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Floating Solar Power Plant Installation and Indian Overview

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Abstract - *The high energy demand and the constant depletion of the fossil fuels these problems lead us to shift our focus to renewable energy sources which are not only the future unlimited source of energy, it is also eco-friendly and viable for the environment. Hydro and Wind though are renewable sources but majorly depnends on project location and area. Solar energy on the other hand can be extracted from any place. The major issue with the solar energy is the requirement of land which is scarcely available in the world and even costly to get. But floating solar plants can be installed in any water bodies which will not only reduce the cost of the land but will increase the amount of generation with the cooling effect of water. This research paper concentrates upon the global scenario and indian overview on this new technology will also focus upon the effect ofpanel shade on the ecosystem.*

Key Words: *fossil, renewable , Hydro , wind.*

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I. INTRODUCTION

Floating solar power plants are quite similar to normal solar power plants installations, except for the fact that they are built on a water body, thereby eradicating the need for land. Many times, even in developed countries with large land areas having plenty of lands available for projects, the land in the vicinity of prime energy consumers (i.e. cities, industrial zones, etc.) is notavailable or highly unaffordable. Floating solar power plant,(FSPV) also popularly known as 'floatovoltaic' is an attractive option at such places since it is independent of land availability. Especially at places where land is a roadblock, floating solar installations are a positive step for energygeneration.

At present, among the 60+ countries actively pursuing the deployment of FPV (see Map 1 below), more than 35 countries are home to an estimated 350 operational FPV systems, which up until the end of August 2020 had a cumulative capacity of approximately 2.6 GW. Although still considered a niche, FPV is projected to experience an average growth rate of above 20% in the coming five years.

In this context, Asia is expected to account for roughly two thirds of the global demand, mostly driven by China, India, South Korea, Taiwan, Thailand and Vietnam.

FSPV Scenario in the UK

With more than 13 MWP of installed capacity, the UK is the fifth largest country in terms of FSPV installation. Like many other Asian countries, lack of space for land-mounted PV in the country is the main reason for going towards FSPV plants. The majority of the plants in the UK are installed on irrigation and water treatment ponds. In March 2016, the world's first deep water reservoir (maximum depth of 18.4)

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FSPV Scenario in Japan

With more than 210 MWP of installed capacity, Japan is aleading country in terms of total numbers of installation and home to 73 of theworld's 100 largest FSPV plants. The majority of these plants are installed on man-made waterbodies having main purpose to retain rainwater orirrigation.

FSPV Scenario in China

To date, China is the world's largest market for FPV. Currently, FPV systems are either deployed as a result of a bidding scheme, thus eligible for a FIT granted over 20 years or as a so-called grid-parity project, i.e., without any form of subsidy support. To illustrate the on-going demand for FPV, in June this year, China's Datang Power released a tender seeking several bids for a total capacity of 820 MW of FPV to be installed across China by December 2021.

Country	Water body type	Typical range of % ofwater surface area covered by FSPV plants	Typical range of depth of water body on which FSPV plants are installed (in meters)	Typical range of water level variation(in meters)

China	Irrigation ponds	10%–30%	3.5–14.1	3.5– 8.0
	Industrial ponds	No information	No information	No information
	Large water bodies	10%–40%	No information	No information
	Mining ponds	10%–20%	3–12.5	4.8
Japan	Irrigation ponds	10%–70%	1.8–15.1	1.8–15.1
	Industrial ponds	No information	No information	No information
	Water storage reservoirs	15%–86%	3.0–5.0	3.0–5.0
Taiwan	Irrigation ponds	11%–28%	3.6–4.6	2.4–4.6
	Industrial ponds	15%	14	5
	Water storage reservoirs	7%–10%	No information	No information
UK	Irrigation Ponds	2% –15%	4.0–18.4	4.0–18.4
	Water treatment plant	48%	10	10

The republic of Korea Scenario in Europe

Korea was among the early mover to have adopted FSPV. Till date the country has installed more than 79 MWp of FSPV plants and more than 2300 MWp are in pipeline. Korea was the first country to install a tracking-based FSPV plant having a capacity of 465 kW in 2014. Recently, the Ministry of Trade, Industry, and Energy (MOTIE) has announced its plans for developing 2.1 GW of FSPV- based projects at Saemangeum Seawall Dyke located on the southwest coast of the country. The project will be built in two stages . The first stage with a capacity of 1.2 GW is to be completed by 2022 and the remaining 900 MW by 2025 in the second stage. Upon completion, the project will be 14 times larger than the present world's largest 150-MW FSPV-based project of China.

Indian FSPV Scenario

The FSPV as a technology is still in the nascent stages of development in India. The journey started with a 10kW FSPV plant on a pond in Rajarhat, Kolkata in 2015. In 2016, NTPC installed country's largest 100kW plant on a reservoir of its combined cycle power plant situated in Kerala's Kayamkulam district. Later in December same year, Kerala State Electricity Board started its operation of 500kW plant at Banasura Sagar reservoir in Wayanad district replacing NTPC's 100kW as a largest FSPV-based plant. The plant is actually a scaled-up version of the 10kW plant commissioned in January 2016 at the same location. The plant was able to bring some confidence to FSPV promoters by successfully surviving the recent flood ravage in the state.

Investment Requirement in India

Recent bids results indicate a sharp decline in the investment cost for FSPV. In the latest tender result of the country's first large-scale FSPV plant of 70MW capacity, cost as low as INR 35 per Wp has been quoted by developers. This is the lowest cost achieved in the entire world so far. Further considering last year's trends, one can see the 45 percent reduction in the cost, which is significant. Even though the costs have decreased, it is still very early to come to any generalization, since the FSPV as a technology is still in its early stage of market penetration. The reduction in costs, particularly in India may be linked to many factors like – decrease in the cost of floaters because of improvement in manufacturing process, reduction in the material cost, reduction in thickness of solar panels. While falling cost is a welcome trend, it is also important to check whether this is not impacting the overall quality of the projects, since degradation in the quality of FSPV projects has higher potential to impact local biodiversity compared to ground- mounted solar PV. Hence it is essential to form proper guidelines/standards to keep the things in check from the initial stage of market development in the FSPV technology.

The cost also majorly depends on these factors

1. Depth of Water body
2. Project location
3. Water-level variation
4. Site conditions – speed of wind and direction, of it solar irradiations, ambient temperature, humidity levels, etc.
5. Size of the plant

2. Floating Solar and Jobs

A new case study, *Employment Potential of Emerging Renewable Energy Technologies – Insights from the Floating Solar Sector*, examines the direct employment potential across the floating solar project development cycle and captures the sector's skill development needs. Estimates are drawn from project-based surveys and interviews with manufacturers, developers, and engineering, procurement, and construction (EPC) providers. The study provides insight into the operational strategies and team structure, in addition to discussing the typical duration of different phases of project development and the corresponding workforce employed. The case study is developed by the Council on Energy, Environment, and Water (CEEW) and Skill Council for Green Jobs (SCGJ) along with NRDC.

An FPV solar project includes four stages for a successfuldeployment

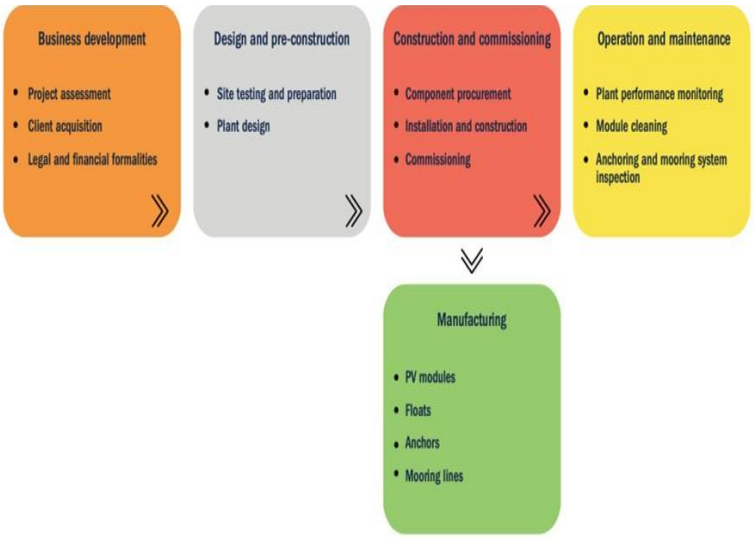
Key Data

- A small-scale FPV plant (capacity <1 MW) directly employs 58 workers while a mid-scale (capacity <10 MW)plant employs 45 personnel, over the course of their deployment.

- FPV generates indirect job opportunities through manufacturers of specialized components like floats, anchors, and mooring system as well as domestic modulemanufacturers.

- FPV offers opportunities for people qualified in hydraulic engineering, marine architecture, and plastic blow- molding techniques in addition to those required in ground- mounted solar operations.

- By setting time-based targets for FPV capacity, the Indian government can widen the employment potential of this sector, bolster efforts to drive the COVID-19 economic recovery and achieve its Paris Agreement climate goals



Key Recommendations

1. The Ministry of New and Renewable Energy (MNRE) should specify standards for PV modules used in theFPV sector.

2. The Ministry of Skill Development and Entrepreneurship should develop training programmes on specialised skills relevant to the FPV industry such as marine architecture and hydraulic engineering.

3. The FPV industry should regularly release data onemployment and skill

Project phase	Duration (days)		Number of people engaged	
	Small-scale	Mid-scale	Small-scale	Mid-scale
Business development	30	110	11	12
Design and pre-construction	15	14	6	2
Construction and commissioning	53	195	36	27
Maintenance	30*	Not available	5**	4**

3. CHALLENGES

1. Unavailability of FSPV specific Standards.
2. Unavailability of water body data.
3. FSPV plant components safety and its long termreliability.
4. Absence of local manufacturing.
5. Unavailability of Bathymetry and other studies ofwater.

Bathymetry – the measurement of depth of waterbody.

6. Also these impacts on various fields due to largeFSPV

1. Impact on local marine aquaculture due to the blockage of sunlight reaching the water surface
2. .Impact on the fishing pattern
3. Also, it can reduce oxygen level of water whichaffects water bodies badly.
4. Impact on drinking water quality

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