ExpertSpeak

Utility-scale-solar tariffs: The new low appears unsustainable

Gaurav Singh Chauhan, Senior Research Fellow, Great Lakes Institute of Management and **Ashish Verma**, Analyst, Projects and engineering, Amp Solar,analyse the recent trend on falling solar tariffs and whether these projects are economically sustainable.

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Prime Minister Shri Narendra Modi, in one of his statements this year, said that India is keen to go "above and beyond" Paris-accord, demonstrating a strong resolution towards green-energy. Solar sector has already taken big strides with CAGR (Compounded annual growth rate) of 36.30% since 2011, totaling a capacity of 12.16 GW in utility-scale solar-power (as on March 31, 2017) and is expected to grow with pace of 38% YoY. During this process the solar tariff fell down steeply (upto 80% in last 5 years) and in some cases the bid-tariffs were cheaper than coal-powered generation. Some of this is attributed to better economics and some to financial engineering. Amidst all this there is a growing apprehension about the long term viability of projects at such low tariff. This article attempts to analyze the bid tariff of INR 2.44/kWh (1 kilo-Watt-hour = 1 unit of electricity) in Bhadla (Rajasthan) solar park, INR 3.15/kWh in Kadapa (Andhra Pradesh) solar park and INR 3.30/kWh in Rewa (Madhya Pradesh) solar park to assess whether such low tariffs provide economic viability to these projects or not.

Factors that may have affected tariff

As can be seen (Exhibit 1),project cost fell down by 68% between years 2010-11 and 2015-16 from a high of 17Cr.Rs/kWh to 5.3 Cr.Rs/kWh respectively. This was a result ofa number of economic factors like 80% fall in Silicon (Si) prices during 2011-2016 and overcapacity built-up by Chinese module manufactures when they quadrupled their manufacturing around year 2011. Similarly,localization of plant-components and larger solar plants resulted in economies of scale in year 2012-13. With increasing scale of projects in solar parks (and elsewhere), reverse bidding and lower module costs as the solar-tariff started approaching grid-parity price, forces like foreign investments, cheaper-debt,lower EPC(Engineering, procurement and construction) cost, and BoS (Balance of system) optimizationreduced project-cost (also Operations and maintenance cost)further during 2012-13 to 2015-16.

Generally, the variation in average tariff follows the movement in module price (a major part of project cost) as seen in Exhibit-1 and Exhibit-2, but in later half of 2016-17,the tariff-movement showed a deviation (Exhibit-2). The last three bids in February, March and April of 2017are that of Rewa, Kadapa and Bhadla solar parks respectively, showing a very

Trend in solar project cost, rate of interest and tariff

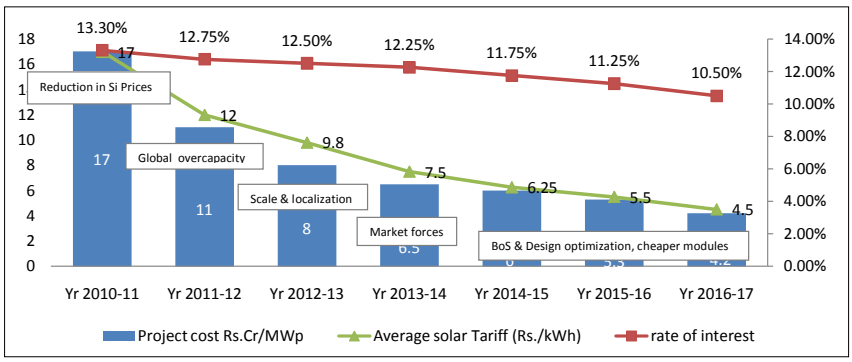

Exhibit-1: Source: CERC benchmarking cost for solar PV, discussion with Solar IPPs and market intelligence

Module Price (ASP)($/Wp) v/s lowest Bid tariff (INR/Wp)

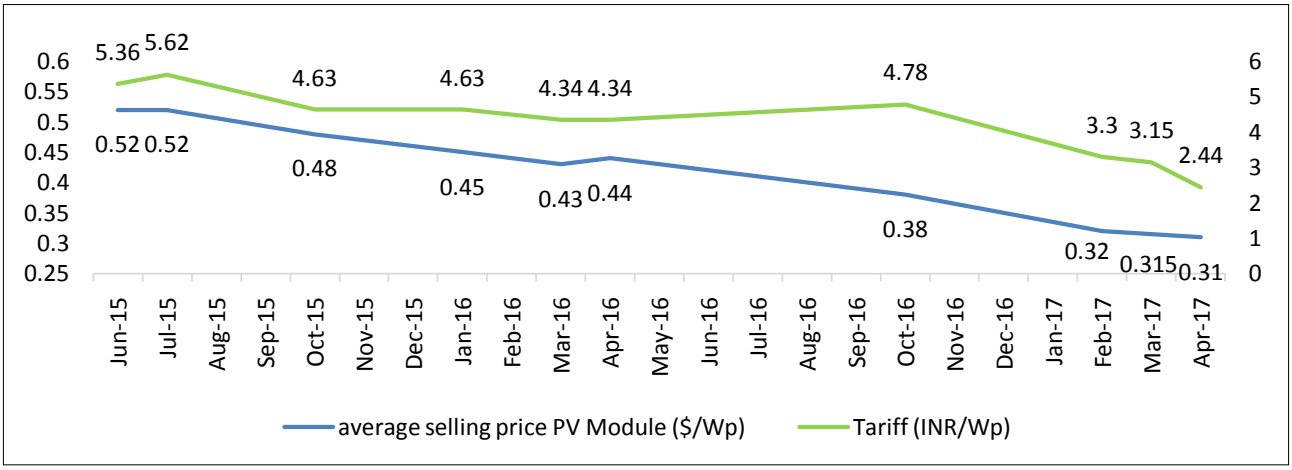

Exhibit-2: Source:Mercom Capital, market intelligence, discussion with Tier 1 Module manufactures, IPP, Bid results

sharp fall in bid-prices, much more than that could be attributed to fall in module prices.What else drove-downthe bid-tariff, in such a short period?

Financial Engineering

By 2016-17, the fall in module prices seemed to have bottomed-up (Exhibit-3) and we saw innovative financial strategies being adopted to bring down tariffs further. This was necessitated by the competition in the industry to win projects bid under solar park model. This period saw the over-subscription of bids upto 12X.

The major financial-levers that have been driving bid-tariff down are:

1. Oversizing and CUF: Earlier the oversizing was upto 20%, whereas now in solar parks with higher solar radiation and lower project costs, the oversizing is being done upto 30% i.e. 130 MWp of DC (Direct current) solar modules for a plant of 100 MWp designated capacity on AC (Alternate current) output side. This has been enabled by higher CUF (Capacity utilization factor) allowed under the tenders nowadays(upto 25%) and lower project costs. Higher oversizing allowed for higher CUF assumption upto 23% and above. This resulted in bidders forecasting higher generation numbers and better profitability.
2. Rate of interest: Rate of interest has eased down and is much lower at around 10% compared to the 13.30% rate in 2010-2011. Solar projects are now perceived less risky, bringing down the cost of debt.
3. Solar module price: Solar module price used to be 52 US-Cents/Wp in 2015-Q2, whereas now it is being predicted around 27 US-Cents/Wp for 2018-Q1&Q2 (as per a survey with tier-1 module suppliers). Also as shown in Exhibit-3 the module prices have leveled out and should reach at 25 US cents/Wp by year 2020. Earlier the module costs assumptions were kept fixed after much deliberate consultations

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Cost structure of leading Module manufacturers (in $/Wp)

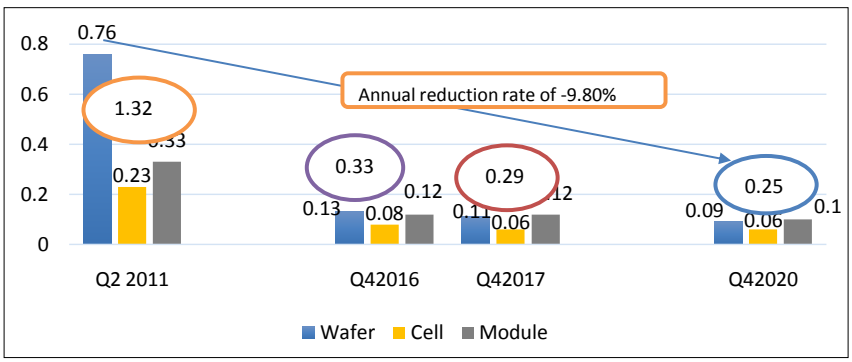

Exhibit-3, Source: Canadian Solar investor presentation, March 2017

Bhadla-III-2016 with a SPREAD of 4.2%

Sensitivity	Base	tariff	Low	tariff	High	tariff	Variation
PLF	23.00%	2.91	20.70%	3.24	25.30%	2.65	22.26%
Rate of interest	10.25%	2.91	11.275%	3.09	9.225%	2.75	12.36%
Solar module cost (US$/Wp)	0.270	2.91	0.297	3.05	0.243	2.77	10.11%
Tenure of loan (Years)	15	2.91	13	2.96	17	2.87	3.14%
Debt ratio	75.00%	2.91	67.50%	2.93	82.50%	2.9	1.03%
O&M cost (exclud.Park)	2.00	2.91	2.200	2.93	1.800	2.9	1.03%

Exhibit-4: Sensitivity analysis of Bhadla-phase-III bi

with module suppliers partnering thepre-bid-agreements. However, nowadays,with falling module prices the bids are put on internal forecasts done by bidders. These forecasts on module prices seem very aggressive and may be grossly wrong.

4. Tenure of loan and debt ratio: Tenure of loan used to be 12 years in year 2015, whereas now the terms are settled at 15 to 18 years.Typically the debt ratio is about 75% debt out of total investment. Higher debt ratio helps lower the bid tariff further by 1 or 2-basis points at debt ratio of 82%.
5. O&M cost: Aggressive assumptions on O&M cost have also helped lower the bid by 2-3 basis points.
6. Tax holiday of 10 years also helps bring down the tariff by 10 basis points but this benefit has been withdrawn.
7. Equity Internal rate of return (EIRR): It is a measure of return/profitability and usually is compared to the rate of interest. The difference between EIRR and interest rate used to be 5% when the interest rates were around 12.25%. However this target-difference (SPREAD) should be around 4.2% nowadays when interest rates are around 10.25%
8. Debt service coverage ratio (DSCR): This is a measure of capability to pay back the debt taken for project development and minimum DSCR across the operational life of a plant should be around 1.1 or above, annually

Evaluating strength of the above-mentioned factors

For deeper analysis, a financial model was run for Bhadla-phase-III bid (with Tax-holiday) and the output has been depicted as a sensitivity chart (Exhibit-4) for three different scenarios viz. Base, low and high. This analysis helped to identify the factors that affect the bid price more than the other factors. It is observed that CUF/PLF affects the bid-tariff the most with 22.26% sensitivity/variation in tariff between low and high cases. Similarly, rate of interest, solar module cost, tenure of loan, debt ratio and O&M cost affect bid-tariff in a decreasing order. It was observed that under base-scenario, a bid price of 2.91 Rs./kWh yields an EIRR of 14.43% giving a SPREAD of 4.18% at aminimum DSCR of 1.13 and average DSCR of 1.54 over 25 years of a project.

Project-wise analysis showsthat, keeping the target EIRR and DSCR as constraints (to check viability), bid-prices 3.30Rs/kWh and 3.15Rs./kWh of Rewa and Kadappa respectively are justifiable in the base-case scenario. While the bid-price of Rewa is viable till a low PLF of 18.50%, the bid-price of Kadappa is viable at a PLF of 21.5% and above. Bid-price for Rewa could have been even lower and looks conservative. However the bid-price of 2.44Rs./kWh in Bhadla phase III seems to be viable only at a PLF of 24% and above, with module price below 24US cents/Wp (very unlikely-refer exhibit-3),much lower cost of debt (than base-case assumptions) and very low rate-of-return expectations. There seems to be no room for accommodating any cost over-run due to operational glitches at bid-price of 2.44Rs./kWh in Bhadla and the project looks unviable.

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