CCUS as a Climate Mitigation Option

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IEA Greenhouse Gas R&D

Part of the IEA ETN since 1991 –

35 Members from 18 countries plus OPEC, EU and CIAB

Members set strategic direction and technical programme

Universally recognised as independent technical organisation
What do we do?

Our Core Activities Are:

Assess Mitigation Options – Focus our R&D CCS
Resource of 300+ reports

Facilitate technology implementation

Facilitate international co-operation
14 international research networks

Disseminate our results as widely as possible
WMO Current Climate Status Report March 2017

- Levels of CO₂ in the atmosphere reached a new high (>400ppm)
- 2016 was the warmest year on record
  - 1.1°C above the pre-industrial period, which is 0.06 °C above the previous record set in 2015.
- Globally averaged sea surface temperatures were also the warmest on record,
  - global sea levels continued to rise,
  - and Arctic sea-ice extent was well below average for most of the year.
- Conclusion: “the influence of human activities on the climate system has become more and more evident”

Global energy-related emissions flat for third year in a row

Three consecutive years of stable emissions alongside global GDP growth

Global energy-related CO₂ emissions

Significant and sustained decline in emissions needed for a 2°C target (2DS)

17 March 2017
Global energy-related emissions flat for third year in a row

Global energy-related CO₂ emissions

Significant and sustained decline in emissions needed for a 2°C target (2DS)
A portfolio-approach is needed for a least-cost low-carbon scenario
CCUS – a key climate policy option

- The IPCC AR5 indicated - CCS is a crucial technology to meet the $2^\circ$C target
  - Climate scenarios could not meet $2^\circ$C without CCS
  - The costs of meeting the $2^\circ$C will be 138% higher if CCS is not included as a mitigation option
- Post Paris CCS “lowered” the target to limit temperature rise to below $2^\circ$C target.
- CCS is expected to be an even more crucial technology if we are to achieve below $2^\circ$C target.
CCS – a key climate policy option (2)

- To go below 2°C significant reductions in greenhouse gas emissions will be required in all sectors not just the power sector.
- CCS is a key technology to achieve deep emissions cuts in the industry sector.
- “Negative emission” technologies like BioCCS will likely need to be deployed from 2030 onwards.
The technologies and sectors making the largest contributions to shifting the world from a 6C to a 2C path between now and 2050. Source: IEA Energy Technology Perspectives 2015.
Current status of CCUS

- CCS technology is proven and in use around the world.
- 22 large-scale CCS projects in operation or under construction globally - CO₂ capture capacity of 40 Mtpa.
- 6 projects in construction as of March 2017
  - 3 projects to be operational in 2017 & 3 in 2018
- 5 more large-scale CCS projects at an advanced stage of development planning,
  - CO₂ capture capacity of ~ 8 Mtpa.
- 11 more large-scale CCS projects are in earlier stages of planning
  - CO₂ capture capacity of ~21 Mtpa.

Source: Global CCS institute
CCUS Deployment

**Power Sector**
- Boundary Dam – Canada
  - >1.3M captured
- NRG Parish (USA)
  - Largest capture unit to date
- Kemper County (USA)
  - Due on stream 2017
- OsakiCoolGen
  - IGCC unit operational
  - CO2 capture 2018/19

**Industry Sector’s**
- Natural gas processing
  - Sleipner -20 years
  - Lula, Brazil
- Hydrogen Production
  - Air Products (USA)
    - >3Mt captured
  - Quest (Canada)
    - >2Mt captured
- Steel manufacture
  - Emirates Steel now operational
- Bio-ethanol
  - IISD (USA)
Demonstration achievements

- CCS is a “proven” technology
- Growing confidence in CCS
  - It can do – “what it says on the tin”
- Growing number of capture vendors
  - Post combustion capture
    - Cansolv, Linde, MHI, Toshiba, Fluor ……
- Learning by doing
  - NOAK projects can be built at lower cost
- EOR gives financial support for early mover projects in regions
Role of CO2- EOR (CCUS)

• North America
  • Provided price for CO₂
  • Financial support to demonstration projects
  • CO₂ pipeline infrastructure plus regulation

• CO2-EOR developments
  • Offshore CO2-EOR at Lula, Brazil
  • On-shore CO2-EOR taking off in Gulf States
    o Pilot project in Saudi Arabia
    o Emirates Steel first mover project in UAE
    o China – first project (Yangcheng Petroleum) in 2019/2020
Next steps

- Progress in CCUS deployment has been significant and cost reductions observed from learning by doing
- Most early CCUS projects have required government support
  - Grants/loans for capital investment
  - Taxes, storage credits etc., towards operational costs
- Government support will still be needed to help drive down costs and/or make business model attractive to industry.
- Ultimately we need to create business models that allow projects to be self financing
  - No “one fits all solution”
- Knowledge transfer from early projects needed
- Proving the storage resource around world is essential
- Build infrastructure to support expanded deployment of CCUS.
- Further R&D to drive down costs