AKSHAY PRAKASH (Issue: 1/2021)

Challenges in "Solar Park" Scheme

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Date: 25/10/2021

- Since ancient times, we worship the Sun as a life-giver to our planet
- India is endowed with vast solar energy potential. About 5,000 TkWh/year energy is incident over India's land area, with most parts receiving 4-7 kWh/ SQ. Met/ day. Solar photo-voltaics (PV) energy can effectively be harnessed providing huge scalability in India.
- Solar power enables rapid capacity addition within short lead time.
  - Off-grid decentralized applications are advantageous from "Rural Electrification" perspective for GREEN Revolution.
- Solar energy is abundantly available.
  - Solar energy (if captured effectively) can meet entire country's power requirements.
  - There has been a visible impact of Solar energy in Indian Energy scenario, during last 10 years & Solar energy sector has emerged as a significant player in Grid connected Gen capacity.

- Decentralized & Distributed applications of Solar Energy have benefited millions Indian villagers by meeting their cooking, lighting & other energy needs in an ENV friendly manner.
- National Institute of Solar Energy has assessed India's solar potential of about 748 GW, assuming oly 3% of waste land area to be covered under Solar PV modules.

- Solar energy has taken a Central place in India's National Action Plan on Climate Change (NAPCC) with National Solar Mission (NSM) as one of the key Missions.
  - Solar Energy supports GOI agenda of sustainable growth, while, emerging as an integral part of solution to meet India's energy needs & an essential player for energy security
- NSM was launched by GOI on 11th Jan 2010, as a major initiative with active participation from State Govts to promote ecological sustainable growth, which will also constitute a major contribution by India to global effort to meet challenges of Climate Change & Green House Gas (CC& GHG) effect.

- **Solar Mission targets installing 450 GW grid-connected Solar power plants by 2030. This is line with India's Intended Nationally Determined Contributions (INDCs) target to achieve about 40% cumulative electric power installed capacity (IC) from non-fossil fuel based energy resources.**

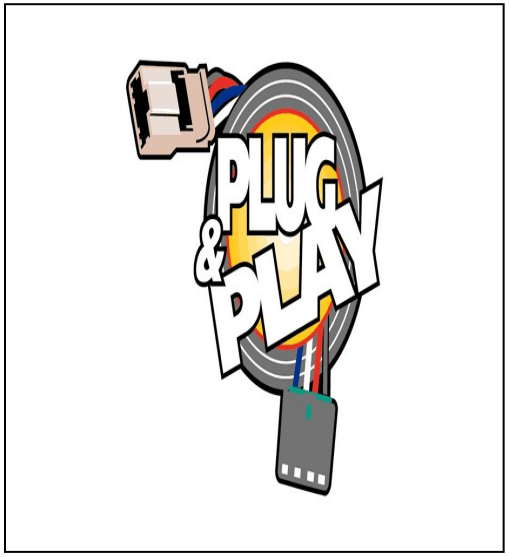
In order to achieve the above target, GOI has launched various schemes to encourage Solar Gen:

- **Setting up of Grid-connected Solar PV power projects**
- **Grid Connected Solar Rooftop Schemes**
- **Canal bank & Canal top Scheme**
- **Solar Park & Ultra Mega Solar Park Schemes,**
- **Viability Gap Funding (VGF) Schemes: Financial Support by GOI to Developers**
- **Central Public Sector Undertaking (CPSU) Scheme: To set up solar PV projects thro' Govt Producers using domestic cells & to facilitate National Energy Security**
- **Defence Schemes: Bidders selected on the basis of bids for minimum VGF requirement for the project**
- **Bundling Scheme (Solar power to be bundled with Gen from Conventional Sourecs)**

Various policy measures undertaken by GOI included:

- Declaration of trajectory for Renewable Purchase Obligation (RPO) including Compulsory purchase from solar Gens, % to be decieded by MNRE/SERCs
- Waiver of Inter-State Tran System (ISTS) charges & losses for Inter-State sale of solar & wind power for projects to be commissioned up to March 2024
- Must Run Status: No backing down instructions from SLDC
- Guidelines for procurement of solar power thro' tariff based competitive bidding process,
- Standards for deployment of Solar PV systems & devices,
- Provision of RT solar & Guidelines for development of Smart cities,
- Amendments in building bye-laws for mandatory provision of roof top (RT) solar for new construction or higher Floor Area Ratio,
- Infrastructure status for solar projects,
- Raising tax free solar bonds,
- Providing long tenor loans from multi-lateral agencies, etc.

- Recently, India achieved 5th global position in solar power deployment by surpassing Italy, as of Dec 2019.
- Solar power capacity has increased by more than 17 times in the last five years from 2.6 GW in March,2014 to 45 GW in Aug, 21.
  - Presently, solar tariff in India is very competitive & has achieved grid parity. (< Rs 3 PU)



- **Solar power projects can be set up anywhere in India, however scattering of Solar projects leads to higher project cost/MW & higher T&D losses.**
  - **Individual projects of smaller capacity incur significant expenses in**
    - **Site development,**
    - **Drawing separate T/Ls to nearest S/s,**
    - **Procuring water & in creation of other necessary infrastructure.**
  - **It also takes a long time for project developers to acquire land, get change of land use & various permissions, etc., which delays the project. (AG Non AG)**
- **To overcome these challenges, "Development of Solar Parks and Ultra-Mega Solar Power Projects" scheme was rolled out in Dec 2014 with an objective to facilitate the Solar Project Project Developers to set up projects in a "Plug-&-Play model".**

Indian Solar Park: Some basic issues

- **Solar Park: A concentrated zone of development of Solar Gen projects, which provides developers an area that is well constructed, with proper infrastructure, access to amenities, where risk of Projects can be minimized (which is developed for supply of merchant power into electricity grid)**
  - **Amid many policy & project execution issues, India's utility-scale Solar Park model has firmly stood its ground.**
- **Ultra-Mega Solar Plant (UMSP): SP with Installed capacity of 1000 MW in a Single Solar Park.**
  - **In 2016 MNRE initially set a target for 40 IND Solar Parks with a combined capacity of 20 GW, & in 2017 MNRE doubled this target to 40GW by 2022.**
  - **Solar parks in India continues to attract global capital & some of the most renowned domestic & international RE developers.**

Basic Issues: MNRE's "Solar Park" (SP) Scheme:

- **MNRE rolled out SP scheme on 12-12-2014.**
  - **Solar parks were proposed to be set up by 31/03/2022. MNRE (vide OM dated 2nd Mar 2020), extended SP & UMSP scheme upto 31/ 03/ 2024 .**
- **SP scheme envisages supporting States/UTs & their agencies, CPSUs & private entrepreneurs, in setting up SP Projects at various locations.**
  - **SP developers will be provided suitable developed land with all clearances, Trans System, water access, road connectivity, communication network, Grod Connectivity etc.**
- **Initially Min Capacity of SP was set at 500 MW & above. However, smaller parks are also considered as contiguous land is difficult to acquire in view of difficult terrain & where there is acute shortage of NA land.**
  - **Implementing agency is termed as Solar Power Park Developer (SPPD)**

Solar Park Project Developer (SPPD):

- **SPs are envisaged to be developed in different modes for development:**
  - **State Designated Nodal Agency (SDNA) (a State Govt PSU or a SPV)**
  - **JV Company is set up between SDNA & SECI/IREDA with 50% equity from each**
  - **State designates SECI/IREDA as Nodal agency**
  - **Private entrepreneurs promote SPs without any equity participation from GOI, but may have equity participation from State Govt**
- **SECI/IREDA will have to designate an agency for development of Solar park & will administer the scheme as per MNRE directions, for GOI funds to be made available under SP Scheme**
  - **MNRE has rolled out SP scheme to fulfil the ambitious target of setting 100 GW Solar Plants in India. GOM has announced Maha RE Policy 2020 to set up 17,360 MW RE projects in Maha, out of which 10,000 MW is projected from Solar Energy.**
  - **As per MNRE Advisory/Clarification dated Nov 5, 2019, the solar capacity on DC side (MWp) can be higher than AC capacity (MW).**
- **Tentative Land requirement: 200 Hectors (500 Acres each) for 100MW Solar Park. (One Acre: 4047 Sq. Mets)**

Land acquisition /Site selection

- **Solar Park needs about *5 Acres/MW land, for projects installation***
- **Land for setting up of SP will be identified by State Govt unless the Implementing Agency has its own land.**
  - **States are encouraged to identify sites receiving good solar radiation & site locations, which are closer to CTU/STU network, preferably with spare Trans capacities & water availability.**
  - **In order to provide for such a large tract of contiguous land with appropriate insolation levels, State Govt may prioritize use of Govt waste land/ non-AG land in order to speed up land acquisition**
- **If necessary, private land may also be acquired by Implementing Agency at lower Price, in order to attract developers.**
  - **If land cannot be made available in one location, then land in a few locations in close vicinity may be taken. Possibility of using cold & hot deserts, sides of highways can also be actively explored.**

Facilities to be provided by Solar Park Project Developer

- Implementing agency (SPPD) has a task of acquiring land with HI Insolation levels, for Solar Park, cleaning it, levelling it, transperantly allocating plots for eligible individual projects.
- SPPDs are entrusted with providing following facilities to Solar Project Developers with aim, to save significant time of the Developers :
  - Land approved for installation of solar Plants & necessary permissions including change of land use (AG□Non AG)
  - Boundary fence/Security of land
  - Road connectivity to each plot of land (Approach roads)
  - Water availability for construction & running of plants & demineralization plant
    - Providing water supply (min quantity: 5-6 KL/MW/Wash) in every 50 MW, SPPD will provide one water point & further water distribution grid will be developed by individual developers, as per layout
  - Flood mitigation measures like flood discharge, internal drainage
  - Construction Power/ Telecom facilities
  - Trans facility consisting pooling stations to allow connection of individual projects with pooling station thro' a network of UG cables or O/H lines.
  - Housing facility for basic manpower/ Parking, Warehouse facilities
  - Setting of Cetralized weather monitoring system
  - Centralized, single Window services at SP

Financial model

- Implementing Agency (SPPD) will develop the land & provide necessary infrastructure like Road connectivity, Trans infrastructure etc.
- Significant investments will also be made in O&M of Solar Park, employing staff & other activities. Entire cost of development including cost involved in acquisition of land will form "Total cost" for project for which an estimate will be prepared beforehand by the SPPD.

Financing Cost involved in developing SP is generally being met from three major sources:

  - Grant from GOI (MNRE Subsidy)
  - Payment by Individual Project developers against land purchase (lease rent), part of which is generally being taken at the time of signing of agreements.
  - SPPD may put in some of its own equity & can raise loans, depending on availability of funds from financial institutions

- SPPD will also create a small corpus for working capital to ensure upkeep & maintenance in the SP in future, which may be recovered through some annual charges to be levied on Individual Prject Developers
- SPPD will formulate a recovery model to ensure sustainability of SP

MNRE support

- State Govt will nominate "Implementing Agency (SPPD)" for Solar Park & also identify land for proposed SP. It will then send a proposal to MNRE, for approval along with the name of SPPD.
  - MNRE will provide Central Financial Asiistsnce (CFA) of up to Rs. 25 Lakh per Solar Park for preparation of Detailed Project Report (DPR).
- Under GOI scheme, Central Financial assistance (CFA) of up to Rs 20 Lakh/ MW is provided on achieving milestones prescribed in scheme.
  - Rs. 12 Lakh/ MW (60%) is provided to SPPDs towards development of internal infrastructures of Solar Parks &
  - Rs. 8 Lakh/ MW (40%) is provided to CTU or STU as the case may be towards development of Trans system.
  - Grant will be managed & released by SECI/IREDA on behalf of MNRE for which SECI/IREDA will be given a fund handling fee of 1%.
- Approved grant will be released by SECI/IREDA as per following milestones:-
  - Issue of Admin approval: 5%/ Land acquisition (> 50% land acquired): 20%/ Financial Closure: 20%/ Construction of Pooling S/S, Land Development & other Common facilities as per DPR: 25%/ Construction of Trans line & Grid Connectivity: 20%/ Final instalment on completion: 10%

- **Solar Park concept involves a State Govt (or Local Discom) facilitating a Single Central Grid connection & taking on procurement & time-delay risks relating to land acquisition.**
  - **This approach has been instrumental in driving economies of scale & attracting global capital into India's RE over the last 6-8 years, with an immediate boon in the form of lower solar tariffs**
- **Utility-sale Solar parks in India have successfully overcome major risks, associated with RE development in India:**
  - **Project execution risk, (Land Acquisition & Grid Connection for Evacuation)**
  - **Off-taker risk/ O&M risk**

Project Execution Risk:

- **Land acquisition process is one of the most critical roadblocks In many infrastructure projects.**
  - **But State Govt & Implenting agencies (SPPD) are helping developers in acquiring large-scale Govt & privately-owned land for solar parks.**
- **Solar parks also have saved developers' botheration for arranging connection of Gen units to nearest S/s (SPPD does it. It can also be thro' tapping of EHV lines (Loop In Loop Out (LILO) Connections)**

O&M Risk:

- **Solar Parks are mandated to build & maintain a road to make project sites accessible. This in turn supports projects construction & promotes maintenance of project for a lifespan of 25 years**

Off-taker Risk:

- **Financial stress of Discoms continues to be a major concern for power sector, with overdue payments of more than Rs 68,762 CR owed to Gencos as on 31st May 2021. Discoms' weak financial position magnifies the investors' risk in new power projects.**
  - **Solar Energy Corporation of India (SECI) & NTPC Ltd, were brought in to underwrite Power Supply Agreement (PSA) with new Solar parks.**
- **SECI/IREDA & NTPC further signed PPA with Discoms, which improved the quality of contracts as SECI/ IREDA/ NTPC take the risk on their own balance sheets, which are much more robust than those of Discoms**

Reverse Bidding Auctions:

- **Introduction of Reverse bidding auctions has helped to bring RE prices down.**
  - **In reverse bidding auctions, developers bid for the lowest attainable tariff, at which they can supply power.**
  - **Auction mechanism drives prices down by promoting competition, but also has introduced transparency & efficiency in the process of contracting new RE capacity.**
- **Ultra Mega Solar Parks (UMSP) have attracted extremely low tariffs all across the globe.**
  - **In a recent tender in United Arab Emirates (UAE), 1.5 GW solar capacity was awarded at a world record low solar tariff of AED0.0497/kWh (US$ 13.5 per MWh) (95 PSPU) to a consortium led by EDF of France & Jinko Solar of China.**

Power Evacuation from Solar Park

- Interconnection of each plot with Pooling Stn thro' UG or O/H cable will be the responsibility of individual Project Developers.
- Implementing agency (SPPD) will set up EHV Pooling Stns & respective transformers inside the Solar Park & will also draw Trans lines to transmit power to a nearby EHV S/s.
  - Responsibility of setting up a new S/S nearby SP to take power from one or more pooling Stns will lie with CTU/STU
  - State Govt in which SP is developed must agree to buy at least 20% of power produced in SP thro' its Discom. States which agree to buy higher % of power will be given preference
- If State Govt is willing to buy More than 50% of power generated in SP, preference will be given to STU, which will ensure setting up of S/s & necessary infrastructure for Trans from S/s to Load Centres.
  - If State is not willing to buy at least 50% of power generated in SP, then CTU is entrusted with responsibility of setting up EHV/UHV S/S right next to SP & its connectivity with CTU network.
  - If STU system has to be used to evacuate power to other states, the STU/ State Govt concerned will have to agree to waive off Wheeling charges or reduce them to affordable level

Fund for power evacuation:

For power evacuation network, MNRE grant may be used.

- If expenditure is high then a separate proposal may be considered for funding from National Clean Energy Fund (NCEF), Green Corridor Program.

- Equity Contribution:
- Implementing Agency (SPPD) may not require a high equity infusion as most of the cost will be covered thro' as MNRE grant & loan.
  - Most of the land is expected to be Govt land. Total expenses on development of park will be worked out by implementing agency (SPPD) in a transparent manner.
- Expenses after taking into account MNRE subsidy, may be recovered thro' sale/ lease charges of land from developers.
  - In fact, Implementing Agency can generate a reasonable amount of Surplus as profit to SPPD, which may preferably be converted in to equity of SPPD so that SPPD gets financial strength for long term sustenance

Hybrid Projects:

- Some other forms of RE like Wind, Biomass etc. may also be allowed to come up in the Solar park area wherever feasible. Projects with CSP technology may be installed in these SPs upto 15% of AUX fuel of gas or biomass.

MNRE GOI Office Memorundums (OMs) dated 21/03/2017, 22/05/2018 & 18/09/2018:

Timeline for Development of Solar Park

- Date of issue of in-principle approval: Zero Date (ZD)
- Submission of DPR: ZD + 4 Months
- Land Acquisition (not less than 50% of land): ZD + 8 Months
- Financial Closure: ZD + 11Months
- Award of work for Pooling Stn: ZD + 14 Months
- Receipt of material on Site for Pooling Stn: ZD + 17 Months
- Completion & Construction of Pooling Stn: ZD +24 Months

- Indian RE Development Agency Ltd (IREDA) will now be Implementing Agency (SPPD) for following Solar Projects, where SECI is SPPD, as well as the Solar Projects to be sactioned in future in which SECI or its JV is the SPPD:
  - 150 MW Solar Park in JharKhand
  - 160 MW Solar-Wind Hybrid in AP
  - 4000 MW Dholera Solar Park Phase II in GUJ (World's biggest Solar Park: under construction)

Exising Solar Parks In India

As of 31st Jan 21, India has established 42 Solar Parks

- **Recent downward trends in solar tariff may be attributed to factors like economies of scale, assured availability of land, & Power Evacuation Facilities, which are available in Solar Park Schemes.**
- **SP would enable States to bring in significant investment from project developers, meet its rising Solar RPO mandate & most importnatly provide employment opportunities to local population.**
  - **SECI was the facilitator for development of Solar Parks. Now, this role is being played by IREDA**
- **Main hudel in success of large scale Ultra Mega Solar Parks (UMSP) is mobiliseation of high capital at least cost. UMSP are land intensive & they pose a resource availability challenge for a densely populated area.**
  - **UMSPs are not as easy to operate as decentralised Solar systems for grid operators. Large scale input of power from utility-scale Gens is harder for Grid Stability Management as it may lead to large voltage & frequency fluctuations because of intermittent nature of UMSPs**

Bhadla IND Solar Park, RAJ (2,245MW)

- **Largest Solar Park in India: Bhadla park is located at Bhadla (Dist Jodhpur) in RAJ, covering more than 14,000 acres. It was developed by following entities. It was fully commissioned on 20 Mar 2020**
  - **RAJ RE Corporation Ltd, thro' its subsidiary, RAJ Solar Park Development Co Ltd, has constructed 745MW capacity.**
  - **Saurya Urja Co of RAJ, a JV of RAJ Govt and IL&FS Energy Development Co, has developed infrastructure for 1,000 MW solar projects.**
  - **Adani RE Park RAJ, a joint venture between Raj Govt & Adani RE Park, (a subsidiary of Adani Enterprises) has developed 500MW solar capacity.**
  - **Solar Energy Corporation of India's auction bid for 500MW in May 2017 saw a record-low tariff of Rs 2.44 PU.**
  - **ACME quoted Rs 2.44 PU to win 200MW,**
  - **SB Energy (SoftBank) quoted Rs2.45 PU to develop 300MW.**

Bhadla has attracted the then record low solar tariffs in India in the range of Rs 2.44-2.65 PU

Pavagada Solar Park, Karnataka (2,050MW)

- **Pavagada Solar park having IC of 2,050MW was fully operational on 27th Dec 2019**
  - **Project, also called Shakti Sthala, is spread across 13,000 acres in KAR's Tumkur Dist. Land for Solar Park was leased for Rs. 21,000/acre annually.**
  - **Facility has been developed by KAR Solar Power Development Corporation Ltd (KSPDCL), a JV between KAR RE Development Ltd (KREDL) & SECI. (SPPD)**
- **KSPDCL acquired the land & required approvals & then awarded contracts for solar power capacity, in a simplified "Plug & Play' model. This facility illustrates how quickly RE infrastructure can be planned, financed & built when a suitable "Energy Policy" framework is in place.**
- **Solar Tariff for various palnts is between Rs. 2.82-4.79 PU**

Develpers of PAVAGAD Solar Park:

- **Tata Power: 400 MW**
- **ReNew Power/ Fortum Solar: 350 MW (each)**
- **Avaada Energy: 200 MW**
- **Adani Green: 150 MW**
- **ACME Solar/ Azure Power: 100 MW**
- **Rattan India/ KRDEL: 50 MW**

Kurnool Ultra Mega Solar Park, AP (1,000MW)

- 1,000MW Kurnool (AP) Solar facility is one of the earliest completed Ultra-Mega Solar Parks (UMSP) It has attracted International capital from firms such as SoftBank, Japan in partnership with Foxconn of Taiwan. It was commissioned in July 2017.
- AP Solar Power Corporation (APSPCL) led development effort, first by acquiring 25 SQ KM land for the project & then funding of Rs.5 Lakh/ MW to improve Roads, Drinking water & Training facilities in surrounding villages. Local skilled & semi-skilled workers were also given preference for jobs in Kurnool UMSP. Under UMPP scheme, GOI provided a subsidy of Rs 2 Lakh/MW to APSPCL to develop the solar park.
  - First 500MW was awarded to Sun Edison at Rs 4.63 PU in Jan 2016 (this asset was later acquired by Greenko in Sept 2016)
  - 350MW was awarded to SBG Cleantech at Rs 4.63 PU,
  - 100 MW to Azure Power of India at Rs 5.12 PU &
  - 50MW to Adani Green at Rs 5.13PU
- Just a year later, solar tariffs were set as much as 50% lower, highlighting the price deflation sweeping thro' the Indian market.

Rewa Ultra Mega Solar Park, MP (750MW)

- 750 MW Rewa SP spreads over 1,590 Acres in Gurh tehsil of Rewa Dist (MP). Project was commissioned in Dec 2019
- Rewa UM Solar Ltd (RUMSL), the implementing agency (SPPD) of the project, is a JV between MP Urja Vikash Nigam Ltd (MPUVNL), MP Discoms & SECI.
- In Feb 2017, in the auction for 750 MW, Rewa Solar Park bids had reached a new record low of Rs 2.97 PU, falling 30% from the previous low of Rs 4.34 PU which was recorded in RAJ in Jan 2016.
  - Tariffs have an escalation of 5 PSPU over 15 years, which brings the levelised tariff to roughly Rs 3.30 PU over the 25-year period.

The winners were

- ACME Solar Holdings (250 MW) at Rs 2.97 PU
- Solengeri Power (250 MW) at 2.974 PU
- Mahindra Renewables (250 MW) Rs 2.979 PU for the first year.

- **Gen from Rewa UMSP is shared between MP Power Management Co. Ltd (MPPMCL) (76%): (Holding Co for MP Discoms) & Delhi Metro Rail Corporation (24%). This provides for 90% of Delhi Metro's current daily power requirement:**
  - **UM solar parks could enable trade between RE rich zones to other States**
  - **This eradicates need for States to build costly & polluting THM projects in their own States, as cheaper & cleaner power could be sourced from UMSP from anywhere in India**

Adani's Kamuthi Solar Park, Ramnathpuram Dist, TN (648 MW):

- **Kamuthi Solar Park (2500 Acres: 10 Sq.Km area) was operational in 2016. SP project was executed by Adani, & it was commissioned in two parts: 360 MW was commissioned in March 2016, & 288 MW was connected in Sept 2016. CUF is 24%**
  - **Kumathi SP consists of 2.5 million solar modules, 380,000 foundations, 27,000 metres of structures, 576 inverters, 154 transformers, & almost 6,000 km of cables. Construction of structures needed to mount the solar panels required 30,000 tonnes of galvanised steel. Around 8,500 workers installed an average of 11 MW/day to complete the project within 8 month. CAPEX for Kumathi SP is Rs 4500 CR. Tariff: Rs 5.10 PU**
  - **Solar panels in Kamuthi SP are cleaned daily by a self-charged robotic system.**

Solar Parks in Maha:

Maha being an AG dominated State has lesser continuous vacant/barren land availability for Solar Parks. Cost of Private land is also very high.

MAHAGENCO, has set up 150 MW solar project in at Shivajinagar in Sakri (Dhule Dist). GOM equity: 20%

- **TTL project cost: Rs 1,987 CR (Rs 12.82 CR/MW). KfW, a German Finanacial Institute, provided debt portion. (VERY HI CAPEX)**
- **In this project: 4 lakh solar modules, 6000 MT's of structural erection, 80000 foundations, 96 inverters, 120 LT/HT panels, over 2000 km. of cabling, over a million interconnections, on 420 acres of undulating & rocky terrain.**
- **Out of 150 MW, 100 MW is produced thro' 'crystalline' PV technology, & 50 MW thro' 'thin film technology'.**

- **Project fully commissioned by March 31 2013. FIT Tariff : Rs 17.91 PU, but Sakri tariff as approved by MERCL Rs 12 PU (because of delay in completion) This was the largest solar park in the World till 2014**

SP in Ambasakhar, Southwest of Chatgaon Village (Beed Dist): 67.2 MW Solar PV stn, which was commissioned on 10th Aug 2017 by Solar Arise

- **Area: 306 Acres (124 hectares). Using 207,015 solar modules.**
  - **Part of the plant uses a seasonal tracking system with remaining using a horizontal single axis tracking system, using polycrystalline Solar PV technology.**
- **Energy produced is drawn by MSEDCL & SECI.**

On 17 July 2020: GOM has directed MAHAGENCO to set up 602 MW Solar Parks in three phases. MAHAGENCO was directed to submit proposal for cabinet approval:

In first phase 187 MW capacity would come up at

- **Kaudgaon (50 MW)**
- **Latur (60 MW)**
- **TPS lands at Bhusawal, Koradi, Parli & Nasik (52 MW) &**
- **Sakri (25 MW).**

- **Loan will be taken from German Govt Agency KfW.**
  - **MAHAGENCO officials said that solar panels would be installed on vacant land near ash bund in Koradi**

In 2nd phase, 3 SPs having (390 MW) capacity would come up in VIDARBHA.

- **Washim (170 MW),**
- **Yavatmal (75 MW) &**
- **Kachrala (Chandrapur) (145 MW).**

- **These SPs would be funded by KfW loan & equity infusion by GOM**

In 3rd stage, 25 MW capacity addition would be done at Sakri SP, using Dom loan of lowest rate of interest & equity infusion by GOM

IMP Activities before establishing Solar Parks (to be carried out by implementing agencies (SPPD)

- ***Physical Verification of Land & Collection, compilation & analysis of relevant data/ info***
    - ***Physical Verification of identified land including Land under endowment, litigation, critical issues such as Monuments & Tombs, Archaeological Sites, Type & No of Trees & Buildings & Structures, Water Body if any falling in the Plot***
- ***Collection of Land documents & Legal verification of documents.***
- **Assessment of Soil Type**
- **Approach & connectivity to site**
- ***Site survey of sub-station & Route survey of Trans lines for interconnection with Grid S/s***
- ***Collection of Meteorological data for Wind speed, Rainfall, Humidity, Temp etc.***
- ***Assessment of Solar radiation & Solar Park capacity potential***
- ***Preparation of PV System reports indicating tentative Solar Gen***
- ***Preparation of Business Model***
- **Getting approvals from various Govt. Depts before starting of work by the individual developers (successful bidders)**

Action Plan for instllation of a Solar Power Plant

Following broad activities are involved in implementation of a Solar Power Plant: *(may not be in this sequence)*

- **Identification of land/ Pre-Feasibility Study**
- **Preparation of Detailed Project Report (DPR) & submissoion to MNRE/ IREDA/ SECI.**
- **Registration with State Designated Agency (MEDA);**
- **Application for grant of grid connectivity to STU**
- **Finalization of Finanacial modules & Financial closure;**
- **Appointment of EPC Contractor on Single Point Responsibility basis**
- **Execution of Project within the proposed targeted completion data**
- **Commercial operation of Solar project & handovering over by EPC contractor**
- **Routine Operations & Maintenance;**
- **Compliance to day ahead scheduling requirements of SLDC**

Typical parameters: Tariff computation for Solar Parks: (basic assumptions)

- **Debt: Equity Ratio: 80:20% (as per MERC RE Tariff Regulations)**
- **Interest on debt: 5%: (based on market trends of recent competitive bidding projects)**
- **Debt repayment period: 12 years**
- **Base Rate of Return on Equity 14% (MERC RE Tariff Regulations 2019)**
- **Annual escalation on O&M expenses: 3.61%**
- **Depreciable value: 90 % capital cost. Salvage value: 10% capital cost**

Working Capital components:

  - **O&M expenses: 1 Month**
  - **Maintenance spares: 15% % of O&M expenses**
  - **Receivables 0.5 months**
  - **Rate of interest on Working Capital: 9.00%**

- **Installed capacity: 100 MW (assumed), Useful life: 25 years, Capacity Utilization Facto (CUF): 20-30%, AUX: 0.5%**
- **Capital cost: Rs 4 CR/MW O&M expenses for 1st year: Rs 6 Lakh/MW**
- **Tax depreciation: 40% Additional depreciation: 20% (as per IT Act)**

Gen: Gross Gen 175.20 MU/ Net Gen: 174.32 MU (with CUF: 20%)

- Discount factor (Weighted AVG Cost of Capital): 5.40%

Depreciation: Upto debt repayment period: 5.83% Beyond debt repayment period: 1.54%

Considering above assumptions,

- **Levelised Cost of Generation(CoG) works out to Rs. 2.76 PU**
- **Tariff for 1st Year: 367 PSPU, fifth year: 333 PU, 10th Year: 303 PSPU, 12th Year: 291 PSPU, 13th year: 154 PSPU, 20th Year: 191 PSPU, 25th year: 205 PSPU**
  - **Solar tariffs discovered conducted by various agencies is in range of Rs. 2.44 PU & Rs.5.70 PU (during Dec 2017 to Dec 2020)**

Some IMP computations for MSEDCL: (Ref: MERC MYT order dated 30.03.2020)

- **Approved PP for MSEDCL PP FY 24-25: 153,204 MU (Page 339 of MYT Order)**
  - **Solar RPO:13.5% i.e. Required Solar PP for FY 24-25: 20,682 MU**
  - **Solar RPO: 6% in FY 21-22: Solar PP: 8516 MU (need for additional Solar PP of 12,166 MU in 3 years)**
- **!00 MW Solar Park: 175 MU with 20% CUF**
- **For 20,682 MU in FY 24-25 (MSEDCL needs about 7000 MW additional Solar capacity to be installed within 3 years), SP is a better opinion for MAHA**

KAR Pavagada's Massive solar park ups heat (02/10)

- There is a large sheet of glass that stretches as far as the eye can see at At Pavagada Solar Park (2050 MW. 12,800 Acres black solar panels, glimmer in the Sun. Pavagad Solar Park was meant to be an answer to ENV hazardous THM & NUC energy sources. But this ultra-modern, eco-friendly solution has brought misery in the life of villagers nearby.
- Common complaint is "Noticeable change in temp". "Pavagada is hot, but the heat is even more unbearable now. Nights have become warmer even during winters. Days are burning hot in summer," said residents of Vallur.
  - Vallur, Tirumani, Balasamudram, Kyatagancharulu & Rayacharulu are the 4 villages where KSPDCL leased land from farmers to set up Shakti Sthala, SP
- "Earlier, we used to sleep outside only during summer. But now we do it in all seasons," said Narayanappa, a villager. KSPDCL was supposed to plant trees but nothing has been done, he added. Villagers complained that temp has gone up at least by 5 degrees C (from around 32 to 37 degrees C).
  - But researchers & scientists, who have visited PAVAGADA, said increase is marginal at up to 1 degree Celsius in areas located close to the panels.
  - Authorities need to install Temp Sensors at 1, 3 & 5 Km radius from SP site to get better data

- **Land which has now been covered by solar panels is next to human habitat. When the land has vegetation & surface is green, water gets absorbed & Oxygen flows naturally. Also, farming activity keeps soil alive. But with solar panels replacing vegetation, the area has become hotter..**
  - **"Lower albedo effect", which means more radiation from Sun getting absorbed by earth, makes temps rise. Especially in Pavagada, which is known for its rocky hills, this effect is more apparent. If there is vegetation, even shrubs, temp goes down.**
  - **Climate & soil experts suggested that long-term impact of cutting off Sunlight & Rain from the land on which Solar Parks stand needs to be studied *before more such parks are commissioned.***
- **Prof John Quinton from Lancaster ENV Centre Soil Science said, "There has been a large increase in Solar Parks around the world, which has led to a significant change in land use. There is a huge pressure, given the current increasing Demd, on AG land to grow biofuels & to convert it into solar energy parks. Concern is that land may not be able to cope with these changes, which needs to be studied to understand their impact on soil & climate."**
  - **There is a need to compile observations for some more years & compare them with data from previous years, he said.**
  - **Pavagada receives low rainfall, but despite that farmers used to grow good quantity of groundnut, horse gram & green gram. There have been studies globally that show that soil under the solar panels is cooler by 5 degree C as compared to patches exposed to Sun. This is likely to affect many important plant & soil processes, including productivity & decomposition.**

Conclusions

- **Solar Parks: Effective in kickstarting India's Solar energy sector transition. UM solar parks have attracted foreign capital & top global developers to India.**
  - **SP is the Concentrated zone of development of Solar Gen projects & provides developers an area that is well characterized, with proper Trans infrastructure & access to other amenities & where the risk for projects is minimized. Lands acquired for SPs are Govt land or barren lands.**
- **Time Savings in commissioning is the most IMP benefit from SP for private developer. AP, RAJ, MP, KAR, GUJ, TEL, UP & WB have prominent SPs.**
  - **Govt need to address development-related negative social & economic externalities. It must avoid mistakes made in the past with large-scale coal mine & UM THM gen plant development, particularly in terms of development on key AG lands & critical forestry reserves.**
- **Due to excellent response & more demand of Solar Parks coming from states, MNRE is contemplating to enhance the capacity of SP/UMSP schemes from 20 GW to 40 GW.**
  - **IMP Issue: Climate & Soil experts suggested that long-term impact of cutting off Sunlight & Rain from the land on which Solar Parks stand needs to be studied *before more Solar parks are commissioned.***

References

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- MNRE,GOI Office Memorandums: dated 21/03/2017, 22/05/2018, 18/09/2018, 05/02/2019 & OM dated 09/05/2019
- GOI Order dated 02/02/2019 & OM dated 19/07/2019
- OM 19/08/2020: Extension of time lines
- MNRE OM dated 15/06/2020: Development of SP &UMSP
- MNRE, OM dated 26th Mar 2021: Clarification regarding Rehabilitation & Resettelement (R&R) for Solar Parks
- Ref: MNRE Order dated 21/03/2017 & OM dated 2nd March 2021: Extension of Timelines
- MERC (Terms & Conditions of RE Tariff) Regulations 2019
- MERC MYT Tariff Order for MSEDCL for FY 20-21 to FY 24-25 issued on 30th March 2020

Thanks!!! Let the light prevail!!

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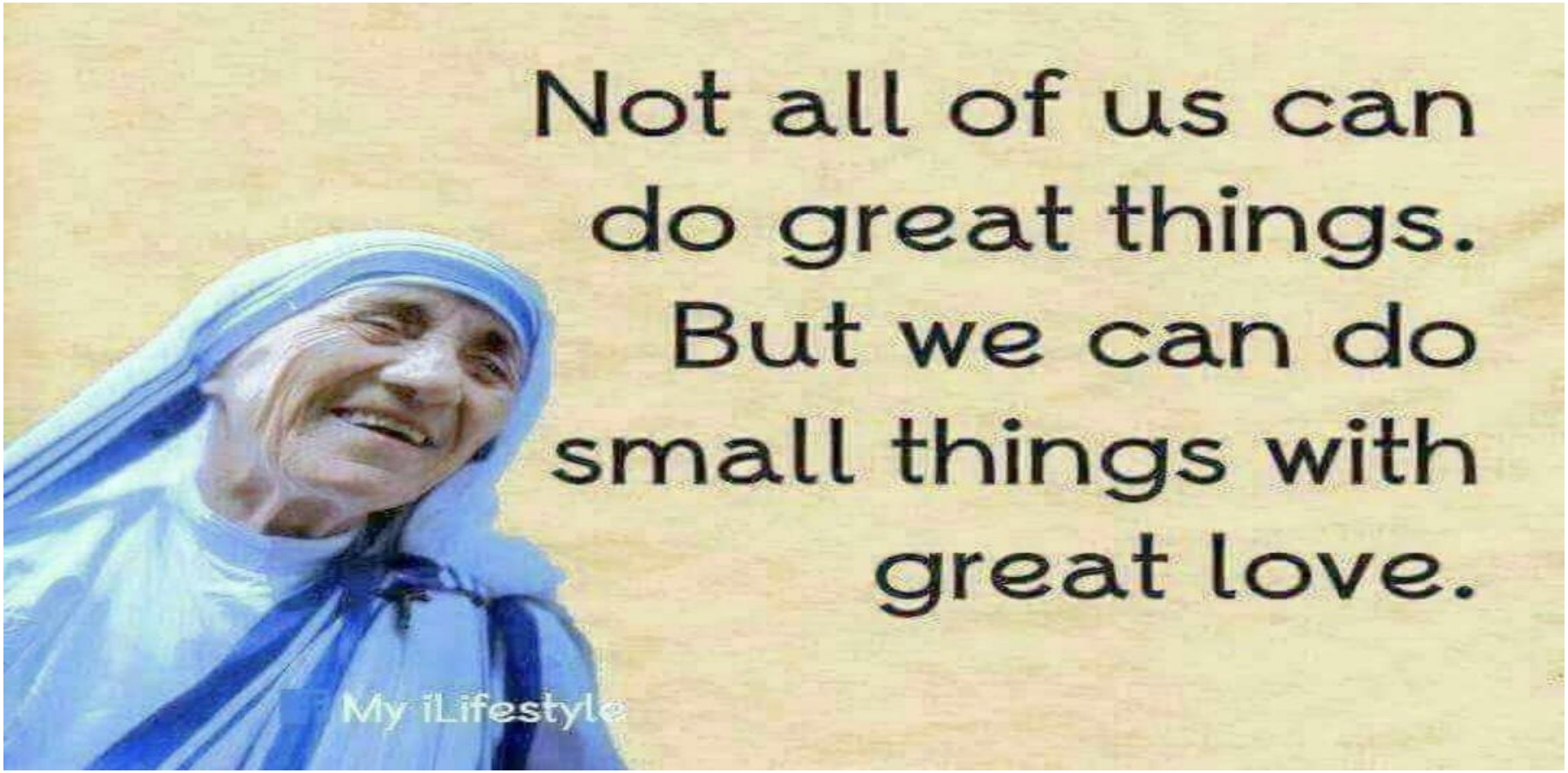

"AKASHAY PRAKASH" is a small effort in explaining complex issues in Power Sector to the best of my knowledge & ablilty.