

Portfolio Generation Investment Under Uncertainty

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Leaders in the design, implementation and operation of markets for electricity, gas and water.



Agenda

- Investment Rationale
- Balancing Generation and Demand
- Generation Investment
 - Coal vs Gas Generation
- Competitor Analysis
- Construction & Operation Risk
- Conclusions

Investment Rationale

- Major power companies
 - Vertically integrated utilities
 - Generation investment considered in context
 - Generation & customer portfolio
 - Optimising generation-demand balance
 - Balancing commodity & carbon price risk exposure
 - Maintaining portfolio competitiveness
 - Relative cost structures
 - Relative risk profiles
 - Maximising returns on portfolio assets
 - Balance sheet financing



Generation-Demand Balance

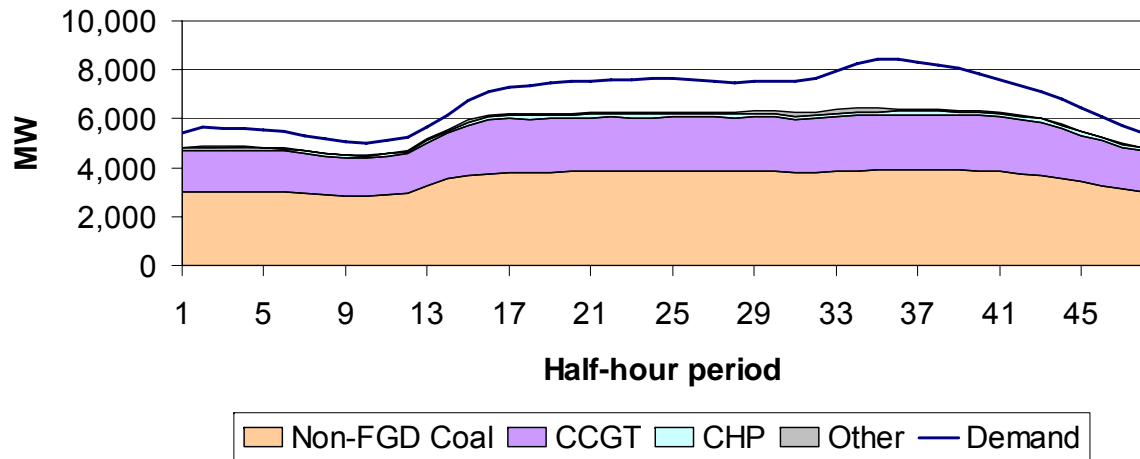
- Managing generation demand balance
 - Strategy to source significant proportion of supply from own generation
- Portfolio balance driver for generation investment
 - Examine both energy requirements & ability to meet load profiles
 - Plant technology & economics
 - Plant flexibility



Example GB Portfolio Balances

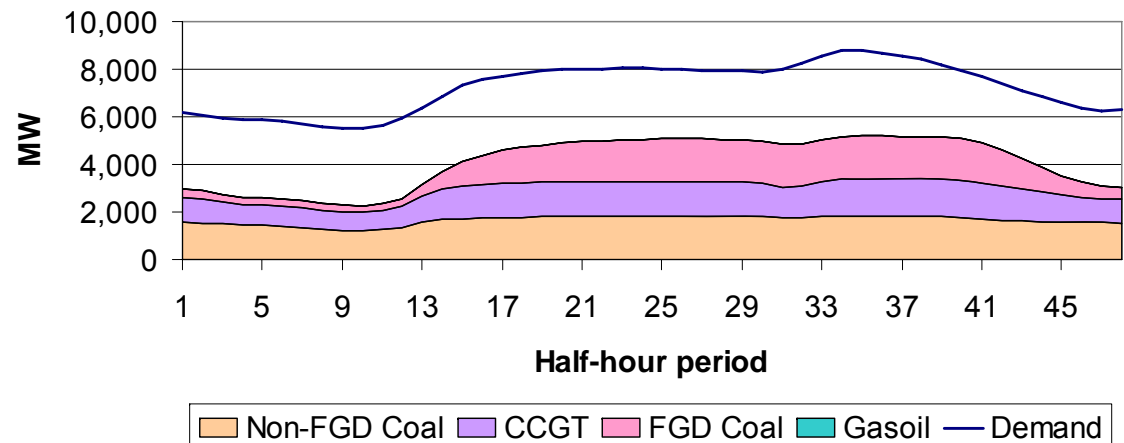
RWE average week day generation/demand profile in January

Average week day generation = 5,740MW, average week day demand = 6,841MW

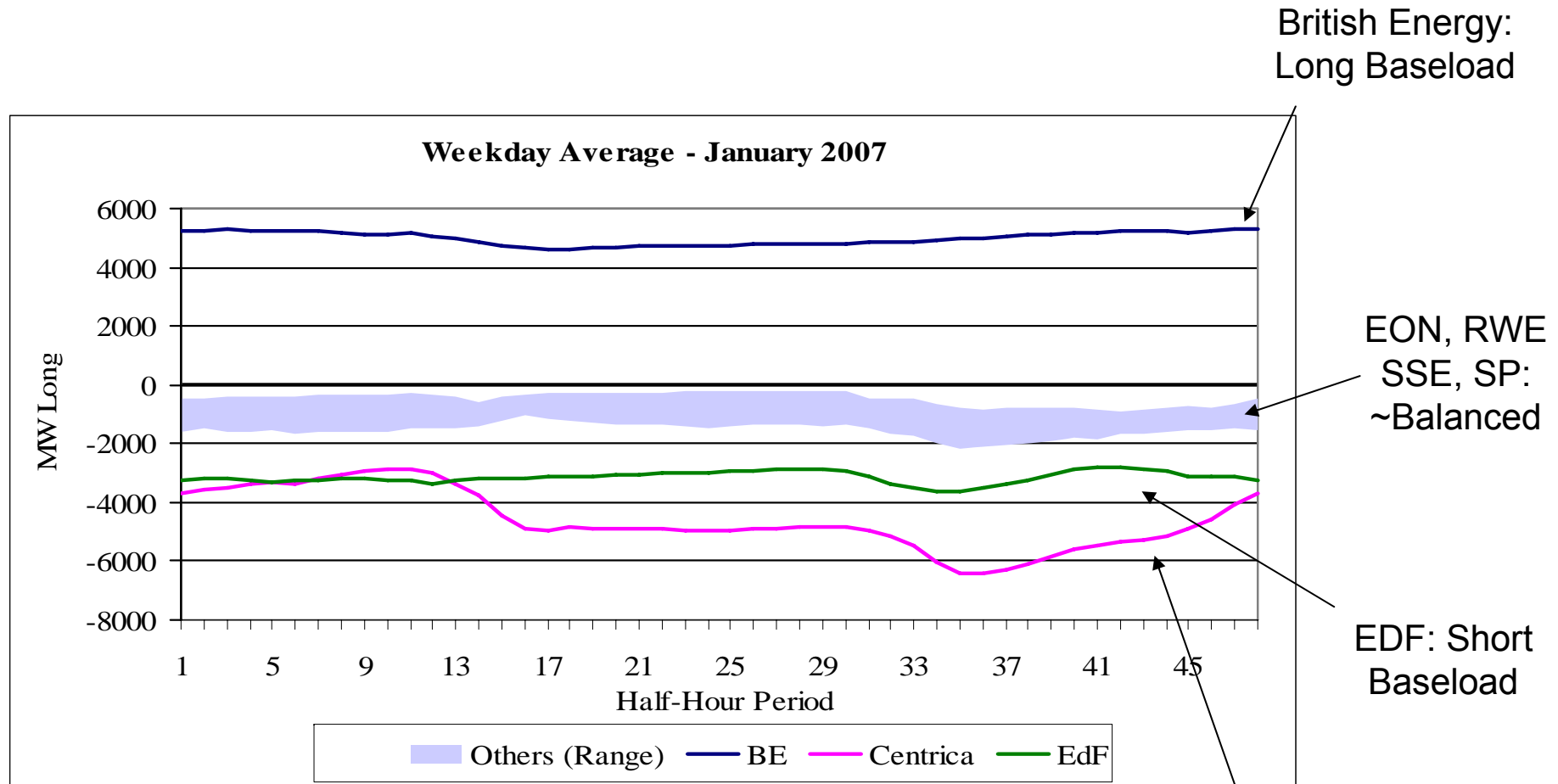


EdF Average week day generation/demand profile in January

Average week day generation = 4,097MW, average week day demand = 7,241MW



GB Example Portfolio Balances



British Energy:
Long Baseload

EON, RWE
SSE, SP:
~Balanced

EDF: Short
Baseload

Centrica: Short
Baseload & Shape

Maintaining Generation-Demand Balance

- Future requirement for new generation capacity
- Generation closures
 - Most plant life can be extended
 - Investment requirements vary but typically less than new build
 - Emissions restrictions (LCPD)
 - Closure of coal plant due to sulphur emissions
 - Nuclear plant
 - Planned lifetimes – although extensions likely
 - Closures provide brown field sites
 - Re-use existing infrastructure
- Load growth
 - Mature supply market
 - Significant market share penetration unlikely
 - Load growth slowing
 - Increasing energy efficiency

Investing in Generation Technologies

- Range of generation technology options
 - Nuclear
 - Dependent upon policy
 - Renewables (EU Targets)
 - Dependent upon financial support
 - Limited availability of sites
- Gas or coal still key technologies
 - Relatively rapid project development
 - Particularly for CCGT plant
 - Similar risk structures
 - Commodity price exposure
 - Carbon price/allocation exposure
 - Capital costs
 - Coal significantly greater cost than CCGT

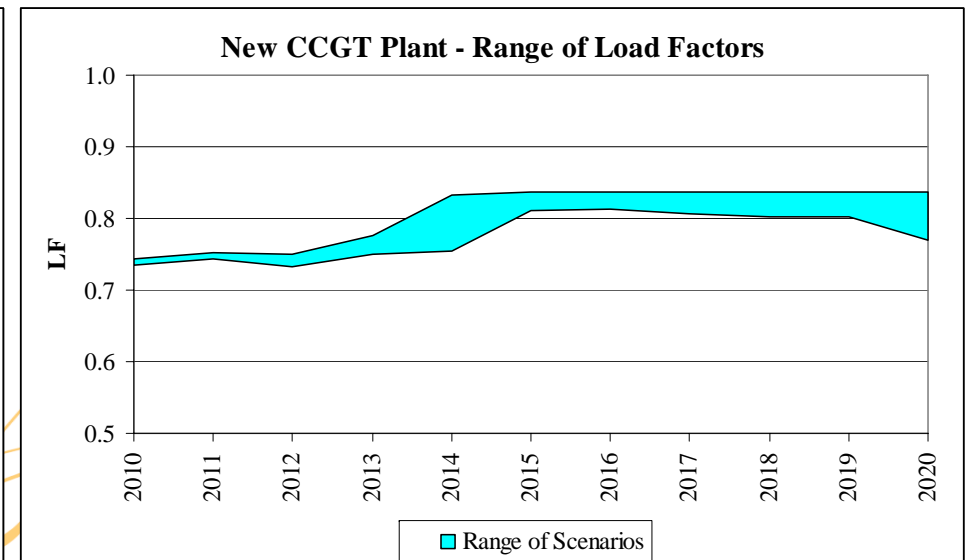
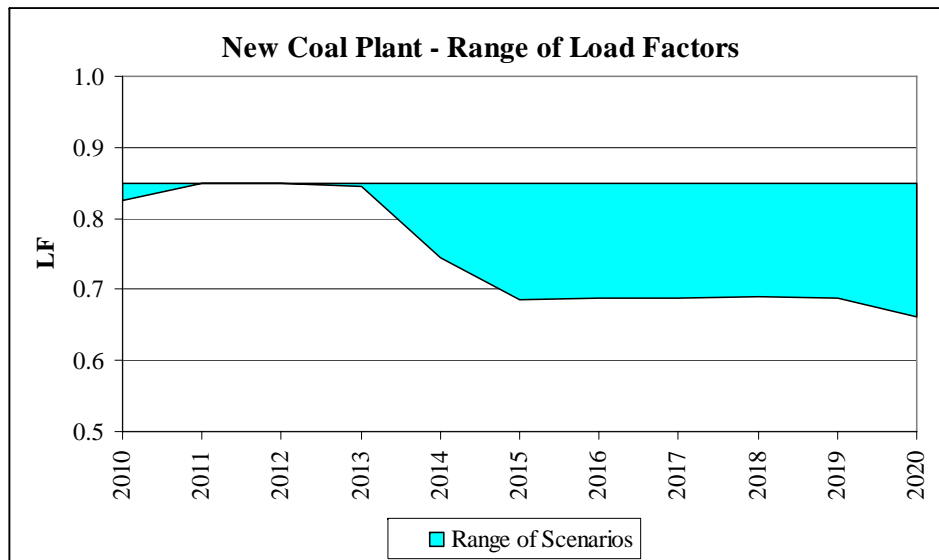
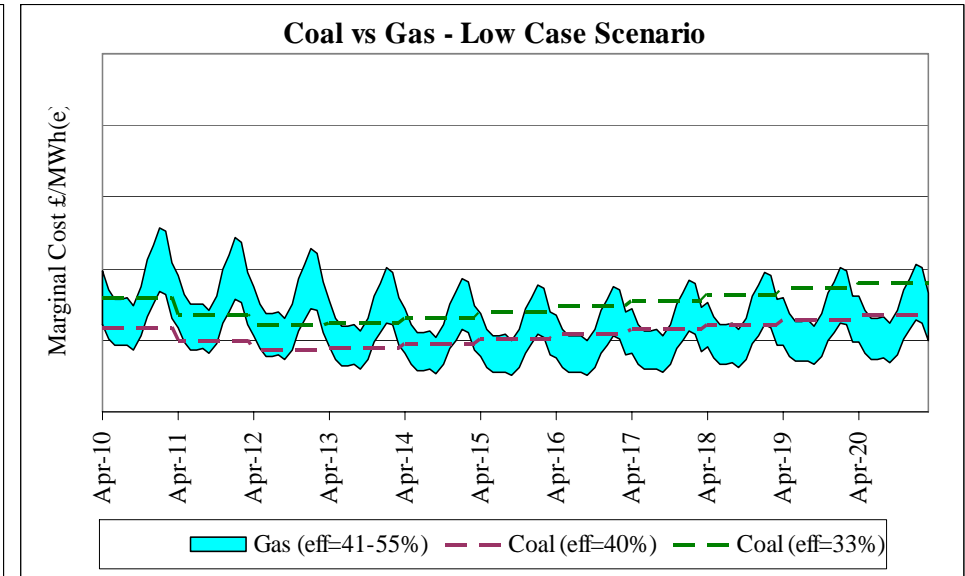
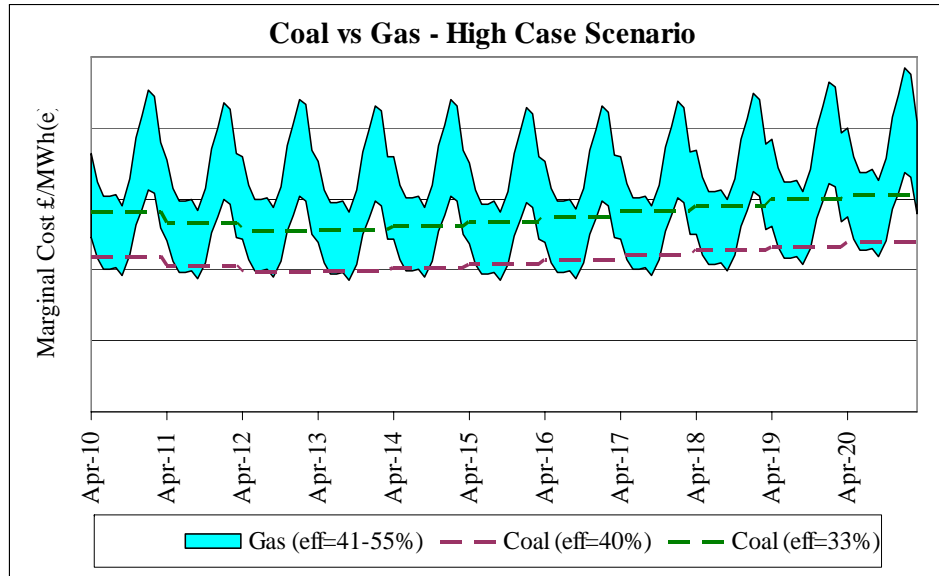
Coal vs Gas Competitiveness

- Relativity of gas, coal and carbon prices
 - No one technology guaranteed to always be high merit
 - Competition between technologies
 - Seasonality of gas prices
 - Competitiveness varies across year
 - Volatile commodity prices
 - Coal plant particularly sensitive to carbon price
 - Position varies across asset life
 - Competition within technology merit order



Coal vs Gas Competitiveness

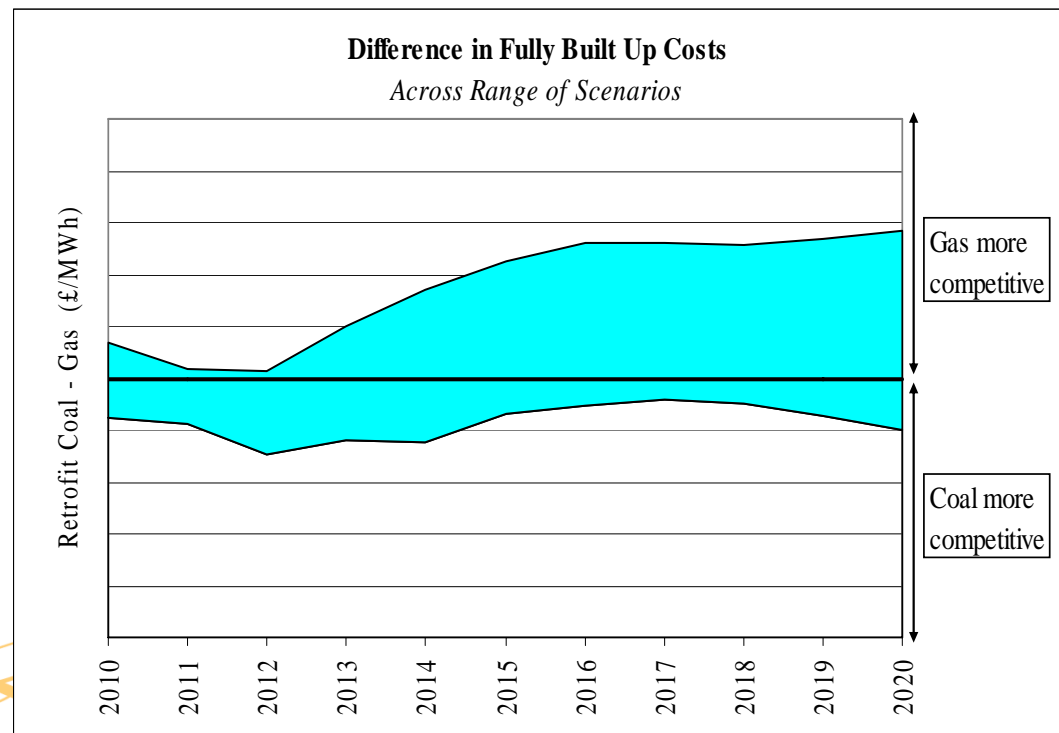
GB Power Sector Modelling



Investment Decisions

GB Power Sector Modelling

- Return on investment
 - Analysis of fully built-up project costs
 - Coal or CCGT could provide returns under different commodity price scenarios
 - Coal plant significantly greater capital cost than CCGT
 - Retrofitting reduces capital expenditure by reusing infrastructure
 - Capital is a limited resource
 - Portfolio balance sheet investment
 - Project financing provides capital flexibility but with stricter terms

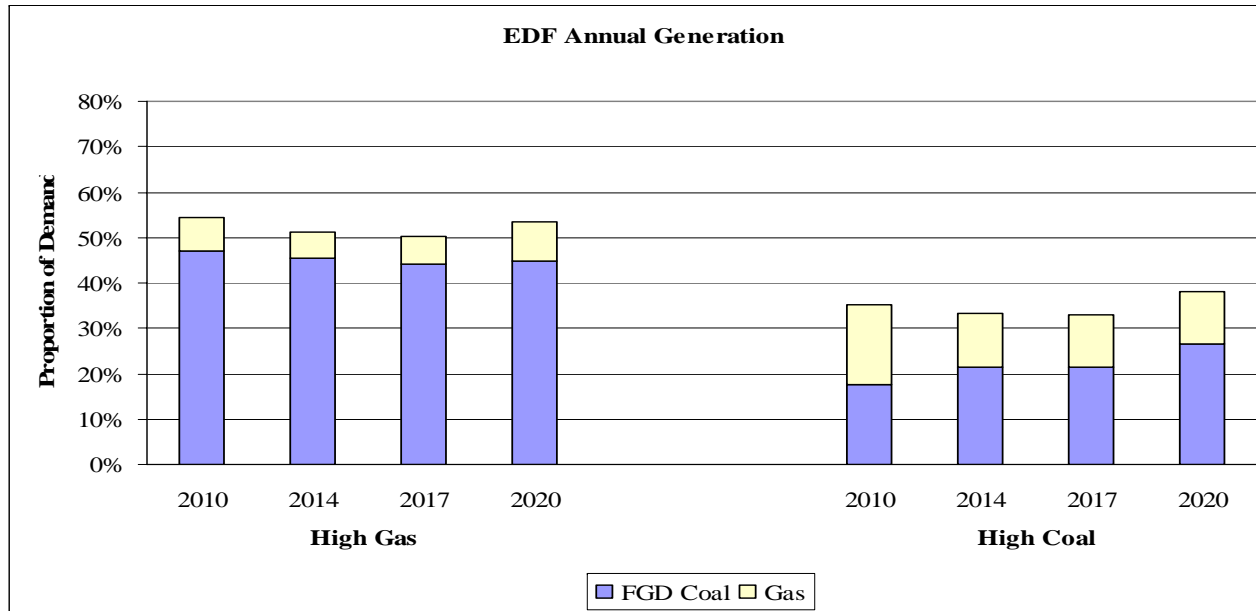


Competitor Analysis

- **Generation Investment for Utilities**
 - Additional issues relative to merchant plant valuation
 - Investments need to show economic returns
- **Managing competitiveness of portfolio**
 - Managing supply-demand balance
 - Power and energy requirements across year
 - Managing portfolio generation mix
 - Minimise portfolio costs
 - Hedging portfolio power price risk
 - Manage commodity and carbon price risk
- **Significant driver of investment decisions**
 - Understand portfolio commodity & power price risk
 - Explore exposures under high gas/high coal scenarios

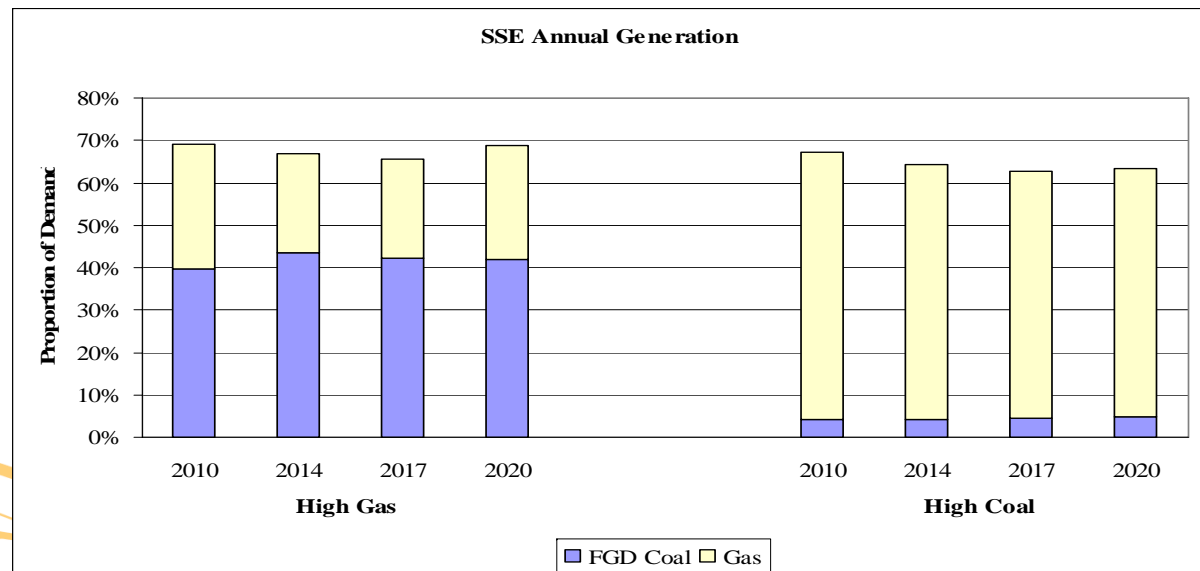
GB Portfolio Exposure

GB Power Sector Modelling



- EDF
 - Short generation
 - Dependence on coal plant
 - Exposed under high coal scenario

- SSE
 - More balanced
 - Mix of coal & gas plant
 - Less exposed to commodity price volatility



Construction & Operation Risk

- CCGT projects
 - Established technology
 - Fixed price turnkey EPC contracts
 - Manufacturer O&M contracts with performance guarantees
- Coal Projects
 - Retrofit, Super-critical, IGCC
 - Relatively little recent European experience
 - Developers may have to share construction & operation risk
 - Significant restrictions in industry capacity
- Need for new plant to be flexible
 - May need to sacrifice thermal efficiency to achieve flexibility
 - Designs may not target high risk new technology
 - Manufacturer guarantees on flexibility

Conclusions

- Portfolio generation investment decisions
 - Differences to merchant plant development
 - Timing & technology decisions
 - Managing portfolio supply-demand balance
 - Hedging portfolio power price risk
 - Managing portfolio generation mix
 - Minimise portfolio costs
 - Manage commodity and carbon price risk



Conclusions

- GB Power market
 - Gas and coal generation likely to provide major capacity additions
 - Relatively rapid project development
 - Number of potential sites
 - 16GW CCGT & 12GW coal project developments
- No clear technology winner
 - Coal or gas could provide returns under different scenarios
 - Relativity of gas, coal and carbon prices
 - Future EU ETS allocations
- CCGT projects
 - Established technology
 - Significantly lower development risk
 - Lower capital cost

Conclusions

- Man-marking between major portfolios
 - Mixed generation portfolios
 - Minimising portfolio generation costs
 - Hedge against volatile coal, gas and carbon prices
 - Move toward balance own generation and demand
 - Hedging exposure to power price
 - Similar risk structures
- Investment decisions based on portfolio contribution
 - Relative competitiveness
 - Relative portfolio risk structure
 - Different portfolios have generation investment requirements
 - Portfolios will continue to develop range of projects
 - Real optionality in project development



Thank You

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