POLICY GROUP

SECTOR NOTE

No. 1 | November 2011

India Solar Policy: Elements Casting Shadow on Harnessing the Potential

Sambit Basu

Table of Contents

I. Introduction

India chugging along its self defined high growth trajectory, to achieve an inclusive and sustainable development, is faced with the multiple challenges of ensuring energy security, overcoming energy poverty and defining a low carbon development path. To power its economic growth, India has traditionally depended on conventional fuel, primarily, which is also likely to remain the mainstay for future development. However, India despite sitting on large coal reserves has been recently facing large supply disruptions, and domestic coal production has failed to keep pace with the rapid buildup in demand. To add to this, the conventional thermal energy market is going through convulsions world over. Faced with the critical challenges, India has to look out for and harness alternative energy sources to secure its development objectives.

Blessed with 300 sunny days in a year and receiving an average hourly radiation of 200 MW/sq km, India is well placed to overcome its key challenges by harnessing the enormous solar potential. Around 12.5% of India's land mass, or 413,000 sq km, could be used for harnessing solar energy[1]. Recognizing this, the Government of India (GoI) included solar energy as a key mission under the National Action Plan on Climate Change and formally launched the Jawaharlal Nehru National Solar Mission (JNNSM) in 2010. The JNNSM is a major initiative of the GoI to ramp up its solar power generation capacities in a phased manner, and seeks to provide impetus to the development of a huge solar market in India. The mission has set out to achieve 1000MW of grid connected solar projects at 33KV and above (with equal share of Solar Photovoltaic or SPV and Concentrated Solar Thermal or CST), 100MW of rooftop and small solar projects, and 200MW of off-grid projects by 2013 (Phase I); 4000MW (and 10000MW on the uptick) grid connected and 1000MW off-grid projects by 2017 (Phase II); and 20000MW grid connected and 2000MW off-grid projects by 2022 (Phase III). The JNNSM aims to achieve 20 million solar lighting systems for rural areas and increase the solar thermal collector area to 15 million sq meters by 2017 and 20 million sq meters by 2022.

To kick start the Phase I, the solar policy (in JNNSM) put forth a mechanism of "bundling" relatively expensive solar power from grid connected projects, selected on pre-defined criteria under JNNSM, with equivalent capacity of power from the unallocated quota of the GoI generated at NTPC coal based stations, which is relatively cheaper. This "bundled power" would be sold by NTPC Vidyut Vyapar Nigam Ltd (NVVN) to the Distribution Utilities at the Central Electricity Regulatory Commission (CERC) determined prices. The Mission provided for NVVNL to procure the solar power by entering into a Power Purchase Agreement (PPA) with the selected Solar Power Developers (SPDs) connected to the grid at a voltage level of 33 kV and above before March 2013. The solar procurement price initially proposed for Phase I was Rs. 17.91/unit. Further, considering that some of the grid connected solar projects were already at an advanced stage of development, the guidelines for migration of Projects from their respective existing arrangements to the ones envisaged under JNNSM were also issued. The projects to be selected under this scheme provide for deployment of both Solar PV Technology Projects and Solar Thermal Technology projects in a ratio of 50:50, in MW terms. Subsequently, guidelines for selection of new grid connected solar power projects (SPV and CST) were issued in July, 2010 by Ministry of New and Renewable Energy.

Further, the JNNSM provides for promotion of manufacturing and development of solar technology by mandating domestic content in projects in Phase I with the objective of establishing India as a global

[1] Arora, D S, Sarah Busche, Shannon Cowlin, Tobias Engelmeier, Hanna Jaritz, Anelia Milbrandt and Shannon Wang, 'Indian Renewable Energy Status Report: Background Report for DIREC 2010', NREL, REN21, gtz, IRADe, India, October 2010 (pp.37)

leader in solar energy, and also provides for promotion of off-grid and small solar applications with the objective of scaling up solar deployment and meeting energy requirements in rural and remote areas.

In addition to the impetus provided at the central government level through JNNSM, several states like Gujarat, Rajasthan and Karnataka have come out with their own solar policies, providing for preferential tariffs and other deployment support (which include provisioning of infrastructure, wasteland for development, evacuation infrastructure, solar parks).

At the close of batch I of Phase I, 37 projects totaling 620 MWs (listed in appendix I) was allotted under the JNNSM (comprising of 30 SPV projects totaling 150MW and 7 CST projects totaling 370MW), 84 MWs of projects brought under the folds of the migration scheme, about 716MWs of solar projects allotted under the Gujarat Policy (appendix II) and several others in various states under state policies.

At a time when the projects selection for first batch of JNNSM Phase I had got over and the bidding of second batch of Phase I is also over, it is prudent to take stock of the developments and assess the effectiveness of the solar policy for achieving the strategic objectives. The questions to ask are:

- Does the JNNSM inspire confidence of facilitating speedy deployment of solar capacity and meeting its desired objectives?
- Is the present solar policy really aligned with the strategic vision of the Government?

This note explores these questions in the light of the developments of first batch of JNNSM Phase I and the provisions of the solar policies in India and the experiences in other countries.

II. Issues affecting effective harnessing of solar potential

On the face of it, with large allotment of capacities under the JNNSM, it appears that the mission is on to a successful start and India has indeed put together a comprehensive solar policy, a major improvement over the previous guidelines, to make India the mecca of solar development and deployment. However, as the India Solar program moves from policy to implementation, several issues and concerns have surfaced proving to be major hurdles for serious solar power developers and lenders. In fact is several projects allotted may not get deployed.

Financing and bankability of solar projects under the JNNSM is emerging to be a major concern, arising from several issues in the policy or inadequacies therein. Thus, despite an apparently improved policy and support provided, solar power development remains expensive and risky for developers and lenders. These issues of concern are discussed here:

a. Auctioning or Reverse Bidding

Initially with the announcement of the JNNSM, solar projects were offered a feed-in-tariff (FiT) or preferential tariff of Rs.17.91/unit to SPV projects and Rs.15.31/unit to CST projects shortlisted in batch I. However, considering the overwhelming response received for the SPV capacity offered, the GoI chose to replace the FiT with a reverse bidding or auctioning mechanism where the fixed capacity of SPV offered would be allotted based on least price offered by SPDs and not first-come-first-serve basis. The auctioning process resulted in allotment of the first 150MW SPV projects and 470MWs CST projects, with 37 SPDs emerging as winners comprising of 30 SPV projects and 7 CST projects. The auctioning led to huge discounts over the initial FiT, where the weighted average of the quoted tariffs for SPV was Rs.12.16/unit and CST was Rs.11.41/unit implying an average of 32% and 25% respectively of the CERC declared FiTs. However, it may be noted that some of the gains due to auctioning would be offset by the higher tariffs paid to the 84MW projects qualified under the migration scheme as compared to the rates offered to these projects by the State Discoms.

Considering the huge savings over the economic life of the projects, the move towards auctioning does appear to be a great success. However, such huge discount in tariffs over CERC determined FiT and the ultimate selection of the SPDs have raised a number of questions regarding the financial feasibility of the projects, hindrances in financial closure and hence timely completion of the projects. The CERC determined tariffs included reasonable returns for the SPDs, but offering such discounted tariffs in the face of high financing costs may result in lenders finding the returns unattractive for a risky business in an immature market. One could also suspect that to protect the margins developers may resort to using substandard equipments, which could result in sub-optimal performance. Also, the winning list of potential developers has companies with questionable credibility in solar business. The potential developers include wool yarn maker, an animation company, auto dealer and pipes supplier. In view of this, it is to be seen how many of the projects achieve financial closure and commissioned on time. It is indeed the case that very few projects would be able to get non-recourse financing.

Although the present policy does include penal provisions imposed on SPDs for abandoning projects or under-performance, but lenders may prefer to wait and watch the developments as they evolve given no precedence of the effectiveness of penal provisions and the various risks they are exposed to. This is not only going to affect the deployment of projects in batch I but also the next tranche of bidding. At the same time the cost benefits of the auctioning mechanism should not be ignored. Strengthening the prequalification criteria of bidders to include prior arrangement with credible EPC partner and due diligence report on project viability accompanying bids would somewhat mitigate the risks perceived by the lenders. Unfortunately, the guidelines released by ministry for the Batch II of Phase I does not strengthen the pre-qualification criteria of the bidders and retains the same principles of allocation, except for extending the timeline for financial closure from 180 days to 210 days from the signing of Power Purchase Agreement (PPA).

The present policy also does not provide for any protection from interest rate risks. At a time when the real interest rates are high, a 25 year PPA carries with it the risks of high tariff regime and Discoms imposing pressure on the SPD to revisit tariffs when interest rates come down. Also there is no way the consumers can get the benefit of declining interest once having the PPA sealed at a higher interest rate.

b. Information on Solar Resource Incidence and Performance of Technologies

The performance of solar projects and returns thereof are highly dependent on the incidence of solar radiation. Quality solar radiation data with very high degree of accuracy with high level of confidence is an essential prerequisite for choice of technology, project development and viability of the project. Information on Direct Normal Incidence (DNI) of solar radiation is required for CST and Global Horizontal Incidence (GHI) is required for SPVs. Presently good quality annual information with fairly high degree of accuracy is available, which is good for framing broad policies. However, moving towards planning for projects require seasonal and monthly information, while project development, assessing project feasibility and designing projects require monthly, daily and hourly data with high level of confidence. A typical meteorological year data may not be always appropriate as they are mostly city based and not for remote areas where the project sites are located. Ground measurement of meteorological monthly-daily-hourly data at the regional level as well as within a few kilometers of proposed sites need to be collected over a statistically acceptable time period to provide developers and lenders the confidence desired. Inaccuracy in solar resource estimation affects expected future returns of the project. Since the information is backward looking, lenders prefer to be conservative with resources and thus prefer higher probability or ‘P’ levels (where P50 is average and P90 is high level of confidence but more conservative).

In view of this, although the solar policy is well founded but planning for phased targets and identification of projects, let aside designing of projects, is definitely not on terra firma. The fact that equal weights are given to large grid connected SPV and CST in the absence of adequate information of solar resources on regional and site specific locations for monthly, daily and hourly variations raises questions about the effectiveness of the policy. Also the risks of project selection and design are very high for lenders to feel comfortable.

This resource issue brings up the next concern about the right choice of technology and size. The annual information shows that few regions in India have high DNI suitable for CST, but GHI levels are high and spread over several regions and thus more suitable for SPV. It may be also noted that SPV technology is very flexible in the context of any topography of land, but CST has to be necessarily set up on a flat topography to ensure high levels of efficiency. Also land requirement is large for grid connected SPV projects. Thus, in the absence of adequate information on correlation between the proposed sites and the technology selected by the SPDs, the lenders may find the risks very high and often not commensurate with the returns. Also the emphasis on grid connected SPVs in JNNSM compared to smaller off-grid and decentralized SPV applications, as well as the equal emphasis on SPV and CST capacity additions appear to have weak analytical basis.

There is an urgency to build up in a transparent manner a repository of detailed information on solar radiation, which in turn could be used to substantiate feasibility and hence bankability of projects. Although Ministry is putting in place 50 monitoring stations on ground for the measurement of solar resources, more such on ground information needs to be rapidly build up and widely disseminated for fast development and deployment of projects.

c. Technology Risk

As discussed above, technology choice and design is strongly correlated with the quantum, type and variability of solar resource. Besides, solar technologies, be it grid connected SPV or CST, are at early stages of deployment and development in India, and therefore carries higher risks on its applicability and performance. In India, crystalline silicon technology accounts for most of the market, and currently, the market share of thin film technology, though fast increasing, is very small (about 10% only). Thin film technology has not reached the efficiency level of crystalline solar cells, but it could bring down the costs of production considerably. This is the risk of technology obsolescence in an emerging and rapidly development technology segment. CSTs are presently not economically viable world over and have very limited information of its performance in India. The lenders are not comfortable of extending non-recourse finance because of higher levels of projects construction and operating risks.

The risks could be mitigated by building up information on the performance of technologies in the light of the resources available. The effectiveness and appropriateness of the JNNSM rests to a great extent on this information.

d. PPA under JNNSM and Financial State of Discoms

The PPA for bundled scheme under JNNSM between the NVVNL and SPDs is a major payment security concern for lenders. This risk arises from the fact that NVVNL as a trader passes on risks of non-receipt of revenues from Discoms for bundled power sales to the SPDs. Poor and worsening financial situation of the State Discoms increases the credit risks for the lenders. Further, few Discoms would honour their obligations under the PPA for 20 years if costs of solar comes down in the next 5 years. Given that payment default by State Discoms is common, lenders do not find the PPAs entirely credible and bankable.

Recognizing the importance of this concern of lenders, the ministry introduced an additional payment security scheme for grid connected solar projects under JNNSM. The Government has approved Payment Security Scheme to facilitate financial closure of projects under Phase I of the JNNSM by extending Gross Budgetary Support (GBS) amounting to Rs.486 crore to Ministry in the event of defaults in payment by the State Discoms to NVVNL. The core component of the Payment Security Scheme is to create Solar Payment Security Account (SPSA) financed from GBS to Ministry to have availability of adequate funds to address all possible payment related risks in case of defaults by Discoms for the bundled power. The PPAs have payment security mechanism for recovering the payments through Letter of Credit (LOC), an escrow mechanism, and subsequently sale to third party or even power exchange pending bilateral negotiation with third party. The Payment Security Scheme will be implemented by the Ministry with the provision of NVVN opening the SPSA for this purpose and draw funds as per mechanism/ provisions of the Scheme. The funds for each year shall be allocated by MNRE into SPSA. As per estimates the Rs 486 crores fund requirement is scheduled for Phase I as:

Fund Deployment Pattern	Incremental Fund Deployment (Cr)	Total Fund Capacity (Cr)
1 Jul 11	1.0	1.0
1 Jan 12	1.0	2.0
1 Jul 12	32.85	34.25
1 Jan13	23.47	58.32
1 Jul 13	58.32	116.64
1 Jan 14	126.39	243.03
1 Jul 14	243.02	466.05

Source: Implementation of a Payment Security Scheme (PSS) for Grid connected Solar Power projects under Phase I of Jawaharlal Nehru National Solar Mission during the year 2011-12, MNRE, GoI, New Delhi, India, 2011

Introduction of this scheme has mitigated the payment risks perceived by the lenders considerably, but the uncertainty associated with the prospects of the projects beyond the first phase of JNNSM and the extremely poor financial situation of the Discoms continue to pose bankability concerns for the lenders.

e. Policy Risk beyond Phase I of JNNSM

A prime risk perceived by the developers and lenders is the policy uncertainty related to the bundling scheme beyond 2014. The project life is about 25 years, but the bundled scheme as well as the payment security is applicable for projects in Phase I, leaving the future of projects beyond 2014 uncertain. Further, in a situation where the power sector is reeling under acute power crisis, rising power supply deficits and coal supply disruptions, the availability of unallocated power from NTPC coal based plants is itself suspect. Even if such unallocated quota exists and is allocated for bundling scheme, it remains uncertain whether such power would be cheap enough if imported coal at very high prices is used. In fact, considering the phenomenal rise in imported coal prices in the global market and also due to the regulatory changes in coal exporting countries (viz Indonesia, Australia), generation costs for entirely imported coal based power in India would probably be as expensive as solar power (i.e. in the Rs. 10-15/unit). This also raises the issue that grid parity for solar projects may be reached earlier than that perceived in JNNSM. All of these question the validity of the development trajectory mapped in the JNNSM and that of the associated provisions.

f. Regulatory Risk

The Renewable Purchase Obligations provided for in the Electricity Act 2003, and the solar specific RPOs introduced under it, and targets specified through amendment of the National Tariff Policy, is considered a major push for grid connected solar in JNNSM. The Renewable Energy Certificates (REC) is considered an important financing mechanism and incentive for SPDs. Although market for REC has great potential but effective policing of RPOs is required as a prerequisite. Enforcing RPOs is an issue considering that most Discoms are State owned and it becomes a self imposed penalty for non-compliance.

Also, under circumstances that the costs of solar technology and projects are coming down rapidly, the regulators would be revising the floor and forbearance prices downwards accordingly. In fact only recently the CERC has revised the floor and forbearance prices of solar REC from Rs 12000/MWh to Rs 9300/MWh and Rs.17000/MWh to Rs. 13400/MWh respectively. This regulatory uncertainty raises concern about the financial viability of the projects. It'll be a while before the costs stabilize and the market for REC really picks up in any meaningful manner, and the complexity arises from the poor financial situation of the State Discoms and their ability to absorb or pass through high cost of renewable energy. The solar policy need to take cognizance of these issues associated with RPO and REC while specifying the targets and quantifying the benefits.

g. Infrastructure Constraint

Solar project sites are mostly located in remote areas and wastelands, which are often not well connected and lacking in adequate infrastructure. Under JNNSM the developer is required to put in place the required infrastructure themselves and also acquire land, secure water connection, get all clearances and put in place the evacuation infrastructure. This is not only costly and challenging for any developer, but also extremely time consuming, and adds to the risks of timely completion of projects. Often detailed information about the project sites in remote locations are not known to the developer at the time of bidding. Creating a database with detailed information on the topography and project site, creating a land bank for projects, facilitating or getting all clearances for the developer, providing the necessary infrastructure in project sites and supporting in evacuation infrastructure would mitigate substantial risks and go a long way in successful deployment of solar projects. Also financial support from Clean Energy Fund could be provided to SPDs for infrastructure buildup, including evacuation infrastructure, to facilitate solar project development and deployment.

h. Other concerns

The JNNSM capacity development and deployment trajectory fails to take cognizance of the fact that finance companies are bound by exposure limits for power sector, and renewable energy, including solar, is treated as part of the exposure to power. This is a major obstacle faced by the lending community and solar power deployment would face a major financing crunch unless the Reserve Bank of India (RBI) declares solar sector as a priority sector for lending or renewable energy is treated separately from power sector.

III. Inconsistencies with Strategic Vision

a. Equal Weight to Grid Connected SPV & CST projects

Mandating development of SPV and CST in the 50:50 ratio and thus imposing technology reservation would curb efficient market allocation and cost reduction. If the ultimate objective of India Solar Mission is to create an environment for competitive solar energy penetration in the country, then such reservations on technology would not be aligned with the strategic vision. JNNSM in its attempt to encourage both the technologies is dictating the technology choice rather than allowing the market to select the most efficient and cost effective technology for Indian conditions.

SPV is an established technology for large and small size projects, and cost is coming down rapidly, while globally the use of large-scale CST for the generation of electricity is still a niche product. CST so far has been successfully implemented in only a few locations worldwide. It is indeed the case that northwestern India is among the list of world regions showing the best solar resource, but the CST technology is not yet mature. The land and water requirement of CST is also very high as compared to SPV. Rajasthan, which has high DNI levels suited for CST, has been reported to have a ‘critical’ water supply status, but still about 86 percent of Phase I CSP projects are located in this state. It is common knowledge that cost competitiveness of solar energy could be achieved by major breakthroughs in technology. This can only be achieved by focused approach on Research and Development (R&D). Reservation in technology deployment is unlikely to have any major impact on this in India. On the other hand if all the technologies are set to compete against each other, the most appropriate technology will be chosen in a cost effective manner. Thus, auctioning without technology reservation could be adopted for award of projects.

b. Emphasis on large MW size grid connected

The emphasis in the JNNSM on developing MW size grid connected SPV projects, instead of primarily focusing on off-grid and decentralized small solar applications, appears to be lacking in strategic vision. Planning for MW scale CST is still justified, where appropriate, but disproportionate focus on deploying MW scale grid connected SPV is definitely questionable. If in the Indian context, the smaller decentralized and off-grid applications are more appropriate, then the subsidy or financial support should be directed towards the same. The German policy which is often hailed as progressive and played a significant role in making Germany to have the largest cumulative solar capacity in the world, has been primarily promoting smaller size solar application. In fact the country offers higher FiTs for smaller installations (e.g. rooftop PV), while the lowest FiTs apply to free-field installations. Germany despite having much poorer solar radiation than India went ahead and promoted development and deployment of smaller SPV applications, while India has focused on large MW size projects despite having high GHI levels in most regions of India. Considering the large number of unelectrified households, the large power deficit situation, high supply losses, poor grid connectivity and poor financial status of the Discoms, it would be more appropriate to promote decentralized solar applications. Solar resources being widely spread may have to be promoted in rural and remote areas in small scale rather than centralised scale more particularly keeping in view the problems of remote area and weak and inefficient grid. With power from conventional fuels becoming more expensive, the solar power is likely to achieve grid parity sooner than perceived. This would make solar power at the decentralized or off-grid level more affordable.

Smaller SPV applications could cover remote and rural electrification, street lighting, home lighting systems, building integrated solar projects, hybrid stand-alone solar projects in places where grid supply is poor or absent, The total requirement for solar off-grid and decentralized applications could be very large, and this would provide enough positive impetus to the global solar industry. Large size grid integrated project may not give the desired multi level benefits compared to small / medium size project. Thus, keeping in view rural development, rural employment, demand side management, energy security, land availability etc, the major focus should be in channelizing subsidy towards development and deployment of small solar applications so that the rural unelectrified can have access to clean energy at an affordable price.

c. Mandating Domestic Content in Solar Technology

The JNNSM guidelines specify that in case of Solar PV Technology, all deployment under the scheme should use a module manufactured in India in Batch I and in Batch II even the cells used in deployment should be domestically manufactured. In case of CST, it specifies that 30% of the total project cost should be utilized for domestic equipment. This proposal may appear to protect the interest of Indian manufacturers and financers, and give a major thrust to domestic manufacturing accordingly facilitating continuous reduction in cost of solar power. Further, it may also appear that given India's significance as an emerging high growth market, this proposal would encourage international players to invest in manufacturing in India. This in turn would help building up sustainable manufacturing capacity within the country, thereby creating jobs and significant opportunities for lenders and investors. However, the question arises whether this is consistent with the comparative advantage of India and aligned with its other policy objectives.

The fact is that India lacks a robust manufacturing base for solar components and systems for solar systems. Currently, India does not have any infrastructure for raw material production (polysilicon) and is entirely dependent on imports for the same. The bulk of the SPV industry is dependent on imports of critical raw materials and components – including silicon wafers. The entire SPV value chain shows that India does not have the comparative advantage till the wafer making stage. To reach the levels of wafer production, it has to produce polysilicon which involves the reduction stage using coke and conventional energy. India does not have enough coke for its steel industry and has to depend on imports. Availability of power is itself a major constrain and is getting more expensive. Also production of silicon, wafers and modules is capital intensive and not labour intensive. Further, bulk of the SPV cost is accounted for by pv modules, while the remaining comprises of balance of system and construction. Thus, clearly India does not have the comparative advantage in production of SPV and has little ability to ramp up productions in a big way, influence break through innovations and bring about significant cost reductions just on the basis of a domestic solar market. Reduction in SPV costs depend on the size of the global PV market and most importantly on research breakthroughs. Domestic SPV market is unlikely to have any major impact on the global PV market, as the Indian market is small compared the world market. The world market in Europe is however going through reducing demand in the wake of financial crisis. It may be noted that even the Chinese solar manufacturing industry (see Box 1), which has grown many fold riding on the export market in Europe, is now looking inward into the domestic market and other export markets in the Asian region. The Indian semi-conductor industry had been receiving Government support for a very long time and if it really had the comparative advantage, it would have done well with wafer production and solar cell manufacturing from the waste of wafer manufacturing like the Chinese did.

Indian solar cell and module manufacturers are hugely in favour of domestic content rules, as they realize that it is difficult for them to compete with much larger and lower cost Chinese companies and their export market in the Europe is going through convulsions and slow down. USA has strongly opposed India's local content requirements specified in JNNSM as it is creating an export hurdle for their solar companies like Sunpower and First Solar. It is noteworthy that the Indian installers and developers have also opposed this local content requirement as this result in lesser choice for suppliers and higher costs.

There is no denying that developing manufacturing capability strengthens security of supply, but there could be other ways of encouraging manufacturing and at the same time ensured that the benefits of incentives extended to them are not reaped by other countries. The strategic vision of India should be to encourage high efficient low cost immediate delivery of power on the global competitive basis to benefit the common man and consumers and not to encourage monopolies and increase subsidy burden and should not be promoted restrictive trade practices. In this regard, reservation of domestic content in modules and cells is unlikely to meet the desired objectives and may even result in no interest or ability of domestic manufacturers to reduce costs and possibilities of time overruns in the absence of adequate manufacturing capability.

Creating domestic demand may not be necessary for encouraging manufacturing. In fact in the solar space, manufacturing has received encouragement for the long time and even much before the focus shifted towards solar deployment. Thus, instead of linking domestic content in deployment, the government should continue to provide financial support wherever the comparative advantage exists in the entire value chain of SPV and CST, and also increase spend on R&D. Germany and many other countries have spend large amounts on R&D for a long time. Capital and other subsidies could also be extended to manufacturing as long as the same is passed on to the SPD through the equipments supplied to them and not passed on in exports in other countries.

IV. Have State Solar Policies done better?

Besides the GoI initiative with JNNSM, several states have formulated their own solar policies to attract investments in the solar space in their States. With the preferential tariff abandoned under the JNNSM, and being replaced by the reverse bidding scheme for selection of SPDs, developers have turned to the state level policies. Most states have introduced their own FiT, which is kept between the CERC specified tariff and the average bid tariff under JNNSM, to attract investments in the state.

Gujarat, Rajasthan and Karnataka have already come up with their own solar policies, and several other states like Andhra Pradesh and Maharashtra are in the process of formulating their own policies. Gujarat was the first to introduce a solar policy in 2009, even before JNNSM was introduced by GoI. Hailed by SPDs as a progressive solar policy and the Government of Gujarat demonstrating its commitment towards development of renewable energy, the state over and above JNNSM has allotted 716MW of solar capacity against an initially declared target of 500MW and signed PPAs for this capacity with 34 SPDs. The share of SPV and CST in the 716MW capacity is 365 MW and 351 MW respectively (see Appendix II). Many developers have also expressed interest in setting up manufacturing capacity in the state. The state expects to bring in a massive investment of about Rs.12000Crores over the next few years.

The Gujarat model offers procuring solar power from developers at a fixed tariff, a la the German and the Spanish model (see Box 1). However, unlike the German model, the focus is not so much on developing smaller off-grid and rooftop capacities but the emphasis is more on grid supplied capacity addition. The State also facilitates land acquisitions, getting clearances and providing for evacuation and other infrastructure. The state has also identified land bank for solar power development from the wasteland areas available in the state. This would not only provide for productive use of wasteland areas but also bring in development in these areas. Taking into consideration the rapid development in solar technology bringing down costs and taking note of the need for preferential tariffs in the initial years till grid parity is achieved, Gujarat offers CERC approved higher tariff for the first 12 years and a much lower tariff for the remaining 13 years. The applicable tariff as recently approved by CERC is for SPV Rs.15/kwh for first 12 years and then Rs.5/kwh, and for CST it is Rs 11/kwh for first 12 years and then Rs.4/kwh.

Rajasthan, which is also planning to develop more than 500MW over the next few years, over and above JNNSM, on the other hand has adopted an approach similar to the JNNSM. The policy offers all possible routes for the SPDs to take, from grid connected to off-grid, and has also provided for bundling arrangements and auctioning routes for the state to procure power. Rajasthan with its huge solar potential is in any case a very attractive destination for investors. The State has also already strengthened transmission network and more specifically in regions where solar potential is relatively high. Karnataka introduced the policy with the intent to harness more than 200MW of solar capacity, in addition to JNNSM, and has proposed to adopt competitive bidding route for procurement of solar power at a discounted tariff. It is expected that soon most of the states would go for the auctioning route, as the cost burden of fixed FiT is quite high as more capacities are added and consumers are provided with subsidized power because of political considerations. The experience of Spain is a case in point, where recent reduction in FiT consequent to the financial crisis has seen a major downsizing of solar capacity additions. In these states with high solar potential, substantial capacity addition may also see annual capping of additional solar capacity if transmission capacity fails to keep pace in these states.

Notwithstanding aggressive policies introduced and large numbers of PPAs and capacity allotted, several projects in these states may actually get delayed because of several reasons. Several projects may be postponed because of delay in financial closure as lenders and developers may still consider some of the risks much higher than the returns in a high financing cost regime. The main concern with the states is the financial weakness of the state owned Discoms having high losses and surviving on subsidy from State Governments. The other key risk faced by the SPDs is inadequacy of information on solar resources of the level of detail required for effective technology choice, planning and design of projects. In fact many developers may decide to pay an annual penalty of several lakhs of rupees for delaying their projects, and wait for costs to drop so that they can get better returns. The risks are many and though state policies have been an improvement over JNNSM in some states, it is unlikely that large solar capacity additions would actually fructify over the next couple of years.

With the intent of mitigating the risks perceived by the developers and lenders, and reduce costs of financing as well as facilitate availability of finance, Gujarat and Rajasthan have been developing Solar Park and some of the other states like Andhra Pradesh will follow suit. The concept of Solar Park is similar to developing Industrial Parks and involves the State Government identifying areas of land where several MW size plants amounting to more than 1000MW capacity of solar generation can be established. The state government would provide in the solar park the necessary infrastructure, regulatory and other governmental support, including special fiscal and financial incentives as well as facilitating clearances. The costs incurred by the state government would be subsequently recovered from the developers in the park. Solar parks could be developed to accommodate both generators as well as solar manufacturers. A 500MW Charanaka Solar Park in Patan District of Gujarat is being developed, and it is believed that all the projects in the park are on track. Similarly, Rajasthan is in the process of developing a solar park which could accommodate more than 1000MW. The park in Gujarat is being developed by GPCL on around 2400 hectares of wasteland. It is expected that solar park would decrease the cost of solar power generation due to economies of scale, accelerated development, fiscal benefits and reduced cost of finance because of reduced risks. The Planning Commission has approved Rs.210 crores central assistance for the Gujarat Park and ADB has approved a soft loan of about US$100 million, which includes development of a smart grid for evacuation of power. The two key challenges of availability of finance and financing cost for solar projects are mitigated to a great extent with the development of solar parks. Solar Parks appear to be a solution for scaling up MW size solar projects in India. Discussions are on for the creation of Solar Park Finance Vehicle and other financial tools, supported by credit enhancement mechanisms by domestic and international governments.

Box 1: Solar Power: International Experience

Germany: German solar policy's objectives – both explicit and implicit – are among the most aggressive in the world. Germany's planned phase-out of its substantial carbon-free nuclear generation plants, as well as its vulnerability to political uncertainty of natural gas supplies from Russia, had exacerbated its energy security concerns: a development that accelerated its support for renewable energy. On the domestic value addition front, solar PV has been a major part of Germany's export-oriented economic development approach. Germany fixes the price for solar power in the form of feed-in tariffs (FiTs) over 20 years. Higher FiTs are offered for smaller size systems, usually rooftop, while the least are offered to ground-mounted systems greater than one megawatt. The quantity is somewhat controlled by imposing a strict annual degression rate, which is a percentage reduction in feed-in tariffs based on the quantity or solar capacity installed during the previous year. Due to recent drop in solar PV prices, Germany reduced its feed-in tariffs twice during 2010. Even then, the annual installed solar PV capacity exceeded 7,400 MWs, equal to about a third of solar capacity addition expected under JNNSM in the coming decade. This translates to a large financial commitment for Germany's electricity consumers over the next 20 years.

Spain: Spain set the price for solar procurement by offering FiTs for 25 years. However, unlike Germany, it also fixed the quantity in the form of a cap, to limit the financial impact on its utilities. To circumvent the issue of project selection, as noted earlier, the Spanish government decided to accept all projects till one year after 85% of the annual cap was met. When the Spanish government increased its FiTs for PV by 75% in 2007 to provide a boost to its solar sector, 2,661 MW of PV were installed, exceeding the annual cap of 1,200 MW two times over. The additional capacity of 1,461 MW meant a large unexpected financial commitment of a net present value of several billion euros over the next 25 years. Further, the Spanish government had and continues to keep electricity consumer tariffs low and reimburses utilities for the deficit by paying through the national budget, i e, taxpayer monies. Spain was one of the worst hit countries during the financial crisis with a high budget deficit. Although the deficit was not all due to support for renewable energy, the government could not keep offering high FiTs for solar energy generation (Craig 2009). In September 2008, it slashed the FiTs by 23%. The Spanish PV market collapsed with only 70 MW of installed capacity being added in 2009. Further, the Spanish government is even considering retroactive cuts to FiTs for existing projects, a move that breaches contracts and provides considerable uncertainty to the Spanish solar sector.

California, USA: In December 2010, the California Public Utilities Commission in the United States introduced the Renewable Auction Mechanism to procure renewable energy projects of less than 20 MW, which mainly include solar. Under this mechanism, the required installed capacity will be fixed and projects selected based on least cost rather than first-come-first-served basis at a set FiT (CPUC 2010). The programme aims to use standard terms and conditions to lower transactional costs and provide contractual transparency needed for effective financing.

China: China enacted its landmark Renewable Energy Law in 2005, which gave a high priority to the development and utilization of renewable energy. This led to a big push in renewable energy deployment, especially in the wind sector where China now has the largest wind deployment (approximately 45 GW) in the world. However, solar capacity additions have been relatively small until recently. The total installed solar capacity by the end of 2010 was approximately 900 MW, with more than half of this capacity (520 MW) coming in 2010 alone.

Until 2009, the main push for solar PV in China was in off-grid installations for remote rural communities, the result of Brightness Rural Electrification and Township Electrification programs that started almost a decade ago. In 2009, just prior to the Copenhagen talks, China launched its most ambitious solar deployment program, the Golden Sun initiative, to create some domestic demand for its solar manufacturers in anticipation of the reducing international PV demand during the early days of the financial crisis. The program aims to install approximately 642 MW of grid-connected and off -grid solar PV at a cost of approximately US$3 billion over the next three years. However, the annual demand is an order of magnitude smaller than China's PV cell manufacturing capacity.

China has shown phenomenal growth in production, increasing its PV manufacturing capacity eighty-fold in the last five years; it was the largest manufacturer in 2010, producing approximately 13,000 MW, or 48 percent of the global capacity. The Chinese solar energy industry began in the mid-1980s, when semiconductor companies started manufacturing solar cells with waste raw material from wafer production. By 2000, the domestic industry

Solar Power: International Experience (contd.)

could fulfill the modest Chinese domestic market demand, although there were very little exports. Since 2005, China has focused on supplying solar PV equipment to Western countries such as Germany, Spain, and the US, where demand was buoyed by generous purchase support for PV deployment. The Chinese solar industry started developing a comprehensive supply chain, including the manufacture of polysilicon material, ingots, wafers, cells, and modules. This growth in the solar PV industry was concurrent with the Chinese government's push after 2000 to develop a comprehensive semiconductor industry from chip design to production and testing.

The Chinese government's pro-export currency policy arguably played a major role in its export-oriented growth. This currency policy (used by Japan in the 1980s and Korea in the 1990s) pegged the Chinese currency to the US dollar, thus preventing it from appreciating against the same. The Chinese government also offers tax incentives and low-cost credit and financing from state-controlled banks to its solar industries, advantages enjoyed by other Chinese manufacturing sectors as well. Chinese manufacturers have also benefited from low labor costs, subsidized electricity rates, and close proximity to raw material suppliers.

In terms of RD&D support and strategic goals, the Chinese government has identified energy technologies such as hydrogen fuel cells, energy efficiency, clean coal, and renewable energy as focuses of the National High-Tech Development Plan (863 program), while making utility-scale renewable energy development central to the National Basic Research Program (973 program). It approved US$585 million jointly for the 863 and 973 programs in 2008.

China's recent purchase support policy initiatives do show promise, but it might be hard to raise domestic demand to match its manufacturing capacity, since the relatively high costs will be borne by the electricity consumers and the state exchequer via the National Renewable Energy Fund.

Source:

Deshmukh Ranjit , Ranjit Bharvirkar, Ashwin Gambhir and Amol Phadke (2011). 'Analysis of International Policies in the Solar Electricity Sector: Lesson for India', Prayas Energy Group, Pune, India, and Lawrence Berkeley National Laboratory, CA, USA; India, July 2011.

Deshmukh Ranjit, Ashwin Gambhir, Girish Sant (2011). 'India's Solar Mission: Procurement and Auctions', *Economic & Political Weekly,* 46 (28), EPW July 9, 2011.

V. Concluding Comments

The India Solar Mission is a significant improvement over all previous solar policies formulated by the Government, and there is serious intent of the Governments both at the centre and states to kick start development of solar energy and harness the huge potential that exists in India. Several countries, including Germany, that has added huge solar capacities does not have as much potential as India does, and thus there is huge investment opportunity in the solar space in India. However, to attract serious investors, India has to get its act right and put in place a conducive policy aligned with India's strategic vision and objectives. There are some elements in the present policy acting as hurdles in the way of mitigating the risk perception, and some of the provisions may not be entirely aligned with the strategic objectives. However, drawing from international experiences and the lessons from the initiatives in India so far, by overcoming prevailing hindrances would unleash an enormous potential of solar energy in India.

The key challenge for developing solar projects is availability of finance and high financing costs primarily arising from the high risk associated with viability of projects and the weak financial status of the state owned Discoms. Although JNNSM attempts to address these, but there are clear gaps in the way solar policy has been rolled out so far. The move towards auctioning approach is indeed useful from the perspective bringing down the costs at which solar energy is offered by SPDs, but a precondition for successful implementation of the same would be to strengthen the prequalifying criteria of the potential bidders. Ensuring firm agreements with credible EPC and detailed project viability reports should be included as prequalifying criteria to prevent participation of non-serious players. Also the bid guarantee bonds should be deterrent enough for any non-serious participant.

The most important element for mitigating multiple risks is to put in place adequate and quality information on solar resources and performance of technologies in a transparent manner. A lot of attention and investment should be channelized towards creating such knowledge repository on a priority basis to mitigate risks perceived by the developer and investor community. The targets specified in policies and plans should be based on strong analytical foundation to send out credible signals.

The off-taker risk arising from the high loss and poor financial situation of the procurers is common to both conventional and non-conventional power generators. In case of solar the risks are higher because energy is more expensive and hence risk exposure is higher. The GoI, as an additional comfort to the prevailing payment security mechanisms in the PPA, has provided for the creation of solar payment security account from gross budgetary support. Further financial support extended by international development banks (like ADB) and international governmental support in the form of risk guarantee mechanisms and soft loans would bring additional comfort to lenders and developers. However, the real difference can be seen when the state government take the necessary step to improve the financial situation of the Discoms.

To rapidly scale up solar project and prevent implementation delays, the Government should ensure that delays do not arise on account of getting the required clearances, land acquisition, and inadequacies in infrastructure. Clean Energy Fund and other similar funds could be used to support and finance evacuation infrastructure for the projects and other infrastructure essential for developing projects.

Technology reservation of any form may not be optimal for allocation of resources. Thus, providing equal focus on SPV and CST has little justification when CST has not achieved much success and SPV has made significant strides in bringing down cost of solar. Ideally for MW scale projects auctioning without technology reservation should be the right approach to ensure harnessing the most efficient technology in a cost effective manner. Also mandating domestic content for solar projects is sub-optimal. Creating a domestic market for the manufacturing sector, which is not large enough to bring about reduction in costs and boost technology R&D, may actually lead to adverse market situations and converse incentives. Moreover, incentives to manufacturing sector should be extended to those aspects of the value chain where there is comparative advantage. As the deployment of solar projects pick up, the stimulus will automatically flow to the manufacturing segments. At this stage of development in the country, when there is more than adequate capacity globally to source technology at economical terms, it makes little sense to mandate domestic component in project development.

Finally, excessive emphasis on MW size projects may not be appropriate for faster and greater penetration of solar technology in India. Further, given the priorities of the Government to eradicate energy poverty and provide energy access to all, and given the regional spread of solar resource availability in India, it would be more useful to promote smaller size off-grid and rooftop projects. This does not in any way imply that MW size projects should not be promoted, but the focus should shift more towards the smaller sized projects. This would not only unleash a large untapped demand and huge potential for SPV technology. The German model where higher FiT is offered to smaller projects compared to larger projects could be looked into for its applicability in India. Such focus on smaller sized projects would also help channel subsidy better, release subsidies due to migration from diesel based captive generation and mitigate large off-taker risks prevailing. As the grid gets extended many of these smaller installations would be able to also provide energy to the grid, and with well planned caps on infirm capacity addition the problem of congestion and excessive financial liability could also be addressed.

It is therefore clear that the gaps in the prevailing policy are few but quite critical for effectively unleashing the solar potential in India. The solutions are widely recognized and need to be prioritized so as not to lose the momentum created by the JNNSM and the state initiatives, and ensure that India emerges as the global destination for investment in solar energy.

Appendix I

List of Projects Selected under Migration Scheme of JNNSM

Sr. No.	Name of Applicant	State	Capacity of the Plant (MW)	Whether Solar PV or Solar Thermal
1	Maharashtra State Power Generation Co. Limited, (MAHAGENCO), Mumbai	Maharashtra	4	Solar-PV
2	Clover Solar Pvt. Ltd., Mumbai	Maharashtra	2	Solar-PV
3	Videocon Industries Ltd., Mumbai	Maharashtra	5	Solar-PV
4	Enterprises Business Solutions, USA	Punjab	5	Solar-PV
5	Azure Power (Punjab) Pvt. Ltd. Amritsar	Punjab	2	Solar-PV
6	Acme Tele Power Limited, Gurgaon	Rajasthan	10	Solar-Thermal
7	Comet Power Pvt. Ltd., Mumbai	Rajasthan	5	Solar-PV
8	Refex Refrigerants Limited, Chennai	Rajasthan	5	Solar-PV
9	Aston Field Solar (Rajasthan) Pvt. Ltd.	Rajasthan	5	Solar-PV
10	Dalmia Solar Power Limited, New Delhi	Rajasthan	10	Solar-Thermal
11	Entegra Ltd. Ansal Bhawan, New Delhi	Rajasthan	10	Solar-Thermal
12	Entegra Ltd. Ansal Bhawan, New Delhi	Rajasthan	1	Solar-PV
13	AES Solar Energy Pvt. Ltd. Gurgaon, Haryana	Rajasthan	5	Solar-PV
14	Moser Baer Photo Voltaic Ltd. New Delhi	Rajasthan	5	Solar-PV
15	OPG Energy Pvt. Ltd. Chennai Tamil Nadu	Rajasthan	5	Solar-PV
16	Swiss Park Vanijya Pvt. Ltd.	Rajasthan	5	Solar-PV
	Total		84	

Source: MNRE (2010). 'List of Project Developers Qualified for Migration to Jawaharlal Nehru National Solar Mission', Government of India, New Delhi, India.

NVVN signed MoU with the above 16 Project developers to set up to 84 MW capacity solar power projects under migration scheme, comprising of 54 MW capacity through SPV and balance 30 MW through STP.

List of Projects Selected Under JNNSM for Bundling Scheme

Bidder Name	Bidder's City	Solar Project Type	Proj Cap (MW)	Location	State
Camelot Enterprises Private Limited (Project Company : Firestone Trading Pvt Ltd.)	Mumbai	PV	5	Kalhe	Maharashtra
Khaya Solar Projects Private Limited	Gurgaon	PV	5	Dist: Naguar, Tehshil: Naguar, Vill: Mundwa	Rajasthan
DDE Renewable Energy Limited	Faridabad	PV	5	Dist: Naguar, Tehshil: Khinvsar, Vill: Bhojas	Rajasthan
Electromech Maritech Pvt. Ltd.	Pune	PV	5	Dist: Naguar, Tehshil: Khinvsar, Vill: Bhojas	Rajasthan
Finehope Allied Energy Private Limited	New dlehi	PV	5	Dist: Naguar, Tehshil: Khinvsar, Vill: Bhojas	Rajasthan
Vasavi Solar Power Pvt. Ltd.	Hyderabad	PV	5	Naguar, Khinvsar,Bhojas	Rajasthan
Karnataka Power Corporation Limited	Bangalore	PV	5	Mandya, Malavalli, Belakavadi	Karnataka
Newton Solar Private Limited	Ahmedabad	PV	5	Dist: Naguar, Tehshil: Khinvsar, Vill: Bhojas	Rajasthan
Greentech Power Private Limited	New Delhi	PV	5	Jodhpur, Phalodi,BAP	Rajasthan
Saidham Overseas Private Limited	Gurgaon	PV	5	Naguar, Khinvsar, Bhojas	Rajasthan
Mahindra Solar One Private Limited	Mumbai	PV	5	District: Jodhpur, Tehsil:Phaldom Village:Amla	Rajasthan
Azure Powe (Rajasthan) Pvt Ltd	New Delhi	PV	5	Naguar, Jayal, Kathali	Rajasthan
Rithwik Projects Private Limited	Hyderabad	PV	5	Anantapur, Kadiri, Kutagulla	Andhra Pradesh
Saisudhir Energy Limited	Hyderabad	PV	5	T. Veerapuram, Rayadurg Taluk, Anantapur Dist.: AP	Andhra Pradesh
Maharashtra Seamless Limited	Gurgaon	PV	5	Jaiselmer, Pokaran, Pokaran	Rajasthan
Viraj Renewables Energy Private Limited	Mumbai	PV	5	Jodhpur District, Phalodi Tehsil, Rawre Village	Rajasthan
Northwest Energy Private Limited	Mumbai	PV	5	Village-Kantia, District- Nagaur	Rajasthan
SunEdison Energy India Private Limited	Chennai	PV	5	Bikaner, Kolayat, Deh	Rajasthan
Electrical Manufacturing Co. LTd.	Kolkatta	PV	5	Allahabad, Naini	Uttar Pradesh
Alex Spectrum Radiation Private Limited	Kolkatta	PV	5	Gajner, Kolkayat, Bikaner	Rajasthan
Indian Oil Corporation Limited	New Delhi	PV	5	Barmer, village Marudi	Rajasthan
Coastal Projects Limited	Hyderabad	PV	5	Chitradurga, Molakalmur, Murudi	Karnataka
Welspun Solar AP Private Limited	New Delhi	PV	5	Anantapur District, Amadgur Mandal, Thummala Village	Andhra Pradesh

Bidder Name	Bidder's City	Solar Project Type	Proj Cap (MW)	Location	State
CCCL Infrastructure Limited	Chennai	PV	5	Tuticorin District, Kombukaranatham Vilalge	Tamil Nadu
Alex Solar Private Limited	Kolkatta	PV	5	Khurda, Khurda	Orissa
Punj Lloyd Infrastructure Ltd.	Gurgaon	PV	5	Jodhpur, Bap, Phalodi	Rajasthan
Amrit Animation Pvt. Ltd. (Project Company : Amrit Energy Pvt Ltd.)	Kolkatta	PV	5	Jaisalmer, Pokran, Lanwa	Rajasthan
Oswal Wollen Mills Limited	Ludhiana	PV	5	Jodhpur, Phalodi,Natisara	Rajasthan
Precision Technik Private Limited	Kolkatta	PV	5	Jaisalmer, Pokran, Nokh	Rajasthan
Lanco Infratech Limited (Project Company: Diwakar Solar Projects Private Limited)	Hyderabad	Thermal	100	Jaisalmer, Nachna, Chinnu	Rajasthan
KVK Energy Ventures Private Limited	Hyderabad	Thermal	100	Jaisalmer, Nachana-1, Chinnu	Rajasthan
Megha Engineering and Infrastructure Ltd (Project Company: MEIL Green Power Ltd.)	Hyderabad	Thermal	50	Anantapur, Pamidi, Virannapalle	Andhra Pradesh
Rajasthan Sun Technique Energy Private Limited	Navi Mumbai	Thermal	100	Bikaner, Kolayat, Ladkan	Rajasthan
Aurum Renewable Energy Private Limited	Mumbai	Thermal	20	Jamnagar, Dwarka, Mojap	Gujarat
Godawari Power and Ispat Limited (Project Company: Godavari Green Energy Limited)	Raipur	Thermal	50	Jaisalmer, Jaisalmer, Parewar	Rajasthan
Corporate Ispat Alloys Limited	Mumbai	Thermal	50	Jaisalmer, Pokhran, Nokh	Rajasthan

Source: MNRE (2011). 'JNNSM Phase-I Selected Projects List', Government of India, New Delhi, India

Appendix II

Allotment of Solar Capacities in Gujarat

Sr. No.	Name of Company	Allotment, MW
1	AES Solar Company P. Ltd, USA	15
2	Astonfield Solar (Gujarat), USA	25
3	Azure Power Ltd. USA	15
4	Common Wealth Business Technologies, UK	10
5	Dreisatz GmbH, Germany	25
6	Environmental Systems Pvt. Ltd. Mumbai	5
7	Euro Solar Ltd., Bhachau	5
8	JSW Energy, Mumbai	5
9	KRIBHCO, Surat	5
10	Lanco Solar P. Ltd. Hyderabad	35
11	Mi GmbH, Germany	25
12	Millenium Synergy Ltd. Bangalore	10
13	Moser Baer Ltd. NOIDA	15
14	PLG Power Ltd., Nasik	40
15	Precious Energy Ltd. (Moser Bear) New Delhi	15
16	Solar Semiconductor P. Ltd. Hyderabad	20
17	Solitaire Energies Ltd. (Moser Bear) New Delhi	15
18	Sunkon Energy P. Ltd. Surat	10
19	Tathith Energies USA	5
20	Top Sun Energy Ltd., Gandhinagar	5
21	Torrent Power Ltd. Ahmedabad	25
22	Unity Power Ltd. (Videocon Group), Aurangabad	5
23	Waree Energies Ltd. Surat	20
24	Zeba Solar, Portugal	10
	Grand Total of Photovoltaic	365
	Solar Thermal Projects	
1	ACME Telepower Ltd. Gurgaon	46
2	Adani Power Ltd., Ahmedabad	40
3	Cargo Motors, Delhi	25
4	Electrotherm Ltd., Ahmedabad	40
5	Abengoa Ltd., Spain	40
6	IDFC Delhi	10
7	KG Design Services P. Ltd., Coimbatore	10
8	Sun Borne Energy Technologies Gujarat L.	50
9	NTPC, New Delhi	50
10	Welspun Urja Ltd. Ahmedabad	40
	Grand Total of Solar Thermal	351
	Grand Total (Photovoltaic + Thermal)	716

Source: Government of Gujarat (2009). 'Capacity allotment for solar power project development in Gujarat', Gujarat, India.

References

ADB (2011). Presentations from Solar Workshop & Training organized by ADB & NERL, New Delhi, India.

Ahuja, Dushyant (2010). 'Financing Solar Projects in India', *Energetica India*, May/June 2010.

Arora, D S, Sarah Busche, Shannon Cowlin, Tobias Engelmeier, Hanna Jaritz, Anelia Milbrandt and Shannon Wang, 'Indian Renewable Energy Status Report: Background Report for DIREC 2010', NREL, REN21, gtz, IRADe, India, October 2010

Deshmukh Ranjit , Ranjit Bharvirkar, Ashwin Gambhir and Amol Phadke (2011). 'Analysis of International Policies in the Solar Electricity Sector: Lesson for India', Prayas Energy Group, Pune, India, and Lawrence Berkeley National Laboratory, CA, USA; India, July 2011.

Deshmukh Ranjit, Ashwin Gambhir, Girish Sant (2011). 'India's Solar Mission: Procurement and Auctions', *Economic & Political Weekly,* 46 (28), EPW July 9, 2011.

GERC (2010). 'Determination of tariff for Procurement of Power by the Distribution Licensees and others from Solar Energy Projects', Order No. 2 of 2010, Ahmedabad, Gujarat, India

Government of Gujarat (2009). 'Capacity allotment for solar power project development in Gujarat', Gujarat, India.

Government of Gujarat (2009). Energy and Petrochemicals Department, 'Solar Power Policy', Gandhinagar, Gujarat, India.

Government of Rajashtan (2010). Energy Department, 'Rajasthan Solar Policy', Rajasthan, India.

Green World Investor (2010). 'Can ADB rescue India's JNNSM with Loan Guarantees and Equity Investment', www.greenworldinvestor.com, 14 Dec 2010.

Green World Investor (2010). 'USA Opposes India's Solar Energy Domestic Content Requirements', www.greenworldinvestor.com, 15 Dec 2010.

Karnataka Government Secretariats (2011). 'Karnataka Solar Policy (2011-16)', Bangalore, Karnataka, India.

MNRE (2009). 'Jawaharlal Nehru National Solar Mission: Towards Building SOLAR INDIA', Government of India, New Delhi, India. http://india.gov.in/allimpfrms/alldocs/15657.pdf

MNRE (2010). 'Guidelines for Migration of Existing Under Development Grid Connected Solar Projects from Existing Arrangements to the Jawaharlal Nehru National Solar Mission (JNNSM)', Government of India, New Delhi, India.

MNRE (2010). 'List of Project Developers Qualified for Migration to Jawaharlal Nehru National Solar Mission', Government of India, New Delhi, India.

MNRE (2011). 'Implementation of a Payment Security Scheme (PSS) for Grid connected Solar Power projects under Phase I of Jawaharlal Nehru National Solar Mission (JNNSM) during the year 2011-12', Government of India', New Delhi, India.

MNRE (2011). 'Jawaharlal Nehru National Solar Mission: Building Solar India – Guidelines for Selection of New Grid Connected Solar Power Projects Batch II', Government of India, New Delhi, India.

MNRE (2011). 'JNNSM Phase-I Selected Projects List', Government of India, New Delhi, India.

MNRE (2011). 'Payment Security Mechanism for Grid Connected Solar Power Projects under Phase 1 of JNNSM', Press Note, Government of India, New Delhi, India.

Peddada, S. Rao (2010). 'National Solar Mission & Solar Technology Deployment in India', Presentation, New Delhi, India, October 2010.

Prabhu, Raj (2011). 'Focus on India's Solar Policy Framework', www.pv-magazine.com, 06 April 2011.

Raghavan, Shuba V, Anshu Bharadwaj, Anupam A Thatte, Santosh Harish, Kaveri K Iychettira, Rajalakshmi Perumal, Ganesh Nayak (2010). 'Harnessing Solar Energy: Options for India', CSTEP, Bangalore, India, 2010.

Stuart, Becky (2011). 'India Solar Industry off to a Successful 2011, but Bankability Issues Exist', www.pv-magazine.com, 20 April 2011.