Program for
“Energy Trading, Derivatives and Risk Management”
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Case studies
We use cases throughout its course in various forms. The cases support the application of the newly gathered knowledge in practical applications. Furthermore, cases stimulate independent thinking and discussion among participants. A number of cases are mentioned in the program below but others will be used as well.
Course contents

Day 1 morning: “Introduction to energy markets: international and UK”

Introduction to energy markets
- Short review of the organisation of energy markets, trading venues and trading purposes.
- Players in the trading markets: banks, brokers, traders, end users, producers:
  o What is their role? Why do they trade? How do they make money?
- Energy markets and how they function:
  o OTC versus exchange trading
  o Spot versus forward trading
  o Forward and futures markets and how they function:
- Focus on the UK energy market:
  o How is the UK electricity market organized?
  o What physical products are traded in the UK and on what platforms?
  o What financial products are traded in the UK, why and by whom?
- Developments in trading markets
- Dealing with illiquidity in trading markets

Day 1 afternoon – risk management framework

Risk management in a trading organisation
- Types of risk: market, credit, operational
- Pros and cons of active risk management
- Risk appetite and risk capital
- Defining trading limits and book structures

Operational risk management
- Best practices in operational risk measurement
- The main approaches for measuring, treating, reducing and reporting operational risk

Credit risk management
- Counterpart analysis and ratings
- Exposure and potential future exposure
- Clearing and marking-to-market
- Credit risk management tools: collateral, credit derivatives, netting, clearing

Market risk management
- Mark-to-market position and exposure
- The use of Value-at-Risk in a trading organisation
- The use of other at-risk measures, including Cashflow-at-risk: pros and cons
- Stress tests
- Stop-loss limits
Day 2 morning: “Energy price behaviour”

Energy price characteristics: Volatility, seasonality, mean-reversion, spikes
- Evolution of volatility in energy markets
- Volatility calculation approaches
- Comparing spot with forward volatility: jumps and mean-reversion
- Causes of seasonality
- Measuring correlations

Case studies include: volatility estimation and using mean-reversion

Building forward curve models
- Hourly forward curve for power and gas markets
- Marginal production costs and the supply stack in power markets
- Building curves for long-term forward prices
- Combining history with current prices to derive hourly forward curves
- Applications of forward curves

Day 2 afternoon: “Energy derivatives: power, CO₂ and fuel markets”

Energy derivatives: Understanding the characteristics of forwards, futures, swaps, options
- Overview of the different market places: physically and financially
- Trading in energy forwards and futures
- The energy forward curve: backwardation and contango
- Comparing swaps, forwards and futures
- European, American, and Asian options. Calls and puts.
- Constructing pay-off diagrams

Case study – “Caps and floors”
Analyzing the potential risks and rewards of a capped end-user natural gas contract: exchanging upside potential for downside insurance

Case Metallgesellschaft
- The Metallgesellschaft case: what went wrong with the roll-over hedge
- Setting up a roll-over hedge
- Impact of non-perfect correlations and the volatility curve on the roll-over hedge

Main principles behind the valuation and hedging of derivatives:
- The principles of a good valuation approach
- Mark-to-market versus mark-to-model
- Applying arbitrage to the valuation of forwards and futures
- Delta, gamma and other option Greeks
- Delta, gamma and vega hedging
- The Black and Black-Scholes formula for pricing options on forwards and futures
- Implied volatility
- Volatility curves

Case study – “Implementing a delta-gamma hedge”
How much can be secured using static and dynamic delta-gamma hedging of an energy option?
Day 3 morning: “Power plant valuation and Structured products”

Structured energy products:
- Financial engineering
- Breaking down complex structures in basic products
- Commodity spreads: sparks, darks and cracks
- Swing options, take-or-pay, tolling and other structured products

Approaches for valuation of energy structured products
- Historical simulation
- Price trees to value American-style options
- Monte Carlo simulation

Case studies: (a) valuation of the option to extend a contract, (b) valuation of an option when volatility increases towards delivery

Net Present Value, Internal Rate of Return and Real Options:
- How to calculate a Net Present Value, and what does it mean?
- Setting the required rate of return or calculating the internal rate of return
- When is real options analysis appropriate: flexibility to respond to uncertainty
- Different types of real options: postponing, expanding, switching, terminating
- Examples of real options in energy markets: gas storage, pipelines, LNG, emission reduction, oil refining, oil and gas exploration

Theory and Case study NPV: “Investing in a CCGT power plant”
- How to build an NPV model for a power plant
- The impact of the forward curves and scenarios of them
- The impact of plant characteristics
- The impact of hourly power price variations
- Strengths and Limitations of the NPV approaches
- Using price simulations to capture the flexibility value and make a better risk analysis

Day 3 afternoon: “Risk management implementation”

Implementing VaR and other at-risk measures
- Choosing an evaluation horizon for contract duration (e.g. 3 years is tradable)
- Choosing confidence levels and trading horizon
- Choosing what exposures to include
- VaR in an organization to allocate risk capital
- Limitations of VaR and CfaR, and the need for stress-testing

Trading and hedging strategies: Optimising return while minimising risk
- Hedging against spot price risk
- Expected and unexpected hedging costs
- Hedging from a utility perspective
- Hedging from an end-user perspective: comparing fixed versus variable
Designing an effective hedging scheme for a power plant

- Short versus long-term exposure of a power plant
- Sequential hedging: increasing hedge towards delivery
- Liquidity in fuels and power versus CO₂: implications for the what ‘legs’ need to be hedged
- Trading in and out of spark and dark spreads: combining risk appetite expected with mean-reversion in spreads