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Background paper

Governance of renewable energy in India: Issues and challenges

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Abstract

Renewable energy (RE) has become an important agenda of India's energy planning process especially since climate change has taken centre stage in the domestic and international policy arena. To demonstrate its commitment to renewable energy, the government has set aggressive targets for renewables and several incentives and policy initiatives at the Central and State levels have been put in place both for grid connected and off-grid renewable energy.

It is evident that the development of renewable energy sector hinges on the combination of legislative frameworks, funding mechanisms, institutional arrangements, and co-ordination mechanisms, which work together to support the implementation of RE strategies, policies and programmes. It is seen that despite the growing momentum of activity in this sector, there are certain issues which highlight the gaps in the governance of renewable energy in India. This paper discusses some of the key regulatory and governance issues which have a bearing on RE sector. These pertain to technical and institutional capacity, planning and budgetary allocations, transparency and accountability, regulatory compliance and social and environmental concerns. The paper highlights these issues with specific examples and sums up the way forward for addressing some of these gaps.

Introduction

Renewable energy has become an important agenda of India's energy planning process especially since climate change has taken centre stage in the domestic and international policy arena. To demonstrate its commitment to renewable energy, the government has set aggressive targets for renewables, which have a shown progressively increasing share in the energy mix. This achievement has been possible because of the policy framework and guidelines put in place by the central and state governments. Despite provisions for several incentives, policy initiatives, and overall an enabling environment, there are certain bottlenecks that need to be addressed for renewable energy to play a significant role in India's energy future.

This paper analyses regulatory and governance challenges and the way forward for the growth of renewables, focusing on the grid connected sector. It delves into the following key aspects:

- Technical and institutional capacity
- Planning and budgetary allocations
- Transparency and accountability
- Regulatory compliance with respect to Renewable Purchase Obligations (RPOs)
- Social and environmental issues

The study is based on a review of literature and is informed by discussions with renewable experts and stakeholder consultations (Annexure-I). Secondary literature including journal papers, peer-reviewed publications, renewable energy policies, regulations, and tariff orders was reviewed. A workshop was also organized on 24 July 2012 to deliberate on the key issues in renewable energy sector at the national and state levels with respect to policies, regulations, and financing. Meetings were held with state utilities, regulatory commissions, project developers, state nodal agencies, and government departments to understand state-specific issues in renewable energy. The list of stakeholders is provided in Annexure 1. The study has taken a technology-neutral approach keeping in view the objectives of the study, which attempt to examine issues in the renewable energy sector from a holistic perspective.

Overview of the renewable energy sector in India

Renewables contribute about 12.3% of the total installed capacity in the country (CEA, 2013). Around 97% of the installed capacity is grid-connected and off-grid power constitutes a small share (MNRE, 2013). Wind continues to be the mainstay of grid connected renewable power in India (Figure 1). Globally, India ranks sixth in terms of renewable electric power global capacity (REN21, 2013). The historical growth of renewables has been tremendous with a compounded annual growth rate of 22% over the last decade (2002–2012). The rate of growth has been particularly significant for solar over the last three years (2009–2012), which grew from less than 10 MW to more than 0.7 GW MW in 2005–2006 to about 30 GW in 2013 (as on 31 October, 2013) (MNRE, 2013).

Further, the Government of India has projected capacity addition of 72,400 MW by end of the Thirteenth Plan (2022), of which solar is expected to contribute 28%. The policy thrust to renewables has been significant and specific targets have been announced to accelerate the deployment of renewable energy. The National Action Plan on Climate Change (NAPCC, 2008) envisages a dynamic RPO target of 10% at the national level for 2015 with an annual increase of 1% so as to reach around 15% by 2020.

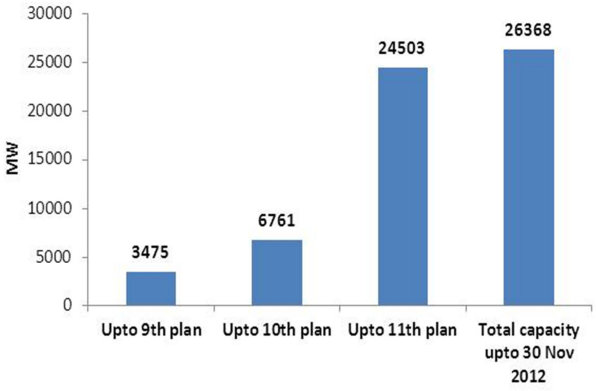

Figure 2 Plan-wise growth of the renewable energy capacity in India

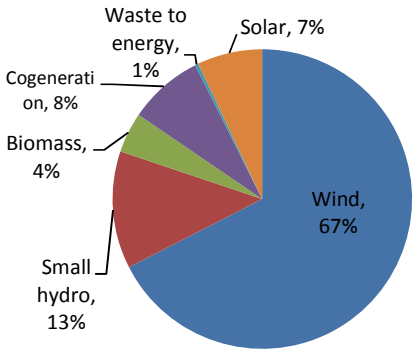

Figure 1 Break-up of grid interactive capacity (As on 30 October 2013)

Source: (MNRE, 2013)

Legal and institutional framework

The key legislation which guides the development of renewable energy in India is the Electricity Act, 2003. The Electricity Act 2003 mandates the State Electricity Regulatory Commissions (SERCs) to promote generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person. The National Tariff Policy, 2006, directs SERC to fix certain minimum percentages for purchase of renewable power.

There are multiple agencies involved in the renewable energy sector in India. At the central level, the Ministry of New and Renewable Energy (MNRE) is the nodal ministry of the Government of India (GoI) for all matters relating to new and renewable energy.[1] The broad aim of the ministry is to develop and deploy new and renewable energy for supplementing the energy requirements of the country. MNRE also conducts resource assessments for renewable energy and supports R&D in renewable energy technologies. There are specialized technical institutions set up under MNRE such as the Solar Energy Centre,[2] C-WET, and Sardar Swaran Singh National Institute of Renewable Energy (SSS-NIRE), which serve as technical focal institutes for solar, wind, and bio-energy, respectively.

[1] MNRE is the world's first exclusive ministry set up solely for the development of renewable energy.

[2] The Solar Energy Centre is now known as National Institute of Solar Energy (NISE).

At the state level, there are nodal agencies and departments which operate under the purview of the respective state governments for the effective implementation of all renewable energy and co-generation schemes. These agencies promote renewable energy deployment at the local level by channeling central-level subsidies, implementing demonstration projects, and providing assistance to interested parties. Many of the state agencies are also designated agencies for the implementation of the Energy Conservation Act, 2001. The MNRE provides grants to these agencies for their recurring and non-recurring expenditure. Financial assistance to renewable energy projects is provided through the Indian Renewable Energy Development Agency (IREDA) — the financial arm of the MNRE — which provides loans and also channels funds and other initiatives to promote renewable energy. IREDA is registered as a non-banking financial company and arranges its resources through market borrowing and lines of credit from bilateral and multilateral lending agencies.

In addition, there are a number of government institutions whose mandate encompasses the renewable energy sector. For example, the Ministry of Power (MoP) is responsible for the national electricity policy and national tariff policy, both of which play a key role in promoting procurement of renewable energy-based power. The Ministry of Environment and Forests (MoEF) is responsible for providing environmental clearances for renewable energy projects. The institutions classified according to their roles in the renewable energy sector are depicted in Table 1.

Institutional roles for renewable energy Sector

Table 1: Roles of state and central government agencies in policy development, regulation, and promotion of renewable energy

Level	Central government (Ministry of Power/ Ministry of Finance)	MNRE	CERC
Central	• Develops national electricity tariff policies, which also cover renewable energy • Provides fiscal incentives for promoting renewable energy	• Develops national renewable energy laws • Sets technical standards for renewable energy • Conducts resource assessments for renewable energy; supports R&D in renewable energy technologies • Promotes effective use of information technology for renewable energy, manages database • Reviews renewable energy programmes to understand their effectiveness and efficiency	• Sets guidelines for feed-in tariff design for different renewable energy technologies • Regulates the regional electricity corporation mechanism • Regulates interstate open access, and third party sales
State	**State government**	**State nodal agency**	**SERCs**
	• Develops state-level renewable energy policy • Provides fiscal	• Conducts resource assessments for various renewable energy sources • Allocates renewable energy	• Develops feed-in tariff methodologies for different renewable energy technologies

	incentives for promoting renewable energy sources	projects and progress monitors • Provides facilitation services to project developers — Facilitates clearances and land acquisition • Creates awareness and educates the masses about adoption of renewable energy • Maintains database on renewable energy sources	• Determines RPOs and enforcement mechanism • Sets regulations on intrastate wheeling, open access, and third party sale

Source: World Bank (2010).

Policy framework

The Government of India (GoI) has enacted several policies which support the expansion of renewable energy. The National Electricity Policy 2005 allows the SERCs to establish a preferential tariff for electricity generated from renewable sources to enable them to be cost-competitive. The Tariff Policy 2006 requires fixation by SERCs of a minimum percentage of RPO from such sources taking into account availability of such resources in the region and its impact on retail tariffs. The Tariff Policy also states that procurement of renewable power for future requirements shall be done through a competitive bidding process and in the long-term, renewable energy technologies would need to compete with other sources in terms of full costs. To this effect, the MNRE brought out the guidelines and standard bidding documents for grid-connected renewable energy in December 2012 after several rounds of consultations with stakeholders. The guidelines for competitive procurement have been framed under Section 63 of the Electricity Act, 2003 which states:

> Notwithstanding anything contained in Section 62, the Appropriate Commission shall adopt the tariff if such tariff has been determined through transparent process of bidding in accordance with the guidelines issued by the Central Government.

While the allocation for solar has already been done through competitive bidding under the National Solar Mission and state solar policies, these guidelines seek to also cover all other renewable energy sources, such as wind, small hydro, geothermal, biomass, tidal, etc. The guidelines seek to create competition in the grid-connected renewable energy sector, bring transparency and fairness in allocation, reduce information asymmetries among bidders, bring standardization, and hence reduce ambiguity in the whole process of project allocation. The guidelines are on the same lines as drafted by the MoP for conventional power wherein bidding takes place through two routes: (i) in the first case where location and technology is not specified by the procurer and hence the developer has full freedom to decide these factors and (ii) in the case with location- and fuel-specific bidding, i.e., the procurer specifies the location and/or fuel and is also responsible for arranging the same. States such as Rajasthan and Karnataka have adopted the competitive bidding model. Rajasthan has announced that it may also allow competitive reverse bidding for wind parks.

The flagship policy initiative for solar energy in India is the Jawaharlal Nehru National Solar Mission (JNSSM) launched in 2010, which has set ambitious goals on generation capacity additions from

solar technology — solar thermal and solar photovoltaic — in terms of both grid-connected and off-grid applications. The Mission has adopted a three-phase approach, spanning the period of the Eleventh Plan and the first year of the Twelfth Plan (up to 2012–13) as Phase I. The remaining four years of the Twelfth Plan (2013–17) has been marked as Phase II and the Thirteenth Plan (2017–22) will be Phase III of the project.[3] The JNNSM establishes a national-level policy framework for solar energy utilization including power generation in India. The first phase of the mission has seen significant progress in the deployment of utility-scale solar projects enabled by the reverse bidding mechanism introduced by the Government of India. To achieve 500 MW of PV and 500 MW of solar thermal, the central government conducted two batches of reverse auctions (Batch 1 and Batch 2) (See Box 1). Phase I of the mission has been concluded, though not all projects have been commissioned. Post the launch of JNNSM, several significant regulatory and policy developments have taken place. The National Tariff Policy was amended in January 2011 prescribing solar-specific RPOs to be increased from a minimum of 0.25% in 2012 to 3% by 2022. The Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs) have issued various regulations including solar RPOs, Renewable Energy Certificates (REC) framework, tariff, grid connectivity, forecasting, etc., for promoting solar energy.

Box 1: Jawaharlal Nehru National Solar Mission: Key lessons from Phase I

JNNSM in many ways is a first of its kind national-level programme for solar energy in India. The process of price discovery in JNNSM was unique, discovered through a process of reverse bidding carried out in two successive batches. This was introduced mainly because of the overwhelming response from developers who had bid for more than 30 times of the capacity on offer. Applications were received for more than 5,000 MW much higher than 1,100 MW on offer. Project developers were selected based on discounts offered on CERC-determined tariffs. It was executed through NTPC Vidyut Vyapar Nigam (NVVN) which acted as the nodal agency to purchase 1,000 MW of solar power from the project developers, bundle it with the unallocated power available from the NTPC coal-based stations, and sell this 'bundled' power to the Distribution Utilities. This new concept called Bundling was introduced to keep the cost of bundled power low compared to the cost of only solar power. Reverse bidding resulted in steep fall in prices to as low as Rs 5.45/kWh. Batch 1 saw a 32% reduction in solar PV tariffs and a 25% reduction in solar thermal prices (from the CERC-determined tariffs). In Batch 1, around 150 MW solar PV projects and 470 MW solar thermal projects were allocated. In Batch 2, the remaining 350-MW solar PV projects were allotted. Batch 2 saw an ever steeper reduction in prices, which were approximately 43% lesser than the CERC-determined prices. Most of the solar PV projects have been commissioned while all the solar thermal projects, except one 50 MW project which was commissioned recently, are running behind schedule. Some state projects which were already at different stages of development were also given the option of migrating to the JNNSM, scheme subject to the interest of developers and state governments. A total of 16 projects of 84-MW capacity were selected under the migration scheme. Apart from these large-scale grid-connected plants, small rooftop plants — of capacity less than 2 MW each — totalling to 88MW capacity, were also allotted under Generation based incentive (GBI) scheme in the Rooftop PV and Small Solar Power Generation Programme (RPSSGP).

While initially there were concerns regarding the bidding process which allowed some small inexperienced players to quote aggressive prices, this was allayed with all but one project coming online. Furthermore, with stringent penalty clauses and guidelines set by the govt. stating that firms that do not commission their projects within the stipulated time (12 months for photovoltaic and 28 months for CST) stand to lose significant amounts of money relative to their initial capital investments, the process ensured that checks and balances were in place. Also since tariffs are generation based, any underperformance results in losses to the project developer, therefore incentives are in place to ensure appropriate performance (Deshmukh et al. 2011b).

[3] The first phase targets envisage 1,100 MW of utility grid-connected power including rooftop, 10,000 MW by 2017 and 20,000 MW by the end of 2022. For off-grid solar applications, the target is 2,000 MW by 2022, while the target for solar collectors is around 20 million sq.m. by 2022.

State solar policies

Encouraged by the success of JNNSM in 2010, several states have announced their own state solar policies and programmes with the exception of Gujarat which took a lead in announcing its solar policy a year before JNNSM (Table 1). State policies are broadly aligned with the JNNSM objectives; however, there are some deviations as well. For example, many of the state policies have not mandated domestic content requirement for the projects as opposed to the approach taken by JNNSM. Gujarat, Karnataka, Tamil Nadu, and Andhra Pradesh have not mandated domestic content requirement while Rajasthan has a Domestic Content Requirement (DCR) clause.[4] Table 2 gives an overview of the state policies. Several other states such as Punjab, Uttar Pradesh, etc., are in the process of drafting their own policies. Interestingly, more than 70% — around 760 MW — of the installed capacity of a total 1,050 MW of solar installation in the country has come under state-specific policies and programmes (MNRE, 2012)

Table 1: States with solar policies in India (As on 31 Nov 2013)

State	Month of release	Target addition (MW)
Andhra Pradesh	September 2012	Has not set a target
Chhattisgarh	October 2012	500–1,000 MW by 2017
Gujarat	2009	500 MW
Karnataka	2011	350 MW by 2016
Kerala	November 2013	500 MW by 2017 and 2,500 MW by 2030
Madhya Pradesh	January 2012	
Punjab*	December 2012	1,000 MW by 2022
Rajasthan	2011	12,000 MW by 2022
Tamil Nadu	October 2012	3,000 MW by 2015
Uttarakhand	September 2013	500 MW by 2017
Uttar Pradesh	1st Quarter of 2013	500 MW by 2017

Note: *Solar targets are part of the Renewable Energy Policy

[4] Madhya Pradesh allocated projects of 200 MW through tender which was not guided by a solar policy. Under the solar programme, DCR was mandated for PV projects.

Table 2: Overview of state solar policies

	Tamil Nadu	Andhra Pradesh	Karnataka	Punjab	Madhya Pradesh	Uttar Pradesh	Rajasthan	Total/ average
Allocation date	June 2013	June 2013	Apr 2012	July 2013	May 2012	July 2013	Mar 2013	Most of the allocations happened in the first half of 2013
PPAs signed as on September 2013 (MW)	0	60	60	0	225	0	75	420
Tariff (INR/ kWh)	6.48 (with an escalation of 5% p.a. for the first 10 years)	6.49	7.94–8.5 (60 MW) 5.51–8.05 (130 MW)	7.2–8.63	7.9–8.05	8.01–9.27	6.45	7.59
New PPAs expected to be signed by the year end (MW)	500	80	100	230	0	120	0	1,330
Further allocations (MW)	None	500*	None	None	None	None	RfS for 1 MW x 50 announced	550
Delayed projects (MW)	NA	NA	50	NA	120	NA	NA	170
Expected commissioning date of projects under deployment	Dec 2014	Dec 2014	Mar 2014 (50 MW) Dec 2014 (110 MW)	Dec 2014	Mar 2014	Dec 2014	Mar 2014	250 MW by March 2014; 1,240 MW by Dec 2014
Expected period of procurement	Jan 14–Mar 14	Jan 14 – Mar 14	Ongoing	Jan 14 – Mar 14	Ongoing	Jan 2014 – Mar 2014	Ongoing	Most of the procurements will take place between Jan–Mar 2014

Source: (Bridge to India, 2013)

While the introduction of state solar policies are certainly good steps in complementing the JNNSM, and attracting private investment, the way in which the bidding process was managed in some states has created regulatory uncertainty and negatively impacted the investor's confidence. The capacity allocation process in Tamil Nadu and Andhra Pradesh were modified during the course of bidding. Andhra Pradesh announced a change in allocation policy after the completion of bidding, where the lowest bid (L1)[5] process was changed to a fixed tariff of Rs 6.49/kwh. In Tamil Nadu, the state utility managing the bidding TANGEDCO, revised the tariff and extended the deadline for interest submission impacting the bidding process.

[5] The State of Andhra Pradesh followed a L1 (lowest bid) process different from other states, where developers were required to meet the lowest tariff being offered by any other developer for a given sub-station where as in other states such as Rajasthan and Tamil Nadu, developers were required to meet the lowest bid (L1) across the state.

Regulatory framework

The regulatory oversight in the sector is provided by the CERC and SERCs. However, at present, only grid-connected renewable energy based systems come under the regulatory purview. The off-grid decentralized renewable energy based systems are not regulated in the present set-up. For the grid-interactive systems, the CERC sets guidelines for feed-in tariffs for different renewable energy technologies and issues regulations for interstate open access. The SERCs determine feed-in tariffs for different renewable energy technologies, set RPOs for states, issue regulations on open access, third party sales, etc. The SERC have the most direct impact on feed-in tariffs, RPOs, and open-access charges and they are loosely bound by the directives and guidelines of the CERC .As on 31 January 2013, 27 states have issued RPO regulations and 25 states have come out with regulations for REC (including draft regulations) (Renewable Energy Regulatory Framework, MNRE, 2012). Most of the states have announced feed-in tariffs for renewables and regulations for intra-state open access. It is important to note that the final say on how renewable energy projects should be developed rests with state-level agencies and the progress on the ground depends mainly on state-level policies on feed-in tariffs and RPOs, evacuation, clearances, open access, and facilitation from state nodal agencies.

The regulatory framework for renewables in India is continuously evolving with increasing penetration and progressively higher shares coming from these sources. The GoI has brought the Renewable Regulatory Fund (RRF) regulations in 2010 as per the provisions of the Indian Electricity Grid Code Regulations, 2010. This fund seeks to bring in better prediction of generation by wind/solar generators and participation in scheduling and hence better system operation. It aims to achieve better generation prediction using weather forecasting tools and immunize wind generators from paying deviation in Unscheduled Interchange (UI)charges up to a certain level of variation, beyond which the deviation charges will be socialized across states.[6]

The key renewable energy support policies implemented in India for renewable energy promotion have been summarized in Table 3.

Table 3: Key renewable energy policies implemented in India for grid-based projects

	Solar	Wind	Biomass	Small Hydro
Targets				
Targets	●	*	*	*
Price-based Instruments				
Feed-in tariff	●	●	●	●
Generation-based incentives	●	●	○	○
Concessional wheeling charges for captive users	●	●	●	○

[6] The wind generators shall be responsible for forecasting their generation up to an accuracy of 70%. If the actual generation is beyond +/- 30% of the schedule, the wind generator would have to bear the UI charges. For actual generation within +/- 30% of the schedule, no UI would be payable/receivable by generator. The host state shall bear the UI charges for this variation. However, the UI charges borne by the host state due to the wind generation shall be shared among all the states of the country in the ratio of their peak demands in the previous month in the form of a regulatory charge known as the 'Renewable Regulatory Charge' operated through the Renewable Regulatory Fund (RRF). Though this provision was to be made applicable from 1 January 2011, it has not been implemented yet. This will be applicable for new wind farms with collective capacity of 10 MW and above connected at connection point of 33 KV level and above and who have not signed any PPA with states or others.

Net metering	●	○	○	○
Banking	○	●	●	○
Carbon market/CDM transactions	●	●	●	●
Renewable Energy Certificates (REC)	●	●	●	●
Quantity-based Instruments and Procurement Mechanisms				
Renewable Purchase Obligation (RPO)	●	●	●	○
Competitive bidding/auctions	●	○	○	●
Investment Cost Reduction/Financial Incentives				
Accelerated depreciation	●	○	●	●
Green Funds (e.g., soft loans, grants)	●	●	●	●
Capital subsidy	○	○	○	○
Equity participation	●	●	●	●
Tax Exemptions	●	●	●	●
Custom/excise duty exemption	●	●	●	●
Grid connection and dispatch	●	●	●	●
Other Measures				
R&D funds	●	●	●	●
Single window clearance systems	●	●	●	●

Source: Adapted from (Azuela & Barroso, 2011)

Notes: ● Exist ○ Absent

*Targets do not exist as part of a policy or a mission objective such as for solar under JNNSM. Targets exist under Annual Plans of MNRE.

Key Aspects of Governance in the Indian Renewable Energy Sector

Capacity and supporting infrastructure

Achieving ambitious renewable energy targets requires the presence of a vibrant industry and enabling infrastructure. The renewable energy sector in India is primarily dominated by the private sector. While the wind industry in India is considered to be mature, occupying the sixth position in wind turbine manufacturing globally, the solar industry is still growing and ramping up its manufacturing capabilities. Despite having measures to bolster indigenous manufacturing capabilities in the solar sector, there are gaps to be addressed on this front.

Creation of a robust indigenous manufacturing sector and the positioning of India as a solar hub is one of the stated objectives of the JNNSM. Towards achieving this objective, India has put in place DCR on solar cells and modules for solar PV projects based on crystalline silicon. However, this measure has been largely ineffective in spurring the local manufacturing industry, because many of the developers managed to circumvent this requirement by opting for thin-film technology, which was exempt from DCR.[7] While in the first batch of Phase 1, installations were equally distributed between thin-film and crystalline silicon PV (50% each), however it further deteriorated in Batch 2 wherein 59% used thin film technology and 41% used crystalline silicon (CEEW/NRDC, 2012). This has resulted in the supply of cheaper modules from countries such as Taiwan, the USA, and Malaysia with Indian manufacturers unable to compete with these international module suppliers in terms of costs. Several leading manufacturers such as Tata solar, Indosolar, Lanco solar, Moserbaer, etc., have been adversely affected because of fewer local orders and falling exports, with most of them reporting significant losses in 2011–12.[8] As of October 2013, with some exceptions, most of the photovoltaic (PV) manufacturing capacity in India is either lying idle or operating at a very low capacity. The Indian manufacturers have called for an anti-dumping investigation and imposition of anti-dumping duties on suppliers from these countries. In addition, there are very few companies operating in the upstream segment of the solar PV value chain (Polysilicon, ingot, and wafer production). Most of the companies are involved in cell and module production. There are hardly any companies in polysilicon production, around 10–15 companies in cells, and 50 companies in module production (SNP Infraresearch, 2011).There is a strong need to focus on building up the manufacturing and R&D capabilities in the upstream segment of the solar industry.

Institutional capacity

Institutional capacity among other aspects also depends on the human-know, skill base of the personnel involved as well the availability of robust data which can guide the development of policy and regulatory frameworks.

[7]At the time of policy announcement, there was only one company with thin film manufacturing capabilities (Moserbaer); therefore, in order to avoid a situation of giving one firm monopoly status, projects based on thin films were exempted from DCR.

[8] Indo-solar stopped manufacturing completely in 2011 and defaulted on bank loans, Moserbaer went into corporate debt restructuring while Tata BP Solar decided to close their manufacturing arm (Johnson, 2011).

Technical capacity and skills sets

Government departments need to build strong capacities to deal with the requirements of increasing renewable energy penetration. The skill-sets required for the renewable energy sector are often very different to those required for conventional energy sources. Some of the states with progressively higher shares of renewables such as Gujarat, Rajasthan, Tamil Nadu, etc., are and will continue to face the challenge of effective grid integration of these intermittent sources of energy in the future. Tamil Nadu, which has 40% of the country's wind resource, has been asking wind farms to back down or stop generating electricity due to an over-congested grid. It has installed 7.1GW of wind energy but is unable to transport this to other regions due to the absence of sufficient connectivity.

Thus, a planned approach is required to ensure that power system safety, security, and stability remains intact at all operating conditions. The state load dispatch centres which are responsible for integrated operation of the power system in the states need to be equipped with state-of the art forecasting systems and tools for proper management and safe operations of the grid. In addition, the capacities of the government personnel will have to be enhanced to this end. The Central Electricity Authority (CEA) has outlined a plan of action for development of renewable energy management centres at three different levels — state, regional, and national which will undertake forecasting of renewable generation and coordination with the dispatch centres. While some states such as Gujarat have taken a lead in initiating forecasting facilities for renewables, other states in India are yet to initiate action on this front.

On the other hand, there are skill gaps existing in the renewable energy industry such as design and fabrication of biomass gasifiers, erection and commissioning of large-scale biomass plants, feedstock planning and management of biomass plants, design skills to match wind speeds and capacity of turbines, etc., which have to be systemically addressed by developing partnership models among the industry, institutions, and the government (CII, 2010).

Data availability

To formulate sound policies and roadmaps for renewable development, availability of reliable good-quality resource data is crucial. Reliable data on resource (biomass) pricing patterns is important for the regulators to set tariffs. While a number of initiatives have been taken by MNRE to address the gaps on this front, at the state level, very few state nodal agencies are maintaining a comprehensive data bank or knowledge repository on renewables. In case of biomass, the Biomass Resource Atlas developed by the Indian Institute of Science with MNRE is outdated and does not accurately reflect the resource developable energy potential. There is very little reliable and detailed information on the consumption and supply of biomass. In such cases, developers hire consultants/third parties to do biomass assessments; however, due to lack of standardized system for measurements and accounting procedures, the estimates vary widely depending upon the methodology used. The estimates can widely vary from consultant to consultant depending upon the methodology, for the same geographic area (Kumar and Pragati, 2011). The biomass primary surveys are also cumbersome, time-consuming, as well as expensive. Furthermore since agriculture is a state subject, data is available only from the state agriculture departments and this data is highly contested for low levels of accuracy and reliability (Kumar and Pragati, 2011).

In the case of solar energy, overall power generation and the Capacity Utilization Factor (CUF) of solar PV plants and solar thermal plants depend on Global Horizontal Irradiance1 (GHI) and Direct Normal Irradiance (DNI), respectively.[9] The reliability of solar resource data also impacts the lender's assessment of these projects and affects their overall bankability. Solar project developers use satellite modelled data of NASA, NREL or appoint external agencies to measure on-ground data. Satellite modelled data can be used only with 70–80% confidence level. Recent evidence from ground observations and production from commissioned projects in Rajasthan shows that GHI estimates from satellite are good but DNI is over-stated. For example, for a 2.5 MW solar thermal power plant in Rajasthan Acme Telepower, the actual on ground measurement was 20% less than modelled data. Due to discrepancies in the satellite modelled data, performance of recently developed projects have been below expectations.

Some of these concerns have been taken up by the MNRE–CWET which is setting up solar radiation measuring stations in 51 locations in different states of India with the support of GIZ. However the concerns on accurate data availability of biomass resources still looms large.

State nodal agencies and ease of execution

State nodal agencies (SNAs) have a very critical role to play in the facilitation of different clearances required for renewable energy projects. The SNAs in most states are supposed to act like single window clearance agencies facilitating the approvals required from different line departments such as pollution control, fisheries, mining, forests, etc.; however, the practice in most states is that the onus is on developers to get the clearances required for their projects. This was confirmed by the state nodal agencies of Haryana and Karnataka during stakeholder interviews. As per industry estimates, on an average it takes around a year to complete the land acquisition process in the state. As per Karnataka state policy, the private developers cannot acquire agricultural land for renewable energy projects. The land has to be converted to non-agriculture land to be acquired. The whole process of identifying suitable land, conversion, and finally acquisition is an extremely time-consuming process.[10]

Karnataka has allocated wind projects with a total capacity of 12 GW out which only 2.2 GW has been commissioned, 6.6 GW is yet to be commissioned, and the rest (3.5 GW) has either been rejected, surrendered or cancelled (PwC, 2013). The capacity yet to be commissioned is either stuck due to land acquisition or clearances issues, or lack of intent from the developers. Developers and industry experts feel that the allocation committee meetings do not take place as often as they should because of which more than 2.5 GW capacity is yet to be allocated.

[9] GHI is the total amount of solar radiation per unit area, i.e., intercepted by a flat, horizontal surface. It includes both direct beam radiation (radiation that comes from the direction of the sun) and diffuse radiation (radiation that has been scattered by the atmosphere and which comes from all directions of the sky). DNI is the amount of direct beam solar radiation per unit area, i.e., intercepted by a flat surface, i.e., at all times pointed in the direction of the sun.

[10] There is no time-frame defined for converting agricultural land to non-agricultural use-alienation. Currently, the process takes around 8–9 months.

Planning and budgetary allocations

Given the increasing pace of renewable capacity addition in the country and the potential of the sector, massive investments are required from government and private sources. However, it is seen that the budgetary investments in renewable energy in India have not been concomitant with the sector's growth. Since Eleventh Plan, budgets for renewable energy have never reached 1% of the total budgetary spending (CBGA, 2013). The annual outlay for renewable energy has remained at just 0.09% of the total budgetary expenditure (TBE) in 2012–13. The average allocation for the sector for the whole Eleventh Plan period was merely 0.072% which has increased to 0.081% in 2012–13 (renewable energy) and 0.092% in 2013–14 (BE), respectively, in the Twelfth Plan period. A sharp increase is observed particularly in 2010–11 post the announcement of the National Action Plan on climate change which accorded high priority to clean energy.

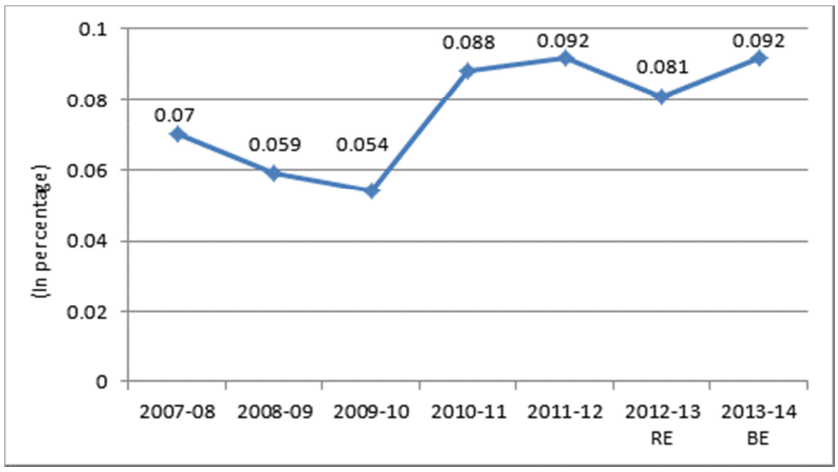

Figure 3: Budget Allocation for MNRE as a Percentage of the Total Budgetary Expenditure since 2007–08

Source: Centre for Budget and Governance Accountability (2013)

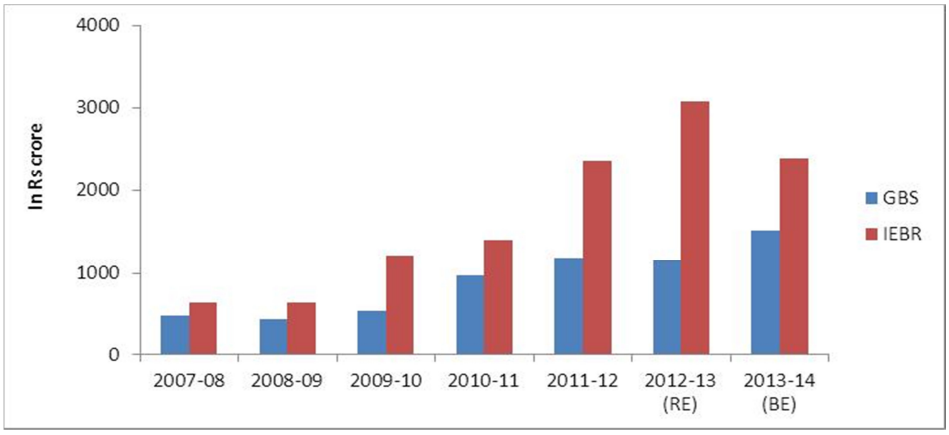

Figure 4: Budgetary Allocation for renewable energy since 2007–08

GBS- Gross Budgetary Support;

IEBR –Internal and Extra Budgetary Resources

Source: Centre for Budget and Governance Accountability (2013).

The plan outlays[11] approved for MNRE of around Rs 40,876 crore for Twelfth Plan is grossly inadequate compared to the plan outlays approved for Ministry of Power and Ministry of Petroleum which have received as high as Rs 8.8 lakh crore for the Twelfth period. Though MNRE has received the projected gross budgetary support of Rs 19,113 crore in the Twelfth five year plan, the outlays for the first two annual plans are not adequate. Against the total requirements of Rs 2,979 crore for the annual plan 2012–13, MNRE received nearly Rs 1,163 crore, a shortfall of Rs 1,816 crore. Further, against the annual plan requirements of approximately Rs 4,000 crore in 2013–14, MNRE has received Rs 1,533 crore. The estimated fund for the next three annual plans is Rs 38,534 crore to be utilized. This skewed allocation across annual plans may affect the capacity of the implementing agencies and hinder the development of renewables.

Transparency and accountability

Transparency and accountability are key principles to good governance. In general, the renewable energy sector has been lauded for instituting transparent procedures and measures for accountability (See Box 2); however, there are some issues with respect to transparency in the disbursal of the National Clean Energy Fund (NCEF) and its operational modalities. The NCEF — operational since FY 2010–11 — has been conceived of as a separate non-lapsable corpus to support research and innovative projects in the field of clean energy technology. The fund is created through the levy of a clean energy cess on both domestic and imported coal (Rs 50 per tonne).[12] It is being administered by the Ministry of Finance. The fund has been largely criticized for inconsistencies between the stated objectives, operational guidelines, and final approval of the projects (Panda and Jena, 2012). It has been found that instead of funding cutting-edge R&D on clean technology, it is being used to cover the budgetary shortfalls for projects implemented by various ministries and departments. More so, most of the projects funded are decentralized small-scale renewable energy based technologies. The other major drawback is the inability of the fund to attract private participation. There is a need to eliminate the ambiguities surrounding the use of the fund and bring in more transparency on the process of disbursal of funds.

Box 2 Transparency in operational procedures: Good practices

Under the National Solar Mission, several projects are operating in the north-western State of Rajasthan. Seven associate companies of a private company known as the LANCO Group were granted commissioning certificates for a 5 MW solar project by the Rajasthan Renewable Energy Corporation Limited (RRECL). RRECL is the state nodal agency responsible for monitoring the completion of projects under the NSM in that state. However, the certificates were granted even before the plants were completed, in direct violation of the guidelines of NSM. The MNRE proactively launched an investigation in this regard, identified misconduct, and acted in a timely manner. Furthermore, NVVN, the agency responsible for monitoring NSM projects has penalized three of the seven companies which produced false commissioning certificates, laying the foundation for stricter implementation of policies.

Source: http://www.bridgetoindia.com/the-national-solar-mission-loopholes-and-consequences/, last accessed on 3rd March 2014

[11] Approved plan outlay is the total of gross budgetary support and internal and extra budgetary resources.

[12] Project funding is open to all, and projects are eligible to receive support in the form of loan or viability gap funding where assistance shall be given to the extent of 40% of the total project cost.

Regulatory compliance

Most of the states have specified RPOs targets with separate solar and non-solar targets (See Appendix for the state-specific solar and non-solar RPO). However, due to the lack of enforcement of RPO regulations and in the absence of imposition of penalties on obligated entities, many of the state discoms are not complying with their RPO targets. Recently, the utilities of Haryana filed a petition with the regulatory commission to review the RPO targets set by the commission, by claiming that achieving RPO target is 'impossible' due to lack of renewable capacity additions in the state and high cost of solar power which can add to the financial burden of electricity consumers of Haryana (HERC, 2013). The commission while acknowledging the limited renewable capacity addition in the state, directed that RPO targets cannot be revised as they were set in line with the renewable energy potential of the state and had already been revised downwards in the renewable energy regulations, 2010.

A snapshot of RPO compliance of a few states for FY 2011–12 has been given in Table 4. As can be seen from the Table 4, most of the states have fallen short of complying with RPO targets, except Tamil Nadu

Table 4: RPO compliance of a few states (FY 2011–12)

	Torrent Power		**GUVNL and its subsidiaries**		
	Target	**Actual**	**Target**	**Actual**	
- **Gujarat**					
Solar	0.50%	0.00%	5.00%	4.30%	
Wind	5.00%	1.08%	0.50%	0.26%	
Others	0.50%	4.40%	0.50%	0.15%	
Total	6.00%	5.00%	6.00%	4.71%	
- **Punjab**					
Solar	2.37%	1.67%			
Non-solar	0.03%	0.01%			
Total	2.40%	1.68%			
- **Maharashtra**					
		MSEDCL	**TPC-D**	**Best**	**R- Infra**
Solar	0.25%	0.02%	0.07%	4.54%	4.72%
Non-solar	6.75%	7.14%	6.78%		
Total	7.00%	7.16%	6.85%	4.54%	4.72%
- **Haryana**					
Solar	0.25%	0.25%			
Non- Solar	1.25%	0.97%			
Total	1.50%	1.22%			

	Torrent Power		GUVNL and its subsidiaries		
	Target	**Actual**	**Target**	**Actual**	
- **Tamil Nadu**					
Solar	8.95%	9.53%			
Non- Solar	0.05%	0.02%			
Total	9.00%	9.55%			
- **Uttar Pradesh**					
Solar	0.025%	0.006%			
Non- Solar	4.5%	4.1%			
Total	4.525%	4.106%			

Source: Patil (2012), Joshi B (2012), HAREDA (2012), MNRE (2012)

In all cases, instead of imposition of penalty, the state regulatory commissions have allowed to carry forward the shortfall to next year, i.e., FY 2012–13. However, the recent order by the Maharashtra Regulatory Commission could be seen as a breakthrough order as far as enforcement of RPO is concerned (Box 3). Other state regulatory commissions could follow this example to bring about compliance and ensure stricter implementation of regulations. Further, records on RPO compliance are also not available with many state nodal agencies.[13] In many cases, the state agencies are required to submit a quarterly report to the regulatory commission on RPO compliance, where with the exception of Gujarat none of the other states are adhering to this requirement. Secondly, despite the applicability of RPO targets on open access and captive users, their compliance with RPO targets is unknown. In this context, the benchmark judgement of Rajasthan High Court on the applicability of RPO on captive and open access consumers can be considered to be a favourable development which will strengthen RPO enforcement and set a precedent for other renewable energy rich states.[14] The non-compliance with RPO targets also has had implications on the REC market. The recent trends in REC market in India indicate a surplus of sellers and paucity of buyers, which is attributed to the non-compliance of obligated entities to RPO target. The falling trend in prices (non-solar) is clearly indicative of the lack of demand, which again is mainly because of non-compliance by obligated entities (Annexure II).

[13] Some SNAs in states such as Gujarat and Haryana have started to report quarterly compliance of RPO to the regulatory commissions.

[14] The Rajasthan High Court rejected the civil writ petitions filed by 17 obligated entities in Rajasthan that had claimed that the Rajasthan Electricity Regulatory Commission (RERC) had no right to notify RPO targets to captive power plants and open access users in the state. The court dismissed the petitions stating that they were 'devoid of merits.' The petitioners are not believed to have challenged the High Court's order in the Supreme Court yet (IEX, 2013).

The case of Maharashtra is an interesting example of ensuring compliance of RPO. The electricity regulator MERC tried to enforce the RPO targets before the renewable energy certificate (REC) regime; however, there were several issues which demonstrated difficulties in RPO compliance. In 2007–08, the total RPO target was 4%, however only one distribution utility — Tata Power Co., was able to meet the target out of the four distribution companies which were not able to procure renewable energy because of the lack of suppliers in their distribution areas and the high cost for sourcing them from outside. The high demand for existing renewable generators led to increase in price of renewable energy due to lack of supply and rise in land prices which made new renewable energy projects financially unviable. With the introduction of REC regulations, the situation has changed remarkably with buyers being able to buy RECs to meet RPO.

In a recent order issued by the MERC in July 2013, it has directed all distribution companies to comply with the RPO targets and clear their backlog of previous years, failing which stiff penalties will be imposed on them. It has ordered over 90 entities, including distribution companies, private captive power consumers, and open access consumers to meet their renewable purchase obligation of past four years cumulatively beginning from 2010–11 before 31 March 2014. MERC has also set up a commission for timely collection and review of data with regard to compliance of RPO. The panel set up by MERC will maintain a record of all open-access consumers and captive users and their REC trading. The performance of all obligated entities would be reviewed every two months.

Box 2: RPO enforcement in Maharashtra: Good practice

Source: CPI (2012), MERC (2013)

Social and environmental issues

The environmental and social concerns associated with renewable energy projects have generally not been very widely discussed in India. There could be two reasons for the same; the first being the fact that typically renewable energy projects are outside the purview of Environmental Impact Assessment considering the fact that such projects have negligible negative impact on surrounding environment. The other being that cases where there have been problems on this front are not many in number and are therefore not widely reported. The recently commissioned report by MNRE on developmental impact and governance issues of renewable energy projects has put forth similar views on this subject.

Notwithstanding this fact, it is seen that some renewable energy projects — for example wind and small hydro power projects — have had significant effects on local ecosystems. The recently concluded report of the Western Ghats Ecology Expert Panel (WGEEP) highlights several issues and concerns associated with the setting up of wind projects in the Western Ghats, which have several high wind potential sites. The setting up of transmission lines, hauling of construction cranes for setting up wind masts as well as hauling the wind masts themselves require construction of roads necessitating the large-scale destruction of forests, habitats and soils, including leading to landslides and massive soil erosion in these high rainfall areas (MoEF, 2011). Apart from damaging effects on landscape, they also have negative impacts on bird mortality and cause habitat fragmentation. The case of the controversial Enercon wind project near the Bhimashankar Wildlife Sanctuary in Maharashtra which has caused grave destruction to the flora and fauna has also been investigated in the report (WGEEP, 2011).

Many of the renewable energy projects such as biomass and municipal solid waste plants (up to a capacity of 15 MW), wind, small hydro power, and Solar PV plants (up to a plant size of 50 hectares)

are exempted from Environmental Impact Assessment. Pressure on water resources due to solar thermal plants (which require large quantities of water for cooling the steam used to power the electric turbines) in dry and arid areas such as Gujarat and Rajasthan, which are already short of water, requires a careful examination.

A second important issue associated with the development of renewable energy is with respect to land. Renewable energy projects are set up in forest, revenue/government or private land. Availability of land for setting up renewable energy projects is a contentious issue. For example, in Karnataka many of the high wind potential sites fall in forest lands and the non-availability of non-forest land contiguous to forest land for compensatory afforestation has been cited as one of the major problems in the state (MNRE, 2011).

Wind projects require vast tracts of land to the order of 15–20 acres per MW (on total land covered basis), whereas on a foot-print basis they require significantly less at about 5–6 acres per MW. Given the shortage of land, practice of land allotment on foot-print basis is considered appropriate, though presently it is not being followed in many states. Maharashtra on the other hand, does not have clear cut procedure for executing renewable energy projects on revenue land (MNRE, 2011). Private land acquisition is again challenging involving issues of just remuneration of land and resources. In many cases, local communities are not adequately compensated for the loss of land. Protests by farmers in Sangli and Dhule districts in Maharashtra demanding higher land compensation is a case in point. In Sangli district, around 44 wind turbines with an installed capacity of 74 MW were shut down in April 2007, due to protests from the local populace and additionally there were problems related to acquisition of land for construction of access roads and power lines. As a result, some of the projects were shifted to neighboring state like Gujarat and Karnataka (Nath, 2012).

Given the increasing scarcity of permissible sites with adequate wind potential MNRE through its communication dated 15 May 2012, has requested state governments to examine their land policy for wind power installations and formulate a policy for land allocation on a ‘footprint’ basis. This refers to the land required for turbine pads, electrical support equipment and link roads, i.e., minimum necessary land for setting up wind projects, in contrast to the existing practice of procuring entire project areas which a wind farm covers.

Addressing gaps: The way forward

There are a multitude of policy instruments and financing schemes for promoting renewables, despite which implementation has been slightly lagging or is happening at a slow pace because the sector is beset with certain inefficiencies. There are several factors which are responsible for the weak progress as discussed in the earlier sections. Having said that, growth of renewables in India over the last five years has been impressive and to continue on this growth path there are certain issues which can be dealt with good governance. The following key recommendations emerge from this study:

1. Ambitious targets for renewables set by the central and various state governments can be achieved only if there are sound implementation and enforcement mechanisms to oversee compliance. In particular, RPO enforcement has to be made stringent with regulators imposing penalties on discoms in case of non-compliance in a fair and transparent manner. The Maharashtra and Rajasthan examples serve as good precedents in this regard. Other state regulatory commissions could follow this example for stricter enforcement of RPOs. Quarterly reporting of RPO to regulatory commissions should be followed by the nodal agencies and this requires regular follow ups and verification with the obligated entities. However, for stricter RPO enforcement it needs to be pointed out that liquidity of the discoms is a key consideration given that many of the state discoms are cash strapped and financially stricken. The liquidity concerns of discoms can be addressed to a large extent by the financial restructuring of the state owned utilities, which is already underway in some states — Haryana, Uttar Pradesh, Rajasthan, and Tamil Nadu).

2. In view of the strategic and policy focus on solar, there is a compelling need to ramp up the manufacturing capabilities in the solar industry. In addition to the DCR measures which have shown lukewarm results, other measures such as provision of low-cost financing to the solar manufacturing industry, setting up of integrated solar manufacturing hubs will provide the much needed fillip to the industry. Further, the solar manufacturing is rapidly evolving globally and within the country, especially with learnings from National solar mission. Funds for R&D and technology up-gradation — for cell-efficiency and enhanced production — could be made available through the NCEF.

3. Increasing penetration of renewables in the electricity mix requires proper planning and sound managerial and technical capacities at the institutional level. The Load Dispatch Centres are the key agencies in the states for planning and managing renewables in terms of day to day operations. It is essential to enhance their technical capabilities in terms of setting up forecasting tools and software for managing the intermittency and at the same time increasing the skill base of the employees managing these responsibilities in the state centres. Accurate resource data is a very important part of the planning process to frame targets and the availability of this data is crucial. While for wind and solar, efforts are already underway, for biomass state nodal agencies should take a lead in coming up with a biomass resource databank collating latest information from district and state level agencies. For example, HAREDA has conducted an independent study on availability of biomass district wise. The studies are priced and are available to developers. Such practices could be adopted by other state nodal agencies also.

4. The budget allocation for MNRE has to be increased in view of the aggressive capacity addition targets set up the states. Further, there is a need to eliminate the ambiguities surrounding the use of the NCEF and bring in more transparency on the process of disbursal of fund.

5. Land issues faced by the project developers could be resolved to a certain extent if land banks could be created under the aegis of the land and revenue department of the states and enabled through information technology. An online repository of land banks of the available land in state with all pertinent information including land use, infrastructure available, location, market access, etc. This could lead to lesser community developer conflicts and smoother project implementation.

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Annexure - I

List of Stakeholders

Haryana	
Haryana Electricity Regulatory Commission (HERC)	R N Parasher, Chairman, HERC Sanjay Verma, Director, Tariff
Haryana Power Purchase Corporation (HPPC)	Ashok Parasher, Chief Engineer Seema Sidana, Asst Engineer
Haryana Renewable Energy Development Agency (HAREDA)	D K Chopra, Project Director
Project developers	**Small Hydro** Mandip Jangra, P&R Engineering **Solar** Shyam Saran, Managing Director, SDS Solar Deepak Chauhan, Head, Business Development, Zamil Infrastructure
Karnataka	
Karnataka Renewable Energy Development Ltd (KREDL)	C R Vijayadev, General Manager K Ramesh, Asst General Manager B C Purushottam, Asst General Manager
Department of Forests, Government of Karnataka	Kanwerpal, Secretary
Karnataka Power Transmission Corporation Ltd (KPTCL)	D Chetan, Executive Engineer

Annexure – II

Renewable energy certificate market

The REC trend in 2012 throws some interesting insights. Increase in the number of sellers for non-solar RECs is noticed in the months post June 2012. However, for solar RECs the demand has been high as compared to supply and this was much more pronounced in the initial months, when solar RECS had just started trading mainly because of lack of sellers in the market. This is because many of the solar plants have been recently commissioned. Surplus sell bids in the market in the latter half of the year is also due to the fact the most of the obligated entities (mostly discoms) postpone buying RECs till the end of the financial year since compliance is monitored on a yearly basis. Further, the market clearing price which is a by-product of volume traded has also shown significant volatility. Non-solar RECs which were trading close to the forbearance price of Rs 3,300 in the initial months have significantly declined and have been trading at the floor price of Rs 1,500.

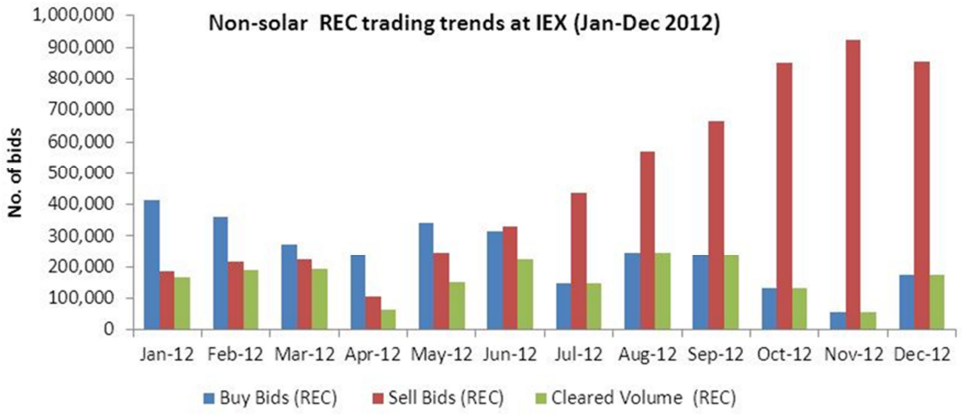

Figure A1: Non-solar REC trading trends in IEX
Source: IEX, 2012

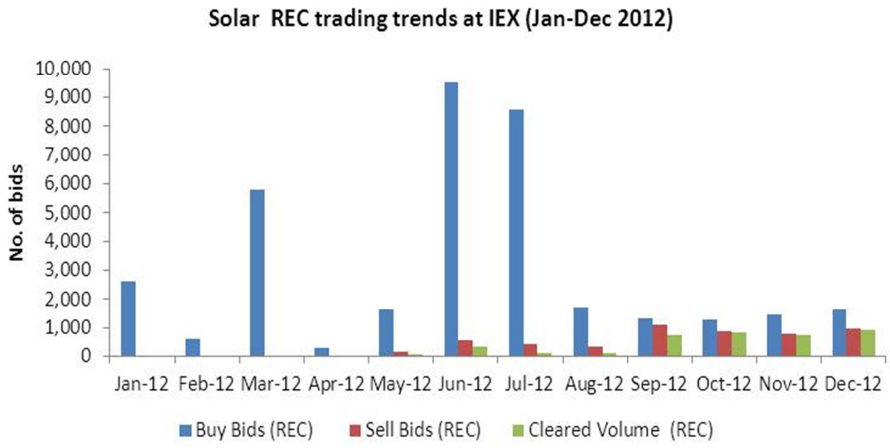

Figure A2: Solar REC trading trends in IEX
Source: IEX,2012