IEA CLEAN COAL CENTRE

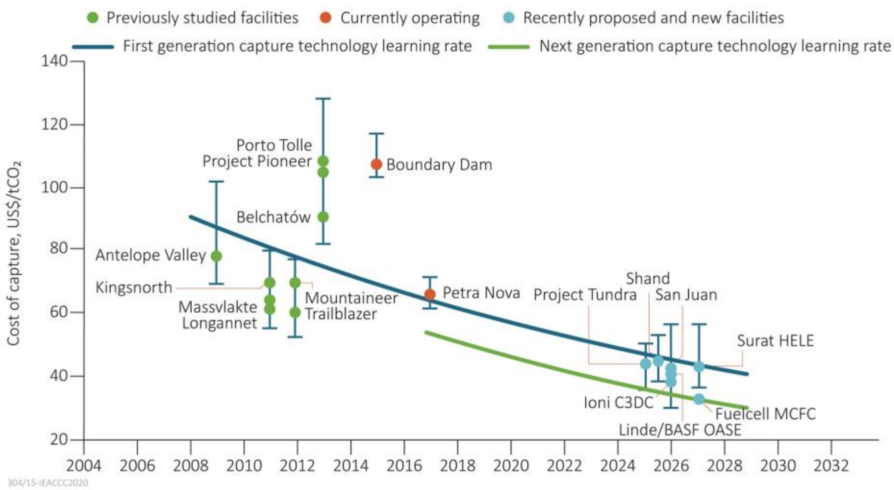
EXECUTIVE SUMMARY
NO 304 – JULY 2020

CARBON CAPTURE UTILISATION AND STORAGE – STATUS, BARRIERS AND POTENTIAL

The case for CCUS – Fuel power generation fitted with CCUS is a key part of the transition to a net zero CO_2 emissions future. The International Panel for Climate Change has shown that excluding CCUS from the portfolio of technologies to reduce emissions would double the cost. Around 170 GWe of coal-fired power generation with CCUS will be needed by 2050 to limit global temperature rise to 2°C or below. The Asia Pacific region accounts for more than 50% of global CO_2 emissions and should become a key focus for the roll-out of commercial CCUS.

CCUS technology status – The elements of the CCUS technology chain are in place for commercial deployment, indicating that the barriers to widespread large-scale deployment of CCUS are not technical. Several other next generation technologies that could provide step change cost reductions and increase efficiency are being researched and developed and could in time be on the market.

The cost of CCUS, which is probably the single most important lever for wide-scale roll-out of the technology, has reduced significantly. Recent project studies including the Shand FEED study predict CO_2 capture costs at around 43–45 US$/t$CO_2$ removed cost, within a proposed timescale for commencement of plant operations by 2024-28. Further cost reduction can be expected through 'learning by doing' where perhaps 50–70% cut could be achieved from the current cost of around 65 US$/t$CO_2$, as the technology is rolled out commercially.



Levelised cost of electricity for large-scale coal power generation plant with post-combustion CO_2 capture

Availability of the power plant was an issue in the early CCUS demonstrations, but it has now reached acceptable levels. For example, the Boundary Dam CCUS facility has increased its availability to around 85% over the last two years, in line with the facility's design availability of 85%.

CCUS capture levels will need to increase from the current 85–90% to closer to 100% to allow the power plants to continue to operate in a net-zero emission future as any residual CO_2 emissions from CCUS facilities will not be compliant without offset from negative CO_2 emissions elsewhere. Where auxiliary plant are used to provide steam and energy for the CCUS facility, they will also need to include CCUS to achieve very high capture levels overall.

Next steps – Despite the cost reduction that has been achieved to date, CCUS has been deployed in relatively few countries and in general has relied on the revenue stream from enhanced oil recovery (EOR). While this has enabled the first demonstration projects to get off the ground, the policies currently in place are insufficient and further actions need to be taken.

More positive carbon price signals need to be sent to drive the growth in CCUS. Whether the carbon price is effectively valued through carbon emitted, emissions trading schemes or tax credits on the amount of CO_2 stored, the value needs to be around 40–80 US$/t$CO_2$ by 2020, increasing to 50–100 US$/t$CO_2$ by 2030. Currently, less than 5% of global CO_2 emissions have a carbon pricing regime which is consistent with this, a notable initiative being the 45Q tax credit system in the USA which provides 50 US$/t$CO_2$ for geological storage or 35 US$/t$CO_2$ for EOR by 2026.

The 'hub and cluster' approach enables the sharing of transport and storage networks which can improve the economics of CCUS due to economies of scale and overall de-risking of storage liability and cross-chain issues. There is however likely to be an initial investment barrier to the hub and cluster infrastructure where the balance of risk and return is insufficient for initial private sector investment. Here, governments should consider taking this role to kick-start development with the option of privatising the business after it has gained sufficient CO_2 source and sink 'customers'.

The availability of debt financing for CCUS projects needs to increase significantly, with banks having a critical role to play. To qualify for debt financing, CCUS projects will need to provide assurance that key risks are identified with mitigations in place and that 'hard-to-manage' risks are allocated to government in the short term. The cost of debt will need to reduce from the current 14–15% level to below 10% in the medium term, as successive CCUS projects are able to address risk and drive down the cost of debt risk premium.

System/network operators need to recognise the auxiliary services such as reactive power and frequency response provided by coal powered plant and allow for financial compensation for these services. Such services will become increasingly important as the share of non-dispatchable renewable power sources, primarily wind and solar, increase in global power systems. The integration of a CCUS facility must therefore not adversely affect the power plants ability to provide these services.

Compliance with SDGs – CCUS is a key technology contributing in particular to SDG13 – Climate Action, as part of the transition to a net-zero CO_2 emissions future. A combined approach of limiting global temperature rise, whilst providing access to reliable and affordable energy to support economic development and improved living standards should be pursued.

Each executive summary is based on a detailed study which is available separately from www.iea-coal.org. This is a summary of the report: Carbon capture utilisation and storage – status, barriers and potential by Greg Kelsall, CCC/304, ISBN 978-92-9029-627-0, 93 pp, July 2020.