GLOBAL CCS INSTITUTE

Global Carbon Capture and Storage Institute Ltd

Key Messages

July 2023

Global Carbon Capture and Storage Institute Ltd
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Key messages – July 2023 Update

1. Reaching global climate goals (including the Paris Agreement and net-zero targets) will require a massive scale-up of CCS.

The climate science is clear – to limit warming to below 1.5˚C and avoid the worst impacts of climate change, we need to curtail our global emissions and reach net-zero by mid-century. Carbon capture and storage (CCS) is a pivotal technology that can help the world rise to the urgency of this challenge due to its ability to significantly reduce carbon dioxide (CO_2) emissions at their source and to address CO_2 already in the atmosphere via carbon dioxide removal (CDR) technologies.

Scientists at the Intergovernmental Panel on Climate Change (IPCC) have mapped out different pathways for reaching the world's climate goals and have consistently found that CCS has an important role to play. In the *Special Report on Global Warming of 1.5˚C*[1], the IPCC found that three of the four pathways to reaching net-zero by 2050 involve the use of CCS. This result is echoed in the 2022 *IPCC Sixth Assessment Working Group III on Mitigation (AR6 WG3)*[2], in which most of the pathways identified involve CCS – including the scenario with heavy reliance on renewable energy. The only pathway without CCS would require a (highly unlikely) plummet in global energy demand.

Across the various pathways depicted in the *IPCC Special Report on 1.5˚C*, somewhere between 350 and 1200 gigatonnes (Gt) of CO_2 will need to be captured and stored this century. According to the International Energy Agency's (IEA) Net-Zero Roadmap[3], globally around 7.6 Gt will need to be captured per year by 2050. Currently, the CCS projects in operation have the capacity to capture and store about 50 megatonnes (Mt) of CO_2 per year, meaning the use of CCS must increase at least 100-fold by 2050 to meet the net-zero roadmap laid out by the IEA.

2. There has been a surge of interest in CCS in recent years, but it is not a new technology. It has been used safely and effectively for over 50 years.

While it has only recently started to receive significant policy and financial incentives that have helped it gain traction as a climate solution, CCS is a proven technology that has been used safely and effectively since the 1970s. As of July 2023, there are 37 large-scale CCS facilities in commercial operation, 20 in construction, one with operations suspended and 200 in various

[1] *Intergovernmental Panel on Climate Change, Special Report: Global Warming on 1.5˚C. 2018. https://www.ipcc.ch/sr15/*

[2] *IPCC, Sixth Assessment Report, Climate Change 2022: Mitigation of Climate Change, the Working Group III contribution. 2022. https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/*

[3] *International Energy Agency, Net-Zero by 2050 – A Roadmap for the Global Energy Sector, https://www.iea.org/reports/net-zero-by-2050*

stages of development. The operating facilities have the capacity to capture and store approximately 50 Mt of CO_2 per year.

3. CCS can provide significant emissions reductions in hard-to-abate industries.

Concrete and steel are critical materials for developing and maintaining safe and durable infrastructure, like roads and buildings, but production of cement, iron, and steel calls for high-temperature heat requirements which emit CO_2 and/or involve chemical processes that inherently result in CO_2 production. In a 2020 report on *CCUS in Clean Energy Transitions*[4], the IEA noted that heavy industries account for almost 20% of global CO_2 emissions and that CCUS is the most viable solution (and in some cases the only solution) for reducing emissions from cement, iron, steel and chemicals production.

4. CCS is the conduit to a new energy economy of hydrogen production and CO_2 utilisation.

Hydrogen is likely to play a major role in decarbonising certain hard-to-abate sectors. It may also be important in transportation and flexible power generation. CCS is an important conduit to low-carbon hydrogen production at scale, and can spur hydrogen infrastructure development in the near-term.

CO_2 utilisation is another frontier in the world of CCS that can expand investment in carbon capture technologies and allow businesses to engage in the circular carbon economy.

5. CCS enables technology-based carbon dioxide removal (CDR).

According to the IPCC, all pathways that limit global warming to 1.5C include the use of CDR (both technology and nature-based solutions) in addition to the implementation of emissions reductions. CDR is not a silver bullet, but it can fill a unique gap by addressing historic emissions and residual emissions in hard-to-abate industries and sectors, like aviation for example.

Through shared transport and storage infrastructure, CCS provides the foundation for technology-based CDR such as bioenergy with CCS (BECCS) and direct air capture with carbon storage (DACCS). Hence investment in CO_2 transport and storage infrastructure today will facilitate CDR in the future.

6. CCS reduces emissions from power generation and enhances the reliability of the power grid.

There is no 'one-size-fits-all' solution to reducing emissions from power generation; we need to use <u>all</u> the proven tools in our kit, including CCS. Power plants equipped with CCS can supply flexible low-carbon electricity that complements the variable nature of renewables like solar and wind generation. This is not to say that CCS is a 'free pass' to continue the unabated use of fossil fuels. Rather, CCS enables power grids to decarbonise while maintaining their reliability

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[4] *IEA, CCUS in Clean Energy Transitions*, https://www.iea.org/reports/ccus-in-clean-energy-transitions

and resilience. Moreover, CCS can reduce emissions from recently built coal and gas-fired power stations in the global south that aren't ready for retirement yet and would otherwise continue emitting CO_2 at unsustainable rates.

7. CCS creates and sustains jobs in communities that have historically relied on high-emission industries to support their local economy.

Steel, cement, and fertiliser are commodities and materials that our modern society relies on to sustain crops and maintain safe and reliable infrastructure. While these key commodities and materials are needed, we cannot live with the emissions produced.

CCS has extensive social value in communities that rely on hard-to-abate industries, including steel, cement and fertiliser, where it protects existing jobs, creates new jobs and delivers a just transition for those communities.

One of the main challenges to achieving a just transition is that job losses from high-emissions industries may be concentrated in one place, while low-carbon industrial jobs are created somewhere else. Even where geography is not a barrier, it is rare that mass job losses are followed quickly by large scale opportunities. CCS can help facilitate a just transition in these cases by allowing existing industries to transform into low-carbon opportunities, thereby making sustained contributions to local economies while also moving toward net-zero.

For carbon capture, storage and removals to be scaled up to the levels required, climate justice and concerns of communities need to be central and fully integrated into policymaking at the national and international level.

8. Geological storage of CO_2 is safe and effective, and there are abundant storage resources to support widespread CCS development.

Carbon dioxide storage is the final stage of the CCS value chain and has been done safely and effectively for over 50 years. The main method is geological storage, which involves injecting captured CO_2 into porous rock formations (not caverns) – typically underground at depths of more than 1 km. It uses the same forces and processes that successfully trapped oil and gas (including naturally occurring CO_2) in the Earth's subsurface for millions of years.

Close to 300 Mt of CO_2 has already been successfully injected into storage formations underground[5]. In Norway alone, the Sleipner and Snøhvit facilities store 1.8 Mt per year and have stored more than 26 Mt of CO_2 since 1996.[6] According to the IPCC, CO_2 retained in

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[5] *IPCC, Sixth Assessment Report, Climate Change 2022: Mitigation of Climate Change, the Working Group III contribution. 2022.* https://www.ipcc.ch/report/sixth-assessment-report-working-group-3/

[6] *IEA, Net-Zero by 2050 – A Roadmap for the Global Energy Sector,* https://www.iea.org/reports/net-zero-by-2050

appropriately selected and managed geological reservoirs is likely to exceed 99% retention over 1,000 years.[7]

There is an abundance of potential storage sites globally. Approximately 20,000 Gt of potential CO_2 storage resources have already been identified, including in almost every high-emitting nation[8]. To put that number in context, the IEA's *Net-Zero Roadmap*[9] says that globally around 7.6 Gt will need to be captured per year by 2050.

These aren't just 'potential' storage sites, according to the IEA; new CCS project announcements have increased planned CO_2 storage capacity by 80%[10] in the past year alone.

9. CCS is a financially smart climate solution as costs will continue to decrease with further deployment.

CCS is a versatile technology that can be applied to a variety of emissions sources, enabling a low-cost system solution to reaching net-zero goals. The IPCC's *AR5 Synthesis Report on Climate Change*[11] found that it would cost, on average, more than twice to reach global climate goals without the deployment of CCS. It is also important to consider the steep costs of failing to meet global climate goals and experiencing the worst impacts of climate change versus the cost of deploying CCS and other proven climate technologies.

Moreover, learning rates and economies of scale will continue to drive down costs further as successive CCS facilities come online. One way to mitigate financial and operational barriers is through the development of CCS networks, an increasingly popular model for deployment that allows for multiple CO_2 sources to share transport and storage infrastructure, reducing both risks and costs.

10. Recent global policy developments are accelerating the deployment of CCS, but additional incentives are needed to scale CCS deployment at the pace necessary to meet global climate goals.

The total potential capture capacity of CCS facilities operating and in development has grown by 44% in the past year, according to the Institute's 2022 Global Status Report[12]. Recent global policy developments, such as the Inflation Reduction Act/45Q tax credit enhancements in the United States and the Green Deal Industrial Plan and EU Innovation Fund in Europe, are a

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[7] *IEA, https://www.iea.org/reports/ccus-in-clean-energy-transitions*

[8] Global CCS Institute, Storage factsheet

[9] *IEA, Net-Zero by 2050 – A Roadmap for the Global Energy Sector, https://www.iea.org/reports/net-zero-by-2050*

[10] *IEA, https://www.iea.org/commentaries/how-new-business-models-are-boosting-momentum-on-ccus*

[11] *IPCC, https://www.ipcc.ch/report/ar5/syr/*

[12] *2022 Global Status Report, https://status22.globalccsinstitute.com/*

significant factor in this growth, but more is needed. The use of CCS must increase at least 100-fold by 2050 in order to reach net-zero emissions, which is going to require significant investment from both the public and private sectors, and additional financial and policy incentives.

Policy priorities for governments involve defining the role of CCS in national reduction targets, recognising the long-term value of geological storage of CO_2, developing specific CCS laws and regulations, facilitating establishment of CCS networks, and creating conditions for investment.