http : //www.cigre.org

CIGRE 2012

C5-113

Implementation of Renewable Energy Certificate (REC) Mechanism in India

S.K. Soonee[1], Minaxi Garg, S.C. Saxena, Satya Prakash
Power System Operation Corporation Ltd.
India

SUMMARY

India's grid connected installed capacity as on 31.10.2011 was about 182 GW with renewable capacity of about 21 GW which constitutes about 11% of total installed capacity. India has a huge renewable energy potential, which is estimated at 85,000 MW for non-solar sources and more than 100,000 MW for solar. Electricity Act 2003 mandates the promotion of efficient and environmentally benign policies. National Action Plan on Climate Change (NAPCC) has been formulated at the National policy level and clearly states that the National RPO must be set at 5% at the beginning of 2009-10, which is to be increased by 1% each year for the next ten years. By 2015, every state in India will need to source at least 10% of its energy from green sources. Government of India has also announced the National Solar Mission, which mandates 20 GW of solar energy in the Country by 2022. To promote renewable resources, various policy initiatives have been taken. One such policy tool is Renewable Purchase Obligation (RPO) specified by the Appropriate Regulatory Commissions, under which the States have been obligated to prescribe a portion of power to be purchased from renewable sources. In India, wind, solar, biomass, co-generation and small hydro plants with capacity of less than 25MW are considered as renewable energy sources. Both non-market and market based mechanisms are in operation in India for promotion of renewable energy sources. Various initiatives taken in the form of non-market based instruments for promotion of renewable energy are tax waivers, accelerated depreciation (80% in the first year), Preferential Tariff for Electricity generated from Renewable Energy Sources, Generation Based Incentive, etc. Renewable Energy Certificate (REC) Mechanism, a market based instrument, has been introduced in India on 18th November 2010. REC Mechanism provides a means to address the dispersed availability of renewable energy sources across various States in the Country separates the 'green' component from the 'electricity' component and facilitates meeting of the RPO by the obligated entities. A pan-India market has been created for trading in RECs through the Power Exchanges. A unique attribute of RECs is that it is fungible and facilitates inter-state transaction of renewable energy with least cost and technicality involved. One REC represents one MWh of energy generated from renewable sources. The paper discusses the regulatory framework, various aspects associated with the implementation of REC Mechanism in India, experience gained so far.

KEYWORDS

Renewable Energy Certificates (REC), Indian Electricity Market, Central Electricity Regulatory Commission (CERC), National Load Despatch Centre (NLDC), Renewable Purchase Obligation (RPO), Power Exchanges

1. INTRODUCTION

Recognizing the importance of energy security for sustained growth & development and conservation of limited fossil fuel resources, India has put into place a National Action Plan on Climate Change. Stress has been laid on harnessing and promoting renewable energy sources in the Country. Ministry of New and Renewable Energy (MNRE), Government of India sources recognizes the following sources of energy as renewable energy sources (RE Sources):

a. Wind
b. Solar
c. Small Hydro (< 25 MW)
d. Biomass

[1] sksoonee@powergridindia.com / sksoonee@gmail.com

e. Bio fuel / cogeneration, etc.

The two major renewable sources of energy are Wind and Solar. In terms of installed capacity, India is the fifth largest producer of wind energy after China, USA, Germany and Spain. The renewable energy sources are not evenly distributed across the geographical of the country. Wind based renewable energy sources are mainly located in the Southern and Western part of the Indian peninsula. Solar is predominantly in the Western part of the country. A summary of the available renewable energy sources in the country as on 31st August 2011 is shown in Figure – 1. The geographical distribution of Wind and Solar energy sources is shown in the Figures – 2 and Figure – 3 respectively.

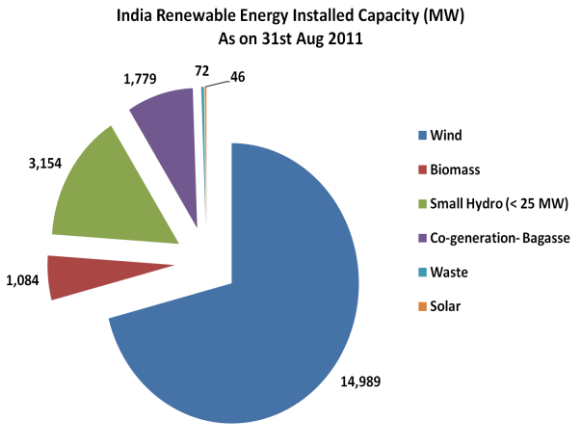


Figure – 1: Renewable Energy Sources in India

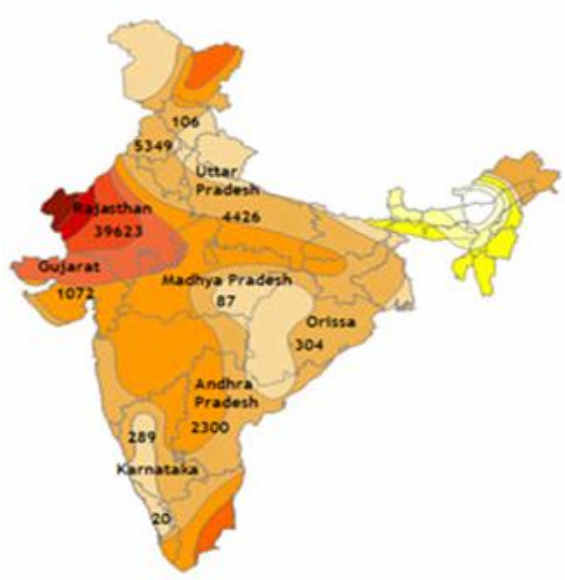


Figure – 2: Solar

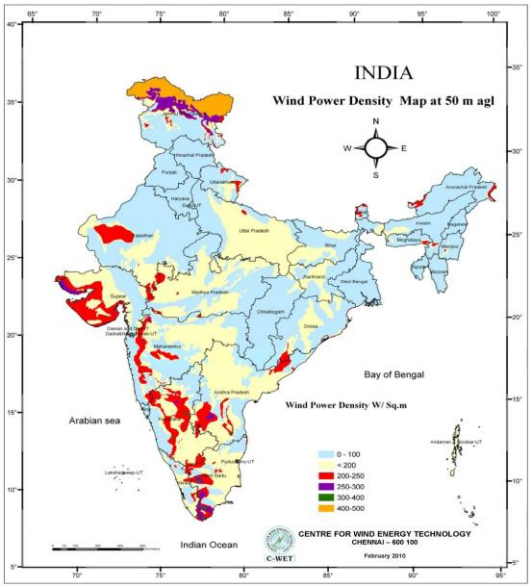


Figure – 3:Wind

The legal mandate is provided by the Electricity Act 2003, the preamble to which mentions *"promotion of efficient and environmentally benign policies"* as an objective. India has a federal structure of governance, with the Central Electricity Regulatory Commission (CERC) at the Central level and the State Electricity Regulatory Commissions (SERCs) at the State level. SERCs specify a percentage of the total consumption of electricity, in the form of Renewable Purchase Obligation (RPO), which the obligated entity must procure from renewable energy sources. The National Action Plan of Climate Change (NAPCC) has set the target of 5% renewable energy purchase for FY 2009-10 which is proposed to be increased by 1% for next 10 years. Various initiatives taken in the form of non-market based instruments for promotion of renewable energy are tax waivers, accelerated depreciation (80% in the first year), Preferential Tariff for Electricity generated from Renewable Energy Sources, Generation Based Incentive, etc.

The distribution of RE sources is uneven across the country and thus meeting the RPO compliances for the utilities/consumers becomes difficult. Considering this distribution of RE sources, SERCs especially in those states where the potential of RE sources is not significant, find it difficult to specify higher RPO targets. For example, given the fact that Delhi does not have sufficient renewable energy potential, the State Regulator of Delhi has specified RPO of 1% for the obligated entities in the State.

In India some states like Rajasthan and Tamil Nadu have very high potential of RE sources and the State Regulators in such States have specified a higher RPO target to the tune of 10%. Since in such states there are avenues for harnessing the potential even beyond the RPO level fixed by the State Regulators, the actual procurement from renewable sources exceeds the RPO levels.

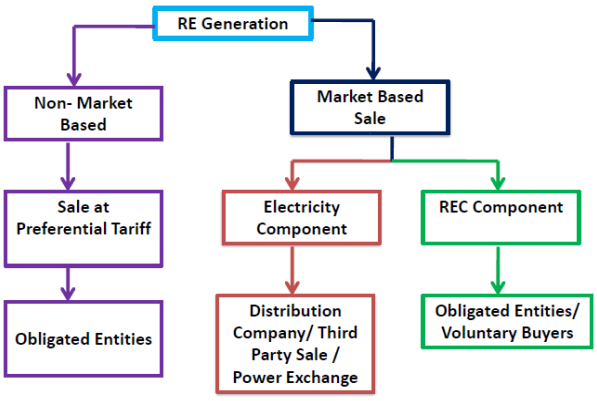
High cost of generation from renewable energy sources acts as a deterrent for the distribution licensees and consumers purchasing electricity generated from RE sources even to meet the RPO level mandated by the State Regulator.

Another significant deterrent to integration of renewable energy sources is the unpredictable and variable nature. A concerted effort is being made to address this issue by using advanced forecasting tools. As a consequence of the variable nature of generation, scheduling becomes difficult. Sudden variations in the generation from renewable energy sources impose a burden on the host utility in terms of commercial charges for deviation from the schedule.

The existing commercial mechanisms for promoting renewable energy sources include non-market based instruments such as tax waivers, accelerated depreciation (80% in the first year), Preferential Tariff specified by the Appropriate Regulator for Electricity generated from Renewable Energy Sources, Generation Based Incentive (GBI) Scheme, etc. In order to promote further investment and development of renewable energy sources on a pan-India basis, the need for a market based instrument was felt. 'Renewable Energy Certificate (REC) Mechanism' provides such a market based instrument which can be traded freely and provide means for fulfillment of RPO obligations by the distribution utilities / consumers.

2. REGULATORY FRAMEWORK AND PROCEDURES FOR REC MECHANISM

At the National Level, CERC has notified the Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) Regulations, 2010 on 14th Jan-2010 for implementation of the REC Mechanism in India. The energy generated by the renewable energy sources is split into two components namely the 'Electricity Component' and the 'Green Attribute'. Cost of electricity generation from renewable energy sources is classified as cost of electricity generation equivalent to conventional energy sources and the cost for environmental attributes. The environmental attributes can be exchanged in the form of Renewable Energy Certificates (REC). Renewable Energy (RE) Generators have the option to sell the energy generated under preferential Tariff or under the REC Mechanism. This is conceptually shown in Figure – 4. CERC has designated the National Load Despatch Center (NLDC) as the Central Agency for implementation of REC Mechanism in India. In accordance with the CERC Regulations, the Central Agency has made available the following Procedures for REC Mechanism, duly approved by CERC:



Figure– 4:Conceptual Framework for REC Mechanism

(a) Procedure for Registration of Renewable Energy Generation Project
(b) Procedure for Issuance of Renewable Energy Certificates
(c) Procedure for Redemption of Renewable Energy Certificates

Much of the success in implementing RECs depends on state entities At the State Level, the SERCs are responsible for providing the Regulatory Framework for implementation of RECs and designating State Agencies in this regard. Majority of the States (28 States) have provided the requisite framework. In order to harmonize the REC process across various States, the Central Agency has also

provided a duly approved "Model Procedure/Guidelines for Accreditation of Renewable Energy Project for REC Mechanism by the State Agency".

3. SALIENT FEATURES OF THE REC MECHANISM IMPLEMENTED IN INDIA

Depending on the type of RE Source, two types of RECs have been mandated namely "Solar REC" covering Solar based sources (Solar PV and Solar Thermal) and "Non-Solar REC" covering all renewable sources except solar. The salient features of REC mechanism in India are:

a) Grid connected RE sources, approved by MNRE, are eligible under this scheme.
b) One REC is issued for One MWh of electricity injected into the grid from renewable energy sources.
c) RE generation with existing Power Purchase Agreement on preferential tariff are not eligible for REC mechanism.
d) REC issued remain valid for 365 days from the date of issuance of such certificate
e) Captive Generators (including self consumption) are eligible for REC if they do not avail promotional / concessional Wheeling Charges, Banking Facility and Electricity Duty Waiver.
f) RECs are purchased by voluntary as well as obligated entities to meet their RPO compliance. The obligated entities are distribution utilities, open access consumers and captive power producers.
g) SERC designate 'State Agency' for RPO compliance and accreditation for REC mechanism at State level.
h) CERC has designated National Load Despatch Centre (NLDC) as Central Agency for registration, repository, and other functions for implementation of REC framework at national level.
i) Trading in RECs can be carried out in the CERC approved Power Exchanges only. Re-trading of RECs is not allowed
j) Central Agency extinguishes the RECs sold in Power Exchanges in its records in 'First-in-First-out' order.
k) CERC has notified the 'Forbearance Price' and the 'Floor Price' for trading of RECs (both for Solar and Non-Solar RECs) which are reviewed periodically. A forecast of these prices has been provided till 2016-17.
l) A centralized integrated web based software application has been put in place for use by all stakeholders through the website www.recregistryindia.in. It is used by the RE Generators, State Agencies, Central Agency, Power Exchanges, SERCs and CERC for all activities. A detailed reporting system is also available for the stakeholders.

4. REC PROCESS

The REC process comprises of four stages i.e. Accreditation, Registration, Issuance and Redemption are shown in Figure – 5 and discussed below.

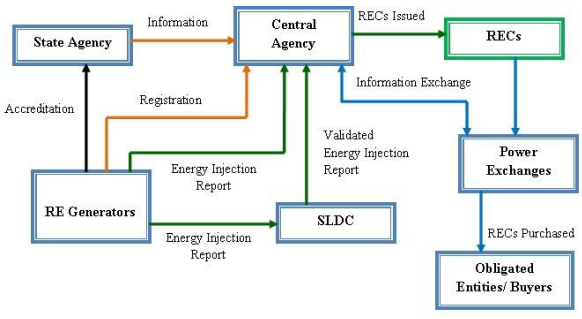


Figure – 5: REC Process

(a) Accreditation: The State Agencies, as may be designated by the SERCs, act as the agency for accreditation and recommending the renewable energy projects for registration, subject to fulfillment of eligibility conditions for participating in REC mechanism in accordance with conditions outlined under the CERC REC Regulations. An application for availing accreditation may be made by the generating company to the host State Agency through the centralized web based application. The State Agency, after duly inspecting/verifying conditions, grants a 'Certificate for Accreditation' (valid for five years unless revoked) to the concerned Applicant for the proposed RE Generation project, which is also called the 'Eligible Entity'. The process of accreditation is normally completed within 30 days from date of receipt of complete information by State Agency.

(b) Registration: After accreditation, an application for availing registration is made by the RE Generator to the Central Agency, on the same web based application. The Central Agency,

after duly inspecting/verifying conditions, grants 'Certificate for Registration' (valid for five years unless revoked) to the concerned Applicant as 'Eligible Entity' confirming its entitlement to receive Renewable Energy Certificates for the proposed RE Generation project. The process of registration is normally completed within 15 days from date of receipt of complete information by Central Agency.

(c) Issuance: An application for issuance of Renewable Energy Certificate is made by the Eligible Entity to the Central Agency on the Web Based Application. The application for issuance of certificate includes Energy Injection Report duly certified by the concerned State Load Despatch Centre. The application for issuance of Renewable Energy Certificates may be made on a fortnightly basis, i.e., on the first day of the month or on the fifteenth day of the month. The Central Agency issues RECs to the Eligible Entity after confirming the claims made by the Eligible Entity, with the Energy Injection Report submitted by the State Load Despatch Center (SLDC).

(d) Redemption: The Eligible Entity may place for dealing the RECs, both 'Solar' and 'Non-Solar' Certificates, on any Power Exchange, where the trading in RECs takes place. Successful trades are intimated to the Central Agency for redemption and extinguishing of the RECs. RECs are currently traded on two power exchanges, Indian Energy Exchange and Power Exchange of India Ltd.

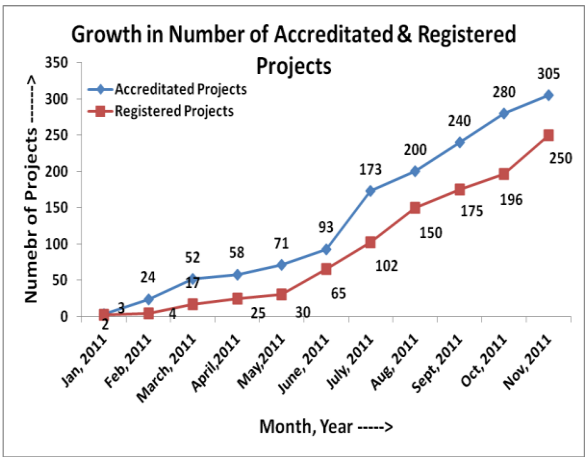
Fees and charges for the REC Process have been specified by CERC as INR 45,000 for Accreditation, INR 7000 for Registration and INR 10 for issuance of one REC.

5. MARKET DESIGN FOR TRADING IN RECs THROUGH POWER EXCHANGES

A closed, double sided auction with uniform price discovery mechanism has been put in place in the Power Exchanges for trading of RECs. The market lot size is 1 REC. Trading sessions are held monthly on the last Wednesday of the month (1300 hrs to 1500 hrs) and these are concurrent for Solar and Non-Solar RECs. Participation is voluntary and RE Generators may choose any of the Power Exchanges for sale of RECs. The prices quoted for purchase of RECs are between the 'Floor prices' and 'Forbearance prices' specified for the Solar and Non-Solar RECs by CERC. A post trade check has been implemented wherein the Central Agency checks that the quantity of RECs offered for sale through any or all of the Power Exchanges by any RE Generator does not exceed the total quantity of RECs issued to that RE Generator. The Central Agency checks the combined maximum bid volume in the Power Exchange(s) for each eligible entity against the quantity of valid RECs for that entity for both 'Solar' and 'Non-Solar' Certificates. Central Agency sends a report to Power Exchange(s) confirming the availability of the valid RECs with the eligible entity. In case the combined maximum bid volume placed for dealing in the Power Exchange(s) exceeds the quantity of valid RECs held by the eligible entity as per the records of the Central Agency, then, the Central Agency advises the Power Exchange(s) to exclude such bid(s) while working out the Market Clearing Price and the Market Clearing Volume for that trade. The Power Exchange(s) work out the Market Clearing Price and the Market Clearing Volume taking into account the advice received from the Central Agency and send the final cleared trades to the Central Agency for extinguishing of the RECs sold in the records of the Central Agency. The RECs are extinguished by the Central Agency in the 'First-in-First-out' order.

6. EXPERIENCE GAINED

National Action Plan on Climate Change (NAPCC) envisages the dynamic minimum renewable purchase specification (DMRPS) to be 5% during FY 2009-10 which shall be increased by 1% every year for subsequent 10 years. The results of a study conducted by CERC to determine likely growth under the REC Mechanism keeping in view the mandate given under the NAPCC show three possible scenarios for participation under REC Mechanism i.e. optimistic (177 projects with capacity 1000 MW), pessimistic (71 projects with capacity 400 MW), and realistic (106 projects with capacity 600 MW). In a short span of 11 months post introduction of the REC Mechanism in India, the optimistic overall achievable targets set out by the study have been surpassed. Till the end of November 2011, a total of 1955 MW of capacity in 305 projects have been accreditated by State Agencies across the country (Figure – 7). Uneven distribution of renewable energy resources in India is clearly from the pattern of the Accredited and Registered Project shown in Figure – 8.



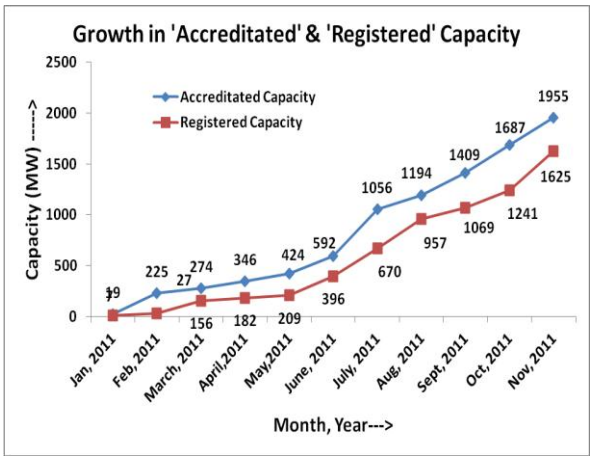


Figure – 7: Growth in 'Accreditation' & 'Registration' of RE Projects

The first 532 RECs were issued in the month of March 2011 to wind & co-generation based RE projects and the number of RECs issued has been steadily increasing. A total of nearly 460,000 RECs, which is equivalent to 460 MUs of renewable energy injected into the grid, have been issued till November 2011. With increase in the number of renewable energy projects participating in the REC Mechanism, the expected number of RECs issued per month, based on present accredited projects, is expected to be of the order of half a million RECs per month.

The first successful trading of RECs took place on 30th March 2011 and since then, monthly trading sessions on the last Wednesday of each month. The details of RECs issued and redeemed are available transparently to all stakeholders through the common web portal www.recregistryindia.in and the websites of the Power Exchanges. A snapshot showing the status of RECs as in November 2011 is shown in Figure – 9. A huge demand for RECs is observed from the large quantum of buy bids placed in the Power Exchanges. This is evident from the behavior of the market participants as shown in Figure – 10. The monetary value of RECs traded is shown in Figure – 11. Further, it is also observed that some voluntary buyers are also purchasing RECs.

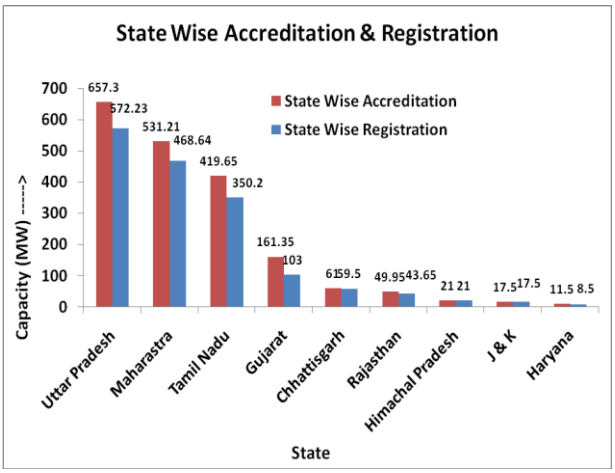
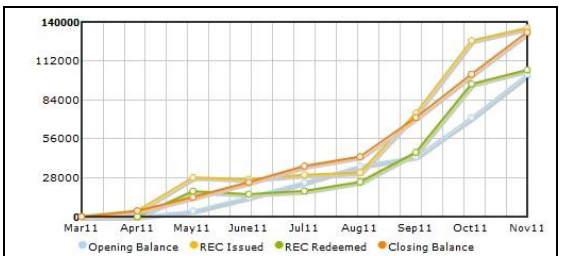


Figure – 8: State Wise Accreditation and Registration (as on 3rd December 2011)



Month, Year	Opening Balance	REC Issued	REC Redeemed	Closing Balance
Mar, 2011	0	532	424	108
Apr, 2011	108	4503	260	4351
May, 2011	4351	28270	18502	14119
June, 2011	14119	27090	16385	24824
Jul, 2011	24824	30224	18568	36480
Aug, 2011	36480	31813	25096	43197
Sep, 2011	43197	74612	46362	71447
Oct, 2011	71447	126544	95504	102487
Nov, 2011	102487	135697	105527	132657
Total:		459285	326628	

Figure – 9: RECs Issued and Redeemed

There has been a tremendous increase in the participation of RE Projects under REC Mechanism and within a period of 11 months after the 1st 'Accreditation', a total of 305 projects with an installed capacity of capacity 1955 MW has been accredited at an average of 28 projects per month and capacity of 177.73 MW per month. Significant investment in renewable energy has been triggered by the introduction of the market based REC. This also speaks volumes about the improved investor confidence in the country. The first Solar Project with a capacity of 8.5 MW has also been accredited

in the state of Maharashtra and this is expected to get commissioned in March 2012. With sepearte RPO for Solar, solar projects are expected to contribute significantly towards the total Renewable Energy Sources in the future.

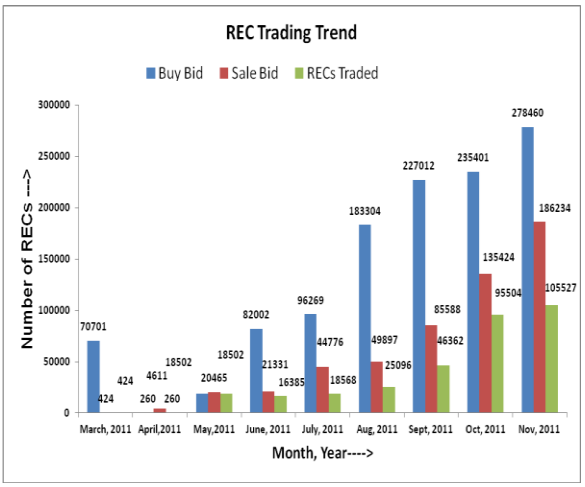


Figure – 10: Trades in RECs

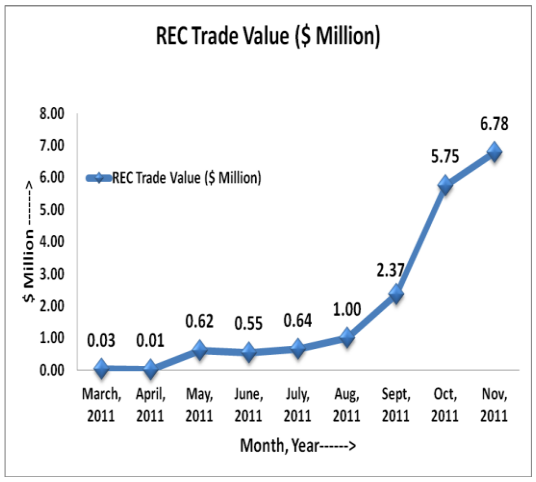


Figure – 11: Value of RECs traded (assuming $1 = ₹45)

In order to maintain the integrity and probity of the entire REC Mechanism, CERC Regulations provide for the appointment of a 'Compliance Auditor' in consultation with the Central Agency and this is currently under progress.

7. ISSUES AND CHALLENGES

Some of the challenges faced during the implementation of the REC Mechanism and foreseen in the near future are as follows:

a) Dealing with large numbers of small RE Generators of a wide variety poses a challenge in terms of sheer numbers and coordination requirements.
b) Verification of the RE generator facilities physically by the concerned State Agencies.
c) Notification of the required Regulatory framework by some of the States is still under process. Further, motivating states with quantum of renewable energy sources more than the RPO requirement for further promotion of such sources is a challenge.
d) RPO monitoring is a challenge at the ground level.
e) Periodicity of RPO compliance monitoring is presently on an annual basis. However, for driving the market, a more frequent compliance monitoring frequency may be needed.
f) Capacity building of stakeholders on a large scale is a challenge. Central Agency has conducted 12 workshops over a period of 12 months during 2010 and 2011 to educate various Stake Holders like the SERCs, State Agencies as well the project developers about the regulatory procedures and the technical aspects of the REC scheme. Some state regulatory agencies have also organized workshops for promoting the RPO regulations and REC scheme.
g) With more and more renewable energy projects coming, the development of an adequate and robust transmission system is pre-requisite. This is also important from the perspective of maintaining secure and reliable grid operation which is non-negotiable.
h) Suitable commercial mechanisms to handle deviations such as the proposed Renewable Regulatory Fund (RRF) are required to handle variable generation sources.
i) The cost of renewable energy is still very high as compared to that from conventional sources. This is primarily due to the high cost of technology. R&D, innovation and availability of equipment suppliers locally may resolve this issue.
j) Cyber security issues associated with the centralized web-based application.

8. DISCUSSION AND WAY FORWARD

India is one of the few countries in the world to have introduced the REC Mechanism. Introduction of the REC Mechanism has provided a market based mechanism for promotion and large scale

integration of renewable energy sources in the Country. Trading through the Power Exchanges has facilitated a pan-India market for renewable and a price discovery is taking place, providing appropriate signals for investment and brought about investor confidence and comfort. As a consequence, this has provided a boost to investment in the renewable sources. Investment has also been triggered in the development of local manufacturing facilities for RE generating equipment such as wind turbines and solar cells. REC Mechanism has also facilitated another avenue for fulfillment of the RPO compliance requirements by the obligated entities. This is especially true for States which are less endowed with renewable energy sources. The participation of RE generators in the REC mechanism is increasing at exponential rate and has surpassed all estimates. Concerns being raised by the stakeholders for future consideration include monitoring and strict compliance of RPO, increase in time limit for application for RECs, increasing the validity period of the RECs, re-trading of RECs, inclusion of off-grid renewable energy sources and combining of Solar and Non-Solar RECs in the long run. The concerns mentioned above need to be addressed to facilitate further growth of the REC mechanism.

ACKNOWLEDGEMENT

Authors are grateful to the power system fraternity, POWERGRID and POSOCO Management for the encouragement. The views expressed in this paper are those of the authors and not necessarily of the organization they belong to.

BIBLIOGRAPHY

[1] Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) Regulations, 2010.
[2] Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) Regulations 2010, Amendments thereof and Statements of Objects and Reasons.
[3] Anoop Singh. Nationally Tradable Renewable Energy Credits for Renewable Portfolio Obligation in the Indian Power Sector, *The 2nd Joint International Conference on "Sustainable Energy and Environment (SEE 2006)"21-23 November 2006, Bangkok, Thailand.*
[4] Website of Indian Energy Exchange www.iexindia.com
[5] Website of Power Exchange of India Ltd. www.powerexindia.com
[6] Website of Central Electricity Authority. www.cea.nic.in
[7] Website of MNRE. www.mnre.gov.in
[8] Website of Forum of Regulators www.forumofregulators.gov.in
[9] Website of CERC: www.cercind.gov.in
[10] Website of NLDC: www.nldc.in
[11] Website of REC Registry: www.recregistryindia.in
[12] Website of Maps of India : www.mapsofindia.com
[13] S.K. Soonee et.al, Renewable Energy Certificate Mechanism in India, 16th National Power Systems Conference, December 2010.
[15] Emerging Markets for Renewable Energy Certificates: Opportunities and Challenges, National Renewable Energy Laboratory, Colorado, USA
[16] National Action Plan on Climate Change, Government of India, http://pmindia.nic.in/climate_change.htm
[17] Making solar thermal power generation in India a reality – Overview of technologies, opportunities and challenges, The Energy and Resources Institute (TERI), India
[18] Assessment of Investment Climate for Wind Power Developers in India, Indian Renewable Energy Development Agency
[19] NERC Special Report – Accommodating high level of variable generation
[20] Namrata Mukherjee, Renewable Energy Certificates, In Wind Chronicle, Volume 4 No 4 Aug-Sept 2008.