Voltaic turbine – A paradigm shift proposed in generating electricity

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Abstract. Sustainable demand for electric power results in a warehouse that naturally favors development of wind turbines that are significantly quieter and more efficient for generating electricity than today’s fleet. Achieving this will require a revolutionary new concept, in particular “Magneto Voltaic Power plant” that generate electricity with the help of repulsive force which cause the turbine blades to rotate. The magneto voltaic power plant triggered the original development of wind turbines raising its energy and output power. This paper outlines the main issues involved in replacing the wind source to that of the repulsive force. It’s shown that implementation of repulsive force generates electric power at a feasible cost and this would clearly be the enabling technology for generating electricity of the future.

1. Introduction
Generation of electricity using wind power has received considerable attention worldwide in recent years. First wind turbines were built by the end of 19th century by Prof James Blyth in Scotland (1887), at which 72 wind driven electric generator produce the electric power of range 5-25 kW. Later improvisation in this technology leads to the gaining of electricity at a rate of 7.58 Mw by Enercon E-126. Advance development in the field of windmill looks out for alternating source for generating power. At present year the solar based wind turbines has filled the position for generating electric power, but the electric power that has been generated are of less power output and the cost efficiency behind the solar power is high. To meet such demand of gaining larger power generation and also to meet the cost efficient here establishes a new concept called “Magneto voltaic power plant”. The main concept behind this criterion is that uses of permanent magnet. The classic property of the magnet is that the like poles attract each other and the opposite poles repel each other. The maglev trains have been the most powerful trains that use repulsive force between the tracks and the wheels which causes the trains to levitate from the tracks and travel at a speed of 300 miles per hour, implementing this principle in the turbine blades and that makes the blades to rotate at the constant rpm, which helps in generating larger power. Due to the significant drawback of generating continuous power from the past decades starting out from the ancient turbines to that of the present solar turbines the results of generating the power at the feasible cost paves to be of high risk. To overcome those recession techniques numerical and experimental study of the optimal geometric arrangement of magnets and the repulsive forces generated between them shows that there is an existence of forces between them to turn the turbines blades.
In the first part of the study, it is established experimentally that there exists an optimal forces between the two adjacent pair of blades, depicting the architecture and the working of the turbines. The second part of the research is carried out of collecting the most powerful magnets which is capable of withstanding very higher temperature and the gauss power produced by the magnet and also the lifetime property of the magnets. From the mathematical it is found that the generation of electricity will be around 0.12 Kw. The setup has the greater advantages over the resulting wind turbines is that for generating of power at home appliance the magnetic turbine setup is placed at the certain height as it generates electric power due to the repulsive power between the blades, when ordinary wind turbine that depends on wind when placed below the magnetic setup, the velocity of air the generates from the magnetic turbine can used for generating the ordinary wind turbines so that the dual amount of power could be generated. A repulsive force between the magnets is calculated by the Coulombs inverse square law and also has analyzed the performance of the magnets by the magnetic theory. Detailed description of the turbines arrangement, selection of magnets, mathematical model, power generation are depicted.

2. Architecture
The magneto turbines consist of two blades in which two blades are separated at a suitable distances facing each other, where one of the blades remains stationary and other has the ability to rotate. The arrangement of magnets is an important aspect for rotating the blades at the required rpm. The system consists of stationary turbine blades that are placed in a slot of 15 degrees. Across the diameter, the magnets are placed at an equal interval of angle 15 degrees, thus covering the space with 24 magnets, ranging up to 30 cm and the rotary turbine has three blades separated at an equal angle. The turbine blades consist of the magnets placed at the faces of the blades using suitable fixing mechanism. The power plant is designed with three turbines blades of which each blade of 1m weighs 16.285 kg made up the of fiber glass materials. Since for the generation of electricity, magnets are needed to rotate at an rpm of 1200-1800. So the setup is designed for rotating the blades at a required rpm, which could be implemented in the industry and dwelling for daily uses of power.

Figure 1. Arrangement of magnets in a wind turbine setup.

The starting of the rotary turbine blades requires a small amount of starting current. When the turbine begins to rotate, the repulsive force is created between the magnets placed in the rotary turbine blades in proximity to that of the stationary turbine blades. The 24 magnets that are placed at the stationary blades are shown in figure 1, which produces repulsive force causing the blades to rotate such that the torque is induced at the set up creating rotation motion. When the blades start to rotate it transfers some energy to the rotor. The wind-turbine shaft is connected to the center of the rotor. When the rotor spins, the shaft spins as well. In this way, the rotor transfers its mechanical, rotational energy to the shaft, which enters an electrical generator on the other end.

The generator is a simple device. It uses the properties of electromagnetic induction to produce electrical voltage - a difference in electrical charge. Voltage is essentially electrical pressure - it is the
force that moves electricity, or electrical current, from one point to another. So generating voltage is in
the effect of generating current. A simple generator consists of magnets and a conductor. The
conductor is typically a coiled wire. Inside the generator, the shaft connects to an assembly of
permanent magnets that surrounds the coil of wire. In electromagnetic induction, if you have a
conductor surrounded by magnets, and one of those parts is rotating relative to the other, it induces
voltage in the conductor. When the rotor spins the shaft, the shaft spins the assembly of magnets,
generating voltage in the coil of wire. That voltage drives electrical current (typically alternating
current, or AC power) out through power lines for distribution. The arrangement of the magnets must
be in such a way that the magnets placed between the turbine blades must be either North Poles or
South Poles so that same poles always repel each other.

Magnets in the rotary blades are inclined at an angle of 15 degree, so that there will be easy
movement of blades. The repulsive forces produced will be too high which results in movement of the
turbine blades. The stationary blades have the capability to glide with the hub. When the wind turbines
are started it rotates at the constant rpm generating constant power output. To makes the wind turbines
to rest the distance between the magnets in stationary blades is rotated in anticlockwise along with the
hub so that the distances between the turbine blades get increased, so that the speed of the turbine
blades decreases dramatically, on further increasing the distance results the turbine blades to stop. As
we all know that speed of the blade is inversely proportional the distance between them.

3. Preferred Magnets
The selection of magnets plays the vital role because the speed of the turbine blades depends on the
gauss of the magnet. For a larger gauss power the repulsive force produced is higher so that the blades
rotate at a larger rpm. The magnet chosen for this operation is the neodymium iron boron magnet,
which is the world powerful magnets whose gauss power varies from (11- 14) k Gauss. This has the
larger lifespan of 10,000 years and has the operating temperature of 280 K.

For the operation of turbine blades the neodymium magnet with gauss 1450 is assumed.
Length = 2 in
Width = 5 in
Thickness = 4 in
Weight of one magnet = 4.990 kg
The stationary blades are placed with 24 magnets therefore the weight of 24 magnets would be 119.76
kg. The turbine is made up of fiber glass material and hence
The weight of single blade of 30cm = 16.285 kg.
The weight of three blades would be = 48.855 kg.

![Diagram](image)

**Figure 2.** Front view of the arrangement of magnets in the Magneto turbine.

When the distance between the magnets gets increased the repulsive force is decreased, which
shows that the distance between the magnets and the repulsive force are inversely proportional. Each
magnet between the blades is inclined to an angle 30 degrees, so the repulsive forces generated would
not affect the blades and also the mean time it prevent the opposite rotation of the magnets. Due to the rotation the blades the centrifugal forces gets acted towards the centre of the rotary blades since the force generated from the blades is transformed to the centre, the force that drives the turbines is the repulsive force towards the centre the forces is calculated by the Coulomb’s inverse square law.

\[
F = \left[ \frac{B_0^2 A^2 (L^2 + R^2)}{\pi \mu_0 L^2} \right] \left[ \frac{1}{x^2} + \frac{1}{(x + 2L)^2} - \frac{1}{(x + L)^2} \right]
\]

(1)

Where

\[
B_0 = \frac{\mu_0}{2} M
\]

\[A = \text{Area of each pole magnet in m}^2\]

\[L = \text{Length of the magnet in m}\]

\[M = \text{Magnetization magnitude (100,000 A/m)}\]

From equation (1), for the different value of x, the corresponding repulsive forces are calculated.

| Distance ‘x’ (cm) | Repulsion Force Between both Magnets |
|-------------------|--------------------------------------|
| 1                 | 23.8 Lbs. 105.867 N                  |
| 2                 | 12.1 Lbs. 53.823 N                   |
| 3                 | 6.2 Lbs. 27.578 N                    |
| 4                 | 3.4 Lbs. 15.123 N                    |
| 5                 | 1.9 Lbs. 8.451 N                     |
| 6                 | 1.1 Lbs. 4.893 N                     |
| 7                 | 0.7 Lbs. 3.113 N                     |
| 8                 | 0.4 Lbs. 1.779 N                     |
| 9                 | 0.3 Lbs. 1.344 N                     |
| 10                | 0.2 Lbs. 0.889 N                     |
| 11                | 0.1 Lbs. 0.444 N                     |
| 12                | 0.1 Lbs. 0.444 N                     |
| 13                | 0.1 Lbs. 0.444 N                     |
| 14                | 0 Lbs. 0 N                           |

From the tabulated values shown in table 1, between the repulsive forces and the distance between, the graph is plotted, where the distance between the magnets (x) are taken along the x axis and the repulsive forces generated are plotted along y axis as shown in figure 3.
The repulsive force plays the main criteria in rotating the turbines, for the object to move from the particular places certain forces is required, same as that for moving a turbine we requires certain forces, Here the force that are used to rotate the turbine is the repulsive force. Since the forces are acting at the tip of the blades drives the forces at the centre, hence the forces acts from the tip of the blade to the centre we call this force to be the centrifugal forces, which acts towards the centre.

### 4. Mathematical Model

Equations are written for the amount of torque that has been produced when the rotating motion is induced and also the amount of power that is obtained by the rotation of the turbines are derived and are calculated.

Assumption made for the calculations are:
Consider
- Length of the turbine blade = 0.3 m
- Weight of the turbine blade = 16.285 kg for one blade (fiber glass material)
- Radius of the turbine blade = 0.35 m.

For the turbines to rotate it is necessary that some forces are acting between the blades, Centrifugal forces are the forces that are acted towards the centre, hence for this magneto turbine the repulsive force at the tip of the blades drives towards the centre.

\[
F = mr^2 \quad \text{(2)}
\]

\(F\) is the repulsive forces calculated from the table 1. Since the distance between the magnets are considered to be \(x=1\) cm the corresponding repulsive force from the figure 3 is 105.867 N, \(v\) is the velocity of the blades that are created.

\(v = 0.225 \text{ ms}^{-1}\)

Since when the rotation motion is produced in the blades, the turbine moves along the circumference of a circle of radius \(r\) and the angular velocity of the blades is calculated \((\omega)\) from the “Equation (3)”, where \(v\) is the linear velocity.

\[
\omega = \frac{v}{r} \quad \text{(3)}
\]

\(\omega = 0.75 \text{ rad sec}^{-1}\)
Wind turbines work by converting the kinetic energy generated from the blades into rotational kinetic energy in the turbine and then electrical energy that can be supplied. Kinetic energy is the energy possessed by the body by virtue of its motion. Kinetic energy is calculated from equation (4)

\[ K_{\text{rotation}} = 0.5 I \omega^2 \]  (4)

Where \( I \) is the moment of inertia and \( \omega \) is the angular velocity calculated from the “Eq. (3)”, is substituted in “Eq. (4)”, to calculate the kinetic energy induced due to the rotation of the blades. The inertial role is played when the blades continues in its state of rest or of uniform motion unless it is compelled by force. The inability of the blades to change its state of rest or motion by itself is called inertia. The inertia at rotational motion is called moment of inertia \( I \), hence \( I \) is calculated from the “Eq. (5)”, where \( m \) is the mass of the blades since the magnets are attached to the blades the mass includes the sum of mass of the blades and the mass of the magnet, hence weight of the one blade = 16.285 kg, since the turbine contains three blades its weight = 48.855 kg. Since the magnets are attached on the blades the weight of one magnet = 4.990 kg and hence for three magnet it is 14.97 kg. Total mass = 63.82 kg

\[ I = mr^2 \]  (5)

The value of \( I \) obtained from “Eq. (5)”, is substituted in “Eq. (4)”,

Hence

\[ K_{\text{rotation}} = 0.5 I \omega^2 \]

The power in the wind is given by the rate of change of kinetic energy,

\[ P = \frac{dE}{dT} = 0.5v^2 \frac{dm}{dt} \]  (6)

As mass flow rate is given by:

\[ \frac{dm}{dt} = \rho A \frac{dx}{dt} \]  (7)

And the rate of change of distance is given by:

\[ \frac{dx}{dt} = v \]

We get

\[ \frac{dm}{dt} = \rho Av \]

Hence from “Eq. (6)”, the power can be defined as the

\[ P = 0.5\rho Av^3 \]  (8)

The swept area of the turbine can be calculated from the length of the turbine blades using the equation for the area of a circle:

\[ A = \pi r^2 \]

Where \( r \) is the radius of the turbine blades (0.3 m)

\[ A = 3.14 \times (0.3)^2 \]

\[ A = 0.282 \text{ m}^2 \]

Sub the value of \( A \) and the density of the neodymium magnet (\( \rho \)) is the 7.5gcm\(^{-3}\) which is 7500 kg m\(^{-3}\) in “Eq. (6)” we get the power produced from the turbine blade is

\[ P = 12.04 \text{ MW} \]

For turbine blades to generate electricity it is necessary for the blades to rotate at (1200-1800) rpm, hence the rpm is assumed to be 1200. From the blade momentum theory weight of the turbine blades changes cubic of their length and the power increases by square of their length. Which is evident that
the largest amount of power is produced from the repulsive force between the magnet and by this power plant it does not depends on the climatic factor for generating electricity and due to continuous repulsion constant amount of power is developed. To avoid attraction force from the magnet to the other parts of the total section, Demagnetizers are used. Except the face from which the Repulsive force is produced must be cover with demagnetizers (like demagnetizing paint or with advanced wooden covers). This helps in obtaining better performance.

5. Results
The result shows that the repulsive forces between the magnets are based on the distance between the magnets and also at the gauss power of the magnet. When large amount of blades is used the repulsive forces produces is enormous so that the power produced is also enormous in this case of blades selection. As we know from figure 4.

![power comparison graph](image-url)

**Figure 4.** Relationship between power and the distance between the magnets.

The increase in weight of the blades produces larger amount of power thus producing tremendous amount of power thus only with repulsive forces between the magnets larger amount of electricity is produced. This could be implemented in wide places for generating electricity at a feasible cost and less transportation. If the rotary turbine is arranged with larger blades the magnets used are more to generate larger power. Thus the larger amount of magnet contributes to the larger electric power.

6. Conclusion
The magneto turbine which could generate large amount of power than that of the present wind turbine generating power based on the source of the wind. This paper outlines the alternative way of generating power using magnets in replacing the wind source, so that the power obtained is continuous and efficient. When there is continuous rotation of wind turbine at a constant rpm. The power produced would be continuous and hence with this technology due to its continuous rotation the speed produced would be higher so that velocity of the air is at high so ordinary wind turbine can be implemented beside so that power produced would be high.
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