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FLOATING SOLAR PLANT

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ABSTRACT

Now a days the biggest challenges before India is the power crisis. The constant depletion of fossil fuels and high energy demand focuses us to use renewable energy sources which are not only the future unlimited energy sources, it is also eco-friendly and sustainable for the environment. Even though solar power generation has several advantageous over other forms of electricity generation, the major problem is the requirement of land which is scarcely available in the world and its cost. Also India being the seventh largest country in terms of area and gifted with fairly well sunshine almost 300 days in year, solar has lots of potential in store of us.A new era in solar power i.e. FLOATING SOLAR POWER plants will solve this issue. This floating solar plant can be installed in any water bodies which will not only decreases cost of the land but also will raises the amount of generation with the cooling effect of water. Studies have also shown that if the rear surfaces of solar panels are kept cooler, then their ability to generate power goes up by 16%.

Keywords: *Efficiency, Floating solar, PV, Solar Panels, Water.*

I. INTRODUCTION

Electricity crisis is the main problem in Bihar. Due to lack power, industries cannot open shops there. Bihar doesn't have enough coal to run thermal power plants. In India 65% of energy is generated with coal and Indian industry consumes 70% of total coal of the country. It is high time India moves away from coal-intensive electricity production and explores renewable energy resources like solar energy.

In recent years, renewable energy sources are growing rapidly all over the world. Solar energy is considered to be one of the most promising energy alternatives due to its ubiquity and sustain-ability. The solar energy is freely and enormously available throughout the world. The best way to use solar energy is PV system. Photovoltaic (PV) modules are one of the most effective, sustain-able, and eco-friendly products in the field of renewable energy. The main burden of land mounted solar system is availability of land. There is large water bodies available in various parts of the country which can reduce the saving cost of land and operating cost for power generation expenses. So the solar PV systems can become a very logical alternative for harnessing solar energy by utilizing obtainable water bodies and help to increase the economic viability of solar projects. Energy from photovoltaic's though a re-newable source, maintains a low efficiency of less than 15% in its long life use. Floating solar generate more electricity than ground-mount and rooftop (solar) systems because of the cooling effect of water. It also reduces reservoir evaporation and algae growth by shading the water. The floating platforms are 100% recyclable, utilizing high-density polyethylene which can withstand ultraviolet rays and corrosion.[6]

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II. PHOTOVOLTAIC SYSTEM

P-N junction made solar cells most commonly made from silicon. As a simplification, one can imagine bringing a layer of n-type silicon into direct contact with a layer of p-type silicon. In practice N-junction Silicon made cells made by doping an p-type region and n-type region.

If a piece of N-type region placed near the P-type region then, the recombination of electron and. holes created. And when this combination of electron and hole pairs are done, electric filed is created. The electric field promotes charge flow, known as drift cell, that opposes and eventually balances out the diffusion of electrons and holes. The region where electrons and hoes are diffused is known as depletion region. Because it contains practically no mobile charge carriers. It is also known as the space charge region, although space charge extends a bit further in both directions than the depletion region.[4]

III. CONSTRUCTION

3.1 Pontoon

Pontoon is a floating device made up of Polymer and has enough buoyancy to float on water with heavy load placed on it . The platform is design to hold suitable number of modules in series parallel combination according to the requirement and space avail-ability.

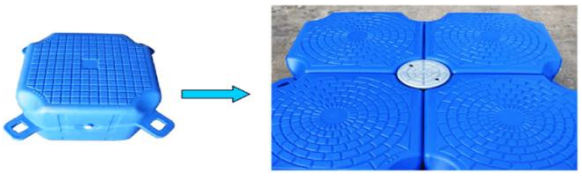

Fig 3.1.1 pontoon

3.2 Floats

Multiple plastic hollow floats with effective buoyancy to self weight ratio are connected in series such as to formed a giant pontoon. The floats are typically made of HDPE (high density poly-ethylene), known for its tensile strength, maintenance free, UV and corrosion resistance. Glass fiber reinforced plastic (GRP) can also be used for construction of floating plat-form. HDPE is commonly used for the fabrication of fuel tanks, milk bottles, water pipes, and can be recycled as well.

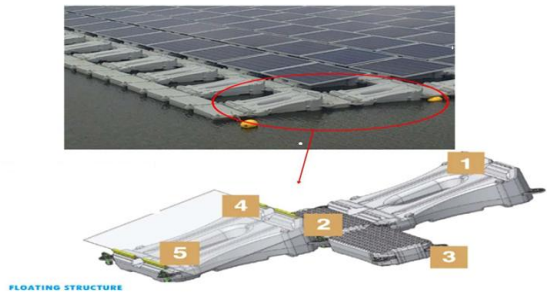

Fig 3.2.1 Floating structure

1 Main float supporting PV module 2 Secondary float

3 Tab connection 4 Gasket to mount module

5 Module locking

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3.3 Mooring system

Mooring system it is a permanent structure that holds the system at a placed. Examples include quays, wharfs, jetties, piers, anchor buoys, and mooring buoys. In the case of a floating solar system, the mooring system keeps the panels in the same position and prevents them from turning or floating away. The biggest challenge is that to installed mooring system in deep water. Mooring system for floating platform can be done with nylon wire rope slings which can be tied to bollards on bank and lashed at each corner. [1]

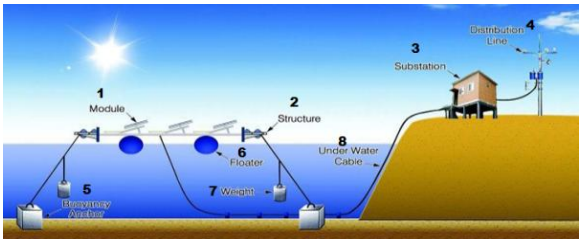

Fig.3.3.1 layout of plant

1Module	2structure
3substation	4Distribution line
5Buoyancy anchor	6Floater
7Weight	8Under water cable

VI. PROBLEM'S OF THIS SYSTEM

6.1 Shading on panels due to water?

Solar shading is the dirty phrase of the solar industry. Due to waves created in the water, sometimes water come on the surface of the panels. so, due to this the PV cells acts as a load and the efficiency reduces, also the power out decreases.

Because without getting the heat, electrons hole pairs cannot formed in the Solar cells and the energy cannot be generated. So, to eliminate this effect panels tilted by some angle so, water can easily removed.

As compare to land mounted system the energy generation decreases only 2-3% of total energy that of in land mounted it decrease 50% of total.

6.2 Effect of flood in rainy season?

As we know in rainy season more water come into the reservoir with more kinetic energy. So, due this more waves created in the reservoir and system get displaced & some time it get damaged.

Mostly system is installed in the man-made pond. So there is no such causing. But if the system installed in river, so we have to protect and eliminate this effect.

So, to eliminate this and to save our system mooring system must be strong enough to with stand and more weights are connected to system.

6.3 How to transfer energy from panel to battery?

Cables used for this system should me robust and mechanically strong. High temperature resistance and excellent weatherproofing characteristics provide a long service life to the cables used. The connectors with

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high current capacity and easy mode of assembly are to be used for the connections of the power plant cables. With this cables power can be transfer to the battery, which is installed in battery room.[5]

VII. CASE STUDY

India's largest floating Solar Energy Plant at Kerla, capacity of 100Kwp SWELECT Energy Systems Ltd (a leading Manufacturer of Solar PV Modules & Integrator of High Quality Solar PV Power Systems) has successfully built and commissioned India's largest Floating Solar Energy plant at Rajiv Gandhi Combined cycle power plant(RGCCPP in Kayamkulam, Kerala for NTPC. The floating structure was commissioned in a short span of 22 days. This plant was constructed under campaign of 'Made in India'.

To reduce the cost of the system, a collaborative indigenous floater development project has been taken up by NETRA with Central Institute for Plastic Engineering and Technology (CIPET), Chennai. NETRA, NTPC and SWELECT Energy Systems Ltd worked jointly in this program. And system has 25 years of continues working life.

7.1 Features:

- Indigenously developed floaters
- Cost effective (compared to commercially available floating PV system)
- India's Largest installation of its kind at NTPC
- A good display of Make in India initiative

7.2 Benefits:

- No land required (no land cost/availability/acquisition issues/no uprooting of trees)
- Reduction of evaporation of water and algae growth in water bodies
- Expected increased generation because of cooling effect on PV panels (water is at cool temperature when the atmospheric air is hot – per day generating around 5.7 kWh / kWp)
- Reduced installation time when compared to land
- PV modules stay free from dust to large extent – resulting in low maintenance on cleaning.

7.3 PV Modules:

The CEA specifies design qualifications and quality standards for both crystalline (c-Si) and thin film modules. In addition, the MNRE also specifies standards through the National Solar Mission. These standards are:

- IEC 61215 for crystalline silicon PV modules
- IEC 61730, that provides requirements for construction of the module, testing

and safety qualification.

- IEC 61701, that specifies the salt mist corrosion testing for modules that are used in coastal corrosive atmospheres.

The IEC standards apply to all modules, used in Indian solar PV projects, either manufactured in India or imported into India. They, however, consider the environmental effects of the Indian weather conditions into their quality check process.

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Table 5.3.1 Specification of solar panel

Nominal Max. Power (Pmax)	310w
Opt. Operating Voltage (Vmp)	36.4v
Opt. Operating Current (Imp)	8.52A
Open Circuit Voltage (Voc)	44.9V
Short Circuit Current (Isc)	9.08A
Module Efficiency	16.16%
Operating Temperature	-40°C ~ +85°C
Max. System Voltage	1000 V (IEC) or 1000 V (UL)
Dimensions	1954x982x40mm
Weight	22Kg
Other	Salt mist and blown sand resistance, for seaside.

7.4 Power transfer:

Output shall be stepped up to 11 KV using KVA outdoor type ONAN transformer. Power from 11 KV side of the transformer will be transferred through double circuit Double pole overhead transmission lines to the 11KV transmission line, through a FIT Panel, operated by KSEBL located 1 km from the site.[2]

Table 5.4.1 Project capital cost(approx.)

Particular	Cost(INR)
Solar modules and connectors	36,45,600
Civil, general works, mounting structure & mooring system	39,85,660
Power conditioning units/inverters	9,24,140
Evacuation cost up to inter-connection point (cables and transformers)	13,85,533
Land preparation	2,94,000
Accessories and Taxes	10,09,119

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Installation, commissioning, contingency & consultancies	13,45,540
Fish hatcheries & inspection alleys	3,10,000
	12,899,592

VIII. CONCLUSION

Use of solar energy is efficient in nature as it is renewable energy source. By using such type of energies to generate and environment can be protected from global warming. With such technology precious land is saved. Comparing the land mounted system floating plant has more advantages. Efficiency also more which is main consideration of any generating station. Maintenance also less in floating system.

As the solar panels are mounted on the water bodies the water surface are shaded so, water evaporation also reduced to the 70%.

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