

Design and Construction of Windmill for Pumping Water

Students: Nawaf F. Al-Dosari, Adel S. Al-Harbi, Abdulrhman A. Al-Amri

Supervisors: Dr. Naeim Farouk Mohammed, Dr. Mutabe Aljaghtam

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Abstract:

A windmill is a machine that converts the energy of wind into rotational energy by means of vanes called sails, it can be used in different applications. These applications maybe pumping water in large amounts such as in farms, stand-alone system for homes, universities, schools, health clinics and industrial applications.

Objective:

The main objective of this project is to figure out how much power can be generated from a renewable energy source like wind. Furthermore, to create a windmill that has the essential properties of a windmill. there are more objectives, including :

- Construct a windmill to generate renewable energy that will help to reduce pollution.
- Lower the cost of energy used to pump water.
- Learn about the design of windmill and all the design considerations.

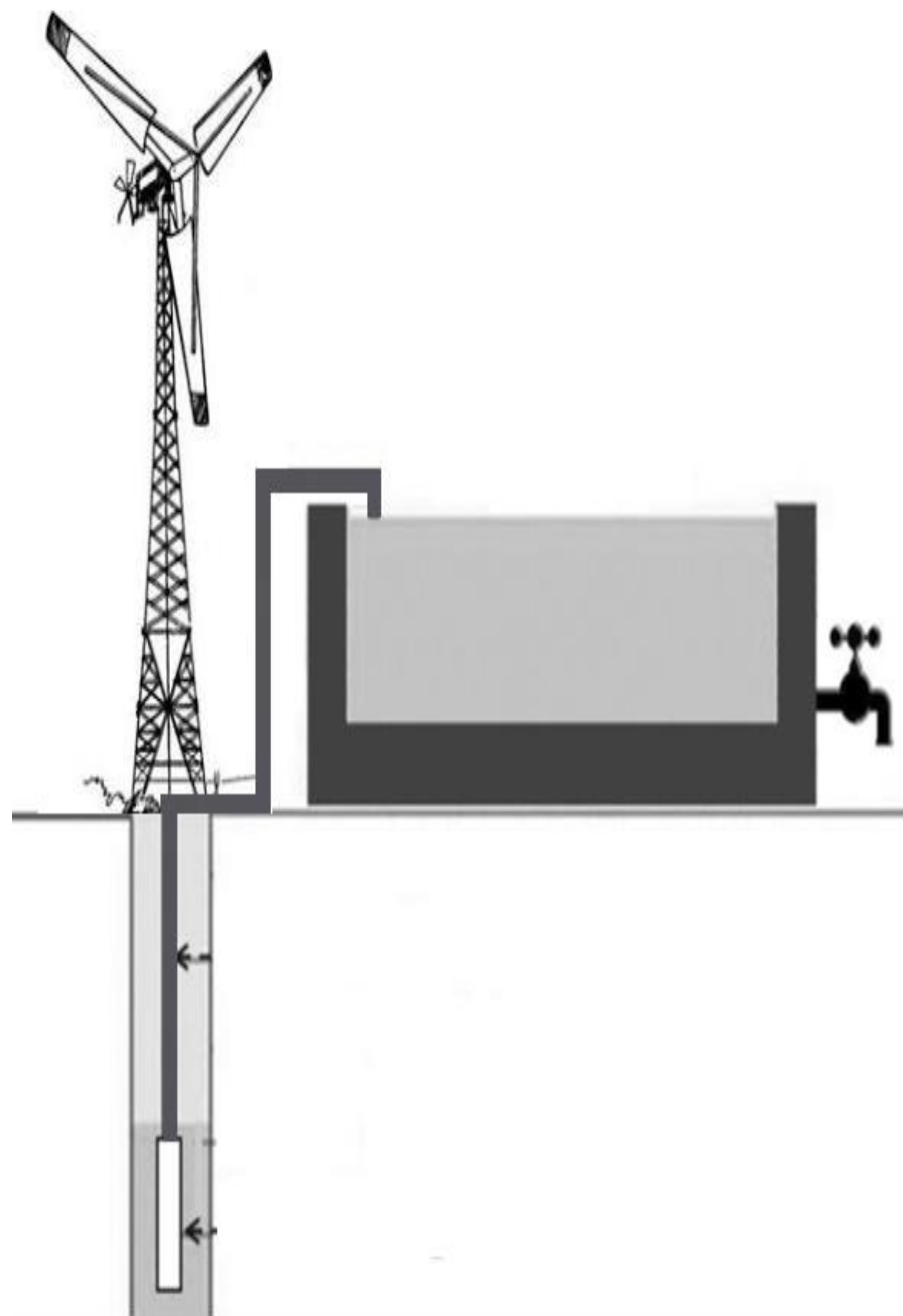
Description:

Windmills are machines that convert energy from the wind into useful work by rotating. The rotation of a windmill often powers a motor or generator used to produce mechanical work.

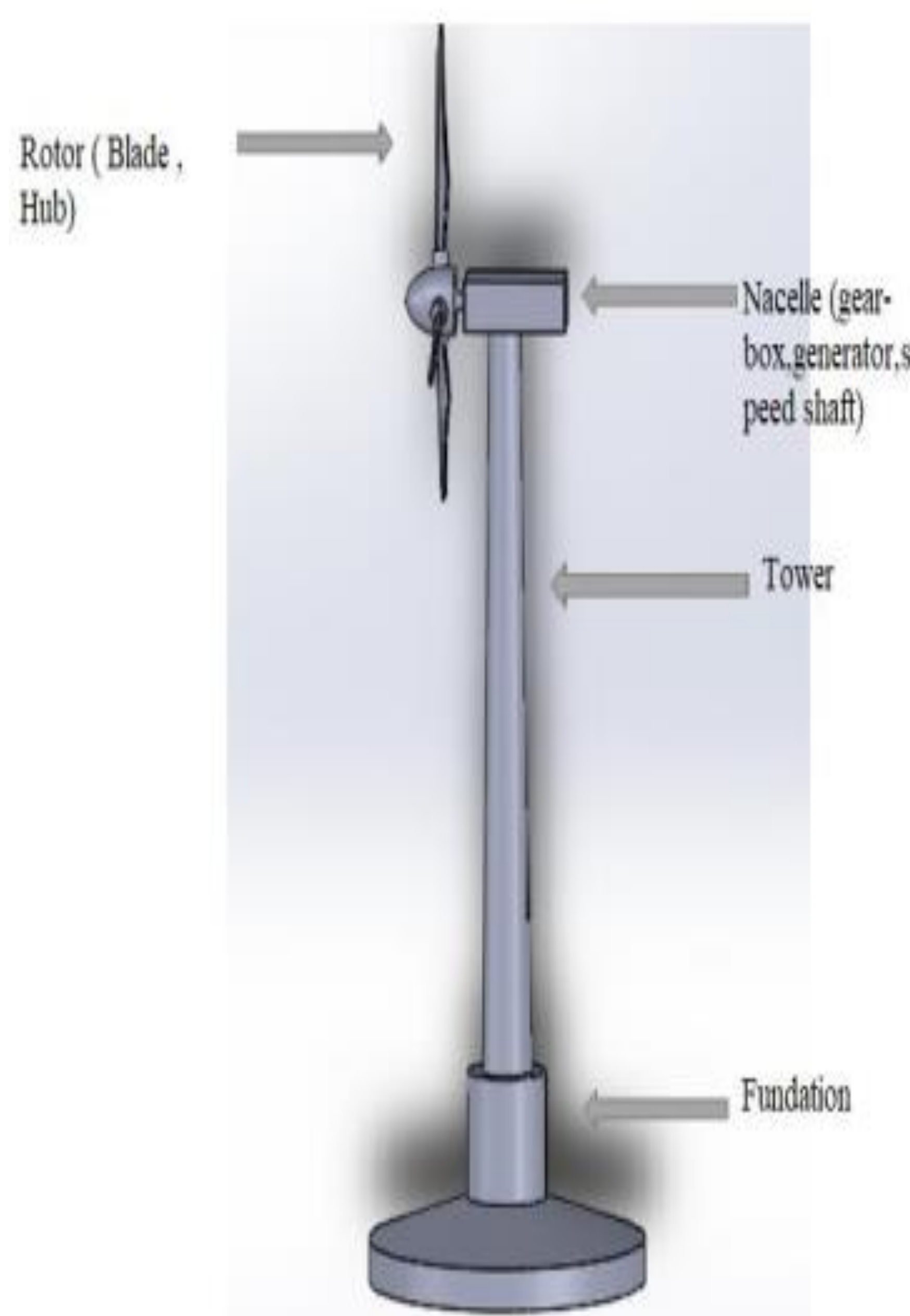
Component:

The principal component groups in a wind turbine are:

- Rotor.
- Generator.
- Nacelle.
- Gearbox.
- Tower.



Windmill water pumping system.



Wind turbine component.

Mathematical Modeling:

Some equations used in the analysis are:

- Overall efficiency

$$\eta_0 = C_p \times \eta_{\text{mech}} \times \eta_{\text{pump}}$$

- The wind power on the rotor blades is given by

$$P_{\text{wind}} = 0.5\rho Au^3$$

The tip speed ratio given by

$$\lambda = \frac{R\omega}{u}$$

Constraints:

Our study take in consideration the following constraints:

- Safety
- Environment
- Economic

Conclusion:

Renewable energy is energy generated from natural resources and has a variety of sources such as wind. Wind power is one of the clean renewable energy and for several years its contribution to solving energy issues. Wind energy are going to be an attractive technology of other energy sources for KSA. Energy can be generated using windmills that provide clean energy that is used directly on water pump.

Future Work:

In the future work, it will consist of the selection of the design and apply the mathematical modeling and finally, the construction of the prototype of the windmill