Wind Powered Water Pumping Systems for Irrigation in Pudukkottai Region

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Abstract- *At present, as there is a demand in electricity generation, this impact result in the scarcity of water generation for irrigation purpose to the agricultural farmers, which affect the rural development. In India 25% of electricity is consumed by irrigation pumps. In our project, we generating power using renewable energy which will be available throughout the year. A wind generation takes place by wind turbines, which supplies power to the reciprocating pump, which is used to drive water from ground and it can be stored in a tank. Then it can be supplied to the field based on the requirement of water for the crops.*

Keywords- Rural development, Wind Turbine, Gear box, Reciprocating Pump, Wind Intensity.

I. INTRODUCTION

Pudukkottai region is the underdeveloped area (Fig.1.). Scarcity of water is high. Also annual rainfall rate is minimum. So the majority of irrigation pumping in Pudukkottai uses electricity.

An increasing demand of electricity results in poor supply of electricity for rural areas. So the renewable source of energy comes under discussion which is wind energy.

Our main aim is to apply the concepts of wind energy usage for Pudukkottai Region and to suggest whether this type of system can be replaced.

In this research, we are generating power using renewable energy which will be available throughout the year. We are getting sustainable energy from wind which produces minimum amount of energy. A wind generation takes place by wind turbines which supplies power to the reciprocating pump, which is used to drive water from ground and to store in a tank.

Fig.1.Pudukkottai District Map

II. WORKING OF WIND POWERED PUMP

Windmills can be used to pump water and generate electricity. There are two types of wind powered water pumps.

The traditional reciprocating pump has the wind mill situated directly over the water source (Fig.2.). It offers the best pumping capacities using gear box and reciprocating pump, but requires periodic maintenance and part replacement.

Compressed air pumping systems (Fig.3.) are now the most commonly used because of their low cost. This type of wind mill pump compresses air which in turn, activates a pump located in the water. Water enters the pump until the floating valve rises to close the inlet opening, at which time the compressed air displaces water out of the pump and up to the trough. The air exhausted aerates the water source so that good water quality is maintained.

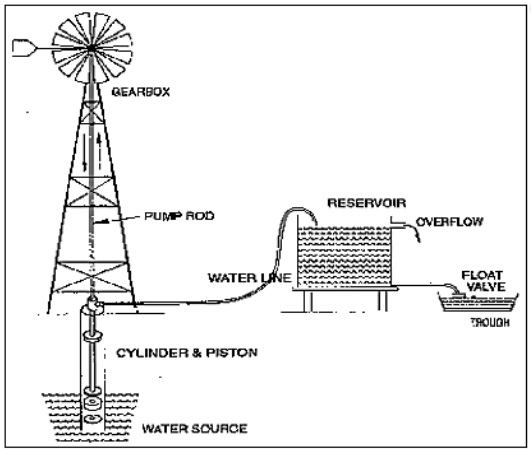

Fig.2.Wind powered (reciprocating) pump

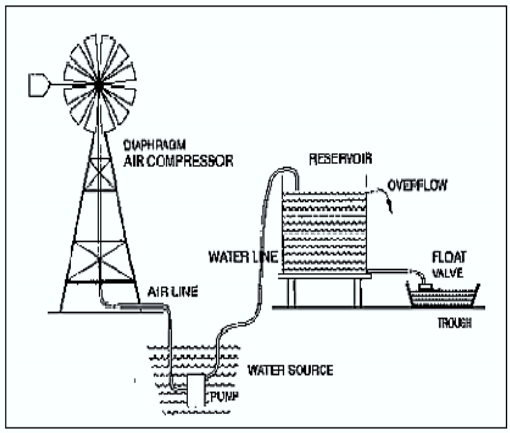

Fig.3. Wind powered (air-activated) pump

III. WIND RESOURCES

The amount of water a wind- powered water pumping system can deliver, depends on the speed and duration of the wind, the size and efficiency of the rotor, the efficiency of the pump being used, and how far the water has to be lifted. The power delivered by a windmill can be determined from the following equation:

$$P = 0.0109(D^{**2})(V^{**3})\,n$$

Where P is power in watts, D is the rotor diameter in meters, V is the wind speed in kilometers per hour, and h is the efficiency of the wind turbine. As can be seen from this expression, relatively large increases in power result from comparatively small increases in the size of the rotor and the available wind speed; doubling the size of the rotor will result in a four- fold increase in power, while doubling the wind speed will result in an eight – fold increase in power.

However, the efficiency of wind turbines decreases significantly in both low and high winds, so the result is that most commercially available windmills operate best in a range of wind- speeds between about 15km/hr. and 50km/hr.

Average speed of the wind for the year 2013 is plotted inFig.4.forPudukkottaiRegion. In which in the month of June, wind intensity reaches the maximum value of 20km/hr. In the month of February it reaches the minimum value of 6.524km/hr. Hence the average wind intensity is14.53km/hr.

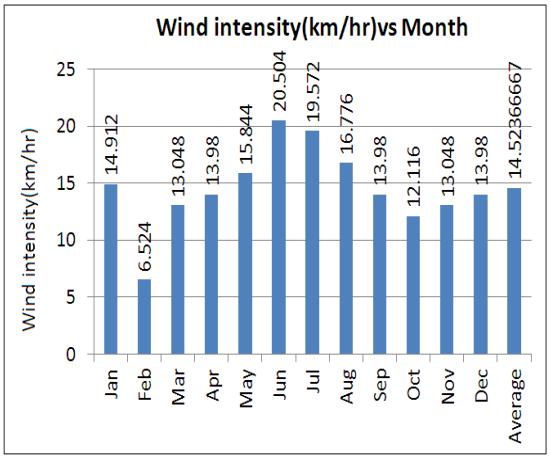

Fig.4.Wind resources in Pudukkottai Region-Wind speed (km/hr.) Vs. Month

IV. CONCLUSION

- ✓ The agriculture in our country is highly dependent on rainfall.
- ✓ The system is fully based on renewable energy which is always available without any limitations.
- ✓ Technological improvement in system and a new designed wind turbine makes system more efficient.
- ✓ Adopting wind energy means for water pumping has resulted in huge benefits.
- ✓ Most commercially available wind mills operate best in a range of the wind speed between about 15km/hr. and 50km/hr.
- ✓ Pudukkottai region is located in the shore of Bay of Bengal, but wind energy available i.e. the average wind intensity is 14.53km/hr.
- ✓ Hence it may be preferable to install water pumping system near the coastal lines of Pudukkottai region because the required wind energy is available only in that line.

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