STAKEHOLDER CONSULTATION WORKSHOP

On

Designing a BCS-Style Framework for India

Session 2: Market Integration, Price Signals and Settlement Architecture

Structure & Flow of the Presentation

1. Contextual Background
2. Market Integration
3. Price Signals
4. Settlement Architecture

CONTEXTUAL BACKGROUND

Strategic Context

OBJECTIVE

- Leverage collective domain expertise to rigorously assess and stress-test the proposed concepts
- Ientify key issues, boundary conditions and priority focus areas
- Examine causal linkages and systemic implications across market signals, operational dynamics and settlement structures

OUTCOME

- Generate insights to inform the analytical scope, methodological approach and sequencing of activities
- To be undertaken in Task 2

CONTEXT FOR DISCUSSION

- Presentation material is preliminary and indicative
- Intended to support informed brainstorming and deliberation

Contextual Setting - Framing for Discussion

Transition to Market-Based Mechanisms

- India's need to shift from 'Out-of-Market' to 'In-Market' mechanisms to enhance transparency, efficiency and provide forward looking price signals

Challenges with Renewable Integration

- Increasing RE penetration causes price volatility & revenue uncertainty
- Impacting investment & system reliability

Need for Financial Stability

- Current market structures offer limited long-term revenue certainty
- Necessitating exploration of CfD-type BCS mechanisms

MARKET INTEGRATION

Power Market Design Challenges for RE Integration

In-Market vs Out-of-Market Regimes in India

Dimension	In-Market Problem	Out-of-Market Problem
Core Cause	High price volatility, uncertainty, incomplete markets	Over-reliance on PPAs, subsidies, fixed payments
Revenue Nature	Fully market-linked (e.g., MCP on Indian Energy Exchange)	Fixed/assured irrespective of market prices
Price Signal Strength	Strong but volatile	Weak / Distorted
Key Economic Issue	Revenue uncertainty	Price distortion and Inefficiency
Dispatch Behaviour	Efficient	Inefficient (must-run / non-economic dispatch)
Investment Signal	Weak for long-term investments	Misaligned (over- or under-investment)
Market Liquidity	High but Participation low	Reduced liquidity (locked-in contracts)
Price Formation	Reflects real-time supply-demand	Artificially suppressed or distorted
Risk Allocation	Entirely on Generator / Market participant	Shifted to DISCOMs /Government
Transparency	High	Low (hidden subsidies, cross-subsidies)

India Requires an Efficient Power Market Operation

Needs a Market-Based Economic Despatch (MBED)

For an effective MBED	Imperative to Power Exchange Integration
Rising VRE penetration	Increasing variability & uncertainity challenges System operations
Balancing requirements	Higher ask for reserves & ramping support, raising system costs
Forecasting challenges	Prediction errors lead to imbalances & deviations
Intermittency management	Requires faster, more flexible market operations
Transmission constraints	Curtailment risks restrict renewable dispatch
Market design evolution	Can allow Power exchange linked operations

Role, Need & Relevance of PXs

Fo a BCS-style like mechanism

Platform for transparent reference price formation settlement	- Provide robust, anonymised & competitive price discovery through DAM, GDAM & GTAM - Prices to serve as credible & manipulation-resistant reference indices
Anchor for financial settlement without physical disruption	- Enable contracts to remain financially settled instruments reference againts it product index - Allow dev. btw strike price & market price are netted, without altering physical schedules
Improving bankability and investor confidence	- Use of transparent, exchange-discovered prices as settlement benchmarks reduces counterparty & information asymmetry risks - Enhancing the creditworthiness & financing viability of next-gen RE assets
Operationalising risk management & hedging	- Provide the ecosystem (clearing, settlement, margining frameworks) reqd to operationalise BCS style mechanism as hedging instruments - While allowing participants to manage price volatility while retaining exposure to efficient dispatch signals
Reinforcing efficient system dispatch	- Linking BCS style mechanism settlements to DAM/GDAM/GTAM outcomes, ensures physical dispatch driven by least-cost principles - Allowing financial contracts operate in parallel, preserving grid efficiency & economic merit order
Enabling standardisation & regulatory oversight	- Exchanges, under the supervision of CERC, provide for for std contract design, data transparency and settlement discipline - Critical for scaling a BCS style mechanism
Enhancing liquidity and market depth	- Will incentivise higher participation from generators, DISCOMs and C&I consumers by a BCS style mechansim - Increasing traded volumes on exchanges and improving liquidity, which in turn strengthens future price signals

Quick overview of Power Exchange Market for FY 25

Particular	DAM	GDAM	GTAM
Growth Y-o-Y	3–5%	~100%	~150-200%
Buyer and Seller Composition	Buyers: Majority DISCOMs Sellers: Central/State + Pvt Gen	Buyers: DISCOMs + C&I Sellers: RE IPPs	Buyers: DISCOMs + Corporates Sellers: RE IPPs
High Market Participation	> 1,000 buyers/Sellers daily	NA	NA
Role in Price Signaling & Renewable Support	- Influences Bilateral contracts - Support balancing RE supply fluctuation	- Lower prices due to RE costs - Improves market transparency over bilateral contracts	- Portfolio Planning - Hedging price volatility
% of all short term market	70%	10%	

Product	Suitability as Reference Price
DAM	High (but manipulability risk)
GDAM	Medium (low liquidity risk)
GTAM	Low (not market-discovered MCP)

Challenges for Next Gen RE Developers

Power Exchanges	Are structurally short-term
Projects have High capital intensity	Long asset lives
Energy Only Markets	Under-compensate for rendering system adequacy & flexibility
Externalities are unpriced	Carbon, Energy security, Health benefits, etc
First-mover disadvantage	Early nex gen adopters do not have de-risked supply chains & learning curves
Project Financing	Debt markets require revenue certainty
Patient Intitutional Capital	Avoid unhedged commodity price risk

Requirements of Developers & DISCOMs

For DISCOMs

1. Cost of renewable generation (LCOE)
2. Capacity Credit for RE
3. Storage and balancing costs
4. Remove misalignment between tender design & market realities

Efficient electricity markets and stable investment frameworks are not substitutes — they are complementary layers

For RE IPP Developers

1. Reduce complexity in contractual obligations
2. Lend certainty in revenue stream
3. Address Volume risk
4. Present a hybrid approach for exposure to both in-market & Out-of-market transaction
5. Give Payment security

PRICE SIGNALS

Bridging In-Market & Out-of-Market Gaps

Role of a BCS style Mechanism in Providing Effective Price Signals

- **Resolves the Current design dichotomy**

  Efficient dispatch provides stability and not distort market signals and operations

- **Implication for RE integration**

  Delivers credible long-term investment signals alongside efficient dispatch

- **Dependence on robust price signals**

  Effectiveness hinges on a credible reference price (e.g., DAM/GDAM on PXs) that reflects system conditions

- **Preservation of market efficiency**

  As a post-settlement financial adjustment, avoids distorting merit-order dispatch

- **Improved risk allocation and investment climate**

  Enables balanced risk-sharing and enhances bankability of RE projects

Congestion and Dynamic DSM implications

Price signals to be rigorously evaluated for their sensitivity & resultant impact on market behavior and outcomes

Policy Shift and Market Signal	Shift to dynamic congestion pricing (₹3–₹10/kWh)
	Linked to Dynamic DSM signals
	Proposes real-time locational & temporal price signals
	Embeds transmission scarcity pricing into dispatch & scheduling decisions
Potential Implications for RE IPPs	Material increases in revenue uncertainty (DSM & Congestion penalties)
	Congestion charges ≥ typical RE tariffs
	Shift from "must-run" to market exposure
	Location becomes economically critical
	Risks for Projects in congestion-prone corridors
Structural Impact on RE Market Economics	Transition from energy-only to congestion-adjusted net realization
	Nodal/Temporal value differentiation (locational marginal pricing signals)
	Incentivizes co-location with Storage/Hybridisation/Flexible dispatch
Potential Implications for BCS-style Mechanism	Strengthens the case
	Strike price design to consider post-congestion net realization
	Reference price selection
	National or Zonal market price
	Congestion adjusted price (net of congestions)
	Risk allocation challenges:
	Who should bear the congestion risk—Generator, Offtaker, or System?

Reference: CERC Dynamic Congestion Charges Consultation paper (Mar'26)

SETTLEMENT ARCHITECTURE

Potential Institutional Structure for a BCS style Framework & Settlement

Entity	Primary Role	Key Responsibilities	Structure as in UK CfD framework
MoP/MNRE	Policy & Strategy	- Formulates the policy framework & budgetary outlays for next-gen RE procurement - Defines technology-specific sub-targets & (Strike Price) caps and establishes the timeline for competitive bidding cycles	DESNZ (Dept. for Energy Security & Net Zero)
NVVN or SECI	Tender & Bid Process management	- End-to-end management of the competitive bidding process, including bidder registration, techno-commercial evaluation & qualification validation - Administration of the e-bidding portal, the conduct of e-Reverse Auctions for price discovery and awarding the final Contract	NESO (National Energy System Operator)
IREDA or SECI	Contract Counterparty & Payment Settlement	- A Central Nodal Agency for the formalization of 15 to 25-year contractual obligations with developers - Its mandate includes end-to-end payment management, the administration of settlements & lends oversight of scheduled construction milestone	LCCC (Low Carbon Contracts Company)
CERC	Appeals Body	Acts as the Apex Independent Regulator to adjudicate disputes & hear appellate petitions from developers & Nodal Agency decisions & maintaining integrity of the market-based procurement framework	Ofgem (Office of Gas and Electricity Markets)
RPCs & RLDCs	Settlement	- Responsible for Energy Accounting and Settlement Services through the collection of validated meter data based on REA & DSM statements - Providing the definitive basis for the financial settlement of power injected or drawn by generators and buyers	Elexon (Settlement Body)

Core Structural Difference (UK vs India)

- Critical Design consideration to be factored in developing a BCS style mechanism in India
- Structural Differences in Price Formation: Auction-Based MCP vs Indexed CfD Reference Pricing

Feature	India DAM MCP (if used)	UK CfD Reference Price*
Nature	Single auction outcome	Index / Averaged
Time granularity	15-min discrete	Hourly Averaged
Sensitivity to individual bid	High	Negligible
Market depth	Low	High
Manipulability	High	Low

*Referenced to EPEX SPOT (Great Britain market coupling platform)
- Product is Day-Ahead Auction (Hourly contracts)
- Cleared through a pan-European market coupling mechanism

Options for preventing BCS induced Cannibalization

Avoid System-wide Price Suppression Externality

Reference Price Design (CRITICAL)	Do NOT use Single-node MCP
	Use (a) Market Coupled Price (pan-India) or (b) Volume-weighted average price or (c) Multi-period average (e.g., weekly/monthly) or (c) Volume-Weighted Average Price (VWAP)
Bid Price Constraints	Impose Minimum bid price range (+/- % to previous day price, etc.)
	If not adhered too, BCS mechanism payment reduced or suspended
Extreme negative bidding	Remove incentive to depress prices artificially
Volume-Weighted Settlement Caps	Limit BCS incentive to only for "reasonable dispatch range"
	Prevents excessive "must-run" behaviour
Market Power Monitoring by the BCS Settlement Agency (like UK's LCCC) with oversight from CERC	Detect Abnormal low bidding patterns
	Penalize Strategic manipulation

Funding Architecture Options for Payment Security in a BCS style Mechanism

Options for Indian Design consideration

Option	Funded by	Who Pays
1	Electricity Consumers	Rate Payers
2	Budgetary Support	Tax Payers
3	Transmission Charge-Based Mechanism	Rate Payers
4	Fossil Fuel Consumption-Based Levy	Carbon Charge
5	Option 2 (initially) followed by Option 1	Hybrid

Funding should in principle borne by beneficiaries

Beneficiary	Logical Funding Source
Clean energy transition	Taxpayer
Electricity consumption	Ratepayer
Carbon reduction	Fossil users
Grid Infrastructure usage	Full Transmission charges to be levied

RISK/CONS	OPTION 1
Tariff increase	Political sensitivity
DISCOM pass-through delays	Regulatory lag
Cross-subsidy distortion	Burden on paying consumers

RISK/CONS	OPTION 2
Fiscal burden	Competes with other priorities
Policy uncertainty	Budget cycles vary
Not scalable	Large RE volumes require huge payouts
Vulnerable to	Policy changes & Fiscal stress

RISK/CONS	OPTION 3
Complex allocation	Zonal issues
Weak linkage to RE benefit	Indirect
Regulatory complexity	CERC + CTU coordination

RISK/CONS	OPTION 4
Real-time carbon tracking infrastructure	Needs robust MRV
Complexity	Hard to implement initially
Volatility	Revenue unpredictability

Forward-looking & innovative, though complex - Merits consideration

Pricing carbon as a market charge not as Tax

Carbon-Intensity Adders in Market Settlements

- As System-level settlement adjustments, not generator penalties
  - PX market settlements (DAM/RTM) on PXs
  - DSM / Balancing charges

Rationale

- Targets dispatch-driven emissions, not capacity
- Preserves merit-order dispatch and efficient market clearing
- Regulatory alignment under Electricity Act, 2003 (charge-based not tax)
- Operationally simple, leveraging existing settlement systems

Problems Addressed

- Carbon externality not priced in energy-only markets
- High-emission marginal units can dispatch without consequence
- Enables predictable funding stream for BCS/CfD-type mechanisms

Could be anchored to Grid Carbon Intensity Index (GCII)

- GCII is a system-level metric that measures how carbon-intensive electricity supplied by the grid is at a given point in time, usually expressed as kg CO_2 per MWh.

Who would compute (ex-post) GCII in India

- Published by Grid India based on SCADA/energy accounting data & official emission factors
- Possibly on a zonal or time-block granular level

Develop on Existing Building Blocks to generate hourly GCII

- CEA's grid emission factors (annual or periodic publication)
- CEA's annual Plant-level emission factors
- Real-time generation mix data Captured by Grid India (National Power Portal)

Back

Thank You !

Over to the Session Moderator