Business models for Solar Parks

Strictly Private and Confidential

October 2014
Section 1

RE in India
An overview of Power sector in India

- India’s installed capacity is 246 GW (As on May 2014).
- India has RE capacity of **31,707 MW** (as on May, 2014) which accounts to 13% of the installed power capacity
- Current share of renewable energy (in **energy produced**) is 5% against a target of 15% by 2020
- Solar Purchase Obligation target of 3%, which would require 34 GW of installed capacity by 2022

India is endowed with huge solar energy potential with most states having about 300 sunny days per year with annual solar radiation in the range of 4.5-6.5 kWh/m²/day

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*Source: MNRE, GoI ; Energy Statistics, 2012; CEA Statistics

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Policy measures supporting capacity addition of solar projects

Key Driver - National Solar Mission (JNNSM)

- Conceived under the National Action Plan for Climate Change to establish India as global leader in solar power by creating policy conditions for its diffusion.
- Accelerate generation capacity addition to drive down costs and achieve grid parity by 2022.
- National Policy amended (Jan 2011) for mandatory Solar RPOs for all power utilities.

- **National Action Plan of Climate Change.** Govt. Of India mandates increase of renewable penetration in energy from 5% to 15% by 2020.

- **National Solar Mission.** Targets 20 GW Solar energy capacity additions by 2022.

- **State policies.** Individual State specific solar policy targets 10GW+ capacity addition by 2022.

- **Renewable Purchase Obligations.** States have already specified; ranging from 2% to 14% of the total energy demand to be met by renewable energy.

- **Renewable Energy Certificate.** Delinking green and brown power, facilitating regional transfer and equitable sharing of costs.
Solar policy directives- JNNSM and state policies

**Phase I (Already allocated)**
- NVVN – 1054 MW
- RPSSGP – 98.05 MW
- Others – 24.38 MW

**Phase II**
- Batch-I (PV) with VGF – 750 MW
- Batch-II (PV) Bundling Mechanism – 3000 MW
- Batch-III (PV) with VGF – 1000 MW
- Batch-IV (PV) Defense – 1000 MW
- Pilot Projects (CSP) – 100 MW

**Targets through state policies**
- Tamil Nadu - 3000MW by 2015
- Andhra Pradesh - 1000MW by 2017
- Rajasthan – 25000MW Chhattisgarh – (500MW – 1000MW) by 2017
- Karnataka – 2000 MW by 2021
- Madhya Pradesh - 800 MW by 2016
- Uttar Pradesh - 1000 MW by 2017
- Kerala - 500 MW by 2017
- Punjab - 500 MW by 2022

State wise solar capacity in India – March 31, 2014: **2632 MW**

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Feed-in-Tariff, accelerating capacity addition

**Tariffs evolved in FIT - Competitive bid process (INR/kWh)**

- Bid process for solar projects indicate a downward revision in FIT prices.
  - Weighted average price of INR 6.0 per kWh – 7 per kWh realized in the recent bids largely possible due to drop in EPC prices by over 40% in the last 18 months.
- Ongoing projects / PPA signed under NSM— Indicates sites with high PLF (>19%) largely considered, i.e. Rajasthan and Gujarat are much favoured with over 80% of installed capacity.
- **States specific policies recently announced likely to add +2 GW** – in the next 24 months (Tamil Nadu, Andhra Pradesh, Telangana, Rajasthan, Karnataka, Uttar Pradesh, Bihar, Punjab)
- India is endowed with huge solar energy potential with most of the states having about 300 days of sunshine per year with annual mean daily global solar radiation in the range of 4.5-6.5 kWh/m2/day.
Section 1 – RE in India

Availability of Land to support Solar: Utilising Wastelands

<table>
<thead>
<tr>
<th>Solar Resource</th>
<th>Wastelands in a few states (% of total area)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average annual sum (2005-2010)

- < 1250
- 1400
- 1550
- 1700
- 1850
- 2000
- 2150

kWh/m²

October 2014
Section 2

Solar Parks
The value proposition

Benefits

- Utilization of large available wastelands
- Better network optimization, better grid integration and reduced transmission losses
- Huge potential for savings in terms of basic infrastructure facilities like land, water, construction power, roads, power evacuation system
- The removal of regulatory hurdles allowing for accelerated deployment
- A 20% reduction in CAPEX from building within a Solar Park can lead to almost 18% reduction in tariff
Benefits from Solar park

Stand-alone Solar Project
- Higher development cost & higher line losses at 33kV
- Expensive O&M and Security Costs
- Remote site difficult to manage

Solar Project in Solar Park
- Shared Development cost & lower line losses in 132kV
- Distributed O&M and Security Cost
- Common infrastructure support & pool of resources
- Easy clearances and Peace of Mind
Gujarat Solar Park

Gujarat, with a motive to promote cleaner sources; took a pro-active approach by formulating and announcing Solar Power Generation Policy in January, 2009 and appointing Gujarat Power Corporation Limited (GPCL) as the nodal agency for the development of solar projects.

### Gujarat Solar Park

<table>
<thead>
<tr>
<th>Solar Park</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PPA Signed</td>
<td>No. of Projects</td>
</tr>
<tr>
<td>MW</td>
<td>231</td>
</tr>
<tr>
<td>Commissioned</td>
<td>No. of Projects</td>
</tr>
<tr>
<td>MW</td>
<td>224</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eligible Unit</th>
<th>Any company / corporate body /association / body of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>590 MW</td>
</tr>
<tr>
<td>Land</td>
<td>2024.15 Ha (5,001.67 acres)</td>
</tr>
<tr>
<td>Investment</td>
<td>Rs. 4500 Crore [Rs. 550 Crores for infrastructure and land acquisition and Rs. 3,996 crores for Solar Power Plant (Developers investment)]</td>
</tr>
<tr>
<td>Sale</td>
<td>Fixed tariff. Developers encouraged to get projects under NSM as well.</td>
</tr>
<tr>
<td>Facilities provided by Govt. of Gujarat</td>
<td>Adequate land, Road Connectivity, Water, Drainage network, Environmental clearances, Fire station, Compound wall, Fencing, Telecom network, street lights and other civic amenities.</td>
</tr>
<tr>
<td>Power Evacuation</td>
<td>Transmission line, 66KV substation for supplying the Auxiliary power, 400 x 220 x 66 KV Substation to evacuate power to be provided by State Transmission company -GETCO</td>
</tr>
</tbody>
</table>
Gujarat Solar Park – Implementation Framework

Gujarat Solar Park, Charanka, Patan district

GEDA

Processed applications

Policy directives

Financial Institutes

Project funding

GERC/CERC

Tariff determination

Government agencies

Tariff determination

GPCL

Nodal Agency for Solar Park development

GETCO

Transmission infrastructure

SSNNL

Water availability

Infrastructure development charge

Shared with solar developer, manufacture, R&D setup
Rajasthan Solar Park

Land allocation and planning
- In March 2010, the GoR reserved 10,000 hectares of contiguous government land in the Jodhpur district and 16,000 hectares of government land in the Jaisalmer district as a land bank for solar deployment.
- The engineering study, soil & survey testing has already been completed and phase 1 is in progress.
- 75 MW of projects have been allocated and 20 MW from Essel Infra has already been commissioned.

Transmission
- Rajasthan State Transmission Utility, RVPN, approved plans, in principle, for extensive transmission build-out, according to the need and build out pace of the solar parks.
- Land identified for 400 kV substation and construction has started. Transmission lines have also been drawn up

<table>
<thead>
<tr>
<th>Location</th>
<th>Village Bhadla, Tehsil Phalodi, District- Jodhpur</th>
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<tbody>
<tr>
<td>Area Available</td>
<td>10,000 hectare (3000 ha in Phase I, 5000 ha in Phase II and 2000 ha in Phase III)</td>
</tr>
<tr>
<td>Capacity Planned</td>
<td>1500 MW</td>
</tr>
</tbody>
</table>

Solar Policy for managing solar parks
- Rajasthan has released “Rajasthan Solar Energy Policy, 2011”, which features the development of solar parks and provides incentives/ concessions to Developers of Solar Power Plants.
- RREC has been identified as the state’s nodal agency for solar, to operate as a single point of responsibility for the solar park, including single window clearance, Allotment of Govt. land at concessional rate, Allocation of water etc.
- Prospective developers in Rajasthan who will receive a PPA allocation from Rajasthan state solar policy, are being encouraged by the GoR to locate their plants in the solar park.
# Role of PwC in development of Gujarat and Rajasthan Solar Park

## Technical
- PwC prepared the master-plan for development of solar park
- Detailed action plan and timelines in association with govt. agencies.
- Advise state transmission company plan to evacuate power
- Assess technical issues and propose solutions
- Identify best practices and propose optimal arrangement for equipment & facilities for the solar park.

## Policy & Regulatory
- Preparation of procurement plan, contract packages and related due diligence for the project.
- Advise state government agencies for the development of conducive policy & regulatory framework for establishment of solar parks.
- Assessment of existing arrangements for industrial parks, SEZ in India and abroad
- Propose legal status of the solar park agency, appropriate organization structure, governance and management mechanism, dispute resolution etc.

## Financial
- Drawing Cost estimates
- Economic and financial model for the transmission line and evacuation infrastructure
- Analysis of Financials of Transmission companies (GETCO and VPN) for ADB Loan
- Propose and evaluate appropriate business models.

## Marketing and capacity Building
- Consultations with central and state government, regulators, international and national private sector investors and development partners.
- Organized Workshop on Solar park in Jodhpur and Ahmedabad, hosting more than 400 participants (more than 150 overseas participants)
- Assist RREC to get concurrence of the relevant agencies
- Draft contractual agreements between govt. agencies and potential investors.
Section 3

Developing Solar Parks
### Solar Park: Requirements

#### Resources (for 1000 MW)
- Investment of Rs. **5,500-7,000 Cr** for solar PV projects
- Investment of Rs. **500-700 Cr** for transmission network
- Shade free area of approx. **8,000 Acres**
- Water requirement of approx. **8 Million Litres per day**

#### Infrastructure
- Road (Internal and Approach road), plots
- Buildings- Administrative, storage, residential, training etc.
- Equipments for remote monitoring, SCADA etc.
- Transmission lines and substation
- Drainage, storage and treatment
- Boundaries, lighting, watch tower, telecom towers, buffer zones

#### Policy
- Suitable model for developing the park
- Robust framework to provide certainty and oversight to investor
- Environmental clearances, water, coastal, hazardous material, airport clearances
- Standardised Power Purchase Agreement (SPPAs), RFS /RFP
- EPC contract, O&M contract etc.

#### State Governments
- • Follow MNRE Scheme on development of solar parks and endeavour to create necessary infrastructure.
- • Designate a nodal agency responsible for the development of solar park
- • Focus on utilising wastelands and buying power through state DISCOMs
Developing Solar parks: Models

- Significant benefits to the developers come at a premium, which is being charged by the concerned government entities

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<table>
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<tr>
<th>Options</th>
<th>Returns</th>
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</table>
| Options | • Sell/lease out the plots to prospective project developers. Allotment Price per metre square (inclusive of all applicable taxes, duties, cess etc.) payable by the plot applicant  
• MNRE also planning a subsidy scheme |
| Power sale | Developer to make his own arrangements |

Options for States

- 100% Ownership  
  - Initial upfront investment requirement  
  - Necessary infrastructure to be set up by States

- JV with SECI  
  - SECI will also invest equity and know how of solar projects  
  - SECI may also sign PPA

- JV with PSU or Private player  
  - Infrastructure to be set up by JV  
  - To reduce equity requirement, equity contribution may be the cost of land as % of project cost
# Overall Framework: Leasing/Selling Land

## During Solar Park Development

<table>
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<th>Infrastructure Development</th>
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<tbody>
<tr>
<td>• Formation of Solar park SPV</td>
</tr>
<tr>
<td>• Land Development</td>
</tr>
<tr>
<td>• Power evacuation infrastructure</td>
</tr>
<tr>
<td>• Weather monitoring station</td>
</tr>
<tr>
<td>• Water and other amenities</td>
</tr>
</tbody>
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## Funding

| Debt Raising |
| Subsidy and support from Govt. |
| Owner’s Equity |

## During Solar Project Installation

### Milestones

- Allotment of plots to project developers
- Project commissioning
- Timelines as per agreement

### Revenue Stream 1

- Upfront recovery of x % of solar park development cost
- Recovery of remaining (100-x) % of solar park development cost
- Recovery of service charge for services (water, security etc)

### Revenue Stream 2

- Lease agreement

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Section 3 – Developing Solar Parks

**Building solar projects on IPP Mode**

- **Prospective Developer**
- **Solar Park EA/SPV**
- **Financial Institution**
- **EPC Contractor**
- **Project Company (JV/SPV)**
- **Off Taker**
- **Shareholders Agreement**
- **Financing Agreement**
- **EPC Contract**
- **Power Purchase Agreement**
- **O&M Contract**
**RESCO mode**

**Benefits:**
- RESCO designs, builds, finances and operates the equipment and takes on the performance risk of the project.
- Solar Park Agency signs PPA with the RESCO and PSA with DISCOM.
- RESCO with experience and good balance sheet can easily get funding, not a burden on Solar Park Agency.
- Technical expertise of RESCO and better O&M of project.
Section 4
Options for Developers
The way forward

- Land banks with good solar irradiation and access to grid connectivity and infrastructure.
- Fast approvals and clearances.
- Well structured EPC cost.
- Low finance options for supply and project.
- Efficient project management.
- Well designed contracts and agreements.
- Analysis of various sales options.
- Selection of right power purchase agreements.
- Well designed contracts and agreements – construction and plant maintenance.

Right mix of both factors: costing & sales model will result in commercially viable projects.
Power sale options for solar energy projects

1. Regulated Market
   (National and State policies)
   - Feed-in-tariff
   - APPC + REC

2. Open Market
   (State specific policies) 3rd part & Captive Sale
   - Sale at competitive price and avail REC
   - Sale to voluntary green power purchasers
   - Sale to Conventional Captive Plants
1. Regulated market sale options

Two options exist under regulated market:

**Feed in tariff / Preferential tariff**

- Most preferred sale option in the market as seen from National and State policies.

- Sale through a long term PPA (25 years) to state discom at preferential tariff /Feed-in-tariff.

- Weighted average price of INR 6.45 per kWh – 8 per kWh realized in the recent bids largely possible due to drop in EPC prices

- Tariff largely discovered through a competitive bid process estimated to provide 10% - 15% returns and largely driven by financing options.

- REC cannot be claimed under this mode.

**Average Power Purchase Cost + REC**

- Sale under a long term PPA with state discom on Average Power Purchase Cost notified by State Electricity Regulatory Commission.

- REC can be claimed under this mode.

- In this sales mode, energy produced is sold to State Utilities at APPC (INR 2.0/kWh – INR 3.0/kWh) of the state as realization.

- Tariff largely discovered through a long term PPA (10 years) and largely driven by REC price. However, low APPC, uncertainty in REC market and low bankability is a hindrance

- Non-visibility of REC price beyond 2017 and firm APPC for the PPA period are seen as market hurdles.
2. Open market sale options

**Open Market Sales Options (3rd party & Captive)**

- **Sale at competitive price without concession**
  - Generator *will not avail any concession* provided by the government (other than Solar Park policy), so as to claim RECs.
  - Sale to licensee or to an open access consumer at a mutually agreed price, shall be issued **Half Certificate** for 1 MWh. *(CERC draft amendment to REC regulations)*

- **Sale to consumers with voluntary green power purchase plan**
  - Avail concession
  - Sell at a price higher than grid price to satisfy RPO requirement
  - No REC Claim

- **Sale to Conventional Captive Plants**
  - Avail concession, hence can not avail REC
  - Sell under open access mechanism with long term PPA
  - Share any upside and downside in the REC price
  - Captive plant meets its RPO

**Target markets**
- Large Industrial & commercial consumers;
- Multinational companies with surplus cash flow; (IT firms like Microsoft, IBM etc., Oil firms like Shell, Essar, etc)
- Companies with high tax outflow;
- Large captive plants based on conventional fuel;
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