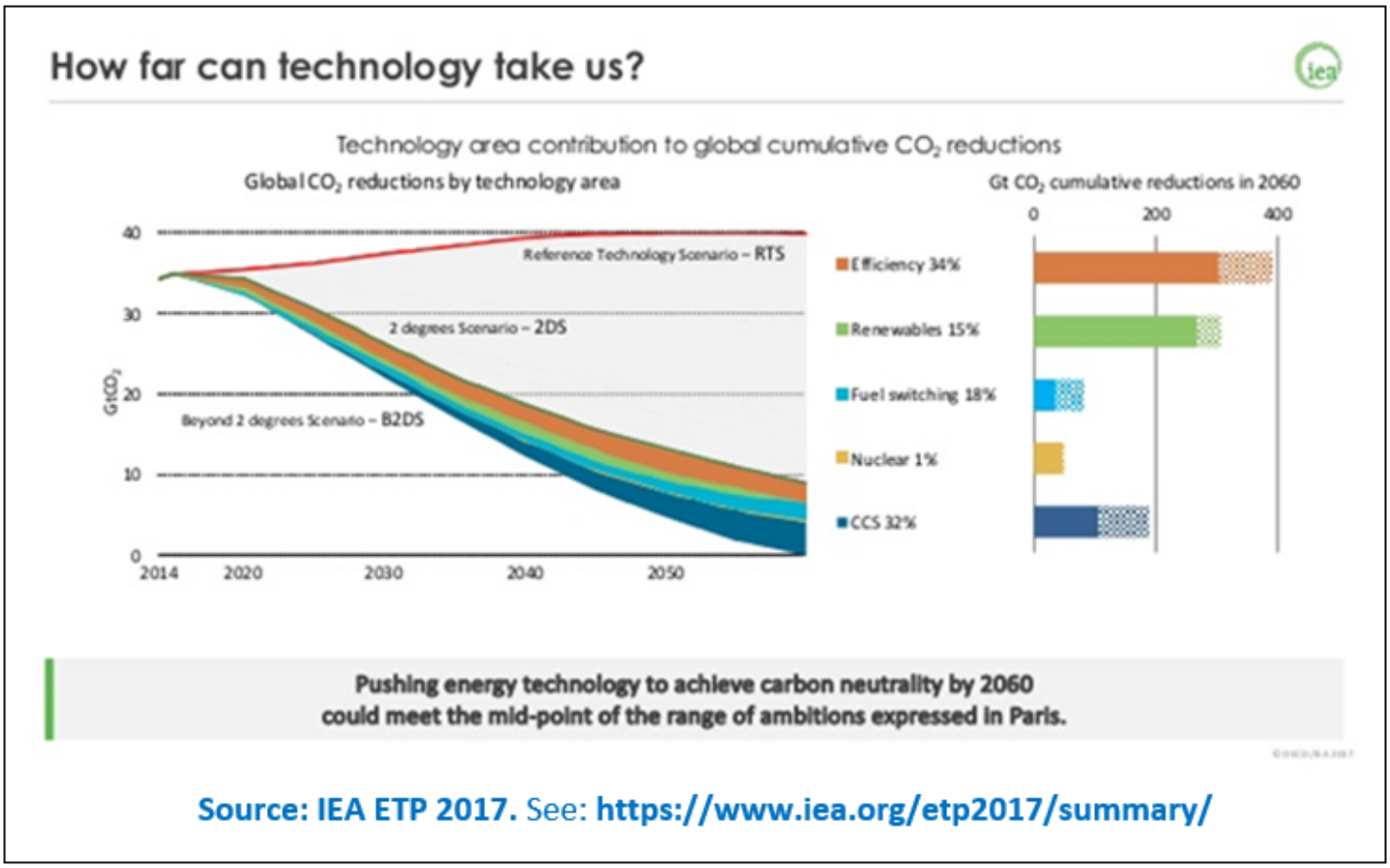
CCS Technical Status Brief – October 2017

The IEA Greenhouse Gas R&D Programme (IEAGHG) is part of the IEA's Energy Technology Network and its role is to assess the potential to mitigate greenhouse gas (GHG) emissions from the use of fossil fuels in the power, oil and gas and industry sectors. The IEAGHG's remit covers all greenhouse gases but we focus on research activities primarily on assessing CO_2 mitigation options. Of the CO_2 mitigation options, Carbon Capture and Storage (CCS) is considered to offer the most potential for CO_2 mitigation from the use of fossil fuels across the sectors we consider. Further details of the activities of the IEA Greenhouse Gas R&D Programme can be found on our website at **www.ieaghg.org**.

This CCS Technical Status brief has been prepared to summarise key technical developments on CCS in the last 6 months, identified by IEAGHG providing information for both its members and the broader community. The IEAGHG provides reports and webinars, those directly relevant to this brief are referenced at the end of the document.

Role of CCS More Important in Below 2°C World

The IEA's 2017 ETP report[1] has confirmed that the global power sector can reach net-zero emissions by 2060 under its Below 2 Degree C (B2DC) scenario. This will require a scaled up deployment of a portfolio of low carbon technology including a 32% share by CCS (up from 14% under the 2DS scenario). There is also a 2% contribution from BioCCS under the renewables component.



Source: IEA ETP 2017. See: **https://www.iea.org/etp2017/summary/**

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BioCCS Plays a Significant Role in the B2DC Scenario[1]

Negative emissions become increasingly critical under the IEA's B2DC scenario. BIoCCS delivers almost 5Gt of negative emissions by 2060. These reductions, the IEA state, are key to the energy sector becoming emissions-neutral by 2020. Scaling of BioCCS deployment, both in the sustainable biomass supply chain and CCS, both pose significant challenges to allow this potential to be realised.

Demonstration Projects Reach Notable Capture and Storage Milestones

The Boundary Dam 3 CCUS Project in Saskatchewan, Canada had captured nearly 1.6 Mt CO_2 by August 2017 before its scheduled shut-down[2]. The CO_2 is typically sold for EOR operations; however, over 100,000 tonnes of CO_2 have also been injected into a deep saline reservoir 3.2 km below ground, and monitored.

The Air Products Industrial CCUS Project has operated continuously since start up in early 2014. To date, over 4 Mt of CO_2 have been supplied for EOR operations in Texas USA where its storage is monitored[3]. The project uses vacuum swing adsorption technology to capture the CO_2, the first application of this capture technology at this scale in the world.

The Quest CCUS Project began operation in November 2015 and, since then, it has captured and safely stored over 2.6 Mt CO_2[4]. The project captures CO_2 using an amine-based capture technology. The CO_2 is transported via an 80 km pipeline to the storage site where it is injected and permanently stored in a saline reservoir more than 2000 m underground.

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Can CCS Deployment Match Road Map Requirements?

The IEA CCS roadmap show a steep curve for CCS industry build-out top 2030 and beyond. IEAGHG commissioned a study that compares the anticipated CCS build-out rates with those achieved in other sectors. This has shown that comparable build-out rates have been achieved in industry to those required for CCS, if sufficiently strong incentives for a technology are established[5].

Retrofitting CCS in Refineries

CCS in refineries is a new industry option studied by a multi-partner research team in which IEAGHG participated. The study focused on a range of refinery options typical of the European refining sector. The study showed that it was technically feasible to retrofit CCS into refineries, with capture rates of up to 75% typically of total emissions. Costs were high (150-210 $/t CO_2 avoided) but opportunities to cut costs were identified for subsequent work on this topic[7].

Ensuring Storage Integrity

The geological strata above a storage reservoir ("the overburden" can serve to both hinder and help migration out of any storage reservoir. The study therefore aimed to better inform risk assessments for CO_2 storage sites by providing relevant information on the effect of large-scale features associated with natural fluid migration analogues in the overburden[8]. New CO_2 storage sites can then be selected to minimise the likelihood and effects of migration out of the subsurface thus ensuring storage site integrity.

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Significant Progress in Post Combustion Capture Observed

The IEAGHG organised to 4th Post Combustion Capture Conference at the National Carbon Capture Centre (NCCC) in the USA in September. The conference tracks progress made and developments on post combustion capture worldwide[6].

Attendees at the NCCC Tour

Post-combustion capture using amine solvents remains the most mature carbon capture technology. New research on Temperature swing adsorption (TSA) was presented which is a promising process, with low regeneration energy requirements compared to amines. PCCC4 saw the development and characterisation of new membrane materials described. Innovative hybrid systems, such as membrane absorption, membrane plus nanoparticles, or membrane contactors were also presented. Common to all post-combustion systems presented at PCCC4, it is expected that a combination of novel systems and new configurations will be the key for the next generation of lower cost CO_2 capture plants.

Further Reading

1. https://www.iea.org/etp2017/
2. http://www.estevanmercury.ca/news/business-energy/bd3-carbon-capture-up-and-running-after-three-months-down-1.22737268
3. https://energy.gov/fe/articles/doe-supported-co2-capture-project-hits-major-milestone-4-million-metric-tons
4. http://www.shell.ca/en_ca/about-us/projects-and-sites/quest-carbon-capture-and-storage-project/carbon-capture-and-storage.html
5. http://www.ieaghg.org/publications/technical-reports/49-publications/technical-reports/802-2017-tr6-ccs-industry-build-out-rates-comparison-with-industry-analogues
6. http://www.ieaghg.org/docs/General_Docs/PCCC4/PCCC4_Summary.pdf
7. http://www.ieaghg.org/publications/technical-reports/49-publications/technical-reports/819-2017-tr8-understanding-the-cost-of-retrofitting-co2-capture-in-an-integrated-oil-refinery
8. http://www.ieaghg.org/publications/technical-reports/129-publications/new-reports-list/817-2017-08