



# Carbon Capture & Storage

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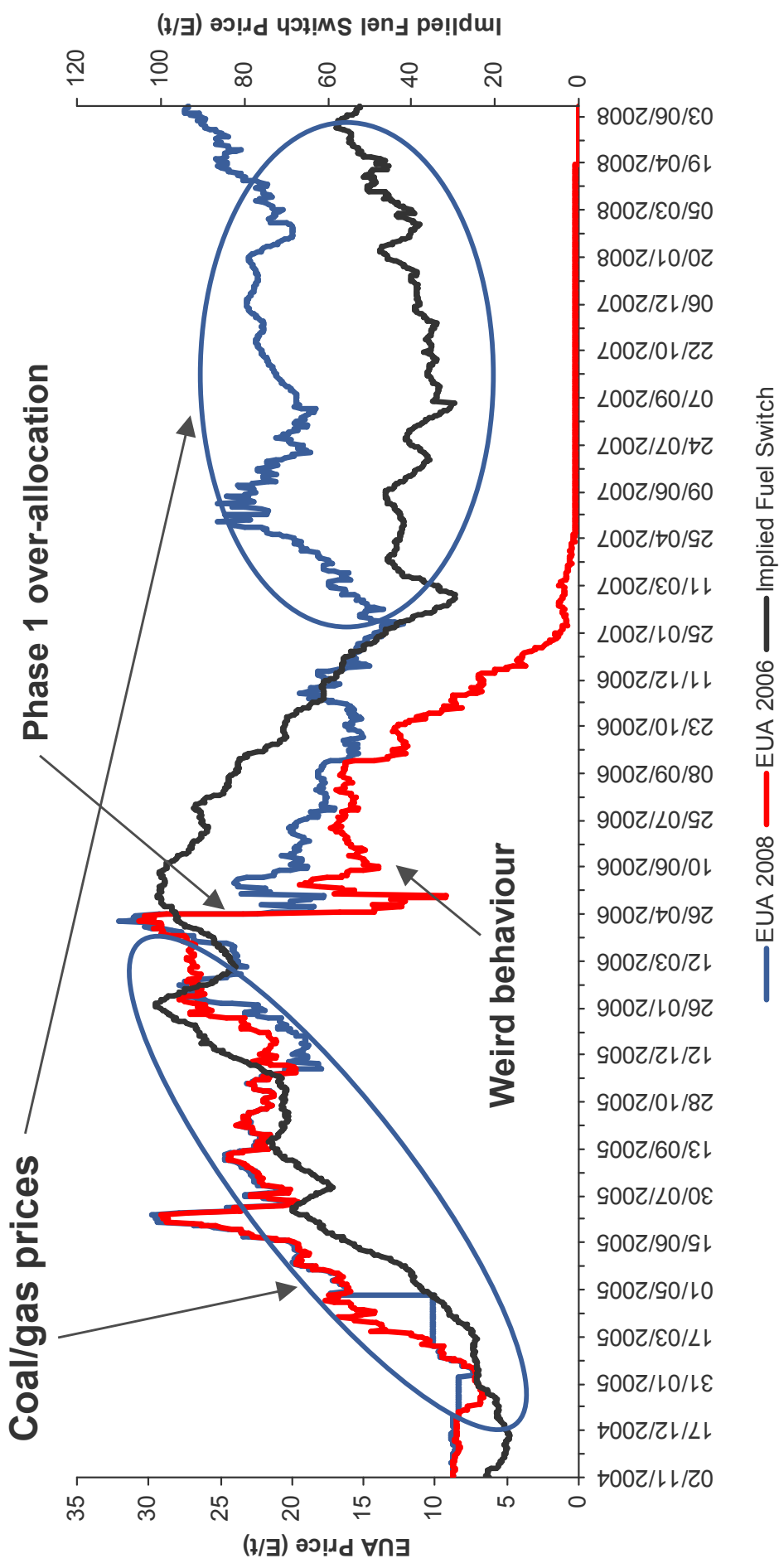
**Climate Change Capital<sup>®</sup>**



# Carbon Related Investments

.....but what price??

# Understanding carbon prices – *fundamental, design & behaviour*





# Carbon Capture & Storage

The Zero Emissions Platform

# CCS costs summary

## Input assumptions

- **Fuel costs fixed at:**
  - ▶ Gas price: 45 €/therm
  - ▶ Coal price: € 2.25/GJ
- Indexed at 2% p.a.
- **Capex profile:**
  - ▶ 3 year construction
  - ▶ Scheduled 20% in 1<sup>st</sup> year, 45% in 2<sup>nd</sup> year, 35% in 3<sup>rd</sup> year
- **Plant operating life: 20 years**
- **Plant availability: 85% (ramped up from 70%)**
- **CO2 capture rate: 88%**
- **CO2 transport & storage costs:**
  - ▶ approx € 5-6/tonne
  - ▶ total capex € 225m
    - € 75m capex
    - € 1.5 m/Km and 100 Km of pipeline length
- **Financing at 10% WACC**

Average 'central case' estimates from industry studies (low – high range shown in brackets)

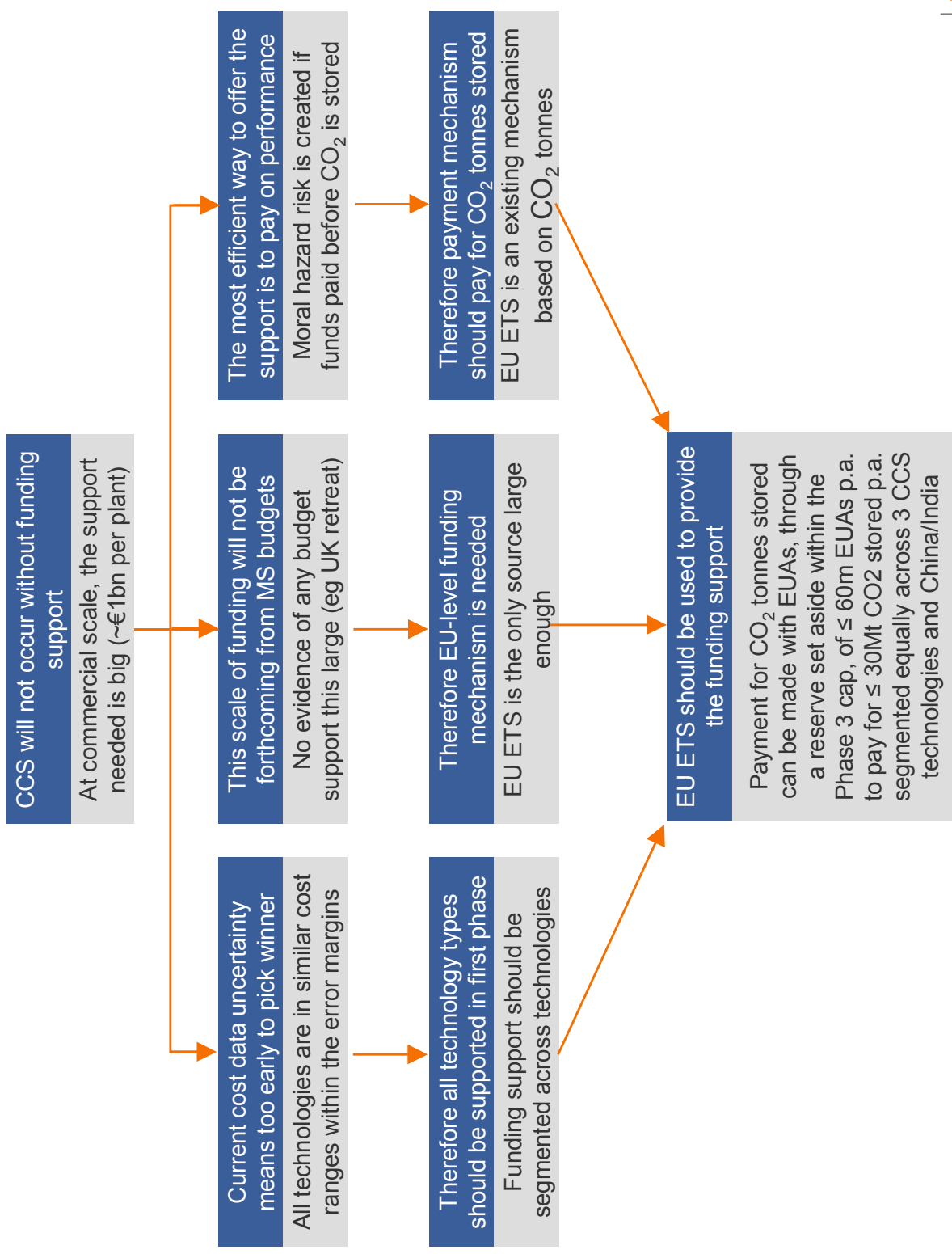
For one commercial-scale 800MW plant <sup>1</sup>	Total cost <sup>2</sup>	Capex only <sup>3</sup>	Annual cost <sup>4</sup>	Annual cost per CO2 tonne <sup>5</sup>
	€m	€m	€m p.a.	€/tCO2 p.a.
IGCC with pre-combustion CCS	861 (566 – 1125)	566 (464 – 668)	124 (91 – 153)	24.90 (18.30 – 30.50)
PC with post-combustion CCS	1114 (881 – 1418)	784 (616 – 952)	153 (124 – 183)	30.70 (24.70 – 36.70)
PC with oxyfuel CCS	1364 (945 – 1851)	891 (538 – 1243)	186 (131 – 237)	37.20 (26.30 – 47.40)
CCGT with post-combustion CCS	1016 (977 – 1150)	685 (616 – 823)	334 (324 – 373)	66.90 (64.70 – 74.70)

## Notes

1. These are the incremental costs of CCS (ie excluding power generation costs), assuming a carbon price of €12/tonne fixed for 20 years. Note that all costs could be 30% higher or lower on current estimates. Also note that these are the direct costs of construction and operation – before any allowance for the increased costs arising from being a first-mover.
2. **Total cost** represents an NPV of all incremental capex and opex over 20 years at 10%.
3. **Capex only** excludes incremental operating costs which are 30% - 50% of total costs; therefore capex support alone would be insufficient to deliver CCS deployment. Note that transport and storage infrastructure represents £225m of the capex for each technology.
4. **Annual cost** represents the incremental operating costs and annualised capex assuming 20 year financing at 10%. If paid for 20 years, this is the equivalent of the Total Cost.
5. **Annual cost per CO2 tonne** assumes 800MW plant stores 5 million tonnes of CO2 p.a.



# Principles and design of CCS support mechanism





# Appendix

## Climate Change Capital

# Climate Change Capital

Climate Change Capital (“CCC”) is a leading Investment banking group specialising in the commercial opportunities created by a low carbon economy. CCC advises and invests in companies who recognise that combating global warming is both a necessity and an economic opportunity.

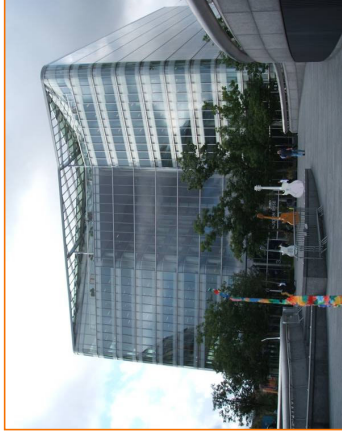
CCC is the leader in the provision of financial and market-related policy advisory services and financing for clean power, clean technology, clean fuels and carbon markets. With 125 employees, CCC is headquartered in London with dedicated teams focusing on China, Spain, North America, India and Latin America.

Through the combined talents of advisors, finance professionals, environmentalists and access to a significant capital base, CCC is perfectly placed to help its clients adapt to, and profit from, a vast new energy economy.



# Contact Climate Change Capital

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