



Science and Engineering Symposium  
4<sup>th</sup> International Science, Social Science, Engineering and Energy Conference 2012

## The Prototype of Solar Water Turbine: A Case Study of a Catfish Pond

T. Nonthaputha<sup>a,\*</sup>, P. Prasongjan<sup>a</sup>, S. Tantiwivat<sup>b</sup>, J. Phookwantong<sup>c</sup>

<sup>a</sup>*Department of Electronics and Telecommunication Engineering, Faculty of Industrial Education and Technology, Rajamangala University of Technology Srivijaya, Songkhla, 90000, Thailand*

<sup>b</sup>*Department of Mechatronic Engineering, Faculty of Industrial Education and Technology, Rajamangala University of Technology Srivijaya, Songkhla, 90000, Thailand*

<sup>c</sup>*Department of General Education, Faculty of Liberal Art, Rajamangala University of Technology Srivijaya, Songkhla, 90000, Thailand*

---

### Abstract

This paper proposes a solar water turbine: a case study of a catfish pond. The structure and equipment of the solar water turbine is suitable, moveable, and cheap. The equipment of the solar water turbine consists of solar cell, battery charger, DC power gear, buoy, inverte, and 4 sets of 16 inches blades. The experiment was set in two 5\*12 meters catfish ponds and compared between the pond with and without solar cell blades. The result reveals that the growing of the catfish and the quality of the water in the pond with solar cell blades is better than the pond without solar cell blades. Furthermore, the pond with solar cell blades can save more energy than the other.

© 2013 The Authors. Published by Kasem Bundit University.

Selection and/or peer-review under responsibility of Faculty of Science and Technology, Kasem Bundit University, Bangkok.

*Keywords:* Water turbine, Solar cell, Catfish

---

### 1. Introduction

Global warming refers to the rising average temperature of Earth's atmosphere and oceans and its projected continuation. The Earth's average surface temperature, expressed as a linear trend, rose by  $0.74 \pm 0.18$  °C over the period 1906-2005. Climate model projections are summarized that Earth's average surface temperature will increase 1.1 to 6.4 °C. [1] The global warming is the case study of unlimited human needed that has an affect on Earth's natural resources. In the last century, fossil fuel such as coal, petroleum, and natural gas which take for millions years to deposit are burned to create powers and electricity. It reveals that the fossil fuel demand is larger than its deposition that is why the carbon dioxide (CO<sub>2</sub>) balance is damaged extremely [2]. The cause of global warming is the greenhouse gases rising produced by human activities. Those activities have increased the amount of greenhouse gases in the atmosphere, leading to increased radiative forcing from CO<sub>2</sub>, methane, ozone,

---

\* Corresponding author. E-mail address: [thanat.n@rmutsv.ac.th](mailto:thanat.n@rmutsv.ac.th)

CFCs, and nitrous oxide. Global warming makes the sea rise, and when the sea rises, the water covers many low land islands. Global warming also caused natural disaster, flood, earthquake, extremely storm, earth warmer, and epidemic. It seems that the global warming effect is getting worse in a short-term trend.

The major causes of greenhouse gases increasing are the changes in land-use, particularly deforestation, energy sources that contain carbon, industrial processes, agriculture and livestock, and waste disposal and waste water. The changing to use the natural resources to reduce greenhouse gases increasing is affected to economy, social and cultural system both positively and negatively [3]. Alternative energy such as solar energy, wind energy, underground thermal energy, and thermal energy from the sun is the interesting way to reduce the greenhouse gases increasing.

Solar energy is the energy received by the earth from the sun. This energy is in the form of solar radiation, which makes the production of solar electricity. Solar energy can produce electricity for 150 kw a month that can reduce CO<sub>2</sub> in the atmosphere for 140 kg., 70 kg. coal saving, and 475 gallon water saving[4].

The agriculture of Thailand may be traced through historical, scientific, and social aspects which produced modern Thailand's unique approach to agriculture. Following the Neolithic Revolution, society in the area evolved from hunting and gathering, through phases of agro-cities, and into state-religious empires. Immigration of the Tai produced a distinct approach to sustainable agriculture compared with most other agricultural practices in the world. Unique elements of Thai agriculture include irrigation technologies which spanned a millennium. It also had administrative structures which originated with agricultural water control. Thailand has global leadership in production and export of a number of agricultural commodities, and its agribusiness sector includes one of the world's largest multinational corporations. There still remains potential for further large increases in productivity from known technologies.

Thailand leads the world in producing and exporting rice, rubber, canned pineapple, and black tiger prawns. It leads the Asian region in exporting chicken meat export and several other commodities, and feeding more the four times its own population from. Thailand also seeks to expand its exports in livestock [5]. Shrimp and fish agriculture that uses a water turbine for increasing O<sub>2</sub> in the pond wastes both electricity and fuel as well as increases global warming and high costs. Consequently, this paper presents the prototype of a solar water turbine : a case study of a catfish pond for increasing O<sub>2</sub> in the pond that can be suitable, moveable, cheap and save the energy.

## **2. Material and Method**

### *2.1 Electric Motor*

Motor is an electrical engineering that changes electric energy into mechanical energy. Motor can be divided into two types by its utilization: alternating current motor (A.C. Motor) and direct current motor (D.C. Motor) [6].

### *2.2 Direct Current Motor Types*

Series motor or series field provides high starting torque and is able to move very large shaft loads when it is first energized. Since the series field winding is connected in series with the armatures, it will carry the same amount of current that passes through the armature. For this reason the field is made from heavy gauge wire that is large enough to carry the load. Since the wire gauge is so large, the winding will have only a few turns of wire [7]. Shunt motor is a method of connecting field windings in parallel with the armature. The shunt DC motor is commonly used because of its excellent speed regulation [8]. In [9], Compound motor is a combination of the series motor and the shunt motor. It has a series field winding that is connected in series with the armature and a shunt field that is in parallel with the armature. The combination of series and shunt winding allows the motor to have the torque characteristics of the series motor and the regulated speed characteristics of the shunt motor.

### 2.3 Battery [10]

A battery is a device that converts chemical energy directly to electrical energy. It consists of a number of voltaic cells; each voltaic consists of two half-cells connected in series by a conductive electrolyte containing anions and cations. Batteries are classified into two broad categories, each type with advantages and disadvantages:

- Primary batteries irreversibly (within limits of practicality) transform chemical energy to electrical energy. When the initial supply of reactants is exhausted, energy cannot be readily restored to the battery by electrical means. Primary batteries are used for small appliances which are affordable price and short life such as dry cell for flashlight and clock battery. Some types of primary batteries used, for example, for telegraph circuits, were restored to operation by replacing the components of the battery consumed by the chemical reaction.
- Secondary batteries can be recharged; they can have their chemical reactions reversed by supplying electrical energy to the cell, restoring their original composition. Secondary batteries are not indefinitely rechargeable due to dissipation of the active materials, loss of electrolyte and internal corrosion.



Fig. 1. Battery [11]

### 2.4 Solar cell [12]

A solar cell (also called photovoltaic cell or photoelectric cell) is a solid state electrical device that converts the energy of light directly into electricity by the photovoltaic effect. Assemblies of solar cells are used to make solar modules which are assembled together (such as prior to installation on a pole-mounted tracker system), the resulting integrated group of modules all oriented in one plane is referred to in the solar industry as a solar panel. The electrical energy generated from solar modules, referred to as solar power, is an example of solar energy.

Photovoltaic is the field of technology and research related to the practical application of photovoltaic cells in producing electricity from light, though it is often used specifically to refer to the generation of electricity from sunlight. Cells are described as photovoltaic cells when the light source is not necessarily sunlight. These are used for detection light or other electromagnetic radiation near the visible range, for example infrared detectors, or measurement of light intensity.



Fig. 2. Solar cell panel

The solar cell works in three type : 1) Photons in sunlight hit the solar panel and are absorbed by semiconductor materials, such as silicon. 2) Electrons (negatively charged) are knocked loose from their atoms, causing an electric potential difference. Current starts flowing through the material to cancel the potential and this electricity is captured. Due to the special composition of solar cells, the electrons are only allowed to move in a single direction. 3) An array of solar cells converts solar energy into a useable amount of direct current (D.C.) electricity.

### 2.5 A floating buoy and blades

A floating buoy is an appliance that seizes and supports all of the tools for floating as a water level. A floating buoy is made of a very thick plastic that is designed for a different weight supporting. Blades are made for O<sub>2</sub> increasing in the water, most of them are seized with a movable floating buoy.



Fig. 3. A floating buoy and blades [13]

### 3. The prototype of a solar water turbine design

The prototype of a solar water turbine consists of the solar energy system that generates 12 volts 40 watts pressure. The pressure is controlled by a battery controller. After that the battery will push the voltage into two parts : 1) inverter ; converts the voltage from 12 volts to 220 volts to control the magnetic and 2) timer; motor that has a voltage for the blade rotating. The functions are controlled by a timer, as shown in Fig. 4.

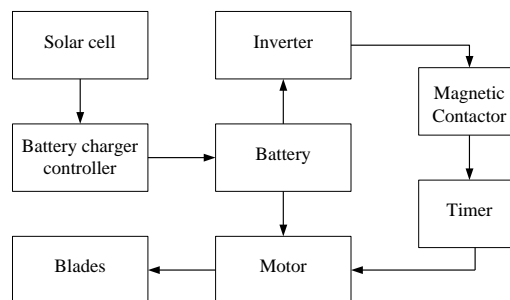


Fig. 4. Block diagram of the prototype of a solar water turbine



Fig. 5. Solar cell



Fig. 6. Battery charger



Fig. 7. Battery

For the electrical equipment, the 20 watts 2.7 amperes (40\*40 cm. long and wide) solar cell as shown in Fig. 4 is connected to a battery charger as shown in Fig. 6. The 40 amperes 12 volts battery has been chosen for generating the voltage to meter and inverter that converts the voltage from 12 volts to 220 volts. That voltage is suitable for the timer and magnetic contactor as shown in Fig. 8 and 9, respectively.



Fig. 8. Timer



Fig. 9. Magnetic contactor



Fig. 10. Floating buoys



Fig. 11. Blades



Fig. 12. The prototype of a solar water turbine

#### 4. The Results

The study was conducted with the catfish ponds by using the prototype of a solar water turbine as shown in Fig. 13.



Fig. 13. The prototype of a solar water turbine in the 5\*10 meters catfish pond

The experiment was tried out with the 5 meters wide and 12 meters long catfish ponds, 10 cm. long catfish in a number of 100 catfish each pond. The catfish was fed for a kilogram of food once a day in the pond with and without the prototype of a solar water turbine. The results were collected for 4 weeks as shown in Table 1.

Table 1. The catfish size in the pond with and without the prototype of a solar water turbine

Weeks	Catfish size in the pond without the prototype of a solar water turbine (cm.)	Catfish size in the pond with the prototype of a solar water turbine (cm.)
		10
1	12	13
2	14	15
3	17	19
4	23	20



Fig. 14 and 15 are comparing the catfish size between the catfish in the pond with and without the prototype of a solar water turbine. It is revealed that the catfish from the pond with the prototype of a solar water turbine is bigger than the catfish from the pond without the prototype of a solar water turbine.



Fig. 14. The catfish size in the pond without the prototype of a solar water turbine (week 4)



Fig. 15. The catfish size in the pond with the prototype of a solar water turbine (week 4)

## 5. Conclusion

The catfish in a pond with the prototype of a solar water turbine was better growing than the catfish in a pond without the prototype of a solar water turbine. Furthermore, the catfish pond with the prototype of a solar water turbine can save the energy that conduce to increase the global warming and the farmers can adapt this experiment to the sufficiency economy fishery.

## References

- [1] [http://en.wikipedia.org/wiki/Global\\_warming](http://en.wikipedia.org/wiki/Global_warming).
- [2] Lampang Team .Global Warming. 2008. From : <http://www.thaiail.com/globalwarming>.
- [3] [http://library.thinkquest.org/CR0215471/global\\_warming.htm](http://library.thinkquest.org/CR0215471/global_warming.htm).
- [4] Rothschild David De. 2008. The live earth global warming survival handbook.
- [5] [http://en.wikipedia.org/wiki/Agriculture\\_in\\_Thailand](http://en.wikipedia.org/wiki/Agriculture_in_Thailand).
- [6] Jarat Boonyathamma. 2006. Types of electric motors. From:<http://www.rmutphysics.com/charud/howstuffwork/motor/motorthai2.htm>.
- [7] <http://www.toolingu.com/definition-460200-35691-series-motor.html>.
- [8] <http://www.toolingu.com/definition-460200-35693-shunt-motor.html>.
- [9] <http://zone.ni.com/devzone/cda/ph/p/id/39>.
- [10] [http://en.wikipedia.org/wiki/Battery-\(electricity\)](http://en.wikipedia.org/wiki/Battery-(electricity)).
- [11] [http://www.siambig.com/shop/view.php?shop=carbattery&id\\_product=110917&sid=173897288b317a4d08ba2ab2c3691cb2](http://www.siambig.com/shop/view.php?shop=carbattery&id_product=110917&sid=173897288b317a4d08ba2ab2c3691cb2).
- [12] [http://en.wikipedia.org/wiki/solar\\_cell](http://en.wikipedia.org/wiki/solar_cell).
- [13] Sin machinery building company. 2010. Increasing oxygen water hitting turbine machine. From [http://ns.arkarnsin.com/category\\_new\\_buy2.php?s\\_page=4&id=cc00301165&idcatalog2=cc003](http://ns.arkarnsin.com/category_new_buy2.php?s_page=4&id=cc00301165&idcatalog2=cc003).