GHGT-13 SUMMARY

John Gale
GHG TCP

71st WPFF

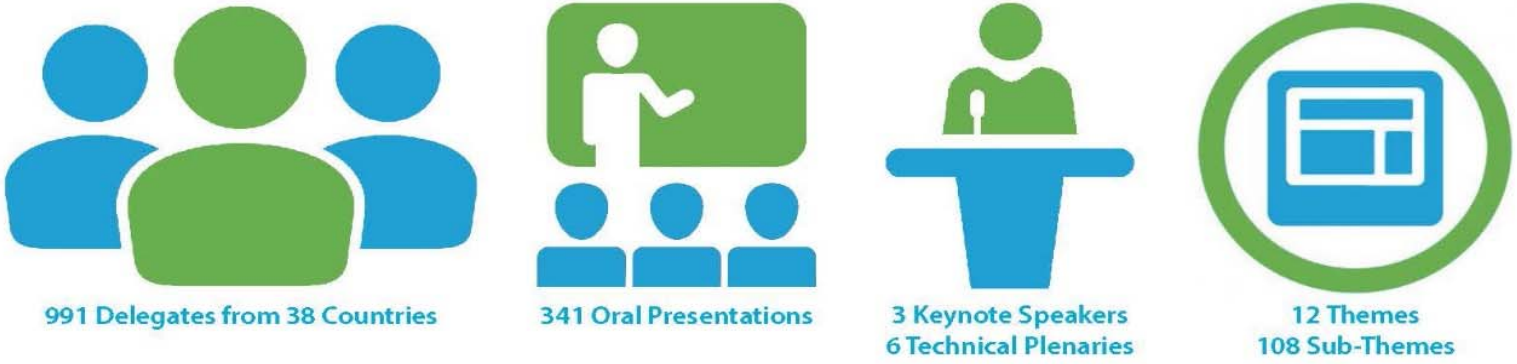
15-16th December 2016

Paris, France

Conference Framing

- Paris Agreement now ratified, committing ourselves to achieving to temperature target of below 2^0C.
- CCS identified as a key mitigation technology option by the UNFCCC to get to 2^0C.
- CCS will be more important in a below 2^0C world
- Negative emission technology like BioCCS will also be critical post 2030
- COP22 underway to start the drive for more stringent mitigation action by countries
- Important for conference to demonstrate that CCS is ready to be implemented at the scale needed

GHGT-13 Statistics



Story of GHGT13 by Tweets @ https://storify.com/ukccsrc/ghgt-13

Opening Plenary Lectures

- Launch of "20 Years of CCS" - Kamel Ben Naceur, IEA
- "CCS the Time is Now" - Trude Sundset, CEO Gassnova
  - Outlined plans for three FEED studies for CCS on industrial units (incinerator, cement, fertiliser plant)
  - Offshore storage and transport using ships
  - Operational by 2020
- Climate Change: Too late for 2°C? - Prof Thomas Stocker, University of Bern
  - Warming is unequivocal
  - The CO_2 budget will be exhausted by about 2035.
  - By 2035, the 2°C target will be lost.
  - We need a new industrial revolution with decarbonisation and sustainability at its core, CCS one of a number of key technologies

All presentations at: http://www.ghgt.info/ghgt-13/ghgt-13-programme/item/plenary-sessions-4

Demonstration Projects

Key Points

- Boundary Dam and Quest Projects operating for over one year both captured 1Mt CO_2 to date
- Sleipner now injecting for 20 years – 19Mt CO_2 stored
- Boundary Dam, Sleipner and Quest both had strong government support
- Boundary Dam and Kemper Projects both use coal which has predictable long term costs
- Quest, Sleipner and Tomakomai projects are injecting into saline aquifers (onshore and offshore)
- Boundary Dam and Kemper Projects business models based on sale of products (CO2-EOR, ash & sulphur)
- Jubail Industrial City, CCUS project sells CO_2 for EOR and uses CO_2 to produce methanol and urea

Demonstration Projects

Capture Equipment

- Quest – equipment manufactured off site and assembled as modules on site
  - Cansolv capture process
- Boundary Dam – Cansolv CO_2 and SO_2 scrubbers assembled on site
- Kemper – Selexol unit built to cost, manufactured offsite and transported by road
- Jubail Industrial City, Linde capture technology
  - First capture unit on an ethylene glycol plant – 500, 000Mt CO_2 pa

Public communication

- Quest, Kemper, Boundary Dam and Tomakomai projects have active public communication/engagement programmes
  - Tomakomai – monitoring data broadcasted in Council Offices

New tools and data sets

- Scaling up Carbon Capture Pilots
  - Scale up of capture technologies is important to demonstrate lack of risk to investors
  - Testing at 10tpd scale at Mostad is expensive
  - New computational and simulation tools developed by USDOE will be used to assist scale
- Data sharing opportunities launched see:
- http://www.ieaghg.org/publications/blog/119-meetings-and-conferences
  - Geoscience Australia and the CO2CRC released their data from their Ginninderra Controlled Release Facility
  - The CO2 Storage Data Consortium (CSDC) is a new international collaboration for sharing reference datasets from CO_2 storage projects in deep saline formations

Summary of key learnings

- Capture
  - Cansolv technology new industry benchmark for technology comparison
  - Several 2nd/3rd generation amine based technologies have advanced to pilot plant testing
  - 3rd generation alternative solvents showing promise to further improve energy and cost performance of amine systems
- CCS Value
  - Modeling of CCS integration into power systems clearly shows the value of flexible CCs technology
- CCS reduces air pollution as well as CO_2 emissions
  - "Double whammy"
- CCS only technology to allow fossil fuels to be used without exceeding carbon budget.

Summary of Key Learnings

- Storage
  - Significant advances in the understanding and quantification of CO_2 trapping mechanisms presented
  - Leakage should be effectively zero in the vast majority of projects; where leakage happens, it is likely to be episodic (e.g. well blow-out) and detectable
  - The benefits of 20 years of experience and investment in CO_2 storage is paying huge dividends in the advancement of knowledge and capacity to implement CCS at scale
- Transport
  - More focus on ship transport to start off CCS
  - Public or public/private investment needed

Hot Topics

CO2 Use/Utilisation

- Subject of "lively" Panel Discussion
- General consensus – utilisation is **NOT ALWAYS** mitigation
  - CO_2-EOR is the leading form of CO_2 utilisation and has the potential to store permanently some CO_2, it is a mitigation option
  - Chemical products (methanol and urea) do not permanently store CO_2 and therefore are not mitigation options
  - Some CO_2 based polymers could conceivably last for 50-100 years but that is still not long enough as a mitigation option.
  - Mineralisation is a niche opportunity at very best it is CO_2 neutral only
- Expecting large amounts of free renewable energy to be available to convert industrial CO2 to chemicals is improbable.
- CCU can contribute to new infrastructure
  - Capture plant on new industrial processes
    - Waste incinerator, Saga City Japan (10tpd CO2 unit, Toshiba amine technology)
    - Ethylene Glycol plant, Saudi Arabia
  - Not likely to lead to extensive pipeline network in Europe

Hot Topics

BioCCS and Negative Emission Technologies

- Discussion panel co-hosted by Bellona
- General Consensus/Policy messages:
  - BioCCS combines the use of sustainably sourced biomass with the permanent storage of CO_2
  - BioCCS, allows for the net decrease of CO_2 in the atmosphere
  - BioCCS is a key negative emission technology
  - Negative emission technologies will be essential to meet the post Paris below 2^0C temperature target

More details at:

http://bellona.org/news/ccs/2016-11-bellona-co-hosts-bio-ccs-workshop-in-lausanne

Driving CCS in a <2^{0}c

Closing Panel – moderator John Gale (IEAGHG)

- J-F Gagne (IEA), Tim Bertels (OGCI), Jonas Helseth (EU ZEP), Jarad Daniels (USDOE),

Outcomes/Key messages

- Incentives needed to drive projects
- Infrastructure needed to transport/store CO_2
- Innovation needed to drive down costs
- Industry needed to develop storage potential
- Information needs to be better framed

Get this right we can drive Implementation

More information

- On GHGT-13 @www.ghgt.org
- Blogs from GHGT-13 @www.ieaghg.org
- Summary report to be published in new year
- On-line Proceedings to be published in Feb 2017