Renewable Consumption Obligations

22nd Jan 2026

Introduction to RCO

Renewable Consumption Obligation (RCO) mandates that a **minimum share of electricity consumption** is met from **renewable / non-fossil energy**, with compliance measured on **actual energy use rather than procurement or capacity addition**.

Strategic Intent of RCO

1

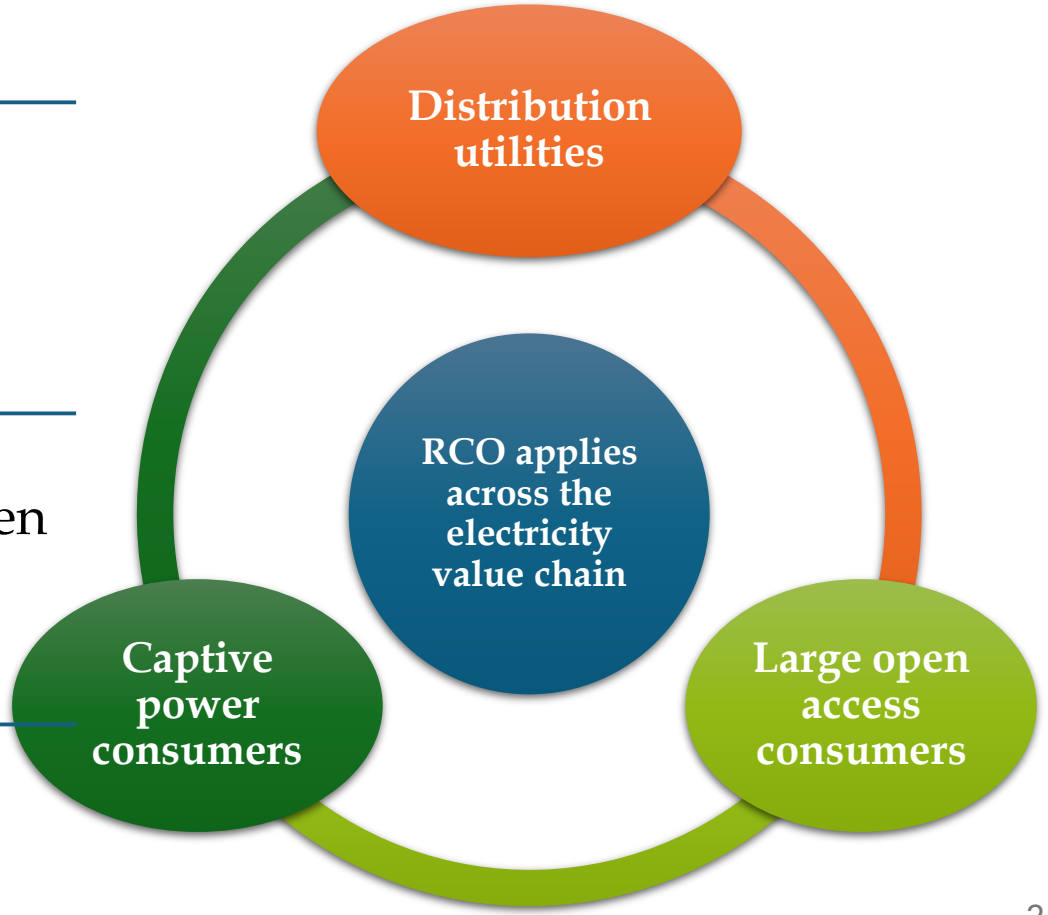
Procurement-centric approaches failed to ensure proportional renewable energy usage, leaving large segments of electricity consumption outside effective obligation.

2

RCO ensures physical absorption of renewable energy, shifting the focus from capacity creation to measurable green consumption.

3

Renewable energy is mainstreamed into regular electricity usage, replacing peripheral or paper-based compliance.



Introduction to RCO

Component-wise Obligation Design

RCO targets can be split into:

Wind Energy	Hydro Energy	Distributed Renewable Energy (≤10 MW)	Other Renewable Energy

Flexibility rule :

Wind, Hydro & Other RE → *fungible*

Distributed RE → *shortfall non-fungible; surplus adjustable*

**Fungibility : Shortfall in one renewable category can be compensated using surplus from another category.*

Coverage of Electricity Consumption

RCO is calculated on actual adjusted electricity consumption and includes:	Electricity drawn from the grid (for OA consumers)
	Electricity self-generated and consumed (for captive users)
	Electricity supplied to consumers (for DISCOMs)
Exclusions:	Electricity from **nuclear sources**
	Most **fossil-based waste heat recovery power**
	Partial exclusion for co-generation and aluminium smelters (as per rules)

Legal & Regulatory Framework of RCO in India

- **Electricity Act, 2003**
  a) Established the foundation for renewable obligations through **Renewable Purchase Obligation (RPO)**
  b) Empowered State Electricity Regulatory Commissions to mandate renewable sourcing by DISCOMs

- **Energy Conservation Act, 2001 (Amended in 2022)**
  a) Introduced the concept of **Non-Fossil Energy Consumption Obligation**
  b) Shifted renewable obligations into a **central, consumption-based legal framework**

- **Institutional Enforcement Mechanism**
  a) Bureau of Energy Efficiency designated for monitoring, reporting and compliance
  b) State agencies and regulators act as coordinating and facilitating bodies

- **National Tariff Policy, 2016**
  a) Reinforced renewable obligations as a core element of tariff and power procurement planning
  b) Emphasized progressive increase in renewable share in the electricity mix

- **RCO Notification (October 2023 and amended on 27th Sept 2025)**
  a) Issued by Ministry of Power and Prescribed **national RCO trajectory** applicable from FY 2024-25 onwards
  b) Defined technology-wise sub-obligations (Wind, Hydro, DRE, Other RE)

Evolution from RPO to RCO – A Strategic Shift

S.No.	Aspect	Renewable Purchase Obligation (RPO)	Renewable Consumption Obligation (RCO)
1	**Core Focus**	Procurement of renewable power	Consumption of renewable / non-fossil energy
2	**Scope of Obligation**	Limited to supply-side procurement	Covers end-use and self-consumption
3	**Regulatory Control**	State-level (SERC-driven)	Centrally driven, nationally uniform
4	**Compliance Outcome**	Variable and uneven across states	Outcome-oriented and measurable
5	**Treatment of Captive Power**	Limited or indirect	Explicitly covered
6	**Policy Objective**	Promote renewable capacity addition	Ensure physical absorption of renewables
7	**Alignment with Energy Transition**	Capacity-focused	Consumption-focused, system-wide

RCO Trajectory: FY 2024-25 to 2029-30

National RCO Trajectory (Applicable to UP)

1. RCO targets notified by the Central Government apply **uniformly to Uttar Pradesh**
2. Progressive increase in renewable consumption obligation:

Financial Year	RCO Target (%)
FY 2024–25	29.91%
FY 2025–26	33.01%
FY 2026–27	35.95%
FY 2027–28	38.56%
FY 2028–29	41.10%
FY 2029–30	43.33%

UPPCL-Specific Implications

1. UP transitions from ~15% RPO (FY 2023–24) to ~30% RCO in FY 2024–25, representing a step-change in obligation
2. Compliance requires simultaneous capacity addition and assured offtake
3. RCO achievement in UP is critically dependent on:
    i. Timely commissioning of contracted renewable projects
    ii. Continuous contracting in line with annual trajectory

Capacity (MW) Contracted / Planned for RCO Compliance

Category	Already Contracted			To be contracted				Total Quantum of Road Map	Contracted Against the Road Map
	FY 2023-24	FY 2024-25	FY 2025-26	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29		
Solar	3025	1488	3348	0	639	0	0	**8500**	**7861**
Wind	0	2167	732	1000	2000	1601	0	**7500**	**2899**
Hydro	0	741.54	456	3500	2500	302.46	0	**7500**	**1197.54**
DRE			1998	675	1800	1800	1803	**8076**	**1998**
Cumulative	**3025**	**4396.54**	**6534**	**5175**	**6939**	**3703.46**	**1803**	**31576**	**13955.54**

Renewable Energy Initiatives

1. **Hybrid Renewable Energy Procurement**
   a. Tenders floated to overcome limitations of standalone solar power
   b. 4010 MW Power Supply Agreements (PSAs) signed for **Firm & Dispatchable Renewable Energy (FDRE)**
   c. 300 MW **Wind-Solar Hybrid** PSAs signed with Renewable Energy Implementing Agencies (REIAs)
2. **Pumped Hydro Storage Projects (PHSP)**
   a. 2750 MW PHSP capacity already contracted
   b. 3000 MW additional PHSP tender **under process**
   c. 500 MW joint PSP tender with Madhya Pradesh – example of inter-state collaboration
3. **Battery Energy Storage Systems (BESS)**
   a. 375 MW BESS PSA signed with **SJVN**
   b. 250 MW BESS PSA signed with **NVVN**
   c. 375 MW **UPPCL BESS tender** under process
4. Solar Energy **: 2000MW** capacity already contracted.

UPPCL Roadmap & Contracting Status

- **UPPCL has prepared a detailed RCO compliance roadmap, aligned with MoP notification which includes :**
  a) Solar, wind and hydro
  b) Annual contracting targets mapped to RCO percentages
  c) 100% fungibility allowed among **Wind, Hydro and Other RE (including Solar)** provides flexibility in UP's resource-constrained context
  d) Revised roadmap accounts for:
  e) SCOD delays
  f) Ongoing tenders and consented capacities
  g) Legacy RPO backlogs as per UPERC directions

RCO trajectory necessitates:

a) Front-loaded procurement decisions
b) Advance visibility of capacity additions
c) Continuous monitoring to avoid year-end shortfalls

UPPCL Roadmap & Contracting Status

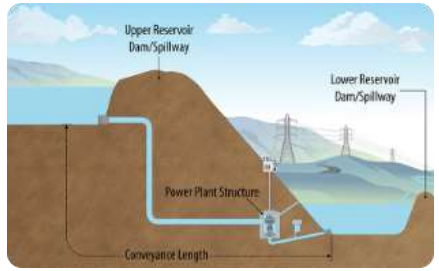
UPPCL Capacity Translation

- **RE capacity planned for RCO compliance (by FY 2031–32): ~23,500 MW** (excl DRE)
  - Solar: **~8,500 MW**
  - Wind: **~7,500 MW**
  - Hydro / Other: **~7,500 MW**

Flexibility Available to UP

- **100% fungibility permitted** among – Wind, Hydro, Other RE (includes Solar)
- Critical for UP due to:
  - Limited wind availability
  - Dependence on inter-state solar & hydro

Power Procurement under Tender Process



Source	Hydro	PSP	Battery Storage
Bid Type	BOOM *(Build, Own, Operate and Maintain)*	BOO *(Build, Own, Operate)*	BOO *(Build, Own, Operate)*
Requisite Capacity (MW)	4000	3000	375 MW (composite model)under consideration
Selection Process	Bucket Filling	Bucket Filling	Bucket Filling

Benefits of RCO for DISCOMs & Power System

Renewable Consumption Obligation (RCO) is the regulatory mechanism through which the Pradhan Mantri Panchamrit commitments are operationalized/facilitated in the electricity procurement framework.

S.No.	Panchamrit Commitment (COP-26)	How RCO delivers it (Procurement logic)
1	**500 GW non-fossil capacity by 2030**	RCO creates assured consumption obligation → bankable demand → enables low-tariff long-term RE PPAs
2	**50% electricity from non-fossil by 2030**	RCO mandates **minimum renewable share in actual consumption** (not just contracts)
3	**Reduce 1 billion tonne emissions**	RCO forces substitution of fossil-based marginal power with renewable offtake
4	**45% reduction in emissions intensity**	Lower weighted average grid emission factor via compulsory RE consumption
5	**Net-Zero by 2070**	Establishes a **long-term structural transition path** for DISCOM procurement portfolios

Benefits of RCO for DISCOMs & Power System

RCO – Benefits Vis-a-Vis RPO

A. Shift from **procurement-based RPO** to **consumption-based obligation** → ensures real renewable offtake
B. Prevents **paper compliance** (excess contracting without dispatch)
C. Allows **least-cost compliance routes**:
    A. Direct RE consumption
    B. RE + storage
    C. RECs / Virtual PPAs
    D. Buy-out (CERC price)
D. Technology-wise targets + fungibility (Wind/Hydro/Other RE) → cost-optimal resource substitution
E. State RPO subsumed → avoids double compliance cost & REC exposure

RCO – Benefits for Power Procurement Cost

A. Lower marginal purchase cost vs exchange-based power procurement

B. Enables **long-term tariff locking** through RE PPAs → price stability

C. Reduces **REC & penalty risk** via predictable annual targets

D. Supports **portfolio optimisation** (Solar + Wind + Hydro + Storage) → lower weighted tariff

E. Buy-out funds recycled into **RE & storage assets** → future system cost reduction

F. Improves **ARR forecasting & procurement planning**

Challenges in RCO

❑ National context

a) **Steep trajectory:** ~30% to **43.33%** renewable consumption in six years

b) **Consumption-based compliance:** Requires assured offtake and grid absorption

c) **Uniform targets:** Applied despite uneven state-wise resource availability

d) **Grid impact:** Higher RE penetration increases intermittency and peak management needs

e) **Penalty exposure:** Financial risk even for marginal shortfalls

❑ Uttar Pradesh context

a) **One-year jump:** ~15% RPO to **29.91% RCO** in FY 2024–25

b) **Resource constraints:** Negligible wind, moderate solar, land limitations

c) **Large demand base:** Highest consumption increases absolute RE requirement

d) **Legacy PPAs:** Fixed thermal costs continue alongside RE procurement

e) **Transmission reliance:** Dependence on inter-state RE and timely augmentation

Renewable Power Sources in context to UP State

Source of Renewable Power	Uttar Pradesh context
Solar Power	Though it's a low cost power, but only vanilla solar not matches UP Demand Profile.
Wind Power	Low cost power, perfectly matches the UP Demand Profile. However, no potential of wind power within UP State.
Hydro Power	Generation profile perfectly matches the UP Demand Profile. However, less potential of Hydro power within UP State.
Co-Gen	Moderate cost power, however the generation is mostly during winter months, which are the off-peak power demand months for UP State.
FDRE /BESS	Storage is customized for managing the peak demand. Excess solar during day hours to be stored to meet evening peak demand.

Impact on Discoms

S.No.	Aspect	National Perspective	Uttar Pradesh (UPPCL)
1	**Scale of Obligation**	Progressive increase from ~30% to **43.33% by FY 2029–30**	Sharp jump from **~15% (FY 2023–24)** to **29.91% (FY 2024–25)**
2	**Incremental Procurement Cost**	Large-scale addition of renewable PPAs and market purchases	Immediate and significant incremental procurement required due to scale
3	**Thermal Asset Impact**	Backing down of coal plants leading to lower PLFs and fixed cost pressure	High fixed-cost burden due to long-term coal PPAs and reduced scheduling
4	**Penalty Exposure**	High financial penalties for shortfall; non-compliance costlier than compliance	Even marginal shortfall can lead to **multi-hundred crore liability**
5	**Cash Flow Stress**	Upfront contracting and payment obligations strain weak DISCOM finances	Large absolute consumption magnifies cash flow and working capital pressure

Impact on Discoms

S.No.	Aspect	National Perspective	Uttar Pradesh (UPPCL)
6	**Tariff & Subsidy Impact**	Potential tariff pass-through subject to regulatory approval	Limited tariff headroom due to rural load, subsidy dependence, and affordability concerns
7	**Transmission & Integration Cost**	Additional costs for balancing, storage, and transmission augmentation	Heavy reliance on inter-state RE exposes UP to transmission charges and waiver phase-out risk
8	**Overall Financial Risk**	Manageable with early planning and diversified procurement	Elevated due to size, rapid escalation, and structural constraints

Penalty Provisions under Renewable Consumption Obligation

Non-Compliance Events

a) Shortfall in meeting prescribed RCO targets

b) Non-submission of annual energy accounts

c) Submission of incorrect / misleading information

Legal Basis

1 **Energy Conservation Act, 2001** – Provides the statutory framework for imposing Renewable Consumption Obligation on designated consumers.

2 **Section 26(3) of the Act** – Empowers the authorities to levy monetary penalties in case of failure to comply with RCO targets or reporting requirements.

3 **Ministry of Power RCO Notification (27 September 2025)** – Formally notifies RCO targets, compliance mechanisms, monitoring process, and penalty provisions at the national level.

Provisions

Monetary penalty imposed by:

- Bureau of Energy Efficiency (BEE)
- State Designated Agencies

Based on magnitude of shortfall and duration of non-compliance

Buy-Out Option (Alternative Compliance)

A. Shortfall can be met by paying **Buy-out price notified by CERC**

B. Funds credited to:
   1) Central Energy Conservation Fund
   2) 75% transferred to State Energy Conservation Fund

C. Used for renewable energy & storage development

Continued....

Practical quantification of RCO penalties beyond statutory provisions

A. Penalty quantified on energy basis (₹/kWh):

Max penalty = *2 × price of 1 MTOE of shortfall*

⇒ **₹ 3.72 / kWh (approx.)** as per annexure calculation.

B. Penalty rate is variable:

MTOE price may increase by **20–30% in subsequent years**, implying higher future penalty exposure.

C. Policy preference clearly stated:

DISCOMs advised to **tie-up & procure renewable energy instead of paying penalties**.

D. Advance compliance expectation:

Renewable consumption norms applicable from **1 April 2024** to avoid penalties.

E. Central facilitation:

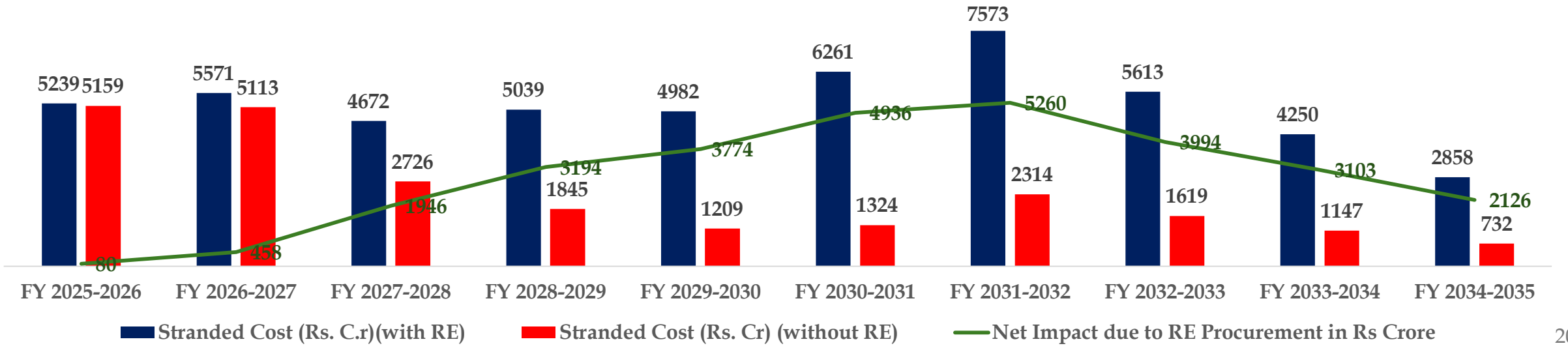
MNRE indicated **support for renewable procurement** to enable compliance.

Cost Implications & Stranded Asset Impact of RCO

Considering Restricted Demand Met till 2026-27 then Unrestricted Demand Met

Stranded Cost: With vs Without RE Roadmap

Particulars	Stranded Cost (Rs. C.r) (with RE)	Stranded Cost (Rs. Cr) (without RE)	Net Impact due to RE Procurement in Rs Crore
FY 2025-2026	5239	5159	80
FY 2026-2027	5571	5113	458
FY 2027-2028	4672	2726	1946
FY 2028-2029	5039	1845	3194
FY 2029-2030	4982	1209	3774
FY 2030-2031	6261	1324	4936
FY 2031-2032	7573	2314	5260
FY 2032-2033	5613	1619	3994
FY 2033-2034	4250	1147	3103
FY 2034-2035	2858	732	2126
Total	**52059**	**23189**	**28870**



Cost Analysis: RE Power vs Market Purchase for Deficit Fulfilment

FY	Market Based Deficit Management			Deficit Management by Sourcing RE Power	Net Saving Through RE sourcing in (Rs Cr.)
	Power to be Procured(MUs)	Anticipated Tariff(Rs./kWh)	Power procurement Cost(Rs.cr.)	Power procurement Cost(Rs.cr.)	
2025-2026	282	6.5	184	149	35
2026-2027	1303	6.5	847	632	215
2027-2028	6906	6.5	4489	3214	1274
2028-2029	16502	6.5	10726	8337	2389
2029-2030	27469	6.5	17855	14318	3537
2030-2031	31808	6.5	20675	17321	3354
2031-2032	26231	6.5	17050	13862	3188
2032-2033	38141	6.5	24791	19382	5409
2033-2034	45823	6.5	29785	23452	6333
2034-2035	53692	6.5	34900	27674	7226
Total	**248157**		**161302**	**128342**	**32961**

Assumptions Considered for Analysis:

1. **Market Tariff**: ₹6.50 / kWh
2. **RE Tariff**
   - Solar: ₹2.75 / kWh
   - Wind: ₹4.00 / kWh
   - Hydro: ₹7.00 / kWh

Renewable tariff considered as per the market trend

Total Market Procurement Cost (@ ₹6.5/kWh): ₹1,61,302 Cr

Total RE Procurement Cost : ₹1,28,342 Cr

Net Saving through RE Procurement: ₹32,961Cr

❑*Technology-wise share derived using respective CUFs to ensure realistic 10-year energy projections.*

❑*Cost estimation based on block-wise projected availability of solar, wind and hydro.*

Financial Impact: RE vs Thermal Backdown

FY	Un-Requisition Thermal Power due to inclusion of RE (Mus)	Total cost of Un-Requisition Thermal Power due to inclusion of RE (Rs. Cr.)	Total Cost of RE replacing thermal power(in Rs.Cr.) *	Net Financial Impact due to RE inclusion(Rs. Cr.)
2025-2026	494	163	207	-44
2026-2027	2864	953	1172	-219
2027-2028	11603	4365	4519	-154
2028-2029	18634	7347	8188	-841
2029-2030	21840	9055	10055	-1000
2030-2031	29482	12257	14479	-2222
2031-2032	32066	13636	16391	-2754
2032-2033	23925	10856	12551	-1695
2033-2034	18371	8837	9662	-825
2034-2035	12265	6271	6435	-164
Total	**171543**	**73741**	**83659**	**-9918**

Assumptions Considered for Analysis:

RE Tariff	Solar: ₹2.75 / kWh
	Wind: ₹4.00 / kWh
	Hydro: ₹7.00 / kWh

Variable Cost (VC) of thermal power considered with a **year-on-year escalation of 4.03%**.

Expected Financial impact on UPPCL due to RE procurement

FY	Cost saved by sourcing Power procurement from Renewable sources instead of Power exchanges (Rs. Cr.)	Additional financial burden on UPPCL by replacing thermal power by RE (Rs. Cr.)	Tentative Gain/Loss of UPPCL by RE Procurement(Rs. Cr.)
2025-2026	35	-44	-9
2026-2027	215	-219	-4
2027-2028	1274	-154	1120
2028-2029	2389	-841	1548
2029-2030	3537	-1000	2537
2030-2031	3354	-2222	1132
2031-2032	3188	-2754	434
2032-2033	5409	-1695	3714
2033-2034	6333	-825	5508
2034-2035	7226	-164	7063
Total	**32961**	**-9918**	**23043**

This projection shows that UPPCL may tentatively save ₹23043 Cr over 10 years by procuring RE instead of sourcing power from the exchange.

Operational & Grid Integration Challenges

Challenge	Operational Impact	System Need / Response
RE Variability & Intermittency	Frequent ramping and balancing stress	Improved forecasting, storage, and flexible generation
Transmission & Evacuation Constraints	Curtailment and stranded RE capacity	Time-bound ISTS & intra-state grid augmentation
Forecasting & Scheduling Gaps	Higher DSM penalties and uncertainty	Advanced weather-linked forecasting systems
Limited System Flexibility	Inability to absorb RE surges or deficits	Hydro, gas, BESS, and demand response
Grid Stability & Low Inertia	Voltage/frequency deviations	Grid-forming inverters and ancillary services
DISCOM Operational Gaps	Weak real-time control and visibility	SCADA, AMI, and capacity building

Resource Adequacy & RCO Alignment

Planning & Structural Alignment

I. **Energy–Capacity Integration**: Align RCO energy obligations with resource adequacy capacity planning to ensure firm supply availability.

II. **Harmonised Planning Horizons**: Synchronise multi-year RCO trajectories with forward-looking resource adequacy assessments.

III. **Integrated Procurement Approach**: Embed RCO compliance within holistic capacity and energy procurement portfolios.

Operational & Reliability Alignment

I. **Peak Demand Responsiveness**: Shape RCO-compliant procurement to support evening and seasonal peak demand requirements.

II. **Firmness-Oriented RE Procurement**: Promote RE procurement bundled with storage, hydro, or RTC structures to enhance reliability.

III. **Reliability-Constrained Compliance**: Align RCO fulfilment with system reliability and security considerations.

Needs of differentiated RCO path for States

Demand Profile Diversity

States vary in demand growth, peak timing, and seasonality, affecting renewable absorption.

Grid & Evacuation Readiness

Transmission capacity and evacuation infrastructure are uneven across States.

Existing Legacy & Pipeline Capacity

Installed RE capacity, tied-up PPAs, and project pipelines vary by State.

Resource Endowment Variance

Solar, wind, hydro, biomass, and storage potential differs by geography.

Financial & Operational Conditions

AT&C losses, power purchase mix, and liquidity impact compliance ability.

Resource Adequacy Considerations

State-specific peak demand and reliability requirements affect RCO alignment.

Way Forward

1

RCO as a Transition Instrument

Renewable Consumption Obligation has evolved into a central mechanism for driving renewable energy uptake across consumption segments.

2

System Integration as the Defining Constraint

Operational flexibility, grid readiness, and forecasting capability increasingly shape the effectiveness of RCO compliance.

3

Resource Adequacy as the Reliability Anchor

Resource adequacy frameworks provide the capacity and reliability lens through which energy-based RCO outcomes are evaluated.

4

Complementary Frameworks in Practice

RCO and resource adequacy operate on different metrics but together determine the sustainability of renewable integration.

5

Need for State-Specific Trajectories

Variations in demand profiles, resource availability, grid strength, and DISCOM conditions necessitate differentiated RCO pathways.

Thank You