

Experience of Solar Renewable Energy Certificate (REC) Market in India

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SUMMARY

Energy security for the country has become a strategic and economic issue to secure the sustained economic growth of the economy. With depleting conventional resources along with concerns regarding the climate change and greenhouse gases etc., the focus is shifted to increased mix of Renewable Energy (RE) into the overall energy requirement of the country. Since the relative cost of electricity generated from such resources is expensive, large scale development of renewable resources need new market instruments coupled with the policy and regulatory support. Enactment of the Electricity Act 2003 by the Parliament of India has lent further support to renewable energy by stipulating purchase of a percentage of the power procurement by obligated entities from renewable energy sources. The renewable purchase obligation as well as preferential tariff for procurement of such power has been specified by various State Electricity Regulatory Commissions (SERCs). Renewable energy sources are not spread evenly across the different states and the high cost of generation from RE sources discourages local distribution licensees from purchasing electricity generated from RE sources. To address this issue, Renewable Energy Certificate (REC) Mechanism, a market based instrument, has been introduced in India on 18th November 2010. REC Mechanism seeks to address the mismatch between availability of RE sources and the requirement of the obligated entities to meet their renewable purchase obligation (RPO) by purchasing green attributes of renewable energy remotely located in the form of RECs. This paper discuss about the REC process, recent amendment in REC Regulations, experience of Solar REC Market, Challenges and way forward for REC Mechanism.

KEYWORDS

Renewable Energy Certificate (REC), Indian Electricity Market, State Electricity Regulatory Commission (SERC), Central Electricity Regulatory Commission (CERC), National Load Despatch Centre (NLDC), Renewable Purchase Obligation (RPO), Power Exchanges, Accreditation, Registration, Issuance, Redemption

1. INTRODUCTION

India has abundant untapped renewable energy potential of wind, solar, biomass and small hydro, among the various renewable energy resources, the potential of wind energy is about 102 GW and solar energy about 750 GW. To tap the potential of the renewable energy for the inclusive and energy secure development of the country, the policy and regulatory support has been provided by the government. The most important piece of legislation for the energy sector is the enactment of the Electricity Act in 2003. The Act enjoins the CERC and SERCs to promote co-generation and generation of electricity from renewable sources of energy. Further, Electricity Act 2003 mandated the formulation of National Electricity Policy, National Tariff Policy and National Electricity plan to ensure optimal utilization of all resources including renewable sources of energy.

The National Electricity Policy 2005 aims to exploit feasible potential of renewable energy resources, reduce capital costs, promote competition and private sector participation etc. Tariff Policy 2006 provides for specification of a percentage of total energy consumption in the area of distribution

licensee from purchase of energy from renewable energy sources, and amendment in tariff policy in 2011 provides that SERCs are required to reserve a minimum of 0.25% for purchase of solar energy by the end of 2012-13 and further go up to 3% by 2022 and the non-solar component has been separately provided. The increase in utilisation of renewable sources of energy is important for energy security of the country and meeting the challenge of climate change. To address the issues related with climate change India has put into place a National Action Plan on Climate Change (NAPCC). NAPCC recommends strong regulatory measures to fulfil the target of 5% renewable energy purchase for FY 2009-10 which will increase by 1% for next 10 years i.e. 15% by 2020. Under the NAPCC, Jawaharlal Nehru National Solar Mission was launched in January 2010 which seeks to establish India as a global leader in solar energy with a target of deploying 20 GW of grid connected solar power by 2022; the target is now revised to 100 GW by 2022. The other benefit of this mission would be lower annual emissions of CO₂ by about 165 million tonnes.

The SERCs set the Renewable purchase obligation (RPO) targets for distribution companies to purchase certain percentage of their total power requirement from renewable energy sources. As the renewable energy potential varies from state to state. Therefore to address the mismatch between availability of Renewable energy sources and the requirement of the obligated entities to meet their RPO across States, the Renewable Energy Certificate (REC) mechanism was introduced in 2010 by CERC. CERC notified REC Regulations on 14.01.2010 to fulfil its mandate to promote renewable sources of energy and development of market in electricity. REC Mechanism, a pan-India market has been created for trading in RECs through the Power Exchanges. 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. REC Mechanism has addressed the geographical Constraints and Inter-State Transfer of Power from Renewable Energy Sources. One REC represents one MWh of energy generated from renewable sources.

CERC has designated National Load Despatch Centre (NLDC) as the Central Agency for the implementation of REC Mechanism. Central Agency is responsible for registration of Renewable Energy Generation Facilities, issuance of RECs, maintenance and settlement of RECs Account, repository of transactions in certificates and other functions as may be necessary for coordination and implementation of REC Mechanism in the country. In accordance with the CERC Regulations, the Central Agency has made available the following Procedures for REC Mechanism, duly approved by CERC:

- (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 the concerned stakeholders. At the State Level, the SERCs provide the Regulatory Framework for implementation of RECs and designating State Agencies in this regard. Majority of the 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".

A centralized integrated web based software application has been put in place for use by all stakeholders through the website www.recregistryindia.nic.in. It is used by the RE Generators, State Agencies, Central Agency, Power Exchanges, SERCs and CERC for all activities related with REC Mechanism. A detailed reporting system is also available for the stakeholders.

2. REC PROCESS

The REC process comprises of four stages i.e. Accreditation, Registration, Issuance and Redemption, are discussed below:

Accreditation: RE Generator through REC web application submit the online application for accreditation of the project. Subsequently, the State Agencies accreditate the project and recommends the registration of the project to Central Agency.

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' to the concerned Applicant as 'Eligible Entity' confirming its entitlement to receive RECs for the proposed RE Generation project.

Issuance: As per the Energy Injection Report issued by SLDC, Central Agency issues RECs to the Eligible Entity.

Trading: Trading sessions are held monthly on the last Wednesday of the month. The Eligible Entity may place bids for dealing the RECs on Power Exchange(s). RECs are currently traded on two power exchanges, Indian Energy Exchange and Power Exchange of India Ltd. 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.

Redemption: Successful trades are intimated to the Central Agency for redemption and extinguishing of the RECs. Further, RECs may also be retained by RE generators to fulfill their RPO. The RECs are extinguished by the Central Agency in the 'First-in-First-out' order.

3. RECENT AMENDMENTS IN CERC REC REGULATIONS

The learnings of the implementation of REC mechanism and issues faced by stakeholders have been addressed by CERC through amendments in REC Regulations. Till date, three amendments have been notified by CERC for effective implementation of REC Mechanism.

- I. Eligibility conditions for RE generators have been clarified to address the various issues of the Stakeholders: (1) Renewable energy generators who have contracted the sale of power through competitive bidding are not eligible for registration under REC Mechanism, (2) Co-generation plants (CGP) for their captive generation are eligible for registration under REC mechanism only upto connected load capacity for issuance of RECs irrespective of the contract signed by them with the third parties, (3) Earlier the Captive Generating plants who are availing the benefit of Electricity duty were not eligible for registration under REC Mechanism, however, with recent amendments such plants are eligible to take benefit under REC Mechanism, (4) RE generator who sells electricity to an entity who uses the purchased energy for meeting their RPO is not eligible under REC Mechanism (5) A distribution licensee who has purchased RE energy over and above their RPO are entitled to receive RECs. This amendment will address the problem of RE rich states that are averse to purchase renewable energy at higher cost in comparison to conventional energy. Through this amendment, DISCOMs will be compensated through issuance of RECs whenever they will purchase renewable energy over and above their RPO.
- II. In the CERC REC Regulations 2010, the REC has the Shelf-life of 365 days. Due to weak market sentiment the shelf life of REC extended from 365 days to 730 days w.e.f. 11.02.2013. Despite of the extension of the validity of Certificate, more than 2600 RECs were expired in FY 2013-14. To address this situation, CERC has extended the validity of the RECs from 730 days to 1095 days.
- III. Second amendment in REC Regulations provided an opportunity to the renewable energy (RE) generator including captive generating plant to retain the RECs for offsetting its RPO as a consumer for their consumption units located in different States. Before this amendment, RE generators, even if, they have RECs in their account are bound to purchase RECs through

Power Exchanges to fulfil their RPO. Till 30th June 2015, 3,05,301 number of RECs have been redeemed by Central Agency from the respective accounts of RE generators.

- IV. Subsequent to launch of the REC Mechanism in 2010, the relative cost of generation of renewable energy especially solar energy reduced considerably; therefore the floor and forbearance prices were revised by third amendment in REC Regulations and the concept of Vintage multiplier factor (2.66) was introduced for Solar Generators which will address the dynamic changes in the prices of solar energy. Due to reduction of floor price and forbearance price of solar RECs w.e.f. 1st Jan 2015 (shown in figure-1), the trading of solar RECs increased considerably since Jan 2015.

	Non-Solar REC		Solar REC		
	w.e.f. (01.04.2012 - 31.03.2017)	w.e.f. (01.01.2015 - 31.03.2017)	w.e.f. (01.06.2010- 31.03.2012)	w.e.f. (01.04.2012- 31.12.2014)	w.e.f. (01.01.2015- 31.03.2017)
Forbearance Price (₹ /MWh)	3,900	3,300	17,000	13,400	5,800
Floor Price (₹ /MWh)	1,500	1,500	12,000	9,300	3,500

Figure -1: Floor and forbearance price as notified by the CERC

4. OTHER IMPORTANT DEVELOPMENTS

- Hon'ble Supreme court(SC) judgement dated 13.05.2015 with regard to the case between Hindustan zinc limited and the Rajasthan electricity regulatory commission (RERC) on the applicability of the RPO regulations framed by RERC on CPP and open access consumers. Hon'ble SC ruled that RPO on captive consumer is justified and interpreted it in the context of Article 51A (g) of the Constitution of India and that it casts a fundamental duty on the citizen to protect and improve the natural environment and the mandate of Article 21 that guarantee right to live with healthy life.
- Hon'ble APTEL order dated 20.04.2015 in the matter of petition filed by various associations requesting APTEL to give directions to the SERCs to comply with RPO regulations framed by the concerned SERCs. The APTEL under section 121 of the Electricity Act inter-alia directed SERCs – (a) to carry forward of RPO as per the RPO regulations, (b) monitoring of compliance of the RPO should be carried out periodically as provided in the Regulations, (c) in case of default in fulfilling of RPO by obligated entity, the penal provision as provided in the Regulations should be exercised, (d) The State Commissions are bound by their own Regulations and they must act strictly in terms of their Regulations, (e) The order states that “If the Regulations recognise REC mechanism as a valid instrument to fulfil the RPO, the carry forward/review should be allowed strictly as per the provisions of the Regulations keeping in view of availability of REC”.

5. EXPERIENCE OF REC MARKET IN INDIA:

A. ACCREDITATION AND REGISTRATION:

As on 30th June 2015, 297 Solar PV projects have cumulative capacity of 594 MW have been accredited by respective State Agencies, and 286 projects having capacity 582 MW from 11 States of the Country have been registered by Central Agency. Solar PV Projects with capacity from 0.1 MW- 19 MW have been registered under REC Mechanism. The State-wise registered capacity is shown in the following table:

State-wise Solar PV capacity in MW							
S. No.	State	No.of Projects	Registered Capacity (MW)	S. No.	State	No.of Projects	Registered Capacity (MW)
1	Rajasthan	92	214	7	Odisha	2	5
2	Madhya Pradesh	82	140	8	Delhi	1	2
3	Tamil Nadu	42	91	9	Tripura	1	5
4	Maharashtra	48	74	10	Gujarat	3	2
5	Andhra Pradesh	9	41	11	Telangana	3	5
6	Chhattisgarh	3	5	Total		286	583

Figure -2: State-wise installed capacity of the Solar PV Projects

B. Capacity Utilisation factor (CUF) for Solar Projects Registered under REC Mechanism

As on 30th June 2015, details of monthly energy injected for complete one year for 320 MW out of 583 MW registered capacity is available, the same has been analysed for calculation of capacity utilisation factor (CUF) for solar PV plants. The CUF is on expected line as it varies from State to State due to variation in solar insolation in different regions. The histogram of CUF for 135 solar PV projects registered under REC Mechanism is shown in the Figure-3.

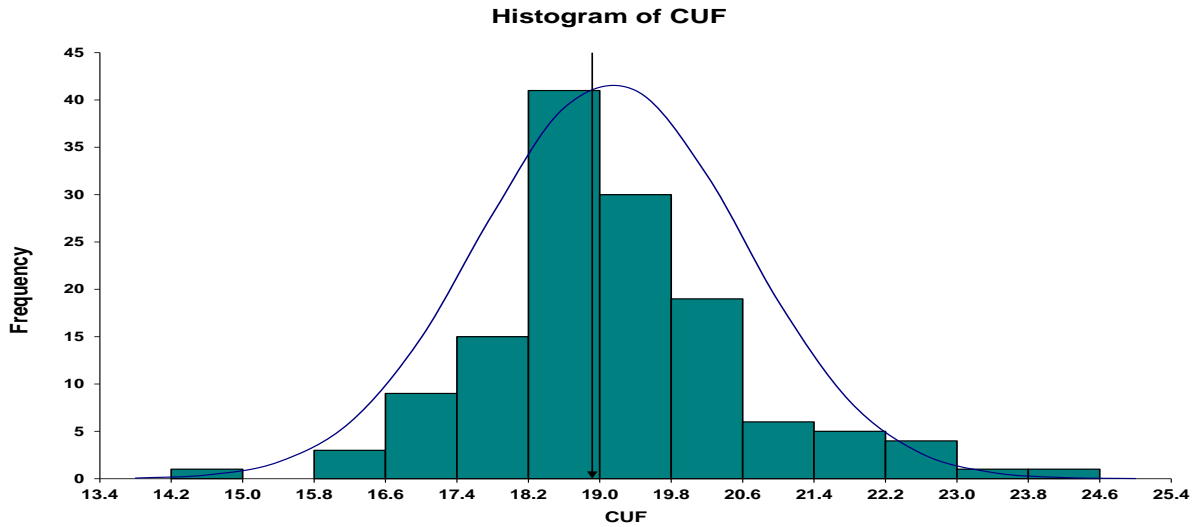


Figure -3: Few details of the Histogram of CUF: Min - 14.2, Max-24, Mean 19.1, Sigma-3.68, stdev-1.5

C. ISSUANCE OF RECs

Issuance of RECs started with a modest figure of 532 RECs in the month of March, 2011. Since then, more than 23.4 million RECs have been issued upto 31st May 2015. As expected, the issuance of RECs increased year by year due to addition of capacity under REC Mechanism. As the Wind power installed capacity is 48 % of the total registered capacity under REC Mechanism, therefore the maximum RECs were issued to the Wind projects and more than 26 lakh RECs have been issued to the Solar PV projects. The graph depicting the year-wise issuance of RECs and RECs issued on the basis of RE technology are given below:

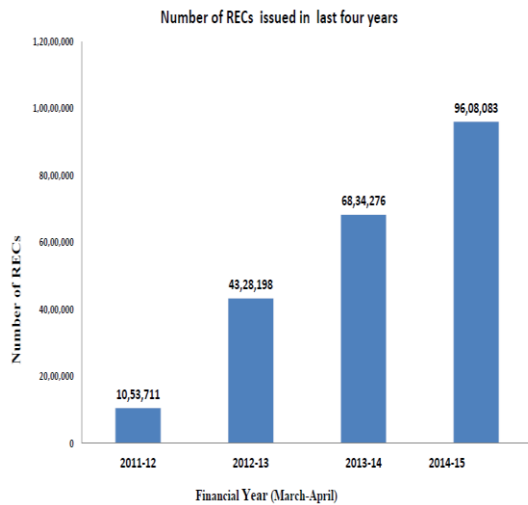


Figure -4: Year-wise issuance of RECs

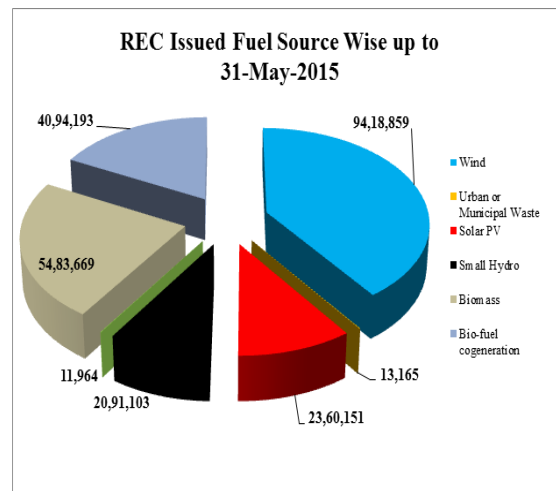


Figure -5: RECs issued on the basis of RE technology

D. Power Sale Options

There are three options available to the RE generators who wish to come under REC Mechanism: (1) Sale to third party under Open Access Regime (2) Sale through Group Captive under Open

Access Regime/Captive power plants for self-consumption (3) Sale of power to DISCOM at Average Power Purchase Cost (APPC). For analysis of the route opted by the registered projects, Central Agency has collected the data from RE generators through REC web application. From the information collected, it emerged that maximum no. of RECs issued to the projects selling power to DISCOM at APPC followed by projects selling power to third parties under Open Access and Captive generating plants. The breakup of the number of projects, Capacity in MW and number of RECs issued under different routes are shown in the following table:

S. No.	Type of Route	No. of Projects	Capacity (MW)	No. of RECs Issued
1	APPC	120	278	14,40,817
2	Open Access	108	197	8,61,639
3	Captive Generating plants	57	107	3,26,183
	TOTAL	285	582	26,28,639

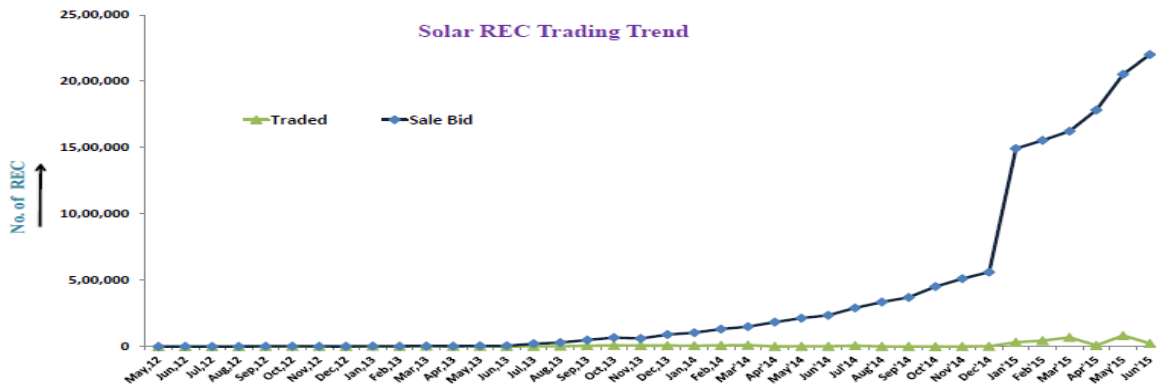
Figure - 6: Details of Power sale options exercised by RE projects registered under REC Mechanism

E. REC TRADING

Total of fifty two trading sessions have taken place since the first session on 30th March, 2011, more than 1 crore RECs were traded and redeemed till 30th June 2015 which shows that the market has increased in depth and volume. The monetary value of more than 1 Crore RECs traded is about INR 1821 Crore.

Trend in Solar REC trading

Issuance of Solar RECs started from May’12 with the issuance of 249 RECs, and 1,642 buy bids were received against the sale bid of 249 RECs, and finally 10 RECs were traded on power exchanges. Due to less liquidity and more demand of RECs, the buy bids exceeded the sale bids from May’12- April’13 and RECs were traded above the existing floor price. However, the situation reversed since May’13 onwards wherein the sale bids exceeded the buy bids therefore RECs were traded on floor price. The graph showing the sale bid, buy bid and number of Solar REC traded is given in figure -7.

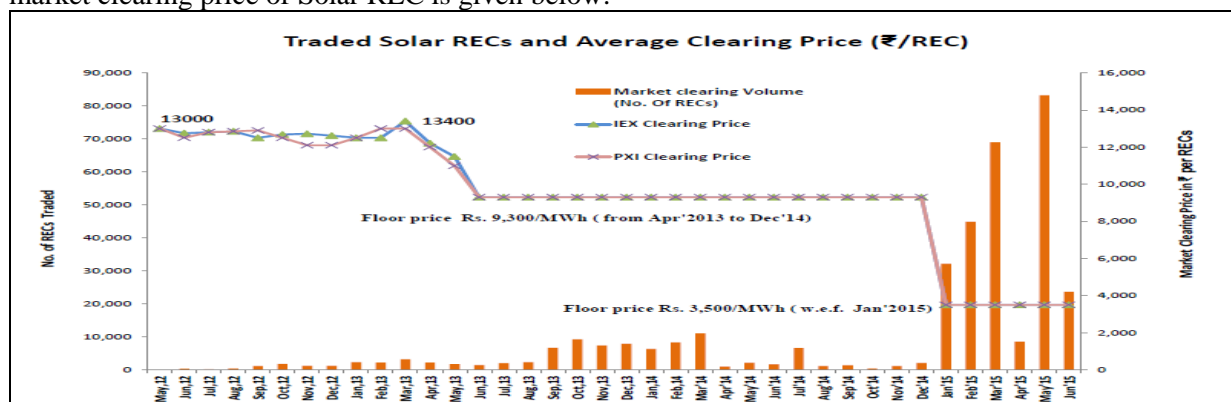


Figure– 7: Trend of Sale bid and REC traded

From the above graph, it is clearly visible that demand–supply gap is increasing due to non-compliance of RPO by obligated entities. In an attempt to revive the solar REC market, Hon’ble CERC issued amendments in the REC Regulations in December 2014. In the said amendment, the concept of vintage multiplier factor (VMF) was introduced with a factor of 2.66, the VMF is applicable to the solar generating companies registered prior to 01.01.2015 and shall be applicable for the period from 01.01.2015- 31.03.2017 i.e. RE generator will receive 2.66 REC against the one megawatt hour of electricity injected into the grid. Beyond 31.03.2017, such projects shall be eligible for one REC for one megawatt hour of electricity injected into the grid. Accordingly, w.e.f. 01.01.2015, the floor price and forbearance price of Solar REC were revised from Rs. 9300 - Rs. 13500 to Rs. 3500 - 5800 respectively. Following the amendments in REC Regulations in December

2014, the trading in Solar RECs increased in the month of Jan-March 2015, the increased trading volume is also attributed to the yearly hike witnessed at the end of the compliance period for 2014-15.

Moreover, the trading of RECs including the Solar RECs increased considerable in the month of May 2015 due to recent Supreme Court order asking captive and open consumers to fulfil their renewable purchase obligations. The Supreme Court judgement is likely to have far reaching implications for enforcement of RPO regulations. The trend of the market clearing volume and the market clearing price of Solar REC is given below:



Figure– 8: Trend of Solar REC Trading

F. State-wise issuance and purchase of Solar RECs

The Section 86 (1) (e) of the Electricity Act 2003 provides for Renewable Purchase Obligation (RPO) on consumption of energy, and the RPOs are determined by respective SERCs. The applicability of RPOs is on the Distribution Companies, Captive Power Plants (CPP) and Open Access consumers. Therefore, the demand for RECs is largely driven by the distribution companies, captive power producers and open access consumers. However, due to non compliance of RPO Regulations, more than 22 lakh RECs are available for trading. Utilities from 6 States purchased more than 79 % of Solar RECs traded through Power Exchanges.

Upto 30th June 2015, more than 26 lacs RECs have been issued to the RE generators registered from 8 States. Since, REC is a Pan-India Mechanism, Utilities from 25 States have purchased more than 3.5 Lac RECs through Power Exchanges. The details of the same is given in the following table:

RECs issued to RE generators and RECs purchased by different utilities of different States							
S. No.	State	RECs Issued	RECs Purchased	S. No.	State	RECs Issued	RECs Purchased
1	Rajasthan	11,57,492	98,123	14	Gujarat	0	4,620
2	Madhya Pradesh	7,28,417	17,717	15	Uttar Pradesh	0	3162
3	Tamil Nadu	3,11,085	672	16	Daman and Diu	0	3106
4	Maharashtra	2,77,792	29,252	17	Mizoram	0	1,055
5	Andhra Pradesh	73,132	13,736	18	Delhi	0	598
6	Telangana	44,048	341	19	Haryana	0	544
7	Odisha	11,020	5,062	20	Meghalaya	0	409
8	Chhattisgarh	8,270	16,152	21	Himachal Pradesh	0	347
9	Jharkhand	0	81,163	22	Uttarakhand	0	311
10	Dadra and Nagar Haveli	0	30,150	23	Tripura	0	297
11	Chandigarh	0	27,113	24	Assam	0	67
12	Pondicherry	0	18,000	25	Karnataka	0	60
13	Punjab	0	7,495		TOTAL	26,11,256	3,59,552

Figure – 9: State-wise details of issuance and Purchase of RECs

6. CHALLENGES

Although, the REC Mechanism has picked up at a faster pace than expected wherein more than 1 Crore RECs have been traded on Power Exchanges, however, inventory overhang of more than 1.5 Crore RECs is a cause of concern of the stakeholders. Some challenges which need to be addressed with regard to REC Mechanism are discussed below:

- **RPO Compliance:** For balancing the supply and demand of RECs, strict enforcement of RPO compliance is required. Periodicity of RPO compliance monitoring is presently on annual

basis, therefore, compliance monitoring frequency may be increased by SERCs. Further, there is lack of coherence in the targets set by NAPCC (15% target by 2020) by and targets set by SERCs.

- **Demand-Supply mismatch impacting trading:** REC market is witnessing oversupply resulting in REC inventory build-up. The low demand is largely on account of weak enforcement of the Renewable Purchase Obligation (RPO). With sell bids outnumbering buy bids, the floor price becomes the market clearing price since June 2013 for Solar REC.
- **Voluntary Market:** Upto 30th June 2015 more than 24,000 RECs have been purchased by Voluntary buyers, most of the RECs were purchased by Central Public sector Enterprises due to inclusion of purchase of RECs under CSR in 2012-13. However, policy and regulatory interventions are required to strengthen the voluntary market.
- **Capacity Building:** Central Agency has conducted 21 workshops for the stake holders, and participated in many conferences/ workshops as resource person since the launch of the REC Mechanism. However, more capacity building workshops may be organised for stakeholders for improving the governance process.

7. WAY FORWARD

Since the launch of the mechanism, response of the stakeholders towards REC Mechanism is quite encouraging. States play a very critical role in this Mechanism and almost all states have notified RPO Regulations. The sheer number of hits on the REC website and no. of RE projects registered under REC Mechanism shows that the REC Mechanism has achieved success in a very short span of time. However, there are challenges regarding the huge inventory of RECs which need to be addressed to maintain a sustainable REC market.

Recently, APTEL in its order dated 20.04.2015 directed SERCs to enforce the RPO regulations and exercise the penal provisions, if required. Hon'ble Supreme Court also directed Captive and open access consumers to fulfil their RPO. Further, SERCs (Maharashtra, Madhya Pradesh, Uttarakhand, Punjab etc.) have taken the non-compliance of RPO regulations very seriously and some of them have also exercised the penal provisions under RPO regulations.

Recent amendment in REC Regulations, orders of SERCs, APTEL, Supreme Court and proposed amendment in Electricity Act 2003 regarding the RPO enforcement augur well for the reinvigoration of the REC market. Since REC Mechanism also provides avenue for voluntary buyers to go green and contribute towards the promotion of renewable energy therefore more efforts are needed to tap the voluntary market through policy guidelines like inclusion of purchase of RECs by Public/Private companies under their corporate social Responsibility (CSR) obligations.

8. ACKNOWLEDGEMENT

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9. BIBLIOGRAPHY

1. Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) Regulations, 2010 and amendment thereof
2. Website of Indian Energy Exchange www.iexindia.com
3. Website of Power Exchange of India Ltd. www.powerexindia.com
4. Website of Central Electricity Authority. www.cea.nic.in
5. Website of MNRE. www.mnre.gov.in
6. Website of Forum of Regulators www.forumofregulators.gov.in
7. Website of REC Registry: www.recregistryindia.nic.in
8. S.K. Soonee et.al, Renewable Energy Certificate Mechanism in India, 16th National Power Systems Conference, December 2010.
9. National Action Plan on Climate Change, Government of India,

10. The Indian Electricity Act, 2003.
11. Website of Appellate Tribunal For Electricity: <http://aptel.gov.in/>
12. Supreme court Judgement: Civil Appeal No. 4417 OF 2015 (Arising out of S.L.P.(C) No. 34063 of 2012) dated 13.05.2015
13. <http://pib.nic.in>
14. <http://www.re-invest.in/>
15. <http://niti.gov.in/>