



*Carbon Capture &
Storage Association*

All Party Parliamentary Coalfield Communities Group

Jeff Chapman

The Carbon Capture & Storage Association

Tuesday 20 September 2011



CCSA Members - 75



2Co Energy	CO2Tech Centre Mongstad	Linklaters	RPS
Air Liquide	ConocoPhillips	Lloyd's Register	Sasol
Air Products	Costain	Maersk Oil & Gas	Schlumberger
Aker Clean Carbon	DNV	Masdar	Scottish Centre for Carbon Storage
Allen & Overy	Doosan Power	Mitsubishi Heavy Industries	Scottish Enterprise
Alstom Power	Drax Power	MMI Engineering	Scottish European Green Energy Ctr
AMEC	Durham University	N8	ScottishPower
Anthony Veder Group	EDF Energy	National Centre for CCS	Senergy
Arup	EON	National Grid	SGS United Kingdom
BG Group	ERM	National Physical Laboratory	Shell
BOC	ESB	Norton Rose	Siemens
BP	Fluor	Peel Energy	Statoil
Calix	Gassnova	Perenco	Tata Steel
Camco International	GDF Suez	Petrofac CO2DeepStore	Tees Valley Unlimited
CCS TLM	GE Energy	Poyry	Total
Chevron	Herbert Smith	Progressive Energy	Vattenfall
Clean Energy Group	Howden Group	PWC	Wood Group Energy
CMS Cameron McKenna	Ingen	Rhead Group	Zurich
CO2 Sense (Yorkshire)	Jacobs Engineering	Rio Tinto	

Vertical slice of policy influence

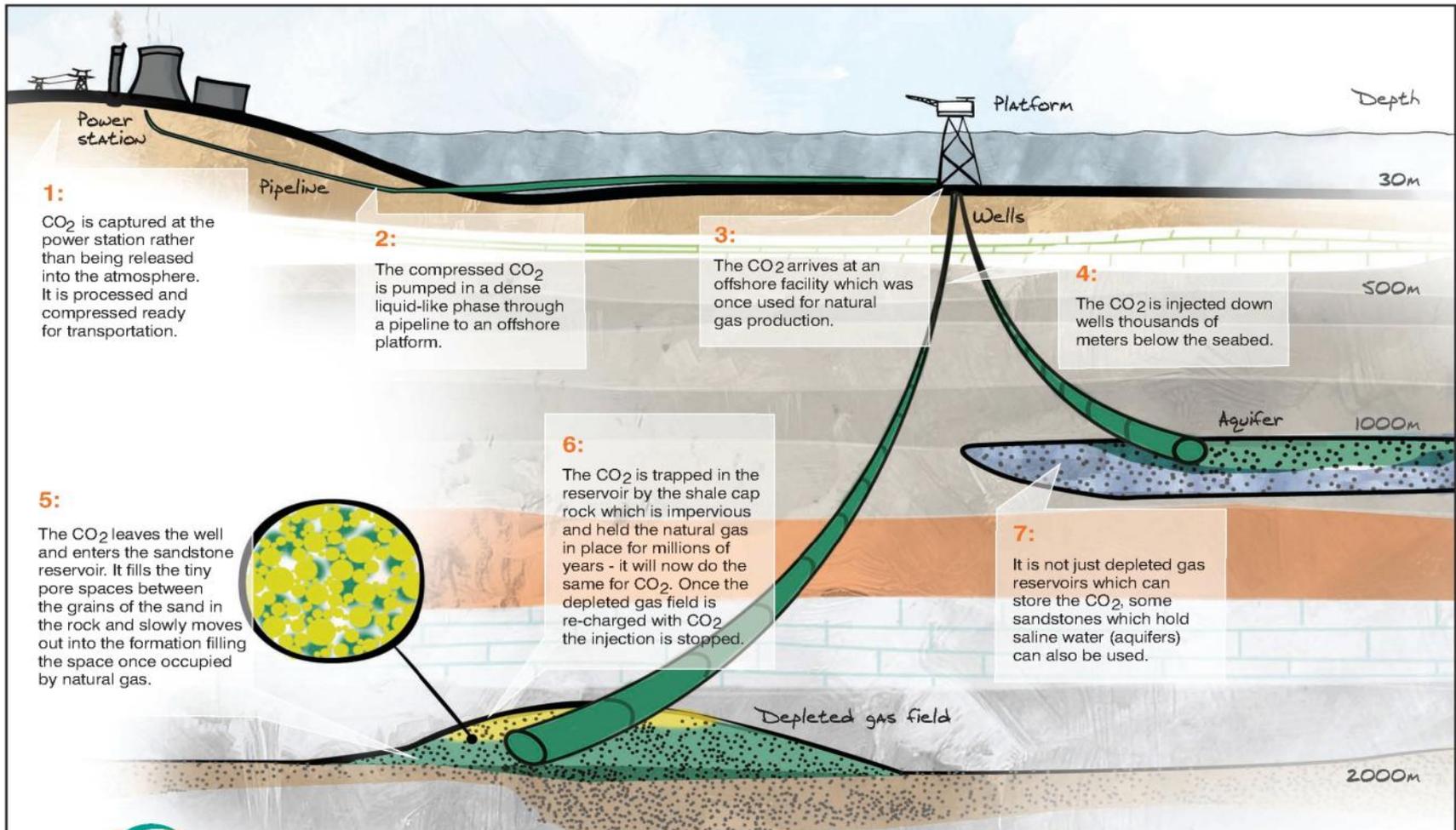


➤ UK

➤ Europe

➤ International

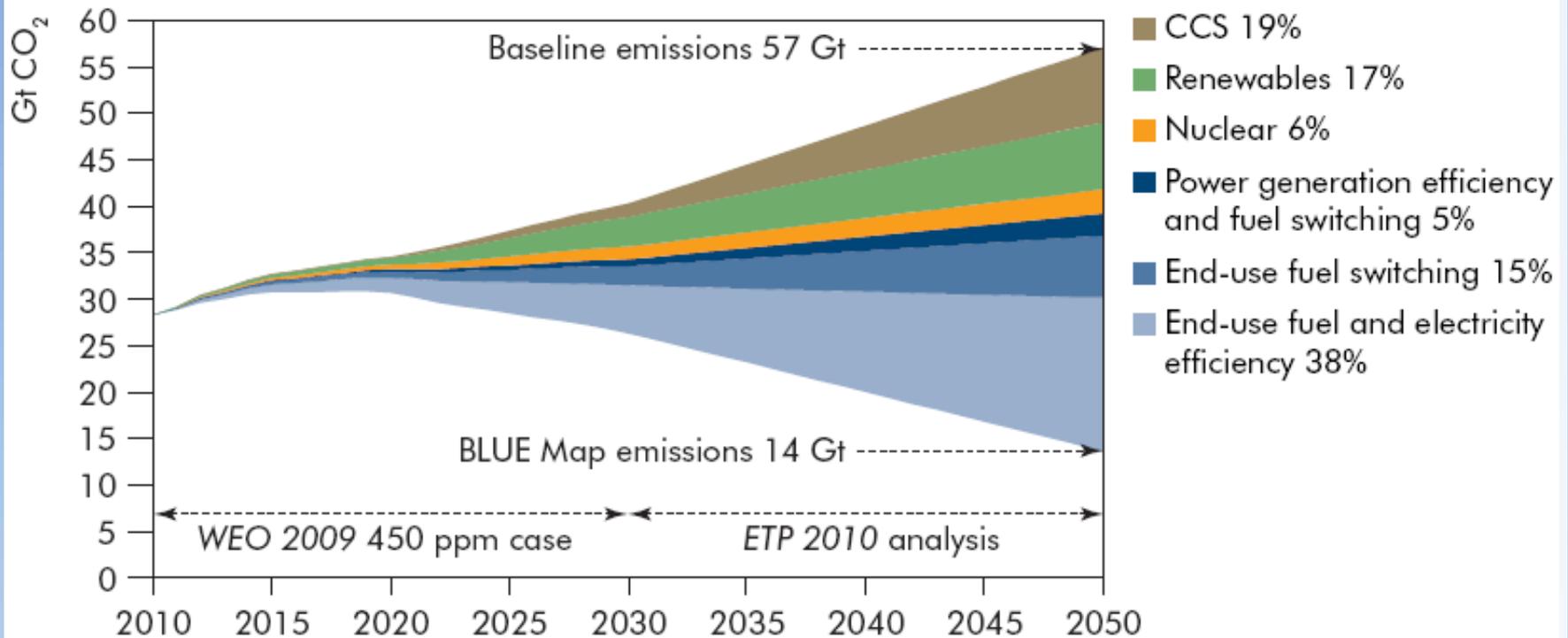
The CCS Process



Carbon Capture and Storage Process

www.co2deepstore.com

CCS is essential to tackling climate change



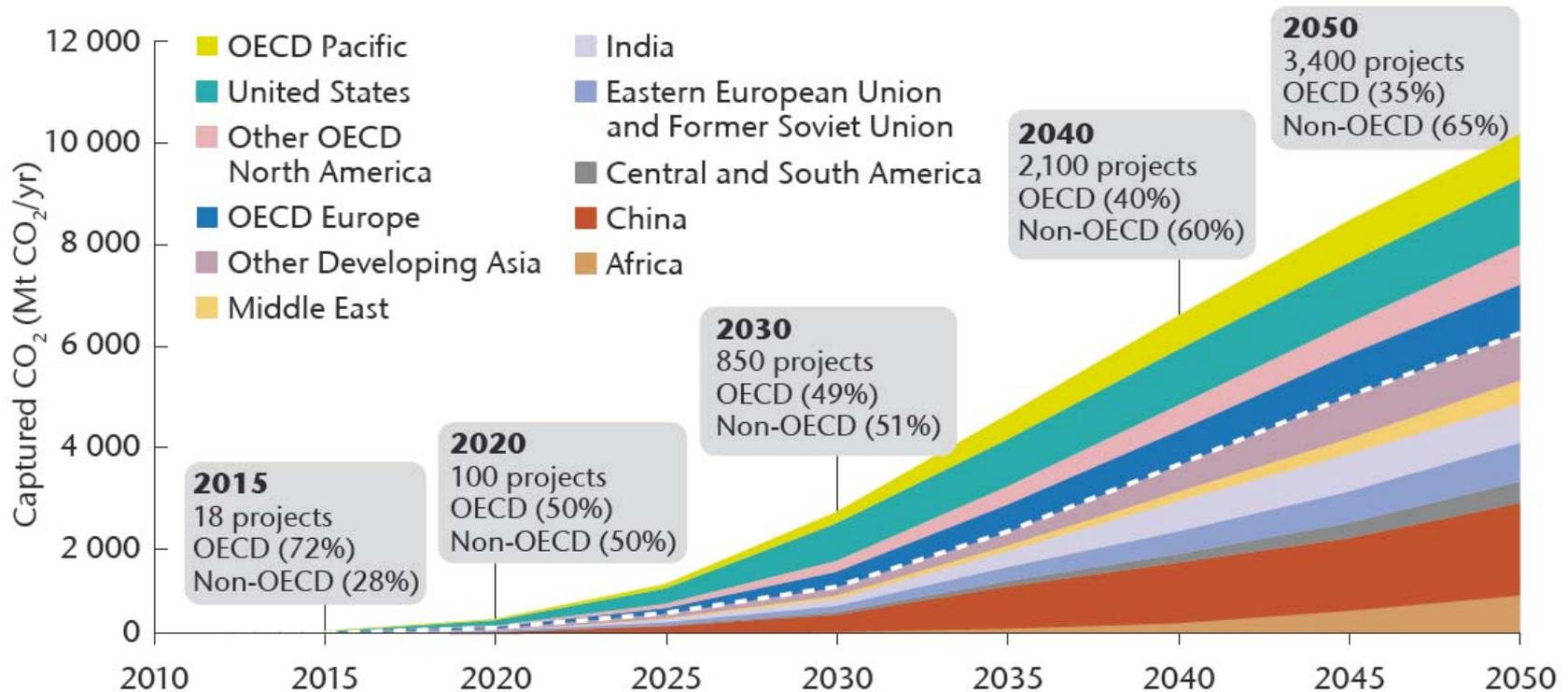
Source: IEA World Energy Outlook 2010

IEA Conclusions:

- It is not possible to halve CO₂ emissions by 2050 without CCS
- Attempting to address emissions without CCS raises costs by >70% (US\$1.28 trillion in 2050)

CCS needed on a big scale

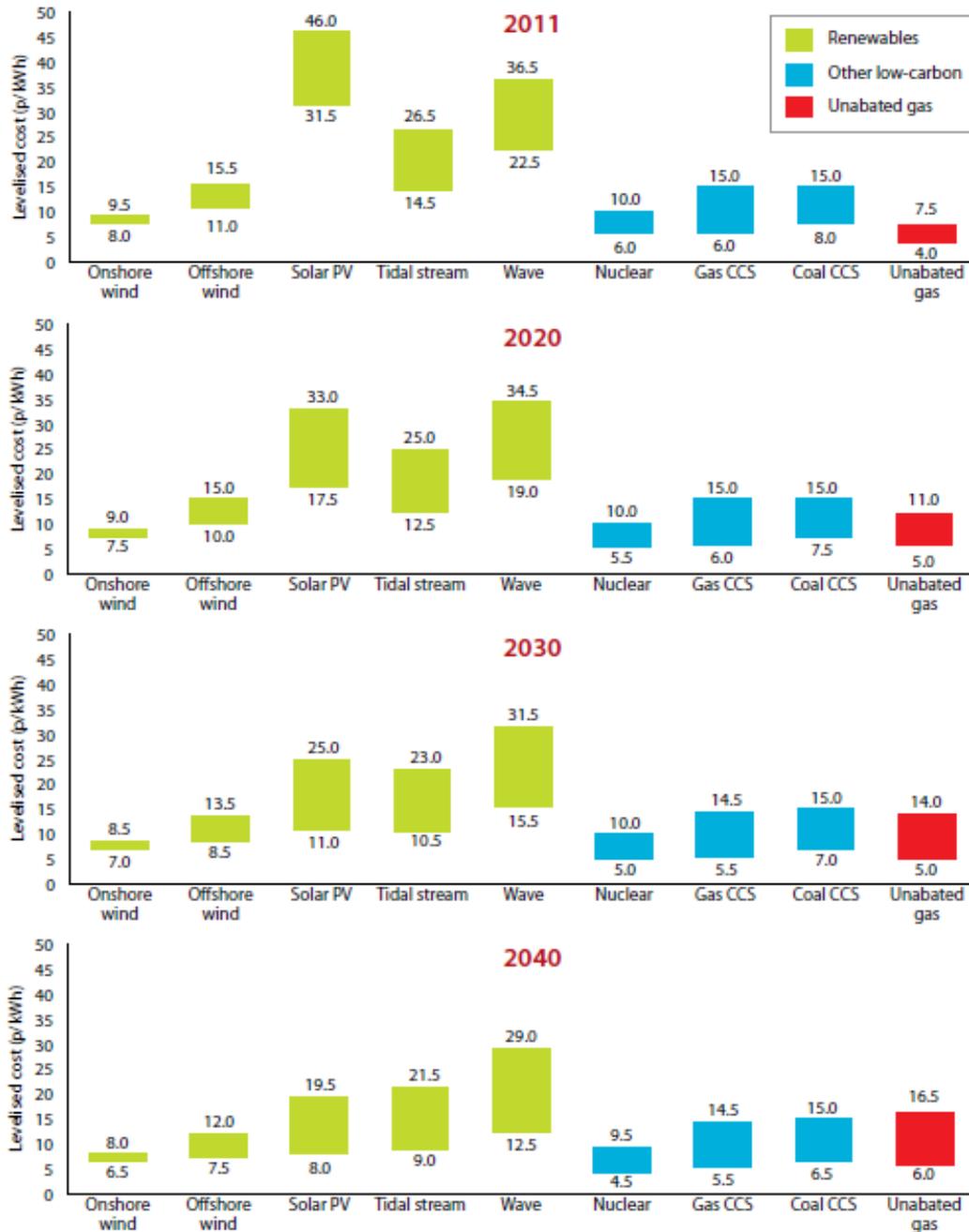
Source: IEA (2009) Technology Roadmap Carbon Capture and Storage



- Note the challenging targets and range of countries
- Additional investment of \$42bn to reach 2020 targets
- Opportunity for UK to set a global example of jobs, growth *and* low carbon economy

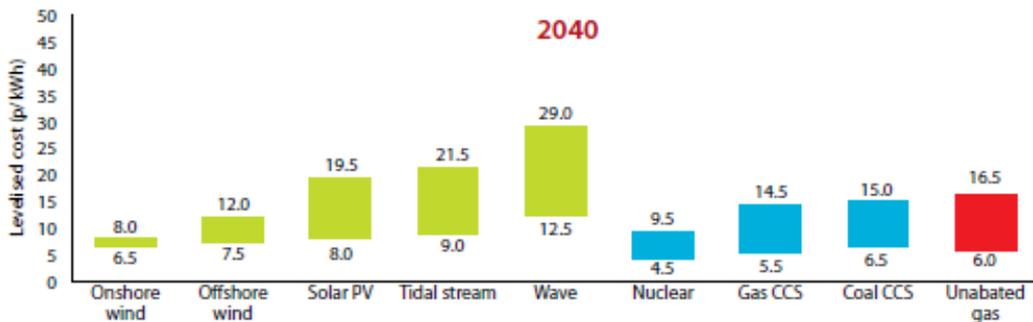
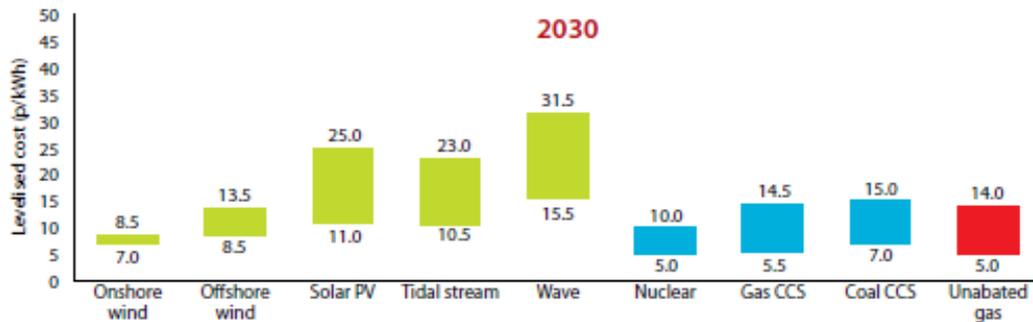
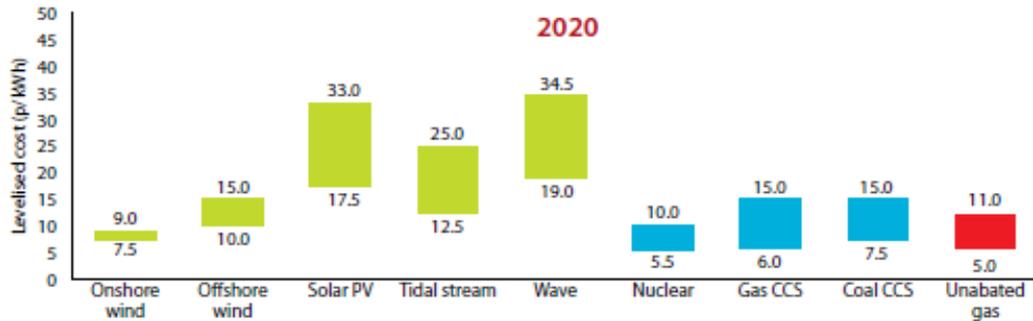
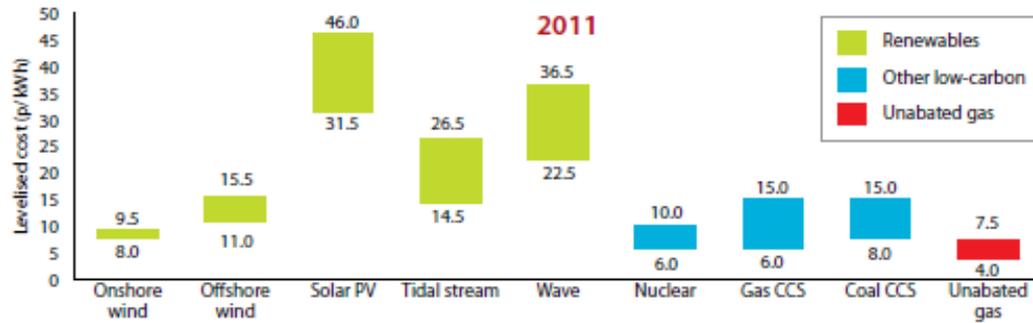
Costs of CCS as a low carbon option for power (1)

- Competitive with other low carbon electricity option
- CCS advantages: reliability and flexibility
- Complements baseload nuclear and intermittent renewables
- Coal (with CCS) can play a role in a diverse energy portfolio to ensure security of supply



Source: Committee on Climate Change

Costs of CCS as a low carbon option for power (2)



➤ CCS causes less of an increase on Overall System costs* than alternatives (+15% vs +40%)**

*Includes grid, interconnectors, back-up

**Reference: PB Power

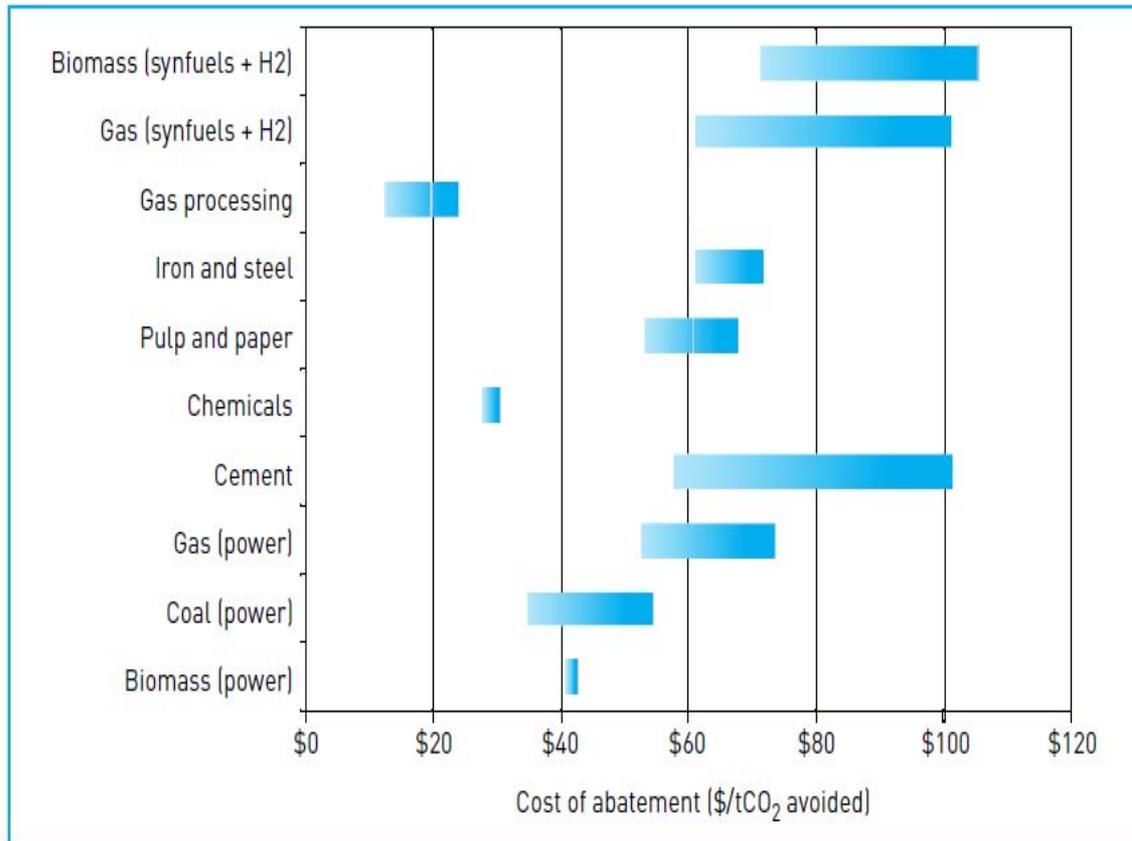
➤ CCC quote Investment costs (levelised): CCS: £1-2Bn/GW; Nuclear: £3Bn/GW; Offshore wind: £7Bn/GW

➤ CCS: lower capital costs than nuclear → lower impact from reduced load factor → flexibility

Source: Committee on Climate Change

Costs of CCS as a low carbon option – for energy-intensive industries

Figure 1: CCS abatement cost range – 2010–50 by sector (USD/tCO₂ avoided)¹⁶



Source: DECC Clean Coal industrial Strategy based on IEA Technology Roadmap for CCS

UK: Climate change and the power sector

- UK Climate Change Act 2008 sets out legally-binding emissions reductions compared to 1990 levels. UK targets:
 - Reduce GHG emissions by at least 34% by 2020
 - Reduce GHG emissions by at least 80% by 2050
- Committee on Climate Change (CCC) recommends decarbonised power sector (50g/kWh) by 2030 to meet the 'carbon budgets'
 - Flexible, low carbon power plants will be needed to back up intermittent renewables and baseload nuclear
- CCC believes 70GW of baseload-equivalent low carbon plants to will be required to 2030.
 - Compare to total UK generation capacity of 85GW in December 2009
 - In 2008 fossil fuels supplied 72% of the UK's electricity
 - Around 35GW of existing coal and nuclear capacity expected to close by mid-2020s

How does CCS fit into the UK electricity mix?

The White Paper on UK Electricity Market Reform (EMR) (July 2011) noted a third of electricity generation could come from renewables by 2030. The remaining 2/3 should be met by nuclear, CCS abated fossil fuels and some unabated fossil fuels. EMR includes:

- **Carbon Floor Price**
 - £16/tCO₂ (2013) → £30/tCO₂ (2020) → £70/tCO₂ (2030)
- **Long-term contracts: Feed-in Tariff with Contracts for Difference (FiTCfD)**
 - World's first financial mechanism to incentivise deployment of CCS beyond demonstration programme
 - Places CCS alongside other low-carbon technologies (nuclear, renewables)
- **Emissions Performance Standard (EPS)**
 - Set at 450g CO₂/kWh
 - No new coal-fired power stations without CCS
 - Allows unabated gas
- **Capacity Mechanism**
 - Can it incentivise keeping existing coal plants running with low load factors?

Why CCS? Why in the UK? (1)

- Hydrogen produced in “pre-combustion capture” installations can be used to power vehicles
- UK plc business could be valued at more than £10Bn/year by 2025, creating more than 50,000 jobs by 2035
- CCS Key to
 - Sustain coal-related jobs and communities
 - maintain energy intensive industries in the UK, e.g. steel, cement and chemical
 - preventing ‘carbon leakage’ - companies relocate to lower cost economies, displacing the CO₂ emissions

Why CCS? Why in the UK? (2)

- The UK has substantial offshore CO₂ storage potential
 - “realistic storage capacity” in depleted oil and gas fields >7.5 GtCO₂
 - Saline formations could provide >20GtCO₂ of storage
- CO₂ produced can also be used for activities such as Enhanced Oil Recovery (EOR).
 - In the UK, CO₂ EOR could provide substantial economic benefits through the recovery of otherwise unattainable hydrocarbons in the maturing North Sea.
- CCS ‘Clusters’ connecting multiple CO₂ sources to multiple CO₂ storage locations will be essential
 - Provisions through clusters could provide cheaper alternative to buying carbon credits

CCS in the UK

- The UK Government announced the UK CCS demonstration programme in 2007
- Government is committed to support 4 CCS demonstrations
- Projects to be operational within this decade
- Government has shown strong leadership with early action on regulation, commitments to demonstration projects and inclusion of CCS in the EMR
- Longannet is cancelled but still four projects
- Need to lay down infrastructure

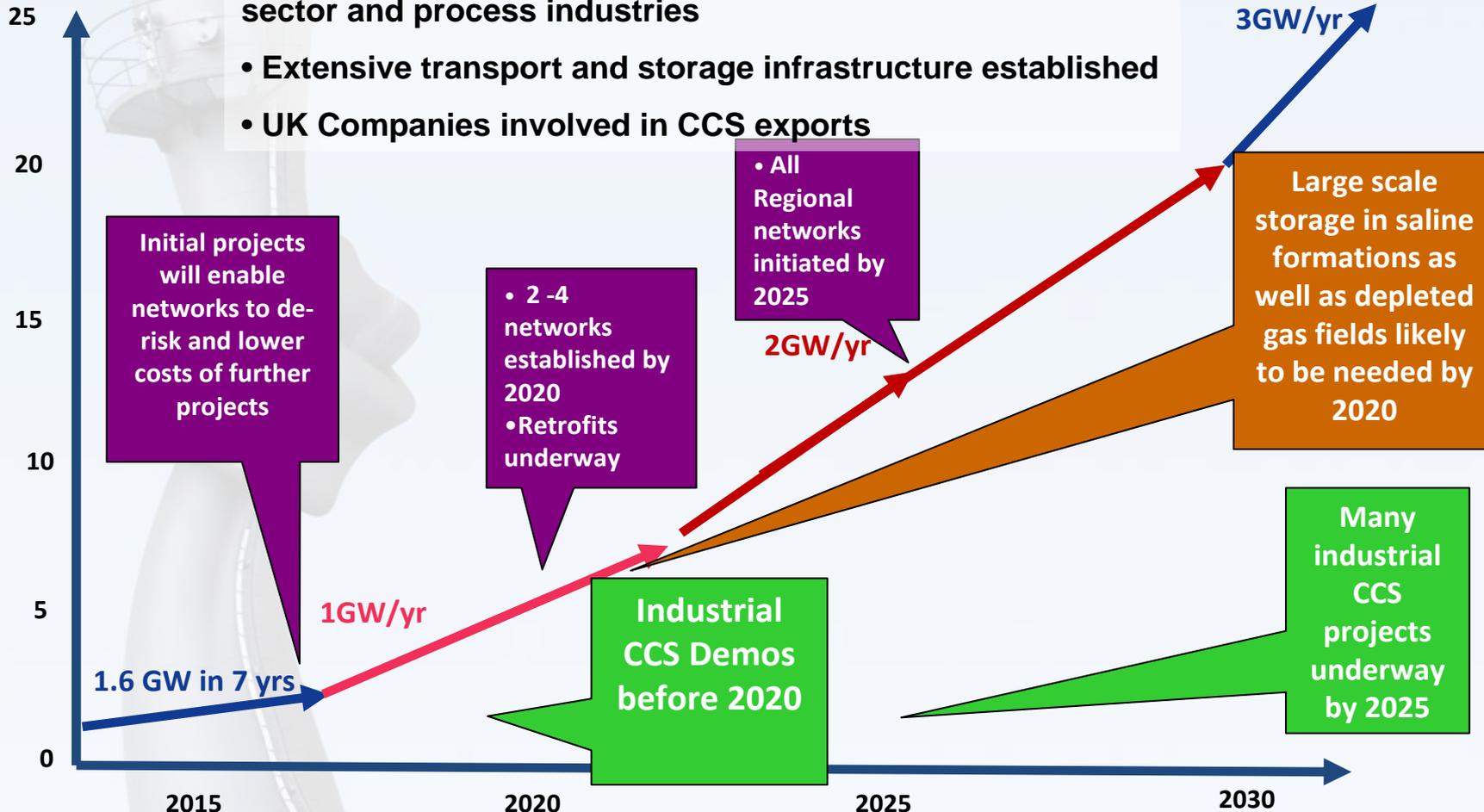


Where are we now?

- UK CCS industry is ready to go
- UK academia has world-class expertise in CCS
- Industrial regions have already begun investigating CCS 'clusters'
 - Scotland, Yorkshire and Humber, the North East, around the East Irish Sea, Thames
 - Vital to maintain UK manufacturing base and energy intensive industries, avoiding 'carbon leakage' whilst meeting climate change commitments.
- What is needed now is government policy to ensure the 'progressive roll-out' of CCS beyond the demonstration programme
 - Vital to set a global example that fossil fuels can be used cleanly, whilst manufacturing and growth can be maintained

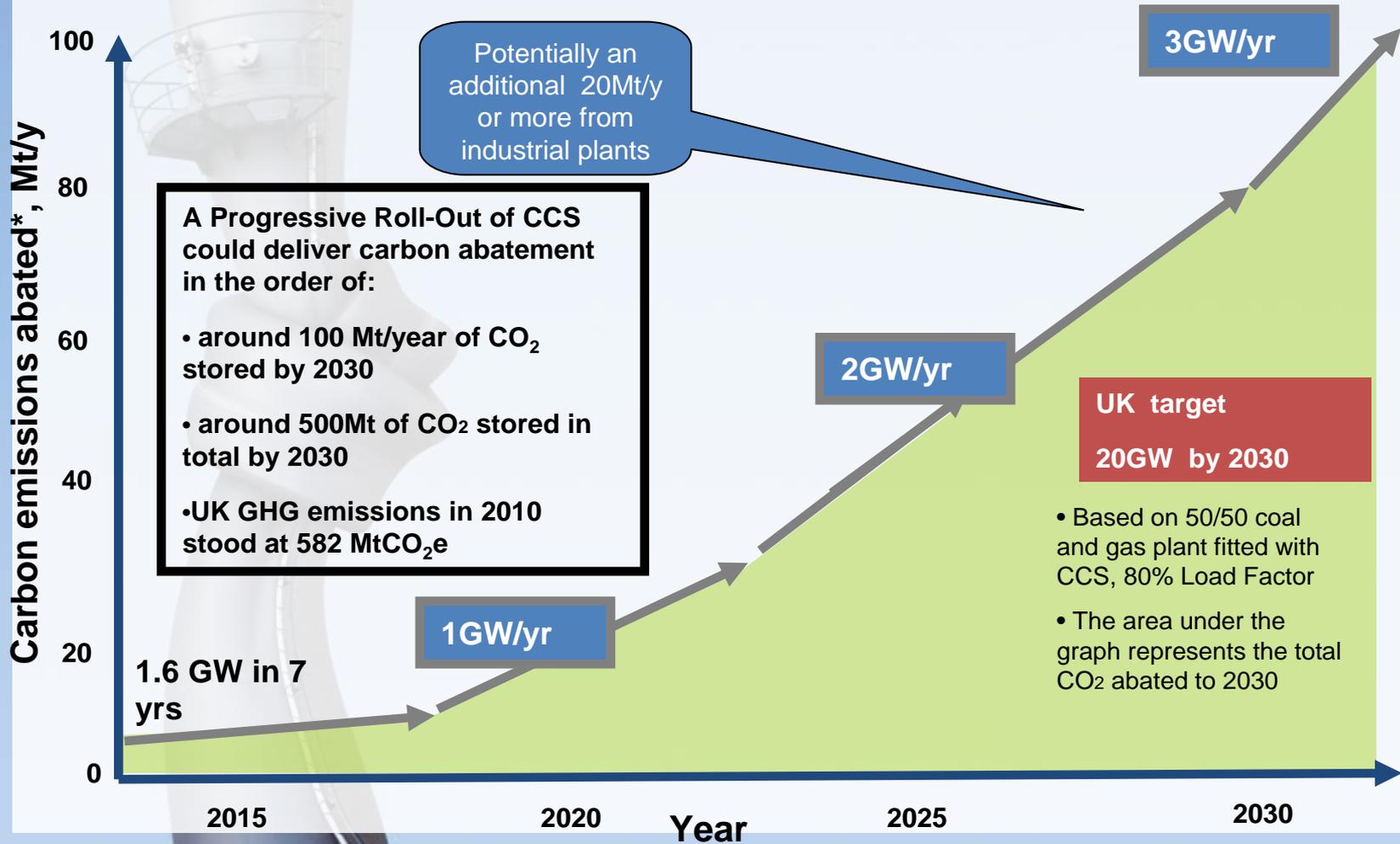
CCSA vision for CCS in the UK to 2030

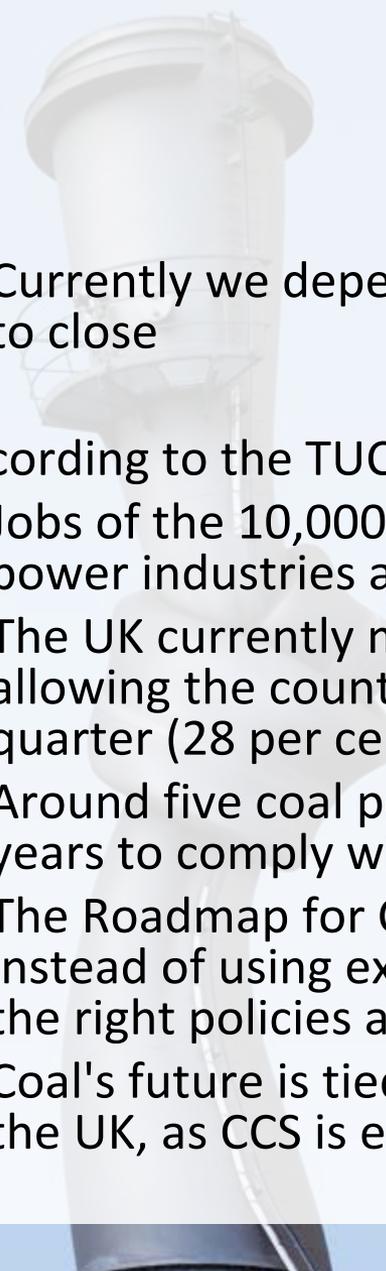
CCS in operation UK, GW



- 20-30 GW of CCS in operation by 2030
- Many CCS projects underway in process industries
- CCS clusters in each industrial established – for power sector and process industries
- Extensive transport and storage infrastructure established
- UK Companies involved in CCS exports

Carbon Abatement from CCS in the UK





Coal CCS in the UK

- Currently we depend on 28GW of coal power plant, most of which is likely to close

According to the TUC Coal Roadmap (October 2011)

- Jobs of the 10,000 people directly employed in the coal mining and coal power industries at risk unless investment is made in CCS
- The UK currently mines more than 18 million tonnes of coal a year, allowing the country's 19 coal-fired power stations to generate over a quarter (28 per cent) of our electricity
- Around five coal power stations are already set to close in the next four years to comply with EU emissions standards
- The Roadmap for Coal warns new gas power stations could be created instead of using existing coal plant/developing new plant with CCS unless the right policies are in place
- Coal's future is tied to the successful development of CCS technology in the UK, as CCS is essential for coal to play a role in a low carbon economy

What is needed to achieve targets? (and when?)

UK Demonstrations

- UK CCS Programme for four projects to be in operation by end 2017 (end 2016 for those which win NER 300 funding)
- DECC call for proposals very soon and conclusions of selection in line with European NER300 funding timeline
- *Risk loss of confidence if further delays*

Electricity Market Reform

- *Early government commitment that EMR will drive roll out of 10 GW of CCS by 2025 (additional to Demos 1-4)*
- *Commitment vital by 2012 in order that projects will be initiated in accordance with our “Progressive roll-out” strategy*

Infrastructure development to be synchronised with needs of roll-out programme:

- Establish means outside EMR to achieve early qualification of storage sufficient for 20-30GW of CCS projects
- Establish means to progressively build Pipeline Networks ahead of their need
- Industrial plants CCS - initiate Pilots and Demos to be in operation by 2018
- Need credible infrastructure plan and start delivering

Further action is required to complete regulation, support R&D, expand capacity and the supply chain in line with the market, and maximize economic benefits within the UK and the export potential from demonstrations and subsequent projects

Latest CCSA report: *A Strategy for CCS in the UK and Beyond*

1. The need for Carbon Capture & Storage (CCS)
2. Costs of CCS as a low-carbon option for power and industry
3. Current status of CCS in the UK
Targets for CCS in the UK: 2020, 2025, 2030
4. Ambitions and targets for CCS in the UK
5. What is needed to achieve the targets?

To find out more visit:

www.ccsassociation.org





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