SUBMISSION TO THE TECHNOLOGY EXECUTIVE COMMITTEE (TEC): CONSULTATION ON TECHNOLOGY NEEDS ASSESSMENTS (TNA)

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The comments contained in this paper are the Institute's views, and do not necessarily represent the collective views of its membership nor does it pre-empt the decisions of its membership on any related matter.

Submission authors
Mark Bonner, Principal Manager, International Climate Change

Enquiries
Please address enquiries to the author at:
mark.bonner@globalccsinstitute.com

TABLE OF CONTENTS

1. THE GLOBAL CCS INSTITUTE

The Global CCS Institute (the Institute) is pleased to submit its views to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat, in response to the Technology Executive Committee's (TEC) taskforce on Technology Needs Assessments (TNAs) call for stakeholder submissions on TNA related matters. The Institute supports all efforts by the TEC and related UN bodies to strengthen the current TNA process.

As a not-for-profit international membership organisation, the Institute brings together the public and private sectors to build and share the know-how and expertise necessary to ensure that carbon dioxide capture and storage (CCS) and carbon dioxide capture, usage and storage (CCUS) can make a significant impact on reducing the world's greenhouse gas emissions. The Institute also connects various parties around the world to help solve problems, address issues and learn from each other to accelerate the deployment of CCS projects. It does this by:

- Sharing knowledge (collecting information to create a central repository for CCS knowledge; and creating and sharing information to fill knowledge gaps and build capacity),
- Fact based advocacy (informing and shaping domestic and international low carbon energy policies; increasing the awareness of the benefits of CCS and the role it plays within a portfolio of low carbon technologies), and
- Assisting projects (tackling specific barriers, particularly amongst early movers; bridging knowledge gaps between demonstration efforts).

The Institute is well placed to provide advice on technology assessments to the TEC due to its extensive project experiences, policy and regulatory expertise, development of case studies, and input into international standardisation efforts. It contributes across a broad range of CCS related scientific, economic and technical matters. It is an Accredited Observer to the UNFCCC, the Green Climate Fund (GCF) Board as well as the Intergovernmental Panel on Climate Change (IPCC). It is a long-time and active observer of TEC business and a member of the Climate Technology Centre's Network (CTCN).

The Institute tracks all CCS related activities globally, as updated annually in its publication *Global Status of CCS*. It is actively engaged in many government, intergovernmental, multi and bilateral initiatives. Such engagements provide the Institute with a deep global reach into CCS policy, program, project and regulatory developments. Please refer to the following website (http://www.globalccsinstitute.com/institute) for further information on the Institute, or contact the Institute's Principal Manager International Climate Change (mark.bonner@globalccsinstitute.com).

2. ENERGY OPTIONS FOR LOWER EMISSIONS

There are four key mitigation options to reducing emissions from the energy sector:

1. CCS/CCUS
2. Energy efficiency
3. Renewable Energies
4. Nuclear.

It is clear that none of these options are singularly sufficient to close the mitigation gap. CCS has the benefit of being able to mitigate at scale the emissions associated with fossil energy use in the stationary energy as well as the industrial sectors (steel, iron, chemical, fertilisers, and cement).

In positioning the global economy to meet the challenges of climate change, it is widely recognised that fundamental long-term decarbonisation of global energy supply is needed. The recently released report by the Intergovernmental Panel on Climate Change (IPCC) states that to contain average

temperature rise within 2°C from pre-industrial times, a reduction in global emissions of between 40-70% on 2010 levels by 2050 is needed, and to near zero by the end of this century.[1]

Such a transformation cannot be achieved rapidly. The decarbonisation of energy systems needs to take place at as fast a pace as is feasible, while avoiding any abrupt dislocation of economic activity. Given the inherent complexity of energy supply systems (linked sectors, transmission networks, markets and actors; large scale, long-lived capital intensive infrastructure) the speed of change will be largely determined by the potential of new technologies to be cost effective and deployable at an appropriate time. Another key determinate will be a technology's environmental credentials (eg the UNFCCC adopts a principle of 'environmentally sound technologies').

As of mid 2015, the Institute identified 55 large scale CCS projects in planning, under construction or operating. The current fleet of CCS demonstration projects continue to show high commerciality and emission abatement potentials, as well as generating substantial positive knowledge spillovers that continue to better inform governments, investors and civil society. The spillovers being created today will benefit future CCS projects.

As with many other large-scale clean energy technologies (concentrated solar power and storage, geothermal, offshore wind), CCS is tracking along a pre-commercial demonstration pathway. The Institute considers that the early stages of development for all of these technologies requires strong government policy intervention, for which there are a number of justifications including:

- Addressing market failures,
- Generation of positive spillovers (ie. learning-by-doing),
- Addressing inherent non-market barriers in the technology innovation lifecycle, and
- Building institutional capacity (skills, systems, institutions).

There are three main issues (listed below) that continue to stifle the development, deployment and diffusion of large-scale clean energy technologies, resulting in an under-investment in these options:

- Lack of policy drivers,
- Relative cost compared to higher emitting and more conventional solutions, and
- Long project lead times.

Such issues are clearly manageable as evidenced by many governments who are providing targeted and substantive incentives to many smaller-scale distributed renewable technologies (eg feed in tariffs, mandated obligations).[2]

3. TNA PROCESS

The Institute recognises the valuable contribution that TNAs can make to the identification of mitigation technology priorities for developing countries. It is clear that TNAs, as a country driven process, is highly regarded by Parties to the UNFCCC and remains central to giving effect to the Convention's Article 4.5[3] (the technology transfer framework). TNA development is a key component of the Poznan Strategic Programme on Technology Transfer supported by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP).

TNAs typically identify a portfolio of environmentally sound and nationally relevant technologies (ESTs), projects and programmes to support the transfer of, and access to these ESTs. TNAs also provide a common focus in which relevant stakeholders can be brought together at a national level to

[1] http://mitigation2014.org/report/summary-for-policy-makers (Page 10)
[2] The Economist cited in February 2014 over 130 countries have such measures in place (http://gelookahead.economist.com/ga/its-all-about-economics/)
[3] Article 4.5 The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.

develop Technology Action Plans (TAPs) and Intended Nationally Determined Contributions (INDCs) and share good practices and lessons learned. TAPs prioritise ESTs as well as identifies enabling frameworks and potential projects with links to financing sources.

In 2010, the United Nations Development Programme (UNDP) released a 176 page *Handbook for Conducting Technology Needs Assessments*[4]. Chapter 5 contains guidance on how to prioritise mitigation technologies, suggesting that "new" technologies should also be considered (ie. technologies or measures that country stakeholders are not yet familiar with). The handbook, which the Institute considers as being highly relevant, indicates that to assist stakeholders to become more knowledgeable about previously unfamiliar technologies, a technology familiarisation process is envisaged, consisting of workshops on technologies, expert lectures, and visiting demonstration projects.

The Institute strongly supports both a formal and informal coordination approach to facilitate a better understanding of the mitigation potential of (what may be) unfamiliar technologies including CCS/CCUS. Although for illustrative purposes the UNDP's handbook seems to rely extensively on renewable energy examples and it might also be useful to diversify the handbook's examples by including CCS. One example of a formal approach currently adopted by the UNFCCC is the Technical Expert Meetings hosted under the Ad-hoc Working Group on the Durban Platform for Enhanced Action (ADP). Closer linkages between the development of TNAs/TAPs and the TEM process might assist in the identification of innovative sources of project support.

4. NEED FOR TNA IMPROVEMENTS

The Institute's analysis of existing TNAs reveals an under-representation in the identification of CCS and CCUS as a core technology to addressing developing country fossil-energy related emissions in both the industrial (steel, cement, iron, fertilisers) and power sectors. The Institute's own tracking of substantive CCS related capacity building efforts spans across at least 22 developing countries[5] to date. This is within a context of only seven published TNA's specifically refer to CCS, including:

1. Bangladesh (mentions CCS linked to an Integrated Gas Combined Cycle project),
2. Kazakhstan (mentions CCS briefly as an option for cement industry),
3. Morocco (planned a pilot project proposed using a solar tower to generate energy to capture CO_2 and then geologically store),
4. Mongolia (assessed CCS in energy sector – but did not identify it as a short term priority),
5. Rwanda (identified a CCS project using 10MW post combustion capture system separation on a combined cycle gas turbine plant with geological storage),
6. Republic of Moldova (mentions CCS), and
7. Thailand (CCS identified as a high priority technology, but with low 'readiness' in Thailand).

This suggests that many developing countries remain unfamiliar with the critical role that CCS mitigation can play at a national level to significantly reduce emissions over the medium term, as well as allow for a continued and more environmentally responsible use of low-cost fossil energy. This was certainly case in point for an Institute discussion with one developing country representative at a CTCN workshop in Bangkok (April 2015) charged with managing his country's imminent and inaugural TNA process. It is also evident from the above listed TNAs that CCS is not a very well understood technology. Often countries have not considered the role CCS can play in enhancing energy access[6] and energy security[7], or its role in complementing other national strategies to transition to alternate low emissions energy sources.

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[4] http://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TNR_HAB/b87e917d96e94034bd7ec936e9c6a97a/1529e639caec4b53a4945ce009921053.pdf

[5] Algeria, Botswana, Brazil, Cambodia, China, Egypt, India, Indonesia, Jordan, Kenya, Kosovo, Lao PDR, Mexico, Maghreb, Malaysia, Philippines, South Africa, Trinidad and Tobago, Thailand, UAE, Venezuela and Viet Nam.

[6] CCS can contribute to energy access via provision of 'climate friendly' base-load power, reaching significant numbers of people.

[7] CCS can contribute to energy security via continued use of indigenous fossil fuel supplies.

A direct consequence of countries unconsciously omitting CCS as an option in TNAs is that it may exclude CCS project opportunities in TAPs, and potentially in INDCs, Nationally Appropriate Mitigation Action (NAMAs) and national Low Emission Development Strategy (LEDS). Such unfamiliarity with the technological possibilities and applications of CCS serves to undermine the extent to which the CTCN can assist developing countries further examine the applicability of CCS to national circumstances (project and policy) as well as future claims on the GCF to support CCS projects in developing countries.

The Institute strongly supports the role of the UNFCCC's Technology Mechanism and its related institutions (TEC and CTCN) to help developing countries further identify and better understand the potential of large-scale centralised energy mitigation technology solutions such as CCS/CCUS, as well as concentrated solar thermal with storage (CSP) and geothermal.

5. FUNDING LOW EMISSIONS TECHNOLOGY PROJECTS

While the absolute volume of funds available is critical, so too are other elements of any funding package that can help reduce the overall project financing costs as well as:

- attract other financiers,
- facilitate the creation of market capacity,
- support public policies that address market failures,
- support innovation and demonstration, and
- help accelerate project delivery.

In addition to energy security and enhanced energy access, CCS can deliver co-benefits (such as energy access, energy security and sustainable development aspects) to developing countries, which can serve to increase its attractiveness to financiers as well.

It is important that financing criteria adopt a principle of technology neutrality to help support the mitigation potential of as broad a range of technologies as possible to address climate change. It is likely that the world, including many developing countries, will continue to use fossil energy in large quantities at least in the medium term – and it is this period in which the atmosphere must see dramatic reductions in emissions if it is to avoid exceeding the 2^0C target. It is apparent from the IPCC's 5th Assessment Report that focussing on renewables and energy efficiency alone will be insufficient to curtail global emissions at least-cost within the necessary time frame and that CCS is also required. The IPCC report also identified that without CCS, the average cost of achieving global emission reduction targets will increase 138%.

The Institute acknowledges that for large-scale clean energy projects (including CCS), multi-development bank financing alone will likely be insufficient. The GCF is therefore encouraged to innovatively leverage its funding resources with additional sources of public/private funding. This may assist in:

- improving the financial viability of commercial-scale low-emissions technology projects,
- further de-risking project financing structures,
- reducing the impact of market failure especially in capital markets, which in turn can further catalyse private sector flows, and
- provision of additional advisory services that can help with the design of investment programmes, as well as with building administrative and project management capacity to reduce the risks associated with project delivery.

The Institute also supports strengthening the nexus between the Technology Mechanism, including the CTCN and TNA/TAP process, and the future roles of accredited intermediaries of the GCF who will be tasked to manage GCF loans and grants. Of critical significance will be the GCF's Private Sector Facility (PSF) that has been charged to engage the private sector to encourage contributions – in addition to public, MDB, bilateral and multilateral sources – to the US$100 billion target per year of climate finance by 2020.

Within this context, the Institute considers the TNA/TAP process, the CTCN and the GCF to be very well positioned to champion a CCS project in a developing country through the prioritisation of national resources, provision of technical and project management assistance, as well as support from the GCF's mitigation investment window.

Finance blending and innovative financial instruments such as 'green bonds' (especially their issuance to institutional investors who are interested in supporting climate related projects) may be two examples that the GCF could further consider leveraging.

6. NEED TO ESTABLISH A VIABLE BUSINESS CASE

Business cases are inevitably heterogeneous regardless of technology, location or proponent. The business case for CCS projects can vary across different actors depending on how it aligns with their respective organisational objectives. For example, in addition to simply achieving a targeted return on investment (ROI), a number of other objectives should be considered including:

- protecting the economic value of localised resource endowments and/or asset portfolios,
- optimising the value of resource endowment exploitation in an environmentally responsible manner,
- technology development,
- commercialisation opportunities (e.g. technology licensing or diversification),
- market leadership,
- compliance with expected future regulatory changes, and
- sustainable development and low emissions economic growth.

Different objectives are often linked to different types of financial risks. Project proponents focused on commercialisation opportunities tend to rely more on ROIs, whereas more public interest focused projects may be willing to accept lower ROIs and/or even a neutral or negative net present value (NPV) to ensure that the technology objectives are achieved.

Private sector financing tends to rely on equity or debt contributions from key project sponsors. Such balance sheet financing is inevitably limited by the risk appetite and ability of project sponsors to contribute a significant proportion of their capital budgets to activities that may not deliver a financial return commensurate with the risks of project development. In many situations, a CCS project's financial position can be improved through exploiting additional revenue streams to cover costs. This can include the sale of captured CO_2 for enhanced hydrocarbon recovery as well as other offtakes (H_2SO_4 etc). In 2014, some 55% of all identified large-scale CCS projects included the planned use of captured CO_2. Similarly, a number of projects surveyed by the Institute are poly-generation projects that integrate upstream and/or downstream processes with their primary industrial process, in order to maximise the value of their industrial offtakes.

The Institute also supports the adoption of a 'meaningful' shadow carbon price in all benefit-cost assessments of projects. As the emissions externalities associated with fossil fuel use are generally not adequately priced into investment decisions, this is a prime example of a market failure. Adoption of a carbon price is economically justifiable as it reflects the expected marginal damage of each unit of harmful emissions.

7. STAKEHOLDER MANAGEMENT

The Institute considers the formal coordination of a broad range of stakeholders (internal and external to the UN system) as being critical to supporting the TNA process. The Institute (either in its capacity as a member of the CTCN and/or through the GEF/UNEP's implementation) would welcome any opportunity to assist in the development of TNAs for developing countries, specifically in relation to ensuring CCS is better understood and considered. The Institute sees great value in external specialist stakeholders such as itself being invited to participate in TNA related workshops, especially those focusing perhaps on unfamiliar clean energy solutions like CCS, and as early in the TNA cycle as possible.