WHAT PRICE STABILITY?

THE VALUE OF PRICE STABILITY FOR DIFFERENT POWER GENERATION TECHNOLOGIES

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Different Notions of Economic Risk Affecting Investment Choices

1. **Long-term electricity price stability in order to compensate the inability of technologies with high fixed cost (sunk costs) to leave markets with unanticipated price falls (absence of real option, independent of risk preferences);**

2. Investment flexibility in the face of uncertain but growing electricity demand due to lower absolute size of units (SMRs, NEA (2012);

3. Exposure of different technologies to long-term changes in different input factors such as interest rates, carbon costs, fuel costs… (IEA/NEA 2010);

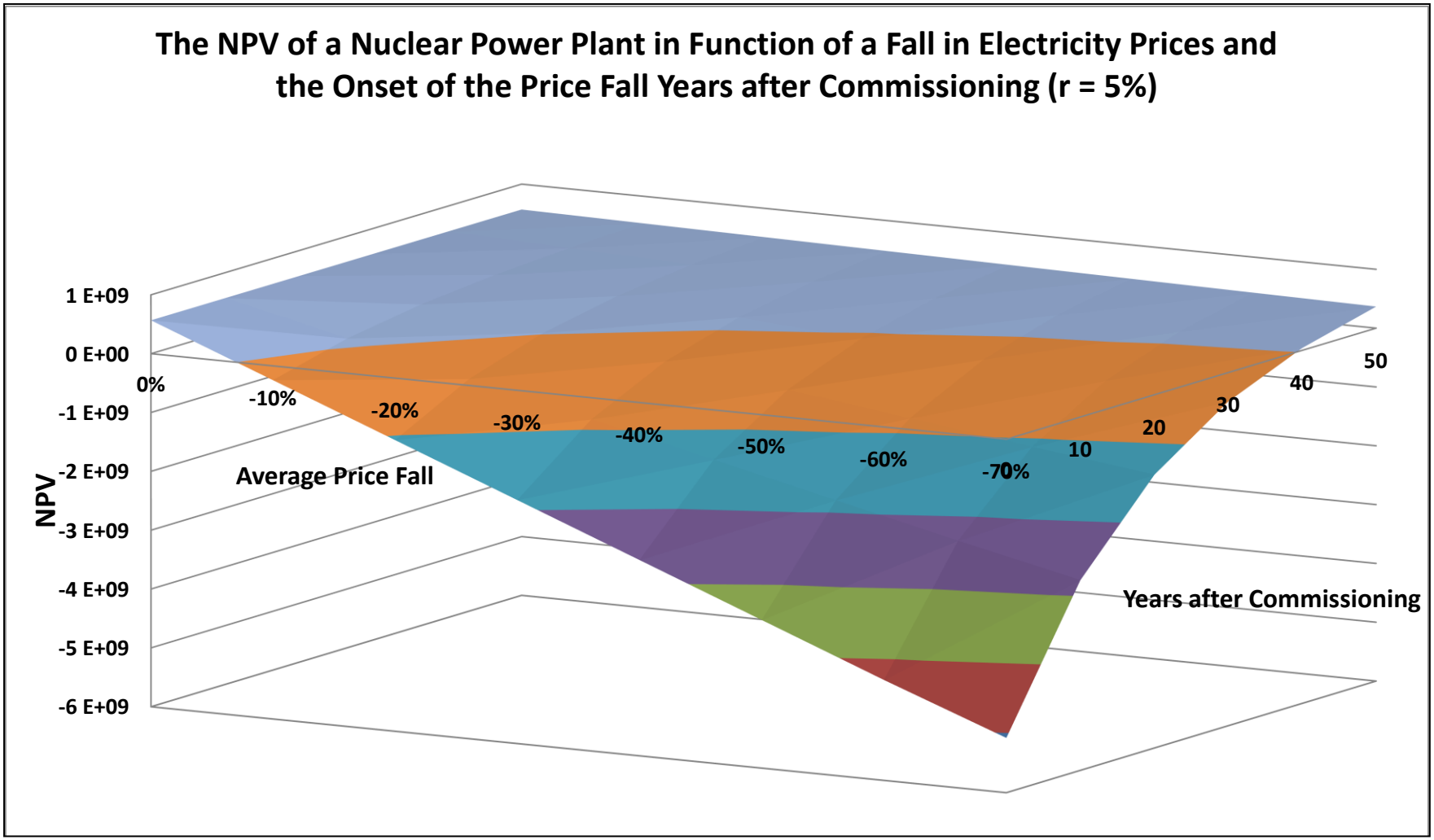
4. Ability to ride out short-term variations in input prices (mainly gas) as the price-setting marginal fuel (Newbery, Roques *et al*.);

5. **Value of price stability for risk-averse investors administered through long-term price contracts, feed-in tariffs, regulated prices, contracts-for-difference etc. for different technologies.**

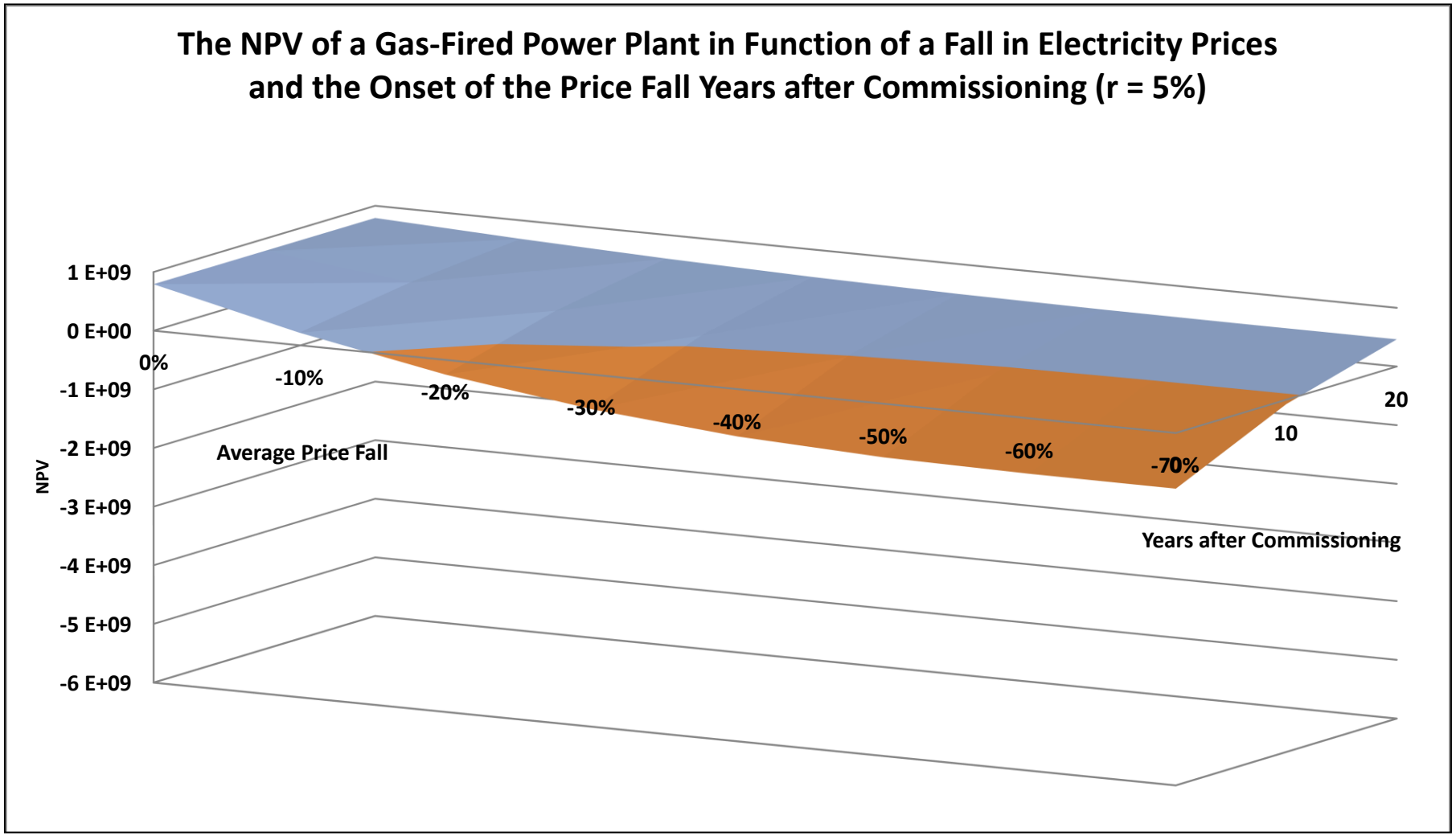
Methodology

1. NPV calculations following methodology in *Carbon Pricing and the Competitiveness of Nuclear Energy* (NEA, 2011); daily European prices for gas and electricity 2005-2010 (with "suspension option" to adjust load factors);
2. Other cost data from *Projected Costs of Generating Electricity* (IEA/NEA, 2010) – European means; no externalities, public goods or system costs (NEA, 2011, 2012).
3. Logic of real-valued option following Dixit and Pindyck (1994) as the value of flexibility (also the "value of waiting)" in the face of unanticipated uncertainty , which is possessed by technologies with low fixed costs (FC);
   a) Share of FC in LCOE nuclear up to 73% or 85% at 5% or 10% interest rate;
   b) Share of FC in LCOE gas (CCGT) 8% to 13% at 5% or 10% interest rate;
4. Risk aversion modelled as constant relative risk aversion (CRRA) that takes into account wealth effects;
5. Further research on more realistic representation of private investor choices through inclusion of tax effects and debt-equity splits.

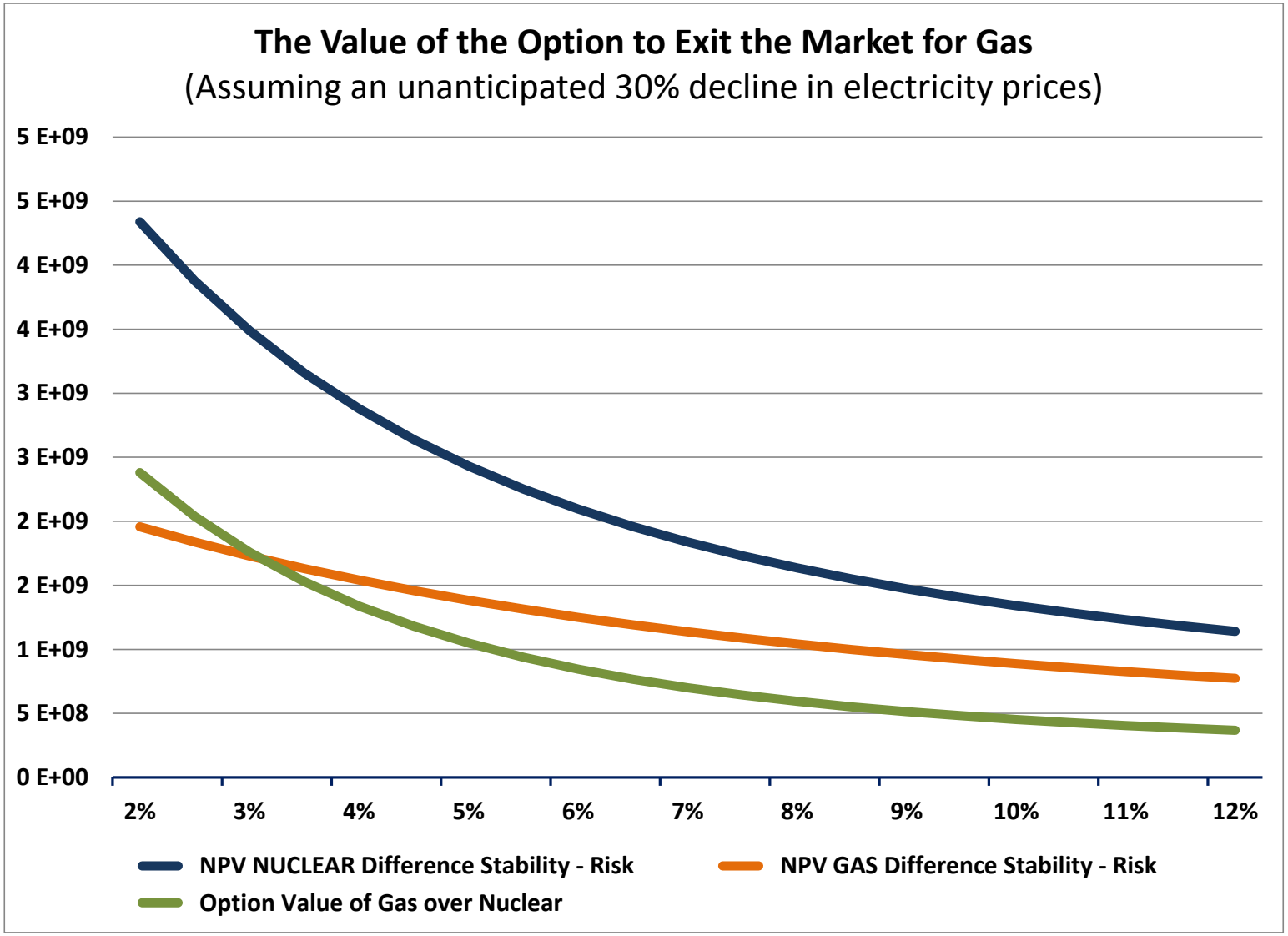
The NPV of Nuclear in Function of Different Price Risks



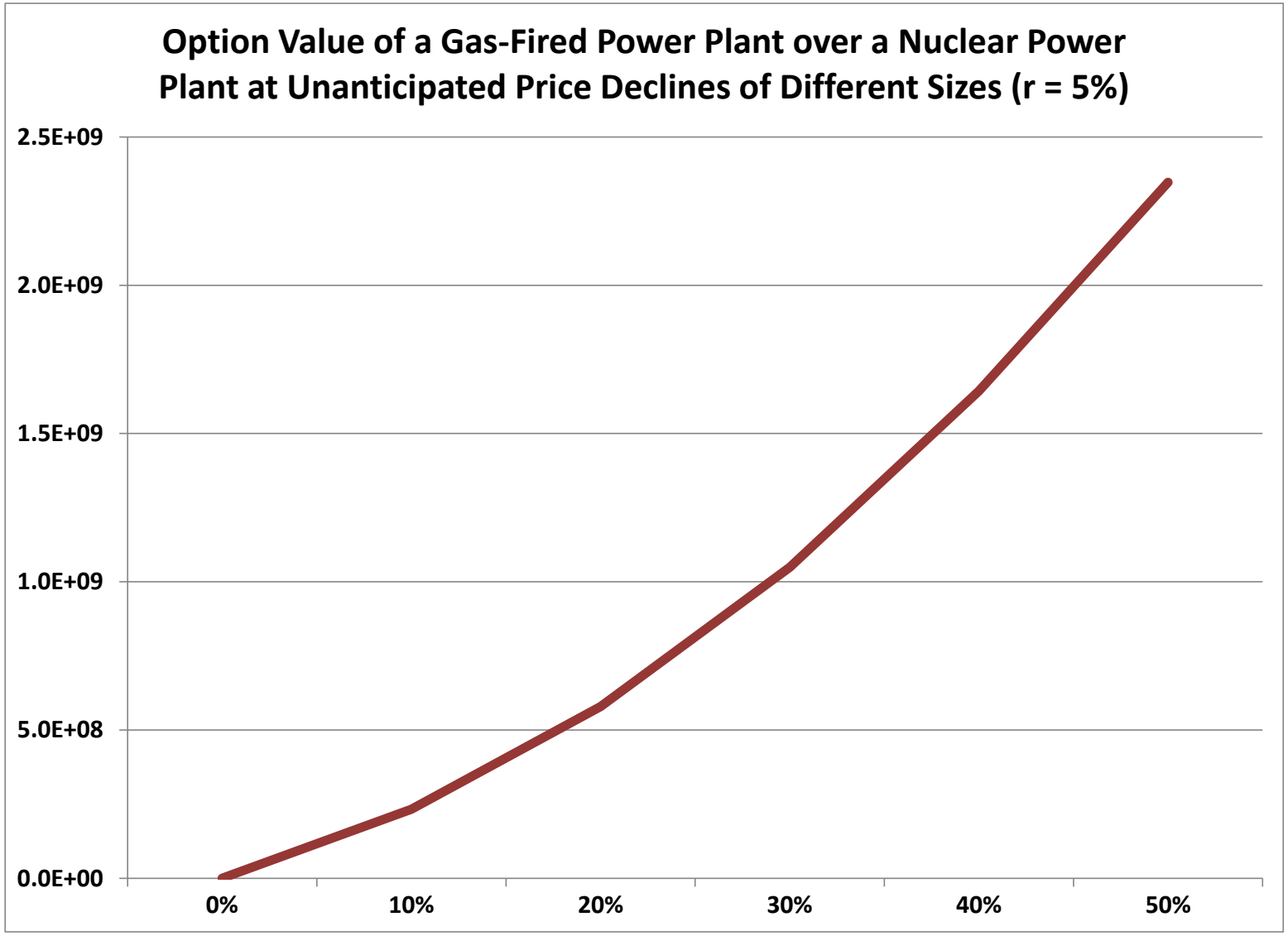
The NPV of Gas in Function of Different Price Risks



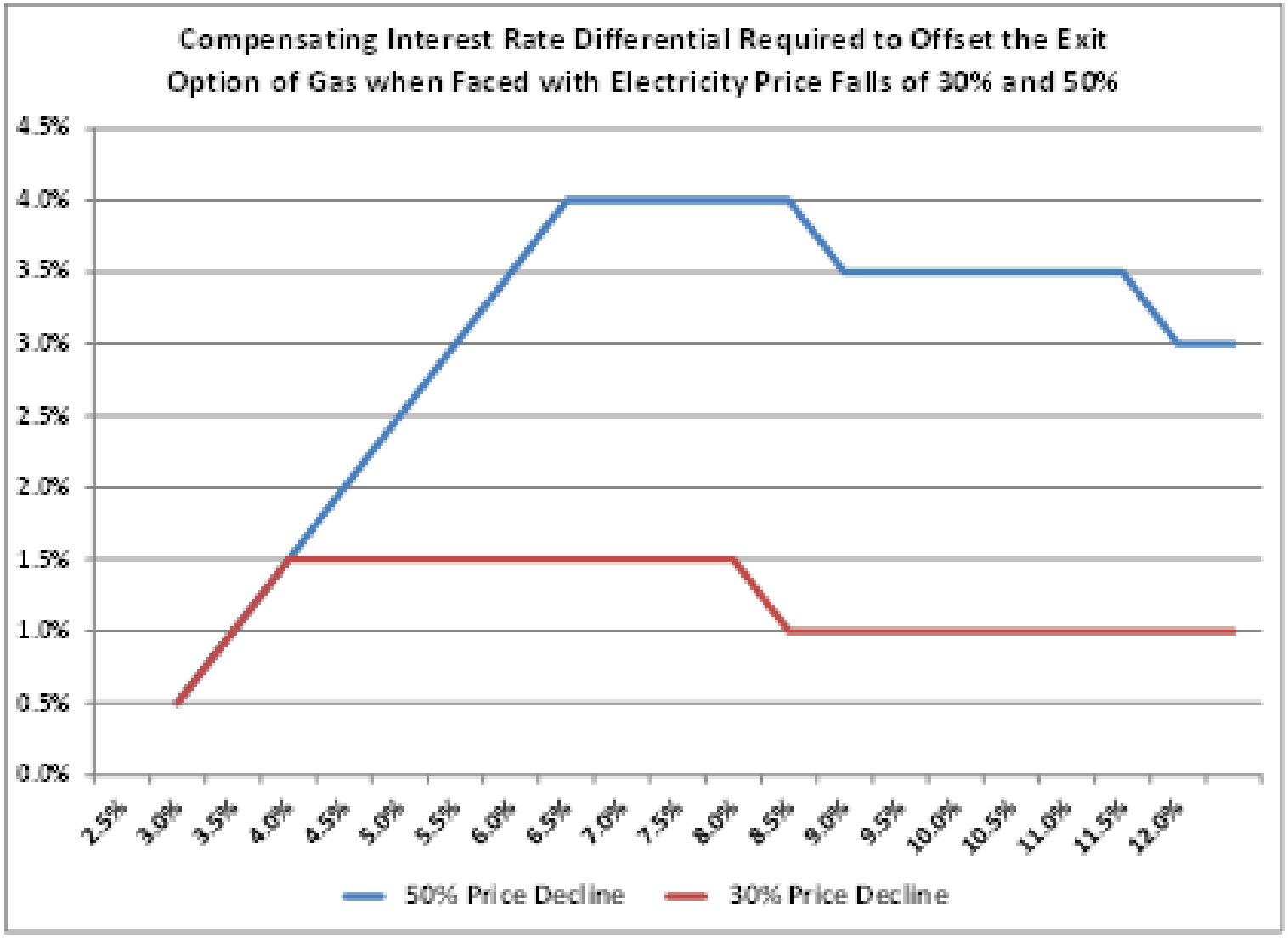
The Value of Price Stability



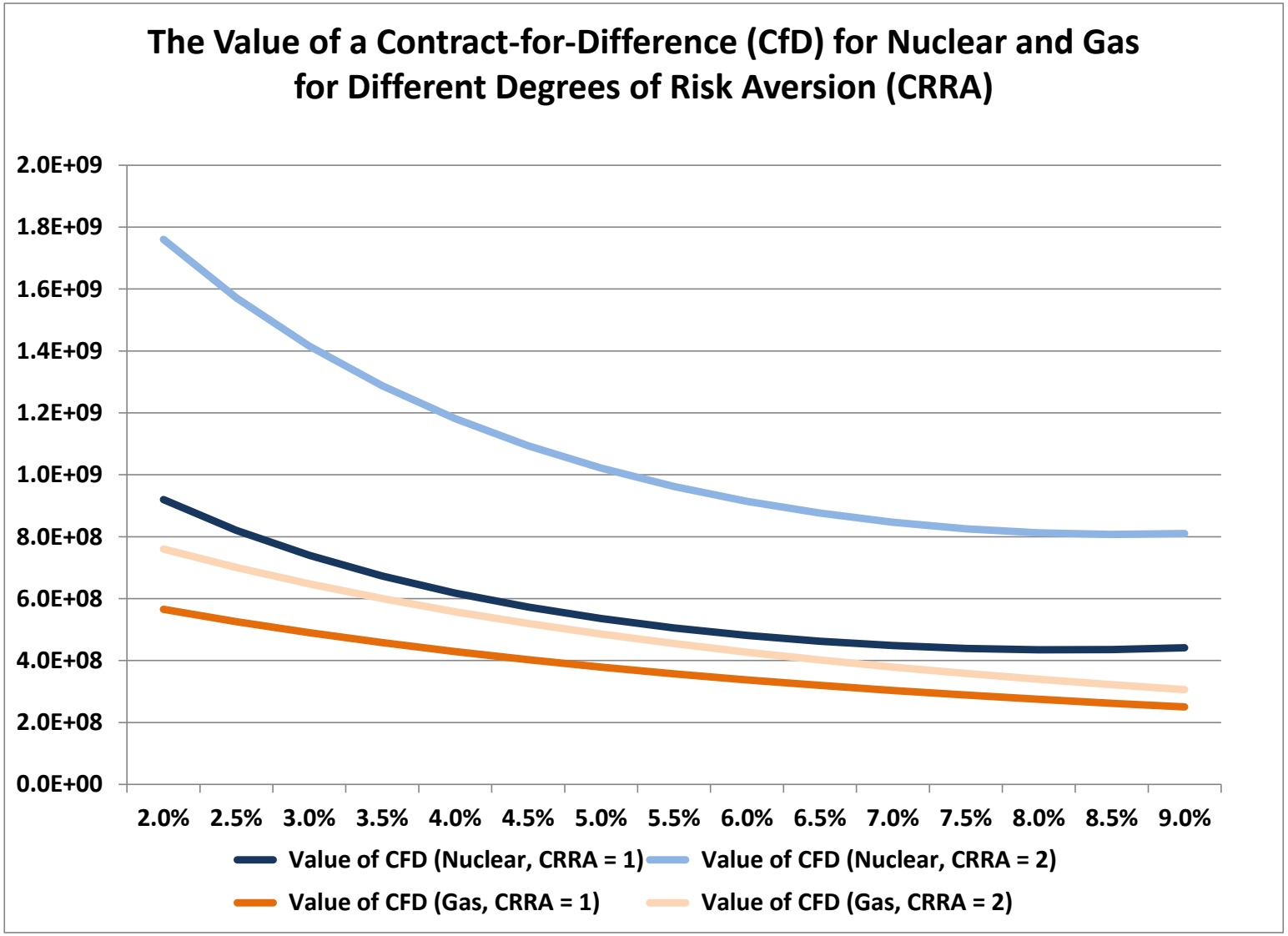
The Value of Price Stability



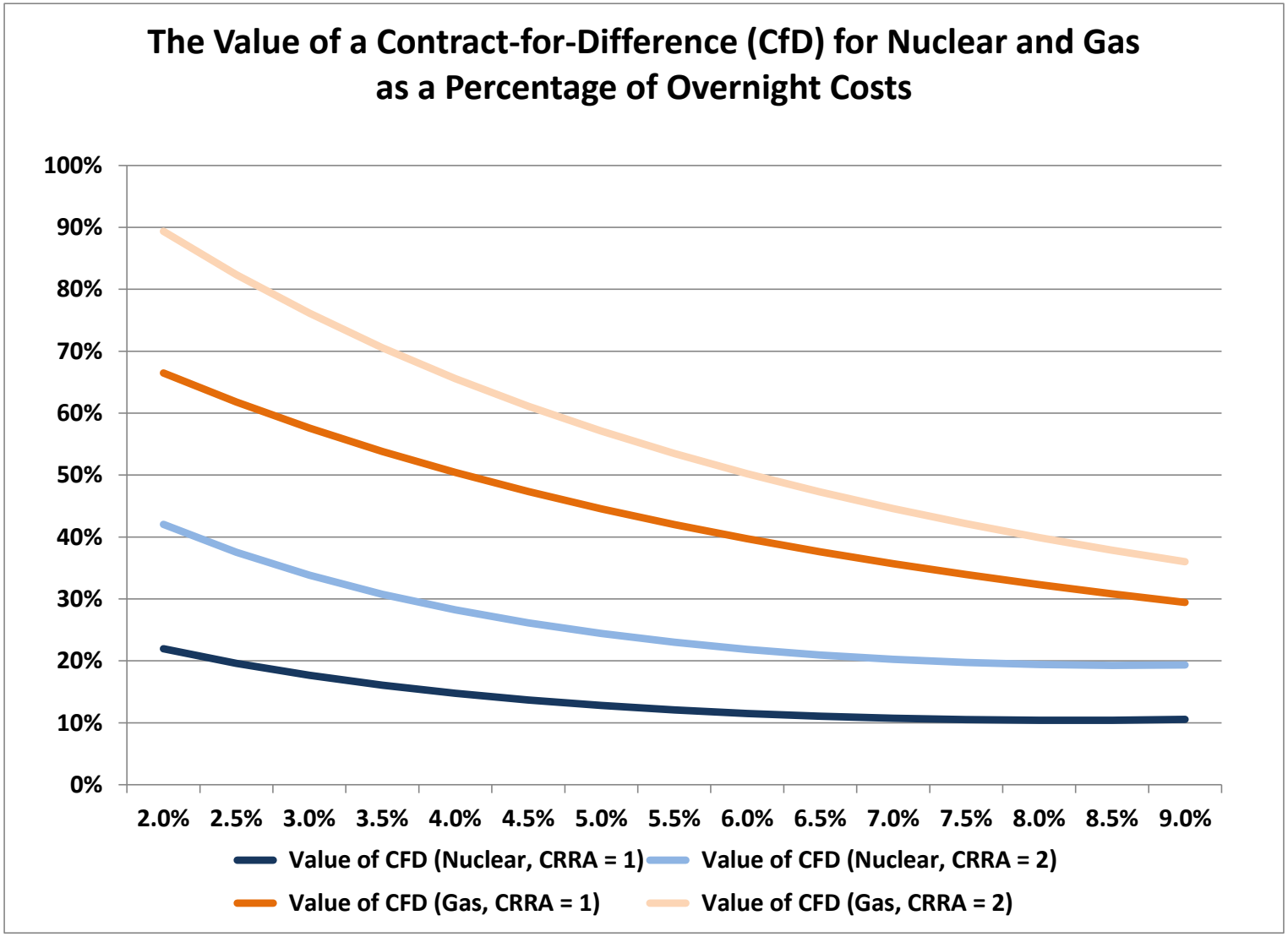
The Value of Price Stability
Off-setting Interest Rate Differential



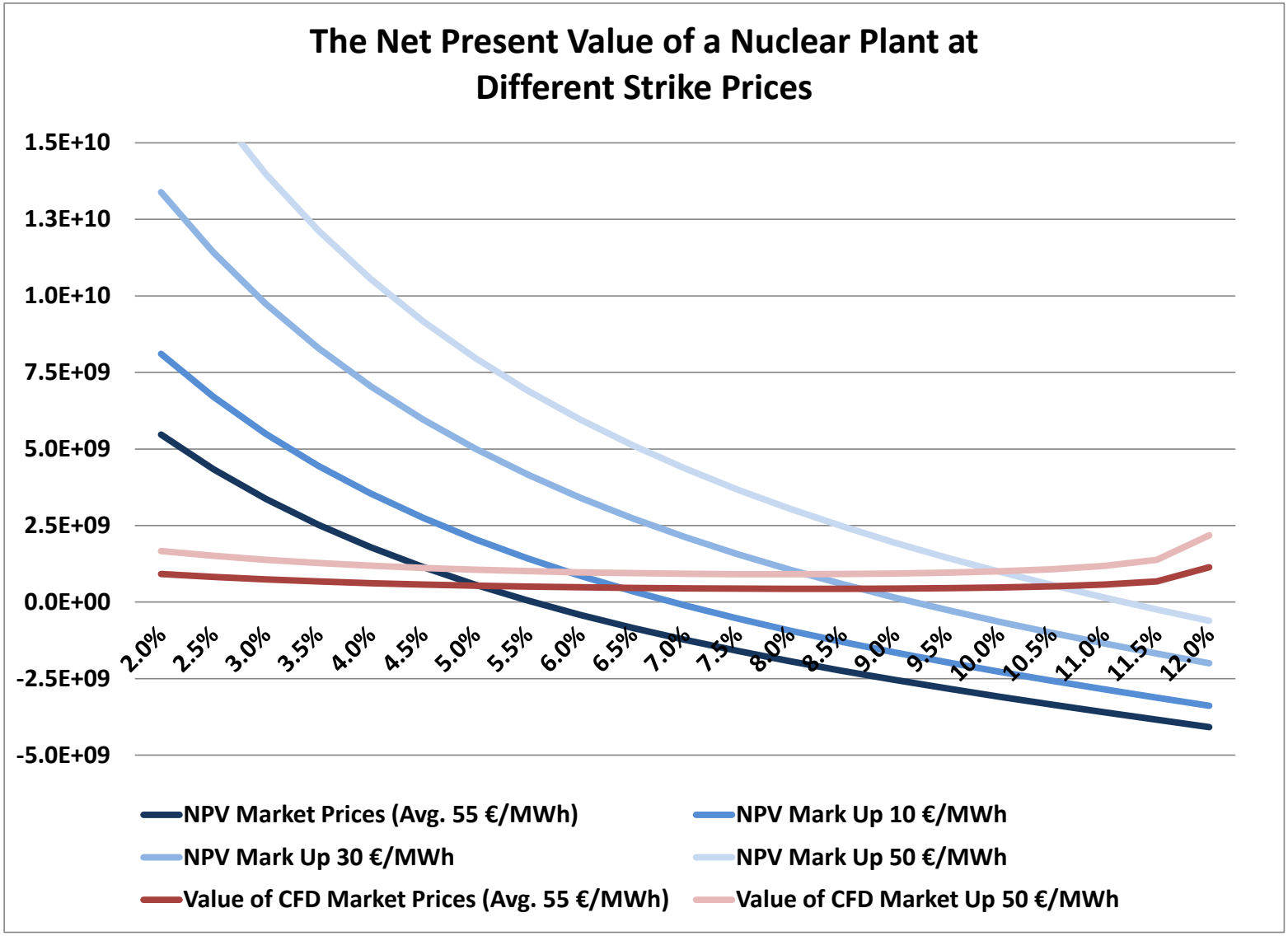
The Value of a Contract-for-Difference (Risk Aversion)



The Value of a Contract-for-Difference Share of Overnight Costs



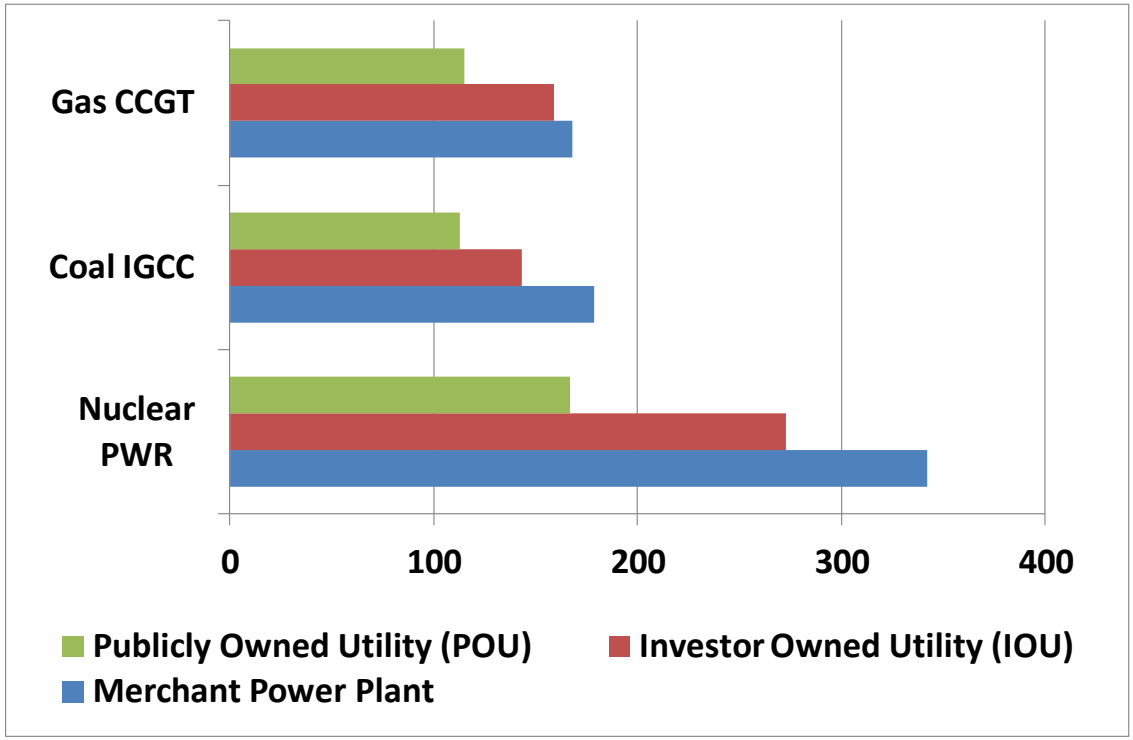
The Value of a Contract-for-Difference Mark-Up over Market Prices



Institutional Choices are Technology Choices

Levelised Costs of Electricity (LCOE) under Different Financing and Regulatory Arrangements

(USD/MWh, Commissioning 2018)



Source: California Energy Commission (2010), *Comparative Costs of California Central Station Electricity Generation*

Ideas for Discussion… Work in Progress

- Long-term electricity price volatility is a major source for risk and uncertainty facing investors in nuclear new build and needs to be appropriately managed;
- Technologies with high fixed to variable cost ratios are particularly vulnerable even at similar LCOEs (fixed price by definition);
- Neglect may lead to economically suboptimal choices in the long-run as investors rationally eschew technologies with high fixed cost in markets with price risk;
- Technologies with low fixed costs, however, are almost by definition carbon-intensive fossil fuel technologies
- Long-term electricity price risk is fundamentally different from short-term price risk which affects high variable cost technologies first.
- Institutional choices (regulated vs. deregulated markets) are neither technology-neutral nor environmentally neutral and need to be discussed in broader fashion.
- Independent of the competitiveness of different technologies, due to selective subsidisation, current electricity market prices would not allow *any* new dispatchable capacity to be built, which requires discussion about "mark-ups".

Annex I

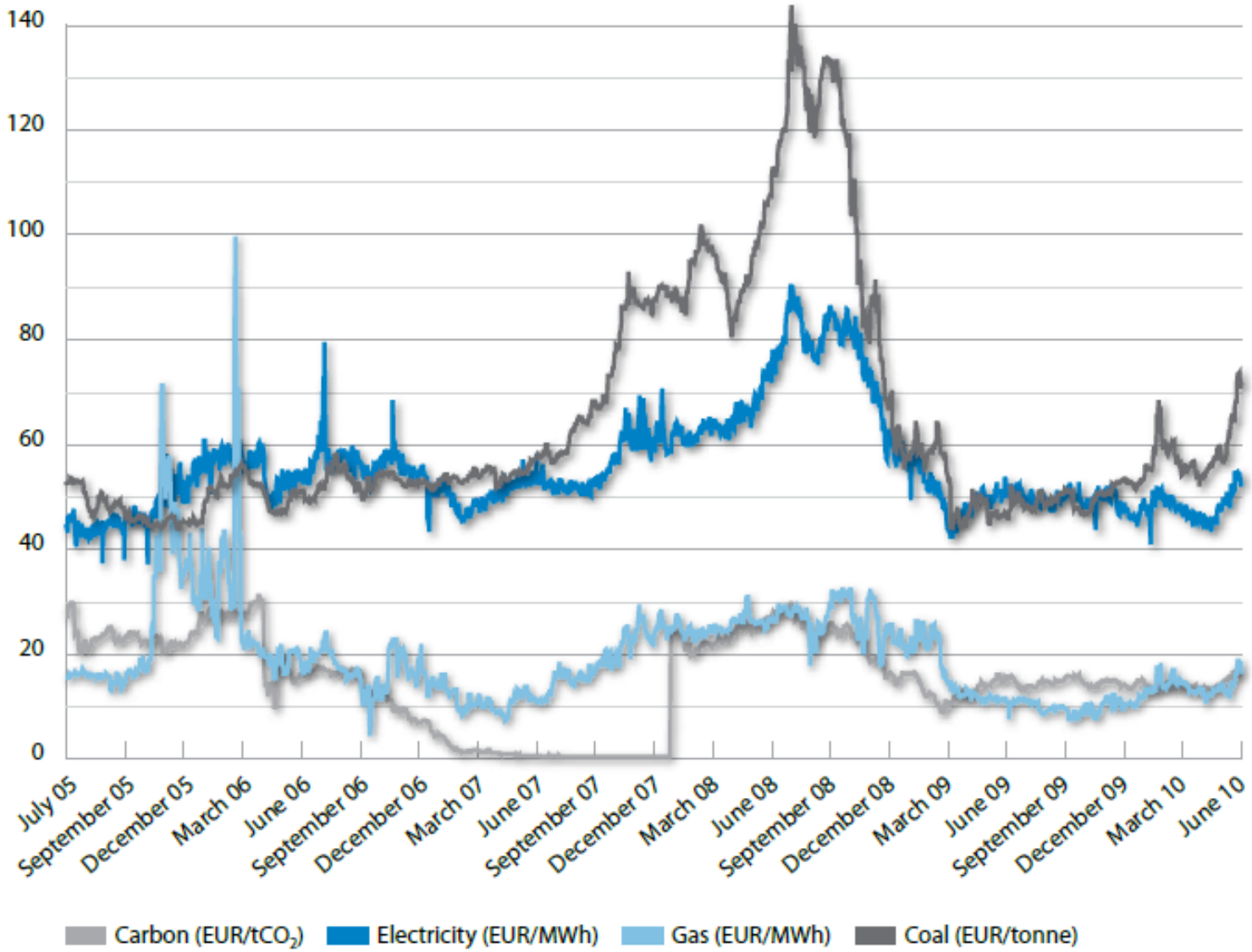
Assumptions on Cost and Technology

	Nuclear	Gas
Technical Assumptions		
Capacity	1000 MW	1000 MW
Construction years	7	2
Lifetime	60	30
Electrical conversion efficiency	n.a.	0.55
Gross energy content of fuel unit	n.a.	1 MWh
CO2 emissions per MWh	0	0.37 tCO2/MWh
Cost Assumptions		
Overnight costs	4 186 €/kW	851 €/kW
O&M	10.92 €/MWh	3.54 €/MWh
Fuel[a]	6.31 €/MWh	Daily
Decommissioning	628 €/kW	43 €/kW

[a] Fuel costs for nuclear energy include cost for the back-end of the fuel cycle.

Source: IEA/NEA (2010), *Projected Costs of Generating Electricity*.

Annex II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Carbon (EUR/tCO2)
Electricity (EUR/MWh)
Gas (EUR/MWh)
Coal (EUR/tonne)