General Observations on the Proposed Capacity Market Framework

The Discussion Paper provides a timely discussion on emerging resource adequacy and reliability challenges in an electricity system undergoing rapid transformation. However, considering the distinctive characteristics of the Indian power sector—particularly the prevalence of long-term contracting, availability-based capacity remuneration mechanisms, and the recently established Resource Adequacy framework—the necessity, scope, and design of a comprehensive capacity market warrant further examination.

A detailed assessment is required regarding the nature of the underlying adequacy challenge, the interaction of the proposed mechanism with existing regulatory and contractual arrangements, implications for consumer tariffs, safeguards against possibility of double remuneration of capacity, and consistency with least-cost planning exercises undertaken by the Central Electricity Authority (CEA).

In the Indian context, a phased approach focusing initially on reserve procurement mechanisms, flexibility products, and secondary capacity trading arrangements may merit consideration before transitioning to a full-fledged capacity market framework.

The proposed framework may be evaluated in light of the following sectoral characteristics:

- Predominance of long-term power procurement through Power Purchase Agreements (PPAs);
- Existing availability-based tariff mechanisms that already provide capacity remuneration;
- The recently notified institutional framework for Resource Adequacy planning.

Key Areas Requiring Further Regulatory Assessment

In order to safeguard consumer interests and ensure efficient market outcomes, the following aspects require detailed examination:

- Impact on consumer tariffs and overall system costs;
- Mechanisms to prevent double recovery of capacity-related costs by generators;
- Alignment with national least-cost planning and resource adequacy objectives.

Further, any market-based capacity mechanism should complement, and not substitute, the existing institutional planning framework for generation and transmission expansion. The proposed framework should remain consistent with statutory planning processes, including:

- Long-term demand projections and planning studies undertaken by the Central Electricity Authority (CEA);
- Resource Adequacy assessments carried out at the national and state levels;
- Integrated generation and transmission expansion planning exercises.

Accordingly, capacity market outcomes should be designed to reinforce, rather than bypass, established planning and procurement processes.

1. Need for a Capacity Market in the Indian Context

The Discussion Paper draws extensively from international experiences where capacity markets were introduced to address the inability of energy-only markets to provide adequate investment signals for ensuring long-term resource adequacy. However, the Indian electricity sector operates under a fundamentally different institutional and market structure.

Capacity addition in India continues to be predominantly driven through long-term contracting arrangements, under which generators recover fixed costs through regulated or contracted capacity payments. In addition, the recently notified Resource Adequacy framework has established a structured planning mechanism for assessing future capacity requirements and ensuring timely procurement of the capacities.

In this context, the Paper may provide a more detailed assessment of whether India presently faces a structural resource adequacy challenge arising from inadequate investment incentives or whether the identified concerns primarily relate to planning, procurement, or operational inefficiencies. The extent to which future adequacy gaps can be attributed to deficiencies in market signals, as opposed to implementation of existing planning mechanisms, may be clearly established.

Further, clarity is required regarding the scope of applicability of the proposed capacity market. Specifically, it may be clarified whether participation would be limited to new capacity additions intended to meet future demand growth or whether existing generating stations, including those operating under long-term PPAs, would also be eligible.

Given that a substantial portion of the existing generation fleet already receives capacity-based remuneration through regulated tariffs or contractual arrangements, permitting such resources to participate in capacity auctions may create a risk of duplicate recovery of capacity-related costs. This issue assumes particular significance in the Indian context where a large share of thermal capacity remains under long-term contractual commitments.

Accordingly, the proposed framework may explicitly address:

- Eligibility criteria for existing contracted resources;
- Treatment of generating stations operating under long-term PPAs;
- Mechanisms to prevent double recovery of capacity-related costs; and
- Transitional arrangements between existing contractual frameworks and any future market-based capacity mechanism.

1. Interaction with the Existing Resource Adequacy Framework

The Resource Adequacy framework has been introduced only recently and its implementation is still evolving across States. Given that the primary objective of both Resource Adequacy planning and capacity markets is to ensure long-term reliability of supply, the relationship between the two frameworks requires greater clarity.

The Discussion Paper may clearly explain the interaction among:

- Resource Adequacy obligations;
- Long-term power procurement planning; and
- Capacity market obligations.

In particular, it may be clarified whether procurement through the proposed capacity market is intended to supplement or substitute existing Resource Adequacy obligations.

Further clarity is required regarding:

- Treatment of States and distribution licensees that have already secured adequate long-term capacity through existing contractual arrangements;
- Integration of capacity market outcomes with approved power procurement plans;
- Roles and responsibilities of various stakeholders in determining capacity obligations; and
- Coordination mechanisms between capacity market procurement and Resource Adequacy assessments undertaken under the existing regulatory framework.

A clearly defined institutional interface between these mechanisms would be essential to avoid duplication of procurement obligations, conflicting investment signals, and unnecessary cost burdens on consumers.

3. Capacity Market Design Must Address Dispatch Certainty and Contractual Rights

A fundamental consideration in the Indian context is the assurance of reliable access to the contracted capacity by distribution licensees. Under the existing framework, long-term PPAs provide buyers with clearly defined scheduling and dispatch rights over contracted generating capacity. Certain capacity market models may weaken this direct linkage between capacity procurement and operational control over generation resources.

If capacity obligations are met through centralized market arrangements, utilities may face uncertainty regarding the availability and dispatchability of resources. Such uncertainty could reduce the willingness of distribution licensees to substitute long-term contractual arrangements with market-based capacity procurement.

The proposed framework should therefore clearly define:

- The nature of dispatch rights associated with procured capacity and compliance mechanisms;
- Performance obligations during scarcity events;
- Allocation of non-performance risks; and
- Mechanisms to ensure that capacity payments translate into reliable system availability.

Unless these issues are adequately addressed, capacity markets may not provide a viable substitute for existing contractual arrangements from the perspective of load-serving entities.

4. Price Formation, Market Power and Investment Signals Require Further Examination

The Discussion Paper does not provide sufficient detail regarding the methodology for determination of the Cost of New Entry (CONE) and Net-CONE, which constitute key inputs for capacity demand curves and market-clearing outcomes.

Given the diversity of technologies, regional cost variations, financing conditions, and fuel price uncertainties, development of a robust and transparent methodology for estimating Net-CONE

is critical. Distribution licensees and other obligated entities would require clarity regarding the basis on which capacity obligations and bidding strategies are to be determined.

Further, the proposed framework does not sufficiently address:

- Measures to mitigate market concentration;
- Potential exercise of market power by dominant suppliers;
- Mechanisms to ensure adequate participation from the supply side;
- Safeguards against excessive capacity prices; and
- Procedures for monitoring and mitigating market manipulation.

In the absence of adequate competition and transparent price discovery mechanisms, capacity markets may result in inefficient procurement outcomes and increased consumer costs without commensurate reliability benefits.

5. Revenue Certainty Under Long-Term PPAs May Continue to Provide Superior Investment Signals

One of the principal strengths of the existing procurement framework is the revenue certainty provided through long-term PPAs. Stable and predictable cash flows facilitate project financing, reduce investment risk, and lower the overall cost of capital.

Under several capacity market designs, generators recover only a portion of their revenues through capacity payments, with the remaining revenues dependent upon future energy market outcomes. Such arrangements may expose investors to significant uncertainty arising from fluctuations in energy prices, fuel costs, renewable generation patterns, and market conditions.

Higher revenue uncertainty generally translates into:

- Increased financing costs;
- Higher risk premiums demanded by investors;
- More conservative bidding behaviour; and
- Ultimately, higher costs for consumers.

These challenges may become more pronounced as renewable penetration increases and wholesale market prices exhibit greater intra-day and seasonal volatility. Accordingly, the Discussion Paper may evaluate whether the proposed capacity market framework would deliver investment signals that are superior, or at least comparable, to those currently provided through long-term contracting mechanisms.

6. Capacity Procurement Should Remain Consistent with Least-Cost Planning Principles

India's generation expansion strategy has historically been guided by integrated planning processes aimed at minimising total system cost while maintaining reliability standards. These planning exercises evaluate investment options on the basis of lifecycle costs, including both fixed and variable components.

In contrast, capacity market procurement is primarily driven by capacity-based bids and may not fully reflect the total economic cost of competing resources over their operating life.

Consequently, there is a possibility that resources selected through a capacity market may not necessarily represent the least-cost solution from a system-wide perspective.

Further, if capacity procurement obligations are not closely linked to independently validated adequacy assessments, there is a risk of over-procurement, resulting in fixed-cost burdens on consumers.

Accordingly, the framework should ensure explicit consistency between:

- National Electricity Plan projections;
- Resource Adequacy assessments;
- Generation expansion planning studies; and
- Capacity procurement volumes.

Capacity procurement targets should be derived from independently validated adequacy requirements and integrated with existing planning processes rather than determined solely through market mechanisms.

7. Secondary Capacity Trading May Offer Significant Near-Term Benefits

Before introducing a comprehensive capacity market, greater emphasis may be placed on facilitating secondary trading of existing contracted capacity.

India already possesses substantial installed and contracted generation capacity, a portion of which remains underutilized due to demand variations, changing load patterns, and contractual rigidities. Enabling secondary capacity transactions could improve utilisation of existing assets and provide flexibility to both buyers and sellers without requiring additional investment in generation capacity.

A well-designed secondary market could:

- Facilitate transfer of surplus contracted capacity;
- Improve utilisation of existing resources;
- Reduce stranded capacity risks;
- Lower procurement costs for utilities; and
- Defer unnecessary capacity additions.

The Discussion Paper may therefore assess whether a robust secondary capacity trading framework could address a substantial portion of emerging adequacy concerns before considering introduction of a full-scale capacity market.

8. Market Design Should Prioritise Flexibility and Operational Reliability

The principal challenge facing the Indian power system over the coming decades may not be the adequacy of installed capacity per se, but the availability of flexible and dispatchable resources capable of supporting large-scale renewable integration.

Increasing penetration of solar and wind generation is expected to create:

- Steep ramping requirements;

- Intra-day balancing challenges;
- Reserve shortages;
- Seasonal variability concerns; and
- Increased requirements for fast-response resources.

A conventional capacity market that values different capacities similarly may not adequately recognise these operational attributes.

Accordingly, the Commission may examine whether flexibility-oriented market products would provide greater system benefits than a generic capacity procurement framework. Such products could include:

- Ramping capability products;
- Reserve capacity products;
- Fast-response ancillary services;
- Storage-based flexibility services; and
- Other reliability services necessary to support high renewable penetration.

Market design should be aligned with the emerging operational needs of the power system rather than focusing solely on installed capacity adequacy.

9. Capacity Accreditation Framework Requires Detailed Development

Efficient capacity market outcomes depend upon accurate assessment of the reliability contribution of different technologies. Installed capacity alone is not an appropriate measure of reliability contribution, particularly in a power system with growing shares of variable renewable generation and storage resources.

The Discussion Paper does not provide sufficient detail regarding the methodology for capacity accreditation across different technologies.

A transparent and scientifically robust accreditation framework should address:

- Effective Load Carrying Capability (ELCC)-based assessment;
- Seasonal and regional accreditation factors;
- Treatment of correlated renewable generation output;
- Reliability contribution and duration requirements of storage resources; and
- Accreditation of hybrid and emerging technologies.

Such a framework is essential to ensure technology-neutral competition and efficient capacity procurement outcomes.

10. A Phased Approach Focused on Reserve and Flexibility Procurement May Be More Appropriate

Given the current stage of evolution of the Indian power sector, reserve adequacy and operational flexibility may represent more immediate challenges than long-term capacity sufficiency.

Recent system operations have highlighted increasing requirements for reserves, balancing resources, and flexibility services to manage renewable variability and maintain grid reliability.

Consequently, reserve and flexibility procurement mechanisms may provide greater near-term value than a comprehensive capacity market.

A phased implementation strategy may therefore be considered:

Phase I

- Reserve capacity procurement mechanisms;
- Expansion of ancillary services markets;
- Market-based flexibility products and balancing services.

Phase II

- Secondary capacity trading arrangements;
- Development of capacity accreditation methodologies;
- Strengthening of resource adequacy assessment processes.

Phase III

- Introduction of a full-scale capacity market, subject to demonstrated need and completion of impact assessments.

Such a phased approach would allow market institutions, participants, and regulators to gain operational experience while minimising implementation risks and protecting consumer interests.

11. Detailed Assessment of Consumer Tariff Impact is Essential

Capacity markets are ultimately justified only if they ensure higher reliability benefits with minimal costs imposed on consumers. Therefore, a comprehensive assessment of tariff implications should constitute a central component of the evaluation process of capacity markets.

The Discussion Paper currently focuses primarily on market design alternatives. A detailed cost-benefit assessment may also be undertaken covering:

- Projected annual capacity procurement costs;
- Impact on retail tariffs under alternative market scenarios;
- Avoided outage and reliability benefits;
- Comparison with existing procurement arrangements;
- Comparison with reserve and flexibility procurement alternatives; and
- Potential long-term impacts on investment costs and market efficiency.

Particular attention may be given to assessing the impact of mandatory participation requirements on market-clearing prices and its impact on overall power procurement costs borne by consumers.

Any proposed capacity market framework should demonstrate clear net consumer benefit relative to existing mechanisms before being considered for implementation.