

The Role of Fossil Fuels and CCS

Climate Change Mitigation: Making Progress in Challenging Times MIT Workshop, Seville 4 May 2016 Samantha McCulloch CCS Unit, IEA

Carbon capture and storage

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Presentation Outline

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1. Global energy outlook

2. The path to 2DS: A role for fossil fuels and CCS







3. Paris Agreement: Implications for CCS





Geography of Global Energy Demand

Over 95% of the projected growth in energy demand between now and 2035 happens outside the OECD (NPS)

Primary Energy Demand, 2035 (Mtoe)



A new chapter in China's growth story



Energy demand in China



Along with energy efficiency, structural shifts in China's economy favouring expansion of services, mean less energy is required to generate economic growth

India moving to the centre of the world energy stage



Change in demand for selected fuels, 2014-2040



New infrastructure, an expanding middle class & 600 million new electricity consumers mean a large rise in the energy required to fuel India's development

Power is leading the transformation of the energy system



Global electricity generation by source



Driven by continued policy support, renewables account for half of additional global generation, overtaking coal around 2030 to become the largest power source



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Percentages represent cumulative contributions to emissions reduction relative to 6DS



CO₂ captured and stored

CCS in the 2DS



Electricity generation from CCS-equipped plants

CCS is important in both electricity and industry.

Over $\frac{2}{3}$ of CO₂ captured is in non-OECD countries.





fossil fuels use is reduced but still has a **44% share in 2050** and are an important part of global energy supply in the 2DS





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But it is not business as usual...





Coal: 'High efficient-low emissions'?

Secure • Sustainable • Together







Gas: a transition or a destination?

Secure • Sustainable • Together







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Secure • Sustainable • Together







CCS underpins a future role for fossil fuels





CCS underpins a future role for fossil fuels



ETP 2014, 2015



CCS is up and running...

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Gorgon (Source: Chevron)



Scotford Upgrader (Source: Shell)



...but deployment must be accelerated

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The maximum capture capacity from all projects in the pipeline is 65 MtCO₂ a year – the 2DS calls for 500 MtCO₂ a year to be stored by 2025.



A supportive policy framework is essential...



...but currently lacking in most jurisdictions



The potential of "EOR+"

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Storing CO₂ through Enhanced Oil Recovery

for profit

Combining EOR with CO2 storage (EOR+)

- Enormous potential for CO₂ storage through EOR
 - Up to 3x the requirements of the IEA 2 degree scenario
- Additional activities to transform EOR to permanent storage:
 - 1. Additional site characterisation and risk assessment
 - 2. Additional measurement of venting and fugitive emissions
 - 3. Monitoring and enhanced field surveillance
 - 4. Changes to abandonment processes





The potential for China: retrofitting coal

Secure • Sustainable • Together



- In 2020, China will have 330GW of coal-fired plant that is
 - larger than 600MW
 - younger than 15 years
 - within 250km of potential storage
- Strategy requires the development of significant storage resource in China

Launch of IEA China Retrofit Report: 18 May, Beijina



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2015 Paris Agreement

- "Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above preindustrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;"
- "... Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions ... so as to achieve a balance between anthropogenic emissions by sources and removals by sinks ... in the second half of this century ..."



Not just ¼ more effort

Carbon Countdown

How many years of current emissions would use up the IPCC's carbon budgets for different levels of warming?









Paris Agreement: implications for CCS

Many models could not achieve atmospheric concentration levels of about 450 ppm CO₂eq by 2100...under limited availability of key technologies, such as bioenergy, CCS, and their combination (IPCC, 2014)

Getting to 'well below 2°C' and onwards to 1.5°C:

- Greater, faster deployment of CCS
- Greater emphasis on CCS in industry (where alternative solutions do not yet exist in many sectors)
- Negative emissions, sinks, and bio-CCS (BECCS)

...but are recent and current government policies compatible with this?



From 2 . . . to 'well below 2': Role for CCS on residual emissions





From 2... to 'well below 2': Role for CCS on residual emissions



Despite 3Gt CO_2 captured and stored, 7Gt of CO_2 emissions **remain** from **industrial sources** in 2050 under 2DS.

How much more can CCS do in industrial applications under 'well below 2°'?



Industry-CCS: enabling clean products to tackle greater ambition

- CCS is a critical technology for many process industries with high specific emissions per tonne of product:
 - Steel: 1,9 2.1 tCO₂ / t of steel
 - Cement: 0.8tCO₂ / t of cement
- Applying CCS can enable clean products, with -50 to -80% CO₂ / t of cement or steel
- ...but: what would drive this?
 - Product standards & mandates
 - CO₂ price
 - Customer demand (to an extent)

















Negative emissions: A greater role for BECCS?

- Combination of bioenergy with CCS can deliver net negative emissions and reduce atmospheric concentrations of CO₂
 - Can address 'overshoot' of carbon budgets in medium term
- But...not all BECCS is good BECCS
 - Sustainability of biomass social and economic issues; competition with food production; loss of biodiversity; pressure on water resources etc
- Availability of geological storage will be critical!









Concluding Messages

- CCS will be an important part of the solution to climate change
- Fossil fuels will continue to play a role in the energy mix, particularly in non-OECD countries
- CCS is ready for deployment, but policy frameworks are lacking
- The Paris Agreement <u>could be</u> a game-changer for CCS



Thank you!

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