Market

- A mechanism through which buyers and sellers interact to determine prices and exchange goods and services
- Entire set of conditions surrounding production, transport and distribution of a product
- Size determined by geography, transport, costs, etc.
In a market everything has a price !!

Price

- is the \textit{value (not cost)} of the good/service in terms of money

- represents the terms on which voluntary exchange of goods & services takes place

- Serves as signal to the producers and consumers
Demand

Å Need + Purchasing power = Demand
Å Law of downward–sloping demand

When price of a commodity is raised, buyers tend to buy less of the commodity, *other things remaining constant* (e.g., purchasing power, related goods, preferences, environment, etc.)
Supply Curve

The supply curve shows the relationship between its price and the amount of that commodity that producers are willing to produce and sell, *other things held constant* (e.g., cost of production, technological advancement, related goods, etc.)
Equilibrium

Quantity demanded is equal to quantity supplied

Price of commodity

Surplus

Shortage

Quantity
Shift in equilibrium
Price elasticity of demand
Change in Quantity Demanded in response to change in Price

Elastic

More Elastic

Less elastic

Perfectly Inelastic

Perfectly elastic
Market Design

Four Pillars of Market Design

- Scheduling & Dispatch
- Congestion Management
- Ancillary Services
- Imbalances

“Making Competition Work in Electricity”, Sally Hunt
Liquid Markets

**Characteristics**
- Many buyers and sellers
- Accessibility of buyers and sellers to each other
- Accessibility to information about the market prices

**Price settles fast to a market price**

**Defining feature**
- Ability to absorb the loss or addition of a participant (buyer or seller) without a noticeable change in the market price
Liquid Markets

Å Law of one price

ï For the same product, same time and same place, there will be one price if the market is liquid

Å UI Market – Liquid?
Efficient Markets

Market is efficient if the participants cannot predict price movements

Arbitrageurs

- Balance prices in different markets
- Benefit from inefficient markets
Indian Electricity Market
Evolution of Power Market in India

- Settlement System: 2002-03
- Open Access: 2004
- PX: 2008
- Ancillaries,
### ENABLERS

<table>
<thead>
<tr>
<th>Legislation</th>
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<tbody>
<tr>
<td>Indian Electricity Act 2003</td>
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<table>
<thead>
<tr>
<th>National Electricity Policy</th>
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<tbody>
<tr>
<td>12-Feb-2005, Para 5.7.1(d)</td>
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<table>
<thead>
<tr>
<th>Regulation</th>
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<tr>
<td>IEGC-Feb 2000</td>
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<td>ABT Order-Jan2000</td>
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<tr>
<td>Open Access-May-2004</td>
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<td>Power Exchange-Aug-2007</td>
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<th>Execution</th>
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<tr>
<td>CTU/STU, RLDC/SLDC</td>
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<tr>
<td>Grid &amp; Market Operation</td>
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<tr>
<td>Control Centres &amp; SEMs</td>
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<tr>
<td>ABT settlement: in stages 2002-03</td>
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### STRUCTURE

<table>
<thead>
<tr>
<th>Balancing Mechanism</th>
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<tr>
<td>Frequency linked</td>
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<table>
<thead>
<tr>
<th>Unscheduled Interchange</th>
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<th>Intra-day STOA</th>
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<th>Day-ahead Power Exchange</th>
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<tr>
<td>Multiple Power Exchanges</td>
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<table>
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<th>Short-term Bilateral</th>
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<tbody>
<tr>
<td>Day-ahead</td>
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<tr>
<td>First-come-first served</td>
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<tr>
<td>Three-month ahead</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Long-term Bilateral</th>
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</thead>
<tbody>
<tr>
<td>Shared resources (ISGS)</td>
</tr>
<tr>
<td>Own resources</td>
</tr>
</tbody>
</table>
Electricity Market Segments

Long-term market (90%)

State Sector generation 45%

Central Sector generation 36%

Pvt Sector generation 9%

Short-term market (10%)

Short-term Market

UI (30.10%)

Bilateral Market (52.32%)

Exchange (17.58%)

Direct Trading 13.95%

Through Traders 38.37%

Bilateral Market

UI (30.10%)
Short Term Open Access: Bilateral and Collective Transactions
Open Access in Inter-State Transmission

- Implemented w.e.f. 6-May-2004
- Revised Regulations w.e.f 1st April 2008 and further amendment in May, 2009
- Products –
  - Monthly bilateral
    - Advance
    - First Come First Serve
  - Day ahead bilateral
  - Collective Transactions through Power Exchange
  - Intra day bilateral
- Permits usage of spare transmission capacity through a transparent process
- Offers choice and freedom to buy & sell power
Power Exchange

- July 2006: Staff Paper by CERC
- February 2007
  - CERC Guidelines for establishment of Power Exchange
- August 2007
  - In principle approval to the first power exchange in the country
- January 2008
  - Revised Regulations for Open Access in Inter-state Transmission, Effective 1st April 2008
- June 2008
  - Procedure for Scheduling of Collective Transactions by CTU
  - Commencement of operations
- October 2008
  - Second Exchange begins operations
- Power Market Regulation, 2010
  - Day ahead Market
Regulatory Framework for Power Exchange

In transition towards a competitive market structure
### Congestion Management: Bid Area

<table>
<thead>
<tr>
<th>Area</th>
<th>Region</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1</td>
<td>North</td>
<td>JK, HP, CHD, PUN, HAR</td>
</tr>
<tr>
<td>N2</td>
<td>North</td>
<td>RAJ, DEL, UP, UTT</td>
</tr>
<tr>
<td>W1</td>
<td>West</td>
<td>MP, CHTG</td>
</tr>
<tr>
<td>W2</td>
<td>West</td>
<td>MAH, GUJ, GOA, DD, DNH</td>
</tr>
<tr>
<td>S1</td>
<td>South</td>
<td>AP, KAR, GOA</td>
</tr>
<tr>
<td>S2</td>
<td>South</td>
<td>TN, KER, PONDY</td>
</tr>
<tr>
<td>E1</td>
<td>East</td>
<td>WB, SIK, BIH, JHAR</td>
</tr>
<tr>
<td>E2</td>
<td>East</td>
<td>ORISSA</td>
</tr>
<tr>
<td>A1</td>
<td>North-East</td>
<td>TRIP, MEGH, MANI, MIZO</td>
</tr>
<tr>
<td>A2</td>
<td>North-East</td>
<td>AS, AP, NAGA</td>
</tr>
</tbody>
</table>
Power Exchanges: Concepts
Power Exchanges

An electricity Power Exchange provides a spot market, mainly day-ahead, for electricity, which like any other market matches demand and supply for each time block, while providing a public price index.
Role of an Exchange

- Standardized specifications - contract structure
- Standard margining system
  - Eliminates credit rating
- Risk Management in a volatile market
  - Robust Clearing & Settlement systems
    - Counter party credit risk absorbed
  - Fair, Safe, orderly market
    - Rigorous financial standards and surveillance procedures
Role of an Exchange

- **Price Transparency**
  - Anonymous auction platform
  - Price Discovery by matching of demand-supply
  - Long term price signals

- **Transparent real time, pan-geographic price dissemination**
  - Benchmark reference price
  - Liquidity to participants

- **Risk Management**
  - Separation of pricing function
  - Neutral, Secure and self Regulated market
## Exchange vs. OTC Contract

<table>
<thead>
<tr>
<th>OTC contract</th>
<th>Exchange Traded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available to limited market participants</td>
<td>Liquid market – wider market participation</td>
</tr>
<tr>
<td>Bilateral/ Customized Contracts</td>
<td>Standardized contracts</td>
</tr>
<tr>
<td>Counter party credit risk</td>
<td>Counter party risk assumed by exchange</td>
</tr>
<tr>
<td>Is an involved participant</td>
<td>Platform is Neutral</td>
</tr>
<tr>
<td>Opaque dealing</td>
<td>Transparent price discovery mechanism</td>
</tr>
<tr>
<td>Bilateral dispute settlement mechanism</td>
<td>Well defined dispute settlement mechanism</td>
</tr>
<tr>
<td>Difficulty in reporting and regulating various trades</td>
<td>The exchange is the central reporting and regulating entity</td>
</tr>
</tbody>
</table>
Central Electricity Regulatory Commission
Part – 2 : Scope of Regulation and Extent of Application
Regulation No.3

Å Markets
- Over the Counter Market
- Power Exchange Market
- Other Exchange Market

Å Contracts
- OTC Contracts directly between buyers and sellers
- OTC Contracts through Electricity Traders –
  - Back to back deals
  - Deals with Open position
  - Contract to aggregate suppliers / buyers and sell / buy to a one or more buyers / sellers
- Financially settled electricity derivatives contracts transacted in OTC market
Regulation No.4

- Delivery based contracts transacted on Exchange
  - Intraday contract /Contingency contract
  - Day Ahead contract
  - Term Ahead contract

- Financially settled electricity derivative contracts transacted on Exchange

- Any new contracts linked with electricity generated from renewable sources, e.g. Renewable Energy Certificates (REC), etc. transacted on Power Exchange.

- Any new contract in areas related to capacity, power price indices, and other areas related to electricity

- Capacity Contracts

- Ancillary Services Contracts
Regulation No.5

Market participants including:

- Grid connected entity(ies) such as but not limited to Generating companies, Distribution Licensees, consumers who have been granted open access.
- Electricity Traders;
- Power Exchanges and Clearing Corporations approved by the Commission;
- Members of Power Exchanges;
- Members of Clearing Corporation;
- Other Exchanges and
- Any other transacting party
Part – 3: Approval / Suspension of the Contracts by the Commission
Regulation No.6

The Commission may, on an application made in this behalf, permit any Exchange to introduce such contracts as specified in Part 2 of these Regulations for transacting on the Exchange.

An Electricity Trader is not required to obtain any approval under these regulations but shall submit information as specified in CERC (Procedure, Terms and Condition of grant of Trading License and other related matters) Regulations, 2009 and comply with the trade reporting requirement as specified in Regulation 59 (iii) hereof.
An Exchange seeking permission under Regulation 6 shall submit to the Commission the complete and detailed contract specifications.

Parameters for examination of such contracts:
- Type of contract
- Price Discovery methodology and matching rules proposed
- Transaction period
- Risk Management mechanism
  - Margining mechanism
  - Final Price Settlement mechanism
- Delivery mechanism
- Delivery Duration
- Penalty for Contractual Deviation (for Term Ahead Market)
Regulation No.8

Permission not given to enter into or transact following contracts unless the same has been permitted to be so launched or introduced by the Commission in terms of notification issued in this behalf -

- Derivatives Contracts;
- Ancillary Services Contracts
- Capacity Contract
Regulation No.9

If the Commission is of the opinion that it is necessary or expedient so to do, it may after granting the concerned person the opportunity of being heard, by order, suspend transactions on any contract for the period specified in the order or withdraw any contract from the market or the Exchange, as the case may be.
Part – 4 : Principles of Market and Market Design
A Power Exchange shall function with the following objectives:-

- Ensure fair, neutral, efficient and robust price discovery
- Provide extensive and quick price dissemination
- Design standardised contracts and work towards increasing liquidity in such contracts
Regulation No.11

A Power Exchange shall adopt the following market design in case of day ahead markets:

1. Price Discovery
   - The economic principle of social welfare maximisation and to create buyer and seller surplus simultaneously during price discovery.
   - The bidding mechanism shall be double sided closed bid auction on a day ahead basis.
   - The price discovered for the unconstrained market shall be a uniform market clearing price for all buyers and sellers who are cleared.
   - In case of congestion in transmission corridor, market splitting mechanism shall be adopted.
   - The delivery / drawl of power shall be considered at the regional periphery.
Delivery Procedure

Participants in Power Exchange shall take "Concurrence, Prior Standing Clearance, or No objection" from their respective State Load Despatch Centres if applicable before participating in the Power Exchange.

Transmission charges and transmission losses shall be handled as per Procedure for scheduling (Open access) of Collective Transactions issued in accordance with CERC (Open access in Inter State Transmission) Regulations, 2008 and as amended from time to time.

Contracts in day ahead market are necessarily for physical delivery and shall be binding on the participant executing the transaction.
The scheduling and delivery of contracts on Power Exchange shall be in coordination with the system operator and in accordance with CERC (Open access in Inter State Transmission) Regulations, 2008 as amended from time to time, The operational details shall be as per the Procedure for scheduling (Open access) of Collective Transactions issued in accordance with CERC (Open access in Inter State Transmission) Regulations, 2008 and as amended from time to time.

The allotment of transmission corridor to Power Exchanges shall be done by National Load Despatch Centre as per directions of the Commission.
Regulation No.12

Å OTC Markets – The following principles of transaction shall be observed:

- OTC market shall provide customized solution to sector participants and endeavour to bring innovation in the market place.
- Contracts to be sold to client shall be based on the suitability, appropriateness and full material disclosure of contract pricing, its risks and implications to the parties entering into the contract.
Regulation No.13

The Physical Market Design should complement security and reliability of power system and under no circumstances should market mechanisms compromise grid security.
Regional Grid Operation: Philosophy as per IEGC

- Operated as loose power pools
- States have full operational autonomy
- State power system treated as notional (flexible) control area
- Very tight control of actual interchange by state utilities & Inter State Generating Stations not mandated
- Deviations from net drawal schedules appropriately priced
GRID MANAGEMENT FUNCTIONS

Å Ex-ante functions
  ï Scheduling

Å Real-time functions
  ï Supervision & control of system parameters
  ï Facilitating Open Access transactions

Å Post-facto functions
  ï Settlement system operation

Å Interaction with stakeholders
Settlement System – ABT & UI

ABT is a scientific settlement system for contracted sale & purchase of power

Has three components

- Fixed Charges or capacity charge
  - Linked to day-ahead declared availability/subscription
- Variable Charges or fuel charges
  - Linked to before the fact energy schedules
- Charges for deviation from commitments

Frequency actuated signal

- Signal transmitted at the speed of dynamics to be controlled

Real time pricing stretched to its physical limits

- Merit order
- Economic load management

Incentives for helping the grid

Opportunities for a diligent player

Simple, dispute-free weekly settlement system
DECENTRALIZED SCHEDULING

Available Declaration

Collective Transactions (PX)

Injection Schedule

Revision in DC

Final Injection Schedule

Entitlements

Requisition & Bilateral Agreements

Drawal Schedule

Revision in Requisition

Final Drawal Schedule

Revisions during Current day

Revisions during Current day

Time

09:00
10:00
15:00
18:00
22:00
23:00

0 to 24 hours

Collective Transactions (PX)

Revisions during Current day

Collective Transactions (PX)

Revisions during Current day
A Typical Dispatch

Surpluses/Deficits - Balance supply and demand

FIRM SHARES IN ISGS

ADVANCE SHORT TERM BILATERAL CONTRACTS

Balance supply and demand
Sharp Price Movements
The End Result

- Frequency is collectively controlled democratically stabilized
- Wholesale market is workably competitive allocative efficiency productive efficiency
- Economic signal available for optimum utilization of resource investments in generation capacity
- Settlement is streamlined dispute-free

Correlation Between Prices and Shortage/Surplus in the Market

Correlation: -0.67

Unconstrained Prices of IEX, June 2008 to Dec 2010
Increasing trend of STOA - Approved Energy (MUs)
Trade under Short-Term Open Access

*Includes Bilateral + Collective transactions
Number of Trading Licencee approved by CERC

As on 30.10.2011
All India UI Billing
(w.e.f. 28-Mar-11 to 11-Dec-11)
Annual UI Volume (Regionwise)

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<td>1462</td>
<td>3498</td>
<td>7862</td>
<td>15800</td>
<td>34784</td>
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<td>Northern Region</td>
<td>331</td>
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<td>361</td>
<td>456</td>
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Rs in Crores
Region wise Cumulative UI Volume in Rs. Crores (Till 11th Dec-11)

- Western Region: 19134
- Northern Region: 27972
- Southern Region: 10237
- Eastern Region: 15962
- North Eastern Region: 2311
- All India: 75617

Rs. in Crores
Regionwise Cumulative UI share (Till 11th Dec'11)

- Western Region: 25%
- Northern Region: 37%
- Southern Region: 14%
- Eastern Region: 21%
- North Eastern Region: 4%
All India UI Billing
(w.e.f. 28-Mar-11 to 11-Dec-11)

Rs. In Crores:

Week No.

Series1

Series3