Introduction

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- **In the appendix, you'll find a list of the terms and acronyms used in this presentation.**
- **You'll find more detailed accounts of FTRs as hedging instruments in the PowerPoint presentations '*Hedging with CfDs and FTRs Financial Transmissions Rights*' and '*PTRs Physical Transmission Rights and cross-border CfDs*' from Houmoller Consulting.**
- **This PowerPoint presentation is animated**
  - ✓ **It's 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*.**

The purpose of this presentation

Two messages in this presentation

- ⇨ This PowerPoint presentation shows the nature of FTRs.
- ⇨ Also, the presentation argues why short-term FTRs can be a good hedging tool
  - ✓ Especially if you have a market with lots of renewable energy
    - – Making long-term predictions of the future electricity production virtually impossible.
    - – And creating high risk of single-hour price spikes.
- ⇨ Note: the two messages are <u>not</u> connected – they are put in the same presentation for convenience
  - ✓ Avoiding to have a presentation per message.

Issue no. 1
The nature of FTRs

Issue 1 – context

- ⇨ **Two cases with the same context.**
- ⇨ **We are considering a north-south border.**
- ⇨ **At the border, there is either**
  - ✓ **Monthly FTR auctions.**
- ⇨ **Or**
  - ✓ **Monthly auctions where physical capacity is sold with the use-it-or-sell-it clause.**
- ⇨ **We are considering a month with 30 days**
  - ✓ **Hence, the number of hours in the month are**

    30 day * 24 h/day = 720 h.

Ignore the following costs/risks

- ⇨ **Ignore risk of wrong prices used in the spot settlement due to local calculations or re-calculations of the spot prices**
  - ✓ **Please refer to the term "volume coupling" in the appendix.**
- ⇨ **Ignore fees paid to power exchanges and clearing houses.**
- ⇨ **Ignore other marginal costs of participating in the auctions**
  - ✓ **And for physical transmission rights: ignore the marginal costs of participating in the physical market.**

Assumption for issue 1

- ⇨ **When these costs/risks are ignored: in the perfect market – and with perfect foresight – the players at the auctions will pay precisely the future congestion rent at the auctions.**
- ⇨ **For issue 1, this will be assumed, in order to make the two cases A and B simple.**

Case A

- ⇨ **For simplicity – assume during all hours of the month, the spot prices on the northern and southern side are 50 EUR/MWh and 54 EUR/MWh, respectively.**
  - ✓ **Average price difference is 4 EUR/MWh.**
- ⇨ **Value of 1 MW in direction south:**
  - ✓ **4 EUR/MWh * 1 MW * 720 h = 2880 EUR.**
- ⇨ **At the monthly auction:**
  - ✓ **Pay 2880 EUR/MW in direction south.**
  - ✓ **Pay 0 EUR/MWh in direction north.**

Price during all 720 hours: 50 EUR/MWh

Border

Price during all 720 hours: 54 EUR/MWh

Case B – average prices

- For simplicity – assume during all hours of the month except one, the spot prices on the northern and southern side is 50.1 EUR/MWh and 50 EUR/MWh, respectively.
- For one hour, the prices on the northern and southern side are 50.1 EUR/MWh and 3000 EUR/MWh, respectively.
- The average southern price is
  - ✓ [719 * 50 EUR/MWh + 3000 EUR/MWh] / 720 = 54.10 EUR/MWh.
  - ✓ The average price difference is

    54.1 EUR/MWh – 50.1 EUR/MWh = 4 EUR/MWh.

Price during 720 hours: 50.1 EUR/MWh

Border

Price during 719 hours: 50 EUR/MWh. For one hour: 3000 EUR/MWh.
Average price 54.10 EUR/MWh

Case B – auction prices

- ⇨ **Value of 1 MW in direction south:**
  - ✓ **(3000 EUR/MWh – 50.1 EUR/MWh) * 1 MW * 1 h = 2949.9 EUR.**
- ⇨ **Value of 1 MW in direction north:**
  - ✓ **(50.1 EUR/MWh – 50 EUR/MWh) * 1 MW * 719 h = 71.9 EUR.**
- ⇨ **At the monthly auction:**
  - ✓ **Pay 2949.9 EUR/MW in direction south.**
  - ✓ **Pay 71.9 EUR/MWh in direction north.**

Price during 720 hours: 50.1 EUR/MWh

Border

Price during 719 hours: 50 EUR/MWh. For one hour: 3000 EUR/MWh.
Average price 54.10 EUR/MWh

Issue 1 – conclusion from case A and case B

- For both cases, the average price difference is 4 EUR/MWh.
- However, the values of the capacities are:
- Case A
  - ✓ 2880 EUR/MW direction south.
  - ✓ 0 EUR/MWh direction north.
- Case B
  - ✓ 2949.9 EUR/MW in direction south.
  - ✓ 71.9 EUR/MWh in direction north.
- Note for case B: the values are positive in both directions. This illustrates the fact that FTRs are options
  - ✓ So are physical transmission rights.
- As is always true for options: the value increases, when the volatility increases.

The average price difference and the auction prices

- ⇨ **With the assumptions mentioned previously, the expected, average price difference can be calculated from the auction prices:**
- ⇨ **Case A – in direction south:**
  - ✓ **2880 EUR/MW / 720 h = 4 EUR/MWh.**
- ⇨ **Case B – in direction south:**
  - ✓ **(2949.9 - 71.9) EUR/MW / 720 h = 4 EUR/MWh.**
- ⇨ **However, it does not work the other way round:**
  - ✓ **Even a perfect forecast of the average price difference will not give you the value of cross-border capacity.**

Issue no. 2

Using short-term FTRs for price hedging

The current financial contracts

Compared with short-term FTRs

- The current financial contracts hedge against area prices during a given time period
  - ✓ Currently, in the Nordic countries, the minimum time period for an area hedge is a month.
- The current financial contracts do not hedge against cross-border price differences
  - ✓ And you can not use these financial contracts to hedge against single-hour price spikes.
  - ✓ However, with ever more wind energy entering the market, more price spikes during a few hours are inevitable!
- Weekly and daily FTR auctions can be used to hedge against this.
- This is important for players who have a lot of wind energy in their portfolio
  - ✓ Or for players, who simply are in areas where there is much wind energy.

Hedging with short-term FTRs

- Assume you are a player with a lot of wind energy in your portfolio
  - ✓ Or you may simply be a player in an area with much wind energy.
- For the Nordic area, the CfDs are notoriously illiquid and have low correlation to the actual spot prices.
- However, with short-term FTRs you need not resort to this primitive price hedging.
- On a short-term basis, you can evaluate whether you need hedging against your obligations
  - ✓ Using short-term FTRs as the tool.
- With FTRs, you can use the price on the other side of the border as the anchor
  - ✓ A FTR is a hedge, if your area price spikes, and the price in the neighbouring area does not.

Appendix
Terms and acronyms

Terminology and acronyms – 1

As used in this presentation

- ***Area*** **is used as the short version of bidding area.**
- ***Bidding area*** **means a geographical area, within which the players can trade electrical energy without considering grid bottlenecks.**
- ***Border*** **means a border between two bidding areas**
  - ✓ **Hence, it need not be a border between two countries. It may be a border between two bidding areas inside a country.**
- ***Congestion rent*** **The arbitrage revenue earned by implicit auction. In implicit auction, for each interconnector, some body must buy energy on the interconnector's low-price side and sell the energy on the high-price side. Normally, this body is appointed by the interconnector's capacity owners; and the arbitrage revenue is collected by the capacity owners. The amount of energy traded cross-border is calculated by means of market splitting or market coupling.**

Terminology and acronyms – 2

As used in this presentation

- ***Double auction*** **A calculation method whereby an exchange's price is set by calculating the intersection between the exchange's supply curve and the exchange's demand curve.**
- ***FTR*** **Financial Transmission Right. For a given border, this is a system, where the TSOs auction off the border's future, unknown congestion rent. The buyers are said to have bought FTRs.**

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- ***Implicit auction*** **The common term for market coupling and market splitting.**

Terminology and acronyms – 3

As used in this presentation

- ***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' spot bids and information on the day-ahead cross-border trading capacity.**
- ***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 spot bids and information on the day-ahead cross-border trading capacity.**
- ***Nordic*** **and** ***Nordic area*** **refer to the countries Denmark, Finland, Norway and Sweden.**

Terminology and acronyms – 4

As used in this presentation

- ***Spot bid*** **A purchase bid or a sales offer submitted to a spot exchange.**
- ***Spot exchange*** **In this document, a spot exchange is an exchange where**
  - ✓ **Electrical energy is traded day-ahead.**
  - ✓ **The day-ahead prices are calculated by means of double auction.**
  - ✓ **Note: the price calculation can be outsourced to a Price Calculation Service Centre (PCSC). The PCSC will calculate the spot prices and the day-ahead plans for the cross-border energy flows for the price coupled region.**
- ***Spot price*** **A price calculated by a spot exchange. Either by a calculation performed by the spot exchange itself, or by a calculation performed by a body, to which the calculation has been outsourced (refer to PCSC).**

Terminology and acronyms – 5

As used in this presentation

- ***Volume coupling*** **A market coupling scheme, where a central body first calculates the spot prices and the day-ahead plans for the cross-border energy flows for the whole coupled region. However, the centrally calculated spot prices are not used. Instead, there are local re-calculations of the spot prices.**
  - ✓ **If you have volume coupling, the prices and the energy flows may mismatch (energy flows apparently going from high-price areas towards low-price areas).**
  - ✓ **This can happen because the spot prices for each bidding area are calculated twice. First, the central body calculates all spot prices for the whole coupled area. Next, for some interconnectors in the coupled area, the market coupler sends price-taking purchase bids to the bidding area on the interconnector's low-price side; and corresponding price-taking sales offers to the interconnector's high-price side. After having received the market coupler's bids, the local spot exchanges re-calculate the local spot prices. However, the redundant, local re-calculations are economic sub-optimizations for sub-areas of the coupled area. Therefore, the local re-calculations may fail to reproduce the prices calculated in the global optimization performed by the central body. In turn, the wrong re-calculations may cause a mismatch between the prices and the energy flows. However, the glaring mismatch is not the most serious effect of the redundant re-calculations. By far, the most serious effect is the fact that the market is supplied with unreliable spot prices.**

Terminology and acronyms – 5
As used in this presentation

⇨ ***TSO*** **Transmission System Operator.**

Thank you for your attention!

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