POWER FOR TODAY. POWER FOR TOMORROW.
1. What is the power exchange?

2. Impact of renewables on volume and prices

3. How can the exchange adapt?
1996: European Directive on energy market liberalization

- 2001: Establishment of POWERNEXT SA
- 2002: Merger of the former Leipzig Power Exchange LPX and the EEX Frankfurt to EEX AG

17 September 2008: Creation of EPEX SPOT SE, owned 50/50 by POWERNEXT SA and EEX AG

1 January 2009: Transfer of POWERNEXT Power Spot into EPEX SPOT SE

1 September 2009: Transfer of EEX Power Spot into EPEX SPOT SE

The Creation of EPEX SPOT and the development of power trading are one of the most visible results of the liberalization of the European Power Market.
What is a power exchange?

An exchange organizes in a:
• centralised, • multilateral, • transparent, • anonymous, manner...

...transactions setting a price and a quantity,...
- All other trade parameters being pre-determined -

... on products that are... :
• standardized, • fungible.

Power exchanges collect purchase and sell orders from professionals in order to generate and make public market prices, in a transparent and fair manner.

Products traded on EPEX SPOT correspond to a hourly power delivery in France, Germany/Austria and Switzerland.

EPEX SPOT is a spot exchange; the lead-time between trading and delivery goes from 24 hours (day-ahead market) to 45 minutes (intraday market).
What is a power exchange?

Futures market
- Long / middle term (years / months)
- Hedging of supply, optimisation of generation

Day-ahead Market
- Short-term (Day+1)
- Balancing of consumption & generation

Intra-day Market
- Ver short term (hours)

Balancing & Reserves
- Real time (minutes)
- System security
In total, EPEX SPOT counts 203 exchange members (Day-Ahead & Intraday) as of 19 April 2012.
Markets, volumes 2011 and delivery zones

Share of national consumption:

- **241 TWh**
  - + 12%
  - Intraday DE: 15.9 TWh (+ 56%)

- **12 TWh**
  - + 30%

- **61 TWh**
  - + 13%
  - Intraday FR: 1.7 TWh (+ 70%)

Delivery zones:

- **314 TWh** in 2011 on all EPEX markets
  - ➢ 12.5 % increase of volume in 2011
  - ➢ 57 % increase of Intraday volumes in 2011

Fixing day-ahead

Day-Ahead Auction

Market Areas
- France
- Germany/Austria
- Switzerland

• Blind auction, 7/7 days
• 24 hours of the next day
• Hours and blocks of hours
• Trading via EPEX Trading System – ETS
  Web based electronic system

Gate closure time
- 11:00 fixing Suisse
- 12:00 fixing DE/AT & France

Publication of results
- 11:10 fixing Suisse
- 12:40 fixing DE/AT & France

- Purchase and sell orders are aggregated in demand and sell curves.
- The market price and the total volume are determined by the intersection of the aggregated demand and sell curves.

\[ \text{MCP} : \text{Market Clearing Price} \]
\[ \text{MCV} : \text{Market Clearing Volume} \]
Continuous Intraday

Market Areas

- France
- Germany

- Continuous trading 24h/24
- 24 hours of each day are traded since 3:00 pm the previous day until 45 minutes before delivery
- Hours and blocks of hours
- 15-minutes contracts in Germany

The intraday market can be used:

- Purchase/sale of quantities that have not been executed during the auction
- Unplanned maintenance after the auction
- Flexible tool to trade closer to real-time
- Arbitrage with neighbouring countries
### Day-Ahead prices evolution 2001-2012

#### Baseload Prices €/MWh

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>Jan-April 2012</th>
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<tbody>
<tr>
<td>Germany/Austria</td>
<td>44,49</td>
<td>51,12</td>
<td>44,72</td>
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<tr>
<td>France</td>
<td>47,50</td>
<td>48,89</td>
<td>53,06</td>
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</table>

#### Daily Day-Ahead prices

![Graph showing daily day-ahead prices from 27/11/2001 to 27/11/2011. The graph compares Germany/Austria (black line) and France (orange line).]
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In the coming years, **market-based models** (e.g. Market Premium) will **progressively replace** the feed-in tariff.
On January 1st 2010, the four German TSOs became obliged by law to sell all domestic renewable energy under feed-in tariff on the exchange.

Volume forecasted in day-ahead are sold on the auction and then adjusted on the intraday market.

- Rising liquidity
- No discontinuity in price evolution
- No increase in volatility

Volume and price development in face of increasing renewable volumes
Inversion of peak / off-peak prices

- However, prices can exhibit specific features in case of high renewable energy production:
  - Inversion of peak/off-peak prices: prices during peak consumption hours become less expensive than off-peak hours.
Negative prices typically occur in situations with high non-dispatchable power production and low demand. Because of high start-up costs, producers prefer to pay rather than switching off their power plants.

- Amplitude and number of occurrences of negative prices are quite stable over time, with a small increase beginning 2012.
- Negative prices can spread to France.

<table>
<thead>
<tr>
<th>Nbr of days with negative prices</th>
<th>FR</th>
<th>DE</th>
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<tr>
<td>2010</td>
<td>0</td>
<td>17</td>
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<tr>
<td>2011</td>
<td>5</td>
<td>15</td>
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<td>2012 (Q 1)</td>
<td>2</td>
<td>6</td>
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<th>Min Prices</th>
<th>Auction DE</th>
<th>IDM DE</th>
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<tr>
<td>2010</td>
<td>-20.45</td>
<td>-59.04</td>
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<tr>
<td>2011</td>
<td>-36.82</td>
<td>-140.88</td>
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<td>2012 Q1</td>
<td>-100.08</td>
<td>-87.45</td>
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</table>

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<tr>
<th>Average Negative Prices</th>
<th>Auction DE</th>
<th>IDM DE</th>
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<tr>
<td>2010</td>
<td>-4.99</td>
<td>-23.46</td>
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<tr>
<td>2011</td>
<td>-10.1</td>
<td>-28.18</td>
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<tr>
<td>2012 Q1</td>
<td>-15.93</td>
<td>-29.55</td>
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</table>
CWE Market Coupling: How does it work?

- The cross border flows at the interconnections are used in an optimal way by implicit allocation of cross-border capacities over the exchange:
  - Mutualisation of order books
  - Less price volatility
  - Prices converge over the region when sufficient cross-border capacity is available.
  - 60% of hours identical across the region.

- Market Coupling has a smoothing impact on price peaks, whether positive (in France) or negative (in Germany).
- But impacts of extreme local events (cold spell, high wind...) also spread mechanically to other markets and impact their prices.
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15-minute contracts on the German Intraday market: more flexibility on the market

- Because of the development of renewable energy in Europe and more specifically of the in-flux of wind energy in Germany, the production of power varies more and more within an hour.

- 15-minute products have been launched on December 15th 2011 to provide more flexibility, especially when power delivery time comes closer and generation forecasts are more accurate.
- 15-minute products will be available for cross-border trading whenever capacity allocation rules will allow for it.
With steadily growing volumes, renewable energy is playing a key role in EPEX SPOTs activity.

In close cooperation with members, TSOs, regulators, industrial associations and political decision makers, EPEX SPOT conducted a study on the integration of renewables on the exchange, from which two main concepts emerged:

**Option 1**: trading Guaranties of origin on the power exchange for direct marketing schemes.

While this option concerns a smaller market segment (max. 20-25TWh), it seems technically and legally feasible in a short term perspective.

**Option 2**: trading Guaranties of origin on the power exchange for FIT & Market Premium schemes.

While this option could potentially reduce the EEG-Apportionment, allow for flexible power labeling and concerns a larger market segment (~100TWh), major legal hurdles have been identified and allow at best a middle- or long-term feasibility.
EPEX SPOT currently focuses its efforts on Option 1: the idea is to investigate “classical” certificate trading on the exchange, based on Guaranties of Origin.

The concept of a two-step auction allowing to reduce the EEG-Apportionment as described in Option 2 is currently postponed (due to legal hurdles).

On a short to middle term perspective, the objective is to assure the tradability of German GoOs on the power exchange. With this in mind, EPEX SPOT keeps up with the introduction of the German GoO-register and pursues its discussions with the Federal Environmental Agency (UBA) as well as the Federal Ministry for Environment (BMU).

In parallel, the French market case is also considered, including the case of small power plants going out of subsidy schemes in 2012.

In summary, EPEX SPOT continues to investigate the possibility to trade GoOs on the exchange and follows the implementation of GoO-registers in several EU countries.
• High influx of renewable power can occasionally disturb prices “usual” behavior: negative prices, inversion of peak/off-peak spread.

• Enhancement of market liquidity can help as a buffer against excessive price volatility.

• However, it is also particularly relevant to provide renewable producers with sound price signals in order to encourage them (whenever possible) to produce power when it is most needed.

• Market coupling smoothes the impact of local shocks on market prices but it also introduces new challenges: is a European price relevant when energy policies remain at the national level?