

# Market Coupling

Ronnie Belmans

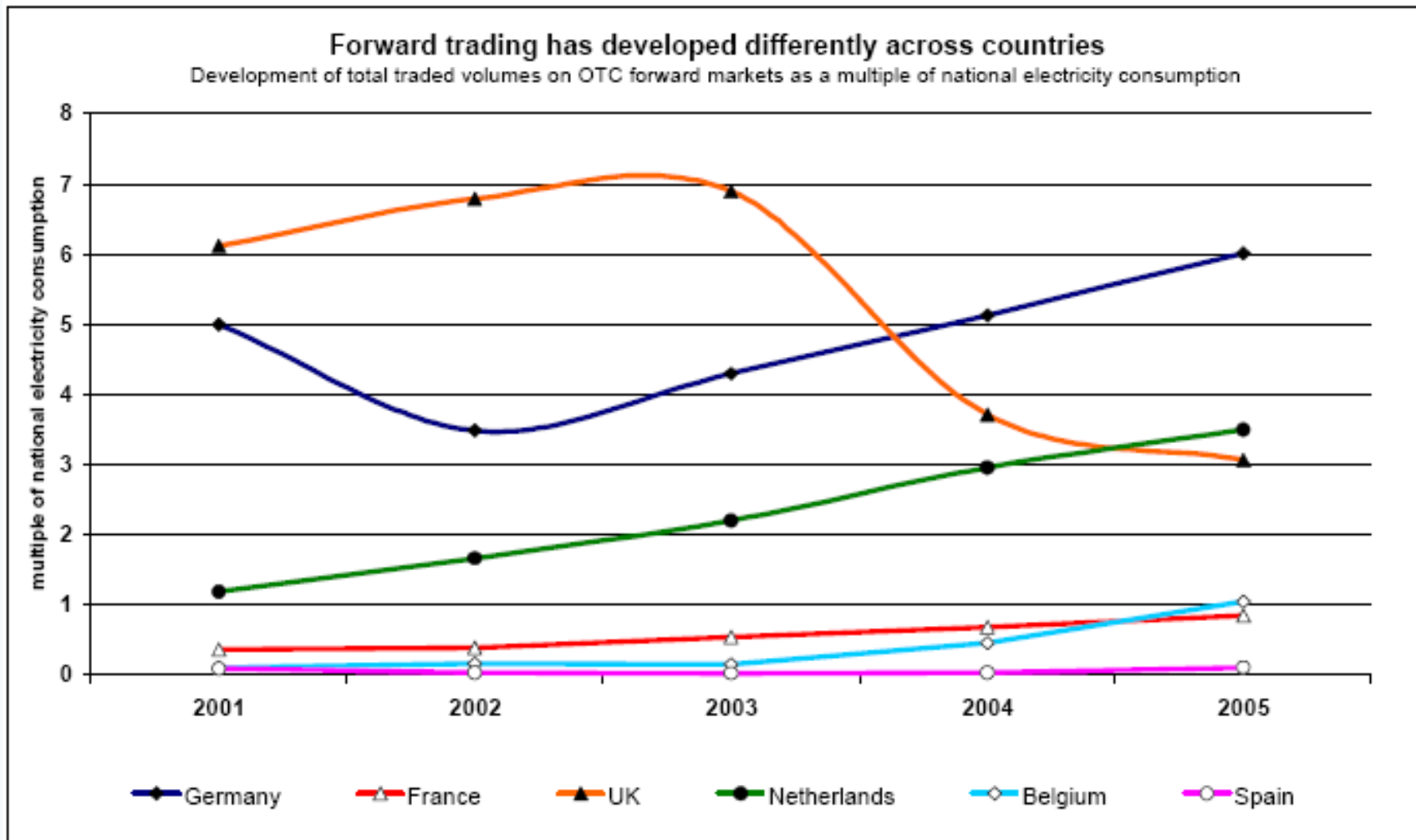
21 June 2007

Warsaw, Poland

- Introduction
- The situation in Europe and the US
- Belpex and Trilateral Market Coupling (TLC)
- A look into the future

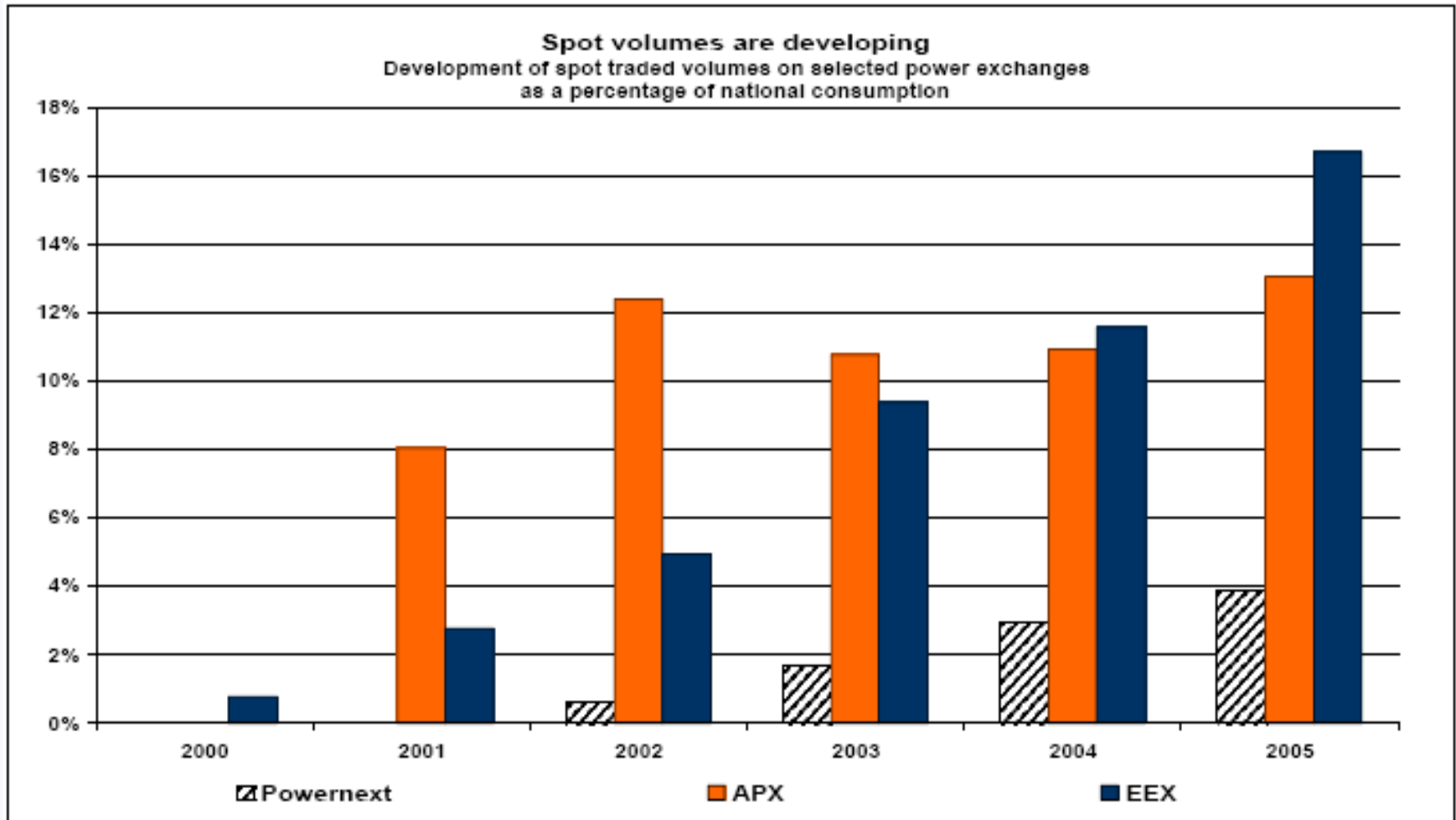
- Top down process constrained by
  - « *subsidiarity principle* »
- General conditions for market creation
  - Market opening, third party access, unbundling
- Initially too much freedom and long term deadlines
  - 1st Directive 96/92/EC allowed nearly everything except an Internal Electricity Market (Hancher)
- Recently less freedom and shorter term deadlines
  - 2nd Directive 2003/54/EC

# Evolution forward volumes



**Source: DG COMP**

# Evolution spot volumes



Source: DG COMP

- Short time interaction between demand and supply
- Anonymous
- Price signal for the market of bilateral contracts
- Close to delivery, generators and traders are vulnerable
- Physical aspects remain important

# Why power exchanges?

## Price signal for the market of bilateral contracts

**Prices on exchanges and OTC markets go hand in hand**  
Day-ahead baseload prices observed on the EEX and the German OTC market in €/MWh



Source: DG COMP Sector Inquiry

# Why power exchanges?

## Physical aspects

- Generation
  - Power output
  - Cost of primary energy
  - Start-up time
  - Dynamics
  - Lack of predictability
  - Physical storage (pumped hydro)
  - Maintenance
- Transmission capacity
- Balancing load and generation





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- Electricity Directive 2003/54/EC
- Moving away from (concentrated) national markets towards a European market for electricity
- ➔ Interconnecting different zones
- ➔ Market Coupling: all participants acting in the same market

# Introduction of markets in Europe

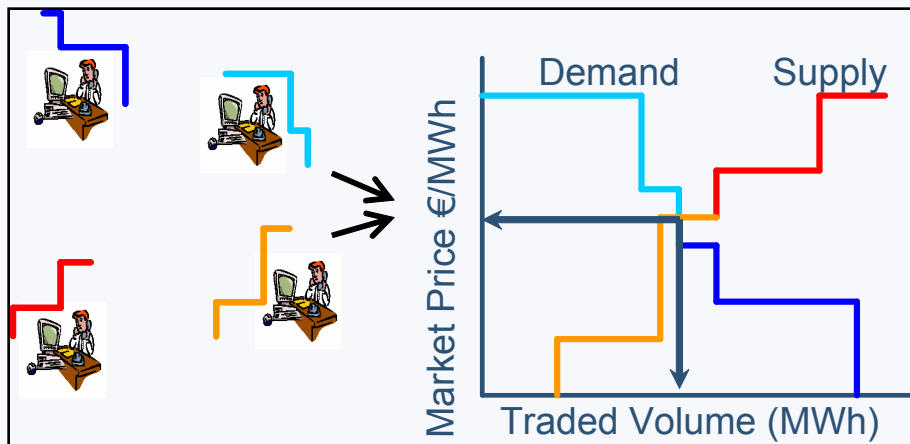
## Status

- Markets mainly national
  - Divers rules and procedures
- Wholesale trade
  - Mainly bilateral
    - Negotiated tailor made long term contracts
    - Over The Counter (OTC) trade
      - Sometimes organized by power exchanges
  - Supplemented with
    - Anonymous day-ahead auction trade
      - Organized by power exchanges

# Power exchanges

## Day auction design

- Mainly national auctions
- Steps towards one market:
  - NordPool
  - TLC



# DG COMPETITION REPORT ON ENERGY SECTOR INQUIRY

10 January 2007

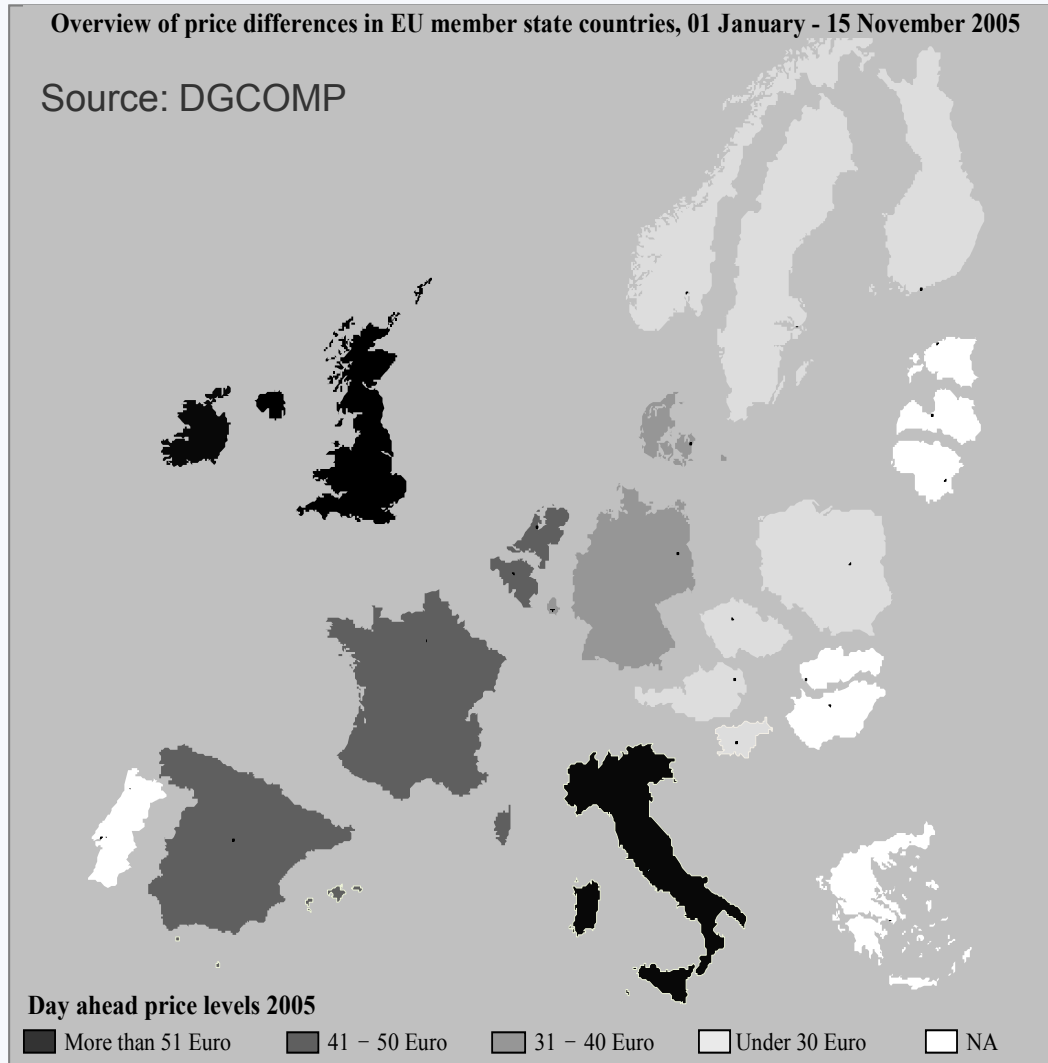
- Competition initially lowered energy prices in Europe in line with market fundamentals
- However
  - while progress has been made
  - the objectives of market opening have not yet been achieved
- Key areas which need to be addressed
  - (2) vertical foreclosure (most prominently inadequate unbundling of network and supply)
  - (3) **lack of market integration** (including lack of regulatory oversight for cross border issues)
  - (4) lack of transparency
  - (5) price formation
  - (6) downstream markets
  - (7) balancing markets
  - (8) liquefied natural gas (LNG)

# The Internal Electricity Market (IEM)

## Limited interconnections

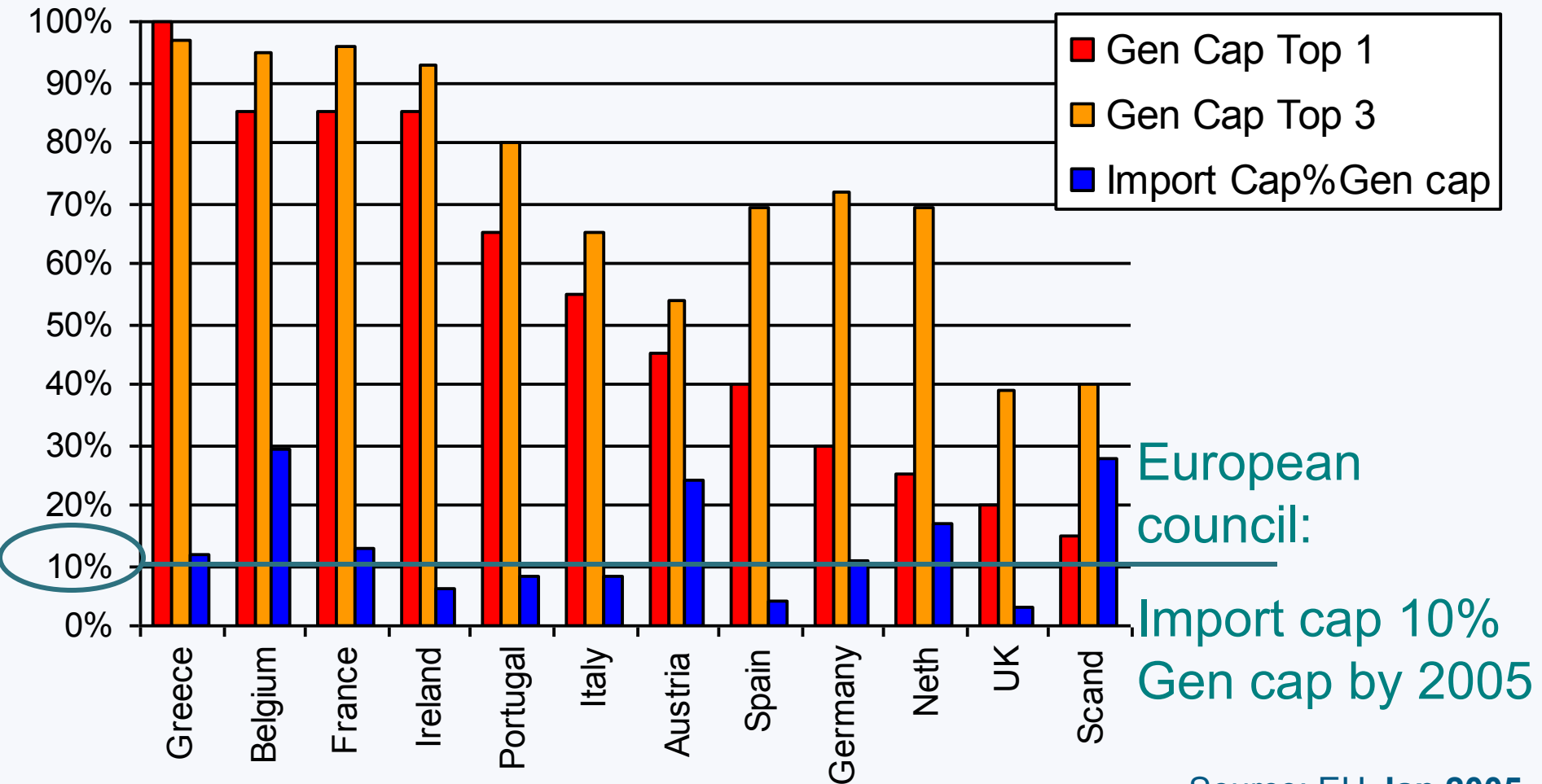
Overview of price differences in EU member state countries, 01 January - 15 November 2005

Source: DGCOMP



# The Internal Electricity Market (IEM)

## Limited interconnections



Source: EU Jan 2005

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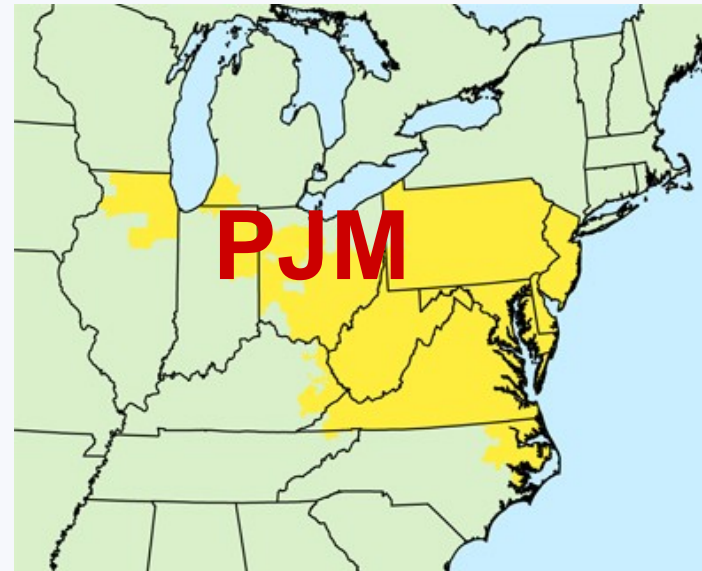


# The reference design

## PJM day-ahead Power Pool

- Mandatory participation
  - Demand side: consumers or their representatives (retailers/suppliers)
  - Supply side: generators
- Internal network constraints are taken into account
  - → Nodal pricing

Designed originally for Pennsylvania, New Jersey and Maryland



Currently regional market with 145 GW peak demand

# European Power Exchanges

## Day-ahead auctions

- Less efficient but simpler design

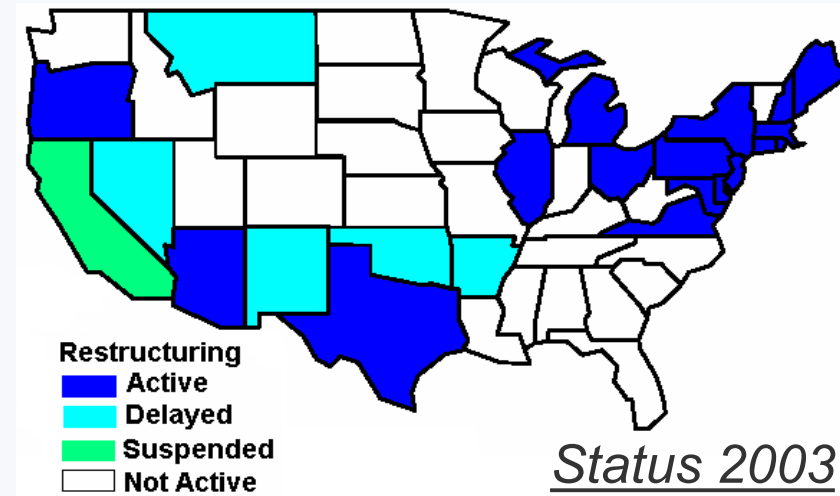
- Network constraints ignored
- Generators cannot explicitly express costs and constraints
  - start-up costs, ramping limits etc
- Pricing is linear
  - No side-payments



- PX have started to introduce new products
  - Allowing generators to implicitly express their costs and constraints (e.g. block orders..)
- Efficiency loss due to imposing linear prices is relatively small (Meeus et al, 2006)
- Full nodal leads to illiquid markets
  - Also power pools use a single price for several physical nodes
  - Some EU countries can already split up in several price zones

# Market integration North America (e.g. US)

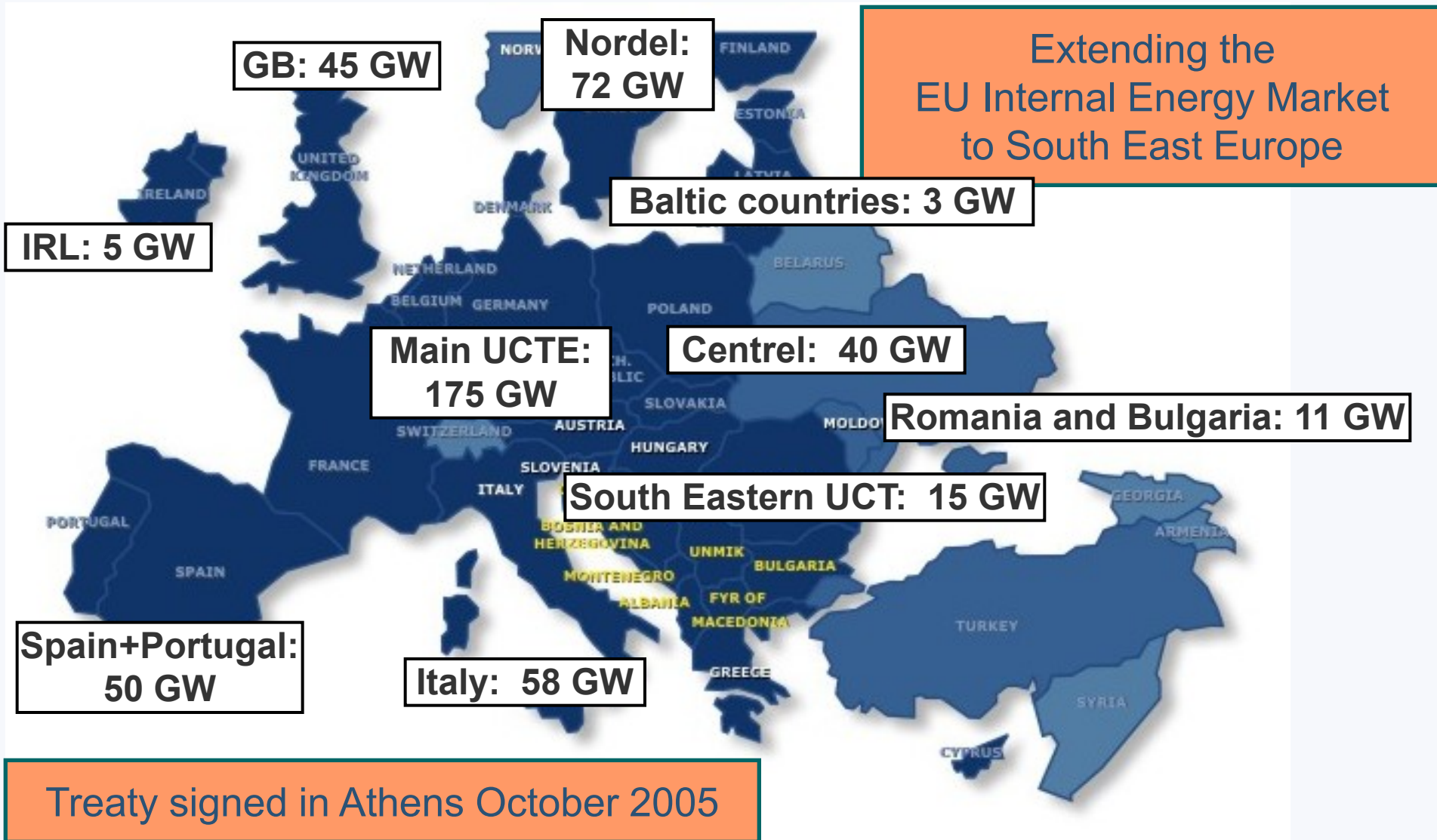
- Markets
  - Patchwork developing and mature markets <> no market
  - Process slowed down
    - 2001 California failure
    - 2003 Black-out
- Market integration
  - Markets weakly linked (if at all)
  - Agglomerative magnets  
(Jens Weinmann, FSR 2007)



## Electric Power Markets: National Overview



# Scale of Market Integration in Europe Energy Community



# Market integration Europe

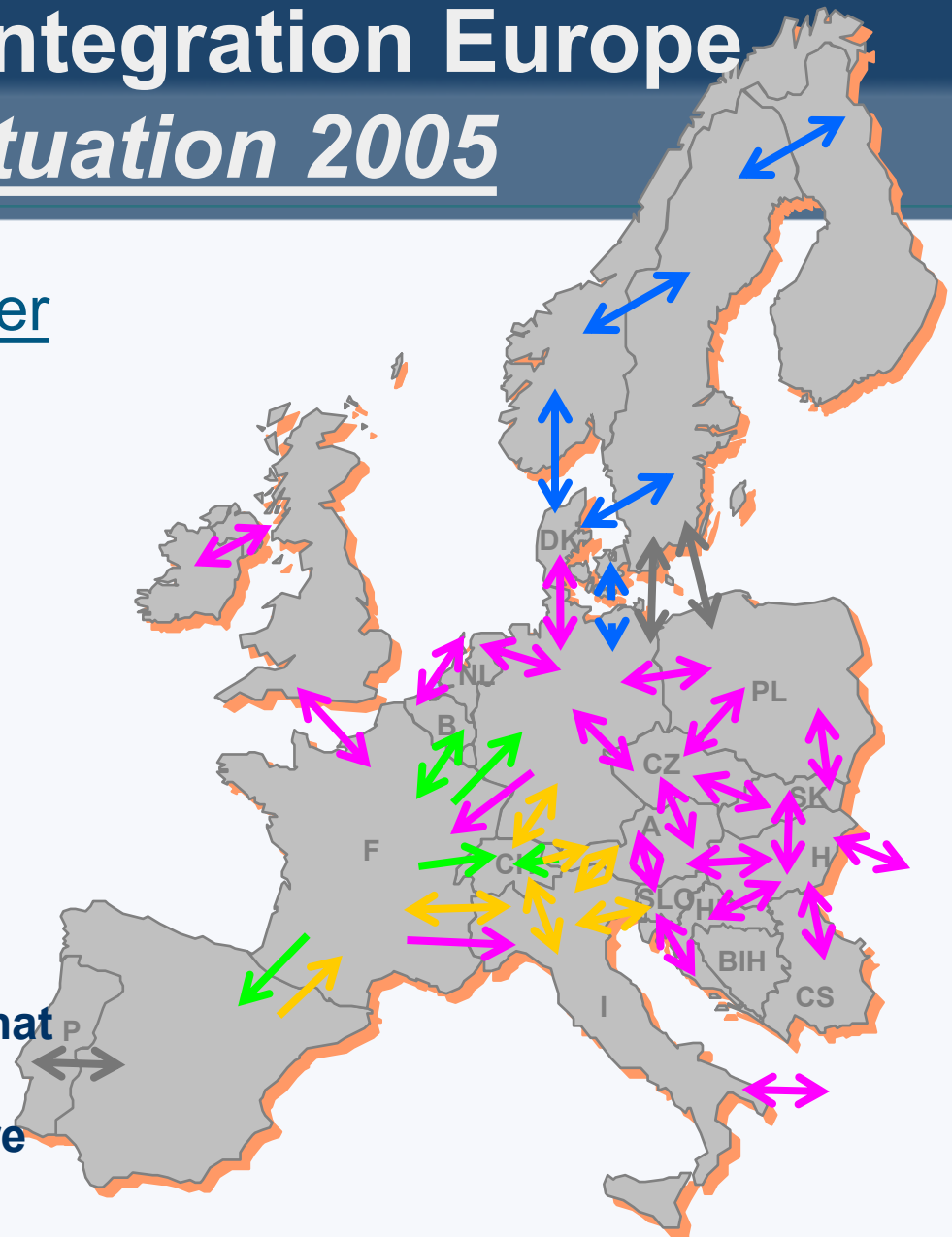
## Situation 2005

- Availability cross-border capacity

- Interconnector scarcity
- Historical contracts

- Access to available cross-border capacity

- **First come, first served**
  - Historical ranking
  - Ranking based on usage
- **Pro-Rata Allocation**
  - Participants ask up to what is available
  - Pro-rata allocation if more requested than available
- **Other (Merchant)**





# Market integration Europe

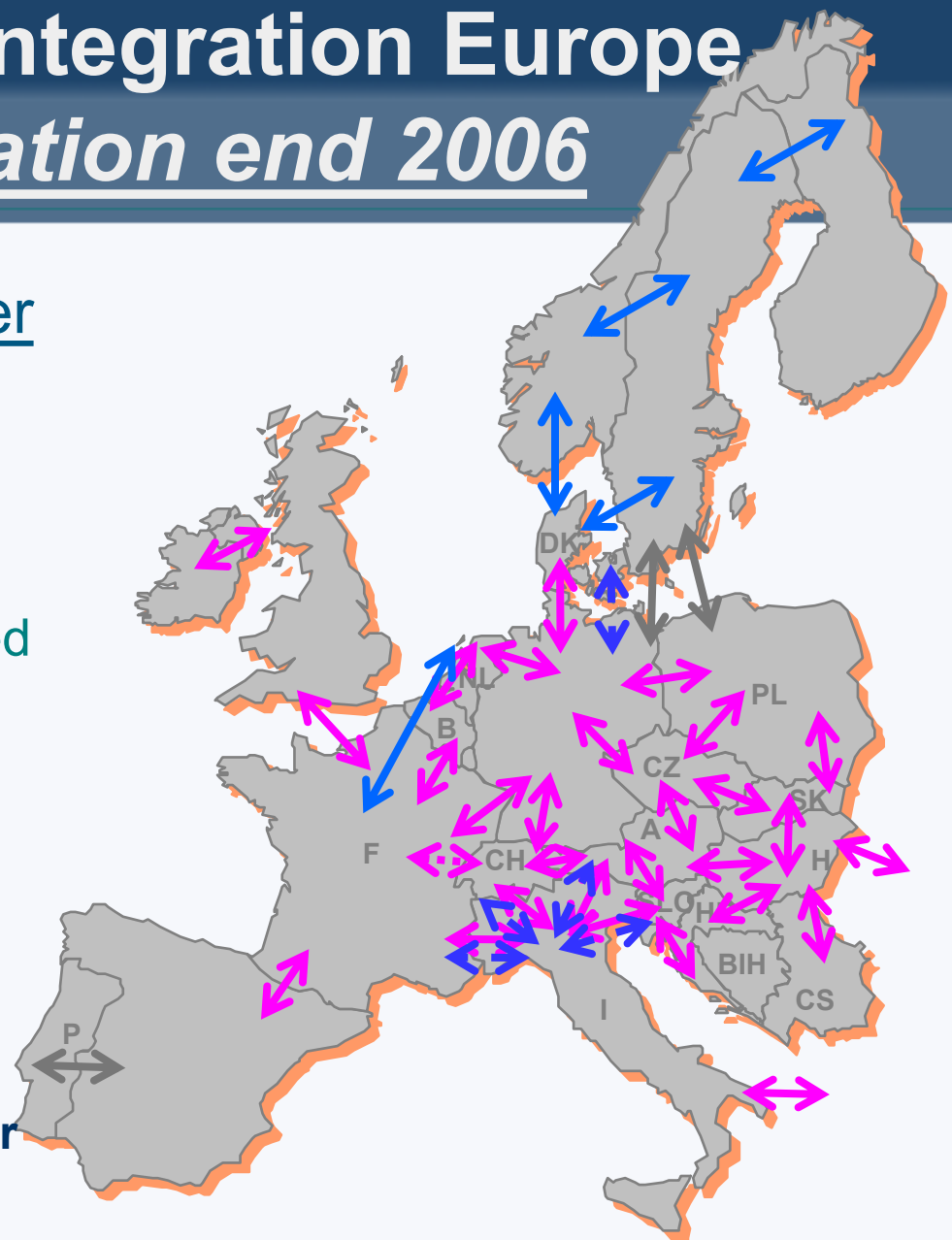
## Situation end 2006

- Availability cross-border capacity

- Interconnector scarcity, but some investment, e.g. F-B
- Historical contracts under pressure, e.g. F-NL cancelled (Case C-17/03 SEP NL)

- Access to available cross-border capacity

- Regulation 1228
  - **Marked based**
- Guidelines
  - **Market based** = **explicit** or **implicit** auction



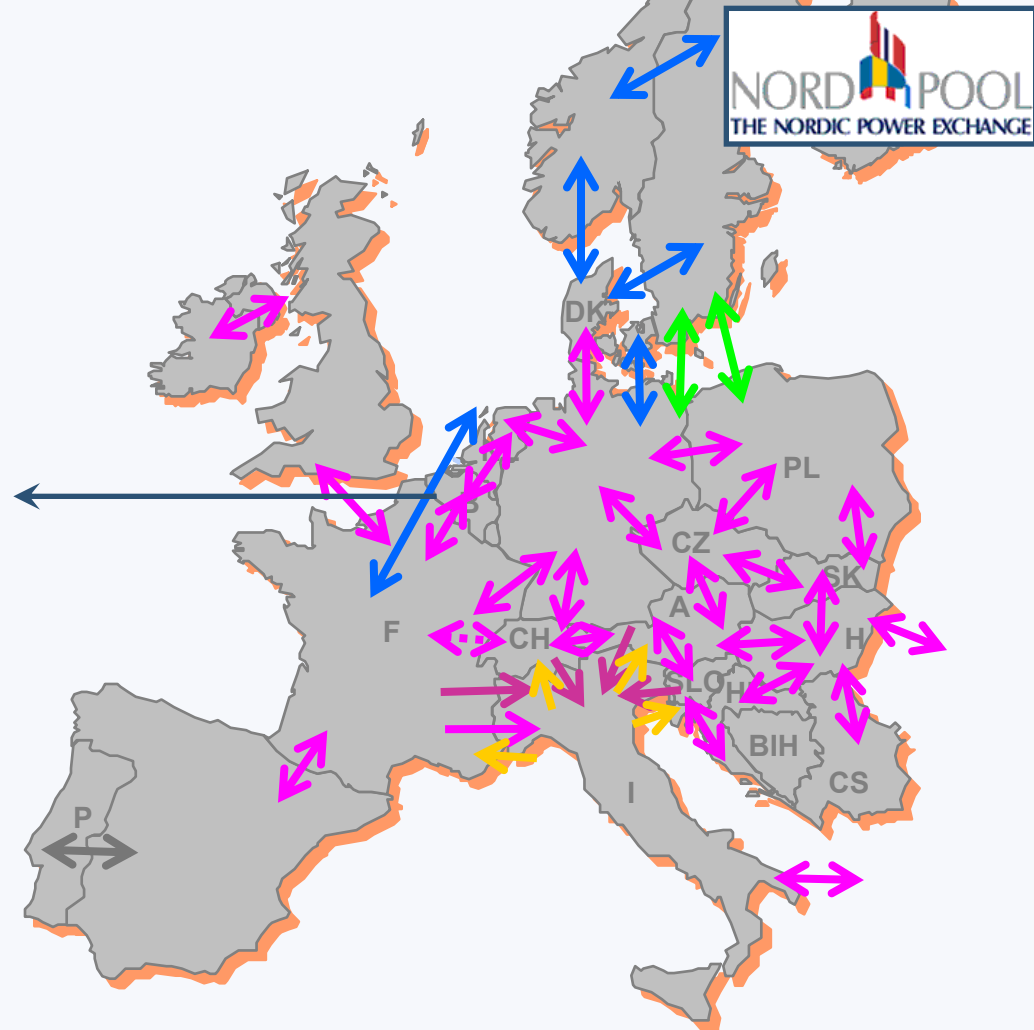


# Creation of agglomerative magnet?



## Coupling day-ahead auctions

- Border capacities used to optimize the clearing of orders
- Removes risk of trading energy and border capacities separately
- Better use of capacities, reduced price volatility



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# Market coupling/splitting

## *Day-ahead auctions*

Explicit auction

Implicit auction

Pro-Rata Allocation

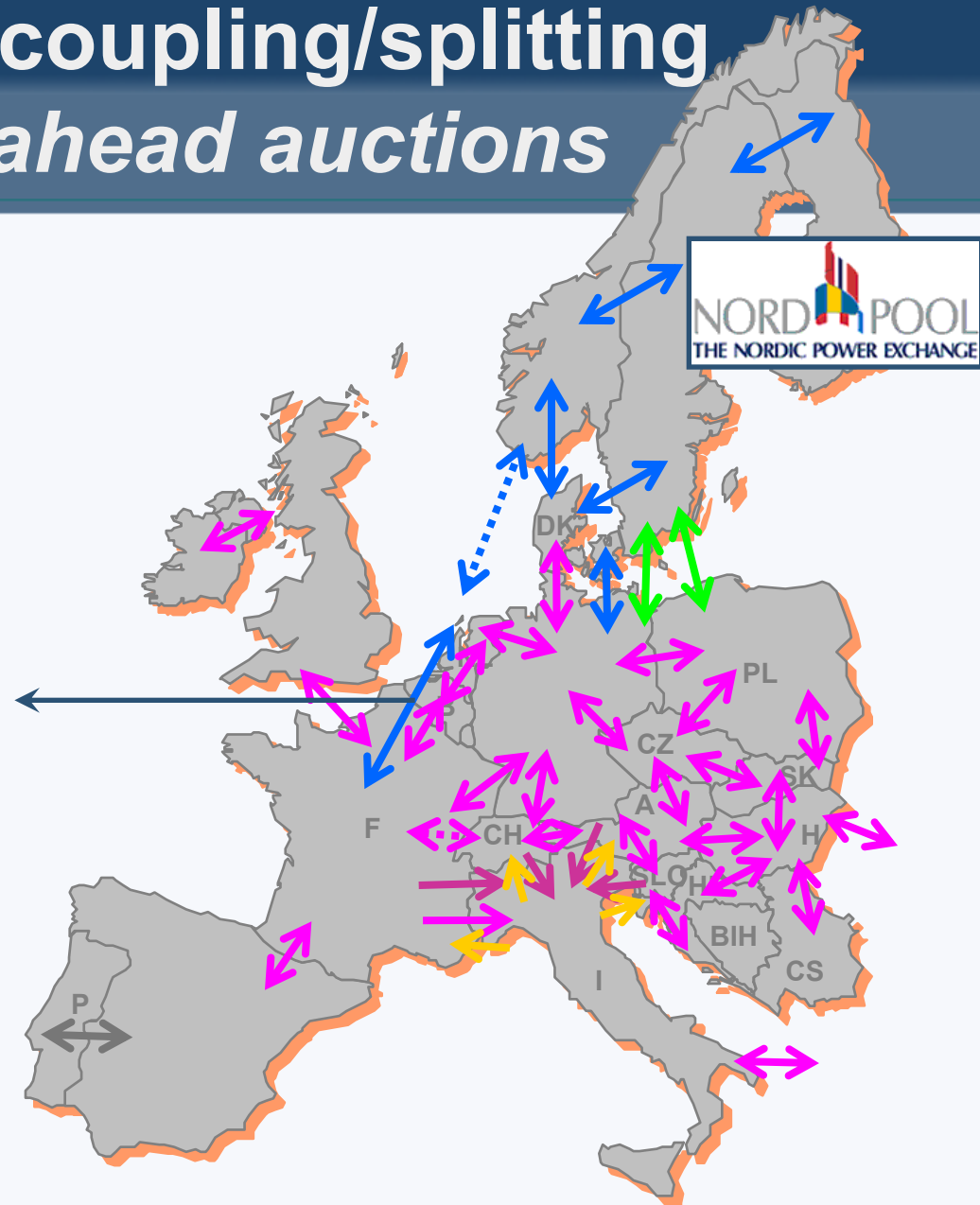
Merchant

Other



2003: PX in Belgium: liquidity?

21 Nov 2006: start-up Belpex,  
coupled with Powernext and APX  
from start



## A power exchange for the Belgian market

- Risk of illiquidity
- An efficient system was preferred

**e.g.: Electricity market in Western Denmark**

Source: Frontier Economics

| Border        | Congestion management mechanism | Actual flow in the "right" direction (% of hours in 2005) |
|---------------|---------------------------------|---|
| DK-West / SE  | Implicit                        | 98%   |
| DK-West / NO  | Implicit                        | 99%   |
| DK-West / D   | Explicit                        | 77%   |
| F-B-NL border | Explicit / FCFS                 | 58%   |

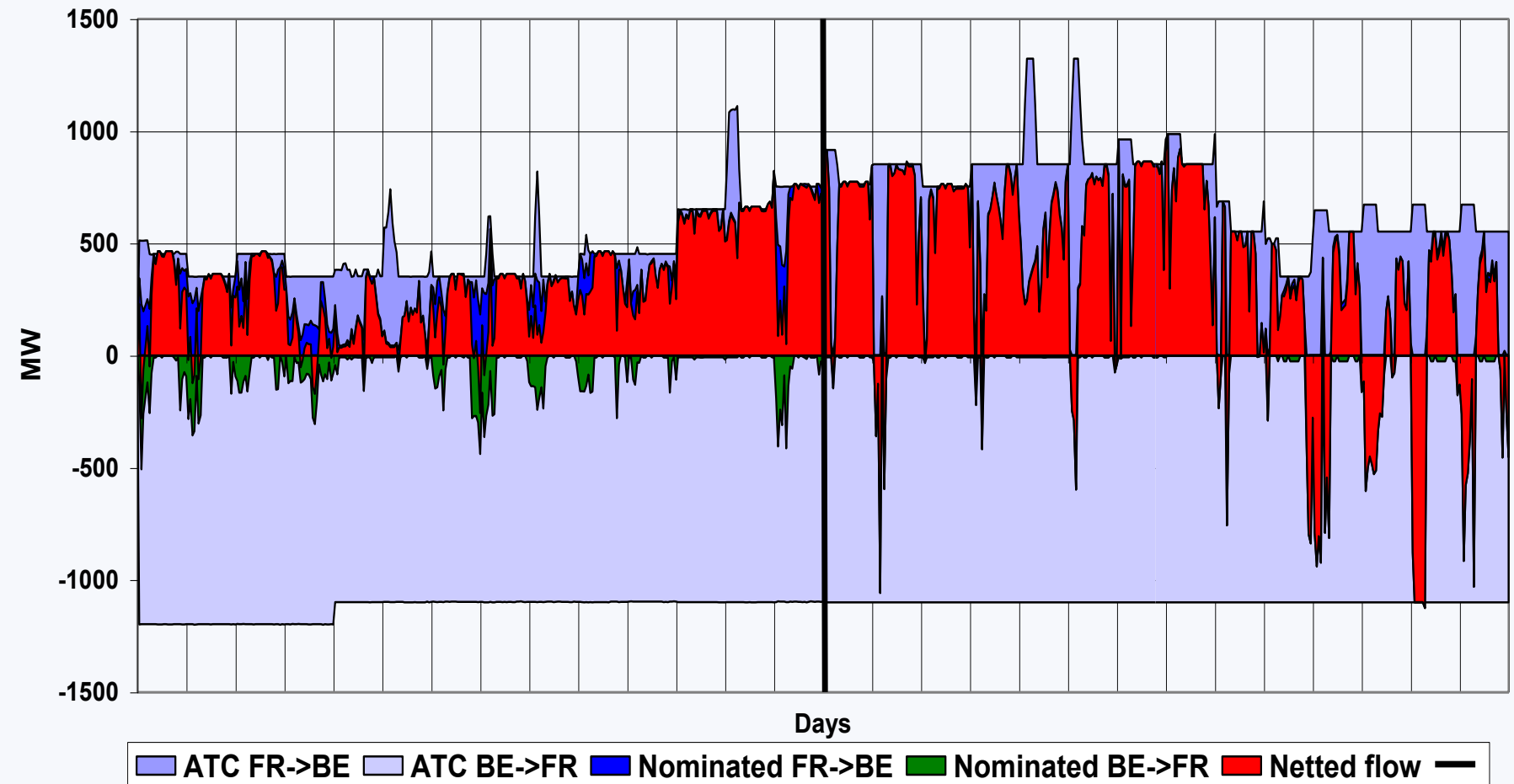
**Opt for the best design**



# Use of interconnection capacity

Utilization of daily allocated capacity on FR-BE border  
before and after introduction of market coupling

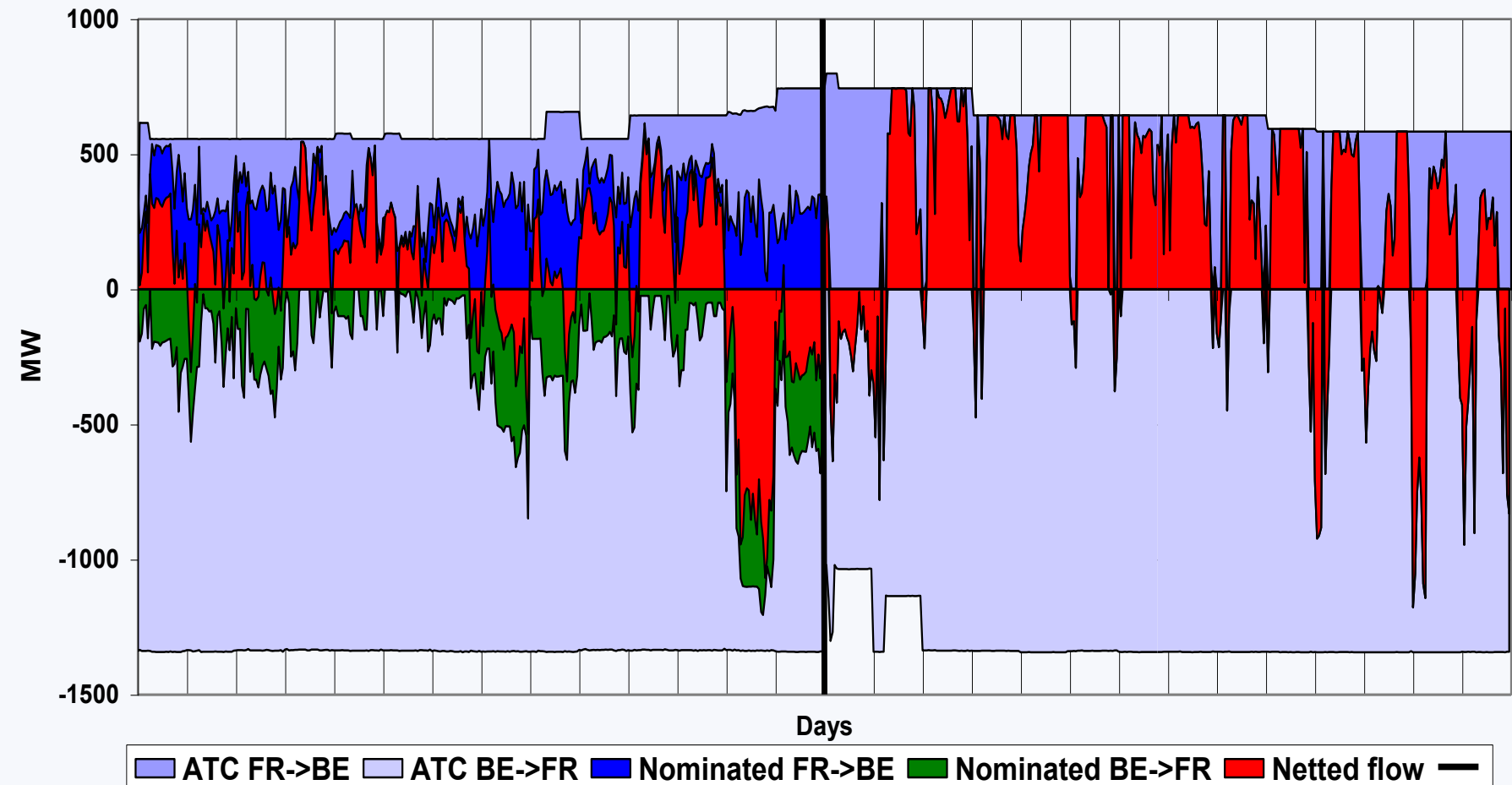
Source: Belpex



# Use of interconnection capacity

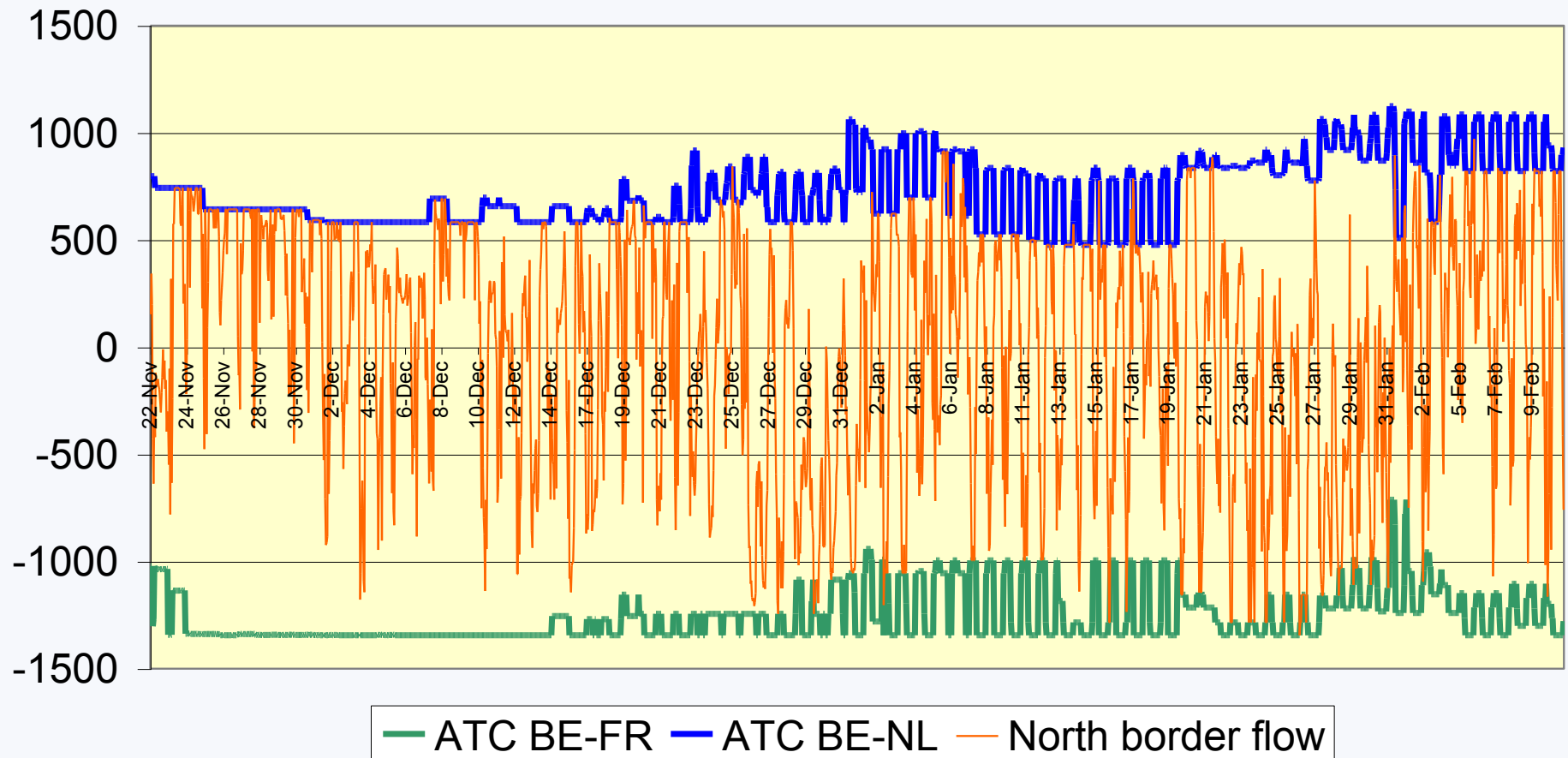
Utilization of daily allocated capacity on BE-NL border  
before and after introduction of market coupling

Source: Belpex



## Relative usage North border

Source: Belpex

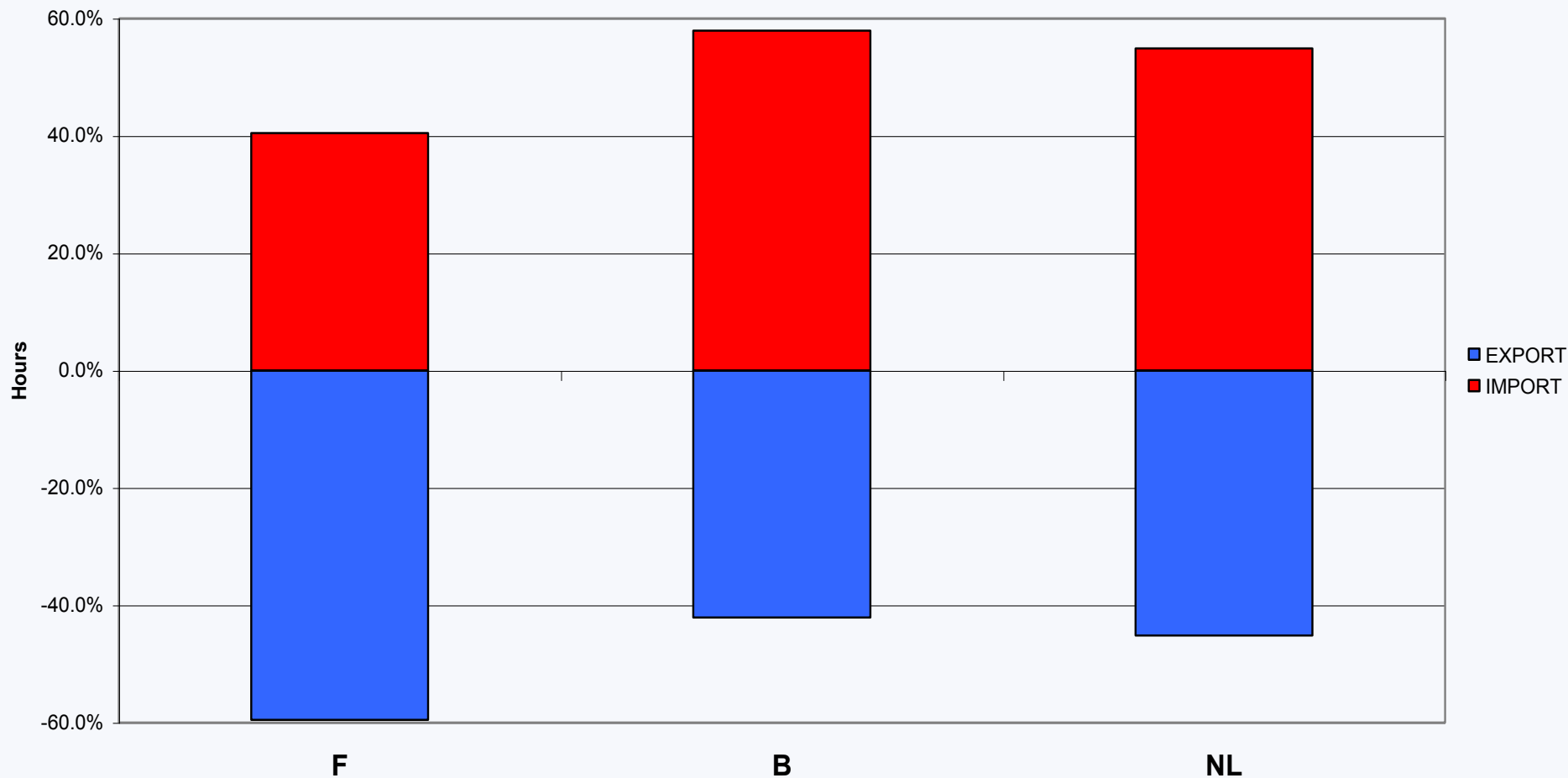


# Use of interconnection capacity

## Export/Import pattern: hours

Source: Belpex

Average Import/Export position (Hours)



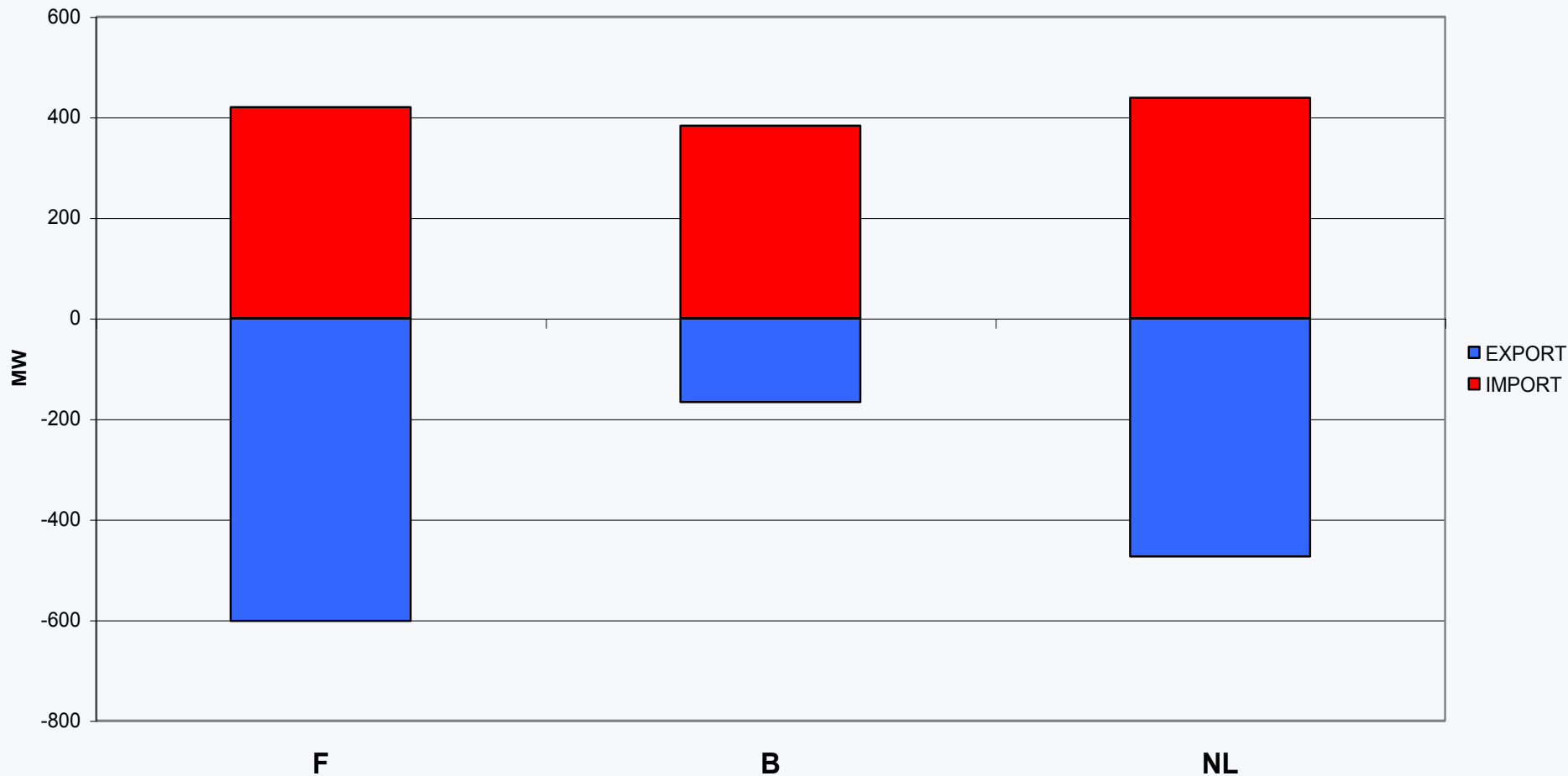


# Use of interconnection capacity

## Export/Import pattern: energy

Source: Belpex

Average Import/Export position (Energy)

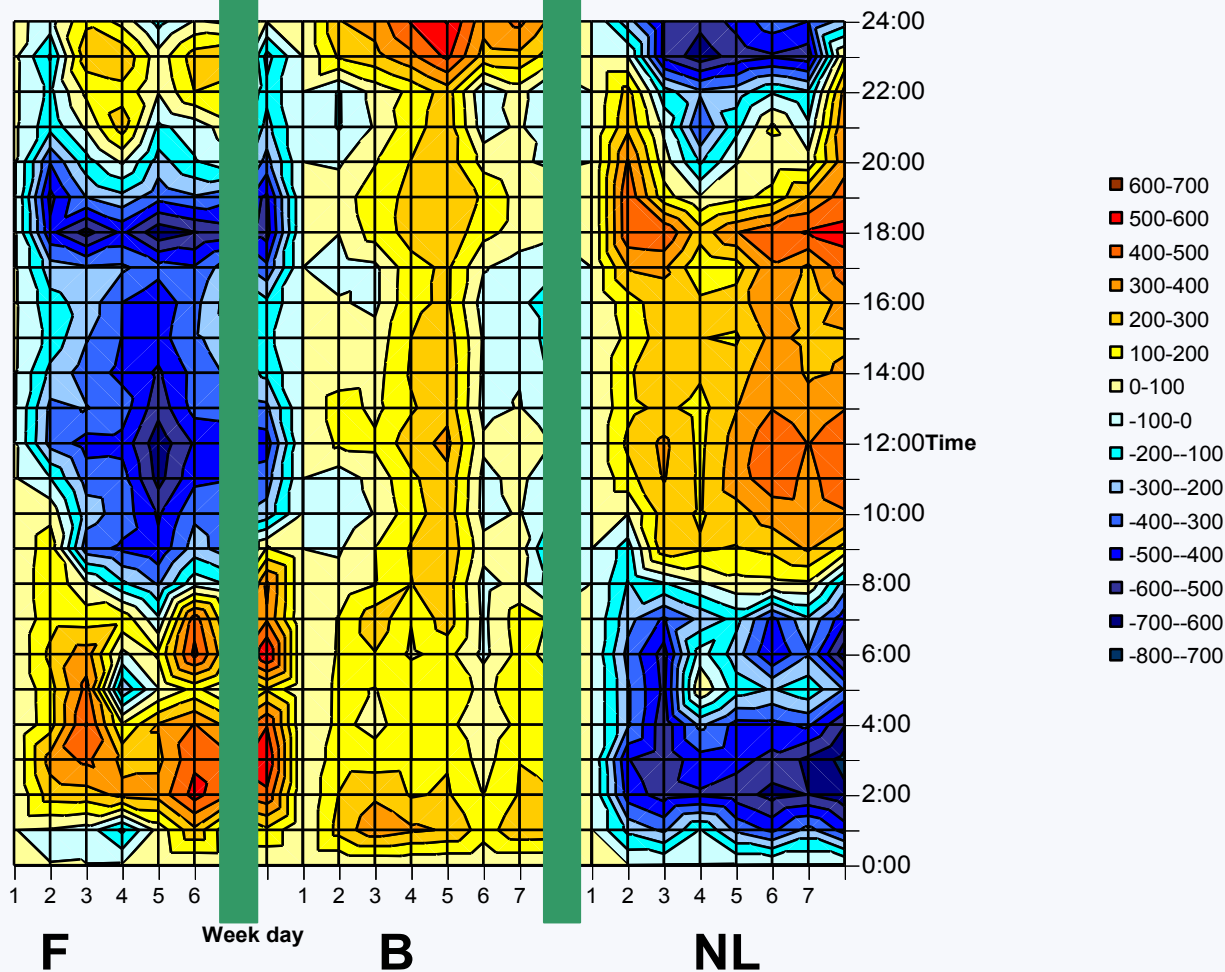


# Use of interconnection capacity

## Export/Import pattern

Source: Belpex

### Export/Import average position

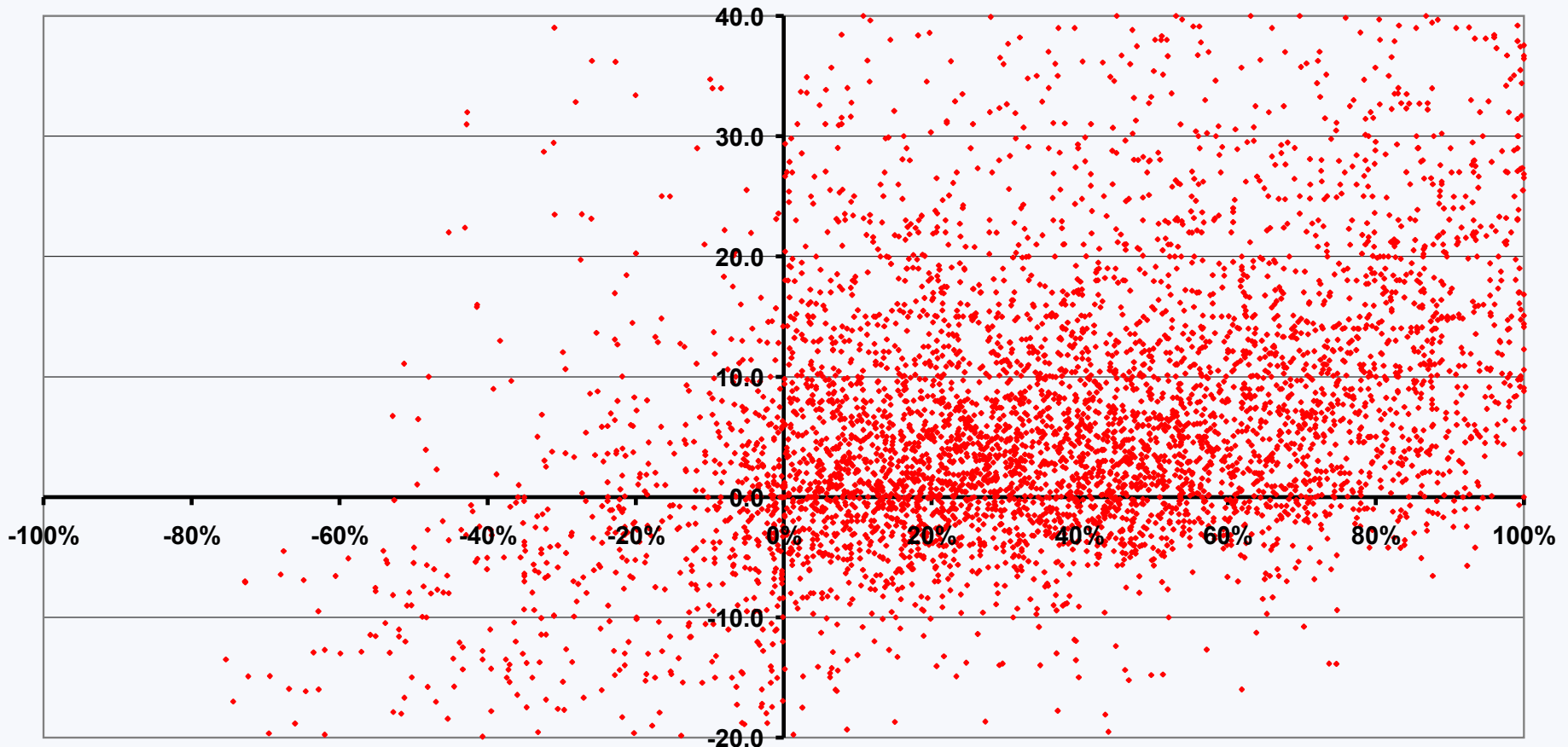


# Interconnection flow vs $\Delta$ Price

## *Before*

Source: Belpex

Use of F - NL "Capacity" (% of av capacity) versus Price difference (€)  
**Before MC**

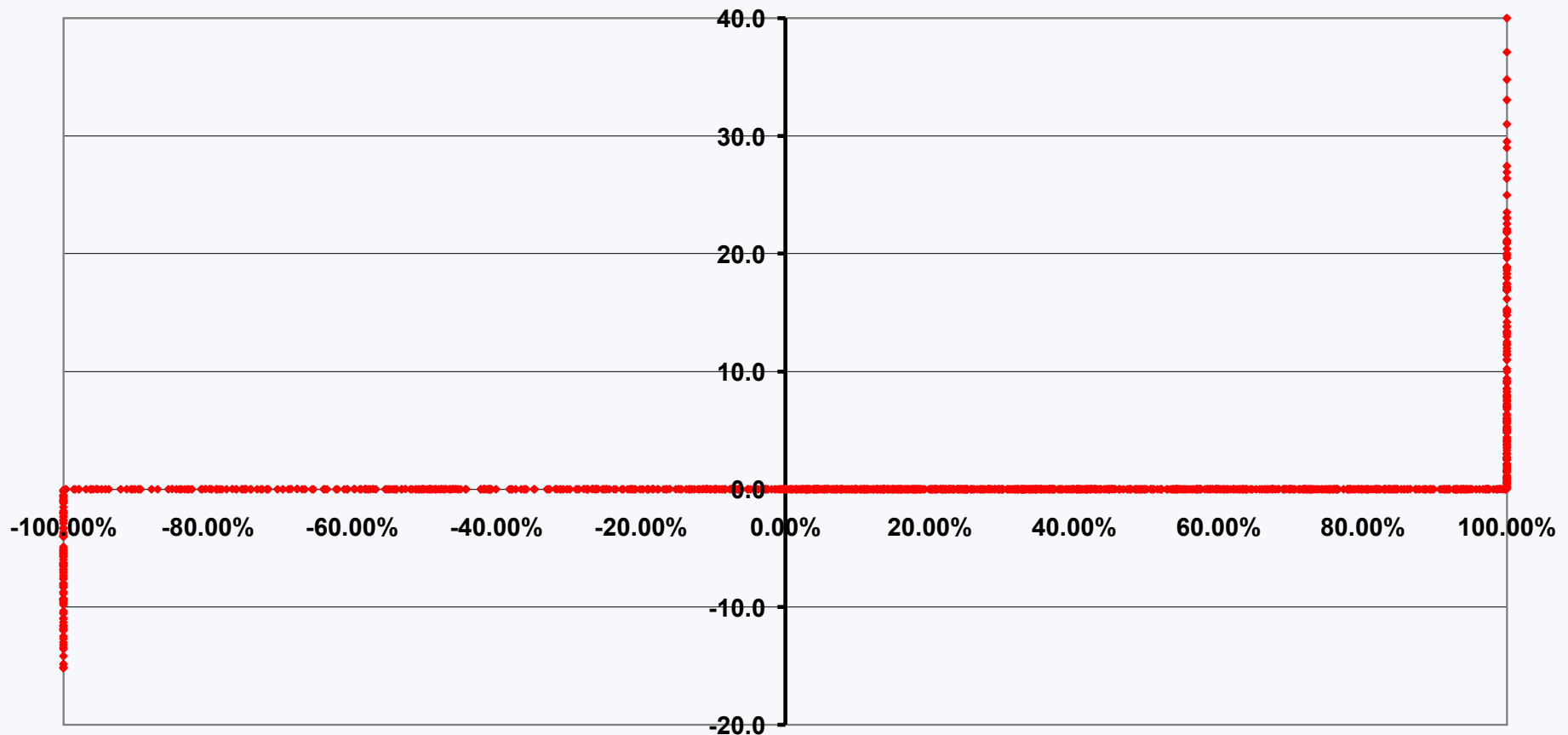


# Interconnection flow vs $\Delta$ Price

## After

Source: Belpex

Use of F - B capacity (% of av capacity) versus Price difference (€)  
during MC

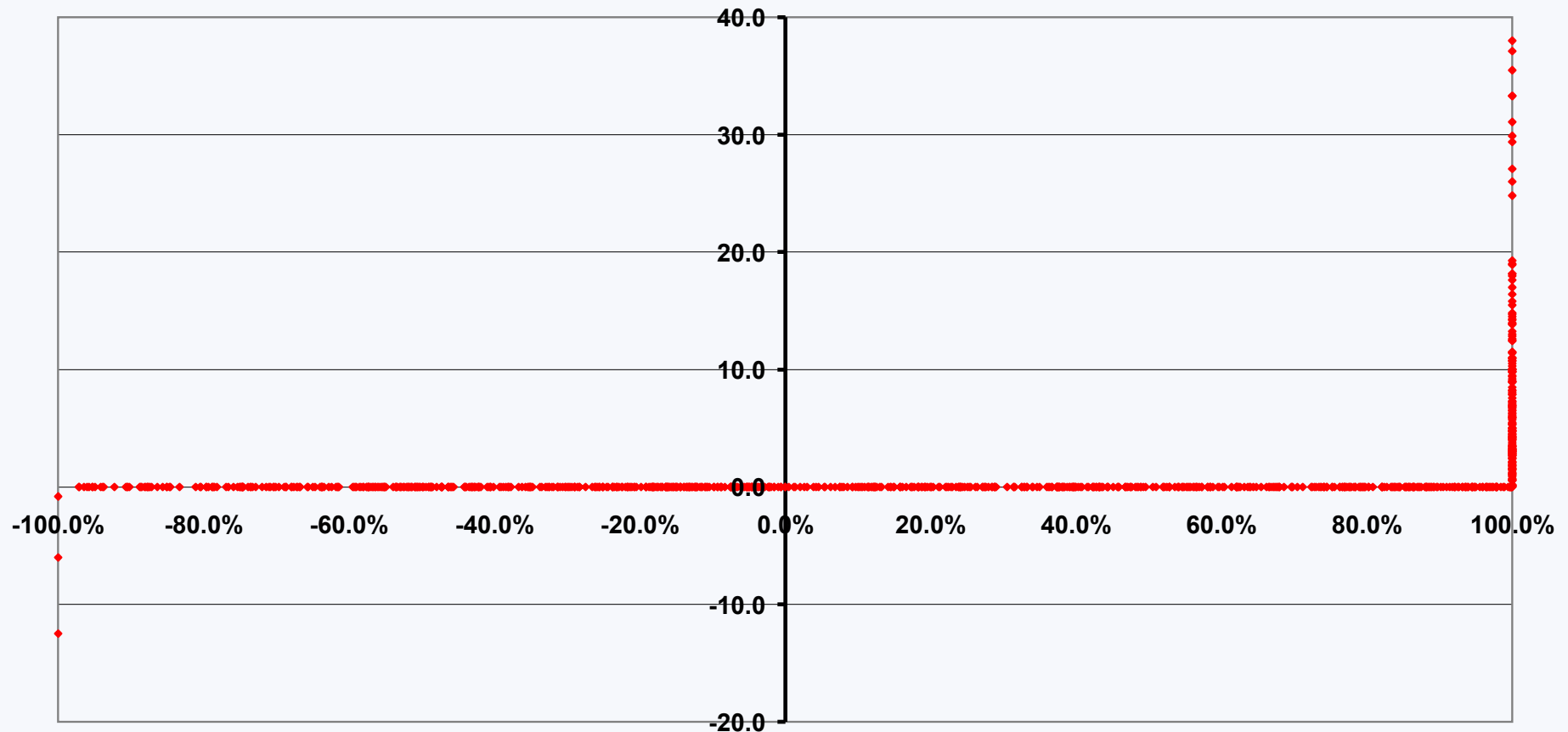


# Interconnection flow vs $\Delta$ Price

## After

Use of B - NL capacity (% of av capacity) versus Price difference (€)  
during MC

Source: Belpex

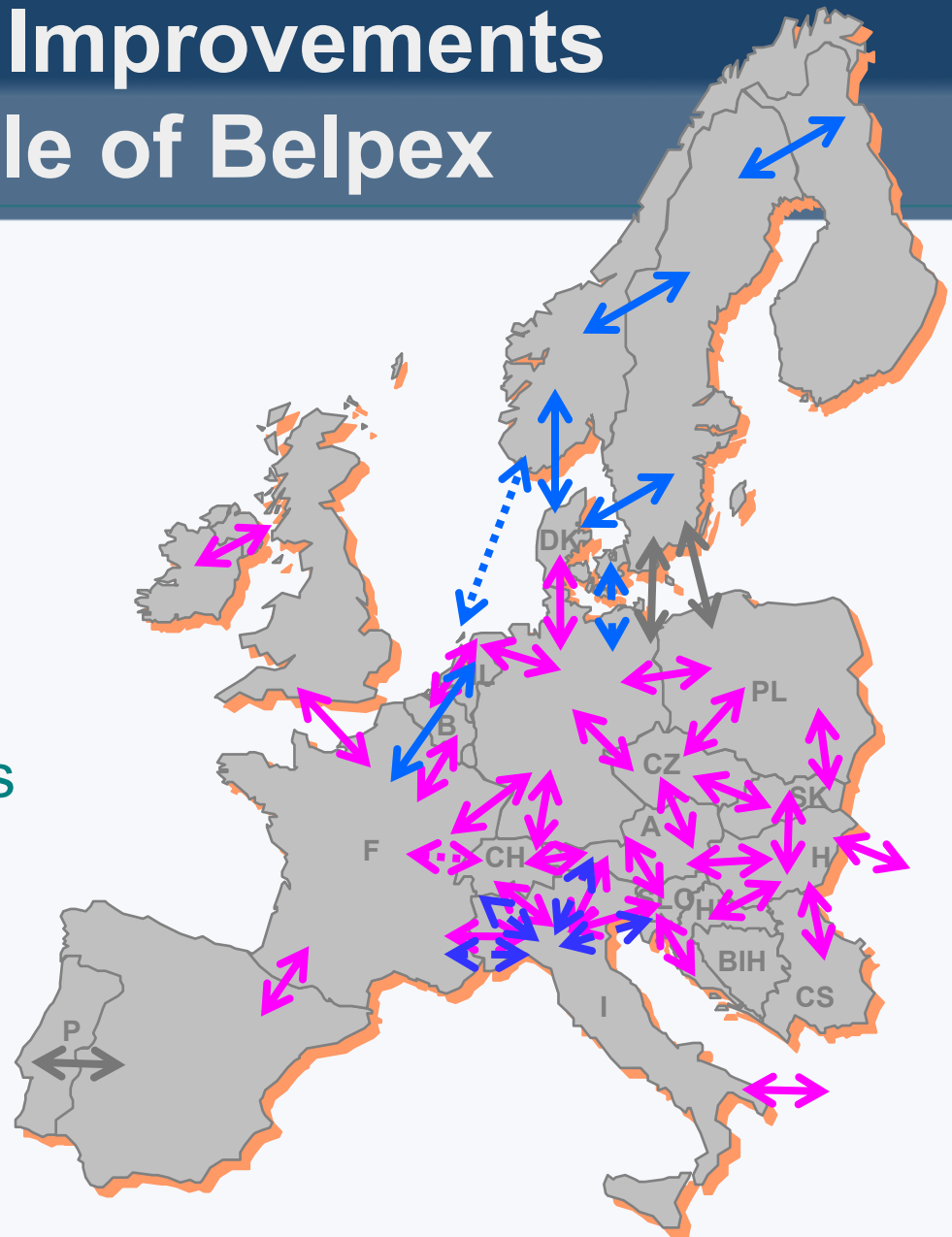


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# Possible Improvements

## The role of Belpex

- Use of border capacity
  - Also intra-day and real-time
    - Development of a new platform
    - Coupling needed?
  - Also secondary markets (UIOLI → UIOSI)



# Possible Improvements

## The role of Belpex

Provide for alternative trading opportunities prior to and after the Belpex Day-Ahead Market

### ➔ Intraday Market?

#### ▪ What?

- Continuous trading of electricity up to one hour prior to delivery
- Hourly and/or quarterly hour products
- Cleared and anonymous

#### ▪ Why?

- Manage portfolio imbalances (changing environment between D-1 and RT)
- Optimize positions
- Conclude close to real time trading opportunities
- Fall Back for missed DAM trading

#### ▪ Opportunities:

- Increasing number of less predictable generation (wind, cogeneration)

Source: Belpex



# Possible Improvements

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Source: Belpex

# Possible Improvements

## Intraday between France and Belgium

- Explicit intraday allocation of border capacity
- After a start-up period with less gates, 12 gates will be available

| Gate (G)  | Time limit for the sending of "Intra-day Access Authorisations"<br>(G + 30 min.) | Time limit for the receiving of nominations by TSOs<br>(G + 1Hr) | Time limit for the sending of nominations confirmations by TSOs<br>(G + 1Hr 45) | Delivery Period |
|-----------|--|--|---|-----------------|
| D-1 21:00 | D-1 21:30  | D-1 22:00  | D-1 22:45   | 00:00 – 24:00   |
| D-1 23:00 | D-1 23:30  | 00:00  | 00:45   | 01:00 – 24:00   |
| 01:00     | 01:30  | 02:00  | 02:45   | 03:00 – 24:00   |
| 03:00     | 03:30  | 04:00  | 04:45   | 05:00 – 24:00   |
| 05:00     | 05:30  | 06:00  | 06:45   | 07:00 – 24:00   |
| 07:00     | 07:30  | 08:00  | 08:45   | 09:00 – 24:00   |
| 09:00     | 09:30  | 10:00  | 10:45   | 11:00 – 24:00   |
| 11:00     | 11:30  | 12:00  | 12:45   | 13:00 – 24:00   |
| 13:00     | 13:30  | 14:00  | 14:45   | 15:00 – 24:00   |
| 15:00     | 15:30  | 16:00  | 16:45   | 17:00 – 24:00   |
| 17:00     | 17:30  | 18:00  | 18:45   | 19:00 – 24:00   |
| 19:00     | 19:30  | 20:00  | 20:45   | 21:00 – 24:00   |

Source:  
Elia/RTE

# Possible Improvements

## Intraday between France and Belgium

- Advantages of Intraday:
  - Better flexibility for the balance responsible parties to face unforeseen changes
  - An optimized use of the available capacity

# Possible Improvements

## The role of Belpex

Provide for alternative trading opportunities prior to and after the Belpex Day-Ahead Market

### → Continuous spot market?

- What?
  - Continuous trading of electricity from D-2 up to D-1 prior to Day-Ahead Market
  - Base load / peak load / weekend products
  - Cleared and anonymous
- Why?
  - Increase trading opportunities
  - Create price discovery process before Day-Ahead Market

# Introduction of new products

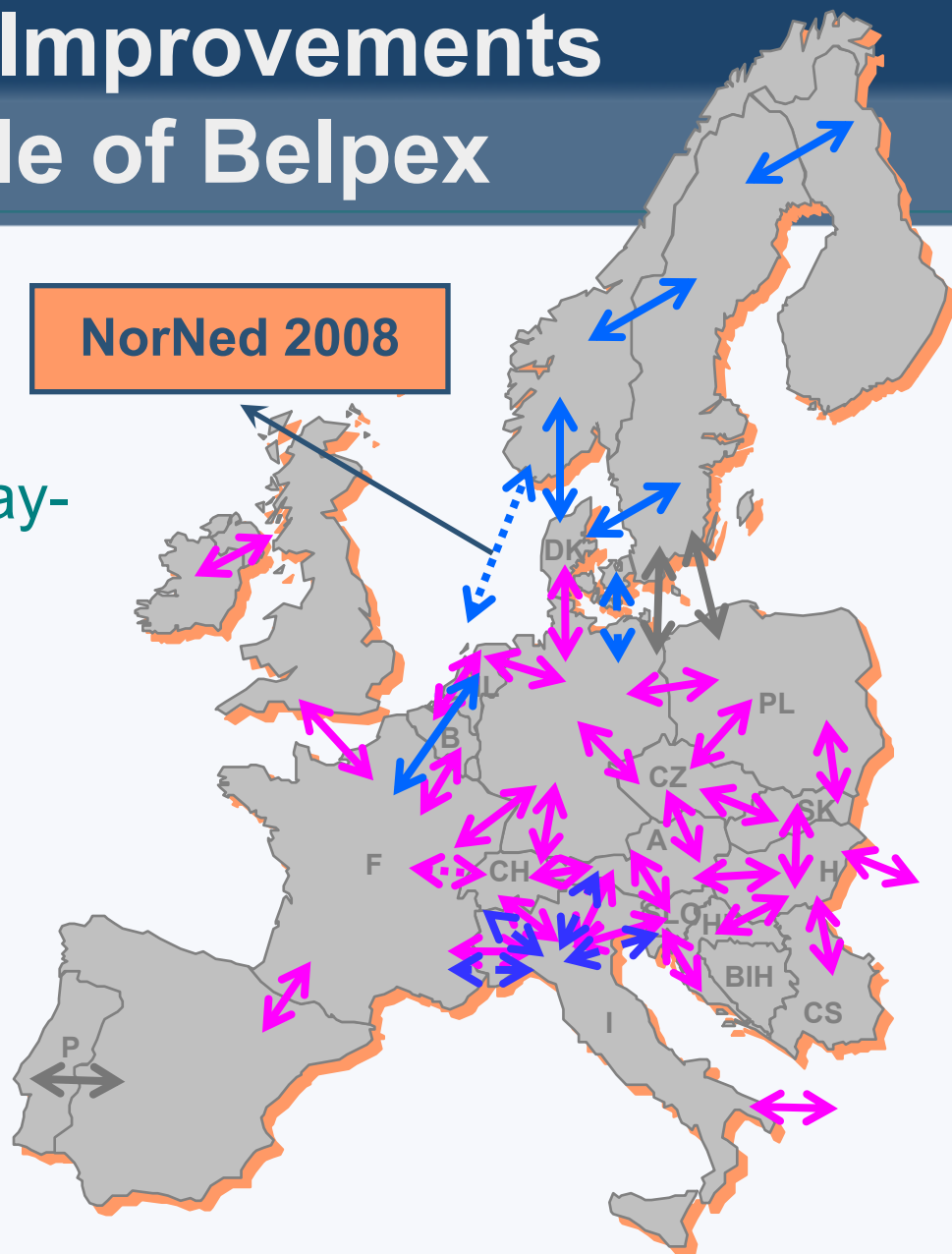
## Possible approach

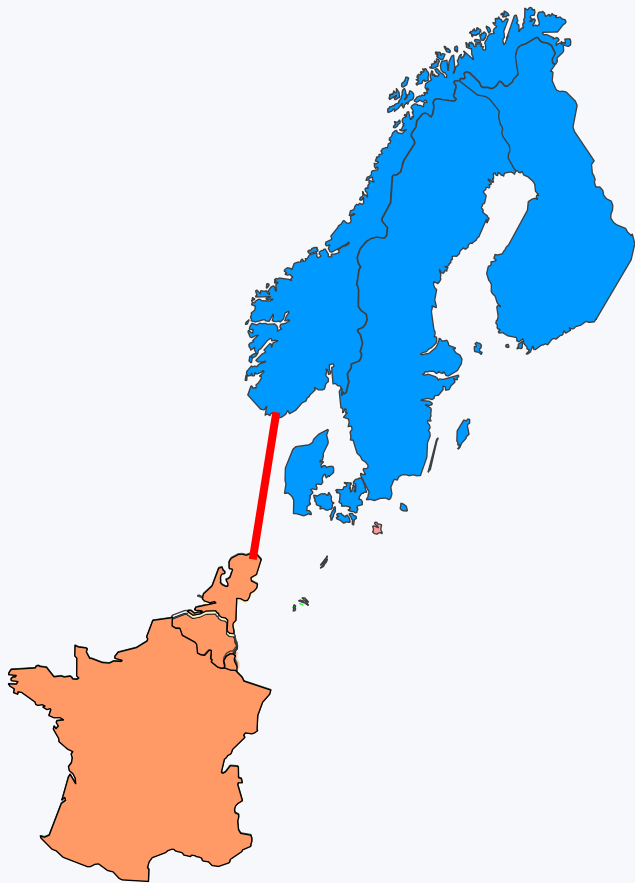
- Non-coupled exchange
  - *Role: Portfolio fine-tuning*
  - Day-ahead auction improves trade with an easy to access and **simple design**
  - New products = increasing complexity = higher transaction costs
- Coupled exchange
  - *Role: gate for international trade with an increased participation in the day-ahead auction*
  - Day-ahead auctions determines which plants are running with an **efficient design**
  - New products = increasing flexibility = correct incentives to the market players

# Possible Improvements

## The role of Belpex

- Coordination of border capacity allocation
  - More capacity for the day-ahead market?
  - Extend the day-ahead coupling
    - E.g. NorNed

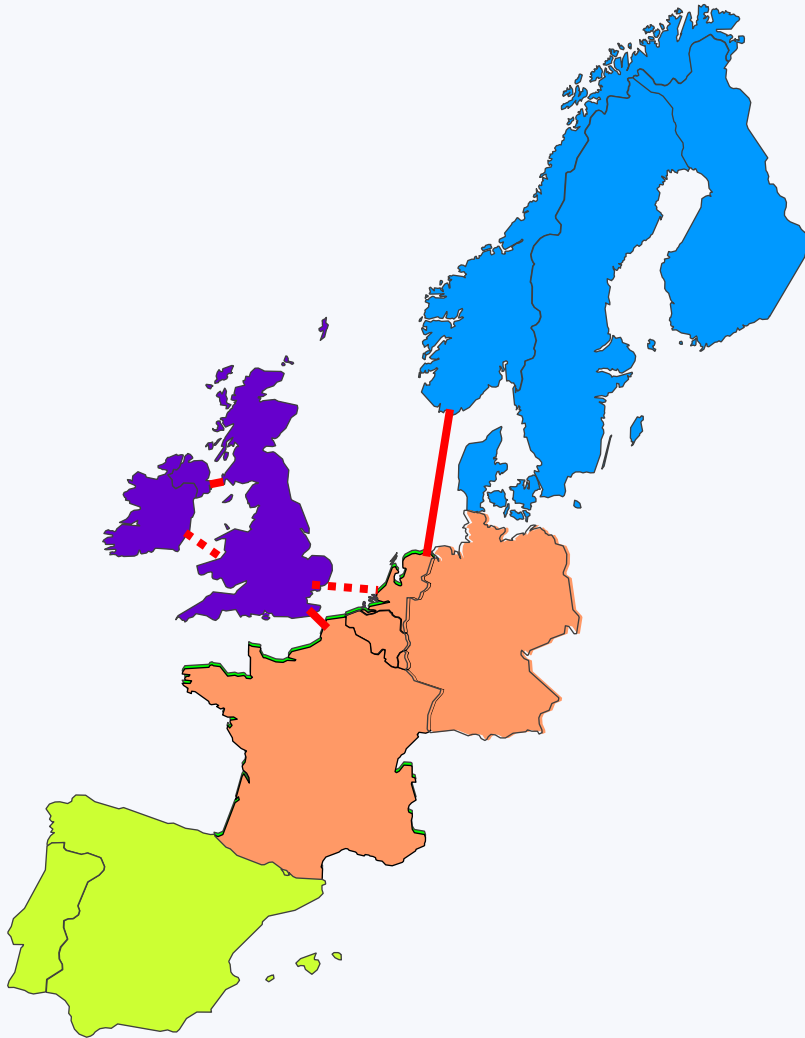




- NorNed cable links two regions, already internally coupled:
  - TLC region Netherlands, Belgium, France
  - Nordic region Norway, Sweden, Finland, Denmark
- Steering committee established:
  - 4 exchanges APX, Belpex, Nord Pool, Powernext,
  - 4 TSO's Elia, RTE, Statnett, TenneT
- Interim solution for live-date of cable October 2007
- Enduring solution

# Next steps: bridging the gap

Source: Belpex



## Enduring solution:

- MMC = Multilateral Market Coupling
- Optimize Nordic and TLC region
- Open solution others can join:
  - Spain, UK, Germany
  - Invite for enduring solution
- Able of coupling many regions
- Flow-based able to handle loop flows



## Market integration in Europe

- A lot of room for improvement
- But promising evolution
- Easier thanks to simpler design compared to US
  - Easier to move forward together
- More fine-tuned markets (e.g. North American Power Pools) more difficult to couple/integrate
  - Politically difficult to harmonize
- TLC is a success
- Formation of European agglomerative magnet?
  - Belpex (TLC) – Nord Pool