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Department of Industrial and Management Engineering
Indian Institute of Technology Kanpur



Forum of Regulators

**4th Capacity Building Programme for
Officers of Electricity Regulatory Commissions
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**Renewable Energy Tariffs, RPO and REC
Mechanism**

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Agenda for Discussion

- Renewable Energy Development in India
- Regulatory and Policy Framework to support RE Deployment
- Evolution of Market Model
- RPO Framework : A Critical Review
- Why REC Mechanism?
- Way Forward

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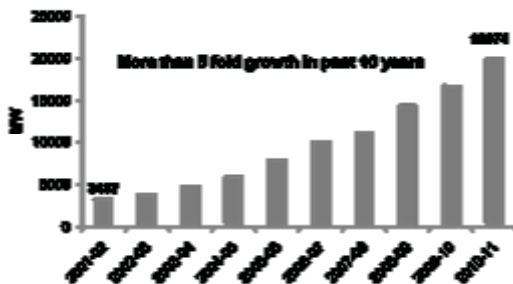
Renewable Energy Development in India



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India has been Leader in harnessing Renewable Energy

- RE installed capacity is approx 12% of total generation capacity (170 GW)
- Renewable Energy contributed with more than 5% to overall energy generation (811BU) during 2010-11
- Large hydro (>25 MW) is not considered in calculation of RE
- Including large hydro (37 GW), total RE capacity would sum up to 57 GW
- Total RE capacity including Large hydro ~ 33% in terms of total generation capacity and 18% of total consumption



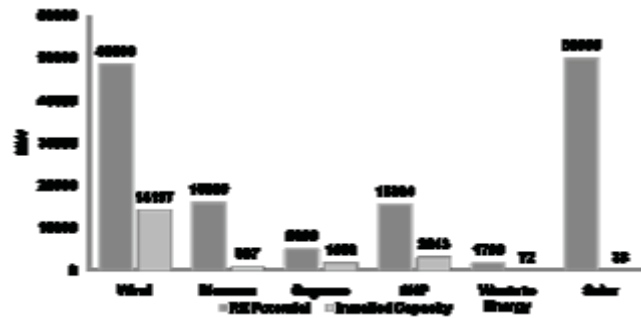
Source : Ministry of New and Renewable Energy

Country	Wind Capacity* (GW)
China	44.7
United States	40.1
Germany	27.2
Spain	20.7
India	14.1

*World Wind Energy Report

India has the 5th largest wind capacity in the World

Renewable Energy Development in India: Present Status

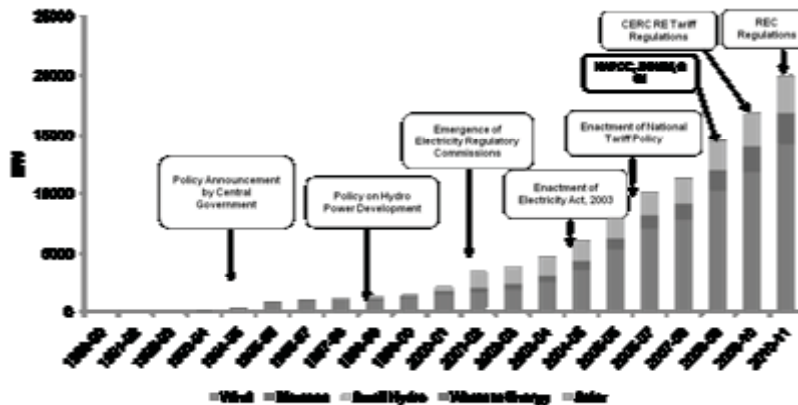


Source : Ministry of New and Renewable Energy

- Study by FOR suggests capacity addition of **45000MW** by FY15 to meet targets envisaged under NAPCC
- RE Capacity Addition, as per MNRE, during FY11 was around 3157MW only
- Considering present installed capacity of RE 19974MW, capacity addition of more than 6000MW is required per annum to achieve 10% NAPCC target

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Key Drivers for Promotion of Renewable Energy in India



Source : Ministry of New and Renewable Energy

The legal clarity and certainty of regulatory principles together with conducive policy framework has ensured continued developer interests in Renewable Energy Sector

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Legal and Regulatory Framework for Development of Renewable Energy in India



Electricity Act, 2003: Enabling Provisions

The EA 2003 has outlined several enabling provisions to accelerate the development of RE based generation

-Section 3

- National Electricity Policy and Plan for development of power system based on optimal utilization of resources including renewable sources of energy

-Section 61

- Tariff Regulations by Regulatory Commission to be guided by promotion of generation of electricity from renewable energy sources in their area of jurisdiction

-Section 66

- Appropriate Commission shall endeavor to promote the development of market (including trading) in power in such a manner as may be specified and shall be guided by National Electricity Policy in Sec 3

-Section 86(1) (e)

- Provides Statutory Framework and Mandates SERC for taking steps for promotion of Cogeneration and Generation of Electricity from Renewable Sources of Energy

National Tariff Policy: Aims and Objectives

- Appropriate Commission shall **fix RPO** and SERCs shall **fix its tariff** latest by April 1, 2006
- Initially Appropriate Commission to **fix preferential tariffs** for distribution utility to procure RE
- In future, distribution utility to **procure RE through competitive bidding** within suppliers offering same type of RE
- In long-term, RE technologies need to compete with all other sources in terms of full costs
- **CERC to provide guidelines for pricing non-firm power** if RE procurement is **not** through competitive bidding

Amendment to Tariff Policy (January 20, 2011)

- SERCs to reserve a minimum percentage for purchase of solar energy ... which shall go up to 0.25% by the end of 2012-12 and further up to 3% by 2022
- Purchase of energy from non-conventional sources of energy takes places more or less in same proportion in different States
- An appropriate mechanism such as Renewable Energy Certificate (REC) would need to be evolved
- REC Mechanism should also have a solar specific REC

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Promotion of RE is by Policy Design and Regulatory Initiative

Central Government

- Electricity Act 2003 (Jun 2003)
- National Electricity Policy (Feb 2005)
- National Tariff Policy (Jan 2006)
- National Action Plan on Climate Change (Jun 2008)

Central Electricity Regulatory Commission

- Regulations for Preferential Tariff for RE (Sep 2009)
- Renewable Energy Certificate Mechanism (Jan 2010)
- Implementation Framework (2010 – ongoing)

State Electricity Regulatory Commission

- Preferential RE Tariff Orders by SERCs (2002–2010)
- Over 19 States have mandated Renewable Purchase Obligations (2004 – 2010)
- Modification to RPO and adoption of REC framework

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NAPCC : Guideline for RE Development

National Action Plan for Climate Change (NAPCC)

- At National level for FY 2010, target for RE Purchase may be **set at 5%** of total grid purchase, to be **increased by 1% each year** for 10 years
- SERCs may set **higher target than this minimum** at any point in time
- Central & State Govts may set up a **verification mechanism** to ensure that renewable power is actually procured
- Appropriate authorities may issue **certificates** that procure renewable power in excess of the national standard. **Such certificates may be tradable**, to enable utilities falling short to meet their RPS
- **Penalties** as may be allowed under EA 2003 may be levied, if utilities are still falling short in RPS

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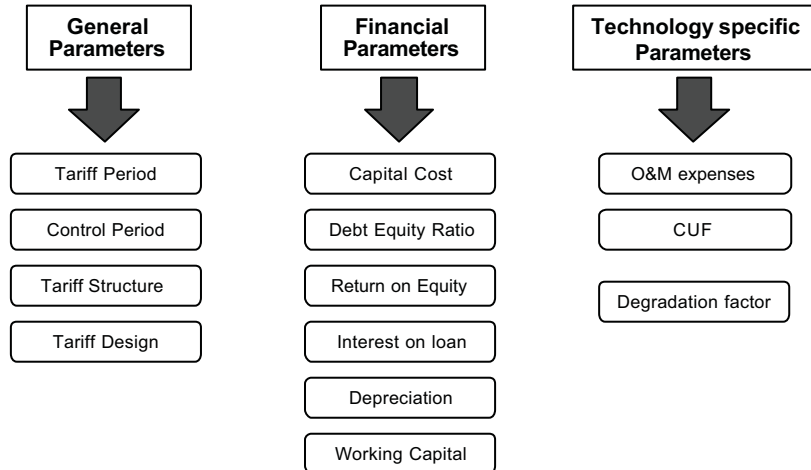
Regulatory & Policy Development at National Level

FOR Report on 'Policies on Renewables' recommends

- Ascertaining Need for Inter-State exchange of RE power
 - Inter-State exchange of RE power is desirable from National perspective and the same should be promoted
 - Mechanism for appropriate treatment for inter-State RE exchange through Regional Energy Account needs to be developed
- Ascertaining feasibility of REC mechanism
 - Concept of RE Certificate as a tool for promotion of RE sources has been used in some countries
 - REC mechanism can be introduced within existing framework of EA 2003
 - Co-operation amongst States is essential and SERCs should recognize procurement of RE generated in other States for purpose of compliance as RPO by regulated entity in their respective jurisdiction

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CERC Tariff Regulations, 2009



Applicable under Sec 79 of the Act : If generating companies enter into or otherwise have a composite scheme for generation and sale of electricity more than one State

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CERC RE Tariff (2011-12) : Wind, SHP, Solar

Particular	Capital Cost (FY 2011-12) (Rs.Lakh/MW)	Levillised Total Tariff (FY 2011-12) (Rs/kWh)	Benefit of Acc. Depr (if availed) (Rs/kWh)	Net Levellised Tariff (Upon adjusting for Acc. Depr . Benefit, if availed) (Rs/kWh)
Wind Energy				
Wind Zone - 1 (CUF 20%)	492.52	5.33	0.80	4.53
Wind Zone - 2 (CUF 23%)		4.63	0.69	3.94
Wind Zone - 3 (CUF 27%)		3.95	0.59	3.36
Wind Zone - 4 (CUF 30%)		3.55	0.53	3.02
Small Hydro Power Project				
HP, Uttarakhand and NE States (Below 5MW)	669.42	3.78	0.47	3.31
HP, Uttarakhand and NE States (5MW to 25 MW)	602.48	3.22	0.42	2.80
Other States (Below 5 MW)	525.97	4.49	0.55	3.94
Other States (5 MW to 25 MW)	478.16	3.84	0.50	3.34
Solar Power Projects whose PPA signed on or before 31st March 2011 Tariff determined for the year FY 10- 11 shall be applicable during the FY 2011 - 12				
Solar PV*	1690	17.91	2.96	14.95
Solar Thermal*	1530	15.31	2.46	12.85
Solar Power Projects whose PPA signed after 31st March 2011 Tariff determined for the year FY 2011 - 12 shall be applicable				
Solar PV	1442	15.39	2.45	12.94
Solar Thermal	1500	15.04	2.34	12.69

* Capital Cost for FY 2010-11

* Capital Cost for FY 2010-11

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CERC RE Tariff (2011-12) : Biomass and Cogeneration

State	Capital Cost (FY 2011-12) (Rs.Lakh/MW)	Levellised Fixed Cost (Rs/kWh)	Variable Cost (FY 2011-12) (Rs/kWh)	Applicable Tariff (FY 2011-12) (Rs/kWh)	Benefit of Acc. Depr (if availed) (Rs/kWh)	Net Levellised Tariff (Upon adjusting for Acc. Depr. Benefit, if availed) (Rs/kWh)
Biomass Power Project						
Andhra Pradesh	426.03	1.90	1.88	3.78	0.19	3.59
Haryana		1.99	2.97	4.97	0.19	4.77
Madhya Pradesh		1.88	1.70	3.59	0.19	3.40
Maharashtra		1.94	2.36	4.31	0.19	4.11
Punjab		1.99	2.94	4.94	0.19	4.74
Rajasthan		1.94	2.34	4.28	0.19	4.09
Tamil Nadu		1.96	2.62	4.58	0.19	4.39
Uttar Pradesh		1.92	2.13	4.06	0.19	3.86
Others		1.95	2.46	4.41	0.19	4.21
Non Fossil Fuel based Cogeneration						
Andhra Pradesh	421.30	2.75	1.77	4.51	0.33	4.19
Haryana		2.44	2.77	5.21	0.28	4.94
Maharashtra		2.14	2.20	4.34	0.25	4.10
Madhya Pradesh		2.34	1.59	3.93	0.28	3.65
Punjab		2.44	2.74	5.19	0.28	4.91
Tamil Nadu		2.16	2.44	4.60	0.25	4.35
Uttar Pradesh		2.77	1.99	4.76	0.33	4.43
Others		2.40	2.28	4.68	0.28	4.41

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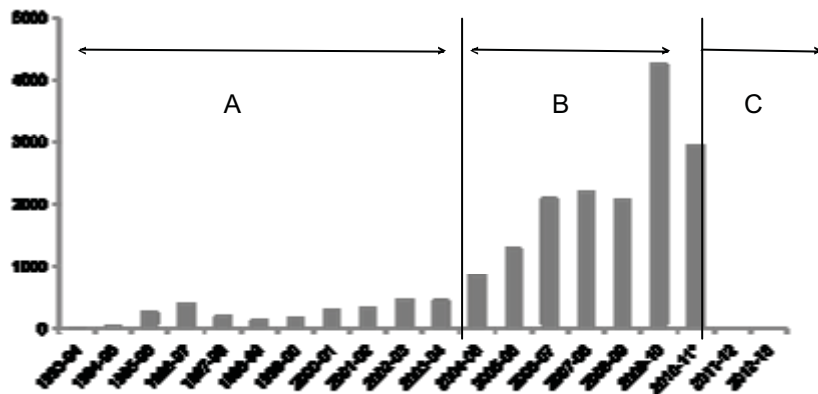


Renewable Energy and Evolution of Market Models



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Evolution of Market Model



A- Market model based on Open Access/wheeling for self use

B- Model based on FIT and RPO for sale to distribution licensee & third party, within State

C- Market model based on instruments with cross border features (REC) catering to National level demand

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Alternate A : Open Access and Wheeling Model

- RE Power Plant setup mainly to meet captive/third party requirements
- Wheeling of power limited to two or three locations
- Governed by State Government policy provisions or concessional wheeling arrangements

Key Considerations for Prospect of OA Wheeling Model

- Market models based on Wheeling and Open Access have the following difficulties
 - Compatibility with Open Access Regulations
 - Pricing Reforms and un-bundling of State Utilities have resulted into High Transmission/Wheeling Charges
 - Complex scheduling and Energy Accounting requirements pose limitation on Inter-State wheeling transactions

Open Access : Wheeling charges & Other Conditions continue to be prohibitive

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Alternate B : Preferential Tariff Based Market Model

- Preferential tariffs determination by various SERCs
- Generic tariff approach based on Norms for projects to be commissioned over pre-specified control period
- Substantial addition of capacity occurred under this market model

Issues in determination of preferential tariff

- Different Approaches for Tariff determination across States:
 - RERC notifies norms through Tariff Regulations
 - MERC specifies tariff parameters through separate Orders
- Ambiguity over the definition of preferential tariff, control period etc.
- Wide variation in financial parameters like O&M expense, interest rate, which is not State specific
- Constant tariff over the Control Period, not reflecting changes in market conditions and underlying parameters

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Alternate C : New Market Model – REC Mechanism

- Renewable Energy Certificate Mechanism to enable Inter-State exchange of RE power
- 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 across States.
- REC mechanism shall facilitate emergence of large number of cross-border RE transactions based on non-firm RE sources and firm RE sources

Aspects considered for REC Design in Indian Context

- Electricity Market is Regulated to large extent
- More than 90 % of electricity volumes continue to be transacted at regulated price
- Preferential RE Tariff Regime to continue (Feed – in – Tariff % REC shall co-exist

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RPO Mechanism : A Critical Review



Section 86 (1) (e) – Driver for RPO

- Section 86(1): The State Commission shall discharge the following functions, namely:
 - *(e) promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;*
- Various State Commissions have put significant emphasis on the last part of this important clause while developing regulations for Distribution Licensees under their jurisdiction

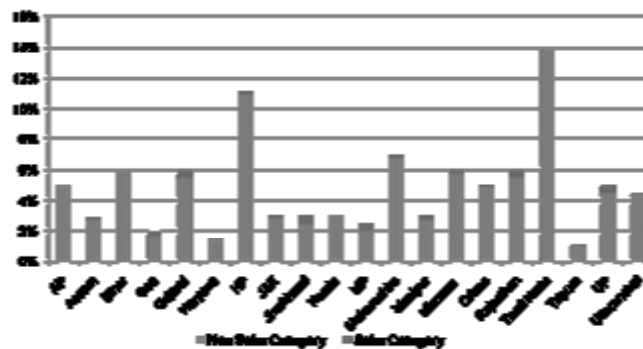
National Tariff Policy : Harnessing RE

Clause 6.4 of NTP States:

- (1) Pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage for purchase of energy from such sources taking into account **availability of such resources in the region** and its **impact on retail tariffs**. Such percentage for purchase of energy should be made **applicable for the tariffs to be determined by the SERCs latest by April 1, 2006**.

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RPO Targets Across the States



- NAPCC recommends 5% RPO in 2009-10 with 1% increase till 10 years
- RE Capacity Addition of around 6000MW per annum shall be required to meet the target envisaged under NAPCC
- Forum of Regulators initiated study on Assessment of Various Renewable Energy resources potential in Different States, determination of RPO Trajectory and its Impact on Tariff

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RPO already established : Key Features

- Specify % of renewable energy every utility need to purchase:
 - Single target for overall renewable energy purchase,
 - Usually close to existing purchase levels,
 - In some cases Y-o-Y targets,
 - no technology specific targets
- Period is up to five years,
- Applicable to OA/Captive in only three States,
- Purchase of RE from outside the State has not been permitted,
- Silent on mode of procurement, competitive or cost based
- Implementation mechanisms need further refinement
- Weak on enforcement methodology

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RPOs – what further was required?

- Separate % for RE sources which are not commercial
- Application of RPO to OA and Captive transactions
- Efficient mechanism for purchase of RE
- Enabling mechanism for inter-state sales
- Nation wide target for purchase of RE
- Stronger enforcement and penalty mechanism
- Mechanism to create competition amongst RE sources

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Need for inter-state sales

- Renewable sources are not spread evenly across country
- Many states with no or little RE, cannot procure RE
- States with good RE have exhausted their capacity
- Currently, no mechanism is available for purchase of RE across the State boundary
- It may not be possible to carry out inter-State sales using CERC OA Regulations for following reasons:
 - Most RE difficult to schedule
 - Transaction is expensive as capacity factors for RE are low
 - Intra-state balancing systems have not yet stabilized
- Therefore, a mechanism which will enable inter-state sale and purchase of renewable energy is required

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RPO for OA and Captive Consumers

- Section 86 (1) (e) also require State Commissions to promote 'Sale of electricity to any person'
- Obvious intent is to promote RE purchase by all users
- Exempting OA consumers would increase burden on already subsidized category of consumers
- Not advisable to exempt large OA / captive consumers
- Except three States, OA/Captive users were not subjected to RPO targets
- However, current methodology of contracting of power makes it difficult to contract for small quantity of RE required by the individual OA consumer
- It is necessary to develop cost effective mechanism to enable purchase of RE by large number of OA/Captive consumers

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Earlier RPO regulations (< 2010) fail to address :

- Nation wide target for purchase of RE
- Enabling mechanism for inter-state sales of RE
- Efficient mechanism for purchase of RE
- Stronger enforcement and penalty mechanism
- Specific targets for RE sources which are not yet commercial
- Application of RPS to OA/Captive/trading transactions

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Status of Renewable Purchase Obligation

State	RPO Target	RPO Met
Maharashtra	4%	3%
Gujarat	2%	2%
Karnataka	10%	11.5%
Tamil Nadu	10%	11%
Punjab	1%	0.74%
Haryana	4%	0%
Madhya Pradesh	10%	0.07%

State	Distribution Utility	2009-10		
		RE Obligation (MU)	RE Procured (MU)	Surplus/(Deficit) (MU)
Rajasthan	JVVNL	1166	508	(658)
	AVVNL	974	447	(527)
	JdVVNL	916	408	(508)
Maharashtra	BEST	286	186	(100)
	TPC D	176	87	(89)
	R Infra D	582	146	(436)
	MSEDCL	5045	2818	(2227)
Tamil Nadu	TANGEDCO	8790	8971	181

- Procurement of Renewable Energy generated within State boundaries, recognised for RPO
- Few State Regulators specified Enforcement Provisions for Non-Fulfillment of RPO
- Several cases filed for reviewing RPO targets in view of shortfall in RE capacity addition in the State
- Mechanism which shall enable procurement of Renewable Energy Generated outside the State Boundaries in Cost Effective manner may help to address the situation.

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Key Challenges in Encouraging Deployment of RE

- Enabling Mechanism for Inter-State sales of Renewable Energy
- Cost Effective Mechanism for purchase of Renewable Energy
- Nation wide target for purchase of Renewable Energy
- Stronger enforcement and penalty mechanism
- Mechanism for purchase of small quantity of RE by individual Open Access consumer



Forum of Regulators (FOR) initiated study to address challenges

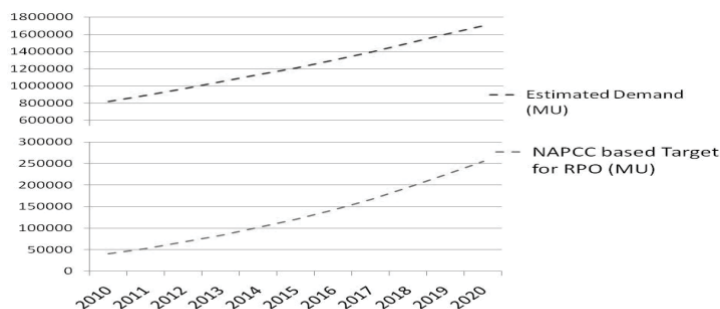
FOR Report (Nov 2008) on 'Policies for Renewables' recommended:

- Need to facilitate 'Inter-State Exchange of RE Power from National Perspective
- Explore feasibility of introduction of REC mechanism as tool to promote RE within framework of EA 2003

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NAPCC has set challenging target for RE Development

- NAPCC target of 5% for RE Procurement in 2010
- Target to increase by 1% each year to reach 15% by 2020
- Separate target for Solar Energy
- Provides for creation of Renewable Energy Certificate Mechanism



Considering that demand for electricity would increase to 1700 BU by 2020, it would create market for 255 BU units of renewable energy generation

NAPCC identified REC framework to realize annual target of National RPO

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Renewable Energy Certificate Mechanism



Why REC Mechanism was created?

- Renewable sources are not spread evenly across country
- Many states with no or little RE were not able to promote RE
- States with good RE felt they have exhausted their capacity to absorb
- It is difficult to carry out inter-State sales using CERC OA Regulations for large scale deployment of RE following reasons:
 - Most RE generators are difficult to schedule
 - Transaction would be expensive due to low capacity factors of RE
 - RE generators are not connected to STU but to Discoms
 - Intra-state balancing systems have not yet stabilized
- Therefore, a mechanism that will enable inter-state sale and purchase of renewable energy was required

Key Objectives for Introduction of REC Mechanism

- Effective implementation of RPS
- Increased flexibility for participants
- Overcome geographical constraints
- Reduce transaction costs for RE transactions
- Enforcement of penalty mechanism
- Create competition among different RE technologies
- Development of all encompassing incentive mechanism
- Reduce risks for local distributor by limiting its liability to energy purchase

In the view of hurdles faced by RE Development, it appears that these objectives should take precedence over others

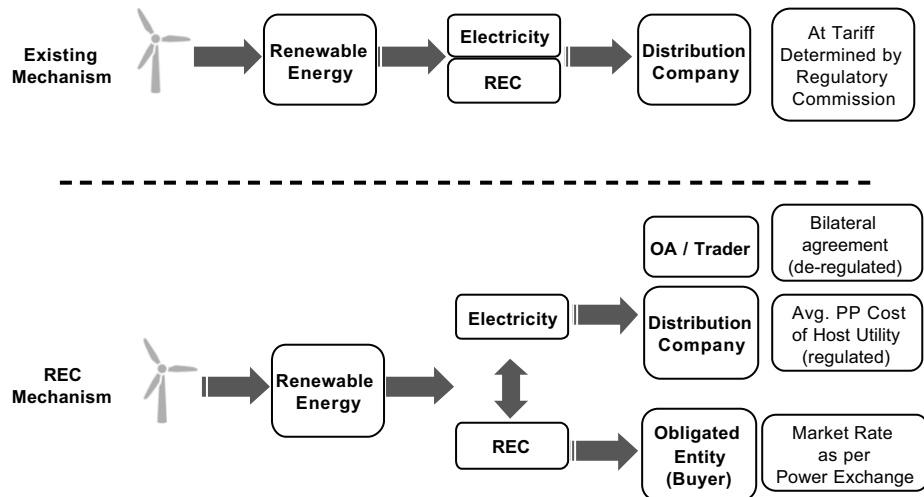
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Chronology of Events – Concept to Implementation



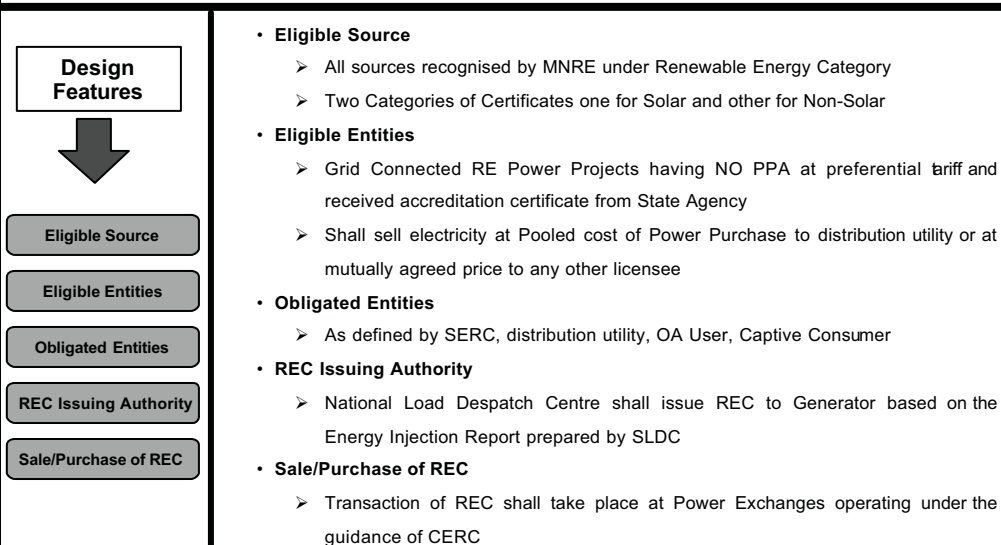
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Concept of REC Mechanism in India



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REC Mechanism Key Design Features



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REC Mechanism Key Design Features

Design Features



Denomination

Form of REC

Pricing of REC

Redemption of REC

Shelf Life

- **Denomination**
 - One (1) REC shall be issued corresponding to 1 MWh of renewable energy is generated and injected into the Grid
- **Form of REC**
 - REC shall be issued electronically to the Generator
- **Pricing of REC**
 - To be discovered only on Power Exchanges through auction route.
 - Floor and Forbearance Price shall be determined by the CERC
- **Redemption of REC**
 - Obligated entities shall purchase REC from Exchange Platform and redeem it in lieu to their fulfilment of RPO with State Agency.
 - Only single trade (once through) permissible. Multiple trades not allowed.
- **Shelf Life**
 - RE Generator shall apply for issuance of certificate from 3 months of energy injection in the grid
 - REC shall be valid for 1 year from the date of issuance

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Entities involved to operationalise REC Mechanism

Institutional Framework



Central Entities

State Entities

- Forum of Regulators
- Central Electricity Regulatory Commission
- Central Agency (National Load Despatch Centre)
- Power Exchanges
- Compliance Auditors

- State Electricity Regulatory Commission
- State Load Despatch Centre
- State Agencies
- Eligible Entities
- Obligated Entities

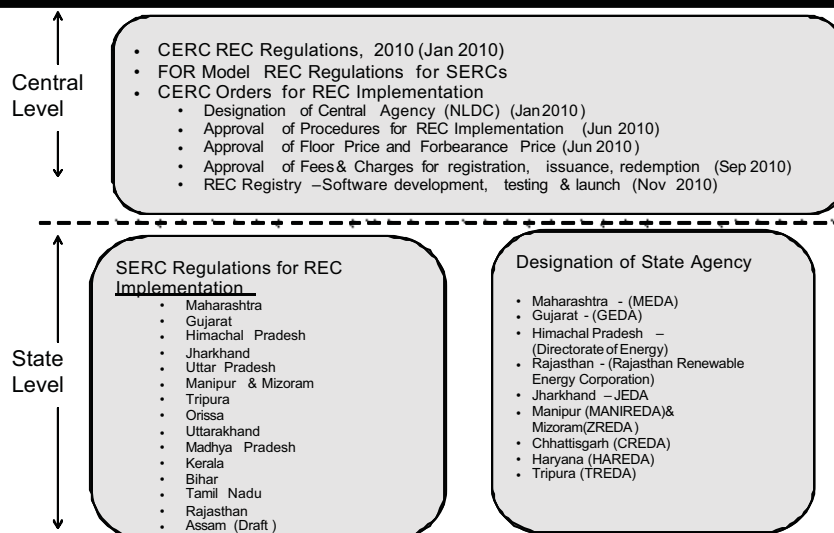
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Key Role performed by FOR

- Formulated Model REC Regulations for SERCs
- Sought Legal Opinion from Solicitor General on key legal aspects
 - Applicability of RPO to Captive Users and Open Access Consumers
 - Statutory backing for Enforcement mechanism as regulatory measure
- Introduced Enforcement Mechanism for non-compliance
 - Apart from legal provisions under EA 2003, obligated entity has to contribute a charge to Fund at Forbearance Price.
 - Fund to be utilised for purchase of RECs or creation of RE infrastructure as directed by SERCs
- Extended scope of RPO applicability to captive users, open access consumers apart from DISCOMs
- Undertook study for setting RPO targets and long term trajectory at National level to accomplish NAPCC goals

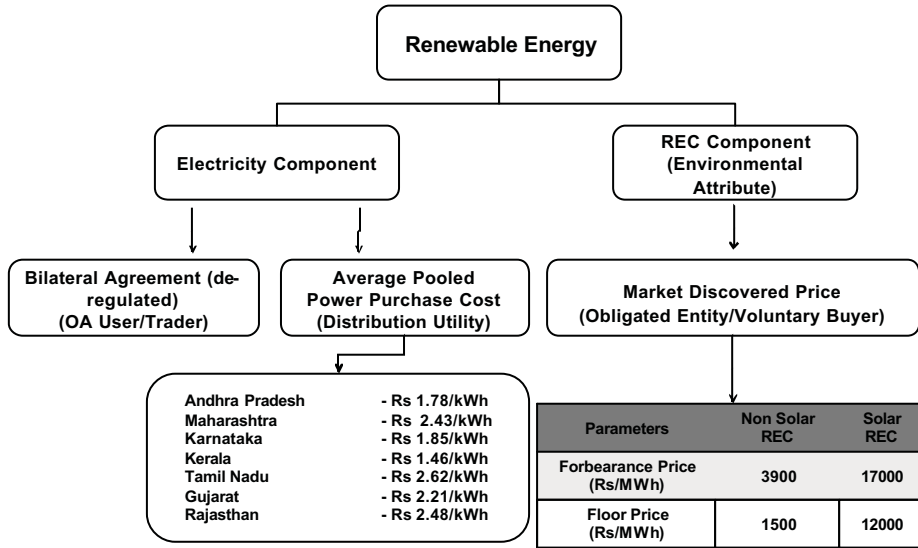
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Initiatives for the Implementation of REC Mechanism



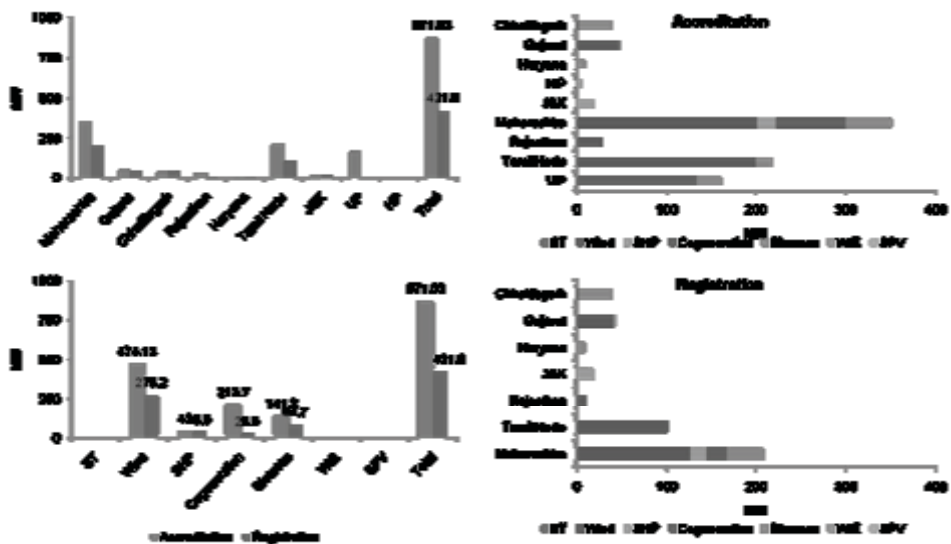
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REC Pricing Framework



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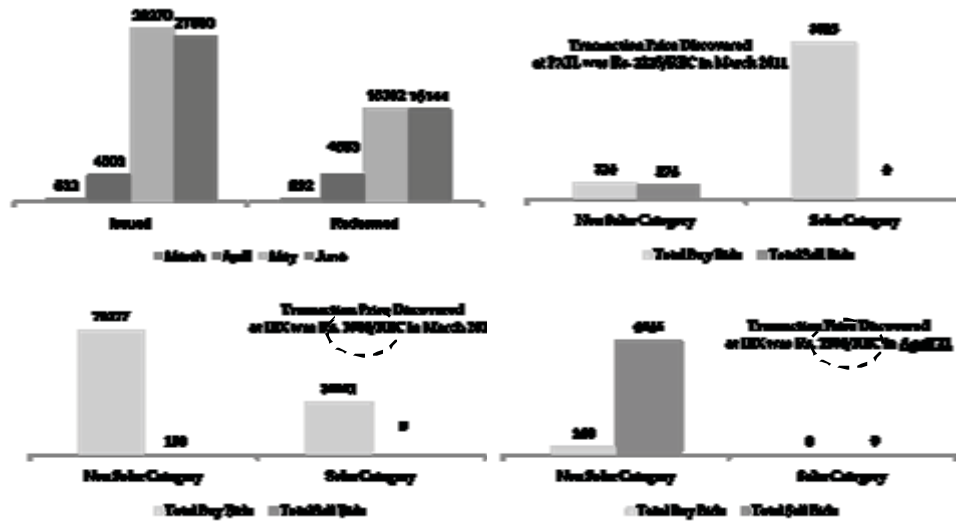
Status of Accreditation and Registration of Projects



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Status of Transaction of RECs (1/2)

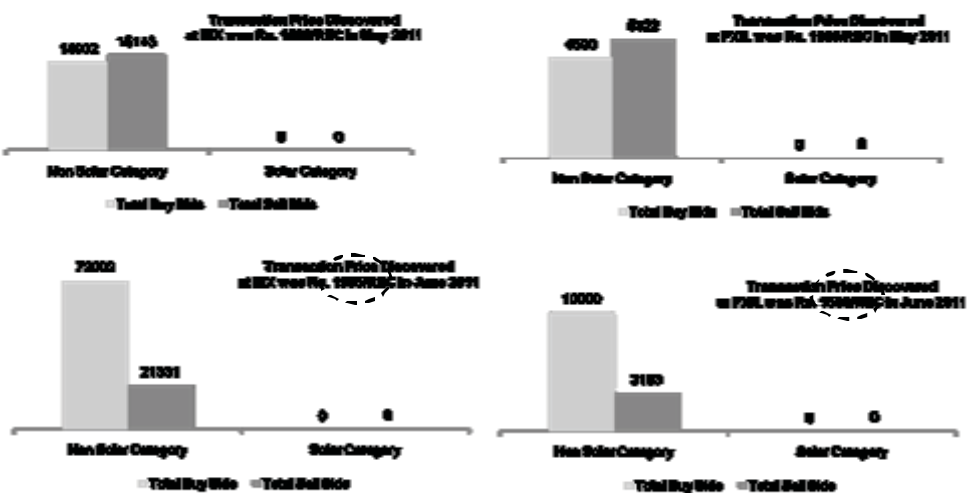
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Status of Transaction of RECs (2/2)

(2/2)



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Way forward for REC Mechanism

- Successful operations of Four trading sessions clearly establishes the operationalisation of REC Mechanism in India
- In order to increase depth and liquidity in the market, next level of reform in REC framework needs to be ushered in.
 - Enabling multiple/bilateral transactions for REC trading
 - Long term visibility of Floor/Forbearance price
 - Long term RPO trajectory and guidance
 - Standard Rules for procurement at APCC/ Model contracting arrangements
- This will stimulate competition amongst renewable energy sources .
- Shall help brining in early grid parity for renewable energy sources.

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Thank you for your attention . . .

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Practical Solutions to Real Life Problems

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