Potential for CCS in the Iron and Steel Sector

John Gale
General Manager
IEA Greenhouse Gas R&D Programme

Seminar on Reducing the Footprint of the Iron and Steel Sector,
Zaandam – Petten, NL,
19-20th April 2017

www.ieaghhg.org
• 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”

IEA Global Emissions Peaked

Global Carbon Dioxide Emissions, 1980-2016
CCUS – a key climate policy option

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

- Falling emissions “as soon as possible” (Art. 4.1)
- Comparison point for least-cost 2°C target paths: 40 Gt (Art. 4.1)
- Net zero emissions 2050–2100 (=balance between anthropogenic emissions and sinks in second half of the century (Art. 4.1))
CCS – a key climate policy option (2)

• To go below $2^0C$ 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.
Rationale for CCS: Only large-scale option for many industries

Figure 1. Global emissions from the seven most CO₂-intense industrial sectors in the IEA *Energy Technology Perspectives* analysis

CCS is the only large-scale mitigation option for many industrial sectors.
Iron and Steel Production Routes

Source: World Steel Association
ThyssenKrupp Steel Europe – Main CO₂-Emitters (schematically) up to 20 mio t CO₂ p.a.
IEAGHG Iron and Steel Sector

CCS activities

• 1st Steel industry CCS workshop with VDEH in Germany in November 2011

• Techno-economic assessment of CCS in steel sector 2013
  • Included a case evaluating Oxy-Blast Furnace with TGR & MDEA CO2 Capture

• Overview of the current state and future development of CO2 capture technologies in the Iron Making Process, TR3, April 2013

• 2nd Steel industry CCS workshop in Japan November 2013 – collaboration with WSA and IETS
The 4 ulcos process routes

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Note report on ULCOS TGRBF work can be found at:
Oxy-Blast Furnace Operation

(Picture of OBF courtesy of Tata Steel)

CO₂ avoided
$56/t
Summary

- CCS can play a significant role in reducing industry CO₂ emissions
- The blast furnace route offers the biggest potential for iron and steel sector emissions reduction
- IEAGHG studies have shown that OxyBF with TGR and CO₂ capture can offer a cost effective way of reducing CO₂ emissions
  - Proof of concept of this options has been demonstrated at pilot scale
  - The planned large scale tests at Florange in France were cancelled
- Future???
Issues to Consider

- If industry pursues the deployment of CCU we need to understand
  - the global implications wrt to CO2 mitigation
  - and our ability to meet the Paris goals
- CCS deployment in industry will require the development of a CO2 transport infrastructure
  - It is proposed to de-link capture and the transport and storage component to reduce the cost burden on projects
  - Who will finance the infrastructure?
  - EU – will this be the European Commission?
  - In USA, CO2-EOR has helped finance the pipeline network.
Thank you, any Questions?

Contact me at: john.gale@ieaghg.org

Website: www.ieaghg.org
LinkedIn: www.linkedin.com/groups/IEAGHG-4841998
Twitter: https://twitter.com/IEAGHG