Introduction

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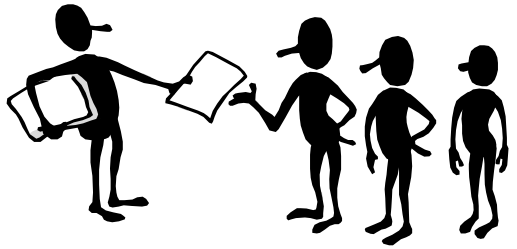


- **In appendix 3, you'll find a list of the terms and acronyms used in this document.**
- **Concerning the documents referred to in this presentation:**
  - **At *houmollerconsulting.dk*, you can download the documents from the sub-page *Facts and findings*.**
- **This PowerPoint presentation is animated**
  - **It's strongly recommended to run the animation when viewing the presentation.**
- **On most computers, you can start the animation by pressing *F5*.**
  - **Now the presentation moves one step forward, when you press *Page Down*. It moves one step backward, when you press *Page Up*.**

Handling Europe's crises

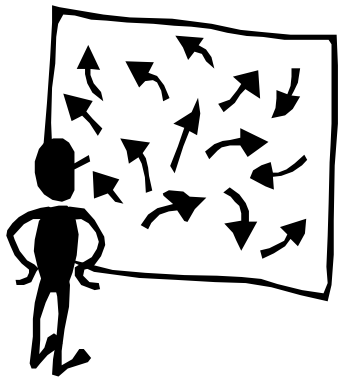
- **Commenting on Europe's crises, the newspaper The Economist wrote:**
  - ***The chances are that Europe will (…) continue rather faster down the path of genteel decline*.**
- **We better prove this wrong! We need a strong and prosperous Europe in order to tackle the challenges**
  - **And in order for Europe to be a guiding star for our neighbours of democracy, market economy and the rule of law.**
- **Naturally, the electricity supply industry is just a small corner of Europe's economy**
  - **But it's our corner, so it's the corner we must fight.**
- **We need a well functioning Single European Electricity Market**
  - **With efficient competition where it's possible to have competition.**
  - **And efficient regulation where competition is not possible.**
- **We cannot achieve this without taking on vested interests and stop rent seeking.**

Market coupling

Day-ahead grid congestion management

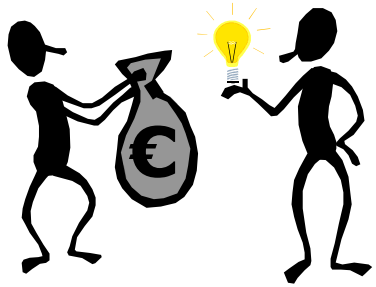
Market coupling – 1

- With market coupling, the day-ahead plans for the cross-border energy flows are calculated using:
  - The market players' spot bids
    - ie, the prices at which the players are willing to buy and sell day-ahead.
  - Information on the day-ahead cross-border grid capacity.
- Actually, market coupling is a step backwards towards planned economy.
- The truly market-based method:
  - Allow the market players to do the day-ahead cross-border trading themselves.
  - However, practical experience shows this gives many hours with energy flows, which are sub-optimal for society.
  - This is because it's difficult for individual market players to make optimal use of the monopoly transportation system (ie, the grid).
- The <u>monopoly transportation system</u> distinguishes electrical energy from most other commodities.



Market coupling – 2

- A perfect bilateral cross-border trading system:
  - A system where all players have perfect oversight of the market
    - ie, all players know the market price.
  - No abuse of market power or any other foul play.

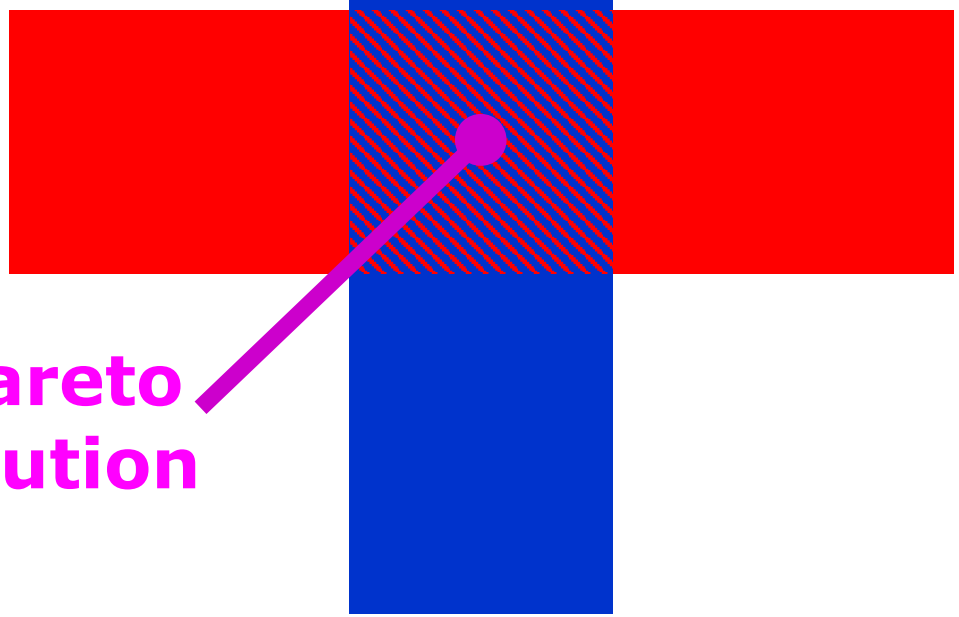


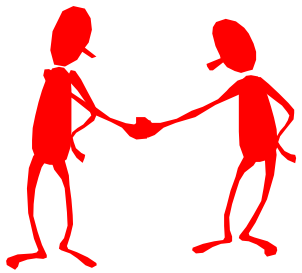
- For the day-ahead market, such a perfect bilateral bilateral cross-border trading system would automatically create a Pareto optimal state.
- The task for the market coupling algorithm:
- As far as possible, reproduce the Pareto optimal state, which a perfect bilateral trading system would automatically have created.

The algorithm calculating spot prices and market coupling flows

The requirement at the previous slide means the algorithm must sit at the intersection between market economy and computer science

Computer science: Mixed-integer linear optimization



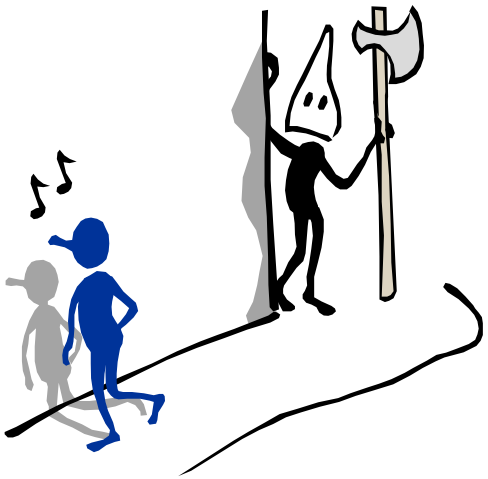


Market economy

Find the Pareto optimal solution

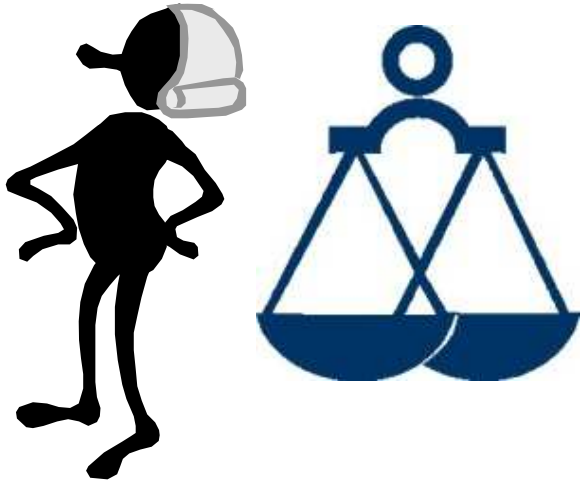
IT specifications

- It's very visible when the exchanges' spot calculations crash.
- However, the losses inflicted by the crashes pale compared with the losses inflicted by wrong software specifications.
- The PCR software has wrong handling of interconnectors and block bids
  - This means the PCR algorithm Euphemia does not even try to reproduce the Pareto optimal state.
- The specification errors can be traced to the spot exchanges' resistance against the welfare criterion
  - The welfare criterion states *the solution produced by the spot calculation must maximize the economic value of the spot trading* (ie, reproduce the Pareto optimal state).
- Due to lack of understanding of market economy and linear optimization, the spot exchanges fought against the welfare criterion.
- In a splendidly daft move, the spot exchanges have installed this resistance in Euphemia's specifications.



The silent kill

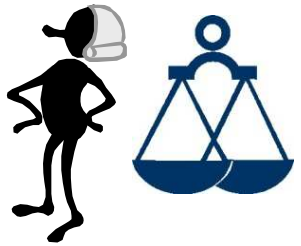
- **Anecdotic evidence indicates Euphemia's wrong handling of interconnectors and block bids may reduce the economic value of the spot trading with 40%!**
- **The daily value of the spot trading in Western-Central Europe easily exceeds € 10 billion.**
- **Good governance and pan-European regulation can deal with this**
  - **For more information, see the PowerPoint presentation *Maximizing the economic value of market coupling and spot trading*.**



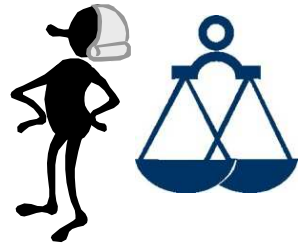
The rule of law

The rule of law – 1

- **Market coupling in effect makes spot exchanges monopolies.**
- **No efficient pan-European regulation is in place to handle this monopoly.**
  - **For more information, see the PowerPoint presentation *Market coupling makes real competition betw spot exchanges unfeasible*.**
  - **You may also note the state of affairs for the telecom markets**
    - **In several European countries, the regulators are trying to prevent the number of major telecom operators to fall from 4 to 3.**
  - **A state with only 2 operators is an extreme example of an oligopoly.**

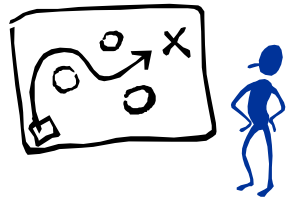


The rule of law – 2
Monopolies must be regulated



- **Where we cannot have competition, we must have regulation.**
- **For the European market coupling, we face multinational monopolies.**
- **Hence we need a pan-European regulation.**
- **There's a simple technique to picture the system, the pan-European regulation must create:**
- ***Imagine we had a number of different electricity grids with a corresponding number of different spot calculation systems***
  - ***<u>The system, which would have been preferred by the players must be the one created by the regulation</u>.***
- **Hence, discussions of Europe's spot trading must focus on where such an imaginary competitive market would take us.**

Where must regulation take the market?



- We have had two models for the European spot market.
- The EMCC model: a single spot calculation for the Single Market
  - This has proven to be very cost efficient
    - And the spot calculation never failed.
- The PCR model: the number of calculation sites equals the number of participating spot exchanges
  - And lots of extra pre-processing and post-processing
    - Hence, via their trading fees, the market players finance lots of redundant staff, computers and software installations.
  - The system is operated by spot exchanges with a poor reliability track record.*)
- Using the technique described at the previous slide: imagine we had two European grids with these two competing spot markets
  - ***Where would the players take their spot trading?***

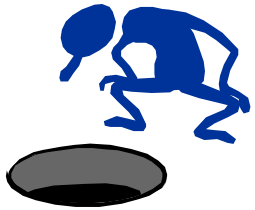
*) For more information, see the PowerPoint ***Market coupling and spot price calculation***.

Nordic energy regulators' position paper

- **Quotations from the paper *Competition between Power Exchanges within bidding zones*:**
- ***NordREG believes that one of the keys to designing a structure that actually would open the market for NEMO services to real competition is to make a clear distinction between natural monopoly functions and functions/tasks that can be provided by competitive companies.***
- ***The potential shortcomings that we have identified in the structure currently proposed stem from this basic principle not being applied.***
- ***(…) monopoly functions are preserved within the NEMOs*.**
- ***(…) In order to be designated a NEMO, new participants have to be prepared to operate the MCO function.***
- ***This will require large investments in IT systems and hardware; these investments will increase costs but not contribute to or give any added value to the market functioning.***

Transparency

- **Captive customers: via their grid fees, all consumers and producers were forced to finance the PCR market coupling.**
- **However, in the Regulatory Reports from the PCR project, the costs are confidential!**



Where did my money go?

- **Introducing transparency: the software used to calculate the European spot prices and the European market coupling flows must be *open source***
  - **ie, the software's source code must be public.**
- **Giving the *geek community* access to the source code gives us a high degree of protection against serious software errors**
  - **ie, a high protection against a European repetition of the Baltic-Nordic spot chaos 5 August 2013.**

Good governance

- **The stakeholders cannot "vote with their feet"**
  - **ie, they cannot choose between competing spot prices and competing market coupling schemes.**
- **Therefore, the stakeholders must have another type of vote.**
- **This means we must ensure <u>fair and real influence</u> for both nations and market players.**
- **As the European spot calculation daily moves vast sums of money between nations and between market players.**
- **Note: the Single Market reduces local exchange councils to dummy influence**
  - **The common spot market requires a common spot calculation with a common European algorithm**
    - **Therefore, the stakeholders can only wield meaningful influence at the European level.**

Good governance and regulation

ACER and national regulators

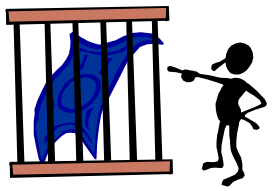
Board
National representation

Democratic control: each country's share can be determined by the Lisbon treaty's voting weights, for example.

Each country's government decides who will represent the country in the board (subsidiarity principle).

Pan-European spot exchange
Administration

Spot Market Council
Consumers, producers, traders, TSOs



Cost-efficient daily operation
A single spot exchange for the Single Market

Settlement

Spot Clearing House

Market players

Send spot bids

Send trading information

Pan-European Spot exchange: calculation of spot prices, flows and each player's spot trading

Send trading and flow information

Send day-ahead cross-border capacity data

TSOs

Pan-European Spot Clearing House.
Settlement of spot trading.

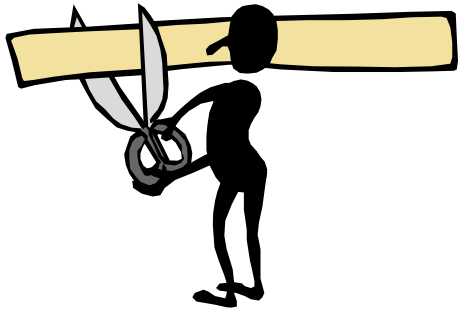
The merits

- **Good governance and regulation will enable Europe to have a spot market with transparency, cost efficiency, accountability, market surveillance and a high reliability**
  - **The latter means a high security against a situation, where there's no spot calculation for the following day**
    - **ie, a high degree of protection against a European repetition of the Baltic-Nordic spot chaos 5 August 2013**
      - **For more information, see the PowerPoint presentation *Single Spot Exchange for the Single Electricity Market*.**

Installing market surveillance

- **Due to the block bids, carrying out market surveillance at the spot market is a very challenging task**
  - **Requiring highly skilled staff and advanced software tools.**
- **Each of the many current European spot exchanges cannot (and should not) afford such staff and tools**
  - **As is also evident: when the spot market have been manipulated, the exchanges' so-called "market surveillance departments" have detected nothing.**
- **Some of the spot exchanges have openly admitted, their "market surveillance departments" actually do not surveille the market.**
- **Naturally, its unsustainable to have exchanges without market surveillance.**
- ***A single European spot exchange can (and should) afford this staff and these tools*.**

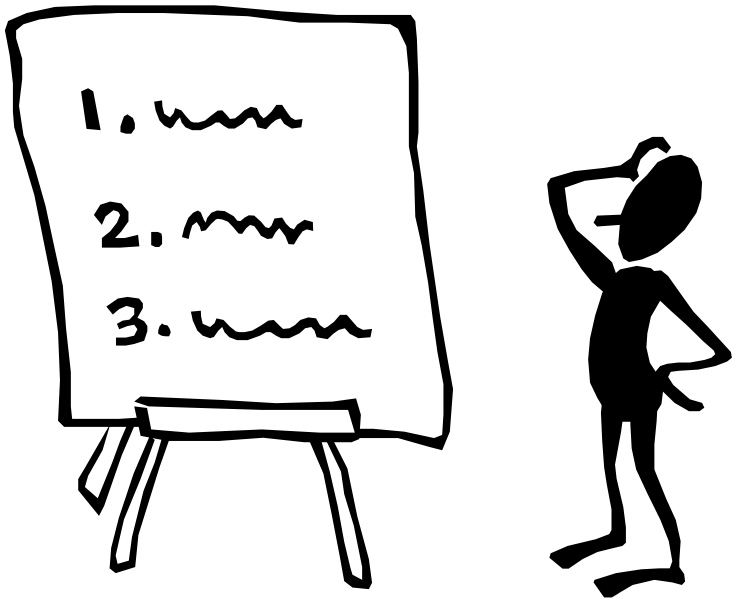
Unbundling



- The operation of spot markets and intra-day markets must be separated.
- With the current state of affairs, the many players at the spot markets are cross-subsidizing the (much smaller number of) players at the intra-day markets
  - For more information, see the PowerPoint presentation *Intra-day trading for The Single Electricity Market*.
- Efficient pan-European regulation can provide Europe with fair trading systems.

Appendix 1

The current calculation of spot prices in Western-Central Europe



Calculation of the spot prices in Western-Central Europe – 1
The current daily operation: the entangling

- As part of the daily operation, the spot exchanges send information on the spot bids to their common calculation algorithm Euphemia.
- However, before the spot exchanges send their bids to Euphemia, the spot exchanges have insisted on aggregating and making the bids anonymous:
  - The block bids and other types of complex bids are made anonymous, so Euphemia cannot see from which player a given bid originate.
  - As for the single-hour purchase bids: for each hour and for each price zone, the purchase bids are aggregated to a demand curve.
  - As for the single-hour sales offers: for each hour and for each price zone, the sale offers are aggregated to a supply curve.
- Euphemia is then sent this entangled (anonymized & aggregated) information.

Calculation of the spot prices in Western-Central Europe – 2
The current daily operation: the untangling

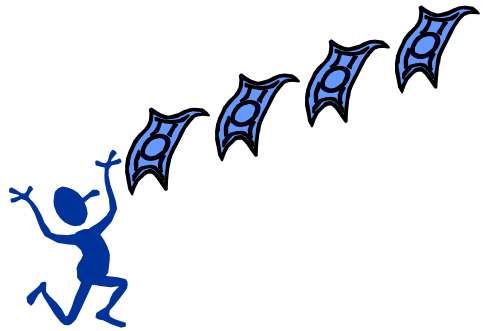
- After the completion of Euphemia's calculation, there's the post-processing
  - Based on Euphemia's spot prices, accepted block bids and other types of accepted complex bids:
    - Each exchange works out what this means for each of its customers' spot trading.
- Via their spot trading fees, the market players pay for the extra pre-processing and post-processing.
- If the pre- or post-processing software of a given spot exchange crashes, the exchange's customers will be in trouble
  - As the other spot exchanges cannot entangle (or untangle) the local information on behalf of the affected exchange.
- So much for the "hot backup" peddled by the spot exchanges.

The system is flawless…

A clear legal framework required

- **PCR (Price Coupling Regions) is the spot exchanges' name for the system presented on the previous two slides.**
- **Naturally, the redundant processing cannot disguise this:**
  - **With PCR the spot exchanges have a common spot calculation.**
- **The European Commission fined EPEX Spot and Nord Pool Spot € 5.98 million for cartel behaviour**
  - **As the two exchanges planned to create a common spot calculation and allocate European territories between them.**
- **However, market coupling renders competition between spot exchanges meaningless.**
- **And no legal action has been brought against PCR.**
- **Again, these inconsistencies illustrate *we need a clear legal framework for the regulation of Europe's spot market***
  - **The current CACM rules will not do, as our current state of affairs illustrates.**

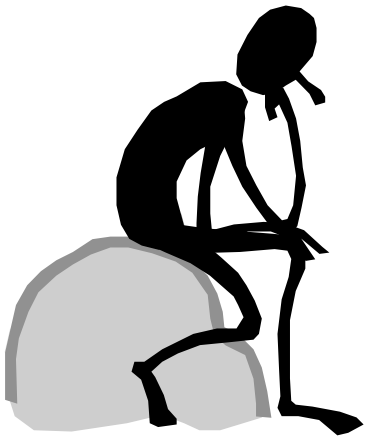
Re-inventing the wheel
With captive customers' money



- **With PCR, the spot exchanges have spent millions of euro re-inventing the wheel**
  - **As the TSOs have financed PCR, the money is paid by Europe's grid users (ie, by captive customers).**
- **The PCR project was redundant, as we had a ready-made solution:**
  - **EMCC's calculation has provided Europe with a cost-efficient spot calculation.**
  - **And EMCC's software had proven reliability**
    - **This contrasts with the spot exchanges' track record**
      - **For more information, see the PowerPoint presentation *Market coupling and spot price calculation*.**

Appendix 2

Why EU's common spot market render competition between spot exchanges meaningless



The grid monopoly causes a spot monopoly

- A special feature of the electricity supply business is the monopoly transport system
  - We're not going to have competing electricity grids
    - We're stuck with a single grid.
- Consequently, for each hour, each price zone must have one, unique spot price
  - The unique spot price will determine if the single grid is used to ship energy into the zone or out from the zone.
- However, the spot prices are the products delivered by the spot exchanges
  - Without delivery of different spot prices, competition between spot exchanges does not make sense.
- A case: how many competing spot exchanges do you have in your country?
- The British experience illustrates "competing" spot exchanges have to merge their delivery of spot prices, when we introduce market coupling.

The monopoly

- **Hence, we arrive at this picture:**

Only one grid (the grid monopoly)

⇩

Only one day-ahead grid congestion management system

⇩

Only one spot price per hour per zone

⇩

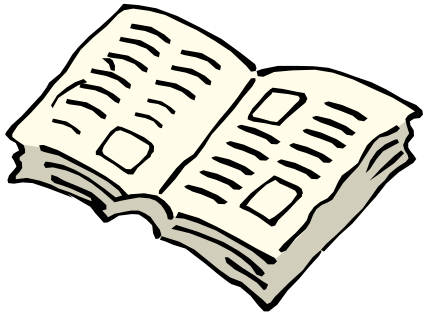
Spot exchanges cannot deliver different spot prices

⇩

Competition between spot exchanges rendered meaningless

For more information, see the PowerPoint presentation *Market coupling makes real competition betw. spot exchanges unfeasible* and the PDF document *Unbundling of spot exchanges and associated clearing houses*.

Appendix 3
Terminology and acronyms



Terminology and acronyms – 1

- ***ACER*** **Agency for the Cooperation of Energy Regulators. An EU body.**
- ***Block bids*** **See the PowerPoint presentation *Market coupling – European price coupling*.**
- ***CACM*** **Capacity Allocation and Congestion Management. EU's guideline on CACM entered into force August 2015. You'll find the guideline here:**

  http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1437991829031&uri=OJ:JOL_2015_197_R_0003
- ***CWE*** **Austria, France, Germany and the Benelux Countries.**
- ***EMCC*** **European Market Coupling Company. Until 4 February 2014, EMCC operated the market coupling between CWE and the Baltic-Nordic area.**
- ***Energy flow*** **Actually, in this presentation, "energy flow" means "day-ahead plans for cross-border energy flow".**

  Note that market coupling/splitting does not create energy flows. It merely creates day-ahead plans for the cross-border energy flows. Later, these plans my be modified by market players' intra-day cross-border trading and/or the TSOs' cross-border trading of regulating energy.

Terminology and acronyms – 2

- ***Euphemia*** **The algorithm used by the PCR spot calculation software. Euphemia has been used for this since 4 February 2014.**
- ***Flow*** **Short-term for energy flow.**
- ***Interconnector*** **An electricity line linking two price zones.**
- ***Market coupling*** **A day-ahead congestion management system, you can have on a border, where two spot exchanges meet. The day-ahead plans for the cross-border energy flows are calculated using the bids sent by the market players to the exchanges – and information on the day-ahead cross-border trading capacity.**

  For simplicity, apart from appendix 3, in this presentation "market coupling" is used as a short-hand for "market coupling/splitting".

Terminology and acronyms – 3

- ***MCO*** **Market Coupling Operator.**
- ***Market splitting*** **A day-ahead congestion management system, you can have on a border, where you have the same spot exchange on both sides of the border. The day-ahead plans for the cross-border energy flows are calculated using the bids sent by the market players to the exchange – and information on the day-ahead cross-border trading capacity.**

  For simplicity, apart from the appendix 3, in this presentation "market coupling" is used as a short-hand for "market coupling/splitting".
- ***NEMO*** **Nominated Electricity Market Operator. An company designated by the competent authority to operate spot trading and/or intra-day trading in a country. The "competent authority" is normally the national energy regulator.**
- ***NordReg*** **An organisation for the Nordic energy regulators. See www.nordicenergyregulators.org**
- ***Pareto optimal*** **See https://en.wikipedia.org/wiki/Pareto_efficiency**

Terminology and acronyms – 4

- ***PCR*** **Price Coupling Regions. The current market coupling in Western-Central Europe. As of 4 February 2014, PCR has replaced the market coupling operated by EMCC. See appendix 1.**
- ***Price zone*** **A geographical area, within which the players can trade electrical energy day-ahead without considering grid bottlenecks.**
- ***Spot calculation*** **The daily calculation producing the following day's spot prices and energy flows. For more information, see the PowerPoint presentation *Maximizing the economic value of market coupling and spot trading*.**
- ***Spot exchange*** **See the PowerPoint presentation *Maximizing the economic value of market coupling and spot trading*.**
- ***Spot market*** **See the appendix of the PowerPoint presentation *Maximizing the economic value of market coupling and spot trading*.**
- ***Spot price*** **A price calculated by a spot exchange. Either by a the spot exchange itself or by a company, to which the calculation has been outsourced.**
- ***TSO*** **Transmission System Operator.**

Terminology and acronyms – 5

- ***Welfare criterion*** **At the outset, due to the block bids, the spot calculation will yield many valid solutions (potentially millions or billions of valid solutions). The welfare criterion states that among the valid solutions, the algorithm must select the one, which maximizes the economic value of the spot trading.**

  For more information, see the PowerPoint presentation *Market coupling – European price coupling*.

- ***Welfare function*** **The function calculating the economic value of the spot trading.**

  For the whole area covered by a given market coupling, the function daily calculates the value of the following day's spot trading. See the PowerPoint presentation *Welfare criterion*.

- ***Western-Central Europe*** **In this presentation, this means the countries Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and UK.**

Thank you for your attention!

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