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Study of Reduction in Evaporation Rate from Reservoir Using Floating Solar Panels –A Review

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Abstract -*Agriculture is one of the important occupations in India, a country with extraordinary climate of heavy rainfall in one region and severe drought in another region. This makes it important to eliminate all losses of water from all types of storages. India has nearly more than 3200 dams which lead to large water surface exposed to sun giving rise to major evaporation losses. Hence to meet the increasing demand of the water, there is a need to save the water. As India is blessed with sunlight all year around, this can be used as source of renewable energy. Solar energy provides an alternate source of renewable energy in rural and urban India for fossil fuels. Large areas are used to lay solar panels decreasing the availability of land for agriculture. Hence the idea of floating solar photo-voltaic cells came into existence. Nevertheless, the study on synergies between the water for food and power production has highlighted that the integration of floating PV will represent the key solutions. This paper gives overview of studies on estimation of evaporation in semiarid areas, installing floating solar plants on water basins, evaporation control using floating PV system and canal roof top solar panel, exploiting existing dams for solar PV system installation, the potential of water infrastructure to accommodate solar PV panels in Mediterranean island, installations of floating PV, analysis of California state water project efficiency , power generation efficiency and prospects of floating photovoltaic system.*

Key Words: **severe drought, renewable energy, floating solar photovoltaic cell, evaporation losses, photovoltaic cells**

1.INTRODUCTION

Water plays very vital role in existence of life on earth, giving rise to mankind. About 70 percent of earth is covered with water. Out of which only 2.5 percent is freshwater. The remaining is saline or ocean based. Even in this 2.5 percent, only 1 percent of freshwater is easily available; rest is trapped in glaciers and snowfields. India has 4 percent of world's water resource supplying 16 percent of world's population. Climatic conditions are severe here with mild winter, hot summer and heavy rainfall. This extraordinary climatic difference causes scarcity of water. India's equatorial climate also results in potential evaporation losses from various water bodies. There are nearly 3200 dams constructed across the rivers to store water in reservoirs for various purposes. This reservoir tends to leave larger surface area exposed to sunlight causing evaporation of freshwater. On the other hand, the crisis of energy is increasing due to increase in population. Most of the energy is consumed in power generation, industries & factories. In developing countries like India, more than 70 percent of the population lives in the rural areas where more than 85 percentage of the energy being consumed from non-conventional sources, the major one being fuel wood. The incrementing cost of conventional fuel necessitates the exploration of other energy sources. Solar energy provides an alternate source of energy in rural and urban India as supersession for fossil fuels. Solar photovoltaic technology is one of the best prevalent renewable energy alternatives. Photovoltaic solar panels absorb light as a source of energy to generate electricity. In this 21st century the use of photovoltaic cells for electricity generation is increasing. This gives rise to necessity of land to lay solar panels. In residential buildings this solar panels can be laid on rooftops as the need for electricity is less compared to industries and factories. For industries and factories large area of lands are used to install solar panels generating higher amount of electricity. Hence the use of land for agriculture is reduced. Based on the above background, floating photovoltaic system can be installed over reservoirs to cover the water surface exposed to sunlight reducing the rate of evaporation. In this paper estimation of evaporation in semi-arid areas, installing floating solar plants on water basins, evaporation control using floating PV system and canal roof top solar panel, exploiting existing dams for solar PV system installation, the potential of water infrastructure to accommodate solar PV panels in Mediterranean island, installations of floating PV, analysis of California state water project efficiency , power generation efficiency and prospects of floating photovoltaic system.

1.1 STUDY ON EVAPORATION.

Evaporation is a process by which a liquid change into vapour form. Water molecules are in constant motion and some have the energy to break through water surface and escape into air as vapors. Evaporation in general is a beneficial phenomenon in regulating global water balance through the hydrological cycle and it is the same phenomenon contributing to massive losses from water bodies. Control of evaporation from land-based water

bodies, has thus remained one of the main planks of water conservation strategies. This assumes greater significance in arid regions, where water scarcities are already a common problem. Factors affecting evaporations are water surface area, temperature, vapor pressure difference, wind pressure, atmospheric and quality of water. M. Alazard, C. Leduc, Y. Travi, G. Boulet, A. Ben Salem studied on the "El Haouraeb dam" located in central Tunisia with insight on "Estimating evaporation in semi-arid areas facing data scarcity" [1]. Their study comprises of physical approach based on Dalton's simplified law, Penman's equation and geochemical approaches based on mass conversation. They compared the results obtained with theoretical approaches with pan evaporation records in order to define the conversion coefficient between the Colorado pan and the lake evaporation. They developed a method to profitably exploit each data set by combining several independent methods, resulting in significant improvements.

1.2 STUDY ON FLOATING SOLAR PANELS.

Floating Photovoltaic is new design solution for Photovoltaic power plant and are generally installed on water bodies such as lakes, reservoirs etc. It is a array of solar panels on a structure that floats on a body of water. Its installation can be classified as photovoltaic plants mounted on pontoons, rafts built in plastic and galvanized steels, rafts built in fully plastics. Marco Rosa-clot, Giuseppe Marco Tina, Sandro Nizetic studied on floating photovoltaic plants and waste water basin in Australia [2]. They suggested floating Photovoltaic design is an integrated solution for PV power plants. They analyze in detail the impact of floating PV system on evaporation rate in water basin. If the water surface is occupied by FPVS, then the wind speed at water surface is reduced, the thermal energy arriving at water surface is reduced approximately by factor of 2 due to conversion efficiency of PV panel and vapour pressure approaches instead of saturated vapour in the cavity created between water and platform. The platform is moored with steel cables 5-10 on each side. Steel cables are of approximately 4 mm diameter with break strength of 1300 kg. They concluded with two main advantages production of energy and large reduction of evaporation rate. Ioannis Kougias and Katalin Bodis studied those Mediterranean islands area is considered as challenging area for development of photovoltaic energy [3]. They studied current status of electricity generation in that area and advantages of using floating PV system. Floating solar system leads to increase in efficiency of solar panels, Irrigation water savings, Energy Generation etc. They faced many challenges including cost of mounting structure, additional cost of civil work for installation, difficulties in energy transport in curvaceous canals etc. They concluded that although project faces lots of problems, there is great scope for PV technology in Mediterranean islands. Luyao Liu, Qinxing Wang, Hailong LI,Qie Sun, Ronald wennersten studied the power generation efficiency and prospect of floating photovoltaic systems [5]. Compared with terrestrial PV systems, a floating PV system may benefit from the cooling effect of water and operate with higher efficiency, since it is installed close to the water surface. In order to examine the cooling effect of water on PV modules, a 3-D finite element analysis was employed to study the temperature of PV cells. The results where then used to calculate the changes in the power generation efficiency of the floating PV system. Kory Burt, Erin Good, Micah Shachar, Justin Pascual studied the efficiency of the California State Water Project [4]. They came up with the three main solutions as follow: installing solar panel to cover the adequate, filling the adequate with floating plastic balls to reflect the sun and covering the surface area with a reflective film. Plastic balls and reflective film compound were rejected considering the environmental factor. They found the cost efficiency by considering the area the solar panel would have to cover, the energy produced in watts and the cost for which the watts are sold. They concluded that, although the panels are expensive and needed to be replaced every 20-30 years, the benefit they bring outweighs the cost.

3. SCOPE OF FUTURE STUDIES.

The growth in economy and population lead to ever-increasing demand for water and energy. Floating photovoltaic solar plant system is a new design solution for power plants, which ultimately helps to reduce water wastage and also in terms of harnessing renewable energy. Though enormous studies are carried on Floating solar photovoltaic system but somewhere it is a need to study its effect on bio-diversity. In fact, more detailed and immediate studies are required to establish the true extent of implementation of floating photovoltaic solar system by considering the environmental impacts.

4. CONCLUSION.

On the basis of studies carried out in this various review paper, we can able to conclude that the Floating photovoltaic solar system is one of the integrated solutions for reducing the evaporation loss from water bodies as well as utilizing renewable energy to at most. Few studies revealed information about indirect methods to calculate evaporation in water bodies. Penman's equation found to be the key for calculating evaporation rate theoretically.

5. REFERENCES

[1] M. Alazarda, C. Leduc, Y. Travi, G. Boulet, A. Ben Salem, [2014]" Estimating evaporation in semi-arid areas facing data scarcity: Example of the El Haouareb dam (Merguellil catchment, Central Tunisia)", Journal of Hydrology: Regional Studies 3, 265–284.

[2] Macro Rosa-Clot, Giuseppe Marco Tina, Sandro Nizetic, [2017] "Floating photovoltaic plants and waste water basins: an Australian project", Energy Procedia 134,664-674.

[3] Ioannis Kougias, Katalin Bodis, Arnulf Jager-Waldau, Magda-Girona, Fabio Monforti-Ferrario, Heinz Osseinbrink, Sandor Szabo,2016 "The potential of water infrastructure to accommodate solar PV systems in Mediterranean islands", Solar Energy 136, 174–182.

[4] Kory Burt, Erin Good, Micah Shachar, Justin Pascual, 2015 "An analysis of the California State Water Project's efficiency".

[5] . Luyao Liu, Qinxing Wang, Hailong LI,Qie Sun, Ronald wennersten ,2017 " Power Generation Efficiency and Prospect of Floating Photovoltaic Systems', Energy Procedia 105,1136-1142.

6. BIOGRAPHIES

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