Barriers to development of renewable energy in India & proposed recommendations

A Discussion Paper

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Introduction

India has set out on the path of harnessing renewable energy (RE) sources than never before. The reasons are many and are not hard to find within the chronic shortage of power, matters of energy security and environmental concerns. The country's energy strategy is moving strongly in favour of renewable energy (RE) technologies. This strategy has made India a leader in a number of renewable energy technology (RET) applications such as grid connected wind energy generation, decentralised solar PV for rural applications, decentralized distributed generation etc. India has now has set itself very aggressive targets for RE capacity addition. The 11th Five Year Plan (FYP) (FY 2007-12) envisages the addition of 14,050 MW of additional capacity, which means adding, in 5 years, more capacity than what India has added since independence.

However, RE capacity addition and development of the sector suffers on account of a number of constraints, overlaps and gaps prevalent in the current policy and regulatory environment. It is becoming clear that the policy and regulatory framework introduced so far has been appropriate only for accelerating the early growth of the sector from a small base and helping in mainstreaming RE. However this policy and regulatory environment has now (with changing market conditions and imperatives) become outmoded for the sector. Though the Ministry of New and Renewable Energy (MNRE) has been taking proactive steps for improving this environment, its initiatives have been able to address specific problems and constraints, and have not been successful in helping the RE sector as a whole in India to leap frog ahead.

There is therefore a need to review the existing environment for development of RE and propose a new approach to the development of this sector. With this objective, this paper examines the current status of RE development in India and the existing environment for such development. It examines the barriers to further development as well as gaps constraining investments in this sector of renewable energy. It then makes recommendations towards removing such barriers and adopting new mechanisms for the promotion of RE. In sum, the paper identifies the issues that have to be addressed in order to achieve a widespread use of RE, so that determined and practical steps can be taken to increase substantially their application.

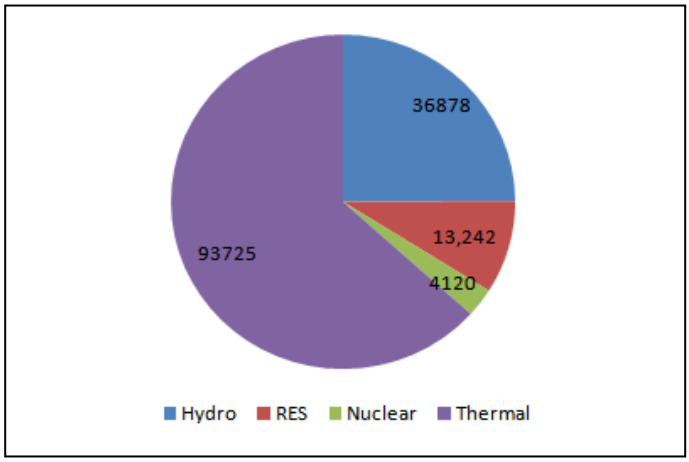
RE technologies (RETs) in India can be divided into two categories: (i) near commercial and commercial technologies such as wind, small hydro power (SHP), solar PV, biomass and co-generation (cogen) that have matured and are being deployed or are close to deployment, and (ii) emerging technologies such as solar thermal and biofuels that will need time to mature. The latter will also have to undergo pilots before commercial deployment. This paper focuses on the RETs that fall in the first category. The paper also restricts itself to grid-connected RE.

1. Status of RE development in India

Today, the RE sector contributes a very small percentage of the total installed power capacity of the country (approx. 9% at the end of FY 2008-09) (see figure 1). The share of different technologies in the total RE capacity existing in the country is presented in figure 2. It is clear that wind energy makes up the largest proportion of RE. It has also overtaken the installed nuclear power capacity by nearly a factor of two. On the other hand, solar power – whether PV or thermal – is yet to gather momentum.

The growth in RE capacity addition picked up pace during the Tenth (10th) Plan. In this Plan, the sector was not only able to achieve its targets but also exceeded the target by almost 120%. A review of the physical achievements during this Plan indicates that RE capacity of 6795.44 MW was added as against a target of 3583.50 MW. Of this, 5426.4 MW came from wind power, 536.83 MW came from small hydro, 785 MW from bio-energy and 46.58 MW from waste to energy.

Figure 1: Role of RE in India's power generation capacity as on March 31, 2009 (in MW)[1]



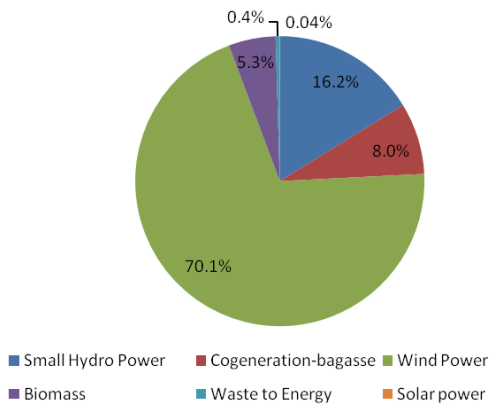
Source: Ministry of Power

Figure 2: Technology wise grid-interactive RE capacity in India as on October 31, 2009 (in MW)

RET wise installed capacity

RET	Installed Capacity
Small Hydro Power	2,519.88
Cogeneration-bagasse	1,241.00
Wind Power	10,891.00
Bio Power	816.5
Waste to Energy	67.41
Solar power	6
Total	15,541.79

Share of different RETs in total RE capacity



Source: MNRE

2. RE potential in India

The contribution of renewable energy to the power sector has increased and is expected to increase in the future. MNRE is targeting a huge capacity of renewable energy in India and aims to add almost four times the present capacity by 2017. Table 1 highlights the potential and target cumulative capacity addition for each of the RETs in India till FY 2016-17. It is evident that wind will continue to dominate the future capacity addition from RE in India and India is expected to harness around 88% of its available potential of wind by 2022. The potential of SHP is also expected to be harnessed up to 43% of its potential. However, the potential for each of the RETs is expected to change (increase) in future with more resource assessments and technological advancements.

[1] According to the MNRE, the total RE capacity in the country as on March 31, 2009 was 14,485 MW. The difference in magnitude of RE capacity addition as reported by different agencies in the country arises on account of discrepancies in reporting of data and the different time frames when such data is reported. The objective here is to give a fair idea of the extent of RE capacity existing in the country.

Table 1: RE potential and target cumulative capacity addition (in MWeq)

Type of RET	Estimated potential as on March 31, 2009	Target addition till 2011	Target addition till 2017	Total capacity in 2017
Wind	45,195	17,600	35,000	45,243
SHP	15,000	3,376	6,500	8,930
Biomass	16,881	1,025	1,500	2,203
Cogeneration-bagasse	5,000	2,016	3,400	4,449
Waste to Energy	2,700	244	600	659
Solar	50,000	53	10,000	10,002
Total	*1,34,776*	*24,314*	*57,000*	*71,485*

Source: MNRE

Table 1 makes it clear that there is a huge potential for RE and only a small part of the potential has been tapped so far. Going by the past record, these anticipated capacity additions may not materialize in their entirety as the development of RE is critically dependent on a variety of factors (which will be touched upon later in this paper). To get realistic estimates about the capacity addition that would be possible, it may be useful to consider that only 15,000[2] MW of the planned incremental capacity would be added in the country by 2017.

3. Drivers of RE in India

The main driver for RE at the global level, particularly in Europe and North America is the reduction of emissions. Increased levels of greenhouse gases have primarily been held responsible for global warming and consequently, climate change. Europe and North America being the largest emitters of greenhouse gases in the world, the need to reduce emissions of these gases provides a very compelling reason for them to make use of alternative and cleaner sources of energy. While the need to protect and preserve the environment is taking the forefront in India, concerns over energy security and the stability of the energy supply continue to be the main drivers of RE in the country.

The Expert Committee of GoI on Integrated Energy Policy (IEP) notes that to deliver a sustained growth of 8% through 2031, India would need to grow its primary energy supply by 3 to 4 times and electricity supply by 5 to 7 times of the 2003-04 levels[3]. The country currently imports about 72% of its oil consumption and this is expected to reach 90% by 2031-32. The scenario for coal imports is not going to be very different. It is envisaged that India will import 50-60 million tons (MT) of coal every year by the end of the Eleventh Five Year Plan (11th FYP). According to scenarios developed by the Expert Committee on IEP, imports could increase to as much as 45% of the total coal requirement. Besides issues of energy security, such growing dependence on imports also raises concerns of price shocks and vulnerability before supplying countries.

Long term energy security is just one aspect. The country also needs to address the shortage of power that has engulfed it over the years and access to electricity. The peak power shortage in June 2009 was 14% in June 2009 and has been upwards of 11% every year since 1997-98[4]. The scenario varies from state to state with some states facing a peak power shortage of 35% in June 2009[5]. While the level of village electrification for the country as a whole reached 83% at the end of June 2009[6], the level of household electrification continues to remain poor. Last available estimates indicate that 90% of urban households

[2] Current RE capacity is a little less than 15,000 MW and it may be assumed that only another 15,000 MW is doable till 2017.
[3] Integrated Energy Policy, 2006
[4] Ministry of Power, Annual Report, 2008-09
[5] Central Electricity Authority, Power Supply at Glance, July 2009
[6] Ministry of Power, www.powermin.nic.in accessed at 2.55 p.m. on October 23, 2009

and only about 55% of rural households are electrified[7]. No doubt, efforts are being made to increase electrification. But given the shortage of power prevailing in the country, increased electrification would perhaps make no difference.

Allied benefits of energy security are savings in foreign exchange on account of reduction in import of conventional fuels. Another off-shoot of any scale-up in RE investment and development would be more investment in RE manufacturing. This in turn would lead to savings in foreign exchange (from import of RE equipment), allow development of equipment manufacturing and ancillary industries specific to renewable energy technologies and generate employment.

Promoting renewable energy resources also has a positive impact on the net creation of jobs. Rough estimates indicate that a 4000 MW ultra mega power project (thermal power) would create employment for approx. 300 people. 1 MW of RE necessitates the employment of minimum 5 people thereby implying that about 20,000 people would get employment through 4000 MW of RE. International experience also supports this fact. For instance, RE jobs in Germany shot up from 160,500 in 2004 to 249,300 in 2007 green jobs in Germany in 2004 on account of the systematic expansion of RE[8].

4. Policy and regulatory framework for RE

5.1 Overall environment for development of RE

India is one of the few countries in the developing world which has pioneered the development of renewable energy. Following the first oil shock in the 1970s which brought to light concerns about energy access and energy security, India recognized the relevance of these natural sources of energy. Thereafter, the sector witnessed slow but steady growth over the next three decades. The milestones in the RE sector in India can be summarized as follows:

- Establishing the Commission for Additional Sources of Energy in 1981 for promoting research and development in renewable energy.
- Establishing the Department of Non-conventional Energy Sources (DNES) in 1982 in the Ministry of Energy
- Wind-resource assessment and publication of a data-book in the early 1980s
- Research and development, capacity building and demonstration programs in the areas of biogas, cooking stoves and solar energy in the 1980s
- Installing the first grid-connected wind turbine in 1985 and beginning of the demonstration program by DNES in 1986
- Establishing the Indian Renewable Energy Development Agency (IREDA) in 1987 to finance renewable energy projects.
- Upgrading DNES into a full-fledged Ministry of Non-conventional Energy Sources (MNES; now MNRE) in 1992.
- Recognition of renewable technologies for power generation in 1992, by their inclusion in the Eighth Five Year Plan (1992-97)
- Policy to encourage private sector investment in renewable energy and guidelines for renewable energy tariffs by MNES in 1993

Until 1993-94, the primary approach for development of RE was through the provision of subsidies. After that, the approach has shifted to include the provision of fixed tariffs for purchase of power from RE. MNRE, in 1993, issued policy guidelines prescribing a price of Rs 2.25/kWh with a 5% annual escalation

[7] Shonali Pachauri & Adrian Muller, A Regional Decomposition of Domestic Electricity Consumption in India: 1980-2005, Presented at the annual IAEE conference at Istanbul on June 20, 2008 available at http://www.iiasa.ac.at/Research/PCC/recent-events/Pachauri&Mueller_Istanbul_June2008_Final.pdf

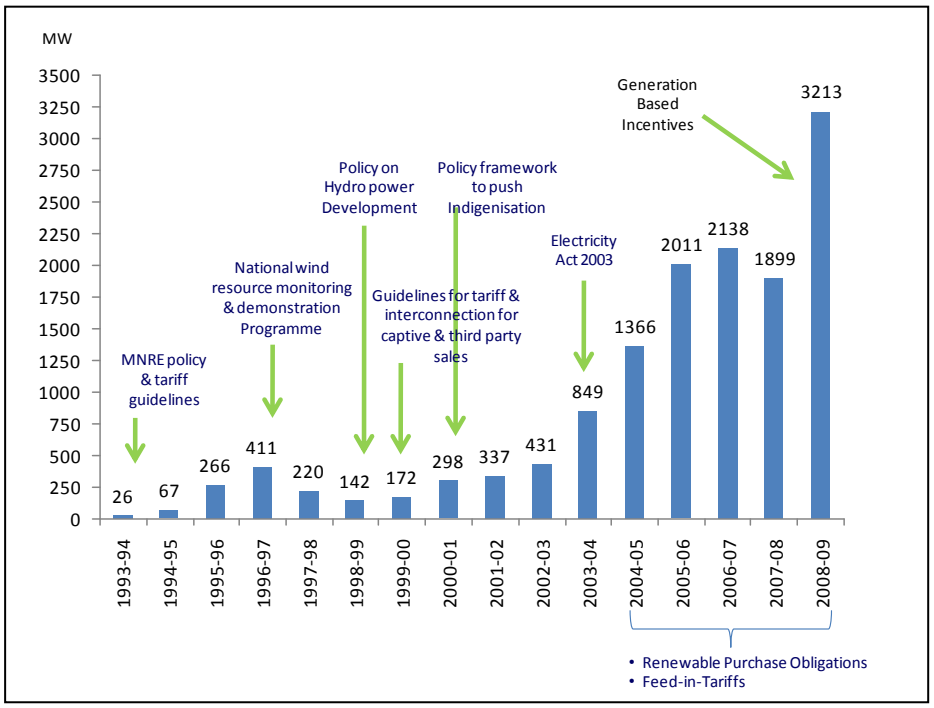
[8] http://www.renewableenergyworld.com/rea//news/article/2008/04/renewable-energy-jobs-soar-in-germany-52089

(with 1993 as base year). It also allowed wheeling and banking of energy generated by RE sources to facilitate private investments in the sector. These guidelines were valid for a period of 10 years. These guidelines were adopted with different variations by utilities in different states. Several states even brought out their policies for RE, based on MNRE's guidelines; some even giving additional incentives for RE investments.

The enactment of the Electricity Act 2003 (EA 03) has radically changed the legal and regulatory framework for this sector by providing for policy formulation by the Government of India and making it mandatory for state electricity regulatory commissions (SERCs) to take steps to promote renewable and non-conventional sources of energy within their area of jurisdiction. Section 3 of EA 03 clearly mandates that the formulation of the National Electricity Policy (NEP), Tariff Policy and Plan thereof for development of power systems shall be based on optimal utilization of all resources including renewable sources of energy. Further, EA 03 has specific provisions for determination of feed-in tariffs for renewable energy sources as well as for creation of renewable portfolio standards for states. Annexure I describes the provisions of EA 03 and the policies formulated therein for RE.

Figure 3 maps the capacity addition in RE with the main events that have driven forward this sector.

Figure 3: Events influencing RE development and RE capacity addition (in MW)



Source: MNRE, others

5.2 Policies for promotion of RE

Over the years, the Government of India through the Ministry of New and Renewable Energy (MNRE) (earlier known as the Ministry of Nonconventional Energy Sources) and Ministry of Finance (MoF), and the State Governments have used a number of policy instruments towards promotion of RE. A summary of these initiatives is provided in table 2. Annexure II discusses these initiatives in detail.

5.3 Regulatory framework for promotion of RE

Regulatory measures have mainly taken two forms: Renewable Purchase Obligation (RPO) and Feed-in Tariffs. A summary of these measures is provided in table 3. Annexure III discusses these initiatives in detail.

5. Barriers to development of RE

The barriers to development of RE in India, in general, are described below. Some of these may be specific to a technology, while some may be specific to a policy, site or a region.

6.1 Policy and regulatory barriers

6.1.1 Policy framework for RE

There is no single comprehensive policy statement for RE in the country. Policies have been issued as and when necessary to facilitate the growth of specific RETs. Further, the plans for development of RE do not match up to these policies. Table 2 indicates that the RE capacity addition targeted by MNRE and the capacity addition planned under the Jawaharlal Nehru National Solar Mission (JNNSM), also known as Solar India, is inadequate to meet the target for RE generation mandated under the National Action Plan on Climate Change (NAPCC)

Table 2: Mismatch between RE capacity envisaged under policy and capacity addition targeted

	2009-10	**2010-11**	**2011-12**	**2016-17**
Energy Requirement (in MU)[a]	820920	891203	968659	1392066
Share of RE as mandated under NAPCC (in %)[b]	5%	6%	7%	12%
Quantum of RE required (in MU)	41046	53472	67806	167048
RE capacity addition targeted by MNRE (in MW)	15542[c]	20376	25211	57000
Solar capacity targeted under JNNSM (in MW)			1000	10000
Quantum of RE available (in MU)[d]	29952	39269	50514	129122
Additional RE required to meet RE share mandated under NAPCC (in MU)	11094	14203	17292	37926

a As per 17th EPS
b 5% in 2009-10 & 1% increase each year
c As on 31.10.2009
d Assuming a capacity utilization factor of 22%

The policy framework at the state level is no better. In fact, in many states policies have only created uncertainty for investments in RE. For example, in Madhya Pradesh, the policy for promotion of non-conventional energy sources waves wheeling charges as well as cross subsidy surcharge for RE. The state government would provide subsidy to the distribution utilities towards wheeling charges @ 4% of the energy injected at the rate of prevailing energy charges for the user for encouraging RE. The policy also exempts wind energy from the payment of electricity duty for a period of 5 years from CoD provided actual generation is at least 70% of the energy generation declared in the DPR. However, the policy is applicable only for a period of 5 years. Therefore, there is a high degree of policy and regulatory uncertainty for investment in RE.

In case of biomass projects, most states don't have defined policies as far as the radius within which such plants can be established. It has been seen that biomass plants have come up in close proximity to each

other thereby affecting the availability of fuel to each other. As a result, these plants have been rendered unviable.

6.1.2 Provision of Accelerated Depreciation to wind developers

Wind power growth has hinged on the 80% accelerated tax depreciation that is provided by the GoI. In view of this, a bulk of wind power capacity has been set up on the balance sheets of existing companies which wanted to save income tax. Many of these projects are in fact located in low wind speed areas and have failed to deliver on the kind of energy production that was expected of them. Foreign investors who had no income tax to save did not find it lucrative to invest in wind energy assets.

It has also been seen that buyers take decisions from investment in wind power projects at the last moment (just before September 30 and March 31 every year to avail of the accelerated tax depreciation), the equipment suppliers in the country have evolved as developers themselves. The equipment suppliers typically undertake all development activities including land acquisition, construction, PPA finalization and transmission tie-up. in fact, many equipment suppliers have bought huge quantities of land in the high wind potential sites and sell these as part of the deal to the buyers. After the commissioning of the project, they even undertake operation and maintenance (O&M) for the buyers. Therefore, readymade projects are sold off the shelf by equipment suppliers. Since the equipment suppliers are undertaking the functions of developers as well, buyers are forced to pay a premium for the wind power projects. This has resulted in wind power projects being more expensive and even restricting competition for equipment supplies.

6.1.3 Regulatory framework for promotion of RE

Definition of RPO

A review of the RPO determined by different SERCs indicates that there are differences in the definition of the framework for RPO. There is little consensus on whether a single RPO percentage should be specified for all RE sources, or RE source/RE technology-specific percentage needs to be specified. There are some issues which merit discussion here. In case technology-specific RPO is specified and there is limited availability of a particular RE source in a year, will the SERC allow such shortfall in RE procurement to be met through another type of RE source? If not, the concerned discoms may have little incentive to explore other RE sources; indirectly limiting investments is such other RE sources/RETs. Further if the discom can meet it's RPO through RETs/RE sources not specified by the SERC, it should not be liable to pay penalty for non-achievement.

Another issue is that of the level of RPO. The level of RPO has to be carefully determined by SERCs. While a high RPO target would incentivize discoms to purchase more RE power, thereby encouraging investments, such targets may be ambitious in the short term. On the other hand a low target may put a restriction on the amount of energy purchased by a discom from RE sources. This was the case in Gujarat where the discoms reportedly stopped signing energy purchase agreements with wind developers as they had met their RPOs (2.28% as against the mandated 2% in FY 2007-08). Moreover, currently the discoms have little incentives to exceed their RPO.

Finally, some states such as Maharashtra, Gujarat, Madhya Pradesh and Karnataka do not allow the procurement of RE power from outside the state. This is detrimental for the overall development of RE in the country.

Applicability of RPO

Section 86(1)(e) of EA 2003 provides for specification of RPO on the 'consumption' within the area of discoms. This implies that the RPO should be applied on entire consumption in the area of discoms and not to procurement of energy by the discoms alone. Currently, only Maharashtra, Rajasthan and Andhra Pradesh impose RPO on open access (OA) and captive consumers.

Table 3: Policy instruments for promotion of RE

	Name of Instrument	Primary responsibility	Objective of Intervention	Applicability
1	Fiscal interventions			
a.	Capital Subsidy	MNRE	Provide a subsidy to bring down upfront investment costs	- Demonstration projects in Small Hydro, Biomass and Wind Power - Solar power applications
b.	Indirect Taxes - Cess, Exemption from VAT/ Sales Tax & Electricity Duty, Exemption from Import/ Excise Duty, Accelerated Depreciation (AD)	Ministry of Finance, State Governments	Lower the gap between RE based power and conventional power	- AD only for wind and solar Technology Neutral in case of other interventions
c.	Direct Tax exemptions/ Tax Holidays	Ministry of Finance	Provide direct tax exemptions which incentivize RE based power generation	Technology Neutral
d.	Interest Subsidies	MNRE	Provide a subsidy on interest to reduce cost of capital and in turn life cycle cost of projects	- Demonstration projects in Small Hydro, Biomass and Wind Power (till 2006) - Solar power applications currently
2	Production Subsidies (GBI)	MNRE	Provide an incentive for production of power	Solar & Wind
3	RE Funds	State Governments and State Nodal Agencies	Provide low cost funds to promote investments in RE	Technology Neutral
4	Demonstration Projects and R&D Grants	MNRE	Showcase technology development with the aim of inviting investments	Technology Neutral
5	Carbon Trading	Ministry of Environment and Forests	Provide a financial incentive for carbon mitigation, thereby encouraging clean power generation	Technology Neutral
6	State RE Policies (including issues such as development of transmission networks to connect RE projects, and wheeling & banking, Third Party Sale)	State Governments	Provide a policy framework for encouraging RE investment in the state	Technology Neutral

Source: compiled from various sources

Table 4: Regulatory framework for promotion of RE

	Type of regulation	Primary responsibility	Objective of the regulation	Applicability
1.	Tariff related			
a.	Feed in Tariffs (FIT)/ Preferential Tariffs	SERCs	Provide an assured price for RE projects feeding into the grid	Technology Neutral
b.	Terms and conditions for determination of tariff	CERC	Provide an assured price for RE projects feeding into the grid	Technology Neutral
2.	Renewable Purchase Obligations/ Renewable	SERCs	Provide a target of RE share in	Technology neutral or technology specific

	Type of regulation	Primary responsibility	Objective of the regulation	Applicability
	Portfolio Standards		power generation and distribution to encourage RE generation	depending on state
3.	Green Power (Voluntary Purchase)	SERCs	Allow consumers choice to purchase higher cost green power and provide incentives for RE generation	Technology Neutral
4.	Regulations addressing systemic issues such as open access, development of transmission networks to connect RE projects, and wheeling & banking, Third Party Sale	State Government/ SERCs	Facilitate development of RE plants, and allow RE generators flexibility in generation and sale of power	Technology Neutral

Source: compiled from various sources

Enforcement of RPO

Thus far, only a few states such as Rajasthan and Maharashtra have specified penalties mechanism on distribution licensees in case the RPO is not met by them. Table 4 indicates the extent of penalty levied in these states. In case of Rajasthan, the penalty is called a RE surcharge and is to be paid to the State Transmission Utility (STU). The surcharge so collected will be credited to a fund to be utilized for creation of transmission system infrastructure of RE plants.

Table 5: Penalties for non-achievement of RPO

	Penalty Clause	Levied on
Maharashtra	Rs. 5/unit for FY 2007-08; Rs. 6/unit for FY 2008-09	Distribution licensee, open access consumer & Captive Power Plant
Rajasthan	RE surcharge of Rs. 3.59/unit for FY 2007-08; to continue until revised	Distribution licensee, open access consumer & Captive Power Plant

Source: SERC orders in concerned states

Few instances of penalties on distribution licensees (discoms) for non-achievement of RPOs have been reported so far. So far only the Maharashtra Electricity Regulatory Commission (MERC) has penalized the discoms in Maharashtra for not meeting the mandated RPOs (refer table 5). MERC has introduced an enforcement charge for shortfall in compliance with RPS obligations at the rate of Rs 5.00/kWh during FY 2007-08, at Rs 6.00/kWh for FY 2008-09, and at Rs 7.00/kWh for FY 2009-10. It was further clarified that this enforcement charge, if levied, shall not be allowed as 'pass through' expense while approving the annual revenue requirement (ARR) of the discom.

Table 6 - Status of RPO across Maharashtra

Licensees	RPO (4% quantified in MU)	RPO (MU)	Shortfall - (MU)	Actual Percentage Achieved	Penalty (Rs Crores)
MSEDCL	3058.073	2658.52	399.54	3.48 %	199.77
TATA Power	107.54	125.00	N/A	4.65 %	
REL	368.29	1.02	367.27	0.01 %	183.63
BEST	184.33	3.49	180.84	0.08 %	90.42
MPECS	24.04	0	24.04	0.00 %	12.020
Total	*3742.29*	*2788.044*	*954.24*	*2.98%*	*485.85*

Source: MERC

Role of FITs/tariff orders

Table 6 provides an analysis of the impact of sound regulatory framework on RET wise capacity added at the state level. The table maps the RET wise capacity addition with the tariff orders/FITs issued[9]. It is clear that almost all biomass and wind potential addition has been in states which have determined a FIT. In case of small hydro, nearly 83.4% of the capacity has been added in states which have issued a tariff order.

Table 7 – RET capacity added across states with tariff orders/FITs

RET	Number of states with potential of >100 MW	Number of these states with tariff orders	Percentage of capacity added across states with Tariff Orders
Small Hydro	25	24	14

[9] While this may be sufficient to indicate the importance of the state level regulatory framework on RE capacity addition, it is important to note that the MNRE determined tariff which was valid till 2004 may have played a significant role in this capacity addition.

Wind	10	9	10
Biomass	16	15	13

Source: MNRE, SERCs

Orissa makes an interesting case as far as the impact of the regulatory framework on RE investments is concerned. The state has a wind potential of 255 MW. The information on state-wise cumulative wind generation available from MNRE indicates that Orissa does not (perhaps barely) contribute to wind generation. Likewise for SHP, only 44.3 MW is installed against a potential of 295 MW. It is important to note that the state does not have a proper regulatory framework for these RETs.

While determination of FIT is one aspect of the regulatory framework, adequacy of this FIT is another important aspect to be addressed. TNERC, in May 2006, determined the FIT for wind as Rs 2.9/unit in 2006. This tariff was largely perceived as inadequate and is reflected in the pace of capacity addition of wind power in the state. While the state added 858 MW of wind capacity in FY 2005-06, capacity addition fell to 577 MW in FY 2006-07 and 381 MW in FY 2007-08[10]. TNERC, in March 2009, revised the FIT to Rs. 3.39/unit for windmills commissioned after April 1, 2009. Another case of inadequate FIT can be seen in AP. FIT determined by the Andhra Pradesh Electricity Regulatory Commission (APERC) in 2004 were ceiling tariffs. As a result, the discoms in AP were offering to procure power from RE projects at rates that were much lower than those prescribed by APERC. These tariffs, not being economically viable, several developers dropped their investment plans. Table 7 provides an overview of wind power capacity addition in AP to illustrate this point.

Table 8 – Year wise wind power capacity addition in Andhra Pradesh (in MW)

	2002-03	**2003-04**	**2004-05**	**2005-06**	**2006-07**	**2007-08**
Capacity addition	0.0	6.2	21.8	0.5	0.8	0

It has been seen that many SERCs tend to use proxies instead of working out tariffs in a cost-plus basis. For example, among the 9 SERCs that have issued tariff orders for solar PV based power generation, only 2 have provided details of the parameters used for determining the tariff (Chhattisgarh and Uttar Pradesh). Some SERCs have taken the tariff of other RE technologies in the state as a reference point and added the level of subsidy (as declared by MNRE) to arrive at the tariff for solar PV based IPPs (West Bengal). There are two issues here. Similarly, there are SERCs that have provided details of parameters used for determination of FIT of some other RETs. First, if the FIT does not reflect the underlying costs, no capacity addition will take place. Second, subsidies - where declared by MNRE – are payable for limited periods; beyond that the FIT will be inadequate.

Finally, many SERCs have determined FITs for limited periods. For instance, the West Bengal Electricity Regulatory Commission (WBERC) has prescribed FIT for five years from the date of regulations coming into force. This FIT is clearly inadequate given that the life of the power plants is 20 years, thereby giving rise to regulatory uncertainty and impacting the bankability of the project. For any project developer and lender, it is important that the project revenue stream is known in advance, at least for the period of debt servicing (10-12 years).

While CERC has issued regulations on the terms and conditions for determination of tariffs for different RETs, many states are yet to decide on adopting CERC tariffs. Many states and developers have argued that the tariff norms adopted by CERC are inadequate. For example, in case of solar projects, CERC does

[10] Most of the capacity addition in FY 2006-07 and FY 2007-08 would be those where installation started in earlier years. Capacity addition in future years would reflect the impact of TNERC's order. However, given the time to commissioning of wind projects, this may broadly reflect the impact of TNERC's order.

not distinguish between location/region or technology as far as PLF is concerned. In reality, the PLF would vary across locations/regions and technologies. This is also true of wind projects. Therefore, they have argued for a review of CERC's 'one size does not fit all' tariff framework.

The impact of regulation and FITs needs specific mention in case of SHPs. Almost all states determine cost plus tariffs for SHPs. As a result, to ensure high returns through high tariffs, developers have been pushing up capital cost or have not been allowing capital costs to decrease.

Third Party Sales through Open Access

Section 39 of the Act directs the State Government to set up a STU, which shall own the transmission network in the state and provide non-discriminatory Open Access (OA) to its network. Section 42 of the Act directs the discoms to provide non discriminatory OA to its distribution network to eligible customers on payment of wheeling charges and other applicable surcharges. This has been imbibed in the regulatory framework in many states.

However, state utilities are averse to allowing OA to RE sources. In fact, it has been seen in many cases that the distribution utilities are resenting export of RE power to other states and are trying to block OA to RE based generators with the intent of forcing them to sell this energy to the state utilities at dictated prices[11]**.** In some states, OA for RE generators is restricted to consumer categories with lower tariffs. For example, in Gujarat, though the wind power policy of the state allows third party sale (TPS) to any consumer in the state, in practice RE generators are allowed to sell power only to industrial consumers and not to commercial consumers. This is because commercial consumers have higher tariffs than industrial consumers and the state does not want to lose such high paying consumers to OA. In a case such as this, developers/investors have no incentives by way of profit margins to supply to industrial consumers.

Besides the above issue, states also restrict OA citing difficulty in scheduling due to the unpredictable nature of such generation. Further, even though RE generation can be predicted with 70%, utilities insist on predictability of generation with 90% probability. Another issue is the absence of firm policies or regulatory framework for wheeling charges for RE. The case of Madhya Pradesh as highlighted earlier is an example of the lack of regulatory certainty on wheeling charges for OA in case of RE. In case of SHP, TPS becomes unviable after taking into account wheeling charges and free power to the state government.

6.2 Institutional barriers

6.2.1 Inter-institutional coordination

Lack of coordination and cooperation within and between various ministries, agencies, institutes and other stakeholders delays and restricts the progress in RE development. A case in point is the implementation of the GBI announced for wind projects by the MNRE. IREDA started accepting applications from wind projects under the GBI scheme soon after the announcement of this scheme. However, the GoI has rejected applications that were made before the notification of the scheme through the gazette and is considering only application made after such notification. While this justification may hold ground in principle, in practice IREDA should not have started accepted applications before the notification through gazette. Such gaps in implementation of policies on account of absence of inter-institutional coordination reduce the faith of investors in the investment climate for RE.

[11] CERC's discussion paper on promotion of co-generation and generation of electricity from renewable sources of energy a discussion paper (may 2008)

6.2.2 Single window clearance system

Several states have adopted a single window project approval and clearance system for RE. These include Punjab, Himachal Pradesh, Haryana, Rajasthan and Uttarakhand. However, the effectiveness of this system is questionable. The issue is sometimes complicated by the fact that delays in obtaining clearances for projects awarded through competitive bidding (such as SHP) result in the levy of a penalty on the developer. It is understood that Punjab is one of few states where this system is robust as it sets a time bound target for getting all approvals (a time period of 60 days has been specified by Punjab) and RE developers to not have to follow up with different state government departments.

6.2.3 Pre-feasibility reports for hydro

It is well known that in most states, the state utility or a government owned entity entrusted with the responsibility of hydro power development in entrusted with the task of developing the Pre-feasibility Reports (PFR) for hydro projects. Several problems have been observed in this arrangement. First, the development of the PFR is not a big priority for many state utilities, thereby leading to a delay in the preparation of PFR and allocation of the project. Second, most of these entities undertake the development of PFRs using very conventional norms which do not incorporate possible innovations from the perspective of cost reduction or capacity enhancement. As a result, developers find it difficult to rely on the state nodal agency's PFR and have their own PFR developed. Development of PFRs may be a barrier for small and local developers seeking to implement such projects. Examples of this can be seen in Sikkim where Polyplex Industries was allocated 3 project sites of 40, 80 and 90 MW each. The developer was able to convert these into 3 projects of 100 MW each through better engineering.

6.3 Fiscal and financial barriers

6.3.1 Budgetary constraints

The GoI has announced BGI for wind, roof top PV and for solar power plants that do not qualify under the JNNSM and sell to the state utilities. However, the extent of fund allocation towards payment of such GBI remains to be seen. The budget for FY 2010-11 is awaited in this regard and would be an indicator of GoI's seriousness to this end.

6.3.2 Financing of RE projects

RE projects face several difficulties as far as financing is concerned. In general, the development of RE faces barriers in obtaining competitive forms of finance due to lack of familiarity and awareness of technologies, high risk perception, and uncertainties regarding resource assessment. These have been elaborated below:

- RE projects tend to have little or no fuel costs and, low operation and maintenance (O&M) costs but their initial unit capital costs tend to be much higher than fossil generation systems. The higher ratios of capital cost to O&M cost are significant because they indicate that these projects carry a disproportionately heavy initial burden that must be financed over the life of the project. This makes exposure to risk a long-term challenge (which also has policy and regulatory -risk implications).
- The risk of non-provision of subsidies on account of limited or non-availability of resources with the government is also significant since these subsidies may be the life-line of the project.
- The generally smaller nature of RE projects results in lower gross returns, even though the rate of return may be well within market standards of what is considered an attractive investment.
- Developers of RE projects are often small, independent and newly established developers who lack the institutional track record and financial inputs necessary to secure non-recourse project financing. Lenders therefore perceive them as being high risk and are reluctant to provide non-recourse project finance. They wish to see experienced construction contractors, suppliers with proven equipment, and experienced operators.

- Some RETs are newly commercial and are, subsequently, not widely known among lenders (although this is changing rapidly). This results in inaccurate perceptions of risk w.r.t these projects amongst lenders, thereby making financing difficult.
- The intermittent generation characteristics of RETs may place them in an unfavorable position regarding structuring of contracts for power transmission as compared to conventional power projects.
- For small and local developers seeking to implement RE projects, the lack of financial support for working capital requirements hinders O&M of the equipment.
- The development and operation of small-scale RE projects involves the same business and financial risks as any enterprise. Variability in earnings and therefore in returns to the equity investors does not enthuse many local entrepreneurs to get involved with such projects.
- The paperwork and soft costs associated with identifying and obtaining access to financing for small- and medium-scale RE projects is high relative to the financing needs.
- Issues relating to under performance or below par PLF and uncertainties inherent to such projects (like those on account of hydrology or wind pattern assumed at the time of financing) also pose a barrier to funding of projects.
- Since any delay in payments by off-taking state utility would directly impact debt serviceability, lenders often seek credit enhancement mechanisms such as Debt Service Reserve Account (DSRA) or Bank Guarantee (BG) which may be beyond the small and local developers' ability.
- Limited understanding/expertise on RE in the financial institutions also acts as a barrier to financing.

6.4 Market-related barriers

6.4.1 Level playing field for RE

The current structure of subsidies in the power sector is such that subsidies are effectively being provided to conventional fossil fuel resources. These give conventional fuels an unfair advantage over RE, thereby giving the impression that the difference between the price of conventional power and RE based power is too high.

6.4.2 Market for RE

The market for RE projects/products in India can be classified into four segments:

- Government market: where the government buys the output of the projects as a consumer, often providing budgetary support for it
- Government driven market: where the government pursues the use of RE in establishments outside its control for social reasons, often providing budgetary support or fiscal incentives for the same. For example, the government promotes the use of solar applications in schools, malls and hospitals.
- Loan market: where people take loans to finance RE based applications since self-financing is limited
- Cash market: where High Networth Individuals (HNI) can buy RE based applications for m,eeting personal energy needs

India is currently at an initial stage of the first two segments. The GoI is not focusing on promoting the third and fourth categories of RE, which may offer high potential for RE based applications.

6.4.3 Fuel costs for biomass

In case of biomass-based projects, unreliable biomass supply, non-existence of an organized fuel market and frequent price fluctuations threaten project viability. It was seen that in early 2000, the cost of biomass was nominal (Rs 300-400 per tonne) in most States. Over the years, the increase in demand of biomass for power generation as well as alternative uses has resulted in a demand-supply gap in this sector and resulted in spiraling biomass prices.

The type of biomass available differs from state to state and so do the alternative uses for biomass. For instance, in Andhra Pradesh, rice husk is used by the fisheries industry for packaging for export purposes. But by and large biomass is alternatively used by SME sector to replace the coal for heating (operating boilers), cattle fodder and household usage in rural areas. The availability of biomass and coal in a state determines the change in price of biomass. For example, in Chhattisgarh where coal is available in abundance and at no transportation cost, the degree of price elasticity for biomass is relatively very low in comparison to the coal. Not surprisingly, the price of biomass is at around Rs. 1615 per MT as compared to the coal price of Rs. 2100 per MT (including cost of transportation)[12]. On the other hand, due to their geographical location, northern states such as Punjab and Haryana, have a critical constrain of coal supply for small scale industry, therefore the demand and price elasticity of biomass is very high. The biomass price has reached up to Rs 3500 per ton in these states. It may be argued that the potential for biomass based power projects in both these states is significantly high. While that is true, the alternative usage of such biomass is also high. For instance, almost the entire quantity of wheat stalks collected is used as cattle fodder in both the states.

6.4.4 Inadequate market prices

The price of RE power is determined on a cost-plus basis with the objective of ensuring cost recovery for RE projects. Pricing does not reflect environmental costs, thereby masking the striking environmental advantages of the new and cleaner energy options. As a corollary, it can be said that undertaking life cycle assessment costs of fossil fuels and RETs would serve to reduce the gap between the price of fossil fuel based power and RE power.

6.4.5 Transmission network

Availability of evacuation infrastructure and grid integration are amongst the biggest problems affecting the development of RE projects, particularly SHP projects or wind projects that are located at remote locations with limited or no evacuation infrastructure. Though states are required to provide the infrastructure for evacuation of power from RE projects, in practice it is the RE developer who has to provide for such infrastructure. This has an impact on the cost of the project. Even where states provide evacuation infrastructure, such infrastructure is inadequate. In fact, instances of scaling down of RE projects due to inadequate evacuation infrastructure have come to light. For example, Sai Engineering's 20 MW project in Toos, Kullu (HP) was scaled down to 10 MW due to the absence of adequate evacuation infrastructure. Similarly, Tamil Nadu was in FY 2007-08 unable to utilize all power generated from wind due to lack of adequate evacuation capacity[13]. It had to consequently buy more expensive power from other states to meet its needs. The small size of many RE projects and seasonality of generation add another dimension to the problem as the size of the project does not adequately justify the economic viability for extending transmission lines for such projects. Nevertheless, the issue needs to be adequately addressed.

The development of evacuation infrastructure and provision of measures for connectivity to the grid for RE sources is considered the responsibility of the transmission utility. However, the distribution licensees also have a major role to play in evacuation of RE generation, as many RE sources are often connected at distribution voltages. The Forum of Regulators (FOR) has noted that barring few utilities, such as Maharashtra State Electricity Transmission Company Ltd. (MSETCL), Rajasthan Vidyut Prasaran Nigam (RVPN) and Himachal Pradesh State Electricity Board, others have not included evacuation infrastructure for RE as part of their overall transmission or distribution capex plans. Even for these utilities, lack of funds is a major issue in being able to realize such plans. It is also understood that utilities are not well aware with the transmission requirements for evacuation of RE based power.

[12] http://cserc.gov.in/pdf/25-2009-Interim.pdf

[13] It is understood that TNEB is addressing this problem now by development the requisite transmission network.

6.4.6 High equipment costs

It is generally believed that volumes and advancement in technology would drive down capital costs. However, this is not always true. Several examples exist to this end - the automobile sector being, perhaps, the best example. Similarly, it has been observed that the capital cost of even the commercially deployed RETs has not declined over the years, despite increasing capacity. On the contrary, it has been observed that developers or equipment providers have been quoting increasing capital costs over the last few years. For example, a trend analysis in terms of movement of capital cost for wind projects funded by IREDA for the period from the FY 2004-05 to FY 2008-09 indicates that the average capital cost has gone up from Rs. 4.79 Cr/MW to Rs. 5.76 Cr/MW[14]. Several reasons have been cited for this – the main ones being the huge demand supply gap due to exports, inadequate built up capacity in the Indian RE equipment industry and cartelization of equipment suppliers. As a result, the cost of power from these RETs remains high.

6.4.7 Inputs for RE plants

Many RE projects suffer from problems similar to those faced by conventional power plants. Wind and solar thermal projects require huge amounts of land. In addition to land, solar thermal also requires huge quantities of water. The absence of water in several states having high solar power potential such as Rajasthan may complicate the task of capacity addition.

6.4.8 Absence of serious developers for SHP

The SHP segment has seen several non-serious players who have primarily bid for projects or entered MoUs and got project allocations only to make short-terms gains through the sale of projects - post clearances - to the buyer who pays the largest premium to them.

6.5 Technological barriers

6.5.1 Technology risk

In case of many new RETs such as solar thermal, the risks related to technology are high. Since the technology is at a development stage, the risks remain are not clearly known. Further, even though the technology may have been deployed elsewhere in the work, the expected performance of such technology under Indian conditions not known. Moreover, the risk of technology obsolescence is high.

6.5.2 Absence of minimum standards

Some RETs are characterized by the lack minimum standards in terms of durability, reliability, performance, etc., thereby affecting their large scale commercialization.

6.5.3 R&D and manufacturing capabilities

One of the biggest problems confronting RETs such as solar is the high upfront cost of establishing a solar plant. Investments in R&D with the objective of cost reduction and scaling up of operations to utilize economies of scale have long been advocated as the solutions to these problems. Around the world companies and government backed research projects are engaged in advanced R&D and are continuously setting up bigger, more advanced manufacturing facilities. In India however, manufacturing facilities are only focused on replicating the existing technologies and are limited to small processing units. India's manufacturing capacity is about 700MW for PV modules as compared to facilities in countries like USA, China, Germany, Malaysia etc. capable of multi-giga watt production. India is relying on international suppliers for equipment as well as technology. However, there is no indigenous capacity/capability for solar thermal power projects.

[14] Explanatory Memorandum issued by CERC For Draft Terms and Conditions for determination of Tariff For Renewable Energy Sources, May 2009

6.5.4 Non-availability of local technology

In many cases, the technology or equipment is imported. This implies that spare and replacement parts when required may not necessarily be readily available especially in more remote locations.

6.6 Information barriers

6.6.1 Lack of skilled manpower

Lack of trained personnel for training, demonstration, maintenance and operations along with inadequate awareness and information programs for technology dissemination impedes renewable energy penetration. Experience indicates that subsequent to installation of RE projects/applications, no proper follow-up or assistance was available for their maintenance thereby impacting their working. The impression that has permeated from such experiences is that RE installations don't work.

6.6.2 Lack of information and awareness

General information and awareness in relation to new technologies and understanding the practical problems in implementing and maintaining RE projects is limited.

6. Review of select programmes/policies of GoI for promotion of RE

7.1 Jawaharlal Nehru National Solar Mission

As mentioned earlier, the JNNSM announced in November 2009 has brought about significant changes in the way solar power will be developed in the country. Key provisions of JNNSM are summarized in Box 1 (for more details, refer to Annexure IV). While the intent of the JNNSM is not under doubt, there are several issues that require greater clarity and further action. This section discusses the status of the key policy and regulatory actions being undertaken to implement the JNNSM and the concerns emerging therein.

7.1.1 *Status of implementation of JNNSM*

Solar Power Purchase Policy

The GoI has appointed NVVN as the Nodal Agency for purchase and sale of grid connected solar power under Phase -I of the JNNSM. The solar plants participating under the scheme have to be connected to the grid at 33 kV and above. For each MW of solar power procured by NVVN under a PPA, NVVN will be allocated an equivalent amount of capacity from the unallocated power of NTPC coal based stations. The tariff for the sale of this bundled power will be determined by CERC. In addition to this tariff, utilities will have to pay a facilitation charge to NVVN. MNRE and NVVN have estimated that the bundled power would be sold in the range of Rs. 5-5.50 per unit (see Figure 4). Since this price would be lower than the price of electricity purchased through the power market, discoms would be willing to buy this bundled power (See Table 8). Prima facie, this seems to be a good solution. By purchasing this bundled power, states/discoms would get thermal power to meet some amount of the power shortage faced by them. At the same time, they would be able to meet their RPO.

Box 1: Salient features of JNNSM

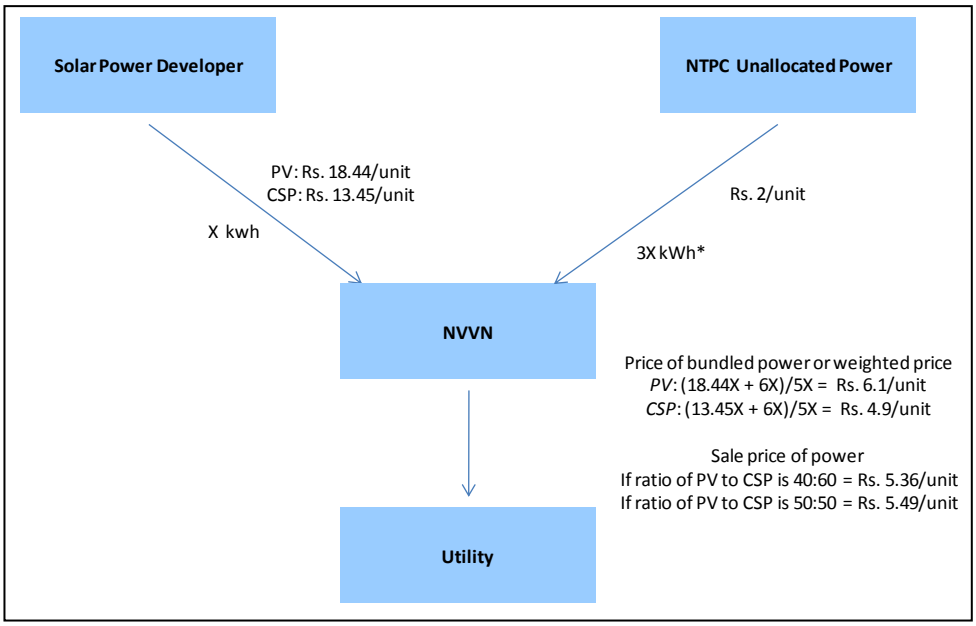
- Achieving installed capacity of 20,000 MW in a phased manner by the end of the 13th Five Year Plan in 2022

Phases	*Target for grid solar power including roof top*	*Target for off grid solar applications*
Phase I (2010-13)	1000 – 2000 MW	200 MW
Phase II (2013-17)	4000 MW (10,000 MW based on enhanced international finance & technology transfer)	1000 MW
Phase III (2017-22)	20,000 MW	2000 MW

- Demonstration projects focused on CSP in Phase I
  - 50-100 MW Solar thermal plant with 4-6 hours' storage (which can meet both morning and evening peak loads and double plant load factor up to 40%)
  - A 100-MW capacity parabolic trough technology based solar thermal plant
  - A 100-150 MW Solar hybrid plant with coal, gas or bio-mass to address variability and space-constraints
  - 20-50 MW solar plants with/without storage, based on central receiver technology with molten salt/steam as the working fluid and other emerging technologies

- Shift away from GBI based framework to one that relies on reducing the cost of delivered solar power for grid-connected solar projects
  - NTPC Vidyut Vyapar Nigam (NVVN) to purchase power the 1,000 MW solar power (connected to 33 KV or more grid) planned in Phase I
  - GoI to allot another 1,000 MW capacity of thermal power from unallocated quota of NTPC stations i.e. from power available under GoI's discretion to allocate to states that are in shortage
  - NVVN to bundle this power and sell it at a rate determined by CERC
- Solar specific RPO to be fixed for states after modification of the National Tariff Policy 2006 – RPO may start with 0.25% in Phase I and increase to 3% by 2022
- Provision of a GBI to rooftop solar PV and other small solar power plants connected to LT/11 KV grid
  - GBI rate: tariff fixed by CERC minus notional tariff of Rs. 5.5 per unit, with 3% annual escalation
- Provisions for technology development, fiscal incentives, indigenization requirement and human resource development

Figure 4: Bundling mechanism for sale of solar power under JNNSM



* Given the higher capacity factors of coal based generation
For illustration purposes only

MNRE and NVVN are in the process of devising guidelines for the implementation of this policy. Two distinct schemes have been devised: a Migration Scheme for existing projects i.e. Solar Power Developers (SPDs) who have already initiated definite process of setting up solar power plants and have made arrangements for sale of power to utilities and a scheme for new projects i.e. SPDs approaching with new proposals for setting up solar power projects. The time frame for the signing of PPAs and power sale agreements (PSAs) under both schemes is indicated in Figures 5 and 6 and the minimum requirements for SPDs to qualify under the schemes is listed in Table 8. It is important to note that out of the 1000 MW proposed to be developed under this route, 250 MW will be contributed by NTPC from its proposed solar thermal plants at Anta and Suratgarh.

Figure 5: Time frame for completion of Migration Scheme under solar power purchase policy of JNNSM

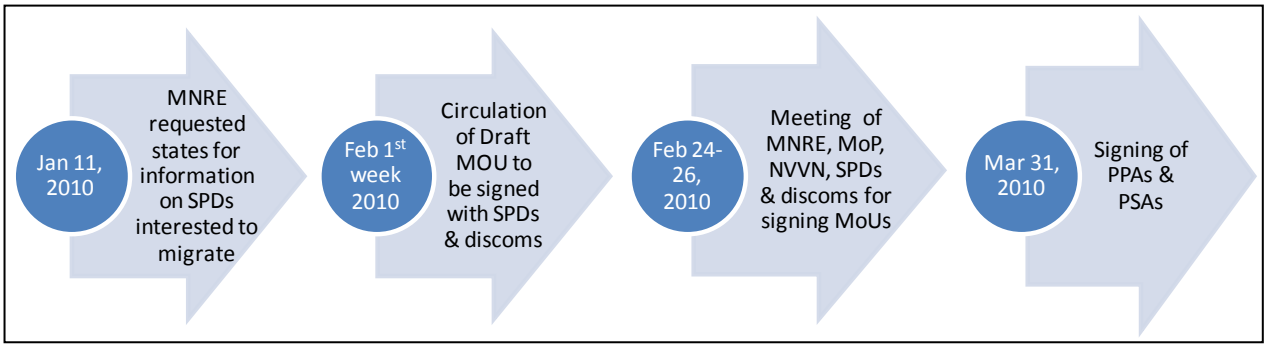


Figure 6: Time frame for completion of scheme for new projects under solar power purchase policy of JNNSM

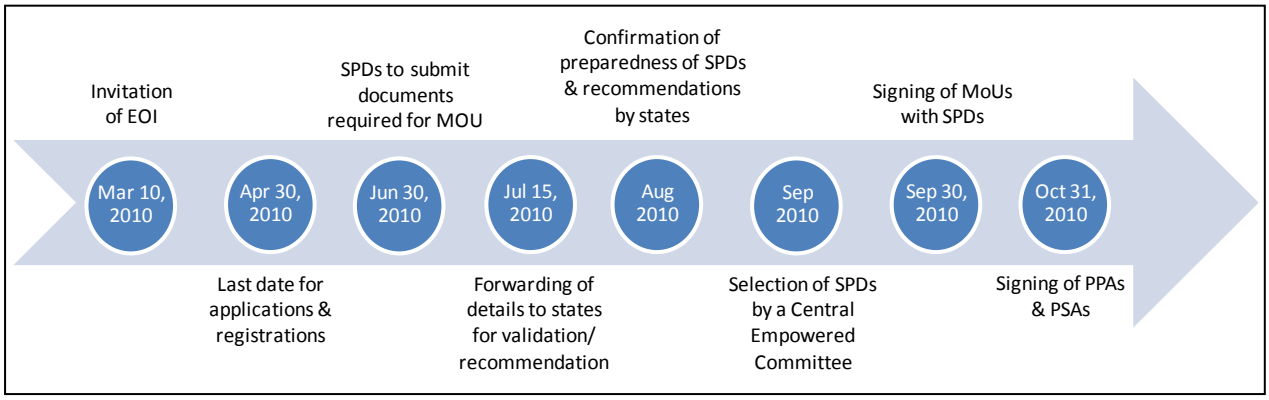


Table 8 – Salient features of the schemes proposed under the solar power purchase policy of JNNSM

	Migration scheme	Scheme for new projects
Minimum qualification requirement for SPDs	-	- Net worth of the SPD for the past three years (level to be determined) - Turn-over of SPD for the past three years (level to be determined) - Technical requirement (to be determined) - Confirmation for plant CoD to be on or before March 31, 2013
Criteria for participation under the scheme	- Clear title and possession of land (say @ approx. two hectares/MW) - Approval from STU for evacuating power to the grid at 33 kV and above - Confirmation from concerned states/discoms for purchase of all the power from the solar power plant through NVVN - Necessary water linkage from the concerned State Authorities (for CSP plants) - Letters of comfort for funding the project - Bank Guarantee @ Rs. 50 Lac per MW to NVVN, out of which Rs. 25 Lac per MW to be given at the time of signing of MOU & balance Rs. 25 Lac per MW to be given at the time of signing of PPA - No change in equity holding permitted from MOU signing till PPA execution	- Confirmation from STU for evacuating power to the grid at 33 kV and above - Availability of statutory and other clearances as applicable - Complete Detailed Project Report - Letter of comfort for Equity/Debt from Promoter(s) /Financial Institution(s) - Letter of confirmation from the State Authority regarding identification/ notification/allotment of land for setting up of the solar power plant - Necessary water linkage from the concerned State Authorities (for CSP plants) - Submission of Bank Guarantee (to be determined) - No change in equity holding permitted from MOU signing till PPA execution
Features of PPA with SPDs	- PPAs to be the same as that signed with discoms	- PPA for 25 years as per CERC regulations - Tariff to be determined by CERC - SPD to deliver power at 33 KV or above substation of discom / STU - Discoms to bear transmission charges, losses, RLDC/SLDC charges, scheduling charges or any other charges for supply of solar power beyond delivery point - Billing & Payment cycle as per Energy Accounts issued by RPC/SLDC - Scheduling of power as per Indian Electricity Grid Code - NVVN to establish irrevocable revolving Letter of Credit in favour of SPD prior to commencement of electricity supply from the plant - Payment Security Mechanism as per Tri Partite Agreement and open irrevocable revolving Letter of Credit - Aggregate share holding of Promoter not to go below 51% for 3 years after COD. Any reduction thereafter to be approved by NVVN

Generation Based Incentive

Under the JNNSM, GBI is available to solar PV installed on residential rooftops; and commercial, institutional, industrial & other rooftops; as well as to tail-end grid connected projects. The payment of GBI to these installations will be made by utilities on net metering basis and the GBI will be paid/reimbursed to utilities by the GoI through IREDA. The duration of the PPA to be signed between the establishments deploying rooftop PV and the utilities would be determined by the SERCs. The SERCs are also required to formulate guidelines/regulations for the metering and billing arrangements between the utility and the rooftop PV operator. It is learnt that the FOR is formulating standardized billing and payment guidelines in this regard. The FOR is also preparing a Model PPA which would be issued to the utilities by March 2010. The Central Electricity Authority (CEA) is in the process of issuing technical guidelines for the connection of such installations with the grid.

Technology to be promoted

In case of the scheme for new projects under the Solar Power Purchase Policy, the ratio of Solar PV to Concentrated Solar Power (CSP) or Solar Thermal is proposed at 40:60.

Demonstration Projects

The MNRE aims to set up these projects through the competitive bidding route. The Power Finance Corporation (PFC) is preparing bid documents for award of these projects and the bidding is expected to be initiated by the end of 2010.

7.1.2 Key concerns on JNNSM

While the objectives of JNNSM are laudable and so is the GoI's intention and efforts towards its implementation, there are several concerns that need to be addressed to ensure its smooth implementation. These concerns are as follows:

- The target of 20,000 MW under the JNNSM appears unrealistic given the domestic capability for solar projects, technology risks associated with solar energy and financial implications of the target. Further, the JNNSM does not provide concrete plans on the manner in which the target of 4000 MW would be scaled to 10,000 MW at the end of 12th plan.
- What should be the appropriate technical and financial criteria for qualification of SPDs under the scheme for new projects in the Solar Power Purchase Policy? The GoI is keen to encourage only serious players to come forward under this scheme and is therefore contemplating rigid qualification criteria. This may however be detrimental for smaller players who may have genuine intent as well as the ability to set up projects.
- Some developers have proposed the setting up of projects in smaller areas of land than that being contemplated by GoI. For example, while GoI is considering land requirement of approx. two hectares/MW, some developers have come forward with proposals involving land requirement of 1.2 hectares/MW. Lower land requirement translates into lower time of land acquisition and therefore faster project implementation. The question therefore is how the GoI should choose developers who propose projects with lower land requirements.
- Several developers have expressed concern over the GoI's focus on solar thermal in the first phase JNNSM. It has been argued that the GoI is ignoring global trends which indicate that solar thermal is a new and still to be commercialized technology. However, some experts don't subscribe to this. They assert that the solar thermal technology is in no way new or unproven. Another argument against the focus on solar thermal is the long time frame for commissioning of solar thermal projects. This has an implication in commissioning solar thermal plants by 2013 to meet the targets of the first phase of JNNSM. Therefore, there is a need for GoI to back its focus on solar thermal with adequate evidence.
- The time frame proposed for the application and registration of new projects under the scheme for new projects in the solar power purchase policy is aggressive. This is also significant in light of the proposed conditions of the PPA which state that the aggregate share holding of promoter has to be

more than 51% for 3 years after COD. Given the small time given for making applications under the scheme, developers who are not able to meet the qualification requirements may tie-up with anyone meeting these requirements to ensure qualification. However, this may become a problem in view of the PPA's conditions. Moreover, bringing in a serious investor or partner may become difficult. Therefore, there is a need to examine the proposed time frame.

- Though the mission lays a lot of thrust on R&D, the R&D strategy may actually take a long time to finalize. The GoI must set a time frame for the setting up of the high level Research Council described in the Mission, the development of the technology roadmap by them to achieve more rapid technological innovation and cost reduction, and the establishment of the National Centre of Excellence (NCE) to implement the technology roadmap.
- Another aspect where the Mission is weak is the scaling up of R&D demonstration projects or pilots to the commercialization stage. The Mission talks about funding support from the NCE for performance-linked solar R&D programmes including such demonstration projects. However, it remains silent on the support required to take projects or R&D to commercialization stages. Such support is important in keeping with the past experience of demonstrations projects in RE in India where a number of pilot projects have been undertaken but have not been pursued further.
- The implementation of the Mission may also face barriers because of the absence of the solar supply chain in India. There are no manufacturers for silicon, crystals and wafers in the country and limited number of equipment suppliers for cells (this is true even globally). The quality of equipment is often inconsistent due to the absence of industry standards and the spares are expensive. In case of roof top PV, the lead time for supply of balance of supply (BOS) materials such as inverters is very high. These problems are compounded by the absence of local service capability. While the Mission focuses on the creation of local capacity to build technically qualified manpower, interventions such as creation of a supply chain are weak.
- The issues related to land acquisition for solar thermal projects would be the same as those for any conventional power project. Unless the issues surrounding land acquisition are addressed in the overall context of infrastructure projects, it is unlikely that the capacity addition targeted for the first phase would be met.
- The Mission does not provide any incentive to states to enable speedy implementation. The only perceptible role for states is provision of land, water, provision of infrastructure for evacuation of power from solar projects. No clarity has been provided and no mechanism spelt out on the manner in which power purchased under the solar power purchase policy by NVVN would be allocated to states. Certainty in this regard is crucial for states as they would be required to meet solar RPOs determined by SERCs going forward. A related issue here is the migration of existing projects to the solar power purchase policy. Developers are concerned that in the absence of clarity on allocation of power by NVVN, states may not allow them to migrate under this policy. It may be argued that in the event of shortage in procurement of solar power, states can fulfill their RPOs by purchase of solar RECs. But the uncertainty in the level of RPOs in future, quantum of RECs generated and price of RECs poses a barrier here.
- The Mission only recommends the provision of fiscal incentives from the Ministry of Finance (MoF) in the form of custom duties and excise duties concessions/exemptions on specific capital equipment, critical materials, components and project imports. There is no commitment from the MoF to this end. This issue is critical for developers in light of the deadline for application and registration of new projects proposed by MNRE and NVVN.
- The Mission proposes the creation of a single window clearance mechanism for solar power projects. However, states as well as CERC have opined that provision of single window clearance is difficult
- Increased RPOs for solar energy would imply the need to increase consumer tariffs which may be difficult for most utilities. It may be argued that the share of solar energy in the total power purchased by a state utility would be relatively low and therefore should not have a significant impact on consumer tariff. However, in a scenario where state regulators and utilities increasingly find it

difficult to make any tariff hikes, they would find it difficult to pass on even the smallest impact of increased solar RPOs to consumers.

- The availability of transmission infrastructure to evacuate and transmit power that would be generated if the planned capacity addition materializes is suspect.
- The Mission provides for GBI for roof top PV. The extent of GBI has been linked to the tariff to be determined by CERC. However, there is no mention of the time frame for which this GBI would be provided. Further, this GBI would be routed through the state utilities. The intention of utilities towards this end is suspect. The absence of a regulatory framework for roof top PV at the state level is also a cause of concern. Unless states are active and issue regulations enabling roof top PV in line with the guidelines issued by FOR, the deployment of roof top PV would not see progress.

Finally, an issue that is of concern is that projects that do not qualify under the solar power purchase policy will have to supply directly to state utilities. Even though the GoI has stated that GBI would be available to these projects as per the GBI scheme announced by GOI before the announcement of the JNNSM (see Annexure II), developers are concerned about the poor payment security mechanism made available by state utilities as well as the financial viability of utilities.

7.2 GBI for wind

As indicated in Annexure II, MNRE is providing GBI to grid-connected wind power projects@ Rs. 0.50/unit for a period not less than 4 years and a maximum period of 10 years in parallel with accelerated depreciation on a mutually exclusive manner, with a cap of Rs. 62 lakhs/MW. However, GBI will be provided only to wind projects selling power to state utilities as well as captive wind power projects. Projects undertaking TPS by way of merchant power or open access are excluded from the purview of the scheme. The GoI should reconsider the exclusion of projects undertaking TPS as TPS would enable the expansion of the wind power market.

7. Recommendations

Policy

- GoI must formulate a comprehensive policy or action plan for all-round development of the sector, encompassing all the key aspects. The action plan should be prepared in consultation with the State Governments. It is understood that the Energy Coordination Committee of GoI has approved the preparation of an umbrella RE law to provide a comprehensive legislative framework for all types of RETs, their usage and promotion. However, GoI has fixed no timeframe for the formulation and enactment of such a law. The GoI must speed-up this task and ensure that the desired law be enacted expeditiously.
- Must Run Status for RE – GoI should accord a 'Must Run Status' for RE based power to ensure effective utilization of this power. CERC - under the (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009 - has determined that all RE plants except for biomass power plants with installed capacity of 10 MW and above, and non-fossil fuel based cogeneration plants shall be treated as 'must run' power plants and shall not be subjected to 'merit order despatch' principles. To ensure that states adopt this provision in their regulatory framework, a statement to this effect in a comprehensive policy for RE by GoI would be more effective.
- States must be encouraged to remove policy and regulatory uncertainty surrounding RE. They must be encouraged to identify their thrust areas as far as RE development is concerned. Punjab is a good example here. The NRSE Policy of the state clearly specifies the objective, targets, thrust areas and measures to achieve the targets. It also provides short and long term targets for the RE sector in the state. Gujarat is another example. The state government has identified wind and solar power as its thrust area. In case of biomass, states must be encouraged to have clear policies on the radius for setting up biomass plants. Strict adherence to such a policy must be encouraged in order to ensure the viability of biomass projects.

- Provision of GBI may be considered for SHPs as well. The tariff determined by CERC with normative capital cost may be adopted for this purpose.
- In case of solar thermal, a UMPP-like mechanism may be adopted for the award of projects. A special purpose vehicle (SPV) may be set-up for a project wherein this SPV is responsible for all initial project activities including the acquisition of land, obtaining clearances, preparation of DPRs, tying up of basic facilities required for the implementation of the project etc. before handing over the project to a selected developer.
- In case of biomass projects, developers must be encouraged to involve the farming or fuel supply community by providing them a share in the revenues earned from the project.
- There is a need for stronger initiatives at local body levels for the promotion of RE. For example, local bodies must be discouraged from granting municipal approvals for commercial building in urban areas unless it houses a solar application. Solar installations should be a pre-condition for a power connection from the utility.
- The commercial success of RETs depends significantly on adoption and enforcement of appropriate standards and codes. GoI must prescribe minimum performance standards in terms of durability, reliability, and performance for different RETs to ensure greater market penetration.

Regulatory

- As discussed earlier, only 16 states have notified RPO. States must be mandated to set RPO targets in a defined time-frame failing which the CERC may be given the task of determining the RPO for them.
- There is an urgent need for clarity on the RPO framework. It may be better to specify the overall RPO percentage rather than technology-specific percentages. This in turn would encourage investments in RE on the basis of techno-economic analysis. Further, there should be no cap on RPO.
- RPO must be levied on OA and captive consumers as well.
- For RPO to be effective and their objectives to be met, it is imperative that an enforcement mechanism be introduced in all states.
- SERCs must monitor the compliance of RE obligation through the ARR/Tariff approval process. Further, SERCs must consider monitoring compliance with RPO, subject to availability of energy from renewable sources (not restricted to the state), by invoking sections 142 and 146 of EA 03 against the responsible officer of the utility.
- Suitable incentives should be devised to encourage utilities to procure RE power over and above the RPO mandated by the SERC.
- SERCs may amend the license for power distribution should be amended to include fulfillment of RPO. This would imply that non-fulfilment of RPO would be treated as violation of license conditions and would attract suitable actions under EA 03.
- A number of states (such as Maharashtra, Gujarat, Madhya Pradesh and Karnataka) do not allow the procurement of RE power from outside the state. This puts an artificial barrier in the way of RE power generation and investment across the country. Instead, regulators can identify ways and means of selling this power to neighbouring states short on RE resources or RPO at a mutually agreed upon rate.
- All state governments/SERCs may consider concessional transmission on RE being sold within the State.
- CERC has issued tariff guidelines covering critical aspects related to renewable energy sources from long term perspective of harnessing of available renewable energy potential. These guidelines provide clarity on each component of the FIT for different RETs as well as the useful life of different RETs. The control period for these guidelines is three years. States must align their FITs to the provisions of these guidelines.

Transmission Requirements

- Grid connectivity to RE generation should be provided by STUs through their capex plans that are approved by the SERCs. Transmission system plans prepared by STUs should cover evacuation and transmission infrastructure requirements for RE sources.
- There is a need to provide funds and capacity to STUs for this purpose.
- STUs should also bee made accountable and penalized if fail to fulfill this responsible. A possible penalty mechanism is this regard can be making the STU responsible for deemed generation if evacuation is not in place by the time of commissioning of the projects. This mechanism has been adopted in Himachal Pradesh.
- There is a need to establish specific norms for grid connectivity for RE projects. SERCs can take this up under section 86(1) (e) of EA 2003. However, since these aspects would need to be addressed as part of the larger issue of grid standards and standards for construction of transmission lines, the CEA may undertake this exercise under sections 34 and 73(b) of EA 03.
- There is a much stronger need for co-ordination and consultation between the STU and the nodal agency responsible for development of RE at the state level for the development of transmission infrastructure for RE projects that are in the process of being allotted or development or are likely to be bid out in the near future.

Fiscal incentives

- GoI may consider fiscal incentives in the form on excise and customs duty reduction/exemption for RE equipment

Financing of RE

- In order to increase the availability of funds for RE projects, GoI may consider mandating insurance companies and provident funds to invest 10% of their portfolio into RE. Such investments, in fact make business sense for the insurance companies. RE, given its benefits, will cause less damage to the environment and human health thereby implying a lower risk of insurance payouts for these companies.
- RE should be declared as a priority sector. At present the priority sector broadly comprises agriculture, small scale industries and other activities / borrowers (such as small business, retail trade, small transport operators, professional and self employed persons, housing, education loans, microcredit etc.). The inclusion of RE in priority sectors will increase the availability of credit to this sector and lead to larger participation by commercial banks in this sector.
- GoI should ask banks to allow an interest rebate on home loans if the owner of the house is installing a RE application such as solar water heater, solar lights or PV panel. This would incentivize people to integrate RE applications into their home, thereby encouraging the use of RE. The rebate could vary depending on the number of applications installed or the type of installations installed.
- GoI may consider allowing a higher exemption on the rate of interest of home loans under income tax rebates for indivuals who install RE applications in their homes. Once again, the extent of rebate could vary depending on the number of applications installed or the type of installations installed.

Manufacturing

- To achieve low cost manufacturing and therefore lower capital costs, and to capitalize on its inherent advantages in the solar sector, India needs to consider revamping and upgrading its solar R&D and manufacturing capabilities. In this regard, GoI may consider promoting a core company to produce wafer and silicon. This will enable substantial reduction in the costs of solar technologies.
- Given the continuing high capital costs of even the commercially deployed RETs despite increasing capacity, there is an urgent need to encourage price reduced capital cost manufacturing through policy.

Development of a fuel cost adjustment methodology for biomass projects

In a scenario of fixed FIT, the volatility in biomass prices suppresses the plant load factor (PLF) of power plants. Though many SERCs have revised the FIT and would do so in future, they may consider putting in place a fuel cost adjustment methodology to pass though any increases in fuel costs in tariff as has been done in the case of coal based plants.

CERC - under the (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009 - has specified the price of biomass and bagasse for different states and determined a fuel price indexing mechanism. It has also provided the option of normative escalation of 5% per annum for each subsequent year of the three year control period. SERCs need to adopt this approach. Such fuel cost adjustment in tariff will however need a strong institutional set-up for monitoring the price of biomass as well as the costs of its collection, transport and storage.

Better location analysis for biomass projects

In order to achieve continuous and reliable fuel supply for biomass plants, their location must be optimized. State nodal agencies must therefore, develop a plan for development of biomass projects indicating the number and location of such plants by considering the total biomass potential available in each district, the density of such availability and potential collection centres.

Capacity building and information dissemination

- There is an urgent need for technical assistance programs designed to increase the planning skills and understanding of RETs by utilities, regulators, local and municipal administrations, and other institutions involved.
- Information specific to viable RETs needs to be made easily accessible both to increase general awareness and acceptability as well as to aid potential investors and sponsors of such projects.
- Capacity building initiatives should be undertaken to train people/workers to operate, and maintain RE facilities
- There is a need to improve the maintenance support mechanism for RE products/plants for redressing the post-installation problem faced by the users. For RE plants, the after sales service network can be strengthened by encouraging the setting up of service centers by the manufacturers which are involved in the supply of the systems. For RE applications, the same can be done through the Akshaya Urja shops.

- **Annexure I: Provisions for development of RE under Electricity Act 2003 and policies issued therein**

Electricity Act 2003

The EA 03 has following provisions for promotion and development of RE:

- **Section 3(1)** requires GoI prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power systems based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and RE.
- **Section 61(h)** requires electricity regulatory commissions (ERCs) to consider the promotion of co-generation and generation of electricity from RE when determining the terms and conditions for the determination of tariff in their jurisdictions.
- **Section 86** promotes RE by ensuring grid connectivity and sale of renewable electricity. It mandates SERCs to promote cogeneration and generation of electricity from RE by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee (discoms)

National Electricity Policy

The NEP was notified by GoI in February 2005 as per provisions of Section 3 of EA 03. Clause 5.12 of NEP contains several conditions in respect of promotion of RE. The salient features of the said provisions of NEP are as follows:

- **Clause 5.12.1** targets the reduction in capital costs of RETs and identifies competition as one of the means for such reduction. It also specifies the need for adequate promotional measures for development of RETs and their sustained growth.
- **Clause 5.12.2** requires SERCs to determine tariffs for purchase of power from RE by discoms (until RE can compete with conventional sources in terms of cost), specifying percentages that progressively increase the share of electricity purchased by discoms from renewable sources.
- **Clause 5.12.3** highlights the benefits of cogeneration and promotes its use by suggesting that SERCs promote arrangements between a co-generator and a discom for purchase of surplus power from such plants.
- **Clause 5.2.20** states that efforts will be made to encourage private sector participation through suitable promotional measures to increase the overall share of non-conventional energy sources in the electricity mix.

Tariff Policy

The National Tariff Policy (NTP) was notified by GoI in January 2006 as per provisions of Section 3 of EA 03. This policy has further elaborated the role of regulatory commissions, mechanism for promoting harnessing of renewable energy and timeframe for implementation etc. The salient features of NTP with regard to RE are as follows:

- SERCs to specify minimum percentages for electricity to be purchased from RE sources by April 1, 2006.
- Future procurement of RE by discoms to be done, as far as possible, through competitive bidding process (as specified under Section 63 of EA 03) within suppliers offering energy from same type of RE sources.
- GoI to lay down guidelines within three months for pricing non-firm power, especially from RE sources, to be followed in cases where such procurement is not through competitive bidding.

Annexure II: Policy interventions for promotion of RE

Fiscal Incentives

- Capital subsidy: The MNRE has been running several capital subsidy programmes. These subsidies are provided on installation of the equipment; they are not linked to the use or performance of the equipment.

- Interest subsidy: The GoI has been providing subsidies in the form of reduction in the interest rate for financing installation of equipment. Currently, interest subsidy is available to end users of solar thermal programme, for both domestic and commercial applications.

- Direct Tax benefits: The GoI has offered a 10 year tax holiday under section 80 IA of the Income Tax Act for all RE projects including solar. It also has a scheme for accelerated depreciation under which tax savings can be claimed against investments in solar up to 80% of the asset value starting from year 1.

- In-direct tax benefits: Indirect tax benefits such as reduction or exemption of electricity duty (ED), VAT, octroi or other local taxes have been used as an instrument by state governments for reducing the price the consumer pays for using RE based power including solar. States such as Madhya Pradesh and Punjab have exempted such projects from the payment of VAT and octroi or other local taxes. Others such as Gujarat and Madhya Pradesh (MP) have exempted consumption of electricity generated by solar power projects from payment of ED. In case of MP, the exemption of electricity duty and cess is applicable for the first five years of the project. In Rajasthan, consumption of electricity generated by solar power projects for captive use or for sale to a nominated third party attracts reduced ED (50% of ED that would otherwise be applicable) for a period of 7 years from the date of commissioning of the project.

Production subsidies

The MNRE introduced Generation Based Incentives (GBI) to back up the feed-in tariffs for grid-connected solar and wind power in 2008. GBI is an attempt to change the nature of the RE industry India, especially wind. Till now wind investors primarily included Indian corporations or individuals who could off set their income tax liabilities by investing in wind or solar through accelerated depreciation. However few foreign firms or Independent Power Producers (IPPs) found this market attractive on account of limited or no income tax to off set. Brief descriptions of the GBI schemes are provided below.

<u>GBI in solar</u>

Prior to the announcement of JNNSM, the GoI had announced the provision of GBI for grid interactive solar projects up to a maximum capacity up to 50 MW (including solar photovoltaic as well as solar thermal power generation) during the 11^{th} plan period subject to minimum installed capacity of one MW per plant. Under the scheme, a maximum cumulative capacity of 10 MWp of solar PV power generation projects and 10 MW of solar thermal power generation projects could be set up in a State. The scheme envisaged provision of GBI of a maximum of Rs. 12/unit for solar PV and Rs. 10/unit for solar thermal after taking in account the per unit power purchase rate provided by the SERC or utility for that project. The GBI for a project would be determined after deducting the power purchase rate offered by the utility under the PPA from a notional amount of Rs. 15/unit for solar PV and Rs. 13/unit for solar thermal projects. The power generation plant is to be commissioned by December 31, 2009 after which the incentive will reduce by 5% and the ceiling rate for the incentive would become Rs. 11.40/unit for solar PV and Rs. 9.50/unit for solar thermal projects.

GBI in wind

Under this scheme, the MNRE is providing GBI to grid-connected wind power projects@ Rs. 0.50/unit for a period not less than 4 years and a maximum period of 10 years in parallel with accelerated depreciation on a mutually exclusive manner, with a cap of Rs. 62 lakhs/MW. This implies that companies can avail either accelerated depreciation or GBI, but not both. Once a company has opted for one benefit, it cannot change the option later. The total disbursement in a year will not exceed one fourth of the maximum limit of the incentive i.e. Rs.15.50 lakhs/MW during the first four years. The scheme will be applicable to a maximum capacity limited to 4000 MW during the remaining period of 11th FYP. The provision of GBI will continue till the end of 11th FYP.

The GBI will cover wind projects selling power to state utilities as well as captive wind power projects. But projects undertaking third party sale by way of merchant power or open access are excluded from the purview of the scheme.

State specific policies for promotion of RE

A number of state governments (Karnataka, Punjab, Rajasthan, and Madhya Pradesh to name a few) have introduced state level policies for the promotion of RE. Some have issued policies specific to certain RETs. Gujarat and Maharashtra are a case in point with Gujarat having issued policies specific to wind and solar energy and Maharashtra having issued policies for wind, waste to Energy and cogen. The state policies encourage investments in RE through measures such as single window clearance system, creation of green energy funds, streamlined procedures for allocation of RE projects and project sites, other incentives such as relaxation in state taxes etc.

RE funds

In an effort to promote investment in RE, states like Maharashtra and Rajasthan have created Green Funds for providing soft loans for RE technologies. The Maharashtra Energy Development Agency (MEDA) has created a Clean Energy Fund by taxing conventional energy sources (see Box 2). In case of Rajasthan, the Rajasthan Electricity Regulatory Commission has determined that any short fall to meet the RE obligation by the distribution licensees, open access consumers and captive power users involves the payment of a RE surcharge to the State Transmission Utility (STU). The RE surcharge will be as notified by RERC from time to time. This surcharge collected by STU is credited to a fund to be utilized for creation of transmission system infrastructure of RE based power plants. The state of Madhya Pradesh is also in the process of setting up a green energy fund. The fund would be financed through the cess collected from power consumers within the state.

Box 2: Urjankur Nidhi Fund in Maharashtra

The Government of Maharashtra along with the Infrastructure Leasing & Financial Services (IL & FS) have jointly promoted the Urjankur Nidhi Trust Fund to promote non-conventional energy projects in Maharashtra. This fund would develop and take up equity in RE projects.

The fund has a corpus of Rs 418 crores of which Rs. 218 crores would be contributed by the Government of Maharashtra. This fund would be replenished through the imposition of a green cess of of 4 paisa/unit on industrial and commercial power consumers in Maharashtra. The other 200 crores would be contributed by private institutional investors.

The fund would initially promote bagasse based cogeneration power projects which have a significant potential in Maharashtra. These projects will be developed, implemented and operated through separate Special Purpose Vehicle (SPV) on BOOT basis and the Urjankur Nidhi Fund along with financial institutions and private investors will take up equity in the SPV. The Trust has identified nearly 18 sugar factories and three of these sugar factories have already entered into project development agreement with the Trust.

The trust would provide financial support in the form of equity with maximum support per project of up to 20% of the Project Cost or 20% of the Corpus, whichever is lower. The fund will also provide crucial support functions during project development, project management and distribution of resulting power.

Source - MEDA

Demonstration programmes

- Tailend Grid Connected Solar Power Generation: The tail ends of the grid in rural areas experience voltage drops and power outages. A solar PV plant connected at the tail end of the grid can provide power there and also improve the quality of power in the grid. In order to meet these objectives, the MNRE started a new demonstration programme, permitting utilities, generation companies and state nodal agencies to set up grid connected solar PV plants of 25 kW to 1,000 kWp capacity. MNRE provides support of 50% of the basic cost of the plant, subject to a maximum of Rs.10 crore per MWp. The support will be available to set up 4 MWp aggregate capacity projects in the country during the 11^{th} plan period.
- Wind power: About 26 project sites have been developed in states with high potential for wind power under the Demonstration Programme to establish technological viability of wind farms, resulting in the establishment of around 57 MW of capacity.

Others

- Use of Solar Water Heating Systems in buildings: The GoI has been promoting solar water heating systems (SWHS). However, implementation of the scheme is tedious as several authorities are involved in implementation of any scheme involving SWHS. First, the states have to issue orders to the municipalities within the state on making the SWHS compulsory. As of date, thirteen states and two union territories have issued orders making installation of the SWHS mandatory in certain categories of new buildings. The states are Andhra Pradesh, Chhattisgarh, Delhi, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Nagaland, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and Uttarakhand, the union territories being Chandigarh and Dadra and Nagar Haveli.

Annexure III: Regulatory framework for RE

Renewable Purchase Obligations

Section 86(1)(e) of the Electricity Act 2003 (EA 03) empowers SERCs to specify the percentage of electricity to be procured by the obligated entities (distribution licensees, open access consumers and captive power users) from the RE sources. Accordingly many SERCs have issued Orders/Regulations specifying such percentages. This percentage is referred to as Renewable Purchase Obligation (RPO). At present, 17 SERCs have notified RPO targets for their respective states. Most states have remained technology neutral while specifying these RPOs. But few such as Rajasthan, Madhya Pradesh, Karnataka and Chhattisgarh have specified RPOs from individual RE sources. While most states have advocated a RPO between 1 % and 5 %, MP has advocated a 10% RPO. Moreover, the states of Karnataka and Rajasthan have specified a maximum cap for RE based procurement. Table 9 provides an overview of the RPOs in different states and their achievement. With the exception of Andhra Pradesh, Maharashtra and Rajasthan where RPO has been levied on discoms, open access consumers and Captive Power Plants; RPO has been levied only on discoms in other states.

Table 8: Summary of RPOs at state level for select states

States	RPO (in %)
Rajasthan	2007-08: 4.88% 2008-09: 6.25% 2009-10: 7.45% 2010-11: 8.50% 2011-12: 9.50%
Punjab	2007-08: 1% 2008-09: 1% 2009-10: 2% 2010-11: 3% 2011-12: 4%
Haryana	2007-08: 3% 2008-09: 5% 2009-10: 10%
Maharashtra*	'Percentage RPO' for each Licensee shall be the same as the 'Percentage RPO' for the State as a whole. The 'Percentage RPO' for the State for a financial year shall be the ratio of 'total RE generation' in the State to the 'sum of gross input energy units' for all Licensees for that financial year, excluding any inter-se sale/ consumption of electricity amongst the Licensees
Gujarat	2007-08: 1% 2008-09: 2%
Chattisgarh	Biomass-based plants: 5% each year from 2008-09 to 20010-11 Small hydel plants: 3% each year from 2008-09 to 20010-11 Solar, Wind, Bagasse based cogeneration & others: 2% each year from 2008-09 to 20010-11
Andhra Pradesh	5% each year from 2009-10 to 2013-14
Karnataka	Minimum of 5% and a maximum of 10%
Uttar Pradesh	7.5%
West Bengal**	2008-09: 4.8% 2009-10: 6.8%

	2010-11: 8.3% 2011-12: 10%
Himachal Pradesh	Minimum 20% of total consumption during a year

*** For the purposes of determination of 'Percentage RPO', generation from all types of renewable energy sources as approved by MNRE is considered; Only 'RE generation' from grid-connected RE projects is considered; 'RE generation' excludes RE generation by developers meant for self-consumption and third-party sale purposes to a Licensee's consumers.*
** For WBSEDCL*

Feed-in Tariff (FIT) or Preferential Tariff

The existing regulatory framework requires SERCs to determine FITs for procurement of RE power by the distribution licensees under RPO regime. It is envisaged that SERCs will determine tariff separately for each type of technology adopted for harnessing any of the RE sources. Accordingly, many SERCs have determined the FITs for various RETs. These SERCs have generally followed a 'cost-plus' approach for determination of FITs. States that are yet to adopt FITs include Orissa, Bihar, Jammu and Kashmir, Jharkhand, and the North East states. Tables 9-12 summarize the FIT determined by different SERCs for different RETs.

Table 9: FITs for wind energy and assumptions for FITs across states

	Capital cost (Rs. Cr/MW)	**Return on equity**	**Derating**	**Auxiliary consumption**	**O&M expenses (% of capital cost)**	**Escalation in O&M expenses**	**Period for which tariff is specified (in years)**	**Tariff (Rs/kWh)**
Maharashtra	4	16%	5% (after 10 yrs)	0%	1.50% for 3 yrs, 2% in yr 4	5% (from 4th year)	13	3.50-5.30
Karnataka	4.25	16%	0%	0.50%	1.25%	5% (annual)	10	3.4
TN	5	16% (pre-tax)	1% (annually)	0%	1.10% (for 5 yrs)	5% (from 6th year)	20	2.9
Gujarat	4.65	14% (post-tax)	0%	0%	1.50%	5% (annually)	20	For new projects: Rs.3.37 For old projects: Tariff as per PPAs entered earlier
Rajasthan	5.25	16%	1.25% of CUF from 6th, 10th, 14th & 18th year		1.25%	5.72%		Project specific tariff for new plants
Punjab								Rs.3.49 (with base year 2006-07) with five annual escalations @ 5% up to 2011-12.

Haryana	4.30	16%						Rs 4.08 for 2007-08, Escalated at 1.5% per annum
Andhra Pradesh							5	Rs. 3.37
Tamil Nadu	5.35	17.63% pre tax upto 31-3-2009; 19.85% pre-tax after 31-3-2009			1.1% of 85% of capital investment; Maintenance of land and civil works 0.22% of the remaining 15% is allowed	5%		Rs.3.24 if commissioned upto 31-3-2009; Rs.3.39 if commissioned after 1-4-2009
Uttar Pradesh								Rs. 2.50 for 2005-06 with an escalation of 4% per annum

Table 10: FITs for solar power across states

Preferential tariffs for solar energy	**Solar PV**	**Solar Thermal**		
	CoD up to Dec 2009	**CoD after Dec 2009**	**CoD up to Dec 2009**	**CoD after Dec 2009**
Rajasthan				
Covered under GoI Policy	Rs.15.78 /kWh	Rs.15.18 /kWh	Rs.13.78 /kWh	Rs.13.18/kWh*
Not covered under GoI Policy	Rs.15.60 /kWh	Rs.15 /kWh	Rs.13.60 /kWh	Rs.13 /kWh
West Bengal				
Covered under GoI Policy	Rs 4/ Kwh + GBI	Rs 4/ Kwh + GBI	Not determined	
Not covered under GoI Policy	Rs 11 / Kwh	Rs 10 / Kwh	Not determined	
Uttar Pradesh	Rs 15/ Kwh	Rs 15 / Kwh[#]	Rs 13 / Kwh	Rs 13 / Kwh[#]

Gujarat	Rs 13 / Kwh (1-12 years) Rs 3 / Kwh (13-25 years)	Rs 12 / Kwh (1-12 years) Rs 3 / Kwh (13-25 years)	Rs 10 / Kwh (1-12 years) Rs 3 / Kwh (13-25 years)	Rs 9 / Kwh (1-12 years) Rs 3 / Kwh (13-25 years)
Haryana*	Rs 15.96 / Kwh	Rs 15.16 / Kwh		
Andhra Pradesh*	Rs.3.70/ kWh + WPI		Not determined	
Maharashtra**	Rs 3/ Kwh + GBI	Rs 3/ Kwh + GBI	Rs 3/ Kwh + GBI	Rs 3/ Kwh + GBI
Punjab	Rs.7/Kwh (with base year 2006-07) + annual escalation @ 5% up to 2011-12			
Karnataka	Rs 3.40/ Kwh + GBI	Rs 3.40/ Kwh + GBI	Rs 3.40/ Kwh + GBI	Rs 3.40/ Kwh + GBI
Chhattisgarh***	Rs 15.84/kwh		Rs. 13.26/kwh	
Tamil Nadu	Rs. 3.15/kWh			

[#] commissioned before 31/12/2011
* 5 years
** 10 years; commissioned upto 31/3/2010
*** commissioned upto 31/12/2010

Table 11: FITs for SHP and assumptions for FITs across states

	Tariff (Rs./kWh)	**Capital Cost (Rs./MW)**	**Return on equity**	**Auxiliary consumption**	**O&M expenses (% of capital cost)**	**Escalation in O&M expenses**
Punjab	Rs.3.49 (with base year 2006-07) with five annual escalations @ 3% up to 2011-12.					
Haryana	Rs 3.67 for 2007-08, Escalated at 1.5% per annum	10.25	16%	0.5%		
Maharashtra	Tariff of Rs 2.84 in first year, which increases by Rs.0.03/unit every year till the debt repayment is over (10^{th} year) Tariff of Rs 3.11between years 10-15 after which it again increases annually at a constant rate of Rs. 0.03/unit	4.4	16%	0.5%	3%	4%
Andhra Pradesh	Tariff from yr 1-10: 2.60, 2.52, 2.44, 2.36, 2.27, 2.19, 2.11, 2.03, 1.95, 1.88	3.625	15%	1%	1.5%	4%
Karnataka	Rs.2.80 without any escalation for the first 10 year period from the year of commercial operation of the plant	3.9	16%	0.5%	1.5%	5%

Uttar Pradesh	Tariff determined for each of the 20 years of the life of plant for plants commissioned between 2005-06 to 2009-10					
Himachal Pradesh	Rs. 2.87 for SHP projects upto 5 MW; project specific rates for SHP with capacity more than 5MW and upto 25 MW	6.5	14%	0.5%	2%	4%

Table 12: FITs for biomass & bagasse and assumptions for FITs across

	Biomass Tariff (Rs./kWh)	**Bagasse Tariff (Rs./kWh)**
Rajasthan	Project specific tariff for new plants	Project specific tariff for plants
Punjab	Rs.3.49 (with base year 2006-07) with five annual escalations @ 5% up to 2011-12	Rs.3.49 (with base year 2006-07) with five annual escalations @ 3% up to 2011-12.
Haryana	Rs 4 for 2007-08, Escalated at 2% per annum	Rs 3.74 for 2007-08, Escalated at 2% per annum
Maharashtra	Fixed: (1 - 1.70; 2 - 1.67; 3 - 1.63; 4 - 1.59; 5 - 1.54; 6 - 1.49; 7 - 1.43; 8 - 1.37; 9 - 1.32; 10 - 1.25; 11 - 1.18; 12 - 1.11; 13 - 1.02); Variable: 2005-06 1.34; 2006-07 1.41; 2007-08 1.48; 2008-09 1.55; 2009-10 1.63; 2010-11 1.71; 2011-12 1.80; 2012-13 1.89; 2013-14 1.98; 2014-15 2.08; 2015-16 2.18; 2016-17 2.29; 2017-18 2.41)	Rs.3.05 for the first year of operation, escalation of 2% per annum
Gujarat	Rs. 3.08 for entire project life of 20 years	Rs 3.00 for entire project life of 20 years
Chattisgarh	Fixed (1 - 1.78; 2 - 1.75; 3 - 1.73; 4 - 1.68;5 - 1.63; 6 - 1.58; 7 - 1.53; 8 - 1.48; 9 - 1.43; 10 - 1.38); 75:25-Variable: 2005-06 1.20; 2006-07 1.26; 2007-08 1.32; 2008-09 1.39; 2009-10 1.46; 2010-11 1.53; 2011-12 1.61; 2012-13 1.69; 2013-14 1.77; 2014-15 1.86); 75:15-Variable (2007-08 1.27; 2008-09 1.34; 2009-10 1.40; 2010-11 1.47; 2011-12 1.55; 2012-13 1.62; 2013-14 1.71; 2014-15 1.79)	
Karnatka	Rs.2.85 per unit in the first year of commercial operation of the plant, annual escalation of 2% per annum for subsequent period of 9 years Fuel price of Rs.1000/- per MT escalated at 5%	Rs.2.80 per unit in the first year of commercial operation of the plant, annual escalation of 2% per annum for subsequent period of 9 years
Uttar Pradesh	Variable Cost for 2005-06 Rs. 1.2821, escalation of 6% per annum for each subsequent year.	Variable Cost for 2005-06 Rs. 1.2821, escalation of 6% per annum for each subsequent year.

Green Power

Green power is a concept wherein the utility supplies consumers with RE based power and charges the consumers the actual cost of this power. This power is aimed at consumers who are environmentally conscious and is priced higher than normal retail tariffs. Within India, only the Andhra Pradesh Electricity Regulatory Commission (APERC) has introduced the Green Power under its FY 2008-09 retail tariff

order. APERC has fixed the tentative Green Power Tariff at Rs.6.70 /kWh for FY 2008-09, and the difference between this tariff and the normal tariff would be used to create a 'Green Power Fund'. It has further determined that consumers buying green power have the option of obtaining Clean Development Mechanism (CDM) benefits and Renewable Energy Certificates (RECs), whenever these are introduced.

Annexure IV: Detailed provisions of National Solar Mission

Solar Power Purchase Policy

NVVN appointed the Nodal Agency for purchase & sale of grid connected solar power at 33 kV & above under Phase -I

- For each MW of solar power, MOP to allocate equivalent MW capacity from unallocated quota of NTPC stations
- NVVN to bundle solar & thermal power & sell it at regulated tariff plus facilitation charges

Solar RPO

Renewable Purchase Obligations of utilities to be split into solar and non-solar

- RPO may start with 0.25% in Phase I and increase to 3% by 2022
- RPO to be fixed after modification of the National Tariff Policy 2006
- RE Certificates to meet RPO

Generation Based Incentive

Provision of GBI to100 MW capacity solar projects connected to LT/11 KV grid

- Eligibility: own consumption as well as power fed into the grid
- GBI rate: tariff fixed by CERC minus notional tariff of Rs. 5.5 per unit, with 3% annual escalation

Demonstration Projects

Technology configurations not covered under 1,000 MW capacity

- Projects to be set up following competitive bidding to enable price discovery
- Maximize indigenous content
- Technology transfer

Off - grid opportunity

Promote solar home lights & other power applications to cover 10,000 MW villages & hamlets

- Re-finance facility/Soft loans up to 5% annual interest rate by IREDA
- 30% subsidy for select applications
- 90% subsidy for niche applications to special category areas

Fiscal/Financial incentives

Increase competitiveness of solar projects & provide enabling environment for solar manufacturers

- Recommendation to MoF for custom and excise duty concessions/exemptions on specific capital equipment, critical materials, components & project imports
- SEZ like incentives to manufacturing parks

HRD

Build technically qualified manpower of international standard

- Develop specialized courses at engineering colleges
- Ministry of Labour to introduce training modules/ course materials for technicians
- 100 fellowships a year to support students/ groups
- National Centre for PV Research & Education at IIT, Mumbai

R&D

Improve efficiency of existing/new materials & applications & develop cost effective storage technologies

- Development of National Centre of Excellence & Centres of Excellence to undertake & fund R&D
- High level Research Council to guide overall strategy
- Support Incubation & Innovation through a Venture Fund