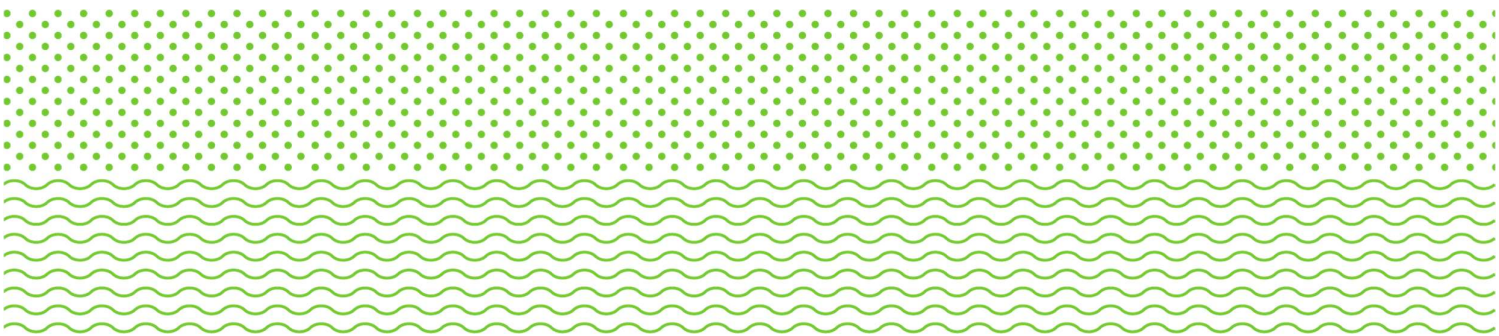
GLOBAL CCS INSTITUTE

CCS: A solution to climate change right beneath our feet

Submission to the UNFCCC from the Global Carbon Capture & Storage Institute

28 MARCH 2018



Dear Sir/Madam

CCS: A solution to climate change right beneath our feet

As the world authority on Carbon Capture and Storage (CCS), the Global CCS Institute is delighted to have the opportunity to present the CCS story in the spirit of the Talanoa dialogue.

To that end, we have included dialogue from a diverse and reputable stakeholder constituency to support this submission.

CCS is one of the most significant, but conversely, one of the most unheralded clean technologies in terms of climate change influence.

Our job, as a member-led organization representing the interests of governments, global corporations, private companies, research bodies, academic institutions and NGOs, is to accelerate the deployment of CCS as an imperative technology in tackling climate change and meeting Paris climate change targets.

As the following narrative will testify, Paris climate change targets simply cannot be met without CCS.

Where are we?

As a clean technology, it is fair to say that CCS is yet to be fully recognised for the vital contribution it needs to make if achieving Paris climate change targets are to be a reality.

When its compelling credentials are considered, it is hard to understand why CCS has not been embraced in the same way as some other clean technologies.

For instance:

1. A safe and proven process

The process of capturing CO_2 from energy intensive industries and securely burying it deep below ground is safe and well proven. The technology has been operating successfully for 45 years (since the Apollo 17 moon landing).

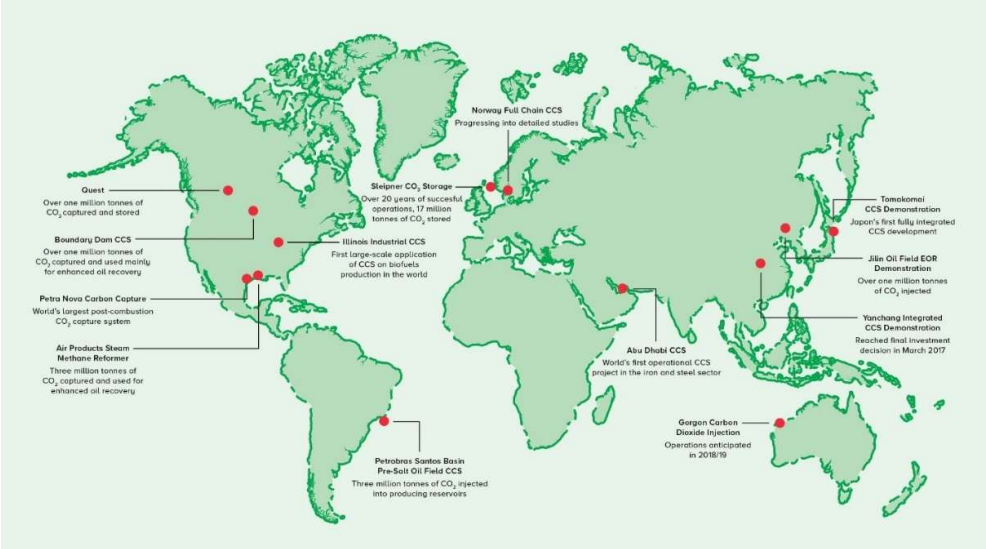
CCS's safe and commercial characteristics are supported by a mass of expert opinion.

Says Niall Mac Dowell, senior lecturer at the Centre for Environmental Policy at Imperial College, London:

"In West Texas, the oil industry has used carbon dioxide in enhanced oil recovery since the 1960s and '70s."

Currently, there are now 17 large-scale CCS facilities in commercial operation around the world – with five more coming onstream within the next 12-18 months. In China, where CCS has been embraced at the highest government levels, eight facilities are in development.

Figure 1: Key CCS facility developments globally



2. Proven and promoted by science

CCS has been proven as integral to a "net zero" future by pre-eminent research and analysis including the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA).

The IEA, in its publication, *Energy Perspectives 2017,* says meeting the 2-degree target requires an inclusive approach combining energy efficiency (40 per cent), renewables (35 per cent), CCS (14 per cent), nuclear (6 per cent), and fuel switching (5 per cent).

Looking further ahead, to the so-called Beyond 2-degree scenario (B2DS), the IEA maintains that CCS would be needed to provide 32 per cent of global emission reductions.

In a recent study, *The role of CCS in meeting climate policy targets,* University College London (UCL), concluded that CCS must be part of any strategy to limit temperatures to 2 degrees.

Says Report co-author, UCL Professor Paul Ekins:

"The development and deployment of carbon capture and storage should be given a significant role as part of the strategy for limiting the effects of climate change."

Columbia University's Newberry Professor, Wallace Smith Broecker, the scientist who in 1975 first coined the phrase "global warming", says:

"Garbage brought disease to our streets. We learned to dispose of it. Sewage poisoned our waters. We learned to treat it. CO_2 threatens to change our climate. Hence we must learn how to capture and bury it."

Lord Nicholas Stern, the IG Patel Professor of Economics and Government at the London School of Economics, says:

"We have not yet witnessed countries embrace the full array of clean technologies needed to achieve Paris targets. CCS is absolutely necessary. It is necessary too in major parts of economic activity outside the power sector."

Sustainable Development authority and author, John Elkington, who in 1994 conceived the concept of the 'triple-bottom line', says:

"Carbon capture and storage is vitally important if we are to have any chance of meeting the Paris Climate Accord objectives."

3. The only answer for industry/the only claim to "clean coal"

CCS has been recognised as the only technology capable of decarbonizing industry – notably the steel, cement, fertilizer, petrochemicals, and pulp and paper sectors.

Since industry alone represents 21 per cent of total global emissions, CCS is the most obvious way forward and it is being embraced across multiple locations.

Notably, in the Middle East, there are already two CCS facilities in operation; *Al Reyadah*, the world's first CCS steel application in the United Arab Emirates and the *Uthmaniyah* CCS facility, a natural gas to chemicals plant, in Saudi Arabia.

Similarly, and most significantly, CCS is the only way of making "clean coal" a reality. This becomes especially crucial given 40 per cent of global electricity is generated from coal and more than 1500 coal plants are either in construction or development.

4. Cost effective and commercial

CCS is versatile and cost effective. It complements renewables by providing low carbon on dispatchable power.

Through the application of Enhanced Oil Recovery (EOR), CCS has been able to demonstrate its commerciality. Of the 17 facilities in operation, 13 are carbon capture, utilisation and storage (CCUS) facilities.

Additionally, costs continue to fall as new facilities come onstream and "learning by doing" allows more cost efficiencies to be identified. For instance, the Boundary Dam and Petra Nova CCS facilities in Canada and the United States respectively, have identified costs savings of 20-30 per cent were they to build their facilities again.

Another commercial attribute of CCS is its ability to decarbonize diverse industrial estates, or "hubs and clusters". In the Netherlands (the Port of Rotterdam "backbone" facility) and in the UK (the Teesside Collective) signify major strides in a commercially shared approach to CO_2 mitigation.

UK MP and Chairman of the UK All Party Parliamentary Group for CCS, Alex Cunningham, is a major proponent of this approach:

"The technology is proven and the government can no longer hide behind its claims that it is too expensive to implement. It is too expensive not to

implement."

5. The catalyst to a new energy economy

CCS is the catalyst to a new energy economy which preserves jobs, creates new employment opportunities, and new product streams.

This includes the manufacture of CCS-specific components such as boilers and turbines, and new energy economies such as hydrogen and bioenergy with carbon capture and storage (BECCS).

CCS is also enabling the manufacture of new CO_2 re-use applications.

Australian Ambassador for the Environment, Patrick Suckling, says:

"Innovative approaches to using carbon dioxide are emerging as scientists and engineers race to make useful products out of carbon dioxide."

New CO_2 derived products include washing sodas, mattresses, upholstered furniture, bricks, stone and cement.

CCS is now being recognised as the conduit to a new hydrogen economy – allowing hydrogen to be generated from coal and natural gas with no CO_2 emissions.

More than half a dozen CCS clean hydrogen initiatives are underway in Europe alone, and Japan is presently examining the establishment of a hydrogen export economy, using brown coal to create clean hydrogen, in Australia.

6. CCS and health

Poor air quality is a major threat to human health and globally, about 3 million premature deaths are attributable to outdoor air pollution caused by fossil fuels. This is expected to rise to 6-9 million people by 2016.

Global welfare costs associated with premature deaths from outdoor air pollution are a staggering $US3 trillion and these are projected to rise to US$18-25 trillion by 2060.

CCS technologies have the capacity to significantly curtail atmospheric pollutants, particularly sulphur and nitrogen oxide emissions, fly ash and heavy metals (mercury).

Decarbonising industry through CO_2 conversion technologies will have a hugely positive effect on the health of millions of people.

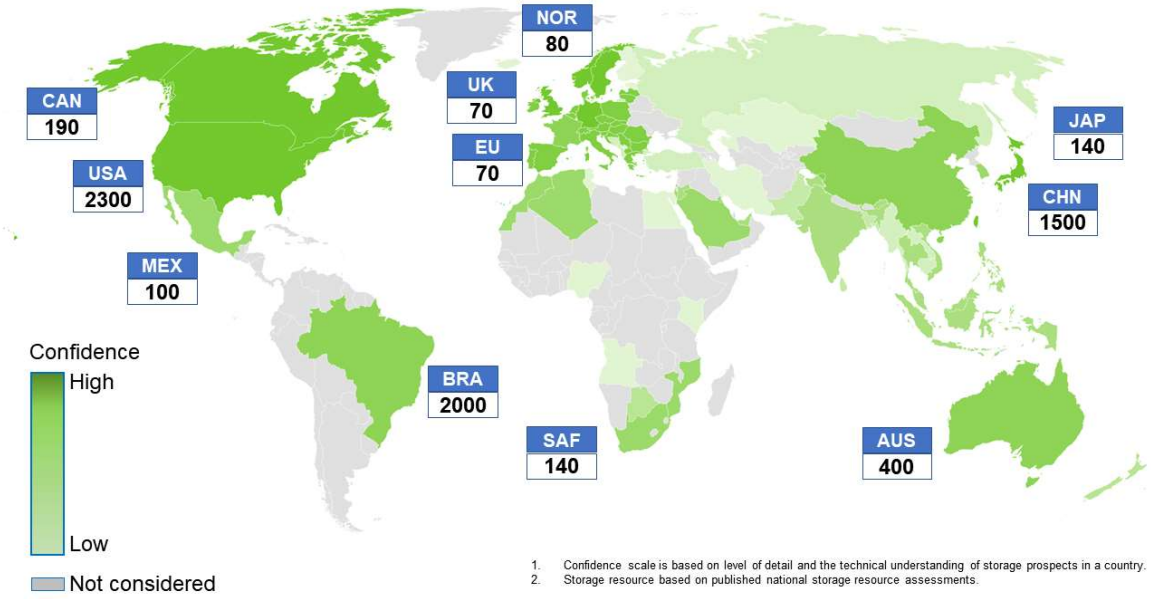
7. Abundant underground resources

The world has more underground CO_2 storage resources than are needed to meet Paris climate targets. A large proportion of the world's key CO_2 storage locations have been meticulously mapped and almost every high emitting nation can claim substantial underground storage resources.

Countries including China, Canada, Norway, Australia, the United States, the United Kingdom, Japan, Brazil and India all boast major storage capacity, and more than 40 sites around the world are safely and securely injecting anthropogenic CO_2 underground.

Figure 2:

Global Storage Prospectivity and Resource



7. Political momentum

Recent political activity in the United Kingdom and the United States indicates a shift-change towards endorsement of CCS as a `must have' technology. In February this year, UK Energy Minister, Rt Hon Claire Perry, said the Government was examining CCUS potential and has duly created a dedicated council (on which I am honoured to sit), to speed deployment.

Minister Perry has commented:

"We see it as vital; we want to be a world-leader in the new technology."

Concurrently, also in February, the US Congress approved the most significant pro-carbon capture and storage (CCS) national policy in a decade, a tax credit for CO_2 storage, known as 45Q. This legislation won bi-partisan support and is expected to stimulate the development of new CCS projects across the United States.

Said US Senator, Sherrod Brown (Democrat, Ohio):

"By spurring investment in carbon capture technology, these tax credits support clean air and good jobs."

In Australia, the Government has begun proceedings to amend legislation banning investment in CCS technologies by national financier, the Clean Energy Finance

Corporation (CEFC). If successful, this will allow for equal investment incentivization in CCS technologies as are currently available to wind, solar and battery storage initiatives.

Australian Energy and Environment Minister, Hon Josh Frydenberg, says:

"Access to finance is one of the barriers to investment in CCS and a change to CEFC legislation will provide a significant signal of support and reduce risk for investors."

These developments are promising but need to be tempered with the reality that the legal and regulatory status of CCS shows slow progress. The Institute's *Legal and Regulatory Indicator 2017* identifies only five 'Band A' countries in which CCS-specific laws have been enacted. They are; Australia, Canada, Denmark, the United Kingdom and the United States.

These developments attest to the need for both 'policy instruments and policy people' to incentivize CCS. A further 27 countries make up 'Band B' where CCS laws are applicable across "parts" of the CCS project cycle. Additionally, 21 countries make up 'Band C' where very few CCS specific laws are applicable.

It is evident from these statistics that more needs to be done to achieve equilibrium across various jurisdictions.

At current pace, Paris climate change targets will not be reached without CCS.

For CCS to meet its obligations and deliver its 14 per cent quota towards "Paris", the world needs exactly 2,732 CCS facilities by 2050. With only 17 large-scale facilities currently in operation, that is a huge gap to bridge.

Where do we want to be?

Given this context, it is clear we want (and we need), to accelerate CCS deployment.

CCS must become synonymous with climate change and share equal footing with the raft of clean technologies which all need to be brought to bear if the world is serious about turning down the temperature dial.

This will be achieved by broadening CCS' constituency of support and through recognition that by Paris climate change targets are not possible without CCS technology.

All of the mechanisms under the Convention recognise that CCS is an appropriate and environmentally sound clean technology.

However, as the COP24 Talanoa Dialogue draws near, it is critical to find ways of encouraging the Parties to the Convention to incorporate CCS into their plans.

Similarly, it is important that mechanisms which drive down the CCS technology cost curve are embraced.

Given the wealth of scientific evidence in its favour, CCS must be accepted as a technology that has come of age: the only technology able to decarbonise energy intensive industries, and a truly transformative technology which can create new energy economies.

But making CCS part of this solution will require a specific and prescriptive set of economic, environmental and advocacy tools.

How do we get there?

As an active participant in all UNFCCC Technology Executive Committee (TEC), Climate Technology Centre and Network (CTCN), the Green Climate Fund (GCF), and as an accredited observer to the IPCC, it is clear to us is that achieving Paris climate targets will require CCS but its scalability is dependent on three key factors.

1. Tailored and predictable market mechanisms: All of the mechanisms under the Framework Convention recognise CCS as instrumental and environmentally sound but it still lacks the market mechanisms that will stimulate its deployment. We believe the following instruments are essential:

(a) The setting of credible, **economy-wide reduction targets** consistent with the Paris Agreement's aims. The Paris Agreement is bottom up, therefore Nationally Determined Contributions (NDCs) are crucial. It is essential that when the next round of NDCs are due (from 2025 onwards), convention machinery signals CCS' importance for all parties which can use them;

(b) **The timely development of CCS-specific legal and regulatory regimes**. It is imperative that legal and regulatory regimes adequately address all aspects of the project lifecycle. This is critical in providing greater investor and public confidence in the technology. Remaining barriers to CCS must also be removed from other international agreements (eg, the London Protocol), to ensure that global mitigation ambitions for the technology are not frustrated.

(c) introduction of a **carbon value** in countries where none exists. Further investment and incentivisation in CCS is critical. A value for CO_2 reduction must be created at the national level. Some cities and states around the world are already taking the initiative and doing this for themselves but it is disjointed and uneven. Whilst valuing carbon is crucial, it is not of itself currently sufficient to drive investment in CCS. Broader government policy settings and the removal of barriers to deployment must be established;

Note: Learning from Norway's approach shows how this can work. After Norway introduced a carbon tax in 1991, the state-run oil and gas multinational, Statoil, found it cheaper to capture and store CO_2 *emissions from its Sleipner and Snøhvit gas fields than pay taxes owed if* CO_2 *was vented into the atmosphere. Since then (almost 30 years), these pioneering facilities have captured more than 20 million tonnes of* CO_2*;*

(d) The **Technical Examination Process (TEP) and Technical Expert Meeting (TEM) processes should focus on CCS** in a consistent and coherent way (FCCC/CP/2017/L.2);

(e) **Recognition of the importance in transferring technology to developing countries.** This needs to ensure that the Technology Needs Assessment and Technology Action Plan process seriously considers CCS as an option when and where appropriate;

(f) **Recognition of the specificities of CCS in Article 6** discussions, especially the incentivising of storage as well as capture);

(g) **Policy predictability** so that the large capital investment, and long gestation/asset-life of CCS facilities are not jeopardized by overt changes in political direction;

(h) **Acknowledgement of CCS in the UNFCCC's International climate action plans and flagship policy statements** with an emphasis on how it can easily and effectively work in unison with other low-carbon technologies.

2. Research and development: Robust Research and Development (R&D) support is essential as various CCS capture technologies refine and evolve. Since numerous CCS technologies exist, and lower cost technologies are being tested on smaller scales, research and development support remains critical.

Work undertaken by the US Department of Energy (DoE) over the past 20 years is a good example of what can be achieved when R&D is applied. During that time, costs associated with first generation capture technologies on power applications have decreased from more than US$100 per tonne of CO_2 captured to US$60 per tonne.

3. Actors, awareness and advocacy: This submission has included endorsement by a number of highly credentialed CCS proponents. We are mindful, however, that CCS support must continue to broaden if it is to play its full and rightful role in enabling Paris climate ambitions to be realised.

As UCL Report: co-author, Dr Nick Hughes, says:

"The success of any CCS programme is also likely to depend on genuine and transparent public engagement."

The Global CCS Institute has taken an emboldened approach to engagement and is "informing through fora" across a variety of spheres. Over the past year, we have rallied governments, policy designers, climate change experts, academics, scientists, industry participants and the media to understand more about this critical technology and the collective stakeholder participation which is needed if CCS is to 'play its part in Paris.'

Former chemical engineer turned journalist, Akshat Rathi (Quartz magazine) characterizes the situation reasonably:

"Ultimately, the world will need to be powered by 100 per cent renewable energy. But CCS is an essential stopgap; without it, experts agree, there isn't an economically feasible way to attain the goals laid out in the Paris climate agreement."

Conclusion

In 2017, CO_2 levels reached a new record level and, according to the World Meteorological Organisation, we are experiencing the highest concentrations of carbon dioxide in almost a million years.

CO_2 emissions have increased every year since 1960 and in the last two years, these hit all-time records.

Added to this, our economies remain heavily dependent on fossil fuels, the source of 80 per cent of the world's energy. In 25 of the last 26 years, the world burned more fossil fuels than the year before. The only year recording a decrease was in 2009, the year of the global recession.

Achieving the Paris climate targets is achievable, but is has been clearly shown that it cannot be achieved without CCS.

As this submission identifies, targets are only achievable if technical, economic, legal/ regulatory, and advocacy issues are aligned. Simply, it requires:

1. **An agnostic "all of the above" approach which acknowledges a portfolio of clean technologies – namely, renewables, energy efficiency, nuclear and CCS (including CCUS, BECCS and DACCS);**

2. **Tailored and predictable market mechanisms;**

3. **CCS advocates who can influence and shape the CCS debate;**

4. **A comprehensive advocacy approach which creates greater awareness for CCS as an imperative "must have" clean technology.**

As we approach COP24 and the significant Talanoa `stock-take' which is imminent, we hope that the UNFCCC will support CCS as an indispensable part of the climate change solution.

It is a solution that literally sits directly below us.

To that end, we welcome you to "join the underground" and continue this dialogue with us further.

Vinaka vaka levu (thank you)

Yours sincerely,

Brad Page
Chief Executive Officer

For further information, please contact:

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