The future of clean coal - where can UCG fit in the mix?

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IEA CCC, UK

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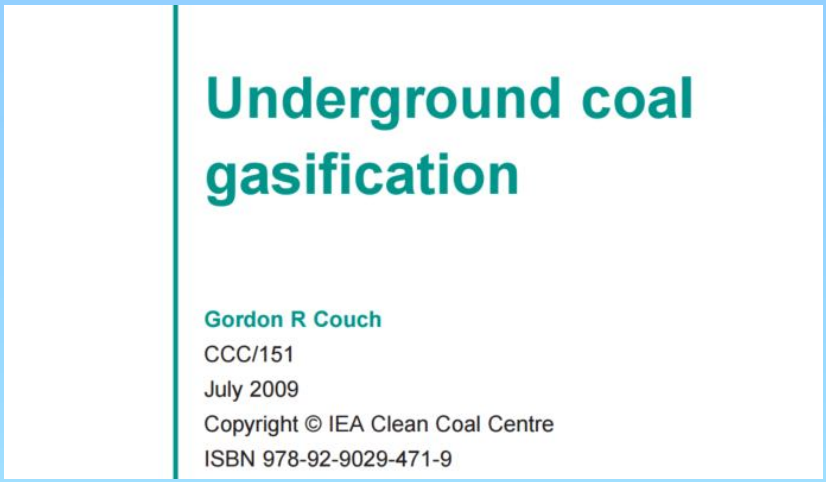

Underground coal gasification

Gordon R Couch

CCC/151
July 2009

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Newsletter

No 70 August 2012

In this issue

WORKSHOP
Advanced ultrasupercritical coal-fired power plants
19-20 September 2012

IEA Clean Coal Centre is organising a workshop on Advanced Ultra-Supercritical Coal-fired power plants. It will be held on 19-20 September 2012 in Vienna, Austria.

The workshop is being used by the IEA to launch its High Efficiency Low Emissions roadmap for coal-fired power plant as this depends heavily on perceptions of how advanced coal-fired power technologies will develop. The main part of the workshop will focus on materials testing and plant design for the highest possible plant efficiencies. Development work is ongoing in China, Europe, India, Japan and the USA, where there are plans to design and build demonstration plants over the coming years. Based on registrations received, all of these countries and regions will be represented with multiple abstracts submitted from Europe, USA, Japan and China. The IEA Clean Coal Centre work programme includes writing a review report on this topic. The workshop presentations and outcomes will be used to inform that report which will be published in 2013.

Vienna from the Cathedral roof

Cafe Sperl

The workshop will be hosted by EVN in Vienna, Austria and is being organised by IEA Clean Coal Centre in co-operation with the VGB, Germany. Those wishing to register and attend need to visit the relevant section of the workshop website at http://ausc.coalconferences.org. Abstract submissions closed on 31 July and the provisional programme based on these submissions can also be found on the same workshop website. Late submissions will be considered but cannot be guaranteed an oral presentation as the programme is already full.

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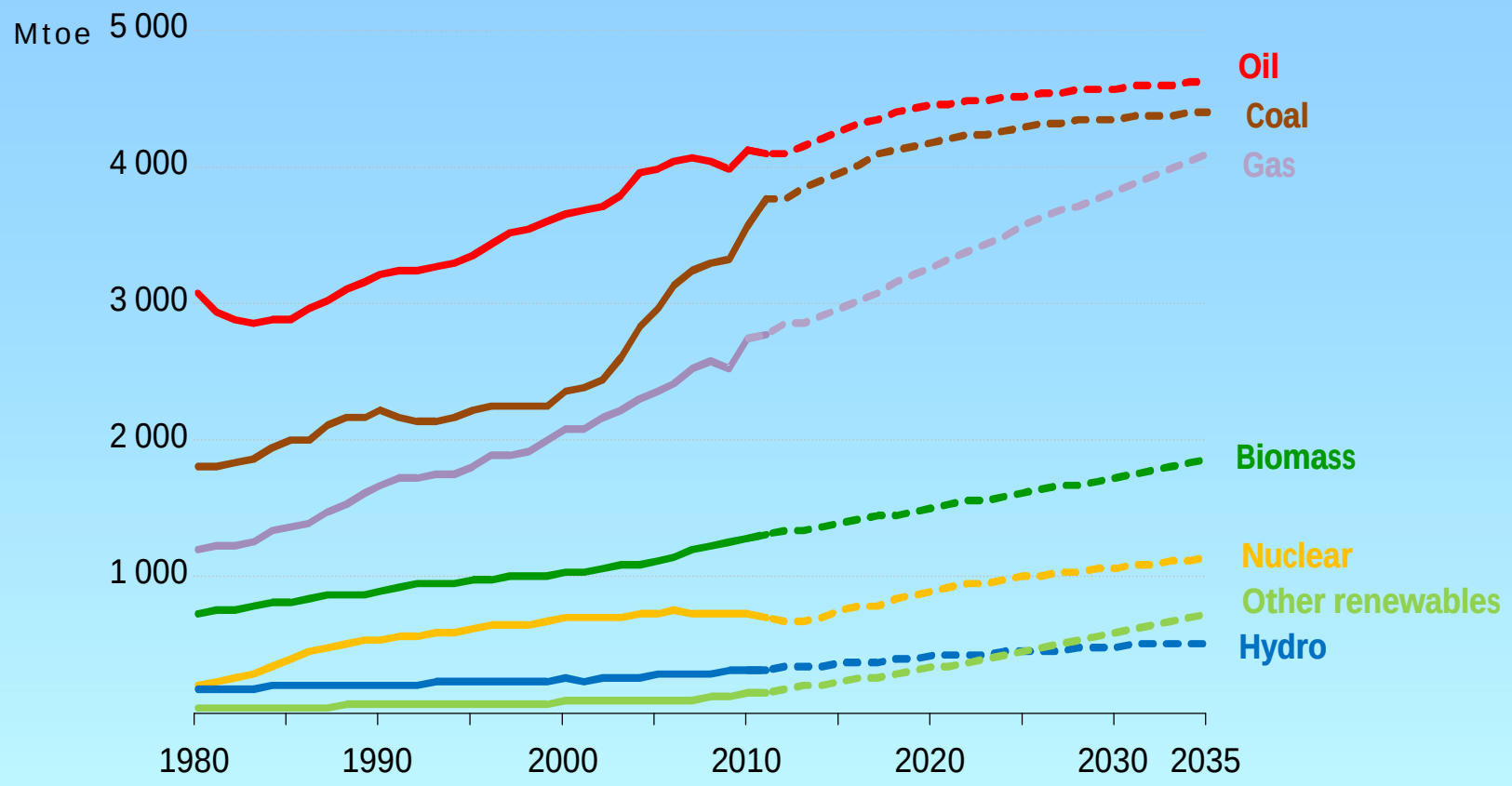
The future of clean coal - where can UCG fit in the mix?

This presentation will cover:

- Current and future energy paths
- The drivers for cleaner coal
- UCG – where does it fit?

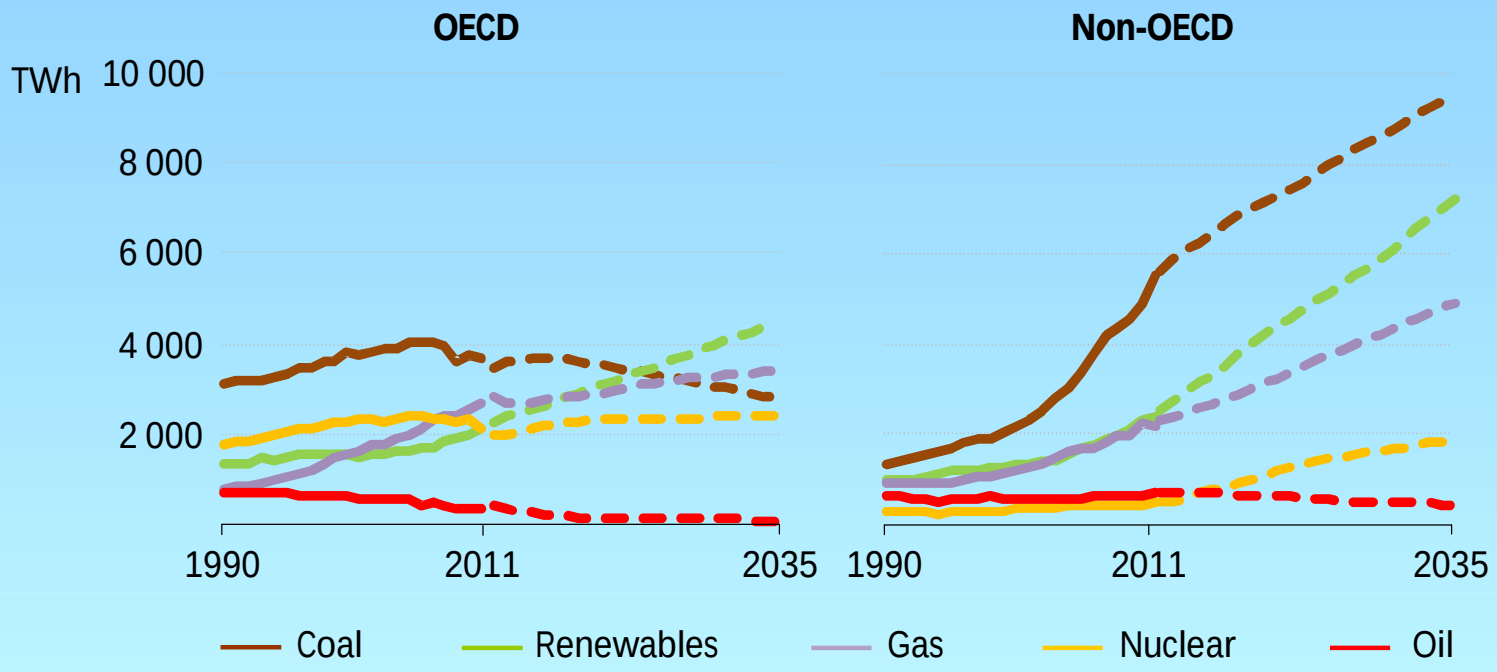
World energy demand continues to rise



Source: IEA WEO, 2013

Electricity generation in non-OECD countries is rising at an incredible rate

Electricity generation by source



Source: IEA WEO, 2013

Global energy is changing

Challenge:

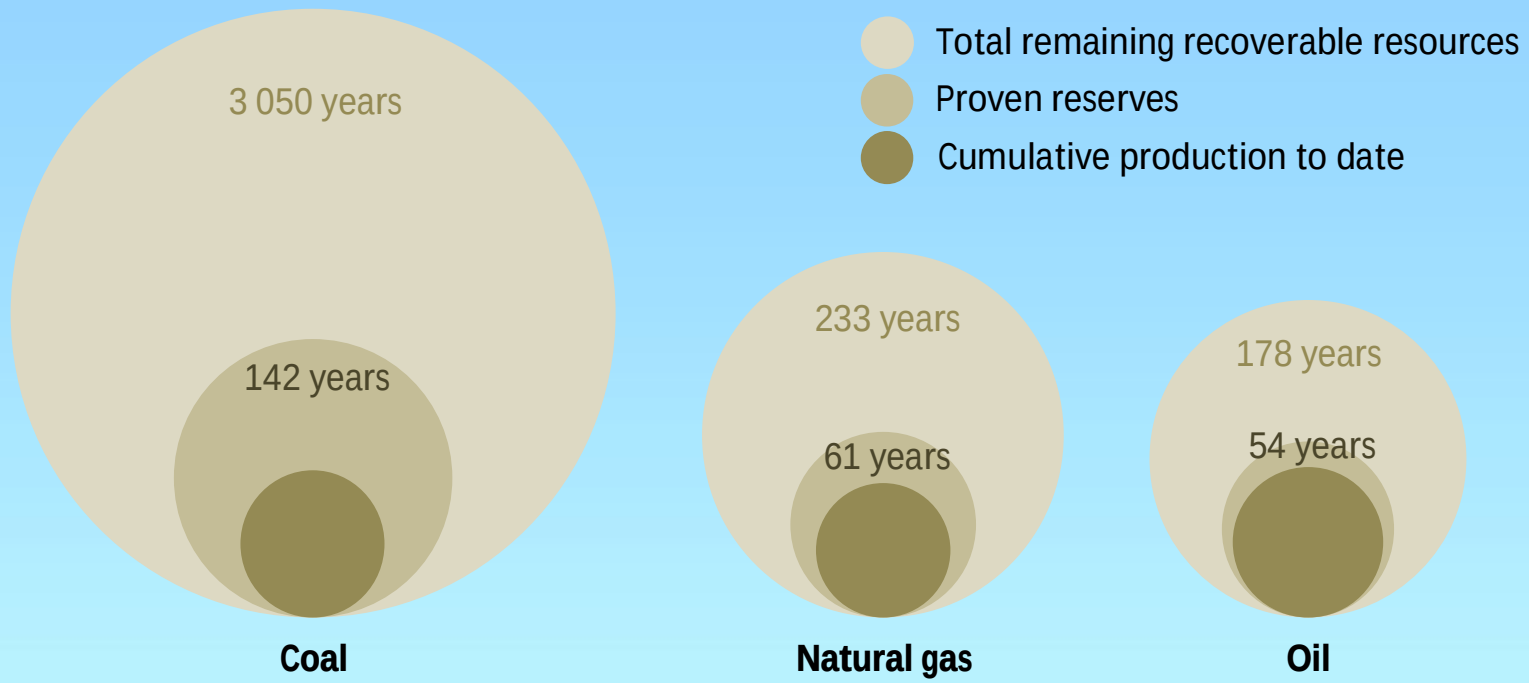
- Developed regions are focusing on energy efficiency and CO_2 reduction

... but

- 1.3 billion people lack electricity, 2.6 billion lack clean cooking facilities whilst having access potential access to coal

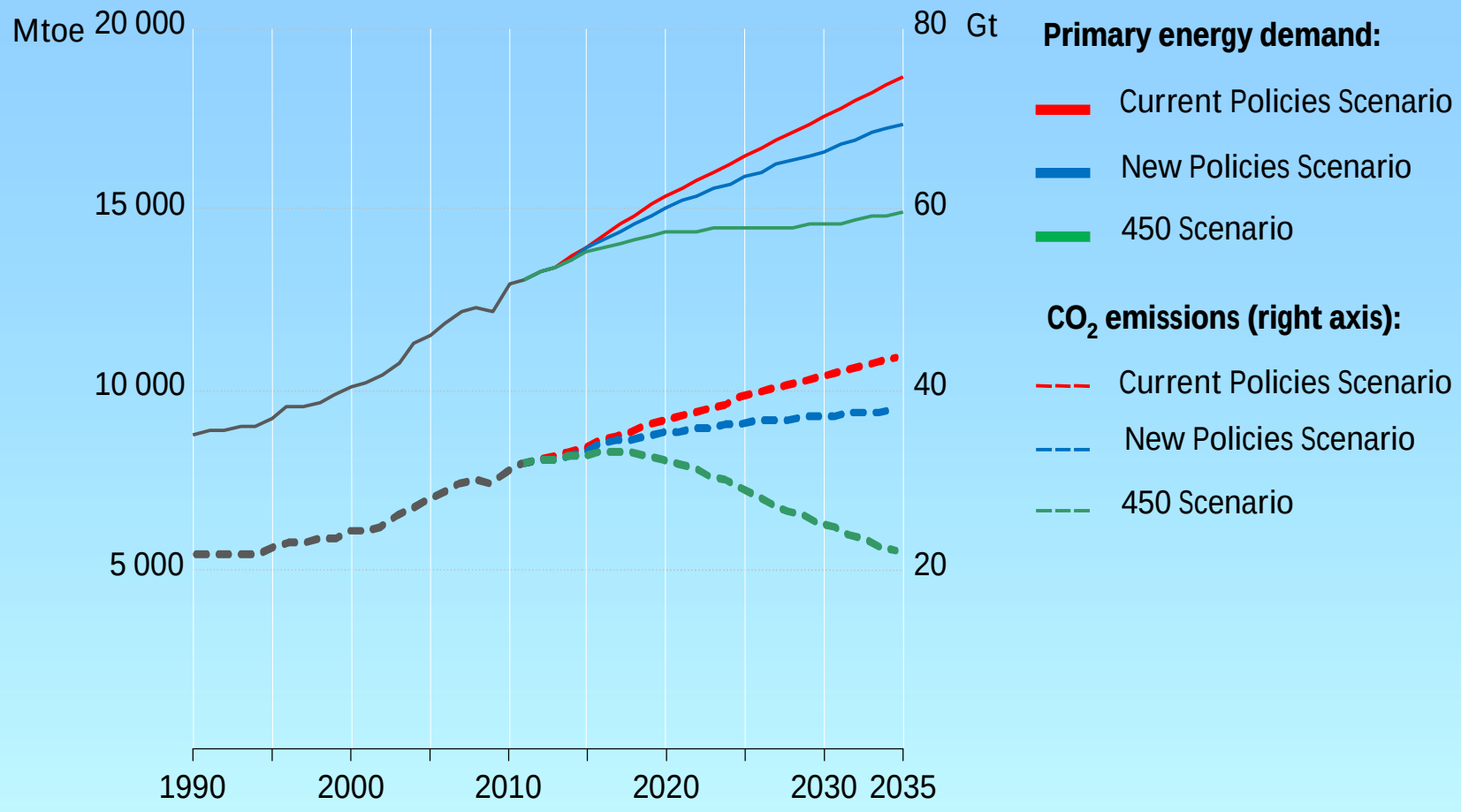
Investment is needed in clean and affordable energy in emerging regions

Fossil energy resources by type



The drivers for cleaner coal

World energy demand & related CO_2 emissions by scenario



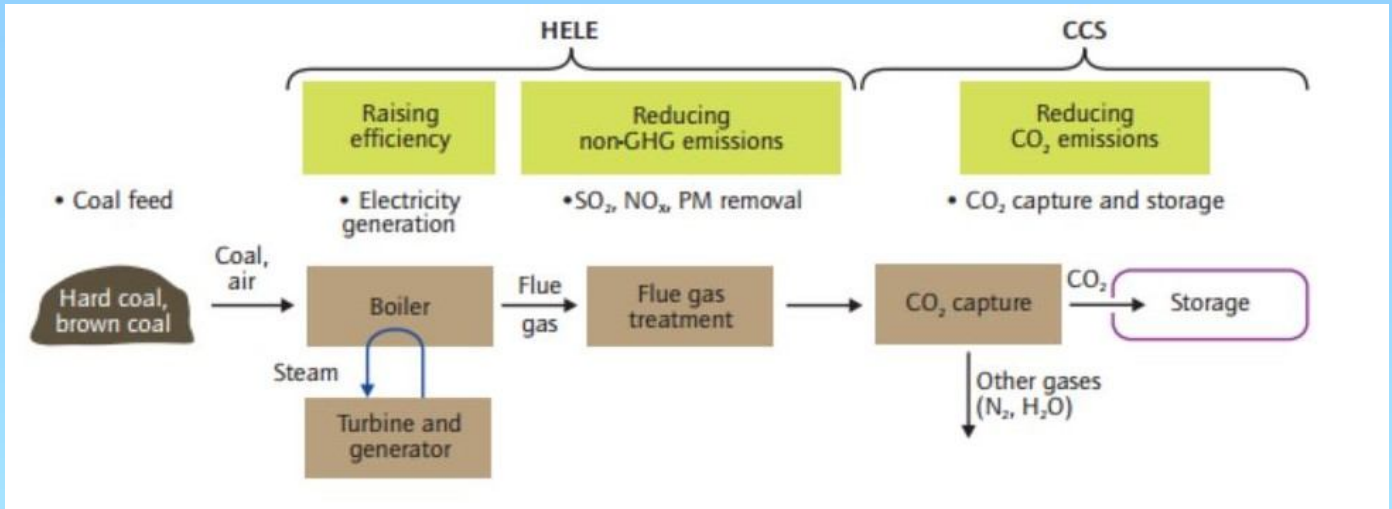
HELE future for coal

HELE is the means by which coal can remain in the energy mix in a carbon-constrained future

HELE = High efficiency low emission technology

- High efficiency combustion (super and ultra-supercritical and gasification options)
- State of the art flue gas cleaning
- Carbon capture and storage (CCS)

HELE Technologies



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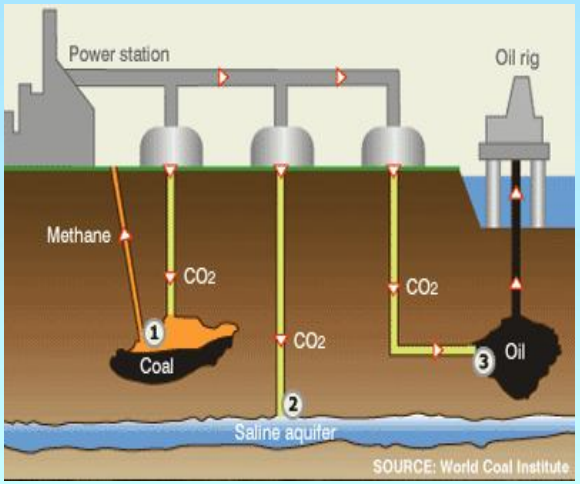
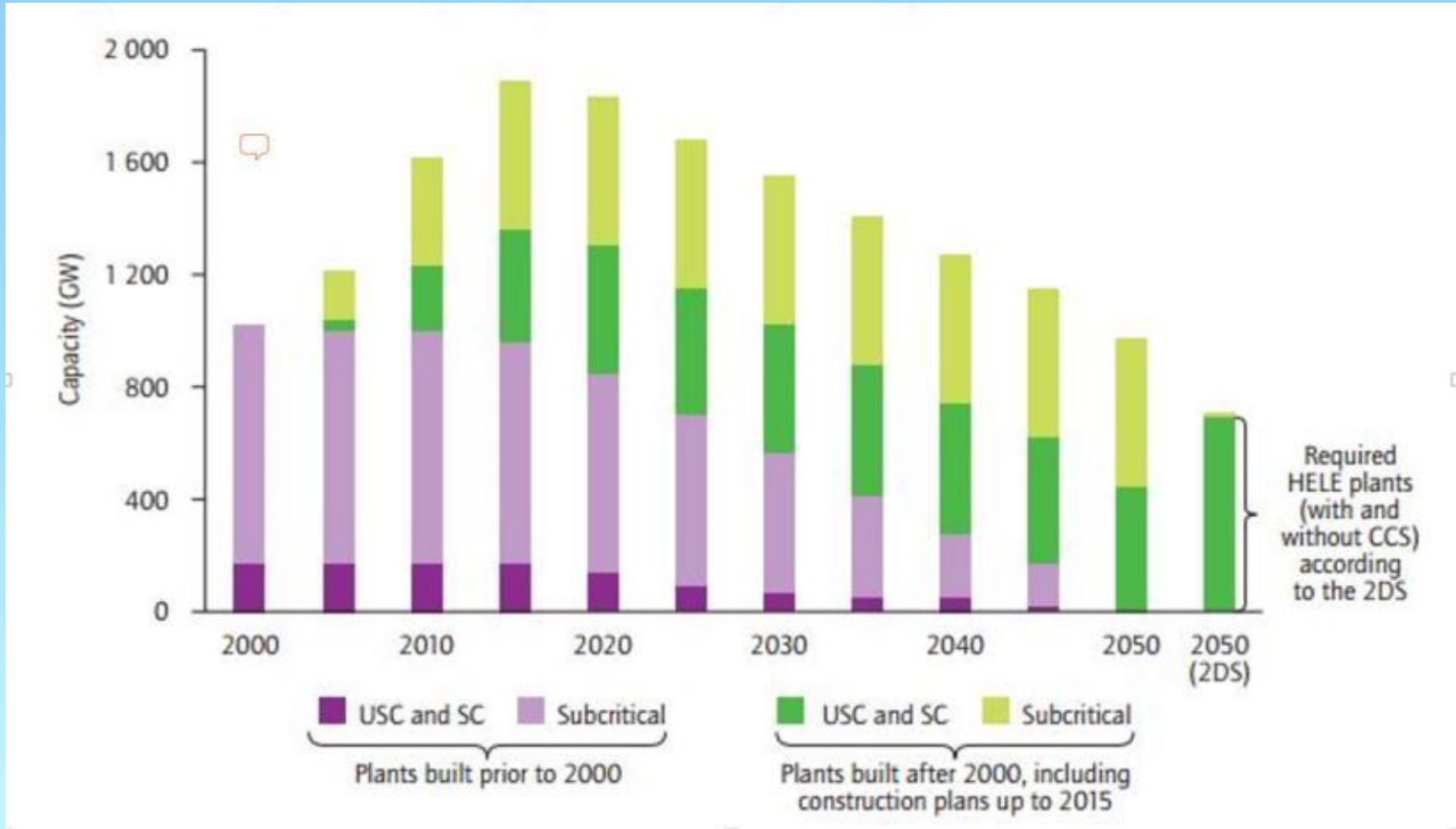


HELE – High efficiency low emission



Legislation is evolving at different rates

But some areas use less energy

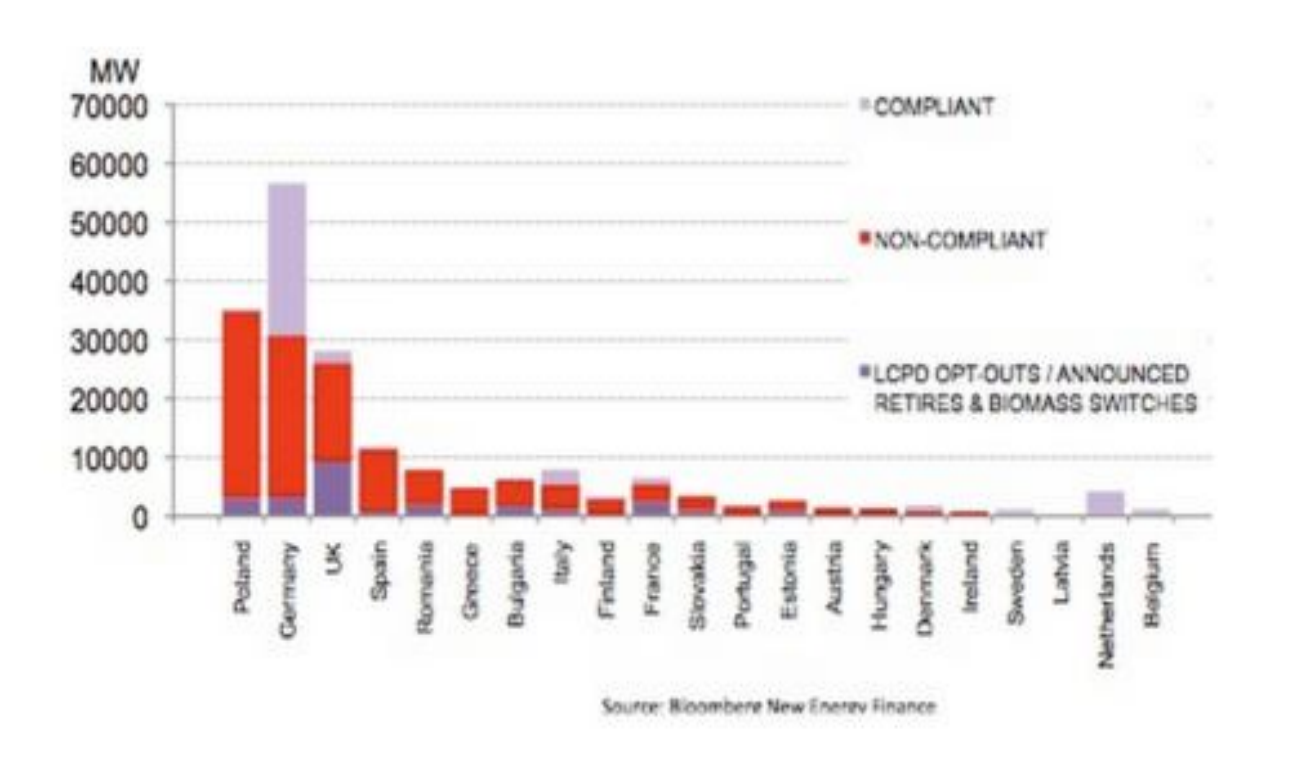
What is legislation doing to the coal sector?

The trend in OECD regions is towards:

- efficient particulate control systems
- >90% sulphur control
- >80% nitrogen oxide control

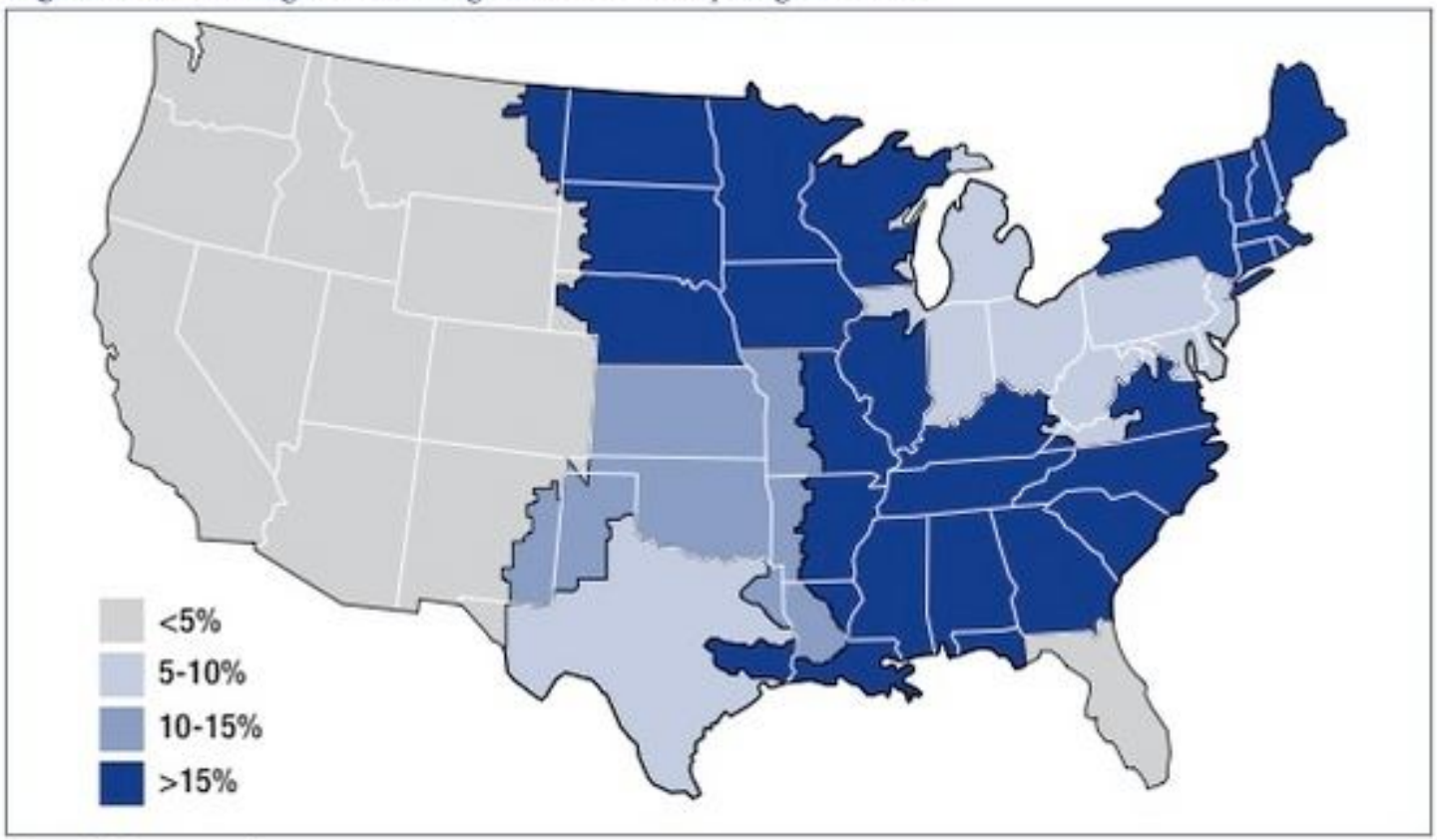
Coal plants must either meet new emission limit values, must trade within bubbles, must switch fuels or must close

Many coal plants in Europe are being phased out



Coal plant closures, USA

Figure 4: Percentage of Existing Coal Retired by Region, 2020



Source: ICF International

China taking HUGE steps to clean up

What effect is legislation having on the coal industry?

In the EU, North America, Japan and China, plants which wish to continue operating into the next decade must be clean and efficient

Despite coal being “cheap”, maintaining a compliant coal plant is becoming expensive and some older plants do not merit the investment to remain open

New plants – must meet even stricter emission limits including, in some regions, either efficiency standards or CO_2 limits

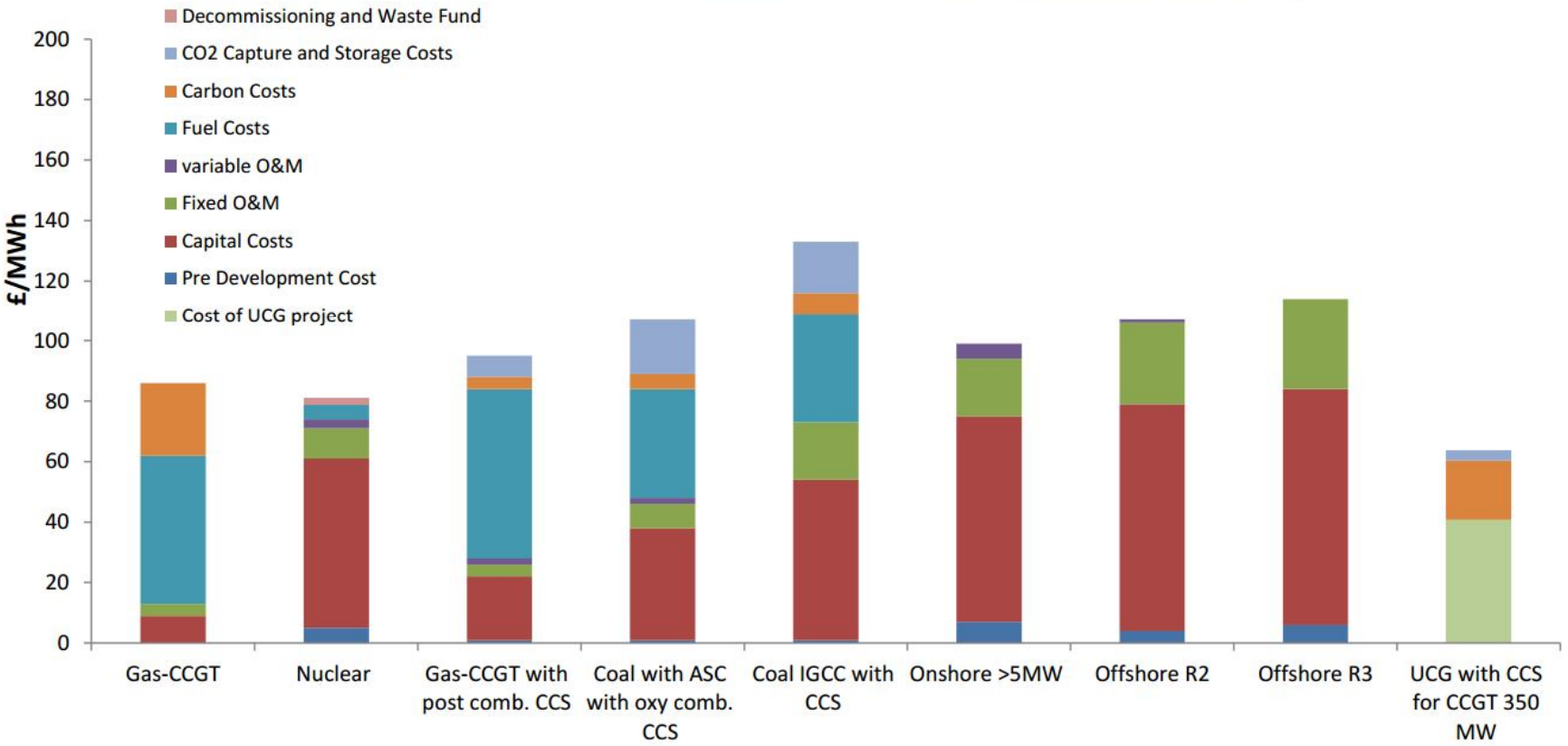
Proposed CO_2 limits for new build coal plants

Country	Proposed CO_2 limit
EIB target*	550 kg/MWh
USA	500 kg/MWh (1,100 lbs/MWh)
Europe	500/450 kg/MWh
Canada	420 kg/MWh
Current average for coal plant	>900 kg/MWh

** Proposed target by the European Investment bank above which funding will not be given*

LOW-COST

UCG emerges as the cheapest energy option for power generation when combined with "Carbon Capture and Storage"



Source: DECC "Electricity Generation Costs 2013" with UCG information from the Research Fund for Coal and Steel of the European Commission " UCG & CO2 Storage" (2013)

Getting funding is challenging

Last year the World Bank announced a new directive to limit financing of coal-fired power plants to "rare circumstances" (*although this may be reviewed*)

Similar policies issued by the Obama Administration have sought to prevent investments into coal-fired power plants by the Treasury Department and the Export-Import Bank

But ... South Africa alone has some 30 billion t of coal reserves. Zimbabwe has another 500 Mt. Tanzania and other countries also have plentiful coal resources

The future for coal?

In the developed world, the challenge is compliance - methods of coal combustion will need to change to meet HELE requirements to remain part of the future energy mix

In the emerging world, the challenge is more often funding and accessibility

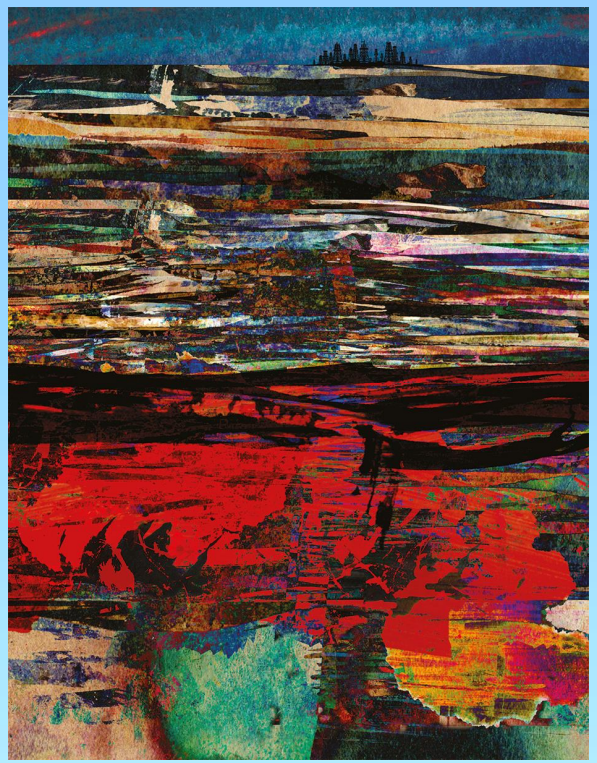
Can UCG be a means of moving coal into the "healthier" gas market?

Majuba

Anti-UCG propaganda

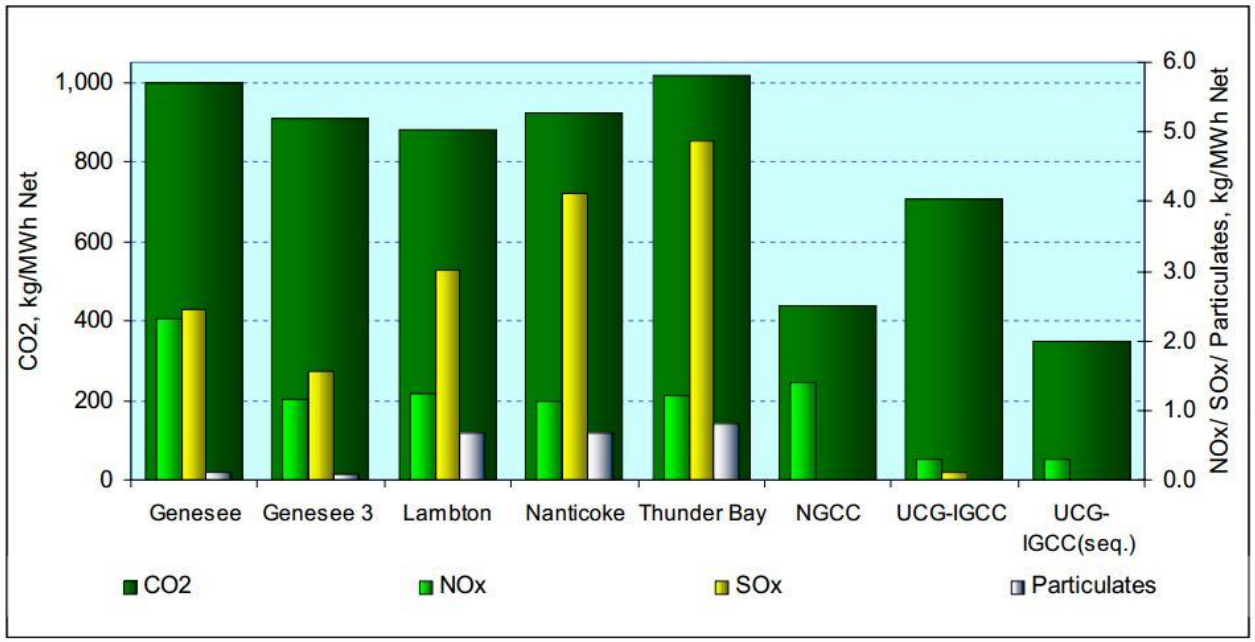
"Setting fire to coal underground could answer our energy prayers, or start an environmental disaster on a bigger scale than ever before.

If you thought shale gas was a nightmare, you ain't seen nothing yet ….To the horror of anyone concerned about climate change, modern miners want to set fire to these deep coal seams and capture the gases this creates for industry and power generation. Some say this will provide energy security for generations to come. Others warn that it is a whole new way to fry the planet."



New Scientist, March 2014

But UCG can be cleaner than conventional coal

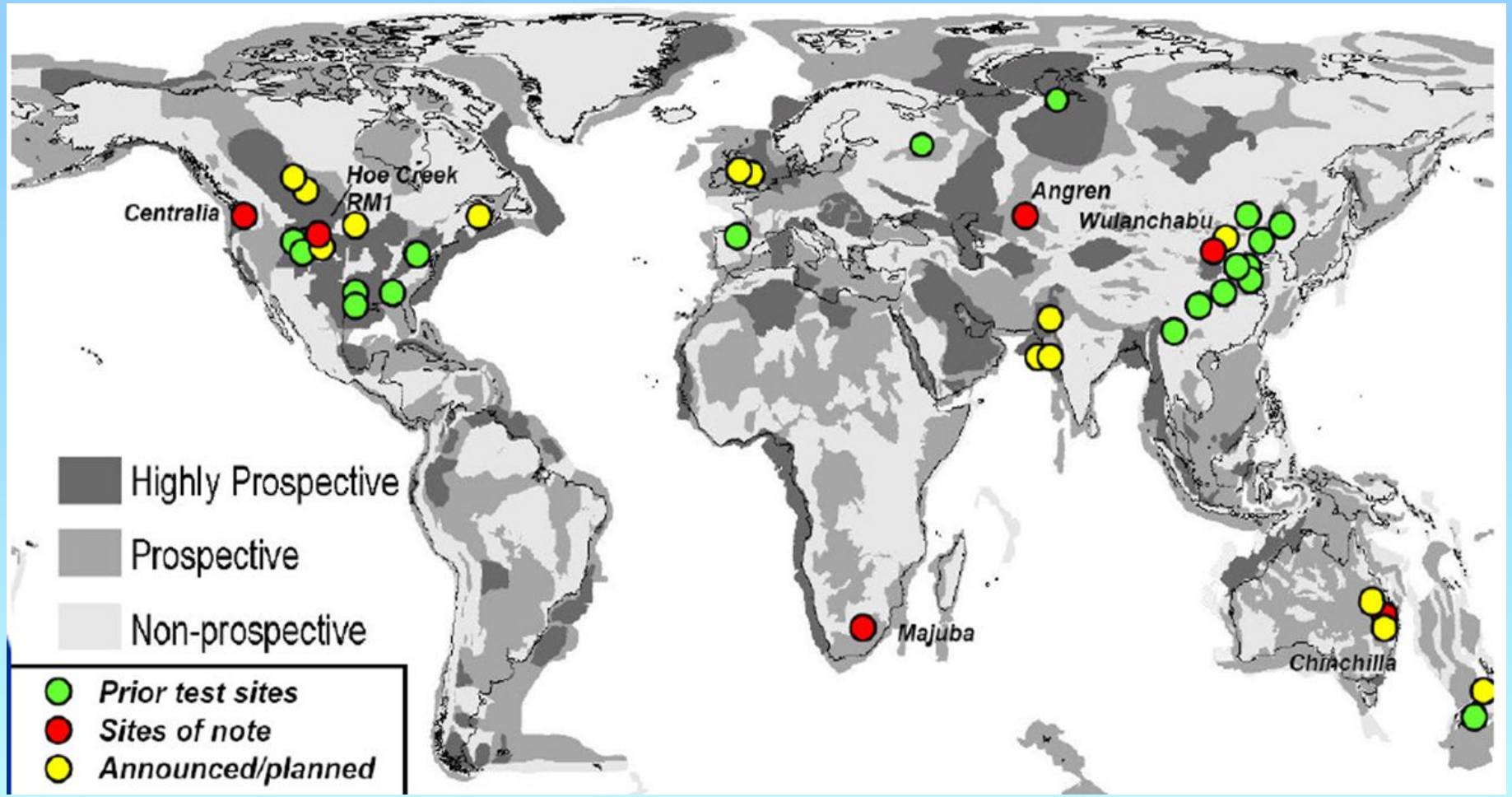


Can UCG be seen as a HELE option?

IEA comments:

- *UCG using state of the art gas turbines could approach the efficiencies achieved by IGCC (up to 45% or more)*
- *UCG might offer a relatively simple and low-cost way of storing CO_2; given favourable geological conditions, CO_2 from reacted syngas could be stored underground in the cavities created by the UCG process*

Significant work on UCG continues



Courtesy of CNR

New developments being announced

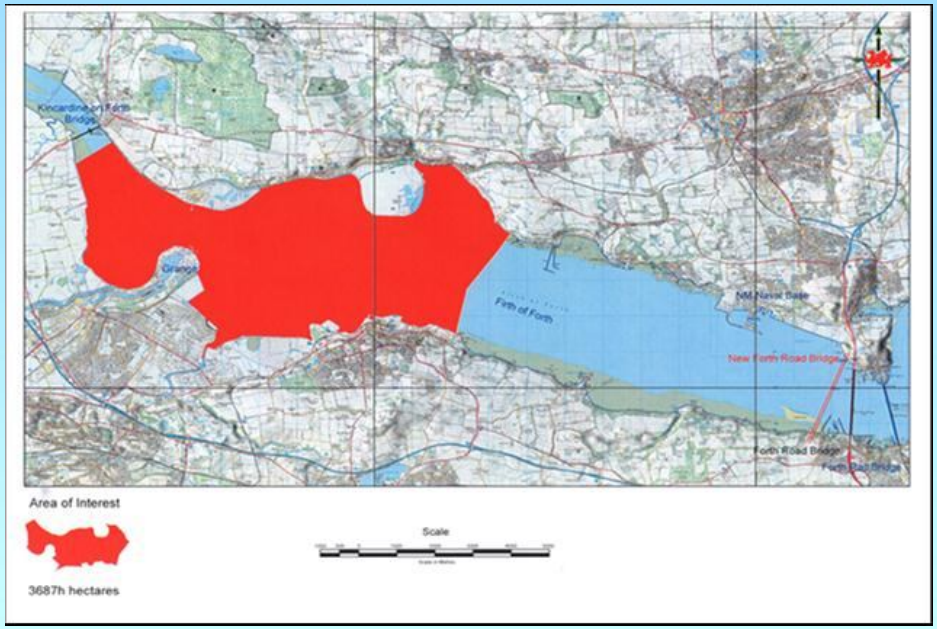
- Linc Energy (MoU) for a 400 MW UCG project in Tanzania to provide power to the Tanzanian electricity grid by 2017 (announced 6th Aug 2014)

- On the 4th August 2014, it was announced that the Indian Government are preparing a draft policy on UCG. Several coal blocks have been identified for UCG purpose for government companies in the state and the applications for the same have been invited
  http://coal.steelguru.com/india/16921/india_govt_preparing_draft_policy_on_underground_coal_gasification

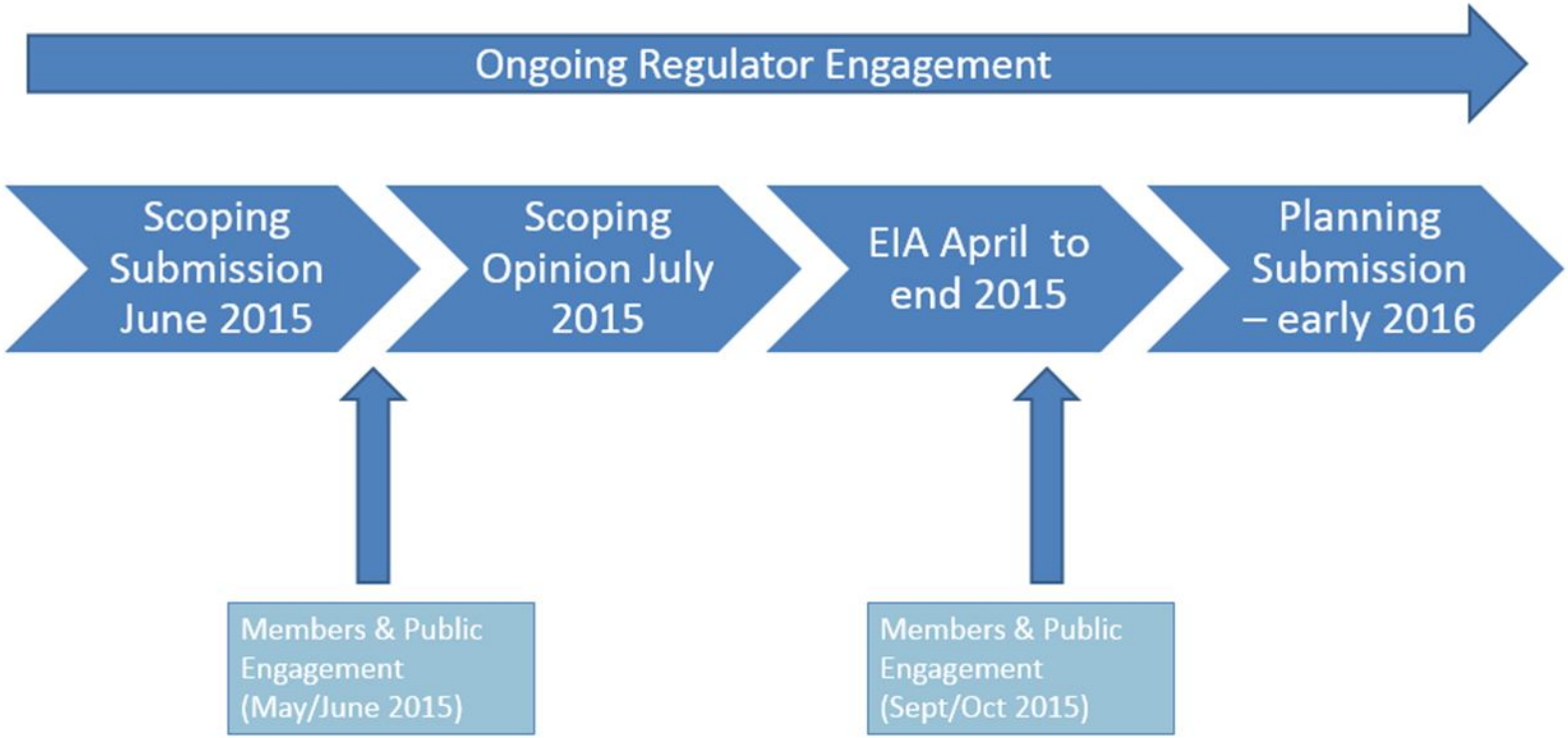
New projects in the UK – Cluff Natural Resources

Cluff Natural Resources currently has 100% working interest in 9 UCG licences in the UK covering a total of 690 km². This includes sites in the Dee Estuary, Kincardine, Durham and Maryport.

5Quarters also investing in a UCG portfolio



Timeline for CNR Project



Potential markets for UCG in the UK

- Feedstock for petrochemical industry
- Primary electricity generation (CCGT)
- Fuel gas for energy intensive industry
- Gas-to-liquids processes
- Fuel for the Hydrogen economy
- Fertilizer (ammonia) & methanol production

... offsetting natural gas use

Challenges for UCG

- funding towards commercialisation
- prove potential as an unconventional gas source
- improved media and public perception
- proof of CCS potential and inclusion as a HELE option

Thank you for listening

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