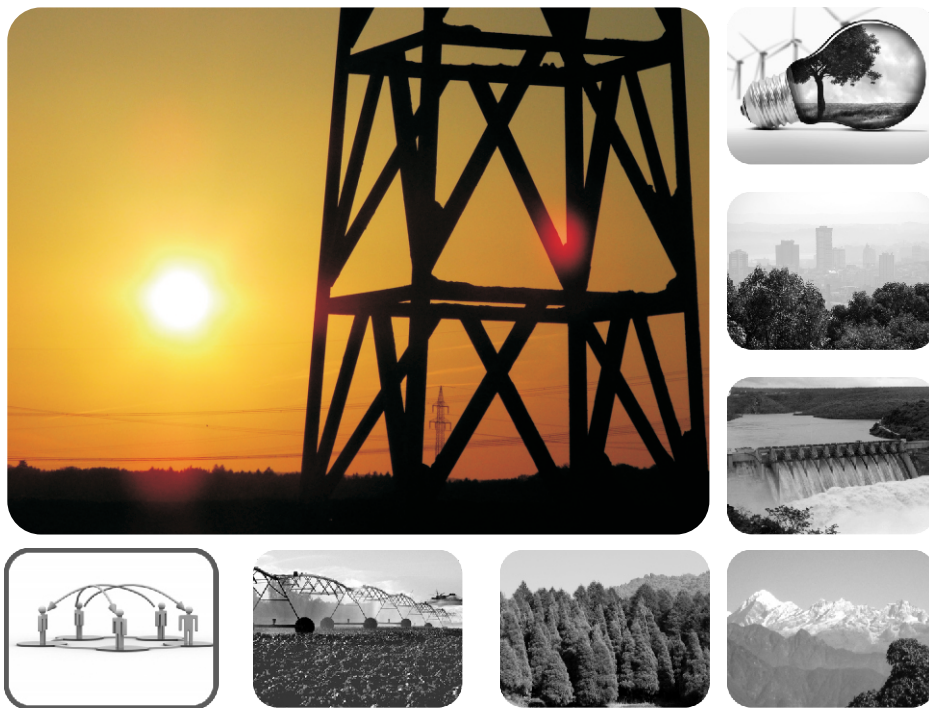


Jawaharlal Nehru National Solar Mission



Mission Brief prepared as part of the Study: Implementation of the National Action Plan on
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Jawaharlal Nehru National Solar Mission

June 2015

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About the Study

This Study has been undertaken to provide pointers to facilitate effective implementation of the National Missions under the NAPCC, as well as to highlight key policy aspects that augur well to further this national mandate. Specifically, the Study has sought to track the progress achieved by each of the National Missions since their launch up to March 2015 and also evaluate them through the lens of core policy implementation functions.

Using a combination of desk research and expert interviews, the Study has consolidated informed insights on strategies to accelerate and enhance the efficacy of the Missions' implementation, apart from documenting details of their progress. The Study team has interacted with key Government officials, domain experts in affiliated technical and academic institutions and independent research organizations to gain perspectives from all relevant stakeholders in this context. A distinct format has been followed for reviewing the Missions which have achieved quantifiable progress against their targets.

The findings of this Study were disseminated at a policy workshop, hosted by IFMR LEAD in June 2015 at New Delhi, bringing together policymakers from the concerned Union Ministries, bilateral agencies and other relevant stakeholders. The event marked a focused dialogue on the progress of the NAPCC thus far as well as the way forward for the Missions. Inputs from the workshop have been incorporated into the Study report. While the Study objectives, methodology adopted and findings across Missions have been summarised in this report, detailed findings on each Mission have been elaborated in individual Mission briefs.

Introduction

Through the implementation of the NAPCC, India attempts to catalyze the balance *comme il faut* between her growth objectives and apprehensions over global climate change. The Jawaharlal Nehru National Solar Mission (JNNSM) under the NAPCC was launched in 2010 with the objective of achieving grid parity by the year 2022. It aimed at the deployment of 20,000 MW of grid connected and 2,000 MW of off-grid solar power during the three phases of its operative period. However, given the progress¹ that has been achieved thus far in the form of grid-interactive power (3382.78 MW) and off-grid/captive power (227.12 MW), the Central Government has raised the target of the JNNSM to 100 GW to be achieved through grid connected projects, off-grid projects and solar parks by 2022.

Even though the Electricity Act of 2003 had provisioned the State Electricity Regulatory Commissions (SERC) to make Renewable Purchase Obligations (RPO) mandatory for the States to promote Renewable Energy (RE), it was the JNNSM that laid the grounding for the solar market in India². Comprehensive in its guidelines and innovative in its strategy of price determination (through reverse bidding mechanism), the JNNSM has already made palpable impact on India's gradual transition from fossil-fuel run economic development to one based on non-fossil fuels. Large public sector, thermal power segment players are expanding their portfolios through their investment in mega-scale solar projects, at the Central Government's persuasion. After the unveiling of the JNNSM by the Central Government, many States have drafted and launched their solar policies that provide supplementary or substitutive impetuses.

The realization of the JNNSM targets is heavily dependent on the State solar policies. Hence there is a strong case for the creation of an environment that enables States to learn from the policies of their counterparts. An interactive approach is essential for the accelerated growth of the Indian solar sector as commercial parity is yet to be achieved. This can be done only through the tracking of the State policy measures. An assessment of the solar policies is vital to evaluate the effectiveness of its legal structure, funding and coordination mechanisms, and institutional provisions. Gauging policy efficacy is desirable for efficiently channelling resources as well.

At the outset, it appears that India has emerged the latest hub of solar development with a comprehensive national policy and sound individual State policies. Large capacity allocations under these policies add credibility to this claim and propel the notion of a successful start. However, moving down the design-implementation continuum of the policy, several issues emerge and prove to be hurdles in the successful deployment of the allotted projects. The most conspicuous would be the lack of direct linkage of the Mission's climate change mitigation objectives and its cumulative installed capacity targets. However, it is worthwhile to highlight how the Mission initially was propelled by the enabling regulatory environment and has now catapulted solar power to a position of near economic viability.

This section has been sub-divided: the first part tracks the achievements of the JNNSM up to February 2015, in terms of the installed capacity and the second part identifies the key challenges faced by the solar sector in the country and attempts to understand the reasons behind the same in order to recommend effective mitigative strategies.

¹ As recorded by the MNRE as of 28 February 2015.

² Before the announcement of the JNNSM, India's solar power capacity was only 17.8 MW in early 2010.
<<http://www.indianenergysector.com/solar/progress-under-jnnsms>>

Tracking the Mission's Progress

In the beginning of 2010, the total installed capacity of solar power in the country was a mere 17.8 MW which grew to 506.9 MW by March 2012 and to 2.75 GW by July 2014. This whopping leap within a span of four years can be almost wholly accredited to the launch of the JNNSM in 2010.

During Phase 1 of the Mission, there were 63 projects allocated through two reverse auctions which witnessed more than 500 bidders in competition. The prices discovered were record lows and the investments in the solar sector within India increased to over Rs. 12,000 Crores. Progress to such an extent in the field can be largely attributed to regulatory concessions (the Accelerated Depreciation (AD) benefit, tax exemptions, etc.) that were made available to the solar power developers. Also, the concept of price discovery through the reverse bidding mechanism was new to the country and attracted private investment from all industries. Given the 300 days of sunshine that India receives, the investors saw large potential waiting to be tapped.

Despite the well-prescribed targets and a detailed Mission document, the aim of achieving 20 GW of cumulative solar capacity by 2021-22 had seemed ambitious. However, the new Central Government aims at scaling up India's solar capacity to a tenth of the total power demand through achieving a cumulative capacity addition of 100 GW within the same period³.

The scaled up target is heavily dependent on the coordination and smooth functioning of present and new institutions. The JNNSM is administered and executed by the Ministry of New and Renewable Energy (MNRE). The NTPC Vidyut Vyapar Nigam (NVVN) signs power purchase agreements (PPAs) for the duration of 25 years to purchase solar power from the solar power developers and supply a pre-determined amount of power to the Distribution Companies (DISCOMs). In the event of the power remaining unsold or default on the buyer's side, there is a payment security fund to insure the NVVN. This fund is managed jointly by the MNRE and the NVVN. The solar projects under the MNRE and NVVN were to be financed by the Indian Renewable Energy Development Agency (IREDA). The IREDA operates as the financial arm of the MNRE and is a public limited government company. On the 20th of September, 2011, the Government of India created the Solar Energy Corporation of India (SECI) to aid as the implementing arm of the JNNSM.

³ Due to dramatic changes in both the weightage given to application segments and the targets *per se*, the tracking has been done in accordance with the previous roadmap laid out in the Phase 1 document of the JNNSM.

TABLE 1: SEGMENT-WISE PHYSICAL PROGRESS DURING THE FIRST QUARTER OF 2015

Segment (as on 28.2.2015)	FY 2014-15		Cumulative Achievements
	Target	Achievement	
Grid Interactive Solar Power (Capacities in MW)	1100	750.77	3382.78
<i>Key Observations</i>			
<ul style="list-style-type: none"> • Reverse auction mechanism drove the prices too low to yield financially viable projects. • Reliance on the Engineering, Procurement and Construction (EPC) contractor blurred the distinction between the solar power developer (designated producer of solar electricity) and the contractor. • The solar market began consolidating into the hands of a few developers at a very early stage. • Developers are unclear as to which agency/entity is responsible for the last-mile infrastructure and this results in delays. • Coordination between the JNNSM and the State projects has been dwindling. 			
Off-Grid/Captive Power: Solar Photovoltaic (SPV) Systems (Capacities in MW)	60	52.77	227.12
<i>Key Observations</i>			
<ul style="list-style-type: none"> • Theoretically, erratic weather fluctuations unavoidably result in suboptimal system operations. • High initial cost of solar PV systems (which is currently on a steady decline) • The lack of proper introduction and implementation of the net-metering system which would have solved the issue of the surplus power generation. 			
Solar Water Heating Collectors (million m²)	0.50	0.66	8.76
Segment	Achievements		
(as on 10.3.2015)	Under MNRE/SECI	Through State Government	Cumulative Achievements
Grid Connected SPV Rooftop Projects (Capacities in MW)	18.299	22.94	41.239
<i>Key Observations</i>			
<ul style="list-style-type: none"> • Rooftop projects have more than often witnessed severe delays in disbursement of subsidies due to the complexities of the subsidy structure and the involvement of multiple agencies. • Cost of grid support provided to distributed generators is not compensated by the regulators in most cases. • Net-metering regulation needs to be more pro-prosumer⁴ and implemented at the earliest. 			

Source: SECI, MNRE and findings from the Study

⁴ A prosumer is an entity that both produces and consumes electricity.

Implementation Evaluation

The barriers to effective implementation of the JNNSM have been categorized under the three major application segments: Utility Scale Projects, Projects registered under the REC Mechanism, and Grid Connected Solar Rooftop Installations and Off-Grid/Captive Power Generation.

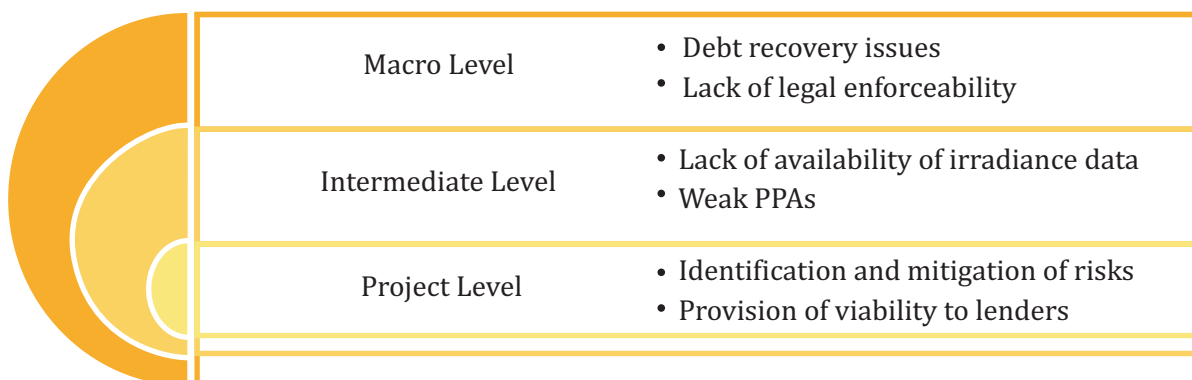
Utility Scale Projects

Difficulty in Raising Debt Finance

Raising debt finance is still the major concern for solar power developers in India. Though access to affordable capital is essential to any energy project, it becomes even more so for solar PV as the largest portion of the lifetime cost of such a project is of its capital expenditure. The capital cost estimated by the Central Electricity Regulatory Commission (CERC) for solar PV projects is Rs. 691 Lakhs/MW for the FY 2014-15 (CERC, 2014) implying that the solar projects require a high investment upfront and would have longer payback periods. Also, there are structural challenges curbing the investment of Indian banks in the solar sector. Due to large amounts of credit already extended towards the power sector (mainly thermal power plants), banks have stretched their respective exposure limits (FICCI Solar Financing Subgroup, 2013). Hence, the renewable energy sector faces a credit crunch.

The availability of non-recourse financing⁵ for solar power development is almost non-existent in India currently despite infrastructure projects being technically eligible for the same. Most of the developers in the country work with either full or limited recourse funding, which increases the financial risk of the developer manifold. The reasons attributed to the lack of non-recourse funding in India are threefold (Bridge to India, 2013), as shown in the figure below.

FIGURE 1: REASONS FOR THE LACK OF NON-RECOURSE FUNDING



Source: SECI, MNRE and findings from the Study

1. *Macro level:* The primary problem associated with non-recourse financing that lenders face is the concern over debt recovery. Moreover, the legal framework does not stringently enforce payment claims. The debt scenario can be improved through a gradual increase in the credit-worthiness of the project developer through timely repayment of loans and the strengthening of the company's reputation.

⁵ Non-recourse financing is a type of loan that offers only the balance sheet of the project that is being funded as collateral. This means that the lending bank is not entitled to seize the other assets of the borrower in case of default on the payments. Projects that have high capital expenditures and long loan periods generally opt for this type of finance.

The passage of the Recovery of Debts Laws (Amendment) Bill, 2011 in December 2012 by the Indian parliament has enabled banks to recover bad loans in more efficient and effective manners and therefore reduced the probability of incurring non-performing assets.

2. *Intermediate level:* In this category, the two causes for concern for the lenders are: firstly, the lack of availability of accurate irradiance data; and secondly, the poor bankability of the Power Purchase Agreements (PPAs).

Unavailability of Quality Irradiance Data

Banks are cautious of investing in solar projects as the projections of performance and revenues are directly correlated with the information on the incidence of solar radiation and these are not available in short intervals in a consistent manner. The right choice of technology and the determination of viability and size of Concentrated Solar Thermal (CST) projects are dependent on information on Direct Normal Incidence (DNI) of solar radiation while SPV projects rely on data on Global Horizontal Incidence (GHI) (Basu, 2011).

Policy formulation requires annual information with high accuracy and currently this information is made available. However, the project planning phase demands seasonal and monthly information. Subsequent to this phase, project development, feasibility assessment of the project and its designing require monthly, daily and even hourly data with a high confidence interval. Also, most meteorological data received is city based though the project sites are often located in remote, rural areas. Moreover, there is a high margin of error in the available data (as high as 10%) and this turns out to be a severe setback in accurate estimation of future power generation.

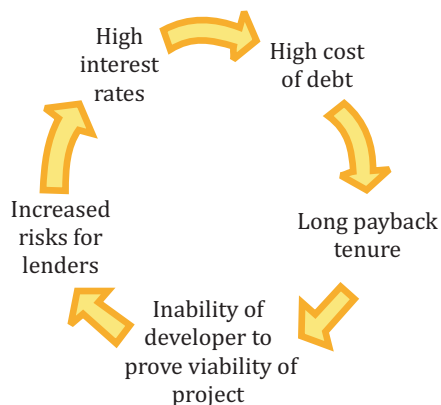
Developers generally use satellite-modelled data (which can be used only with 70–80% confidence level) of National Aeronautics and Space Administration (NASA), National Renewable Energy Laboratory (NREL) or appoint external agencies to measure on-ground data. Due to incongruities in this type of data, the despatch of recently developed projects has been below projections.

Poor Bankability of PPAs

The weak financial health of India's public utilities is a fundamental crisis that needs to be mitigated and weak PPAs are a manifestation of the same issue. This will be discussed in detail in the subsequent sections.

3. *Project level:* The issues at this level are associated with the identification and mitigation of risks (in other words, improving the bankability of the PPAs) and the inability of developers to prove viability to lenders. The latter is a result of a vicious cycle as shown in Figure 2. The long term solutions to this problem would be running successful pilots and improving the creditworthiness of off-takers, thereby reducing lender risks. The crucial elements to obtaining non-recourse financial closure are:
 - a) Convincing the lenders that the projects' risks have been effectively covered and measures for their mitigation are well in place
 - b) There has been professional execution of the project development process
 - c) The project resonates financial viability, and
 - d) The developer is in the sector for the long haul with a sustainable motive and would be in need of more debt in the future.

FIGURE 2: VICIOUS CYCLE OF POOR VIABILITY OF SOLAR POWER PROJECTS



Source: Study by research team

Weak Bankability of PPAs

The cash-strapped situation of Indian public utilities has severely affected the bankability of PPAs and has contributed significantly towards reducing investor confidence.

Factors affecting the bankability of PPAs

1. Weak financial position of Indian DISCOMs
2. Nascent, inconstant, discontinuous and regionally diverse regulatory environment
3. Requirement of high upfront capital investment
4. Excess credit exposure to conventional power projects currently faced by banks
5. High prevailing interest rates (over 13% per annum)

Power Off-taker Risk

Off-taker risk is the decisive factor from a payment security perspective. A default in payment can make a project unrealizable and conceivably jettison the developer's ability to configure this liability. At present, almost all of the off-taker and payment hazards are linked with the poor financial state of DISCOMs and a lack of long term policy clarity.

As mentioned earlier, the NVVN was the nodal agency for executing projects under JNNSM Phase 1. For the second phase, the onus was transferred to the SECI. Of the two entities, the NVVN is of better financial strength because defaults in payment from DISCOMs may affect the payment from SECI to project developers. The NVVN can neutralize the effect of such defaults by paying from their other trading businesses and benefits from the strong financials of the National Thermal Power Corporation (NTPC). The SECI too has a corpus of Rs. 170 Crores, but without leveraging other sources like National Clean Energy Fund (NCEF), this would last only for a limited period of time.

Compared to these two agencies, the State DISCOMs are in poor financial condition. Most PPAs under State solar policies are signed with the DISCOMs and hence the financial health of these companies plays a decisive role in the lending decisions of the financial institutions. Though the State Governments have provisioned a certain amount from their budgetary allocations to support DISCOMs in improving their financial conditions, the companies would need more time to become profit making.

Therefore, it is desirable for States to incorporate provisions for a payment security mechanism to shield project developers from the cash-strapped status of the DISCOMs.

Permit Requirements and Working Instructions

Clear Division of Roles & Responsibilities

Although most clearances and consents must be obtained at the State level, it is worthwhile for MNRE to establish a procedural roadmap for solar development by charting out responsibilities of intervening public institutions, both at the State and the Centre. The MNRE has evolved into becoming a subsidy provider while the State regulatory authorities are responsible for regulations and implementation depends on the DISCOMs for which MNRE may provide guidelines.

Adequate Control Period

For solar power projects with short control periods, a major problem that developers face would be the acquisition of land within this short duration, especially in the case of larger solar plants. Land acquisition is a pre-requisite for the DISCOM to conduct load flow studies that determine whether the nearest substation would have the capacity to accept the load from the plant's evacuation facility. Moreover, the transmission facility from the plant to the nearest substation has to be constructed by the developer and handed over to the DISCOM. This means that the developer is responsible for obtaining the Right-of-Way for transmission lines, which is a time consuming exercise that even the State Governments and utilities find difficult to achieve. The DISCOM would accept the security deposit from the developer and sign the PPA only once all these steps have been accomplished.

It is recommended that State Governments do away with sudden tenders and stringent timelines and allow for adequate preparatory time for the developers. Developers opine that prior identification of a) substations with spare capacities, b) land, c) water for construction and d) transmission facilities, would provide a more conducive environment to raising debt finance. Sustainable solar energy tariffs must be representative of risks involved and hence should be determined based on realistic assumptions, which relate to capital costs, capacity utilization factors (CUFs), grid availability, cost of debt finance and the cost of operation and maintenance.

Land Availability Challenges and Solar Parks

The primary challenges faced by solar power projects in the country were procedural delays and legal complications arising out of private land acquisitions, Change of Land Use certificates for conversion of agricultural land, the Right-of-Way issues for building evacuation systems and the promised, but unavailable, Single Window Clearances.

In order to mitigate these diverse issues, the idea of Solar Parks was mooted to promote a plug-and-play mechanism of solar power deployment. These Solar Parks were aimed at being achieved through firstly, the identification and development of a large expanse of land in a centralized area; secondly, provision of the requisite infrastructure like evacuation network, auxiliary power, water supply systems, etc. for uninterrupted and speedy development of solar power projects; and thirdly, through enhancement of wastelands identified by the government.

Solar Parks on paper promise to cater positively to all stakeholders involved: while clustered infrastructural development, savings on electricity generation, reduction in emissions and investment influxes are bonuses to the government, single window clearances and ease of access to a plug-and-play system are incentives to the solar power developers. Financiers receive due diligence assistance from the government as well.

However, major hurdles that this application segment faces are the non-availability of continuous stretches of land, accessibility to the project site, availability of water for consumption and construction and operation and maintenance (O&M) activities, availability of evacuation facilities to the site for the power required for construction, the non-availability of construction material and harsh weather. Given the nascent stage that this segment is in, the addressal of these challenges are yet to run their due course.

Projects registered under the REC Mechanism

Heterogeneous and Inconstant Regulatory Environment

Policy initiatives surrounding the solar energy sector are not all equally transparent, financially sound and implementable. As an example, the REC mechanism at the national level and the SPO mechanism in Tamil Nadu are both dependent on demand that has to be induced through enforcement of the obligations. Given that each State has a different approach towards implementing these obligations and different degrees of earnestness in implementing them, it is extremely difficult to ascertain the actual resulting demand for solar power or RECs. For any project under the REC, developers should try to maximize the realization of revenue through the tariff in the PPA. Ideally, the revenues from the PPA should be able to serve interests and repayment of the loan. Lenders are more inclined to a bankable private PPA at a viable tariff, while resorting to revenues from the REC mechanism only as an additional incentive. The REC market faces certain viability issues of its own (as described in the following section) and its prices are uncertain. *It is therefore advisable to promote private off-takers at this stage and rely less on the REC mechanism.*

It is highly desirable to have utmost clarity on the requirement of permits and applicability of cross subsidy, wheeling, transmission and power banking charges at the time of planning. A developer would need to scrutinize the publicly available regulatory documents and then work closely with the State DISCOM, SERC and the connecting substation to ascertain such charges at the time of project planning.

Troubled Renewable Energy Certificates Market

The major issue with the REC mechanism is the lukewarm demand for the certificates in the two power exchanges viz. Power Exchange India Limited (PXIL) and Indian Energy Exchange (IEX). The main reason behind this is the loose enforcement mechanism for Renewable Purchase Obligations (RPO) and the absence of stringent enforcement of penalties in case of default. There is only one instance till now where the Uttarakhand Electricity Regulatory Commission (UERC) has monetarily penalized the State DISCOMs, namely the Uttarakhand Power Corporation Limited (UPCL) for defaulting on the carried forward targets of RPOs (Uttarakhand Electricity Regulatory Commission, 2014). The Andhra Pradesh Electricity Regulatory Commission (APEREC) has mandated the obligated entities to meet their RPO requirements by buying RECs at the floor prices, however, it has merged the solar and non-solar RPOs in its draft regulation (Andhra Pradesh Electricity Regulatory Commission, 2014). State regulators could learn from these examples of penalizing defaulters to facilitate stricter enforcement of RPO targets. Once the DISCOMs start achieving their targets, the demand for these certificates are expected to increase.

High Prices of RECs

Another reason for the unenthusiastic demand is the price of the RECs; the solar RECs have a floor price of Rs. 9.3/unit and forbearance price of Rs. 13.4/unit. Most of the certificates are traded at floor price and that is much higher than the current average levelised cost of electricity (LCOE) of solar energy (in the range of Rs. 7-8 per unit for utility scale systems). Hence it is economical for developers to produce from their own solar power plants. Similarly, it is better for DISCOMs to procure solar power from producers at a lower price than opting for solar RECs to fulfill the RPO. *Hence, a market-driven REC pricing backed by a strictly implemented and enforced RPO mechanism is the way forward.*

The Forum of Regulators (FoR) invited a comprehensive study and recommendations on the REC market at their 41st meeting (Forum of Regulators, 2014). Based on their report, the CERC announced the draft regulations for the REC market in September 2014 (Central Electricity Regulatory Commission, 2014). The REC floor and forbearance prices are proposed to be modified to Rs. 3,500/REC and Rs. 5,800/REC respectively. A vintage multiplier has also been introduced for old projects which have already registered their certificates and are yet to sell them in the exchanges.

A sound understanding of the contextual factors that affect solar power deployment in India is of vital importance as the national policy aims to achieve ambitious targets in seven years and any mid-course correction or reprising measure would be dependent on these factors. Though effective policy initiatives can be compared and adapted amongst the different States, each of them would have separate roadmaps for successful Mission implementation.

Grid Connected Solar Rooftop Installations and Off-Grid/Captive Power Generation

Timely Disbursement of Subsidies

The MNRE has indicated its intention⁶ of reducing the subsidy for 'Grid Connected Rooftop and Small Solar Power Plants Programme', through limiting both the scope (beneficiaries) and the amount (from 30% to 15%) of the subsidy. It is important to note that timely disbursement of subsidies is vital in this transition process and if not delivered, could have significant effects on the cash flows and working capital expenses of the installers. The subsidies create an expectation amongst the beneficiaries and if not disbursed, could lead to a stagnated market as observed in the past. For instance, the budgetary allocation for *Installation of Solar Power Generators above 3 kWp up to size of 100 kWp with aggregate capacity of 25 MWp* under the Central Financial Assistance (CFA) scheme was deferred for a considerable period of time, adversely affecting the sector. It was only on 12th August 2014 that MNRE finally received the allocation to proceed with the sanctioning of the 30% capital subsidy. The above mentioned delays in capital subsidy disbursements hamper the implementation of the rooftop scheme severely. It would be beneficial for the segment if the MNRE could clear all approved subsidy applications and ensure timely disbursement of future applications. Alternatively, the market can be better served by having realistic feed-in-tariffs instead of capital subsidies.

⁶Through its order No. 5/34/3013-14/RT
<http://mnre.gov.in/file-manager/UserFiles/solar-power-generation-3kwp-upto-100kwp.pdf>

Engagement of Public Constituents

The level of acceptance for a given policy and the degree of compliance with it depend on an engagement with the relevant stakeholders. Often policies do not provide sufficient opportunities for stakeholder engagement in its administration. It is desirable and even necessary that a draft of the guidelines for the commissioning of projects is first sent out for stakeholders' comments and suggestions before being finalized. There should be substantial efforts towards incorporating feedback and the rationale behind dismissing any input provided by stakeholders must be explicitly stated.

The associated consultative processes require a level of engagement which is important to effective policy implementation. An active engagement of the DISCOMs, the State Nodal Agencies, the State Departments of Energy, consumers, developers, manufacturers and financiers is crucial for arriving at a policy and regulatory framework that has the requisite support for these key players.

The experience thus far shows that a closer interaction with all stakeholders is needed while framing policies and regulations. Stakeholders will be motivated to comply with regulations, including RPOs, if they partake in the framing processes of the same.

Key Observations

1. **Stakeholder support:** The market for solar energy has become more sophisticated and players have come forward to unleash its potential, thereby necessitating improved coordination in garnering stakeholder action and support.
2. **Infrastructural hurdles:** Developers face various kinds of infrastructural hurdles during the course of project development. Acquiring clearances for converting land use to accommodate solar project development is a major hindrance as developers encounter claims from other parties over government-allocated land. Difficulties pertaining to obtaining Right-of-Way, power evacuation facilities and transmission lines to substations are another major issue. Lastly, there is an evident lack of availability of skilled labor acting as a deterrent to large-scale project development.
3. **Issues regarding obtaining finance:** The prevailing interest rate in India is around 13% which is high and dissuades project development, principally because solar power development requires large upfront capital. Moreover, most Indian banks are reaching their sectoral limits for the renewable energy sector and there is lack of availability of non-recourse funding.
4. **RPO compliance:** Uncertainties surrounding the regulatory environment and enforcement mechanisms tend to reduce investor confidence. Hence the REC mechanism can be fully functional only if the RPO compliance is duly enforced and the mechanisms for trading are detailed *sans* ambiguity.
5. **Capacity building for the financial community:** Banks and financial institutions need to increase information sharing through networking and also initiate capacity building activities within the financial community. The MNRE has taken the first steps forward in terms of creating awareness and disseminating information. However this needs to be taken forward to ensure that projects receive adequate and affordable funding.

A long term plan for the execution of the Mission is critical to ensure the progress of the solar sector. All stakeholders must be made aware of such a roadmap and it must be inclusive of the entire supply chain. Capacity building of the labor force and mechanisms to obtain sufficient and customized resources (financial and otherwise) must be clearly outlined as well.

References

- Andhra Pradesh Electricity Regulatory Commission. (2014). *Draft Amendment for RPO Regulation*. APERC.
- Basu, S. (2011). *India Solar Policy: Elements Casting Shadow on Harnessing the Potential*. IDFC.
- Bridge to India. (2013). *Bankability and Debt Financing for Solar Projects in India*. New Delhi: Bridge to India.
- Central Electricity Regulatory Commission. (2014). *Determination of Forbearance and Floor Price for the Solar REC (Petition No. SM/016/2014 Suo Motu)*. Chennai: CERC.
- CERC. (2014). *Petition No. SM/354/2013 (Suo-Motu)*. New Delhi: GoI.
- Energy Sector Assistance Programme. (2013). *Paving the Way for a Transformational Future: Lessons from JNNSM Phase I*. World Bank.
- FICCI Solar Financing Subgroup. (2013). *FICCI Solar Energy Task Force Report on Financing Solar Energy*. New Delhi: FICCI - SETF.
- Forum of Regulators. (2014). *Minutes of the 41st Meeting of the Forum of Regulators*. New Delhi: Government of India.
- Ghosh, A., Palakshappa, R., Raje, S., Lamboria, A., Jaiswal, A., Gowrishankar, V., et al. (2012). *Laying the Foundation for a Bright Future: Assessing Progress Under Phase 1 of India's National Solar Mission*. Mumbai: CEEW; NRDC; Shakti Foundation.
- Jawaharlal Nehru National Solar Mission. (2010). Ministry of New and Renewable Energy, Government of India.
- Krithika, P., & Mahajan, S. (2014). *Background Paper: Governance of Renewable Energy in India: Issues and Challenges*. New Delhi: TERI.
- Magal, A., Engelmeier, T., Mathew, G., Gambhir, A., Dixit, S., Kulkarni, A., et al. (2014). *Grid Integration of Distributed Solar Photovoltaics (PV) in India*. Prayas Energy Group.
- MNRE - No. 30/11/2012-2013/NSM. (2014). *Continuation of "Off-Grid and Decentralized Solar Applications" Scheme in the 2nd Phase of the JNNSM During the 12th Plan Period including 2014-15: "Guidelines Grid Connected Rooftop and Small Solar Power Plants Programme"*. New Delhi: GoI.
- Uttarakhand Electricity Regulatory Commission. (2014). *Order on non-compliance of RPO by UPCL*. Dehradun: UERC.

