



CO₂ Capture Ready Plants

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Overview

- The need for capture ready plants
- Definition of capture ready
- Technical requirements
- Economic considerations
- Which technologies are best for capture ready?



Why are Capture Ready Plants Needed?

- CCS is currently not economic in most cases
 - No economic incentives in many countries
 - Even where there are incentives they are usually too low and uncertain
- CCS is still at the development and demonstration stage
 - Demonstration plants are needed to improve investor confidence
 - Regulatory issues are being addressed
- There is a large demand for new power stations in the near future
 - Developing countries – mainly new capacity
 - Developed countries – mainly replacement capacity
- Power plants have long lives (>50 years)
 - Emission reductions are likely to be necessary during their lifetimes

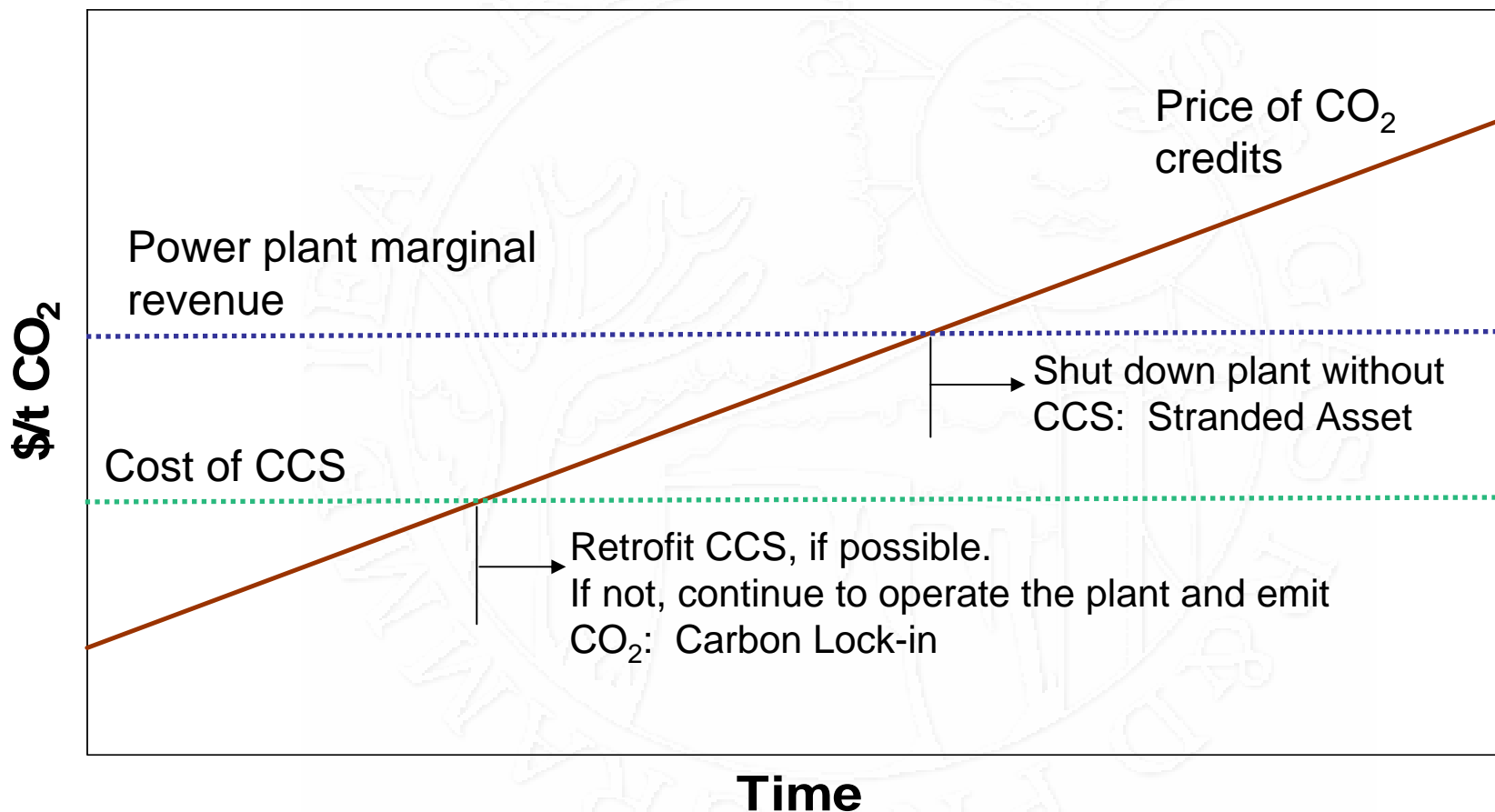


What is meant by 'Capture Ready'

- A CO₂ capture-ready power plant is a plant which can include CO₂ capture when the necessary regulatory or economic drivers are in place.
- The aim of building plants that are capture-ready is to reduce the risk of 'carbon lock-in' or 'stranded assets'.



Carbon Lock-in and Stranded Assets





Capture Ready Requirements

- 'Essential' requirements
 - Carry out a design study on retrofit of CO₂ capture
 - Include sufficient space and access for the additional facilities that would be required
 - Identify reasonable route(s) to storage of CO₂
- Optional pre-investments
 - To reduce the downtime and cost of capture retrofit
 - To optimise the plant operation after retrofit

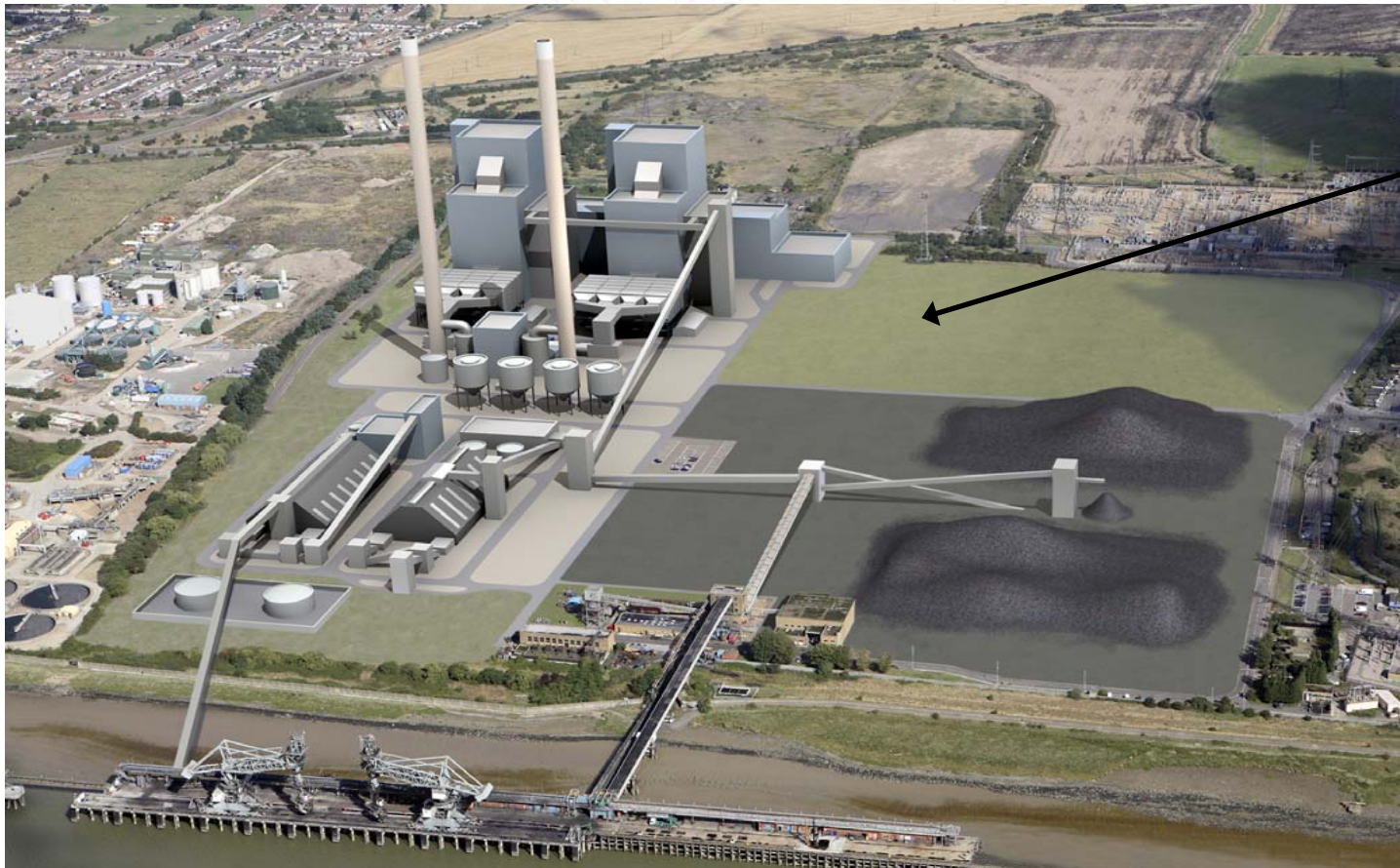


Essential Requirements: Space and Access

- Space for new equipment etc
 - Oxygen plant, flue gas cooler, CO₂ compressor etc
 - Electrical distribution, cooling water, waste water treating etc
 - Safety barrier zones, if required
 - Extra space needed during construction
- Space for access within the existing plant
 - Pipe work and tie-ins with existing equipment
- Additional generating capacity, if required
 - CO₂ capture usually reduces net power output
 - By about 20% for current oxy-combustion technology
 - May need to build new capacity to maintain the site power output



CO₂ Capture Ready Plant



'Capture Ready' area

Proposed 'capture ready' power plant at Tilbury
(One of the possible options for this site)

Courtesy of RWE Npower



Essential Requirements: Access to CO₂ Storage

- Where are potential CO₂ stores?
- What are their capacities?
- How to transport CO₂ to the stores?
 - Rights of way for pipelines
 - Safety
 - Public acceptance
 - Proximity to other potential CO₂ sources
 - Large economies of scale for pipelines
- An alternative power plant site may be preferred



How to Establish a Credible CO₂ Store?

- Identify a broad area where a large amount of storage is expected to be available, e.g. the North Sea
- Identify specific reservoir(s)
 - What needs to be done to characterise the reservoir?
 - Seismic surveys
 - Exploratory drilling
 - Costs could be significant
- Purchase a reservoir or a contractual option to use it
 - To avoid someone else using the reservoir



Pre-Investments – Maximising Efficiency

- The efficiency/capital cost trade-off is different for plants with CO₂ capture
 - Thermal efficiency is lower
 - Cost of generation is higher
 - The trade-off favours higher efficiency/higher capital cost designs, e.g. ultra supercritical steam cycles
- Higher efficiency designs reduce emissions even before capture retrofit
 - An important environmental benefit

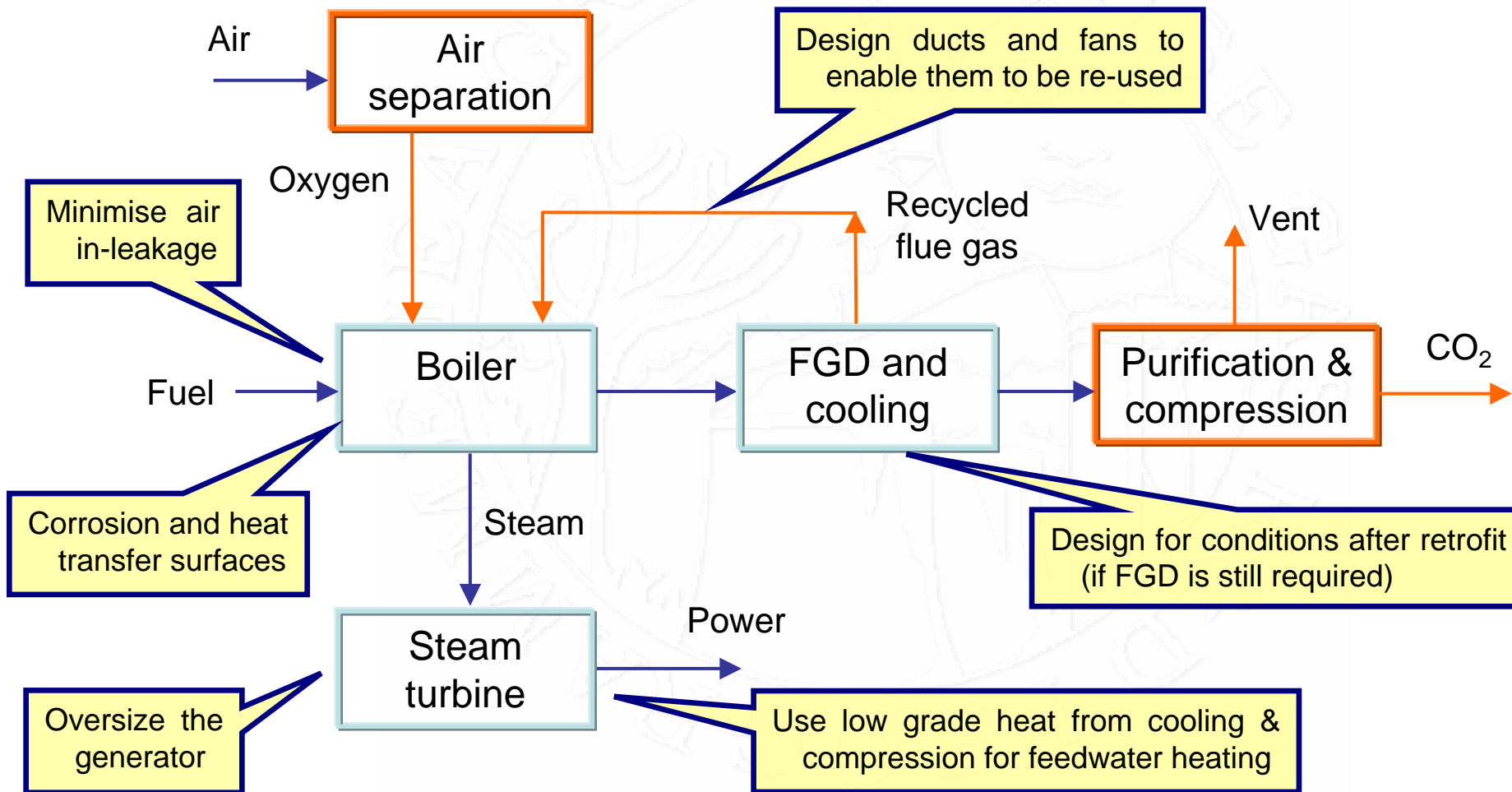


Pre-Investments - General

- Oversize pipe racks etc
- Include flanges for connecting new plant
- Provision for expansion of the control system, on-site electricity distribution, cooling capacity etc
- Some of these investments are expected to have low costs and high economic returns



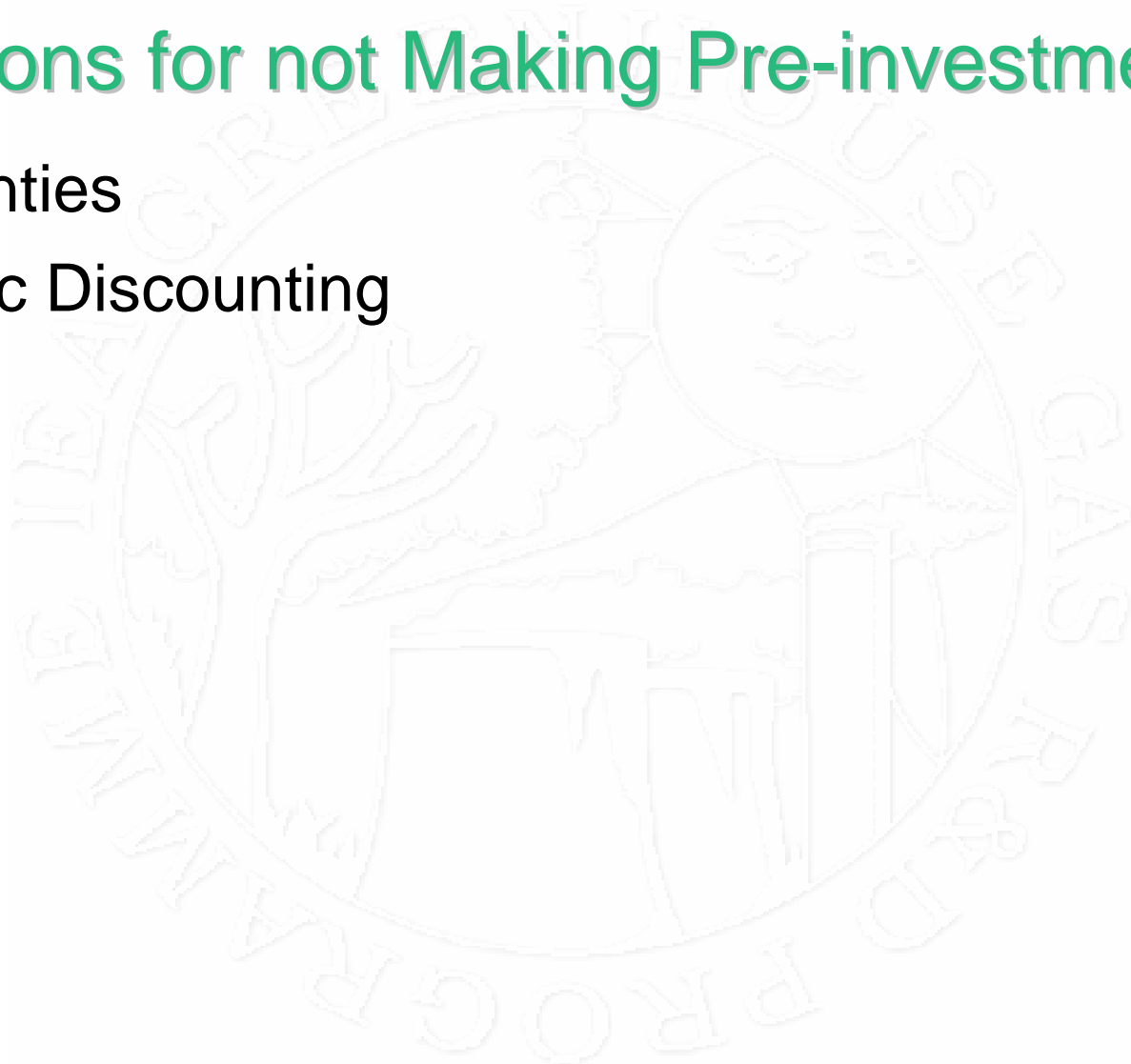
Pre-Investments – Oxy-Combustion





Reasons for not Making Pre-investments

- Uncertainties
- Economic Discounting





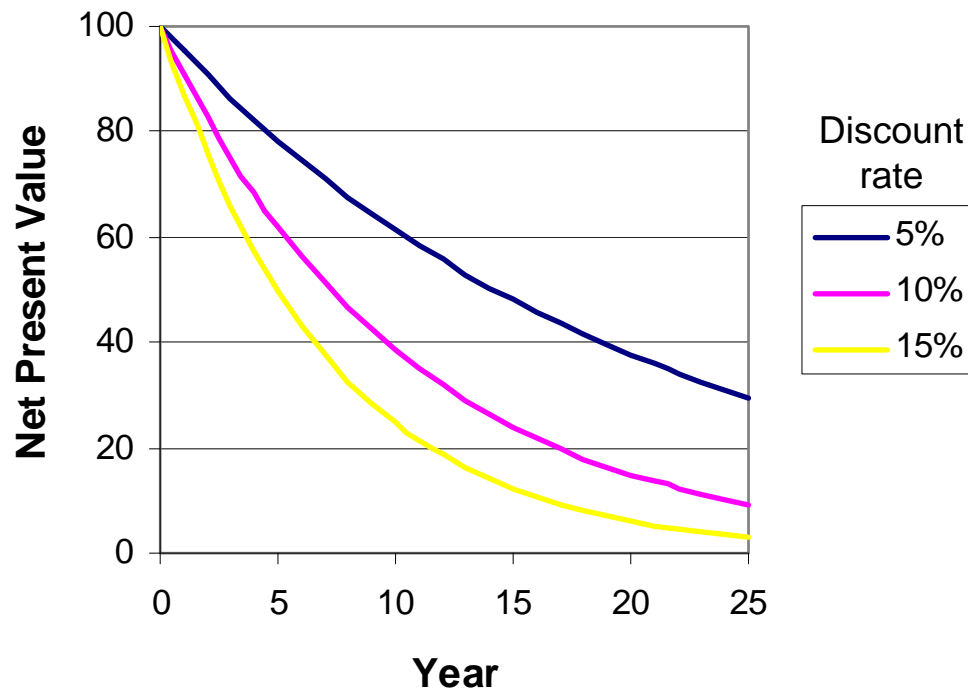
Uncertainties

- If or when will capture retrofit be required?
 - Future values of carbon credits
 - Regulatory requirements
- Current uncertainties in large scale plant designs
- How will capture technologies develop in future?
 - Capture ready plants should be designed for current technologies
 - Incremental improvements in future
 - Possibility of substantially better technologies
 - Future technologies should be considered to reduce the risk of obsolescence



Economic Discounting

- Economic resources are worth less in the future than at present
- It may be several years before capture retrofit is required



➤ ***Major pre-investment is unlikely to be worthwhile if there is a long time before capture retrofit***



Which Process is Best for Capture Ready?

- Post-combustion capture
 - Retrofit to capture ready plants is relatively simple
 - Capture ready requirements are relatively well understood but technology developments e.g. ammonia scrubbing could change the requirements
- IGCC pre-combustion capture
 - Potentially attractive option for new-build power plants with capture
 - IGCCs without capture are expected to be more expensive than pulverised coal plants – choosing IGCC is a major pre-investment
 - Capture retrofit impacts on many aspects of the plant, unless significant pre-investment has been made
- Oxy-combustion
 - Some risks for capture ready because oxy-combustion is still at the pilot plant scale
 - Plants could also be made capture ready for post-combustion as a fall-back



A Note of Caution

- Capture Ready does not reduce emissions
 - Unless a higher efficiency plant design is selected
 - In some cases emissions may be slightly higher
- Capture Ready is not a substitute for capture
- Some people may regard Capture Ready as 'greenwash'
- Plants with capture need to be built to demonstrate technology and increase investor confidence



Conclusions

- Capture Ready can reduce the risk of Stranded Assets and Carbon Lock-in
- Main Capture Ready considerations are:
 - Carry out a study of capture retrofit options
 - Leave space and access for capture plant
 - Identify reasonable route(s) to storage of CO₂
- Major pre-investment is unlikely to be worthwhile unless capture is going to be retrofitted soon after plant start-up
- Capture Ready is not a substitute for capture



Thank you
Any questions?

