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# **Carbon Capture and Storage Projects and Financing**

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## What is the pathway to finance CCS?



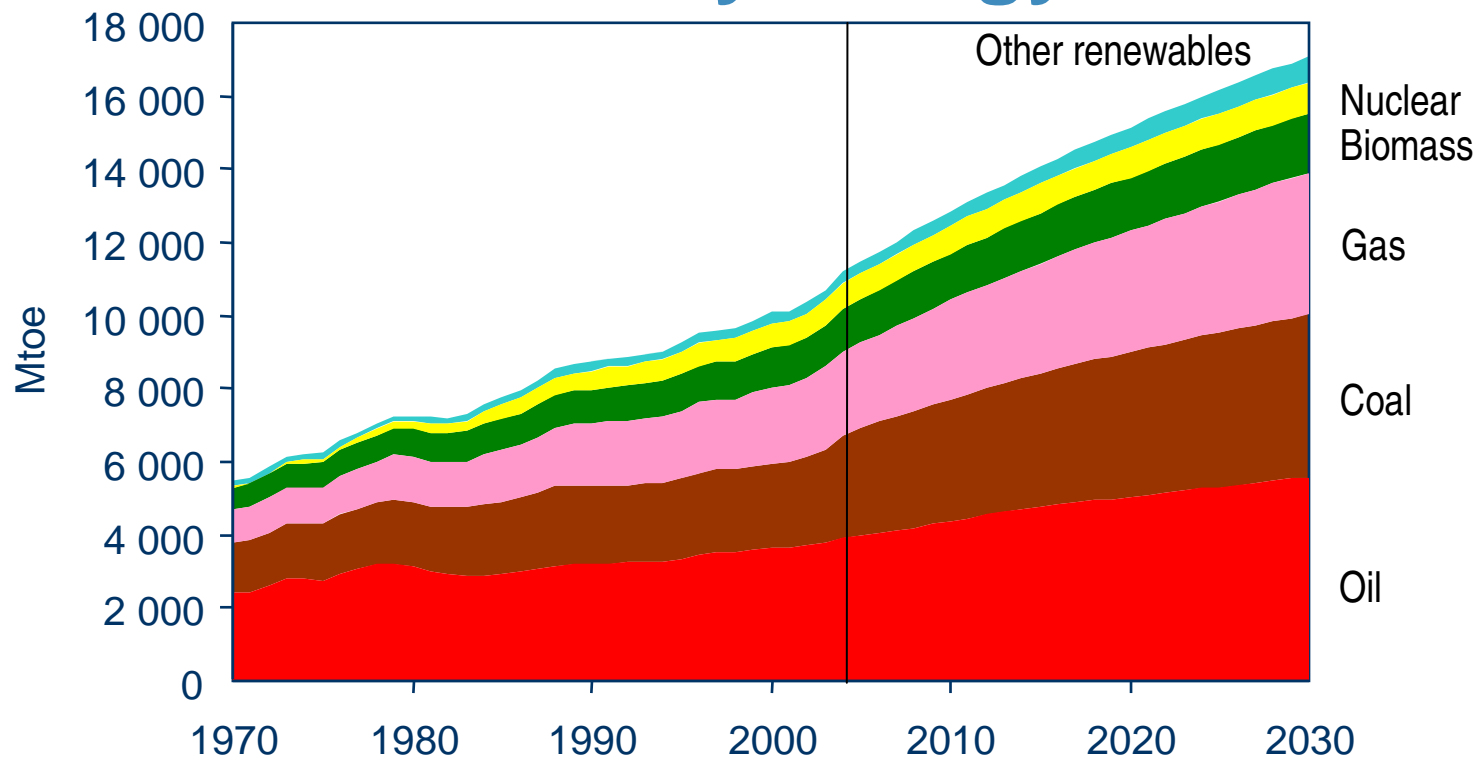
## Introduction

- How do we finance CCS Projects?
- Why is CCS such a key technology?
- How much will be invested in the energy sector?
- Where are the proposed projects?
- How big is the challenge?

## Future Scenarios and the Role of Coal

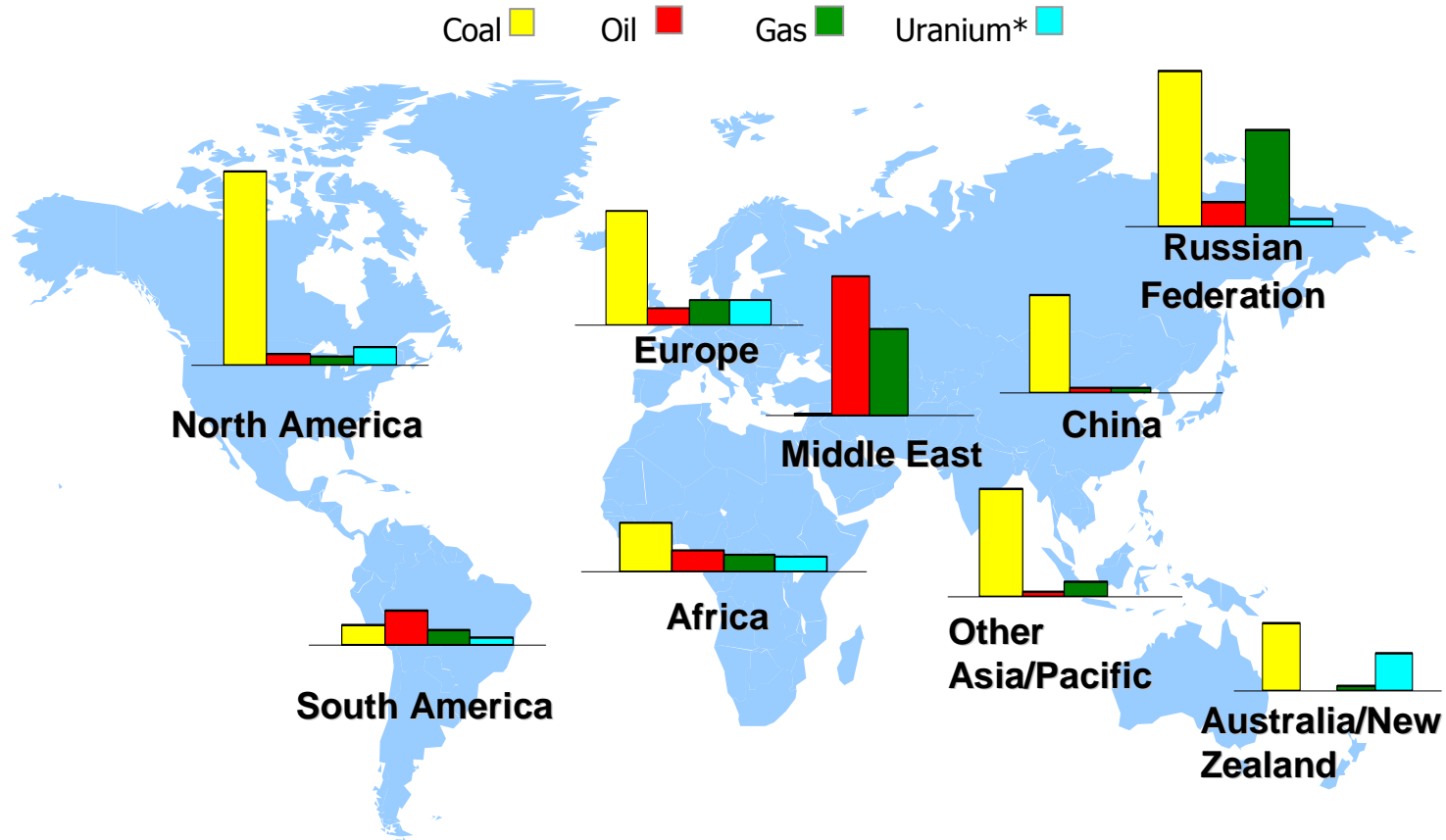
- What will be the energy demand?
- How will it be met?
- How much coal is left?
- Where is it?
- What are the implications for CO<sub>2</sub> emissions?

## WEO 2006 Reference Scenario: World Primary Energy Demand



*Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms*

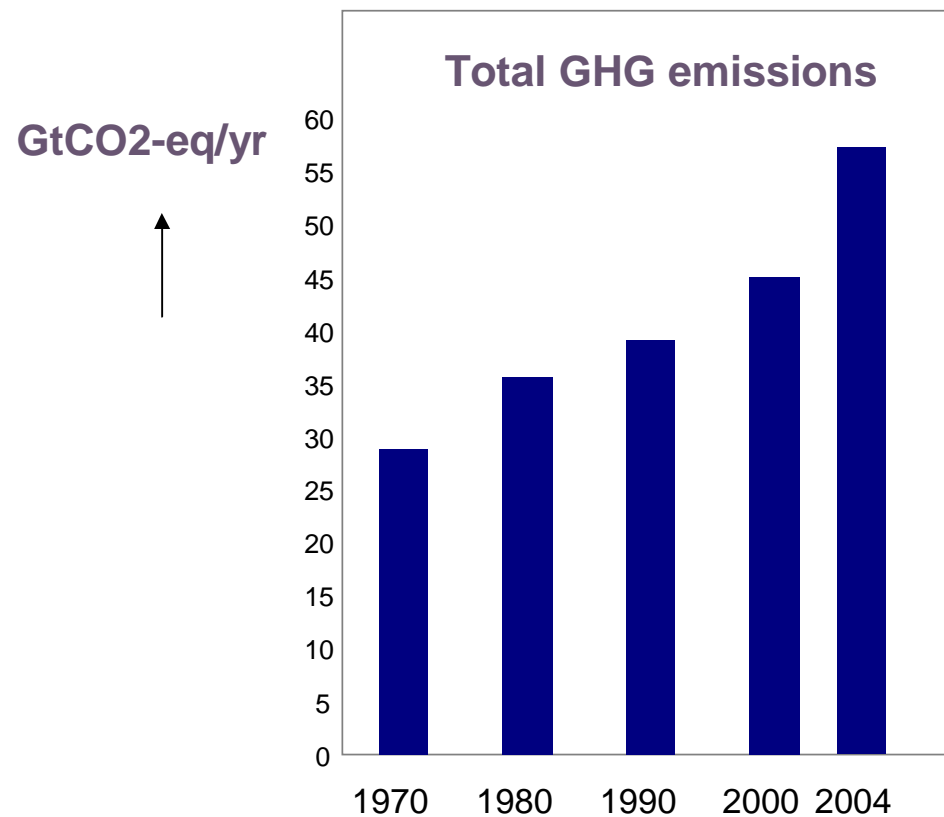
## How much energy is left in the world?



Sources: BP Statistical Review 2005; WEC Survey of Energy Resources 2001; Reasonably Assured Sources plus inferred resources to US\$80/kg U 1/1/03 from OECD NEA & IAEA Uranium 2003; Resources, Production & Demand updated 2005; \*energy equivalence of uranium assumed to be ~20,000 times that of coal

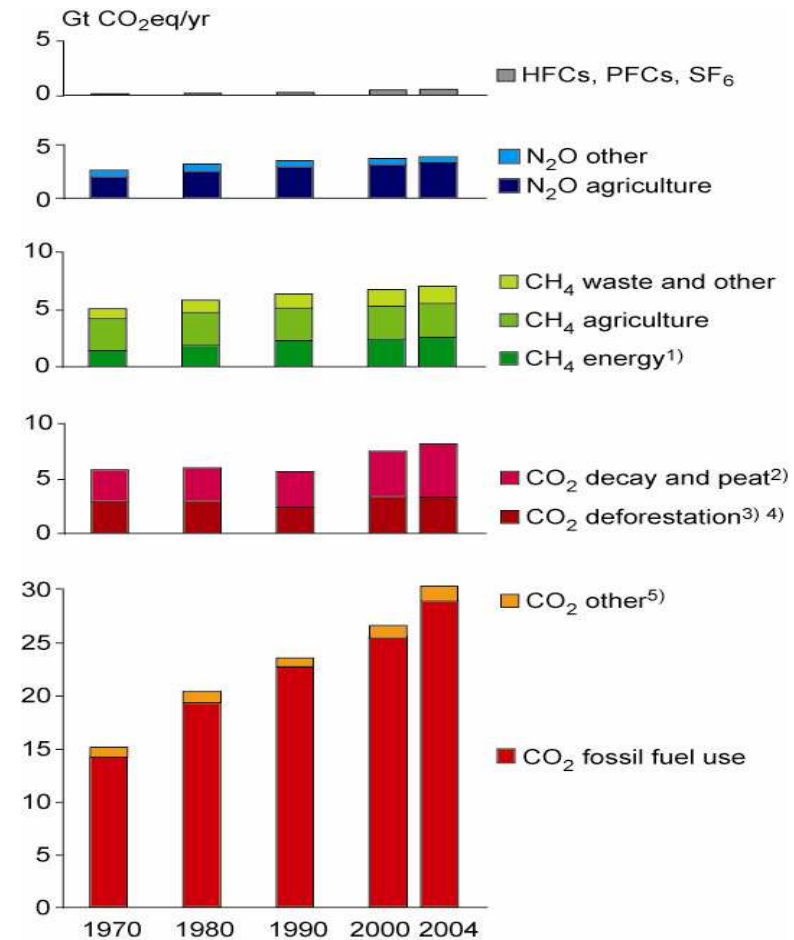


**IPCC WG III in 2007 estimated between 1970 and 2004 global GHG emissions increased by 70 %**



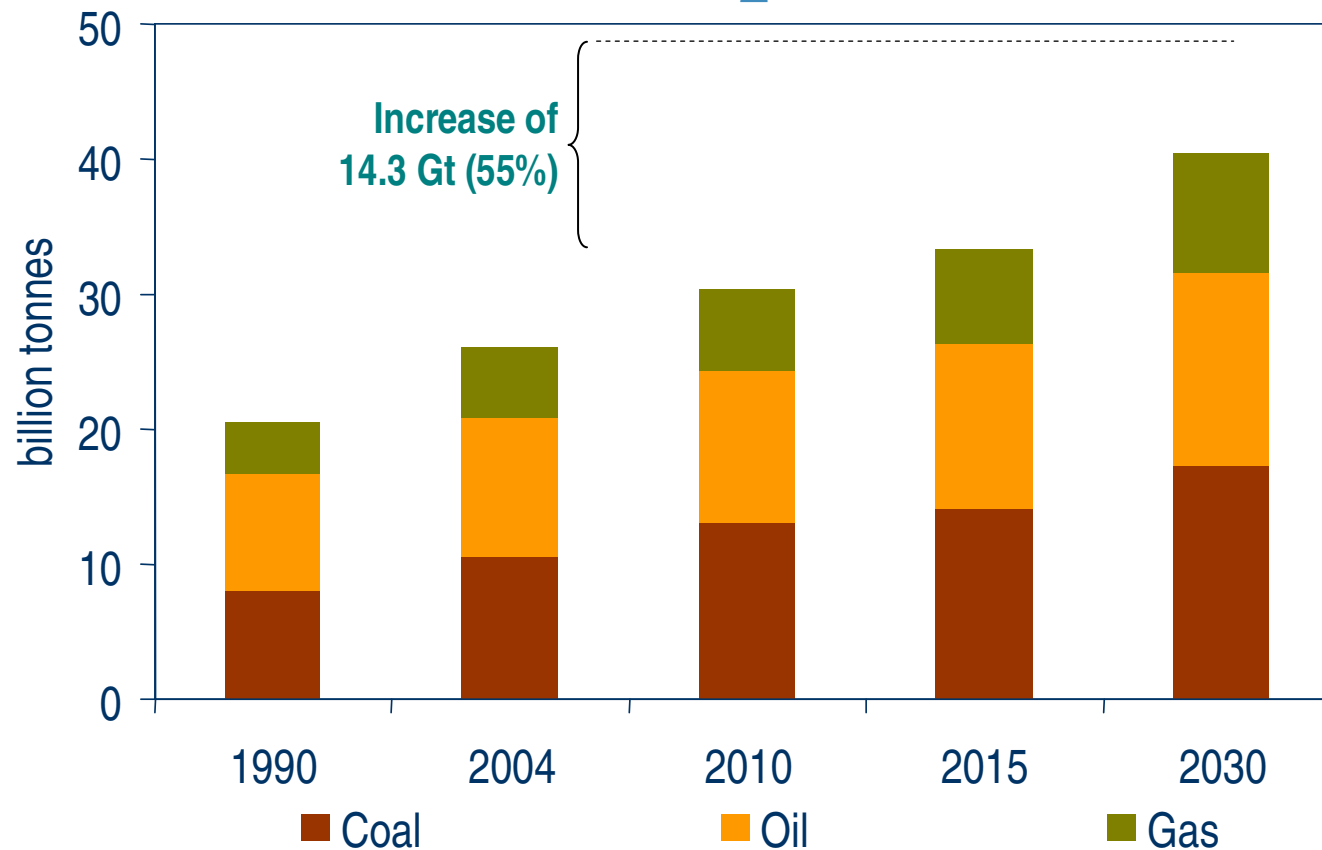
## Carbon dioxide is the largest contributor

- IPCC Special Report on Emission Scenarios estimates a range of 25 - 90 % increase of GHG emissions in 2030 relative to 2000





# WEO 2006 Energy-Related CO<sub>2</sub> Emissions by Fuel



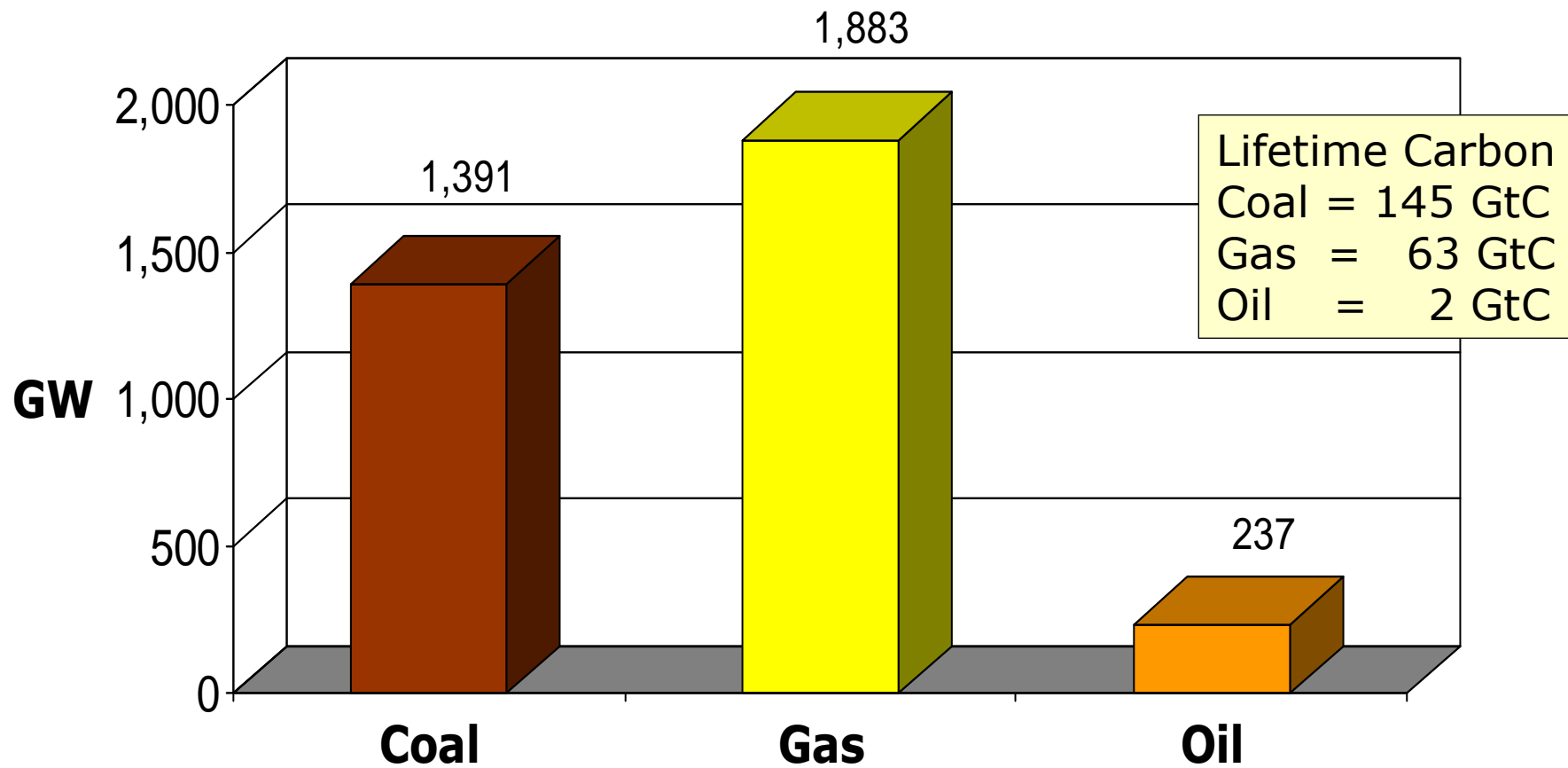
*Half of the projected increase in emissions comes from new power stations*

## Need to Act now to avoid Carbon Lock-in

### New and replacement fossil fuel power generation capacity (GW)

	<b>2010</b>	<b>2020</b>	<b>2030</b>
World	520	967	1205
OECD	160	309	363
Developing Countries	343	587	750
Transition Economies	16	72	90
European Union (25)	39	105	132
North America	83	141	171
China	162	210	260
India	24	66	97
Russia	5	27	34

## Carbon Lock-in - New Fossil Units 2003-2030



## Using CCT and CCS

Table 1. **Regional scenario results**

MtCO <sub>2</sub> yr reduction in 2030	SPCC low	SPCC high	IGCC low	IGCC high	CCS low	CCS high
	30%	100%	20%	60%	10%	50%
China	193	645	129	387	247	1233
India	58	193	39	116	74	370
Indonesia	26	88	18	53	34	168
US+Canada	154	513	103	308	237	1187
EU-25	143	475	95	285	220	1100
OECD Asia	45	149	30	90	69	345
Australia	12	41	8	25	19	95
total	631	2104	421	1262	899	4497

# Proposed Integrated CCS Projects



## Some Of The Proposed Zero Emission Power Plants In The European Union

Date Announced	Companies Involved	Technology Options	Plant Capacity	CO2 Avoided per year Million Tonnes	Estimated Cost	Place and Date of start of Operation
May 2005	VATTENFALL	Thermal Oxyfuel Pilot Coal Power Plant with CO2 capture	30 MW		40 million €	Germany 2008
March 2006	STATOIL and SHELL	Natural Gas Power Plant a) Capture and transport of CO2 for offshore injection b) Enhanced oil recovery	860 MW	2.5	1 - 1.5 billion \$	Norway 2010-2011
March 2006	RWE	IGCC Power Plant-, CO2 capture and storage	450 MW		1 billion €	Germany 2014
May 2006	SIEMENS	IGCC (Polygasification process + CCS + polygeneration)	1000 MW		1.7 billion €	Germany 2011
Sept 2006?	GE/ POLISH UTILITY	IGCC Power Plant-, CO2 capture and storage	1000 MW		?	Poland

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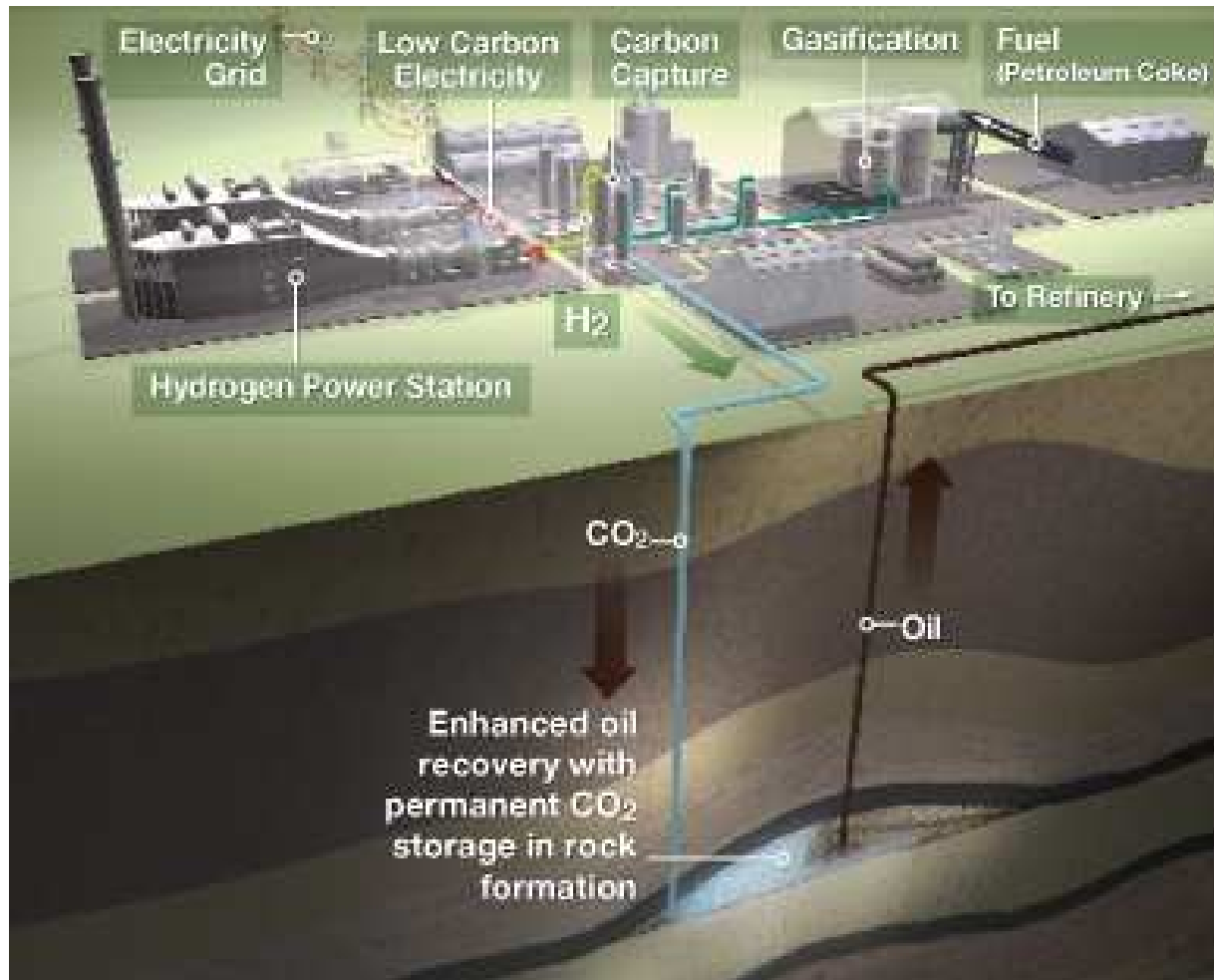
hydrogen energy



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a joint venture

## DF2 - Carson Hydrogen Power Project





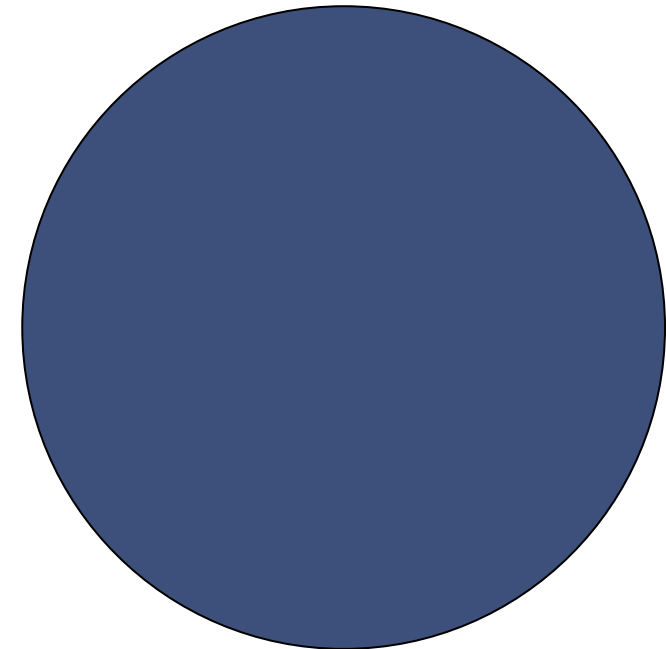




## Size matters!

Cumulative globally sequestered CO<sub>2</sub> → •

Cumulative global need to sequester CO<sub>2</sub> →



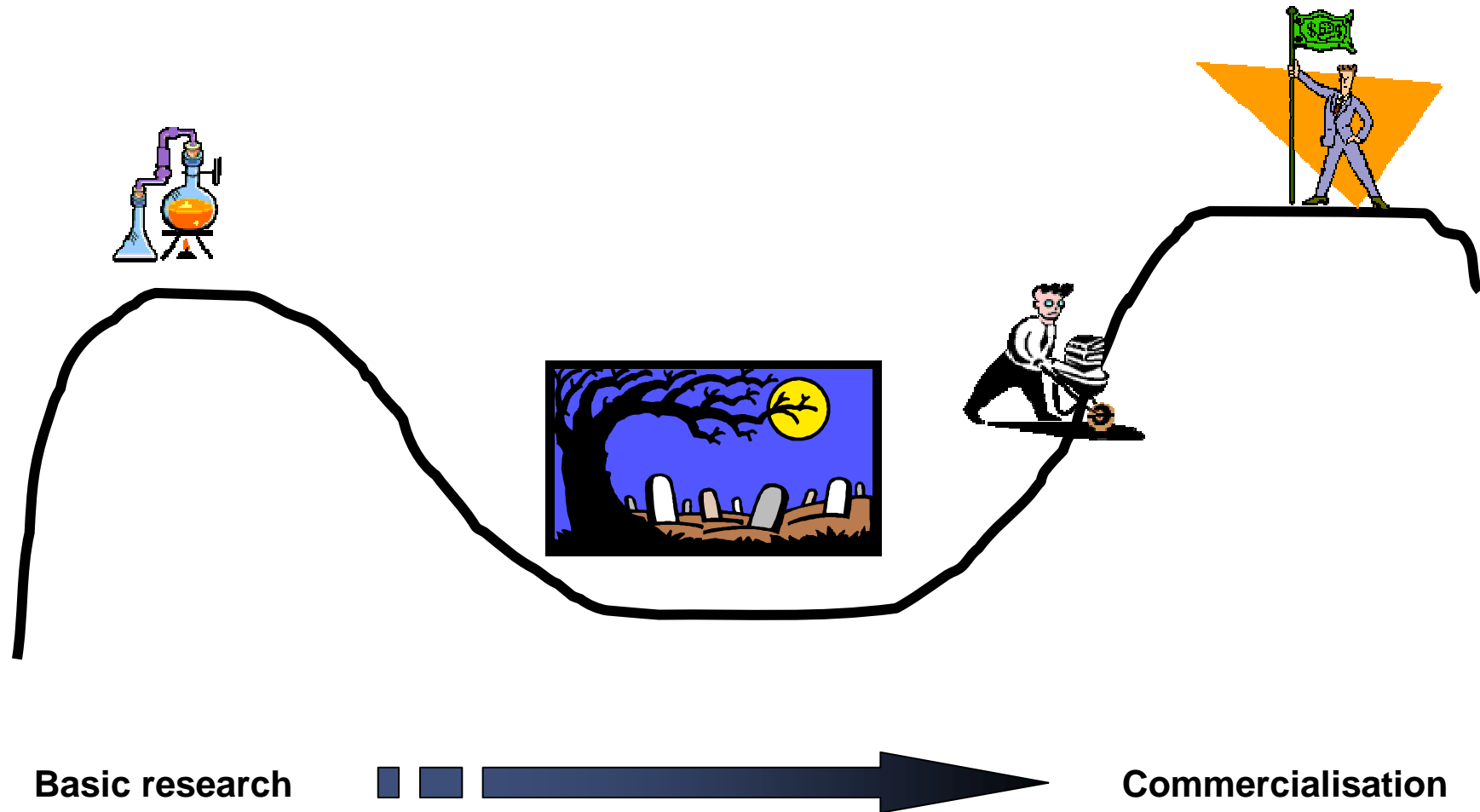
### Feed and emissions for a 1,000MW utility



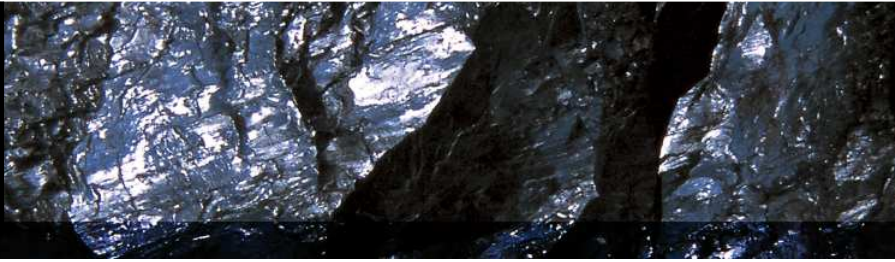
## CCS Commercialization

- Too few large scale demonstrations to accelerate deployment of CCS technologies
- This approach could result in risk of project failure
- High profile failures concerning CCS projects will result in a reluctance to invest in the deployment of CCS technologies
- What is the path forward to rapid commercialisation of CCS?

## How can CCS avoid the “Valley of Death”?



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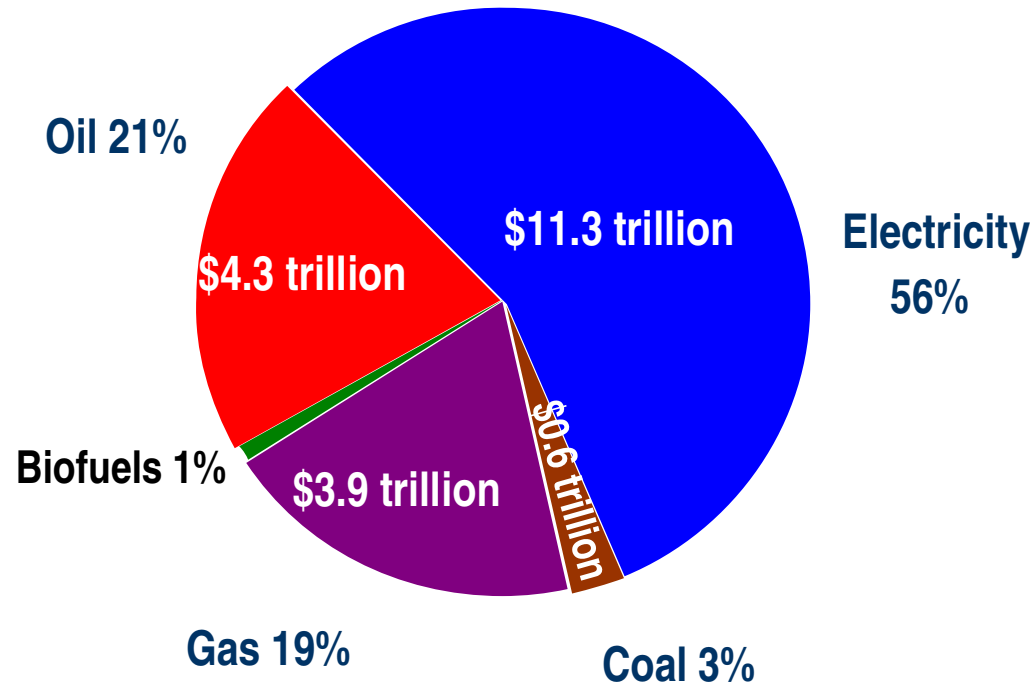


**How much will it cost?**



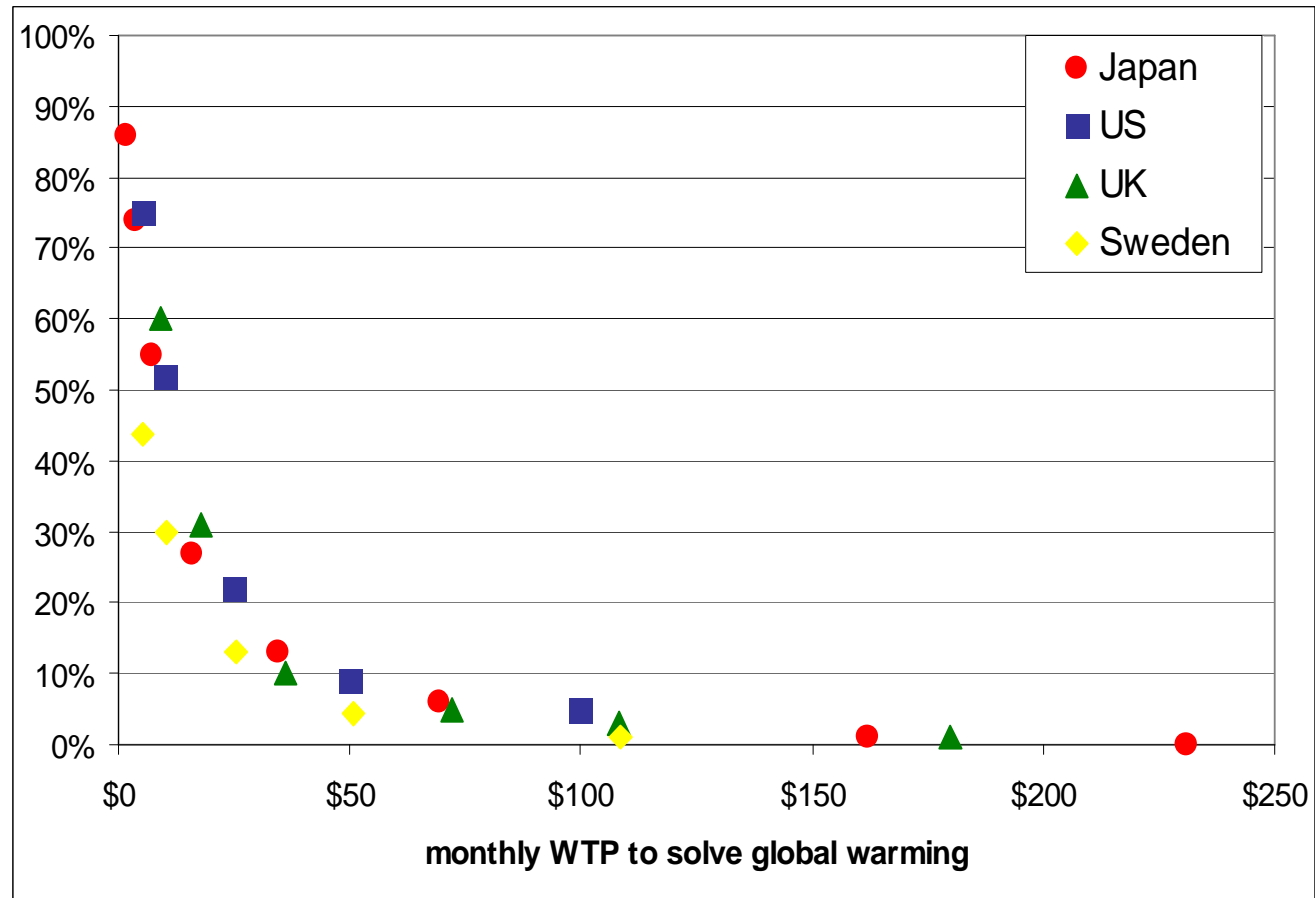
## IEA WEO 2006 Reference Scenario: Cumulative Investment, 2005-2030

\$20.2 trillion (in \$2005)



*Investment needs exceed \$20 trillion – \$3 trillion more than previously projected, mainly because of higher unit costs*

## Are people willing to pay the price?



Source: David Reiner, University of Cambridge & MIT



## The Expert Meeting

- The Status of CCS
- Industrial Perspectives on CCS and their experience
- Banks, Insurance and financing CCS



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“All I’m saying is **NOW** is the time to develop the technology to deflect an asteroid”