



AN EXPLORATION OF THE OPPORTUNITIES TO PROMOTE CARBON CAPTURE AND STORAGE (CCS) IN THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

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1. Executive Summary

CCS mitigation is already accepted as an environmentally sound and sustainable development (SD) friendly mitigation solution within the United Nations Framework Convention on Climate Change (UNFCCC) noting its explicit recognition in the Kyoto Protocol (Article 2.a.iv), and its eligibility in the Clean Development Mechanism (CDM) and the Green Climate Fund (GCF).

These are important reference points for CCS as the SD agenda is increasingly embedded into all aspects of the climate change agenda – including influencing the allocation of its financial and non-financial resources. In order for CCS to be considered by the global international climate community as a mainstream mitigation option, and for it to attract the resources of the UNFCCC, its deployment business case needs to clearly articulate and value both its direct mitigation benefits as well as its associated co-benefits such as positive SD impacts and its ability to control heavy metals and air pollutants.

In addition to the growing importance of climate change actions within the context of delivering on the UN's Sustainable Development Goals (SDGs), the UNFCCC agenda of *climate response measures* is also increasingly manifesting as an important issue for all low emissions technologies, especially for CCS. This agenda includes two important issues: (i) economic diversification and (ii) a 'just transition' of the workforce. These two issues can be more broadly interpreted as the planning, implementation and impact of actions aimed at transitioning from emissions intensive to more decarbonised economic activities (say coal mining etc) and reforming labour markets to take advantage of 'new economy' opportunities (respectively). It will be important that CCS prosecutes an SDG relevant business case within the context of these two emerging issues.

The extent to which a global carbon budget consistent with a 'well below average 2°C rise' in warming can be satisfactorily managed will ultimately depend on how serious all countries are in controlling their power and industrial sector emissions in the pre- and post-2020 periods. This necessarily implies that national interests in CCS must increasingly be formally identified by Parties within the UNFCCC agenda. This can be done through a portfolio of existing communication processes, programs and mechanisms (referred to in this paper as 'vehicles'). All of these vehicles apply to varying degree (ie. usually level of detail) to both developed and developing countries to hold them to account for their climate commitments and responses.

The more institutionalised (ie. government endorsed) approaches of Low Emissions Development Strategies (LEDS), Nationally Determined Contributions (NDCs), Nationally Appropriate Mitigation Actions (NAMAs), National Communications (NCs) and Biennial Update Reports (BURs) contain details of overarching national policy frameworks and high level support available to implement the mitigation and adaptation goals contained within.

NAMAs for example have quite a near-term focus and impact (relevant to the pre-2020 period) and can help build support for, and therefore strongly linked to, the longer term visions of LEDs and NDCs (relevant to the post-2020 period). UNFCCC vehicles such as LEDS and NAMAs are in themselves complementary concepts to each other and can help shape national climate response frameworks formally expressed in NDCs, NCs and BURs; while also aim to facilitate real mitigation project opportunities.

The bottom-up approaches or project level approaches of the Technology Needs Assessments (TNAs), Technology Action Plans (TAPs), CDM, Climate Technology Centre and Network (CTCN), and GCF generally have more implementing details for specific actions and project proposals, coupled with general descriptions of how they align with a country's long-term climate and SD strategies and needs.

Monitoring, reporting and verification (MRV) systems such as International Assessment Review (IAR) and International Consultation and Analysis (ICA) aim to provide an overall framework for evaluating progress of implementation of individual and aggregate mitigation actions and climate policies that have been cited in the various UNFCCC's vehicles. MRV is important for enhancing transparency and compliance at both domestic and international level, as well as served as a management tool in the process of developing and adjusting strategic objectives and priorities over time.

It is important that as these UNFCCC vehicles get periodically updated they reflect the evolution of country commitments and national interests. This is why it is so important that Parties with high fossil emission signatures should increasingly and explicitly refer to CCS in the next wave of their NAMAs and NDCs, as well as reflect its inclusion in these vehicles in all other UNFCCC vehicles. This is critically important if CCS is to be treated fairly and equitably within the formal decision making processes of the UNFCCC, especially in regards to the policy deliberations of Parties, and ultimately in the allocation of resources.

2. Introduction

The following ‘vehicles’ (ie. reporting, review, discussion platforms, cooperative approaches, planning tools and strategies) are all constructs of the UNFCCC – which is the principal global fora addressing climate change.

- National Communications (NCs) and Biennial update reports (BURs);
- International Assessment Reviews (IAR) and International Consultation and Analysis (ICA);
- Nationally Appropriate Mitigation Actions (NAMAs);
- Monitoring, Reporting and Verification (MRV);
- Low Emissions Development Strategies (LEDS);
- Nationally Determined Contributions (NDCs);
- Technology Needs Assessments (TNAs);
- Technology Action Plans (TAPs);
- Technical Examination Process (TEP) and Technical Expert Meetings (TEMs);
- Sustainable Development Goals (SDGs);
- Cooperative Approaches that include project level and market based activities such as the Clean Development Mechanism (CDM);
- Country driven applications for Green Climate Fund (GCF) and Global Environment Facility (GEF) financing; and
- Country driven technology requests for assistance to the Climate Technology Centre and Network (CTCN).

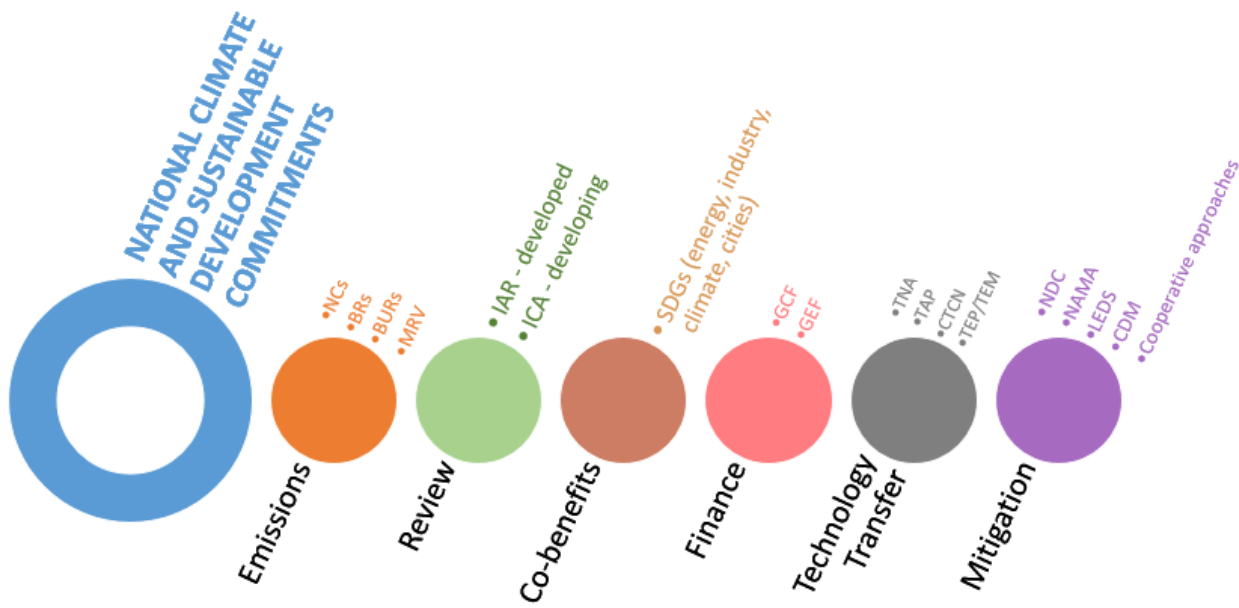
While most of these vehicles were established prior to the Paris Agreement (2015), they all remain relevant to the current national climate action efforts, and are linked and highly complementary in supporting the climate actions of both developed (sometimes referred to as Annex I and Annex II under the Convention and Annex B under the Kyoto Protocol) and developing nations (sometimes referred to as non-Annex I under the Convention and non-Annex B under the Kyoto Protocol); as well as to the delivery of the Sustainable Development Goals (SDGs).^{1,2} All of them have been implemented to varying degree, with some in the process of being revised and updated.

This short report aims to illustrate and explain how these vehicles are linked and how they individually and collectively can be used to support CCS while simultaneously enhancing climate mitigation outcomes.

¹ Annex I Parties include the industrialised countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (EIT), including the Russian Federation, the Baltic States, and several Central and Eastern European States. Annex II Parties consist of the OECD members of Annex I, but not the EIT Parties. Annex B Parties have commitments under the Kyoto Protocol. Non-Annex I and Non-Annex B Parties are mostly developing countries.

² <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Diagram 1 The UNFCCC's Vehicles

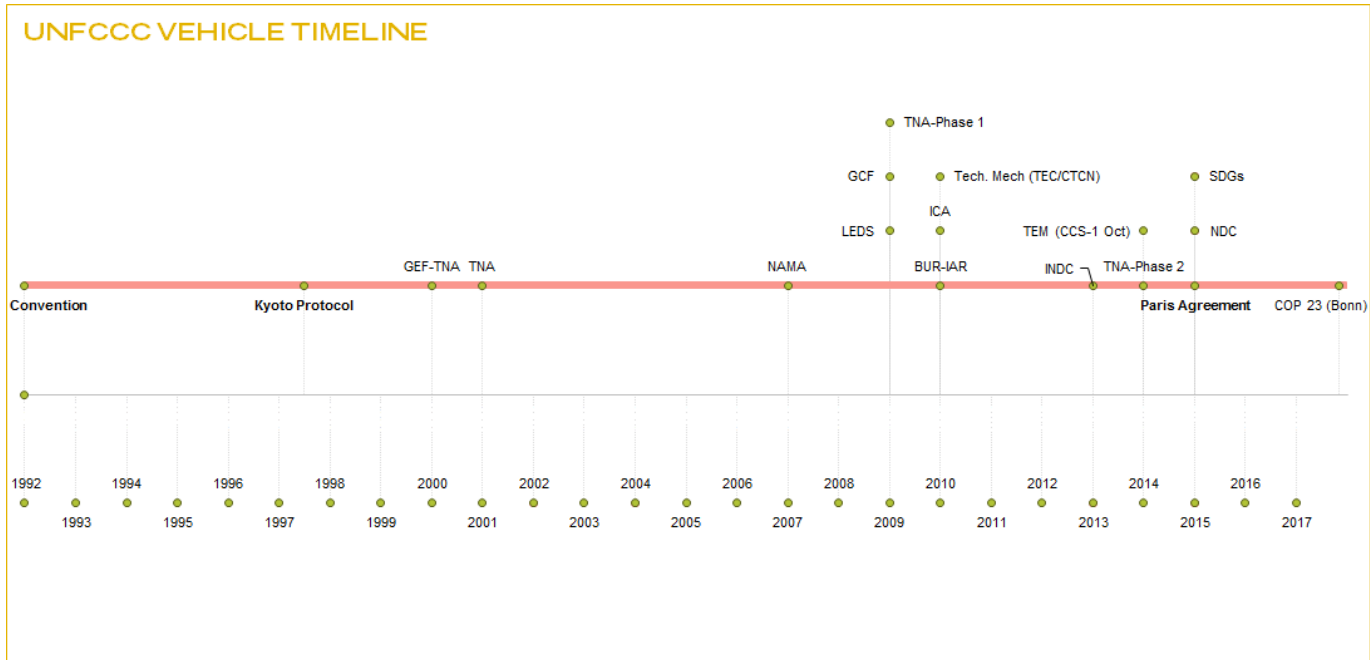


Source: MBonner, GCCSI

All of these vehicles aim to enhance the implementation of the Convention to deliver on its ultimate objective,³ and many treat mitigation and adaptation as having equal importance. This paper focuses mainly on mitigation. The following provides a quick overview of each vehicle listed above.

3. Description and role of each vehicle

Diagram 2 Timeline for the establishment of the UNFCCC's Vehicles



Source: MBonner, GCCSI

³ Article 2: The ultimate objective of the Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

National Communications (NCs), Biennial Reports (BRs) and Biennial Update Reporting (BURs)

Developed country Parties to the Convention have a number of reporting and review requirements, including:

- An annual National Greenhouse Gas Inventory (NGGI) which contain information on emissions (emissions observation data, emission factors and methodologies used to estimate emissions);
- The submission of a NC report every 4 to 5 years, which contain information on climate policies and measures and technology transfer to developing country Parties (among other things like emissions and financial support); and
- A biennial report (BR) every 2 years outlining the progress made by Parties in achieving their national emission reductions as well as the provision of technology support to developing countries (BRs can be attached to NCs as an appendix to when due dates overlap).

Example of a NC with CCS: *Australia's Sixth National Communication on Climate Change*

"The development of low-emissions fossil fuel technologies, including carbon capture and storage (CCS), is important for any least-cost transition to a low-carbon economy and the ongoing strength of Australia's energy exports. The Government is investing in a range of measures to support the development of CCS technologies both domestically and internationally."

Source: http://unfccc.int/files/national_reports/annex_i_natcom/application/pdf/aus_nc6.pdf

Developing country Parties to the Convention also have a number of reporting and review requirements, including:

- The submission of a NC report every 4 years, which contain information on greenhouse gas inventories, climate policies and measures and nature of technology transfer; and
- A biennial update report (BURs) every 2 years (exceptions are for 'lesser developed countries' and the Alliance of Small Island States which can submit at their own discretion) including information on mitigation actions, constraints and gaps, and support needed and received; and
- National Adaptation Programme of Actions (NAPAs).

Example of a BUR with CCS: *Thailand's First Biennial Update Report*

"For the climate change mitigation, the following [...] technology options [...] of technology needs in the energy sector have been prioritized:

- Carbon Capture and Storage (CCS): Technology and process for capturing CO₂ from large point source, such as fossil fuel power plants, transporting it to a storage site depositing it where it will not enter the atmosphere."

Source: <http://unfccc.int/resource/docs/natc/thabur1.pdf>

International Assessment and Review (IAR)

Expert Review Teams (ERT) review the developed country Party NGGI reports every year, and the NCs within 1 to 2 years of their submission. The IAR process for developed country Party BRs was established in 2010 to promote the comparability of climate action efforts (ie. emissions reduction).

Example of an IAR with CCS: *Summary report on the multilateral assessment of Norway at the forty-second session of the Subsidiary Body for Implementation*

"[...] emphasized the importance of advancing carbon dioxide capture and storage technologies for achieving Norway's long-term goal of reaching carbon neutrality."

Source: http://unfccc.int/resource/docs/2015/webdocs/nor_ma.pdf

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International Consultation and Analysis (ICA)

The ICA process was adopted in 2010 at COP 16 as part of the measurement, reporting and verification (MRV) arrangements for developing country Party (ie. non-Annex I) BURs.

Example of an ICA with CCS: *Summary report on the technical analysis of the first biennial update report of South Africa*

“For carbon capture and storage (CCS), the South African Centre for Carbon Capture and Storage has developed a road map for evaluating the potential for CCS and for a test and demonstration plant. The implementation of CCS activities from 2025 onwards is expected to create estimated reductions of 249 Mt CO₂ eq. The road map stipulates that piloting for storage will start from 2017 onwards.”

Source: <http://unfccc.int/resource/docs/2015/tasr/zaf.pdf>

Nationally Appropriate Mitigation Actions (NAMAs)

NAMAs were formally established in 2007 at the 13th Conference of the Parties (COP 13), and can apply to both developed and developing countries to help structure and implement their emission reduction potentials in the pre-2020 period. COP 13 yielded The Bali Action Plan, which states:

“[NAMAs] by developing country Parties in the context of sustainable development, supported and enabled by technology, financing [...] in a **measurable, reportable and verifiable** manner”

“**Measurable, reportable and verifiable** nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives, by all developed country Parties [...]”⁴

Example of a NAMA with CCS: *Development and Installation of Carbon Dioxide Sequestration Technologies in Pakistan (NS-138)*

“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 the prevailing situation of energy crisis in the country.”

Source: http://www4.unfccc.int/sites/nama/_layouts/un/fccc/nama/NamaSeekingSupportForPreparation.aspx?ID=75&viewOnly=1

The development of a NAMA is voluntary and can refer to any action that reduces emissions relative to 'business as usual' and that falls under the umbrella of a national governmental initiative. They can include policies directed at transformational change within an economic sector, or actions across sectors for a broader national focus; and are supported and strongly enabled by technology, financing, and capacity-building.

A publicly accessible NAMA registry is operated by the UNFCCC secretariat. Its purpose is to increase opportunities for implementation of and recognition for NAMAs, especially in developing countries.

Measurement, Reporting and Verification (MRV)

The Bali Action Plan also established a need for MRV protocols to be applied to developing country Parties. Measurement occurs at the national level and refers to emissions, mitigation actions (including technology transfer) and their effects, and the support needed and received. Reporting is implemented through the NCs and BURs where all Parties report on their climate actions. Verification is addressed at the international level, through the ICA of BURs.

⁴ Decision 1/CP.13 Paragraph 1 b.i and b.ii

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The UNFCCC also strongly pursues environmental integrity through the establishment of sound modalities and procedures (M&P) for the governance of its mechanisms (such as the CDM). M&Ps define the important role of MRV in the compliance regimes of such mechanisms.

Example of MRV with CCS: *Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities*

“Subsequent verification and certification reports shall be submitted to the Executive Board not later than five years after the end of the previous verification period. Verification and certification shall continue beyond the end of the last crediting period of the proposed CCS project activity and shall only cease after the monitoring of the geological storage site has been terminated in accordance with the conditions for the termination of monitoring [...]”

Source: https://unfccc.int/files/meetings/durban_nov_2011/decisions/application/pdf/cmp7_carbon_storage_.pdf

Low Emissions Development Strategies (LEDS)

While LEDS have no Party agreed definition, they are generally used to describe national plans that encompass climate-resilient economic growth. LEDS primarily aim to advance national climate change policy in a co-ordinated, coherent and strategic manner and were first formally referred to in 2009 at COP 15 which stated:

“We [note: Heads of State, Heads of Government, Ministers, and other heads of agreeing delegations] should cooperate in achieving the peaking of global and national emissions as soon as possible [...] and that a **low-emission development strategy** is indispensable to sustainable development.”⁵

Preparation of a LEDS is often seen as an enabling exercise (ie. can help focus policy priorities and attract finance) to help prioritise near-term NAMAs, and can be useful for considering how NAMAs can complement longer-term national strategies like NDCs.

Example of a LEDS with CCS (developed country): *United States Mid-Century Strategy for Deep Decarbonization*

“Coal and natural gas power plants can continue to play a major role in the U.S. electricity system if their associated CO₂ emissions are captured and prevented from being released into the atmosphere. CCUS technology can significantly reduce or eliminate emissions from coal or natural gas plants [...]”

In many industrial processes (such as hydrogen production from steam methane reforming, ethanol production, and processing of natural gas, among others), the separation of CO₂ is an inherent part of the fuel production process. Capture from these high-purity sources is less capital intensive in comparison to capture from diffuse sources of CO₂, such as power generation. These industrial CCUS opportunities could provide

Example of a LEDS with CCS (developing country): *Mexico’s Climate Change Mid-Century Strategy*

“Lines of action:

- M2.9 To continue exploring carbon capture and sequestration (CCS) technologies aimed at the implementation of projects. This will include the possibility of using CCS for enhanced hydrocarbon recovery.
- M2.10 To promote highly efficient technologies, fuel substitution, industrial process redesign, and CO₂ capture technologies in energy-intensive industries such as cement, steel, petroleum, chemical, and petrochemical industries.”

Source: https://unfccc.int/files/focus/long-term_strategies/application/pdf/mexico_mcs_final_cop22nov16_red.pdf

⁵ Decision 2/CP.15 Paragraph 2

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Nationally Determined Contributions (NDC)

The notion of 'Intended' NDCs was first introduced in 2013 at COP 19 and formalised in the Paris Agreement at COP 21. Once a country ratifies the Paris Agreement, their INDC becomes their first NDC unless revised and resubmitted. The purpose of INDCs/NDCs is to support the implementation of the Paris Agreement by outlining national climate actions and agendas for the post-2020 period.

The Paris Agreement requires all Parties, developed and developing, to prepare, communicate and maintain successive (ie. every 5 years) NDCs, as well as the domestic mitigation measures it will implement to give effect to them. Like NAMAs, NDCs are recorded in a public registry maintained by the UNFCCC secretariat.

Example of an NDC with CCS (developed country): *Canada's NDC Submission to the UNFCCC*

Electricity sector regulations make Canada the first major coal user to ban the construction of traditional coal-fired electricity generating units. These regulations will also lead to the phase-out of existing coal-fired electricity units without carbon capture and storage.

Source: <http://www4.unfccc.int/ndcregistry/Pages/Party.aspx?party=CAN>

Example of an NDC with CCS (developing country): *The NDC of the Kingdom of Saudi Arabia under the UNFCCC*

"Carbon Capture and Utilization/Storage: promote and encourage actions in this area. As part of its sustainability programme, the Kingdom of Saudi Arabia plans to build the world's largest carbon capture and use plant. This initiative aims to capture and purify about 1,500 tons of CO₂ a day for use in other petrochemical plants. Saudi Arabia will operate on pilot testing basis, a Carbon Dioxide – Enhanced Oil Recovery (CO₂-EOR) demonstration project to assess the viability of CO₂ sequestration in oil reservoirs and any other useful applications. Forty million standard cubic feet a day of CO₂ that will be captured, processed and injected into the Othmaniya oil reservoir. This pilot project has comprehensive monitoring and surveillance plans. The success of this pilot will determine the extent this program will contribute to the Kingdom's ambition in addressing climate change."

Source: <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Saudi%20Arabia%20First/KSA-INDCs%20English.pdf>

Technology Needs Assessments (TNAs) and Technology Action Plans (TAPs)

The purpose of TNAs is to assist participating developing country Parties identify, analyse (including deployment barriers) and prioritise technologies for selected sectors. They can help establish a portfolio of environmentally sound technology (ESTs) projects and programmes. The term EST is widely used within the context of the international climate change and sustainable development agendas, and was first cited in 1992 under Article 4.5 of the Convention.⁶

The Global Environment Facility (GEF) Council first agreed in 1999 to fund the identification of technology needs. TNAs were subsequently and formally introduced in 2001 at COP 7, which defined them as "... a set of country-driven activities that identify and determine the mitigation and adaptation technology priorities [...] particularly developing country Parties. They involve different stakeholders in a consultative process to identify the barriers to technology transfer and measures to address these barriers through sectoral analyses. These activities may address soft and hard technologies, such as mitigation and adaptation technologies, identify regulatory options and develop fiscal and financial incentives and capacity building."⁷

⁶ The Convention, 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."

⁷ Decision 4/CP.7, Annex Theme C.3

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The undertaking of TNAs and the implementation of their results through TAPs are referenced in the implementing decisions of the Paris Agreement in the context of elaborating a new technology framework under the Technology Mechanism,⁸ to facilitate the:

- Preparation of bankable projects; and
- Provision of enhanced financial and technical support.

The results of TNAs place countries in a good position to develop their medium/longer term plans (ie. TAPs) that include project concepts as well as the strategies needed to bridge localised needs to global support options. TAPs can serve as a basic building block for enhanced mitigation action by giving countries the foundation necessary to scale up prioritised technologies.

For example, TAPs can be used as a basis for country driven applications for Green Climate Fund (GCF) funding, for Climate Technology Centre and Network (CTCN) technical assistance, as well as for developing NDCs, NAMAs and LEDS that can help strengthen the institutional capacity, arrangements and support for technologies of national interest.

Example of a TAP with CCS: *Technology Action Plan – Thailand*

Table 32 Technology action plans for CCS

| No. | Activities | Period | Related stakeholders | Key indicators | Priority | Fund resources | |
|-----------|------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------|
| No. | Activities | Short | Period | Long | Related stakeholders | Key indicators | Priority |
| Financial | | | | | | | |
| D1 | Apply for international funding on CCS | Policy and Regulatory | | | | | |
| D2 | Research funding for CCS | D7 | Assign responsible parties for CCS | | | | |
| D3 | Develop a long-term policy to support CCS | D8 | Develop policy that supports CCS technology e.g. design, construction, operation, injection, and monitoring post-injection | D12 | Study and research the geology and related data in both off-shore and on-shore | | |
| D4 | Encourage government agencies (PTT, EGAT, SCG) or research institute to study and/or invest on CC pilot projects | D9 | Study the international standards and regulations in both the international context and sea borders, especially in natural gas and oil field | D13 | Study on CCS for storage, site assessment, geology, hydrogeology, EOR potential, technology selection, risk management, and best practices study | D16 | Establish CCS training programs |
| D5 | Feasibility study on CCS-CDM | D10 | Identify the needs for appropriate regulation or guideline or standard or licenses on CCS including safety guideline which should be along with international context | D14 | Study the impact analysis of CCS to climate change from main technology | D17 | Create CCS international cooperation development |
| D6 | Study the potential of internationally supported NAMA concept | Technology | | | | | |
| | | D11 | Feasibility study on location of CCS in both off-shore and on-shore | Capacity Building | | | |
| | | D15 | Inform stakeholders about the issue related to CCS, especially on environmental impacts | D19 | Establish the CCS research network from public agency and academic institute | | |

Source: http://unfccc.int/ttclear/misc/_StaticFiles/gnwoerk_static/TNR_CRE/e9067c6e3b97459989b2196f12155ad5/b8455264942543f8872863505ad259fe.pdf

The development of TNAs and TAPs often include highly participatory approaches, including consulting with technical expertise and the engagement of stakeholders (ie. workshops, one on one consultations and structured questionnaires) as well conducting literature reviews. The subsequent policy options and recommendations that emerge from the resulting TNA and TAP processes are often adopted by governments to support the development of local projects.

The TNA process is overseen by the United Nations Environment Programme (UNEP) and funded by the GEF, while work on enhancing guidance for preparing TAPs has been mandated to the Technology Executive Committee (TEC) which is the Technology Mechanism's policy body.^{9,10,11}

The TEC subsequently reported to COP 18 (2012) that:¹²

- The development and implementation of TNAs and TAPs should continue and become better integrated with

⁸ Decision 1/CP.21 paragraphs 65, 67.a and 67.b

⁹ 36 countries participated in Phase I of the TNA process over the period 2009 and 2013, including: Africa & Middle East: Cote d'Ivoire, Ghana, Kenya, Lebanon, Mali, Mauritius, Morocco, Rwanda, Senegal, Sudan, Zambia, Ethiopia; Asia & CIS: Azerbaijan, Bangladesh, Bhutan, Cambodia, Georgia, Indonesia, Kazakhstan, Lao PDR, Moldova, Mongolia, Nepal, Sri Lanka, Thailand, Vietnam; Latin America & Caribbean: Argentina, Bolivia, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Peru

¹⁰ 26 countries participated in Phase II of the TNA process commencing in 2014, including: Africa & Middle East: Burkina Faso, Burundi, Egypt, Gambia, Jordan, Madagascar, Mauritania, Mozambique, Seychelles, Swaziland, Tanzania, Togo, Tunisia; Asia & CIS: Armenia, Malaysia, Philippines, Pakistan, Kazakhstan, Lao PDR; Latin America & Caribbean: Belize, Bolivia, Grenada, Guyana, Honduras, Panamá, Uruguay

¹¹ Phase III of the TNA process has been approved by the GEF and will involve 20 countries.

¹² TEC/2016/13/6 (22 August 2016) Annex paragraphs 2.1 and 2.b

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other UNFCCC related processes, including the preparation of NAMAs and NCs (note: post COP 21 is also clearly relevant to NDCs); and

- There is a need to engage the financial and business communities and funding sources under and outside the UNFCCC to facilitate the implementation of the TNA outcomes.

Technical Examination Process (TEP) and Technical Expert Meetings – Mitigation (TEM-Ms)

The TEP on mitigation consists of regular in-session thematic TEM-Ms and focused follow up work, generally conducted by Parties in collaboration with international organisations and partnerships. The TEM-M process commenced in 2014 and it was subsequently agreed by Parties that it would be extended to 2020 in order to help implement best practice policies and bridge the emissions reduction ambition gap. TEM-M sessions are generally hosted at the mid-year intersessional meeting of the subsidiary bodies and at the end of year COPs.

Related decisions supporting the TEP process in the implementation of the Paris Agreement called for cooperation in “... facilitating the implementation of policies, practices and actions in accordance with national sustainable development priorities” to assist the development of economically, environmentally and socially viable project proposals in the “high mitigation potential areas” identified.¹³

Example of a TEM-M with CCS: *Workplan on Enhancing Mitigation Ambition: Technical Expert Meeting on Carbon Capture, Use and Storage, Tuesday, 21 October 2014, 10.00 a.m.–6.00 p.m. – Summary by the facilitator*

“The TEM participants heard that carbon capture, use and storage should be considered as one element of an ultimate and necessary transition to net-zero emissions.”

Source: https://unfccc.int/files/bodies/awg/application/pdf/adp2-6_summary_report_ccus_for_posting.pdf

Sustainable Development Goals (SDGs)

In 2015, the UNFCCC formally welcomed the United Nations General Assembly’s adoption of the SDGs.¹⁴ There are two SDGs of particular relevance to this analysis: SDG 7 (ensuring access to affordable, reliable, sustainable and modern energy for all) and SDG 13 (taking urgent action to combat climate change and its impacts). Both have adopted ‘global indicator frameworks’ that were developed by an Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) and agreed to in March 2016.

Progress towards achieving SDG 7 will be reviewed at the UN’s high-level political forum on sustainable development in 2018; and for SDG 13, in 2019.

SDG-7 essentially adopts the objectives of the UN’s Sustainable Energy for All (SE4ALL) of:

- Ensuring universal access to affordable, reliable and modern energy services by 2030;
- Increasing substantially the share of renewable energy in the global energy mix by 2030;
- Doubling the global rate of improvement in energy efficiency by 2030;
- Enhancing international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology by 2030; and
- Increasing the mobilisation of annual funds (as a % of GDP) to clean energy services within the context of the UNFCCC’s \$100 billion commitment; and
- Expanding infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries by 2030.

¹³ Decision 1/CP.21, paragraph 109.a

¹⁴ A/RES/70/1 “Transforming our world: the 2030 Agenda for Sustainable Development”

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SDG 13 objectives include:

- Strengthening the resilience and adaptive capacity to climate-related hazards and natural disasters in all countries; and
- Integrating climate change measures into national policies, strategies and planning.

Integrated examples of the need for SD within the UNFCCC include:

The Paris Agreement specifically emphasises the relationship between climate action and sustainable development. Article 2 for example states “This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of **sustainable development** ...”.

The UNFCCC’s Subsidiary Body for Scientific and Technological Advice (SBSTA) has also been tasked under the Paris Agreement’s Article 6 (cooperative approaches) to establish a “mechanism to contribute to the mitigation [...] and support **sustainable development** [...]” as well as undertake a work programme to develop a “framework for non-market approaches to sustainable development”.¹⁵

Cooperative approaches (CAs)

CAs essentially include the following four instruments:

- Market mechanisms;
- Non-market mechanisms;
- Internationally transferred mitigation outcomes (ITMOs); and
- Mechanism to support sustainable development.

The Paris Agreement (Article 6) recognizes that some Parties choose to pursue voluntary cooperation in the implementation of their NDCs to allow for higher ambition in their mitigation and adaptation actions and to promote sustainable development and environmental integrity. These approaches can include both market and non-market mechanisms.

ITMOs provides those Parties, who want to trade their surplus domestic mitigation outcomes directly with other Parties to help deliver on their NDCs, with the means to do so. While the M&Ps are still to be developed by the SBSTA – especially robust accounting rules – ITMOs in theory might include actions that reduce and/or avoid emissions, expressed either directly in terms of emissions levels (tCO₂-e) or indirectly in alternate terms (energy capacity).

A new market instrument was established under the Paris Agreement, to be governed under the authority of the COP, to generate mitigation outcomes that support positive sustainable development outcomes (Article 6.4 to 6.7). Its objective is to generate mitigation outcomes that can also be used to fulfil the NDC of another Party, similar to what the CDM does under the Kyoto Protocol.

Green Climate Fund (GCF) and Global Environment Facility (GEF)

The UNFCCC’s GCF was established in 2010 at COP 16 but was first proposed in 2009 at COP 15. It aims to support a paradigm shift in the global response to climate change by allocating its resources to low-emission and climate-resilient projects and programmes in developing countries. It is designed as an operating entity of the Convention’s financial mechanism and governed by a 24 Board member Board, representing countries, and receives guidance from the COP. Its Governing Instrument, which explicitly includes CCS as an eligible funding activity, was adopted in 2011 at COP 17.

¹⁵ Decision 1/CP.21, page 25 Article 6.4 and Article 6.9

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The current level of available funds stands at about US\$10 billion and is ongoing. It has a commitment to balance the allocation of available funds between mitigation and adaptation. It encourages direct private sector engagement through the Private Sector Facility (PSF), and describes its decision making as embracing “risk-bearing capacity” in support of innovation. A variety of financial instruments are leveraged, including grants, concessional loans, subordinated debt, equity, and guarantees to further crowd in additional financing and to give flexibility to match the needs of the project.

Example of GCF provisions for CCS: *Governing Instrument For The Green Climate Fund*

“35. 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.”

Source: https://www.greenclimate.fund/documents/20182/56440/Governing_Instrument.pdf/caa6ce45-cd54-4ab0-9e37-fb637a9c6235

The GEF was established in 1992 and aims to catalyse climate action. Through its strategic investments, the GEF works with partners to reduce poverty, strengthen governance and achieve greater gender equality. The GEF is a partnership that comprises of 18 agencies including UN agencies, multilateral development banks, national entities and international NGOs. It is supporting projects in over 183 countries and has a large network of civil society organizations (including the private sector) – in terms of achievements, the GEF has supported some 800 mitigation projects resulting in almost 3GtCO₂-e of emissions reduction at a total investment of about US\$5.3bn. This translates to about US\$1.70tCO₂-e abated.

Example of GEF consideration of CCS: *Carbon Dioxide Capture and Storage Conclusions and Recommendations from a Scientific and Technical Advisory Panel (STAP) Brainstorming Meeting, October 17-18, 2007*

“In response to the COP’s request, the GEF is re-examining its possible role in relation to CCS. This might include developing a small programmatic effort to enable appropriate specialists in relevant developing countries to inform themselves about CCS; it might also, perhaps, assist them in becoming involved in the development of CCS technology (such developments are currently largely being carried out in OECD countries; several of these countries are also planning full-scale demonstrations of the technology).”

Source: https://www.thegef.org/sites/default/files/council-meeting-documents/GEF.C.33_Inf.14_4.pdf

The GEF represents a financial mechanism that extends across 5 major international environmental conventions including: the Minamata Convention on Mercury, the Stockholm Convention on Persistent Organic Pollutants (POPs), the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD) and the UNFCCC. For its latest round of funding (called the 6th replenishment which extends from 2014 to 2018), the GEF has secured US\$4.4Bn; in total it has or is supporting some 4,200 projects with grants equal to US\$15.3Bn and co-financing worth US\$90.1bn. The GEF is currently leveraging about US\$5 in additional financing for every US\$1 it invests.

Climate Technology Centre and Network (CTCN)

The CTCN is the operational arm of the UNFCCC's Technology Mechanism, which complements but is independent to the policy arm of the TEC. It is currently hosted by UNEP and the UN Industrial Development Organization (UNIDO), and aims to promote the accelerated transfer of ESTs. It provides assistance in response to requests submitted by developing countries via their nationally-selected focal points, or National Designated Entities (NDEs). In doing so, it relies on its global Network of climate technology experts (including the Institute) to design and deliver customised solutions tailored to local needs. While the CTCN does not provide funding directly to countries, it does support (up to US\$250K per request) the provision of technical assistance provided by experts on specific climate technology sectors.

Example of CTCN request for CCS: *CTCN Request For Assistance (RFA) from Nigeria: CCS*

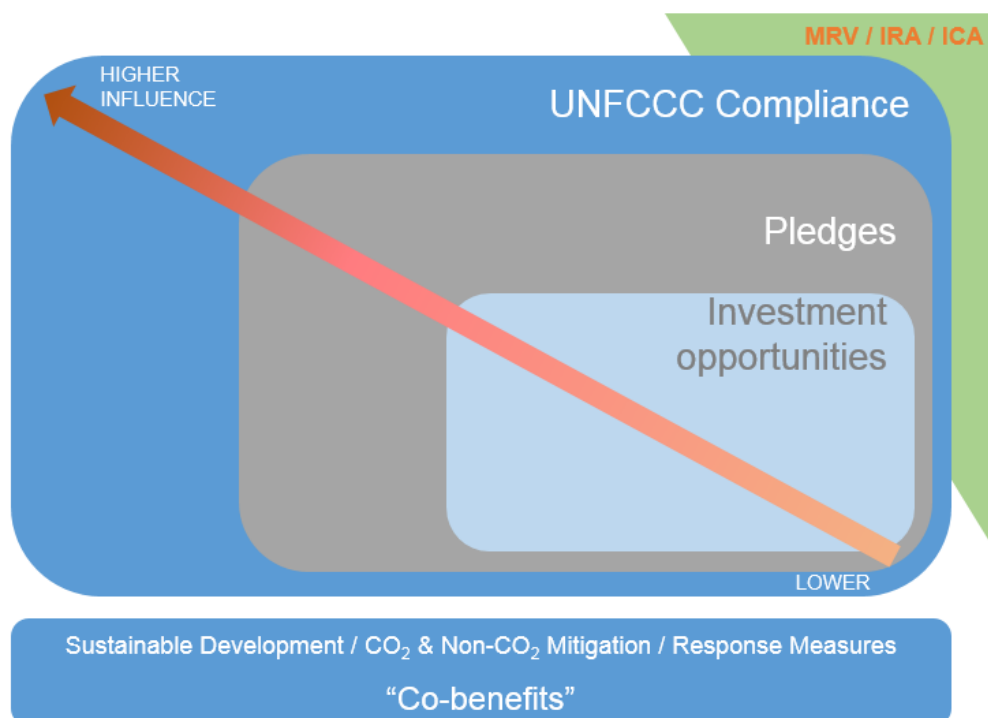
"We at CTCN have received three requests for technical assistance from the NDE of Nigeria related to CCS. To summarise all three requests focus on developing policy guidelines and an institutional framework, identification of potential carbon storage sites and undertaking baseline studies of geological reservoir for capacity assessments."

Source: email to Network members of the Climate Technology Centre (8 September 2016)

4. Potential influence of these vehicles

It is possible to categorise these vehicles in terms of their potential influence on the allocation of UNFCCC resources to technologies (like CCS). Firstly, they can be categorised by the extent to which they fulfil a UNFCCC compliance requirement/s (ie. Convention, Kyoto Protocol, Paris Agreement, modalities and procedures); secondly, the extent to which they represent national commitment/s; and thirdly by the level of economic activity being endorsed.

Diagram 3 Stylised linkages and influence of the vehicles



Source: MBonner, GCCSI

There appears a much greater scope of influence on the allocation of UNFCCC resources (including favourable policy developments and making eligible project financing) when a technology is formally referenced in vehicles that are:

1. More institutionally compliant in nature;

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2. Communicate a high-level of commitment to and/or reliance on; and/or
3. Identifies tangible investment opportunities scrutinised by a UNFCCC authorised entity (ie. Nationally Designated Entity) and/or in an early phase of a project pipeline.

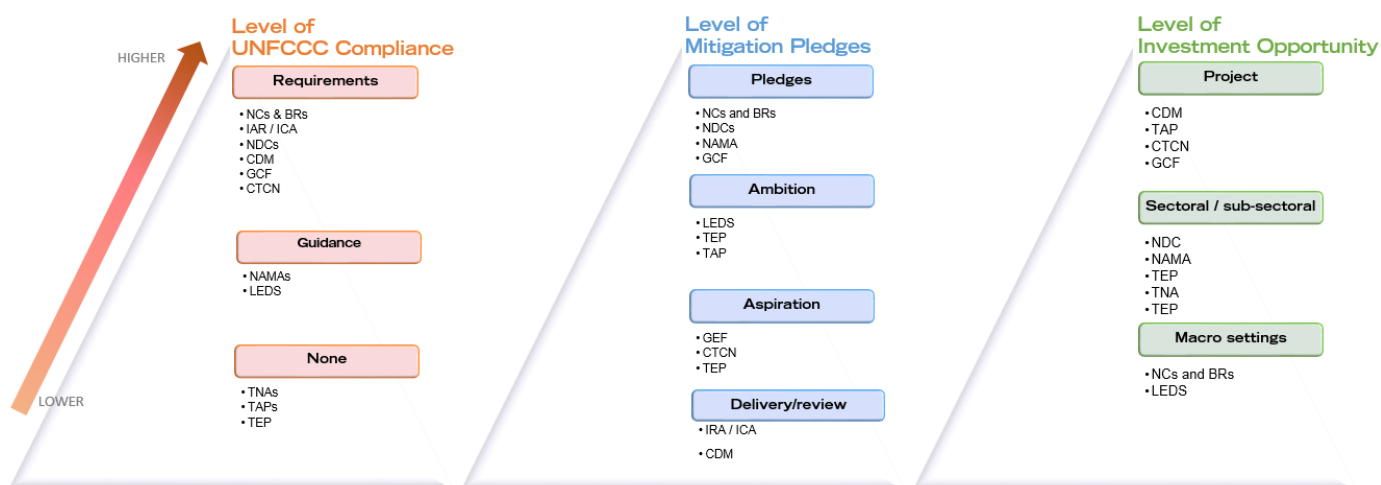
The more institutionally compliant the vehicle, the superior the standing it has with UNFCCC Parties. This may be due to the sovereign ownership of the documents. They have generally undergone a domestic public review process, a formal government approval process (ie. Cabinet level or similar), and will likely be formally and periodically reviewed at the national and international levels. Such reviews may include Parties being subjected to internationally rigorous and highly transparent IAR and ICA processes. These sorts of vehicles most strongly represent the diversity of national interests of UNFCCC Parties and their performance, and therefore likely carry the most weight in influencing the Party-led discussions and pledged resources of the UNFCCC.

The national communication of future pledges and/or legally binding commitments to climate actions, including the need to support the development and adaptation of large-scale high potential mitigation options for domestic deployment, also carries substantial weight when it comes to influencing the allocation of UNFCCC resources. The only legally binding UNFCCC mitigation commitments fall under the Kyoto Protocol's second commitment period (over the period from 2013 to 2020) for some developed countries. The pledges outlined in the NDCs under the Paris Agreement are not legally binding, although the intent of nations to protect and/or enhance their international reputations should serve as an effective compliance regime of sorts. This is especially true in the context of the requirement for Parties to update their NDCs with no backsliding of emissions reduction targets, as well as being scrutinised to periodic global stocktakes that track international progress towards meeting the climate goals. The signalling of national ambitions or aspirations tend to be more instructive for UNFCCC strategic discussions rather than representing tangible project level investment opportunities. For this reason, such vehicles tend to have a lower sphere of influence than the ones above.

The ability of the UNFCCC to help mobilise the financial resources needed for the implementation of mitigation projects has been well demonstrated through mechanisms like the Kyoto Protocol's CDM, the Technology Mechanism's CTCN, the finance mechanism's GCF, and perhaps to a lesser extent, TAPs. The more details that can be formally outlined on mitigation opportunities and/or implementation settings, the greater the confidence relevant decision makers display when allocating UNFCCC resources to support such projects. While all mitigation projects present some level of technological, financial and reputational risk, a strong relationship seems to exist between rigid UNFCCC compliance process (ie. proposals sanctioned through authorised entities) and the perceived level of technology or project risk. While this may make for safer UNFCCC decision making by mitigating associated risks, it can also serve as a barrier to examining and supporting alternate and potentially very innovative nascent technologies.

The following diagram shows a qualitative and comparative analysis of the various vehicles across the three categories.

Diagram 4 Scope of influence based on 3 criteria



Source: MBonner, GCCSI

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It can be seen that all vehicles serve very different yet largely complementary purposes. Each caters for a diversity of mitigation approaches to help nations deliver on their efforts to better control their emissions.

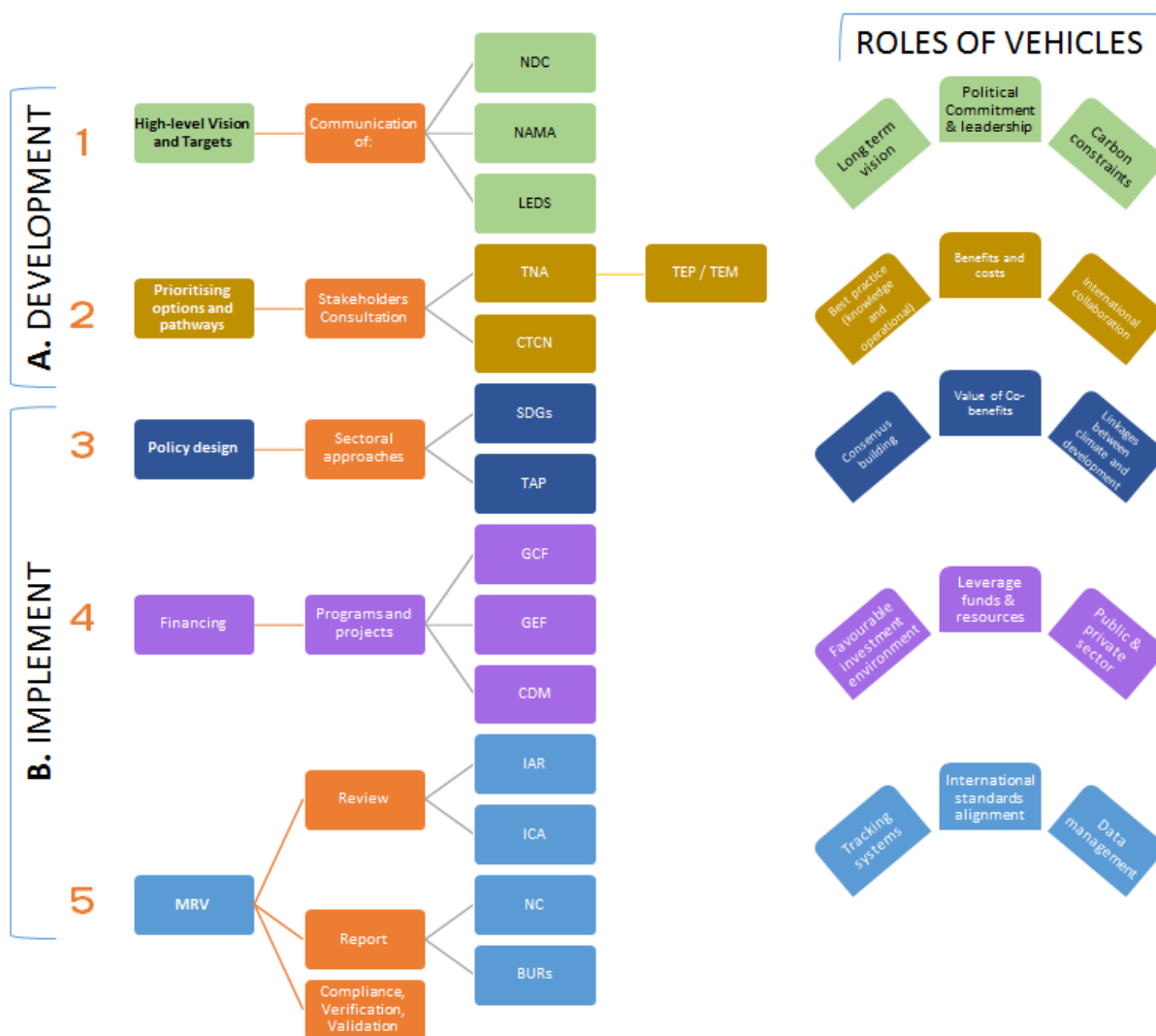
Some vehicles like the TNAs and TAPs can strongly signal scope for international cooperation to develop both the institutional and technological capacities to deploy the most appropriate mitigation solutions in the sectors that matter most. For many countries, this should facilitate better emissions controls for fossil dominated power and industrial sectors – both in the current fleet of assets via CCS retrofit opportunities, and for future investments with CCS greenfield plants.

Current UNFCCC processes however tend to under-represent this mitigation imperative in many of the identified vehicles. This is likely due to a lack of Party awareness of CCS solutions, which in part could symbolise a lack of evidence based information that is available to Parties; but more concerning could be an apparent and inherent bias against CCS solutions by some UN institutions – who are often responsible for overseeing many of these processes (TNAs, TAPs, TEPs). Such biases against CCS are not warranted when considering its operational and technological performance and reliability, or its environmental integrity and dependability. At its root, CCS gets caught up in the ideological opposition by these institutions to the continued use of fossil energy.

5. Potential impact of vehicles

The UNFCCC's vehicles have a major role to play in coordinating global action and directing the necessary resources to high-potential mitigation technologies and specific projects.

Diagram 5 Core elements in support of climate mitigation action



Source: MBonner, GCCSI

There are essentially two core phases (listed as A and B above) and five key stages (listed as 1 through 5 above) to encouraging entities to reduce their emissions. The first stage is the setting of national interest priorities in regards to climate action (high-level vision and targets). It is critical that national commitments to reducing emissions are adopted at the highest of political levels, with mitigation outcomes clearly and formally defined and explained. This sends very strong signals to economic actors (emitters, solution providers, community) that at some stage they will be compelled (ie. incentivised or penalised) to control their emissions (ie. operate in an environment of carbon scarcity). This allows economic actors to hedge and/or monetise their future carbon risks. Domestic climate actions are highly correlated to meeting nationally determined international commitments (Paris Agreement), and as such are explicitly expressed in NAMAs (pre-2020 period), NDCs (post-2020 period) and LEDs.

The second stage is understanding and prioritising the many potential technological pathways that can help a nation achieve its emissions reduction pledges. The mitigation of emissions is typically given effect through encouraging behavioural change (ie. valuing the emissions signatures of goods and services) and the adoption of technological solutions. Both approaches rely heavily on information dissemination (ie. emissions intensity, carbon pricing) and knowledge sharing – especially in regards to prospective high-mitigation potential technologies such as CCS. Many country's will need to adapt imported technologies to localised circumstances and so understanding the true benefits and costs of their application/s, as well as accessing international know-how is essential. This stage can be well enhanced at the national level through both the TNA process (which in turn is informed by the TEP / TEM-M initiative) and the services of the CTCN.

The start of the implementation phase is represented by the third stage of policy design. This is a critical stage for all technologies. The policy development process usually involves highly participatory processes, not only for the stakeholders who will be most impacted by such settings, but also the wider community as many of the government response measures will require trade-offs in terms of resources (many being publicly provided resources funded through tax receipts) and social policy outcomes (ie. the relative prices of goods and services). As such, governments aim to establish a national mandate in which to undertake mitigation action (ie. consensus building) as well as demonstrate value for money. This is where the concept of co-benefits applies (ie. non-CO₂ benefits of emissions reduction actions) especially within a sustainable development context for developing countries. The priorities of the SDGs and the tangible opportunities outlined in TAPs all have a role to play in shaping the type of climate actions that ultimately get supported (ie. including environmentally sound technologies).

The fourth stage of project financing is commonly identified as one of the most important stages. While appropriate and sufficient policy settings are vital to support the development of promising and nascent technologies (ie. robust national innovation systems) and the operationalisation of projects (ie. variable costs), it is the accessing of affordable financing (ie. acceptable weighted average cost of capital) to cover the upfront capital requirements of projects that perhaps serves as one of the most inhibiting barriers to technology deployment. The risk premiums imposed by financial institutions on innovative and more immature technology projects can be prohibitively costly. Institutions like the GCF and GEF have a relatively high propensity to assume a 'fair' share of such risk burdens with project proponents, and can make it more attractive to access private sector capital by leveraging its own (predominately public sector sourced) funding. The CDM is another mechanism in which the abatement generated by a registered project can be rewarded with an income stream by globally trading the resulting asset (certified emission reduction unit). These assets can be treated similar to any other financial assets (ie. derivatives such as forwards, futures, options etc).

The final stage is critical for the community to have confidence in the efficacy and dependability of the settings implemented above – this is confidence that the emissions reductions achieved are both real (and not double counted) and permanent. The transparency in which mitigation actions are assessed and reported on (ie. MRV systems) are very important. The international compliance system for the UNFCCC is non-punitive and essentially reliant on international reputation; especially in regards to assessing and reporting on a country's mitigation performance relative to its mitigation pledges and commitments. The former is implemented through IARs and IACs and the latter communicated in the NCs and BURs.

6. Potential relevance of these vehicles to CCS

The findings of the IPCC, as contained in both its 4th and 5th Assessment Report's, should ideally put the deployment necessity of large scale clean energy technologies like CCS at the front and centre of the Technology Mechanism's agenda; and yet the Technology Mechanism has provided very little focus, momentum or support for technologies like CCS to date. The IPCC highlights that achieving a 2°C temperature goal, let alone a "well below" target, is

almost impossible to achieve and certainly not at least cost without the wide-scale deployment of CCS in both developed and developing regions.

Meaningful mitigation outcomes can only be achieved by ensuring that the most cost-effective, scalable and environmentally dependable mitigation technologies reach the right communities and applications on a timely basis. This is especially relevant in developing countries given that around 65% of current global emissions are generated by these regions.¹⁶

The consequence of the UNFCCC vehicles for CCS is that they can provide both the business case for its deployment and the right operational settings. The extent to which such settings alone will be sufficient to encourage investment in CCS in any one country will largely depend on the propensity of national climate responses to also deliver on a suite of complementary economic and social policies (co-benefits). Such co-benefits for CCS could include control of non-CO₂ pollutants, poly-generation (hydrogen, chemicals), direct foreign investment and know-how, enhanced oil recovery from existing resources, diversified employment prospects, skills and technology transfer (and the like).

Referring to diagram 5 above, even the consideration and signalling of an imminent and increasingly strident carbon constraint over time in the development phase (stages 1 and 2) can profoundly reveal the type of policy trade-offs that are possible (command and control versus more laissez-faire approaches). If a national mitigation target is ambitious, then the cost of domestic mitigation will likely be much higher than it is at present regardless of policy approach taken.

In regards to stages 3 and 4 of the 'implementation phase' shown in diagram 5, there exists a broad range of policy options that can help reduce what would otherwise be 'unilaterally' borne costs (ie. access to lower cost mitigation opportunities through national or international emissions trading). What is clear is that high potential mitigation technologies like CCS are relatively more costly than unabated technologies, and so technology owners and investors alike necessarily require higher market prices for lower emission goods and services to earn a reasonable rate of return on their investments. On the other hand, the social costs associated with climate mitigation need to be minimised so that the price of these low emissions goods and services do not become too regressive in nature.

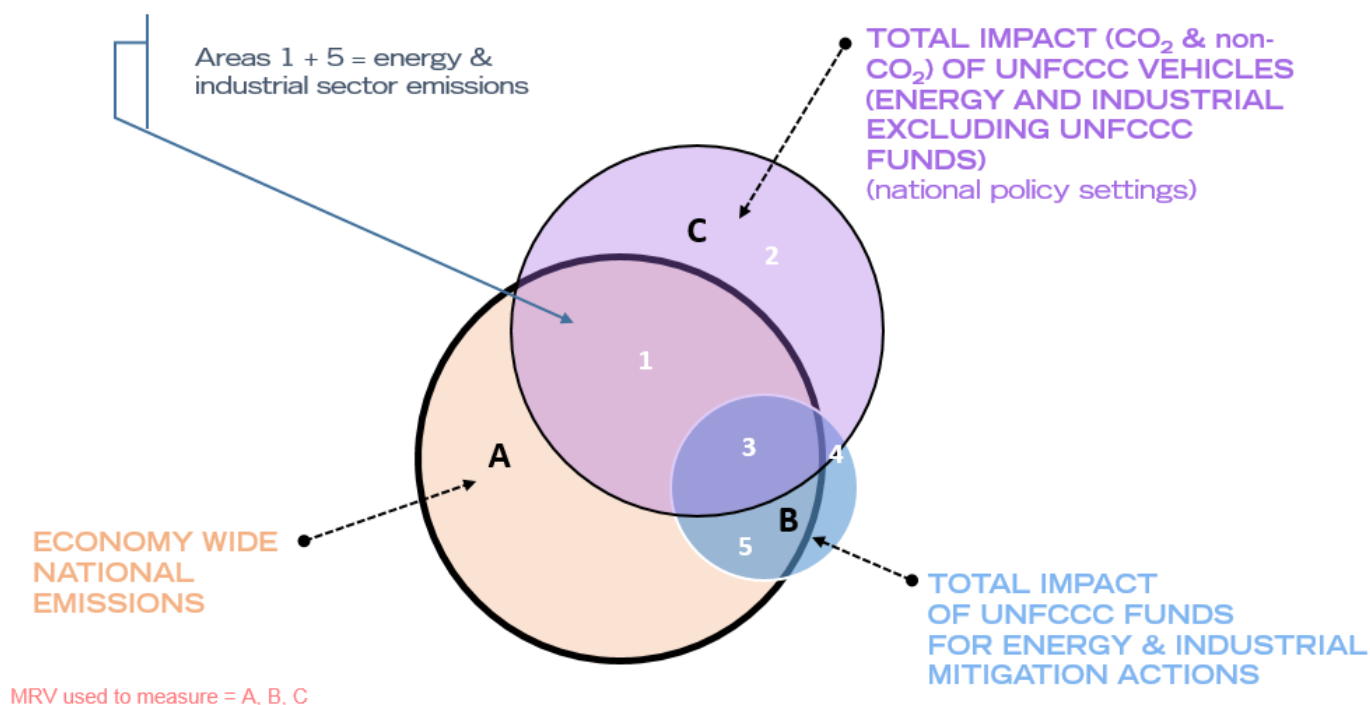
There are many domestic policies that can help mitigate the initial high cost of firming the performance of nascent and promising mitigation technologies. In doing so, they can simultaneously generate substantial cost reductions for those technologies by simply sharing with markets and financiers a better understanding of technology application and capability. This can provide for reductions in risk premiums (ie. cost of capital), access to and cost of insurance products as well as engineering learning-by-doing that can avoid making the same sorts of project level or operational mistakes again.

Stage 5 of the 'implementation phase' in diagram 5 illustrates the critical role MRV must be allowed to play in ensuring the implementation of efficient and effective policy settings to deliver on the national interest priorities established in stages 1 and 2. Diagram 5 illustrates the role of MRV in better understanding the impacts of each of the UNFCCC's vehicles (including funds) in facilitating CCS related emissions reductions. Although abstract in nature, it is envisaged that such an approach could be applied analytically to estimate their value.

As an additional contribution to this discussion, a stylised approach to assessing the impact of 'implementation' stages 3, 4 and 5 as shown in diagram 5 is presented in Appendix 1.

¹⁶ <http://www.cgdev.org/media/developing-countries-are-responsible-63-percent-current-carbon-emissions>

Appendix 1 Stylised approach to understanding the impact of implementation



Total Impacts (spheres A, B, C)

- 1 = Impact of UNFCCC vehicles (policy) on energy and industrial related CO₂-e emissions reductions
- 2 = Impact of UNFCCC vehicles (policy) on energy and industrial related non-CO₂ outcomes (co-benefits)
- 3 = Impact of UNFCCC vehicles (policy) and funds on energy and industrial CO₂-e emissions reductions
- 4 = Impact of UNFCCC funds on energy and industrial related non-CO₂ outcomes (co-benefits)
- 5 = Impact of UNFCCC funds on energy and industrial CO₂-e emissions reductions

Source: MBonner, GCCSI

This diagram aims to represent the importance of the policy settings and available resources cited within the UNFCCC's vehicles to help deliver on the necessary mitigation outcomes.

The chart can be interpreted by using the areas of the Spheres and their respective sub-sections.

Analytical framework explained

Assuming that all Parties emissions need to be net zero emissions by the latter part of this century, and this is to be achieved in a SD friendly manner, then let:

- Sphere A represent the total amount of emissions needing to be mitigated (the whole of the orange circle);
- Sphere B represent the UNFCCC's finite amount of financial resources available to help reduce emissions in the energy and industrial sectors (the entire blue circle):
 - Note that much of this funding will be conditionally allocated on the basis of parallel SD outcomes.
- Sphere C represent all of the supporting policies and strategies that Parties aim to implement to achieve their climate action goals as cited within the UNFCCC's vehicles (the entire purple circle).

Stylised results explained

Although stylised (ie. the areas of the bubbles do not represent any quantitative estimate of the size or value of the mitigation outcome), the conceptual framework could easily lend itself to such an assessment. For example, the intersections of the bubbles can be interpreted as follows:

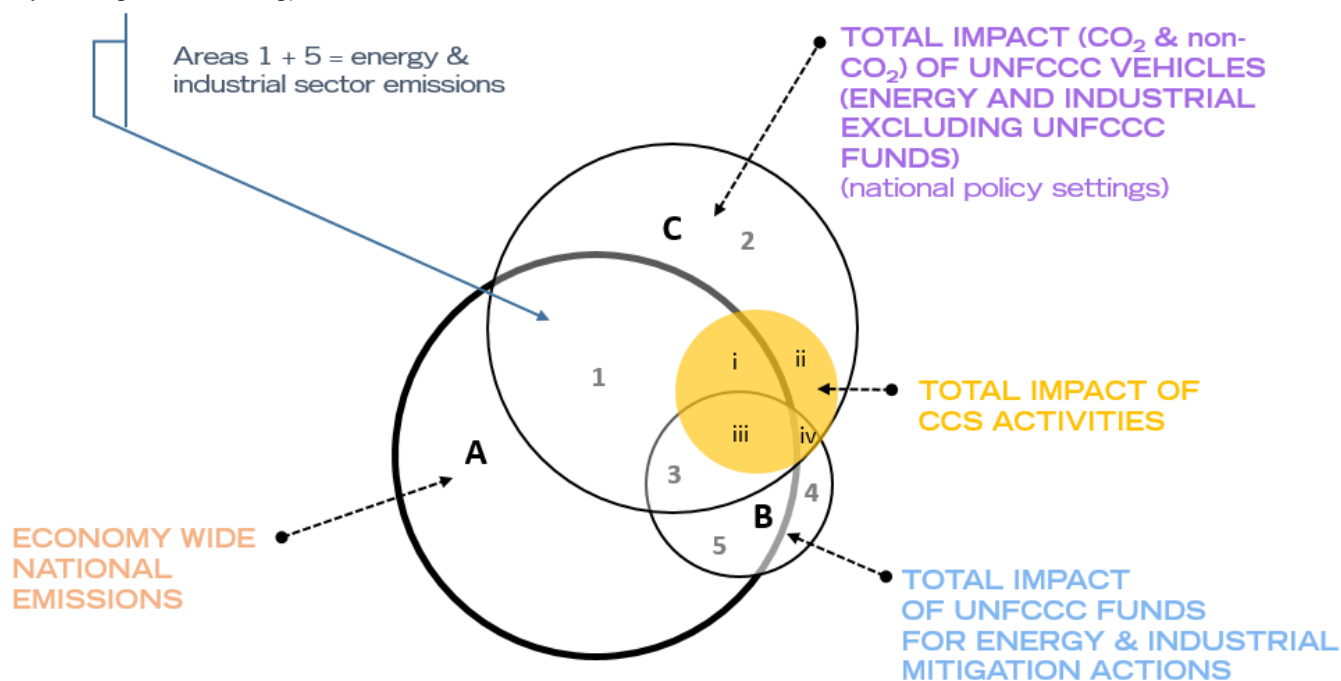
- The intersection of Sphere B (available funds) with Sphere C (supporting policies) represents CO₂ mitigation outcomes in the energy and industrial sectors driven by:
 - Policy alone (purple shaded area 1);

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- Funding alone (blue shaded area 5); and
- A combination of either a complementary policy and funding and/or duplicative settings of policy and funding (deeper blue shaded area 3).
- Total non-CO₂ mitigation (SD) outcomes can be estimated by shaded areas 2 and 4, with area 2 led by policy settings and 4 led by funding.

Add CCS into the analysis

Given the above interpretations, it is also possible to also illustrate the potential impact of the UNFCCC's resources (policy settings and funding) on CCS outcomes.



CCS Impacts

$\Sigma i + iii$ = Impact of **CCS (vehicles + funding)** on energy and industrial CO₂-e emissions reductions

$\Sigma ii + iv$ = Impact of **CCS (vehicles + funding)** on energy and industrial non-CO₂ outcomes (co-benefits)

The CCS (hypothetical) contribution can be represented by:

- Total CO₂ outcome equals the combined areas of i (policy led) and iii (funding led);
- Aggregate non-CO₂ outcomes equals the combined areas of ii (policy led) and iv (funding led).

Note that the International Energy Agency recently presented at the 46th intersessional meeting of the UNFCCC (May 2017, Bonn) that the cumulative CO₂ emissions reductions outcome required from CCS under a 2 degree scenario is 15%. In the above diagram, this would be represented by summing areas i + iii.

The total amount of emissions still needing to be addressed in this example that fall outside of any UNFCCC driven outcomes can be represented by Sphere A less areas 1 + 3 + 5; while the non-CCS abatement required is represented by Sphere A less areas (1 - i) + (3 - iii) + 5.