

# Power Market and Development of Power Exchange by NTPC

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Presentation by  
**NTPC Vidyut Vyapar Nigam limited**  
*(A Wholly Owned Subsidiary of NTPC)*

# Power Market

- Any (more or less) **organized exchange of electricity contracts.**
- An **arrangement for transaction of electricity (MWhr)** and capacity (e.g. ancillary services -normally **MW**)
- A **sum total of commercial arrangements** for sale and purchase of electricity
- We have to differentiate between electricity markets in a **competitive structure** and in vertically integrated **monopoly supply structures.**

**One can define electricity markets by the purpose of their existence**

# Power Market

## *.....differentiation by purpose*

- Electricity markets in traditional or a vertically integrated monopoly supply structures aim directly at optimizing the usage of assets.
- Electricity markets in **liberalized** or **deregulated** or **competitive** supply structures aim at determining the market price for electricity, which balances supply and demand.

# Main Market classification

## Centralized vs. decentralized dispatch

- **Centralized dispatch ("PJM Model")**

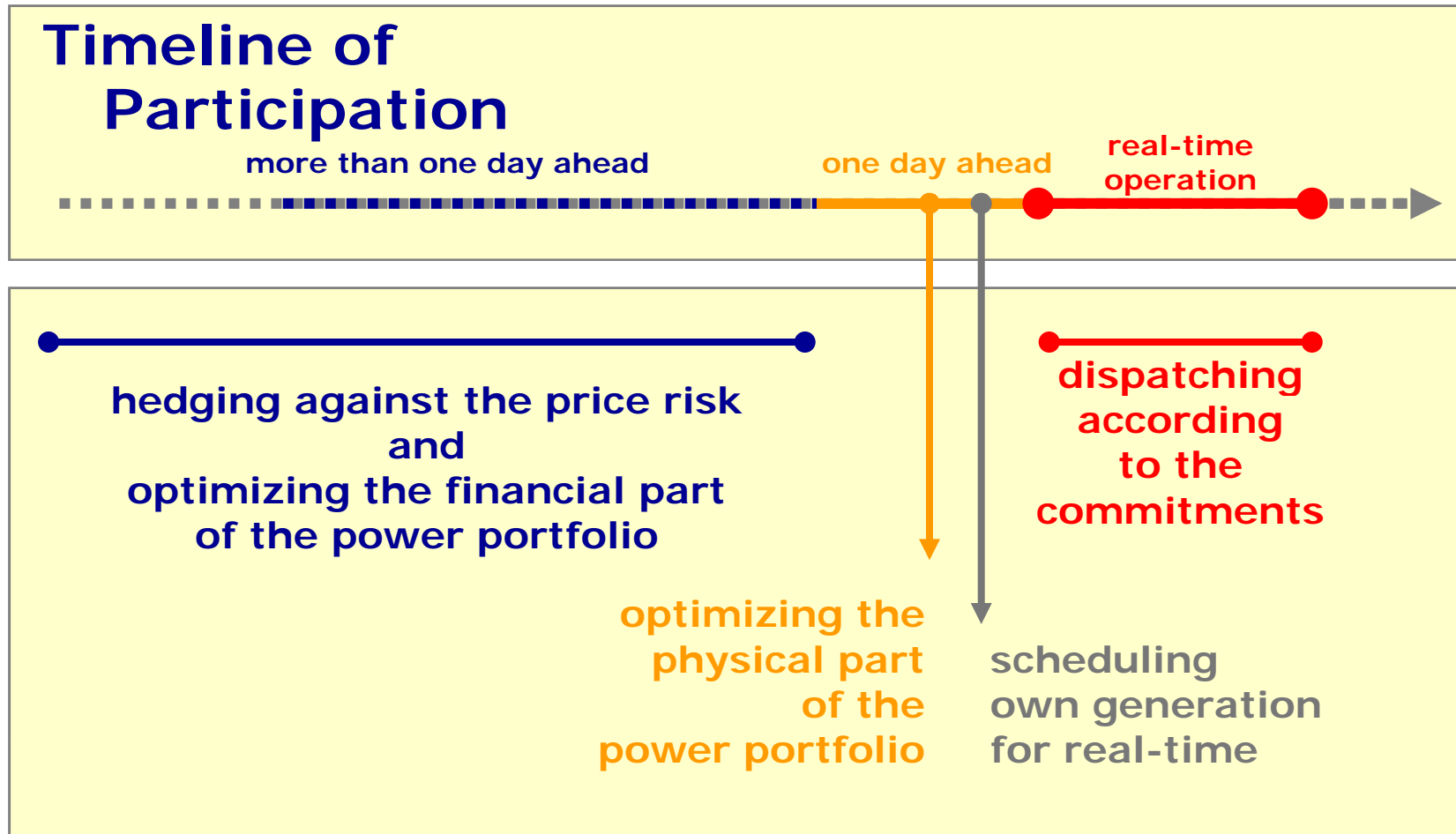
- the **system operator** controls the entire market- *MANDATORY POOL*
  - Market Operation is integrated with System Operation
  - Locational Marginal Prices calculated in real time (5 minutes interval) reflect energy cost and congestion cost
  - Schedules & dispatch based on Generator bids and secure system operation.
  - Limited demand side participation in price formation

- **Decentralized dispatch ("Nordic Model")**

- The **market participants** control their own schedules
  - Typically both seller and buyer submit price & quantity offers.
  - Bids and offers are portfolio based & not unit based
  - Market Operation is separated from System Operation
  - Power Exchange handles trading on day-ahead basis.
  - Congestion managed in trading is handled by market splitting

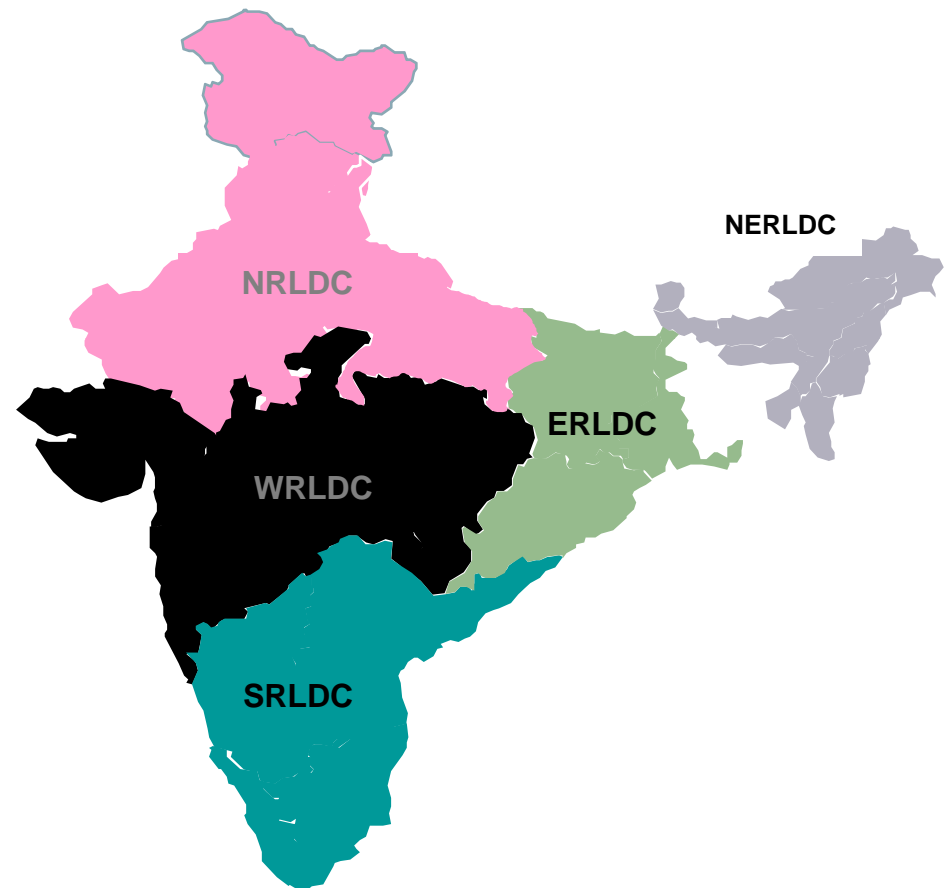
# Market timeline

Contracts for electricity can be differentiated over a time horizon



# Indian electricity system

- **At Regional Level**
  - Five Regional Load Dispatch Centers, operated by PowerGrid
  - A number of Interstate Generators (ISGS)
  - Transmission between regions
- **At State Level**
  - 28 states, responsible for generation, transmission & distribution.
  - Effectively “Control Areas”
    - State Load Dispatch Centre
  - States purchase power from ISGS
  - Trade between states facilitated by trading firms



# Indian wholesale market

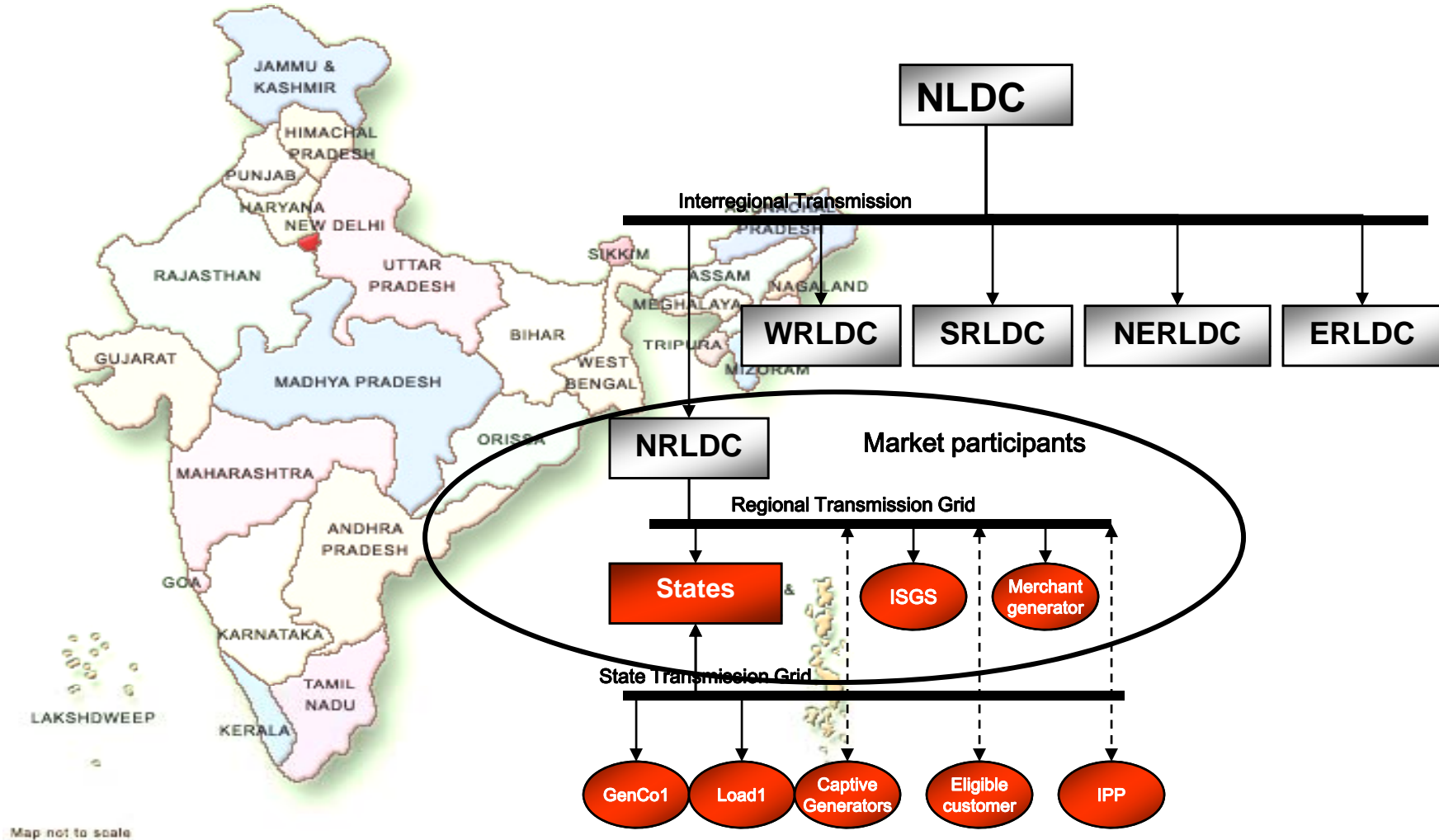
- **Wholesale market: regional/national level-** *Inter-state transactions*  
(Situation within states to change with unbundling of SEBs)
- **The states have pre-determined shares in the ISGS**
  - Right to a certain capacity/energy at a predetermined tariff
- **The RLDCs organize day-ahead scheduling of the ISGS:**
  - The ISGS informs about their available capacity for the next day – the ***supply***
  - The States nominate withdrawal schedules according to their shares of available capacities – the ***demand***
  - RLDCs matches supply and demand subject to transmission capacities
  - Not “used” capacity can be traded – 3% of total electricity generation.
- **Current trading**
  - Between states
  - International import/export (Bhutan, Nepal..)
  - Potential participants: state-embedded generators/IPPs/loads/others
- **Real-time “balancing” mechanism by the states & ISGS through the ABT/UI**

# Short term trading in India

## **ELECTRICITY ACT 2003 AIMS AT PROMOTING COMPETITION**

- **Two distinct layers- *hierarchical structure***
  - **Inter-state trading**
  - **Intra-state trading**
- **Inter-state trading market is effectively a single national market across all the five regions**
  - **Enabled by decentralized dispatch, day-ahead scheduling and real-time imbalance settlement (UI) available at inter-state level**
  - **Open Access Regulations**
  - **Terms and Conditions for inter-state trading license**
  - **Short-term open access is based on availability of (residual) transmission capacity- can be booked up to 3 months in advance**
  - **Trading volumes limited by inter-regional transmission link capacity**
- **Intra-state trading would also need enablers like decentralized dispatch, day-ahead scheduling and real-time imbalance settlement at intra-state level**

# Inter-state electricity market structure

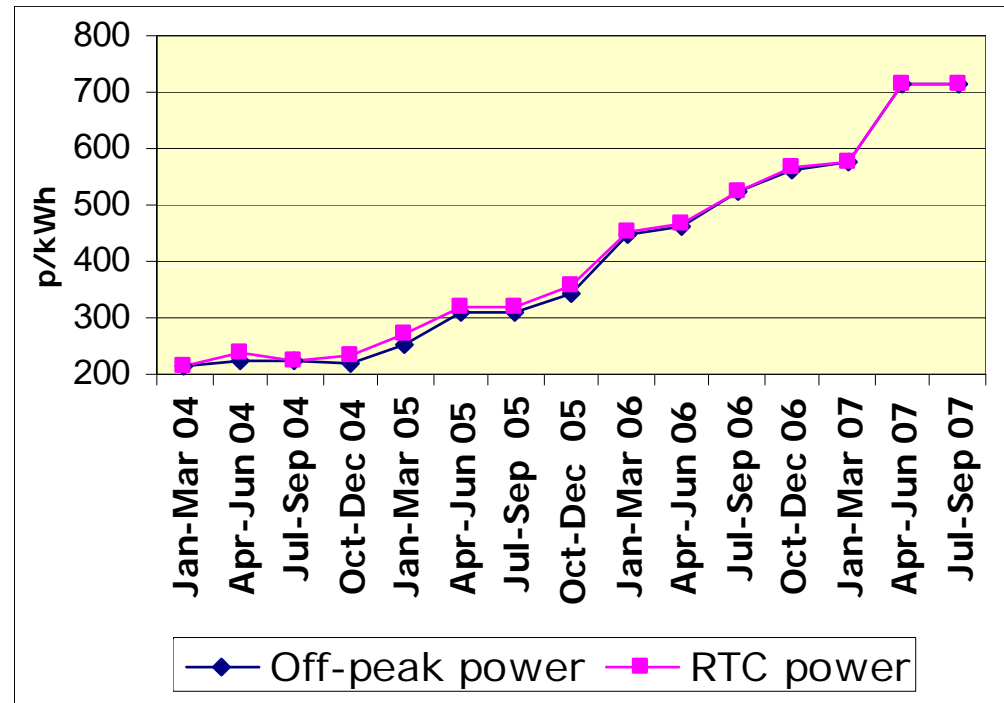


## Present Trading Practices and need for Power Exchange in India

- Inter-state trading volumes crossed **15 BU in FY06 as against 4 BU in FY03**. Volume of trading is likely to increase considerably in the coming years.
- Sellers have been calling for separate tenders for surplus available with them and traders compete with each other on prices to get the supply. This situation has resulted in prices of traded power moving only in one direction (higher). The main cause is one-sided competition
- The buyer is a **price-taker** in current scenario.
- A platform for wide choice of sellers and buyers is not available
- No effective Counter-Party Risk Management
- Variety of contract conditions and disputes

# Trend of traded power prices

Quarter	Purchase Rate in p/kWh	
	Off-Peak	RTC
Jan-Mar 04	215.0	215.0
Apr-Jun 04	225.0	240.0
Jul-Sep 04	225.0	225.0
Oct-Dec 04	220.0	235.0
Jan-Mar 05	252.8	270.0
Apr-Jun 05	311.1	320.5
Jul-Sep 05	311.1	320.5
Oct-Dec 05	344.1	356.1
Jan-Mar 06	446.0	450.8
Apr-Jun 06	461.0	466.0
Jul-Sep 06	522.0	523.8
Oct-Dec 06	562.0	564.5
Jan-Mar 07	574.0	576.5
Apr-Jun 07	715.0	715.0
Jul-Sep 07	715.0	715.0



# NTPC Initiative on Market Development

- Appointed *M/s NordPool Consulting AS, Norway and M/s CRISIL, India* as Consultants to study International Electricity Markets and prepare a Detailed Project Report for setting up a Power Exchange at National Level in India.

## *Methodology*

- Analysis of Indian Electricity Trading Market
- Study of International Electricity markets including a study tour of select markets abroad
- Consultations with stakeholders
- Development of PX Model for India

# What is Power Exchange

- A common platform for trading of electricity on day-ahead basis
- Neutral and transparent – well defined rules
- Anonymity of bids
- Financial counter-party for trades
- Competitive price discovery
- Simultaneous handling of energy contracts and transmission access
- Electronic platform- fast & efficient
- Promotes system balance
- Low transaction cost

# Recommended Model for India

## European Model (“Nordic model”)

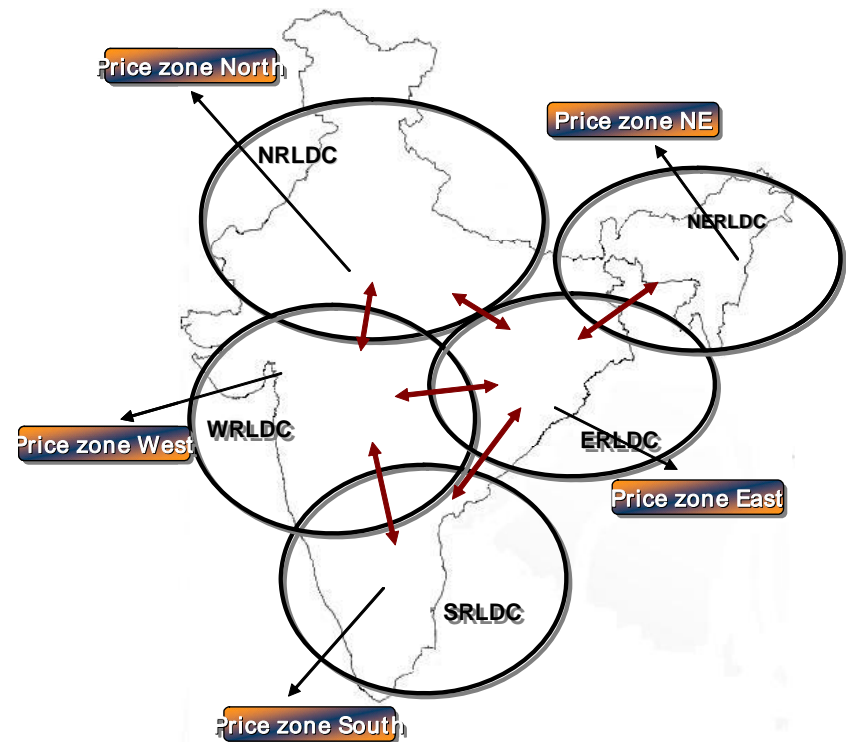
- There is a Day-ahead Market for trading and a Real-time Balancing Market for System Balancing.
- Day-ahead Market is operated by Market Operator (PX) and real-time market is operated by System Operator (RLDC)
- Market Operation is decoupled from System Operation. However, they co-operate closely.
- The **market participants** control their own schedules
- Bids and Offers are Portfolio based.
- Congestion in trading is managed by market splitting
- PX schedules are binding contracts
- Imbalances in real-time are handled by System operator

# PX in India- An Incremental Move

- **Bilateral trading already taking place. However, buyers are price-takers. PX is an alternative choice to trade, with demand side participation in price discovery.**
- **PX does not guarantee lower prices, but recognizes the actual value of the commodity- at which supply and demand match.**
- **Long-term PPAs not affected – PX only for tradable surplus, merchant capacity, CPPs – a *Voluntary Marketplace***
- **Participants are not willing to sell their short-term surpluses into the market on account of uncertainty in demand forecasting. PX shall facilitate such surplus capacity into the market on day-ahead basis**
- **Credit risk is perceived as one of the significant risks in electricity sector. PX shall help in mitigating counter party credit risks**
- **Utilities shall be able to optimize their total power procurement costs through mix of purchases through the PX and long-term power purchase**
- **Conveniently fits into System Operation**

# Bid zones

- The market is separated into geographic zones
- The borders between zones are typically grid sections with frequent congestion
- Bids from participants are registered to a specific zone
- Example for India:  
Typically, one bid zone for each region. The number of zones are configurable depending on the actual situation-to be decided by RLDCs.

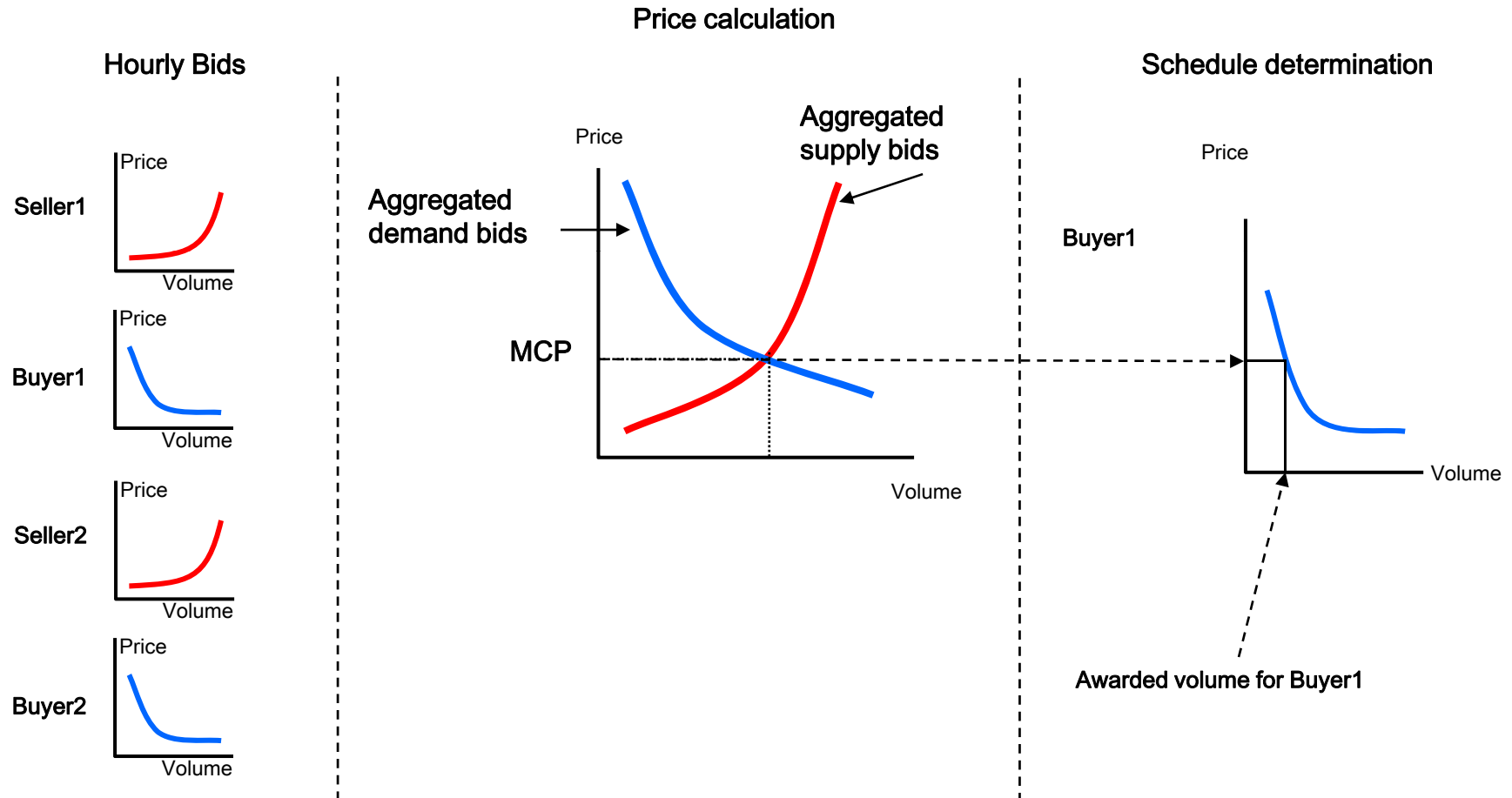


# Day-ahead market principles

- **Bid-zones** and the available transmission capacity between bid zones is defined by **System Operator**.
- **Both Buyers and Sellers** submit simultaneous anonymous hourly bids for all 24 hours of the next day. Bidders indicate price and corresponding volume they are willing to buy or sell.
- For each hour, the bid price at which quantum of sale & purchase is equal, is called the Market Clearing Price (MCP)
- Congestion management by market splitting to ensure that no transmission constraints are violated

# Price and volume calculations

*Principle (single zone or no transmission constraint)*



## Market splitting for congestion management

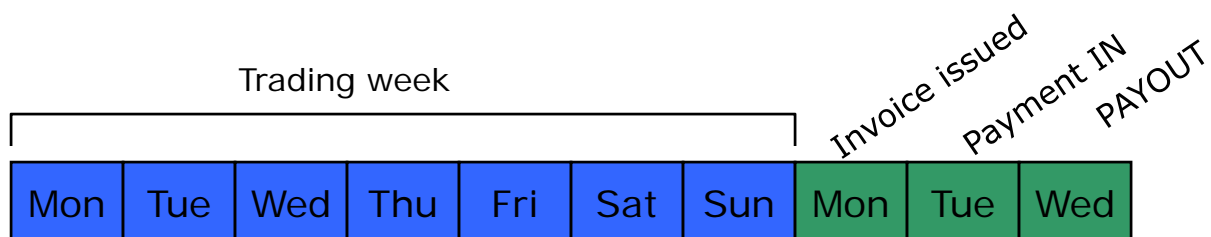
- Initially a common solution- MCP & Clearing Volume - is calculated for the entire market.
- If the calculated tie-line flows exceed line capacity, it is called congestion
- Market is 'split' at such tie-lines. We calculate MCP for each zone separately, but,
  - *We add tie-line capacity to supply curve in deficit zone and to demand curve in surplus zone*
- The resulting tie-line flows shall be within limits.
- In this case, we get different zonal prices

# Important enablers required for PX

- Assignment of part of short-term open access (transmission capacity) for PX
- Currently, short-term open access charges and scheduling of transmission losses (losses adjusted in kind) are applied on contract-path basis.
- A contract-path can not be identified for PX trades. Alternate methodology required whereby transmission charges and losses can be socialized.
- Effective inter-face with System Operators
- CERC to issue regulations in this regard

# Settlement and payments - principles

- The schedules determined in the PX are **physically** and **financially binding** contracts.
- The PX is the financial counterparty to all trades.
- Typically, there is daily settlement and weekly payment
- The collateral that is required shall cover the aggregated value of the daily net purchases not paid for
- The PX system shall include features and processes for handling of counterparty risk through collaterals to offset counterparty risks. (Separate clearing house is not required for a PX)
- Electronic fund transfer is commonly used.
- To finance the operation of the PX a transaction fee is charged both to sale and purchase volumes.



# Implementation of Power Exchange

- Permission required from CERC
- PX shall be a separate company
- Important aspects
  - Important infrastructure for the sector
  - Must be responsive to the needs of market
  - Build confidence in market mechanism
  - Transparent, fair & non-discriminatory rules
  - Participant training is crucial
  - **Close cooperation among stakeholders**
- NTPC is setting up PX jointly with other major stakeholders
- Implementation time: About 1 year after CERC approval

# PX and Cross-border Trade

- In many European markets, cross-border trade is routed through PX.
- Neighboring countries can access entire national market through PX
- Requires physical interconnection and commercial agreements over transmission access, transmission tariffs, scheduling, handling of imbalances, exchange rates, banks etc. (Traders like NNVN can play an important role).
- Our PX can also host market platforms for neighboring countries

# THANK YOU

For feedback/ comments/ queries, please contact:



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