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ENERGY AND NATURAL RESOURCES

The Rising Sun

Grid parity gets closer

A point of view on the Solar Energy sector in India

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Foreword

The Solar PV industry has seen dynamic changes in the last twelve months. Module prices have seen precipitous fall thereby encouraging forecasts of early grid parity; while at the same time, this has raised concerns about the health of the manufacturing sector and sustainability of the cost reductions. In our last report released in May 2011, we anticipated that utility-scale grid parity in the timeframe of 2017-2019 for India. We now believe it is likely to occur at the earlier end of that range and therefore solar power presents a potential disruptive change in our energy scenario. This could help India leapfrog the energy technology space, and enable solar power to make a meaningful and substantive contribution to our energy scene by the end of this decade. Policy makers need to take serious note of this potential.

The National Solar Mission has triggered the development of solar ecosystem capacity in India in the last two years. India's solar capacity has grown from less than 20 MW to more than 1,000 MW in the last two years[1]. The seeds have been sown and investments in capability building have been made. What is now needed is that the 'green shoots' have to be nurtured; else, we could see them die away, putting significant national resources to waste. We believe that the Government should keep the momentum going by providing sufficient clarity on the market, announcing the next phase of the NSM quickly and addressing some regulatory issues which can open up the private contracts market.

This year, our report focuses on the solar cost trends and looks at segments of the market which are most suitable for adoption of solar power within the coming few years. Given the financial position of the power utilities, we believe that rooftop market for customer segments that already see parity with utility power tariffs has the potential to be a game changer in the coming five years. Within rooftop, the solar lease model is becoming attractive in the Indian market. Given the fuel, land and environment challenges that the country is facing in setting up new power capacity, we feel that the state governments, utilities and regulators should encourage this market to realize its potential by providing critical enablers such as net metering infrastructure, banking facility and developing an ecosystem for rooftop market installations.

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1 Ministry of New and Renewable Energy (MNRE)

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Executive summary

The challenges in the power sector continue. India is facing a power deficit of 9 percent[1] and this is likely to continue over the next few years. In many states, industries are facing upto 50[2] percent power cuts. The gap between the power purchase costs and the power tariffs has severely constrained the finances of state power utilities with net losses estimated at around INR 88,170 crores[3] in 2012-13. India faced massive power black-outs in July, 2012 due to overdrawing and grid indiscipline.

On the other hand, solar power costs have reduced rapidly in the last few years. Globally, the solar photovoltaics (PV) market has grown from around 9.5 GW in 2007 to 69 GW of cumulative installations by 2011[4]. Accordingly, the solar PV industry has grown from USD 17 Bn in 2007 to USD 93 Bn in revenue by 2011.[5]

The Indian solar market has seen significant growth with the installed solar PV capacity rising from under 20 MW to more than 1000 MW within the last two years. In fact, the tariffs discovered in the highly competitive bidding in the recent rounds of auction under Jawaharlal Nehru National Solar Mission (JNNSM) and State level programs are already comparable to the marginal power tariffs applicable for industrial and commercial power consumers in some states in India.

Table 1: National Solar Mission - Tariffs Discovered[6]

	Round – I (Dec - 2010)	Round – II (Dec – 2011)
Solar PV Tariffs		
Highest Tariff	12.75 (USD0.23)	9.44 (USD0.17)
Lowest Tariff	10.95 (USD0.20)	**7.49 (USD0.14)**
Median Tariff	12.12 (USD0.22)	**8.91 (USD0.16)**
Marginal Retail Power Tariffs	**5.50 – 7.50[7] (USD0.10 - USD0.14)**	

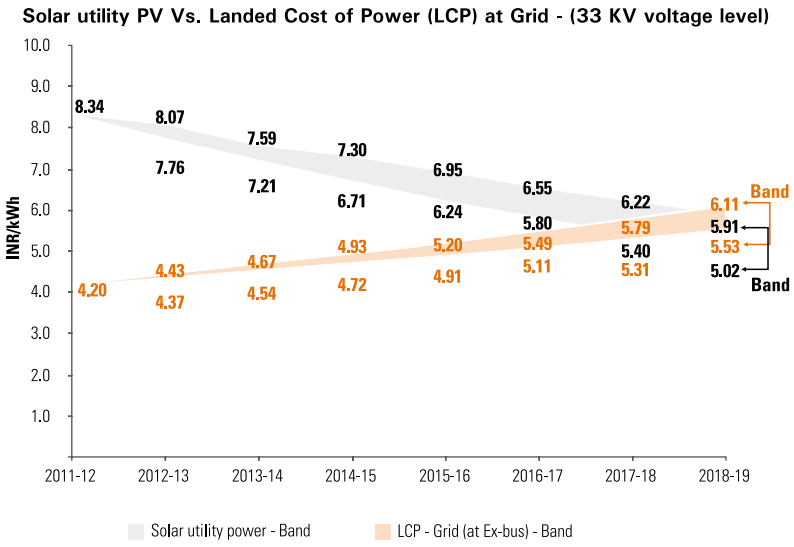
1 CEA – Monthly Highlights of Power Sector – July,2012
2 CEA – Monthly Highlights of Power Sector – July,2012
3 Thirteenth Finance Commission Report
4 BP Statistical Review - 2012
5 Solarbuzz
6 Exchange Rate – INR 55 per USD
7 Power tariff range for the highest slabs for certain consumer categories across States as per the State Tariff Orders

We had estimated in our analysis last year that grid parity could happen in the period 2017-19. The recent trends in the solar power prices indicate that utility scale grid parity could happen at the earlier end of this range[8].

The point at which grid parity occurs is a function of two variables – the rate of increase in conventional power prices and the rate of decrease in solar power prices. We believe the following could be the key trends:

- We expect landed cost of conventional electricity to consumers to increase at the rate of 4 percent per annum in the base case and 5.5 percent per annum in an aggressive case. This factors the increasing proportion of raw material imports, cost of greenfield generation, and higher investments in network assets to improve operational efficiencies of utilities.
- We expect solar power prices to decline at the rate of 5-7 percent per annum. This is after factoring the increasing economies of scale in equipment manufacturing and advancements in product technology which improves solar-to-electricity conversion efficiency. Emergence of low cost manufacturing locations are expected to aid this trend.

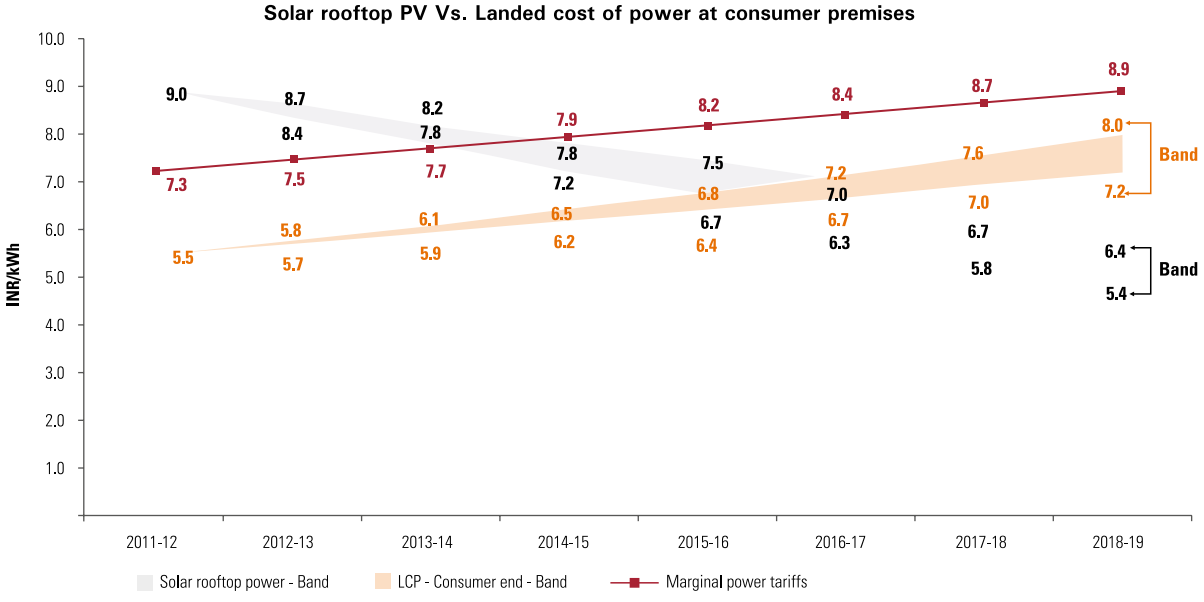
Fig.1: Grid Parity for Solar Power – Utility Level



Source: KPMG's Solar Grid Parity Model

It is also worthwhile to look at parity in respect of cost of power delivered to the consumer i.e. consumer level conventional landed cost of power vis-à-vis the cost of power from solar PV installation on the rooftop.[9]

Fig.2 Grid Parity for Solar Power - Consumer Level



Source: KPMG's Solar Grid Parity Model

8 Levelised power tariffs – INR 3.75 per unit; T&D Cost – INR 0.15 per unit (upto 33 KV level); Losses – 8.0 percent

9 Levelised Power Tariff – INR 3.75 per unit; Losses – 20 percent, T&D Cost – INR 0.80 per unit

The prevailing power tariffs for some cross-subsidizing consumer categories are higher than the landed cost of power. Helping the case for consumer end parity is the recent rise in power tariffs for consumers across multiple states. We believe that grid parity could happen earlier for certain market segments – especially the industrial and commercial category of power consumers. The retail tariffs of these segments are already upwards of INR 7-8 per unit at the margin and would be even higher if one were to take a levelised view (long-term cost).

An innovative lease model can further improve the market attractiveness for consumers by avoiding high upfront costs and reducing monthly power bills. For example, a high-end residential consumer[10] can install a 1 KW solar PV system[11] - to reduce marginal power consumption - with a monthly EMI payment of around INR 2000[12] for five (5) years and avoid an average discounted monthly payment of around INR 1200 over the lifetime (25 years) to the grid. With rising power tariffs, the lease model can make it attractive for power consumers at the bottom of the pyramid - the less affluent residential power consumers - to adopt solar PV systems within this decade.

Further, even at the wholesale procurement level for utilities, the marginal cost of power procurement is in the range of INR 4.00-5.50 per unit[13] in many states, which after adding the costs of transmission and distribution and associated losses comes to INR 5.50 -7.50 per unit[14] as delivered to the consumer. As a result, when utilities supply power during the power deficit situation and in peak periods, the state power utilities are often not in a position to recover their power purchase costs through consumer tariffs. Hence, there is a case for the utilities to encourage rooftop solar power for captive consumption that can displace the need for power procurement on the utilities part. Looking at the economic analysis, we believe that over the next five years around 4000-5000 MW of rooftop solar power market potential can be economically viable. To realize this however, utilities and regulators should create an enabling environment recognizing the specific characteristics of solar power.

Solar power can already economically reduce diesel power consumption. The cost of diesel based power production is upwards of INR14/kwh, much higher than that of solar power; however, diesel power is available on demand. In states which have power deficits, if utilities agree to regulate load shedding to consumers according to sunshine hours, then solar power can effectively mitigate diesel consumption, thus saving the economy precious resources and foreign exchange. By extending the 'banking facility', which allows the consumer to get an offset for solar power generation against his monthly energy consumption, and the required metering infrastructure, utilities can play an important role in developing solar power market for captive consumption. The 'banking facility' would enable a captive solar power producer to inject power into the grid and draw it back as and when required - subject to the terms and conditions of the agreement with distribution utilities.

While the Renewable Energy Certificate (REC) market for solar power is still in a nascent stage, the enforcement of renewable purchase obligations on utilities and captive consumers along with the energy efficiency scheme Perform Achieve Trade (PAT) of Bureau of Energy Efficiency (BEE) can give a push to the solar market. PAT scheme, under the National Mission on Enhanced Energy Efficiency (NMEEE) is aimed at improving energy efficiency in the industry thereby reducing energy consumption. In the first phase, 478 designated consumers have been given around 5-6 percent energy reduction targets to be met over a period of three years. Use of renewable energy in place of conventional power allows these consumers to get an offset against their energy consumption.

10 Monthly average power consumption ~ 400 units

11 Solar PV system can replace the day time power consumption ~ 30 percent of the total power consumption of a consumer from the grid

12 Zero Downpayment

13 Tariff Petitions from Distribution Utilities

14 Transmission & Distribution (T&D) Cost – INR 0.80 per unit, T&D loss – 20 percent

Being intermittent in nature, it is argued that solar power could pose grid integration issues. Several studies[15] on distributed generation suggest that penetration levels of upto 15 percent are permissible without requiring any additional investments. While grid integration issues may not be an area of concern in the next five years even if the rooftop market penetration accelerates, yet a detailed interconnection study needs to be conducted taking into account the immense potential that rooftop market provides. Such studies have been conducted in countries where a high proportion of energy comes from renewable sources and have resulted in transmission related investments as well as specification of standards for renewable energy production equipment.

Another segment of solar energy that is witnessing increased level of interest recently is the solar thermal market for process heating. We believe that the economics for this market should drive usage of solar community cooking, industrial process heating and solar enabled cooling given the favorable payback with fuels such as furnace oil, diesel, commercial LPG. We believe that the market potential of the solar thermal process heating industry comprising – community cooking segment, cooling segment and industrial process heat for priority industries - to be about 5.25 Mn sqm of solar collector area.

Based on our analysis of various market segments, we believe that the cumulative solar PV power market potential is likely to be around 12.5 GW by 2016-17. The table below summarizes our estimates of potential for solar PV across key market segments:

Forecast of the solar power market in India

<table>
<tr><th>Distributed Generation</th><th>Utility Scale Projects</th></tr>
<tr><td>Rooftop Market ~ 4,000 MW
(Fast approaching grid parity)</td><td rowspan="2">Government Support Utility Scale Market ~ 4,000 MW
(Phase – II program of Central Govt and State solar programs)</td></tr>
<tr><td>Diesel Replacement ~ 2,000 MW
(Driven by economics)</td></tr>
<tr><td colspan="2">Captive and REC Market ~ 2,500 MW
(Driven by solar renewable purchase obligations and Accelerated depreciation market - shifting demand from wind power)</td></tr>
<tr><td colspan="2">Total Solar Market Potential (by 2016-17) ~ 12,500 MW</td></tr>
</table>

Source: The Rising Sun - 2012, KPMG in India analysis

15 US DOE – Sunshot Vision Study; EWEA – Large scale integration of wind energy in European power supply

Central and State governments have an important role to play in harnessing solar power. Supporting solar industry over the next five years is crucial to realize the immense potential solar power offers for an energy starved country like India. Some of the enabling measures include:

- Provide market certainty and stability in the near term – The worst thing to happen to the sector is a sudden withdrawal or reduction of the market support that has been provided in the last two years. Ecosystem capacities have been built on the back of this support program, and a stable gradual program needs to be sustained. This means that the next round of the central program needs to be announced quickly.
- Share National Clean Energy Fund (NCEF) with State Governments – The NCEF has been created through levy of a cess on coal which is ultimately borne by states/consumers. A direct subsidy from this fund can be provided to states that meet certain targets in encouraging solar power. This financial assistance can help States support solar power and mitigate payment security concerns.
- Promote retail participation in Renewable Energy Certificates (REC) trade – The REC market provides an alternate market option today for renewable energy producers. By enabling access for retail and off-grid consumers - the adoption of solar power can be increased substantially. Moreover, increase in participation in the REC trade will lead to higher liquidity and promote transparency in the market.
- Promote 'private contracts' solar power market – Solar power is likely to reach parity for retail power consumers earlier than at the grid-level. Rooftop and small scale solar power projects at consumer-end have several advantages over grid connected solar power plants. State governments and regulators can encourage deployment by providing the necessary infrastructural support, appropriate regulations such as "banking facility" or "net metering" facility that allow commercial viability for power.
- Consider providing a partial risk guarantee mechanism – We have seen use of foreign currency financing in many solar projects which have enabled the cost of power to be reduced substantially. Financing related costs can contribute as much as 45 percent of the total cost of solar power. It is encouraging to see dollar denominated funding flowing into the sector. However, the recent volatility in the currency movements will raise the cost of such financing. A partial risk guarantee fund can be created by the Central Government to mitigate this risk. The economic rationale can be developed based on the long term mitigation of forex exposures due to enhanced energy security and lower dependence on energy imports that solar power will enable.
- Support lending community – Increasing the availability of credit to solar market is critical for the success of solar program in India. A separate solar/renewable energy sector specific exposure/cap can go a long way in increasing the pool of financial resources for solar sector. Given the importance of energy security and carbon mitigation potential, lending to solar/renewable sectors should be classified as 'priority sector'. Furthermore, debt mobilization through say - long tenure tax free solar bonds - can go a long way in providing access of low cost long term debt for developers. This can address the inherent asset liability mismatch of the banking system and lend stability to the interest rates charges on developers.
- Creation of Solar Sector Focused Manufacturing & Investment Zones – Government of India has proposed the creation of a number of National Manufacturing & Investment Zones (NMIZ) to boost growth of manufacturing sector in India. The concept of NMIZ proposes a framework for more business friendly policy, procedures and approval ecosystem, combined with superior physical infrastructure[16]. Government should consider developing solar industry focused manufacturing and investment zones to encourage investments in this clean source of energy. This will enable development of scale economies and equip India with the required supply chain manufacturing infrastructure to harness its immense solar potential. In addition, the State Governments could identify potential sites for developing solar parks with all the basic infrastructure in-place.

In sum, supporting solar power in the next five years is important to nurture the 'green shoots' that have emerged in the ecosystem and set the platform for solar power to play an important role in meeting the energy security and clean energy considerations of India. As mentioned in our earlier report of May 2011, we believe that solar power can make a substantive contribution by the end of the thirteenth plan, potentially meeting as much as 7 percent of our power requirement and mitigating 30 percent of our imports of coal and 2.6 percent of our carbon emissions in that year. The forex savings due to coal and diesel mitigation can be as high as USD 8 billion per annum[17] by then.

The promise of this great source of energy has grown stronger over the last one year. In this respect, the sun has truly risen.

16 "Ministry of Commerce & Industry, Press Information Bureau, January 2011"
17 Total Coal Savings ~ 70 Mn tones; Coal Price – USD 100/tonne, Diesel Savings – 1 Bn litres

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