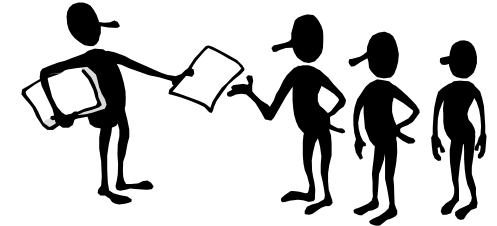


Introduction

Anders Plejdrup Houmøller
Houmoller Consulting ApS

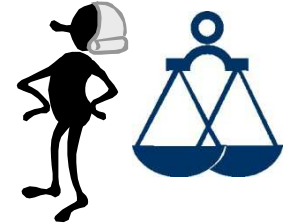


- ▶ **In appendix 3, you'll find a list of the terms and acronyms used in this document.**
- ▶ **Concerning the documents referred to in this presentation:**
 - **At *houmollerconsulting.dk*, you can download the documents from the sub-page *Facts and findings*.**
- ▶ **This PowerPoint presentation is 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.**



- ▶ **March 2014, the European Commission fined the spot exchanges EPEX Spot and Nord Pool Spot EUR 5.98 million**
 - **Due to the two exchanges' plan to create a common platform for spot calculation and allocate European territories between them.**
- ▶ **However, with PCR the exchanges have a common spot calculation!**
 - **Please refer to appendix 1.**
- ▶ **Actually, EU's common spot market requires a common spot calculation**
 - **This is an essential part of the Single European Electricity Market.*)**
- ▶ ***The challenge: the common spot calculation render competition between the spot exchanges meaningless***
 - **Please refer to appendix 2.**

***) For more information, see the PowerPoint presentation
*Market coupling – governance and operation***



The rule of law

Monopolies must be regulated

- ▶ Where we cannot have competition, we must have regulation.
- ▶ In this case, 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*
 - *The system, which would have been preferred by the players must be the one created by the regulation.*
- ▶ 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 two competing 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 (ie, proven reliability).**
- ▶ **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 a lot 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?***

*) See the PowerPoint presentation
Market coupling and spot price calculation.



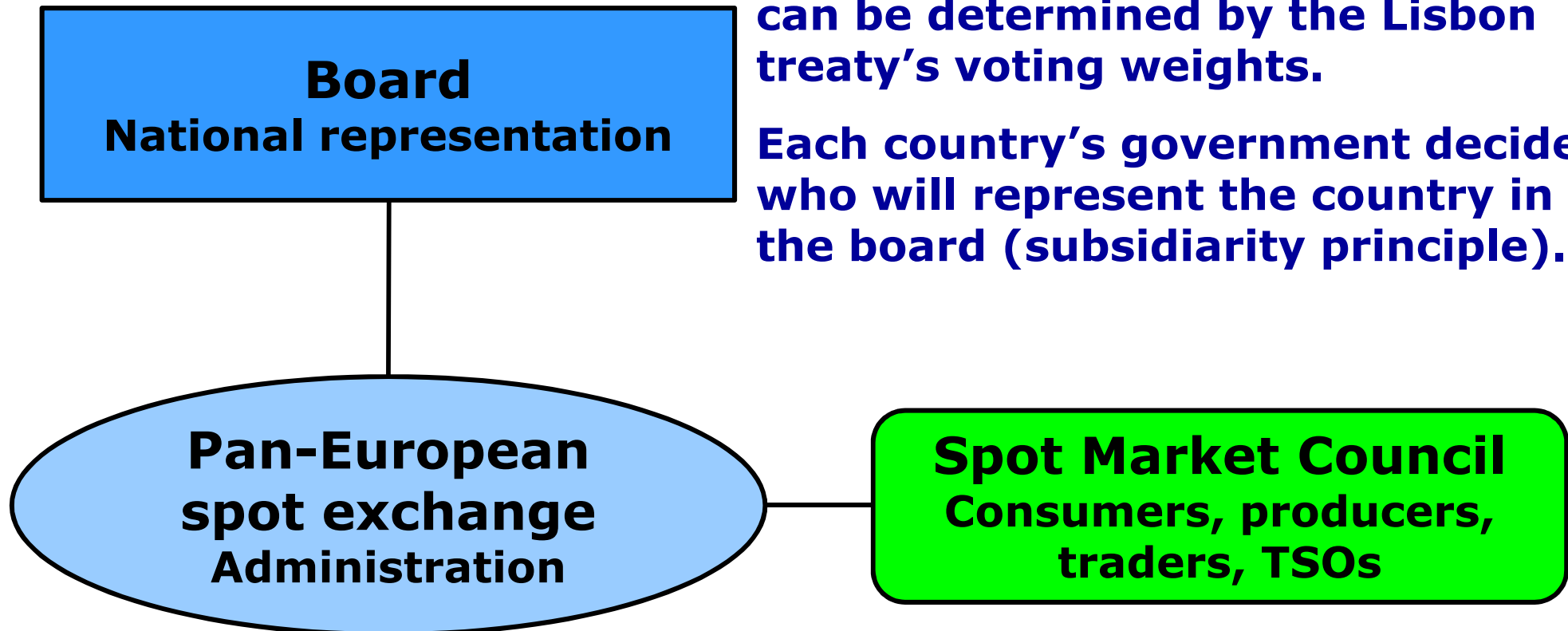
- ▶ **The stakeholders cannot “vote with their feet”**
 - **ie, they cannot choose between competing spot prices and competing market coupling schemes.**
- ▶ **Therefore, the stakeholders must have another type of vote.**
- ▶ **This means we must ensure fair and real influence for both nations and market players.**
- ▶ **As the European spot calculation 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 a European level.**

Good governance and regulation

ACER and national regulators

For example, each country's share can be determined by the Lisbon treaty's voting weights.

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



The merits

- ▶ **Good governance and regulation enables 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.**



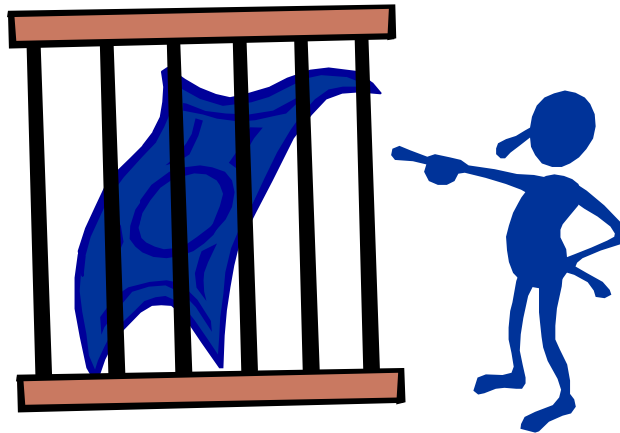
Transparency

- ▶ **Captive customers: via their grid fees, all consumers and producers are forced to finance the PCR market coupling**
 - **As the TSOs are paying the spot exchanges for PCR.**
 - **See appendix 1.**
- ▶ **However, in the Regulatory Reports from the PCR project, the costs and governance are confidential!**
- ▶ **It's surrealistic, the costs and governance are secret:**
 - ***Just hand over your money. We'll not tell you how much you via your grid fees pay for PCR.***
 - ***Neither will we tell you how your money is spent.***
 - ***Nor will we inform you on the governance of the project, you are forced to finance.***



**Where did my
money go?**

Cost efficiency



Cui bono?

For whose benefit is it?



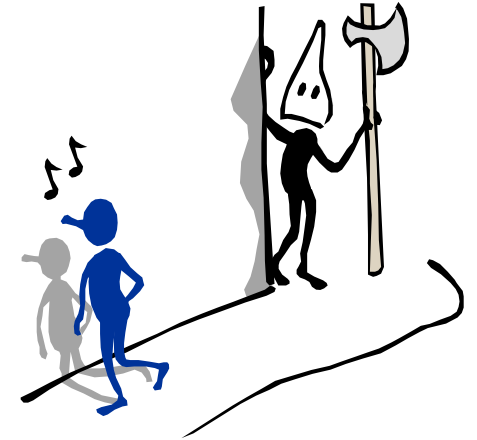
- ▶ **As outlined in appendix 1: the current calculation of the spot prices in Western Europe has lots of extra pre-processing and post-processing.**
- ▶ **The added cost and the added risk of the extra processing are clear.**
- ▶ **What is the added value?**
 - ***In other words: for who is the extra processing an advantage?***

CE Wrong IT specifications

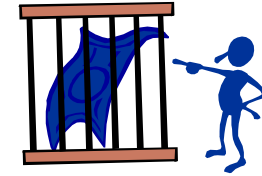


- ▶ **Naturally, it's very visible when the exchanges' spot calculations crash.**
- ▶ **However, the losses inflicted by the crashes pale compared with the losses inflicted by wrong software specifications.**
- ▶ **The PCR software has wrong handling of interconnectors and block bids.**
- ▶ **The specification 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.***
- ▶ **Due to lack of understanding of 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 their PCR software specifications.**

The silent kill

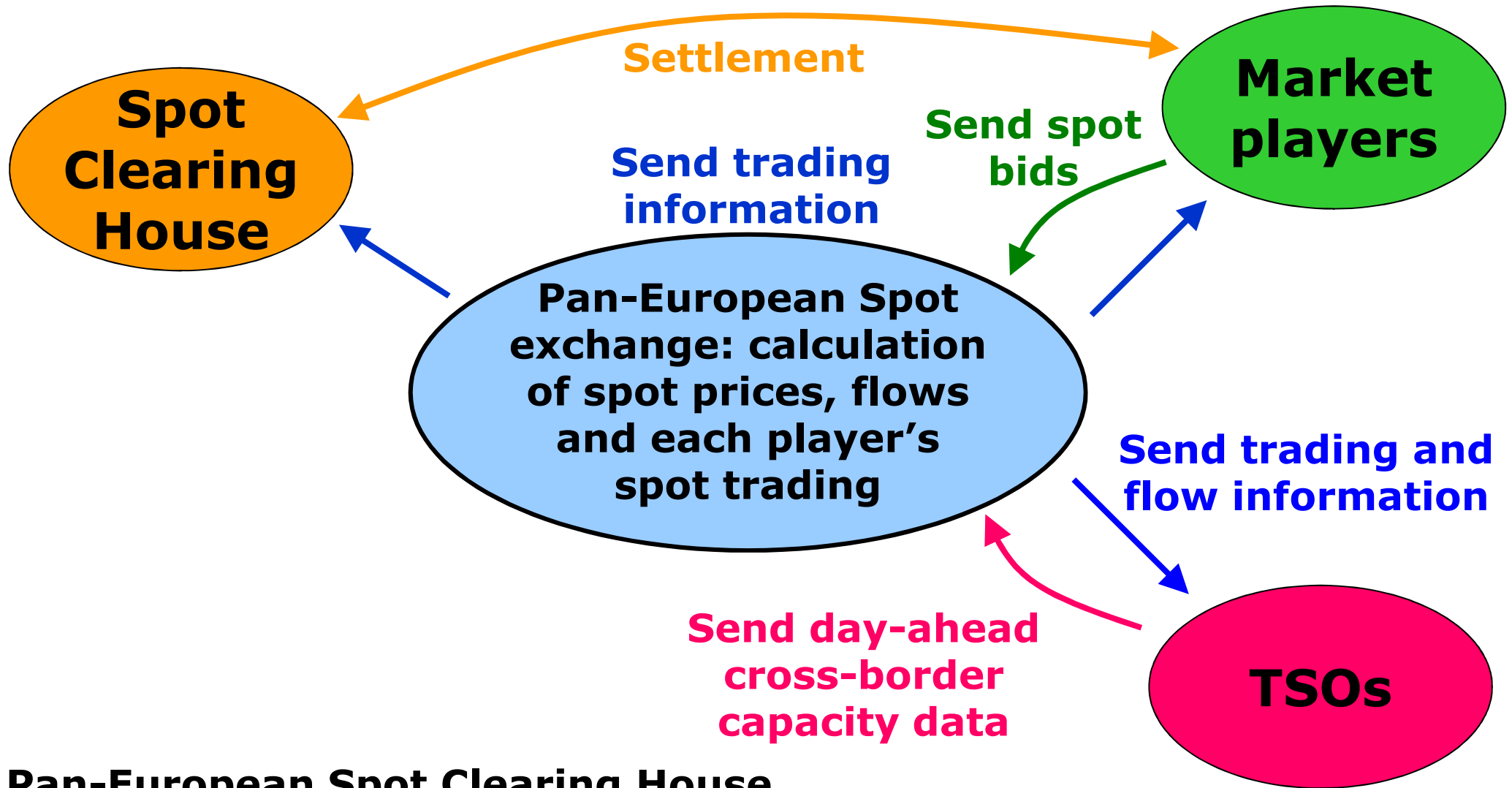


- ▶ **Anecdotic evidence indicates PCR's wrong handling of interconnectors and block bids may reduce the economic value of the spot trading with 40%!**
- ▶ **The daily economic value of the spot trading in Western Europe can easily exceed EUR 8 billion.**
- ▶ ***Good governance can deal with these relics of planned economy***
 - ***See the PowerPoint presentation *Maximizing the economic value of market coupling and spot trading.****



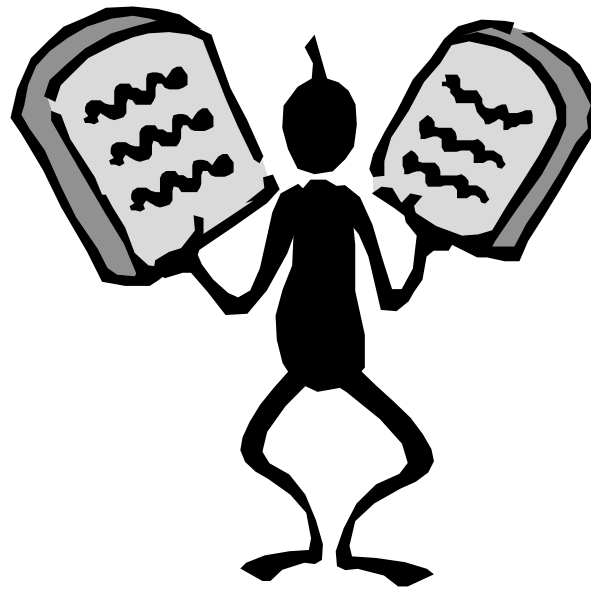
- ▶ **From 2013 to 2014, Nord Pool Spot increased its variable spot trading & settlement fee with 20%**
 - **This is the dominant fee.**
 - **No fees were reduced.**
- ▶ **As this is a volume fee, the increased volumes should have enabled a reduction of the fees.**
- ▶ **The fees are quoted in euro. The euro inflation is currently about 0.3%.**
- ▶ **Simultaneously, a large part of Europe's electricity supply business is engaged in ferocious cost-cutting**
 - **In a competitive environment, the spot exchanges' fees would have had to follow suit.**
- ▶ ***Good governance and pan-European regulation enables cost control.***

A single spot exchange for the Single Market



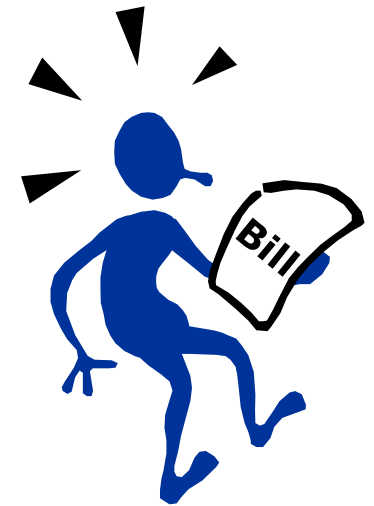
**Pan-European Spot Clearing House.
Settlement of spot trading.**

Accountability



Lack of accountability is costly

- ▶ **With impunity, the spot exchanges have inflicted heavy losses on market players and societies**
 - **Losses have been inflicted, when the spot exchanges' redundant re-calculation of spot prices have crashed.*)**
 - **However, even these losses pale compared with the losses described at slide no. 12.**
- ▶ **As described at slide no. 27: with PCR, the spot exchanges have forced captive customers to pay millions of euro**
 - **To a project where the spot exchanges have tried to re-invent the wheel.**

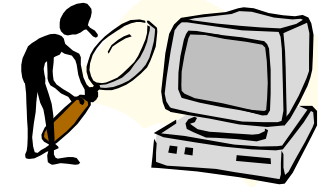


***) See the PowerPoint presentation
*Market coupling and spot price calculation***



Introducing accountability

- ▶ **November 19, 2013 Nord Pool Spot's re-calculation of the spot prices for the following day crashed**
 - **Producing unreliable prices for Southern Sweden.**
- ▶ **The exchange changed the spot prices at 2:58 pm CET**
 - **Not for the first time, the exchange thereby violated its own rule book**
 - **The rule book used by Nord Pool Spot November 2014 stated: the spot prices cannot be changed after 2 pm CET.**
- ▶ ***Good governance and pan-European regulation can ensure all actors are accountable for their actions.***

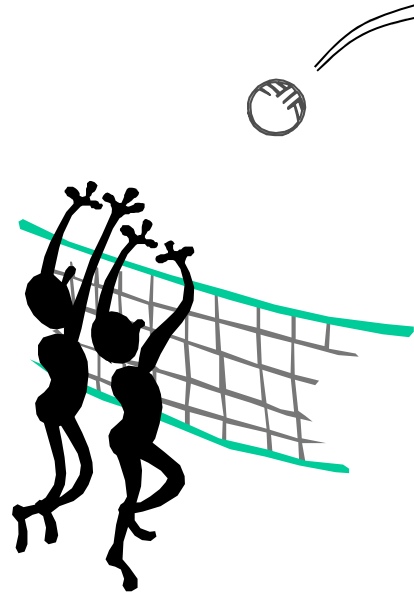


Installing market surveillance

- ▶ **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.***

High reliability

**Qualifying the concept of a single
spot calculation for the Single Market**



- ▶ **Question: how can we avoid a European spot chaos corresponding to the Baltic-Nordic chaos 5 August 2013?**
 - **The Baltic-Nordic chaos was caused by the crash of Nord Pool Spot's re-calculation of the spot prices.**
- ▶ **Answer: do not put all your eggs in one basket!**
- ▶ **We need a shadow calculation carried out on a separate computer system**
 - **Using software developed by another supplier than the one responsible for the primary IT tool**
 - **This second-source feature is very important**
 - **Without this, a single software bug can sink Europe's spot calculation.**

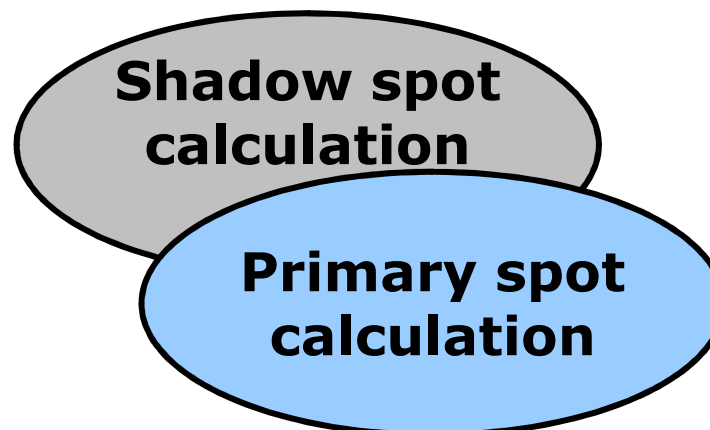


In contrast: with the second-source feature and the shadow calculation, the N-1 criterion is fulfilled for Europe's spot calculation.

Improving reliability

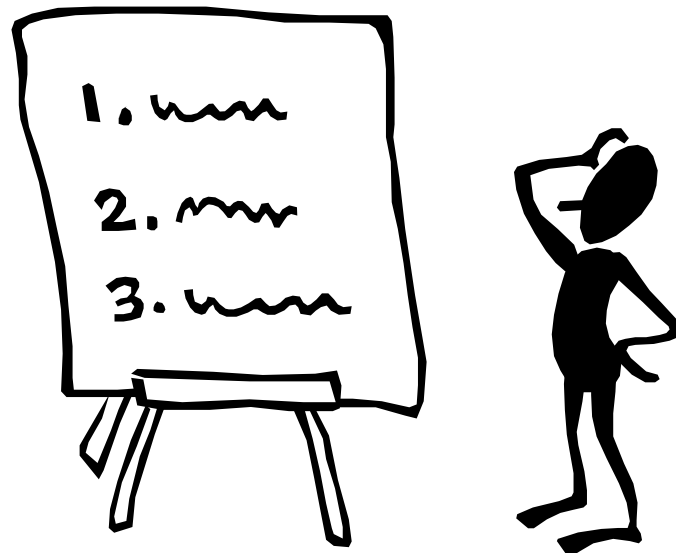
Shadow spot price calculation

- ▶ **Fulfilling the N-1 criterion is not free.**
- ▶ **However, following this basic security rule is much safer and cheaper than the PCR system peddled by the spot exchanges**
 - **With PCR, the spot calculation is supposed to rotate between all the participating spot exchanges.**
 - **And there's pre-processing and post-processing at every spot exchange**
 - **Hence, an absurd number of calculation sites – all using the same software from the same supplier**
 - **ie, no second-source security.**



Appendix 1

The current calculation of spot prices in Western Europe



Calculation of the spot prices in Western 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 the flexible hourly 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 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 accepted flexible hourly bids:
 - Each exchange must work 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 region in question will not have a spot price calculation for the next day
 - 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...***



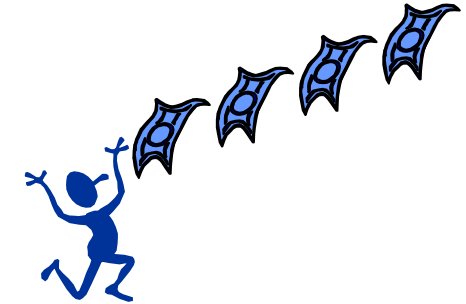
A clear legal framework required

- ▶ **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 has fined EPEX Spot and Nord Pool Spot EUR 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.***

- ▶ **Note: such untangling could also have been done when EMCC was responsible for the central calculation of the spot prices.**
- ▶ **However, the spot exchanges refused to use EMCC's spot prices**
 - **Although EMCC's calculation always produced reliable prices**
 - **In contrast to the spot exchanges' re-calculations.**
- ▶ **When Nord Pool Spot's re-calculation of the spot prices for 5 August 2013 crashed, the exchange took the argument to the extreme**
 - **Claiming it was technically impossible to use EMCC's central calculation to figure out individual players' spot trading**
 - **As EMCC's central calculation only had anonymized & aggregated information on the players' spot bids.**
- ▶ **However, precisely this untangling is currently done daily by the spot exchanges, when Euphemia's calculation is completed...**
- ▶ **For more information: see the PowerPoint presentation *The European spot market for electricity*.**

Re-inventing the wheel

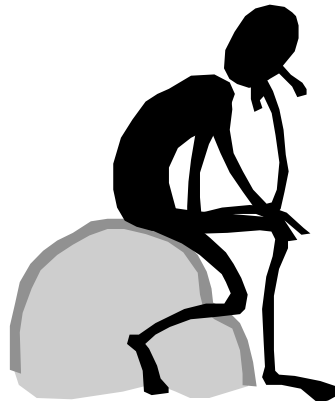
With captive customers' money



- ▶ **With PCR, the spot exchanges have spent millions of euro re-inventing the wheel**
 - **As the TSOs are financing PCR, the money is paid by Europe's grid users (ie, by captive customers).**
- ▶ **The PCR project is redundant, as we have a ready-made solution:**
 - **EMCC's calculation has provided Europe with a cost-efficient spot calculation.**
 - **And EMCC's software has proven reliability**
 - **This contrasts starkly 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**

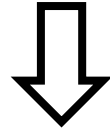


The grid monopoly causes a spot monopoly

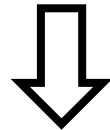
- ▶ **A special feature of the electricity supply system is the monopoly transport system**
 - **We're not going to have competing electricity grids**
 - **We're stuck with a single grid.**
- ▶ **Consequently, for each hour, each price zone must have one, unique spot price**
 - **The unique spot price 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.**

► Hence, we arrive at this picture:

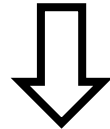
Only one grid (the grid monopoly)



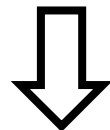
Only one day-ahead grid congestion management system



Only one spot price per hour per zone



Spot exchanges cannot deliver different spot prices

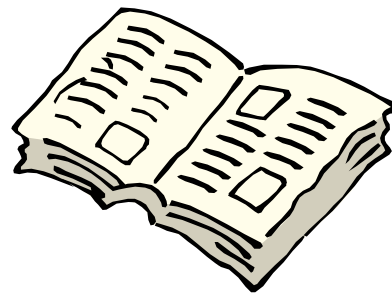


Competition between spot exchanges rendered meaningless

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



- ▶ **ACER** Agency for the Cooperation of Energy Regulators. An EU body established in 2010.
- ▶ **Block bids** See the PowerPoint presentation *Market coupling – European price coupling*.
- ▶ **CET** Central European Time.
- ▶ **CWE** Central Western Europe. 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. See marketcoupling.com.
- ▶ **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 may be modified by market players’ intra-day, cross-border trading and/or the TSOs’ cross-border trading of regulating energy.

- ▶ **Euphemia** The algorithm used by the PCR spot calculation software. Euphemia has been used for this since 4 February 2014.

- ▶ ***Flexible hourly bid*** A sales offer sent to a spot exchange with a threshold price P and an energy volume V . The next day, the seller will for one hour sell the volume V , if the spot price during the hour is at least P . The seller has not specified the hour.

If one or more flexible hourly bids are accepted: among the high-price hours of the next day, the spot price calculation software will allocate the flexible bids in a way, which maximizes the economic value of the spot trading. See the PowerPoint presentation *Welfare criterion*.

- ▶ ***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 two exchanges' bids 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”.

- ▶ **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 exchange's bids 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".
- ▶ **N-1 criterion** At the outset, this is the ability of the electricity supply system to survive the unplanned outage of one major component (for example, the system must be able to cope with the failure of one transmission line or one major power station).
Somewhat confusingly, in other businesses, the *N+1 redundancy* describes pretty much the same. The N+1 redundancy is a form of resilience that ensures system availability in the event of failure of a single component.
In this document, the *N-1 criterion* means Europe's spot calculation system is backed up by a shadow spot calculation system (slide no. 20).

- ▶ **PCR** Price Coupling Regions. The current market coupling in Western 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.

- ▶ ***Welfare criterion*** At the outset, due to the block bids, the spot calculation will yield many valid solutions (potentially millions 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 Europe*** In this presentation, this means the countries Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Great Britain, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain and Sweden.

Thank you for your attention!

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