Solar, wind and Tidal Hybrid Floating System Solar, Wind and Tidal Hybrid Electricity Production System

[1]Sahil Ashwinbhai Patel, [2]Sharvil Rajeshbhai Patel, [3]Rushi Jayeshbhai Patel
[1]BE Student, [2]BE Student, [3]BE Student
[1]Mechanical Department,
[1]Ahmedabad Institute of Technology, Ahmedabad, India

Abstract— Nowadays, requirements of electricity around the globe are rising at very high rate. It is now widely accepted that conventional resources, which are being used presently for power generation, may not be sufficient enough to cope up with the future demand. Additionally, these conventional resources like fossil fuels (i.e. coal, gasoline and natural gas) causes pollution and are harmful for the environment. This leads us to develop new methods of power generation viz. renewable energy (i.e. solar, wind, tidal energy etc.). Production of electricity by using the combination of solar, wind and tidal energy gives appreciation to the green technology. Currently, there is no such hybrid system based on renewable resources. Our product will help government, oil refineries, resorts on sea-shore, etc. and will economically support them. Health hazards will be reduced as our product uses clean and green technology and will also maintain the atmosphere level.

***Index Terms*—Renewable Energy, Wind Energy, Solar Energy, Tidal Energy, Aspect Ratio, Swept area**

I. INTRODUCTION (HEADING 1)

The contemporary non-conventional sources of energy like wind, tidal, solar etc. were the conventional sources until James Watt invented the steam engine in the eighteenth century. In fact, the New World was explored by man using wind-powered ships only. The nonconventional sources are available free of cost, are pollution-free and inexhaustible. Man has used these sources for many centuries in propelling ships, driving windmills for grinding corn and pumping water, etc. Because of the poor technologies then existing, the cost of harnessing energy from these sources was quite high. Also because of uncertainty of period of availability and the difficulty of transporting this form of energy, to the place of its use are some of the factors which came in the way of its adoption or development. The use of fossil fuels and nuclear energy replaced totally the non-conventional methods because of inherent advantages of transportation and certainty of availability; however these have polluted the atmosphere to a great extent. In fact, it is feared that nuclear energy may prove to be quite hazardous in case it is not properly controlled. India is a large and spread over a wide area so it's quite difficult to access electricity each and every part of the country using Traditional Generation, distributed generation in which electricity is produced at consumer end serves a better end. In Traditional Generation sometimes the grid failure leads to the blackouts while in Distributed Generation this case will not occur. Traditional Generation consist of long transmission lines which makes it costly in case of Distributed Generation there is no need of long transmission line which ,makes its cost effective.

Figure 1: Solae Wind and Tidal Hybrid model

Traditional generation system are quite complex as there are very big system consisting of many parts while distributed generation is quite simple in its construction. Traditional generation is an effective method but there are some rural areas are in India which is still inaccessible so the Distributed Generation will play a significant role in remote and inaccessible regions.

II. ADVANTAGES

- Using this product, it will overcome the negative outcomes of the current technologies that are being used for production of energy.
- Using this product, we can get clear and clean outcomes as it uses renewable sources of energy.

- Production cost is less as compared to current products.
- Maintenance cost will be reduced.
- Local people will get benefitted from this product.
- Easy replacement of damaged parts.
- Most eco-friendly source of energy.

III. PRODUCT DESIGN

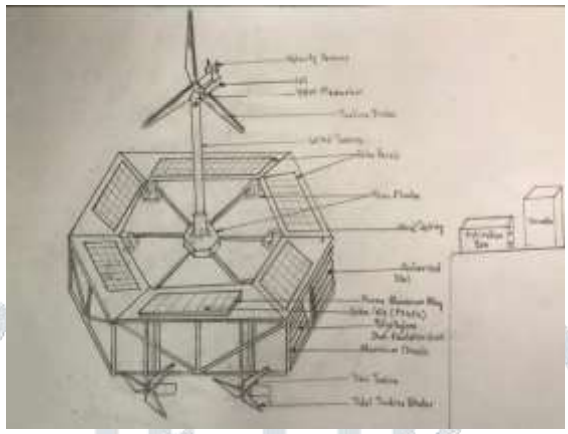

Figure:2 Product Design

IV. DIMENSION PARAMETERS & POWER CALCULATIONS

- Solar power generation calculation:

3W*6(number of panels) = 18W
= 13 W (25% losses)
Average sunlight hours = 7h
Power generated per day = 13*7= 91W

Battery requirements:

91W/ 6V = 15Ah + 50% extra (battery losses) = 24Ah (approx.)

- Tidal power generation calculation

Tidal range: 5m (Approx.)
Specific density of sea water: 1025.18 kg/m3
Area of device: 1m x 2m = 2 m2 x 40(number of devices) = 80m2
Mass of water = Area * tidal range * mass density = 4.10 x 105 kg
The mean power generation potential per day
= ½ * Area * Density * Gravity * Tidal Range Squared * 2 / Time in one day
= ½ * 80 * 1025.18 * 9.81 * 25 * 2 / 86400 sec
= 230 W (approx.)

Power conversation efficiency = 30%
= 230 * 30 / 100
= 70 W per day (approx.)

- Wind Power Generation Calculation Radius of Blades
  r = 0.066
  Wind Speed V = 2.764 m/s

Air Density ρ = 1.127 kg/m3
Maximum Power Co-efficient Cp=0.4
Rotor Swept Area A=πr2

Power Generation,
P = 0.5 ρ A V3 Cp
= 0.5*1.127*π (0.066)2*(2.764)3*0.4
= 0.0651 kW
= 6.51 W

1 Unit Power Generation = 5*6.51
= 32 W

TIP SPEED RATIO (TSR) = (tip speed of lade) / (wind speed). The tip speed ratio is a very important factor in the different formulas of blade design. Generally can be said, that slow running multi bladed wind turbine rotors operate with tip speed ratios like 1-4, while fast runners use 5-7 as tip speed ratios. The task is now to fit the known generator capacity and revolutions to the wind speed and to the swept rotor area.

FORMULAS ARE NEEDED:
Power (W) = 0.6 x Cp x N x A x V3,
Revolutions (rpm) = V x
TSR x 60 / (6.28 x R),
Cp = Rotor efficiency,
N = Efficiency of driven machinery,
A = Swept rotor area (m2),
V = Wind speed (m/s) TSR = Tip Speed Ratio,
R = Radius of rotor,

- **Problem Summary**:

Currently non-renewable energy resources are used for the production of the electricity as well as power generation. Although non-renewable energy sources are abundant and affordable the biggest disadvantage is that they can't be replaced or revitalized. These non-renewable energy resources include fossil fuels [i.e. oil (petrol, diesel), natural gas, coal and uranium which is used for the power generation in nuclear power plants. Fossil fuels which are used in vehicles, industries etc. produces toxic gases like Sulfur Dioxide (SO2), Hydrocarbons (HC), Nitrogen Oxides (NOx), Carbon Monoxide (CO). These gases cause harmful effects to human health as well as environment. And radioactive uranium used for power generation in nuclear power plants causes kidney disease, cancer etc. Non-renewable energy resources are also responsible for the green-house effect, global warming and acid rain as they produce Sulfur Dioxide (So2), Carbon Monoxide (CO) & Carbon Dioxide (CO2).

So, to overcome these disadvantages and of non-renewable energy resources and to reduce the highly increasing demand of electricity generation by conventional resources the use of alternative resources like renewable energy has become essential. Renewable energy includes solar energy, wind energy, tidal energy etc. Hence, we are trying to implement our efforts for the betterment of the environment and society by supporting green technology with the help of our product.

V. REFERENCES

[1] Hybrid Renewable energy system Wikipedia [Online]
Available: https://en.wikipedia.org/wiki/Hybrid_renewable_energy_system
[2] Wind Solar Hybrid System – Suvarna Urja Wind Power
[You-tube Video] Available: https://www.youtube.com/watch?v=NmiQ4a2w9aE
[3] Wave and Wind Hybrid Power Generation System
[You-tube Video] Available: https://www.youtube.com/watch?v=qtT28aaXFKU
[4] Jeff Sloan, "Tidal turbine blade toughened for turbulent salt sea".
Internet: https://www.compositesworld.com/articles/tidal-turbine-blade-toughened- for-turbulent-salt-sea
[5] Very Large Floating Structure Wikipedia [Online]
Available: https://en.wikipedia.org/wiki/Very_large_floating_structure