Market integration: the Dutch-Belgian French market and beyond

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Agenda

- Introduction APX
- Market Coupling NL-B-Fr
- CWE market coupling NL-B-Fr-D-Lux
- Inter-regional matters: CWE-Nordic coupling and BritNed
APX Group: gas and electricity exchanges

- APX Gas NL (TTF)
- APX Power NL
- APX Gas UK (NBP)
- APX Power UK
- APX ZEE (Zeebrugge HUB)
- Market Coupling together with other exchanges
Corporate overview

Operations:
- 5 markets on line
- service activities
  - Operations (Belpex)
  - Market coupling (TSO’s)
  - Carbon clearing
- 206 gross memberships

Traded (2006):
- 178 TWh of energy
- € 5.3 billion of contracts
- 10% of UK gas demand
- 18% of NL power demand

Corporate:
- Anglo-Dutch management
- Positive financial results
- Shareholders TenneT (74.5%, Transmission System Operator NL) and Gasunie (25.5%, Gas infrastructure company NL)
APX Group volumes: Yearly Average GWh/day 1999 to 2007 (July)

- APX Power NL
- APX Power UK
- APX Gas UK
- APX Gas ZEE & NL

<table>
<thead>
<tr>
<th>Year</th>
<th>APX Power NL</th>
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<th>APX Gas ZEE &amp; NL</th>
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EnMO Acquisition (July 2003)
UKPX Acquisition (July 2004)
Development of APX Group Members per Market 1999 to 2007 (July)

- APX Power NL
- APX Power UK
- APX Gas UK
- APX Gas ZEE
- APX Gas NL

EnMO Acquisition (July 2003)
UKPX Acquisition (July 2004)
Types of electricity markets

- **Mandatory pricing**
  - Nodal pricing
  - Area pricing
    - No Im/export coordination
    - Im/export coordination

- **Voluntary**
  - Area pricing
    - No Im/export coordination
    - Im/export coordination

**Electricity markets**

- **Most of USA/Canada; South America; Australia, New Zealand, Russia**

- **UK before 2000, Spain, parts of USA/Canada**

- **UK today, Most parts of Europe 2000-today**

- **Scandinavia 1995, Netherlands-Belgium-France 2006 NW-Europe 2009**
Day-ahead spot market, area-based

- Market volume = outcome of market
- Physical suppliers and financial parties
- Voluntary market
- Some % of demand daily traded and priced
- Long term contracts can be physical or financial
Hourly day-ahead scheme + blocks

Demand Blocks example

Supply Blocks example
Daily schedule

00:00: Delivery + balancing market

11:00  Trading

16:00  OK  E-program

Prepare  11:00  Trading  12:00  E-program  16:00 OK  E-program

00:00: Delivery + balancing market
European electricity market

Achievements
- Free customers
- Transmission System (grid) operators
- Efficiency of utilities
- Role of regulators

Shortfalls
- Volatile prices
- Low liquidity
- Transparency issues
- Inefficient use of transportation
- High level of market concentration
- Market power issues

→ Fragmented market
Market Coupling removes fragmentation

Infrastructure
- Build more capacity.... and/or
- Make better use of existing capacity!
- → Market Coupling

Initiatives
- Scandinavia (Nordic Europe): from 1992
- New region:
  - Netherlands
  - Belgium
  - France
Explicit daily auctions:

- Risks of 2-step trading of capacity / energy
- No guarantee use it or lose it
- Im/exports not always in right direction (low→high price)
- Different to transfer power across successive borders
- Not all market participants participate in cross-border
- Area prices separate, even when there is no constraint

→ Integrate by market coupling
Hourly utilization of transit capacity between Netherlands and France, 2005

Source: Frontier Economics

- Adverse flow: 42% of all hours
- Incomplete use of im/export capacity, with remaining price differences

Nominated flow as % of available capacity

Net transit nomination as a percentage of available capacity

Hourly price difference: APX - Powernext (EUR/MWh)
(3) Bij voldoende capaciteit: 1 geharmoniseerde markt met 1 prijs
Advantages of Market Coupling

- Removes unnecessary risks of trading short-term transmission capacity and energy separately
- Guarantees the optimal utilization of transmission capacity
- Less prone to market abuse since capacity cannot be hoarded
- All market participants benefit from cross-border capacity
- Encourages liquid, robust spot markets

Optimal use of capacity (particularly when prices are close)

Single market (when there is sufficient capacity)
Market Coupling solution
Netherlands-Belgium-France

Before: separate operation of:
- Cross-border auctions/allocation
- Spot markets

- Sub-optimal use of cross-border capacity
- Incomplete, sometimes inadequate

After
- One integrated system, 1-step operation
- Spot markets and cross-border flows in one
- Generating spot market prices
- 3 exchanges working together
- Political will
- Start: 22 November 2006
Decentralized market coupling

Mechanism

Hourly “NEC” curves
(Net Export/import Curve)

- Start: exchange price without im/exports
- Price influence (down or up) on potential im/exports
- Each exchange produces NEC curves, based on bids in its area
- Can be done with different exchanges and systems
Decentralized market coupling: unconstrained/constrained

Unconstrained case:
Enough transmission capacity
Price for both areas identical: enough capacity to set one price at intersection of curves

Constrained case:
Limited transmission capacity
Prices for areas differ: set at max. im/exports; congestion revenue
TLC technical solution

TenneT → ELIA
  Available capacity
  NL-BE border

Coordination module

ELIA → RTE
  Available capacity
  BE-FR border

APX
  Bid- and offer
  information in
  standardized
  format
  Price & volume
  * = Iterative calculations

Belpex
  Resolve blocks

Powernext
  Settlement &
  Publishing of results

* = Iterative calculations
Market Coupling Daily Process

- TLC PXs harmonised Gate closure to 11:00am
- Average publication time results: 11.15 am
  *(Target time 11:30am, latest possible publication 11:45am)*
Import and export: co-operation between exchanges and grid companies
Price convergence

Daily average prices for TLC countries

<table>
<thead>
<tr>
<th>Date</th>
<th>Price (Euros/MWh)</th>
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<td>Dec</td>
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<td>Mar</td>
<td></td>
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<td>Apr</td>
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</tbody>
</table>

- **Powernext**
- **Belpex**
- **APX**
Price evolution

Daily average prices for TLC countries

- Powernext
- Belpex
- APX
Achievements of market coupling: integration of price areas

Either prices will converge 100%, or prices diverge – but then the transmission capacity used for 100%

→ Better price index
→ Better efficiency and better economic results
→ Better basis for long-term contracts & investments

Shown are the data for January 2007
Percentages vary each month

Old situation

100% of time

6%

73%: “Copper plate”
Achievements of market coupling: Price difference Netherlands-France

Hourly price difference, €/MWh

Before Market Coupling
Winter 2006

40% $\Delta P > 10\,€$

51% $\Delta P 1..10\,€$

8% $\Delta P < 1\,€$

After Market Coupling
Winter 2007

9% $\Delta P > 10\,€$

19% $\Delta P 1..10\,€$

4% $\Delta P < 1\,€$

68% $\Delta P=0$

Equal price “copper plate”
Exchanges becoming price areas
Percentages nov 06 – aug 07

Possible outcomes of TLC
1. BE-NL and FR-BE borders congested: 3 price areas
2. BE-NL border congested: 2 price areas
3. FR-BE border congested: 2 price areas
4. No congestion: 1 single market

With the old method: only outcome 1, even if there was enough transmission capacity to bring the prices together

Today, either prices will converge fully, or transmission capacity will be fully utilised
Import/export utilization before and after

Utilisation of day-ahead capacity on the Belgian-Dutch border

market coupling
Achievements of market coupling: utilisation of border interconnector

Utilisation percentage of Belgian-Dutch border
10-day moving average, November 2006-August 2007
Time % of fully utilized border capacity: Dutch-Belgian border Jan 2006 – May 2007

Utilisation full import capacity to NL
Utilisation full export capacity from NL

10 days average
TRILATERAL COUPLING OF THE BELGIAN, DUTCH AND FRENCH ELECTRICITY MARKETS
Mix of implicit and explicit auctions

Nordic model: only daily cross-border
- No auction of long-term capacity
- All capacity daily allocated in market “splitting”
- Long-term contracts are financial

Central European model: mix of daily and long-term
- Explicit auction for monthly/yearly capacity
- Daily capacity auction, explicit or implicit (=market coupling)
- Both physical and financial cross-border contracts

Future: Use It Or Sell It?
Parties submit explicit capacity back to TSO, receive implicit auction revenue
→ Use as FTR (Financial Transmission Right)
Market Coupling becomes bigger

- Scandinavia (Nordic Europe): from 1992
- Realized: (2006): France, Netherlands, Belgium
- Now: same countries plus Germany and Luxemburg: Memorandum of Understanding signed on 6 June 2007

European energy commissioner Piebalgs welcomes the Memorandum of Understanding.
Memorandum of understanding

MoU signed between CWE parties on 6 June 2007
- Ministries
- Regulators
- TSOs
- Exchanges
- Industry associations

Main features:
- Market coupling of CWE region plus adjacent regions likely to be already coupled (i.e., Nordic) plus other committed countries
- Introduction: 1 January 2009
- Capable of extension on other borders – other regions
- Flow-based transmission solution is the objective
- Possible intermediate step (based on individual border capacities)

Key issues
- Technical solution
- Governance framework
- Project organisation
Price convergence simulation for coupling in CWE region (NL-B-Lux-D-Fr)

Hourly price difference, €/MWh

Results Historically

<table>
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<tr>
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<th>Fr-NL</th>
<th>Fr-Ge</th>
<th>NL-Ge</th>
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<tbody>
<tr>
<td>∆P &gt;10 €</td>
<td>35%</td>
<td>38%</td>
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<tr>
<td>∆P 1-10 €</td>
<td>56%</td>
<td>52%</td>
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<tr>
<td>∆P &lt;1 €</td>
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Simulated coupling

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<th>Fr-Ge</th>
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<tr>
<td>Equal price “copper plate”</td>
<td>68%</td>
<td>54%</td>
<td>66%</td>
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* by APX

** simple daily ATC capacities like used in the explicit auctions (not flow-based)
Flow-based transmission model

- Market Coupling can be based on
  - Available transmission Capacity (ATC), Border-by-border
  - Power Transm. Distr. Factors
- Capacities/flows modeled as areas linked by bottlenecks; PTDFs used to calculate flows
- Physical electrical flow paths taken into account (loop flows), not “contract path”
- Maximises use of inter-area transmission capacity

*But …*
- Are countries the right areas?
- More detailed model? Internal constraints?
- Allocation/use of revenue?
Added functionality

- Extendable to N-markets
- Support for meshed networks with both AC and DC lines
- Use of PTDF matrices for AC lines (optional)
- Ramping on DC lines
- Losses over DC lines
- Per MW flow tariffs
- (Price difference bids for ATC modeled lines)
- (Exotic block bid formats)
Multilateral Market Coupling (MLC)

ATCs, PTDFs, ramping limits, losses and per MW flow tariffs

Coordination module

NEC* + NBV

APX

Belpex

Powernext

...N

Bids & offers

Settlement & Publishing of results

Price & volume

NEC = Net Export Curve

** = Iterative calculations
Inter-regional coupling
- NorNed
- German-Danish
- BritNed (NL-UK)
- Other regions?
How to couple the regions

Option type 3: Inter-Regional Coupling (MC Dome variant)

- Iberia
- CWE MC
- NPS
  - NO₁
  - NO₂
  - SW
  - Fi
  - DK₁
  - DK₂
- Italy, S-East
- UK
- Ir
- Central East

Coupling options:
- Tight coupling (Price + Volume)
- Loose or Volume coupling