

Impact of Renewable Energy Certificate (REC) Mechanism in India

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Abstract—India's Grid connected installed capacity of Renewables, as on 30.04.2017, is about 57 GW which is about 17% of the total installed capacity in the country. Due to huge potential of Renewable Energy (RE) in the country, an ambitious target to install 175 GW renewable power including 100 GW solar power has been put forth by the Government of India. Such large scale deployments of renewable resources need a facilitative policy, appropriate regulatory framework, new market instruments, institutional capacity building, etc. The Electricity Act 2003 has lent further support for promotion of renewable energy by stipulating purchase of a percentage of the total power procurement by obligated entities from renewable energy sources. The renewable purchase obligation (RPO) as well as preferential tariff for procurement of such power has been specified by various State Electricity Regulatory Commissions (SERCs). Renewable energy sources are spread unevenly 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[1]. REC Mechanism seeks to address the mismatch between availability of RE sources and the requirement of the obligated entities to meet their RPO by purchasing green attributes of renewable energy in the form of RECs. This paper discuss about the REC processes, amendments in REC Regulations, Impact of amendments and Judicial orders, analysis of REC Market, Challenges and way forward for REC Mechanism.

Keywords- Renewable Energy Certificate (REC), State Electricity Regulatory Commission (SERC), Central Electricity Regulatory Commission (CERC), National Load Despatch Centre (NLDC), Power System Operation Corporation Ltd. (POSOCO), Renewable Energy (RE) generator, Renewable Purchase Obligation (RPO), Power Exchanges, Accreditation, Registration, Issuance, Redemption

I. INTRODUCTION

There is huge untapped renewable energy potential in the country. To tap the potential of the renewable energy, the

policy and regulatory support has been provided by the Union Government as well as by the respective State governments. The most important legislation for the energy sector is the Electricity Act in 2003[2]. 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. National Tariff Policy provides: specification of a percentage of total energy consumption of distribution licensee from renewable energy sources by SERC, separate RPO for Solar and non-solar energy sources, Solar RPO to be 8% by 2022 (excluding hydro power), Vintage and technology multiplier allowed in REC etc.

The SERCs notify the RPO targets for obligated entities. 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 through REC Regulations on 14.01.2010 [3]. Through REC Mechanism, a pan-India market has been created for trading in RECs through the Power Exchanges. The energy generated by the renewable energy generator may be considered as having two components- 'Electricity Component' and the 'Environmental Attribute'. The total 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).

REC Mechanism has helped the obligated entities to fulfill their RPO. One REC represents one MWh of energy generated from renewable sources.

CERC has designated National Load Despatch Centre (NLDC), POSOCO as the Central Agency for the implementation of REC Mechanism with responsibility 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 [4]. As per CERC Regulations, the Central Agency after approval of CERC has provided the following Procedures for implementation of the 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

In order to streamline the Accreditation process across various States, the Central Agency has also made a Model Procedure 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 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. Detailed reports are also in public domain on the REC website. The block diagram depicting the conceptual framework of CERC REC Regulation is shown below:

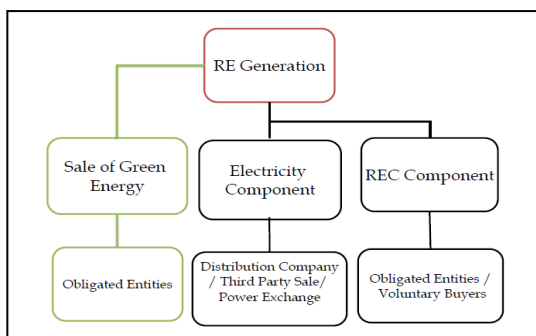


Figure1: Conceptual Framework for REC Mechanism as per CERC Regulations

I. 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: Subsequent to accreditation, an application for registration is made by the RE Generator to the Central Agency through REC web application. The Central Agency, after duly verifying the application, issue the 'Certificate for Registration' to the concerned Applicant, after registration, applicant is entitled to receive RECs for the RE Generation project.

Issuance: As per the Energy Injection Report issued by the concerned 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 (IEX) and Power Exchange of India Limited (PXIL). The prices quoted for sale/purchase of RECs are between the 'Floor price' and 'Forbearance price' specified for the Solar and Non-Solar RECs respectively by CERC.

Redemption: Power Exchange(s) intimate successful transactions to the Central Agency, subsequently Central Agency do 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.

II. RECENT AMENDMENTS IN THE CERC REC REGULATIONS AND THEIR IMPACT ON STAKEHOLDERS

Central Electricity Regulatory Commission on the basis of the inputs received from stakeholders, amended the principal REC Regulations. Till date, four amendments have been notified by CERC for effective implementation of REC Mechanism. Salient points of the amendments are given below:

a. RE generator(s) who sell electricity directly or through trader, to an entity that uses the purchased energy for compliance of RPO, is not eligible under REC Mechanism [5].

This clarification has reduced the legal cases filed before CERC and other forums.

b. Distribution licensee (DISCOM) who has purchased RE energy over and above their RPO is entitled to register and receive RECs [5].

This amendment has addressed the problem of RE rich states which are averse to purchase renewable energy over and above their RPO at higher cost. Till 30.06.2017, more than 0.6 million RECs has been issued to two DISCOMS.

c. Amendment in the CERC REC Regulations also provided an opportunity to the RE generator including captive generating plant (CGP) to retain the RECs to offset RPO of its consumption units located in different States [5]. Prior to the amendment, RE generators, even if, they had RECs in their account, were bound to purchase RECs through Power Exchanges. This amendment has

reduced the transaction cost of the RE generators who are availing the facility of self-retention for compliance of RPO.

Till 30th June 2017, more than 1.1 million RECs have been redeemed by the Central Agency from the respective accounts of RE generators, as the same have been self-retained.

- d. Principal CERC REC Regulations 2010 provided that validity of REC is 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[5]. In spite of extension of validity of Certificates, more than 2600 RECs expired in FY 2013-14. Subsequently, CERC extended the validity of the RECs from 730 days to 1095 days w.e.f. 31.12.2014 [6].

Recently, many stakeholders approached CERC for extension of validity of RECs otherwise their RECs would expire due to low demand of RECs by the Obligated entities. Vide order dated 30.03.2017, CERC has extended the validity of RECs upto 31.03.2018 for all solar and non-solar RECs that are expiring between 31.03.2017 and 30.09.2017 [7].

This has avoided the financial loss to the concerned RE generators on account of expiry of RECs.

- e. 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 w.e.f. 31.12.2014, and concept of Vintage multiplier factor (2.66) was introduced for Solar Generators to address the changes in the prices of solar energy upto 31.03.2017 [6]. Recently, vide order dated 30.03.2017, CERC again revised the floor and forbearance price for solar and Non-solar REC.

Due to downwards revision of Floor and Forbearance prices, the trading of solar RECs increased considerably since Jan 2015.

- f. As per conditions specified in the Regulations, fourth Amendment in the REC Regulations disallowed the Registration and issuance of RECs to the extent of self-consumption of energy generated from renewable energy generating plant(s) [8].

In accordance with the amendments, more than 100 Projects having cumulative capacity of 700 MW have been de-registered from REC Mechanism by the Central Agency.

III. IMPACT OF REC MECHANISM ON STAKEHOLDERS

A. *Investment facilitated by REC Mechanism*

REC Mechanism has provided an additional avenue to RE generator(s) to sell their power locally to

DISCOM and/or open access consumer, and take benefit under REC Mechanism. Further, quantum of transactions and traded price of RECs at Power Exchanges gave signal to RE generators for investment as well as procurement of renewable energy by the concerned stakeholders.

As on 30th July 2017, total capacity of 4480 MW has been registered under REC Mechanism. Subsequent to notification of CERC Regulations on 14.01.2010, more than 3700 MW (out of 4480 MW) has been commissioned and registered under REC Mechanism. Subsequent to notification of REC Regulations, capital investment of more than ₹ 220 billion has been made by the stakeholders for commissioning of 3700 MW RE generation capacity.

B. *Facilitates RPO Compliance*

REC Mechanism has created a pan India market and facilitated the compliance of RPO of the obligated entities which includes the DISCOM, Captive Power plants (CPP) and Open Access consumers. Without REC Mechanism, it would have been very difficult for CPPs to comply the concerned RPO Regulations.

C. *Inter-State Transactions*

REC Mechanism is also facilitating the inter-state transaction of Renewable energy. To maintain the integrity of the RPO compliance on the basis of actual energy injected into the Grid, RECs are being used for settlement of deviations between contracted energy (scheduled) and actual energy injected into the grid [9].

D. *Impact on CO2 Emissions*

As per Central Electricity Authority report on CO2 Baseline Database for the Indian Power Sector, weighted average emission factor is 0.82 ton CO2/MWh [10]. As per the emission factor, emission reduction of 34 Million ton of CO2 may be attributed to generation of more than 41 million MWh (1REC=1MWh) by the RE projects registered under REC Mechanism.

Further, RECs as an instrument to promote actions that address climate concerns has been included in the India's intended nationally determined contribution (INDC) [11].

E. *Integrity and Probity of the REC Mechanism*

As per CERC REC Regulations, CERC has appointed compliance Auditors to inquire into and report on the compliance of REC Regulations by the projects Registered under REC Mechanism. Compliance Audit of more than 80 Projects has been done by the Auditors. On the basis of compliance reports, Central Agency has taken the appropriate actions against the concerned generators who are violating the REC Regulations [12]. The compliance

Audit Mechanism has ensured the integrity and probity of the REC Mechanism in the country.

F. Dissemination of Information and Transparency

REC Mechanism has been implemented through REC Registry website, and relevant reports are available in the public domain. Due to that very few RTI requests has been received by Central Agency.

Implementation of REC Mechanism by Central Agency has also set an exemplary example before stakeholders. On the basis of this experience, Ministry of Power has entrusted the function of Registry of 'Energy Saving Certificate (ESCerts) trading' to the POSOCO, and authorize POSOCO to establish the necessary framework to discharge the functions under Perform Achieve Trade (PAT) Mechanism.

Cross-fertilization of ideas through regular interactions between Central Agency, State Agencies in meetings, workshops has improved the process of decision making with regard to solving the problems of the RE generators with Regard to REC Mechanism.

IV. JUDICIAL ORDERS / INTERPRETATION AND THEIR IMPACT

- A. Hon'ble Appellate Tribunal of Electricity (APTEL) judgement 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 recognize 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" [13].
- B. 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 on Captive Power Plants (CPP) and open access consumers. Hon'ble Supreme Court ruled that RPO on captive consumer is justified in the broader context of Fundamental duties of Citizens to protect and

improve the natural environment; and Fundamental Rights of the citizen that guarantee right to live with healthy life [14].

The impact of the order on the obligated entities is very high in terms of the purchase of RECs. Till 30.04.2017, 12.9 Million RECs purchased in 24 months after the order, is more than 9.7 million REC purchased in 50 months prior to the above mentioned judgement.

Subsequent to the Order, till 30.04.2017, Captive generating plants and Open Access consumers has purchased 10.2 Million RECs, which is about 79 % of the total RECs redeemed by obligated entities for compliance of RPO.

- C. Hon'ble CERC vide order dated 30.03.2017 reduced the floor and Forbearance Price w.e.f. 01.04.2017.

Table-1: Floor and forbearance price

Floor and Forbearance price of REC				
	Prices prevalent before the order dated 30.03.2017		Prices after the order dated 30.03.2017 w.e.f. 01.04.2017	
	Non - Solar REC	Solar REC	Non - Solar REC	Solar REC
Forbearance Price (Rs./MWh)	3,300	5,800	3,000	2,400
Floor Price (Rs./MWh)	1,500	3,500	1,000	1,000

Against the above mentioned CERC order, many stakeholders have filed Petition before Appellate Tribunal and Hon'ble Supreme Court. Hearing of the matter in APTEL is still going on. Meanwhile, vide interim order dated 08.05.2017, Hon'ble Supreme Court had stayed the trading of RECs at Power Exchanges [15]. Subsequently, on 14.07.2017, Hon'ble Supreme Court modified the stay order dated 08.05.2017 and inter-alia allowed the trading of non-solar RECs at Power Exchanges at Prices determined through CERC Order dated 30.03.2017. Further, till the matter is pending before APTEL, the difference between the floor price applicable before and after the 30.03.2017 shall be deposited with CERC by the Power Exchange(s) [16].

V. ANALYSIS OF REC MARKET

A. ACCREDITATION AND REGISTRATION OF RENEWABLE ENERGY PROJECTS

As on 30th July 2017, 1244 projects with cumulative capacity of 5516 MW have been accredited by respective State Agencies, and 1095 projects having capacity of 4480 MW from 21 States of the Country have been registered by Central Agency. RE Projects with capacity from 0.1 MW- 50 MW have been registered under REC

Mechanism [17]. The source-wise breakup of Accreditation and Registration are given in Table 2.

Table-2: Details of Accredited and Registered Projects

Accredited and Registered Projects (source-wise)					
S. No.	Source	Accredited		Registered	
		Capacity	No. of Projects	Capacity	No. of Projects
1	Wind	2,682	628	2,418	562
2	Solar PV	748	374	735	362
3	Biomass	699	75	558	62
4	Bio-fuel cogeneration	1,075	124	512	75
5	Small Hydro	299	40	255	33
6	Biogas	2	1	2	1
7	Urban or Municipal Waste	8	1	0	0
8	Solar Thermal	3	1	0	0
	Total	5,516	1,244	4,480	1,095

B. ISSUANCE OF RECs

Issuance of RECs started with a modest figure of 532 RECs in the month of March, 2011. Since then, more than 41.6 million RECs have been issued upto July 2017. As expected, the issuance of RECs increased year by year due to addition of capacity under REC Mechanism [17]. The graph depicting the source-wise RECs issued is given below:

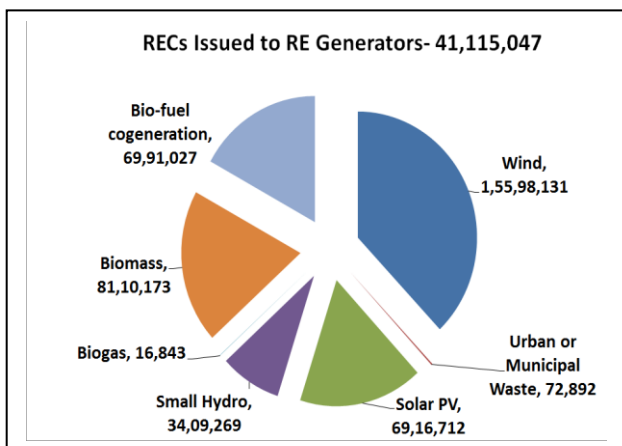


Figure – 2: Source-wise breakup of RECs issued (As on 30.07.2017)

C. REC TRADING

74 trading sessions of RECs till April 2017 have taken place since the first trading of RECs which was held in March, 2011. More than 21.6 Million RECs have been traded at power Exchanges, the monetary value of RECs traded is about ₹ 37.4 Billion. Further, number of buyers,

number of sellers and number of RECs transacted on Power Exchanges in the last six years are given below:

Table 3: Details of Trading of RECs on Power Exchanges

Number of Buyers, Sellers and number of RECs traded on Power Exchanges			
Financial Year	Number of buyers of RECs	Number of sellers of RECs	Number of RECs transacted through Power Exchanges
2011-12	385	118	10,15,274
2012-13	780	325	25,89,814
2013-14	1,052	498	27,48,694
2014-15	784	661	30,61,922
2015-16	1,286	737	49,55,153
2016-17	1,698	783	64,87,739

Source: IEX and PXIL

Further, trading of RECs in the last six years shows the increasing volume of transaction of RECs. The trend of REC trading on Power Exchanges is given below:

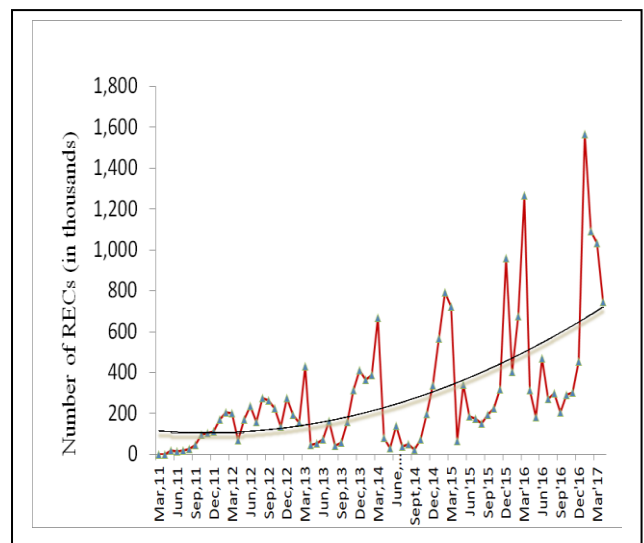


Figure-3: Trend of REC trading (Source: IEX [18] and PXIL [19])

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. As per the Regulations the applicability of RPOs is on the Distribution Companies, Captive Power Plants (CPP) and Open Access consumers. Since launch of the Mechanism upto 30.03.2017, distribution companies purchased about 37% of the total RECs, and remaining 67% RECs purchased by both captive power plants and open access consumers.

Since, REC is a Pan-India Mechanism, stakeholders from 30 States/UTs have purchased more than 20.8 Million RECs through Power Exchanges till 30.03.2017. The States whose utilities had purchased RECs for RPO compliance are given in Table 4:

Table 4: Name of the States whose obligated entities had purchased 20.8 million RECs

RECs Purchased by the obligated entities of States/Union Territories					
S. No.	State/UT	No. RECs Purchased	S. No.	State/UT	No. of RECs Purchased
1	Maharashtra	63,83,711	16	Daman and Diu	3,24,554
2	Gujarat	39,87,528	17	Madhya Pradesh	2,98,871
3	Rajasthan	20,13,765	18	Assam	2,59,438
4	Punjab	11,60,702	19	Chandigarh	2,49,381
5	Dadra and Nagar Haveli	7,17,403	20	Goa	2,05,000
6	Jharkhand	7,15,933	21	Kerala	1,17,636
7	Odisha	6,27,224	22	Telangana	1,02,260
8	Delhi	5,02,335	23	Himachal Pradesh	92,545
9	Tamil Nadu	4,90,060	24	Haryana	72,178
10	Chhattisgarh	4,60,813	25	Meghalaya	20,209
11	Andhra Pradesh	4,59,780	26	Uttar Pradesh	20,051
12	Karnataka	4,55,534	27	Manipur	3,997
13	West Bengal	3,73,045	28	Mizoram	3,160
14	Uttarakhand	3,48,520	29	Tripura	297
15	Pondicherry	3,34,407	30	Bihar	227
Total					2,08,00,564

(Source: IEX and PXIL)

Due to more availability and less demand of RECs, the sale bids exceeded the buy bids; therefore RECs are being traded at floor price since September'12 for non-solar and since June'13 for Solar RECs.

VI. CHALLENGES

More than 21 million RECs have been traded on Power Exchanges; however, inventory overhang of about 19 million RECs is a cause of concern of the stakeholders. Challenges which need to be addressed by the CERC/SERCs with regard to smooth functioning of the REC Mechanism are discussed below:

A. RPO Compliance

For sustainable REC Market strict enforcement of RPO compliance by concerned SERCs is required. For strict RPO compliance, RPO monitoring system at the State as well as Central Level is required for timely action.

Bankability of the Projects registered under REC scheme has been affected due to huge inventory of the RECs.

B. Demand-Supply mismatch impacting the trading of RECs

REC market is witnessing oversupply in comparison to demand which is resulting in build-up of huge REC inventory. Due to sell bids outnumbering buy bids, the floor price becomes the market clearing price both for solar and non-solar RECs since June 2013 & September 2012 respectively. This has skewed the discovery of price of REC at Power Exchange(s).

C. Lack of Voluntary Market

Upto 30th March 2017, 29,226 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 Corporate social Responsibility (CSR) by DPE in 2012-13. Due to lack of such guidelines in the ensuing years, voluntary procurement of RECs reduced considerably.

D. Market Design related Issues

RE generators based on various approved technologies are being registered under the REC scheme. However, only two types of RECs (Solar and Non-solar) are being issued to the RE generators.

Further, vintage and technology based Multiplier factor, secondary market etc. are some of the demands of the RE generators. Moreover, Floor and Forbearance Price of REC are the options for transaction of RECs at Power Exchange(s).

E. Capacity Building

Central Agency has conducted 26 workshops for stakeholders, and officials from State Agencies have participated in many conferences /workshops. However, more capacity building workshops for Captive Power Plants, open access consumers are required to sensitize about recent Hon'ble Supreme Court order for compliance of RPO by CPP/OA consumers.

VII. WAY FORWARD

More than 30 States/UTs have notified RPO Regulations, and these regulations provide that obligated entities may purchase RECs for compliance of their RPO. The number of projects registered, number of RECs issued, and number of RECs traded on Power Exchanges indicate the success of REC Mechanism in a very short span of time.

However, challenges regarding huge inventory due to lack of purchase of RECs by the obligated entities is a serious concern and that needs to be addressed on priority basis. In this regard, incentive and penalty structure may be designed for effective compliance of RPO by the entities. Recently, few SERCs have taken the non-compliance of RPO as a serious matter and exercised the penal provisions under RPO regulations.

Recent Amendments in the REC Regulations, orders of SERCs, APTEL, Supreme Court and tariff policy regarding the RPO compliance augur well for the reinvigoration of the REC market in the country. Further, capacity building workshops, awareness campaigns etc. are required for inculcation of the environment friendly behavior among institutions as well as in individuals through voluntary purchase of RECs.

VIII. ACKNOWLEDGEMENT

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REFERENCES

- [1] Central Agency for Renewable Energy Certificate(REC) Mechanism
<https://www.recregistryindia.nic.in/index.php/general/publics/index>
- [2] Ministry of Power
<http://powermin.nic.in/en/content/electricity-act-2003>
- [3] Central Electricity Regulatory Commission, REC Regulations 2010
http://www.cercind.gov.in/Regulations/CERC_Regulation_on_Renewable_Energy_Certificates_REC.pdf
- [4] Central Electricity Regulatory Commission, Designation of NLDC, POSOCO as Central Agency for REC Mechanism
http://www.cercind.gov.in/Regulations/Notification_Renewable_Energy_Generation.pdf
- [5] Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) (Second Amendment) Regulations, 2013
http://www.cercind.gov.in/2013/regulation/REC%20Regulations8_7_2013.pdf
- [6] The Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) (Third Amendment) Regulations, 2014
<http://www.cercind.gov.in/2014/regulation/noti16.pdf>
- [7] Determination of Forbearance and Floor Price for the REC
http://www.cercind.gov.in/2017/orders/02_SM.pdf
- [8] Central Electricity Regulatory Commission (Terms and Conditions for recognition and issuance of Renewable Energy Certificate for Renewable Energy Generation) (Fourth Amendment) Regulations, 2016.
<http://www.cercind.gov.in/2016/regulation/Noti.pdf>
- [9] Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) (Second Amendment) Regulations, 2015
<http://www.cercind.gov.in/2015/regulation/Noti7.pdf>
- [10] Central Electricity Authority(CEA) - CO2 Baseline Database for the Indian Power Sector
http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf
- [11] The United Nations Framework Convention on Climate Change, Inclusion of RECs India's INDC
<http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf>
- [12] Central Electricity Regulatory Commission order on Compliance Audit under the Renewable Energy Certificate Mechanism.
http://www.cercind.gov.in/2014/orders/SO_321.pdf
- [13] Hon'ble APTEL Order dated 20.4.2015
<http://aptel.gov.in/judgements/OP%20No.%201%20of%202013%20&%201A%20No.%20291%20of%202013%20&%201A%20No.%20420%20of%202013%20&%20OP%20No.%202%20of%2013%20&%20OP%20No.%204%20of%202013.pdf>
- [14] Hon'ble Supreme Court Order dated 13.05.2015
<http://supremecourtindia.nic.in/jonew/ropor/rop/all/286034.pdf>
- [15] Hon'ble Supreme Court Order dated 08.05.2017

http://supremecourtindia.nic.in/jonew/courtnc/rop/2017/13957/rop_934754.pdf

- [16] Hon'ble Supreme Court Order dated 14.07.2017
http://supremecourtindia.nic.in/supremecourt/2017/13957/13957_2017_Order_14-Jul-2017.pdf
- [17] Central Agency for Renewable Energy Certificate(REC) Mechanism- Source-wise breakup
https://www.recregistryindia.nic.in/index.php/general/publics/REC_Source_Wise_Breakup
- [18] Website of Indian Energy Exchange
<https://www.iexindia.com/marketdata/recdata.aspx>
- [19] Power Exchange of India Ltd.
<http://www.powerexindia.com/PXILReport/pages/RECMVPRReport.aspx>

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