

Design and Fabrication of A Solar Boat Model

**Shinde Dnyaneshwar Tukaram, Shende Rahul Uttam, Raut Sujit Shivaji,
Narkhedkar Rohit Ankush**

Department of Mechanical Engineering, S. B. Patil College of Engineering, Indapur, India

ABSTRACT

The environment awareness has been developed worldwide so progressively and turns into the instant needs over the last few years. Researchers in all disciplines have a particular responsibility of development which is environmentally friendly and lead towards sustainable future development. Solar energy is a cosmic renewable energy source which has massive energy existing as heat and light and can convert it into electricity. Besides the domestic uses, solar power can be utilized as the alternative of the oil in boat's fuel and capable of minimizing the water pollution and fuel cost as well. The purpose of this research is to design and fabricate a boat based on solar power. The boat will be conducted by the energy processed from solar by minimizing environmental pollution and fuel cost. Besides, for any cloudy or emergency condition, a backup power system integrated with the photovoltaic cell will drive the boat to make the system more secured. Both mechanical and electrical part of the boat has been designed which is found more reliable, efficient and economic.

Keywords : Eco-friendly Ocean, Fuel Consumption Reduction, Solar Tracking System, etc.

I. INTRODUCTION

The conventional sources of energy are getting exhausted due to their continuous use. There are numerous researches on alternatives available for conventional energy. It is concluded that the solar energy should be preferred than any other alternatives due to their availability. We are concentrating on one fact that whatever the load is there on the boat is, it balanced on the water and whatever power required driving the boat is just a push force. In this project we are making a small working model of solar boat. The boat that runs on solar power only. The conventional ship is runs on fossil fuels. The solar power can be effectively and successfully utilized for Boat.

Problem Identification

1. The ordinary boat uses diesel fuel to run the generator of the boat, and then supply electric power to run the electric motor. So, find the use of new alternative energy to substitute the usefulness of

fuel. The solar electric boat is one of the alternative energy that can possibly solve this problem.

2. The solar electric boat cannot be used at night because there is no sunlight to produce energy. However, this problem can be solved by using rechargeable batteries that can supply current to the electric motor of the solar boat at night.

Nomenclature

SR. NO.	ABBREVIATION	FULL FORM OF ABBREVIATION
1	PV	Photovoltaic
	PVC	Polyvinyle Chloride
2	MEPC	Marine Environment Pollution Commity
3	IMO	International Marine Organisation
4	PMS	Power Management System
5	AC	Alternative Current
6	DC	Direct Current
7	KHz	Kilohurtz

II. METHODS AND MATERIAL

$$W = V * I = 10 \text{ watt}$$

The solar boat is proposed for recreation activities used. It is also applicable for one or two person. Because of the **high-cost** to develop an actual size of ordinary boat, the size of the boat will be **scale-down to (1: 16)**. we will use the remote control boat as my main equipment. The model dimensions of the boat is about length (0.6 meter) x width (0.3 meter) x height (0.300 meter). The unladen weight about 2.7 kg (and the load 4 that can be support is about 1.5 kg . Below are the full characteristics and specifications of the solar powered electric boat model project.

Design and Model Creation

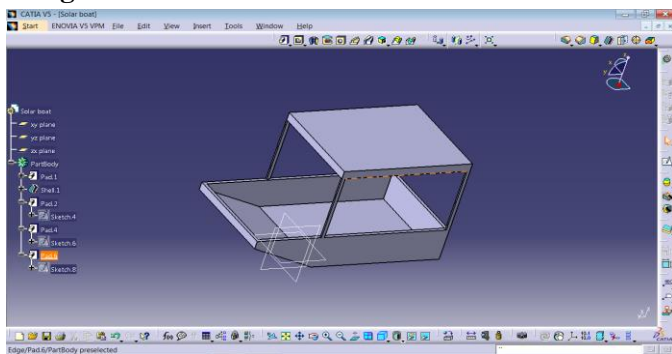


Figure1. 3D Drawing of our Solar Boat Model

Specification of Solar Boat Model

- 1 Model length- 0.6m
- 2 Model width- 0.3m
- 3 Model height- 0.3m
- 4 Model weight- 2.7 kg
- 5 Velocity of boat model- 0.225m/s
- 6 Power required to drive boat- 3.5watt
- 7 Efficiency of model- 70%

Photovoltaic Generating System

In our boat the area available for laing a photovoltaic array is about 0.102 m². On this area, it is possible to install EN612156/61730-1/2 module class A safty class ii ; every single panel has a dimensions of 350 mm × 290 mm × 24.89 mm, Maximum Power Voltage (*Vmp*) 17.40 V, Maximum Power Current (*Imp*) 0.58 A, which leads to a Maximum Output Power (*WPmax*) 10+-3% W in Standard Test Condi- tions.

The yearly average electrical energy from photovoltaic array is given by the following equation.

III. RESULTS AND DISCUSSION

Solar Boat Model Material

Table 1. Specification of Material

Material	Density (g/cc)	Yield strength (psi)	Tensile strength (psi)	Tensile modulus (psi)	Chemicals resistance
PVC	1.42	12800	7500	411000	Class B

Solar Panel Specification

Table 2. Specification Of Solar Panel

Max voltage	Max current	Power	Cell type	Length	Width	Depth	Weight
18.70 Vmp	0.541 mp	10watt	Mono crystal line	350 mm	290 mm	24.89 mm	1.50kg

Batteries

For our solar boat model, we assume that the average electrical power necessary during the cruise is 10W

Table 3. Specification Of Batteries Used For Model

voltage	No of cells	Capcity (Amp/hour)	Length (m)	Width (m)	Height (m)	Weight (kg)	Battery acid(liters)	Charging current (amp/hour)
12	6	4	120	70	92	1.330	0.294	0.4

Propeller

A propeller is a type of fan that transmits power by converting rotational motion into thrust. A conventional water propeller is the most commonly used type of propeller. The propeller must transfer all the solar panel power to the water to drive the ship. Keep the shaft angle low to maximize forward thrustcomponent and minimize the vertical thrust component.

In our solar boat model we have used 60mm diameter propeller



Figure 2. Propeller

Motor

The motor used in solar boat model is geared motor essentially driven by magnetic attraction and repulsion between the permanent magnets in the motor stator and the rotor which is an electromagnet powered by solar panel. The motor RPM varies directly with voltage.

Table 4. Specification of Mother Used For Model

Voltage (v)	RPM	Torque (kg-cm)	Current (mA)	Shaft length (mm)	Size (mm)	Weight (grams)	Reduction ratio
12	500	3.5	57.6	7	55*48*23	32	1:48

IV. CONCLUSION

The design of a Solar-Electric Boat model by increasing ratio for tourists' transport along the coast, in the rivers, in the lakes has been presented. With our system, it is possible to replace the standard fuel engine with an electric one, by accepting a loss in power, and without changing the weight and the dimension of the boat. Our boat has greater price in comparison to an equivalent boat equipped with traditional propulsion. Currently to manufacture a solar-electric boat there are extra cost due to photovoltaic plant, battery bank and management control system. These additional costs are partially compensated by reduction of operation costs; in solar-electric boat there is no consumption of fuel and the costs of maintenances are relatively lower. Within ten years the extras costs are amortized. Besides, the great advantage of the use of renewable energy produces indirect socio-economic advantages; ecosystem preservation, reduction of CO₂, NO_x and SO_x emission, etc. In this project we have proposed an innovative management of charge/discharge for battery. With this

management, we have optimized the batteries life, and during the navigation we have a real time control of the navigation autonomy. Besides we have designed ship with zero pollution and very low running costs; all the necessary energy for the navigation has origin by renewable. Electricity produced by photovoltaic is safer and more environmentally benign than conventional sources of energy production. However, there is environmental, safety, and health issues associated with manufacturing, using, and disposing of photovoltaic equipment. The manufacturing of electronic equipment is energy intensive. The electricity produced is higher than the one necessary to manufacture the photovoltaic modules and the energy break-even point is usually reached in a period from three to six years.

V. REFERENCES

- [1] Solar-Electric Boat, Giuseppe Schirripa Spagnolo, Donato Papalillo, Andrea Martocchia, Giuseppe Makary, Journal of Transportation Technologies, 2012, 2, 144-149
- [2] Design and Fabrication of an Automated Solar Boat, Khizir Mahmud, Sayidul Morsalin and Md. Imran Khan, International Journal of Advanced Science and Technology Vol.64 (2014), pp.31-42
- [3] Solar And Wind Powered Concept Boats, Hakan Gursu, International Journal (Oct 2010)
- [4] Development of Solar Powered Boat for Maximum Energy Efficiency, Juraci Carlos de Castro Nóbrega and Andrej Rössling International Conference on Renewable Energies and Power Quality (ICREPQ'12) Santiago de Compostela (Spain), 28th to 30th March, 2012
- [5] Optimal sizing of hybrid PV/diesel/battery in ship power system Hai Lan, Shuli Wen, Ying-Yi Hong, David C. Yu, Lijun Zhang, Science Direct (Aug 2015)
- [6] Strategies to Reduce Air Pollution in Shipping Industry, Chul-hwan HAN, The Asian Journal of Shipping and Logistics Volume 26 Number 1 June 2010
- [7] Propellers & Solar Boats, Reg Frank, Philip Thiel, Theo Schmidt, The Amateur Yacht Research Society (Oct 1991)