# CCUS as a Climate Mitigation Option

John Gale

Programme Director

IEA Greenhouse Gas R&D Programme

**Resources for the Future Seminar**

**Carbon Capture, Utilization, and Storage (CCUS): Status, Issues, Needs**

**May 24, 2017, Washington DC, USA**

# IEA Greenhouse Gas R&D

Part of the IEA ETN since 1991 –

What We Are:

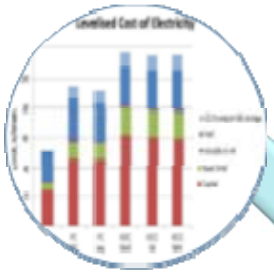
35 Members from 18 countries plus OPEC, EU and CIAB


Members set strategic direction and technical programme


Universally recognised as independent technical organisation

# What do we do?

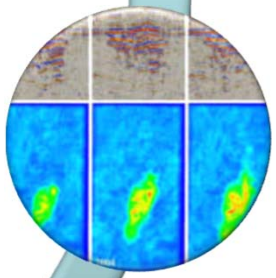
Our Core Activities Are:



Assess Mitigation Options – Focus our R&D CCS

Resource of 300+ reports

Facilitate technology implementation



Facilitate international co-operation

14 international research networks

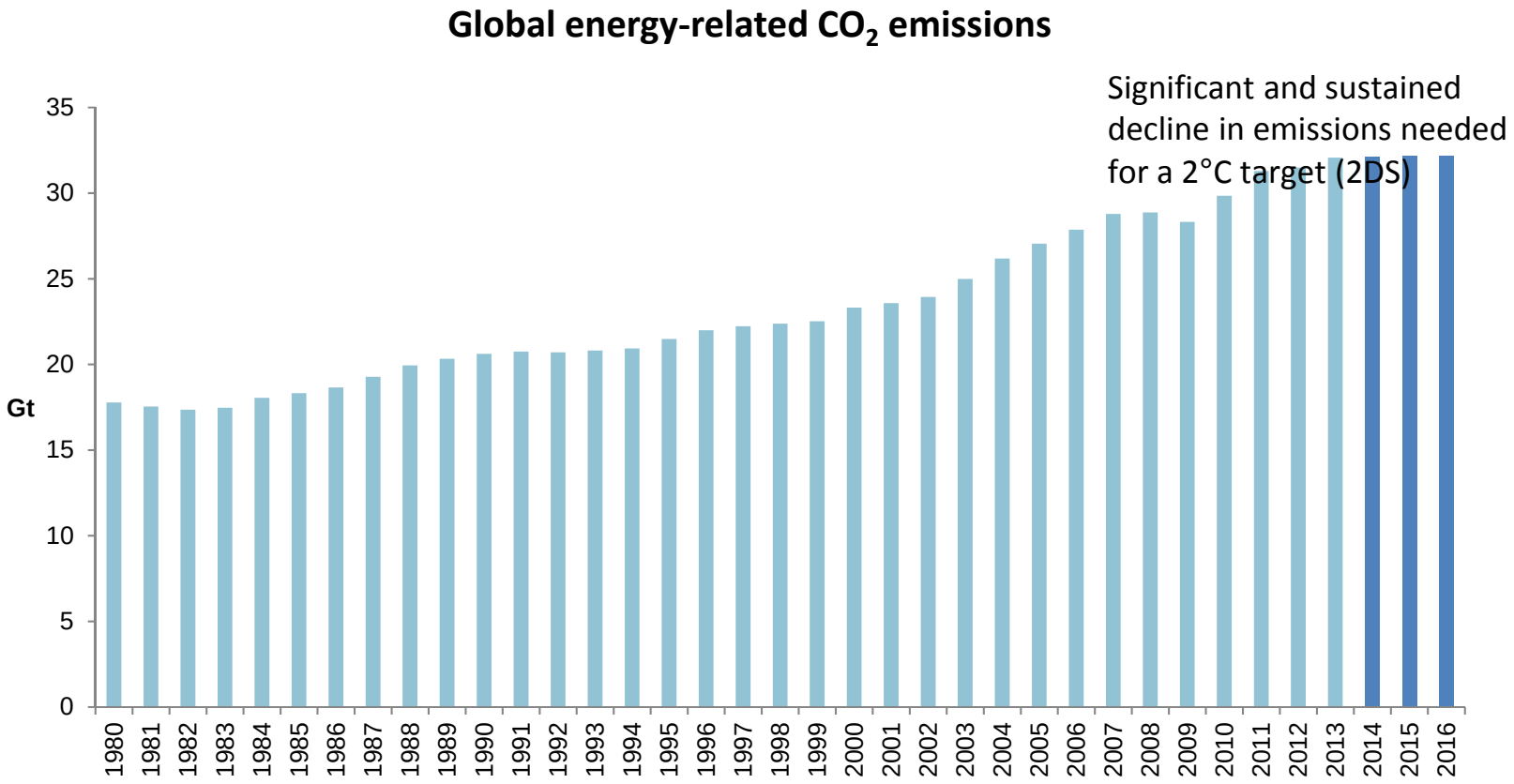
Disseminate our results as widely as possible

# WMO Current Climate Status Report March 2017

- Levels of $CO_2$ 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"

https://public.wmo.int/en/media/press-release/climate-breaks-multiple-records-2016-global-impacts

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




*Three consecutive years of stable emissions alongside global GDP growth*

17 March 2017

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

**Global energy-related $CO_2$ emissions**

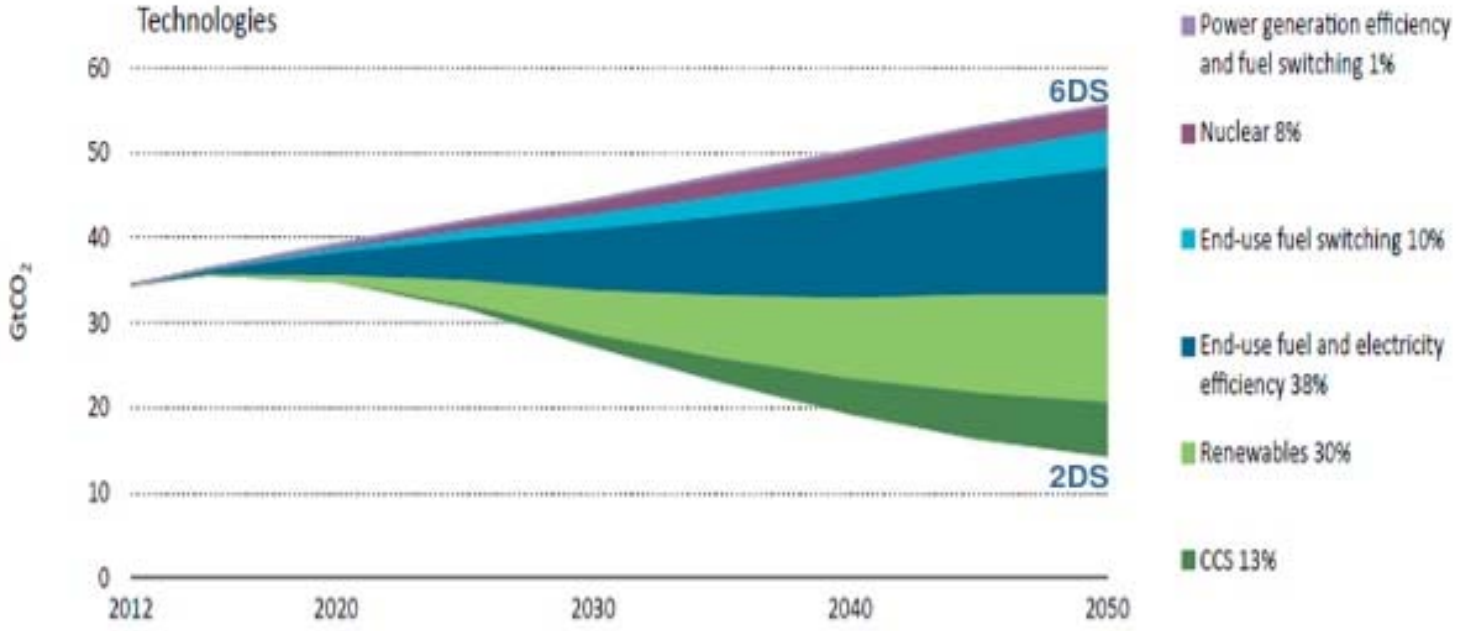

Significant and sustained decline in emissions needed for a 2°C target (2DS)

17 March 2017

# Technology mix for carbon emissions reduction in the 2DS

ETP 2015

Contribution of technology area to global cumulative CO2 reductions




Source: ETP 2015

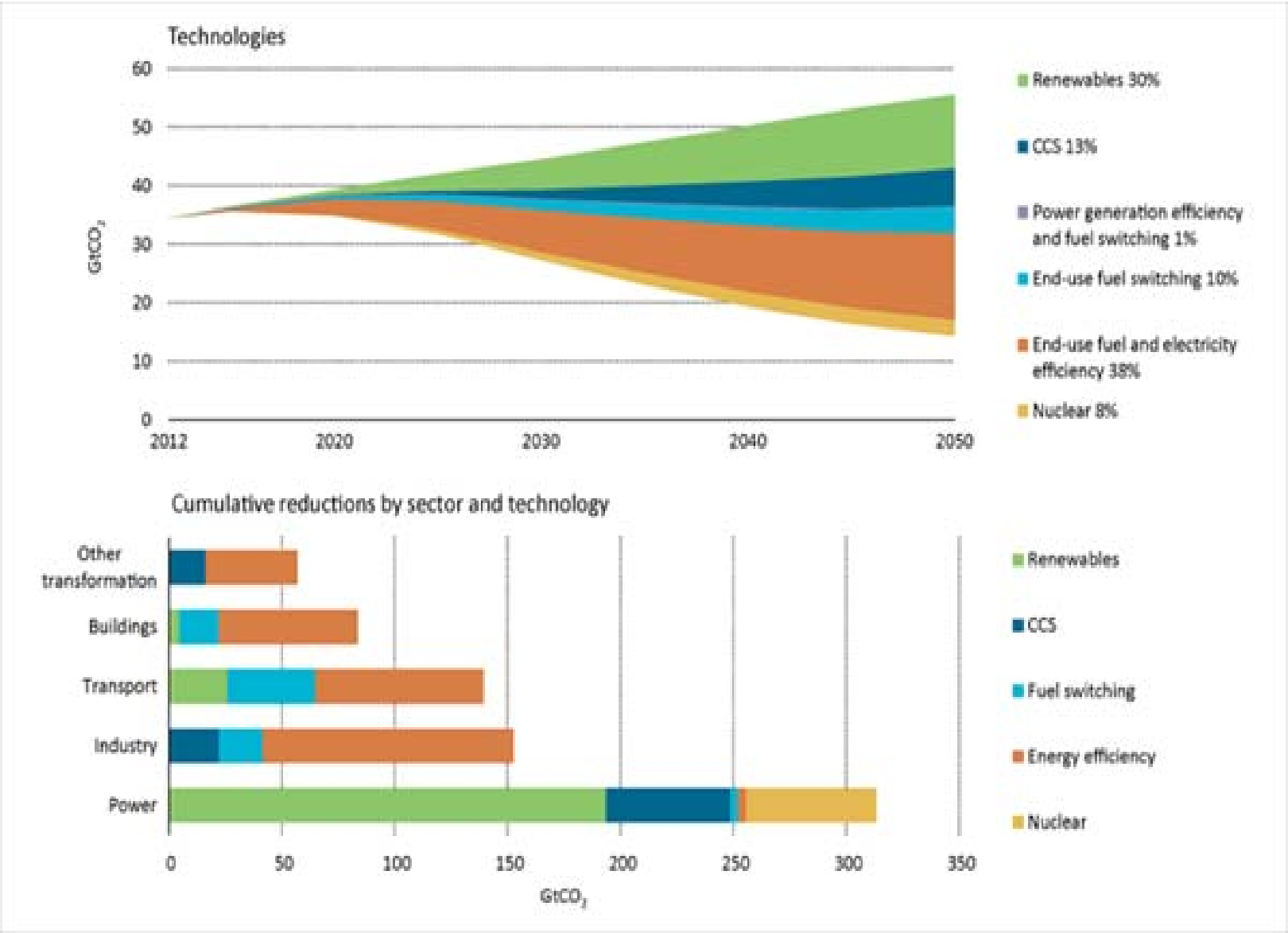
*A portfolio-approach is needed for a least-cost low-carbon scenario*

# CCUS – a key climate policy option

- The IPCC AR5 indicated - CCS is a crucial technology to meet the $2^0$C target
  - *Climate scenarios could not meet $2^0$C without CCS*
  - *The costs of meeting the $2^0$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 $2^0$C target.
- CCS is expected to be an even more crucial technology if we are to achieve below $2^0$C target.

# CCS – a key climate policy option (2)

- To go below $2^0$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 - $CO_2$ 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,
  - $CO_2$ capture capacity of ~ 8 Mtpa.
- 11 more large-scale CCS projects are in earlier stages of planning
  - $CO_2$ capture capacity of ~21 Mtpa.

**Source: Global CCS institute**

# CCUS Deployment

## Power Sector

- Boundary Dam – Canada
  - >1.3 captured
- NRG Parish (USA)
  - Largest capture unit to date
- Kemper County (USA)
  - Due on stream 2017
- OsakiCoolGen
  - IGCC unit operational
  - $CO_2$ 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 $CO_2$
  - Financial support to demonstration projects
  - $CO_2$ pipeline infrastructure plus regulation
- CO2-EOR developments
  - Offshore CO2-EOR at Lula, Brazil
  - On-shore CO2-EOR taking off in Gulf States
    - Pilot project in Saudi Arabia
    - Emirates Steel first mover project in UAE
    - 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

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