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# Design and Experimental Analysis of Wind Powered Operating Pump Prototype

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**Abstract:** The aim of our project has to design a windmill pump and therefore our scope will be limit the power consuming to a windmill for water pumping. The windmill drives a pump that pumps water from a well for irrigation. Calculations have been made on the energy available in the wind and an energy analysis was then performed to see what wind speed is required for the system to work. However, all these sources are limited and are the main cause of pollution and this has led to development and more focus on sustainable energy supply with minimum pollution effects. Hence research and analysis has shown that wind energy, solar energy and biomass are the most prominent solutions to the above problems because they eco-friendly and readily available in nature. Wind energy can be generated using windmills that provide mechanical energy that is used directly on machinery e.g. water pump and grinder; or wind turbines that provide electrical energy.

**Keywords:** windmill, water pumping,sustainable energy.

## 1. Introduction

Wind energy is a source of renewable power which comes from air current flowing across the earth's surface. Wind turbines harvest this kinetic energy and convert it into usable power which can provide electricity for home, farm, school or business applications on small (residential), medium (community), or large (utility) scales.Wind energy is one of the fastest growing sources of new electricity generation in the world today. These growth trends can be linked to the multi-dimensional benefits associated with wind energy.

**Sustainable:** Wind is a renewable energy resource, it is inexhaustible and requires no "fuel" besides the wind that blows across the earth. This infinite energy supply is a security that many users view as a stable investment in our energy economy as well as in our children's' future.

**Affordable:** Wind power is a cost-competitive source of electricity, largely due to technological advancements, as well as economies of scale as more of these machines are manufactured and put online around the world.

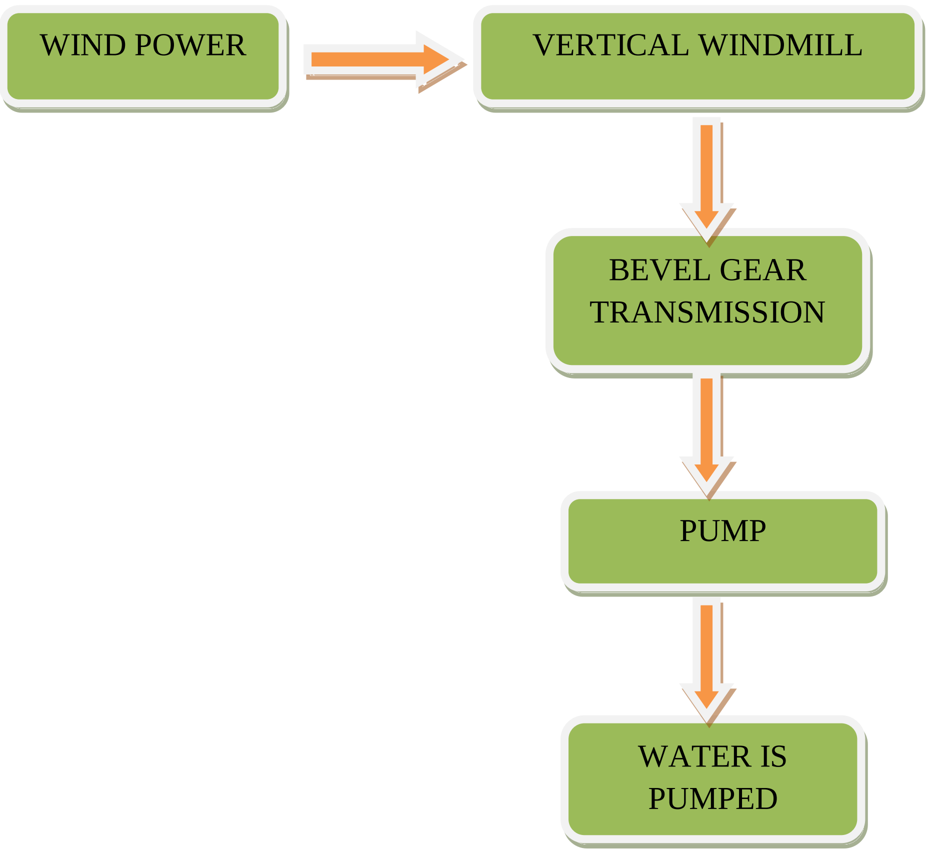
**Pump**: By having only two vanes, the risk of clogging from foreign matter in the fluid being pumped is reduced over a pump with more vanes. (For even messier fluids a single vane can be used.) This type of pump might be used for pumping sludge or other contaminated liquids. It is also common for moving liquid paper stock. All of the head in an impeller type pump is created by the impeller itself. The rest of the parts induce losses to the maximum head. Losses are induced by friction of the fluid against the sides of the parts, by mechanical friction of the pump shaft, and from hydraulic efficiency losses such as fluid eddies and changes in direction (which takes energy)

The scope of project is to overcome the consuming of non-renewable energy by usage of sustainable energy.

## 2. Proposed Methodology

The vertical windmill rotates by the wind energy and transmitted by bevel gear through rotating shaft. The shaft from the bevel gear is coupled by the pump which pumps the water from water source.




## 3. Experimental Setup

Figure 1: Creo model

Figure2: Fabricated design prototype

| S.NO | COMPONENTS | SPECIFICATIONS |
|---|---|---|
| 1 | Frame | 920 x 610 |
| 2 | Shaft | L 300 |
| 3 | Bearing | D 30 |
| 4 | Wind mill | D 600 |
| 5 | Pump | A-114 |
| 6 | Bevel gear | D 80 & D 40 |

## 4. Experimental Analysis

Axial trust required to lift the water

Fa = 98*s*Q^2/D^2

Fa = axial trust

S = specific gravity

Q = flow rate in $m^3$/h

D = diameter

Q = Cd A[2Δp/ρ]

Cd = coefficient of discharge (0.61 for Flat plate orifice)

A=surface area (m^2)

□ **p** = pressure difference (Pa)

**Calculation for axial trust**

| Specific gravity (kg/m$^3$) | Flow rate Q(m^3/h) | Diameter of impeller (mm) | Axial trust Fa (N) |
|---|---|---|---|
| 1.1 | 22.8 | 150 | 762.432 |
| 0.9 | 24.2 | 200 | 527.073 |
| 0.8 | 26.8 | 250 | 459.673 |

## 5. Result and Discussion

The primary goal of this report is to consider the environmental effects due to electricity and to reduce the initial cost for installing, and by considering 2 major losses occurring in wind powered water pump. As follows,

- Knocking noise
- Rubbing noise

These losses are identified and clear study is made on the wind pump.For those 2 major losses in which separate study is carried out by each of our team member and observations and discussions made with professors and guide at the particular loss occurring component.Considering all the observations we finally found the reasons of those losses and given our part of best suggestions from our study towards the rectification in order to implement and to reduce the rejection rate of water wind mill during testing.Therefore,simultaneously it reduces the environmental pollution and produces efficient amount of output.

## 6. Scope for Further Work

The design prototype can be implemented for irrigation with the usage of sustainable energy where we can reduce the pollution and consuming of nonrenewable energy is avoided.Future work would consist of a redesign of this model to see exactly how much data we may be missing with the assumption that we made with low price, weight and capacity. Despite all the assumptions, we still have realized that this product can be very marketable and that the demand is extremely large for agriculture with low cost which means this is a viable design that will yield a high return on an investment.

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