

Aligning RE Development with Regulations: Market Incentives and Regulatory Mechanisms

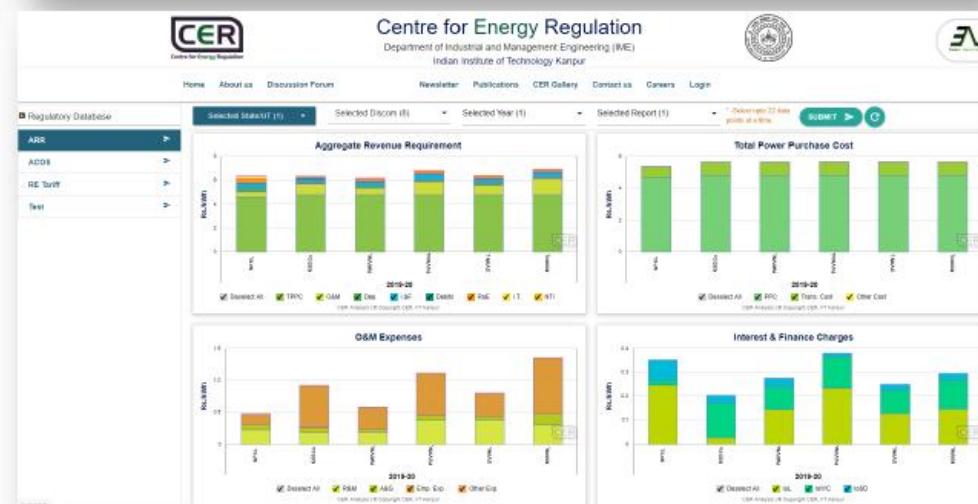
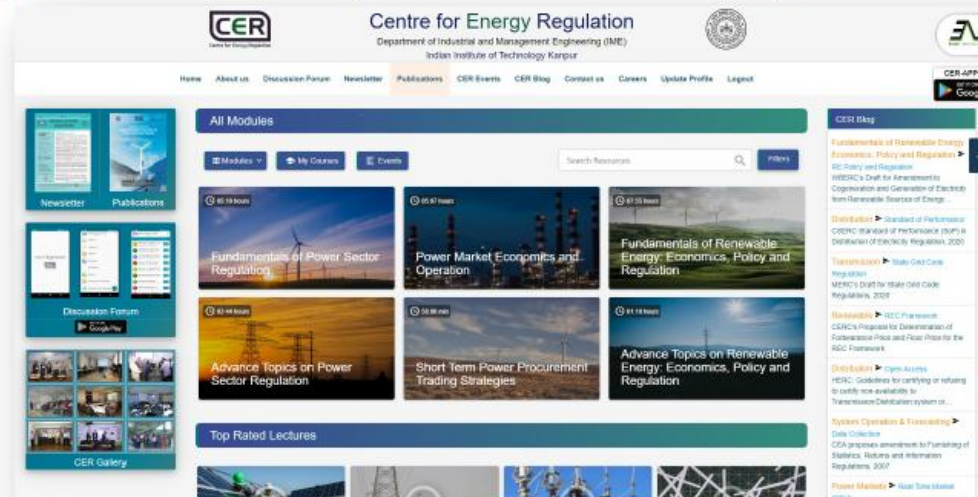
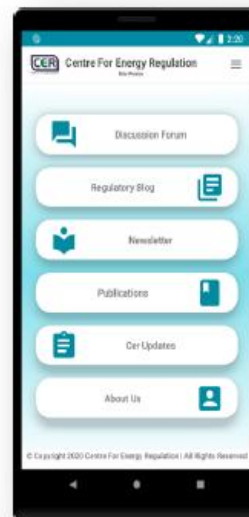


Anoop Singh

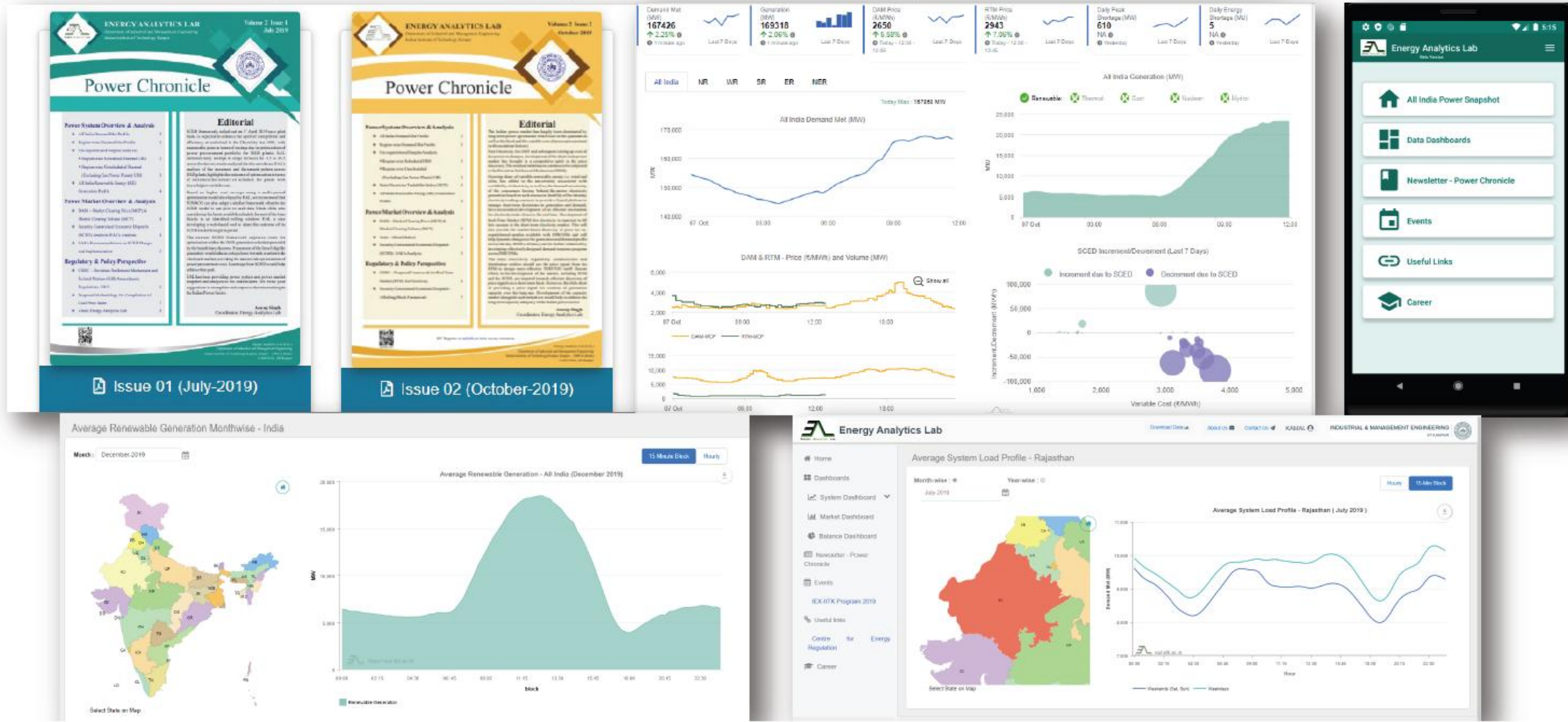
Centre for Energy Regulation

Department of Management Sciences
Indian Institute of Technology Kanpur

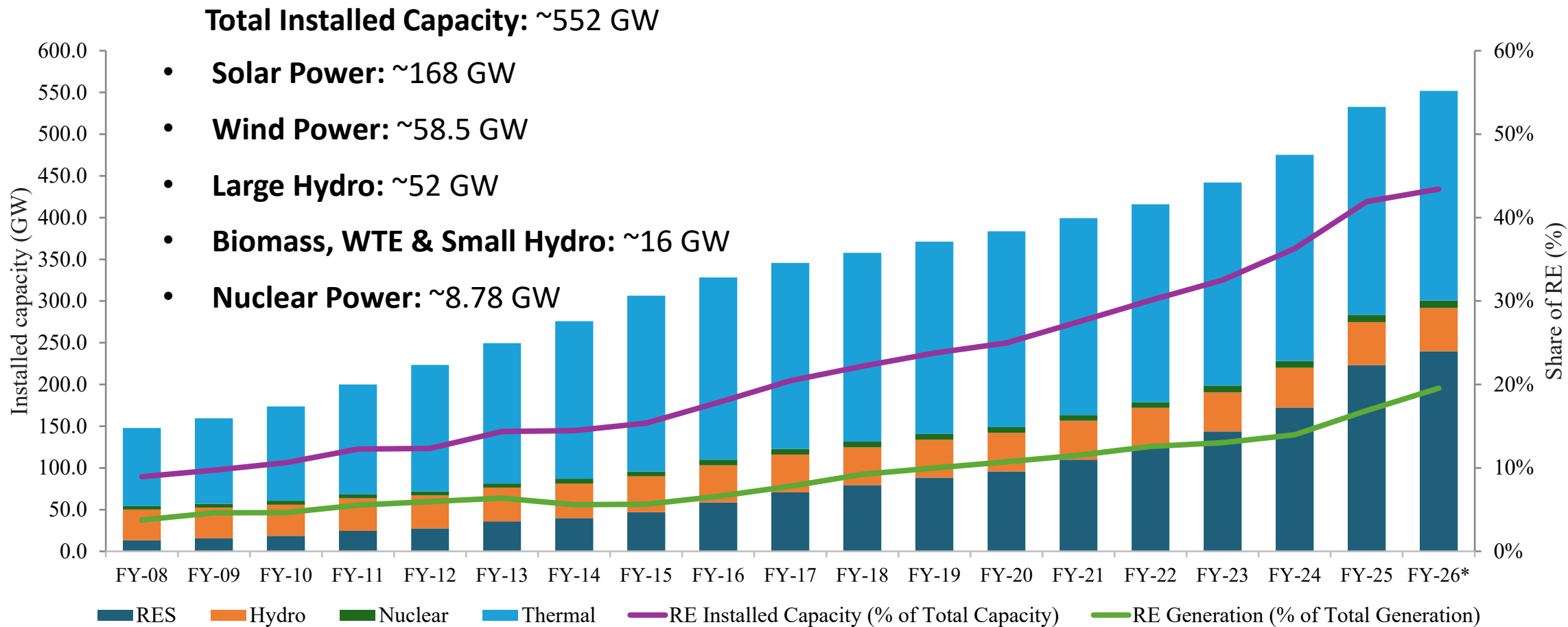
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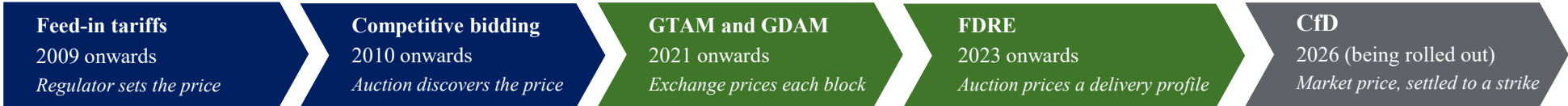


Background: Renewable Energy in India

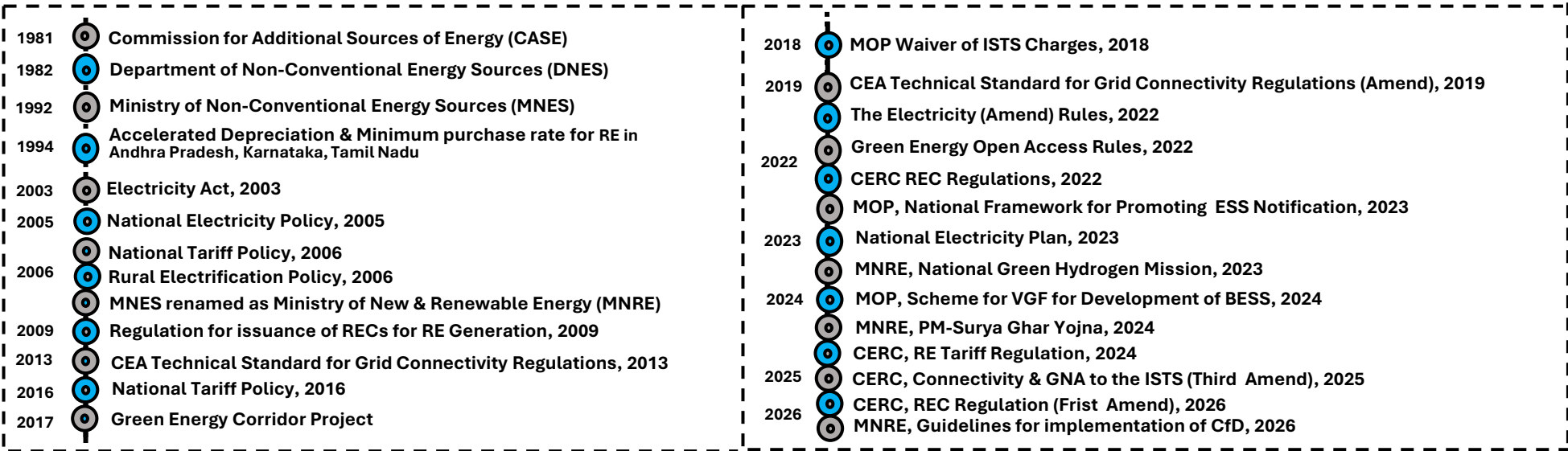


Evolution of India's RE Policy and Regulatory Framework

Evolution of Procurement and Pricing Instruments for RE Development:



Evolution of RE Policy & Regulations:



Evolution of Deviation Settlement (DSM):



Electricity Act, 2003 & Beyond – RE TARGETS

Electricity Act, 2003 – Empowering RE

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): *“Promotion of co-generation and generation of electricity from renewable sources of energy”*

Section 66: *“(Development of market): The Appropriate Commission shall endeavour to promote the development of a market (including trading) in power”.*

Section 86(1)(e): *“promote co-generation 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**”*

Tariff Policy 2016

RPO Trajectory

- ✓ Achieve 17% share in energy mix by 2022 with 8% from solar

REC mechanism

- ✓ Technology & vintage-based REC multipliers

Competitive Bidding for RE

- ✓ Mandatory competitive bidding for RE (except Waste-to-Energy)
- ✓ Tariff based on regional solar & wind resource variations

Transmission Charge Waiver

- ✓ No/Tapered inter-State transmission charges for solar, wind, PHP & co-located BESS) (till notified period)

MoP Notification on LT RPO Trajectory: 2016

Guidelines for Long term RPO growth trajectory of Renewable Purchase Obligations for Non-solar as well for Solar-reg

*“Para 6.4(1) of the policy provides that pursuant to provisions of section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage of the total consumption of electricity in the area of a **distribution licenses for purchase of energy from renewable energy sources, taking into account availability of such resources and its impact on retail tariffs.** Cost of purchase of renewable energy shall be taken into account while determining tariff by SERCs. Long term growth trajectory of Renewable Purchase Obligation (RPOs) will be prescribed by the Ministry of Power in consultation (RPOs) will be prescribed by the Ministry of Power in consultation with MNRE.”*

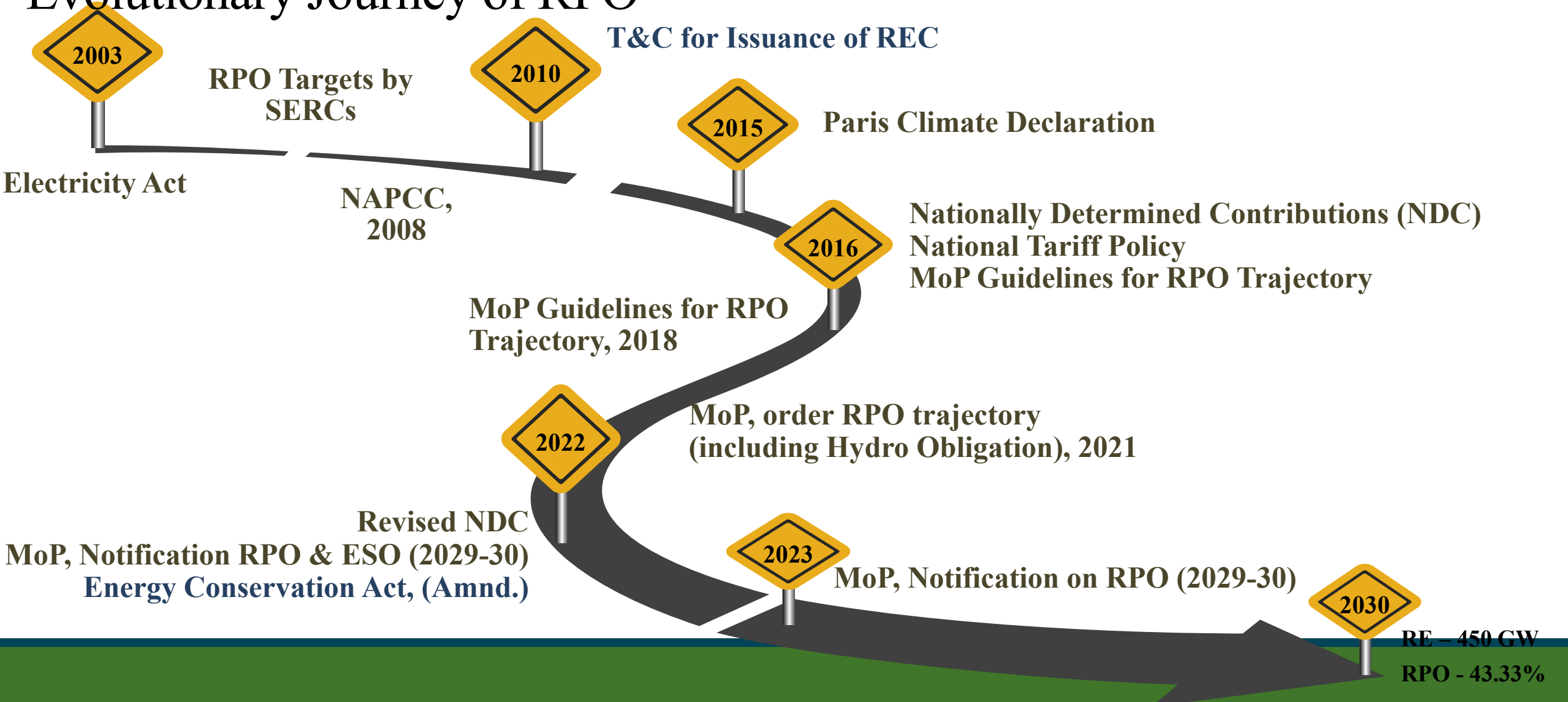
Energy Conservation (Amendment) Act, 2022

Section 14:

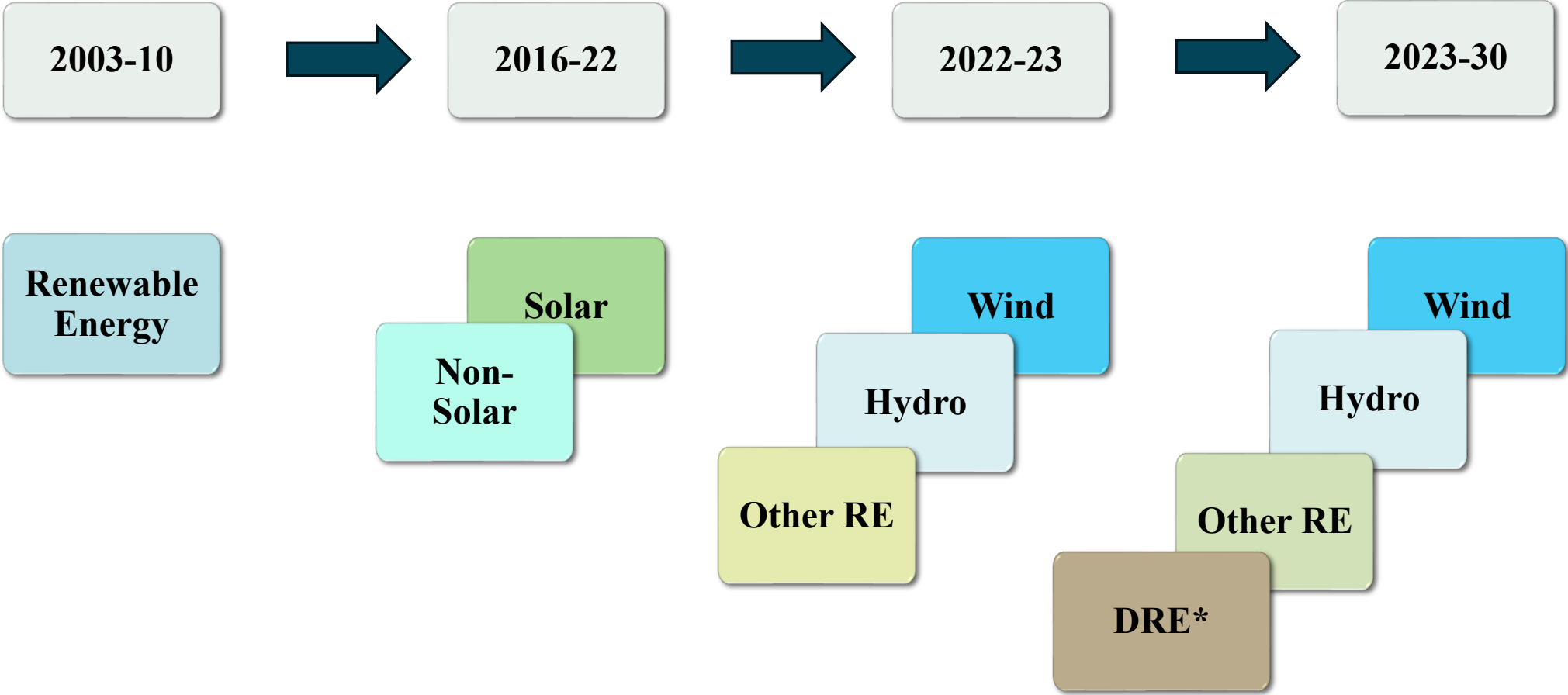
(n) “direct every designated consumer to comply with energy consumption norms and standards;”

(x) “specify minimum share of consumption of non-fossil sources by consumption may be specified for different types of non-fossil sources for designated consumers as energy or feedstock, provided different share of different designated consumers”

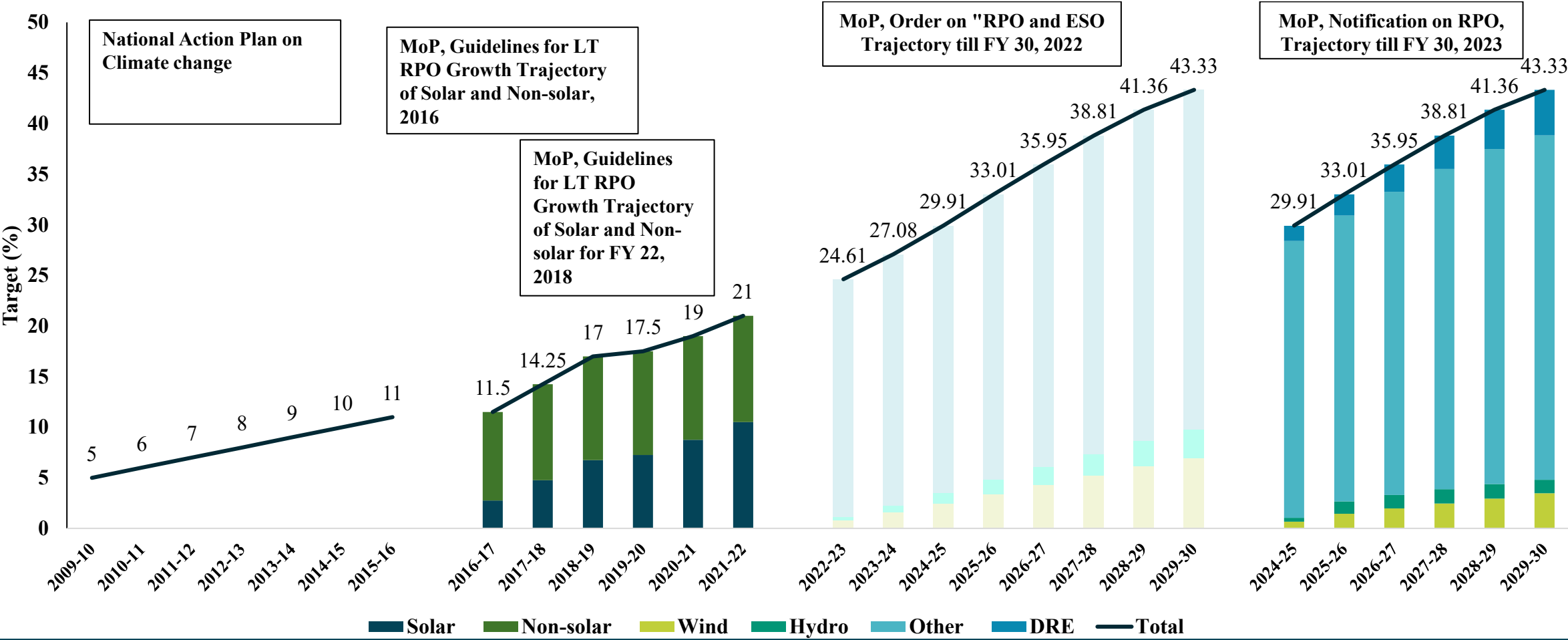
Evolutionary Journey of RPO



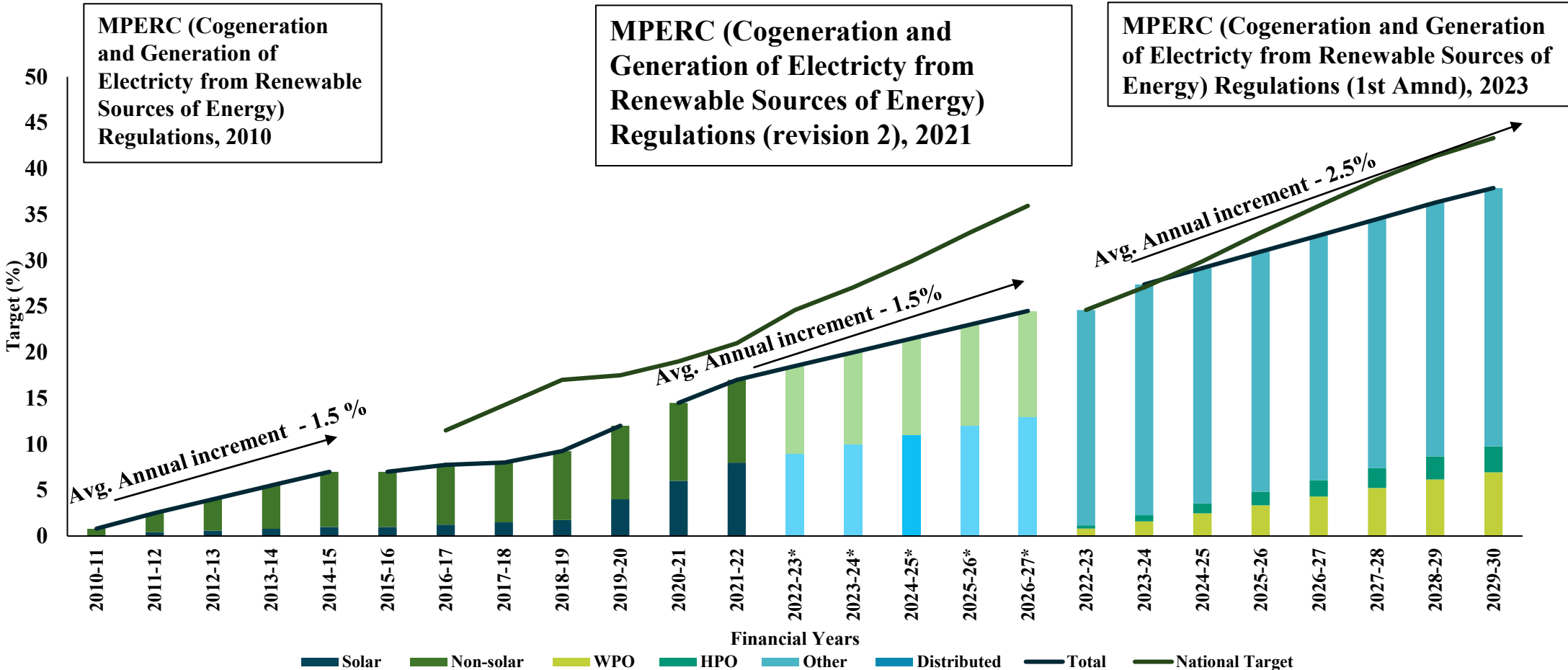
RPO Categorisation by RE Source



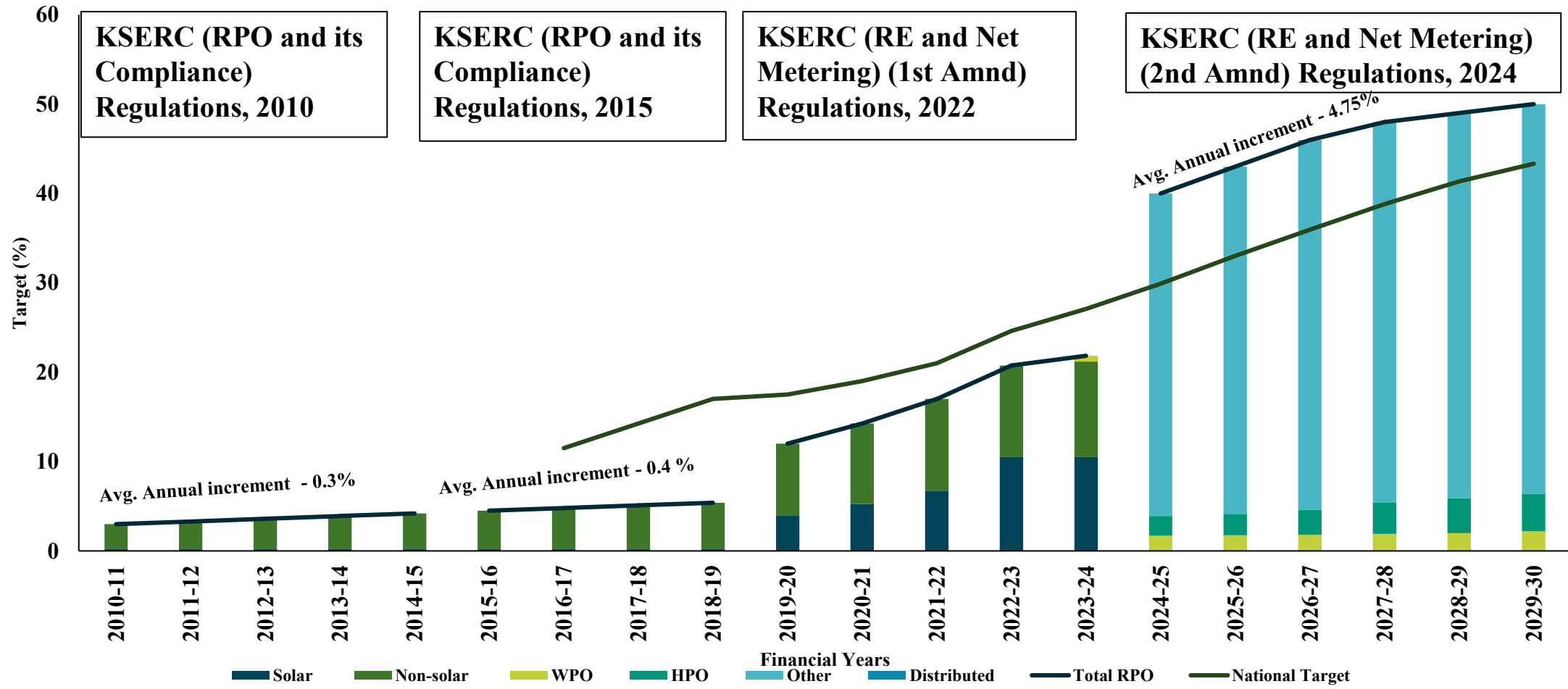
National level RPO Target



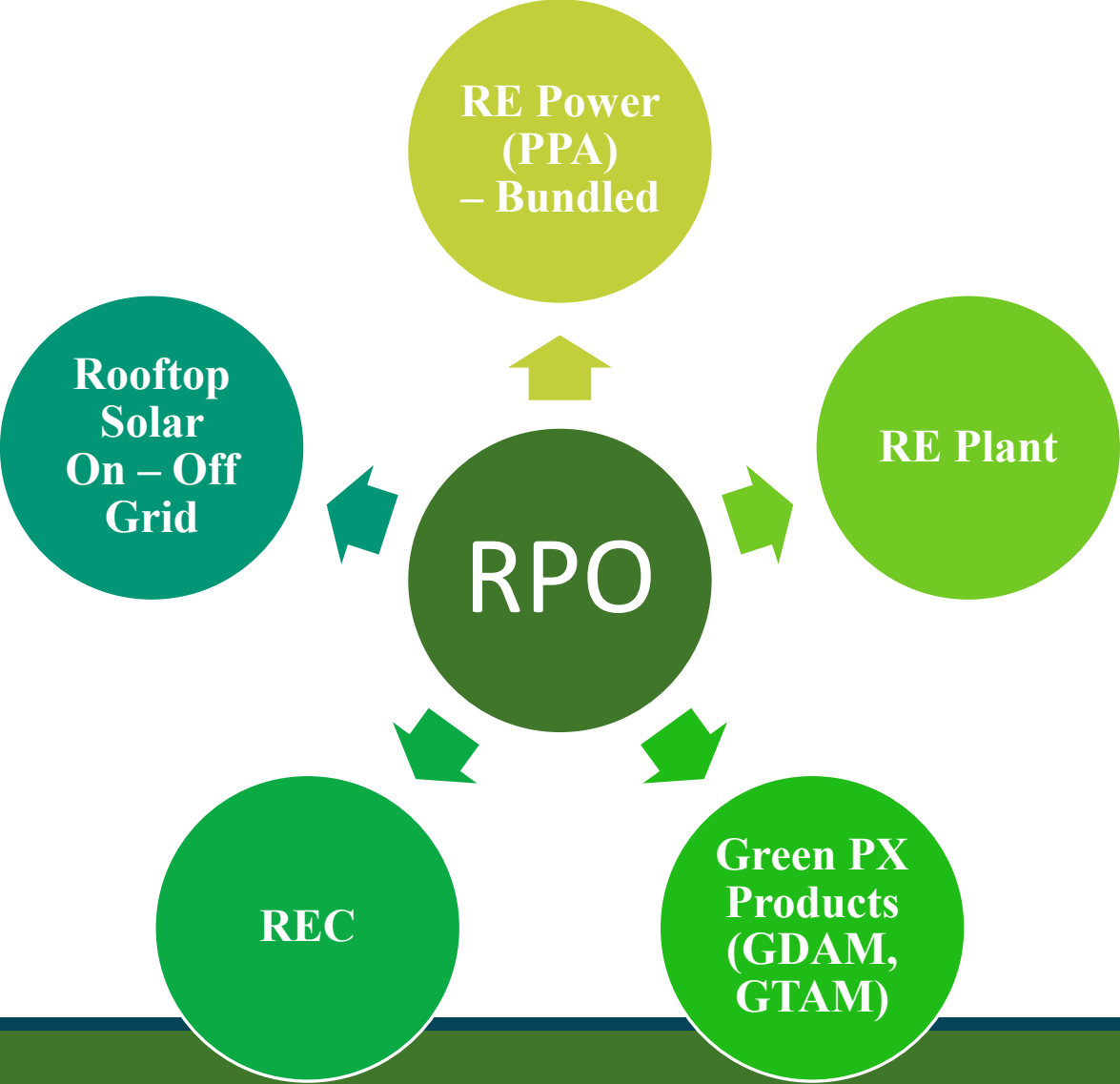
RPO Target: MPERC



RPO Target: KSEDC



Modes of RPO Fulfilment



CER's Opinion on Draft RPO & REC Regulations



Regulatory Outlook	
Opinion on UPERC (MYT for Distribution and Transmission Tariff) (Third Amendment) Regulations, 2024 [Draft]	2
Opinion on OERC (Terms and Conditions for Determination of Generation Tariff) Regulations, 2024	4
Opinion on CERC (Terms and Conditions of Tariff) (First Amendment) Regulations, 2024 [Draft]	13
Opinion on CERC (Appointment of Consultants) (Fifth Amendment) Regulations, 2024 [Draft]	16
Opinion on MoP (Tariff based Competitive Bidding Guidelines for Procurement of Storage capacity/Storage Energy from Pumped Storage Plants), 2024 [Draft]	17
ERC Tracker	
Regulatory Updates	19
India's Electricity Landscape: Average	19
Tariff Orders	24
Regulations	24
CER News	
Capacity Building Programme for LDCs on "Regulatory and Policy Framework in the Indian Power Sector: Load Despatchers Perspective"	25
Regulatory Certification Programme on "Power Market Economics and Operation"	25
Free Registration at cer.iitk.ac.in	

Editorial

Power purchase cost accounts for approximately 70-80% of the final tariff paid by consumers. The projected quantum of energy sales, sources of supply, cost of procurement (capacity as well as variable charges) and variation in share of renewables determine the overall cost of power procurement for the distribution licensees. While the projected costs pertain to the tariff control period, the actual cost of power procurement fluctuates from month to month. Power procurement cost generally trends upwards, primarily due to rising cost of coal. This escalation places stress on the working capital requirement of the Discoms, who are entitled to working capital based on the approved cost of power procurement. Section 62 of the Electricity Act, 2003 provides for adjustment towards such cost changes within a year.

Discoms should diligently follow the process for Fuel and Power Purchase Adjustment, Surcharge (FPPAS) in a timely manner to ensure that the additional interest cost burden does not impact on their financial performance. The regulatory framework for FPPAS should account for the allowable cost increase, primarily due to cost of power purchase tied up u/s 62 or 63 of the Electricity Act, 2003. However, short-term power procurement beyond the limit imposed in terms of quantum as well as maximum/average price, should be excluded from the calculation of FPPAS. Apart from price of coal, variability in quality of coal supplied to the thermal power stations can be linked to uncertainty associated with variable cost, thus impacting the FPPAS to be paid by the consumers. Visibility of such variations to the regulators and end consumers would sensitise the two key stakeholders responsible for the approval and the payment of FPPAS respectively. Regulatory framework for tariff across the country should ensure archival and visibility of such information for all the thermal power plants by source of coal supply. This would help ascertain the concerns of the generators, and help design solutions thereof.

Competitive bidding guidelines for storage, particularly the pumped storage plant (PSP) sites, should ensure sufficient competition and a choice of public-private partnership model. Given the rising flexibility requirements of the Indian power system, the availability of PSPs and their required charging and discharging rates should be integral technical characteristics for competitive bidding.

Anoop Singh (Editor)
Founder & Coordinator, Centre for Energy Regulation

Keywords: FPPAS, Emission Control System, Flexible Operation, Auxiliary Energy Consumption, Transmission Charges, Tariff Determination, PAT Scheme, Battery Energy Storage System, Frequency Response Performance, Coal Price Caps and Storage Capacity Charge.

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POSOCO (Detailed Procedure for REC Mechanism in compliance of CERC (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations, 2022) [Draft]

The POSOCO on 15th Feb, 2022 notified the draft CERC (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations, 2022. The key highlights of the draft are mentioned below:

Introduction: The draft defines the roles, responsibilities and functions of the different entities involved in the process of issuance of the certificates along with the complete process of issuance, validity of the certificate, denomination of the certificate, etc.

The procedure is made defining the step-wise process for accounting of generation in respect of eligible entities, accreditation of REGS including CGP under REC Mechanism, their accreditation & registration of eligible entities, issuance and redemption of the certificate.

Functions of Agencies:

- **NLDC** will be responsible for registration of projects of eligible entities, issuance of certificates, maintain accounts of registry along with other functions as mentioned in the Regulations.
- **State Agency** is the agency designated by the concerned State Commission for accreditation of eligible entities connected to the intra-state transmission system for the grant of RECs.
- **RLDC** shall undertake accreditation to the eligible entities connected to the inter-state transmission system and issuance of Energy Injection Report (EIR).
- **SLDC** shall take up issuance of EIR on the basis of electricity generated and injected to the grid.

Process for implementation of REC Mechanism

Accreditation of the eligible entities → Registration of the eligible entities → Issuance of Renewable Energy Certificates (RECs) → Exchange and redemption of RECs(s).

Eligibility for issuance of Certificates

Following entities shall be eligible for issuance of Certificates.

- Renewable energy generating stations (REGS) – Tariff not determined by Section 62 or 63 of EA, 2003 or electricity

Opinion on DERC (Renewable Purchase Obligation and Renewable Energy Certificate Framework Implementation) Regulations, 2024 [Draft]

DERC notified draft on "Renewable Purchase Obligation and Renewable Energy Certificate Framework Implementation" Regulations, 2024 on 10th June, 2024. The key highlights of the draft are mentioned below:

Objective: The draft Regulation for implementing RPO and Renewable Energy Certificate (REC) frameworks in the National Capital Territory of Delhi. It mandates that discoms, captive & open access consumers meet specific RPO obligations, with targets varying yearly for different RE sources, including wind and hydro power. The draft defines key terms such as, set compliance mechanisms and outline penalties for non-compliance. The framework aims to ensure that a portion of electricity consumption in Delhi is met through RE sources, promoting sustainability and energy diversification in the region.

CER Opinion

CER Capacity Constraints for Increased Consumer Load: Clause 5 (2) (a) – "Own Generation from renewable energy sources. – There shall not be any capacity limit for installation of power plants from renewable energy sources, by entities for their own consumption and such plants may be set up at any location in India and power shall be transmitted by using open access. Provided that the generating plant may be set up by the entity itself or by a developer with which the entity enters into a power purchase agreement." (emphasis added)

The proposed clause does not account for potential capacity constraints of the supporting infrastructure. A consumer who intends to consume higher than the Sanction load, the feeder or the distribution transformer may have a capacity limitation to handle this additional energy procured. A proviso may be added to subject the same to the limit due to system constraints, particularly those at the distribution network level.

While the above clause specifies no capacity limit for installation of RE power plants for own consumption, clarity with respect to plants with shared capacity by consumers within the area of a distribution licensee or multiple distribution licensees in the state. A consumer may have multiple locations across different license areas in the state of Delhi, and thus should have flexibility of setting up a shared generation capacity or enter into a PPA for the same.

The above clause should also permit setting up of a generating unit owned by a group of consumers within or across different distribution licensees within the state.

CER Green Energy Supply to Consumers: Clause 5 (2) (c) (i) – "Any consumer may elect to purchase green energy either up to a certain percentage of the consumption or its entire consumption and they may place a requisition for this with their distribution licensee, which shall procure such quantity of green energy and supply it and the consumer shall have the flexibility to give separate requisition for solar and non-solar;" (emphasis added)

To cite this article, please click

Key Concerns in RPO Framework

RPO definition

Accounting of green energy



DAM & TAM



Accounting of non-obligated entities RPO toward

discoms

Monitoring and compliance mechanism

Visibility and transparency

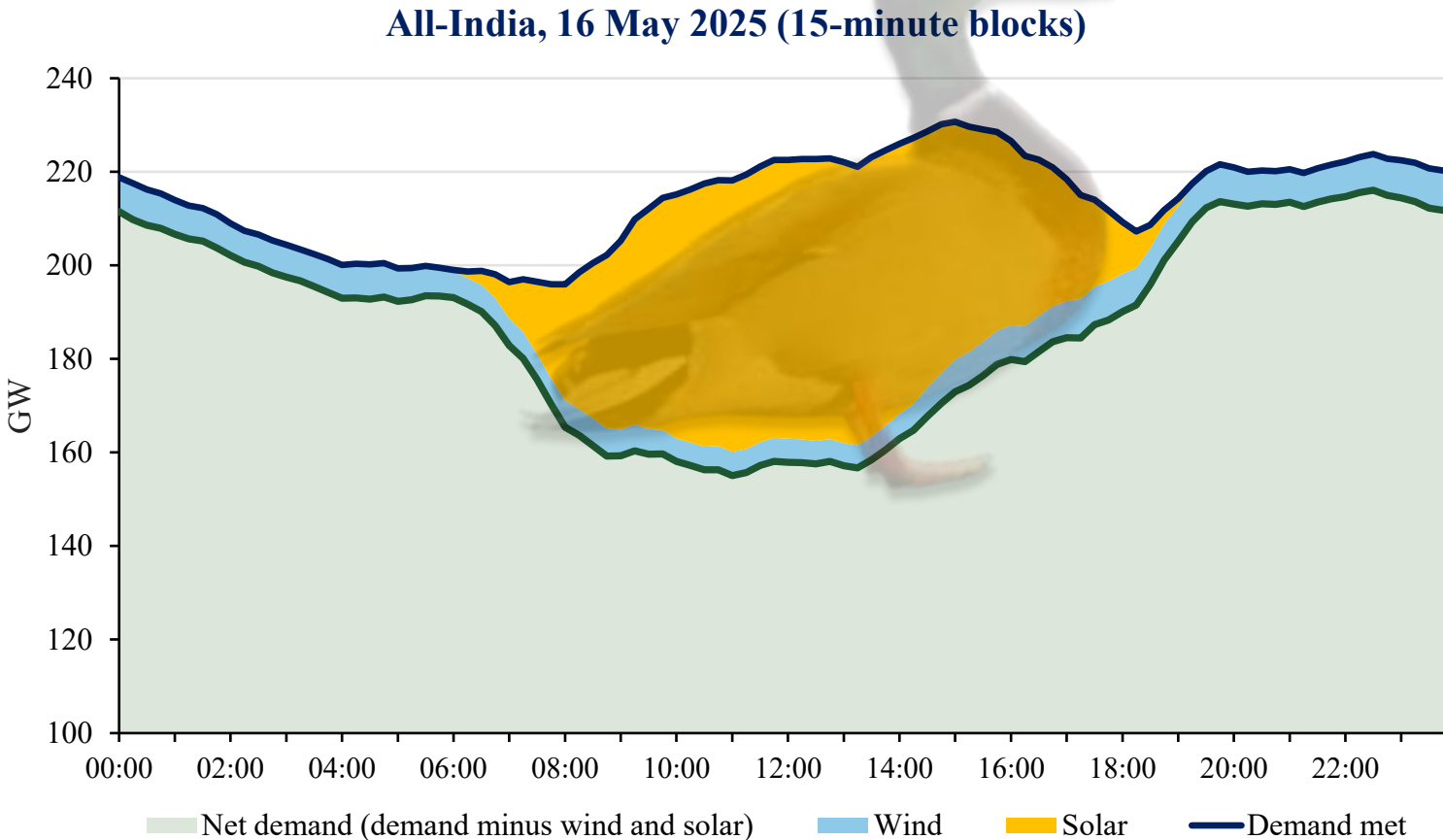
RPO target setting approach

Impact of uncertainty in projected demand and RE availability

Energy 'gap' due to asymmetric fungibility across REC and RPO Target

Background: Indian Duck Curve

- Between 11:00 and 19:45, hydro rises from 9.7 to 28.4 GW and thermal from 136 to 172 GW to cover the solar fall-off.



155 GW Net demand at its lowest, 11:00

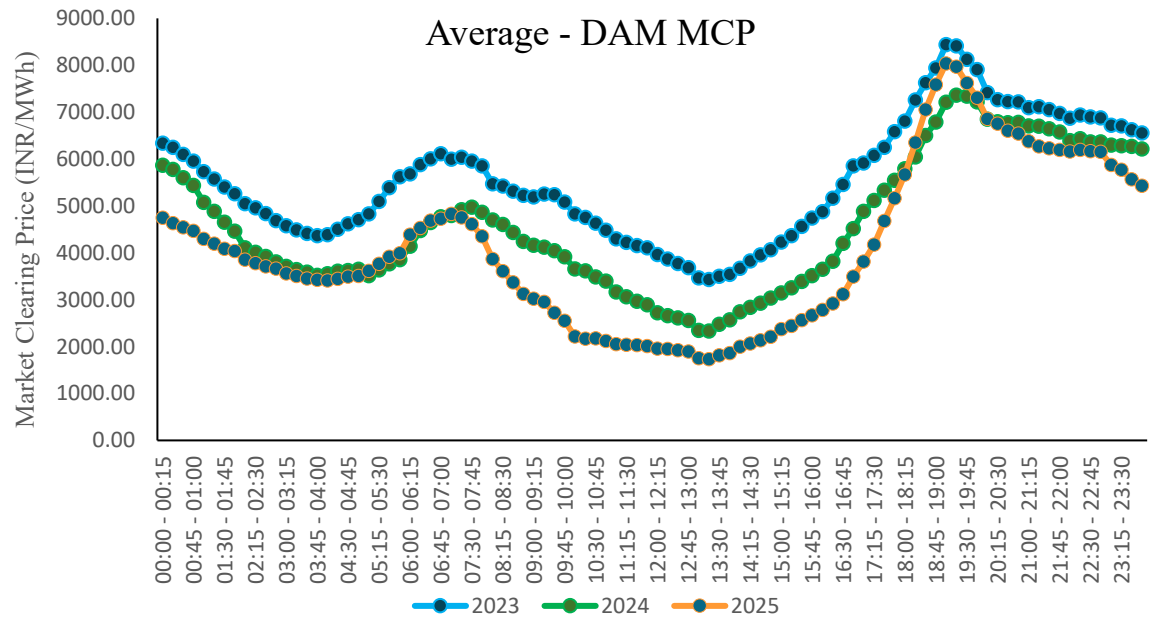
60 GW Solar peak at 12:30, 27% of demand met

61 GW Rise in net demand from the midday low to 216 GW at 22:30

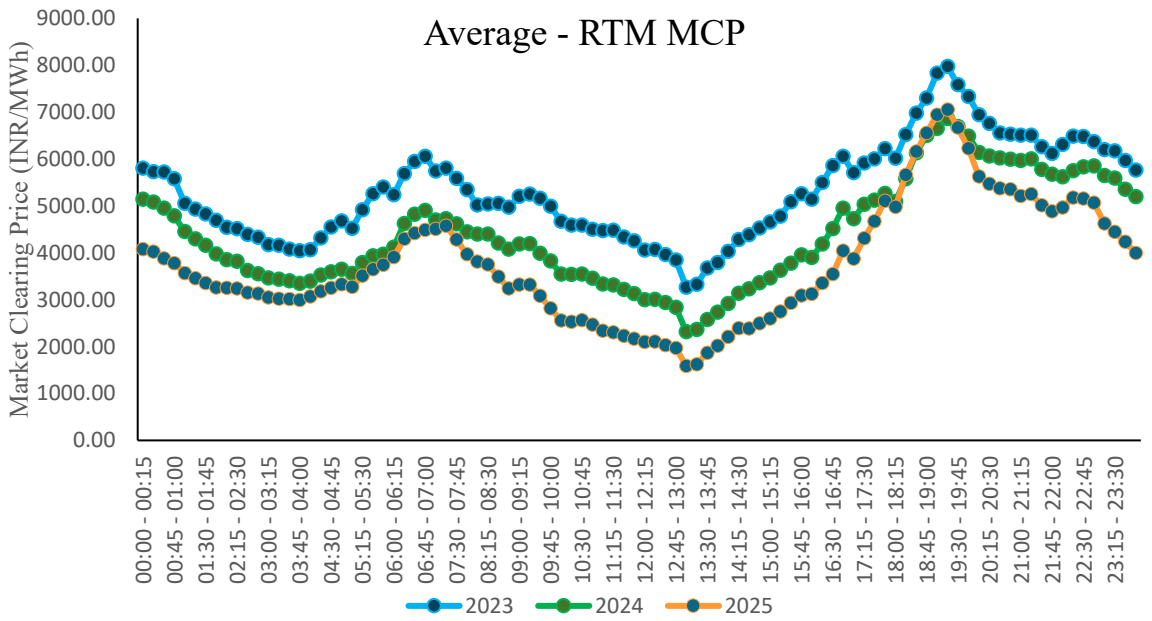
17.8 GW Steepest one-hour net-demand ramp, 18:15 to 19:15

Background: Average MCP – DAM and RTM

DAM



RTM



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GTAM and GDAM: evolution and design

- Before 2020, RE was under 1% of day-ahead and term-ahead exchange volumes, and green power had no price of its own.

Who can trade on Green Markets: Discoms (for RPO compliance, selling surplus), open access and captive consumers, and merchant or uncontracted RE.

Green Term-Ahead Market (GTAM)

Trading began 21 August 2020

- Bilateral trades through the exchange, no long-term PPA needed
- Contracts: green intraday, day-ahead contingency, daily and weekly
- Continuous matching for intraday and contingency; open auction for term contracts
- Separate solar, non-solar and hydro contracts; purchases count towards RPO

Green Day-Ahead Market (GDAM)

Launched 27 October 2021

- Part of the integrated day-ahead market; 15-minute blocks for the next day
- Double-sided closed auction, like the conventional DAM
- Green bids clear first; uncleared green bids roll into the conventional DAM
- Separate green price; ISTS charges waived; purchases count towards RPO

Opportunities

- A merchant route for surplus and uncontracted RE
- Daily RPO and RCO compliance for obligated buyers
- A green price for each 15-minute block
- A charging source for storage: CERC's 2026 draft counts GDAM energy as RE

Challenges

- Volumes stay thin next to long-term PPAs
- Solar-heavy sell side: midday glut, scarce evening supply
- No long-dated hedge, so they cannot finance a new plant alone
- Prices diverge across GDAM, DAM and RECs

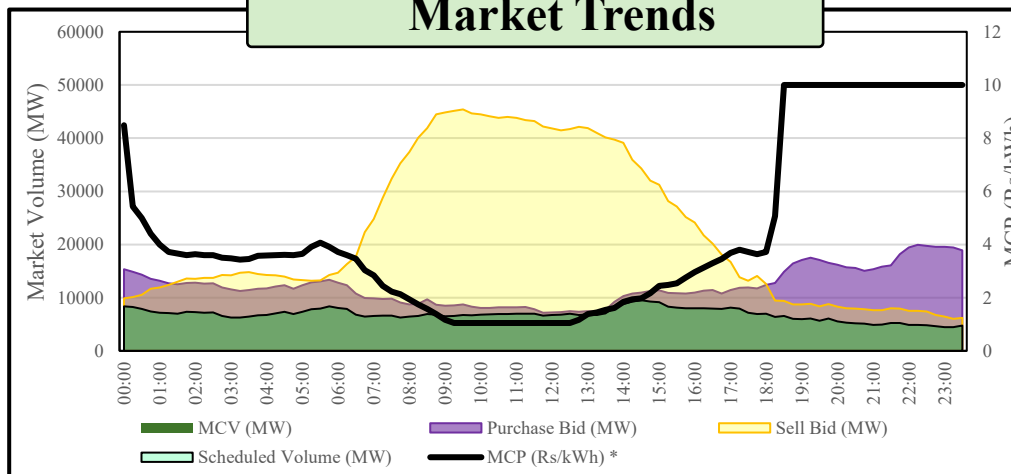
Background: Recent Trends in RE Regulation and Markets

- India's Regulatory landscape reward an RE project for getting built.
- The market now rewards it for when and where its power reaches a buyer.

Regulatory Incentives

- Exemption from **Cross Subsidy Surcharge (CSS)**
Waste-to-energy, Captive plants (GEOA), Green Hydrogen/Ammonia
- No **Additional Surcharge (AS)**
Wind Offshore by Dec 2032
- Up to **100% ISTS Waiver**
Co-located BESS / PSPs commissioned by June 2028
- VGF scheme available for **BESS projects**

Market Trends



1 Unsold Capacity

~**45 GW** of awarded RE capacity had
Letters of Award but no signed PPA or PSA
- as on Jan 2026

2 Curtailments

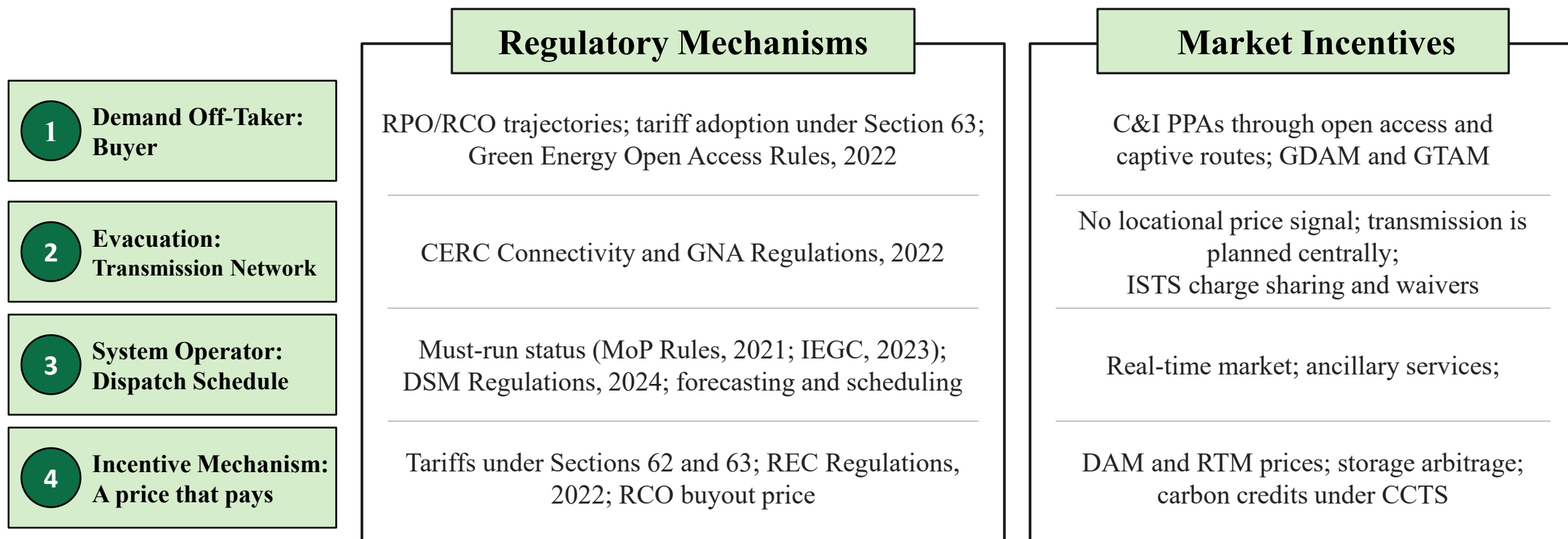
33% of the 54.8 GW of newly commissioned
RE was evacuating on temporary GNA
- May 2026

3 Peak vs Off-Peak Price

₹1.47 vs ₹8.86 average IEX day-ahead
price per kWh, 08:00–16:00 against 18:00–23:00
- June 2026

Introduction: Enablers of RE Development

- **Ministries** (MNRE, MoP) set targets and bidding trajectories;
- **Regulatory Commissions (CERC, SERCs)** frame market design and tariffs;
- **System Operator** facilitate Dispatch Schedule
- **Market** Power exchanges discover prices for the residual volumes.



Feed-in tariffs

- **Feed-in tariffs rewarded every unit generated, at any hour, at a price the regulator sets.**
- Revenue certainty made the first projects bankable, and a published tariff was simple for small developers.

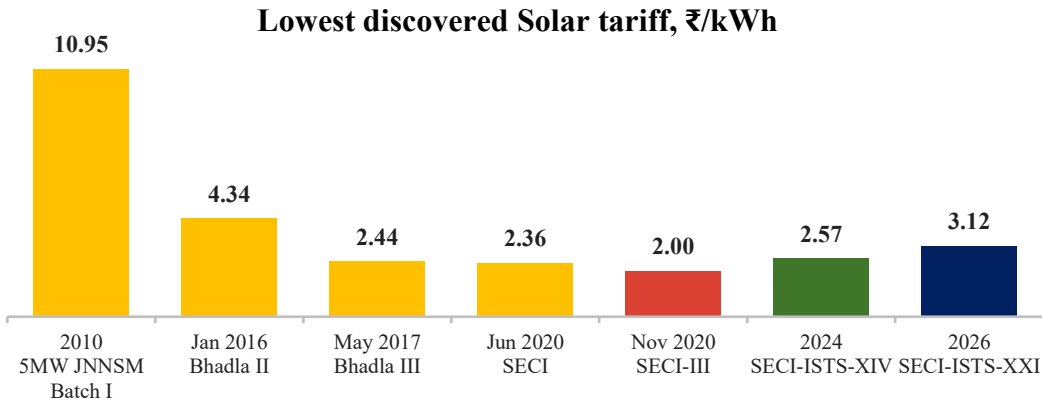
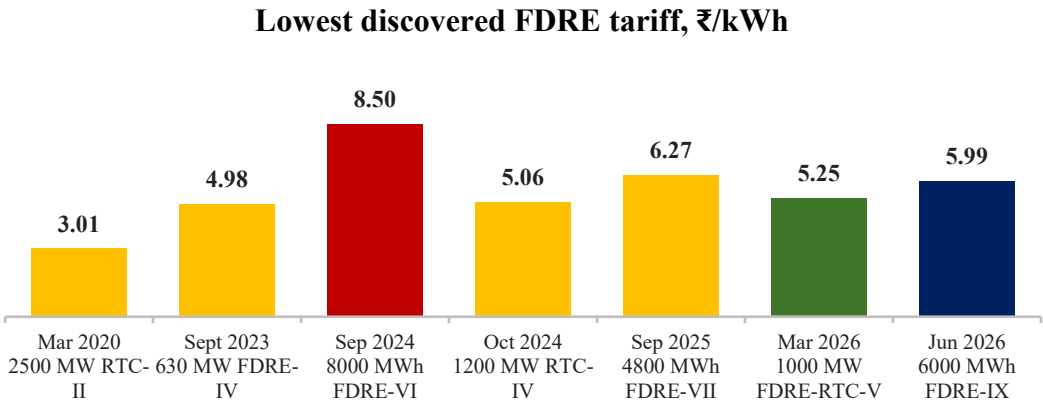
How a feed-in tariff works

- 1 Regulator fixes normative costs: capital cost, capacity utilisation factor, debt terms, return on equity, O&M
- 2 A levelised tariff is determined for each technology, for the life of the plant
- 3 The discom signs a long-term PPA at that tariff and buys all output
- 4 The cost passes through to consumers in retail tariffs

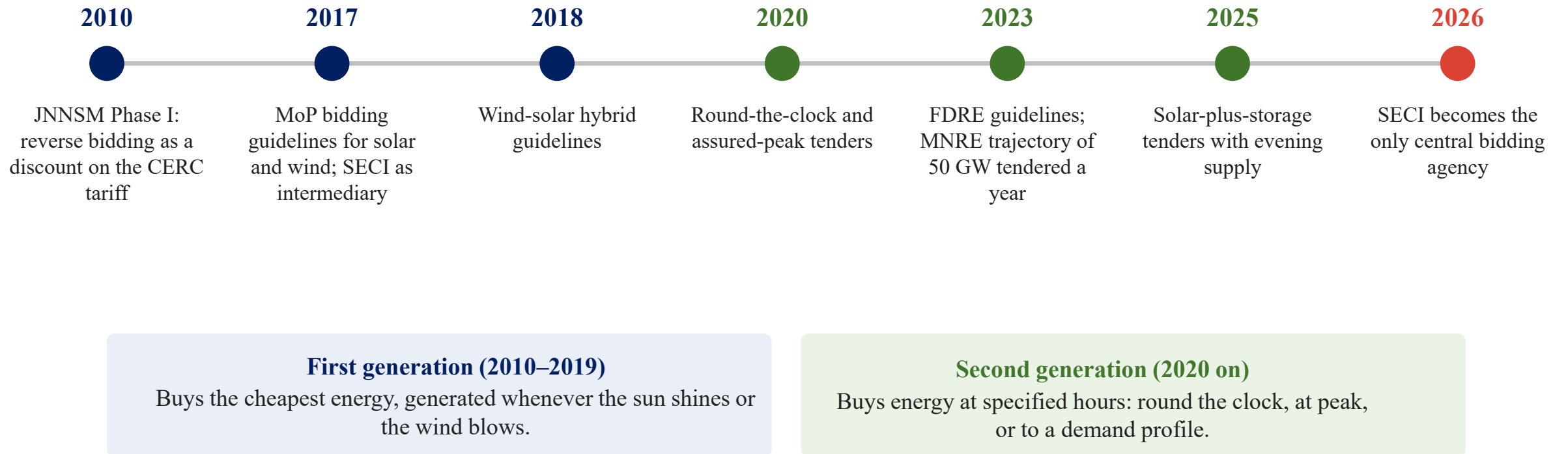
Where FiTs failed

- An administered price trails a falling cost curve
- Discoms stay locked into early high tariffs for 25 years
- Tariffs set state by state, with no price discovery
- Every unit paid the same, whatever the hour

Market Outcome – Competitive Bidding



Competitive bidding: From the FiT to FDRE

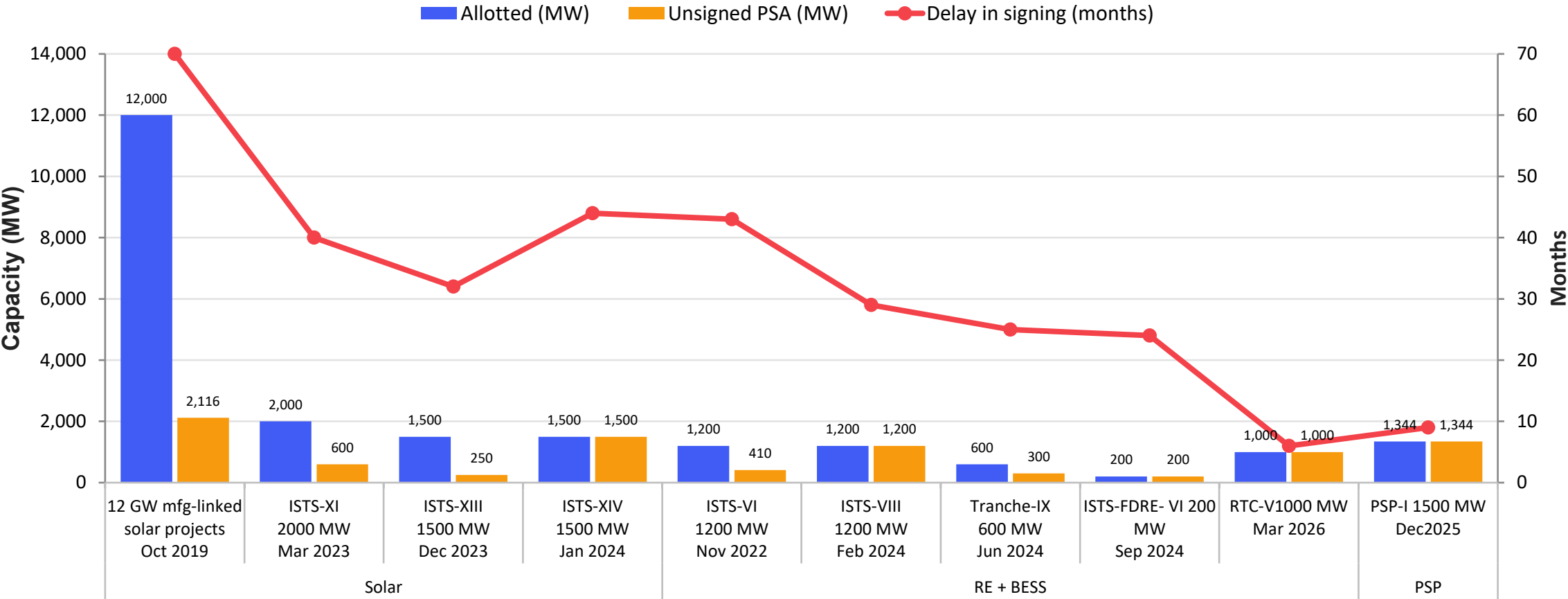


Competitive bidding: Design aspects and Associated risk

- Competitive bidding rewards the lowest ₹/kWh, for energy at any hour.

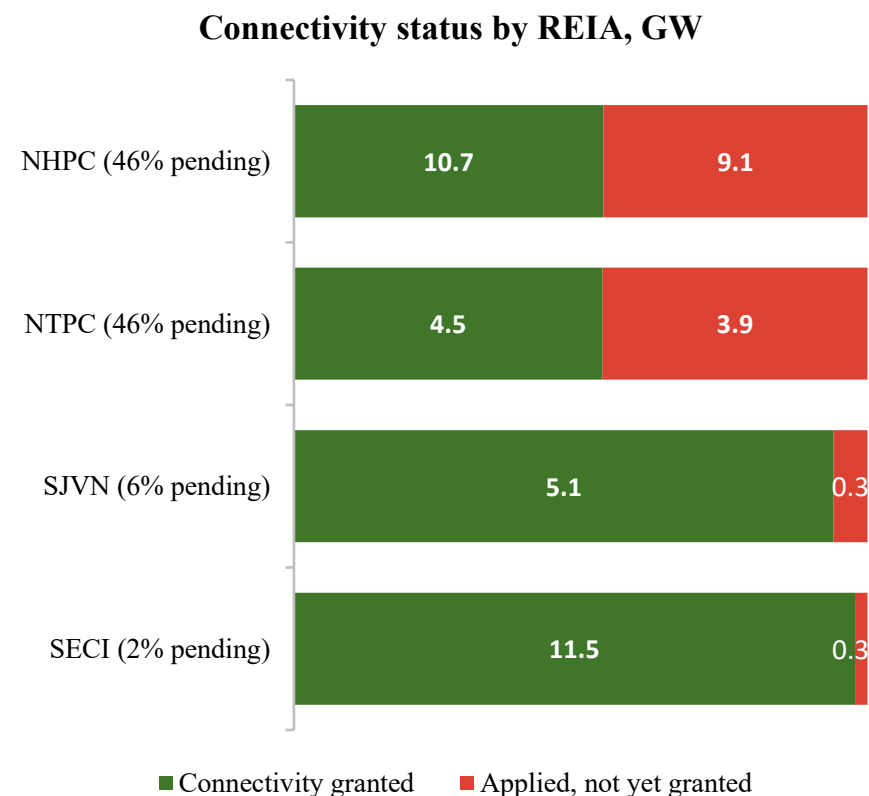
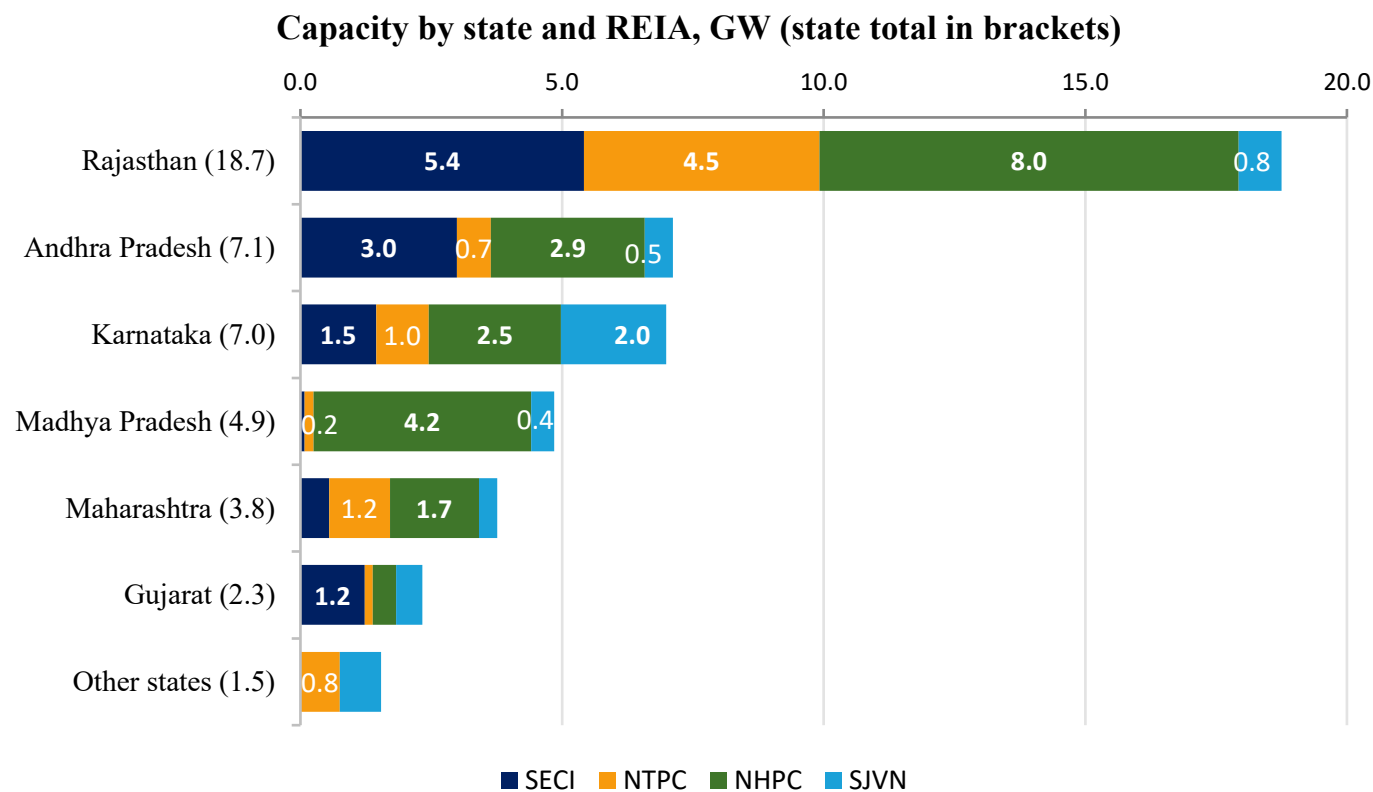
Design element	How it works in India	Associated Risks
Price discovery	E-bidding, then e-reverse auction; lowest bids win until capacity is filled	Developer: <i>Tariff and cost risk</i>
Intermediary	SECI signs a PPA with the developer and a PSA with the discom; ₹0.07/kWh trading margin	SECI and Developer: <i>until the PSA is signed</i>
Contract	25-year fixed tariff, no indexation	DISCOM: <i>price;</i> Developer: <i>cost overruns</i>
Payment security	Late Payment Surcharge Rules, 2022; letters of credit; payment security fund	Shared risk: <i>much lower since 2022</i>
Transmission	GNA connectivity; ISTS charge waiver, phasing out from July 2025	Developer: <i>if the connectivity is late (curtailment)</i>
Change in law	New duties and taxes after the bid are passed through	Discom and its consumers

SECI's concluded tenders with unsigned PPAs



Transmission Stranded Capacity by State and REIA

- Rajasthan holds 41% of the 45.3 GW; 13.5 GW (30%) still awaits connectivity.



Waiver of transmission charges for use of ISTS

- ISTS charge waivers are governed by CERC Sharing Regulations, 2020.
- Graded relief for RE projects facing transmission delays (Draft 5th Amend)
- Extended waiver periods for integrated BESS (Draft 5th Amend)

Category	Period of COD	Number of years from COD	% of drawl Schedule from identified Generating station or ESS
REGS based on wind or solar or RHGS based wind and solar source	On or before 30.6.2025	25 years	75
	1.7.2025 to 30.6.2026	25 years	75
	1.7.2026 to 30.6.2027	25 years	50
	1.7.2027 to 30.6.2028	25 years	25
	After 30.6.2028		0
Co-located BESS	On or before 30.6.2028	12 years	100
Non Co-located BESS	On or before 30.6.2025	12 years	100
	1.7.2025 to 30.6.2026	12 years	75
	1.7.2026 to 30.6.2027	12 years	50
	1.7.2027 to 30.6.2028	12 years	25
	After 30.6.2028		0

Category	Period of COD	Number of years from COD	% of drawl Schedule from identified generating station or ESS
REGS based on Offshore Wind	On or before 31.12.2032	25 years	100
	01.01.2033 to 31.12.2033	25 years	75
	01.01.2034 to 31.12.2034	25 years	50
	01.01.2035 to 31.12.2035	25 years	25
	After 31.12.2035	NA	0
Green Hydrogen or Green Ammonia Plant	Up to 31.12.2030	25 years	100
	01.01.2031 to 31.12.2031	25 years	75
	01.01.2032 to 31.12.2032	25 years	50
	01.01.2033 to 31.12.2033	25 years	25
	After 01.01.2034	NA	0
Category	New hydro projects: Date of signing of PPA and award of construction work	Number of years from COD	% of drawl Schedule from identified generating station or ESS
New hydro projects	1.7.2025 to 30.6.2026	18 years	75
	1.7.2026 to 30.6.2027		50
	1.7.2027 to 30.6.2028		25
	After 30.6.2028		0

CfD Pilot: De-risking India's Renewable Power Market

An instrument to move stranded RE capacity onto the grid

The problem

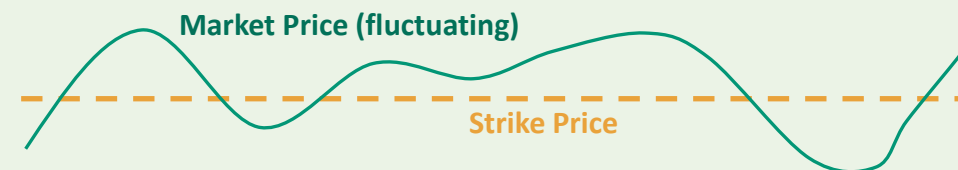
- ~ **44 GW** of build RE capacity has no buyer – tenders won, LoAs / PPAs issued, but Discoms are not signing PSA with REIAs.
- **7.6 GW** of the RE capacity is sitting unsold with SECI alone (as on Aug-2026).
- **25-year** PPA lock-in model doesn't align with how fast RE now need to integrate.

MNRE Guidelines for Contract for Difference (CfD)

Contract-for-Difference (CfD) is a financial instrument that manages revenue-risk for RE generators (merchant plants) selling power directly on power exchanges, where prices swing with real-time demand and supply.

- Guarantees a **fixed “strike price”** to the generator, while settlement still happens against the live market price.
- Provides **partial protection** when market prices are low, and shares the upside when prices run high. It doesn't fully insulate the generator either way.

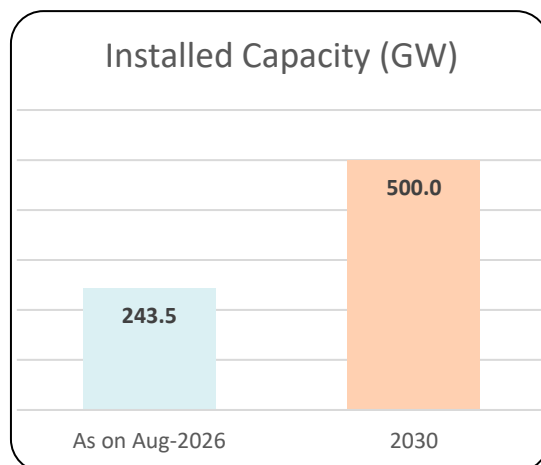
CfD pool settlement



When MCP < strike price,
The Pool tops up the generator's revenue, partially covering the shortfall so the RPD isn't fully exposed to a weak market.

When MCP > strike price,
The generator shares part of the upside back with the Pool, keeping the mechanism roughly self-funding over time.

- India has crossed 50% non-fossil installed capacity
- Now targeting 500 GW of clean energy by 2030
- And bidding out ~50 GW of new RE capacity per year.



SECI – CfD- I : 2026

SECI invites proposals for setting up of ISTS-connected RE projects under Contract for Difference (CfD) Mechanism for assured Peak Supply of 1000 MWh (500 MW x 2 Hrs.)

Key highlights of the Tender:

- Projects to be build on Build Own Operate (BOO) basis.
- 12 year contract, after which RPD is free to go merchant or sign a PPA.
- Developers with existing or under-construction RE projects that have untied (unsold) capacity can also bid under this RfS.
- Single-stage, two-envelope bidding process
- Selection via transparent reverse bidding, bucket-filling, for total 500 MW
- Contracted capacity per bidder: min 50 MW, max 150 MW
- RPD selects any 2 hours within Peak Hours (18:00–24:00), on a day-ahead basis
- RPD acts as seller on PXs, as per CERC Power Market Regulations, 2021
- SECI's role limited to CfD settlement only
- Settlement based on difference between discovered MCP and Strike Price (SP), per CfDA
- Calculated for each 15-minute time-block – 8 blocks/differences per day

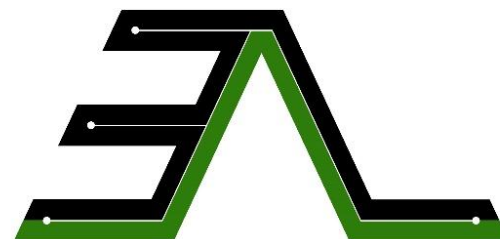


Thank You



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