Financial Instruments for Energy Markets

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Key questions for discussion today

1. What are some of the commercial/financial risks involved in the energy sector? (taking the electricity sector as an example)

2. How does an utility operate and manage these risks? (taking Vattenfall as an example)

3. What are the tools/products that are available to market players (producers, investors and customers) for managing these risks?

4. How can we expect the energy markets to evolve? What new risks, needs and products may arise?
General overview of enterprise risks for an integrated utility company

1. Financial risk
   - Financial risk (short-to-medium-term)

2. Operational risk
   - Risks in operational assets and infrastructure, and personnel and organisational risks (short-to-long-term)

3. Strategic risk
   - Risk for changes in political policies, changes in public opinion, changes in regulations and risk in choice of technology (medium-to-long-term)

Focus on financial risks for today’s discussion
### Examples of commercial / financial risks along the value chain showing the high diversity of risks

<table>
<thead>
<tr>
<th>Traditional value chain</th>
<th>Case examples</th>
<th>Main commercial / financial risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>Hydro Power Plant</td>
<td>- Electricity price risk</td>
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<tr>
<td></td>
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<td>- Volume risk - precipitation risk</td>
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<td></td>
<td></td>
<td>- Electricity price volatility and time spread risk</td>
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<tr>
<td>Optimisation</td>
<td>Coal/Gas-fired power plant</td>
<td>- Green Dark Spread risk (Power, Coal, FX, CO2)</td>
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<td></td>
<td></td>
<td>- Clean Spark Spread risk (Power, Gas, CO2)</td>
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<tr>
<td>Distribution</td>
<td>Fuel Sourcing</td>
<td>- Time spread risk</td>
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<td></td>
<td></td>
<td>- Transportation / Freight risk</td>
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<tr>
<td>Sales</td>
<td>Fixed price (Swing) contract</td>
<td>- Electricity price risk</td>
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<tr>
<td></td>
<td></td>
<td>- Volume risk - (partly driven by temperature risk for Nordic B2C customers)</td>
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<tr>
<td>Customer / third party</td>
<td>Aluminium producer</td>
<td>- Aluminium-Power spread risk</td>
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These risks are significant considering the high volatility of the underlying commodities.
How is an utility company structured to manage these risks? Vattenfall as an example

**Vattenfall in a nutshell**
- 100%-owned by the Swedish state
- Main markets are: Nordics, Germany, Netherlands and UK
- Main products are: Electricity, Heat, Gas
- Fully integrated utility, works in all parts of the value chain: Production, Distribution, Sales and Trading
- Diversified production portfolio: Hydro, Nuclear, Coal, Wind, Biomass and Gas

**Vattenfall’s organisation**
- Regional organizations, but one centralized cross-regional commercial Business Division (Asset Optimisation and Trading - AOT)
- Most of the commercial risks are managed centrally within BD AOT.
1. Hedging, production planning and dispatching of Vattenfall’s generation capacities (coal, hydro, gas, nuclear, wind, biomass)

2. Providing Vattenfall with market access to all relevant commodity wholesale markets (physical and financial): power, gas, coal, oil, biomass, carbon credits, freight, green certificates

3. Sourcing, transporting and storing of physical commodities

4. Developing and marketing of tailored, non-standard products to customers/third parties

5. Portfolio management, market access and consulting for industrial customers and municipal utilities

6. Proprietary trading
Overview of the “financial” tools/products available for market participant to manage these risks

<table>
<thead>
<tr>
<th>a</th>
<th>Standard products</th>
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<tbody>
<tr>
<td>• Mainly traded over exchange (e.g. Nordpool OMX Nasdaq, ICE)</td>
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<tr>
<td>• Often possibility to clear trades via a Clearing House if traded Over The Counter (OTC)</td>
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<tr>
<td>• Often reasonable liquidity</td>
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<td>• Not necessarily financial products, but quite often with physical delivery, depending on commodities and markets</td>
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<table>
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<tr>
<th>b</th>
<th>Tailor-made products/solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Solely traded Over The Counter (OTC)</td>
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<tr>
<td>• Very much tailored made products fulfilling a counterparty’s or customer’s specific needs/risk profile.</td>
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<td>• Increasing demand for these kind of products/solutions</td>
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The delineation between standard or tailor-made products is partly based on market liquidity/maturity and differs significantly between commodities and markets
### Main Standard Products

#### Fixed price products
- 3 main product types: forward, futures, swaps depending on:
  - Settlement: financial or physical
  - Margining: daily, monthly or none (only at delivery)
- One party takes the fixed price risk on behalf of the other party.

#### Standard options
- Different type of options: European, (American, Asian)
- Option (not obligation) to buy or sell at a predefined price
- Option premium to be paid to the option provider
- Typically used for trading volatility and securing cap or/and floor prices

### Examples of products available on NordPool (OMX) for Nordic Power
- Financially settled baseload and peakload forwards/futures for System Price and EPADs (price areas) with weekly, monthly, quarterly and yearly delivery periods.
- European options for Baseload power with quarterly and yearly delivery periods.
Example of tailor-made efficient hedging products

Virtual Power Plant (VPP) or Virtual Hydro Plant (VHP)

- Close to “perfect” hedge to the commercial risks of a power plant
- Generally, a purely financial virtual power plant decoupled from the actual physical dispatch of a real power plant, but designed to mimic it to the best extend.
- For VHP, possibility to have real (stochastic) water inflow to hedge the weather risk

GDS Swap

- One party provides a fixed baseload or profiled Green Dark Spread to the power plant owner for a predefined period.
- Relatively efficient hedge for heat driven CHP or not very flexible coal-fired power plant

Standard products are not sufficient to properly hedge a coal fired or hydro power plant, in particular the following embedded risks:

- Weather risks (in the case of Hydro power plant)
- Profile risks (volume time price risks on hourly basis)
- Option/flexibility value
- Green Dark Spread risk (timing of hedging of the different legs) (in the case of a Coal-fired power plant)

Need for more sophisticated/tailor made hedging products
3b Example of tailor-made products/solutions (2/2)

- Standard products are not sufficient to properly fulfil the specific needs of certain customers

- Example of a customer with:
  - Different sites across Europe where electricity is consumed
  - Corporate branding strategy for only consuming green electricity and being self-sufficient from a electricity supply
  - Typically, customer would lease, purchase or construct wind farms in a country/ location where there are good financial pre-requisites and good wind statistics
  - Willingness to transfer the electricity produced by wind farms to the consumption sites

- Need for a tailor-made solution for fulfilling the customer’s wishes/ambition

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Example of tailor-made solution

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<th>Customer’s tailor-made package</th>
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<tbody>
<tr>
<td>• Purchase of the wind farm output</td>
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<tr>
<td>- Wind Power Purchase agreement (PPA), including imbalance risk</td>
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<tr>
<td>- Purchase (&amp; hedging) of Electricity Certificate</td>
</tr>
<tr>
<td>• “Transfer” (financially speaking) the power to where the customer consumes it, i.e. hedging of cross-border power price spreads</td>
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<td>• Power supply contract at consumption locations including imbalance management</td>
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How is the energy market likely to develop?
Implications in terms of products/needs

Trends in the energy markets

- Markets increasingly global and interconnected
- Rising share of intermittent production (renewables)
  - Driving short-term power price volatility
  - Moving decision closer to real time
  - Increasing weather risk exposure to producers
- A new energy landscape with increased decentralized production (“Prosumer”) requiring eventual grid upgrades
- Uncertain regulation (CO2, financial regulations)

Examples of potential new products or existing one with increasing interest

- Weather derivatives or embedded structures hedging the weather risks
- Increased focus and liquidity on the very short-term market (intraday, balancing market)
- More tailor-made products/solutions
- Wind or Solar PPA packages
- Wholesale Market Access Services provided to customers/third parties (Direct Marketing)
- Demand Response Products
- Aggregation of Distributed Production.
Thank you
The new energy landscape

The traditional value chain

Production
Centralised large plants

Optimisation
Hedging & optimisation of own portfolio

Distribution
One way delivery of energy

Sales
Commodity products

Consumer

The new energy landscape

Decentralised
Proptechs
Heat pumps
Micro and small-scale CHPs
Small-scale Onshore wind

Demand side management
Large-scale Heat
Centralised renewables (e.g. Wind power)
Large-scale low emitting (Hydro & Nuclear)
Large-scale fossil

Optimisation
Optimisation of large-scale and aggregation of small-scale production

Prosumer
Solutions of products & services
Smart, two-way delivery of energy and information

Sales
Distribution

1) A prosumer is a customer who is both a consumer and producer