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6 March 2017

RE: SECOND ROUND OF CONSULTATION ON ENERGY SECTOR STRATEGY DISCUSSION DRAFT

Background

The Global Carbon Capture and Storage Institute (the Institute) is the world's preeminent authority on carbon capture and storage (CCS) and appreciates the opportunity to provide a submission to the Asian Infrastructure Investment Bank (AIIB) in developing its Energy Sector Strategy.

The Institute's mission is to accelerate the deployment of CCS globally in order to achieve the deep cuts in carbon dioxide (CO_2) emissions necessary to meet climate targets.

CCS represents a range of technologies that directly reduce emissions from a variety of industries involving the combustion of fossil fuel (e.g. power generation and steel manufacture) and others where CO_2 is a by-product (e.g. chemical and cement production).

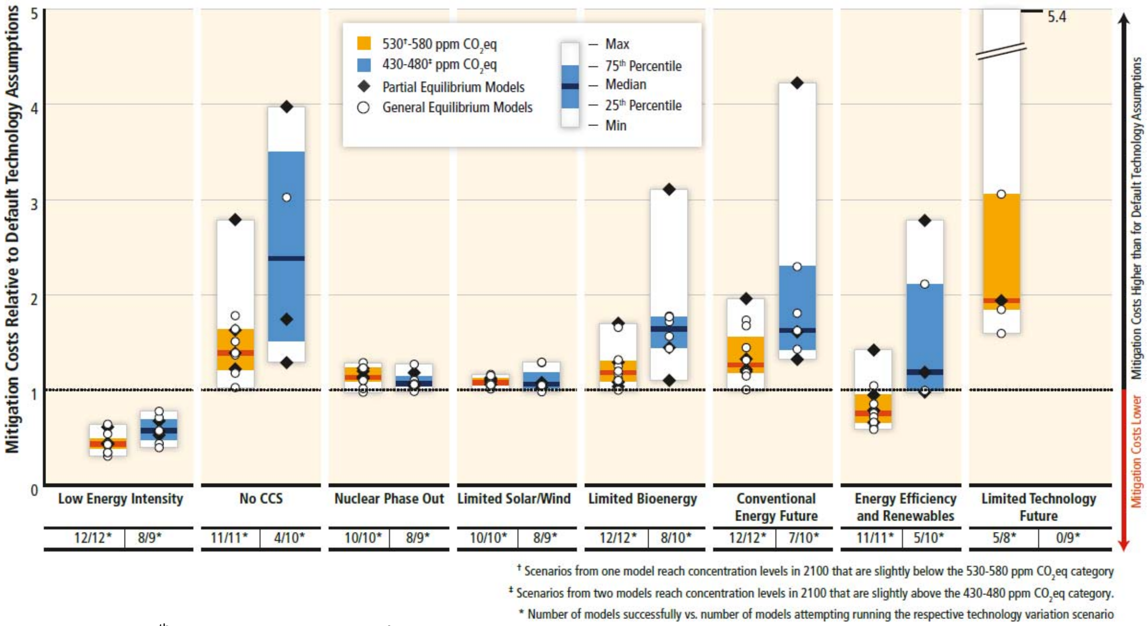
CCS is essential in a carbon constrained world

Modelling of least cost emission pathways consistently identifies that CCS would be deployed in large volumes if emission targets arising from the Paris Agreement are to be achieved.

The Intergovernmental Panel on Climate Change (IPCC) 5th assessment report commented on a range of modelling that examined the impact of particular mitigation technologies on the cost and likelihood of limiting global temperature increases. The results of this are shown in Figure 1, where the median cost of achieving 450 parts per million CO_2 concentration was 138% higher in scenarios that blocked CCS compared to default scenarios where CCS was included.[1]

[1] http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter6.pdf

Figure 1: Mitigation costs 2015 to 2100, with varied technology availability



Source: IPCC, 5th Assessment Report, Figure 6.24.

On these results, the IPCC noted:

> …the lack of availability of CCS is most frequently associated with the most significant cost increase… One fundamental reason for this is that the combination of biomass with CCS can serve as a CDR [carbon dioxide removal] technology in the form of BECCS… In addition to the ability to produce negative emissions when coupled with bioenergy, CCS is a versatile technology that can be combined with electricity, synthetic fuel, and hydrogen production from several feedstocks and in energy-intensive industries such as cement and steel.[2]

This finding is consistent with other modelling that shows that the least cost pathway to climate stabilisation requires the broadest possible range of low emission technologies including CCS. The IEA periodically reports on the potential role of CCS alongside other technologies in its World Energy Outlook and Energy Technology Perspectives reports. Its latest publication suggests CCS would contribute to 12% of cumulative emission reductions out to 2050, relative to business as usual scenario.[3] In electricity generation, CCS complements rather than substitutes other climate mitigation measures such as renewables, and vice versa. In industrial applications such as natural gas processing and cement production, CCS is the only method available to achieve deep cuts in emissions.

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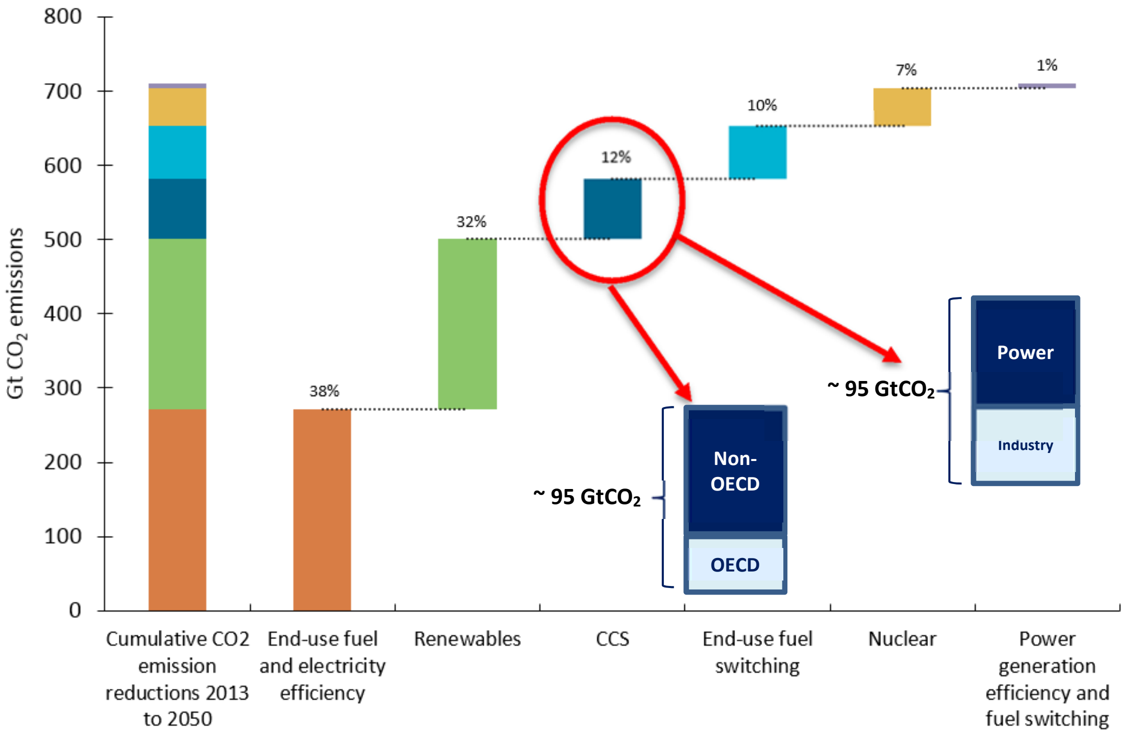
[2] http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter6.pdf, pp. 451-453.
[3] http://www.iea.org/etp/

Figure 2: Contribution to cumulative CO_2 emission reductions, 2013 to 2050



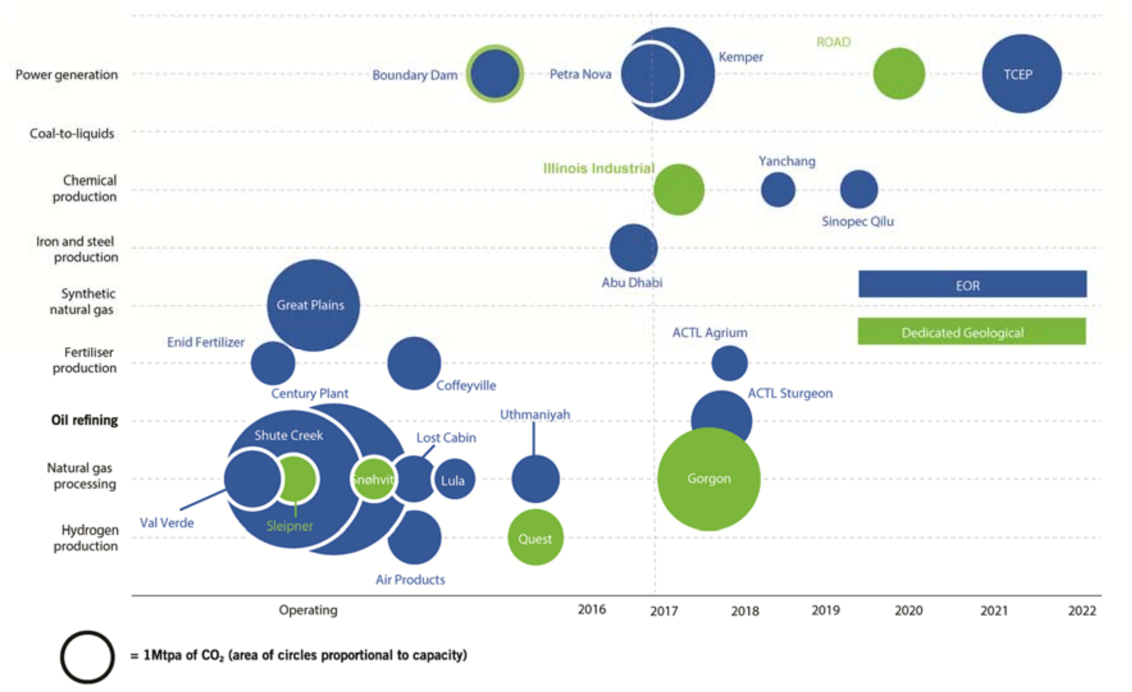
Source: data from IEA, Energy Technology Perspectives, 2016.

<u>CCS is proven, safe, reliable and operating at commercial scale around the world today</u>

CCS is a proven technology at large scale. The Institute's projects database currently tracks 38 large scale CCS facilities around the world today in a full range of applications.[4] 21 of these facilities are in operation or in construction. Some of these facilities have been operational for over 20 years. The Institute also tracks 72 individual smaller pilot and demonstration projects.[5] Large scale projects with expected completion dates out to 2022 are illustrated by capture capacity and by industry in Figure 3.

[4] http://www.globalccsinstitute.com/projects/large-scale-ccs-projects
[5] http://www.globalccsinstitute.com/projects/pilot-and-demonstration-projects

Figure 3: Large scale facilities in operation, construction and advanced planning



Source: Global CCS Institute.

Three of these large-scale facilities are in the power sector, on coal-fired generators:

- The Kemper County Energy Facility in Mississippi is expected to be operational within the next month. It is a newly constructed plant, and has a CO_2 capture capacity of approximately 3 million tonnes per year and peak output of 582MW (net). The facility will also produce around 135,000 tonnes per year of sulphuric acid and approximately 20,000 tonnes of ammonia per year for sale. This landmark project will be the first commercial scale deployment of the TRIG^{TM} coal gasification process developed jointly by Southern Company and KBR in partnership with the US Department of Energy.

- The Petra Nova Carbon Capture Project in Texas was launched in January 2017. It is a retrofit of an existing power station. It has a CO_2 capture capacity of approximately 1.4 million tonnes per year from a 240MW slip-steam of the 610MW (net) coal-fired generating unit. This is the world's largest post-combustion capture project at a power station.

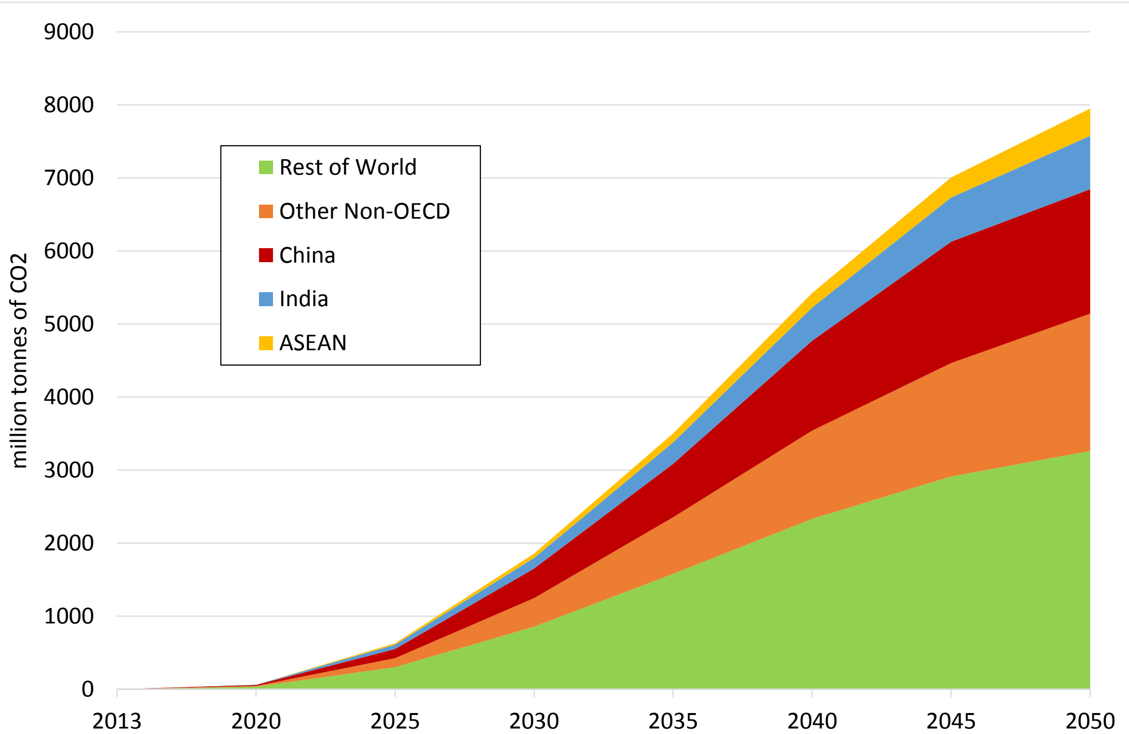
- The Boundary Dam Unit 3 plant in Saskatchewan, Canada was launched in October 2014. It is also a retrofit to an existing power station of over 40 years of age. It has a CO_2 capture capacity of approximately 1 million tonnes per year. Unit 3 has a net generating output of 115MW.

The costs, level of government support and commercial drivers for these projects are varied, however all demonstrate that CCS in the power sector is viable and happening today. In particular, they demonstrate that coal-fired generating units can reliably operate with only 10% of the emissions of an unabated coal plant and 25% of the emission of an unabated gas plant.

<u>CCS will be most important in developing countries</u>

Scenario modelling also indicates that CCS will be more important in non-OECD countries, particularly those in the Asia region. Figure 4 illustrates the disaggregation of total CO_2 captured under the IEA's 2 degree scenario.

Figure 4: CO_2 captured, all industries, 2013 to 2050



Source: data from IEA, Energy Technology Perspectives, 2016.

Overall these data reflect that developing countries have a higher degree of reliance on fossil fuel emitting processes, combined with higher rates of economic and energy demand growth, than for OECD/ developed countries. Some examples of this and prospects for CCS activities in the developing Asia region are:

- China — China's economy is highly dependent on coal in a variety of sectors and the Government has made strong statements about the necessity of CCS alongside other technologies in meeting climate goals.[6] China is making significant headway in developing CCS capabilities via various pilot and demonstration scale projects, as well as R&D programmes. Its first commercial scale CCS facility is expected to commence in 2018, from coal gasification in chemical plants, in Shaanxi Province.[7] This is one of eight large scale CCS facilities in various stages of planning in China. Prospects for CCS in various coal-to-chemical processes are promising given this is a low cost emission reduction option (less than $20/tonne of CO_2) and these processes are in the vicinity of oil fields amenable to the use of CO_2 for enhanced oil recovery.[8] Prospects of retrofitting post-combustion capture to China's large and relatively young fleet of coal-fired power stations, which currently make up 50% of global coal fired capacity, has been the subject of various studies including a 2016 report by the IEA.[9]

- India — like China, India is highly dependent on coal which provides for roughly 70% of India's total energy consumption. India is also rapidly developing and its energy policy has a significant impact on the global climate, with India being the 4th largest global emitter. Carbon Clean Solutions Limited announced in October 2016 that it had officially launched a new project designed to capture more than 60,000 tonnes of CO_2 per annum from a 10MW coal-fired power station near Chennai. The captured CO_2 will be used by an Indian firm for soda ash production. This is an important development given efforts to diversify India's power sector into clean sources of supply, while at the same time ensuring energy security and access in a situation of rapidly growing demand.

- Indonesia — in March 2016 a number of parties, including the Asian Development Bank, signed a 'Memorandum of Cooperation' to support the Gundih CCS Pilot Project in Indonesia. This project is on natural gas processing from the Gundih field which contains around 20% CO_2. This CO_2, which is currently separated and vented into the atmosphere, would be transported and injected into a nearby uneconomic hydrocarbon storage reservoir. The pilot project seeks to confirm the feasibility of storing CO_2 in a depleted reservoir and thereby provide valuable lessons for local and international developers, including the development of regulation of CCS activities.

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[6] NDRC/NEA, 2016. *NDRC/NEA Notice on Publishing "Energy Technology Revolution Innovation Action Plan (2016-2030)'.*
[7] http://www.globalccsinstitute.com/projects/yanchang-integrated-carbon-capture-and-storage-demonstration-project
[8] https://www.adb.org/sites/default/files/publication/175347/roadmap-ccs-prc.pdf
[9] https://www.iea.org/publications/insights/insightpublications/ThePotentialforEquippingChinasExistingCoalFleetwithCarbonCaptureandStorage.pdf

- Malaysia — Malaysia is a large producer and consumer of fossil fuels, with CO_2 emissions per capita among the highest in the region (and rising) and comparable to countries like Poland and China. A key reason for this is the prevalence of coal and gas-fired generation in its electricity fleet, making up around 88% of output.[10] Malaysia also has material emissions from upstream oil and gas production, with Petronas committing to several GHG targets and liaising with other CCS developers, including Petrobras regarding its experience in offshore CO_2 injection. Petronas plans to start an offshore CO_2 injection pilot for its K5 project by 2020. The K5 gas field has a CO_2 concentration of around 70%.[11]

- Thailand — over 50 potential sources of emissions in Thailand were recently assessed in terms of their suitability for CCS, predominantly in coal and gas-fired generation and cement production.[12] Two emission sources from natural gas processing were identified as the most suitable of these given the high purity of their CO_2 emissions and proximity to storage sites to which they were already connected via high pressure gas pipelines.

<u>CCS can provide important co-benefits and assist in achieving development goals</u>

The Institute supports the AIIB's general proposed framework, including reference to Sustainable Development Goal 7 and enabling investment in the latest clean energy technologies.

We also note that some feedback on the AIIB's issues paper called for an outright ban on fossil fuels and on coal-fired generation in particular.[13] From the outset, we understand the concerns about continued investment in coal and other fossil fuel activities. We stress, however, that CCS is not a "coal" or "fossil fuel" technology – it is an emission reduction technology.

The Institute recognises and fully supports a full range of efforts in reducing CO_2 emissions, including the financing of renewable power, energy efficiency and fuel switching as a transitional option. We also note the practices of many countries that continue to invest in large coal and gas generation as a centralised power option and where abundant fossil fuel reserves allow, and there is a pressing need to meet larger energy demand growth. There is also a high degree of dependence on

[10] http://meih.st.gov.my/documents/10620/f3b9119e-e139-4527-9da6-d77e2eab1c34
[11] http://www.petronas.com.my/media-relations/media-releases/Pages/article/PETRONAS-AND-TOTAL-TO-STUDY-THE-DEVELOPMENT-OF-HIGH-CARBON-DIOXIDE-GAS-FIELD.aspx
[12] https://www.adb.org/publications/prospects-carbon-capture-and-storage-southeast-asia
[13] https://www.aiib.org/en/policies-strategies/strategies/.content/index/Summary-of-Comments-on-Issues.pdf

existing fossil fuel infrastructure in power and industrial applications, creating a challenge in managing CO_2 emissions and other pollutants from these sources.

CCS technologies provide a degree of flexibility in how developing countries can balance objectives of energy access and economic development with curbing emissions from large power and industrial sources. While not a costless option, CCS offers the prospects of relying on traditional forms of power generation, and the continuation of important economic activities like steel and cement production without the associated CO_2 emissions. CCS can thus enable countries to enjoy co-benefits such as:

- pro-longing the economic life of productive fossil assets
- capacity to invest in environmentally responsible fossil energy use
- improving energy resilience
- enhanced job creation and preservation
- potentially improving a country's balance of payments.

For electricity generation, the capture of CO_2 on coal-fired power stations, because of the need to remove particulates and other pollutants in this process, can also address the detrimental health impacts of localised pollution.

Further details and a summary analysis of co-benefits are contained in the attached factsheet.

CCS can also provide important benefits by complementing higher rates of intermittent renewable energy sources:

- CCS applied to gas and coal plants can provide electricity when needed and is fully dispatchable, including for backup.
- CCS can be retrofitted to existing fossil fuel generators, thus taking advantage of already sunk investments which would otherwise be stranded or under-utilised.
- CCS does not require the generator or grid operator (or customer) to incur the costs of energy storage or additional transmission and distribution infrastructure that is required where intermittent energy sources achieve high levels of penetration in a grid.
- CCS is applied to rotating synchronous generators and thus provides the frequency and voltage control services essential to maintain a stable grid.

Fitting coal and gas-fired generators with CCS can also be more cost effective in displacing emissions than some renewable energy technologies.[14] That is, because of the larger scale and higher utilisation rates of fossil fuel plants, the additional costs associated with CCS are offset by a very large amount of avoided emissions. In contrast, intermittent renewable technologies have lower utilisation rates, which means they displace a smaller volume of CO_2 emissions from fossil fuel generators.

These characteristics should be accounted for in the AIIB's Results Monitoring Framework. Specifically, while renewable energy investment should be encouraged and obviously displaces emissions, the share of renewable energy in primary energy consumption as identified by the AIIB is only an indirect indicator. The focus should be on the CO_2 emissions per MWh generated, including the CO_2 emissions avoided by a particular project. This measure should be expanded to non-power projects and, as suggested, a cost per tonne of CO_2 basis would allow for a complete value for money comparison across the full range of projects.

Capacity building is key to enabling investment in new technologies

The Institute has contributed over USD$25 million to global CCS capacity development initiatives including those managed by the Asian Development Bank, World Bank and Carbon Sequestration Leadership Forum funds. In addition to committing to funding mechanisms and activities managed by others, the Institute also has its own capacity development program which has had demonstrable success.

The main objective of the Institute's Capacity Development Program is to develop and implement tailored capacity development programs with the principal goal of creating an enabling environment that will facilitate favourable conditions for CCS through the different stages of CCS development.

The Institute has extensive experience in partnering with country stakeholders to develop and implement tailored capacity development programs. Our unique methodology enables us to undertake a CCS assessment and use that knowledge to determine what CCS-relevant capacities a country or stakeholder already has and where an integrated work program could be most valuable in building on those capacities.

Our experience can be drawn upon by the AIIB in developing its own understanding of the challenges in raising financing and implementing projects in the region, as well as in assisting the public and private institutions with which it deals.

[14] http://www.globalccsinstitute.com/publications/costs-ccs-and-other-low-carbon-technologies-2015-update

The Institute's capacity development work has focussed on four areas:

- Directly assisting developing countries through partnerships that develop and implement integrated capacity development work programs.
- Develop information and knowledge-sharing products in order to share lessons coming out of the engagement with countries of focus (e.g. reports, factsheets).
- Develop and manage strategic partnerships with other CCS capacity development organisations.
- Support demand-driven requests for Capacity Development assistance.

Recent examples of this include:

- In October 2016, the Institute's Public Engagement and Outreach team worked with Mexico's Energy Ministry (SENER) to develop and deliver a CCS education and outreach training workshop for over 40 representatives from Mexican government, industry, academic and science outreach organisations.
- Facilitation of education materials and workshops aimed at school-level children completed in partnership with the Ministry of Science and Technology (MOST) of the People's Republic of China
- The Institute was invited by the Trinidad and Tobago Ministry of Environment and Water Resources to undertake a CCS legal and regulatory review. This review formed part of a wider *Mainstreaming of Climate Change into National Development and Capacity Building for Participation in Carbon Markets* that was funded by the Inter-American Development Bank. A key component of this activity was developing the capacity of regulators, policy makers and industry executives to understand CCS policies and technologies as applicable to their own areas of expertise.
- Development of the Malaysia and Mexico CCS Capacity Assessments and Capacity Development Work Programs. Key activities under these programs have included scoping studies, legal and regulatory reviews, study tours and policy workshops. In the case of Mexico, the Institute also collaborated with the World Bank regarding the application of CCUS to gas-fired generators, including legal and financial regulations.[15]
- The Institute held a CCS Roundtable in April 2014 in Brazil to undertake a CCS Capacity Assessment & Develop tailored CCS Capacity Development Program. Key activities under this program include development of the Brazilian CO_2

[15] http://www.globalccsinstitute.com/insights/authors/MeadeHarris%20Goodwin/2015/12/14/cop21-side-event-financing-demonstration-and-deployment-ccs-developing-countries?author=MjEyNg%3D%3D

Storage Atlas and a workshop on bio-CCS for negative emissions held by the Institute, the IEA and University of Sao Paolo.

- Support for the World Bank's CCS Trust Fund program (alongside the United Kingdom and Norwegian Governments) which initially focused on scoping opportunities in 9 countries, and is now focusing on supporting pilot projects in Mexico and South Africa.[16]

- Advising the Japanese Government on legal and regulatory frameworks for CCS.

The Institute also has a variety of ties with multilateral organisations, including as an accredited observer to the Green Climate Fund, whose mandate includes CCS[17], and observer to the UNFCCC. The Institute is also a participant in the Technology Executive Committee (TEC) and a member of the Climate Technology Centre and Network (CTCN).

The Institute would be pleased to work with or on behalf of the AIIB on CCS-related topics, including in collaboration with the Institute's networks and diverse membership.

Any questions on this submission should be directed in the first instance to Lawrence Irlam, Senior Adviser – Policy and Economics on +61 3 8620 7342.

Yours sincerely

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[16] http://www.globalccsinstitute.com/insights/authors/WebinarOrganiser/2015/05/06/key-issues-and-barriers-developing-countries?author=MTc1OTM%3D
[17] https://www.greenclimate.fund/documents/20182/56440/Governing_Instrument.pdf/caa6ce45-cd54-4ab0-9e37-fb637a9c6235

GLOBAL CCS INSTITUTE

SUSTAINABLE DEVELOPMENT AND CARBON CAPTURE AND STORAGE

This paper identifies the sustainable development (SD) co-benefits and trade-offs associated with carbon dioxide (CO_2) capture and geological storage (CCS) projects in developing countries.

The attractiveness of CCS investments to developing countries can be very different to those of developed countries, with the former's interest perhaps leaning more towards the associated SD co-benefits of CCS projects, and the latter's interest more towards the accelerated opportunities to decarbonise energy systems and industrial processes.

CCS offers developing countries an enhanced scope of choice in how, by how much and indeed when to reduce their greenhouse gas emissions signatures from fossil energy use in order to facilitate longer term development goals. It does this by avoiding any imminent need to eliminate the use of fossil energy from their current energy and industrial needs; thereby ensuring minimal disruption to economic activities and jobs.

The SD co-benefits associated with CCS can serve to increase its attractiveness to many developing countries. These include:

- pro-longing the economic life of productive fossil assets,
- capacity to invest in affordable and environmentally-responsible fossil energy use,
- improving energy resilience,
- enhanced job creation and preservation, and
- potentially improving a country's balance of payments.

The accompanying diagram (overleaf) illustrates the type and scale of co-benefits.

The choice facing all governments is really one of 'when' rather than 'if' to abandon unabated conventional fossil-energy technologies. CCS is the only near commercial technology that offers an environmentally responsible use of fossil energy while simultaneously preserving many of its socio-economic benefits.

The challenge for many governments is that continuing with a business as usual approach to economic development could undermine a range of medium to longer term SD goals, including avoiding the dangerous impacts of climate change; but a move to relatively higher cost energy supplies might undermine the goal of affordable energy for all.

The argument is of course more complex than represented by these two apparent extremes.

Governments are justified in allocating scarce public resources in support of low emission energy futures not only on the basis of the 'greater public good' – such as driving broad SD goals and climate change mitigation – but also in an effort to encourage and leverage financial support from a range of international funds (including the Green Climate Fund, carbon markets such as the Clean Development Mechanism, and overseas development assistance). Governments also often seek to leverage the commercial interest of the private sector by offering to share the associated financial risks of nascent technology projects.

In an effort to optimise the benefits of public investment in clean energy projects; and to minimise the cost to the public purse, governments need to consider the extent to which supported projects can deliver multiple policy objectives – be they economic, environmental, social, technological, or institutional.

As the accompanying diagram illustrates, the potential of CCS to deliver on all of these factors is very high (and for comparison purposes only, the potential of a base-load renewable technology such as concentrated solar power with storage (CSP) is also presented).

It is clear however that the world's resource of fossil energy will remain the 'energy source of choice' for most developing countries in coming decades, especially within a context of addressing energy poverty and enhancing energy security.

It is also manifestly clear to the global community that fossil energy use cannot continue to be used unabated, and that CCS remains a critical mitigation option that can help developed and developing countries alike address the climate challenge.

CO-BENEFITS OF CCS

ENVIRONMENTAL

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
AIR	Reduce/avoid CO2-e	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
AIR	Reduce/avoid SOx	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
AIR	Reduce/avoid NOx	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
AIR	Reduce/avoid fly ash	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
AIR	Reduce/avoid particulates	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
AIR	Reduce non-Methane VOCs		
AIR	Reduce noise pollution		
AIR	Reduce/avoid odours	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
AIR	Reduce/avoid dust	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
LAND	Reduce/avoid solid waste	+++++++++++++++++++++ (HIGH)	+++++++ (SLIGHT)
LAND	Produce compost	+++++++++++++++++++++ (HIGH)	
LAND	Produce fertilizer	+++++++++++++++++++++ (HIGH)	
LAND	Uses irrigation		
LAND	Prevents soil erosion	+++++++ (SLIGHT)	
LAND	Uses minimum tillage		
WATER	Better waste water control		
WATER	Conserves/saves water	------------------ (HIGH)	------------- (PARTIAL)
WATER	Improved water access		
WATER	Cleaner water supply		
WATER	Improved water ecology		
RESOURCE ENDOWMENT	Enhanced mineral resources	++++++++++++++ (PARTIAL)	
RESOURCE ENDOWMENT	Enhanced plant life		
RESOURCE ENDOWMENT	Enhanced species diversity		
RESOURCE ENDOWMENT	Enhanced forests		
RESOURCE ENDOWMENT	Protects depletable resources		

SOCIAL

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
JOBS	New long term jobs	++++++++++++++ (PARTIAL)	+++++++ (SLIGHT)
JOBS	New short term jobs	++++++++++++++ (PARTIAL)	+++++++ (SLIGHT)
JOBS	New income sources	++++++++++++++ (PARTIAL)	
JOBS	Other job opportunities	+++++++ (SLIGHT)	+++++++ (SLIGHT)
HEALTH AND SAFETY	Prevents/reduces disease	+++++++ (SLIGHT)	+++++++ (SLIGHT)
HEALTH AND SAFETY	Prevents/reduces accidents	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Prevents/reduces crime	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Preserves food	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Reduces indoor air pollution	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Enhances health services	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Improves sanitation	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
HEALTH AND SAFETY	Improves waste management	++++++++++++++ (PARTIAL)	
EDUCAT-ION	Job-related training	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
EDUCAT-ION	Enhanced educational services	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
EDUCAT-ION	Project knowledge transfer	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
EDUCAT-ION	Other educational benefits	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
WELFARE	Improved work conditions	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
WELFARE	Improved housing conditions	+++++++ (SLIGHT)	+++++++ (SLIGHT)
WELFARE	Community advancement	+++++++ (SLIGHT)	+++++++ (SLIGHT)
WELFARE	Poverty alleviation	+++++++ (SLIGHT)	+++++++ (SLIGHT)
WELFARE	Improved wealth distribution	+++++++ (SLIGHT)	+++++++ (SLIGHT)
WELFARE	Income diversification	++++++++++++++ (PARTIAL)	+++++++ (SLIGHT)
WELFARE	Increased municipal revenues	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
WELFARE	Empowerment of women	+++++++ (SLIGHT)	+++++++ (SLIGHT)
WELFARE	Other welfare benefits	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)

ECONOMIC

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
ENERGY	Increase energy supply	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
ENERGY	Access to energy	+++++++ (SLIGHT)	+++++++ (SLIGHT)
ENERGY	Assist affordability of energy	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
ENERGY	Assist energy reliability	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
ENERGY	Assist energy security	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
GROWTH	Provide new investments	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
GROWTH	Provide new industrial activities	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
GROWTH	Provide new infrastructure	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
GROWTH	Enhance productivity	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
GROWTH	Increased access to micro-credit		
GROWTH	Reduce production costs and services		
GROWTH	Create new business opportunities	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
GROWTH	Generate other economic benefits	+++++++ (SLIGHT)	+++++++ (SLIGHT)
BoP	Assist reduce foreign dependency	+++++++ (SLIGHT)	+++++++ (SLIGHT)
BoP	Generate macro economic benefits	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)

TECHNOLOGY

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
TRANSFER, ADAPTATION & CAPACITY	Develop/diffuse new localised tech.	+++++++ (SLIGHT)	+++++++ (SLIGHT)
TRANSFER, ADAPTATION & CAPACITY	Introduce/diffuse new import tech.	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
TRANSFER, ADAPTATION & CAPACITY	Enhance access to IPR	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
TRANSFER, ADAPTATION & CAPACITY	Adaptation of new tech.	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
TRANSFER, ADAPTATION & CAPACITY	Facilitate knowledge sharing	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)
TRANSFER, ADAPTATION & CAPACITY	Learning by doing spillovers	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)

POLITICAL

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
PUBLIC SECTOR	Enhance tax revenue opportunities	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)
PUBLIC SECTOR	Enhance policy development capacity	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
PUBLIC SECTOR	Reduce social tensions (fairer distribution of benefits)		
LAW	Improve recognition of human rights		
LAW	Contribute to UNFCCC obligations	+++++++++++++++++++++ (HIGH)	+++++++++++++++++++++ (HIGH)

GOVERNANCE

INDICATOR	CRITERIA	IMPACTS (NONE | SLIGHT | PARTIAL | HIGH)	
		CCS	CSP
	Improve regulatory frameworks	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
	Improve governance oversight	++++++++++++++ (PARTIAL)	++++++++++++++ (PARTIAL)
	Improve corporate social responsibility	+++++++++++++++++++++ (HIGH)	++++++++++++++ (PARTIAL)

Source: Global CCS Institute, 2014

Legend: Horizontal bar charts
+ indicates positive impact
- indicates negative impact
Scale of impact is indicated by both colour and length