COMPETITIVE ENERGY MARKETS AND CROSS-BORDER TRADING

JAN ZAKRAJŠEK

TBILISI, AUGUST 2010
OUTLINE

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- MARKET DESIGN
- WHOLESALE ENERGY MARKET
- EU ENERGY MARKET
- SEE ENERGY MARKET
- CROSS-BORDER CONGESTION MANAGEMENT METHODS
  - IMPLICICIT ALLOCATIONS
  - EXPLICIT ALLOCATIONS
  - MARKET COUPLING/SPLITTING
WHY TO INTRODUCE COMPETITIVE ENERGY MARKET?

• Benefits of introducing competition
  – Efficiency
    • Lower costs > Add value > Increase margins > Economic growth > Social welfare
  – Fair market price
    • Clear signal for investors > New investments > Economic growth > Social welfare
MAIN PRINCIPLES OF COMPETITIVE ENERGY MARKET

- Transparent and non-discriminatory access (exit) to the market
- Availability and accuracy of market information
- Efficient administration and market operations
- Managing the risks
- Legal unbundling and privatisation of commercial services
MARKET DESIGN FRAMEWORK

Market design shall deliver the results set by the energy policy.

- Energy licensing
- Tariffication
- Green mechanisms
- Environmental issues
- Infrastructure investment
- Transmission rights
- CB capacity allocations
- Ancillary services
- Balancing requirements
- Imbalance settlement
- Scheduling protocols
REGULATORY FRAMEWORK OF COMPETITIVE MARKET (I/II)

• Government
  – Energy Act

• Ministry
  – Decrees on Performance of Public Services - TSO, DSO, MO
  – Decrees related to Small Renewable Producers
  – Decree on the Licenses for Energy Activities

• Regulator Agency
  – Methodologies for Grid Fee calculation
  – Rules for obtaining and revoking energy license
REGULATORY FRAMEWORK OF COMPETITIVE MARKET (II/II)

- **Transmission System Operator**
  - Transmission Grid Code (approved by REG + GVT)
  - Rules on Access to Cross-border Capacity (approved by REG + GVT)
- **Distribution System Operator**
  - Distribution Grid Code (approved by REG + GVT)
- **Market Operator**
  - Market Rules (approved by REG + GVT)
  - Balancing Market Rules (approved by TSO + REG)
  - Renewables Support Scheme Code (approved by GVT)
THE ROLE OF MARKET OPERATIONS

Example of Slovenian Market Operator BORZEN

Market Operator as a Public Service Obligation

Market Operations
- Recording of closed contracts
- Recording of operational forecasts
- Drawing up of the operating schedules
- Imbalance settlement
- Balancing market

Balance scheme management
- Balance scheme membership contracts register
- Open contracts register

Centre for RES/CHP Support
- Feed-in system for RES/CHP
- Security of supply based on DPE
- Ensuring adequate level of installed production capacity
- Programmes for efficient use and saving of electricity
- Guarantee of origin registry
- Wood biomass exchange

Financial settlement
EXAMPLE OF BALANCE SCHEME (BORZEN, SLOVENIA)
WHOLESALE ENERGY MARKET

An opportunity for buyers and sellers to:

• Compare prices and search for arbitrage opportunities
• Estimate portfolios:
  – Sell surpluses
  – Buy deficits

The result is a market equilibrium between supply and demand.
WHOLESALE ENERGY MARKET II/II

Market equilibrium
– brings economic and social welfare

- Market price
- Volume transacted
PRODUCTS DEFINITION

- Physical hourly products
  (00-01, 01-02, 02-03……. 23-00)

- Physical block products
  Base, Peak, Off-peak, EU-peak, EU-Off-peak…

- Financial products
  Futures, Forwards, Options, etc.
MARKET RELATIONSHIPS

- **Bilateral**
  - Market participants are concluding transactions bilaterally

- **OTC**
  - Concluding transactions through intermediate/broker
    - GFI, ICAP, SPECTRON, etc.

- **Organized wholesale markets**
  - **Mandatory Pool**
    - HTSO - Greece, NordPool - Scandinavia, Opcom – Romania
  - **Power Exchange**
    - SouthPool - Slovenia, EEX - Germany/France, EXAA - Austria, etc.
## MARKET RELATIONSHIPS

<table>
<thead>
<tr>
<th>Market</th>
<th>Bilateral markets</th>
<th>Brokerage (OTC)</th>
<th>Organized wholesale markets</th>
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<tr>
<td>Relationships</td>
<td>Bilateral relationships / Agreements, EFET</td>
<td>Intermediaries / Brokers</td>
<td>Exchanges</td>
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<td>Regulation</td>
<td>Non-regulated</td>
<td>Non-regulated</td>
<td>Regulated</td>
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<tr>
<td>Products</td>
<td>Non-standardized products, EFET</td>
<td>Standardized and non-standardized products</td>
<td>Standardized products</td>
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<tr>
<td>Partner</td>
<td>Known partners</td>
<td>Anonymity varies</td>
<td>Anonymity</td>
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<td>Principle</td>
<td>Phone, email</td>
<td>Phone, email, platform</td>
<td>Online platform</td>
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<td>Prices</td>
<td>Non-transparent prices</td>
<td>Non-transparent / Transparent prices</td>
<td>Transparent prices</td>
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<tr>
<td>Costs</td>
<td>No transaction costs</td>
<td>Low transaction costs</td>
<td>Transaction costs</td>
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<tr>
<td>Risk</td>
<td>Counterparty risk</td>
<td>Counterparty risk</td>
<td>No counterparty risk</td>
</tr>
<tr>
<td>Admission</td>
<td>No admission</td>
<td>Simple admission</td>
<td>Complex admission</td>
</tr>
</tbody>
</table>
MARKET TIMEFRAME

Intra - Day
- Physical market
- Hourly products
- Continous trading/ Auctioning
- Imbalance settlement
- Operational dependence

Day and Week Ahead
- Physical market
- Hourly and block products
- Auctioning / Continous trading / Bilateral
- Portfolio management
- Weather and operational dependence

Long term (M,Q,Y,2Y,3Y)
- Financial and physical market
- Physical and financial products (futures, options…)
- Continous trading / Bilateral
- Risk management
- Long-term planning
MARKET DEVELOPMENT

Level:

- **0**: Closed market
  - Non-liquid bilateral market
  - Few (private) market participants.

- **1**: Partially opened market
  - Liquid day-ahead bilateral market
  - Partially liquid organised DAM
  - Some (private) market participants

- **2**: Competitive day-ahead market
  - Sufficient market volume on DAM
  - Increased number of market participants
  - Development of a price index

- **3**: Partially liquid future market (forward)
  - Introduction of long term products
  - Portfolio management development

- **4**: Competitive wholesale market
  - Liquid day ahead and long term market
  - Many market participants
  - Perfect competition

- **5**: Partially liquid financial derivatives market
  - Market participants with a need for a risk management products

- **6**: Liquid financial derivatives market
  - Market participants with a need for a complex risk management products

Number of transactions:
- ~0:1
- ~0:1
- ~1:1
- ~3:1
- ~5:1
- >10:1

Margins development:

Financial vs. physical trading ratio:

<table>
<thead>
<tr>
<th>Level</th>
<th>Number of Transactions</th>
<th>Margins Development</th>
<th>Financial vs. Physical Trading Ratio</th>
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<tbody>
<tr>
<td>0</td>
<td>0:1</td>
<td>0:1</td>
<td>~0:1</td>
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<td>~5:1</td>
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<td>5</td>
<td></td>
<td></td>
<td>&gt;10:1</td>
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<tr>
<td>6</td>
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</table>
EU ENERGY MARKET

- European market EU-27
  450 million customers, total consumption 3.000 TWh

- Liberalization process
  Started in 1990’s with rules for the internal market in electricity, Directive 96/92/EC and Directive 2003/54/EC.

- The internal energy market contributes to:
  - establishing healthy competition,
  - securiting of energy supplies,
  - reinforcing the competitiveness of the European economy, and
  - a better use of existing cross-border capacities.
Transmission System Operations – ENTSO-e

- Performed by 42 TSOs from 34 countries
- Activities among 6 associations:
  - Reliable operations and management
  - Technical evolution and security of supply
  - Market integration
  - Network development statements
  - Network codes
  - Consultation with stakeholders and
  - Positions towards energy policy issues
Transmission System Operations – ENTSO-e

Comparison of transmission tariffs: sum of generation and load fees

Source: ENTSO-e; 2010
REGIONAL MARKET APPROACH TOWARD SINGLE MARKET

A STEP-BY-STEP APPROACH

- MARKET OPENING
- HARMONISATION OF MARKET RULES / DESIGNES
- HARMONISATION OF NETWORK TARIFFICATION SYSTEMS
- HARMONISATION OF CONGESTION MANAGEMENT METHODS
SEE CROSS-BORDER TRADING

Total physical export in SEE was 58 TWh in 2009
Total physical import in SEE was 63 TWh in 2009
CROSS-BORDER FLOWS IN SEE

GWh IN 2008
HYDROPOWER INVESTMENT PROMOTION PROJECT (HIPP)
TRANSMISSION CAPACITY DEFINITION

Total transfer capacity (TTC)
Is the maximum exchange program between two areas

Transmission reliability margin (TRM)
Is a security margin that incorporates uncertainties about the calculated TTC values

Net transfer capacity (NTC)
Defined as NTC=TTC−TRM, is the maximum exchange program between two areas compatible with security standards

Already allocated capacity (AAC)
Is the total amount of allocated transmission rights including capacity or exchange programs.

Available transmission capacity (ATC)
Defined as ATC=NTC−AAC, is the portion of NTC that remains available after each phase of the allocation procedure for additional commercial activity.
RIGHTS AND OBLIGATIONS ARISING FROM ALLOCATED PTR

– Gives the right to the holder for nomination of cross-border contracts,
– Gives the right and obligation to the holder to notify (schedule) the cross-border transfer,
– Allow the holder to use it or not (UILI or UISI conditions)
Capacity Allocation in SEE and CEE
Timeframe of allocated CB capacity

- Yearly > UIOSI on monthly basis
- Quarterly > UIOSI on monthly basis
- Monthly > UIOSI on daily/weekly basis
- Weekly > UIOSI on daily basis
- Daily UIOLI
- Intra-Daily UIOLI
- Balalancing

Source: Power Market Functioning In Practice, Peter Styles
Level of coordination (I/II)

– **Unilateral Allocation**
  The issuer of cross-border rights is offering only the share ‘belonging’ to the market it represents

– **Joint Allocation**
  All the rights between the markets involved are offered by a single issuer

– **Coordinated Allocation Mechanism**
  All the rights between the markets involved are defined and offered in full coordination
LEVELS OF COORDINATION IN SEE

Central Allocation Office for SEE (CAO) – 2010, 2011?
www.central-ao.com
TRANSMISSION GRID MODELLING

• Market model of the transmission grid is the basic input to any capacity allocation and use:
  – **Zonal model**, introducing market zones, where transfers are not affected by congestions in transmission grid within
  – **Nodal model**, each node in the transmission grid is a separate market zone

• In Europe, market zones generally coincide with individual TSO’s control zones (with notable exception of the Nordic markets and, in some respects, Italy)
TRANSMISSION GRID MODELLING

• Available capacities for commercial transfers between the markets can be calculated in different styles:
  – interconnection-centric: NTC / ATC
  – flow-based: PTDF & BC (CAO)

• In Europe, only interconnection-centric approach is used (for the moment)
FIRMNESS OF THE CAPACITY

- Firmness defines whether the issuer can curtail the capacity allocated:
  - **Firm** – no curtailment/withdrawal/cancellation is possible
  - **Non-firm** – subject to ‘Force Majeur’ and possibly a wider range of conditions

- Main issues:
  - Market Coupling is only possible with firm capacity
  - ‘Force Majeur’ definitions vary substantially and auditability of reasons for its execution is very limited
  - Compensation in case of curtailment is subject to individual product definitions (according to rules for allocation)
Criteria for evaluation of congestion management methods

- Market-based
- Fair and non-discriminatory
- Economically efficient
- Transparent
- Feasible
- Compatible with the market structure
CAPACITY ALLOCATION METHODS

NON-MARKET BASED METHODS

- Priority based
  - Green priority
  - First come, first serve
- Pro rata
  - Access limitation
- Other
  - Different legal framework
  - Retention

MIGHT GIVE INCORRECT ECONOMIC SIGNALS.

MARKET BASED METHODS

GIVE PERFECT ECONOMIC SIGNALS. THE METHODS ARE THE PREFERRED SOLUTIONS IN A MARKET ENVIRONMENT.

- Explicit Auctions
  - Marginal price
  - Pay as bid
- Implicit Auction
  - Market Coupling
  - Market Splitting

OTHER
Non – market based allocation methods

PRIORITÉ BASED

☐ The method is non-discriminatory, transparent and easy to implement compared to other mechanisms.

☐ Most common is first come, first serve – chronological ranking of reservations until all the capacity is allocated.

☐ They usually favour domestic entities and long-term trade

☐ Drawback: they do not give any economic incentive to other market players.
Non – market based allocation methods

PRO RATA

- Based on *principle of pro-rata curtailment* of transactions
- All transactions are partially curtailed – proportionally to the requested capacity.
- This method *provides no incentives* toward the efficient use of the grid.
- *Pro rata cause unwanted behavior* – market players secure the desired quantity by overestimating capacity needs. With this method some anti-gaming measures, such as obligations to use all designated capacity should be introduce.
Non – market based allocation methods

OTHER

- ACCESS LIMITATION: This method applies to DC interconnectors with ownership that differs from linked networks. A few users may retain benefits from cross-border trade.

- DIFFERENT LEGAL FRAMEWORK: This method applies to countries such as Switzerland and Russia, that are not EU member states and that do not follow EU legislation.

- RETENTION: In this case the capacity is reserved for vertical integrated utilities.
Market based allocation methods

**AUCTIONING**
- Explicit auctions (capacity only)
- Implicit auctions (capacity is a by product)
Market based allocation methods

EXPLICIT AUCTION I/II

- Explicit auctions make a distinction between transmission capacity and energy. Only transmission capacity is allocated.

- Capacity is not coupled to energy:
  - Advantage: Easier to introduce; in case of low liquidity of the market or no PX on one (both) side(s) of the border
  - Disadvantage: capacity has to be valued under high price uncertainties → lead to unused arbitrage possibilities
Market based allocation methods

EXPLICIT AUCTION II/II

- Two different price-setting mechanisms:
  - Market clearing price (preferred)
  - Pay-as-bid price
Market based allocation methods

IMPLICIT AUCTION I/III

- Implicit auctions do not make a distinction between energy and transmission capacity.
- Transmission capacity is a by-product, although they bring congestion revenue to TSO if congested.
- Bids are standardized as to allow the use of netting
- No inefficient capacity reservations are necessary
- Directions of power flows are dictated by the market
  - Energy flows from the lower price market to the higher price market
Market based allocation methods

**IMPLICIT AUCTION II/III**

- If enough transmission capacity exists market prices in each area become equal, otherwise.
- Higher market price is obtained in the area downstream of congestion, and lower in the area upstream.
- Demand and supply in regional markets are matched based on submitted bids in all areas.
Market based allocation methods

IMPLICIT AUCTION III/III

Lower price market

Higher price market
## Market based allocation methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicit</td>
<td>- Easier to introduce</td>
<td>- A distinction between transmission capacity and energy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Capacity has to be valued under high price uncertainties</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Lead to unused arbitrage possibilities</td>
</tr>
<tr>
<td>Implicit</td>
<td>- 1 product</td>
<td>- More complex harmonization and introduction</td>
</tr>
<tr>
<td></td>
<td>- No inefficient capacity reservations are needed</td>
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</tr>
<tr>
<td></td>
<td>- Alleviate market players of extra costs</td>
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</tr>
<tr>
<td></td>
<td>- Flows are dictated by the market (A&gt;B)</td>
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</tbody>
</table>
Two types of market integration with implicit auctions

- Market integration can be either centralized or decentralized, i.e. "market splitting" or "market coupling"
- Trading can be organized by one or by several exchanges in cooperation

**Market Coupling**
(e.g. FR-BE-NL, SLO-ITA 2011)

**Market Splitting**
(e.g. Nord Pool)
What is Market Coupling?

- Day-ahead trading where supply and demand can meet
- Comprises two or more bidding areas (countries)
- The purpose is maximization of economic surplus of all participants: cheaper generation in one country can cover more valuable demand in another country and vice-versa
- If there is no congestion, there is only one price for all of the bidding-areas.
Positions on Market Coupling/ Implicit Auctions

EC: Market Coupling has “…the highest potential of truly integrating the European electricity market through implicit auctions at the day-ahead stage.”; while explicit auctions “…often lead to inefficient use of interconnection capacity and prevents market integration.” (Report on the experience gained in the application of the Regulation (EC) No 1228/2003 "Regulation on Cross-Border Exchanges in Electricity", 2007)

ERGEG: “…it is now widely recognized that for the day-ahead timeframe, implicit allocation methods are more efficient than explicit auctions and should be the target mechanism for all regions for the day-ahead timeframe.” (ERI Convergence and Coherence Report, 2007)

ETSO & EuroPEX jointly about flow-based market coupling: “…integrated markets are in general more efficient than separate ones, but accept that coupling of regional markets is the most realistic way of achieving efficiency benefits in the short and medium term.” (Flow-based Market Coupling–Interim report, 2004)
Market Coupling between SLO and ITA

- 2 spot areas
- Implicit auctions for D-1
- Explicit for M-1 and Y-1
- Starts in 2011
NordPool – Market Splitting

- ELSPOT - 6 DAM areas
  - Norway – Statnett (two bid areas)
  - Sweden – Svenska Kraftnät
  - Finland – Fingrid
  - Denmark – Jutland & Zealand (two bid areas)
Trilateral Coupling of The Belgian, Dutch and French Electricity Markets

- FR-BE-NL: 3 spot areas
- Implicit auctions for D-1
- Explicit for M-1 and Y-1
Thank you for your attention!

COMPETITIVE ENERGY MARKETS AND CROSS-BORDER TRADING

Jan Zakrajšek

E-mail: jan_zakrajsek@yahoo.com

Phone: +386 41 561 709