

# REC Mechanism in India: Market Analysis, Lessons Learned and Way Forward

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**Abstract-** Renewable Energy Certificate (REC) Mechanism, a market-based instrument, was introduced in 2010 by the Hon'ble Central Electricity Regulatory Commission (CERC) through REC Regulations. Since, launch of the Mechanism more than 55.5 million RECs have been issued to the eligible entities and more than 3500 buyers have purchased about 51.5 million RECs through Power Exchanges (PXs). In addition to this, around 7% of new renewable energy investment in the period 2010-17 came through REC mechanism.

The Renewable Energy target for installation of 175 GW by 2022 and 500 GW by 2030 by Government of India has changed the dynamics of the renewable energy sector. In recent times, tariff of Wind/Solar energy decreased considerably, which necessitated to relook the design of the mechanism from fresh perspective. In this background, this paper analyses the market data available, lessons learned, challenges and way forward.

**Keywords-** Renewable Energy Certificate (REC), Power System Operation Corporation Limited (POSOCO), Renewable Purchase Obligation (RPO), Green Energy Instrument, India

## I. INTRODUCTION

REC mechanism, as a pan-India market instrument has been designed in a way to facilitate obligated entities to fulfill their Renewable Purchase Obligation (RPO). REC Mechanism is based on the REC Regulations notified by the Hon'ble CERC on January 14, 2010[1]. Further, Hon'ble CERC vide order dated January 29, 2010, designated National Load Despatch Centre (NLDC), POSOCO, as the Central Agency for implementation of the mechanism in India [2].

One REC is treated as equivalent to 1 MWh energy injected or deemed to be injected into the grid. There are two types of RECs - Solar REC and Non-solar REC. Solar REC(s) are issued for generation of electricity based on solar energy and non-solar REC(s) are issued for generation of electricity based on renewable energy sources other than solar energy. Moreover, Distribution Licensees (DISCOMs) that has purchased RE energy over and above its RPO are also entitled to register and receive REC(s) under REC mechanism.

There are four processes in the REC Mechanism viz. Accreditation, Registration, Issuance and Redemption of RECs. Trading of RECs can be done through CERC approved Power Exchanges (PXs) i.e. Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL).

The regulations governing REC mechanism have undergone revisions over the period. Salient features of the REC mechanism are given below in Table-1:

**Table 1:** Salient features of the REC mechanism

<b>Participation</b>	Voluntary
<b>REC denomination</b>	1 REC = 1MWh
<b>RE technology</b>	MNRE approved technologies are eligible for participation
<b>Validity</b>	1095 days after issuance of REC extended from time to time
<b>Categories</b>	1. Solar (unique certificate number) 2. Non-solar (unique certificate number)
<b>Sellers</b>	Eligible RE Generators / Distribution Licensees (DISCOM)
<b>Buyers</b>	1. Obligated Entities (DISCOM/ Captive consumers / OA Consumers) 2. Voluntary Buyers
<b>Trading platform</b>	CERC approved Power Exchanges
<b>Trading periodicity</b>	Last Wednesday of the month
<b>Self-retention</b>	Registered plants can retain RECs for RPO compliance of their consumption units located in different States
<b>Banking / Borrowing</b>	Not Allowed
<b>Transfer type</b>	Single transfer only, repeated trade of the same certificate is not allowed
<b>Solar RECs</b>	Floor price: Rs. 1000 / MWh Forbearance price: Rs. 2400 / MWh
<b>Non-solar RECs</b>	Floor price: Rs. 1000 / MWh Forbearance price: Rs. 3000 / MWh

## II. MARKET DATA ANALYSIS

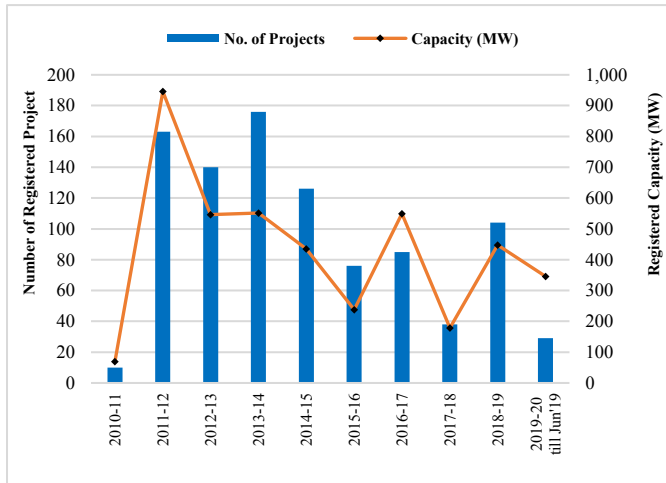
As per CERC REC Regulations 2010, the certificate of Accreditation and Registration issued to the eligible entities by the concerned State Agency and the Central Agency respectively, and certificates are valid for five years from the date of issuance. Moreover, RE generators whose accreditation/ registration is due to expire at the end of five years may approach concerned State Agency then Central Agency for revalidation of the RE project [3].

Due to changes in the eligibility conditions after amendments in the REC Regulations, many RE projects have been de-registered from the REC mechanism. Whereas, many RE generators due to various reasons, also requested to de-register their projects from the mechanism.

As on June 30, 2019, total 1,527 RE projects having capacity of 7,344 MW (including projects revoked/ expired) have been accredited under REC mechanism by the concerned State Agencies. Subsequently, more than 1,441 RE projects having capacity 6,838 MW (including revoked/ expired) have been registered under the REC mechanism by the Central Agency. RE Projects with capacity from 0.1 MW- 250 MW have been registered under REC mechanism.

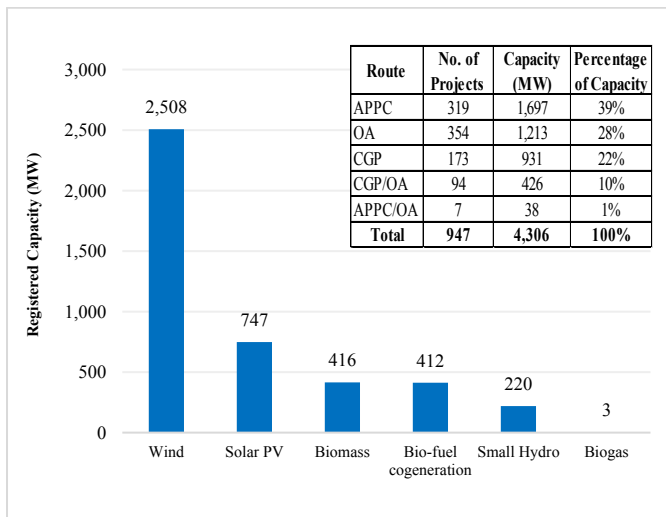
**A. Analysis of Registration of RE Projects**

As on June 30, 2019, total 947 eligible RE projects having capacity 4,306 MW from 19 states have been registered [4]. The financial year wise details of registered RE projects and capacity (in MW) are shown below in Figure-1:



**Figure 1:** FY-wise registered projects and capacity (MW) as on June 30, 2019

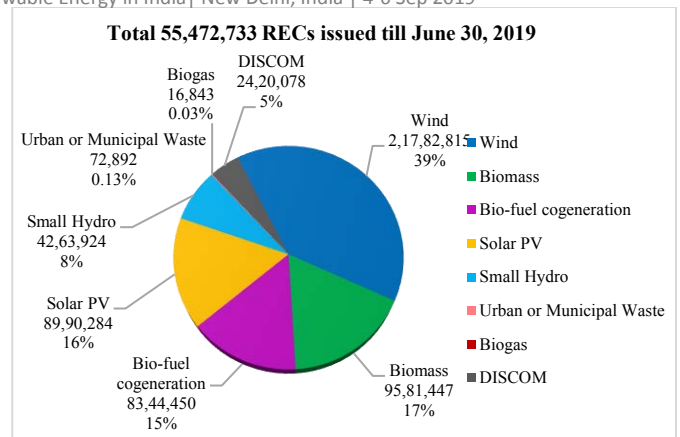
Further, the breakup of registered capacity in terms of technology and off-take route is shown below in Figure -2:



**Figure 2:** Technology and off-take route wise registered capacity (MW) as on June 30, 2019

**B. Analysis of Issuance of Solar and Non-solar RECs to the RE Generators & DISCOMs**

Issuance of RECs started with a modest figure of 532 RECs in the month of March 2011. Since then, more than 55.5 million RECs have been issued to the RE generator up to June 2019 [4]. RECs issuance has increased in subsequent years. The technology wise breakup of RECs issued to eligible entities is shown in Figure-3:



**Figure 3:** Technology wise breakup of RECs issued

**C. Transaction of RECs and Number of Sellers & Buyers at Power Exchanges**

Trading of RECs commenced in March 2011 and till June 2019, 98 trading sessions involving transactions of 51 million RECs have been traded through PXs which amounts to worth of ₹7,843 crore. Financial year wise number of RECs transacted; number of buyers & sellers participated through IEX and PXIL are given below in Table-2:

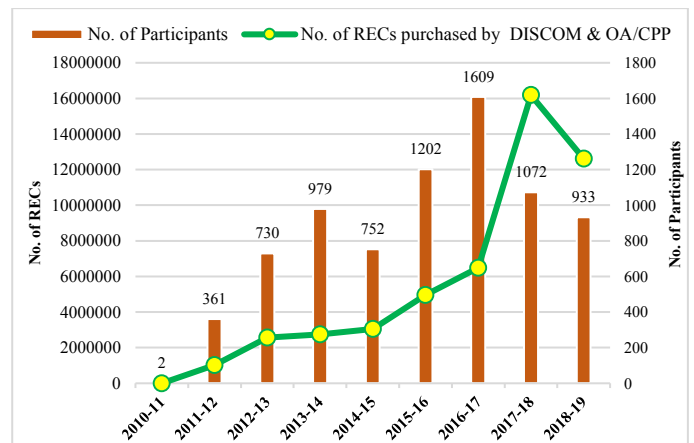
**Table 2:** PXs and FY wise number of buyers & sellers and transacted RECs till June 30, 2019

Financial Year	Number of Buyers of RECs		Number of Sellers of RECs		Transacted RECs		Total Transacted RECs
	PXIL	IEX	PXIL	IEX	PXIL	IEX	
2010-11	1	2	1	1	274	150	424
2011-12	38	359	39	158	64,266	951,008	1,015,274
2012-13	158	644	279	404	598,825	1,990,989	2,589,814
2013-14	179	904	447	597	1,424,371	1,324,323	2,748,694
2014-15	158	663	628	750	1,514,298	1,547,624	3,061,922
2015-16	240	1,092	679	833	1,816,263	3,138,890	4,955,153
2016-17	378	1,382	699	888	1,869,120	4,618,619	6,487,739
2017-18	234	938	685	914	6,854,898	9,329,253	16,184,151
2018-19	182	830	476	675	3,653,223	8,955,572	12,608,795
2019-20 till Jun'19	42	353	152	450	622,457	1,195,535	1,817,992
<b>Total</b>					<b>18,417,995</b>	<b>33,051,963</b>	<b>51,469,958</b>

Source: IEX, PXIL

Since launch of the mechanism, Distribution Companies have purchased ~56% of the total RECs and remaining 44% RECs were purchased by both CPPs/ OA consumers through IEX and PXIL [5] [6].

Financial year-wise trend for number of RECs purchased and number of buyers are shown below in Figure 4:



**Figure 4:** FY-wise number of RECs purchased by DISCOMs and OA/CPP consumers till March 31, 2019

Moreover, the list of DISCOMs who have purchased RECs since launch of the mechanism is given in Table 3:

**Table 3: RECs purchased by DISCOMs till June 30, 2019**

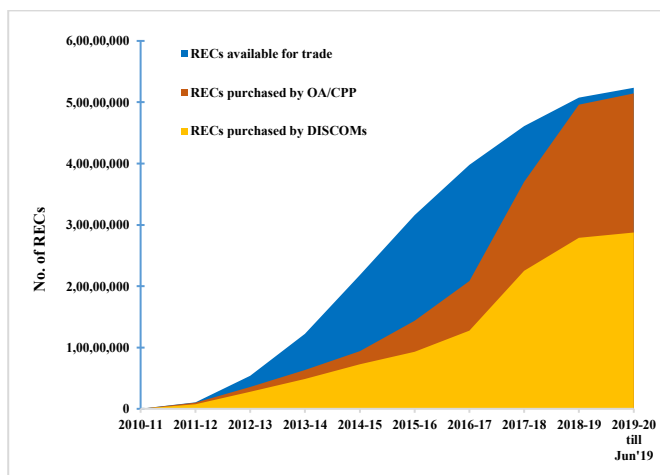
SN	Name of DISCOMs	RECs purchased till trading of Jun'19
1	Maharashtra State Electricity Distribution Company Limited	6,246,910
2	Reliance Infrastructure Limited	2,576,156
3	Brihan Mumbai Electric Supply & Transport Undertaking	2,363,300
4	Tata Power Delhi Distribution Limited/NDPL	2,284,942
5	Torrent Power Limited - Ahmedabad Distribution	2,035,083
6	Bihar State Power Holding Company Limited- Patna	1,699,849
7	Punjab State Power Corporation Limited	1,243,862
8	Damodar Valley Corporation West Bengal	1,153,347
9	The Tata Power Company Limited- Maharashtra	1,131,761
10	Dadra and Nagar Haveli Power Distribution Company	951,681
11	Tata Steel Limited Power Distribution Licensee	935,755
12	Torrent Power Limited - Surat Distribution	921,364
13	Assam Power Distribution Company Limited	705,120
14	Damodar Valley Corporation Jharkhand	693,470
15	Uttarakhand Power Corporation Limited	560,680
16	South Bihar Power Distribution Company Limited	459,492
17	Electricity Department Government of Puducherry	430,949
18	North Bihar Power Distribution Company Limited	399,517
19	Electrical Dept UT Daman and Diu	388,904
20	BSES Rajdhani Power Limited	333,332
21	Electricity Wing of Engineering Dept UT Chandigarh	311,911
22	Electricity Department Government of Goa	292,000
23	Jindal Steel and Power Ltd Distribution License	213,640
24	Gujarat Urja Vikas Nigam Limited	150,000
25	Kerala State Electricity Board Limited	100,000
26	BSES Yamuna Power Limited	66,660
27	Torrent Power Limited - Dahej Distribution	61,540
28	Power and Electricity Department Government of Mizoram	31,754
29	Manipur State Power Distribution Company Limited	3,997
30	Meghalaya Power Distribution Corporation Limited	3,875
31	Himachal Pradesh State Electricity Board Ltd	3,863
32	Tripura State Electricity Corporation Limited	297
<b>Total RECs Purchased by DISCOMs</b>		<b>28,755,011</b>

Since, REC is a pan-India mechanism, stakeholders and voluntary buyers from 30 States/UTs have purchased more than 51 million RECs through Power Exchanges up to June 30, 2019. List of States-wise RECs purchased is given below in Table 4:

**Table 4: State-wise RECs purchased till June 30, 2019**

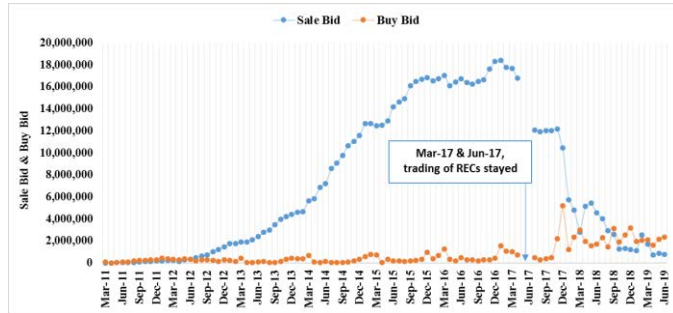
SN	State	RECs Purchased	Percentage RECs Purchased
1	Maharashtra	14,280,141	28%
2	Gujarat	6,364,304	12%
3	Odisha	4,027,208	8%
4	Delhi	3,586,723	7%
5	Jharkhand	3,008,897	6%
6	Madhya Pradesh	2,623,643	5%
7	Rajasthan	2,574,683	5%
8	Bihar	2,559,707	5%
9	Punjab	1,611,633	3%
10	Chhattisgarh	1,343,901	3%
11	Karnataka	1,339,952	3%
12	West Bengal	1,153,354	2%
13	Dadra and Nagar Haveli	1,075,152	2%
14	Tamil Nadu	934,475	2%
15	Assam	928,368	2%
16	Andhra Pradesh	853,429	2%
17	Uttarakhand	708,741	1%
18	Daman and Diu	447,965	1%
19	Pondicherry	432,950	1%
20	Chandigarh	311,911	1%
21	Goa	292,000	1%
22	Uttar Pradesh	232,294	0.5%
23	Telangana	215,483	0.4%
24	Haryana	198,595	0.4%
25	Kerala	146,440	0.3%
26	Himachal Pradesh	137,857	0.3%
27	Meghalaya	44,104	0.1%
28	Mizoram	31,754	0.1%
29	Manipur	3,997	0.01%
30	Tripura	297	0.001%
<b>Total RECs Purchased</b>		<b>51,469,958</b>	<b>100%</b>

More than 3,500 obligated entities have purchased more than 51.5 million RECs since 2011. The trend of RECs purchased by the DISCOMs, open access consumers and captive power plants; and REC available for trade at Power Exchanges is shown below in Figure 5:

**Figure 5: RECs Issuance and Redemption**

**D. Sale and Buy Bids on the Power Exchanges**

The graph showing the sale and buy bids in the monthly trading sessions at PXs are shown below in Figure 6 :



**Figure 6:** Sale and Buy bids of monthly trading till June 30, 2019

From the above graph, it is clearly visible that buy bids are approximately more or less equal to the sell bids during March 2011- August 2012. However, during September 2012 - August 2018, the sale bids are more than the buy bids, which resulted into the huge inventory of RECs. Post September 2018, buy bids are more than the sale bids - which has changed the nature of market from buyer’s market to seller’s market.

**E. Market Clearing Volume (MCV) and Market Clearing Price (MCP)**

Solar and non-solar RECs are being traded through PXs within the floor price and forbearance price as determined by CERC from time to time [7][8][9][10]. Since launch of the mechanism, details of the floor and forbearance prices for solar and non-solar RECs are given below in Table 5 & 6:

**Table 5:** Floor and Forbearance price of non-solar RECs

	01.06.2010 - 31.03.2012	01.04.2012 - 31.03.2017	w.e.f. 01.04.2017
Forbearance Price (Rs./MWh)	3,900	3,300	3,000
Floor Price (Rs./MWh)	1,500	1,500	1,000

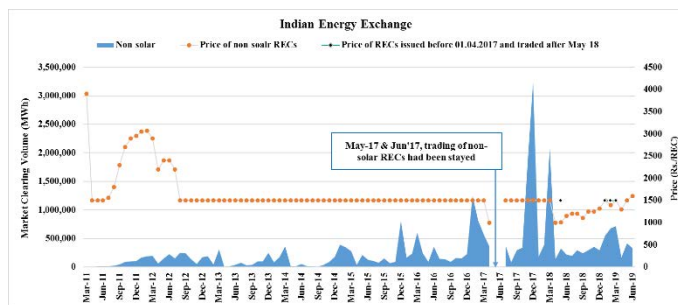
**Table 6:** Floor and Forbearance price of solar RECs

	01.06.2010 - 31.03.2012	01.04.2012 - 31.12.2014	01.01.2015 - 31.03.2017	w.e.f. 01.04.2017
Forbearance Price (Rs./MWh)	17,000	13,400	5,800	2,400
Floor Price (Rs./MWh)	12,000	9,300	3,500	1,000

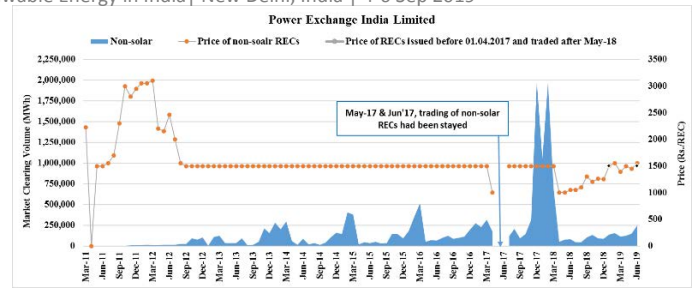
Further, as per Hon’ble Supreme Court order dated May 14, 2018, the trading of non-solar RECs after May 2018 onwards are being held separately for RECs issued pre and post April 01, 2017. The RECs issued pre-April 01, 2017 are being traded at floor price of Rs. 1,500/REC, and RECs issued after April 01, 2017 are being traded as per prices effective from April 01, 2017.

The graph depicting the MCP and MCV discovered in the monthly trading sessions at IEX and PXIL are given below:

**MCP and MCV for Non-Solar RECs**



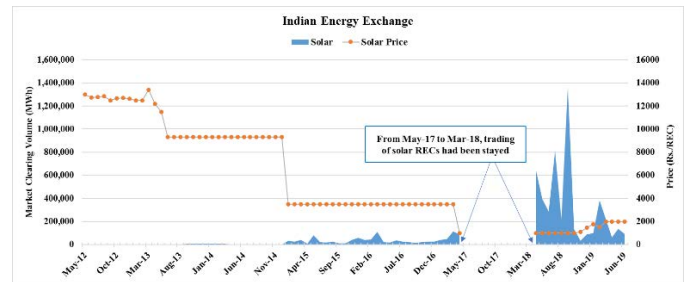
**Figure 7:** Market clearing volume & price of non-solar RECs at IEX



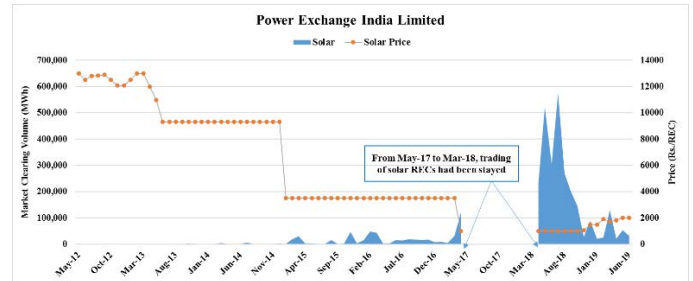
**Figure 8:** Market clearing volume & price of non-solar RECs at PXIL

During May 2012 - May 2013, Solar RECs were traded above floor price, while during June 2013-September 2018, solar RECs were traded on floor price. From October 2018 onwards, more demand and less supply has resulted in trading of RECs above the floor price. The market clearing volume and price of solar RECs at IEX and PXIL is analyzed and shown below in Figures 9 & 10:

**MCP and MCV for Solar RECs**



**Figure 9:** Market clearing volume & price of solar RECs at IEX



**Figure 10:** Market clearing volume & price of solar RECs at PXIL

**III. LESSONS LEARNED**

**A. Experience of the REC Registry**

REC Mechanism has been implemented through REC web application, which has helped all stakeholders in the implementation of the REC mechanism. User friendly dashboards has been provided to the RE generators/State Agencies. Further, this portal has also helped State agencies to monitor RPO compliance of obligated entities with regard to purchase of RECs.

On the basis of experience of management of REC Registry, Ministry of Power has entrusted the function of Registry of Energy Saving Certificates (ESCerts) to POSOCO and authorized it to establish the necessary framework to discharge the functions under Perform Achieve Trade (PAT) scheme.

**B. Impact of REC Mechanism**

The impact of REC mechanism is huge in terms of investment facilitation, market development, RPO compliance and market for voluntary buyers, etc. It is pertinent to mention that more than 3,500 obligated entities have purchased 51.5 Million RECs for RPO compliance. In addition, around 7% of new renewable energy investment in the period 2010-2017 came through REC mechanism.

Moreover, traded value of RECs which is about Rs. 7,845 crores have also given signal to investors to consider REC mechanism as an option for investment in the sector.

RE generators can sell their power as a brown power to any entity under open Access or to DISCOM at APPC and energy generated by such plants is eligible for issuance of RECs. This has provided an avenue for small and large RE generators to take the benefit of REC mechanism without worrying about the power purchase agreement for sale of green energy to the buyers.

RPO compliance for small obligated entities like CPPs / Open Access consumers has become a hassle-free process as obligated entities can procure RECs through Power Exchanges.

In addition to above, REC as a pan-India instrument has facilitated inter-State transaction of RECs which is evident from the fact that RECs have been issued to projects located in 21 States/ UTs and RECs had been purchased by obligated entities of 30 States/ UTs.

Moreover, registered RE generators are also permitted to self-retain RECs to offset RPO of their consumption units located in different parts of the country. In this regard, RE generators from 14 States have retained more than 2 million RECs for RPO compliance for their consumption units.

**C. Compliance audit of RE projects**

CERC empaneled compliance auditors audited registered RE project in first phase during 2012-2013. In first phase 100 RE projects were selected and in second phase of compliance audit, 217 projects/State Agencies/SLDC have been Audited. Auditor’s observation has been shared with respective RE Project, SLDCs, State Agencies and CERC.

As per CERC REC Regulations and Orders, appropriate action has been initiated against non-complying RE Projects.

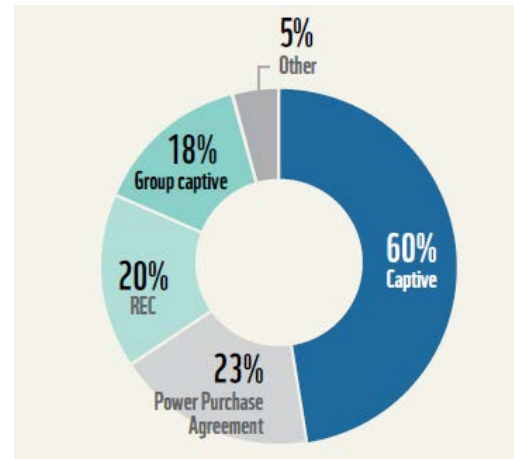
**D. Purchase of RECs vis-a-vis RE for RPO compliance**

REC, green energy instrument which has pan-India validity, has provided freedom and choice to obligated entities (buyers) in terms of the accessibility and availability for procurement of certificates through Power Exchanges. Advantages of RECs over RE purchase for RPO compliance are given below in **Table 7** [11]:

**Table 7: Advantages of RECs over RE purchase**

SN	Particular	Compliance of RPO by Purchase of	
		Renewable Energy	REC(s)
1.	Technology Agnostic	Specific RE Tech.	Yes
2.	Competition among different RE technologies	Not Possible	Possible
3.	Transaction Costs	High	Low
4.	Flexibility in procurement in terms of timing	Yes	No
5.	Location Dependent	Yes	No
6.	Exit Load, Barrier for Utility/ Beneficiary/ Developer/generator	Significant barrier/ only option to terminate the existing PPA	Freedom and flexibility to purchase in terms of quantum/ timing

Moreover, in a survey, it has been found that 20% corporates preferred REC as one of the routes for procurement of renewable energy [12].

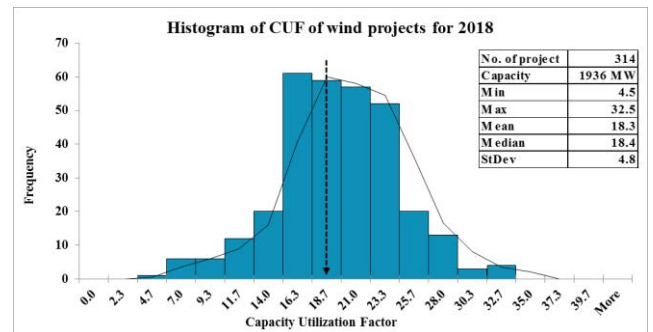


**Figure 11: Renewable Energy Demand in India**

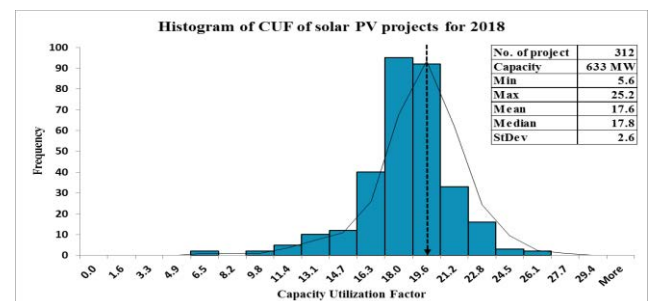
Source: RENEWABLE ENERGY DEMAND IN INDIA - Corporate Buyer’s Perspective by WWF-India 2019

**E. Analysis of Capacity Utilization Factor (CUF) of RE projects**

The details of monthly energy injection of wind, solar PV for the year 2018 has been analyzed for the calculation of Capacity Utilization Factor (CUF) and the same are given below in Figure 12 & 13:



**Figure 12: Histogram of CUF of wind projects for 2018**



**Figure 13: Histogram of CUF of solar PV projects for 2018**

**IV. CHALLENGES AND WAY FORWARD**

Non-compliance of the RPO by the obligated entities is a cause of concern for the stakeholders. Some SERCs have also imposed penalties on the obligated entities for non-compliance of the concerned RPO Regulations.

The Hon’ble Supreme Court, Hon’ble Appellate Tribunal of Electricity (APTEL) and SERCs have also recognized REC as an instrument for RPO compliance.

Recently, MNRE has setup an RPO compliance cell, which will coordinate with the concerned authorities for periodic reporting and apprise the authorities for compliance of RPO.

Up to June 30, 2019, more than 29,000 RECs have been purchased by the voluntary buyers which is quite less in comparison to the market potential. REC, as a market instrument has provided an avenue for voluntary buyers to go green and contribute towards the sustainable development of the country. Moreover, the relevance of REC mechanism is further bolstered by the voluntary initiatives led by the forward-looking companies, like RE100. RE100 is a global corporate leadership initiative bringing together influential businesses committed to 100% renewable electricity [13]. Many Indian companies are also part of the RE 100. Such green initiatives show that there is huge potential for RECs in future.

It has been observed that there are gaps in the RPO target for purchase of green energy vis-a-vis availability or procurement of RE in many States. In this scenario, REC will continue to act as a regulatory instrument for RPO compliance.

The REC mechanism was designed in 2010. At that point of time, there was huge difference between the cost of green energy and brown energy. However, in recent times, cost of wind/solar energy (green energy) reduced considerably; which necessitated the change in the market design of the mechanism. In view of the changing market dynamics, Hon'ble CERC has commissioned the study to relook the design of the mechanism from fresh perspective [14].

Success of implementation of REC mechanism has increased confidence of the stakeholders towards its transparent governance process as well it has increased the confidence of the obligated entities for purchase of REC as a green energy instrument in the country. It is expected that learnings from the implementation of the REC Mechanism will also be used in designing of the tradable market instruments in future.

## V. ACKNOWLEDGEMENT

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## BIOGRAPHICAL INFORMATION

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