

Financial Instruments for Energy Markets

Energy Day, Stockholm School of Economics, SITE
December 2014

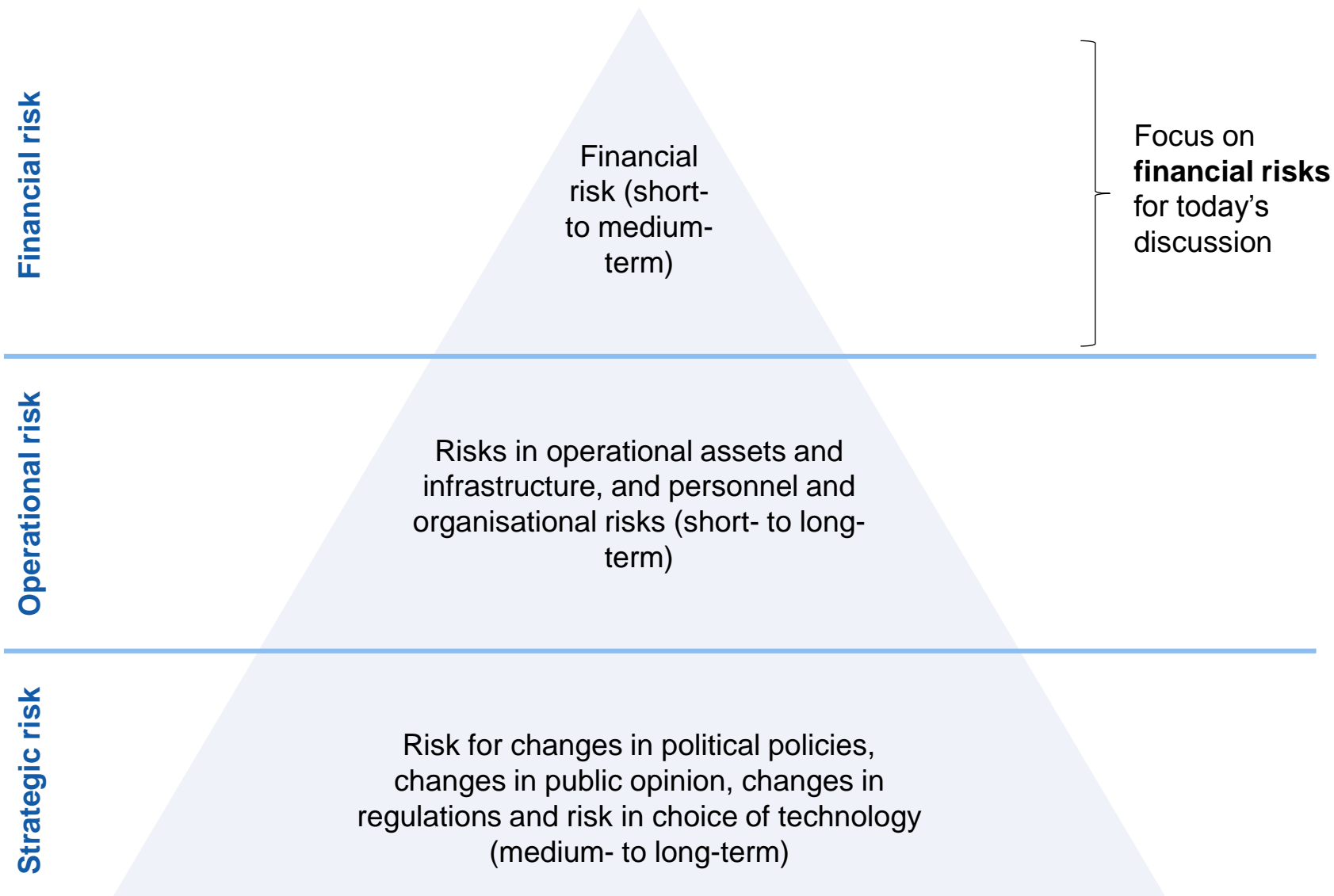
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Key questions for discussion today

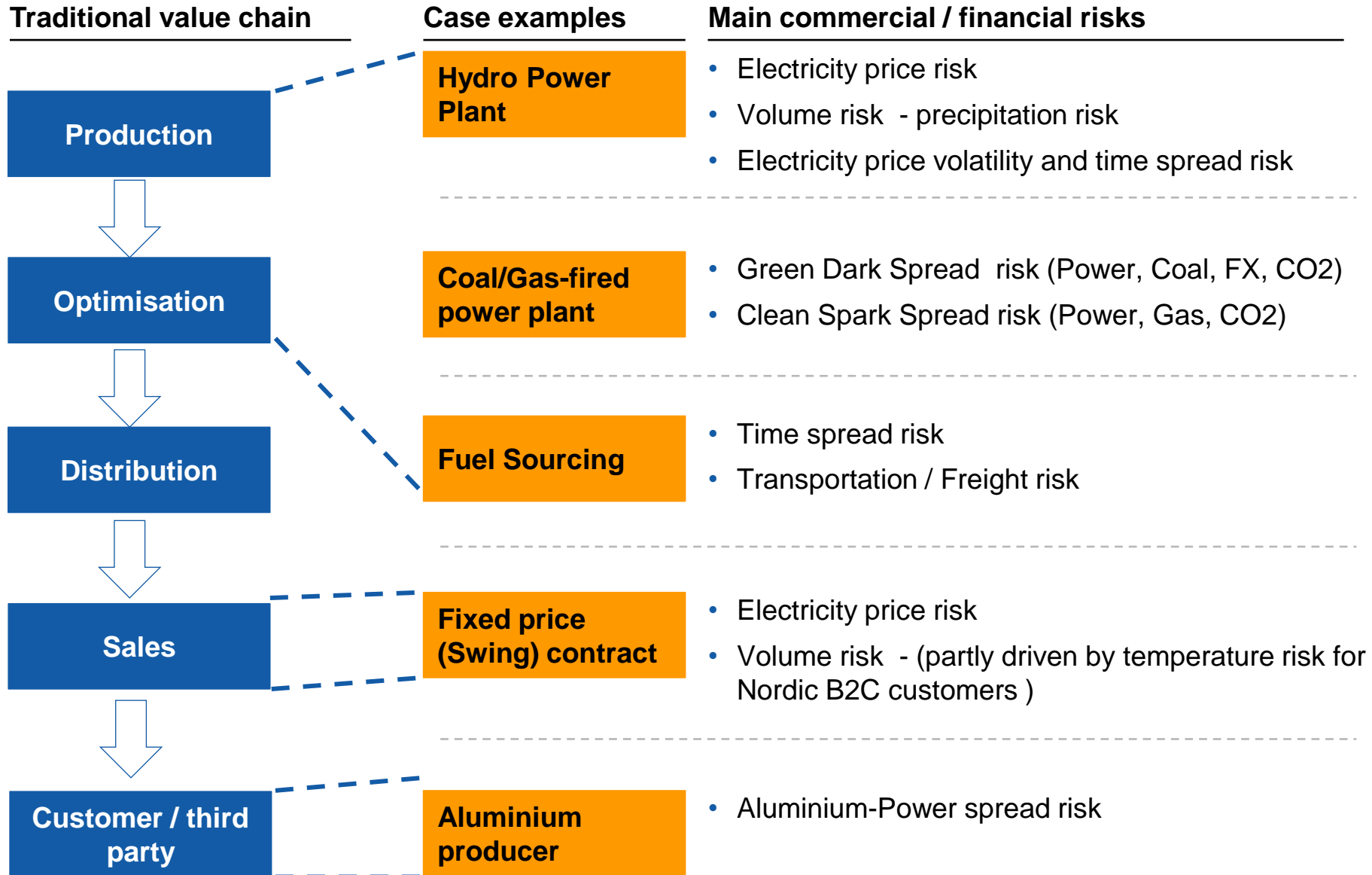
- 1** What are some of the **commercial/financial risks** involved in the **energy sector** ? (taking the electricity sector as an example)
- 2** How does an **utility operate and manage these risks**? (taking Vattenfall as an example)
- 3** What are the **tools/products** that are available to **market 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?

1

General overview of enterprise risks for an integrated utility company

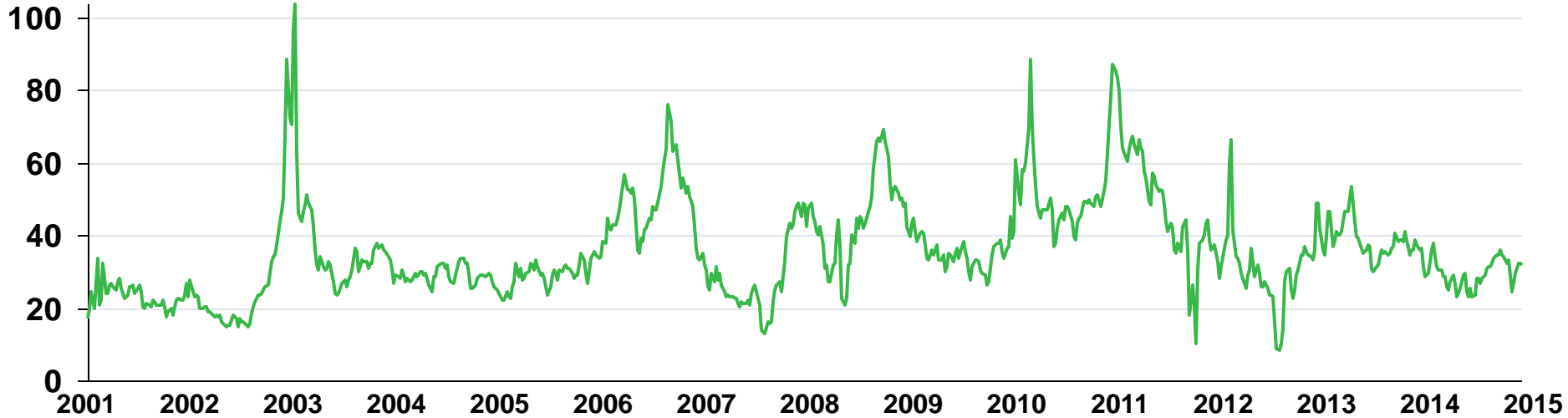


1 Examples of commercial / financial risks along the value chain showing the high diversity of risks



① These risks are significant considering the high volatility of the underlying commodities

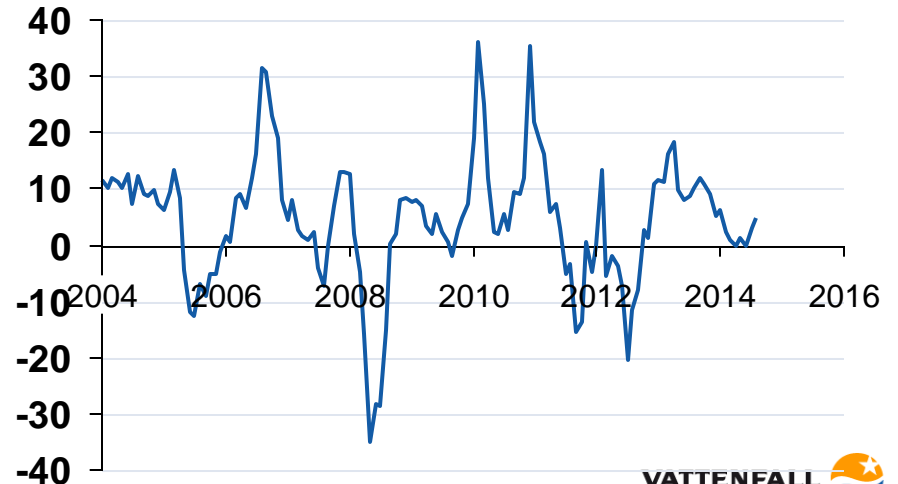
Nordic Power, System Price , EUR/MWh



Clean Spark Spread (German Power; Zeebrugge Gas; 55% efficiency), EUR/MWh

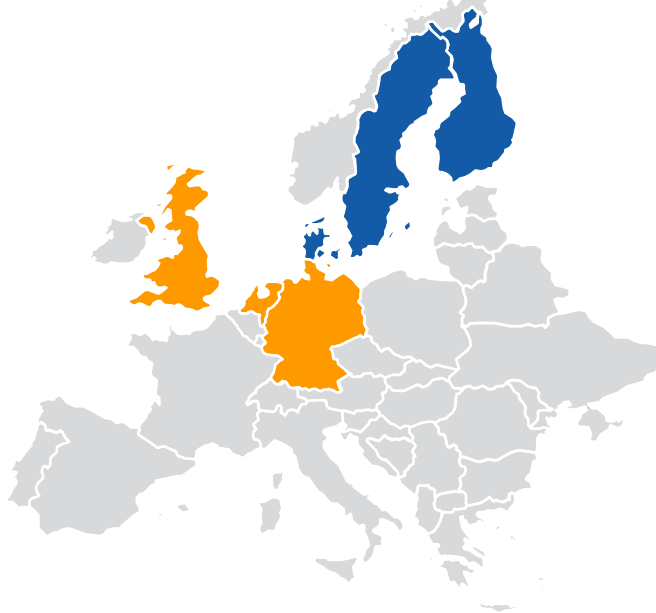


Green Dark Spread (SYS Nordic Power; API2 coal, 38% efficiency), EUR/MWh



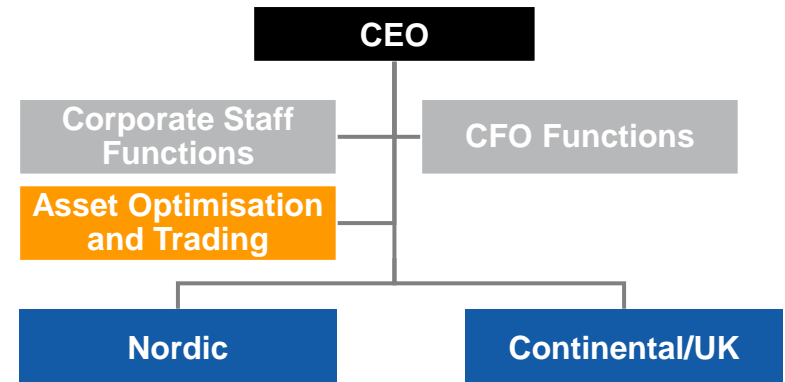
② How is an utility company structured to manage these risks? Vattenfall as an example

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**

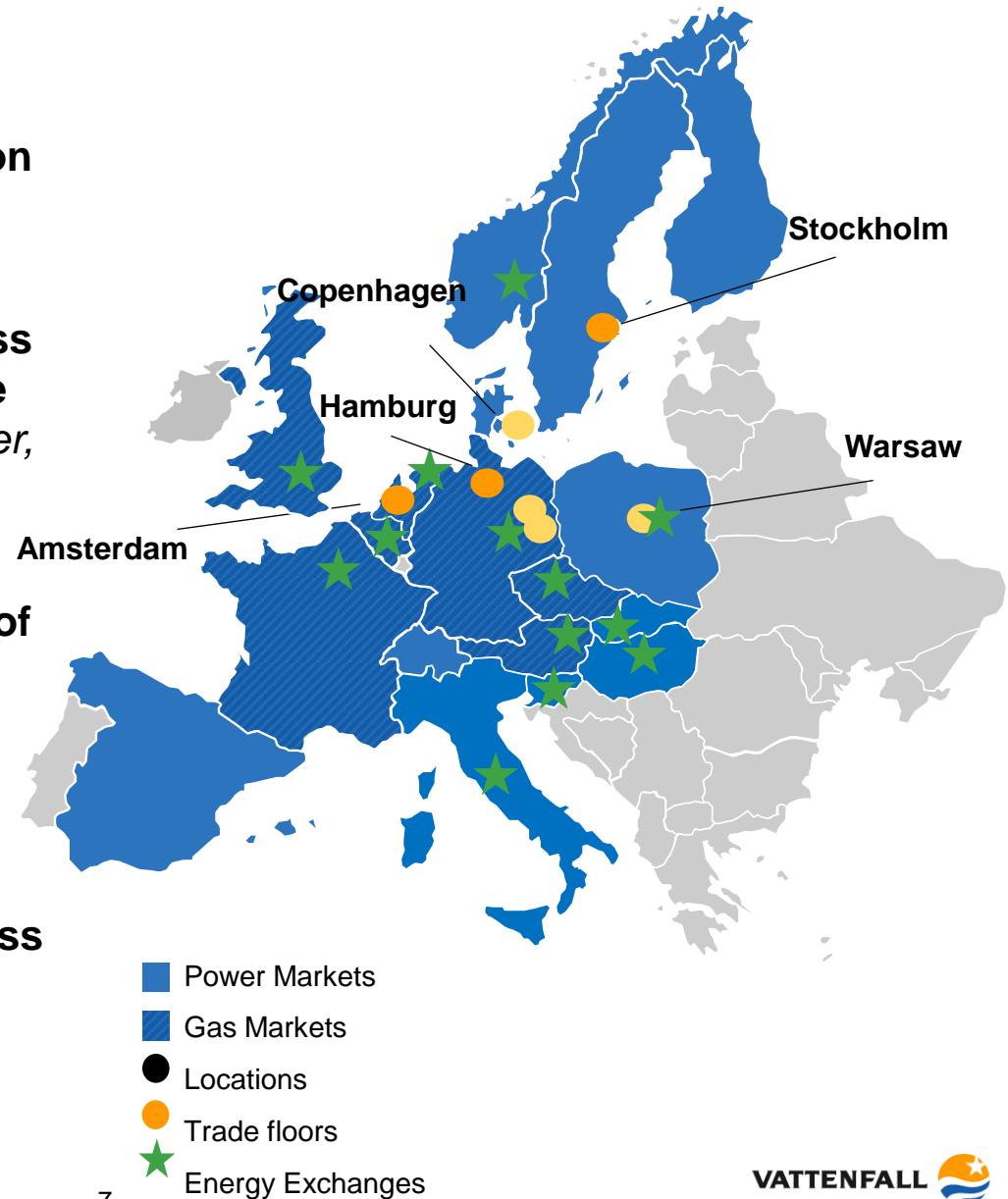
Vattenfall's organisation



- 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.

② Asset Optimisation & Trading - activities and markets

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**



3 Overview of the “financial” tools/products available for market participant to manage these risks

a

Standard products

- Mainly traded over exchange (e.g. Nordpool OMX Nasdaq, ICE)
- Often possibility to clear trades via a Clearing House if traded Over The Counter (OTC)
- Often reasonable liquidity
- Not necessarily financial products, but quite often with physical delivery, depending on commodities and markets

b

Tailor-made products/solutions

- Solely traded Over The Counter (OTC)
- Very much tailored made products fulfilling a counterparty's or customer's specific needs/risk profile.
- Increasing demand for these kind of products/solutions

The delineation between standard or tailor-made products is partly based on market liquidity/maturity and differs significantly between commodities and markets

3a 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

3b Example of tailor-made products/solutions (1/2)

- **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**



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

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**



Example of tailor-made solution

Customer's tailor-made package

- Purchase of the wind farm output
 - Wind Power Purchase agreement (PPA), including imbalance risk
 - Purchase (& hedging) of Electricity Certificate
- “Transfer” (financially speaking) the power to where the customer consumes it, i.e. hedging of cross-border power price spreads
- Power supply contract at consumption locations including imbalance management

4

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)



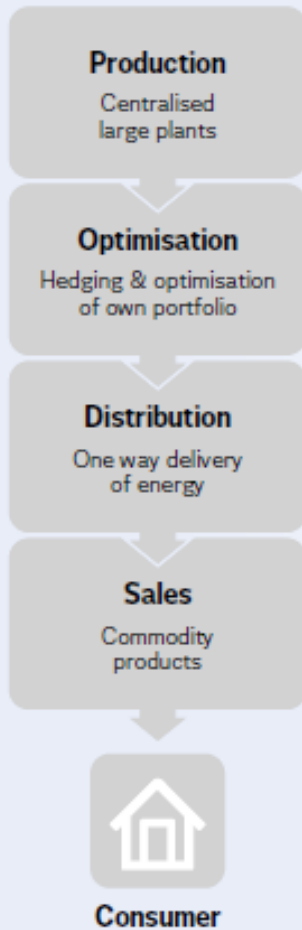
Examples of potential new products or existing one with increasing interest

- 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.

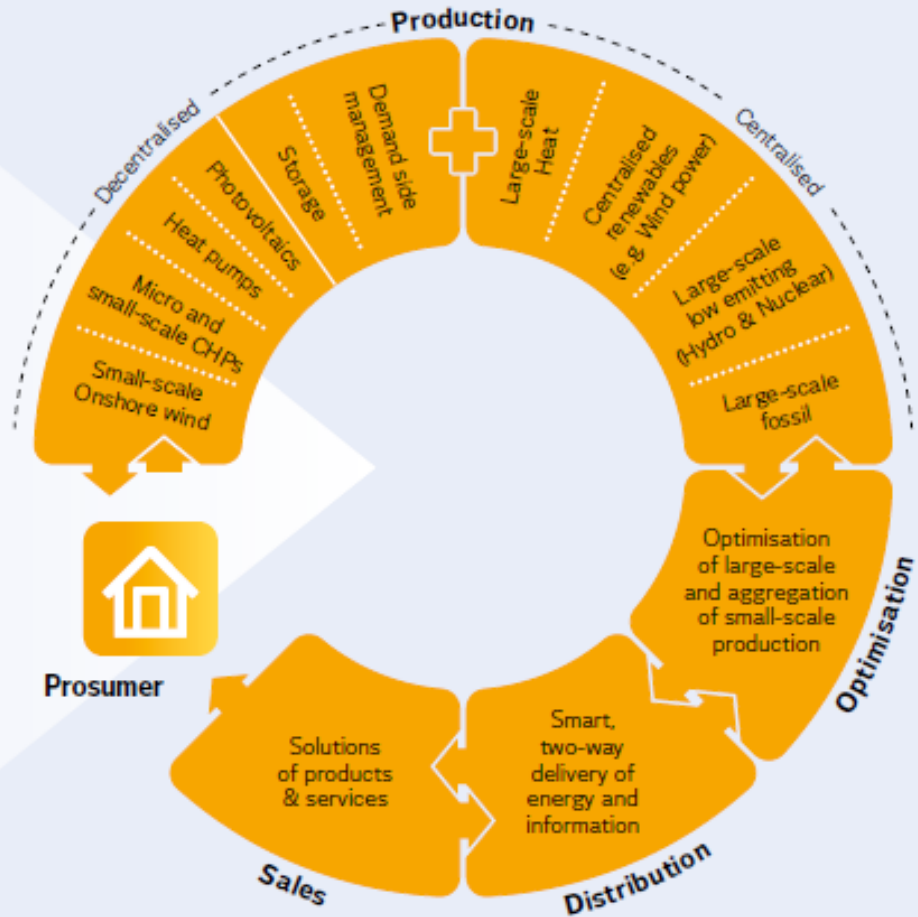
Thank you

4 The new energy landscape

The traditional value chain



The new energy landscape



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