Idam Infrastructure Advisory Pvt. Ltd.

Developments in Renewable Energy Sector

10th Capacity Building Program for ERCs

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Presentation Outline

- Legal and Regulatory Framework for RE Development
- Evolution of Market Models for RE
- Regulatory regime for RE Tariff determination
- Development of REC Mechanism in India
- Challenges for REC mechanism and potential interventions
- Challenges for RPO Compliance Monitoring and potential solution
- Challenges for Grid Integration of RE and future enablers
- Way forward

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(h))**: Tariff Regulations by **Regulatory Commission** to be guided by **promotion** of **generation of electricity** from **renewable energy** sources in their area of jurisdiction.
- **(Section 86(1)(e))**: **Regulatory Commission** to **Specify Purchase Obligation** from **renewable energy sources**.
- **(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) – Driver for RPO

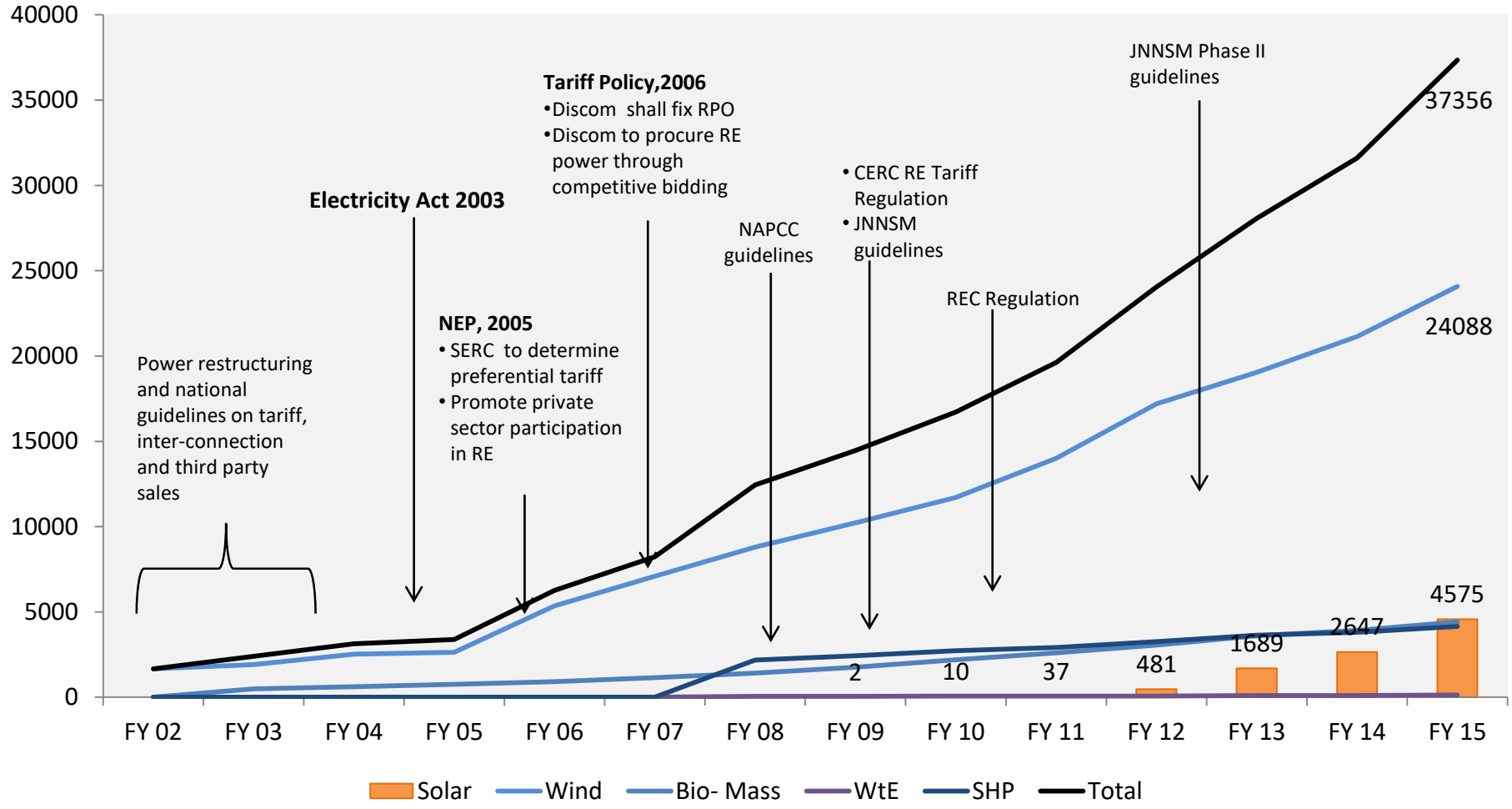
- **Section 86(1):** The **State Commission** shall discharge the following functions, namely:
  - ***(e) promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee;***

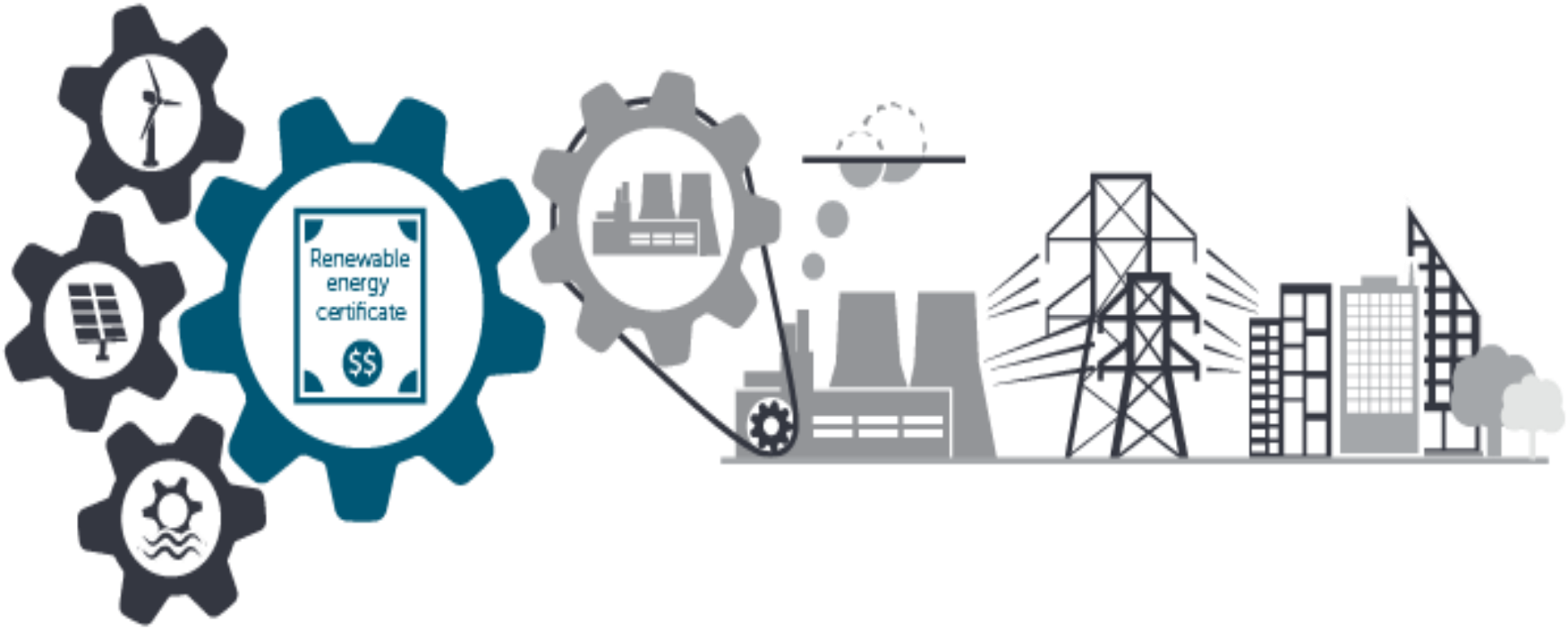
- Various State Commissions have put significant emphasis on the last part of this important clause while developing regulations for Distribution Licensees under their jurisdiction

New Tariff Policy, 2016

- Under the New **Tariff Policy 2016**, development of renewable energy has been given a special consideration
  - New tariff policy seeks State Commissions to fix year wise **RPO trajectory** so as to reach **17% in the total energy mix by 2022 including minimum 8% from Solar**
  - It also refers to **adoption** of an appropriate mechanism such as **REC mechanism** to meet their **purchase obligation** in scenario of RE potential restricted to certain parts of the country
  - **Appropriate Commission** may also **provide** a suitable **regulatory framework** for **encouraging** such other emerging **renewable energy** technologies by prescribing **separate technology based REC multiplier**
  - **Renewable Generation Obligation (RGO)-** New coal/lignite based thermal plants after specified date to also establish/procure/purchase renewable capacity
  - In order to promote renewable energy capacity in the country, there will be **No inter-State transmission charges and losses** to be levied for solar and wind power.
  - Affordable renewable power through **bundling of renewable power** with power from plants whose PPAs have expired or completed their useful life.

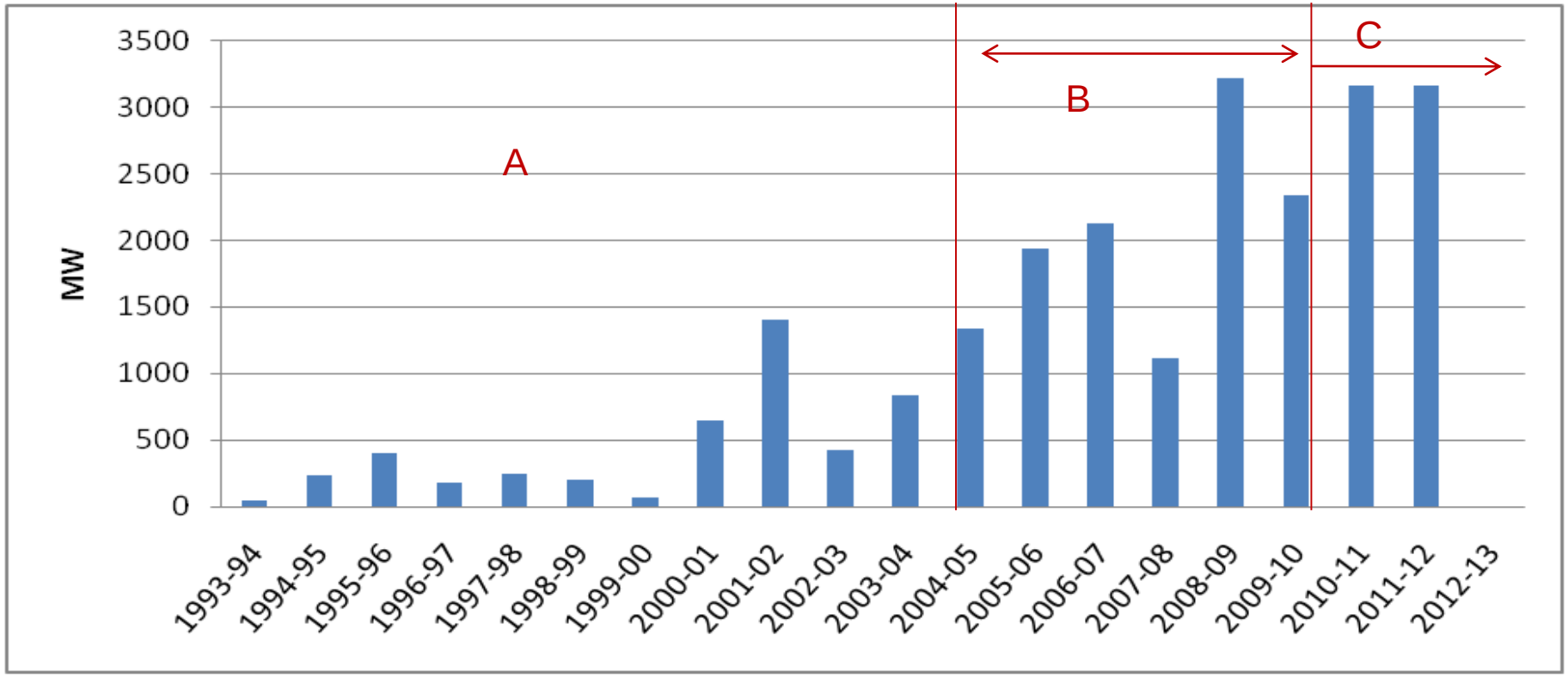
RE Historic Trends and Growth Enablers





Evolution of Market Models for harnessing RE

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

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

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

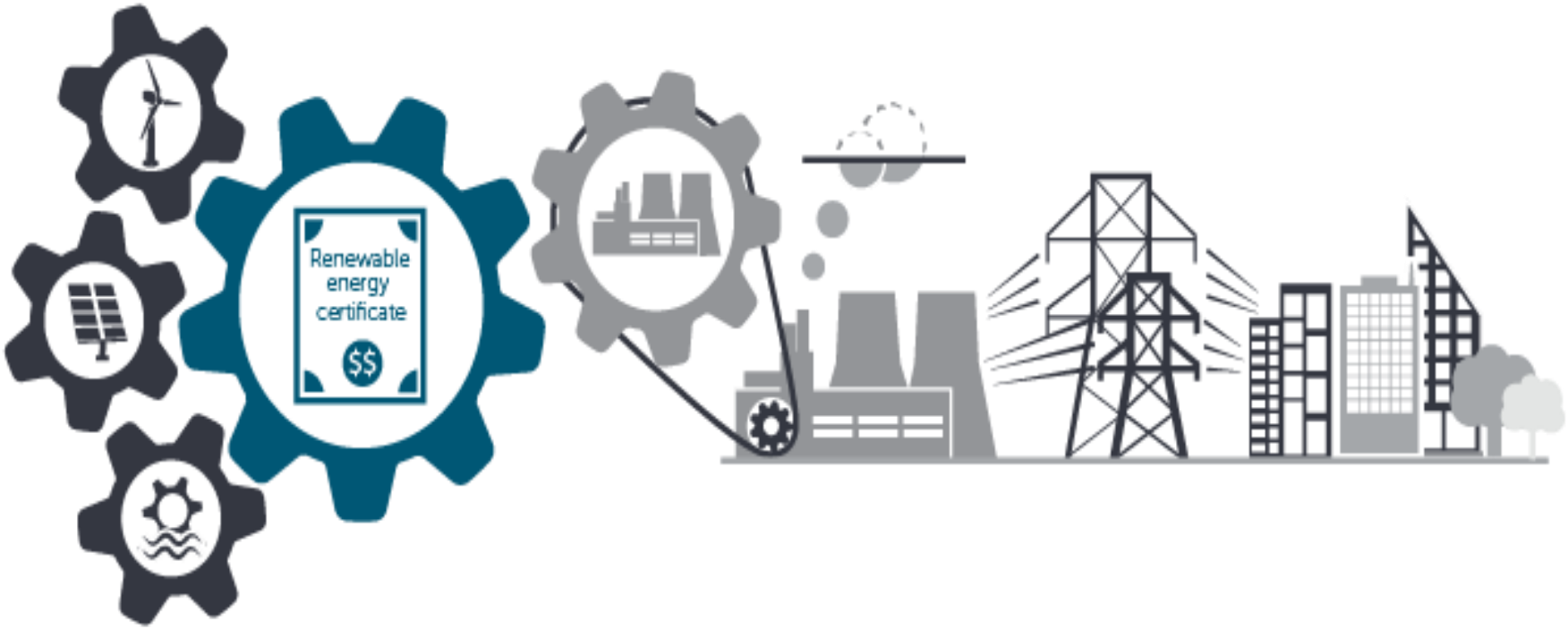
- Different Approaches for Tariff determination across States:
  - RERC notifies norms through Tariff Regulations
  - MERC specifies tariff parameters through separate Orders
- Ambiguity over the definition of preferential tariff, control period etc.
- Wide variation in financial parameters like O&M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

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

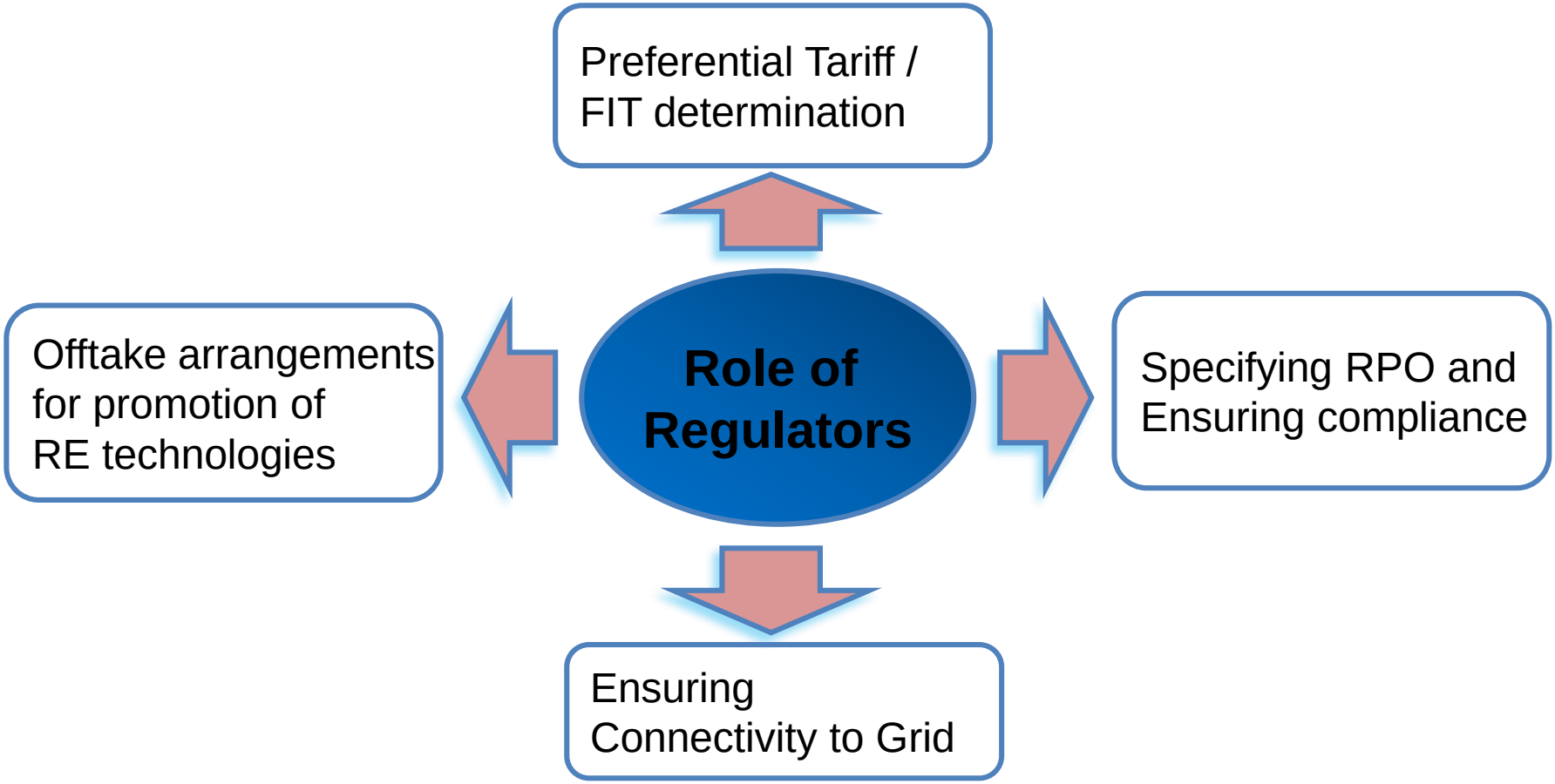
- Electricity Market is Regulated to large extent
- More than 90 % of electricity volumes continue to be transacted at regulated price
- Preferential RE Tariff Regime to continue (Feed – in – Tariff % REC shall co-exist)



Regulatory framework for harnessing of RE Potential

Role of Regulator for promotion of RE

- Area of jurisdiction for RE limited to within State boundary
- SERCs to be responsible for all matters related to renewable energy



Tariff Philosophy for RE projects

- Strictly every project is unique in certain characteristics.
- However, it is difficult to set tariff for each RE project on account of:
  - Site specific nature of Projects
  - Large number of projects exists, with smaller unit size
  - Ownership of the ‘Project Entities’ is diverse.
- Tariff determination for each project will be:
  - Cumbersome
  - Put significant strain on regulatory institutions.
  - RE developers tend to perceive ‘Regulatory uncertainty’
- Therefore, all ERCs have opted for determination of tariff on the basis of representative case though this would lead to some investors earning more than specified rate of return while others earning less.

Two part Vs Single Part

- CERC adopted 2-part tariff for central generating stations.
- NTP provides for 2-part tariff for conventional generation.
- Therefore, many have demanded 2-part tariff even for renewable and non-conventional sources of energy.
- However, for most renewable technologies such as wind, solar or small hydro, it is not possible to determine two part tariffs as generation from these technologies does not involve any fuel and hence variable cost.
- Some ERCs have opted for 2-part tariff for certain technologies such as biomass and cogeneration.
- However, no SERC has adopted two part tariff for wind energy projects or Small hydel projects.

Key Issues : FIT determination

Key parameters for FIT framework

General Parameters

- Tariff Period
- Control Period
- Tariff Structure
- Tariff Design

Financial Parameters

- Capital Cost
- Debt Equity Ratio
- Return on Equity
- Interest on loan
- Depreciation
- Working Capital

Technology specific Parameters

- O&M expenses
- CUF / PLF
- Aux Consumption
- De-ration factor
- Station Heat Rate
- Fuel parameters

Development of Base Case or Generic Case

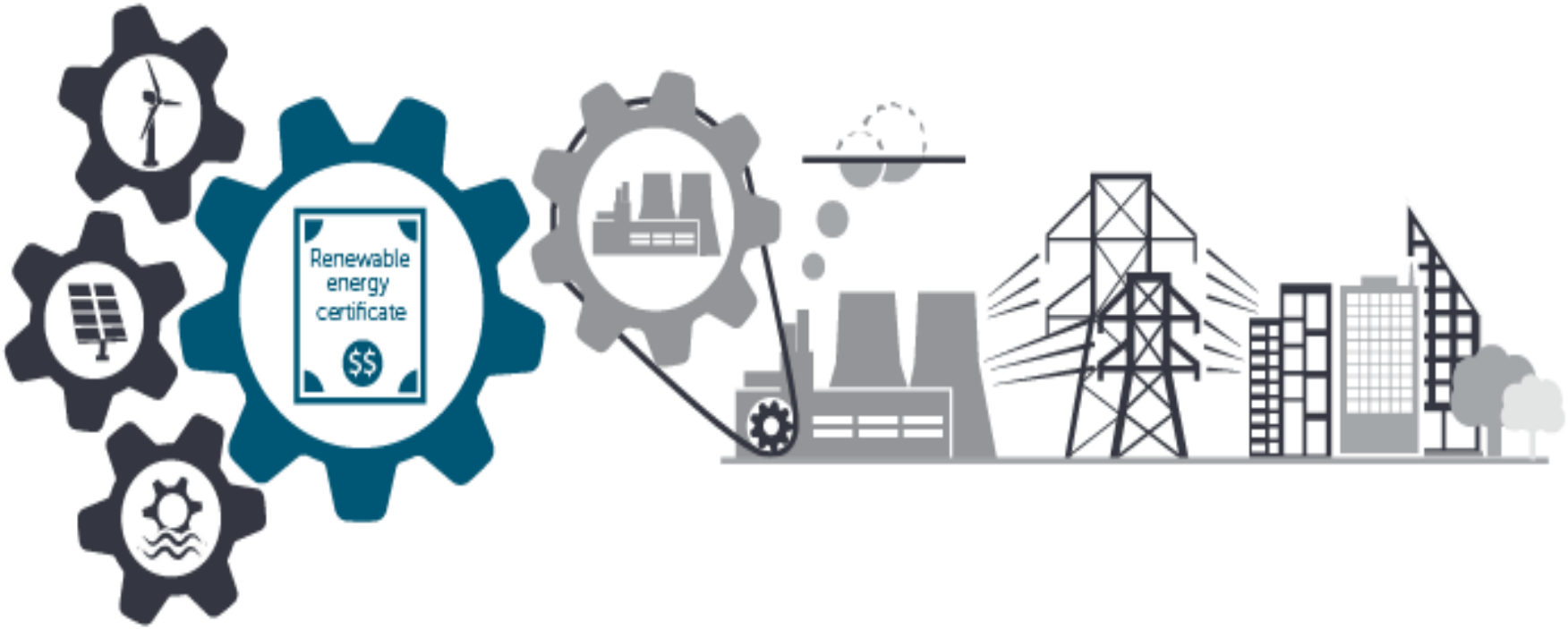
- Eligible RE technologies
- Configuration / Sizing / capacity range & limits
- Resource assessment Geographic factors, diversity & seasonal factors
- Operational Performance Benchmarking – CUF/PLF
- Funding mix & Sources
- Treatment for Grants and Subsidies, Incentive

Other issues to be addressed in RE Tariff

- **Reactive energy pricing**
  - Reactive power is essential part of the power system operation and generators are required to supply the same.
  - However, certain technologies use induction generators which consume reactive power rather than supplying.
  - It is reasonable that the induction generators pay for the reactive energy consumed. However, with advancement in tech. Generators can support Grid. Need for review of reactive energy pricing mechanism.

- **Applicability of Merit order despatch principles**
  - Variable/infirm RE generation treated as ‘Must Run’, hence considered outside MoD. However, requirement of forecasting and scheduling is mandatory.

- **Evacuation arrangements**
  - Definition of Interconnection point and interface with the Grid is very crucial.
  - There are different practices and divergent regulatory principles adopted across states.
  - Role and responsibility for development of Evacuation and cost recovery thereof needs standardized approach.



Development of Renewable Energy Certificate Mechanism in India

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 RPO
- **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

- **In Indian Context, following aspects had to be considered for REC design**
  - Electricity Market is regulated to great extent
  - (> 90% of electricity volumes continue to be transacted at regulated rate)
  - Preferential RE Tariff regime to continue (Feed-in tariff & REC to co-exist)

Chronology of Events – Concept to Implementation

Sep'16	**67th Session of Trading**
Dec'14	**Third Amendment** to REC Mechanism
Apr' 13	**Second Amendment** to REC Mechanism
Mar 30'11	**First Session of REC Trading**
Feb'11	CERC **approved Business Rules** of Exchange Platform
Sep'10	CERC Issued **Order on Applicable Fee and Charges** for Participating in REC Mechanism
Jun'10	CERC has issued **Order on Detailed Procedures for Implementation of REC Mechanism**
Jun'10	CERC has issued **Order on Forbearance and Floor Price** after Public Consultation Process
Jan'10	CERC **Designated National Load Dispatch Centre as Nodal Agency** under the REC Regulations
Jan'10	CERC notified **Regulations for Implementation of REC Framework**
Nov'09	Central Electricity Regulatory Commission **initiated process for Implementation of REC Mechanism in India**
Oct'09	FOR approved **Model REC Regulations** for adoption by SERCs
Jun'09	Team Idam submitted its **Exhaustive Report to MNRE on Conceptual Framework for REC Mechanism in India**
Jan'09	Team Idam made **presentation to FOR on modalities for REC Mechanism in India**, FOR formulated a Working Group
Sep'08	Team Idam submitted its **recommendation to the Working Group on 'Policies on Renewables'**
Aug'08	MNRE asked Team Idam to **Develop Conceptual Framework for REC Mechanism in India**
Jun'08	Hon'ble Prime Minister announced NAPCC recognizing **Implementation of REC Mechanism as tool to promote RE**
Jun'08	FOR initiated study to assess measures for increasing share of RE including **Feasibility of Introducing REC Mechanism in India**

TRANSACTION

IMPLEMENTATION

CONCEPT

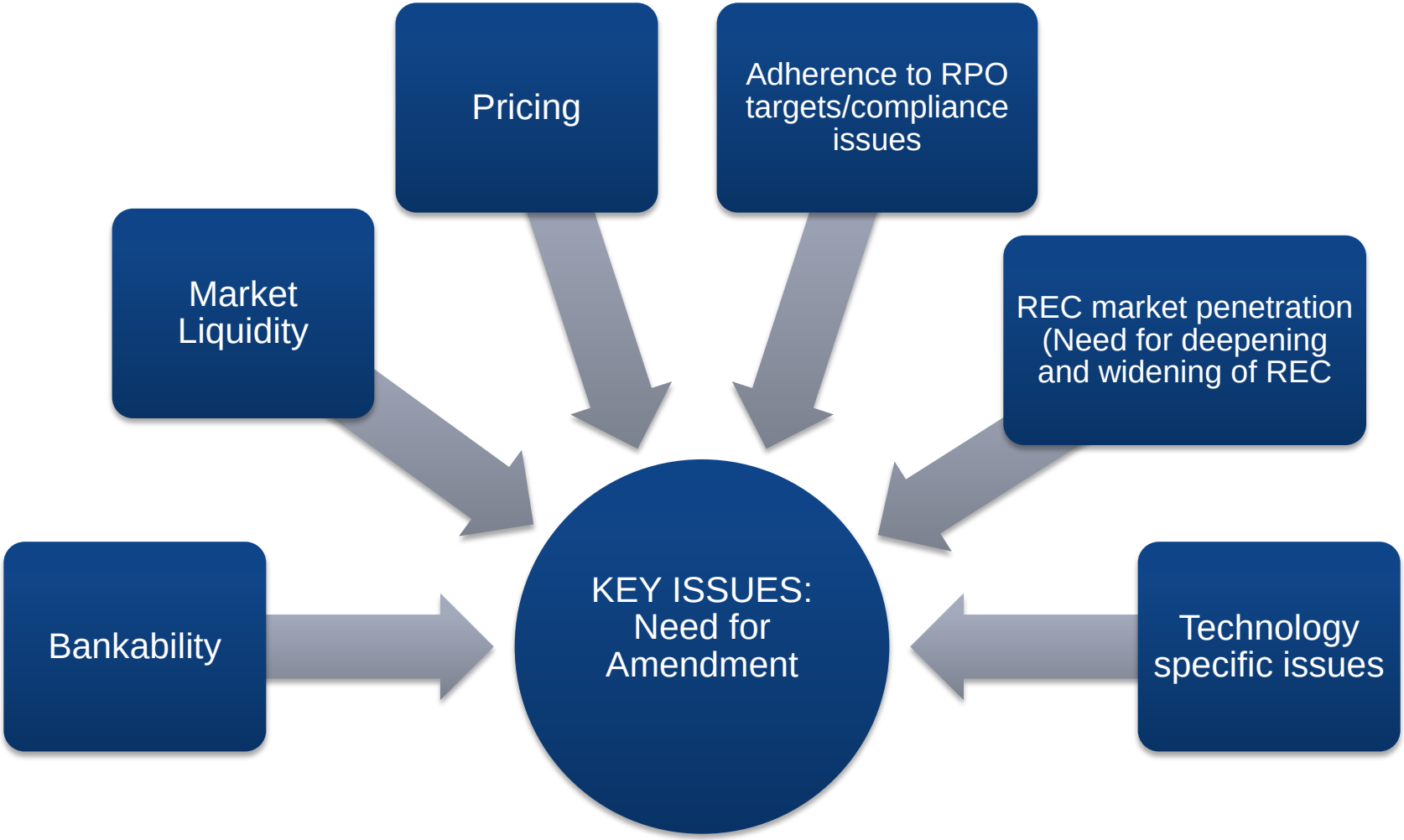
Summary of REC Market in India

Source	Accreditation		Registration		No.of RECs Issued	Closing Balance
	Capacity(MW)	Unit	Capacity(MW)	Unit		
Wind	2537	627	2335	595	1,24,13,414	50,67,027
Urban or Municipal Waste	8	1	0	0	72,892	45,436
Solar Thermal	3	1	0	0	0	0
Solar PV	723	354	703	340	47,04,207	35,79,143
Small Hydro	304	38	243	31	30,31,800	14,23,257
Others	2	1	2	1	14,770	38
Geothermal	0	0	0	0	0	0
Biomass	735	78	682	75	73,21,985	33,43,814
Bio-fuel cogeneration	1077	124	1005	117	64,76,649	37,38,769
Total	**5389**	**1224**	**4970**	**1159**	**3,40,35,717**	**1,71,97,484**

Source: REC Registry of India, as on October 13, 2016

Challenges in REC Mechanism in India

Summary of Key Issues : Need for amendment



Operational Issues in REC Framework: Bankability

Issue Statement

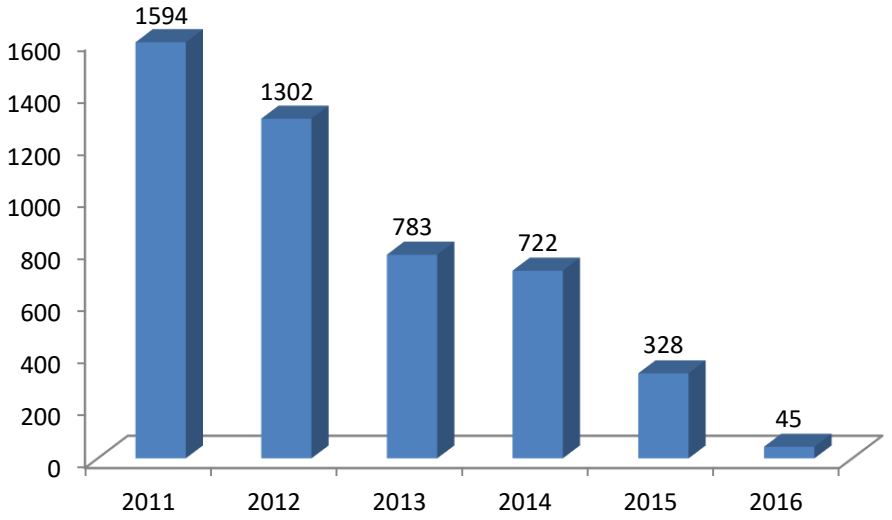
- Currently, Trading in RECs is restricted to CERC approved organized trading platform.
- As a result, generators are not able to assign / securitize RECs in favor of lenders which is necessary to raise money for new projects.
- Lack of bilateral trade also hinders ability of distribution company to enter into long term purchase transactions

Possible Interventions

- Bilateral / multiple transactions of RECs
- DISCOMs upon exceeding their RPO, allowed to participate in REC transactions for surplus RECs

There has been a sharp declining trend in REC project registration during the last three years

Capacity (MW) Registered under REC



Operational Issues in REC Framework: REC Market Liquidity

Issue Statement

- Under the present REC Mechanism, as soon as the transaction takes place at the power exchange, RECs are redeemed.
  - No role for intermediaries which typically play a role of the market makers.
  - Banks/ lenders cannot acquire and then sell RECs.
  - No secondary market for RECs

Possible Interventions

- Creation of a REC Market Maker (RMM)
- Multiple trading of RECs and potential for development of secondary market (Case of Australia's STCs)
- Bundling of RECs with electricity

Concept of REC Market Maker (RMM): Open for Discussions

✓ The REC Market Maker (RMM) will ensure liquidity in the market for RECs.

✓ The RMM can be a government sponsored body that will act as a buyer and seller of last resort

✓ The purchase /sale price rules pre-established by CERC

✓RMM may also play a role in bringing increased discipline and compliance in the market

Operational Issues in REC Framework: Pricing

Issue Statement

- CERC has addressed concern of regulatory certainty by specifying floor & forbearance price for the control period valid upto years 2016-17

Band	Solar REC (INR/MWh)
Forbearance Price	5800
Floor Price	3500

- However, long term price signal is desirable to cover at least debt service period
- Need to look at the basis of determining the floor and forbearance price in view of rising trend of APPC and reduction in RE tariffs

Possible Interventions

- CERC may specify continuation of floor and forbearance for 10 to 20 years in principle, but values to be fixed periodically as per the amended pricing methodology
- Uniform approach for determination of APPC

REC Price Trend

- Non solar RECs trading at the floor price for the last 42 trading sessions (since Aug,2012)
- Solar RECs trading at the floor price for the last 33 trading sessions (since June,2013)

REC Inventory Build Up, Non Compliance of RPO

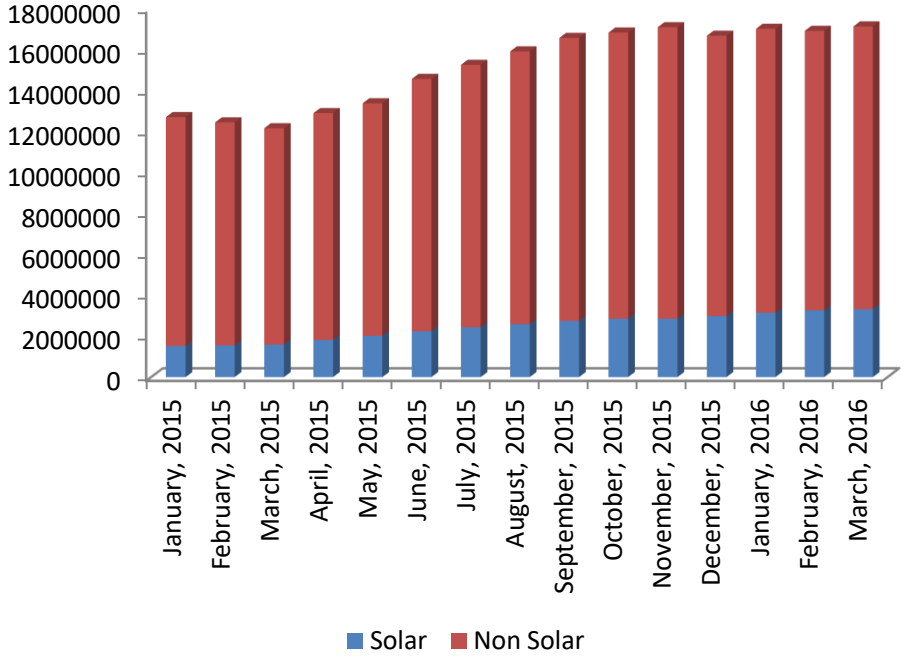
Issue Statement

- More than 17 million RECs (eq. to >17000 MUs of RE) unsold even at the floor price
- Lack of strict RPO enforcement, No penalty on non compliance (exception: few states Madhya Pradesh, Rajasthan, Uttarakhand, Union territories etc.)

Possible Interventions

- CERC has already increased the validity from 365 days to 1095 days
- REC Market Maker / buyback of unsold RECs / further increase in validity period (Buy-back fund in UK, strict penal provisions in Australia, Japan and UK))
- Uniform framework for RPO compliance monitoring at State level
- Majority of States allowed carry forward of RPOs starting from 2010-11 instead of invoking the penalty (forbearance price, purchase of REC) clause of RPO Regulations

REC Registry Closing Balance: Unsold RECs



REC Market Penetration

Issue Statement

- Registered RE capacity under REC mechanism (4.8 GW) is still less than 12% of overall installed RE capacity (>39 GW) in India
- Currently off grid RE projects are not eligible to participate in REC markets
- Very limited voluntary REC market in India
- Lack of capacity building measures at State Nodal Agency (SNA) level

Possible Interventions

- Allowing off grid RE projects to participate in REC market (As done in Australia)
- Expanding the voluntary REC market; creation of an eco-system

RPO Compliance Monitoring for Obligated Entities

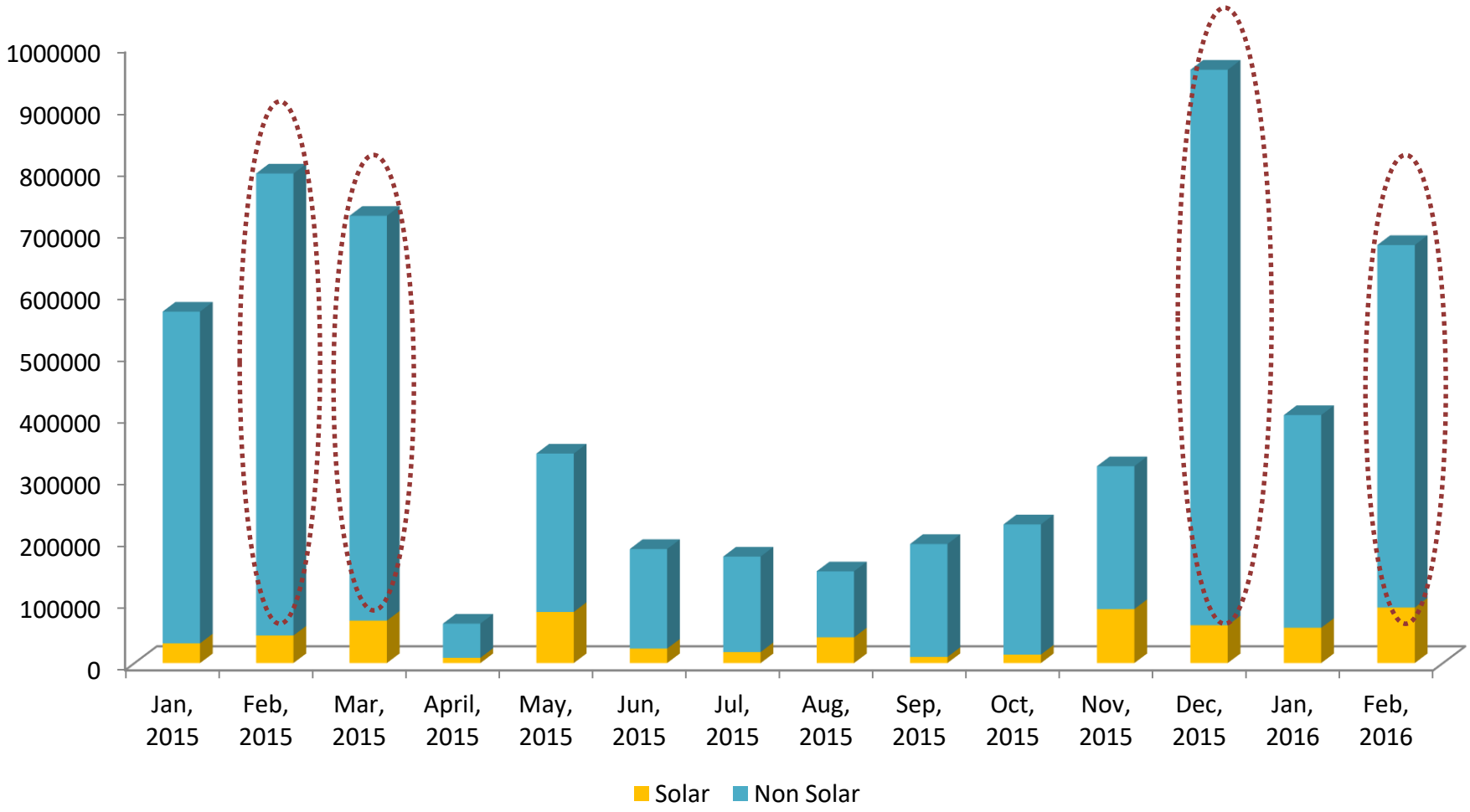
Need for RPO Compliance Monitoring Framework

29 States/UTs have specified obligation for purchase of renewable energy by obligated entities.

- RPO compliance monitoring is crucial to ensure:
  - RPO targets are met
  - Non-compliance is brought to the notice of regulators
- RPO compliance monitoring for DISCOM through Annual Performance Review, but no such monitoring mechanism for other obligated entities.
- Suo-Motu proceedings in few states to review the RPO compliance status by OA and captive consumers.
- RPO compliance review process is undertaken with significant time lag.

Need for an innovative, process-driven and technology-based solution to address these challenges.

Trading of Solar RECs



Steep rise in Trading of RECs as the FY ends; to meet the RPO compliance targets

Challenges in Implementation of RPO Compliance Monitoring

Practical Difficulties in Data Submission,Verification or Compliance Reporting:
Continued engagement with stakeholders through Working Group would be necessary

Lack of Standard Data Formats:
Formulation of standard reporting formats in consultation with SNA

Defining roles & Responsibilities of Each Stakeholder:
SLDC, DISCOMs, EI, SNA

Lack of Awareness among OEs:

- RRECL initiated periodic consultation process by sending letters to CPP & OA consumers
- USAID PACE-D TA Program in consultation with RRECL prepared a Draft Manual for OEs
- DISCOMS should sensitize OA consumers about RPO compliance requirement at the time of grant of Open Access permission
- EI should sensitize CPP consumers about RPO compliance requirement at the time of registration of CPP

WEB-BASED TOOL **Monitor, Record & Report**

RPO compliance status of OEs to SERC

Support to RRECL for RPO Compliance Monitoring framework & Webtool

MNRE-USAID PACE-D TA Program is supporting Rajasthan SNA (RRECL) in the development of RPO Compliance Monitoring and Reporting Framework and Web Tool development.

Assisted RRECL in the formation of RPO compliance reporting cell and designed the data collection forms.		
Designed framework and institutional structure for RPO Compliance Monitoring & Reporting.	Developed a Web-based tool for RPO Compliance Monitoring & Reporting.	Developed Manuals: Accreditation Guidebook, URS Document, Web-Hosting Requirements, Training Manuals, etc. for obligated entities.

- Presented "RPO Compliance Framework for Captive/OA Transactions at State Level" with a focus on RPO framework prepared for RRECL in 51st Meeting of FOR.
- FOR suggested to share the Web Tool/formats for replication in other States.

Approach for RPO Compliance Monitoring Framework

1 RPO Reporting Cell

Cell Structure, Role and Responsibilities of Stakeholders, etc.

2 Forms & Format Design

Formats for RPO compliance data collection from OEs

3 Manual for OEs

RPO information manual for OEs, Accreditation Guidebook, URS Document, Web Hosting Requirements, etc.

4 Reporting Framework Design

Protocol for data collection and M&V, process for OE (CPP/OA) accreditation, list of OE and updating OE list

5 Development of a Web Tool

Quarterly/Annual Reporting to RERC as per the RERC Regulations

6 Compliance Reporting to RERC

Grid Integration & Management of Variable RE Sources

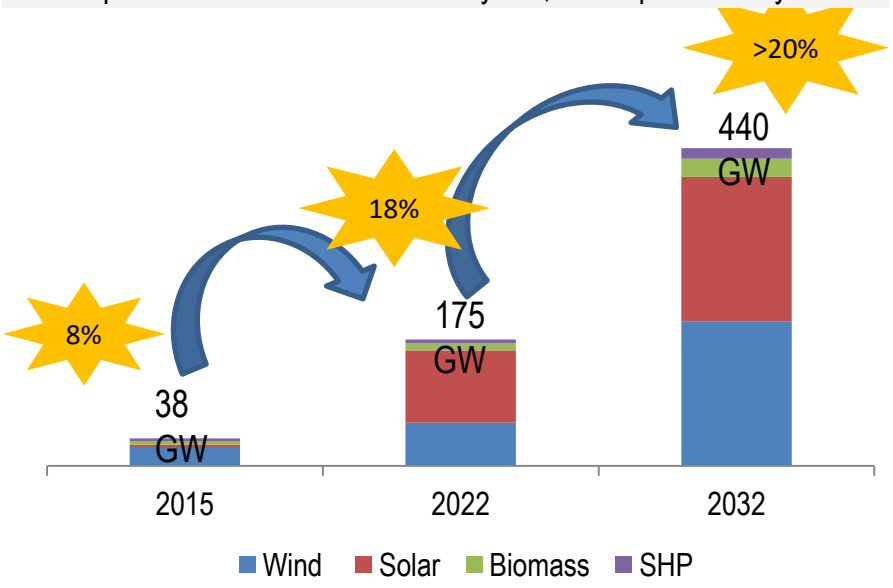
RE Capacity Addition Targets

NAPCC

- NAPCC target of 5% for RE Procurement in 2010
- Target to increase by 1% each year to reach 15% by 2020

CEA perspective plan for FY 2032

- CEA has projected RE capacity additions till 2032
- RE penetration level to increase by 8%, 18% up to 20% by 2032



RE Invest 2015

- Targets 175 GW by 2022
- Includes **60 GW from Wind**, **100 GW from Solar** and 15 GW from other RE
- **90%** of the targeted RE capacity addition planned from Wind and Solar source which are inherently **variable in nature**

COP -21, Paris

- **Reducing carbon emission intensity levels by 35% by 2030** compared to 2005 levels.
- INDCs Commitment- **40% of** the total installed power generation capacity would **be from non-fossil fuel sources by 2030.**

NTP amendments

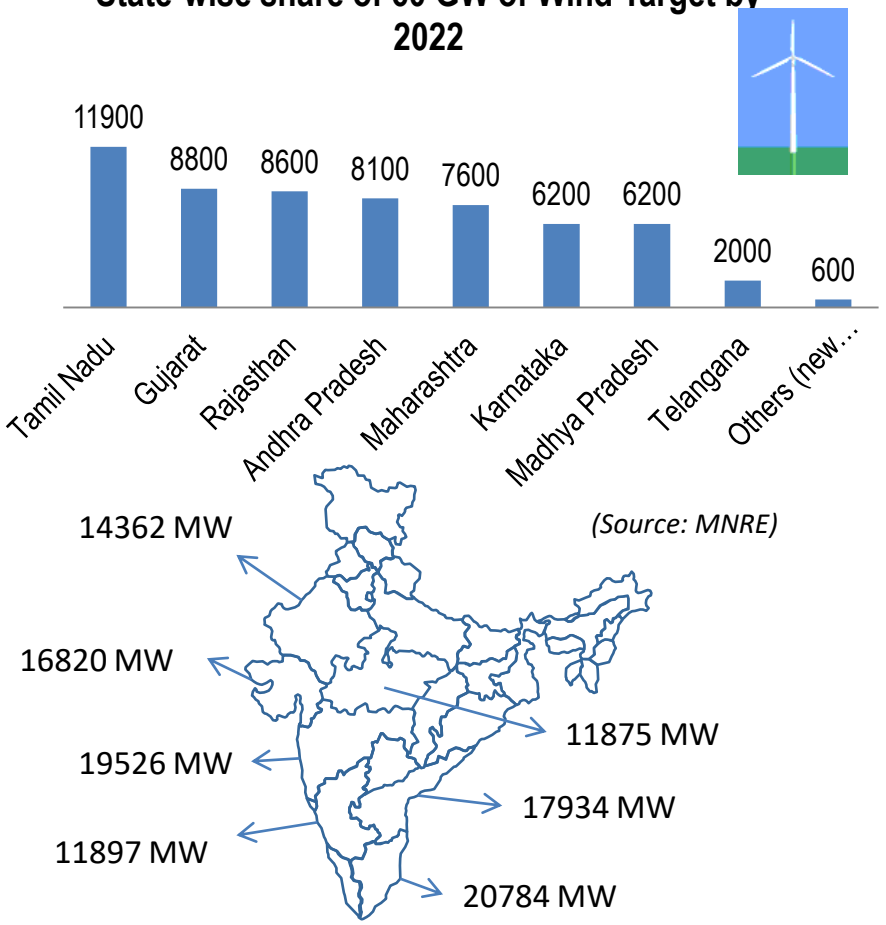
- **8% of electricity consumption shall be from solar energy** by Mar'22 .
- **RGO (Renewable Generation Obligation)**: New coal based plants to establish RE capacity
- **Promotion of micro grids and ancillary services for RE**

State-wise share of Solar & Wind Targets by 2022

State-Wise share of 100GW of Solar Targets by 2022

1	Delhi	**2,762**	20	Kerala	**1,870**
2	Haryana	**4,142**	21	Tamil Nadu	**8,884**
3	Himachal Pradesh	**776**	22	Puducherry	**246**
4	J&K	**1,155**		**Southern Region**	**26,531**
5	Punjab	**4,772**	23	Bihar	**2,493**
6	Rajasthan	**5,762**	24	Jharkhand	**1,995**
7	Uttar Pradesh	**10,697**	25	Odisha	**2,377**
8	Uttarakhand	**900**	26	West Bengal	**5,336**
9	Chandigargh	**153**	27	Sikkim	**36**
	Northern Region	**31,120**		**Eastern Region**	**12,237**
10	Goa	**358**	28	Assam	**663**
11	Guajarat	**8,020**	29	Manipur	**105**
12	Chattisgargh	**1,783**	30	Meghalaya	**161**
13	Madhya Pradesh	**5,675**	31	Nagaland	**61**
14	Maharashtra	**11,926**	32	Tripura	**105**
15	D&N Haveli	**449**	33	Arunachal Pradesh	**39**
16	Daman & Diu	**199**	34	Mizoram	**72**
	Western Region	**28,410**		**North Eastern Region**	**1,205**
17	Andhra Pradesh	**9,834**	35	Andaman Islands	**27**
18	Telengana		36	Lakshadweep	**4**
19	Karnataka	**5,697**		**All India**	**99,533**

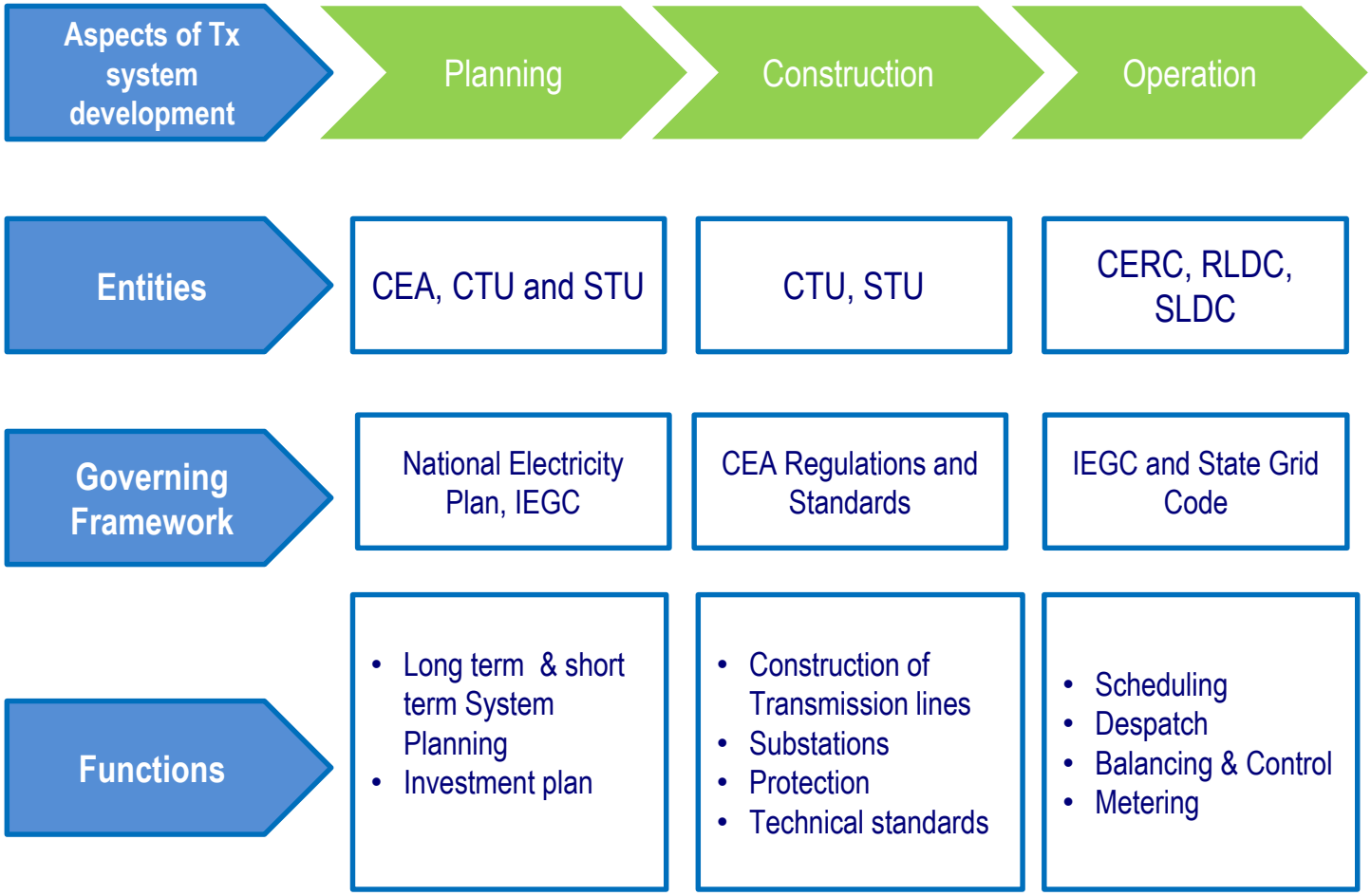
State-wise share of 60 GW of Wind Target by 2022



(Source: MNRE)

Large scale integration of Variable (Solar & Wind) energy is envisaged in the coming years to the Indian Grid

Framework for Grid Integration



Key focus for State level Grid Integration of RE

- Grid Planning processes : need for paradigm shift
- Interconnection process : uniformity across States
- Managing variable and infirm generation
- Forecasting and Scheduling Regime
- Institutional Capacity Building Requirement
- Development of Ancillary Services
- Assessing and socialising cost of Integration

Way forward

- Facilitating Grid Integration of Renewable Energy Resources
  - Necessary amendments to Grid Code and formulation of F&S/DSM framework conducive for harnessing RE potential
  - Institutional and Governance structure for metering, communication, energy accounting & settlement mechanism to be streamlined.
  - Implementation aspects of connectivity, evacuation arrangement to be addressed.
- RPO trajectory and Compliance Monitoring
  - Long term RPO trajectory and improved periodicity for compliance
  - Verification and Enforcement of RPO targets by SERCs for all Oes
- 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
  - Standard Rules for procurement at APPC/ Model contracting arrangements

Thank You

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Thank You

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