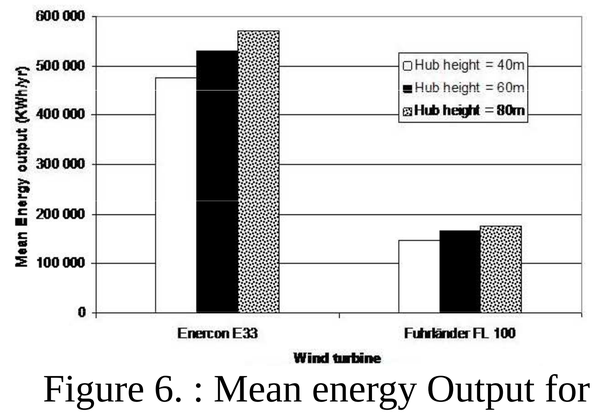

Figure 6. : Mean energy Output for E33 and Fuhrländer FL 100

3. CONCLUSION

✓ Mean wind speed
- at 10m AGL = 4.36 m/s.
- at 40 and 60m AGL = increases by 25% and 32%.

✓ Periods of higher wind speeds
- March to September in the year, from 09:00 am to 6:00 pm.
- They feet well peak demand of electricity.

✓ Frequency distribution of wind speed
- Wind speed remains at the value 3 m/s and above it for about 83% of the year → good advantage.