Centralized Vs. Decentralized Market

IIT Kanpur

26th July, 2019

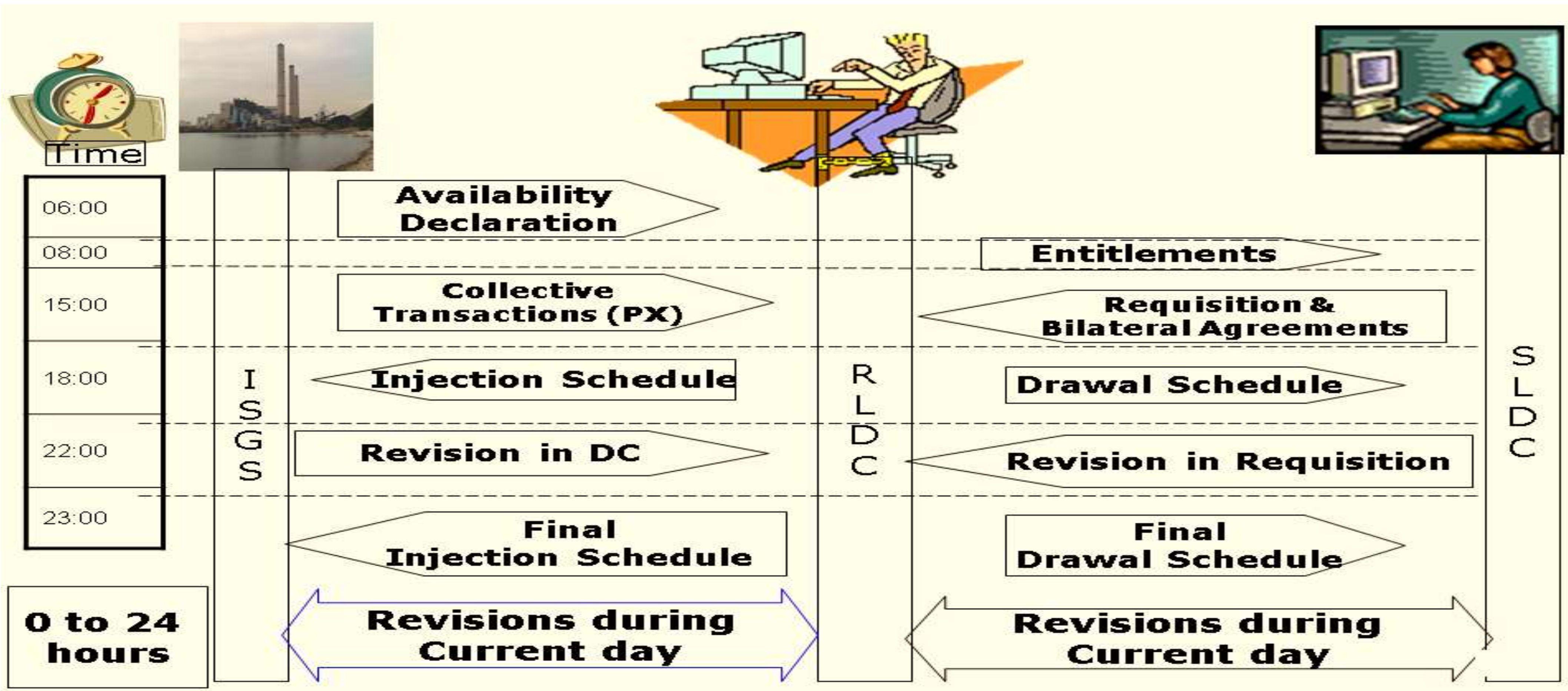
Decentralized Market Model

- Discoms procure power
  - Long Medium and Short term OTC Contracts
  - Power Exchanges
  - Bilateral Transactions with Discoms
  - DSM Mechanism

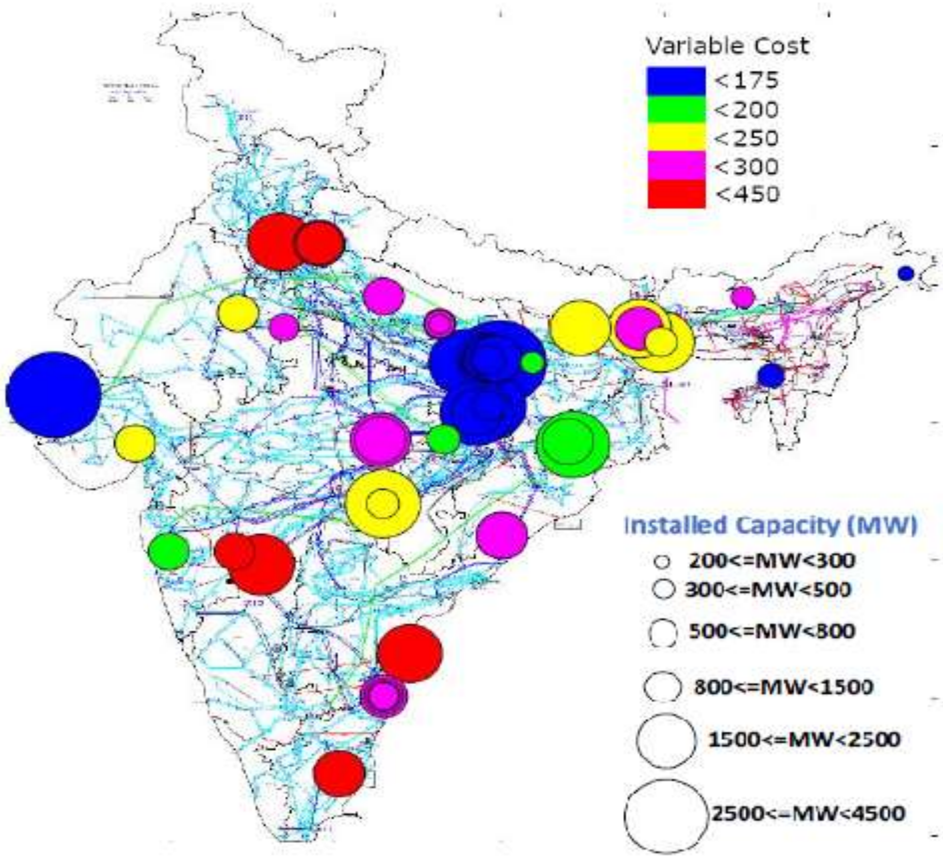
- Discoms self schedule generation from their portfolio and procure the remaining through power exchanges or bilateral transactions with other Discoms etc.

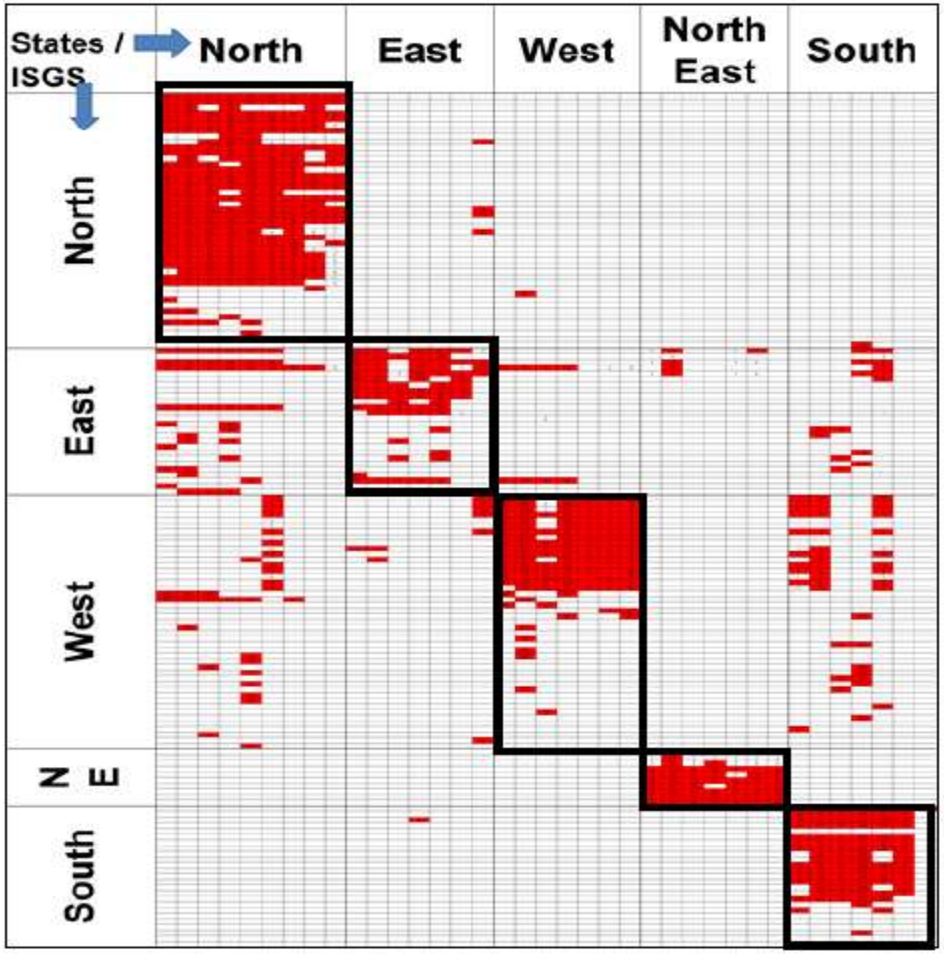
- While placing the requisition for scheduling, Discoms are not obligated to intimate the variable costs of such generators

Scheduling and Dispatch

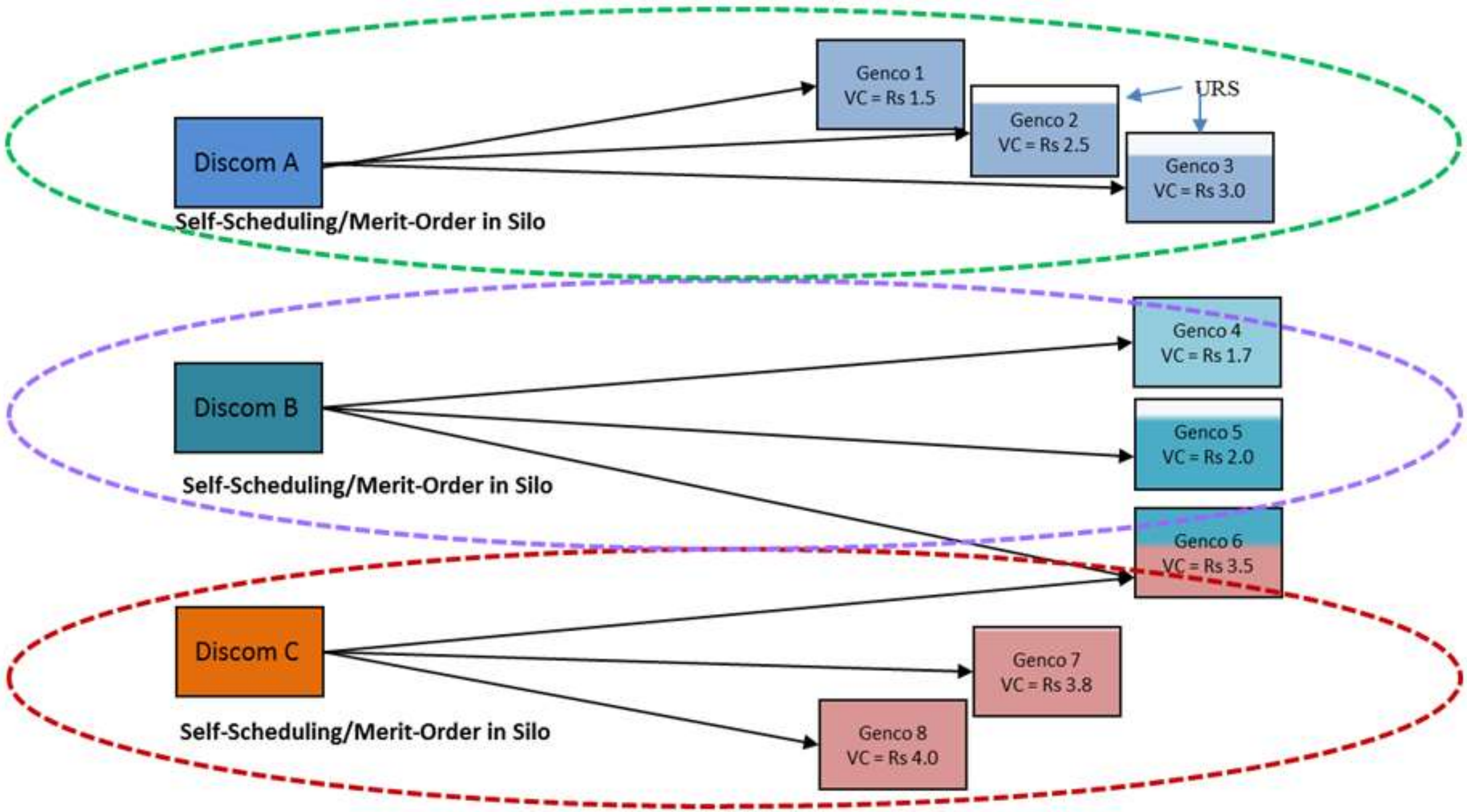


ISGS Allocation & Spatial Distribution

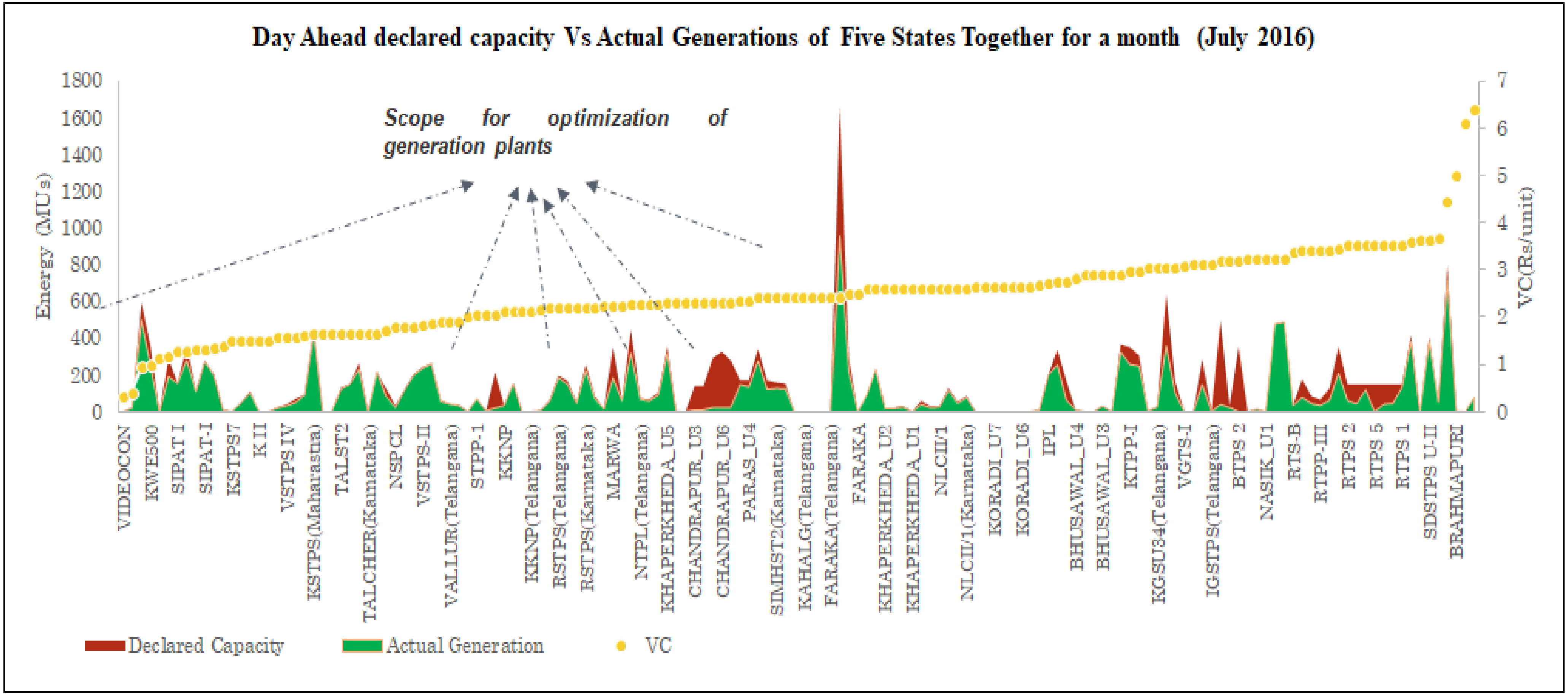




Self Scheduling and Merit Order in Silos



Scope for Optimization



Day Ahead Declared Capacity Vs Actual Generations of generators meeting Five States Demands (AP, MP, Telangana, Maharashtra, Chattisgarh)

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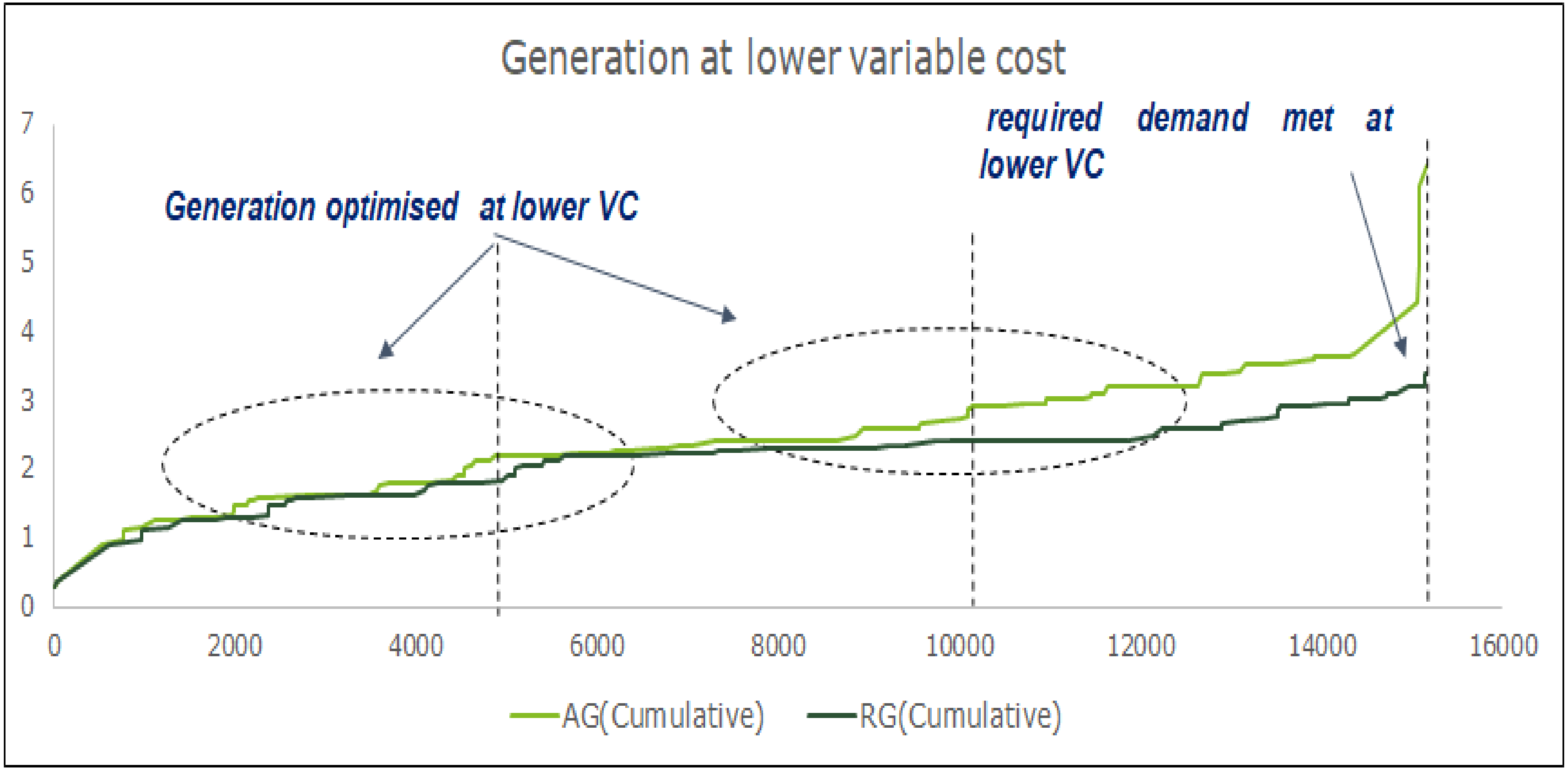
Actual Generation Vs. Pooled Dispatch



**Data presented for entire month of July 2016*

Factors viz. Ramping Rate, Technical Minimum were considered while simulation – approx savings of 10% in VC

Key Issues with Decentralized Model

- State Discoms resort to self scheduling of generation plants without visibility of low cost generation in nearby States

- Costlier generation plants are run in a state whereas cheaper and efficient low cost plants in nearby states are not fully utilized

- Unavailability of System Marginal Cost – No obligations on Discoms to reveal price of contracts

MoP Scheme – 3rd August, 2018

- Scheme on Flexibility in Generation and Scheduling of Thermal Power Stations to reduce the cost of power to consumers

- States requisition power from a station on day ahead basis considering its merit order among all stations from which it has a power tie up

- Many stations with a lower ECR are not fully scheduled - beneficiaries are unable to schedule the power as they do not have PPAs in these stations

MoP Scheme – 3rd August, 2018

- Station-wise allocation and requisition from beneficiaries as per the present system

- **Merit Order Based Generation Bucket Filing** - Schedule the generating stations of the generating company as per the merit order of the generating company subject to transmission constraint

- Surplus realized from supply of power from power station having lower ECR shall be shared with the beneficiaries in the ratio of 50:50. Surplus to the beneficiaries may be shared in proportion to the total drawl by the beneficiaries.

Security Constrained Economic Dispatch (SCED)

- CERC vide order dated 31.01.2019 allowed POSOCO to implement SCED on a pilot basis for 6 months from 1.4.2019

- SCED Optimization Model implemented for all the ISGS Thermal Stations that are regional entities and for whom the tariff is determined by the Commission

- Objective is to minimize the variable cost of generation after the unit commitment has taken place in the day ahead market
    - Subject to constraints – Transmission Capacity, Technical Minimum, Ramping rates etc.

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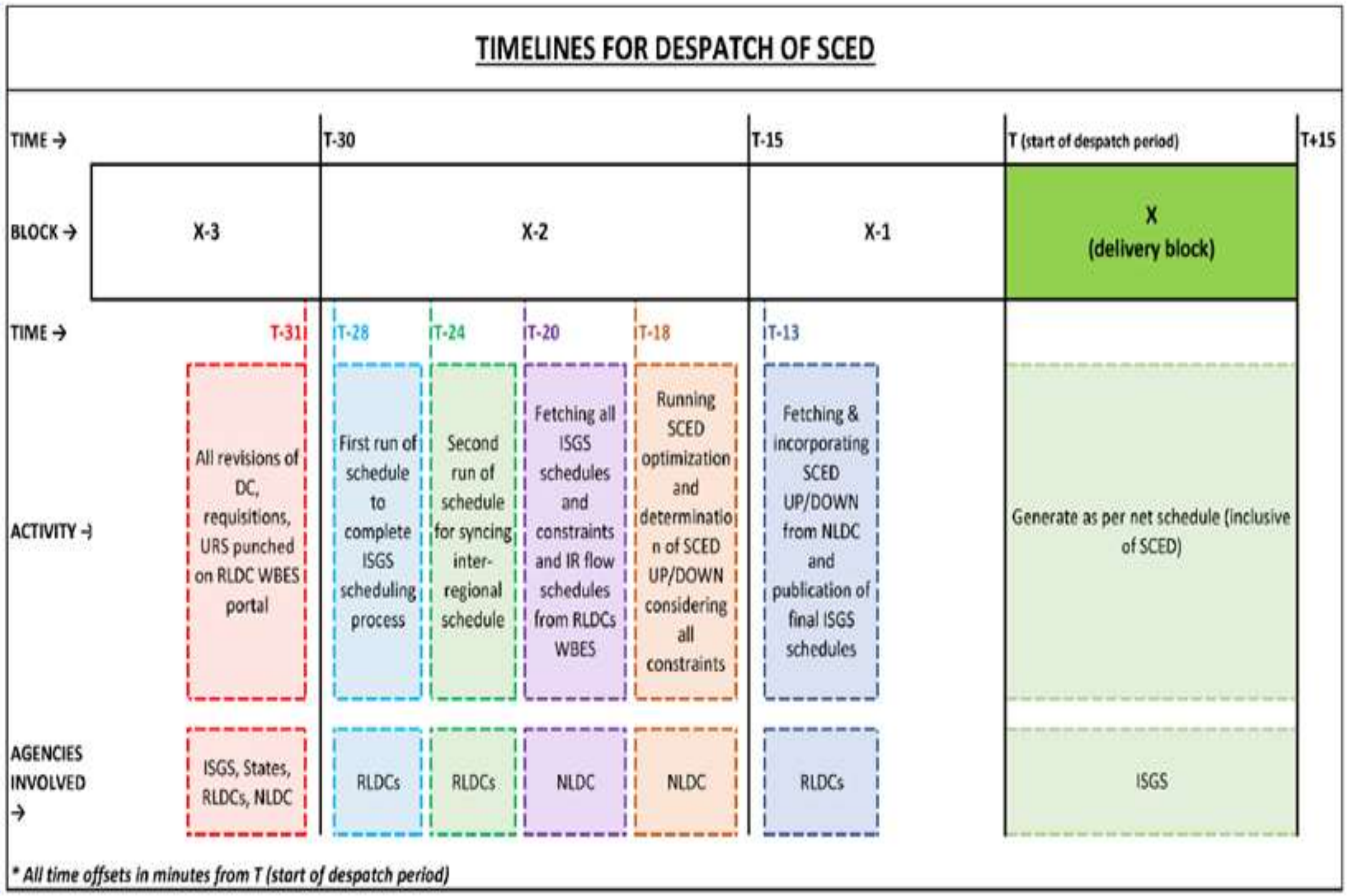
Security Constrained Economic Dispatch (SCED)

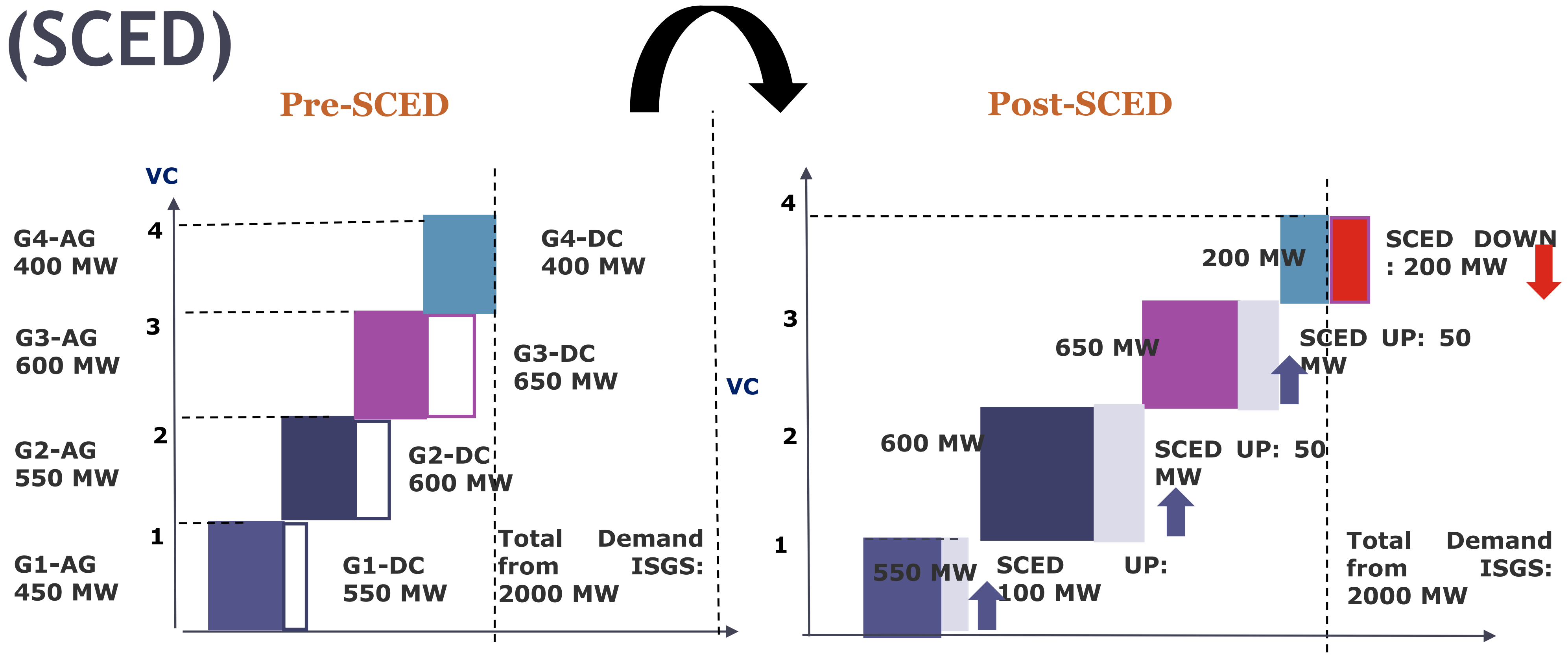
- Variable charges declared by the generators for RRAS purpose is considered in the optimization process
- Scheduled of States/beneficiaries is not changed and beneficiaries continue to pay the charges for the scheduled energy directly to the generator
- NLDC has opened a bank account called National Pool Account
  - For any increment in the injection schedule of a generator due to optimization, generator is paid from the National Pool Account at it variable charge
  - For any decrement the generator shall pay to the National Pool Account at the rate of its variable generation after discounting compensation due to part load operation
  - Benefits/savings shall be decided after the results of the pilot

Security Constrained Economic Dispatch (SCED)

- ***Integration of Regional Scheduling Software Applications at NLDC***
  - Integration of WBES in all regions
  - Automatic schedule preparation in each block
  - Synchronization of ISGS schedules
  - Tight data exchange & processing timelines
  - Complete process repeating every time block



Security Constrained Economic Dispatch (SCED)



Benefits to the pool:
a) Refund of VC of costly generator: 200 *4* 250 = Rs 2 lakhs
b) Part loading compensation to costly generator: = 200*0.5*250 = Rs 0.25 lakhs (say)

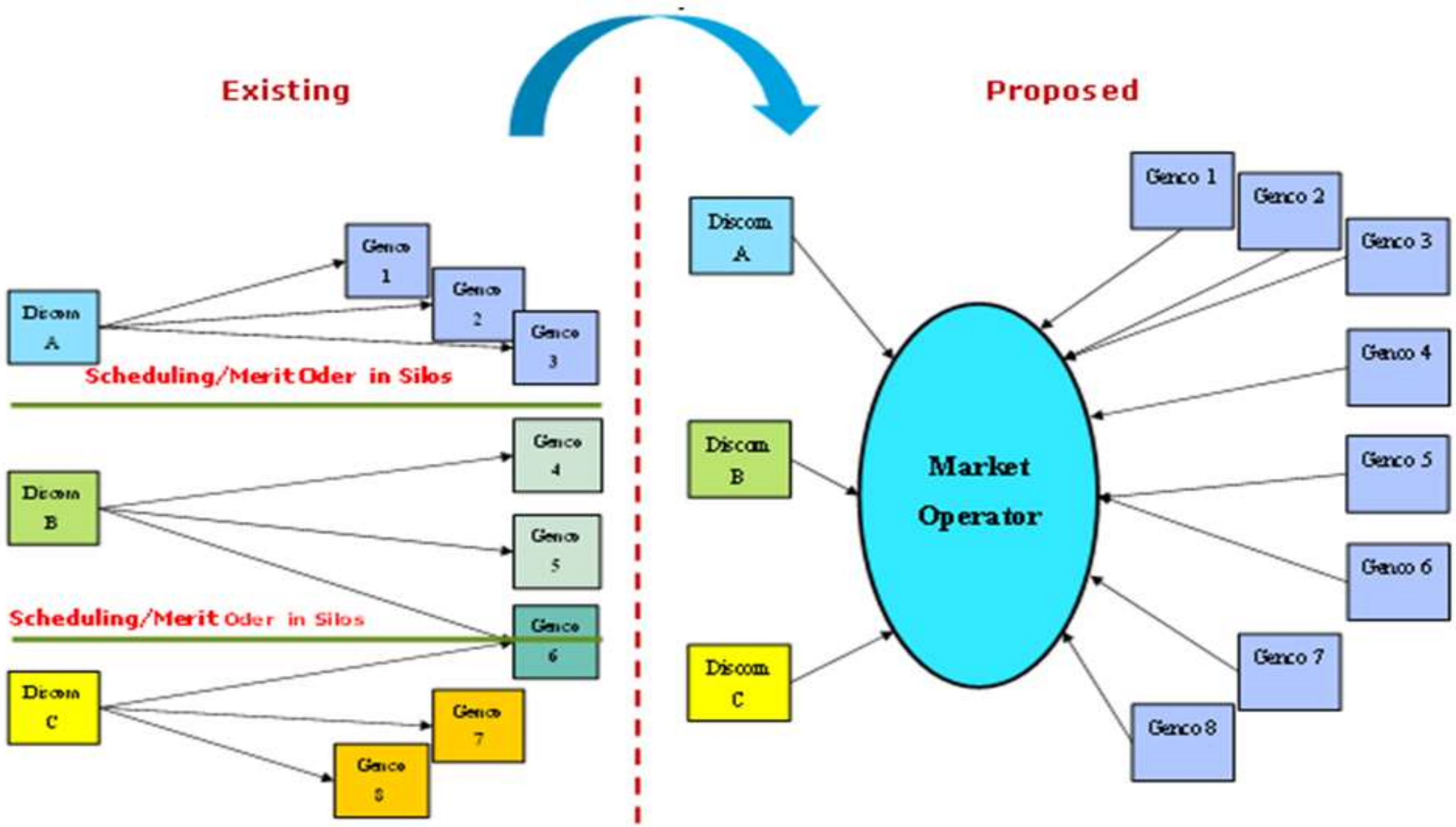
c) Additional payment to cheaper generators =[100*1+50*2 +50*3]*250= Rs 0.875 lakhs

Net profits remaining with the pool: a-b-c = Rs 0.875 lakhs

Issues with SCED

- Inclusion of additional power plants under Section 63
  - Requires the generators to furnish their cost, technical data viz. ramping constraint, technical minimum etc.
- Transparency in Variable Cost – Absence of market based mechanism leads to lack of transparency in the system marginal cost for meeting the demand
- Co-optimization of RRAS and SCED
- Sharing of Revenue with beneficiaries to be decided
- Time period between schedule communication and delivery period currently is less – difficulties in following the SCED signals at a shorter timeframe – time required to stabilize the system

Market Based Economic Dispatch (MBED) Proposal



Market Based Economic Dispatch (MBED) Proposal

Scheduling and dispatch	• All generation plants (State, Central, IPPs) would declare their availability on a **day ahead basis** and all discoms would declares their day-ahead requirement • Gencos and Discoms will submit **bids for quantum of power to be sold / procured** • **Market Clearing Price (MCP) – uniform price based system marginal cost** - would be discovered for each time block

Settlement of Bilateral contract (BCS)	• **Existing contracts** with gencos would continue to be honoured • **Discoms** would continue to pay **fixed costs** to contracted generators **outside of market** • Discoms would pay **Market Clearing Price (MCP) / Area Clearing Price (ACP) for cost of power procured** • For portion of demand met through existing contracts, generators would **refund difference in MCP and variable costs to discoms**

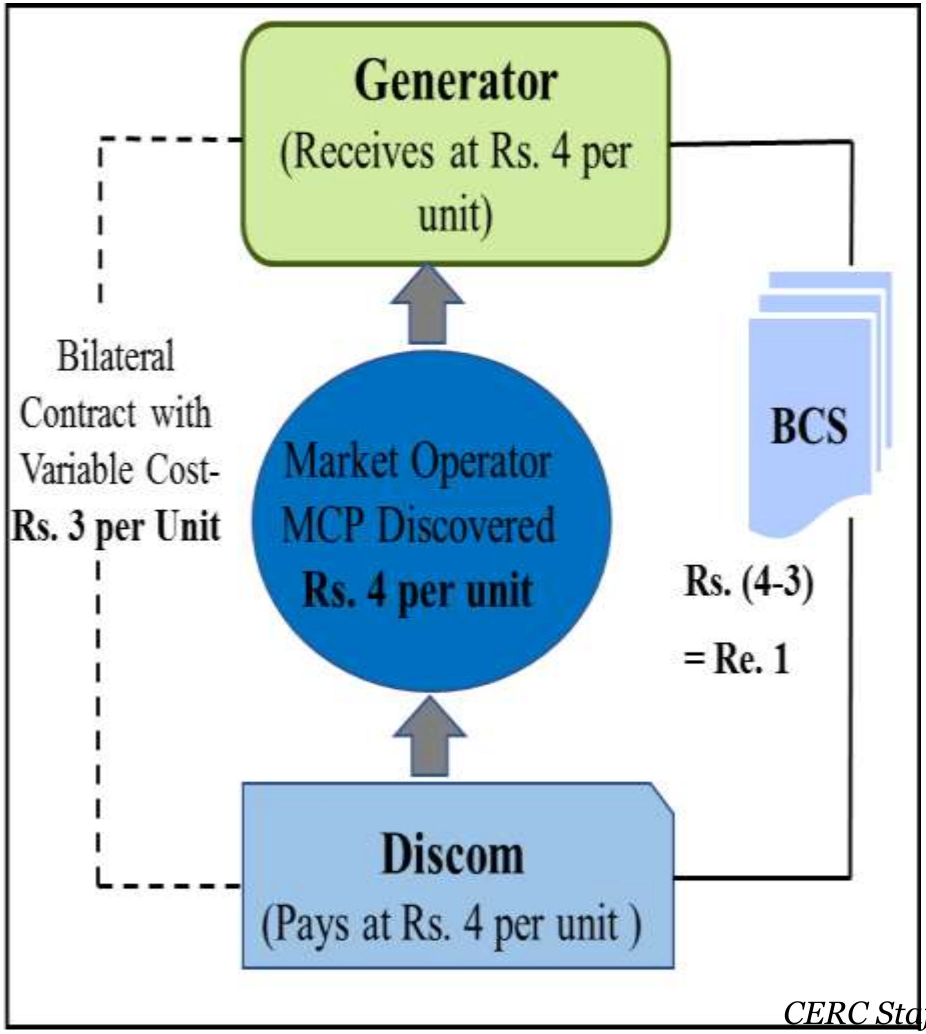
Market Based Economic Dispatch (MBED) Proposal

Consider a discom and a generator with a Contracted Price (VC) of Rs. 3 / kWh

If the Market Clearing Price (MCP) is Rs 4 / kWh,
- discom pays to pool/Market Operator (MO) Rs 4 / kWh
- Generator receives Rs 4/kWh from pool/MO
- Generator refunds discom 1 Re/kWh.

Discoms would be hedged against any increase in the market clearing price through BCS

For demand which is met out side of existing contracts, discoms would pay MCP.



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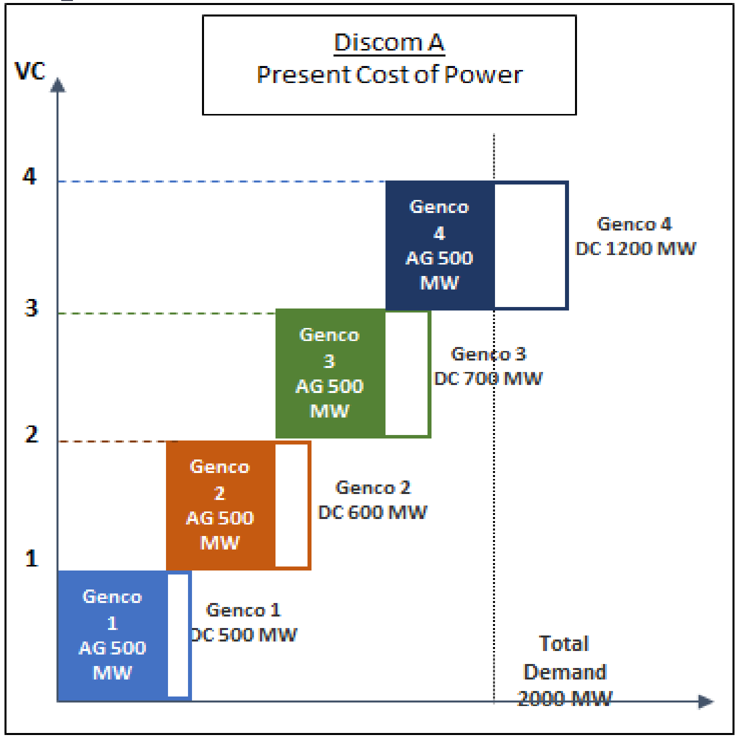
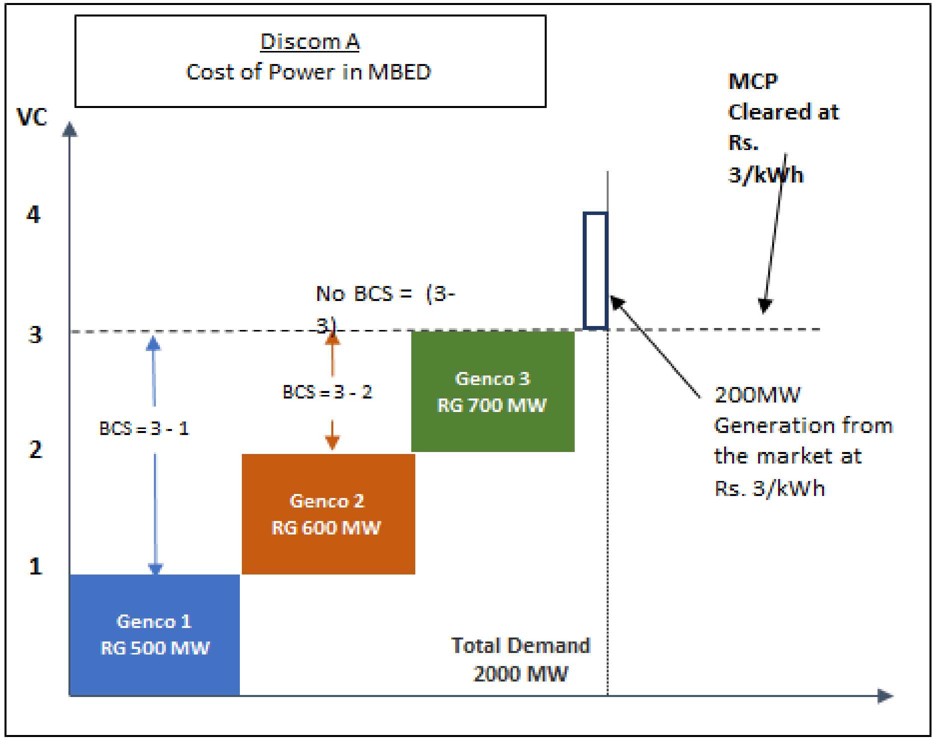
Market Based Economic Dispatch (MBED) Proposal





Cost of power (AG) =

(500*1 + 500*2 + 500*3 + 500*4) * 250

= **Rs 12.5 lakhs**

Note: Multiplication by (1000/4) =250 to take into account 15 Minute Time block

Cost of power (RG) = a - b

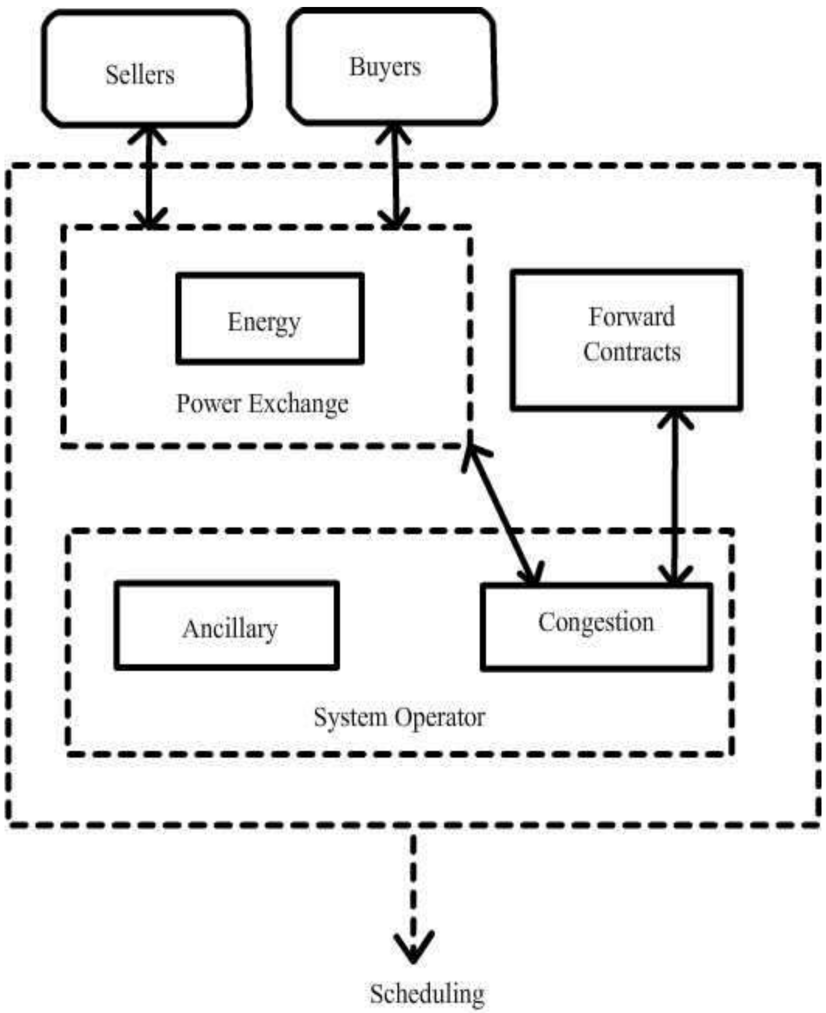
a) Payment at MCP: 2000 *3* 250 = Rs 15 lakhs

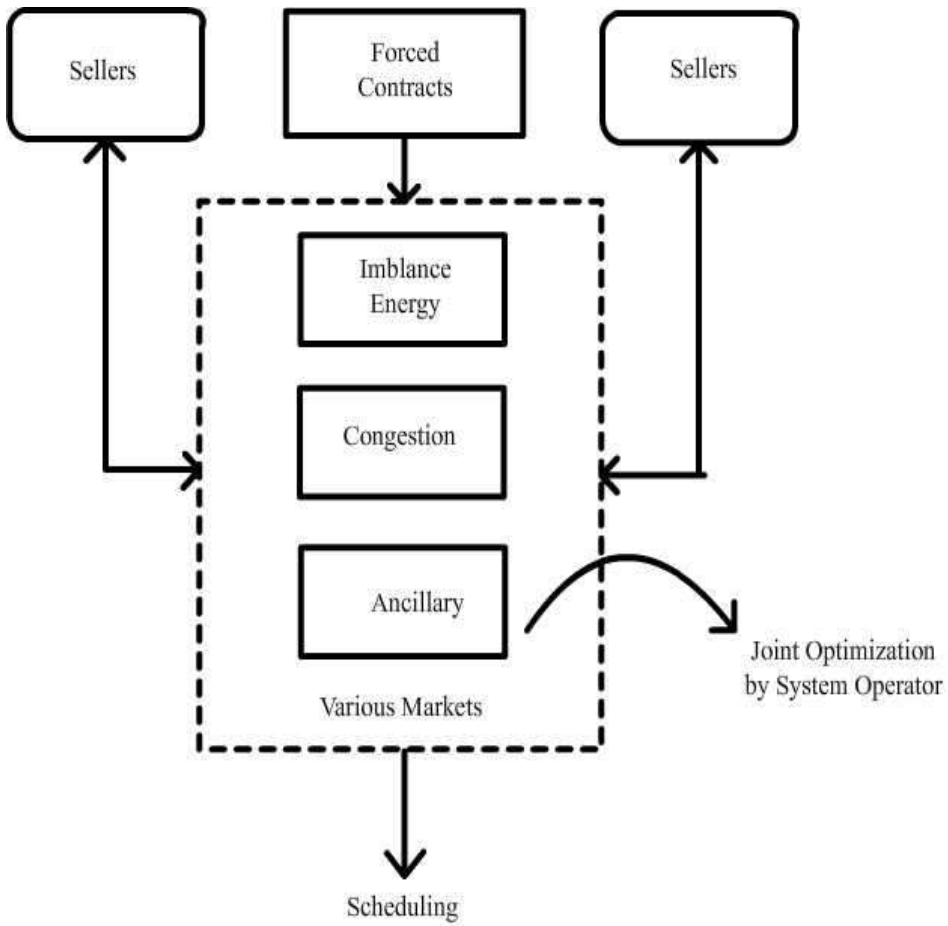
b) BCS = [500*(3 - 1) +600*(3 - 2) + 700*(3-3)] * 250 = Rs 4.00 lakhs

Cost of power (a – b) = **Rs. (15- 4)** = **Rs. 11.00 lakh**

Net Savings = (12.5 – 11.00) = **Rs. 1.5 lakhs**

Centralized Vs. Decentralized Market





Centralized Vs. Decentralized Market

Attribute	Centralized Model	Decentralized Model
Unit Commitment	Central	Decentralized
Reserve	Reserve Market integrated with Spot Market	Separate Reserve Market
Basis for Scheduling	Bids and Offers of Participants	Individual Schedules arising out of bilateral transactions
Imbalances	Integrated with Spot Market	Generally through Day Ahead Market
Involvement of System Operator in Day Ahead Market	Yes	No
Congestion Management	Implicit	Explicit
Significance of Forward Contracts	Risk Hedging	Physical Obligations
Example	PJM, CASIO, ISO-NE	UK Nordic Pool

Key challenges with Centralized Model

- Market design has evolved over the last two decades keeping the federal structure, decentralized scheduling and despatch and voluntary participation

- Role of System Operator/Market Operator – Issue of Multiple Power Exchanges & Price Discovery

- Decentralized markets tend to rely on competition and profit maximization to make the market participants behave in a socially optimal way.

- Resource adequacy in Short & Long Term as well as creation of Stranded Assets

- Readiness at intra-state level – lack of scheduling, time block wise metering, accounting and settlement mechanisms etc. in the state.

Thank You