

# INNOVATIVE RESEARCH ON WATER PUMPING USING WIND FORCE

A.Vijay<sup>1</sup>, M.Shabbir Ahmed<sup>2</sup>, R.Umapathy<sup>3</sup>, R.Selva Kumar<sup>4</sup>, A.Naveen<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Civil Engineering, Panimalar Engineering college, Chennai, India

<sup>2,3,4,5</sup>Under Graduate Student, Department of Civil Engineering, Panimalar Engineering college, Chennai, India

## Abstract

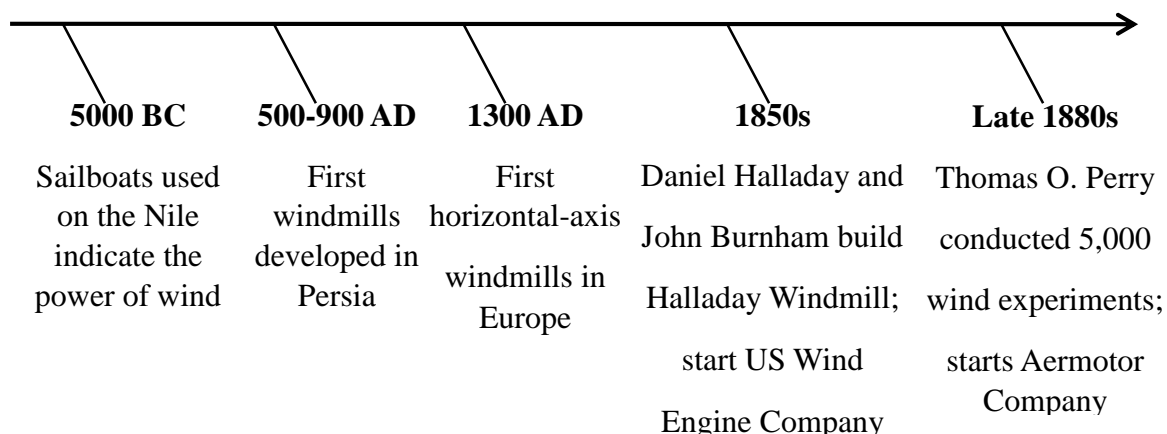
Our project is an innovative research on Water pumping using wind force which is a combo of both water pumping and electricity generation from wind mill simultaneously. A prototype has been created such that it produces electricity and at the same time pumping of water is done by reciprocating action. It is very important and useful for Agriculture and Irrigation. The need for water is inevitable in agriculture and today almost use of pump for irrigation is irresistible. Generally this pumping is carried out using electric power. Our objective towards the project is to use the wind power to pump water for irrigation and also to generate electricity and can utilize it in doldrums so that we could achieve zero energy water pumping or irrigation. It is also completely free from pollution.

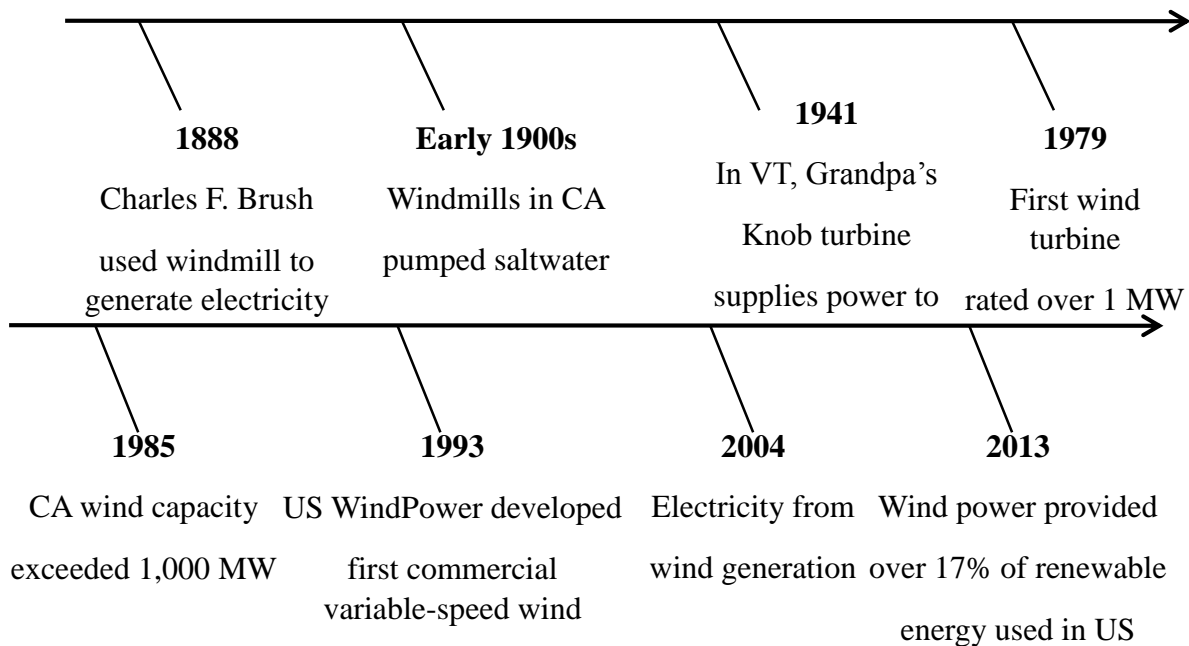
**Keywords:** Doldrums, Zero energy, Pollution free, Water pumping, Alternator.

## 1. INTRODUCTION

The need of pumping in irrigation is very much higher and cannot be avoided now-a-days. So water pumping must be done by some means which by electricity in most cases and the expense of electricity is very high.

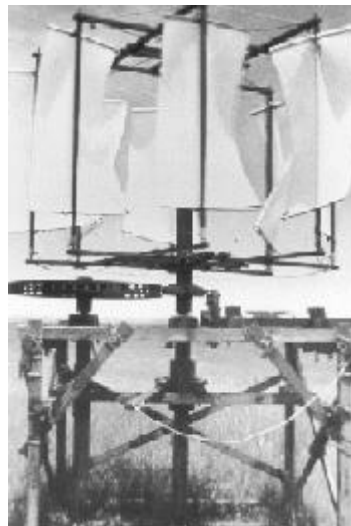
### 1.1. Literature Review





### 1.1.1. Earliest Windmill Design 900 A.D.

It is a Persian Windmill which was invented between 500- 900 A.D. It is a Panemone design which is made of cloth and it is a vertical axis wind mill. It is very inefficient. They also have constructed walls of different alignment to harvest wind.



Picture courtesy: <http://telosnet.com/wind/images/panemone.jpg>

Fig.1.1

### 1.1.2. Daniel Halladay's Self-Governing Windmill

Daniel Halladay's was born in Vermont in 1826. He invented the self-governing windmill in Connecticut in 1854. He also manufactured windmills in Ellington, Connecticut from 1854 to 1863. He sold thousands of windmills to farmers. He finally moved his factory to Batavia, Illinois. It was

designed in such a way that it automatically turned to face changing wind directions. It also automatically controlled its own speed of operation. It was used to pump water for cattle and irrigation.



Picture courtesy: <http://www.windmillersgazette.com/history.html>

Fig.1.2

### 1.1.3. Solid Wheel Windmill - 1867

Solid Wheel Windmill was invented by Reverend Leonard H. Wheeler in 1867. It is more rigidly designed and composed of a fastened wheel attached to a hinged vane. He was the major competitor of Daniel Halladay.



Picture courtesy: <http://www.windmillersgazette.com/images/history02.jpg>

Fig.1.3

#### 1.1.4. Metal Windmill 1870's

Metal windmills had curved blades which were much more efficient. It also had “back geared” system which made it turn easier in lighter winds. People didn't like them at first because they seemed fragile and difficult to repair.



Picture courtesy: [http://thumbs.dreamstime.com/thumblarge\\_466/1262391144JfNKf4.jpg](http://thumbs.dreamstime.com/thumblarge_466/1262391144JfNKf4.jpg)

Fig.1.4

-By 1940 all windmills were made from iron and steel.

## 2. PROTOTYPE AND IT'S WORKING

In this chapter let us see how prototype was made and it's working.

### 2.1. Prototype

The equipment and tools used are,

#### 2.1.1. Equipments

Motor, Rectifier, Piston Pump, Gear mechanism (Gear Pulley), Alternator (Dynamo), Rechargeable battery, Fan blade, Scrap metals and joinery.

### 2.1.2. Tools

Driller Machine, Cutting Machine, Basic tools (Screw drivers, Spanners, Cutting blades, Wire cutters, Volt meter), Welding machine.

### 2.1.3. Assembly

A motor is fixed and its shaft is connected to the wind blades at the end. The shaft is fitted with two gear pulley arrangements. One is meant for pumping arrangement while the other is connected to a belt and then to a dynamo. The dynamo is connected to an rectifier to store the energy generated by the dynamo using a rechargeable battery. The battery is looped with the motor. The rectifier supplies the appropriate amount of energy to the battery and it avoids over loading of electricity supply by cutting the supply when battery is full. Small PVC pipes and joinery were used to create the reciprocating pump. In order to get proper closure and to obtain air tight to produce vacuum and to avoid back flow of water in our prototype. It can be replaced with a check valve in the real case scenario. Levers are connected to the gears and as the gear starts to rotate the lever moves up and down.



Fig.2.1



Fig.2.2



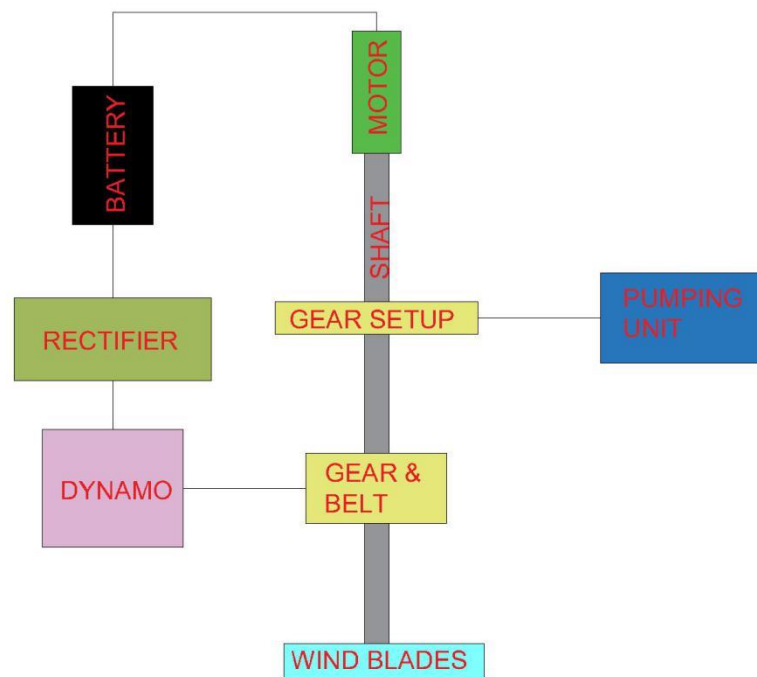
Fig.2.3



Fig.2.4

## 2.2. Working

The working is explained with the help of schematic diagram shown below,



## SCHEMATIC DIAGRAM

Fig.2.3

### 2.2.1. Shaft

The shaft shall rotate either by motor or by wind power. In our prototype, for demonstration it is made to rotate with the help of motor only. As the motor rotates the shaft, it rotates both the gear arrangements and so pumping and energy generation takes place simultaneously.

### 2.2.2. Dynamo

The dynamo converts the mechanical energy into electrical energy and is collected in the battery with the help of an rectifier.

### 2.2.3. Rechargeable Battery

The battery stores the energy from the alternator and it supplies energy for motor to run. It forms a energy loop and we can obtain zero energy irrigation.

#### 2.2.4. Pump

The pump used is a typical reciprocating pump. The pump is made of PVC pipes and it has a head of 7.5cm (distance between inner dead center and outer dead center), since the length of crank rod is 3.25cm. When the rod moves down the spring and ball arrangement closes bottom opening and the water gets pumped, which is called as delivery stroke. When the rod moves upwards, it generates vacuum inside the pipe, so that suction takes place and the water occupies the empty space (Vacuum). This is called as suction stroke. So it can be operated by both wind power and electric motor. At doldrums motor can be operated with the help of the battery itself.

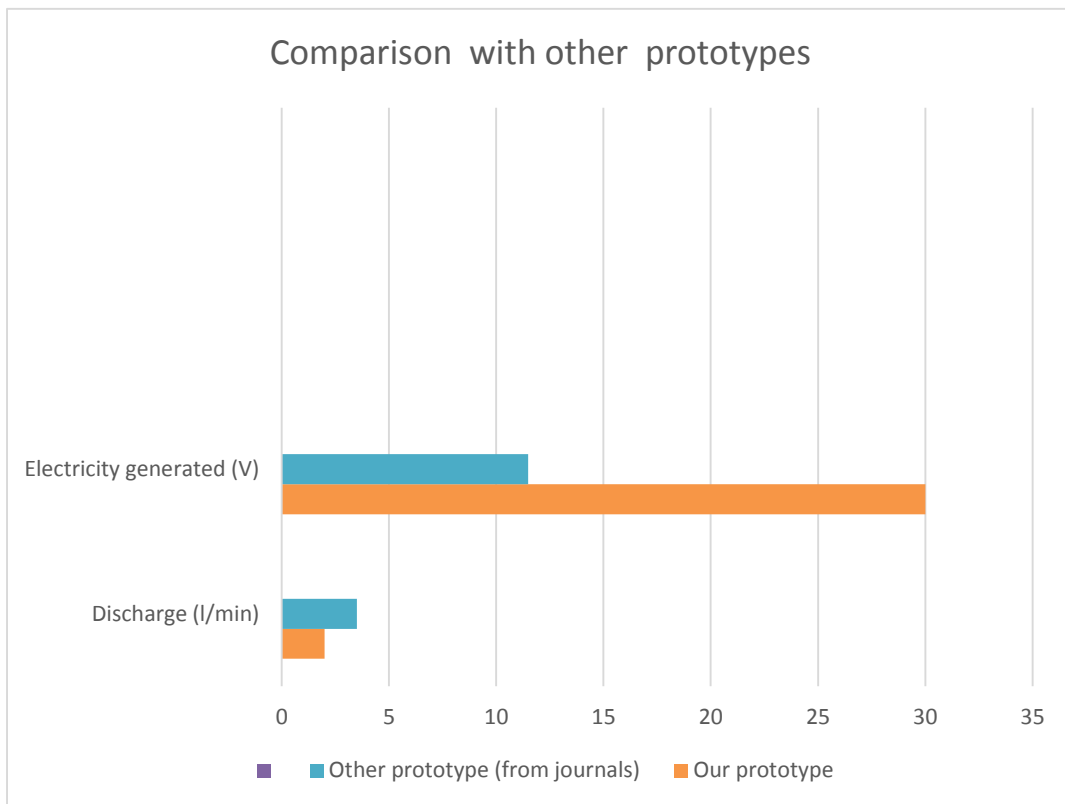
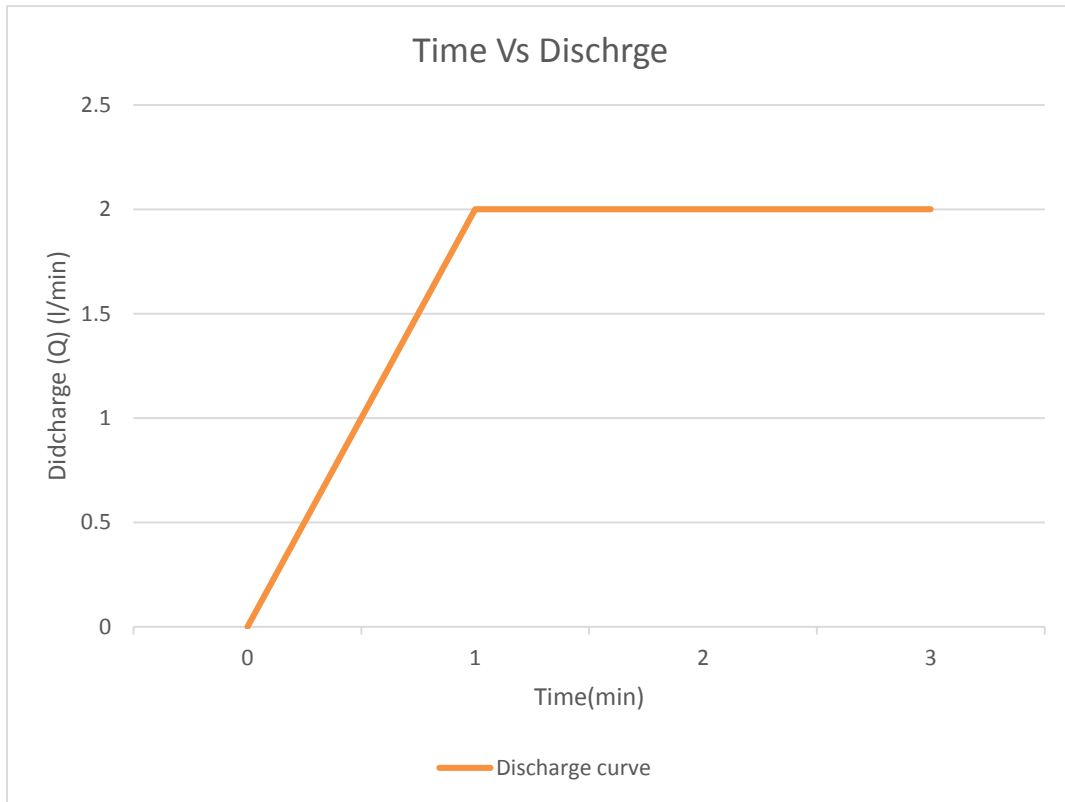
#### ADVANTAGES

- a) Energy recovery from the system.
- b) Energy circulation within the system.
- c) Farmers will be benefited due to low cost or zero cost irrigation.
- d) Effective utilization of wind energy.
- e) It is a simple way, the assembly and mechanism is also simple.
- f) Time and space reduction since it does both the actions simultaneously.

### 3. RESULT AND DISCUSSION

The pumping of water from our prototype is found to be 2 litres/min for a head of 7.5cm. So it is clearly visible that the increased head will definitely give increased discharge and it would reduce the cost of irrigation for farmers. The electricity produced is 100V AC and it is converted to 30V DC by rectifier and 12V DC is sent to battery. The motor we use is 12V motor and hence the energy spent in running the motor is restored again. If a higher voltage battery is used and rectifier can be used to supply energy so that higher energy can be stored.

Basis of comparison	Our prototype	Other prototypes (from journals)
Water pumped	2 litres/minute	3.5 litres/minute
Electricity generated	30V(DC)	11.49V(DC)





## CONCLUSION

- ✓ Using this technique farmers in windy areas can definitely be benefited. Installing this for irrigation must be suggested and implemented.
- ✓ Government can definitely invest some amount in this project so that farmers will get benefited.
- ✓ It is also a low cost project and simple mechanism as compared to others. It is an one time investment and we would enjoy it's benefits for a longer period of time.
- ✓ Small changes can be made in the system in order to get maximum efficiency.
- ✓ Zero energy irrigation can be achieved by using this system.
- ✓ The electric power generated and stored can be used for various other purposes.
- ✓ When wind farm is built with this system a large amount of electricity can be produced while pumping water for irrigation.

## REFERENCE

- [1]. *Wind Power Plants: Fundamentals, Design, Construction and Operation*, R. Gasch, J. Twele, et al., Springer Verlag, 2012
- [2]. *Performance Test on Helical Savonius Rotor*, S.B. Kedare, 2003.
- [3]. *Wind Power Fundamentals*: Alex Kalmikov and Katherine Dykes With contributions from: Kathy Araujo PhD Candidates, MIT Mechanical Engineering, Engineering Systems and Urban Planning MIT Wind Energy Group &Renewable Energy Projects in Action
- [4]. *Wind pump handbook* (pilot edition) prepared by S.K Tewari and R.P. Gupta, Tata Energy Research Institute, 1982.
- [5]. *Thermodynamic and Transport Properties of Fluids SI Units* arranged by G. F. C. Rogers and Y. R. Mayhew Fifth Edition Blackwell Publishing, 1995, Oxford, U.K.
- [6]. *Water pumping design*, NYANGASI, George Oduwo, 2012.
- [7]. *Kenya Wind Atlas*, Kenya Meteorological Department, 2010.
- [8]. IJESC Volume 7 Issue 3 *Water Pumping System using Windmill* by P.Jagadeesh<sup>1</sup>, G.Samath<sup>2</sup>, S.P.Saran<sup>3</sup>, M.Selva<sup>4</sup>, K.Srithar<sup>5</sup>, Assistant Professor<sup>1</sup>, UG Scholar<sup>2, 3, 4, 5</sup>, KSR College of Engineering, Tamil Nadu
- [9]. Gipe, Paul. "Ch.12--Pumping Water." *Wind Power: Renewable Energy for Home, Farm, and Business*. White River Junction, VT: Chelsea Green Pub., 2004. 249-52. Print.
- [10] <http://fineartamerica.com/featured/native-american-windmill-harry-spitz.html>
- [11]. <http://www.backwoodshome.com/articles2/ainsworth90.html>
- [12]. [http://www.lonelyplanet.com/usa/pennsylvania/images/amish-farm-and-windmill-pennsylvania\\$18726-6](http://www.lonelyplanet.com/usa/pennsylvania/images/amish-farm-and-windmill-pennsylvania$18726-6)