The more co-operation, the more competition?

Possible effects of Market Integration of the Belgian and Dutch power markets

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Overview of the presentation

• Introduction to COMPETES model
  - Questions addressed
  - Model structure
• Congestion management B ↔ NL
  - Current auction system
  - Proposed market integration
• Effects of Market Coupling
• Sensitivity analysis on physical capacity: Value under different policies
• Assessment of the liberalised Northwestern European electricity market

• Questions: What is the effect of energy market design & structure, considering generator strategic behaviour, upon:
  ✓ Electricity market prices
  ✓ Transmission prices
  ✓ Income distribution (TSO revenues, profits, consumer surplus)
Why has ECN developed COMPETES?

- Endogenous modelling of strategic behaviour
- Integrating exchanges with neighbouring countries
- Taking into account of (congestion in) the electricity network → Nodal Pricing
COMPETES

Geographic scope of the model
COMPETES

Market structure - Transmission operator

Oligopolistic generators

Sell bilateral to consumers

Buying transmission services from TSO against price $w$

Consumers

TSO
COMPETES

*Market structure - Arbitrageur*

Oligopolistic generators

Arbitrageur trades electricity $p_1 - p_2 > w_{2\rightarrow 1}$

TSO

Consumers

Bilateral $\rightarrow$ Power Exchange
COMPETES

Transmission network

- Type of Game ≈ Cournot
- Physical representation network
  1. Linearized DC Load Flow
  2. Several nodes per country (6 NL, 2 Be)
- Path based representation
  - One node per country → one market price per country
  - Interfaces defined between countries
  - Crediting for counterflows (netting vs. no-netting)
COMPETES

Solution properties

• Complementarity formulation
  - Direct solution of equilibrium conditions
  - Solves large models (1000s of variables)

• Methodology
  - Derive the first-order conditions for each player
  - Formulate market clearing conditions
  - Solve resulting system of conditions
COMPETES

Inputs

• Demand
  - 12 periods $\rightarrow$ 3 seasons, 4 load periods
  - Allocated to the different nodes
  - Source: TSOs and UCTE

• Generation
  - 15 large power generators (4 NL, 1 B, 2 F, 8 G)
  - 5272 generating units in total
  - Marginal costs based on efficiency and fuel type
What are the impacts of a reformed Congestion Management system for B ↔ NL?
Congestion management B ↔ NL

Current Auction System

- Yearly, monthly and daily auctions
- Available capacity for auction [www.tso-auction.nl]
  - Belgium - Netherlands: 1150 MW
  - Germany - Netherlands: 2200 MW
- Total import capacity to NL \( \leq 400 \) MW per party
- Price set by lowest accepted bid
- Daily auction takes place before APX settles
Congestion management B ↔ NL
Proposal for market integration

• Single market
  - One market price
  - TSO responsible for re-dispatch
  - Payments for constrained-off or -on

• Market Coupling (Splitting)
  - Similar to the NordPool
  - If Congestion: two separate market prices

• Brattle advice (February 2003):
  - Market Coupling with divestiture of generating capacity in Belgium
What are the impacts of Market Coupling between B ↔ NL?
Effects of Market Coupling

Differences with the current situation

1) Increased market access into Belgium
   - For (foreign) Generators and
   - For Traders → Introduce arbitrage

2) Netting of transmission capacity

3) Efficient co-ordination of ‘Auction’ and APX
## Effects of Market Coupling

### Definition of scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Import cap on firms</th>
<th>Import cap on arbitrageurs</th>
<th>Netting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B $\rightarrow$ NL</td>
<td>NL $\rightarrow$ B</td>
<td></td>
</tr>
<tr>
<td>Competitive</td>
<td>No limit</td>
<td>No limit</td>
<td>No limit</td>
</tr>
<tr>
<td></td>
<td>B $\rightarrow$ NL</td>
<td>NL $\rightarrow$ B</td>
<td></td>
</tr>
<tr>
<td>Current situation</td>
<td>400</td>
<td>0</td>
<td>950</td>
</tr>
<tr>
<td>Market splitting</td>
<td>None*</td>
<td>None*</td>
<td>None*</td>
</tr>
</tbody>
</table>
Model results
Competitive scenario
€/MWh
Model results
Current Situation vs. Competitive €/MWh

- No netting
- Arbitrage N↔G
- Belgium ‘closed’
- Imports NL 400 MW per party

14.0 (-.3)

33.5 (+5.5)

45.9 (+16.9)

22.5 (+3.6)

7.9

10.9
Model results

Market Splitting vs. Current Situation €/MWh

- Netting $N \leftrightarrow B$
- Arbitrage $N \leftrightarrow G$

Belgium open:
- Arbitrage $N \leftrightarrow B$

Values:
- $37.9 (±4.4)$
- $37.4 (±8.5)$
- $14.1 (±1)$
- $22.2 (±0.4)$
- $7.5$
- $14.7$
- $0.4$
- $16.1$
- $1.0$
Effects of Market Coupling

Welfare comparison compared to Perfect Competition

-3500 -2500 -1500 -500 500 1500 2500

Current Situation  Market Splitting

Difference with competitive Million €/yr

Consumer Surplus  Generators profit  Transmission revenue  Welfare
Effects of Market Coupling

Relevant conclusions

• Market Coupling affects prices and increases overall welfare (+ 182 mln €/yr more than current)
  - Induced by lower prices in Belgium
  - Increased welfare is mainly in Belgium

• What is “in it” for the Netherlands?
  - Profits Dutch generators increase
  - But consumer surplus decreases more
  - Increase of spot market volume
What if marginal costs in Belgium are lower than assumed?
Lower marginal cost in Belgium

All Belgian power plants decreased by 3 €/MWh

- Only marginal changes
- Belgian exports to France increase a little
- Conclusions on Market Splitting still apply:
  - Overall welfare increase
  - Decrease of welfare in NL
  - Prices in NL up, prices in BE down (to similar level)
What if large ‘Belgian incumbent’ is regulated \textit{acts competitively} in Belgium but Cournot elsewhere?
Regulated prices Belgian incumbent

*Electrabel modeled as a price-taker in Belgium*

- **Current Market Structure**
  - Prices lower in both BE and NL (-14.5 and -1.3 €/MWh) compared to unregulated prices in BE
  - Belgian price now lower than in NL

- **Market splitting**
  - Increases welfare
  - Lowers prices both in BE *and* NL

- **Reduced *market power* of Belgian incumbent results in overall price reduction**
Does the value of additional Transmission Capacity depend on the market design?
Value of transmission
10% increase of capacity B $\leftrightarrow$ NL

<table>
<thead>
<tr>
<th>Euro/MW/yr</th>
<th>Competitive</th>
<th>Current Situation</th>
<th>Market Splitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valuation</td>
<td>12658</td>
<td>-8694</td>
<td>734</td>
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<tr>
<td>Transmission</td>
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</tbody>
</table>

- **Competitive**: large increase of consumer surplus
- **Current market** structure: increase of arbitrage to BE, generators’ profits decreases
- **Market Splitting**: decrease of consumer surplus is offset by increase of generators’ profit
General conclusions
Based on COMPETES model results

• The current market structure in Northwestern EU hampers competition → prices above competitive
• Market Coupling increases overall welfare → Increases prices in Netherlands
• Lowering MC in BE has marginal effect → 3 €/MWh decrease only lowers BE prices ~ 0.3 €/MWh
• Price regulation in Belgium → Market Coupling reduces prices in both Netherlands and Belgium
• Valuation of transmission capacity depends significant on market design
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