

Carbon Capture and Storage – some facts and references

Collation: Indira Mann & Richard Stevenson, SCCS, October 2021

CCS is essential to achieve net zero

CCS complements renewables

CCS can remove large amounts of CO₂ from the atmosphere (gigatonnes per year)

- To have a 67% chance of limiting global temperature rise to 1.5 degrees, from the beginning of 2020 we have an estimated global carbon budget of 400 billion tonnes of CO₂ ... so around 10 years' worth of global emissions. Action taken during this decade will be absolutely crucial. *IPCC Sixth Assessment Report* [12]
- The 1.5 degrees target can only be met with a mix of emissions reduction and negative emissions solutions. Over time, the mix will need to include solutions that use long-term storage with a lower risk of reversal (such as geological storage). *The Coalition for Negative Emissions* [7]
- To contain global warming to 1.5 degrees, we will need to capture and store between 350 and 1200 billion tonnes of CO₂ this century. *Global CCS Institute* [4]
- Carbon capture & storage is recognised by the UN as essential climate mitigation tool. *United Nations Economic Commission for Europe* [1]
- We have long known that CCUS will be an essential technology for emissions reduction; its deployment across a wide range of sectors must now be accelerated. *Lord Stern, Grantham Research Institute* [4]
- Climate action without CCS will require the most radical changes in human behaviour. *Global CCS Institute* [4, paraphrased]
- CCS and CCU will be essential for the European transition to net neutrality, ensuring that power generation and industrial processes are secure, reliable and sustainable. *Zero Emissions Platform* [10]
- CCS supports renewables by reducing embedded emissions in cement and steel production [6]
- [CCS is] ... one of the crucial technologies able to support a renewables-led power system. *Acorn CCS & Hydrogen Project public consultation* [13]
- Humans now emit c. 40 billion tonnes of CO₂ each year. CCS could store 10-30 billion tonnes of CO₂ a year by 2050. *United Nations Economic Commission for Europe* [1]

CCS is technologically proven and operational worldwide

- Current research shows that a CO₂ capture rate of 99.9% could become standard. Work is now under way to bring down costs. [NEWEST CCUS project focus]
- 26 projects worldwide [already] capture c.40 million tonnes of CO₂ per year from
 - natural gas processing
 - chemical production
 - power generation
 - ethanol production
 - fertiliser production
 - iron and steel production*Global CCS Institute [4]*
- 26 CCS projects are operating worldwide, with 38 new projects in the pipeline as of 2021 *Global CCS Institute [4]*
- CCS projects have been storing CO₂ in deep geological storage sites for 50 years *Patricia Loria & Matthew B.H. Bright [3]*
- Norway's Sleipner CCS project has safely stored 19 million tonnes of CO₂ since 1996. *Patricia Loria & Matthew B.H. Bright [3]*
- The pipeline of operating and in-development CCS facilities around the world is growing. *Brad Page, CEO Global CCS Institute [4]*
- [SCCS Global Map](#) for project information

CCS is affordable

- CCS will bring significant economic benefits to the UK's industrial heartlands. *CCSA [2]*
- Expenditure on net zero CCUS projects could reach c.£41bn by 2035, boosting the economies of [the UK's] industrial regions where projects will be built. *CCSA [2]*
- The UK's North Sea Transition Deal expects to create 40,000 direct and indirect jobs in decarbonisation projects. *CCSA [2, paraphrased]*
- CCUS investment [...] should be seen as the cost to society of avoiding unacceptable climate change. *United Nations Economic Commission for Europe [1]*

CCS is necessary to decarbonise industry

CCS is part of a just transition

Scotland and the UK are really well placed for CCS

- The diversity of processes to which CCS is being applied is testament to the flexibility of CCS to remove emissions from industries that are hard to decarbonise. *Brad Page, Global CCS Institute* [4]
- CCS enables the decarbonisation of industrial products such as steel, cement, chemicals, lime, agricultural products etc. CCS remains the only way of permanently removing process emissions from heavy industry. *ZEP* [11]
- CCUS will help to safeguard more than 50,000 jobs in [essential industries] iron, steel, cement, chemicals and refining that could otherwise be at risk. *CCSA* [8]
- The UK has a unique opportunity to become a global leader in CCUS development. *Olivia Powis, CCSA* [2]
- [UKSAP] identified 20 specific CO₂ storage sites (from a potential 579 sites) which together represent the tip of a very large strategic national CO₂ storage resource potential, estimated to be around 78Gt (78,000 million tonnes). The top 15% of this potential storage capacity would last the UK around 100 years. *Energy Technologies Institute* [9]
- CO₂ capture and storage in Scotland could deliver 20,600 jobs in the next decade. *Element Energy report for the Acorn CCS & Hydrogen Project* [5]
- The Scottish Cluster will enable carbon capture deployment across a diverse set of emitters ... Investment decisions could commence in early 2023, commissioning from 2025, capture of 6.7 Mtpa of CO₂ by 2030, and over 23Mtpa longer term. www.thescottishcluster.co.uk

CCS is necessary to decarbonise industry

- Cement and steel are used for buildings, roads and renewables; CCS can tackle their embedded CO₂ emissions. [6]
- CCS allows industry to tackle its emissions at source and remain competitive in a global marketplace. [6]
- CCS enables the decarbonisation of industrial products, such as steel, cement, chemicals, lime, agricultural products etc. CCS remains the only way of permanently removing process emissions from heavy industry. *ZEP* [11]

**R&D is supporting safe, rapid and cost-effective delivery of commercial CCS
Our work inspires the next generation of scientists and industry workforces**

- CCUS technologies have evolved quickly in the last 5 years through testing in multiple R&D pilot projects around the world. *United Nations Economic Commission for Europe* [1]
- R&D projects are supporting the development of safe and cost-effective CO₂ capture, transport and storage and accelerating its delivery at large scale [6]
- A range of communications resources in different media can be found on the following project websites:

[SCCS](#)

[ACT Acorn](#)

[REALISE CCUS](#)

[NEWEST CCUS](#)

[LAUNCH CCUS](#)

[ALIGN-CCUS](#)

[SECURE](#)

[STRATEGY CCUS](#)

[PilotSTRATEGY](#)

[European CCUS Projects Network](#)

[HyStorPor](#)

SOURCES

[1] UNECE report on CCUS: https://unece.org/sites/default/files/2021-03/CCUS%20brochure_EN_final.pdf

[2] Supply Chain Excellence for CCUS report for CCSA: <https://www.ccsassociation.org/ccsa-news/ccus-supply-chain-report-showcases-major-uk-opportunity/>

[3] Lessons captured from 50 years of CCS projects, Patricia Loria & Matthew B.H. Bright <https://www.sciencedirect.com/science/article/pii/S1040619021000890>

[4] Global CCS Status Report 2020, Global CCS Institute <https://www.globalccsinstitute.com/resources/global-status-report/download/>

[5] Element Energy report for Acorn: <https://www.storegga.earth/news/2021/news/scottish-cluster-expected-to-deliver-20-600-jobs-in-the-next-decade/>

[6] Scottish Carbon Capture & Storage messaging

[7] The Case for Negative Emissions, The Coalition for Negative Emissions:
<https://coalitionfornegativeemissions.org/wp-content/uploads/2021/06/The-Case-for-Negative-Emissions-Coalition-for-Negative-Emissions-report-FINAL.pdf>

[8] Economic Analysis of UK CCUS: <https://www.ccsassociation.org/wp-content/uploads/2021/07/Economic-Analysis-of-UK-CCUS-June-2021-executive-summary.pdf>

[9] Progressing Development of the UK's Strategic Carbon Dioxide Storage Resource - A Summary of Results from the Strategic UK CO2 Storage Appraisal Project:
<https://www.eti.co.uk/programmes/carbon-capture-storage/strategic-uk-ccs-storage-appraisal>

[10] ZEP website 'Why CCS?': <https://zeroemissionsplatform.eu/about-ccs-ccu/why-ccs/>

[11] ZEP 'Why CCS?' interactive graphic: <https://zeroemissionsplatform.eu/about-ccs-ccu/why-ccs/>

[12] IPCC AR6, Climate Change 2021 The Physical Science Basis - Summary for Policymakers, August 2021:
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

[13] Acorn CCS & Hydrogen Project public consultation:
<https://theacornproject.uk/acorn-ccs-consultation-2021/>

[14] Carbon Brief analysis of UK CCC Sixth Carbon Budget: <https://www.carbonbrief.org/ccc-uk-must-cut-emissions-78-by-2035-to-be-on-course-for-net-zero-goal>

OTHER REFERENCES

[IPCC FAQ on climate change](#)

[Bellona, FAQs about CCS](#)

[UK Government CCUS – Public Dialogue, July 2021](#)

[UK Committee on Climate Change Sixth Carbon Budget](#)

Scottish Carbon Capture & Storage (SCCS) is a research partnership of British Geological Survey, Heriot-Watt University, University of Aberdeen, the University of Edinburgh, the University of Glasgow and the University of Strathclyde. Its researchers are engaged in high-level CCS research as well as joint projects with industry to support the development and commercialisation of CCS as a climate mitigation technology. www.sccs.org.uk