

# A PROTOTYPE OF WIND, SOLAR AND HYDRO ENERGY GENERATOR FOR EDUCATION PURPOSES

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## ABSTRACT:

Due to the increasing of economy cost of fossil fuels, alternative sources of energy, are needed simultaneously with the passage of time. The wind, hydro and solar conceptual is a type of generator to produce the electricity that use the concept of renewable energy, which is wind energy, water energy and solar energy. Turbine is a type of mill that uses the concept of renewable energy which is wind energy. Many of current wind turbines research focus on the large scale of wind turbine. But in this project, a small scale of wind turbine is designed specifically to produce electrical power at low speeds. The shape of blade is designed with 3 or 4 vertical axis wind turbines blades according to the fan speed study. Hydro energy is energy obtained from flowing water will produce electrical energy and will use to recharge the energy that has been used. In this project the screw turbine has been designed specifically to produce electrical energy. The screw turbine will be rotated by a vortex to produce electrical energy. Solar energy is a type of energy that use the of renewable energy which is sunlight. The solar panel will absorb the sunlight and will produce the electrical energy. This project will be an electric generator to produce the electrical energy that will used by residents staying in flat houses. This renewable energy source generator will reduce problems regarding environmental pollution compared to the non- renewable energy.

**KEYWORDS:** *Wind Turbine; Solar Panel, Archimedes Screw*

## 1.0 INTRODUCTION

In this era of globalization, renewable energy will be the basic source to replace non -renewable energy like fossil fuels or diesel petrol. Renewable energy is energy that comes from the environment and from natural sources that will not pollute the environment. Wind energy, hydro energy and solar energy are examples of renewable energy. It can usually be in residential areas or industrial areas to generate electricity by using a combination of 3 types of design such as Wind Turbine, Solar Panel and Archimedes Hydro Screw. In this prototype, the design and efficiency have been improved from time to time to increase power generation as the population grows. A combination of 3 types of energy can supply electrical energy to the community.

The generation of electrical energy from the investigation of the possibility of improving energy captures (wind, solar and hydro), under their characteristic conditions (speed and heat), built-up areas, and the design of the conceptual generator for domestic uses in areas such as apartments. In this research, the main aim is to produce a teaching prototype that can demonstrate various situation and scenarios of electrical energy supply. It is useful to predict the situation of electrical energy supply in the future. Thus, preventing the development which will bring the commotion that will ensue when

a failure of electrical power supply. It also can be as a decision-making tool for any improvement and changes to implemented.

This project consists of the design and development of the prototype fabrications. This project was completed according to the process flow under Section 2.0 Methodology. Among the objectives of this project are:

- (i) To design a prototype energy generator using solar energy, wind energy and hydro energy;
- (ii) To build a prototype energy generator using solar energy, wind energy and hydro energy;  
and
- (iii) To test the completed prototype of energy generator and analyze the results outcome.

## **2.0 LITERATURE REVIEW**

Today is the most cost-effective means of capturing wind energy. They are positioned on land or at sea in a proven windy area. Wind power is a clean resource, which has gained a significant share in global power production. Global availability of wind resources and technological improvements are the main reasons for the growing number of wind farm developments. Moreover, wind power is considered one of the cleanest energy sources, with high economic feasibility due to both equipment and installation falling costs (Leandro Jose et al., 2017). Most horizontal axis turbines are built with two or three blades. It has the main rotor shaft and electrical generator at the top of a tower and must be pointed into the wind. Small turbines are pointed by a simple wind vane, while large turbines generally use a wind sensor coupled with a servo motor. It most has a gearbox, which turns the low rotation of the blades into a quicker rotation that is more suitable to drive a generator.

Solar energy is one type of the renewable energy sources which can be converted easily and directly to the electric energy by Photovoltaic converters. The process of no movable mechanisms to convert solar energy to electric energy is called photovoltaic phenomena whereas the conversion device is called solar cell (Partain, 1995). Solar energy generator is the most effective method of channeling and supplying source of energy. Simple while solar panels generally use a sunlight sensor combined with a servo motor. Most have gearboxes, which convert low blade rotation into faster rotation which is more suitable for moving the generator according to 360 ° rotation panel solar to be converted into electrical energy connected through the generator.

The Archimedes screw turbine is applied in the river, irrigation channel which they are open channel condition. The prime mover force of the open channel is weight of fluid due to gravity, and its pressure distribution is hydrostatic (Tineke Saroinsong, et al., 2016). Basic principle of an Archimedean screw pump is that the handle at the top was turned in an anti-clockwise direction it would draw the water up from the lower level to the top. When used as a hydro turbine the principle is the same but acts in reverse. The water enters the screw at the top and the weight of the water pushes on the helical flights, allowing the water to fall to the lower level and causing the screw to rotate. This rotational energy can then be extracted by an electrical generator connected to the main shaft of the screw.

## **3.0 METHODOLOGY**

The design process shows the steps that were needed to comply from the start until end. Beginning with the design brief about "Wind, Solar and Hydro Energy Generator", it shows a defect that needs to be improved to produce a successful product. More ideas and brainstorming's were required to find the solutions for the problems. This process is also known as identifying the design problem. Analysis is carried out to identify the suitable materials. Modification or refinement can be made to the existing concept while certain steps are common in the development of most product design.

The design of Archimedes Screw, Wind Turbine and Solar Panel were combined to generate the electricity energy. As for the Archimedes Screw design, this prototype is at angled state because it

forms individual pockets where water can get trapped because the tubing curves upward on both sides (Rorres, 2000). If you look at your screw from the side, you will see these pockets filled with water. As you rotate the screw it traps alternating pockets of air and water, and the individual pockets move up the screw to the upper container. If you tilt the screw up at too steep of an angle, eventually one side of each pocket will point downhill allowing the water to flow back down. Those is easiest to see if you stand the pipe up vertically (Kantert, 2008). The design for Wind Turbine involved altitude ground because wind speeds tend to increase with increasing altitude and equivalently contain a larger power density. This high altitude of winds is more energy abundant but the main challenge to utilizing this energy is our ability to engineer devices that were able to reach such heights and transmit power back down to earth (Elizabeth, 2015). The design for Solar Panel involved solar energies which is the green and renewable energy, and easily to get this energy during daytime. Thus, the solar energy is very suitable to use as the potential energy in the experiment, instead of using batteries. The position of sun is important and effect for the solar panel to recharge the energy and generate it (Cynthia, 2015). This project was completed according to the design process flow shown in Figure 1.

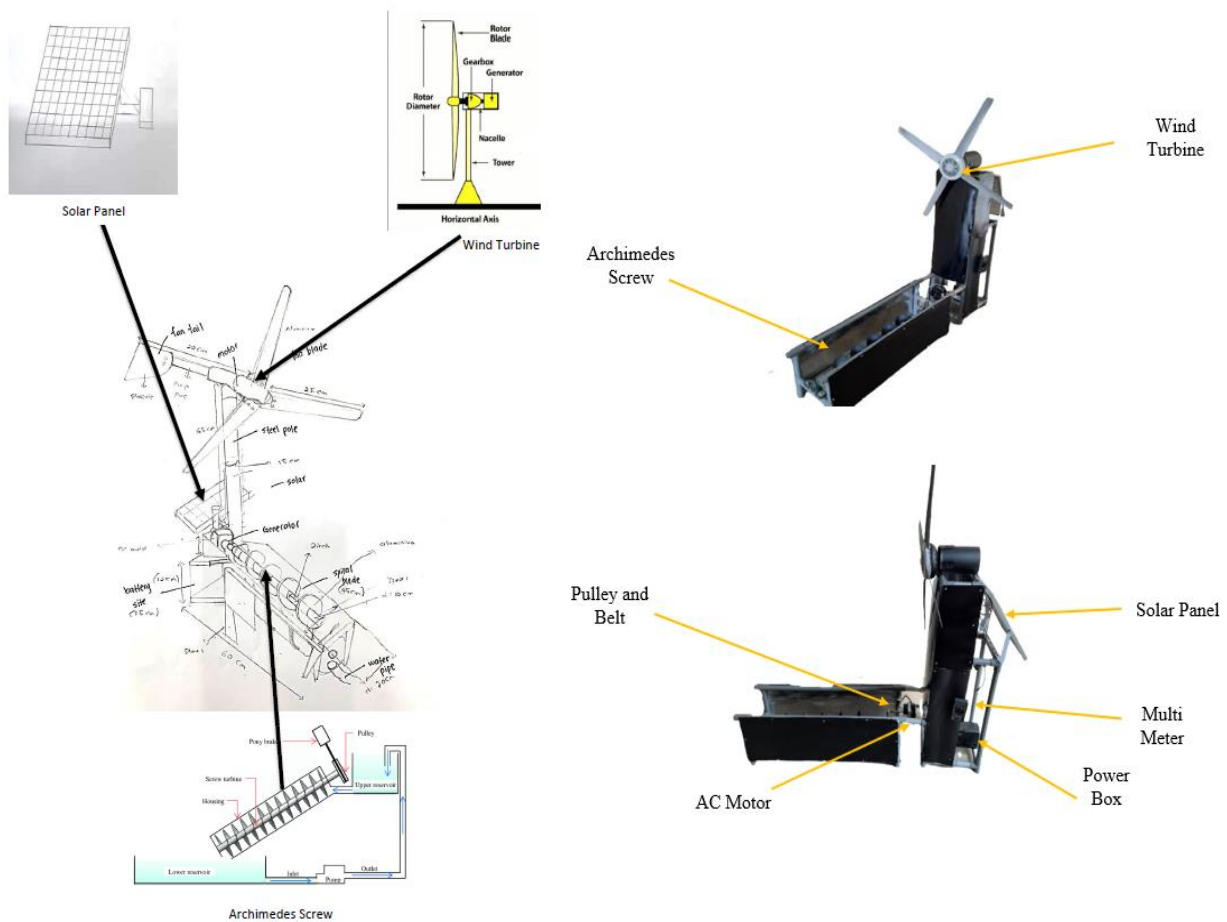


Figure 1: From design stage to finalized prototype

The prototype consists of: -


Table 1: Component and Function


Component	Function
Wind Turbine	A wind turbine turns wind energy into electricity using the aerodynamic force from the rotor blades, which work like an airplane wing or helicopter rotor blade. When wind flows across the blade, the air pressure on one side of the blade decreases.

Archimedes Screw	A consists of a rotor in the shape of an Archimedean screw which rotates in a semi-circular trough. Water flows into the screw and its weight presses down onto the blades of the turbine, which in turn forces the turbine to turn.
Solar Panel	Components placed above the Archimedes screw and below the Wind Turbine to collect sunlight and convert it to electrical energy. The electrical energy is stored in batteries or generators for future use.
Multi Meter	A multi meter is a measuring instrument that can measure multiple electrical properties. A typical multi meter can measure voltage, resistance, and current, in which case it is also known as a volt-ohm-milliammeter (VOM), as the unit is equipped with voltmeter, ammeter, and ohmmeter functionality.
Power Box	The electrical energy contained in the generator.
AC Motor	The rotor then is the rotating part of the AC motor. The objective of these motor components is to make the rotor rotate which in turn will rotate the motor shaft.
Pulley and Belt	A pulley is a wheel on an axle or shaft that is designed to support movement and redirect tension and a belt is a loop of flexible material used to link two or more rotating shafts mechanically.

#### 4.0 RESULT AND DISCUSSION

##### 4.1 Wind Energy

Step 1: Prepare all material	<p>Wind Turbine</p>  <p>Multi Meter</p> 
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Step 2: Put Wind Turbine at High-Altitude Ground	<p>Complete Design of Wind Turbine</p> 
Step 3: Wait for turbine blade spin follow the wind flow	
Step 4: Read the Voltage on Multi Meter	

When the pressure drops, it increases wind speed and will be zero only when the wind speed at the top of the tower reaches zero. It was found also that, there is an increase in friction losses through the tower and a decrease in both temperature difference between inlet and outlet of the tower and in heat losses from tower walls with the rise in wind speed in location. The inlet air velocity to the solar turbine and consequently its specific power was found to be increased with the increase in wind speed at the top of the tower. Therefore, the effect of wind speed at the top of the tower must be taken into consideration during thermosyphon solar tower calculations. By comparing the performance of solar turbine and the free wind turbine located at tower height with the absence of thermosyphon solar tower, it was found that the mean inlet air velocity to the solar turbine located at tower bottom and consequently its specific power is higher than these values for free wind turbine.

Table 2: Speed of Wind

Speed of Wind (km/h)	Observe Voltage (Volt)
10	9.7V
15	17.1V
20	24.7V
25	45.9V
30	57.3V

## 4.2 Hydro Energy



<p>Step 1: Prepare all materials</p> <ol style="list-style-type: none"><li>Archimedes Screw</li><li>Motor</li><li>Bearing</li><li>Pulley</li><li>Belting</li></ol>	<p>Archimedes Screw</p> 
<p>Step 2: Connect the natural wire from motor to positive wire at Multi Meter and the speed wire which is red wire to the negative at Multi Meter</p>	<p>Connected Wire Multi Meter</p> 
<p>Step 3: Connect the Screw to Motor with Pulley, Belting and Motor</p>	<p>Pulley, Belting and AC Motor</p> 
<p>Step 4: Start spinning the screw and observe the Multi Meter</p>	
<p>Step 5: Record data that have been show at voltmeter</p>	

The rotation speed of turbine has a significant impact on its performance. When the rotation speed is changed, the flow rate of turbine changes and the power changes. It was found also that, there is an increase the voltages if the rotation speed of turbine is increased at the end of these experiments.

Table 3: Rotation of Screw (in rpm) of Hydro Energy

Rotation of Screw (RPM)	Observe Voltage (V)
60	3.9V
120	7.8V
180	11.7V
240	15.6V
300	19.5V

### 4.3 Solar Energy

<p>Step 1: Prepare all materials</p> <ol style="list-style-type: none"> <li>i. Solar Panel</li> <li>ii. Power box</li> <li>iii. Bulb</li> <li>iv. Solar Stand</li> </ol>	<p>Set Solar Panel</p> 
<p>Step 2: Connect the Solar Panel to Connector</p>	
<p>Step 3: Place the whole system under Sunlight.</p>	
<p>Step 4: Face the Solar Panel to Sunlight</p>	<p>Figure 11 Placing Solar Panel</p> 
<p>Step 5: Tilt the solar panel at a position of 60 degrees toward the sun.</p>	
<p>Step 6: Switch on the power box to charge the electronic device at output port.</p>	

The sun's rays are most intense at noon, weakest at dawn and dusk, and in between at other daytime hours. Other factors such as cloud cover being equal, a solar panel's output is greatest at noon because the sun's rays are more direct than at other times (Ulanoff Lance, 2015). Seasons also affect the sun's

location in the sky because the earth's axis is tilted at 23.5 degrees with respect to the sun, the seasons change as the planet moves through its year long orbit.

Table 4: Duration of Under Sunlight for Solar Energy

<b>DURATION OF UNDER SUNLIGHT</b>	<b>Observe Voltage (V)</b>
1 Hours	10.0V
2 Hours	11.3V
3 Hours	12.6V
4 Hours	13.2V
5 Hours	14.7V

## 5.0 CONCLUSION

As a conclusion for Wind Energy, magnets play an important role in some of the world's largest wind turbines. Wind is one of the fastest growing sources of clean energy. As such, the role magnets play in helping create this clean energy should not be overlooked, as it is aligned with the mega-trend of sustainability and its benefits. Magnets are being used to lower costs, improve reliability, and increase maintenance intervals in many wind farms around the world and are also being used to reduce construction costs of new turbines by eliminating the need for more costly equipment mounting designs. As a conclusion for Hydro Energy, 40 times hand rotation are more generate voltage than two other speeds. 40 times hand rotation are more efficient because the speed of Archimedes screw is increased than two other total of hand rotations. By using 40 times hand rotation its easily to generate more voltages. However, if the Archimedes screw is testing in real situation likes at tank water with 1000 rpm, it can generate higher voltages. As a conclusion for Solar Energy, that solar panels can absorb sunlight to produce long-lasting electrical energy and produce voltage to calculate the temperature at the time of climax which is at 12 noon to 2 noon. Solar panels are left in the open to get sunlight.

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