

Analysis and insight on emerging renewable segments

FLOATING AND CANAL-BASED SOLAR PV MARKET IN INDIA

Scope, Demand, Challenges and Prospects

WIND-SOLAR HYBRID MARKET IN INDIA

Potential, Projects, Economics and Projections

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India Infrastructure Research

Once dismissed as a niche segment, the concept of floating, canal-top and canal-bank solar PV projects is poised for a significant breakthrough in India. These projects can also be installed on canals, dams, and reservoirs used for industries, irrigation, drinking water storage, as well as aquaculture ponds. While currently India has only a few megawatts of operational floating and canal-top solar projects, there are hundreds of megawatts of these projects under development, and many more tenders are expected by SECI, NTPC, and other PSUs and state-level agencies. With an expected run rate of 2+ GW floating and canal-top solar tenders each year over the next five years, the industry is on the rise.

1. Potential and Overview

- ❖ Market potential
 - By reservoirs and dams
 - By canals
- ❖ Current capacity
 - Floating solar
 - Canal-top solar
 - Canal-bank solar
- ❖ Market share trends in total solar capacity
- ❖ Key benefits
- ❖ Growth drivers
- ❖ Policy targets and financial incentives
- ❖ State policies and regulations
- ❖ Global scenario
- ❖ Risks and challenges (Market, technology, policy and regulations)

SECTION I: FLOATING SOLAR

2. Current Projects and Case Studies

- ❖ List of installed projects (This will provide details pertaining to capacity, location, size, year of commissioning, developer, procurement authority, tariff, EPC, equipment supplier, etc.)
- ❖ Case studies (This will include key project details, project implementation experience, challenges encountered in setting up the project, approval processes, plant performance trends, tariff, offtake, revenue, project cost, technology used, etc.)
 - 2 MW project at Mudasarlova reservoir in Visakhapatnam (GVSCCL)
 - 2 MW project at Banasura Sagar reservoir in Wayanad (KSEB)
 - 100 kWp plant at Kayamkulam in Kerala (NTPC)
 - 10 kW project in Rajarhat, Kolkata (Arka Renewable Energy College and NTKDA)
 - 1 MWp plant at NTPC Kawas, Gujarat

3. Project Pipeline

- ❖ Under development
- ❖ Announced projects and tenders
 - By SECI
 - By NTPC
 - By state agencies

4. Cost Economics, Tariffs and IRRs

- ❖ Capital cost break-up
- ❖ O&M cost trends
- ❖ Cost comparison with ground-mounted plants
- ❖ Tariffs discovered under various tenders
- ❖ Project and equity IRRs

5. Technology and Supplier Ecosystem

- ❖ Technology types and application
 - Liquid Solar Array
 - HDPE floating platform
 - Solar Islands
 - Floating grids
 - Polyculture-based platforms

- Tracking Type FSPV
- Etc.

- ❖ Key suppliers
- ❖ Potential for domestic manufacturing

6. Outlook and Projections (2019-2023)

- ❖ Future growth drivers
- ❖ Perceived challenges
- ❖ Capacity addition projections
- ❖ Tariff projections
- ❖ Investment requirements

SECTION II: CANAL-BASED SOLAR

7. Current Projects and Case Studies

- ❖ List of installed projects (This will provide details pertaining to capacity, location, size, year of commissioning, developer, procurement authority, tariff, EPC, equipment supplier, etc.)
- ❖ Case studies (This will include key project details, project implementation experience, challenges encountered in setting up the project, approval processes, plant performance trends, tariff, offtake, revenue, project cost, technology used, etc.)
 - 10 MW Sardar Sarovar Narmada Nigam Limited, Vadodra, Gujarat
 - 1 MW Losari Canal, Andhra Pradesh
 - 2.5 MW projects each on Sidhwan and Ghaggar Branch Canal, Punjab
 - 4.5 MW project on Chengallodu Canal, Kerala
 - 7.5 MW on Ghaggar Link Canal, Punjab

8. Project Pipeline

- ❖ Under development
- ❖ Announced projects and tenders
 - By SECI
 - By NTPC
 - By state agencies

9. Cost Economics, Tariffs and IRRs

- ❖ Capital cost break-up
- ❖ O&M cost trends
- ❖ Cost comparison with ground-mounted plants
- ❖ Tariffs discovered under various tenders
- ❖ Project and equity IRRs

10. Outlook and Projections (2019-2023)

- ❖ Future growth drivers
- ❖ Perceived challenges
- ❖ Capacity addition projections
- ❖ Tariff projections
- ❖ Investment requirements

Note: The report will include interview/s of senior representatives at tendering agencies, project developers and EPCs, O&M service providers and experienced industry consultants involved with the featured projects.

Wind-solar hybrid power generation model has recently gained traction in the Indian market as the MNRE introduced a new wind-solar hybrid policy to promote grid-connected hybrid power systems. The hybrid power generation system allows for significant synergies with respect to land use and transmission connectivity, two critical issues plaguing the renewable energy sector at present. However, two mega-tenders, each of 1,200 MW, released by SECI so far have received lukewarm response, having been undersubscribed by around 150 MW and 300 MW. Despite this, the potential of wind-solar hybrids as an alternative renewable energy technology remains strong.

The Wind-Solar Hybrid Market in India report analyses the key developments in the segment to determine the market potential of the technology. It also focuses on the government initiatives that will help propel the segment over the next few years. The report provides an insight into case studies of pilot and existing wind-solar hybrid projects in India along with relevant cases from the global wind-solar hybrid market. It analyses the power purchase agreements of wind-solar hybrid plants to determine the key terms for developers. Further, the report focuses on cost economics and return profile of wind-solar hybrid power plants. It also provides capacity projections and the tariff outlook for the next five years till 2023-24.

1. **Executive Summary**
2. **Renewable Energy Market in India**
 - ❖ Market potential, by source
 - ❖ Source-wise capacity and generation analysis
 - ❖ Key recent developments
 - ❖ Growth drivers
 - ❖ Issues and challenges
3. **Wind-Solar Hybrids Overview**
 - ❖ State-wise potential estimated by NIWE
 - ❖ Current status
 - ❖ Key growth drivers
 - ❖ Policy and regulatory developments
 - Central level
 - State level
 - ❖ Issues and challenges
4. **Project Pipeline**
 - ❖ Under construction projects
 - Location
 - Capacity
 - Developer
 - Tariff
 - Tendering agency
 - Offtaker
 - Completion timelines
 - Cost
 - EPC provider
 - Equipment supplier
 - ❖ Announced tenders (This includes information about project capacity, location, offtaker, mode of implementation, timeline)
 - Central agencies
 - State-level agencies
5. **PPA Terms and Structuring for Greenfield and Brownfield Projects**
 - ❖ Tariff structures
 - ❖ Metering arrangements
 - ❖ Treatment of common infrastructure
 - ❖ Payment security mechanism
 - ❖ Legal Terms
6. **Role of Storage**
 - ❖ Existing and upcoming wind-solar storage projects
 - ❖ Policy developments
 - ❖ Future outlook
7. **Cost Economics, Synergies and Returns**
 - ❖ Capex and opex
 - With storage
 - Without storage
 - ❖ Cost and infrastructure synergies
 - ❖ Tariffs discovered under recent tenders
 - ❖ Return analysis
 - With storage
 - Without storage
 - ❖ Cost and return comparison with pure-play solar and wind projects
8. **Outlook and Projections (2019-20 to 2024-25)**
 - ❖ Future growth drivers
 - ❖ Potential risks (Market, technology, financial and policy)
 - ❖ Tariff outlook
 - ❖ Installed capacity projections
 - Optimistic scenario
 - Realistic scenario
 - Pessimistic scenario
 - ❖ Investment requirements
9. **Key Case Studies - domestic and global**
 - ❖ Project size
 - ❖ Location
 - ❖ Developer
 - ❖ Tariff
 - ❖ Project cost
 - ❖ Cost synergies
 - ❖ Equipment supplier
10. **Other Renewable Energy Hybrid Models**
 - ❖ Solar-natural gas
 - Market potential
 - Regulatory possibilities
 - Applications
 - Global experience
 - ❖ Solar-hydro
 - Market potential
 - Regulatory possibilities
 - Applications
 - Global experience
 - ❖ Wind-hydro
 - Market potential
 - Regulatory possibilities
 - Applications
 - Global experience
 - ❖ Solar-wind-hydro
 - Market potential
 - Regulatory possibilities
 - Applications
 - The Global experience

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GST @ 18%	Rs 8,640	Rs 9,720	Rs 10,800
Total	<input type="checkbox"/> Rs 56,640	<input type="checkbox"/> Rs 63,720	<input type="checkbox"/> Rs 70,800
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Enterprise Licence (Multiple Locations)	Rs 72,000	Rs 81,000	Rs 90,000
GST @ 18%	Rs 12,960	Rs 14,580	Rs 16,200
Total	<input type="checkbox"/> Rs 84,960	<input type="checkbox"/> Rs 95,580	<input type="checkbox"/> Rs 1,06,200
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Wind-Solar Hybrid Market in India			
Site Licence (Single Location)	Rs 48,000	Rs 54,000	Rs 60,000
GST @ 18%	Rs 8,640	Rs 9,720	Rs 10,800
Total	<input type="checkbox"/> Rs 56,640	<input type="checkbox"/> Rs 63,720	<input type="checkbox"/> Rs 70,800
<hr/>			
Enterprise Licence (Multiple Locations)	Rs 72,000	Rs 81,000	Rs 90,000
GST @ 18%	Rs 12,960	Rs 14,580	Rs 16,200
Total	<input type="checkbox"/> Rs 84,960	<input type="checkbox"/> Rs 95,580	<input type="checkbox"/> Rs 1,06,200
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GST (18%)	Rs 14,688	Rs 16,524	Rs 18,360
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<hr/>			
Enterprise Licence (Multiple Locations)	Rs 1,22,400	Rs 1,37,700	Rs 1,53,000
GST (18%)	Rs 22,032	Rs 24,786	Rs 27,540
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