EXHIBIT C

The Deployment of Clean Power Systems for Coal

Nick Otter

CCT2007 Sardinia 15-18th May 2007

POWER SYSTEMS

ALSTOM

Agenda

1st topic	Strategy and Drivers
2nd topic	CO2 Reduction and Capture Technologies
3rd topic	Capture Ready Plant and other important issue
4th topic	Concluding Remarks

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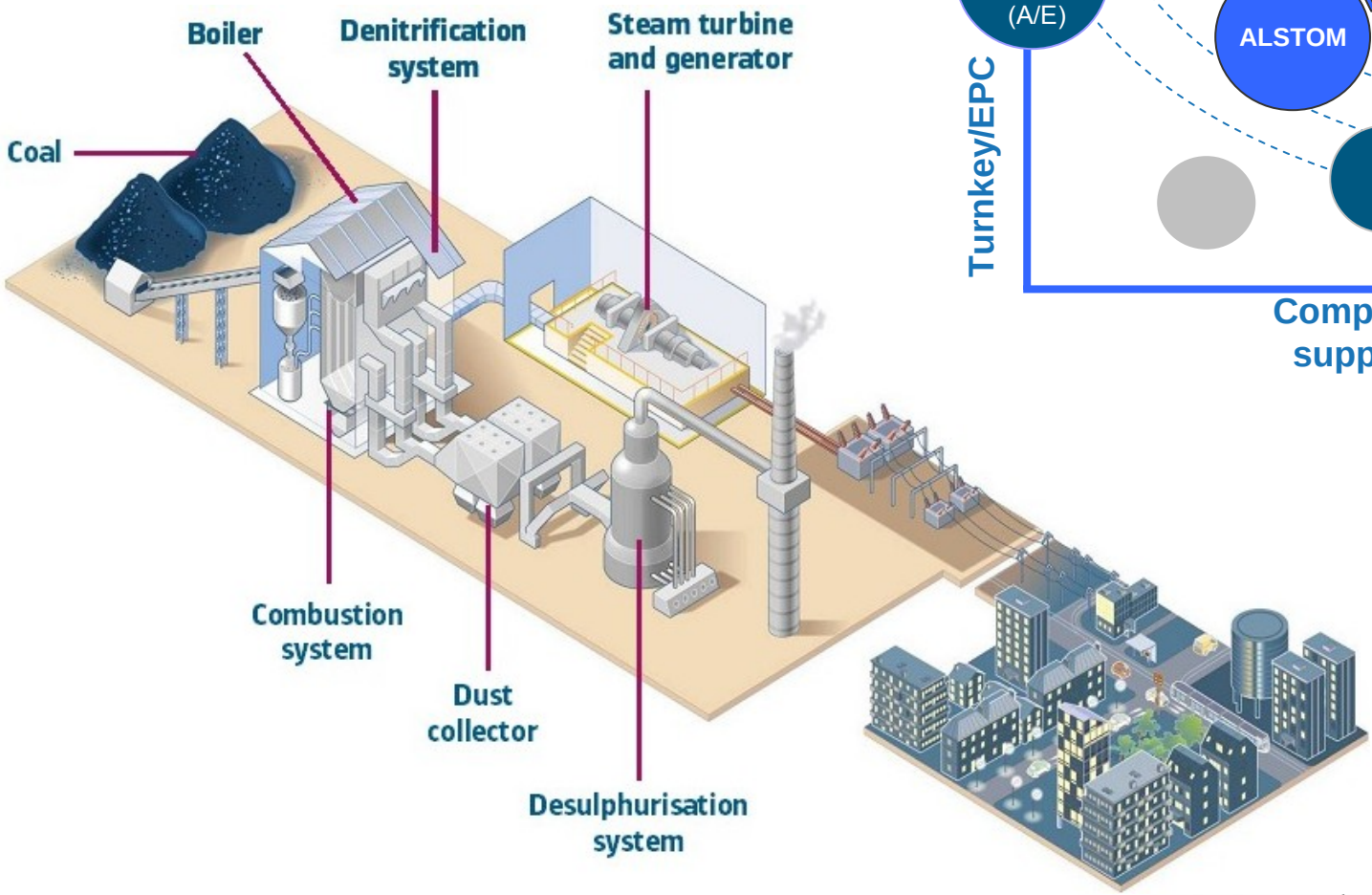
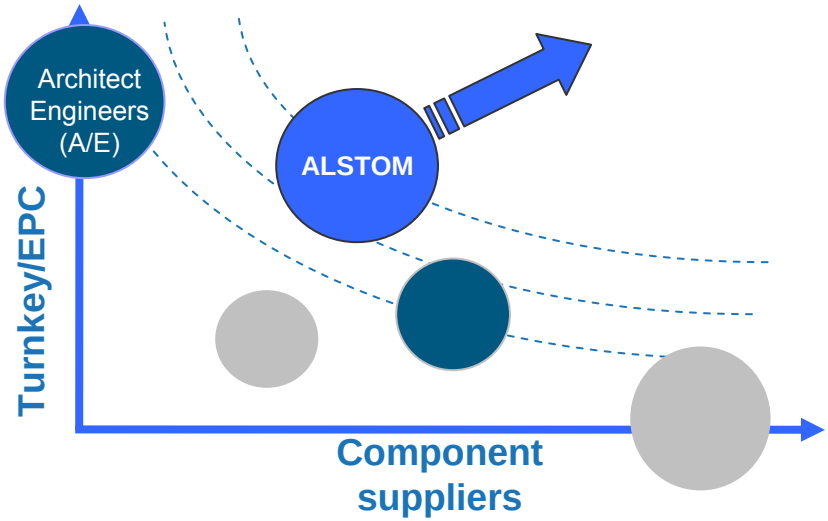
A Power Generation System Provider Perspective





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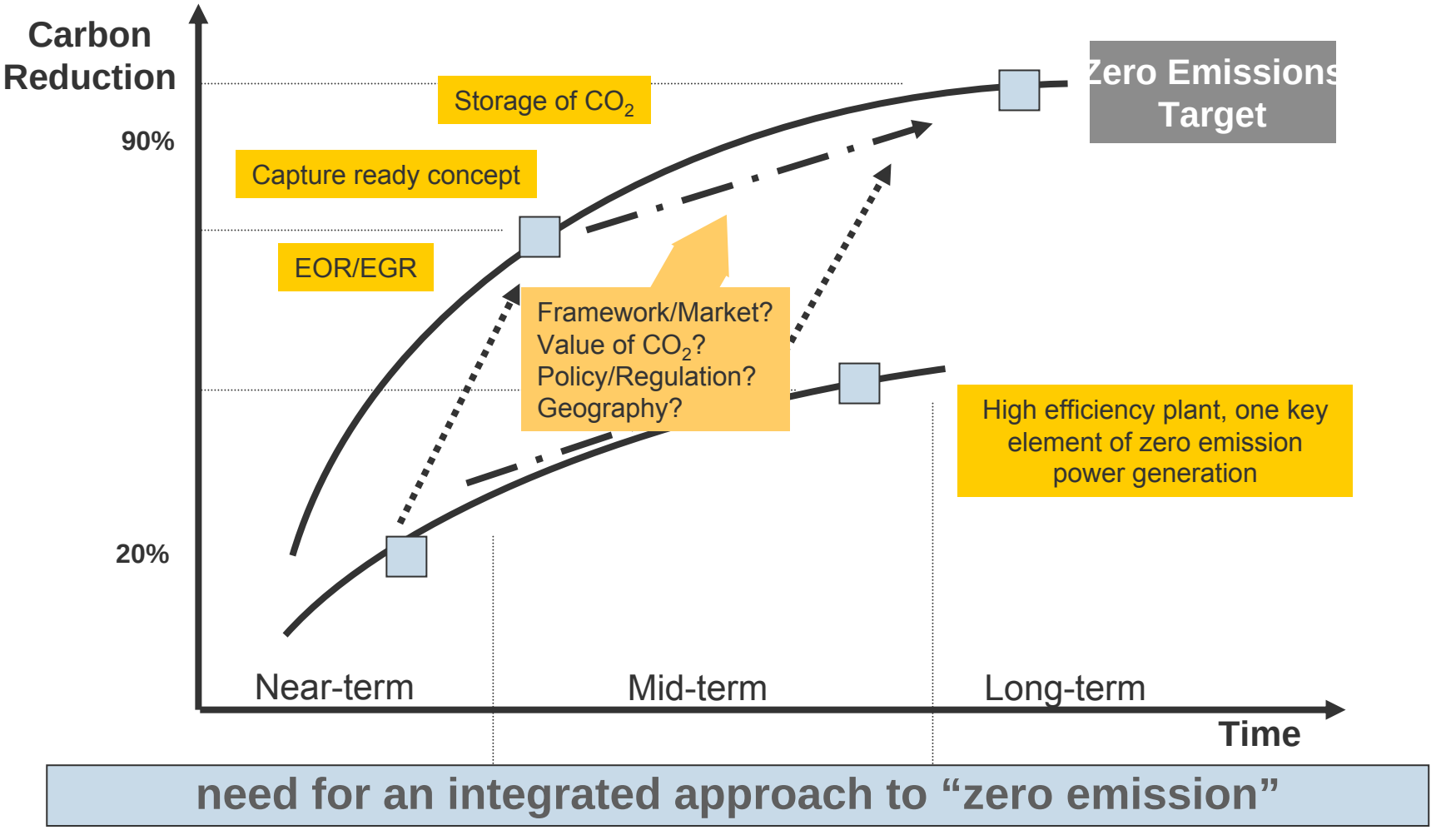
Some key touchstones

- **Importance of clean use of fossil fuels**
  - a critical transitional issue in getting to a sustainable energy future
  - an essential part of the portfolio
- **Importance of accelerating the take-up of clean fossil**
  - need for incentives for early action on `zero emission` power plant
  - stable financial and regulatory framework to get “many of a kind”
- **Importance of addressing issue worldwide**
  - use of high efficiency technologies, and …….
  - ……. prepare the way `zero emission`
    - retrofitting of high efficient coal plant with capture to avoid “carbon lock-in”
    - how to ensure new plant is “capture ready”
    - increase use of low carbon technologies

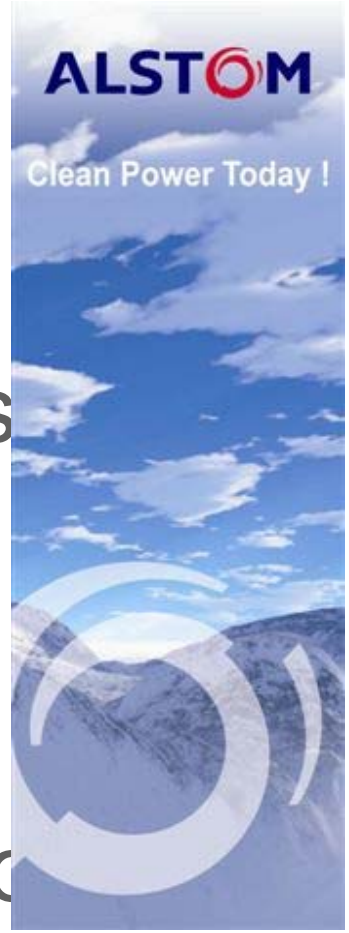
Pathway to zero emission power for fossil fuels



need for an integrated approach to "zero emission"

The ALSTOM CO2 STRATEGY : key elements

- Efficiency of installed base
- Advanced cycles for new plants
- CO2 ready power plant
- Retrofitable CO2 capture solutio



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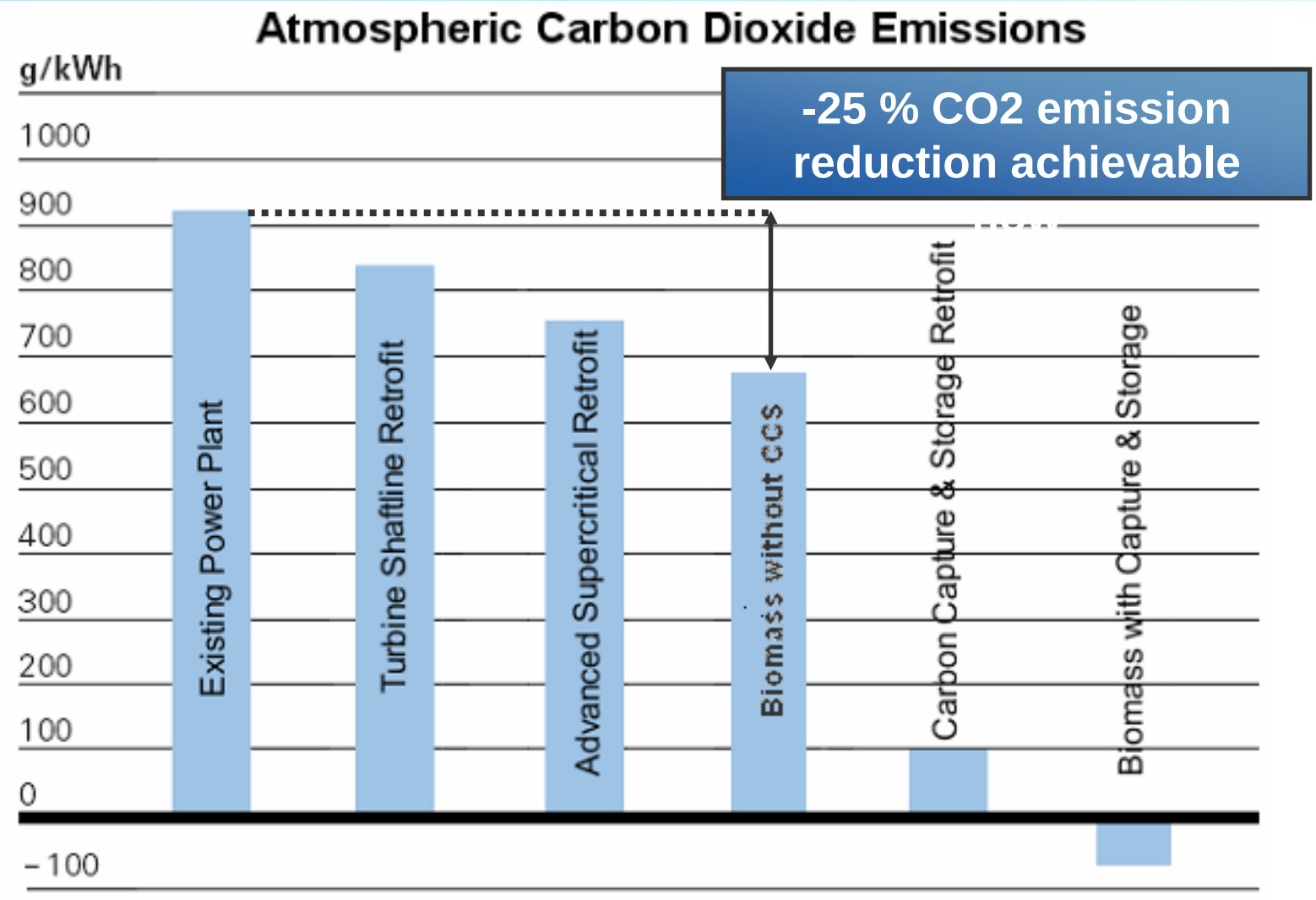
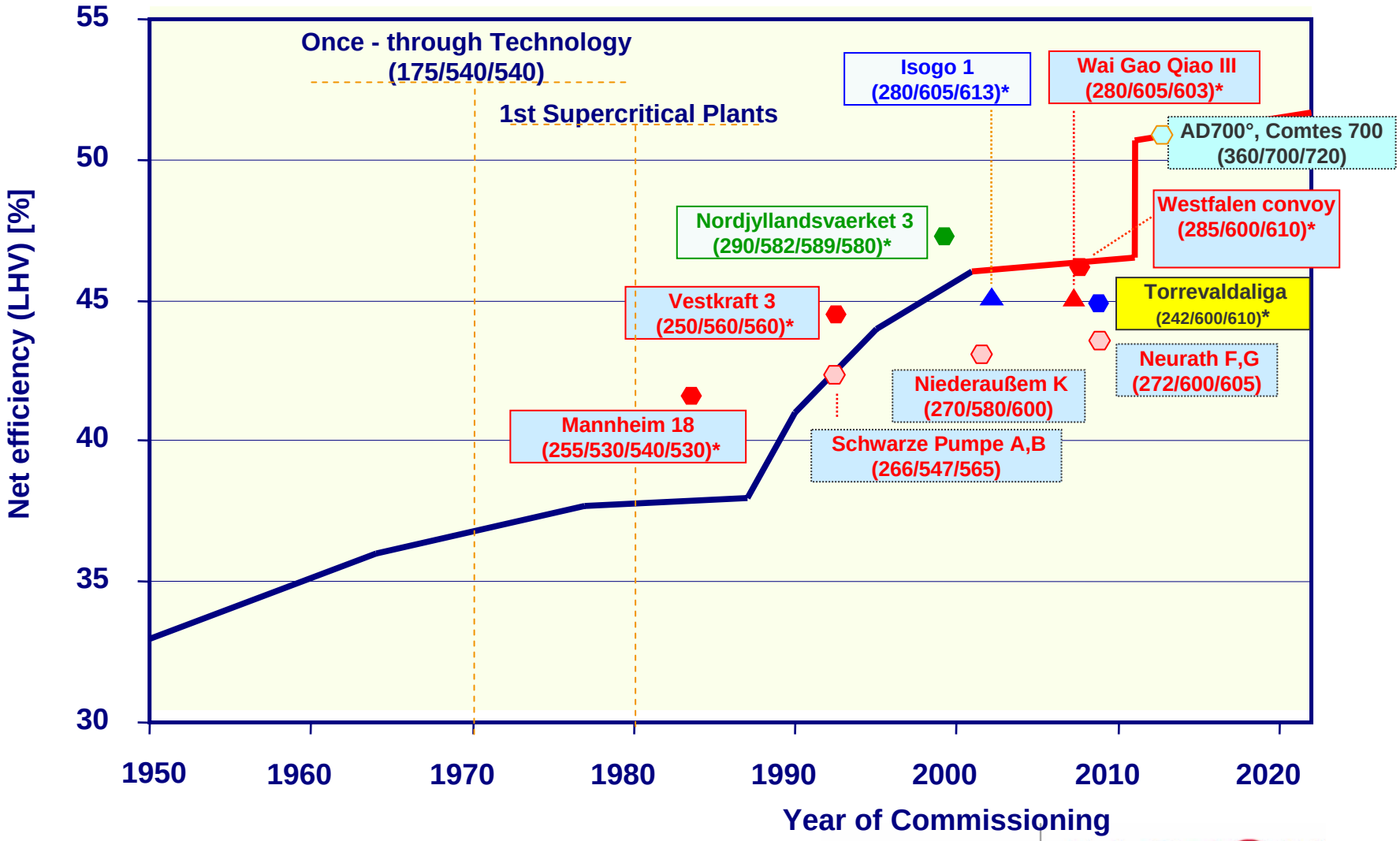
Retrofit = Immediate CO_2 avoidance



Efficiencies of coal fired power plants



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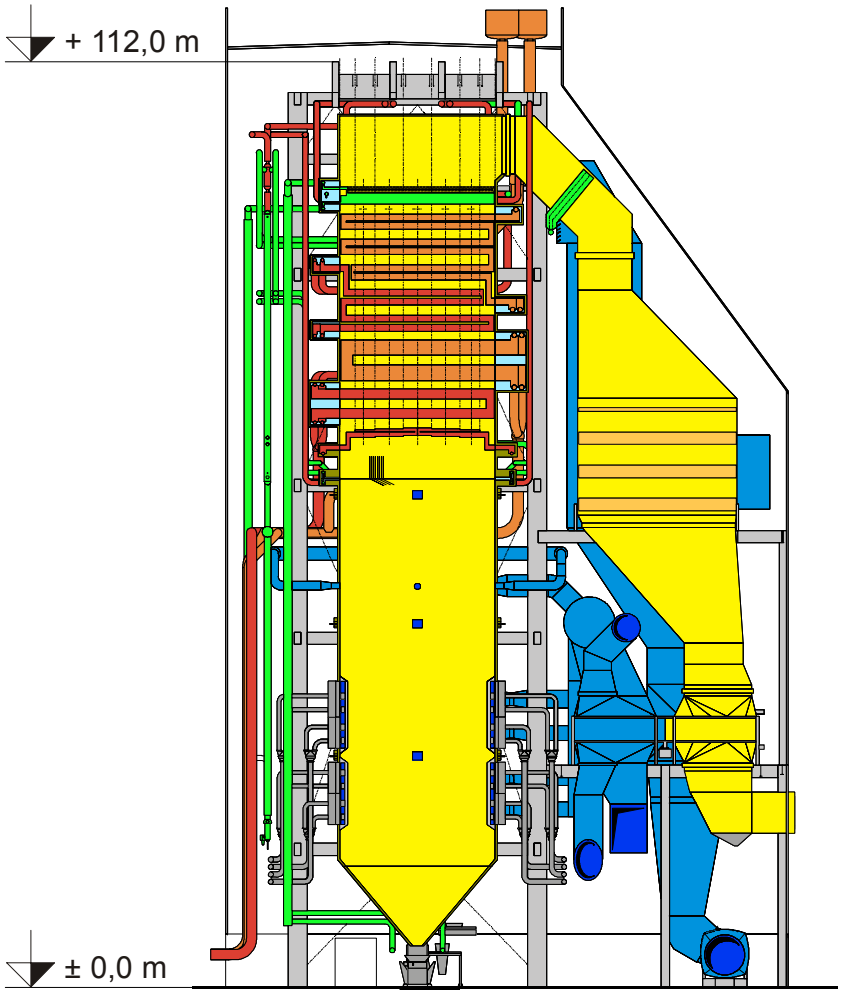
Karlsruhe, Unit 8, 890 MW



Karlsruhe, Unit 8, 890 MW

•	Technology	-	Once Through
•	Fuel Coal	-	Bituminous
•	Capacity	t/h	2.347
•	Pressure	bar	285
•	Temperature	°C	603/621
•	Exit gas temperature	°C	120
•	Boiler efficiency (LHV)	%	95
•	Country	-	Germany
•	Customer	-	EnBW

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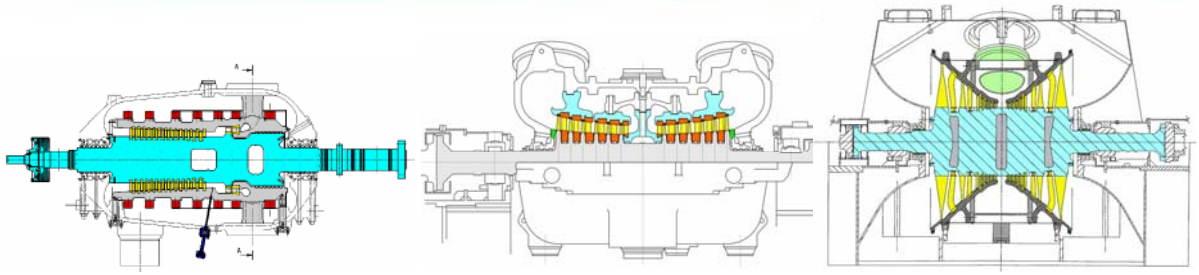
Steam turbine retrofit



	HP Retrofit	IP Retrofit	LP Retrofit
Performance improvement (cylinder Isentropic η)	Δη ~ +5% to 10%	Δη ~ +3% to 4%	Δη ~ +4% to 8%
Emission reduction	~ 1.5%; ~ 30 000 tCO_2/a ~ 170 tSO_2/a	~ 0.5%; ~ 10 000 tCO_2/a ~ 70 tSO_2/a	~ 3%; ~ 50 000 tCO_2/a ~ 340 tSO_2/a

Indicative Figures, Assuming 300 MW el. Output, 6500 h/a, Hard Coal

Sulfur content: 0.7%

Biomass co-firing retrofit

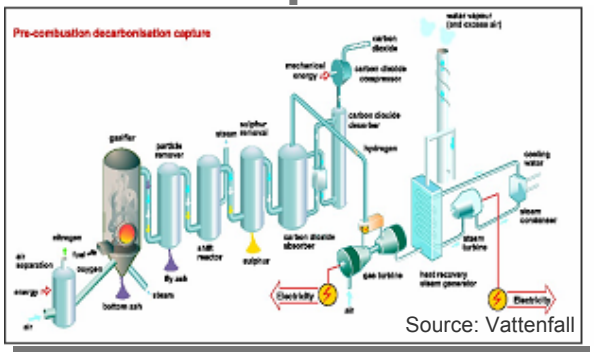
- Fully commissioned in 2006, first dedicated biomass co-firing plant in the UK
- 2/4 x 500 MWe ALSTOM T Fired Boilers EPC retrofit to biomass co-firing
- Processing Up to **20% Biomass** (Heat Input Basis) per unit equivalent to **100MWe**
- Multi Biomass Fuels e.g. Wood Pellets, Palm Kernels, Olive Stones, Olive C

O2 savings per year = 800k T/annu

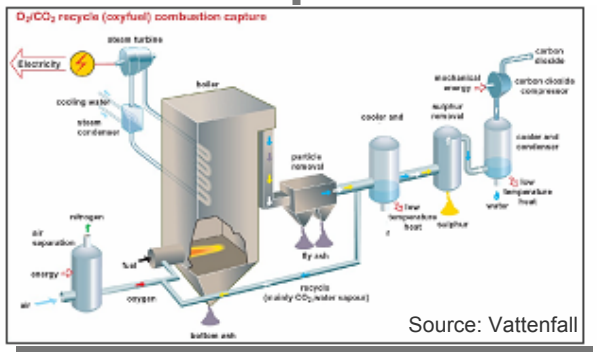
Zero emission technology pathways

Power Plant with CO_2 Capture

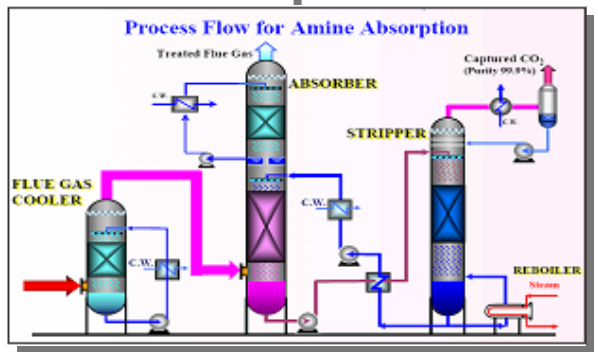
Pre-combustion
(New plants only)



Oxy-combustion
(New + retrofit)



Post-combustion
(New + retrofit)



Efficiency reduction: goal < 5%-points
Cost of CO2 avoided: goal < 20 €/t CO2

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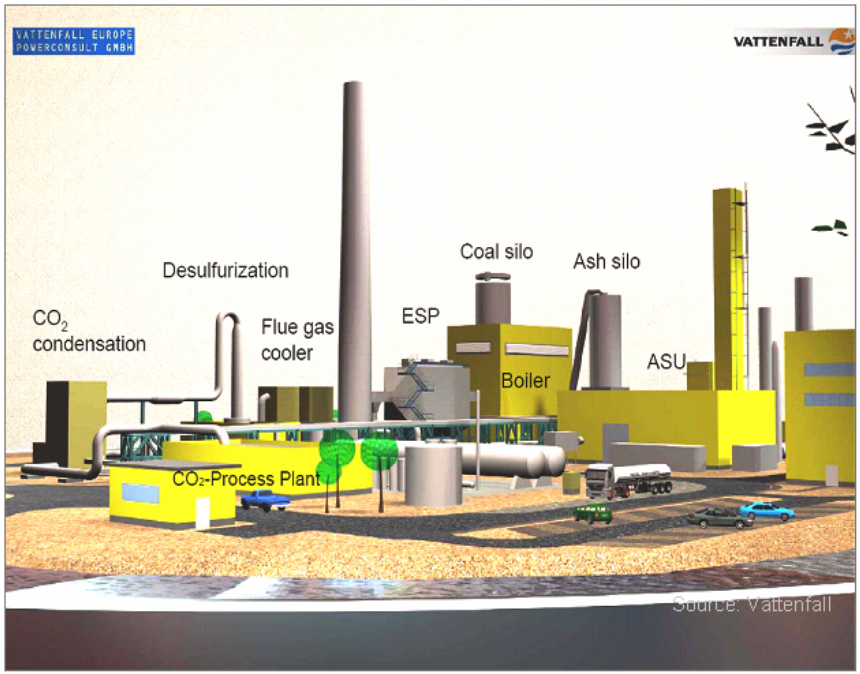
CO_2 capture solutions
Oxy-combustion: 30 MW_{th} Oxyfuel Pilot Plant

CO_2-free coal-fired pilot plant at 'Schwarze Pumpe' site based on Oxyfuel technology (planned operation: mid 2008)



- Large quantity of O2 required
- CO2 separation with no use of chemicals
- Smaller boiler and flue gas volume reduction (Low NOx)

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CO_2 capture solutions
Post Combustion Solutions for New Plants and Retrofit

CO_2 absorption processes (MEA, MDEA)

PP Esbjerg (DK)

1 t CO_2/h pilot plant (CASTOR EU-FP6)

- Available in commercial scale
- Retrofitable and flexible
- High energy demand for regeneration of solvents

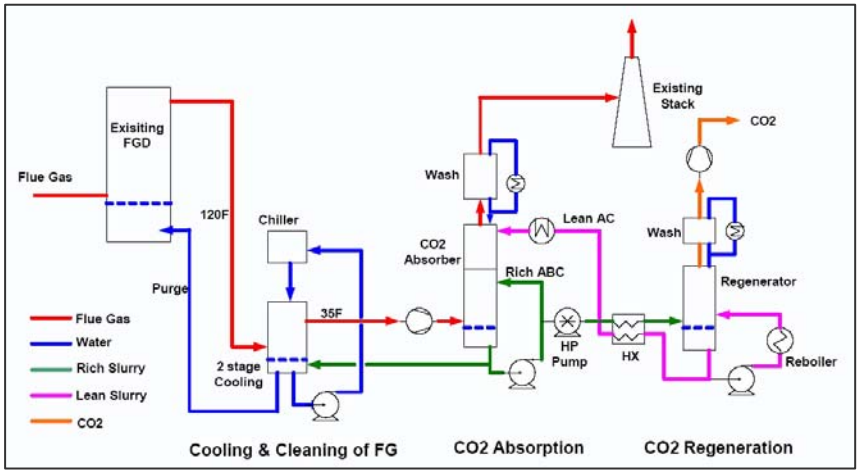
Alternative processes:

e.g. Frosting

CO_2 freezes on cooling fins

Retrofitable CO_2 capture solutions
Chilled Ammonia Process

A promising technology for post combustion carbon capture



Principle

- Ammonia (NH_3) reacts with CO_2 and water. It forms ammonia carbonate or bicarbonate
- Moderately raising the temperatures reverses the above reactions – releasing CO_2

Advantages

- High efficiency capture of CO_2 and low heat of reaction
- Low cost reagent
- No degradation during absorption-regeneration
- Tolerance to oxygen and contaminations in flue gas

5 MW Pilot Plant (USA) Start-up anticipated for 2007

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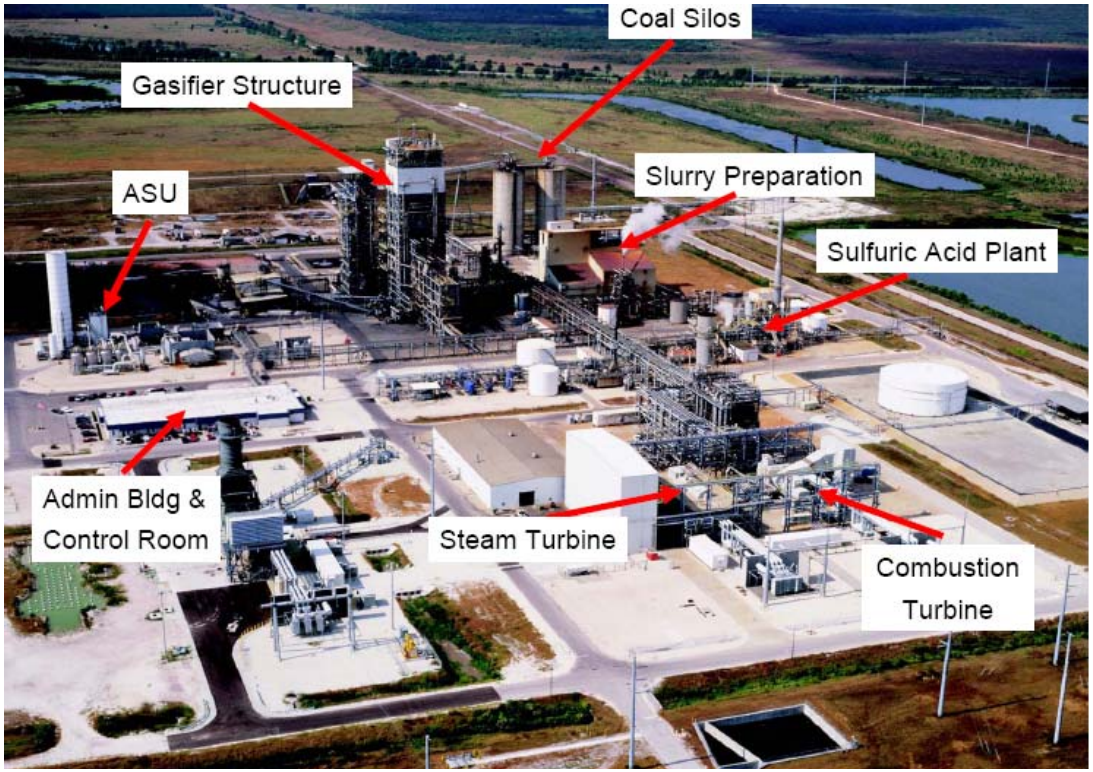
CO2 CAPTURE SOLUTIONS
Pre Combustion Solution for New Plants: IGCC+Capture

Coal gasification



Tampa Electric Company, Polk Power Station, 252 MWe, Mulberry, USA (FL)

- CO2 Capture technology is proven and economical in other industries
- High Capital and Operating Costs
- Limited operation flexibility
- Plant retrofit: not generally possible
- Landspace 1,5 x PC plant for same MW

Hydrogen-fired gas turbines

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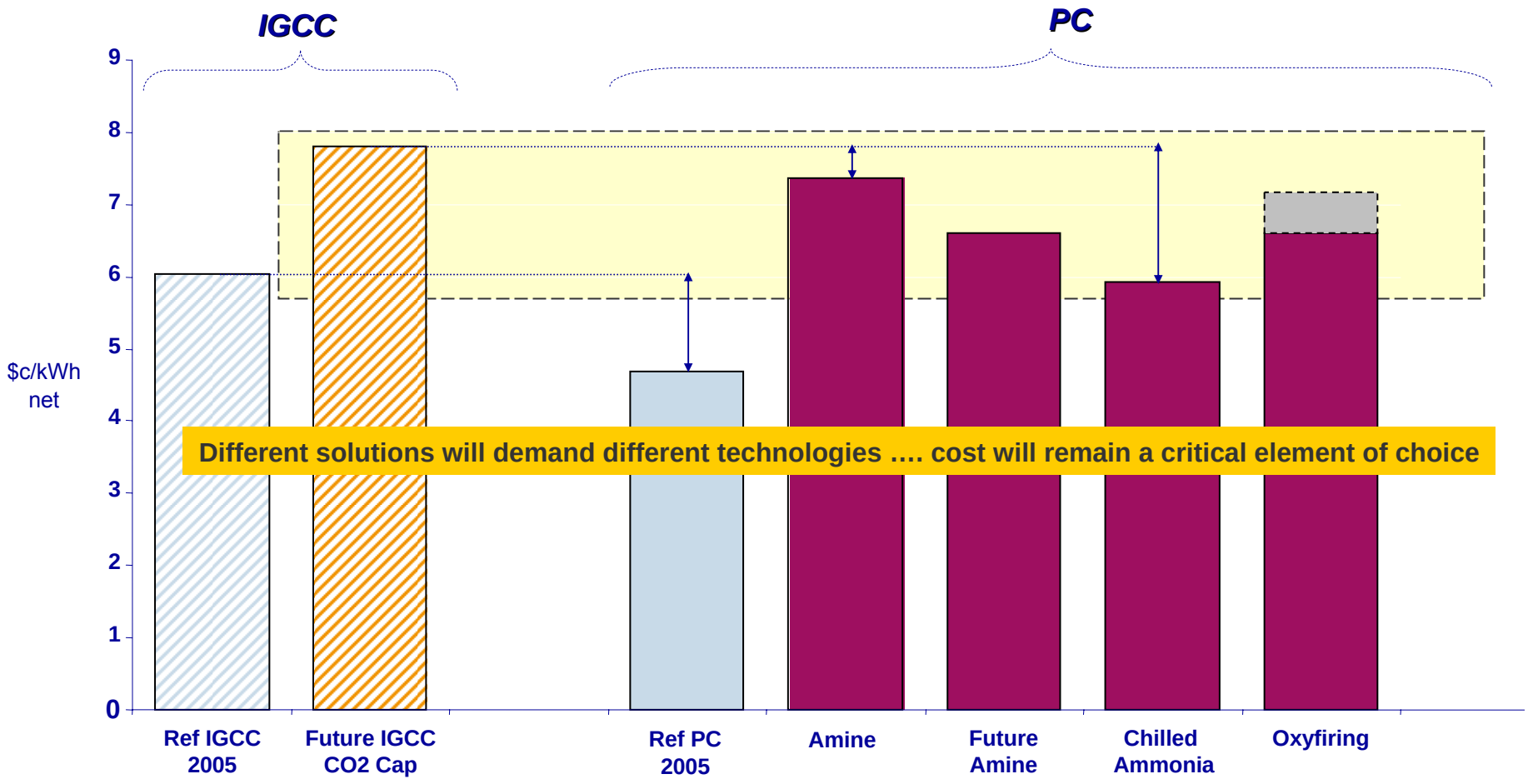
Cost of Electricity :
800MW Coal Plant Comparisons



CO_2 capture technologies impact plant performance

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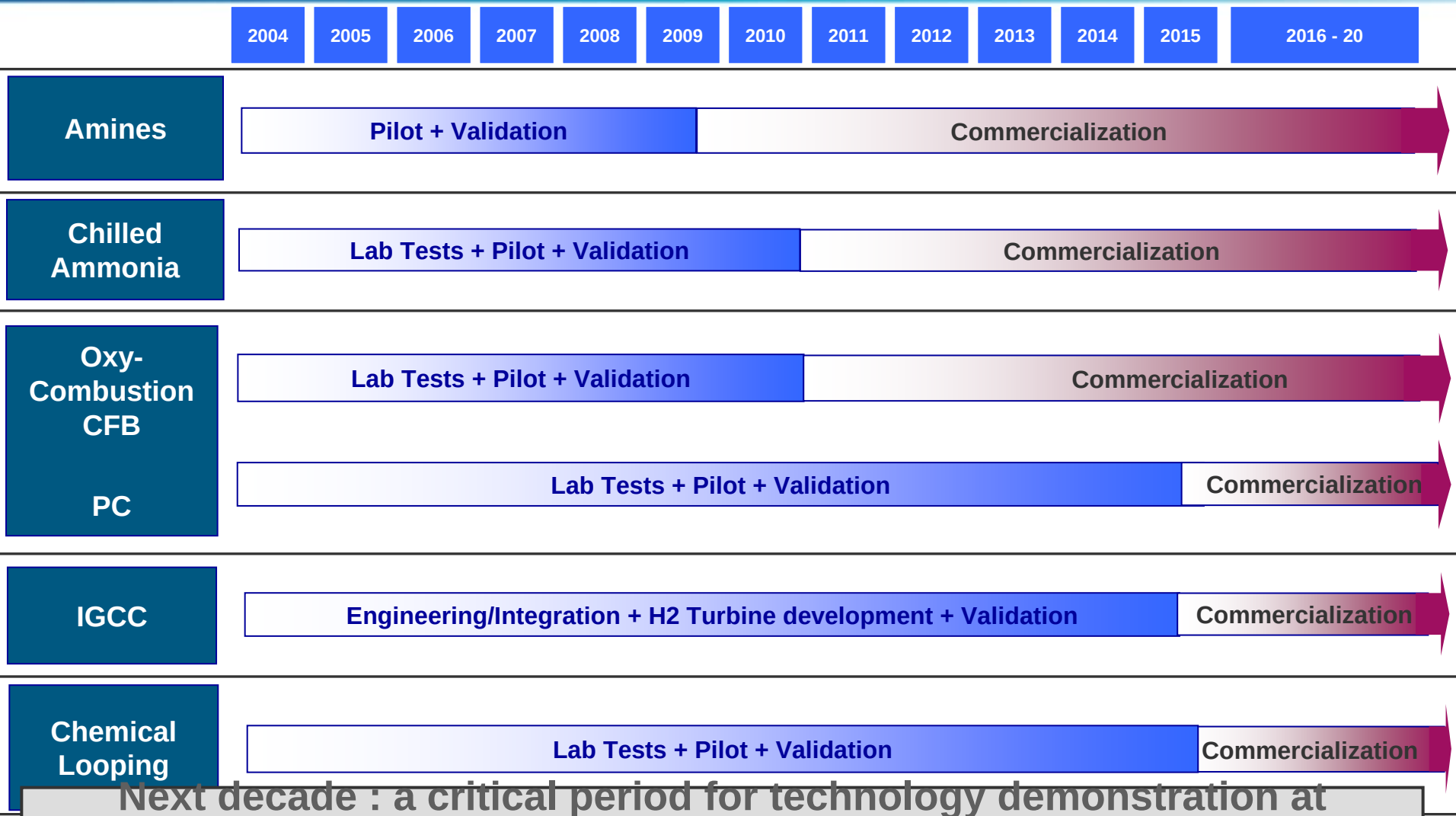
CO_2 capture solutions
Time-line of CO_2 capture processes



Next decade : a critical period for technology demonstration at commercial scale

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Capture ready power plant concept

The need	The answer
Prepare the way for the future ……. address today the issues raised by future stringent CO2 regulations	**CO2 ready power plant concept**

- CO_2 capture ready plant definition:
  - Plant designed to have CO_2 capture added at some time in the future with minimal impact on plant lifetime performance and cost
- Availability of a CO_2 ready plant:
  - Based on post-combustion scrubbing or oxy-combustion processes, coal-fired plants are CO_2 ready provided that:
    - Extra room is left for the installation of the capture plant or the ASU
    - A suitable back-end equipment is installed
    - Future shut-down time is minimised
    - Transport and storage of CO2 is validated

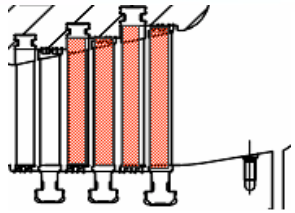
Ensure CO2 readiness of current power plants

Source : ALSTOM analysis

CO_2 "Capture Ready" coal power plant

Control system adaptation

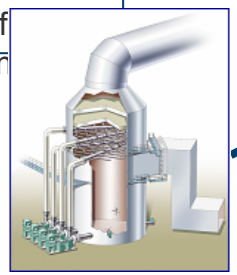
Optimisation
Of the cooling system
Recovery of heat in the
CO2 capture and compression



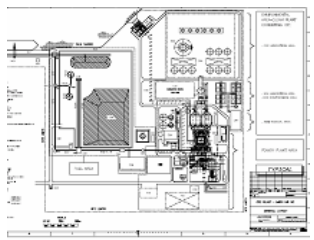
Provisions for steam extractions
Including provisions for adding stages
In the IP cylinder of the steam turbine

Optimisation of the
Boiler surfaces
according
Modifications of
heat load sharin

Provision for auxiliary
Power consumption



Provisions in arrangement planning



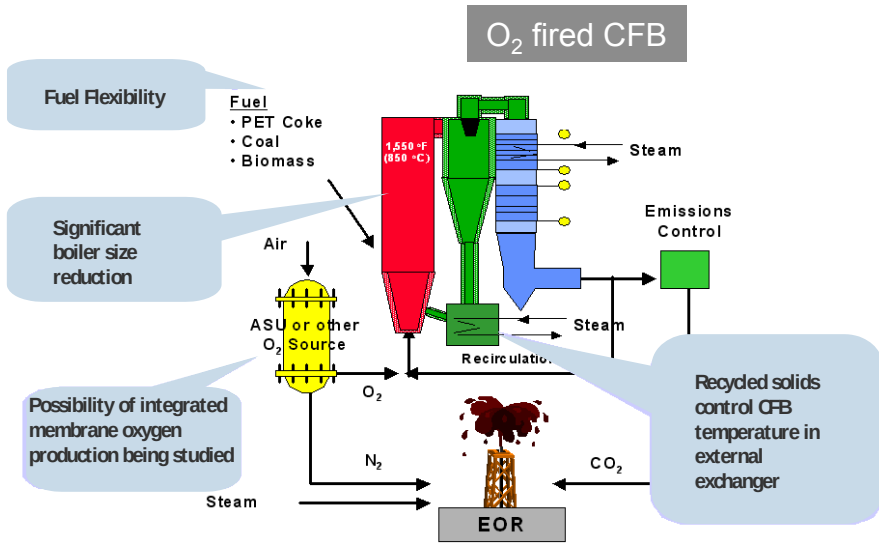
Improve gas clean up
Or possibility to add cleaning

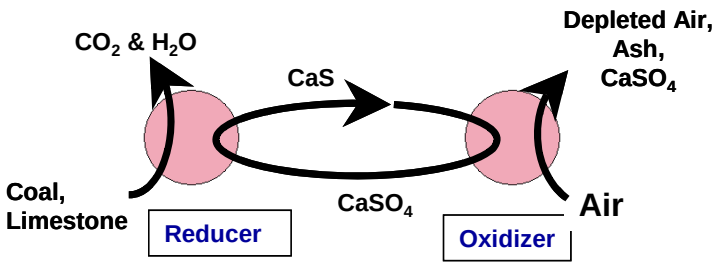
An integrated approach is key

Advanced Capture Processes

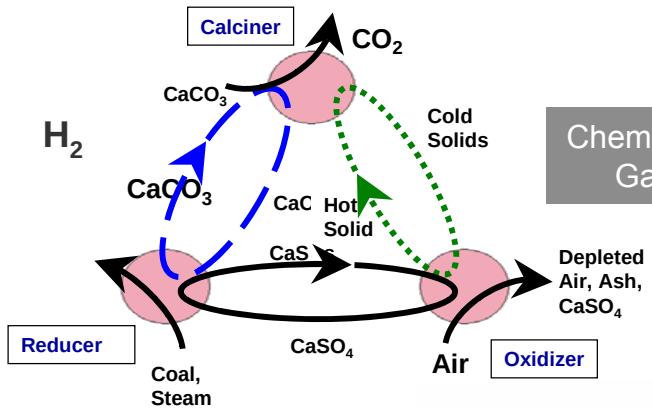
Technology development will provide additional solutions

- **Oxygen Fired CFB**
- **Chemical Looping**
  - Combustion
  - Gasification





Chemical Looping Combustion



Chemical Looping Gasification

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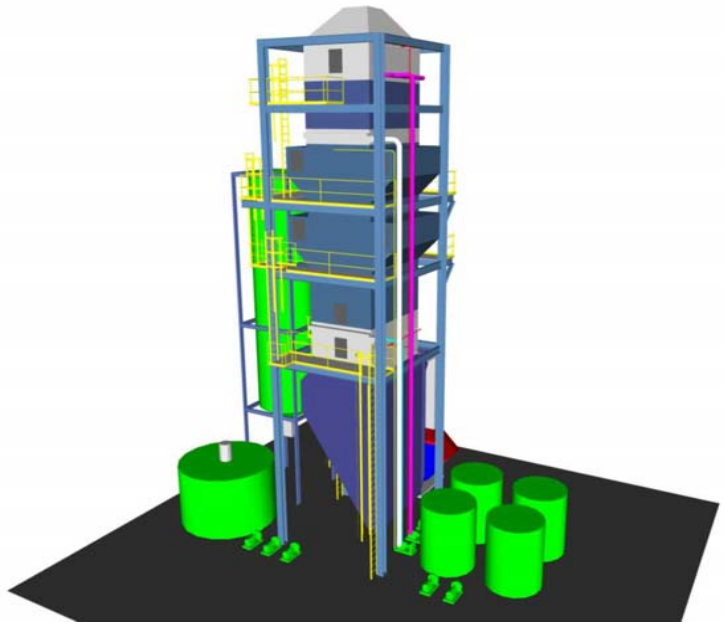
Multi-pollutant Control Systems

- Integrated APC system based around commercially proven and reliable technologies
- Uses readily available reagents
- Produces reusable byproduct(s)
- Superior cost/performance ratio:
  - Extremely compact design
  - Fewer moving parts reduces maintenanc
  - Superior environmental performance
- Targeted emissions levels:
  - SO_2: 0.02 lb/MMBTU (> 99.5%)
  - Hg: 1.0 lb/TBTU (> 90%)
  - PM: 0.01 lb/MMBTU (99.99%)
  - NO_x: 0.05 lb/MMBTU w/SCR

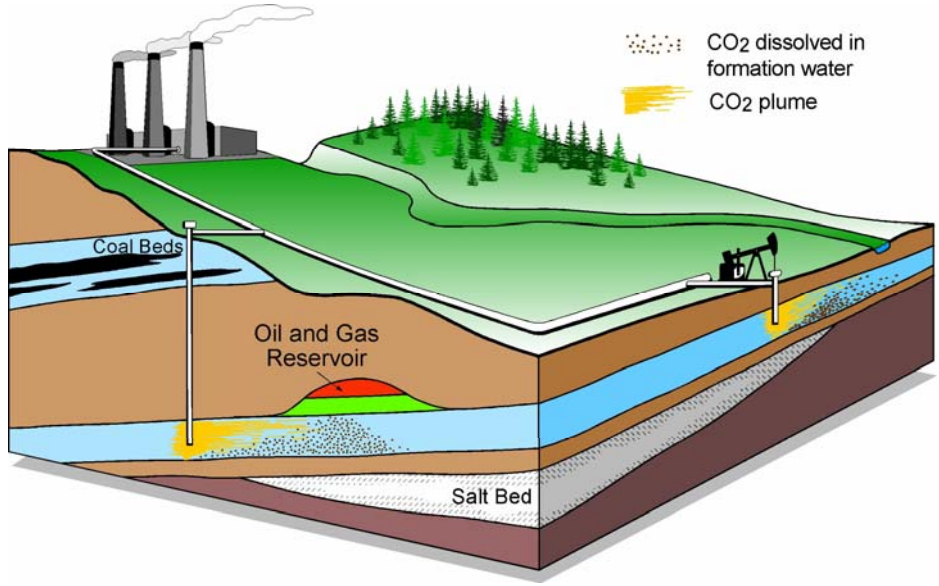


Controls SO_x, $PM_{10}/PM_{2.5}$
Mercury & NOx

Not just CO2

CO_2 Transportation and Storage

Key Issues



- Cost Reduction
- Public Acceptance
- Safe and Effective Storage
- Developing the Legal, Regulatory & Fiscal Framework

No point in capturing CO2 unless storage and/or use is addressed
……. safety and acceptance of CO2 Storage is a critical issue
…… holistic approach required

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Concluding Remarks : CO2 Summary an integrated approach

	Near Term	Medium to Long Term
Installed base	• Integrated retrofit offerings with higher efficiency and STs • Fuel switch • Biomass co-firing	• CO2 post-combustion capture products: amine, ammonia, oxy-combustion for retrofit • Advanced cycles retrofit
New power plants	• Fuel flexibility via CFBs • 620 C best available technology for improved efficiency • CO2 ready power plant concept	• Integrated CO2 post-combustion capture or oxy-fuel firing and chemical looping • 700 C USC boilers & steam turbines • Gasification for polygeneration

Clean Combustion = limiting emissions while maintaining power plant economics

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