WORLD COAL ASSOCIATION

DRIVING CCUS DEPLOYMENT

THE PATHWAY TO ZERO EMISSIONS FROM COAL

Executive Summary

CCUS: where are we?

- Leading international organisations have identified carbon capture, use and storage (CCUS) as a key technology needed to meet the goals of the Paris Agreement. In 2017, the International Energy Agency (IEA) estimated that 14% of greenhouse gas reductions by 2060 will have to come from CCUS in order to meet a 2°C pathway.

- Coal stakeholders together with a range of partners, both public and private, are actively seeking to advance CCUS deployment globally. As of 2018, 21 large-scale CCUS projects are operating or under construction globally.

- CCUS accounts for a third of emission reductions in the IEA's Beyond 2°C Scenario. The Intergovernmental Panel on Climate Change (IPCC, 2014) reported that meeting a 2°C goal would be 138% more expensive without CCUS. Most pathways in the latest IPCC special report depended on CCUS deployment.

- However, according to the Global CCS Institute (GCCSI), over 2732 large-scale CCUS facilities will be needed by 2050 to reach the Paris targets. This equates to 90 facilities entering operation each year between 2020 and 2050.

CCUS: where do we want to go?

- Multiple independent forecasts show that coal (and other fossil fuels) will continue to play a significant role in the energy mix for decades to come. This is particularly true in developing and emerging economies in Asia and Africa where coal is essential to enhancing energy security, supporting energy access and powering industrial development.

- Action to advance CCUS requires an international commitment with a broad constituency of support. This commitment must be backed by meaningful policies and associated incentives that enable a deployment trajectory consistent with limiting global warming to well below 2°C.

How do we get there?

1. **Broaden support for CCUS by highlighting its role in meeting the long term goals of the Paris Agreement**

2. **Establish well-designed legal and regulatory regimes that support CCUS**

3. **Mobilise finance to boost CCUS opportunities**

4. **Undertake research and development to advance the next generation of CCUS technologies**

Driving CCUS deployment – the pathway to zero emissions from coal

In the lead-up to COP24, in the collaborative spirit of the Talanoa Dialogue, the World Coal Association (WCA) calls for a renewed international commitment to advance CCUS. This paper seeks to advance this objective by providing coal industry inputs into the three central questions of the initial stocktaking exercise –

1. Where are we?
2. Where do we want to go?
3. How do we get there?

Engagement in the international policy process

WCA is the global voice for the coal industry. It is formed of coal producers, allied companies and national industry associations. Our membership is global in nature, covering the world's major producing and consuming regions.

The WCA works to demonstrate and gain acceptance for the fundamental role low emission coal technology plays in achieving a sustainable and low-carbon energy future. WCA regularly represents the global coal industry at high-level international events on energy, sustainable development and climate change. We hold –

- Special Consultative Status with the United Nations Economic and Social Committee (ECOSOC);
- Observer status with the United Nations Framework Convention on Climate Change (UNFCCC);
- Observer Status with the Intergovernmental Panel on Climate Change (IPCC);
- Membership of the United Nations Climate Technology Centre and Network (UNCTCN);
- Membership of the International Energy Agency (IEA) Coal Industry Advisory Board (CIAB);
- Signatory status to the UN Global Compact (UNGC);
- Association membership of the International Council on Mining and Metals (ICMM); and
- Memoranda of Understanding with the United Nations Economic Commission for Europe, ASEAN Centre for Energy and BetterCoal.

WCA has responded positively to the Paris Agreement, seeing it as an opportunity to renew commitments to financing low emission technologies. WCA called on the UNFCCC's finance and technology mechanisms to support countries in implementing all aspects of their climate pledges.

The WCA has been clear that deploying low emission coal technologies, including CCUS, will ensure that energy and climate change challenges are addressed as integrated priorities.

In 2014, supporting this view, the IPCC found that meeting a 2°C goal would be 138% more expensive without CCUS[1]. In the latest IPCC report released in October 2018, most pathways to well below 2°C relied heavily on CCUS, including negative emissions from bioenergy[2]. In fact, a third of the incremental emission reductions to go from 2°C to 1.5°C will have to come from deployment of CCUS in a variety of applications[3].

Since COP21, WCA has called on governments to move quickly to support CCUS deployment by promoting policy parity alongside other low emission technologies.

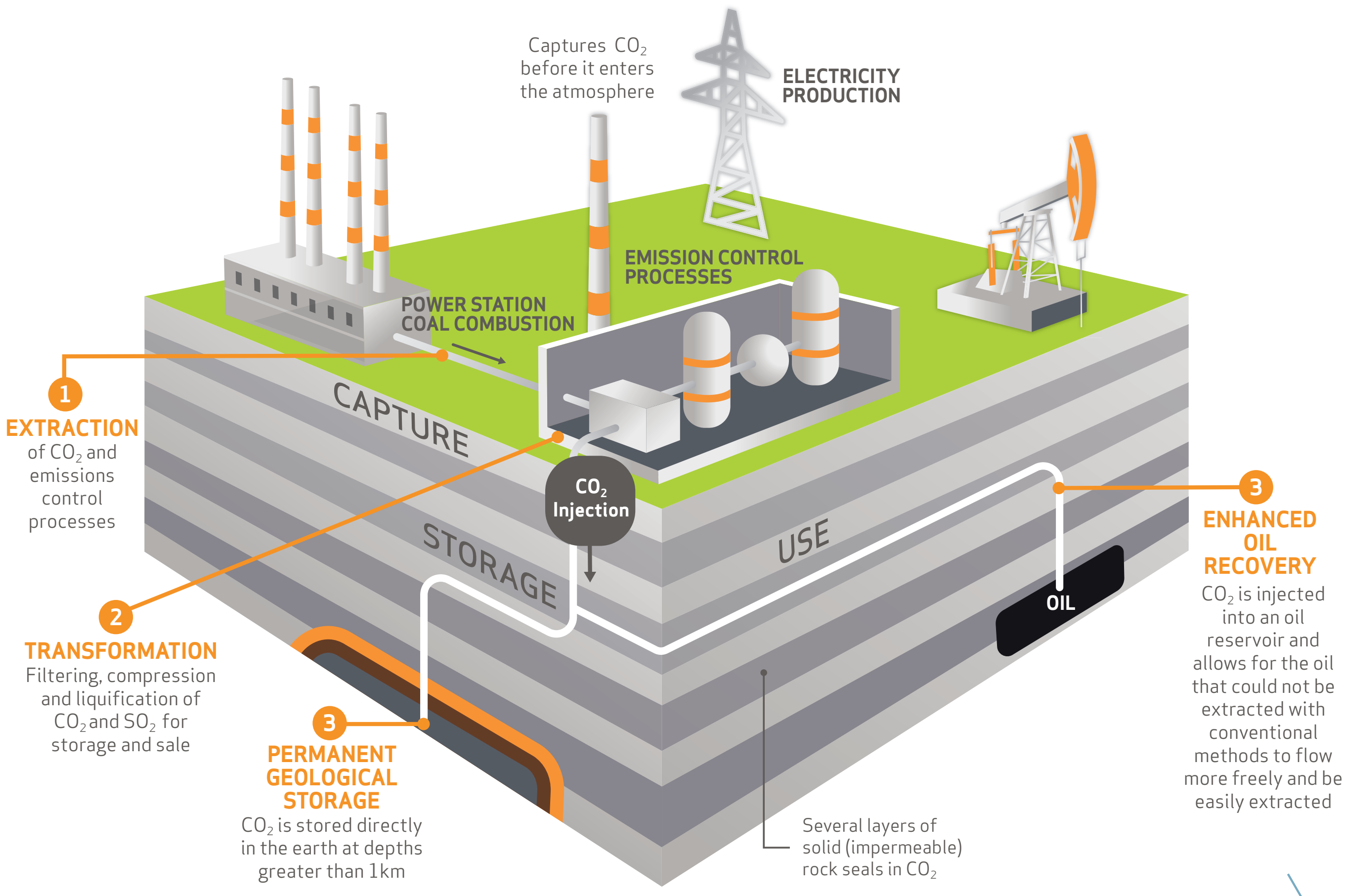
> In 2014, the IPCC found that meeting a 2°C goal would be
> **138%**
> more expensive without CCUS

1. CCUS – where are we?

CCUS is widely recognised as a vital technology required to meet the goals of the Paris Agreement. Together, industry and government have proven first-generation CCUS technologies with 17 large-scale projects operating globally[4]. Another four projects will enter operation by the end of 2018. Combined, these projects have a CO_2 capture capacity of 37 million tonnes per annum (Mtpa) – the equivalent of eight million cars removed from the road each year[5].

Coal stakeholders together with a range of partners, both public and private, are actively seeking to advance CCUS deployment globally.

Demonstration of how CCUS works



Adapted from SaskPower graphic

North America

Canada

In October 2014, the Boundary Dam project came online as the world's first power station to successfully use CCUS technology. The USD 960 million public-private refurbishment programme retrofitted an aging unit at the Boundary Dam power station in Saskatchewan into a reliable, long-term producer of coal-fuelled power, capable of capturing up to one million tonnes of CO_2 each year[6]. The captured CO_2 is compressed and injected underground to enhance oil recovery at the nearby Weyburn oil field.

United States

The global CCUS coal fleet was bolstered with NRG and JX Nippon's Petra Nova Carbon Capture project entering commercial operation in January 2017. Petra Nova is the world's largest post-combustion carbon capture facility installed on a coal-fuelled power plant[7]. Petra Nova uses a 240MW equivalent slipstream of flue gas from the 640MW coal-fired power plant. It can capture 1.4 million tonnes of CO_2 – an equivalent level generated by the energy use of 170,000 houses over one year[8].

An investment of USD 190 million by the US Department of Energy's Clean Coal Power Initiative played a significant part in advancing development of the project. It was commercial opportunities, though, that made the Petra Nova concept a reality. The CO_2 captured at Petra Nova is pumped through 80-miles of pipeline to the West Ranch oil field, operated by joint venture partner Hilcorp Energy. The captured carbon is used to boost oil production without the need to use fracking. Since the process began, production in West Ranch has grown by +1300%[9].

Petra Nova can capture 1.4 million tonnes of CO_2 – an equivalent level generated by the energy use of

170,000

houses over one year

US coal sector players have also invested in research and development to advance CCUS. The National Carbon Capture Center (NCCC) operates with funding from the US Government and industry. Based in Alabama, the US Department of Energy-sponsored research facility works with technology developers from around the world to accelerate the development and commercialisation of technologies that reduce emissions from fossil fuel-based power plants, including coal. The Center reports that coal stakeholders have provided 20% of funding over the last ten years, including USD 25.8 million in the last four years[10].

Following a similar public-private partnership model to the NCCC, the Wyoming Integrated Test Center (ITC) received USD 15 million of state funding, with an additional USD 6 million provided by coal stakeholders[11]. The ITC is one of the few facilities around the world providing researchers an opportunity to test CCUS on an operating coal-fuelled power plant. Flue gas can be diverted to researchers using technology in the plants' exhaust flue. This provides research insights on capture technologies, as well as the potential around commodification of carbon.

The potential deployment of CCUS in the US received a boost in early-2018 when Congress passed the 'Furthering carbon capture, Utilization, Technology, Underground storage, and Reduced Emissions' (FUTURE) Act, which extends and expands the Section 45Q carbon sequestration tax credits. The "45Q" tax credit for storing CO_2 permanently underground will more than double from USD 22 today to USD 50 in 2026. Early analysis has suggested that over the next six years 45Q could lead to capital investment of around USD 1 billion[12]. The Carbon Utilization Resource Council, which includes coal stakeholders, supported efforts to reform the code.

Australia

In 2006, Australian coal producers established COAL21. The initiative raises funds through a voluntary levy on coal production, which is then used to support CCUS commercialisation efforts, as well as advancing other low emission technologies. COAL21 has invested AUD 300 million since its inception to advance CO_2 capture and safe, long-term storage. COAL21 has sought to maximise opportunities through co-investment with other stakeholders (government, electricity generators, equipment suppliers and other investors)[13].

A selection of relevant CCUS investment projects (current and competed) are included below.

COAL21's contribution to the Australian National Low Emissions Coal R&D (ANLEC R&D) programme is of particular note in supporting the next phase of CCUS deployment. ANLEC's programme focuses on reducing investment risk associated with CCUS, thereby accelerating the technology-development cycle. Similarly, CO_2CRC's Otway Research Facility is one of the world's leading research and geo-sequestration demonstration projects involving injection, storage and monitoring of CO_2.

Table 1: Coal21 Investment to advance CCUS

Projects	Funding: COAL21 AUD	Funding: Total AUD
Carbon Transport and Storage Corporation Pty Ltd (CTSCo) Carbon Storage Assessment: Qld	$15.2M	$24M
University of Queensland: Carbon Storage Assessment: Qld	$7.7M	$15.1M
Coal Innovation NSW: Carbon Storage Assessment: NSW	$13.3M	$36.7M
ANLEC: Research & Development Support	$76.9M	$150M
The Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC)'s Otway Research Facility: Research & Development Support	$12.5M	$100M
ZeroGen: Carbon Capture: Integrated Gasification Combined Cycle ZeroGen: Carbon storage assessment: Northern Denison Trough	$41.4M	$182.3M
Wandoan: Carbon Capture: Integrated Gasification Combined Cycle	$6.6M	$19.2M
CTSCo: Carbon storage assessment: Surat Basin	$8.9M	$16.5M
Callide: Carbon Capture: Oxyfuel Demonstration	$82.8M	$245M
DELTA: Carbon Capture: Post-combustion	$0.7M	$2.1M

Asia

China

The Chinese Government's climate pledge submitted in mid-2015 provides a clear indication of the country's commitment to cleaner coal generation[14]. China has been a model in championing the transition toward supercritical and ultra-supercritical technologies, as well as deploying ultra-low emissions technology to reduce or eliminate the release of pollutants, such as oxides of sulphur and nitrogen as well as particulate and trace elements. The government has demonstrated commitment to this transition through international and domestic policy action. In turn, industry has responded through the construction of advanced coal stations in the power sector and funding research and demonstration of CCUS across the power, steel, cement and chemical sectors[15].

The *Roadmap for Carbon Capture and Storage Demonstration and Deployment in the People's Republic of China* report, led by the Department of Climate Change, National Development and Reform Commission (NDRC) and managed by the Asian Development Bank, provides further signals of China's commitment to zero-emissions from coal[16].

Several pilot-scale and demonstration CCUS projects in China show progress towards the report's goals of reducing capture

Table 2: Large-scale, coal-based CCUS facilities in China

Name	Operation date	Industry	Capture type	Capture capacity (Mtpa)	Primary storage type
Sinopec Qilu Petrochemical CCS	2019	Chemical Production	Industrial Separation	0.4	Enhanced Oil Recovery
Yanchang Integrated Carbon Capture and Storage Demonstration	2020	Chemical Production	Industrial Separation	0.4	Enhanced Oil Recovery
China Resources Power (Haifeng) Integrated Carbon Capture and Sequestration Demonstration	2020's	Power Generation	Post-combustion capture	1.0	Dedicated Geological Storage
Huaneng GreenGen IGCC Large-scale System (Phase 3)	2020's	Power Generation	Pre-combustion capture (gasification)	2.0	Enhanced Oil recovery
Shanxi International Energy Group CCUS	2020's	Power Generation	Oxy-fuel combustion capture	2.0	Not specified
Sinopec Shengli Power Plant CCS	2020's	Power Generation	Post-combustion capture	1.0	Enhanced Oil recovery

In 2017, construction began on the Yanchang CCUS project at a coal-to-chemicals facility capable of capturing **400,000** tonnes per year costs and developing nascent technologies. In 2017, for instance, construction began on the Yanchang CCUS project at a coal-to-chemicals facility capable of capturing 400,000 tonnes per year.

There are currently six large-scale (as defined by the Global CCS Institute) demonstration projects in construction or early development in China that use coal as a feedstock [17].

Japan

Japan has long been one of the global champions for cleaner coal technology. Industry and government have invested heavily in advancing CCUS both at home and abroad. Two notable CCUS projects of significance to coal include –

- The Osaki CoolGen Project is developing an integrated coal gasification fuel cell combined cycle pilot combined with a demonstration of carbon capture[18].

- The Course 50 R&D Project captures CO_2 from a steel furnace. The project involves cooperation between the Japanese government, equipment suppliers, and industry[19].

India

Steps are being taken to ensure coal is deployed with the lowest emissions profile[20], including nascent moves to advance CCUS. NTPC, India's largest power utility, has signalled a commitment to CCUS through a thematic focus of its Energy Technology Research Alliance established in 2009[21]. Anglo-Indian firm Carbon Clean Solutions also provides a notable example of CCUS developments in India with a small-scale project that captures CO_2 emissions from a coal boiler and uses the CO_2 in products to produce a revenue stream.

Europe

The Sleipner and Snovit projects in Norway have been significant in improving public perception, addressing perceived risks and sharing lessons for CCUS in Europe. Since 1996, the two projects have captured and securely stored 20 million tonnes of CO_2 into deep saline formations offshore.

In recent years, coal-based CCUS development in Europe has faced several well-recorded challenges. The loss of UK Government support for the White Rose Carbon Capture and Storage project has left the continent without a CCUS project in the power sector. Commentators noted the termination of the project was not the result of technical issues, but rather due to the cancellation of the UK CCS Competition. However, lessons have been learnt from the project and can inform policies and incentives to move CCUS forward.

> There are currently six large-scale demonstration projects in construction or early development in China that use coal as a feedstock

2. CCUS – where do we want to go?

The Paris Agreement commits signatories to 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels'[22].

The World Coal Association recognises this objective. Looking ahead, it will be vitally important that implementation of the Paris Agreement integrates environmental imperatives with the aims of universal access to energy, energy security and social and economic development.

A net zero-emission pathway

Coal is essential to the development of modern and sustainable societies. Across many economies it plays a major role in bringing affordable, reliable electricity to billions of people. It also plays an important part in the production of steel, cement, glass and many other energy intensive materials which are fundamental in the development of transport, energy, housing and water management infrastructure.

Multiple independent forecasts show that coal will continue as one of the fuels of choice in rapidly urbanising and industrialising economies. With use projected to continue through milestone years of the Paris Agreement, a net zero-emission pathway combining energy efficiency, renewables, fossil fuels with CCUS and other low emissions technologies, is required if the objectives of the Paris Agreement are to be met.

2732
large-scale CCUS facilities will be needed by 2050 to achieve the objectives of the Paris Agreement

The Paris Agreement and CCUS

Deployment of CCUS technology is heavily referenced throughout the latest IPCC report, with most pathways based on significant CCUS deployment[23]. This builds on previous IPPC projections that suggest removing CCUS from the portfolio of available mitigation options significantly raises the cost of action[24]. The IPCC has also suggested that pursuing efforts toward well below 2°C will likely depend on the removal of CO_2 from the atmosphere. Biomass with CCUS is one potential approach to generate negative emissions in the longer-term. However, opportunities will depend on investment and development of capture, transport and storage infrastructure today.

GCCSI has estimated that over 2732 large-scale CCUS facilities will be needed by 2050 to achieve the objectives of the Paris Agreement[25]. This is because fossil fuels (including coal) will still account for almost three-quarters of total primary energy demand in 2040, according to IEA's New Policies Scenario[26]. To reconcile the on-going role of fossil fuels with climate action, the IEA has estimated that 14% of cumulative emission reductions to 2060 would have to come from CCUS[27]. By 2050, GCCSI has estimated that the annual amount of CO_2 captured in order to meet the goals of the Paris Agreement would need to be over 5000 million tonnes – close to the US's 2017 carbon emissions[28].

Building an international commitment to CCUS

While the 21 CCUS facilities under construction or operating have advanced the state of the technology for various industries, this is a far cry from what will be needed.

The evidence is clear: the long-term goals of the Paris Agreement will require widescale deployment of CCUS across a diversity of applications, including electricity generation, industrial applications and bioenergy. Action to advance CCUS requires an international commitment with a broad constituency of support. This commitment must be backed by meaningful policies and associated incentives that enable a deployment trajectory consistent with limiting global warming to well below 2°C.

3. How do we get there?

Since the Paris Agreement came into action, WCA has continued to advocate for greater support to enable CCUS deployment. In the spirit of the Talanoa Dialogue, WCA outlines the following actions to build greater international commitment to advance CCUS.

1 Broaden support for CCUS by highlighting its role in meeting the long term goals of the Paris Agreement

It will cost around 2.5% of global gross domestic product to meet the goals of the Paris Agreement[29]. Previous forecasts have shown this cost will rise exponentially if CCUS is not widely deployed[30]. Yet, in recent international climate discussions, just ten countries identified a role for the technology.

The world will require 2732 CCUS facilities in various applications by around mid-century for the technology to meet the IEA's 14 per cent quota to limit warming to 2°C[31]. To put this in context, this would require 90 facilities to come online each year between 2020 and 2050.

Given the diversity of its application – including power generation, industrial, and bioenergy – CCUS has been considered by various countries in the numerous UNFCCC 'vehicles' (i.e. reporting, review, discussion platforms, cooperative approaches, planning tools and strategies). As the format of NDCs are standardised, there is an opportunity to consolidate countries' various climate action efforts, which may exist in some communications but are not reflected in their NDCs.

Similarly, in the next 18 months, countries are required to submit their long-term climate-mitigation plans for action through to 2050. Embedding CCUS within the Paris Agreement infrastructure will provide a true indication of the importance of the technology. It is also vital that developing countries identify a role for CCUS now to promote the collaborative action in finance, capacity building and technology transfer that will be necessary to support deployment.

> ***"To develop and install carbon dioxide sequestration technologies near the Thar coal, Kandra gas fields and other power generation stations with carbon capture and storage; to make safe use of coal deposits for production of energy, in order to cope with the prevailing situation of energy crisis in the country."***
>
> Nationally Appropriate Mitigation Action submitted by Pakistan for support to deploy CCUS, presenting an opportunity for inclusion in future NDCs and long-term climate action plans[32]

2 Establish well-designed legal and regulatory regimes that support CCUS

National, regional and international action will be required to deliver the regulatory, legal and financial framework to ensure that CCUS technology can be deployed at the rate and scale necessary to achieve the goals set in the Paris Agreement. These frameworks will need to consider the 'full chain'– from capture to storage – to build investor and public confidence. Generators and industry require clarity in the scale and terms of support for CCUS.

Public-private partnerships, financial incentives and market-creation mechanisms have, in the past, proven to be effective in resolving market failures in infrastructure investment. Given that CCUS technology is at a relatively early stage of deployment, adopting these approaches for CO_2 transportation and storage infrastructure could lay a foundation for industry to build on.

Policy should be designed to consider suitable public/private risk allocation, reduce liabilities of storage and encourage geographically appropriate infrastructure to allow clusters for potential sites to connect. For example, national governments could award grants through competitive procurement to encourage pre-competitive storage appraisal activity. This would provide vital cost and size data on sites; this data will, in turn, be necessary for private-sector stakeholders to develop sufficiently detailed proposals for evaluation by public-sector bodies, financiers and industry.

The UNFCCC's finance[i] and technology[ii] mechanisms provide opportunities for climate and energy stakeholders to support international counterparts in their CCUS ambitions. However, to capitalise on these opportunities, CCUS must be supported in the same way as other low-carbon technologies.

Near-term support activities could include –

- Supporting governments to develop the legal framework for CCUS deployment, including storage safety requirements
- Exploring and characterisation of potential storage sites
- Supporting governments to develop policy incentives
- Support measuring, monitoring and verification (MMV) during operation and/ or closure.

Internationally, progress has been made to remove barriers from agreements that could prevent CCUS deployment. In 2007, for instance, an amendment to the London Protocol and Convention came into force that allowed for CO_2 storage in sub-seabed formation. A second amendment was passed in 2009 to allow cross-border transportation of CO_2 for permanent storage. To date, however, this amendment still requires ratification and has not yet entered into force. As a priority, countries must work to remove obstacles to CCUS deployment from international agreements.

> ***"We at CTCN have received three requests for technical assistance from the NDE of Nigeria related to CCUS. To summarise all three requests focus on developing policy guidelines and an institutional framework, identification of potential carbon storage sites and undertaking baseline studies of geological reservoir for capacity assessments."***
>
> CTCN Request for Assistance (RFA) to support feasibility and regulation activities for CCUS in Nigeria[33]

It will cost around **2.5%** of global gross domestic product to meet the goals of the Paris Agreement

[i] *Green Climate Fund and Global Environment Facility*
[ii] *Technology Executive Committee and Climate Technology Centre and Network*

3 Mobilise finance to boost CCUS opportunities

GCCSI has suggested that USD 5 billion will be required to support pre-investment enabling activities for the construction and operation of additional pilot-scale projects in developing countries. This should serve as a near-term climate finance target for signatories to the Paris Agreement[34].

CCUS is currently eligible for funding through the Green Climate Fund and the Global Environment Facility. To date, however, only one CCUS project has received approval through these financing tools. While the Green Climate Fund and Global Environment Facility were not developed to fully fund large-scale projects, their participation can be significant in the viability of a project that may otherwise be too risky for commercial investors to undertake alone.

Looking ahead, both vehicles will have an important role to play in mobilising greater levels of multilateral support for CCUS knowledge-sharing, capacity development and, ultimately, project development. Both funds operate with thematic funding windows to allow specialisation and a focus on specific types of projects. A funding window for CCUS should be a priority to actively highlight the availability of funds for CCUS projects and development.

Alongside its role in promoting sustainable economic growth and poverty reduction, the World Bank has an important part to play in action on climate change. Since 2013, the World Bank has reduced support for coal-fuelled power projects, limiting financing to 'rare and exceptional circumstances.' There is little indication to suggest that coal demand has been adversely impacted by changes to World Bank policy. On the contrary, there is growing evidence that the Work Bank position may be leading to perverse incentives for the deployment of less efficient technologies, which limit the number of plants eligible for CCUS retrofit. While it is technically feasible that almost any coal unit can be retrofitted with CCUS (depending on space), plants with high efficiency and lower emissions are the most suitable for economic CCUS retrofit.

In late-2018, WCA published *Reducing emissions from coal: A role for the World Bank* which sets forward a new approach the World Bank could adopt to set a trajectory for zero-emissions from coal. WCA urges the World Bank – and others – to adopt the report's recommendations.

> ***"The Fund will finance agreed full and agreed incremental costs for activities to enable and support enhanced action on adaptation, mitigation, technology development and transfer (including carbon capture and storage), capacity-building and the preparation of national reports by developing countries."***
>
> Provisions for CCUS in the GCF[35]

4 Undertake research and development to advance the next generation of CCUS technologies

R&D efforts will be critical to innovate and make CCUS processes more efficient. Extensive research by universities, industry and government institutions has delivered advances across capture, transport and storage technologies. For example, investment by the US Department of Energy has reduced costs from first-generation capture by 40%[36]. Research has also played a role in building confidence in the potential for long-term CO_2 storage through advances in MMV. To date, 220 million tonnes of anthropogenic CO_2 has been safely injected underground[37].

Support for research should prioritise areas that can best deliver reduced costs and improve existing technologies. Areas of research that could provide the most significant benefits may include: net-negative emissions via biomass energy with CCS (BECCS), including co-firing with coal; next-generation capture technologies; and CO_2-utilisation beyond EOR for other applications. WCA recommends that Mission Innovation and the Breakthrough Energy Coalition prioritise CCUS efforts in these areas.

Supporting enhanced R&D is important in reducing the costs of CCUS. Major breakthroughs and cost reductions, however, will likely best be delivered through deployment. As demonstrated with solar and wind, technology develops along a relatively standard track: nascent technology costs are typically high; technology develops and efficiencies are released through R&D; cost reductions come from economies of scale and learnings through experience. Evidence to date suggests that CCUS is not different.

Conclusion

The Paris Agreement goal of limiting future temperature increases to well below 2°C will require a swift and significant reduction in the emissions associated with fossil fuels. Deploying CCUS is critical to this outcome.

The 2018 Talanoa Dialogue is a crucial opportunity to increase climate mitigation ambition and effectiveness by delivering an international commitment to advance CCUS. This will allow individual countries to maintain their energy security and meet future emission reduction targets at least cost.

Urgent investment in capture technologies, associated transport infrastructure, CO_2 storage site characterisation, techno-economic assessments and public engagement is required. By doing this, CCUS can be deployed along with other low emission technologies to achieve the deep reductions in greenhouse gas emissions required to meet the goals of the Paris Agreement.

Urgent investment in capture technologies, associated transport infrastructure, CO_2 storage site characterisation, techno-economic assessments and public engagement is required

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World Coal Association

The World Coal Association is a global industry association formed of major international coal producers and stakeholders. The WCA works to demonstrate and gain acceptance for the fundamental role coal plays in achieving a sustainable and lower carbon energy future. Membership is open to companies and not-for-profit organisations with a stake in the future of coal from anywhere in the world, with member companies represented at Chief Executive or Chairman level.

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