Electricity Exchanges in South Asia – The Indian Energy Exchange Model

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In this presentation

Overview - Indian Market

Short Term Trading through Exchange

Proposed mechanism for regional electricity market
## Market related legislations

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Description</th>
</tr>
</thead>
</table>
| Electricity Act, 2003 | - De-licensing of generation  
- Development of a multi-buyer multi-seller market in power  
- Trading – licensed activity. |
| National Electricity Policy, 2005 | - Measures to promote competition aimed at consumer benefits  
- Promote competition through developing markets |
| Open Access Regulations, 2004 & 2008 | - Universal Open Access to transmission networks  
- Procedures for ‘Day-Ahead Market’ and OTC transactions |
| Power Market Regulations, 2010 | - Formal framework for Competitive markets  
- Norms for setting up and operating power exchanges |
<table>
<thead>
<tr>
<th><strong>Power Market: Present status</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Long Term (88%)</strong></td>
</tr>
<tr>
<td>&gt; 12 years</td>
</tr>
<tr>
<td>Power Purchase Agreements</td>
</tr>
<tr>
<td><strong>Medium Term (1%)</strong></td>
</tr>
<tr>
<td>3 months – 3 years</td>
</tr>
<tr>
<td>OTC (License Traders)</td>
</tr>
<tr>
<td><strong>Short Term (9%)</strong></td>
</tr>
<tr>
<td>Intra Day – 3 months</td>
</tr>
<tr>
<td>OTC, Power Exchanges (IEX)</td>
</tr>
<tr>
<td><strong>Balancing (2%)</strong></td>
</tr>
<tr>
<td>Real-time</td>
</tr>
<tr>
<td>Deviations (TSO)</td>
</tr>
</tbody>
</table>
Composition of Short-term Market

CERC MMC Report for FY 2013-14

Price & Volume Comparison (FY13-14)

Volume Transacted (BU's) vs Average Price (Rs/kWh)

- Trading Licensees: 4.24 BU's, 28.9 Rs/kWh
- IEX: 2.87 BU's, 24.5 Rs/kWh
- PXIL: 2.52 BU's, 0.97 Rs/kWh

As on Jan’14 1 BU = 1 Billion kWh or 1 TWh
PX Transactions Vs Prices

Last 5 years

As on Feb’14
1 MU = 1 Million kWh or 1 GWh
Trading Through Indian Energy Exchange
# Features of Indian Short term Power Market

## Federal Structure
- *States has autonomy over distribution and Open access*
- *Regulator at National & State levels*

## Multiple Exchange allowed
- Competition among exchange to benefit market

## Distinct Market and System Operators
- 2 Market Operators and hierarchy of System Operators
  - National, Regional (5) & State TSO (33)
  - MO interaction with SO for transmission capacity and scheduling

## Only Physical delivery based market
- Limited forward contracts on exchange (up to 1 weeks)

## Absence of Retailers
- Content/Carriage separation yet to be achieved
- Consumer direct access to market
  - *Over 2300 direct consumer and total 3000 participants*

## Implicit Auction of Transmission Capacity in Day-Ahead Markets
- Trading with 12 price areas
- *Open Access at State level - Every state with different open access feature*
## IEX Market Segments

### Delivery-based Contracts

<table>
<thead>
<tr>
<th>Segment</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Day-Ahead Market**     | *Closed, Double-sided Auction*  
  10-12 am bidding  
  Each 15-min block, 0.1 MW min NOC required |
| **Term-Ahead Market**    | *Day-Ahead Contingency* – Another window 3-5pm   
  *Intra-Day* – for the same day starting 2 pm   
  *Daily-* for rolling seven days (delivery starting after 4 days)  
  *Weekly*– for 1 week (Monday-Sunday) |
| **Renewable Energy Certificates** | *Green Attributes as Certificates*   
  *Sellers:* RE generators not under feed in tariffs   
  *Buyers:* Obligated entities  
  1MWh equivalent to 1 REC |

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**Next… Energy Saving Certificates**
95% Market share 80,000 MWh daily average trade

3000+ participants 2100+ Industries

Transparency  Liquidity  Competition
# Contract Characteristics

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</tr>
</thead>
<tbody>
<tr>
<td>Delivery</td>
<td>Next day</td>
<td>1400 - 2400 Hrs same day</td>
<td>For next day</td>
<td>Continuous trading</td>
<td>For next week</td>
</tr>
<tr>
<td>Auction Type</td>
<td>Closed Auction</td>
<td>Continuous trading</td>
<td>Continuous trading</td>
<td>Continuous trading</td>
<td>Open Auction</td>
</tr>
<tr>
<td>Contracts</td>
<td>15 min</td>
<td>Hourly</td>
<td>Hourly</td>
<td>Block of Hours (Fixed)</td>
<td>Block of Hours (Fixed)</td>
</tr>
<tr>
<td>Trade Availability</td>
<td>All Days</td>
<td>All days</td>
<td>All Days; 1500-1700</td>
<td>All Days; 1200-1500</td>
<td>Wed &amp; Thurs; 1200-1600</td>
</tr>
<tr>
<td>Financial Settlement</td>
<td>Pay-In: D-1; Pay Out – D+1</td>
<td>Pay-in: T+1</td>
<td>Pay in: T+1</td>
<td>Pay-In- D-1; Pay Out – D+1</td>
<td>Pay-In- D-1; Pay Out – D+1</td>
</tr>
</tbody>
</table>

Terms:
- **T** = Trade
- **D** = Delivery
Features of Day Ahead Market

- Physical delivery based market | Min 100kW
- A closed double-sided anonymous auction for each **15-min time block** for the following day
- Bid types: Single Order or Block Orders
- Intersection of aggregated sale and purchase curves defines Market Clearing Price (MCP)
- 12 Bid area defined for congestion
  ATC across bid areas determined by NLDC /RLDCs
- Market splitting determines Area Clearing Price (ACP) specific to an area
  (available at www.iexindia.com)
- Delivery/ Settlement /All OA Charges thru IEX

[Diagram of a market with price and demand/supply curves and a map with bid areas labeled N1, N2, N3, W1, W2, W3, E1, E2, S1, S2, A1, A2]

[Map with regions labeled N1, N2, N3, W1, W2, W3, E1, E2, S1, S2, A1, A2]
DAM trading process

Bidding
- Bids for 15- min each or block bids can be placed
- 10:00 am to 12:00 pm

Matching
- MCP & MCV calculated
- 12:00 pm to 1:00 pm

Review corridor and funds availability
- Corridor availability and funds verified
- 1:00 pm to 2:00 pm

Result
- Final ACV and ACP calculated. Market splitting if congestion
- 3:00 pm

Confirmation
- Collective transaction confirmation by NLDC
- 5:30 pm

Scheduling
- Final Schedule sent to RLDC for incorporation
- 6:00 pm
## Model Price Calculation Algorithm

### Price Tick (Rs.)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>1.1</th>
<th>2</th>
<th>2.1</th>
<th>2.5</th>
<th>3</th>
<th>3.1</th>
<th>4</th>
<th>4.1</th>
<th>5</th>
<th>---</th>
<th>---</th>
<th>---</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio A, MW</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Portfolio B, MW</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Portfolio C, MW</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>-40</td>
<td>-60</td>
<td>-80</td>
<td>-81</td>
<td>-120</td>
<td>-120</td>
<td>-120</td>
<td>-120</td>
<td>-120</td>
<td>-120</td>
<td>-120</td>
</tr>
</tbody>
</table>

### Bid Quantum by different portfolios

<table>
<thead>
<tr>
<th>Total Buy Quantum received, MW</th>
<th>Total Sell Quantum received, MW</th>
<th>Net Transaction, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio A, MW</td>
<td>Portfolio A, MW</td>
<td>Portfolio A, MW</td>
</tr>
<tr>
<td>Portfolio B, MW</td>
<td>Portfolio B, MW</td>
<td>Portfolio B, MW</td>
</tr>
<tr>
<td>Portfolio C, MW</td>
<td>Portfolio C, MW</td>
<td>Portfolio C, MW</td>
</tr>
</tbody>
</table>

### Model Price Calculation Algorithm

- **Market clearing price (MCP)**: 2.5
- **Market Clearing Volume (MCV)**: 60 MW

- **Demand (Buy)**
- **Supply (Sell)**
Typical price trend in DAM
(15min wise)
Proposed mechanism for regional electricity market-SAARC
Next steps in the SAARC Market Integration

**Present Status**
- Long term bilateral PPAs with select countries
- Long Term PPAs along with participation in short term power exchange market
- Market with Multilateral transaction in short and long term
- Single SAARC Market, more advanced products (spot, day ahead, forwards, futures)

**Anticipated evolution of SAARC Integration**
- Limited interconnection with select countries
- Using inherent margins, need for reinforcement of transmission interconnection
- Investment in transmission capacity building, interconnections established with ALL
- Fully synchronous interconnected multi country system established

**Very limited agreement of rules**
- Harmonization of grid code and rules
- Regional regulatory agency, Regional treaty/agreement
Why Exchange for cross border trade

- Competitive & Vibrant Markets
- Transparent and neutral platform
- Price discovery – trusted and reliable
- Double-sided bidding – best price discovery tool
- Implicit Auction: Transmission management
Why harness the Power Exchange markets for regional trade?

• Better resource optimization
  – Can use the inherent margins in transmission to transact power

• Management of daily demand variations
  – Daily demand variations and Peak requirements can be managed optimally through Day-Ahead Transactions.

• Competitive, transparent and neutral market

• Liquid, diversified market

• Standardized contracts, competitive prices through market determined prices (no need for negotiations)
Identification of separate bid area

12 Bid Areas

Additional bid area could be added for each country
Exchange process

1. **Bidding**
   - 10:00 am to 12:00 pm
   - 96 bids for 15 minutes each can be placed

2. **Matching**
   - 12:00 pm to 1:00 pm
   - MCP & MCV calculated

3. **Review/Corridor and funds availability check**
   - 1:00 pm to 2:00 pm
   - Corridor availability and funds verified

4. **Result**
   - 3:00 pm
   - Final ACV and ACP calculated. Market splitting if congestion

5. **Confirmation**
   - 5:30 pm
   - Collective transaction confirmation by NLDC

6. **Scheduling**
   - 6:00 pm
   - Final Schedule sent to RLDC for incorporation

**ATC to be determined by the designated agency in respective country**

**NLDC to inform the designated agency regarding final schedule**
### Proposed Single Market for SAARC
Salient Features

<table>
<thead>
<tr>
<th>Category</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Operator</strong></td>
<td>• Separate Market and Transmission System operator</td>
</tr>
<tr>
<td><strong>Transmission capacity</strong></td>
<td>• Short-term transactions to use balance margins after long term</td>
</tr>
<tr>
<td><strong>Allocation of Capacity</strong></td>
<td>• Implicit auctioning; congestion management through market splitting</td>
</tr>
<tr>
<td><strong>Trade/ Bid entry</strong></td>
<td>• Bids/offers in common exchange</td>
</tr>
<tr>
<td></td>
<td>• Multi-currency trade possible</td>
</tr>
<tr>
<td><strong>Scheduling and Financial Settlement</strong></td>
<td>• Scheduling: TSOs</td>
</tr>
<tr>
<td></td>
<td>• Financial: local MO/TSO/Utility</td>
</tr>
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</table>
Trading through exchange: Enablers

Identifying a Nodal Agency for ATC
- Nodal agencies for ATC Calculations. TSOs in each country eg NLDC in India

Nodal Facilitator to carry out trade
- A member at exchange from each country can carry out the trade on behalf of the country

Policy Interventions
- Necessary regulatory bottlenecks to be relieved

Payment Security
- full pay-in by Buyers in advance, sellers can be paid post delivery

Deviation settlement
- Country with Multiple parties will need to evolve a deviation settlement mechanism

Dispute Resolution
- Forum of SAARC Electricity Regulators (FoSER) or SAARC Energy Centre
Regional Market Evolution in phases...

**Indian Trader as Nodal Facilitator Agency**
- Exchange deals thru Nodal Agency with Cross-border participants
- Indian licensed Trader as nodal agency for all the transactions with other countries

**A Cross-border trader as Nodal Facilitator Agency**
- Exchange deals thru cross-border Member with local participants
- Cross-border Member having government’s mandate and guarantee
Trading through Exchange: Enablers for Nepal

Allow existing under-utilized line of 132 kV and 33 kV for transaction through exchange

Prices determined on competitive basis should not be subject to ETFC approval and cost to be build in tariff regulations

Relaxing conditions to buy/sell power out side Nepal

- As per Electricity Act, 2049, export only feasible as per an agreement between the exporter and government of Nepal
- General exemption from this rule for trading on Power Exchanges will further foster cross border electricity trade through Power Exchange

General exemption from import/export duty specified in the Electricity Act, 2049.
The Electricity Act, 1910 allows for Board/Single buyer to import/export of electricity with previous sanction from Government at Transmission rates determined by the Government.

Utilise IEX platform for the remaining 30 MW as per the agreement after securing 220 MW under medium term arrangements.

Designate PTC/ Trader as the nodal facilitatoir for cross border trade with the exchange.
The Scheduling and Despatch code of Bhutan already technically compatible with Scheduling and Despatch code of IEGC

Treatment of cross border imbalances can be adopted in the grid code

BPC to be entrusted with determining the ATC, scheduling on a daily basis and energy accounting for facilitating transactions through the Power Exchange
Regional Trade: Issues to be addressed

<table>
<thead>
<tr>
<th>Trading</th>
</tr>
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<tbody>
<tr>
<td>• Different Time Zones (Standard Time)</td>
</tr>
<tr>
<td>• Bidding Currency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Linking transmission lines</td>
</tr>
<tr>
<td>• Co-ordination in scheduling and dispatch</td>
</tr>
<tr>
<td>• Energy Metering and Accounting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clearing and settlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Payments transfer mechanism</td>
</tr>
<tr>
<td>• Currency risk</td>
</tr>
<tr>
<td>• Imbalance Settlement</td>
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</tbody>
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<tr>
<th>Margins, Collaterals</th>
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</table>

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<tr>
<th>Legal Recourse, dispute resolution mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Overcoming different legal, regulatory and policy regimes to arrive at a standard set of procedures and policies</td>
</tr>
</tbody>
</table>
Thank You for your attention

www.iexindia.com

Best Power Exchange in India
– Enertia Awards ‘13

Best Performing Power Exchange
– Power Line Awards ‘13 & ‘12

Best E-enabled consumer platform
– India Power Awards ‘09
Evolution Of Power Market in India

- **2000**: Grid Code
- **2002-03**: Settlement Regulation
- **2004**: Open access Regulation
- **2008**: Power Exchange
Way Forward

- **SAARC single Electricity Market**
  - Single Day-Ahead Market for SAARC Market
  - Examples around world:
    - NORDPOOL (4 countries + Lithuania & Estonia)
    - Central West Europe
    - SAPP

- **Limited Harmonisation of Rules (Common minimum)**
  - Balancing & Settlement Rules across countries
  - Payment Security & Commercial terms
  - Grid connectivity standards

- **Gather political will for mutual benefit of energy sectors of countries**

Highly Scalable model for competitive electricity market