

Accelerating Renewable Energy Adoption in India via Floating Solar PV (FSPV)

Mains: GS Paper III | Energy

Why in News?

The Union Cabinet has cleared the Pradhan Mantri Surya Sarovar Yojana (PM-SSY), to build 5,000 MW of floating solar photovoltaic (FSPV) capacity on India's reservoirs and waterbodies.

What is a Floating Solar Plant?

- It is a **solar array that floats on a water surface** and consists of a reservoir, irrigation tank, industrial pond or hydropower lake instead of on land.
- Its modular blocks of panels are assembled onshore, floated out, and held in place by anchors and mooring lines built to withstand wind, waves and shifting water levels.
- Inverters sit on the floats or on the bank, and cables run over the floats to a substation.



How do the plants work?

- Panels convert sunlight to electricity exactly as on land; the difference is the flotation-and-mooring system beneath them.
- Water cooling can lift energy yield, while shading cuts evaporation and

algae growth.

- There are trade-offs, which are mechanical.
- These include continuous motion wears floats, joints and cables.

What does global experience show?

- The report puts cumulative global capacity at roughly 9.6 GW by 2024, with 1-1.2 GW added each year across more than 500 completed projects **over 90%** of them in Asia.
- **China** leads, trailed by countries such as India, South Korea and Japan, where land scarcity, supportive policy and abundant reservoirs have driven adoption.
- Europe is a smaller but expanding market.
- Europe's installations rising from 10 MW in 2017 to nearly 270 MW by 2022, with the Netherlands alone accounting for about 3-quarters of the continent's capacity.
- Israel, Brazil, Chile, Ghana and Australia are emerging players.
- The World Bank has estimated that using even part of the world's man-made reservoirs could support several terawatts of solar.

What is Pradhan Mantri Surya Sarovar Yojana (PM-SSY)?

- It is designed to scale up Floating Solar Photovoltaic (FSPV) projects integrated with Energy Storage Systems (ESS) across India's reservoirs, dams, lakes, and industrial ponds.

Parameter	Details
Scheme Type	Central-sector scheme.
Nodal Ministry	Ministry of New and Renewable Energy (MNRE).
Implementing Agency	Solar Energy Corporation of India (SECI).
Financial Outlay	Rs.5,070 crore.
Target Capacity	5,000 MW of floating solar capacity (FY 2026-27 to FY 2030-31).
Storage Mandate	Co-located ESS with min. 2-hour duration (~10,000 MWh total)
Technical Potential Basis	NISE potential assessment of 102.18 GWp floating solar capacity
Coverage	All States and Union Territories

- Every project must be paired with an energy storage system of at least 2 hours, collectively 10,000 MWh in all, so that States can use the stored power to meet peak demand.

India currently has an installed floating solar capacity of about ~0.7 GW against a potential of 102 GW.

- **Potential States** - Maharashtra (16.28 GWp) and Madhya Pradesh (14.89 GWp) lead, followed by Karnataka, Odisha, Telangana and Gujarat.
- Several are not renewables-rich, so the scheme doubles as a tool for decentralised solar deployment.

What is the Financial Assistance Architecture?

- **Post-Commissioning CFA** - Developers receive Rs.1 crore per MW as Central Financial Assistance (CFA) upon successful commissioning to bridge the ~25% capital cost premium of floating platforms over ground-mounted solar.
- **Project De-Risking Support** - Grants of up to Rs.50 lakh per site fund upfront technical feasibility studies.
- It includes bathymetric and hydrographic surveys, solar-yield assessments, and aquatic ecological impact evaluations within a 9-month window.
- **Implementation Horizon** - Sanctioning window spans FY 2026-27 to FY 2030-31, with financial disbursements continuing through FY 2032-33.

What are the Core Objectives & Strategic Value?

- **Eliminating Land Acquisition Friction** - Utility-scale ground solar requires ~4-5 acres of land per MW, which often triggers local compensation disputes and land-use conflicts.
- FSPV utilizes existing state-owned water surfaces, requiring land only for power evacuation cabling.
- **Mitigating "Duck Curve" & Curtailment**- Unbuffered midday solar generation frequently leads to output curtailment.
- Mandatory 2-hour battery storage ensures electricity generated during peak sunlight is stored and dispatched during high-demand evening hours.
- **Regional Energy Balance**- Non-traditional renewable states with extensive reservoir networks (e.g., Maharashtra, Madhya Pradesh, Karnataka, Odisha, and Telangana) can generate decentralized solar power locally.
- **Water & Efficiency Benefits** - Water cooling raises PV panel operational efficiency, while panel shading reduces surface evaporation losses and inhibits harmful algal growth.
- **Macro-Economic Impact** - Expected to abate ~10 million tonnes of

CO₂ emissions annually while creating 16,000–17,000 jobs across the manufacturing, installation, and maintenance value chains.

What are the Operational Challenges?

- **Higher Initial CapEx** - FSPV costs ~Rs.4.9–5.2 crore/MW compared to Rs.3.9–4.2 crore/MW for ground-mounted solar, with battery storage adding another rs.0.9–1.2 crore/MWh.
- **Environmental Fatigue** - Waves, moisture, and corrosion accelerate wear on floats, joints, and dynamic underwater cabling.
- **Water Level Draft Changes** - Rapid seasonal drawdown in reservoirs alters mooring line tension, requiring specialised, flexible mooring designs.

How does this feed India's climate commitments?

- The 5,000 MW adds to the non-fossil capacity underpinning India's climate pledges, its updated Nationally Determined Contribution and the Panchamrit goals of 500 GW non-fossil power by 2030 and net-zero by 2070.
- The government estimates the scheme will abate around 10 million tonnes of CO₂ emissions annually, while generating 16,000–17,000 jobs across the value chain.

What is the Way Forward?

- The Pradhan Mantri Surya Sarovar Yojana marks a transition from simple capacity expansion to grid-integrated, land-neutral renewable energy.
- By coupling the natural cooling benefits of water bodies with battery storage, India can solve its solar curtailment problem while opening a vast new energy footprint across non-traditional solar states.

Reference

[The Hindu | Floating solar boost in India's renewable energy uptake](#)