

# Design and Finite Element Analysis of Floating Structures (Floats) for Solar Panel Installation on Water Bodies

Piyush M. Bhelkar<sup>1</sup> Dr. Vinod. N. Bhaiwar<sup>2</sup>

<sup>1</sup>M. Tech. Student <sup>2</sup>Assistant Professor

<sup>1,2</sup>Department of Mechanical Engineering

<sup>1,2</sup>G.H.Raisoni college of engineering Nagpur, Maharashtra, India

**Abstract**— Solar energy is the most efficient source of renewable energy, in which solar panel are used to convert sunlight into electricity. Solar energy travels from the sun to the earth in the form of electromagnetic radiation, these radiations are used to produce electricity through solar cells (photovoltaics). The use of solar energy resources is increasing rapidly. The Gujarat state has commissioned Asia's largest solar park at Charanka village. The project is spread over 4900 acres of land acquired by the government from farmers. The major drawback of a conventional solar plant is the requirement of large amount of land. In this project we design a structure (float) which can be installed over a water body on which the solar panels can be mounted. And analyse the design of the structure using analysis FEA software to validate and optimize the design. This project is involving designing and analysing of floating solar farm for Narayani Electricals Works, Koradi, Nagpur.

**Key words:** Solar Panel, Floating Structure Analysis

## I. INTRODUCTION

### A. Solar Farm

The Gujarat state has commissioned Asia's biggest solar park at Charanka village. The park generates 2 MW of solar power out of its total planned capacity of 500 MW. This project is spread over 4900 acres of acquired land by the government from farmers. The major drawback of a conventional solar plant is the requirement of large land. The utilization of solar energy would ultimately lead to the human resources utilization process. Considerable amounts of development foreign aid are received each year by the developing countries.

### B. Floating Solar Farms

The water bodies can also be used for generating electricity through floating solar farms.



Fig. 1: Floating solar farms

## II. LITERATURE REVIEW

Aseem Kumar Sharma Professor (Dr.) D P Kothari: The target of 100GW Solar Power (by year 2022) set by Govt. of

India needs proper utilization of available area for deployment of Solar Power panels. Though land & roof tops are considered as focused areas, Floating Solar power (FSPV) on large reservoirs & other water bodies also offering significant potential. Aim of this paper is to analyse the FSPV potential in large reservoirs of India. This paper also describes the types of FSPV & benefits of FSPV.

Paritosh Sharma, Bharat muni, Debojyotisen: Solar energy is produced by sun through a thermonuclear process. This process creates heat and electromagnetic radiations. Electromagnetic radiations have the energy which directly reaches the earth. The high demand of energy and constant depletion of fossil fuels leads to shift focus to renewable energy sources that are not only the future source of energy, but also eco-friendly and viable for the environment. Wind and hydro though are renewable sources but are area specific. On the other hand solar energy can be installed in any area. The major issue with this energy resource is the requirement of availability of land which is scarcely available and costly to get. But floating solar plants can solve this issue by installing in any water bodies which will reduce the cost of the land and also will increase the amount of cooling effect of water. This paper touches upon the design parameters of the floating structure but will also concentrate upon the effect of panel shade on the ecosystem. Solar panels are naturally cooled as the air above the water body has high content of moisture and hence it can automatically solve the issue of heating losses that occur during its operation.

Krishnaveni, P. Anbarasu& D. Vigneshkumar: The high demand of energy and constant depletion of fossil fuels leads to shift focus to renewable energy sources that are not only the future source of energy, but also eco-friendly and viable for the environment. Even though solar power generation method has many advantages over other forms of power generation, the major issue with this energy resource is the requirement of availability of land which is scarcely available and costly to get. A new era in solar power i.e., floating solar power plants can solve these issues. This floating solar plants can solve this issue by installing in any water bodies which will reduce the cost of the land and also will increase the amount of cooling effect of water. This paper concentrates the technical details of floating solar plants. The floating solar consists solar panels and other components that are fitted on a platform with hollow plastic or tin drums that enable it to float on water.

Hartzell Tynan Scott: This project evaluates the current state of floating solar photovoltaic technology and use of the technology on water management infrastructure in Arizona. The study finds out that floating solar photovoltaic has a higher energy density (100 W/m<sup>2</sup>). This study evaluates and models a small pilot installation on Lake Reservoir, a part of the Central Arizona Project, and finds

lifetime cost per unit energy are higher than the Central Arizona Project currently pays for energy, assuming US median per-watt installed costs for commercial solar. This cost however does not factor in savings from water existing infrastructure, water conservation and reduced land costs. The study suggests water reservoirs by hydropower dams are ideal locations for floating photovoltaic installations. It is justified with a significant background on Arizona's environmental and economic sustainability, as well as regulations recommends for increased renewable energy generation and reduced carbon emissions, this study recommends aggressive implementation of floating solar photovoltaic technology within a sustainable development paradigm. To start, the technical potential for floating solar installations on Lake Pleasant Reservoir will be estimated.

SADIQ ALI SHAH: The problems of lack of potable water and electrical power around the desert environment are analyzed, and their solutions based on the utilization of renewable energy resources are evaluated in this research work. Self-contained, decentralized solar energy powered functions are mentioned in the research results as means to attain the objectives of supplying electrical power, potable water and food to the communities in the deserts area in environmentally sustainable manner. There is a need of analysis of desert community, a questionnaire survey, desert energy model utilization scenarios, solar energy assessment and environmental emissions reduction strategy used as means of analysis in this current research. A potential assignment of a desert site Islamkot, at Thar is carried out to highlight the capability of available solar energy to meet the energy needs of underground processes like pumping, desalination of aquifer water potable water, cultivation of rice, wheat and pulses and domestic power consumption etc. This needs analyses estimate the amounts of electrical power needs of agricultural commodities cultivation, potable water desalination and electricity needs per person per day, which may be scale up for any number of communities living in the deserts.

### III. IDENTIFIED GAPS IN THE LITERATURE

Most of the researchers have investigated almost all type of failures on floating bodies. The purpose of this work is to design a structure (float) which can be installed over a water body on which the solar panels can be mounted, and to analyze the design of the structure using analysis FEA software to validate and optimize the design. Very limited work has been observed on the design of floating structure for solar applications.

### IV. PROBLEM FORMULATION

This project is an industrial project for Narayani Electricals Works, Koradi, Nagpur. It involves the designing and analyzing of a floating structure (float) which can be installed over a water body on which the solar panels can be mounted, An emergent method of solar photovoltaic electricity generation known as "floating solar" dramatically improves the efficiency of photovoltaic generation while also insulating water bodies, thereby decreasing water loss due to evaporation and improving water quality. This is a systems-thinking approach that may be especially beneficial

in transitioning to sustainable water and energy infrastructure for the drought affected in Marathwada region in Maharashtra state.

### V. RESEARCH METHODOLOGY

In present study, we create the CAD model of floating structure (for solar application). Then analysis of design will be performed. If required the modifications and analysis of modified design will be performed after that results will be discussed and design will be finalized.

### VI. CONCLUSIONS

With successful completion of this project, the company Narayani Electricals Works, Koradi, Nagpur will be directly benefited, this solution can reduce the water loss due to evaporation and improving water quality. This is a systems-thinking approach that may be especially beneficial in transitioning to sustainable water and energy infrastructure for Marathwada region.

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