

Floating solar

opportunities and way ahead

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1. Introduction

Floating solar is a new and exciting application of solar PV technology. Conceptualised to overcome land availability issues, the technology has started gaining traction worldwide and is expected to grow strongly over the coming years. Annual capacity addition is expected to grow from an estimated 1.1 GW in 2018 to 4.6 GW by 2022.

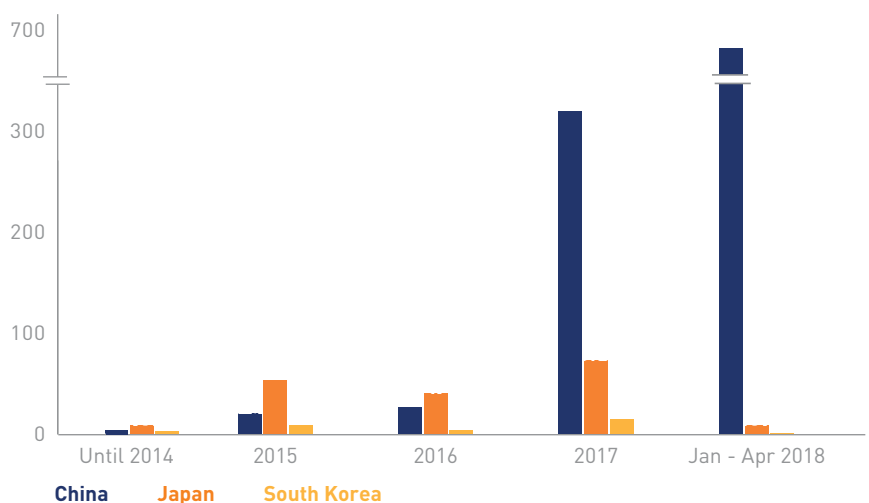
China is the leading international market followed by Japan and South Korea. After years of small-scale installations, large MW-scale projects are getting developed now. China's 150 MW project commissioned recently in Huainan, south Anhui province is believed to be the largest floating solar project in the world¹.

There are number of drivers that make floating solar attractive:

- Solution to land scarcity and alternative land uses – Floating solar negates the need for expensive and time-consuming land acquisition process;
- Utilisation of existing grid infrastructure – Floating solar projects located near consumption centres and/or on reservoirs of hydro-electric dams can utilise existing transmission infrastructure;
- Higher electricity generation – Cooling effect from water surface on the panels results in 3-5% more power output as compared to ground-mounted solar;
- Water conservation – Covering water surface with solar modules is believed to reduce loss of water through evaporation.

Floating solar can be deployed on various types of water bodies including industrial water ponds, irrigation or drinking water reservoirs, quarry lakes, aquaculture ponds, canals and dams. Most of the deployment is on fresh water until the challenges associated with marine environment (high turbulence and salt mist corrosion) are overcome.

Figure 1.1: Floating solar capacity addition in leading countries, MW



Source: IHS Markit, BRIDGE TO INDIA research

¹<https://www.pv-tech.org/news/sungrow-targets-leading-role-in-supply-of-floating-solar-systems-to-booming>



2. Indian market

Floating solar is still in nascent stages of development in India. After the recent commissioning of a 2 MW project at Visakhapatnam, cumulative capacity is now 2.7 MW. MNRE intends to add 10 GW of floating solar as part of its 227 GW renewable energy target for 2022². SECI has invited EOI for developing 10 GW of floating solar projects on BOO basis. Table 2.1 shows commissioned and upcoming floating solar projects in India.

Table 2.1: Floating solar projects in India

Project developer/ procurement authority	Location	Capacity, MW	Year of commissioning
Commissioned			
Arka Renewable Energy College	Kolkata	0.01	2014
Chandigarh Renewable Energy and Science & Technology	Chandigarh	0.01	2016
NTPC	Kayamkulam	0.10	2016
Kerala State Electricity Board	Wayanad	0.50	2017
Indian Oil Corporation	Panipat	0.10	2018
Greater Visakhapatnam Smart City Corporation	Visakhapatnam	2.00	2018
Total		2.72	
Under development			
Maharashtra State Electricity Distribution Company Limited	Ujjani dam, Solapur, Maharashtra	1,000	-
JSW Solar	Across India	250	-
SECI	Rihand dam, Uttar Pradesh	150	-
NTPC	Kayamkulam, Kerala	22	-
Lakshadweep Energy Development Agency	Lakshadweep island	10	-
West Bengal Power Development Corporation Limited	West Bengal	5	-
Bhakra Beas Management Board	Bhakra & Nangal dam, Punjab	5	-
NLC	Andaman & Nicobar Islands	5	-
Greater Visakhapatnam Municipal Corporation	Meghadrigedda reservoir, Visakhapatnam	3	-
Tirupati Smart City Corporation Limited	Kailashgiri reservoir, Chittoor, Andhra Pradesh	4	-
Greater Visakhapatnam Smart City Corporation Limited	Meghadrigedda reservoir, Visakhapatnam	15	-
NTPC	Kayamkulam, Kerala	70	-
Total		1,539	

Source: BRIDGE TO INDIA research

²<https://www.photon.info/en/news/india-targets-set-10-gw-floating-solar-pv-projects>

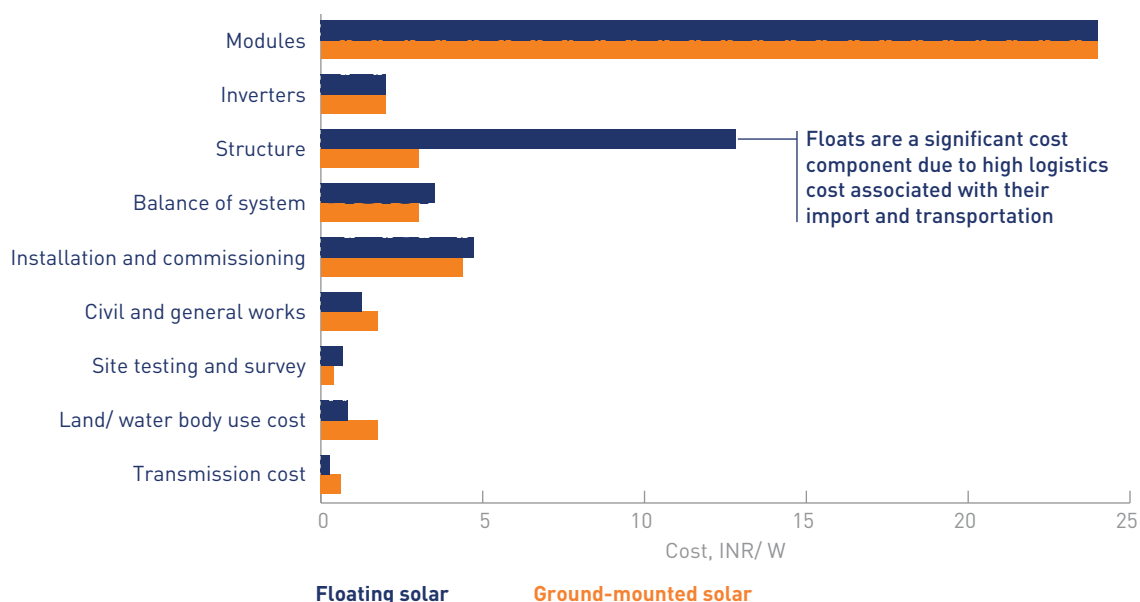
3. Challenges

Floating solar faces some key operational and financial challenges, which need to be overcome for it to become a scalable proposition.

3.1 Higher upfront cost

Floating solar plants are at present 20–25% more expensive to install as compared to ground-mounted PV. The higher cost is due to inclusion of special components like floating structures (floats/ pontoons), mooring systems and submerged water cables.

Figure 3.1: Capital cost break-up for floating and ground-mounted solar systems



Source: BRIDGE TO INDIA research

Notes:

1. Cost has been assumed for a 10 MW system.
2. Cost includes 20% DC:AC overloading, GST and 25% safeguard duty on modules.
3. Testing and survey costs are higher in floating solar because of requirement of bathymetric and hydrographic studies.

Floats are a significant cost component in floating solar in part, due to high logistics cost associated with import and transportation. Currently, domestic production capacity of floats is limited necessitating their import from China or Europe. Import and transportation of these floats - which are hollow and typically made of high density polyethylene (HDPE) - is expensive and commercially unviable.

Some companies like Ciel & Terre have set up a 50 MW manufacturing unit in Maharashtra and others like Yellow Tropus are in the process of setting up facilities in India. Recently, NTPC and Central Institute of Plastics Engineering and Technology (CIPET) agreed to jointly work on comprehensive quality plans, increase vendor base and capacity for production of floats. Sufficient domestic manufacturing capacity and growing volumes are expected to help in reducing cost disadvantage for floating solar projects to 10–15% by 2020.



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3.2 Higher exposure to moisture and UV radiation

High ambient moisture content combined with UV exposure makes floating solar plants susceptible to higher degradation. All metallic components must be kept above water level to prevent corrosion. Modules should be resistant to water ingress and vapour transmission as well as additional UV rays reflected from water surface to avoid issues like delamination, corrosion, snail trail and PID losses.

Prolonged UV exposure causes performance losses due to yellowing or discoloration. Degradation of the modules may also necessitate complete replacement in extreme cases. Use of encapsulants and backsheets that can block UV radiation for a long period of time is therefore desirable.

Based on our interviews and discussions with the industry participants, we understand that at present floating solar projects use same conventional polycrystalline modules that are used in ground-mounted solar. However, it is recommended that modules with higher protection against moisture and UV should be used in floating solar applications – glass-glass modules or modules with high-specification protective backsheets.

Table 3.1: Comparison between glass-glass and high-specification backsheet modules

	Conventional modules	High-specification backsheet modules	Glass-glass modules
Moisture resistance	Low	Higher than conventional modules	Very high
Performance	NA	No negative impact on power generation	Power generation is relatively lower due to higher transmittivity
Weight	Light weight	Light weight	Heavy weight resulting in higher cost of floating structure
Handling and transportation	Low risk	Low risk	Higher risk of breakage
Cost	USD 0.24-0.26/ W	USD € 0.2-0.5/ W more expensive	USD €1.0-1.5/ W more expensive

Source: BRIDGE TO INDIA research

3.3 Absence of bathymetric and hydrographic data

Developing large-scale floating projects requires a thorough understanding of water-bed topography and its suitability for setting up anchors for floats. Extensive bathymetric and hydrographic studies need to be conducted to assess suitable design, desilting requirement and overall techno-commercial viability of the projects. This data on water bodies in India is typically unavailable and it is only recently that SECI has released an EOI for the empanelment of consultants to conduct these studies. We expect such studies to delay implementation by 6-12 months minimum in most cases.

3.4 High water contamination risk

As floating solar systems are usually deployed in ecologically sensitive areas, inadequate design and/ or poor quality can pose water contamination risk during plant construction and operation. Potential leaching out of hazardous materials used in making these components could have a negative impact on both human and marine life.



4. Conclusion

Floating solar technology has a huge potential to scale up and replicate the success of ground-mounted systems in India. It is imperative that policy makers and procurement agencies - BIS, NISE, SECI, NTPC and others - make specific market intervention to exploit this potential:

a) Quality standards and technical specifications should be made more robust

High moisture content adversely impacts modules and other system components. Appropriate quality standards for water vapour transmission rate and UV blocking capabilities must therefore be adopted to survive the harsh operating environment. Standards should be formulated to ensure use of non-hazardous material to prevent water contamination. These measures would have a marginal cost but go a long way in providing quality assurance to users.

b) More domestic manufacturing capacity for floats need to be encouraged

Better visibility of floating solar project pipeline would help in attracting investment in domestic manufacturing capacity for floats. This would help in reducing capital cost and improving floating solar's cost competitiveness.

c) Site studies should be speeded up

Detailed site assessments should be undertaken in advance and speeded-up, where possible, to accelerate project development timelines.



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