Designing of a Wind Power System in Azara area of Guwahati, Assam

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Abstract: ***Wind and Solar energy are the non-conventional sources of energy. It is predicted that the conventional sources of energy will get exhausted in the mere future. Taking that into consideration, a portable model is developed for the utilization of wind energy. Energy produced from the movement of blades depends on different parameters like curvature of blade, blade angle and also the associated drive system. Apart from that it is also dependent on the external factors like wind coming from nearby water sources, texture (i.e. presence of trees, mountains, sand fields) which behaves as wind corridors, seasons etc. The model can produce an output of 12W-16Wdepending on the wind speed. The paper is stressed on the various types of blade design suitable for operating in low wind velocities in Azara area whose exact location is 19.08130 ^{0}N and 72.88860^{0}E (location of School of Technology, Assam Don Bosco University).***

Keywords: Quiet resolution qr5, Wind spine, Wind Corridors, Micro-hydro power plant.

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1. Introduction

Wind is a form of renewable energy whose utilization can provide a solution for the ever increasing energy demand. The problem regarding the making of the wind generation system is blade design suitable for a particular location and the wind velocity of that location. In places surrounding the Guwahati city, the average wind speed for the month of March, 2017 is about 0.94 m/s. In such conditions it is not appropriate to install turbine blades of larger diameter and of any blade design. The maximum average hourly wind velocity in Guwahati city remains almost 0.9m/s. The maximum energy that is generated from each of the direct current generator used in our model (rated specification 600mA and 9V) is significant only if it receives the minimum wind speed required for its operation. Each of the dynamo is producing an average of 3.5V-4.5V depending on the wind velocity. The energy that is produced is stored in the battery (rated specification 12V, 7.2Ah) for future utilization. The model is placed on the terrace of Assam Don Bosco University, Azara campus.

2. Description of the model

The model is made of iron frame where four dc generators are placed in a distant position. A parallel connection two generator pairs are connected to provide a higher output. The shaft of each of the dc generator is connected to a turbine of appropriate blade design to move in a low speed wind. The generated power is stored in a battery. The output of the battery is connected to an inverter circuit and then it is stepped up to 230V AC. This voltage is used to glow a 10W bulb. The block diagram of the model is given below.

3. Area under study

The winds of Guwahati city is mostly influenced by the winds of Brahmaputra River and the corridor created by the hills surrounding the city. A case study was also being undertaken to determine the wind speed near Deepor Beel and Azara area during different times of the day.

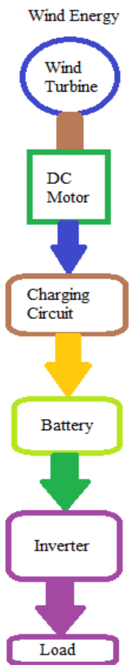

Figure1: Block diagram of Wind Generation Model

I. **TABLE 1:** TABLE SHOWING TIME AND THE WIND VELOCITIES OF DAY 1

Time	*Maximum Wind Velocity(m/s)*	*Minimum Wind Velocity(m /s)*
9:47- 9:49(am)	1.1	0.6
9:49- 10:45(am)	1.7	0.6
10:45- 10:46(am)	1.8	0.6
10:46- 10:48 (am)	3.5	2.5
10:48- 10:59 (am)	2.6	0.9
10:59-11:04 (am)	1.2	0.6
13:04-17:29 (pm)	2.6	1.7
17:29-19:03 (pm)	0	0

Location: Near Deepor Beel
Date: 04/03/2017(Saturday)

II. **TABLE 2:** TABLE SHOWING TIME AND THE WIND VELOCITIES OF DAY 2

Time	*Maximum Wind Velocity(m/s)*	*Minimum Wind Velocity(m /s)*
8:42 - 9:50 (am)	2.1	0.6
9:50-11:32 (am)	3.2	2.0
12:32- 12:34 (pm)	3.4	2
12:34- 12:36 (pm)	4.6	2
12:36- 13:30 (pm)	5.8	3
13:30- 14:00 (pm)	6.7	3
14:00- 17:33 (pm)	6.7	3
17:33 -20:17 (pm)	2.7	0.8
20:17- 20:19 (pm)	1.1	0.6

Location: Near Deepor Beel
Date: 05/03/2017(Sunday)

III. **TABLE 3:** TABLE SHOWING TIME AND THE WIND VELOCITIES OF DAY 1

Time	*Maximum Wind Velocity(m/s)*	*Minimum Wind Velocity(m /s)*
8:42-9:50 (am)	0.3	0.1
9:50-11:32 (am)	0.6	0.4
12:32 - 12:34(pm)	0.9	0.7
12:34 - 12:36 (pm)	1.7	1.5
12:36 - 13:30 (pm)	3.5	1.3
13:30 - 14:00 (pm)	3.2	2.9
14:00 - 17:33 (pm)	3.0	2.5
17:33 - 20:17 (pm)	0.7	0.3
20:17- 20:19 (pm)	0.2	0.1

Location: Azara
Date: 04/03/2017(Saturday)

IV. **TABLE 4:** TABLE SHOWING TIME AND THE WIND VELOCITIES OF DAY 2

Time	*Maximum Wind Velocity(m/s)*	*Minimum Wind Velocity(m/s)*
8:42- 9:50 (am)	0.4	0.2
9:50-11:32 (am)	0.7	0.3
12:32-12:34 (pm)	0.9	0.4
12:34-12:36 (pm)	1.5	1.0
12:36-13:30 (pm)	3.6	3.0
13:30-14:00 (pm)	3.2	2.8
14:00-17:33 (pm)	3.0	1.2
17:33-20:17 (pm)	0.5	0.4
20:17-20:19 (pm)	0.2	0.0

Location: Azara
Date: 05/03/2017(Sunday)

The second location is the area Azara where the wind speed was not as effective as first location. The normal wind velocity is almost around 0.7-1 m/s. From the results obtained it has been found that wind velocity is higher near the Deepor Beel region compared to that in Azara area and the output of the wind generation model will be much higher if placed in the Deepor Beel area.

4. Experiment performed

4.1 Design 1. Wide blade

Figure2: Wide blade

The minimum wind velocity required is 2.8-3.0m/s producing a voltage of 3.6V. When the wind reaches a velocity of 4.7-5.2m/s, it produces a voltage of 5.8V.

4.2 Design 2. Thin straight blade

Figure3: Thin straight blade

The minimum wind velocity required is 3.9m/s producing a voltage of 4V. When the wind reaches at a velocity of 4.3m/s, it produces a voltage of 4.64V.

4.3 Design 3. Curved slim light weight blade

In this model, the width of the blades is reduced keeping the length and shape of the blade constant. The minimum wind velocity required is 2m/s and produces an output voltage of 2.2V.

Figure4: Curved slim light weight blade

4.4 Design 4. Curve plastic blade

Figure5: Curved light weight blades

The design 4 blade is similar to the design 3 but is made of plastic. This will prevent corrosion. The blades are made little thicker to withstand storms which occurs frequently during monsoon. This blade model is the best model recommend for cities like Guwahati where the wind speed is low. The minimum wind velocity required by this blade is 1.7m/s producing an output voltage of 3.3V.

V. **TABLE 5:** COMPARISON OF THE BLADE DESIGNS USED IN THE MODEL

Sl. No.	*Blade design*	*Minimum wind velocity (m/sec)*
1	Wide blade	2.8-3.0
2	Thin straight blade	3.9
3	Curved slim light weight blade	2.0
4	Curved light weight blades	1.7

5. Advantages and disadvantages

The advantage of the model is that it is made up of cheap materials that are easily available in the market and this makes it very economical. The model is

portable and can be used for places where there is low and medium wind velocity. The generation capacity can be increased by cascading more blades in the model.
The disadvantage of the model is that it needs certain amount of maintenance on a regular basis.

6. Limitations

There are a few limitations of the model.

1. Output voltage is fluctuating.
2. In rainy season, the model is not useful if not cascaded with micro hydro power generation models.
3. Wind velocity remains the primary limitation of the model.

7. Future Prospect

The model can be further improved by connecting it to Micro or Nano-grid. There can be a large number of turbines cascaded to provide higher output. It also can be made to synchronize with a solar module to operate as a hybrid source.

8. Conclusion

After almost 20years, it is predicted that coal and petroleum will be exhausted. So, it is very important to engulf the renewable resources to fulfil our daily utilization of energy. This model will be especially useful for the places of low speed wind and for operating low powered devices. This model is made in a cheaper way so that it is affordable. The paper focuses on the comparison of different types of blades designs and their output for the location 19.0813^{0}N and 72.8886^{0}E which is the exact location of the School of Technology, Assam Don Bosco University.

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