A Review of existing models for Electricity Markets in EU countries

INO GATE Local Information Event
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   b. Why?
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3. Market Design Criteria
   a. Reliability & Timelines
   b. Day Ahead Scheduling and Real time Balancing
   c. Capacity Remuneration Mechanisms
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Electricity Sector Restructuring

The seed ...

1978: Fred Schweppe’s Seminal Article “Power Systems 2000”

General movement in favor of electricity industry restructuring

- Introduction of competition
- Imposition of prices reflecting real costs according to use
Electricity Sector Restructuring

... and the harvest

Source: KEMA Presentation
“A webinar for the European Copper Institute
Webinar 2: Market Design”
Dr. Konstantin Petrov / Dr. Daniel Grote
2.11.2009
Electricity Market Reforms – the motivation!

**Competition**
- Increase industry efficiency
- Improve price transparency
- Transfer risk from rate/tax payers to private investors

**Changing global circumstances**
- the advances in generation technologies (i.e. CCGTs)
- ICT economy influence (i.e. market information, demand response)
Electricity Market Reforms – How?

A new model for the electricity sector

Cooperation through vertically integrated monopolies

Source: Lessons from liberalised electricity markets, IEA, 2005
Electricity Market Reforms – The overall structure

Electricity Market

Competitive Areas
- Generation
- Supply

Non-competitive Areas
- Transmission
- Distribution

Subject of “unbundling”
The concept of unbundling

Traditionally: T&D networks owned by the integrated electricity company
Under the competitive environment: unbundling requirements

3 well-known unbundling regimes:
• Accounting
• legal
• Ownership

Very strict unbundling requirements under the 3rd EU Energy Package;
Requires unbundling of:
• Regulated from liberalized activities
• Regulated activities with conflicts of interest, etc.
Unbundling Options under the 3rd EU Energy Package

<table>
<thead>
<tr>
<th>Ownership Unbundling</th>
<th>ISO</th>
<th>ITO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Ownership:</strong> by independent undertaking</td>
<td><strong>System Ownership:</strong> by integrated undertaking</td>
<td><strong>System Ownership:</strong> by integrated undertaking</td>
</tr>
<tr>
<td><strong>System Operation:</strong> by independent undertaking (can be also the Owner)</td>
<td><strong>System Operation:</strong> by an ISO</td>
<td><strong>System Operation:</strong> by (same) integrated undertaking/ Legal &amp; Functional unbundling requirements</td>
</tr>
</tbody>
</table>
The Unbundling process towards the 3rd EU Energy Package

Key Concepts introduced:
- first common rules for generation, supply, transmission
- Unbundling of accounts
- Negotiated Third Party Access

Key Concepts introduced:
- Legal and Functional Unbundling
- Regulated Third Party Access
- introduction of rules on national regulators
Where does the 3rd EU Energy Package aim to?

Further Market Integration will deliver a Single European Market not only for Day-Ahead but also for Intraday, Forwards and Balancing.
...and where are we now?

**Current Status**

15 Countries DA Coupled as of May 2014

<table>
<thead>
<tr>
<th>REGIONAL IMPLICIT AUCTIONS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CWE</td>
<td>Price coupling</td>
</tr>
<tr>
<td>Austria</td>
<td>1 AT PX price coupled to GE (no congestion)</td>
</tr>
<tr>
<td>GB</td>
<td>1 GB PX price coupled to NL via BritNed only</td>
</tr>
<tr>
<td>Nordic + Estonia</td>
<td>Price coupling, also Poland via Swepol</td>
</tr>
<tr>
<td>ITVC</td>
<td>Volume coupling, also CWE - Nordic</td>
</tr>
<tr>
<td>Italy - Slovenia</td>
<td>Price coupling</td>
</tr>
<tr>
<td>Mibel</td>
<td>Price coupling</td>
</tr>
<tr>
<td>Czech - Slovak</td>
<td>Price coupling</td>
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The organization of the electricity sector

4 models (evolution over time):

- Monopoly
- Single Buyer
- Wholesale Competition
- Full Competition
Pre-liberalization Model: Monopoly

Vertically integrated (usually state-owned) company

- GENERATION
- TRANSMISSION
- DISTRIBUTION
- SUPPLY

- High Voltage customers
- MV & LV customers

- Electricity flows
- Contracts

Imports, Exports
Full competition model (1) (wholesale, retail cash flows)

Contracts - centralized market

Wholesale

Retail
Full competition Model (2) (wholesale, retail cash flows)

Bilateral Contracts

- Generator 1
- Imports
- Generator n
- Supplier 1
- supplier 1
- consumers
- Suppliers
- Export
- Supplier 2
- consumers

Wholesale - bilateral
Retail
Full Competition Model

The actors (by order of competitive behavior)

More Competition

Generating companies (GENCOs)
Supply (retailers) companies
Large consumers
Small consumers
Wholesale Market Operator (MO)
Distribution Network Operator (DSO)
Transmission System Operator (TSO)
Regulatory Authority

Less/No Competition
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Are “Competition” and “Reliability” real competitors?

The value chain for reliable electricity supply:
Energy security, adequacy and system security

Reliability of electricity supply

Source: Lessons from liberalised electricity markets, IEA, 2005
Fortunately, some things don’t change!
Electricity Markets – Focus on Market Timelines

- **Time-line**
  - **Long-term/ Mid-term**
    - (years to days ahead)
    - **Forward Market**
      - Uncoordinated Trading
      - Hedge against price volatility
  - **Day D-1**
    - DA Market
    - Schedule gen. units start-up
  - **Days D-1 / D**
    - Intra-Day Market
    - Adjust (‘optimise’) buy/sell positions
  - **Real Time**
    - Real-Time Market
    - Supply / Demand Balance
The time dimension of the EU Target Model

<table>
<thead>
<tr>
<th>Long term PTRs with UIOSI or FTRs</th>
<th>Day ahead market (flow-based market coupling)</th>
<th>Intraday market (continuous trade, implicit allocation with capacity pricing)</th>
<th>Balancing Service providers bidding</th>
</tr>
</thead>
<tbody>
<tr>
<td>months to years ahead</td>
<td>Day ahead</td>
<td>Hours-15 min</td>
<td>SO balancing transactions</td>
</tr>
<tr>
<td>Buyer – seller (broker)</td>
<td>MO/Power exchange</td>
<td>MO/PX</td>
<td>SO</td>
</tr>
<tr>
<td></td>
<td>Bilateral contracts</td>
<td>Cross-border gate closure (h-1)</td>
<td>t-15min t</td>
</tr>
</tbody>
</table>
Power Exchanges

**auction trading** (simple bids and offers)

- Everything is sold at the market clearing price
- Price is set by the “last” unit sold

- **Marginal producer:**
  - Sells this last unit
  - Gets exactly its bid

- **Infra-marginal producers:**
  - Get paid more than their bid
  - Collect economic profit

- **Extra-marginal producers:**
  - Sell nothing
TSO Role in Balancing (1)

- **Two different models:**
  
  **Model 1: Sequential market/TSO responsibility**

  ![Diagram](Direction 1: Sequential model)

  - Market dispatch
  - Reserves hand-over
  - TSO dispatch of all reserves
  - Scheduling gate closure
  - Reserve bidding gate closure

  **Model 2: Parallel market/TSO responsibility**

  ![Diagram](Direction 2: Parallel model)

  - Market dispatch (inter- and intrazonal)
  - Realtime
  - Market dispatch (intra-zonal)
  - TSO dispatch
  - Cross-zonal scheduling gate closure
  - Reserve bidding gate closure
  - Intra-zonal scheduling gate closure (ex-post)
# TSO Role in Balancing (2)

<table>
<thead>
<tr>
<th>Sequential model</th>
<th>Parallel model</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSO has full reserve control</td>
<td>TSO has partial reserve control</td>
</tr>
<tr>
<td>Dispatch freedom bound to schedule</td>
<td>Dispatch freedom out of schedule</td>
</tr>
<tr>
<td>Fits “weak” grids; more time and scope for redispatch</td>
<td>Requires strong grid within the zone; less time and scope for redispatch</td>
</tr>
<tr>
<td>TSO needs more reserves</td>
<td>TSO needs less reserves</td>
</tr>
<tr>
<td>Tends to weaker balancing incentives, due to partial market responsibility for the supply/demand energy balance</td>
<td>Tends to stronger balancing incentives due to full market responsibility for supply/demand energy balance</td>
</tr>
</tbody>
</table>
### Capacity Remuneration Mechanisms

<table>
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<th>Capacity Obligation</th>
<th>Capacity Auctions</th>
<th>Strategic Reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>• decentralized</td>
<td>• centralized process</td>
<td>• centralized mechanism (tender) run by the TSO</td>
</tr>
<tr>
<td>• obligation applied to the supply side</td>
<td>• assessment of the required capacity</td>
<td>• (typically) year ahead the TSO sets the requirements following an adequacy study</td>
</tr>
<tr>
<td>• obligation fulfilled either by direct contracts with generators or through capacity certificates</td>
<td>• covering several years in advance</td>
<td>• different tenders may run depending on the type of reserve</td>
</tr>
<tr>
<td>• self assed -duration</td>
<td>• price set by the auction (all successful generators are paid the same price)</td>
<td>• costs charged through TSO charges to network users</td>
</tr>
<tr>
<td>• generators receive a market based price</td>
<td>• costs charged to suppliers (end customers)</td>
<td></td>
</tr>
</tbody>
</table>
Capacity Remuneration Mechanisms in Europe

Thank You!

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