



Modelling Energy Markets Risks: Issues and challenges

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Risk management and control process

IDENTIFY

- ⊙ Risk ownership
- ⊙ Risk nature
 - Price risk
 - Volume risk
 - Liquidity
 - Basis
- ⊙ Risk sources
 - Power
 - Fuels
 - Carbon
 - FX...

MEASURE

- ⊙ Price models
- ⊙ Calibration
- ⊙ Risk models
- ⊙ Indicators
 - Positions
 - VaR
 - EaR
 - CaR...

MANAGE

- ⊙ Risk Policy
- ⊙ Governance
- ⊙ Capital allocation
- ⊙ Hedging
 - Products
 - Duration
 - Timing...

CONTROL

- ⊙ Compliance
- ⊙ Breaches
- ⊙ Consolidation
- ⊙ Performance



Contribution to business

CORPORATE

Identify and measure Group risk profile and by BU
Contribute to portfolio structuring
Set and control BUs risk limits
Measure risk management performance
Communicate and reinforce stakeholder confidence

BUSINESS UNITS

FIRST LEVEL RISK CONTROL

Risk identification
Risk measurement
Risk monitoring against delegated risks limits
Risk reporting

GENERATION

Asset optimisation
Operation planning
Asset acquisition
Asset life extension
Disinvestments
...

SALES

Structuring
Pricing
Counterparty risk
...

TRADING

Limits setting
Trading strategy
Hedging
Structuring
Pricing
...



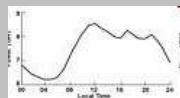
Risk quantification framework

Risk Identification

PORTFOLIO



- outage rates
- efficiency
- dynamic constraints



- volume risk
- interruptibility
- embedded options



- Forwards, futures
- Options
- Structured products
- Virtual assets

MARKET DATA



- Spot and forward prices
- Implied volatilities
- FX rates

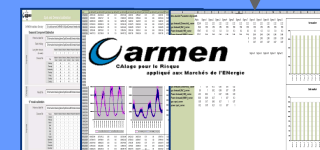
Risk Modelling

RISK ENGINE

MATHEMATICAL FINANCE LIBRARY



CALIBRATION TOOLS



NUMERICAL VALUATION TECHNIQUES

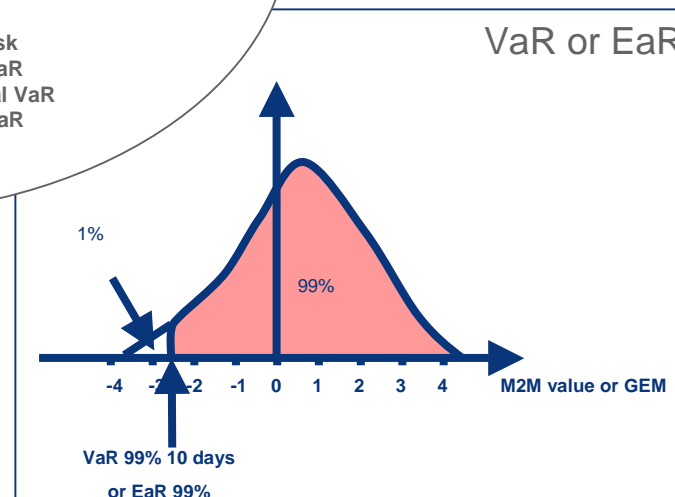
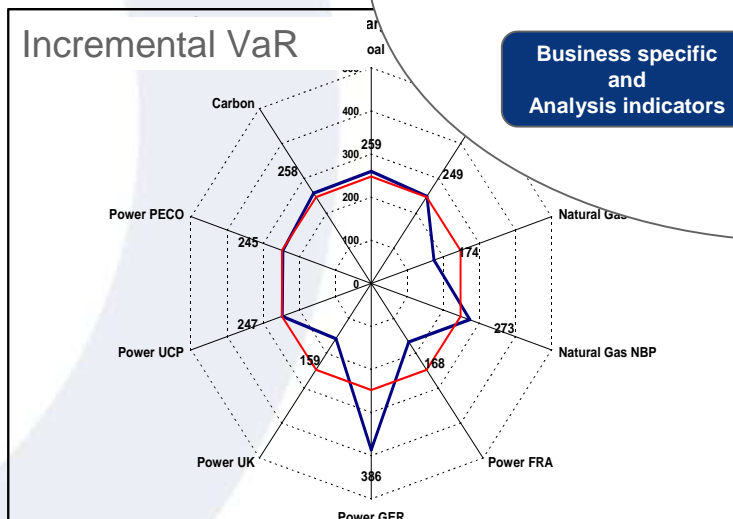
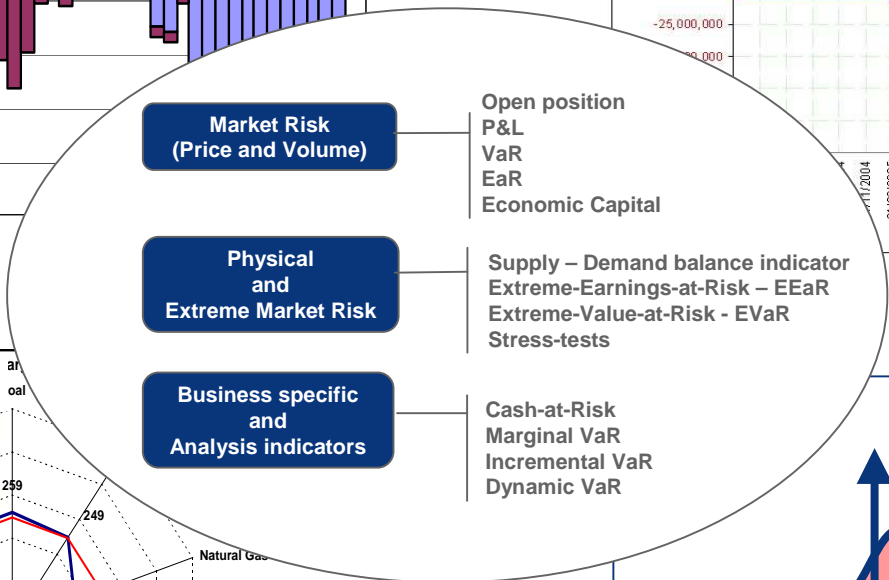
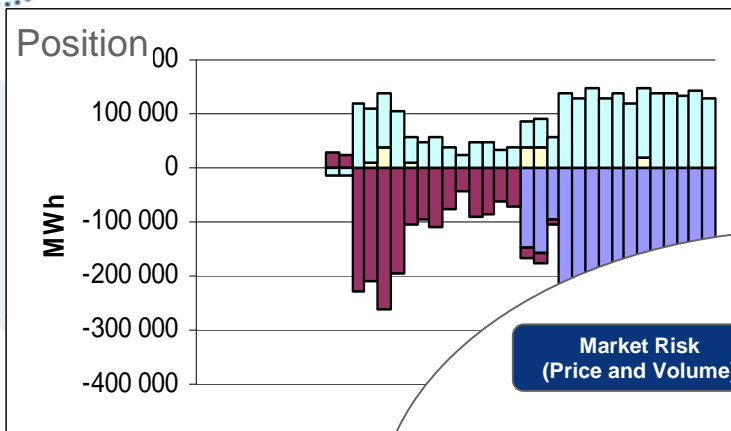


Risk Measures

Positions, VaR, EaR, M2M, EVaR, EEaR...



Examples of market risks indicators





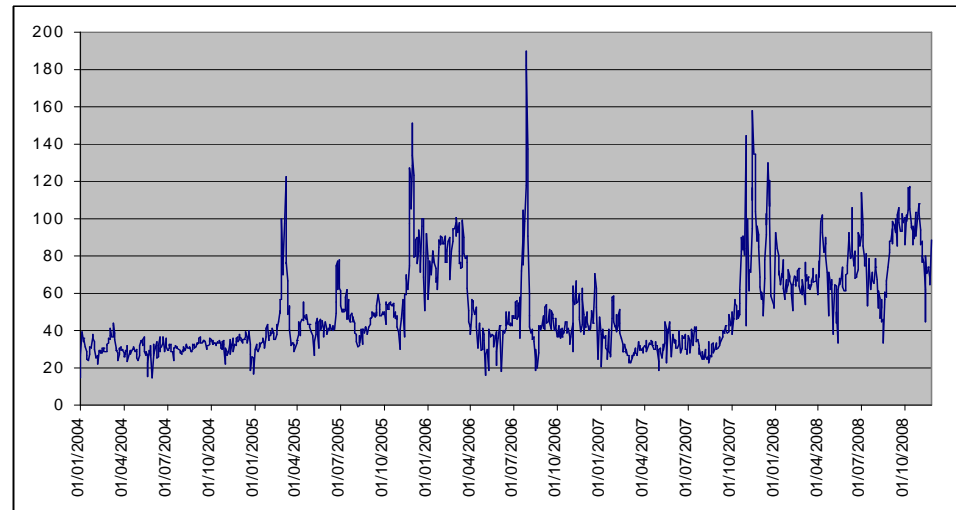
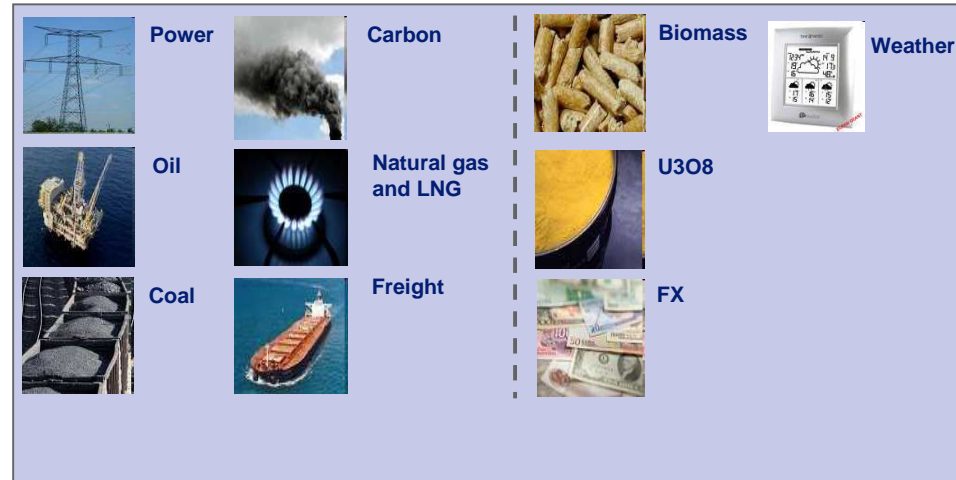
Requirements or wish list?

- ⊙ Exhaustive and objective risk assessment within the precision limits of the models:
 - Cover all Company's assets and businesses
 - Quantification is based on observable market data and results can be backtested
- ⊙ Consistent methodology across all business units, to enable:
 - Better risk communication and understanding across the company
 - Sound risk consolidation and portfolio management at corporate level
 - Sound risk management coordination and risk capital allocation between BU
- ⊙ Effective contribution to risk management decisions:
 - Be flexible and efficient to be operationally implemented
 - Facilitate risk management decisions (e.g. guidance on efficient risk mitigation)
 - Be linked to the KPI that drive the conduct of business across the company



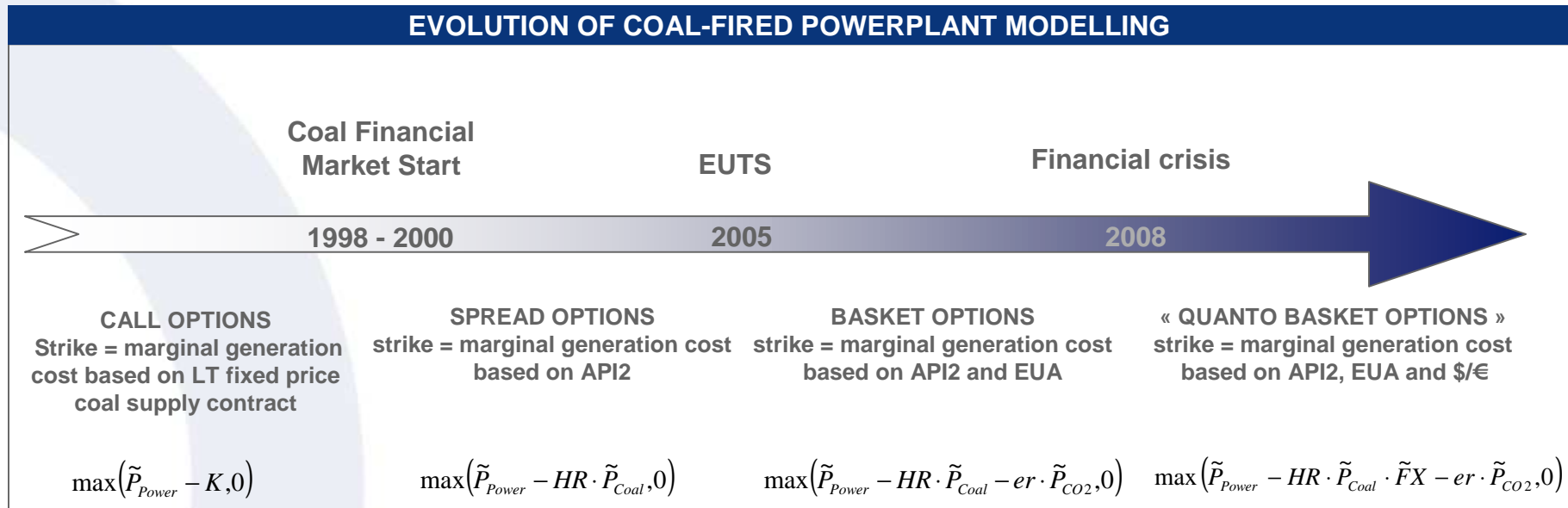
Markets complexity

- ⊙ EDF Group is exposed through its trading and assets management activities to a wide range of market risks
- ⊙ Energy markets show strong peculiarities that challenge the adaptation of standard financial markets native risk models
 - Volatility, spikes, « fat tails » ...
 - Fast evolution
 - Liquidity / market depth
 - Basis risk





Increasing modelling complexity



... *What's next?*

- *Biomass to be taken into account for co-firing*
- *Optimisation CO2 / CER...*



Lessons from past challenges

TECHNICAL

- ⊙ Risk modelling requires a cross-commodity and global approach
- ⊙ Increasing portfolio dimension puts the emphasis on systems performance, systems integration issues rather than on pure mathematics
- ⊙ Increasing assets complexity implies to seek the right balance between modelling detail, accuracy and efficiency
- ⊙ Fast evolving markets and practices calls for models that allow quick and smooth upgrades
- ⊙ Closed forms solutions tends to be replaced by simulations techniques
 - to facilitate modelling of operational constraints
 - To simulate realistic risk-management strategies

GENERAL

- ⊙ Models need to secure organisational « buy-in » by demonstrating their reliability and added value to the decision making process
 - e.g. in identification efficient hedging, indicators linked to observable figures, facilitating risk capital allocation ...
- ⊙ Risk quantification should be linked to key financial performance indicators
- ⊙ Stakeholders confidence in models is greater if
 - they are based on industry standards and well accepted methodologies
 - they use variables that people can intuitively think about
 - Indicators reliability can be demonstrable by statistical backtest



Future challenges for risk models?

- ⊙ Link risk indicators with financial performance management and control
- ⊙ Develop a quantitative framework for risk capital allocation and rewarding risk capital reduction
- ⊙ Develop methodologies for calculating risk indicators that take into account the implementation of hedging policy
- ⊙ Modelling the linkage between volume risk and price risk
- ⊙ Evolution towards Enterprise Risk Management by integration of credit, and business risks into the Company quantitative risk assessment framework
- ⊙ Develop methodologies for integrating quantitative risks assessment in long-term investment appraisal criteria
- ⊙ ...



Conclusion

- ◎ Over the last 4 – 5 years the perspective on risks models has shifted from research and development to operational implementation revealing significant mathematical and practical challenges
- ◎ Over time the central focus progressively shifted from “solving the equations” to making the models good to run in a fast moving operational environment
- ◎ R&D was a key contributor in resolving these issues and developing models with a good balance between mathematical accuracy and operational tractability
- ◎ However, even the best model in the world would be useless if not understood and “bought in” by the decisions makers and consequently doesn’t bring added value to the risk management and control decision making process

- ◎ Thank you for your attention !